International Standard

ISO 13802

Plastics — Verification of pendulum impact-testing machines — Charpy, Izod and tensile impact-testing

Plastiques — Vérification des machines d'essai de choc pendulaire — Essais de choc Charpy, Izod et de choc-traction

Third edition
2025-08

Reference number
ISO 13802:2025(en)

© ISO 2025



COPYRIGHT PROTECTED DOCUMENT

© ISO 2025

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

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 ... **iv**
Introduction ... **v**
1 Scope ... **1**
2 Normative references ... **1**
3 Terms and definitions ... **1**
4 Measurement instruments ... **3**
5 Description of a pendulum impact-testing machine ... **4**
5.1 Types of pendulum impact-testing machines ... 4
5.2 Pendulum impact testing machine components ... 4
6 Procedure for verification and inspection of a pendulum impact-testing machine ... **5**
6.1 Machine design and manufacturer ... 5
6.2 Machine frame field verification ... 5
6.2.1 General ... 5
6.2.2 Installation ... 5
6.2.3 Levelness ... 6
6.2.4 Axial play of the pendulum bearings ... 6
6.2.5 Radial play of the pendulum bearings ... 6
6.2.6 Mechanism for holding and releasing the pendulum ... 6
6.2.7 Free hanging position ... 6
6.2.8 Contact between specimen and striking edge (Izod/Charpy) ... 6
6.2.9 Potential energy, E ... 6
6.2.10 Pendulum length, L_P ... 7
6.2.11 Impact length, L_I ... 8
6.2.12 Velocity of the pendulum at instant of impact, v_I ... 8
6.3 Charpy testing machines ... 9
6.4 Izod testing machines ... 10
6.5 Tensile impact testing machines ... 11
6.6 Energy indicating system ... 12
6.6.1 Types of scale ... 12
6.6.2 Verification of analogue indicating equipment ... 12
6.6.3 Error in the indicated absorbed energy, $W_{i,}$ on analogue indicating systems ... 12
6.6.4 Verification of digital indicating equipment ... 13
6.7 Losses due to friction ... 13
6.7.1 Types of loss ... 13
6.7.2 Determination of the loss due to friction in the pointer ... 13
6.7.3 Determination of losses due to air resistance and friction in the pendulum bearings ... 14
6.7.4 Calculation of the total energy lost due to friction ... 14
6.7.5 Maximum permissible losses due to friction ... 14
7 Frequency of verification ... **16**
8 Verification report ... **16**
Annex A (normative) **Design requirements for Charpy machines** ... **17**
Annex B (normative) **Design requirements for Izod machines** ... **20**
Annex C (normative) **Design requirements for tensile impact machines** ... **23**
Annex D (informative) **Ratio of frame mass to pendulum mass** ... **28**
Annex E (informative) **Deceleration of pendulum during impact** ... **31**
Annex F (informative) **Gauge plate for verification of Charpy impact pendulums** ... **33**

© ISO 2025 – All rights reserved

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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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 properties,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 249, *Plastics,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 13802:2015), which has been technically revised.

The main changes are as follows:

— removed term entries 3.6 (gravity length), 3.7 (gyration length), and 3.19 (half-height Charpy impact reference specimen) and renumbered Clause 3 accordingly;

— corrected the measurement unit and the requirement in 6.2.4;

— updated acceptance criteria in 6.6.3;

— updated the references in Note 2 of the Clause 7;

— corrected value D_1 in Table A.1 to align with the value indicated in Table 4;

— corrected value p_1 in Table B.1 to align with the value indicated in Table 4;

— corrected the Formulae (D.4) and (D.5) in Annex D.

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.

© ISO 2025 – All rights reserved

Introduction

A pendulum impact-testing machine verified in accordance with this document, and assessed as satisfactory, is considered suitable for impact testing with unnotched and notched test specimens of different types.

The verification of some geometrical properties is difficult to perform on the assembled instrument. It is, therefore, assumed that the manufacturer is responsible for the verification of such properties and for providing reference planes on the instrument that enable proper verification in accordance with this document.

© ISO 2025 – All rights reserved

Plastics — Verification of pendulum impact-testing machines — Charpy, Izod and tensile impact-testing

1 Scope

This document specifies frequency and methods for the verification of pendulum impact-testing machines used for the Charpy impact test, Izod impact test, and tensile impact test described in ISO 179-1, ISO 180 and ISO 8256, respectively. Verification of instrumented impact machines is covered insofar as the geometrical and physical properties of instrumented machines are identical to non-instrumented machines. The force/work verification of instrumented machines is not covered in this document.

This document is applicable to pendulum-type impact-testing machines, of different capacities and/or designs, with the geometrical and physical properties specified in Clause 5.

Methods are specified for verification of the geometrical and physical properties of the different parts of the test machine.

These methods are for use when the machine is being installed, has been repaired, has been moved, or is undergoing periodic checking.

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 179-1, *Plastics — Determination of Charpy impact properties — Part 1: Non-instrumented impact test*

ISO 179-2, *Plastics — Determination of Charpy impact properties — Part 2: Instrumented impact test*

ISO 180, *Plastics — Determination of Izod impact strength*

ISO 8256:2023, *Plastics — Determination of tensile-impact strength*

3 Terms and definitions

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

ISO and IEC maintain terminology 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
verification
proof, with the use of calibrated standards or standard reference materials, that the *calibration* (3.2) of an instrument is acceptable

3.2
calibration
set of operations that establish, under specified conditions, the relationship between values indicated by a measuring instrument or measuring system and values corresponding to appropriate standards or known values derived from standards

© ISO 2025 – All rights reserved

3.3
period of oscillation of the pendulum
T_P
period of a single complete oscillation of the pendulum, oscillating at angles of oscillation of less than 5°, on average, to each side of the vertical

Note 1 to entry: It is expressed in seconds (s).

3.4
centre of percussion
point on a pendulum at which a perpendicular impact in the plane of swing does not cause reaction forces at the axis of rotation of the pendulum

3.5
pendulum length
L_P
distance between the axis of rotation of the pendulum and the *centre of percussion* (3.4) and it is the distance from the axis of rotation where the mass of a pendulum would have to be concentrated to have the same period of swing, T_P, as the actual pendulum

Note 1 to entry: It is expressed in metres (m).

3.6
impact length
L_I
distance between the axis of the rotation of the pendulum and the point of impact of the striking edge at the centre of the specimen face

Note 1 to entry: It is expressed in metres (m).

3.7
release angle
α_0
angle relative to the vertical, from which the pendulum is released

Note 1 to entry: Usually, the test specimen is impacted at the lowest point of the pendulum swing ($\alpha_0 = 0°$). In this case, the release angle will also be the angle of fall [see Figure 1b)].

Note 2 to entry: It is expressed in degrees (°).

3.8
impact velocity
v_I
velocity of the pendulum at the moment of impact

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

3.9
potential energy
E
energy of the pendulum in its starting position, relative to its position at impact

Note 1 to entry: It is expressed in Joules (J).

3.10
impact energy
W
energy required to deform, break, and push away the test specimen

Note 1 to entry: It is expressed in Joules (J).

© ISO 2025 – All rights reserved

3.11
frame
part of the machine carrying the pendulum bearings, the supports, the vice and/or clamps, the measurement instruments, and the mechanism for holding and releasing the pendulum

Note 1 to entry: The mass of the frame, m_F, is expressed in kilograms (kg).

3.12
base
part of the framework of the machine located below the horizontal plane of the supports

3.13
anvil
portion of the machine that serves to properly position the test piece for impact, with respect to the striker and the test piece supports, and supports the test piece under the force of the strike

3.14
test specimen support
portion of the machine that serves to properly position the test specimen for impact, with respect to the centre of percussion of the pendulum, the striker and the *anvils* (3.13)

3.15
striker
portion of the pendulum that contacts the test piece

3.16
period of oscillation of the frame
T_F
period of the freely decaying, horizontal oscillation of the frame and which characterizes the oscillation of the frame vibrating against the stiffness of the (resilient) mounting

Note 1 to entry: Examples of the mounting are test bench and/or its foundation (which may include damping material for instance). See Annex D.

Note 2 to entry: It is expressed in seconds (s).

3.17
mass of the pendulum
$m_{P,max}$
mass of the heaviest pendulum used

Note 1 to entry: It is expressed in kilograms (kg).

3.18
Izod/Charpy impact reference specimen
specimen made from stainless steel 80 mm ± 0,05 mm in length and of rectangular section, 10 mm ± 0,02 mm in height, and 10 mm ± 0,02 mm in width

3.19
tensile impact reference specimen
specimen made from stainless steel 80 mm ± 0,05 mm in length and of rectangular section, 10 mm ± 0,02 mm in height, and 4 mm ± 0,02 mm in width

4 Measurement instruments

The verification methods specified in this document call for the use of straight edges, vernier calipers, set squares, levels and dynamometers, load cells or scales, and timing devices to check if the geometrical and physical properties of the components of the test machine conform to the requirements given in this document.

© ISO 2025 – All rights reserved