SLOVENSKI STANDARD
SIST EN 14932:2007

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Polimerni materiali - Raztegljive plastomerne folije za zavijanje v bale - Zahteve in preskusne metode

Plastics - Stretch thermoplastic films for wrapping bales - Requirements and test methods

Kunststoffe - Thermoplastische Stretchfolien zum Umwickeln von Ballen - Anforderungen und Prüfverfahren

Plastiques - Films thermoplastiques étirables pour l' enrubannage de balles - Exigences et méthodes d'essai

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55.040	Materiali in pripomoļki za pakiranje	Packaging materials and accessories
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Plastics - Stretch thermoplastic films for wrapping bales - Requirements and test methods

Plastiques - Films thermoplastiques étirables pour l' enrubannage de balles - Exigences et méthodes d'essai

Kunststoffe - Thermoplastische Stretchfolien zum Umwickeln von Ballen - Anforderungen und Prüfverfahren

This European Standard was approved by CEN on 9 November 2006.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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Foreword

This document (EN 14932:2006) has been prepared by Technical Committee CEN/TC 249 “Plastics”, the secretariat of which is held by IBN/BIN.

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of an identical text or by endorsement, at the latest by June 2007, and conflicting national standards shall be withdrawn at the latest by June 2007.

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

Introduction

The biological and practical requirements for silage stretch films and the interactions with the machinery, used for the wrapping and handling of round bales, have been considered for the design of this European Standard. However, it is difficult to simulate in laboratory conditions some parameters like leak tightness, oxygen permeability, temperature and the manner they interact.

In order to obtain a high quality for silage it is very important to restrict unwanted microbiological activities to very low levels. Carbon dioxide producing processes can be suppressed by high partial pressure of CO_2 inside the bales. Aerobic processes are, of course, suppressed by low oxygen pressure. Consequently, the wrapped bale should be as gas tight as possible. Therefore this European Standard recommends using 6 layers of film as a minimum.

This European Standard does not include as mandatory a test method for the determination of leak tightness on artificial bale. Nevertheless it is recommended for the manufacturers of stretch films to check this property near an appropriate testing laboratory.

There are discussions regarding how the temperature inside the bale will influence how different types of "good" and "bad" microbiological activities will develop in forage. Although the film can be made of any colour, it is a fact that the pigmentation or colour itself will influence the temperature inside the bale, due to sun-radiation. Therefore, this European Standard also includes a method for the determination of the solar reflectance of stretch films.

1 Scope

This European Standard specifies the requirements for dimensional, mechanical and optical characteristics of stretch thermoplastic films for wrapping round bales used for outdoor ensiling of forage.

This European Standard specifies classifications for durability and solar reflectance of stretch films for wrapping round bales.

This European Standard specifies also test methods to check these requirements.

This European Standard is applicable to white, black or coloured films based on polyethylene and/or ethylene copolymers. The range of film widths considered is from 250 mm up to 1 000 mm.

NOTE 6 layers of stretch films, pre stretched up to 80 %, should be used for wrapping round bales.

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.

EN 2155-5, *Aerospace series — Test methods for transparent materials for aircraft glazing — Part 5: Determination of visible light transmission*

EN ISO 527-1, *Plastics — Determination of tensile properties — Part 1: General principles (ISO 527-1:1993 including Corr 1:1994)*

EN ISO 527-3, *Plastics — Determination of tensile properties — Part 3: Test conditions for films and sheets (ISO 527-3:1995)*

EN ISO 4892-2:2006, *Plastics — Method of exposure to laboratory light sources — Part 2: Xenon-arc lamps (ISO 4892-2:2006)*

EN ISO 6383-2, *Plastics — Film and sheeting — Determinations of tear resistance — Part 2: Elmendorf method (ISO 6383-2:1983)*

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

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

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

ISO 9845-1, *Solar energy — Reference solar spectral irradiance at the ground at different receiving conditions — Part 1: Direct normal and hemispherical solar irradiance for air mass 1,5*

ISO 15105-2:2003, *Plastics — Film and sheeting — Determination of gas-transmission rate — Part 2: Equal-pressure method*

3 Terms and definitions

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

3.1
width
total width of the film when laid flat, given in millimetres

3.2
nominal width (W_0)
width declared by the manufacturer in millimetres

3.3
nominal thickness
thickness of the film, as declared by the manufacturer, in micrometres (µm)

3.4
length of the film
largest dimension of the film corresponding to the length of the un-winded roll, in metres

3.5
nominal length *(L_0)*
length of the film, as declared by the manufacturer, in metres

3.6
longitudinal direction of the film (MD)
direction parallel to the length of the film corresponding to the extrusion direction

3.7
transverse direction of the film (TD)
direction parallel to the width (at right angles to the length)

3.8
core protrusion
distance from the edge of the roll to the edge of the core, in millimetres

3.9
neck-in (N_i)
shrinkage of the film in the transverse direction (TD) induced by the stretching of the film in longitudinal direction (MD), in % (see 9.5)

3.10
tightening force
force applied on the film after 10 min to maintain a tensile strain of a value of 50 %, in Newton (N)

4 Materials

Stretch films for wrapping bales according this European Standard are usually manufactured from:

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

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

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

5 Solar reflectance

The solar reflectance of stretch films is defined by the classes “High reflectance” and “Low reflectance”. This classification, given in Table 1, is depending of the value of solar reflectance measured on one layer of unstretched film according to Annex A.

The class of solar reflectance shall be declared by the manufacturer.

Table 1 — Classification according to solar reflectance

Class of film	Solar reflectance R_s %
High reflectance	≥ 28
Low reflectance	< 28

6 Durability

The durability of stretch films is defined by the classes A and B. This classification, given in Table 2, is depending of the duration of exposure of the film to an artificial weathering, conforming to 9.13, 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.

Table 2 — Classification according to artificial weathering

Class of film	Duration of exposure h
A	1 400
B	2 500

NOTE Usually an empirical correlation between the durations of stretch films exposed to artificial weathering (according to 9.13) and the durations of natural weathering is the following:

— Class A corresponds to an exposure of 1 year in the North of Europe;

— Class B corresponds to an exposure of 1 year in the South of Europe.

7 Airtightness and oxygen permeability on bale

The final result of silageing is very much depending on the total airtightness of the bale. There are a lot of parameters involved that can influence measurable properties as film permeability, cling force, holding force, but also properties that is difficult to measure with laboratory equipment such as wrinkles, tiger stripes, film appearance when stretched and others.

Annex F gives guidance for assessing the airtightness and the oxygen permeability on an artificial bale.

8 Requirements

8.1 General requirements

Stretch films shall fulfil the requirements of Table 3.

The nominal thickness and nominal width shall be declared by the manufacturer.

Table 3 — Requirements for stretch films for wrapping round bales

Characteristics	Unit	Requirements	Test method
Appearance		Regular	See 8.2
Nominal thickness	µm	≥ 25	
Tolerance of average thickness/ nominal thickness	%	- 8, + 12	ISO 4593
Tolerance of single point thickness/ nominal thickness	%	- 20, + 28	ISO 4593
Nominal width W_0	mm	$250 \leq W_0 \leq 1\,000$	
Width tolerance	mm	$W_0 - 5 \leq W_0 \leq W_0 + 5$	ISO 4592
Core protrusion	mm	Min 3, Max 10	See 9.3
Length of film	m	≥ 99,0 % L_0	See 9.4
Neck-in	%	< 25	See 9.5
Tensile stress at break in (MD) in (TD)	 MPa MPa	 ≥ 25 ≥ 23	 EN ISO 527-3
Tensile stress at yield in (MD,TD)	 MPa	 ≥ 9	 EN ISO 527-3
Tensile strain at break in (MD) in (TD)	 % %	 ≥ 400 ≥ 600	EN ISO 527-3
Impact resistance	g	≥ 120	Method A of EN ISO 7765-1
Perforation resistance properties Maximum force Total energy	 N J	 ≥ 4 ≥ 0,04	Annex C
Tightening force	N	≥ 1,75	Annex D
Tear resistance	cN	≥ 120 in MD ≥ 400 in TD	EN ISO 6383-2
Adhesion	cN	> 300	Annex E
Total light transmission	%	< 75	EN 2155-5
Coefficient of oxygen permeability [a]	$cm^3/(m^2 \cdot 24\ h)$	< 1 400	Annex A of ISO 15105-2:2003
[a] Checked on 6 layers of un-stretched film.			

8.2 Requirement for appearance

The edges of the reels shall be straight. The winding shall be without bubbles and wrinkles affecting film quality on the face of the roll.

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

9 Test methods

9.1 Determination of thickness

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

9.2 Determination of width

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

9.3 Determination of core protrusion

The core protrusion shall be measured on each side of the roll. The value shall be expressed in mm.

9.4 Determination of length of film

The length of the film shall be determined by unwinding the roll with a calibrated reel in contact continuously with its outside surface (see Figure 1). The calibrated reel is connected to a revolution counter. The diameter of the calibrated reel is measured with an accuracy of ± 0,2 %. The roll is totally unwound at a speed of 100 m/min ± 10 m/min.

The value of the length of the film is calculated with the following equation:

$l = n \times \pi d$

where

— l is the value of the length of the film, expressed in m;

— n is the number of revolutions of the calibrated reel during the total unwinding of the roll;

— d is the value of the diameter of the calibrated reel, expressed in m.