INTERNATIONAL STANDARD

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Plastics — Film and sheeting — Cast polypropylene (PP) films

Plastiques — Film et feuille — Films de polypropylène (PP) moulés

Reference number
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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 17557 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 11, *Products*.

It is based on Japanese Standard JIS Z 1713:1997.

Plastics — Film and sheeting — Cast polypropylene (PP) films

1 Scope

This International Standard specifies the requirements for cast polypropylene (PP) films, which are mainly used for packaging.

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 8295:1995, *Plastics — Film and sheeting — Determination of coefficients of friction*

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 four types as shown in Table 1.

Table 1 — Classification of films

Type 1	Homopolymer[a] film subjected to corona discharge or flame treatment
Type 2	Homopolymer[a] film not subjected to corona discharge or flame treatment
Type 3	Copolymer[b] film subjected to corona discharge or flame treatment
Type 4	Copolymer[b] film not subjected to corona discharge or flame treatment

[a] Containing more than 95 % by mass of propylene.

[b] Containing 50 % to 95 % by mass of propylene.

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 5 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
$500 + 40n$	$^{+5}_{0}$
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	$^{+10}_{0}$
2 000	2	$^{+20}_{0}$
4 000	4	$^{+40}_{0}$
6 000	6	$^{+60}_{0}$
8 000	8	$^{+80}_{0}$
$>$ 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 thickness.

Examples of possible thicknesses are shown in Table 4.

Table 4 — Examples of thicknesses and associated tolerances

Nominal thickness μm	Thickness of film μm	Tolerance μm
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.

Table 5 — Properties of film

Properties		Unit	Requirements				Testing in accordance with Subclause
			Type 1	Type 2	Type 3	Type 4	
Tensile strength at break	Longitudinal[a] Transverse[b]	MPa	$\geqslant$ 34 $\geqslant$ 21				5.4
Tensile strain at break	Longitudinal[a] Transverse[b]	%	$\geqslant$ 280 $\geqslant$ 380				5.4
Coefficient of water vapour transmission[c]		g/100 μm/(m^2·d)	$\leqslant$ 4,0		$\leqslant$ 5,0		5.5
Haze[d]	$h \leqslant$ 30 μm 30 μm $< h \leqslant$ 60 μm	%	$\leqslant$ 7,0 $\leqslant$ 12,0				5.6
Wetting tension		mN/m	$\geqslant$ 34	$<$ 33	$\geqslant$ 34	$<$ 33	5.7
Coefficient of dynamic friction (between surfaces without corona treatment)		—	$\leqslant$ 0,5				5.8
Threshold heat-sealing temperature (between surfaces without corona treatment)[e]		°C	$\geqslant$ 145		$<$ 145		5.9

[a] Longitudinal: direction parallel to extrusion direction.

[b] Transverse: direction perpendicular to extrusion direction.

[c] At 40 °C, 90 % relative humidity.

[d] Only relevant to transparent films.

[e] The threshold heat-sealing temperature is the lowest temperature at which the sealing strength is 3 N per 15 mm of width.

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, coefficient of dynamic friction, wetting tension and threshold heat-sealing temperature at $(23 \pm 2)\ ^{\circ}C$ and (50 ± 5) % R.H. in accordance with ISO 291, after conditioning the specimens for at least 4 h 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 μm.

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 ± 10) mm/min, (200 ± 20) mm/min or (300 ± 30) mm/min.

5.5 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:

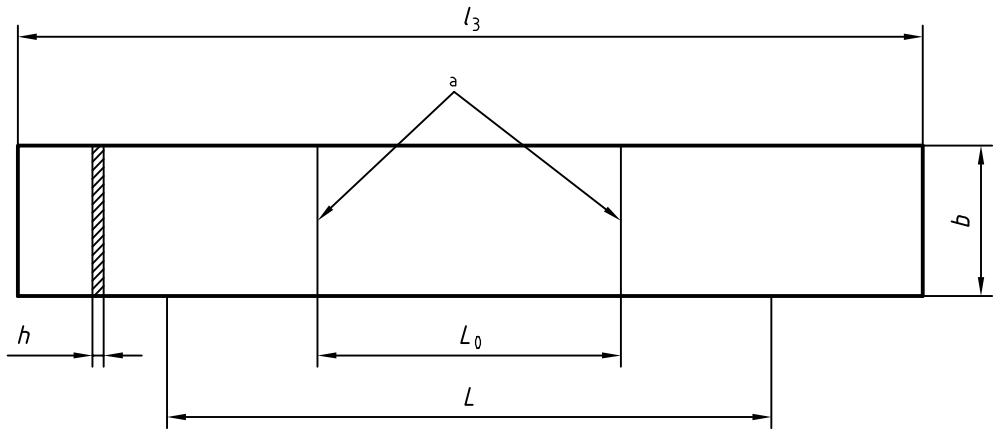
$$\text{PWV} = \text{WVTR} \times \frac{h}{100}$$

where

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

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

h is the thickness of the specimen, in micrometres.



Key

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

Figure 1 — Specimen for tensile testing

5.6 Haze

Determine the haze in accordance with ISO 14782.

5.7 Wetting tension

Determine the wetting tension in accordance with ISO 8296.

5.8 Coefficient of dynamic friction

Determine the coefficient of dynamic friction in accordance with ISO 8295.

5.9 Threshold heat-sealing temperature

5.9.1 Apparatus

5.9.1.1 Heat sealer, equipped with a heater in only one bar, with a heating width of 5 mm or more.

5.9.1.2 Tensile tester.

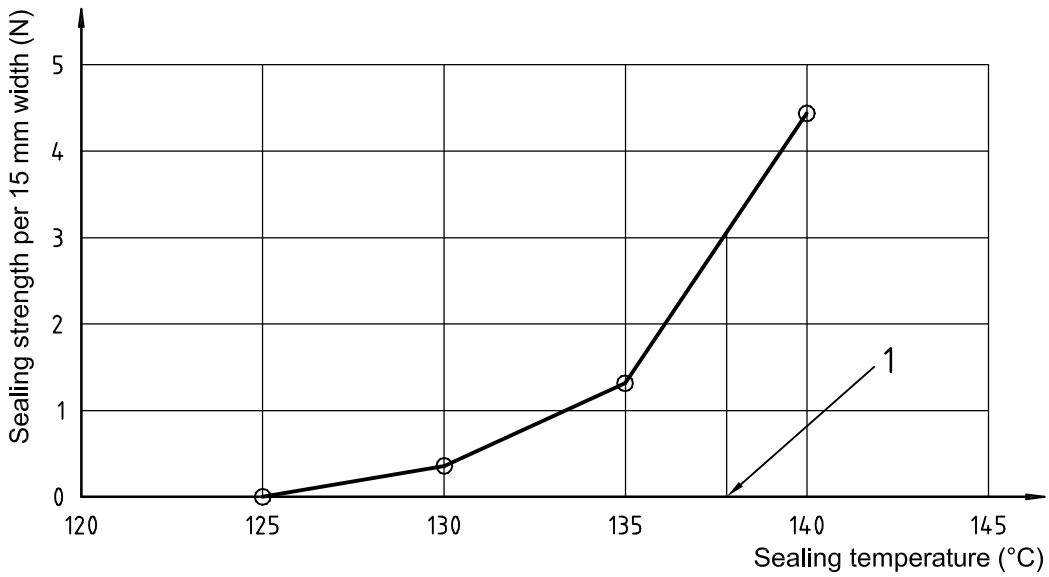
5.9.2 Preparation of test specimens

Lay a piece of film about 100 mm long and 15 mm wide on another piece of film of about the same dimensions so that their untreated surfaces are in contact. Cover the pieces of film with a single ply of polyester film with a thickness of (12 $\pm$ 1,2) μm. Position the assembly between the bars of the heat sealer, with the heated bar uppermost, so that the seal will be made perpendicularly across the middle of the assembly. Seal the films together, applying a pressure of 0,2 MPa at a suitable temperature for 1 s. Repeat the sealing operation at the same temperature to produce four more specimens. Increase the sealing temperature by about 5 °C and

prepare another five specimens. Prepare additional sets of five specimens at higher sealing temperatures, as required (see 5.9.3).

5.9.3 Procedure

Place the ends of a specimen in the jaws of the tensile tester with the distance between the jaws more than 50 mm. Measure the sealing strength, using a crosshead speed of (300 ± 30) mm per minute. Test five specimens at each sealing temperature. Calculate the average sealing strength per 15 mm of width at each temperature. Determine, by plotting a graph (see Figure 2), the temperature corresponding to a sealing strength of 3 N per 15 mm.



Key

1 threshold heat-sealing temperature

Figure 2 — Determination of threshold heat-sealing temperature

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 or flame 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 is made from a homopolymer or copolymer and whether it 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.

ICS 83.140.10

Price based on 7 pages