SLOVENSKI STANDARD
oSIST prEN ISO 6603-2:2022

01-junij-2022

Polimerni materiali - Ugotavljanje prebodne odpornosti togih polimernih materialov - 2. del: Instrumentalni udarni preskus (ISO/DIS 6603-2:2022)

Plastics - Determination of puncture impact behaviour of rigid plastics - Part 2: Instrumented impact testing (ISO/DIS 6603-2:2022)

Kunststoffe – Bestimmung des Durchstoßverhaltens von festen Kunststoffen – Teil 2: Instrumentierter Schlagversuch (ISO/DIS 6603-2:2022)

Plastiques - Détermination du comportement des plastiques rigides perforés sous l'effet d'un choc - Partie 2: Essais de choc instrumentés (ISO/DIS 6603-2:2022)

Ta slovenski standard je istoveten z: **prEN ISO 6603-2**

ICS:

83.080.01	Polimerni materiali na splošno	Plastics in general

oSIST prEN ISO 6603-2:2022 **en,fr,de**

DRAFT INTERNATIONAL STANDARD

ISO/DIS 6603-2

ISO/TC **61**/SC **2**

Secretariat: **SAC**

Voting begins on:
2022-04-18

Voting terminates on:
2022-07-11

Plastics — Determination of puncture impact behaviour of rigid plastics —

Part 2:
Instrumented impact testing

Plastiques — Détermination du comportement des plastiques rigides perforés sous l'effet d'un choc — Partie 2: Essais de choc instrumentés

ICS: 83.080.01

This document is circulated as received from the committee secretariat.

ISO/CEN PARALLEL PROCESSING

Reference number
ISO/DIS 6603-2:2022(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 2, *Mechanical behavior*.

This third edition cancels and replaces the second edition (ISO 6603-2:2000), which has been technically revised.

The main changes compared to the previous edition are as follows:

— References to ISO 6603-1 have been replaced by the corresponding text;

— Normative references and bibliography have been updated and completed;

— Requirements for force measurement accuracy have been revised;

— Definitions for conditioning and test climate have been updated;

— Testing in clamped situation has been defined as the preferred method;

— Precision Data has been added in annex F.

A list of all parts in the ISO 6603 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Plastics — Determination of puncture impact behaviour of rigid plastics —

Part 2: Instrumented impact testing

1 Scope

This document specifies a test method for the determination of puncture impact properties of rigid plastics, in the form of flat specimens, using instruments for measuring force and deflection. It is applicable if a force-deflection or force-time diagram, recorded at nominally constant striker velocity, is necessary for detailed characterization of the impact behaviour.

The test method is applicable to specimens with a thickness between 1 mm and 4 mm.

NOTE For thicknesses less than 1 mm, ISO 7765-2 should preferably be used. Thicknesses greater than 4 mm may be tested if the equipment is suitable, but the test falls outside the scope this document.

The method is suitable for use with the following types of material:

— rigid thermoplastic moulding and extrusion materials, including filled, unfilled and reinforced compounds and sheets;

— rigid thermosetting molding and extrusion materials, including filled and reinforced compounds, sheets and laminates;

— fibre-reinforced thermoset and thermoplastic composites incorporating unidirectional or multi-directional reinforcements such as mats, woven fabrics, woven rovings, chopped strands, combination and hybrid reinforcements, rovings, milled fibers and sheets made from pre-impregnated materials (prepregs).

The method is also applicable to specimens which are either molded or machined from finished products, laminates and extruded or cast sheet.

The test results are comparable only if the conditions of preparation of the specimens, their dimensions and surfaces as well as the test conditions are the same. In particular, results determined on specimens of different thickness cannot be compared with one another (see annex E). Comprehensive evaluation of the reaction to impact stress requires that determinations be made as a function of impact velocity and temperature for different material variables, such as crystallinity and moisture content.

The impact behaviour of finished products cannot be predicted directly from this test, but specimens may be taken from finished products (see above) for tests by this method.

Test data developed by this method should not be used for design calculations. However, information on the typical behaviour of the material can be obtained by testing at different temperatures and impact velocities (see annex D) by varying the thickness (see annex E) and by testing specimens prepared under different conditions.

It is not the purpose of this document to give an interpretation of the mechanism occurring on every particular point of the force-deflection diagram. These interpretations are a task for scientific research.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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*

ISO 293, *Plastics — Compression moulding of test specimens of thermoplastic materials*

ISO 294-1, *Plastics — Injection moulding of test specimens of thermoplastic materials — Part 1: General principles, and moulding of multipurpose and bar test specimens*

ISO 294-3, *Plastics — Injection moulding of test specimens of thermoplastic materials — Part 3: Small plates*

ISO 295, *Plastics — Compression moulding of test specimens of thermosetting materials*

ISO 1268-1, *Fibre-reinforced plastics — Methods of producing test plates — Part 1: General conditions*

ISO 2602, *Statistical interpretation of test results — Estimation of the mean — Confidence interval*

ISO 2818, *Plastics — Preparation of test specimens by machining*

ISO 16012, *Plastics — Determination of linear dimensions of test specimens*

ISO 20753, *Plastics — Test specimens*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
impact velocity
v_0
velocity of the striker relative to the support at the moment of impact

Note 1 to entry: Impact velocity is expressed in metres per second (m/s).\

3.2
force
F
force exerted by the striker on the test specimen in the direction of impact

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

3.3
deflection
l
relative displacement between the striker and the specimen support, starting from the first contact between the striker and the test specimen

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

3.4
energy
E
energy expended in deforming and penetrating the test specimen up to a deflection l

Note 1 to entry: Energy is expressed in joules (J).

Note 2 to entry: Energy is measured as the integral of the force-deflection curve starting from the point of impact up to a deflection l.

3.5
maximum force
F_M
maximum force occurring during the test

Note 1 to entry: See Figures 1 to 4.

Note 2 to entry: Maximum force is expressed in newtons (N).

3.6
deflection at maximum force
l_M
deflection that occurs at maximum force F_M

Note 1 to entry: See Figures 1 to 4.

Note 2 to entry: Deflection at maximum force is expressed in millimetres (mm).

3.7
energy to maximum force
E_M
energy expended up to the deflection l_M at maximum force

Note 1 to entry: See Figures 1 to 4.

Note 2 to entry: Energy to maximum force is expressed in joules (J).

3.8
puncture deflection
l_P
deflection at which the force has dropped to half the maximum force F_M

Note 1 to entry: See Figures 1 to 4 and note to 3.9.

Note 2 to entry: Puncture deflection is expressed in millimetres (mm).

3.9
puncture energy
E_P
energy expended up to the puncture deflection l_P

Note 1 to entry: See Figures 1 to 4 and note 3.

Note 2 to entry: Puncture energy is expressed in joules (J).

Note 3 to entry: When testing tough materials, a transducer mounted at some distance from the impacting tip may record frictional force acting between the cylindrical part of the striker and the punctured material. The corresponding frictional energy shall not be included in the puncture energy, which, therefore, is restricted to that deflection, at which the force drops to half the maximum force F_M.

3.10
impact failure
mechanical behaviour of the material under test which may be either one of the following types:

a) YD yielding (zero slope at maximum force) followed by deep drawing, see figure 1

b) YS yielding (zero slope at maximum force) followed by (at least partially) stable cracking, see figure 2

c) YU yielding (zero slope at maximum force) followed by unstable cracking, see figure 3

d) NY no yielding, see figure 4

Note 1 to entry: Comparison of Figures 2 and 3 shows puncture deflection l_P and puncture energy E_P are identical for the failure types YS and YU. As shown in Figure 4, identical values at maximum and at puncture are found for the deflection as well as the energy in the case of failure type NY. For complex behaviour see annex A.

Note 2 to entry: For more guidance on the classification of failure types, see the informative annex F.

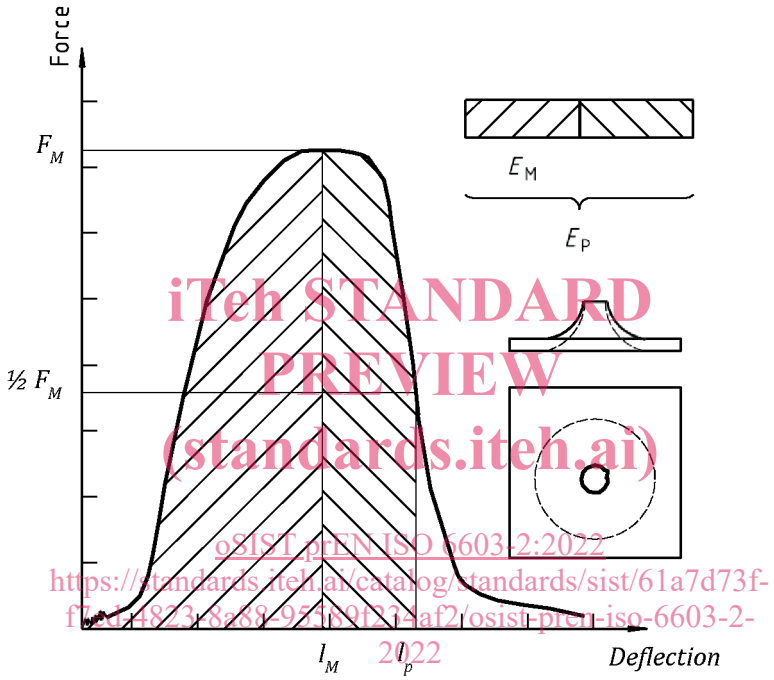


Figure 1 — Example of force-deflection diagram for failure by yielding (zero slope at maximum force) followed by deep drawing, and typical appearance of specimens after testing (with lubrication)

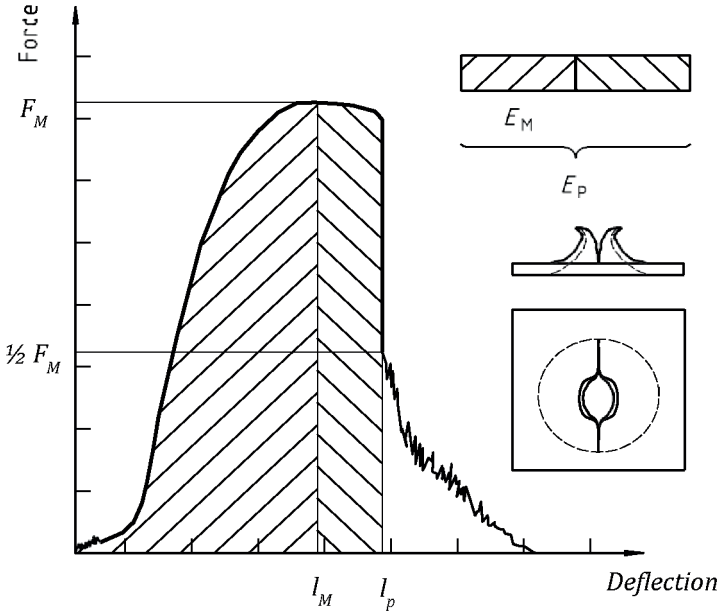
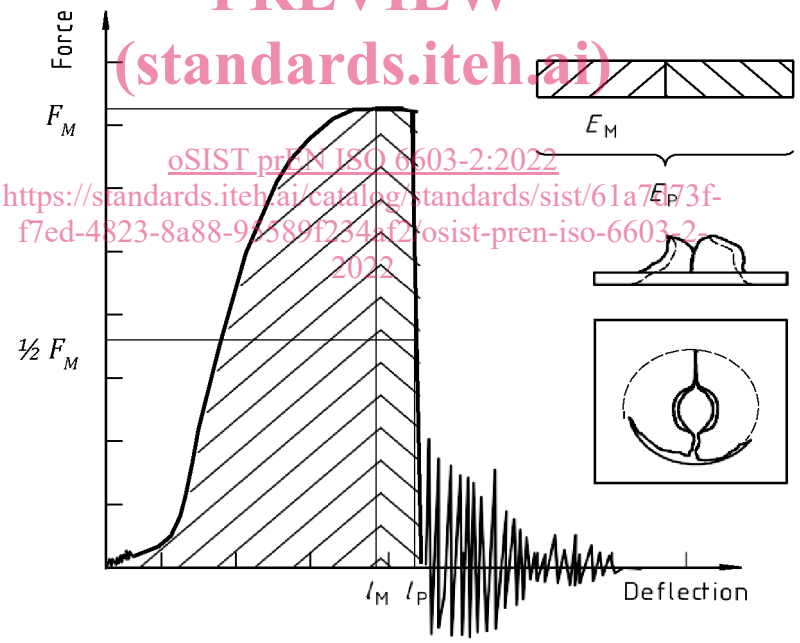


Figure 2 — Example of force-deflection diagram for failure by yielding (zero slope at maximum force) followed by stable crack growth, and typical appearance of specimens after testing (with lubrication)



Note 1 to entry Natural vibration of the force measurement system appears after unstable cracking (striker and load cell).

Figure 3 — Example of force-deflection diagram for failure by yielding (zero slope at maximum force) followed by unstable crack growth, and typical appearance of specimens after testing (with lubrication)

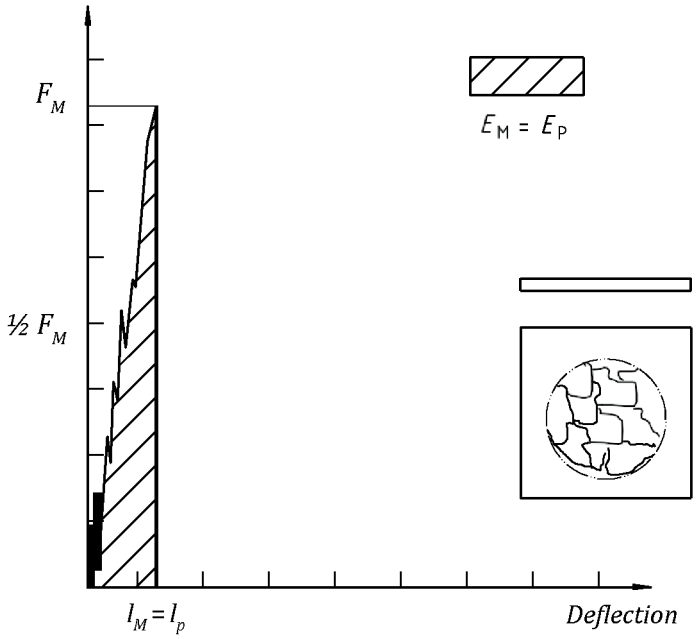


Figure 4 — Example of force-deflection diagram for failure without yielding followed by unstable crack growth, and typical appearance of specimens after testing (with lubrication)

4 Principle

The test specimen is punctured at its centre using a lubricated striker, perpendicularly to the test-specimen surface and at a nominally uniform velocity. The resulting force-deflection or force-time diagram is recorded electronically. The test specimen may be clamped in position (preferred) during the test.

The force-deflection diagram obtained in these tests records the impact behaviour of the specimen from which several features of the behaviour of the material may be inferred.

5 Apparatus

5.1 Testing instrument, consisting of the following essential components

— energy carrier, which may be inertial-mass type or hydraulic type (see 5.1.1);

— striker, which shall be lubricated;

— specimen support with a recommended clamping device.

The test device shall permit the test specimen to be punctured at its centre, perpendicular to its surface at a nominally constant velocity. The force exerted on the test specimen in the direction of impact and the deflection from the centre of the test specimen in the direction of impact shall be derivable or measurable (see Figure 5).

5.1.1 Energy carrier, with a preferred impact velocity v_0 of (4,4 ± 0,2) m/s (see 3.1 and note to 3.1). To avoid results, which cannot be compared due to the viscoelastic behaviour of the material under impact, the decrease of velocity during the test shall not be greater than 20 %.

NOTE 1 For brittle materials, an impact velocity of 1 m/s may be found to be more appropriate because it reduces the level of vibration and noise and improves the quality of the force-deflection diagram (see annex A).