

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Plastic films for electrical purposes –
Part 3: Specifications for individual materials – Sheet 7: Fluoroethylene-
propylene (FEP) films used for electrical insulation**

**Films plastiques à usages électriques –
Partie 3: Spécifications pour matériaux particuliers – Feuille 7: Films de
fluoroéthylène-propylène (FEP) utilisés dans l'isolation électrique**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

PLASTIC FILMS FOR ELECTRICAL PURPOSES –**Part 3: Specifications for individual materials –
Sheet 7: Fluoroethylene-propylene (FEP) films
used for electrical insulation**

FOREWORD

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IEC 60674-3-7 has been prepared by IEC technical committee 15: Solid electrical insulating materials. It is an International Standard.

This second edition cancels and replaces the first edition published in 1992. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) the title of the standard has been changed to unify the name within the IEC 60674 series;
- b) update of the normative references.

The text of this International Standard is based on the following documents:

Draft	Report on voting
15/980/CDV	15/1002/RVC

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 60674 series, published under the general title *Plastic films for electrical purposes*, can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

[IEC 60674-3-7:2023](https://standards.iteh.ai/catalog/standards/sist/4bddab2a-8caa-4b89-905a-3d5299e8b14b/iec-60674-3-7-2023)

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INTRODUCTION

This document is one of a series which deals with plastic films for electrical purposes. The series will consist of three parts:

Part 1: Definitions and general requirements (IEC 60674-1);

Part 2: Methods of test (IEC 60674-2);

Part 3: Specifications for individual materials (IEC 60674-3).

This document contains one of the sheets comprising Part 3, as follows:

Sheet 7: Fluoroethylene-propylene (FEP) films used for electrical insulation

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PLASTIC FILMS FOR ELECTRICAL PURPOSES –

Part 3: Specifications for individual materials – Sheet 7: Fluoroethylene-propylene (FEP) films used for electrical insulation

1 Scope

This sheet of IEC 60674-3 gives the requirements for fluoroethylene-propylene (FEP) films used for electrical insulation.

Materials which conform to this specification meet established levels of performance. However, the selection of a material by a user for a specific application can be based on the actual requirements necessary for adequate performance in that application and not based on this specification alone.

Safety warning: It is the responsibility of the user of the methods contained or referred to in this document to ensure that they are used in a safe manner.

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.

IEC 60674-1:1980, *Specification for plastic films for electrical purposes – Part 1: Definitions and general requirements*

IEC 60674-2:2016, *Specification for plastic films for electrical purposes – Part 2: Methods of test*

IEC 60757, *Code for designation of colours*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

4 Classification

The FEP film shall be of the following types:

- Type 1: General purpose;
- Type 2: Surface treated to render the surface(s) heat sealable and cementable;
- Type 2A: One side treated;

- Type 2B: Two sides treated.

5 Designation

The plastic film shall be identified by the following designation:

IEC Publication number	Film name abbreviation	Type	Thickness (μm)	Size Width (μm)	Length (m)	Colour
IEC 60674-3-7	FEP	Type 1	100	20	200	nc

Any colour abbreviation shall comply with IEC 60757, where applicable. Non-standard colours shall be written out in full.

EXAMPLE: r = regular; nc = natural colour.

6 General requirement

The material shall be a flexible, self-supporting film made from FEP copolymer. Type 2 shall be surface treated on one or both sides to give heat sealability and cementability.

All types shall conform to the general requirements laid down in IEC 60674-1.

7 Dimensions

7.1 Thickness

The film thickness of Type 1 shall be measured in accordance with the requirements of 4.3.2 of IEC 60674-2:2016. The thickness of Type 2 shall be measured using a micrometer in accordance with 4.2.2 of IEC 60674-2:2016.

The overall thickness shall be in accordance with the nominal thickness and the permitted range of thicknesses given in Table 1.

The following thickness ranges are commonly available:

- Type 1: 12,7 μm to 508 μm ;
- Type 2: 12,7 μm to 127 μm .

Table 1 – Nominal thickness and permitted range of thickness

Type	Nominal thickness µm	Overall permitted range of thickness µm	
		Min.	Max.
1 and 2	12,7	8,9	16,5
1 and 2	25	18	33
1 and 2	51	38	64
1 and 2	76	57	95
1 and 2	127	102	152
1	190	158	223
1	254	216	292
1	356	320	391
1	508	432	584

7.2 Width

The film width shall be measured in accordance with the requirements of Clause 6 of IEC 60674-2:2016.

Preferred widths cannot be given on account of the great variety of applications.

The maximum deviation in film width from the nominal shall be $\pm 1,6$ mm.

8 Film length/roll diameter

There are no requirements in this document for film lengths or diameters of rolls. These should be subject to purchase contract.

9 Properties

9.1 Properties not dependent on thickness

See Table 2.

Table 2 – Property not dependent on thickness for all types

Property	Unit	Requirement	Test method	Remarks
Density	kg/m ³	2 150 ± 20	ISO 1183-2:2019	The recommended mixture is 1,3-dibromopropane and ethylene bromide.
Melting point	°C	Under consideration	ISO 11357-3:2018	DSC method
Relative permittivity 23 °C, 1 kHz	–	≤ 2,15	IEC 60674-2:2016, 18.2 ⁾	Use evaporated metal electrodes or non-contacting electrodes (18.2.4 of IEC 60674-2:2016 or 18.2.5 of IEC 60674-2:2016).
Dissipation factor 23 °C, 48 Hz to 62 Hz 23 °C, 1 kHz 23 °C, 1 MHz	–	≤ 0,000 4 ≤ 0,000 3 ≤ 0,000 6	IEC 60674-2:2016, 18.2 ^{b)}	Use evaporated metal electrodes or non-contacting electrodes (18.2.4 of IEC 60674-2:2016 or 18.2.5 of IEC 60674-2:2016).
Volume resistivity 23 °C 170 °C	Ω·m	≥ 1 × 10 ¹⁶ ≥ 1 × 10 ¹⁵	IEC 60674-2:2016, Clause 17	The test voltages are 100 V for thicknesses > 10 µm and 10 V for thicknesses ≤ 10 µm.
Surface resistivity	Ω	≥ 1 × 10 ¹⁵	IEC 60674-2:2016, Clause 16	

9.2 Properties dependent on thickness

See Table 3.

Table 3 – Properties dependent on thickness for all types

Property	Unit	Requirement					IEC 60674-2:2016 Test method Clause
		Nominal thickness µm					
		12,7	25	51	76	508	
Tensile strength Machine direction and transverse direction	MPa	≥ 14	≥ 17				12 ^{a)}
Elongation at break Machine direction and transverse direction	%	≥ 125	≥ 200	≥ 250			12 ^{a)}
Dimensional change for shrinkage Machine direction and transverse direction	%	≤ 5		≤ 3	≤ 2		25

^{a)} Rate of extension 50 mm/min, reference lines 100 mm apart.

9.3 Electric strength (AC test)

See Table 4.