INTERNATIONAL STANDARD

ISO 13000-1

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Plastics — Polytetrafluoroethylene (PTFE) semi-finished products —

Part 1:
Requirements and designation

Plastiques — Semi-produits en polytétrafluoroéthylène (PTFE) —
Partie 1: Spécifications et désignation

Reference number
ISO 13000-1:1997(E)

CONTENTS

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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.

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 13000-1 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 9, *Thermoplastic materials*.

ISO 13000 consists of the following parts, under the general title *Plastics — Polytetrafluoroethylene (PTFE) semi-finished products:*

— *Part 1: Requirements and designation*

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

Annex A of this part of ISO 13000 is for information only.

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Plastics – Polytetrafluoroethylene (PTFE) semi-finished products

Part 1:
Requirements and designation

1. Scope
This specification deals with the requirements for processed unfilled polytetrafluoroethylene (PTFE) products which may occur in several forms. The PTFE used to make the semi-finished product is described in ISO 12086-1 and, as provided in that International Standard, may contain up to one percent of a comonomer. The PTFE used to make the semi-finished product may be virgin, reprocessed, or recycled resin. The addition of up to 1,5 % by mass of pigment or colourant is permitted. The standard allows for four grades based on tensile strength and elongation at break. The semi-finished products can be as processed (type P) or dimensionally stabilized (type S) and also may have specified electrical properties or other properties when they are required for an application.

NOTE: References to other standard specifications for semi-finished products made from polytetrafluoroethylene are listed in Annex A for information.

2. Normative references
The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard 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 472:1988 *Plastics — Vocabulary.*
ISO 1043-1:1997 *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics.*
ISO 12086-1:1995 *Plastics — Fluoropolymer dispersions and moulding and extrusion materials — Part 1: Designation system and basis for specifications.*
ISO 12086-2:1995 *Plastics — Fluoropolymer dispersions and moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties.*
ISO 13000-2:1997 *Plastics — Polytetrafluoroethylene (PTFE) semi-finished products — Part 2: Preparation of test specimens and determination of properties.*

3. Terminology

3.1 Definitions
The definitions in ISO 472 and ISO 12086-1 are applicable to this International Standard.

3.2 Definitions for this International Standard
For the purposes of this International Standard the following definitions apply.

3.2.1
moulded basic shape
(of PTFE): semi-finished product made by preforming and sintering without additional processing.

3.2.2
semi-finished product
material in the form of skived tape, sheets, rods, tubes, tubing, moulded basic shapes or special shapes that is produced for use either directly without further fabrication or in fabricating end use products, or both.

3.2.3
skived tape
film or sheet prepared by cutting, slicing, or shaving.

NOTE: The term "veneered tape" is deprecated.

3.3 Abbreviated terms and symbols
The abbreviated terms given in ISO 1043-1 are applicable to this International Standard.

4. Requirements for PTFE semi-finished products

4.1 General
After considering the specific shape, dimension, and dimensional tolerance, the primary basis for specifying a semi-finished product of PTFE is the tensile strength and percentage elongation at break of the product. Tests to determine the values for specification shall be run according to the methods in ISO 13000-2. The semi-finished product is identified as "type P" for as-processed or "type S" for stabilized and also may be designated as "type E" with specified electrical properties when required for a particular application. The exclusion of the use of reprocessed or recycled material shall be specified if needed in order to meet special customer requirements. The values required for other properties are given in their respective subclauses.

4.2 Dimensions and dimensional tolerances
Dimensional tolerances shall be measured at 23 ± 2 °C.

4.2.1 Skived tape, skived sheet, and film

Code			tolerance
a	thickness	< 0,1 mm	- 0,0; + 0,01 mm
b	thickness	≥ 0,1 mm	- 0,0; + 10 %

The standard tolerance for width is - 0,0 mm; + 3 % with a maximum of 30 mm. For slit skived tape, the exact width is to be agreed upon between purchaser and supplier.

The standard tolerance for length is -0,0; + 2 %.

4.2.2 Moulded sheet

Code			tolerance
a	thickness	< 5 mm	- 0,0; + 0,75 mm
b	thickness	≥ 5 mm	- 0,0; + 15 %

Length and width tolerance shall be - 0,0 mm; + 3 %

4.2.3 Extruded or moulded rods

As extruded or moulded

Code	diameter	tolerance
a	< 10 mm	- 0,0 mm; + 0,6 mm
b	≥ 10 mm	- 0,0 mm; + 6 %

The standard tolerance for length is:

Code	length	tolerance
a	≤ 500 mm	-0,0; + 10 mm
b	> 500 mm	-0,0; + 2 %

Centerless ground

Tolerance on diameter for all diameters: -0,0; + 0,04 mm

Tolerance on length:

Code	length	tolerance
a	≤ 500 mm	-0,0; + 10 mm
b	> 500 mm	-0,0; + 2 %

4.2.4 Thin-walled tube extruded from coagulated dispersion powder

Code			tolerance
a	inner diameter	< 5 mm	± 0,25 mm
b	inner diameter	≥ 5 mm	± 5 %
c	wall thickness	< 1,0 mm	± 0,1 mm
d	wall thickness	≥ 1,0 mm	± 10 %

The standard tolerance for length is -0,0; + 2 %.

4.2.5 **Extruded and moulded tubes**

Code	outer diameter	tolerance inner diameter	outer diameter
a	< 10 mm	- 0,6 mm; + 0	- 0,0; + 0,6 mm
b	≥ 10 mm	- 6 %; + 0	- 0,0; + 6 %

The standard tolerance for length is:

Code	length	tolerance
a	≤ 500 mm	-0,0; + 10 mm
b	> 500 mm	-0,0; + 2 %

The tube shall be capable of being machined concentrically to the required nominal dimensions and the eccentricity of the bore shall not exceed 4,0 % of the nominal inside diameter.

NOTE: The machining of the tube to the nominal dimensions with the inner and outer surfaces concentric is feasible if the maximum inner diameter, calculated by difference between the outer diameter and two times the minimum wall thickness, is within the specified tolerance.

For a moulded tube, the tolerance on the outer diameter shall be a minimum value. A larger diameter than is provided for by the plus tolerance is acceptable for moulded tube, either type P or S that is to be machined to the final dimension.

4.3 **Tensile strength and percentage elongation at break**

The grade for semi-finished products is determined by the minimum values of tensile strength and percentage elongation at break shown in Table 1, determined as specified in ISO 13000-2.

NOTE: There are some configurations of PTFE that might not be able to be produced with a high grade classification.

Table 1

Grade	1	2	3	4
Tensile strength MPa	25	20	15	10
Elongation at break %	280	200	150	75

4.4 **Dimensional stability**

This requirement applies only to type S (stabilized) material.

The maximum change in any dimension shall not exceed 0,5 %, determined as specified in ISO 13000-2.

4.5 Density

All semi-finished products shall have a density in the range of 2,13 to 2,19 g/cm^3 except that:

a. products made from reprocessed material or blends with reprocessed material shall have a density in the range of 2,14 to 2,23 g/cm^3 and

b. tubing extruded from coagulated dispersion powders shall have a density in the range of 2,13 to 2,23 g/cm^3.

4.6 Hardness

All products that have a shape or dimensions such that measurements can be made precisely shall have a ball indentation hardness more than 23 MPa or the hardness determined using the Shore D test shall have a value greater than 54. Both of the hardness tests are described in ISO 13000-2.

4.7 Colour

PTFE that does not contain a colourant shall be white to transparent after sintering. Visual perception of whiteness is usually adequate to appraise this characteristic of semi-finished products. If a quantitative value is required for whiteness, the test procedure in ISO 13000-2 shall be used. The value required shall be as agreed upon between producer and purchaser. If pigment or colourant has been added, its presence shall be reported in all documentation related to a particular product.

NOTE: The presence of pigments or colourants may affect some properties of the material, e. g. chemical resistance and electrical properties, and it is advisable for the purchaser and supplier to agree upon the type and grade of pigment to be used.

4.8 Dielectric strength (DS), breakdown voltage, and electrical flaws

This requirement applies only to materials coded E with specified electrical properties required for an application. The required values for the various shapes reflect the same dielectric strength when corrected for thickness by the standard relationship.

NOTE: The IEC has responsibility for standards related to electrical properties. Since there are, however, no IEC standards that are pertinent to the scope and needs of this International Standard, provision for electrical properties are included in this International Standard. Some references to general IEC standards and specific references to IEC standards for heat shrinkable tubing of PTFE are included in informative annex A.