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**Plastics — Film and sheeting — Biaxially  
oriented polypropylene (PP) films**

*Plastiques — Film et feuille — Films en polypropylène (PP) bi-orientés*

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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.

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 17555 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 11, *Products*.

It is based on Japanese Standard JIS Z 1712:1997.

# Plastics — Film and sheeting — Biaxially oriented polypropylene (PP) films

## 1 Scope

This International Standard specifies the requirements for biaxially oriented polypropylene (PP) films, which are mainly used for packaging. The film may be used alone or in laminates with other films.

This International Standard applies only to films composed of more than 95 % (by mass) of polypropylene.

## 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 291:1997, *Plastics — Standard atmospheres for conditioning and testing*

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

ISO 4593:1993, *Plastics — Film and sheeting — Determination of thickness by mechanical scanning*

ISO 8296:1987, *Plastics — Film and sheeting — Determination of wetting tension*

ISO 14782:1999, *Plastics — Determination of haze for transparent materials*

ISO 15106-1:2003, *Plastics — Film and sheeting — Determination of water vapour transmission rate — Part 1: Humidity detection sensor method*

ISO 15106-2:2003, *Plastics — Film and sheeting — Determination of water vapour transmission rate — Part 2: Infrared detection sensor method*

ISO 15106-3:2003, *Plastics — Film and sheeting — Determination of water vapour transmission rate — Part 3: Electrolytic detection sensor method*

## 3 Classification

Films are classified into two types as shown in Table 1.

**Table 1 — Classification of films**

Type 1	Film subjected to corona discharge, flame or plasma treatment
Type 2	Film not subjected to corona discharge, flame or plasma treatment

## 4 Requirements

### 4.1 Appearance

Films shall be visibly free of flaws, slackness, wrinkles, stains, foreign matter or marks which could impair their serviceability.

The splicing of two films in a roll should preferably be prominently marked to provide a visible indication when the roll is viewed from the end. The method of marking the splice should be agreed upon between the interested parties.

NOTE One acceptable method of doing this is to use coloured adhesive tape.

### 4.2 Dimensions

#### 4.2.1 General

For any individual film selected at random from any delivery, the following dimensions, including their nominal values, shall be as agreed upon between the interested parties.

#### 4.2.2 Width

The film width shall lie between the nominal width and a value 4 mm wider than the nominal width.

Examples of possible widths are shown in Table 2.

**Table 2 — Examples of nominal widths of films and associated tolerances**

Nominal width mm	Tolerance on width mm
$500 + 40n$	$\begin{matrix} +4 \\ 0 \end{matrix}$
NOTE $n$ is an integer, 0, 1, 2, ..., giving width steps of 40 mm.	

#### 4.2.3 Length of film in roll

The length of film in a roll shall lie between the nominal length and a value 1 % longer than the nominal length.

Examples of possible lengths are shown in Table 3.

**Table 3 — Examples of nominal lengths of film in a roll and associated tolerances**

Nominal length m	Length in roll km	Tolerance m
1 000	1	$\begin{matrix} +10 \\ 0 \end{matrix}$
2 000	2	$\begin{matrix} +20 \\ 0 \end{matrix}$
4 000	4	$\begin{matrix} +40 \\ 0 \end{matrix}$
6 000	6	$\begin{matrix} +60 \\ 0 \end{matrix}$
8 000	8	$\begin{matrix} +80 \\ 0 \end{matrix}$
> 8 000	> 8	+ 1 % of nominal length

#### 4.2.4 Inside diameter of core of roll

The inside diameter of the core of the roll should preferably be  $76^{+2}_0$  mm or  $152^{+2}_0$  mm.

#### 4.2.5 Thickness

The average film thickness shall be within  $\pm 10\%$  of the nominal value.

Examples of possible thicknesses are shown in Table 4.

**Table 4 — Examples of thicknesses and associated tolerances**

Nominal thickness $\mu\text{m}$	Thickness of film $\mu\text{m}$	Tolerance $\mu\text{m}$
12	12	$\pm 1,2$
15	15	$\pm 1,5$
20	20	$\pm 2,0$
25	25	$\pm 2,5$
30	30	$\pm 3$
40	40	$\pm 4$
50	50	$\pm 5$
60	60	$\pm 6$

### 4.3 Properties

The properties of films shall meet the requirements specified in Table 5 and Table 6.

**Table 5 — Properties of film dependent on direction**

Property	Unit	Requirements		Testing in accordance with Subclause
		Longitudinal <sup>a</sup>	Transverse <sup>b</sup>	
Tensile strength at break	MPa	$\geq 100$	$\geq 100$	5.4
Tensile strain at break	%	$\leq 270$	$\leq 150$	5.4
Dimensional change on heating	120 °C for 15 min	$\leq 10,0$	$\leq 8,0$	5.5
	130 °C for 5 min	$\leq 10,0$	$\leq 8,0$	5.5
Coefficient of water vapour transmission <sup>c</sup>	$\text{g}/100 \mu\text{m}/(\text{m}^2 \cdot \text{d})$	$\leq 2,0$		5.6

<sup>a</sup> Longitudinal: direction parallel to extrusion direction.  
<sup>b</sup> Transverse: direction perpendicular to extrusion direction.  
<sup>c</sup> At 40 °C, 90 % relative humidity.

**Table 6 — Properties of film dependent on type of film**

Property	Unit	Requirements		Testing in accordance with Subclause
		Type 1	Type 2	
Haze <sup>a</sup>	%	$\leq 5,0$	$\leq 4,0$	5.7
Wetting tension	mN/m	$\geq 36$	$< 35$	5.8

<sup>a</sup> Only relevant to transparent films.

#### 4.4 Physiological behaviour

For applications involving food contact, the film shall conform to all applicable regulatory requirements.

### 5 Test methods

#### 5.1 Conditioning of specimens and test conditions

Determine the tensile properties, haze and wetting tension at  $(23 \pm 2) ^\circ\text{C}$  and  $(50 \pm 5) \% \text{ R.H.}$  in accordance with ISO 291, after conditioning the specimens for at least 4 h under the same conditions. Condition specimens for the determination of dimensional change on heating under the same conditions.

#### 5.2 Appearance examination

Check the appearance of the film with the naked eye.

#### 5.3 Dimensions

##### 5.3.1 Width

Measure the width of the film using a graduated metal ruler.

##### 5.3.2 Inside diameter of core of roll

Measure the inside diameter of the core of a roll using vernier calipers.

##### 5.3.3 Thickness

Measure the thickness of the film in accordance with ISO 4593 at ten equidistant points across the width of the film, using a dial gauge or equivalent. Report the thickness as the arithmetic mean of the ten measurements, to the nearest  $1 \mu\text{m}$ .

#### 5.4 Tensile strength and tensile strain at break

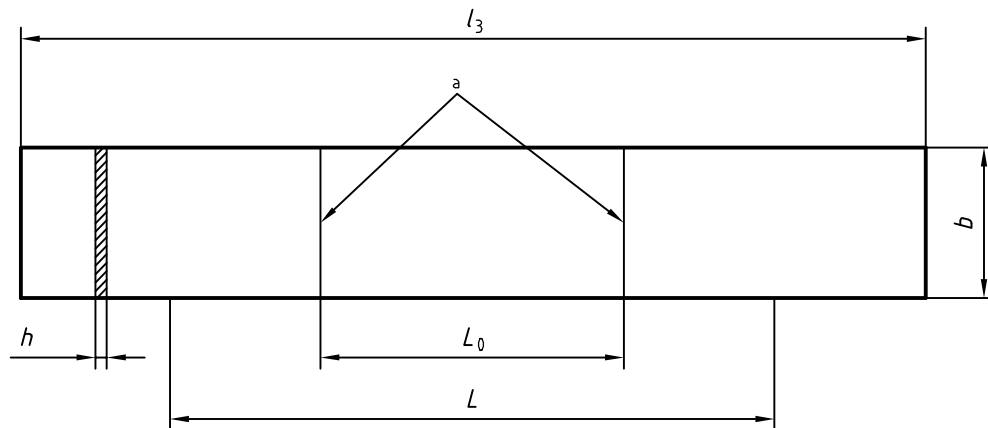
Determine the tensile strength and tensile strain at break in accordance with ISO 527-3. Test five specimens of dimensions as shown in Figure 1. The test speed shall be  $(100 \pm 10) \text{ mm/min}$ ,  $(200 \pm 20) \text{ mm/min}$  or  $(300 \pm 30) \text{ mm/min}$ .

#### 5.5 Dimensional change on heating

##### 5.5.1 Preparation of specimens

Prepare five specimens of 20 mm in width and 150 mm in length for both the longitudinal direction and the transverse direction. Mark off a 100 mm gauge length in the central portion of the specimen, each mark being approximately 25 mm from the end.



**Key**

- $b$  width: 10 mm to 25 mm
- $h$  thickness:  $\leq 1$  mm
- $L_0$  gauge length:  $(50 \pm 0,5)$  mm
- $L$  initial distance between grips:  $(100 \pm 5)$  mm
- $l_3$  overall length:  $\geq 150$  mm
- $a$  Gauge marks.

**Figure 1 — Specimen for tensile testing****5.5.2 Procedure**

Suspend the specimens vertically in a circulating-air oven kept at  $(120 \pm 3) ^\circ\text{C}$  for 15 min or  $(130 \pm 3) ^\circ\text{C}$  for 5 min. After removal from the oven, allow the specimens to cool for 30 min to room temperature. Measure the length between the marks. Calculate the dimensional change of each of the five specimens using the following equation:

$$S = \frac{L_1 - L_2}{L_1} \times 100$$

where

- $S$  is the dimensional change on heating, in percent;
- $L_1$  the length between the marks before heating, in millimetres;
- $L_2$  is the length between the marks after heating, in millimetres.

Report the arithmetic mean of the five results.

## 5.6 Coefficient of water vapour transmission

Determine the water vapour transmission rate in accordance with ISO 15106-1, ISO 15106-2 or ISO 15106-3. From the result, calculate the coefficient of water vapour transmission, expressed per 100 µm of thickness, from the following equation:

$$PWV = WVTR \times \frac{h}{100}$$

where

PWV is the coefficient of water vapour transmission, in grams per 100 µm thickness per square metre day [g/100 µm/(m<sup>2</sup>·d)];

WVTR is the water vapour transmission rate, in grams per square metre day [g/(m<sup>2</sup>·d)];

*h* is the thickness of the specimen, in micrometres.

## 5.7 Haze

Determine the haze in accordance with ISO 14782.

## 5.8 Wetting tension

Determine the wetting tension in accordance with ISO 8296.

# 6 Packaging

The packaging and the size of the unit package shall be as agreed between the interested parties, taking into account the conditions of transportation and storage.

# 7 Marking

## 7.1 Marking on products

If applicable, the fact that the surface of the film has been subjected to corona discharge, flame or plasma treatment shall be clearly indicated.

## 7.2 Marking on packaging

The following shall be marked on the package:

- a) the name of the product;
- b) the classification, i.e. whether the film has been treated or not (see Table 1);
- c) the nominal thickness, width and length of the film in the roll;
- d) the year and month of manufacture;
- e) the manufacturer's name or trademark.

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**ICS 83.140.10**

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