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Penjeni polimerni materiali - Trde pene - Ugotavljanje lastnosti stiskanja (ISO/DIS 844:2019)

Rigid cellular plastics - Determination of compression properties (ISO/DIS 844:2019)

Harte Schaumstoffe - Bestimmung der Druckeigenschaften (ISO/DIS 844:2019)

Plastiques alvéolaires rigides - Détermination des caractéristiques de compression (ISO/DIS 844:2019)

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Rigid cellular plastics — Determination of compression properties

Plastiques alvéolaires rigides — Détermination des caractéristiques de compression

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 61, *Plastics*, Subcommittee SC 10, *Cellular plastics*.

This sixth edition cancels and replaces the fifth edition (ISO 844:2007), which has been technically revised to specify the choice of the procedure for the determination of the compressive strength and corresponding relative deformation, the compressive stress at 10 % relative deformation and the compressive modulus of rigid cellular plastics.

Rigid cellular plastics — Determination of compression properties

1 Scope

This document specifies methods for determining the compressive strength and corresponding relative deformation; the compressive stress at 10 % relative deformation; and the compressive modulus of rigid cellular plastics.

Two methods are given. Procedure A employs crosshead motion for determination of nominal compressive properties. Procedure B employs displacement measuring device (including contact and optical types).

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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*

ISO 1923, *Cellular plastics and rubbers — Determination of linear dimensions*

ISO 7500-1, *Metallic materials — Calibration and verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Calibration and verification of the force-measuring system*

ISO 9513, *Metallic materials — Calibration of extensometer systems used in uniaxial testing*

ISO 5725-2, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

3 Terms and definitions

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

3.1
nominal relative deformation (procedure A)
ε_C
ratio of the reduction (in relation to its initial value) in thickness of the test specimen

Note 1 to entry: It is expressed as a percentage.

Note 2 to entry: ε_{Cm} is the nominal relative deformation corresponding to σ_m (see 3.3).

3.2
relative deformation (procedure B)
ε
ratio of the reduction (in relation to its initial value) of extensometer gauge length

Note 1 to entry: It is expressed as a percentage.

Note 2 to entry: ε_m is the relative deformation corresponding to σ_m (see 3.3).

3.3
compressive strength (procedure A or B)
σ_m
maximum compressive force F_m divided by the initial cross-sectional area A_0 of the test specimen when the relative deformation ε and the nominal relative deformation ε_C respectively is < 10 %

Note 1 to entry: It is expressed in megapascals (MPa).

3.4
compressive stress at 10 % nominal relative deformation (procedure A)
σ_{C10}
ratio of the compressive force F_{10} at 10 % nominal relative deformation ε_{C10} to the initial cross-sectional area of the test specimen

Note 1 to entry: It is expressed in megapascals (MPa).

3.5
nominal compressive modulus of elasticity (procedure A)
E_C
difference in compressive stress divided by the difference in corresponding nominal relative deformation below the proportional limit, i.e. when the relation is linear

Note 1 to entry: It is expressed in megapascals (MPa).

3.6
compressive modulus of elasticity (procedure B)
E
difference in compressive stress divided by the corresponding difference in relative deformation below the proportional limit, i.e. when the relation is linear

Note 1 to entry: It is expressed in megapascals (MPa).

3.7
Cross sectional area
A_0
the initial cross sectional area of the test specimen perpendicular to the loading direction

Note 1 to entry: It is expressed in square millimetres mm^2.

3.8
Conventional proportional limit
X_e
the upper limit of the linear part of the force - deformation curve

Note 1 to entry: It is expressed in millimetres (mm).

3.9
Force at proportional limit
F_e
the force corresponding to x_e (conventional proportional limit)

Note 1 to entry: It is expressed in newtons (N).

3.10
Maximum Force
F_m
the maximum force transferred by the test specimen

Note 1 to entry: It is expressed in newtons (N).

3.11
Force at 10% nominal relative deformation
F_{10}
the force transferred by the test specimen at 10% nominal relative deformation

Note 1 to entry: It is expressed in newtons (N).

3.12
Initial thickness
h_0
the initial thickness of test specimen (Procedure A)

Note 1 to entry: It is expressed in millimetres (mm).

3.13
Initial gauge length
l_0
the initial extensometer gauge length (Procedure B)

Note 1 to entry: It is expressed in millimetres (mm).

3.14
displacement
X
the displacement of the moving plate versus the fixed plate during the test (Procedure A) and displacement of extensometer respectively (Procedure B)

X_m displacement at maximum force F_m

X_{Cm} nominal displacement at maximum force F_m

X_{C10} nominal displacement at 10 % nominal relative deformation

Note 1 to entry: It is expressed in millimetres (mm).

4 Symbols and abbreviated terms

A_0	initial cross-sectional area, in square millimetres
E	compressive modulus of elasticity, in megapascals
E_C	nominal compressive modulus of elasticity, in megapascals
F_e	force corresponding to x_e (conventional proportional limit), in newtons
F_{Ce}	force corresponding to x_{Ce} (conventional proportional limit), in newtons
F_m	maximum force, in newtons
F_{10}	force at 10 % nominal relative deformation, in newtons
h_0	initial thickness of test specimen (Procedure A), in millimetres
l_o	initial gauge length of the extensometer (Procedure B), in millimetres
X_e	displacement at F_e in the conventional elastic zone, in millimetres (Procedure B)
X_{Ce}	nominal displacement at F_{Ce} in the conventional elastic zone, in millimetres (Procedure A)
X_m	displacement at maximum force, in millimetres

X_{Cm} nominal displacement at maximum force, in millimetres

X_{C10} displacement at 10 % nominal relative deformation, in millimetres

ε_m relative deformation corresponding to compressive strength σ_m, in percent

ε_{Cm} nominal relative deformation corresponding to compressive strength σ_m, in percent

ε_{C10} 10 % nominal relative deformation, in percent

σ_m compressive strength, in megapascals

σ_{10} compressive stress at 10 % nominal relative deformation, in megapascals

5 Principle

A compressive force is applied in an axial direction and perpendicular to the faces of test specimen.

There are two procedures:

— Procedure A employs crosshead motion for determination of compressive properties. Procedure A shall be used to determine:

  — compressive strength and the corresponding nominal relative deformation

  — compressive stress at 10 % nominal relative deformation

  — nominal compressive modulus

— Procedure B employs strain measuring devices connected to the specimen (contact or optical extensometer) or similar device which directly measures the sample deformation. Procedure B shall be used to determine:

  — compressive strength and the corresponding relative deformation

  — compressive modulus

6 Apparatus

6.1 Compression-testing machine

Use a compression-testing machine suited to the range of force and displacement involved and having two square or circular plane, parallel plates which are polished (see Note 1) and cannot be deformed (see Note 2). The compression plates shall be of nay convenient size which ensures that test specimens are compressed over their whole areas.

NOTE 1 A surface roughness Ra ≤ 0.4 µm is acceptable.

NOTE 2 A steel plate of thickness t ≥ 8 mm in loading direction is acceptable.

NOTE 3 In case of low thickness samples, platens dimensions should be so that clip on short travel extensometers with stop stud, can be appropriately clamped to the specimen when it put in centre of the platens.

6.2 Devices for measuring displacement and force

6.2.1 Measurement of displacement

Procedure A — The compression-testing machine shall be fitted with a system allowing continuous measurement of the displacement *x* of the movable plate with an accuracy of ± 5 % or ± 0,1 mm if this latter value is a more accurate measurement (see second paragraph in 5.2.2).

Procedure B — The compression-testing machine shall be equipped with an extensometer which directly measures the sample deformation. If used, however, the extensometer shall comply with class 1 of ISO 9513.

The extensometer gage length is function of sample thickness as follows.

Specimen thickness h0, [mm]	Gage length l0, [mm]
20 to 32	15 ± 1,0
>32 to 42	20 ± 1,0
>42 to 52	25 ± 1,0
>52 to 72	35 ± 1,0
>72	50 ± 1,0

The exact gage length used for calculation shall be measured to an accuracy of ± 0.1 mm

6.2.2 Measurement of force

A force sensor shall be fixed to one of the machine plates in order to measure the force *F* produced by the reaction of the test specimen upon the plates during the test. The force measurement shall comply with class 1 of ISO 7500-1 within the relevant part of the curve.

It is recommended that a device be used for the simultaneous recording of the force *F* and the displacement *x* that allows, by obtaining a curve of $F = f(x)$, the graphical determination of the pair of values *F*, *x* required in Clause 8 with the accuracy laid down in 5.2.1 and this subclause, and provides additional information on the behaviour of the product.

6.2.3 Calibration

The machine shall be calibrated periodically according to ISO 7500-1 (force measurement) and ISO 9513 (displacement measurement).

6.3 Instruments for measuring the dimensions of the test specimens

These instruments shall be in accordance with ISO 1923.

7 Test specimens

7.1 Dimensions

The preferred geometry and dimensions are a right prism with a base of (100 ± 1) mm × (100 ± 1) mm × (50± 1) mm.

NOTE Also acceptable, but not preferred, are test specimens which base shall be either square or circular, with a minimum area of 25 cm^2 and maximum of 230 cm^2.

The thickness of the specimens shall be minimum (20 ± 1) mm except for products with moulded skins which are intended to remain integral with the product in use. With such products, the specimens shall be the full thickness, provided that the minimum thickness is 10 mm or greater and that the maximum thickness is not greater than the width or diameter of the specimen.