
**Plastics — Fluoropolymer dispersions
and moulding and extrusion materials —**

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

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*Plastiques — Polymères fluorés: dispersions et matériaux pour
moulage et extrusion*
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Partie 1: Système de désignation et base de spécification

ISO 12086-1:2006

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Published in Switzerland

Contents

Page

Foreword.....	iv
1 Scope	1
2 Normative references	2
3 Terms and definitions.....	3
4 Abbreviated terms and symbols	5
5 Designation system.....	6
5.1 General.....	6
5.2 Data block 1.....	6
5.3 Data block 2.....	7
5.4 Data block 3.....	9
5.4.1 General.....	9
5.4.2 Transition temperatures.....	9
5.4.3 Relative molecular mass.....	11
5.4.4 Mechanical properties.....	12
5.4.5 Density.....	14
5.4.6 Percentage fluoropolymer and surfactant.....	14
5.4.7 Particle size.....	15
5.4.8 Bulk density.....	15
5.4.9 Powder-flow time.....	16
5.4.10 Extrusion pressure.....	16
5.4.11 Contamination.....	16
5.5 Data block 4.....	16
5.6 Data block 5.....	17
5.7 Designatory properties for fluoropolymers.....	17
5.7.1 Designatory properties applicable to all fluoropolymers.....	17
5.7.2 Designatory properties specific to particular classes of fluoropolymer.....	18
6 Example of a designation	19
7 Specifications for fluoropolymers	19
8 Packaging and marking	21
8.1 Packaging.....	21
8.2 Marking.....	21
9 Sampling.....	21
Annex A (normative) Designatory properties for common fluoropolymer types.....	22
Annex B (normative) Designatory properties for common fluoropolymer types with cross-reference listing to the tables for codes in ISO 12086-1 and the test methods in ISO 12086-2.....	24
Annex C (informative) The fluoropolymer family.....	26
Annex D (informative) Standard specifications for fluoropolymers.....	28
Annex E (informative) Listing of test methods included in ISO 12086-2 (in alphabetical order).....	29
Annex F (informative) Brief instructions for use of this part of ISO 12086.....	30

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

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.

ISO 12086-1 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 9, *Thermoplastic materials*.

This second edition cancels and replaces the first edition (ISO 12086-1:1995), which has been technically revised.

ISO 12086 consists of the following parts, under the general title *Plastics — Fluoropolymer dispersions and 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 — Fluoropolymer dispersions and moulding and extrusion materials —

Part 1: Designation system and basis for specifications

1 Scope

1.1 This part of ISO 12086 establishes a system of designation for fluoropolymer materials that may be used as the basis for specifications. It covers the homopolymers and various copolymers of fluoromonomers used as dispersions and for moulding, extrusion and other specialized applications. This part of ISO 12086 describes the designation system and provides codes and tables of values for the designatory properties. The designation system is applicable both to conventional thermoplastic fluoropolymers, processed by various techniques, and those materials that are processed by the unique operations required for the non-conventional thermoplastic polytetrafluoroethylene. The materials include both the fluorocarbon polymers and the various other fluoropolymers as virgin polymers or processed for reuse or recycling. This part of ISO 12086 also includes an extension of the designation system that provides a basis for specification of the materials. This basis for specification may be used to prepare specifications related to well-defined applications. As explained in Clause 5, these specifications will use data blocks 1 to 4 and, if necessary, data block 5 as a complement, the last-mentioned data block containing the specific requirements in relation to the application. Fluoroelastomers are specifically excluded.

1.2 Fluoropolymers are long-chain homopolymers and copolymers of fluoromonomers. Fluoropolymers can be modified with small amounts of different fluoromonomers. In general, provided the polymer is not modified with more than five percent by mass of modifying fluoromonomer(s), it can be classed as the base polymer. PVDF is classed as the base polymer when it is modified during polymerization with up to two percent by mass of additional fluoromonomers in the polymer structure. For PTFE, up to one percent by mass of a modifying comonomer is the limit for the material to be classed as polytetrafluoroethylene. A general discussion of members of the fluoropolymer family is included in Annex C. This part of ISO 12086 is particularly concerned with, but is not limited to, the materials listed in 4.2. The accepted abbreviated term for each material is included in 4.2.

1.3 The various types of fluoropolymer are differentiated from each other by a classification system based on the fluoropolymer genus and appropriate levels of the designatory properties, along with information about basic polymer parameters, intended application or method of processing, important properties, additives, colorants, fillers and reinforcing materials. Designatory properties for each fluoropolymer are selected from the general list in 5.4, and those properties to be designated for each fluoropolymer are listed in 5.7 and in Annexes A and B.

1.4 Provision is made for designation of materials involved in reuse and recycling of the fluoropolymers covered by this part of ISO 12086. A set of designatory properties is provided for reprocessed PTFE because of its special requirements. For non-virgin conventional thermoplastic fluoropolymers, the same designatory properties as used for virgin materials are used with inclusion of the code Z1, Z2 or Z3 in data block 1 as specified in Table 1.

1.5 It is not intended to imply that materials having the same designation necessarily give the same performance. The converse should also be emphasized, i.e. materials with different designations may be suitable for use in the same application. This part of ISO 12086 does not provide engineering data, performance data or processing conditions which may be required to specify materials for particular end-use applications (see the discussion on use of data block 5 in Clauses 5 and 7). If such additional properties are required, they can be determined in accordance with the test methods specified in ISO 12086-2, if suitable.

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 527-2, *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, *Plastics — Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics*

ISO 1183-1, *Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pycnometer method and titration method*

ISO 1183-2, *Plastics — Methods for determining the density of non-cellular plastics — Part 2: Density gradient column method*

ISO 12000, *Plastics/rubber — Polymer dispersions and rubber latices (natural and synthetic) — Definitions and review of test methods*

ISO 12086-2, *Plastics — Fluoropolymer dispersions and moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties*

ASTM D 1430, *Standard Classification System for Polychlorotrifluoroethylene (PCTFE) Plastics*

ASTM D 1600, *Standard Terminology for Abbreviated Terms Relating to Plastics*

ASTM D 3222, *Standard Specification for Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding, Extrusion and Coating Materials*

ASTM D 3418, *Standard Test Method for Transition Temperatures of Polymers by Differential Scanning Calorimetry*

ASTM D 3892, *Standard Practice for Packaging/Packing of Plastics*

ASTM D 4591, *Standard Test Method for Determining Temperatures and Heats of Transitions of Fluoropolymers by Differential Scanning Calorimetry*

ASTM D 4895, *Standard Specification for Polytetrafluoroethylene (PTFE) Resin Produced from Dispersion*

ASTM D 5033, *Standard Guide for Development of ASTM Standards Relating to Recycling and Use of Recycled Plastics*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 472 and the following terms and definitions apply. The terms listed in 3.1 to 3.3 are repeated from ISO 472 to be sure there is no misunderstanding.

3.1

dispersion

heterogeneous system in which a finely divided material is distributed in another material

3.2

fluoroplastic

plastic based on polymers made with monomers containing one or more atoms of fluorine, or copolymers of such monomers with other monomers, the fluoromonomer being in the greatest amount by mass

3.3

latex

colloidal aqueous dispersion of a polymeric material

3.4

amorphous

noncrystalline, or devoid of regular structure

3.5

bulk density

mass (in grams) per litre of material, measured under the conditions of the test

3.6

copolymer

polymer formed from two or more types of monomer

3.7

emulsion polymer

(fluoropolymer materials) material isolated from its polymerization medium as a colloidal aqueous dispersion of the polymer solids

NOTE This definition, used in the fluoropolymer industry, is similar to that for “latex” in ISO 472 and is quite different from the definition for “emulsion” in ISO 472.

3.8

fluorocarbon plastic

plastic based on polymers made from perfluoromonomers only

3.9

fluoroelastomer

elastomer based on polymers made from monomers containing one or more atoms of fluorine, or copolymers of such monomers with other monomers, the fluoromonomer(s) being in the greatest amount by mass

3.10

fluoropolymer

synonymous with fluoroplastic (see 3.2)

3.11

melt-processible

capable of being processed by, for example, injection moulding, screw extrusion and other operations typically used with thermoplastics

3.12
preforming

compacting powdered PTFE material under pressure in a mould to produce a solid object, called a preform, that is capable of being handled

NOTE With PTFE, “moulding” and “compaction” are terms used interchangeably with “preforming”.

3.13
presintered resin

resin that has been treated thermally at or above the melting point of the resin at atmospheric pressure without having been previously preformed

3.14
reprocessed plastic

material from the manufacture of semifinished forms of fluoropolymers that has been converted to a form suitable for further use

NOTE 1 This material is often referred to as a byproduct from processing.

NOTE 2 Related definitions are presented in ASTM D 5033.

3.15
sintering

⟨PTFE⟩ thermal treatment during which the material is melted and recrystallized by cooling, with coalescence occurring during the treatment

3.16
standard specific gravity
SSG

specific gravity of a specimen of PTFE material preformed, sintered and cooled through the crystallization point at a rate of 1 °C per minute in accordance with the appropriate sintering schedule as described in ISO 12086-2

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NOTE The SSG of unmodified PTFE is inversely related to its molecular mass.

3.17
suspension polymer

polymer isolated from its liquid polymerization medium as a solid having a particle size well above colloidal dimensions

3.18
zero-strength time
ZST

measure of the relative molecular mass of PCTFE

4 Abbreviated terms and symbols

4.1 The abbreviated terms given in ISO 1043-1 and ISO 1043-2 are applicable to this part of ISO 12086.

4.2 This part of ISO 12086 is particularly concerned with, but is not limited to, the materials listed below (there are minor differences from ISO 1043-1 and ISO 1043-2 that reflect current usage of the terms and abbreviated terms):

ECTFE	ethylene-chlorotrifluoroethylene copolymer
EFEP	ethylene-tetrafluoroethylene-hexafluoropropene copolymer
ETFE	ethylene-tetrafluoroethylene copolymer
FEP	perfluoro(ethylene-propene) copolymer
PCTFE	polychlorotrifluoroethylene
PFA	perfluoro(alkoxy alkane)
PTFE	polytetrafluoroethylene
PVDF	poly(vinylidene fluoride)
PVF	poly(vinyl fluoride)
TFE/PDD	tetrafluoroethylene-perfluorodioxole copolymer
VDF/CTFE	vinylidene fluoride-chlorotrifluoroethylene copolymer
VDF/HFP	vinylidene fluoride-hexafluoropropene copolymer
VDF/TFE	vinylidene fluoride-tetrafluoroethylene copolymer
VDF/TFE/HFP	vinylidene fluoride-tetrafluoroethylene-hexafluoropropene copolymer

4.3 For the purposes of this part of ISO 12086, the following additional abbreviated terms apply.

AF	amorphous fluoropolymer
ESG	extended specific gravity
MFR	melt mass-flow rate
MVR	melt volume-flow rate
SSG	standard specific gravity
SVI	stretching-void index
TII	thermal-instability index
ZST	zero-strength time

5 Designation system

5.1 General

The designation system for thermoplastics is based on the following standard 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

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 in accordance with ISO 1043-1 (supplemented, if necessary, by the abbreviated term for the fluoropolymer as listed in 4.2 or ASTM D 1600) and information about the composition of the polymer (see 5.2).
- Data block 2: Position 1: Intended application and/or method of processing (see 5.3).
Positions 2 to 8: Important properties, additives and supplementary information (see 5.3).
- Data block 3: Designatory properties (see 5.4 and 5.7).
- Data block 4: Fillers or reinforcing materials designated by letters as given in ISO 1043-2 (supplemented by the codes listed in Table 20), along with arabic numerals representing the nominal percentage content by mass (see 5.5).
- Data block 5: Additional details included in this data block will transform the general designation of a material into a material specification. This may be done by reference to particular requirements for properties, by reference to a suitable national standard, or both. See Clause 7 for further discussion and examples.

The first character of the individual-item block shall be a hyphen. The 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 (,,).

5.2 Data block 1

In this data block, fluoropolymers are identified by the abbreviated term given in ISO 1043-1, followed by a hyphen and one letter that codes additional information about the polymer as specified in Table 1. See 4.2 for a list of commonly used fluoropolymers with the abbreviated term for each.

Table 1 — Code-letters used for additional information in data block 1

Code-letter	Meaning of code-letter
A	Modified
B	Block copolymer
C	Controlled rheology, narrow molecular-mass distribution
D	Dispersion
E	Emulsion polymer
F	Filler resin (additive resin)
G	Casting polymer
H	Homopolymer
K	Copolymer
L	Graft polymer
M	Bulk polymer
R	Random copolymer
S	Suspension polymer
SS	Presintered suspension polymer
Z1	In-house-recovered material; out of specification/waste
Z2	Reprocessed; byproduct from processing
Z3	Postconsumer material

ISO 12086-1:2006

5.3 Data block 2 <https://standards.iteh.ai/catalog/standards/sist/8b41e050-8eab-46aa-96d8-fa4001e350dd/iso-12086-1-2006>

This block can indicate up to eight items of information coded by letters as specified in Table 2. Information about intended application or method of processing is given in position 1. Information about important properties, additives and supplementary information (up to seven items) is given, if requested, in positions 2 to 8. The code-letters are specified in Table 2.

If only one letter is given (e.g. E), its meaning must come from position 1. If information is presented in positions 2 to 8 and no specific information is given in position 1, a code-letter in position 1 is required. If no code-letter is appropriate, the letter X shall be inserted in position 1. An alphabetical order is recommended if more than one code-letter is used in any of positions 2 to 8.

Any indication of an intended application in data block 2 shall be selected carefully. Many materials are capable of more than one application or method of processing, e.g., extrusion (E) and moulding (M). Such materials are not special modifications and shall be coded "general use" (G). Coding for special methods of processing shall be reserved for materials designed for the application.

Table 2 — Code-letters used in data block 2

Intended application or method of processing		Essential properties, additives or other information	
Code-letter	Position 1	Code-letter	Positions 2 to 8
A	Adhesives	C	Coloured
B	Blow moulding	D	Powder
B1	Extrusion blow moulding	D1	Dry blend
B2	Injection blow moulding	D2	Free-flowing
C	Calendering	D3	Not free-flowing
E	Extrusion	E	Expandable
F	Filled compounds	F	Special burning characteristics
G	General use	F1	Oxygen index > 95 %
H	Coating	F2	Flame retarded
H1	Powder coating	F4	Reduced smoke emission
H2	Dip coating	G	Granules
H3	Wet coating	G1	Pellets
H4	Impregnation	G2	Lentils
H5	Spray coating	G3	Beads
K	Cable and wire coating	H1	Stabilized against radiation
L	Monofilament extrusion	L	Light and weather stabilized
M	Moulding	M	Nucleated
M1	Injection moulding	M1	Modified by comonomer
M2	Transfer moulding	N	Natural (no colour added)
P	Paste extrusion	N1	Suitable for food contact
Q	Compression moulding	N2	High purity
Q1	Automatic moulding	P	Impact modified
Q2	Isostatic moulding	R	Mould release agent
R	Rotational moulding	S	Lubricated
S	Sintering	S1	External lubrication
T	Tape manufacture	T	Transparent
T1	Skived tape or film	T1	Translucent
T2	Unsintered tape or film	T2	Opaque
T3	Expanded tape or film	T3	Improved transmission in UV
V	Thermoforming	T4	Reduced transmission in UV
X	No indication	V	Heat shrinkable
Y	Textile yarns, spinning	W1	Improved chemical resistance
		X	Crosslinkable
		Y	Increased electrical conductivity
		Z	Antistatic