

ISO/TC 61/SC 11

Secrétariat: JISC

Début de vote:  
2021-02-12

Vote clos le:  
2021-05-07

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**Plastiques — Plaques en  
poly(méthacrylate de méthyle)  
— Types, dimensions et  
caractéristiques —**

**Partie 3:  
Plaques coulées continues**

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*Plastics — Poly(methyl methacrylate) sheets — Types, dimensions  
and characteristics —*

*Part 3: Continuous cast sheets*

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OUTRE LE FAIT D'ÊTRE EXAMINÉS POUR ÉTABLIR S'ILS SONT ACCEPTABLES À DES FINS INDUSTRIELLES, TECHNOLOGIQUES ET COMMERCIALES, AINSI QUE DU POINT DE VUE DES UTILISATEURS, LES PROJETS DE NORMES INTERNATIONALES DOIVENT PARFOIS ÊTRE CONSIDÉRÉS DU POINT DE VUE DE LEUR POSSIBILITÉ DE DEVENIR DES NORMES POUVANT SERVIR DE RÉFÉRENCE DANS LA RÉGLEMENTATION NATIONALE.

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Numéro de référence  
ISO/FDIS 7823-3:2021(F)

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Publié en Suisse

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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 7823-3 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 11, *Products*.

This third edition cancels and replaces the second edition (ISO 7823:2007), of which it constitutes a minor revision.

ISO 7823 consists of the following parts, under the general title *Plastics — Poly(methyl methacrylate) sheets — Types, dimensions and characteristics*:

— *Part 1: Cast sheets*

— *Part 2: Extruded sheets*

— *Part 3: Continuous cast sheets*

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# Plastiques — Plaques en poly(méthacrylate de méthyle) — Types, dimensions et caractéristiques —

## Partie 3: Plaques coulées continues

### 1 Scope

This part of ISO 7823 specifies requirements for non-modified flat poly(methyl methacrylate) (PMMA) continuous cast sheets for general-purpose use. The sheets may be colourless or coloured, and may be transparent, translucent or opaque.

The thickness range of the sheets covered by this part of ISO 7823 is 1 mm to 10 mm.

### 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 62, *Plastiques — Détermination de l'absorption d'eau*

ISO 75-2, *Plastiques — Détermination de la température de fléchissement sous charge — Partie 2: Plastiques et ébonite*

ISO 178, *Plastiques — Détermination des propriétés en flexion*

ISO 179-1, *Plastiques — Détermination des caractéristiques au choc Charpy — Partie 1: Essai de choc non instrumenté*

ISO 291, *Plastiques — Atmosphères normales de conditionnement et d'essai*

ISO 306, *Plastiques — Matières thermoplastiques — Détermination de la température de ramollissement Vicat (VST)*

ISO 489:1999, *Plastiques — Détermination de l'indice de réfraction*

ISO 527-2, *Plastiques — Détermination des propriétés en traction — Partie 2: Conditions d'essai des plastiques pour moulage et extrusion*

ISO 877-1, *Plastiques — Méthodes d'exposition au rayonnement solaire — Partie 1: Lignes directrices générales*

ISO 877-2, *Plastiques — Méthodes d'exposition au rayonnement solaire — Partie 2: Exposition directe et exposition derrière une vitre en verre*

ISO 877-3, *Plastiques — Méthodes d'exposition au rayonnement solaire — Partie 3: Exposition intensifiée par rayonnement solaire concentré*

ISO 1183-1, *Plastiques — Méthodes de détermination de la masse volumique des plastiques non alvéolaires — Partie 1: Méthode par immersion, méthode du pycnomètre en milieu liquide et méthode par titrage*

ISO 1183-2, *Plastiques — Méthodes de détermination de la masse volumique des plastiques non alvéolaires — Partie 2: Méthode de la colonne à gradient de masse volumique*

ISO 2039-2, *Plastiques — Détermination de la dureté — Partie 2: Dureté Rockwell*

ISO 2818, *Plastiques — Préparation des éprouvettes par usinage*

ISO 2859-1, *Règles d'échantillonnage pour les contrôles par attributs — Partie 1: Procédures d'échantillonnage pour les contrôles lot par lot, indexés d'après le niveau de qualité acceptable (NQA)*

ISO 4582, *Plastiques — Détermination des changements de coloration et des variations de propriétés après exposition au rayonnement solaire sous verre, aux agents atmosphériques ou aux sources de rayonnement de laboratoire*

ISO 4892-2, *Plastiques — Méthodes d'exposition à des sources lumineuses de laboratoire — Partie 2: Lampes à arc au xénon*

ISO 4892-4, *Plastiques — Méthodes d'exposition à des sources lumineuses de laboratoire — Partie 4: Lampes à arc au carbone*

ISO 11359-2, *Plastiques — Analyse thermomécanique (TMA) — Partie 2: Détermination du coefficient de dilatation thermique linéique et de la température de transition vitreuse*

ISO 13468-1, *Plastiques — Détermination du facteur de transmission du flux lumineux total des matériaux transparents — Partie 1: Instrument à faisceau unique*

ISO 13468-2, *Plastics — Determination of the total luminous transmittance of transparent materials — Part 2: Double-beam instrument*

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

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### 3 Terms and definitions

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

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#### 3.1 non-modified cast PMMA sheets

sheets based on homopolymers of MMA, or copolymers of MMA with acrylic or methacrylic monomers, produced by bulk polymerization in the presence of suitable initiators

#### 3.2 flat PMMA sheets

sheets with two plane, substantially parallel surfaces

### 4 Composition

The amounts of plasticizing ingredients (materials that do not undergo chemical reaction to become a part of the polymer), other monomers and crosslinking agents (materials that produce the links between the chains of polymers) present shall be such that the basic properties are not changed from the values given in [Table 3](#). These amounts are in most cases less than a mass fraction of 5 %.

Other additives, e.g. colorants, UV absorbers and pigments, may be included to give specific properties.

National environmental legislation and regulations shall be followed regarding additives.

### 5 General requirements

#### 5.1 Protective coverings

Unless otherwise agreed upon by the interested parties, the surfaces of the sheet, as delivered, shall be protected by suitable materials, for example kraft paper secured with a water-soluble or pressure-

sensitive adhesive, or a polyethylene film, which are readily removable without causing surface contamination or damage.

## 5.2 Appearance

### 5.2.1 Surface defects

The sheet shall have a smooth surface. There shall be no scratches, marks or other surface defects larger than 3 mm<sup>2</sup> each anywhere in the sheet.

### 5.2.2 Inclusion defects

There shall be no bubbles, inclusions, cracks or other defects that could adversely affect the performance of the sheet in its intended application which are larger than 3 mm<sup>2</sup> each anywhere in the sheet.

### 5.2.3 Classification of defects

The area of any defect found in the sheets shall be classified as specified in [Table 1](#). Each defect shall be considered separately.

**Table 1 — Classification of defects**

Classification	Area of surface defect	Area of inclusion defect
Negligible	Less than 1 mm <sup>2</sup>	Less than 1 mm <sup>2</sup>
Acceptable	1 mm <sup>2</sup> to 3 mm <sup>2</sup>	1 mm <sup>2</sup> to 3 mm <sup>2</sup>

### 5.2.4 Distribution of defects

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5.2.4.1 There shall not be a significant number (for the application) of small defects, each of which is defined as negligible in [Table 1](#), within 1 m<sup>2</sup> anywhere in the sheet. What constitutes a significant number shall be agreed between the interested parties.

5.2.4.2 No defect defined as acceptable in [Table 1](#) shall be within 500 mm of another acceptable defect anywhere in or on the sheet.

## 5.3 Colour

The colour distribution shall be homogeneous, unless otherwise specified. Variations in colour shall be agreed upon between the interested parties.

## 5.4 Dimensions

### 5.4.1 Length and width

The length and width of the sheet shall be agreed upon between the interested parties. For cut sheets, the tolerances for each sheet shall be as specified in [Table 2](#).

**Table 2 — Tolerances on length and width of cut sheets**

Length or width mm	Tolerance
Up to 1 000	+3 0 mm
From 1 001 to 2 000	+6 0 mm

**Table 2 (suite)**

Length or width mm	Tolerance
From 2 001 to 3 000	$\begin{matrix} +9 \\ 0 \end{matrix}$ mm
3 001 and over	$\begin{matrix} +0,3 \\ 0 \end{matrix}$ %

#### 5.4.2 Thickness

The thickness tolerance for sheets in the range from 1 mm to 10 mm and up to 6 m<sup>2</sup> in area shall be  $\pm 0,1h$ , where  $h$  is the nominal sheet thickness in millimetres.

The tolerances apply within each sheet and from sheet to sheet.

#### 5.4.3 Tolerances for other sheet sizes

Tolerances for sheet sizes and thicknesses outside the above ranges shall be agreed upon between the interested parties.

#### 5.4.4 Conditions of measurement

Measurements of dimensions shall be made at room temperature, except that, in cases of dispute, measurements shall be made under standard conditions, as specified in ISO 291. For measurements made under ambient conditions, due allowance shall be made for dimensional changes due to the differences in temperature and relative humidity between test locations.

### 5.5 Basic and other properties

#### 5.5.1 Basic properties

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The basic mechanical, thermal and optical properties of sheets shall be as specified in [Table 3](#).

#### 5.5.2 Other properties

Other properties of sheets shall be agreed upon between the interested parties. Examples of, and test methods for, such properties are presented in [Table 4](#).

**Table 3 — Basic properties of PMMA continuous cast sheets — Required values**

Property	Unit	Test method	Required value	Subclause
Tensile strength	MPa	ISO 527-2/1B/5	min. 60	<a href="#">6.5.2</a>
Tensile strain	%	ISO 527-2/1B/5	min. 2	<a href="#">6.5.2</a>
Modulus of elasticity in tension	MPa	ISO 527-2/1B/1	min. 2 700	<a href="#">6.5.2</a>
Charpy impact strength (unnotched)	kJ/m <sup>2</sup>	ISO 179-1/1fU	min. 8	<a href="#">6.5.3</a>
Vicat softening temperature	°C	ISO 306, method B50	min. 95	<a href="#">6.6.1</a>
Dimensional change on heating (shrinkage)	%	<a href="#">Annex A</a>	max. 2,8	<a href="#">6.6.3</a>
Total luminous transmittance <sup>a</sup>	%	ISO 13468-1	min. 90	<a href="#">6.8.1</a>
Light transmittance at 420 nm (thickness 3 mm) <sup>a</sup>	%	ISO 13468-2	min. 90	<a href="#">6.8.3</a>
— before exposure to xenon lamp	%	ISO 13468-2	min. 88	<a href="#">6.8.3</a>
— after exposure to xenon lamp for 1 000 h (ISO 4892-2, method A)	%	ISO 13468-2	min. 88	<a href="#">6.8.3</a>



Table 3 (suite)

Property	Unit	Test method	Required value	Subclause
a For transparent colourless material				

Table 4 — Other properties of PMMA continuous cast sheets — Typical values

Property	Unit	Test method	Typical value	Subclause
Flexural strength	MPa	ISO 178	110 to 115	<a href="#">6.5.1</a>
Rockwell hardness	Scale M	ISO 2039-2	95 to 100	<a href="#">6.5.4</a>
Linear expansion coefficient	°C <sup>-1</sup>	ISO 11359-2	$7 \times 10^{-5}$	<a href="#">6.6.4</a>
Temperature of deflection under load	°C	ISO 75-2, method A	85 to 100	<a href="#">6.6.2</a>
Haze	%	ISO 14782	0,5 to 1	<a href="#">6.8.2</a>
Refractive index, $n_D^{23}$		ISO 489:1999, method A	1,49	<a href="#">6.8.4</a>
Density <sup>a, b</sup>	g/cm <sup>3</sup>	ISO 1183-1, method A or C, or ISO 1183-2	1,19	<a href="#">6.9.1</a>
Water absorption	%	ISO 62, method 1 (24 h, 23 °C)	0,5 <sup>c</sup>	<a href="#">6.9.2</a>
a For transparent, colourless material. b Coloured sheets may have a higher value. c Value reported refers to a square specimen of edge 50 mm and thickness 3 mm.				

## 6 Test methods

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### 6.1 General

#### 6.1.1 Sampling

The sampling procedure shall be agreed upon between the interested parties. The sampling procedure given in ISO 2859-1 is widely accepted and frequently used. Hence it is recommended.

#### 6.1.2 Conditioning and testing atmospheres

Conditioning of specimens (48 h) and tests shall be carried out in accordance with ISO 291 with class 2 tolerances for temperature and relative humidity, except for the Vicat softening temperature, temperature of deflection under load and dimensional change on heating (shrinkage) (see [6.6.1](#), [6.6.2](#) and [6.6.3](#)).

#### 6.1.3 Preparation of test specimens

Specimens shall be prepared in accordance with the procedures specified in ISO 2818, wherever applicable.

When it is necessary to machine the sheet to the thickness required for a particular test method, one original surface shall be left intact.

#### 6.1.4 Specimen thickness

When the sheet has a thickness less than that required for the specimens in a particular test method, specimens having the thickness of the sheet shall be used.

## 6.2 Appearance

Defects and their distribution shall be evaluated by inspecting the sheet illuminated by daylight or by a daylight-type fluorescent lamp with a colour temperature of  $6\,500\text{ K} \pm 650\text{ K}$  and a power rating of not less than 40 W.

## 6.3 Colour

Colour differences between a reference material (standard) and the test sample shall be determined by methods agreed upon by the interested parties.

## 6.4 Dimensions

**6.4.1** The length and width shall be measured to the nearest 1,0 mm, in accordance with [5.4.4](#), using a calibrated rule.

**6.4.2** The thickness shall be measured to the nearest 0,05 mm, in accordance with [5.4.4](#), using a calibrated micrometer or dial gauge, or an ultrasonic probe. Measurements shall be carried out at not less than 100 mm from the sheet edge.

## 6.5 Mechanical properties

**6.5.1** The flexural properties shall be determined in accordance with ISO 178, using, when possible, a 4-mm-thick specimen. The original surface shall be put under tension whenever the specimen has been machined to the specified dimensions. (standards.iteh.ai)

**6.5.2** The tensile properties shall be determined in accordance with ISO 527-2, using type 1B specimens. The test speed for tensile strength and for tensile strain at break shall be  $5\text{ mm/min} \pm 1\text{ mm/min}$  and for the modulus of elasticity in tension  $1\text{ mm/min} \pm 0,2\text{ mm/min}$ .

**6.5.3** The Charpy impact strength shall be determined in accordance with ISO 179-1/1fU, using the standard unnotched bar (dimensions of the specimen  $80\text{ mm} \times 10\text{ mm} \times 4\text{ mm}$ ). The pendulum shall strike the surface that is opposite to the original one if the specimen has been machined to the specified dimensions.

**6.5.4** The Rockwell hardness shall be determined in accordance with ISO 2039-2, scale M, on the original cast surface.

## 6.6 Thermal properties

**6.6.1** The Vicat softening temperature shall be determined in accordance with ISO 306, method B50, using the original cast surface. The rate of heating shall be  $50\text{ °C/h} \pm 5\text{ °C/h}$ . Before the test, the specimens shall be conditioned for 16 h at  $80\text{ °C} \pm 2\text{ °C}$  and cooled to room temperature in a desiccator.

**6.6.2** The temperature of deflection under load shall be determined in accordance with ISO 75-2, method A. Before the test, the specimens shall be conditioned for 16 h at  $80\text{ °C} \pm 2\text{ °C}$  and cooled to room temperature in a desiccator. Measurements shall not be carried out on specimens with a thickness below 3 mm.

**6.6.3** The dimensional change on heating (shrinkage) shall be determined by the method described in [Annex A](#).

**6.6.4** The linear expansion coefficient shall be determined in accordance with ISO 11359-2.