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**Plastics — Film and sheeting —  
Determination of wetting tension**

*Plastiques — Film et feuille — Détermination de la tension de mouillage*

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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 8296 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 11, *Products*.

This second edition cancels and replaces the first edition (ISO 8296:1987), of which it constitutes a minor revision which included the correction of 4.1 to simply specify a "wire bar" (rather than "wire bar No. 2" as in the first edition) and correction of the area over which the liquid is spread in 7.2, second paragraph, from 20 cm<sup>2</sup> to 6 cm<sup>2</sup>.

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# Plastics — Film and sheeting — Determination of wetting tension

## 1 Scope

**1.1** This International Standard specifies a method for determining the wetting tension of surfaces of plastic film and sheeting in contact with drops of specific test solutions.

**1.2** The ability of plastic films to retain inks, coatings, adhesives, etc., is primarily dependent on the character of their surfaces, and can be improved by one of several surface-treatment techniques. These same treatment techniques have been found to increase the wetting tension of a plastic film surface in contact with mixtures of solvents. It is therefore possible to relate the wetting tension of a plastic film surface to its ability to accept and retain inks, coatings, adhesives, etc. The measured wetting tension of a specific film surface can only be related to acceptable ink, coating, or adhesive retention through experience. Wetting tension, in itself, is not a completely acceptable measure of ink, coating or adhesive adhesion.

**1.3** Any contamination of the film surface and any trace of surface-active impurities in the liquid reagents may affect the wetting tension. It is therefore important that the portion of the film surface to be tested is not touched or rubbed, that all equipment be scrupulously clean, and that reagent purity be carefully controlled. Glass apparatus, in particular, is likely to be contaminated with detergents having very strong surface tension reducing ability, unless specific precautions are taken to ensure their absence such as by cleaning with an oxidizing agent, for example chromic-sulfuric acid or sulfuric acid-ammonium peroxydisulfate, and rinsing with distilled water.

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**1.4** The test is not applicable when the surface of the material to be tested reacts chemically with the test solution.

**1.5** It should be noted that surface properties of plastic film and sheeting may change by ageing processes. The measurements must therefore be related to the age of the film.

## 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, *Plastics — Standard atmospheres for conditioning and testing*

## 3 Principles

A series of mixtures of solvents of gradually increasing surface tension are applied to the surface of the plastic film until a mixture is obtained that just wets the film surface. The wetting tension of the surface under test is approximated by the surface tension of this particular mixture.

## 4 Apparatus

Ordinary laboratory apparatus and the following:

**4.1 Hand-coater**, with a wire bar depositing a 12  $\mu\text{m}$  film. Alternatively, cotton-tipped wood sticks or brushes may be used, provided that they give the same test result.

#### 4.2 Brown-glass dropper bottles.

### 5 Test mixtures

Test mixtures of graduated wetting tension shall be prepared by mixing reagent grades of ethylene glycol monoethyl ether (Cellosolve), formamide, methanol and water in accordance with Table 1. The test mixtures shall be stored in the brown-glass dropper bottles (4.2). If well protected, the mixtures change very little with time. If used frequently, they shall be renewed after 3 months.

**SAFETY PRECAUTIONS — When handling the solvents, the appropriate laboratory safety precautions must be taken.**

### 6 Sampling

Whether a film is presented in the form of rolls or in the form of piled sheets, two surfaces are in contact (as a rule, front with reverse). When sampling, care shall be taken that the surfaces to be tested do not come into contact with any other material. In the case of a roll, this is achieved by discarding the outer layer and unwinding a sample without touching the areas to be tested. In the case of a pile, some sheets are taken together and the outermost sheets discarded before testing.

The actual specimens for testing shall be taken from these samples immediately before the tests are carried out. Normally, a specimen measuring 10 cm × 10 cm is sufficient.

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### 7 Procedure

7.1 Conduct the test in standard laboratory atmosphere 23/50 (see ISO 291).

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7.2 Place the test specimen on the ground plate of the hand-coater (4.1). Apply a few drops of the test mixture (Clause 5) to the film in front of the wire bar and spread immediately by drawing the bar.

If a brush or cotton-tipped stick is used for spreading the test mixtures, the liquid shall be spread rapidly over an area of at least 6 cm<sup>2</sup>. The quantity of liquid shall be such that it forms a thin film without pools.

Observe the liquid film of the test mixture under glancing illumination and note the time taken for the continuous liquid film to break up into droplets. If the liquid film holds together for more than 2 s, repeat the test on a new specimen with a mixture of the next higher surface tension, until the liquid film breaks up in less than 2 s. If the liquid film holds for less than 2 s, proceed to lower surface tensions until the film persists for 2 s.

7.3 For each test, use a new cotton applicator. Clean the brush or wire bar after each use by rinsing in methanol and drying, because the liquid remaining on these spreaders will change in composition and surface tension by evaporation.

7.4 Note the mixture that comes nearest to wetting the surface for 2 s, based on at least three determinations with that mixture. The surface tension of this mixture shall be reported as the wetting tension of the plastic film.

### 8 Test report

The test report shall include the following particulars:

- a) a reference to this International Standard;
- b) all details necessary for identification of the plastic film and, if known, its approximate age;
- c) the side and location tested;
- d) the wetting tension of the film.

Table 1 — Test mixtures for the determination of the wetting tension of plastic film and sheeting

Wetting tension mN/m	Ethylene glycol monoethyl ether ml	Formamide ml	Methanol ml	Water ml
22,6			100,0	0
25,4			90,0	10,0
27,3			80,0	20,0
30,0	100,0			
31,0	97,5	2,5		
32,0	89,5	10,5		
33,0	81,0	19,0		
34,0	73,5	26,5		
35,0	65,0	35,0		
36,0	57,5	42,5		
37,0	51,5	48,5		
38,0	46,0	54,0		
39,0	41,0	59,0		
40,0	36,5	63,5		
41,0	32,5	67,5		
42,0	28,5	71,5		
43,0	25,3	74,7		
44,0	22,0	78,0		
45,0	19,7	80,3		
46,0	17,0	83,0		
48,0	13,0	87,0		
50,0	9,3	90,7		
52,0	6,3	93,7		
54,0	3,5	96,5		
56,0	1,0	99,0		
58,0		100,0		
59,0		95,0		5,0
60,0		80,0		20,0
61,0		70,0		30,0
62,0		64,0		36,0
63,0		50,0		50,0
64,0		46,0		54,0
65,0		30,0		70,0
67,0		20,0		80,0
70,0		10,0		90,0
73,0				100,0

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