SLOVENSKI STANDARD
SIST EN 13206:2017+A1:2020

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Polimerni materiali - Prekrivne plastomerne folije za uporabo v kmetijstvu in vrtnarstvu

Plastics - Thermoplastic covering films for use in agriculture and horticulture

Kunststoffe - Thermoplastische Abdeckfolien für den Einsatz in der Landwirtschaft und im Gartenbau

Plastiques - Films de couverture thermoplastiques pour utilisation en agriculture et horticulture

Ta slovenski standard je istoveten z: **EN 13206:2017+A1:2020**

ICS:

65.040.30	Rastlinjaki in druge naprave	Greenhouses and other installations
83.140.10	Filmi in folije	Films and sheets

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Plastics - Thermoplastic covering films for use in agriculture and horticulture

Plastiques - Films de couverture thermoplastiques pour utilisation en agriculture et horticulture

Kunststoffe - Thermoplastische Abdeckfolien für den Einsatz in der Landwirtschaft und im Gartenbau

This European Standard was approved by CEN on 14 November 2016 and includes Amendment 1 approved by CEN on 11 November 2019.

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European foreword

This document (EN 13206:2017+A1:2020) has been prepared by Technical Committee CEN/TC 249 “Plastics”, the secretariat of which is held by NBN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 2020 and conflicting national standards shall be withdrawn at the latest by July 2020.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document includes Amendment 1 approved by CEN on 11 November 2019.

This document supersedes [A1⟩ EN 13206:2017 ⟨A1].

The start and finish of text introduced or altered by amendment is indicated in the text by tags [A1⟩ ⟨A1].

The following technical changes have been made in comparison to EN 13206:2001:

— a minimum thickness of the film is fixed;

— the test methods have been updated as appropriate;

— this revision specifies also test methods for the determination of the chlorine and sulfur contents of the films subjected to use and defines guidelines for installation, use and disposal;

— the classification for the durability of the covering films is extended to a further class.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies the requirements related to dimensional, mechanical, optical and thermal characteristics of thermoplastic films used for covering permanent or temporary greenhouses and walking tunnels and low tunnels used for forcing and semi-forcing vegetable, fruit and flower crops.

Lay-flat perforated cover films are also in the scope of this European Standard.

It specifies a classification for the durability of covering films and the test methods referred to in this standard.

This European Standard specifies also test methods for the determination of the chlorine and sulfur contents of films subjected to use.

This European Standard is applicable to thermoplastic covering films used in agriculture and horticulture in Europe, in the thickness range 20 µm up to more than 250 µm, based on polyethylene and/or ethylene copolymers materials, of the following types: non-thermal films, thermal clear films and thermal diffusing films.

This European Standard also defines guidance for installation, use and disposal of covering films. It defines the conventional expected lifetime, as well as rules that allow evaluating the remaining use potential in the event of a failure before the normal end-of-use date.

NOTE These rules allow estimating the residual value of the films. These provisions only apply to the film itself and the damage it has undergone. Any other problem falls within the scope of professional practices and the general terms and conditions of sale.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 10244-2, *Steel wire and wire products - Non-ferrous metallic coatings on steel wire - Part 2: Zinc or zinc alloy coatings*

EN 13031-1, *Greenhouses - Design and construction - Part 1: Commercial production greenhouses*

EN 16472, *Plastics - Method for artificial accelerated photoageing using medium pressure mercury vapour lamps*

EN ISO 527-1, *Plastics - Determination of tensile properties - Part 1: General principles (ISO 527-1)*

EN ISO 527-3, *Plastics - Determination of tensile properties - Part 3: Test conditions for films and sheets (ISO 527-3)*

A1⟩ EN ISO 4892-1, *Plastics - Methods of exposure to laboratory light sources - Part 1: General guidance (ISO 4892-1)* ⟨A1

EN ISO 4892-2:2013, *Plastics - Methods of exposure to laboratory light sources - Part 2: Xenon-arc lamps (ISO 4892-2:2013)*

EN ISO 4892-3:2016, *Plastics - Methods of exposure to laboratory light sources - Part 3: Fluorescent UV lamps (ISO 4892-3)*

EN ISO 7765-1:2004, *Plastics film and sheeting - Determination of impact resistance by the free-falling dart method - Part 1: Staircase methods (ISO 7765-1:1988)*

ISO 4591, *Plastics - Film and sheeting - Determination of average thickness of a sample, and average thickness and yield of a roll, by gravimetric techniques (gravimetric thickness)*

ISO 4592, *Plastics - Film and sheeting - Determination of length and width*

ISO 4593, *Plastics - Film and sheeting - Determination of thickness by mechanical scanning*

ASTM D 1003-13, *Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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/

3.1
width
overall width of a film when laid flat

Note 1 to entry: It is expressed in millimetres.

3.2
nominal width
width of a film, as declared by the manufacturer/supplier

Note 1 to entry: It is expressed in millimetres.

3.3
nominal thickness
thickness of a film, as declared by the manufacturer/supplier

Note 1 to entry: It is expressed in micrometres (µm).

3.4
roll length
largest dimension of the film corresponding to the length of the unwinded roll

Note 1 to entry: It is expressed in metres.

3.5
nominal length
length of a film roll or sheet, as declared by the manufacturer/supplier

Note 1 to entry: It is expressed in metres.

3.6
nominal mass
mass of a roll or sheet, as declared by the manufacturer/supplier

Note 1 to entry: It is expressed in kilograms.

3.7
longitudinal direction
MD
direction parallel to the roll length, corresponding to the extrusion direction

3.8
transverse direction
TD
direction parallel to the width (at right angle to the length)

3.9
conventional expected lifetime
expected lifetime defined by agreement between the manufacturer/supplier and the customer or, by default, the minimum use duration that the film needs to satisfy

Note 1 to entry: It is expressed in years, months or seasons.

3.10
actual useful lifetime
time interval defined as beginning from the installation date of a film until its removal or an earlier date in case of its failure

Note 1 to entry: It is expressed in months, years or seasons.

3.11
use ratio
ratio of the actual useful lifetime of a film to its conventional expected lifetime

Note 1 to entry: It is expressed as a dimensionless ratio or as a percentage (%).

3.12
remaining use potential
difference between the conventional expected lifetime of a film and its actual useful lifetime

Note 1 to entry: It is expressed in months.

3.13
radiant exposure
H
time integral of irradiance, measured in joules per square metre (J/m^2)

[SOURCE: ISO 9370:2009, definition 3.27 [1]]

4 Types and use

The different types of covering films, their optical and thermal characteristics and use are given in Table 1.

Table 1 — Characteristics and use of covering films

Type	Optical and thermal characteristics	Use
Non-thermal (NTh)	Low IR effectiveness	Forcing and semi forcing crops
Thermal clear (ThC)	High transparency High IR effectiveness	Same use as normal film, when higher IR effectiveness is requested
Thermal diffusing (ThD)	Diffusing light High IR effectiveness	Same use as normal film, when higher IR effectiveness and diffusing light effect are requested

5 Material

Covering films according to this standard are usually manufactured from:

— low density polyethylene (PE-LD), linear low density polyethylene (PE-LLD) and their blends;

— ethylene vinyl acetate copolymers (EVAC) and their blends with PE-LD or PE-LLD;

— ethylene butyl acrylate copolymers (EBA) and their blends with PE-LD or PE-LLD.

6 Durability

The durability of covering films is characterized by the class N, A, B, C, D, E or F. This classification, given in Table 2, is depending on the duration of exposure of the film to an artificial weathering using xenon-arc lamps according to 8.9, which induces a decrease of the value of tensile strain at break equal or less than 50 % of the initial value.

The class of durability shall be declared by the manufacturer.

A1

Table 2 — Resistance to weathering classification

Class	Minimum duration of exposure h	
	At irradiance (narrowband – 340 nm) 0,35 W/(m²·nm)	At irradiance (narrowband – 340 nm) 0,51 W/(m²·nm)
N	400	280
A	2 000	1 400
B	3 500	2 450
C	5 400	4 070
D	6 800	4 670
E	8 500	5 830
F	10 700	7 350

A1

For films intended to be used outside of Europe, longer durations of exposures than this for Class F can be required. In this case, the minimum duration of exposure shall be defined by agreement between the manufacturer/supplier and the customer.

Other light sources may be used provided that a correlation between the test results obtained with these light sources and these obtained after a natural exposure can be demonstrated. This may be useful when the durations of the exposure to xenon-arc lamps as defined in Table 2 are too long. Details of these methods are given in Annex A (informative).

In case of dispute, the exposure to xenon-arc lamps according to 8.9 and the classification according to Table 2 shall be used.

〈A1〉 NOTE An empirical correlation between durability of covering films for greenhouses exposed to artificial weathering and natural exposure is given in Annex B (informative). The correlation study has been performed at an irradiance in narrow band (340 nm) equal to 0,35 W/(m²·nm). 〈A1〉

7 Requirements

7.1 General requirements

Non-thermal films, thermal clear films and thermal diffusing films shall fulfil the requirements of Tables 3 to 5, respectively.

Table 3 — Requirements for non-thermal films

Characteristics	Unit	Nominal thickness					Test method Subclause
	µm	≥ 20 [a]	≥ 60 [b]	≥ 100 [c]	≥ 150 [d]	≥ 200	
Appearance	-	Shall conform to 7.2					7.2
Dimensional characteristics							
Tolerance of average thickness/nominal thickness	%	±5					8.1
Tolerance of single point thickness/nominal thickness	%	- 15, +25					8.1
Width tolerance/nominal width Flat film Tubular film	 % %	 0, +4 0, +2,4					8.2
Tolerance roll length/nominal length	%	0, +4					8.12
Mechanical characteristics on unexposed film							
Tensile stress at break (MD, TD)	MPa	≥ 19					8.3
Tensile strain at break (MD, TD)	%	≥ 250	≥ 300	≥ 350	≥ 400	≥ 450	8.3
Impact resistance							
Flat area	g	≥ 100	≥ 150	≥ 300	≥ 350	≥ 450	8.4.2
Fold area	g	≥ 75	≥ 100	≥ 150	≥ 200	≥ 250	8.4.3
Optical characteristic on unexposed film							
Visible light transmission	%	≥ 90	≥ 88	≥ 88	≥ 85	≥ 85	8.6

[a] 20 µm ≤ nominal thickness < 60 µm.

[b] 60 µm ≤ nominal thickness < 100 µm.

[c] 100 µm ≤ nominal thickness < 150 µm.

[d] 150 µm ≤ nominal thickness < 200 µm.

Table 4 — Requirements for thermal clear films

Characteristics	Unit	Nominal thickness					Test method Subclause
	µm	≥ 25 [a]	≥ 60 [b]	≥ 100 [c]	≥ 150 [d]	≥ 200	
Appearance	-	Shall conform to 7.2					7.2
Dimensional characteristics							
Tolerance of average thickness/nominal thickness	%	±5					8.1
Tolerance of single point thickness/nominal thickness	%	- 15, +25					8.1
Width tolerance/nominal width Flat film Tubular film	 % %	 0, +4 0, +2,4					8.2
Tolerance roll length/nominal length	%	0, +4					8.12
Mechanical characteristics on unexposed film							
Tensile stress at break (MD, TD)	MPa	≥ 20					8.3
Tensile strain at break (MD, TD)	%	≥ 300	≥ 350	≥ 400	≥ 450	≥ 550	8.3
Impact resistance							
Flat area	g	≥ 150	≥ 250	≥ 350	≥ 500	≥ 650	8.4.2
Fold area	g	≥ 75	≥ 100	≥ 200	≥ 350	≥ 400	8.4.3
Elongation under a steady load (MD)	%	≤ 30	≤ 30	≤ 30	≤ 30	≤ 30	8.5
Optical characteristic on unexposed film							
Visible light transmission	%	≥ 92	≥ 90	≥ 90	≥ 88	≥ 88	8.6
Haze	%	≤ 20	≤ 25	≤ 25	≤ 30	≤ 30	8.7
IR effectiveness	%	≥ 40	≥ 50	≥ 55	≥ 65	≥ 75	8.8

[a] 25 µm ≤ nominal thickness < 60 µm.

[b] 60 µm ≤ nominal thickness < 100 µm.

[c] 100 µm ≤ nominal thickness < 150 µm.

[d] 150 µm ≤ nominal thickness < 200 µm.

Table 5 — Requirements for thermal diffusing films

Characteristics	Unit	Nominal thickness					Test method Subclause
	µm	≥ 25 [a]	≥ 60 [b]	≥ 100 [c]	≥ 150 [d]	≥ 200	
Appearance	-	Shall conform to 7.2					7.2
Dimensional characteristics							
Tolerance of average thickness/nominal thickness	%	±5					8.1
Tolerance of single point thickness/nominal thickness	%	- 15, +25					8.1
Width tolerance/nominal width Flat film Tubular film	 % %	 0, +4 0, +2,4					8.2
Tolerance roll length/nominal length	%	0, +4					8.12
Mechanical characteristics on unexposed film							
Tensile stress at break (MD, TD)	MPa	≥ 20					8.3
Tensile strain at break (MD, TD)	%	≥ 200	≥ 220	≥ 350	≥ 400	≥ 500	8.3
Impact resistance							
Flat area	g	≥ 100	≥ 160	≥ 300	≥ 400	≥ 500	8.4.2
Fold area	g	≥ 75	≥ 110	≥ 200	≥ 250	≥ 350	8.4.3
Elongation under a steady load (MD)	%	≤ 30	≤ 30	≤ 30	≤ 30	≤ 30	8.5
Optical characteristic on unexposed film							
Visible light transmission	%	≥ 88	≥ 85	≥ 85	≥ 80	≥ 80	8.6
Haze	%	≥ 30	≥ 30	≥ 30	≥ 35	≥ 35	8.7
IR effectiveness	%	≥ 40	≥ 55	≥ 60	≥ 70	≥ 75	8.8

[a] 25 µm ≤ nominal thickness < 60 µm.

[b] 60 µm ≤ nominal thickness < 100 µm.

[c] 100 µm ≤ nominal thickness < 150 µm.

[d] 150 µm ≤ nominal thickness < 200 µm.

7.2 Requirement for appearance

The free edges of the roll shall be sealed with adhesive tape or by some other similar means, in order to prevent its unwinding.

The edges shall be properly in line and there shall be sufficient tension to prevent the layers of the roll from transverse slipping when it is handled.

The film shall be homogeneous and free from visible defects which may affect the fitness for purpose of the film; check by unrolling at least 2 m of the film and examining it against the light holding it tight at arm's length.

8 Test methods

8.1 Determination of thickness

The thickness of single points of the film shall be determined in accordance with ISO 4593. The average thickness of the film shall be determined in accordance with ISO 4591 or ISO 4593. Testing shall be performed using one strip of film cut in transverse direction of the roll (TD).

8.2 Determination of width

The width of the film shall be determined in accordance with ISO 4592.

8.3 Determination of tensile characteristics

The tensile characteristics shall be determined according to EN ISO 527-1 and EN ISO 527-3 using five test pieces type 2, with a width of 10 mm, cut in each direction of the film, longitudinal direction (MD) and transversal direction (TD), at a testing speed of 500 mm/min.

Calculate the arithmetic average value of the five measurements.

The arithmetic average value shall fulfil the requirements of Tables 3 to 5, as applicable.

8.4 Determination of impact resistance

8.4.1 General

NOTE Films which are wider than 2 000 mm are usually folded lengthwise at least once before winding on a reel. These folds are retained even when the film is laid out flat, and this may affect test results.

In case of a folded film, a distinction shall be made between the test pieces taken from the folds (fold area) and sample sheets taken from areas which have not been folded (flat area).

8.4.2 Flat area

The impact resistance (Dart drop test) in flat area shall be determined in accordance with EN ISO 7765-1:2004, method A.

Calculate the impact failure mass m_f, in grams, in accordance with EN ISO 7765-1.

The impact failure mass m_f shall fulfil the requirements of Tables 3 to 5, as applicable.

8.4.3 Fold area

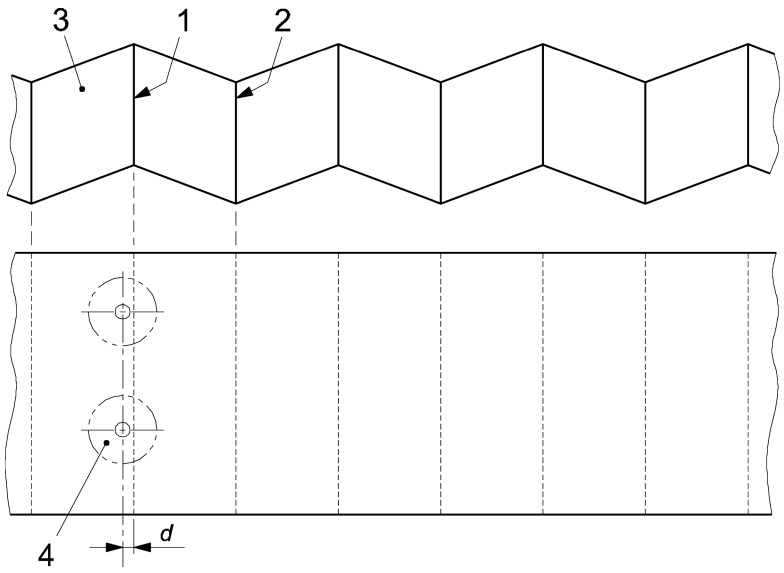
The impact resistance (Dart drop test) in fold area shall be determined using the apparatus specified in EN ISO 7765-1:2004, method A.

Spread out the film with the marked face onto the apparatus and test every folds tangentially twice, alternately internal and external folds, with a mass as specified in Tables 3, 4, 5, as applicable. The tangential test is obtained by shifting forward the fold of 13 mm from the vertical axle of the specimen clamp. See Figure 1.

If no failure occurs, the result is declared “pass”.

If one failure occurs, carry out two additional tests on the fold which failed in the same position (internal or external fold). Then, if no failure occurs, the result is declared “pass” and if one or two failure(s) occur(s), the result is declared “fail”.

If two failures occur, the result is declared “fail”.



Key

1 external fold

2 internal fold

3 film

4 vertical axle of the specimen clamps

where:

d = 13 mm

Figure 1 — Position of impact on folds

8.5 Determination of elongation under a steady load (creep test)

8.5.1 Principle

This test method is intended to measure the creep, expressed as the elongation of the film under a steady load in a vertical static position after a specified time period.

8.5.2 Apparatus

A typical arrangement for testing is shown in Figure 2. The test piece is hold by two grips, the upper grip is clamped to a fixed support and a weight is hung to the lower grip to provide a steady load on the test piece.