INTERNATIONAL STANDARD

ISO 9854-1

Second edition
2023-06

Thermoplastics pipes for the transport of fluids — Determination of Charpy impact properties —

Part 1: General test method

Tubes thermoplastiques pour le transport des fluides — Détermination des caractéristiques au choc Charpy —

Partie 1: Méthode générale d'essai

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

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Foreword

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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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This document was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluid*, Subcommittee SC 5, *General properties of pipes, fittings and valves of plastic materials and their accessories — Test methods and basic specifications*.

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This second edition cancels and replaces the first edition (ISO 9854-1:1994), which has been technically revised.

The main changes are as follows:

— the title has been revised;

— in the Scope, Method A has been modified and Method B has been added;

— in Clause 2, ISO 3126 and ISO 13802 have been added;

— in Clause 3, terms and definitions have been added;

— in Clause 4, the principle has been reworded;

— subclause 5.1 has been revised to suit notched specimens;

— subclause 5.2 has been added, specifying the micrometres and gauges for measuring the dimensions of specimens;

— subclause 5.4 has been added, specifying the use of temperature measuring equipment;

— Figure 3 has been modified, extending the support area to stabilize bigger specimens;

— notched specimens have been added in Table 1;

— subclause 6.2.1 has been revised, giving a method of unnotched specimens preparation;

— subclause 6.2.2 has been added to cover the case of notched specimens;

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— Figure 4, Figure 5, Figure 6, Figure 7 and Figure 8 have been added;

— Clause 7 has been revised, specifying the period of time prior to testing after the production of the pipe and the requirements of liquid bath and air bath;

— subclause 8.1 has been added, giving the procedure for the test for notched and unnotched specimens;

— subclause 9.2 has been added, giving the expression of results of notched specimens;

— in Clause 10, point j) has been revised, giving the type(s) of failure observed and the number and the percentage of each type of failure;

— in Clause 10, point k) has been added, covering the case of notched specimens.

A list of all parts in the ISO 9854 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.

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Introduction

This document specifies the general method for determining the impact properties of thermoplastics pipes.

The test can be carried out at –20 °C, 0 °C or 23 °C, depending on the pipe material and/or size. For the test parameters (i.e. impact energy, specimen dimensions and type of specimen) to be used to determine the pendulum impact strength of pipes, the specifications for specific materials are given in ISO 9854-2, as appropriate.

Data obtained from specimens of different dimensions are not directly comparable.

At present, the ISO 9854 series comprises two parts:

— ISO 9854-1 (this document) gives the general test method under which the impact properties of thermoplastics pipes are to be determined;

— ISO 9854-2 provides specific test parameters to be used to determine the pendulum impact properties of pipes of various materials.

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Thermoplastics pipes for the transport of fluids — Determination of Charpy impact properties —

Part 1: General test method

1 Scope

This document specifies two general test methods, Method A and Method B, to be used for the determination of the impact properties of unnotched and notched specimens cut from thermoplastics pipes for the transport of fluids.

— Method A: unnotched method, for unnotched specimens cut from thermoplastics pipes for the transport of fluids.

— Method B: notched method, for specimens cut from thermoplastics pipes for the transport of fluids, into which a notch has been machined.

The use of Method A or Method B is determined by the relevant product standards.

This document is not intended as a reference test method for the determination of the impact strength of pipes. ISO 3127, relating to the determination of the impact strength of pipes by means of a falling mass, is the reference test method. However, this document can be used for scientific research, materials testing or the examination of pipe when it is not possible to take measurements in accordance with the reference method.

This document can be applied to either isolated batches or continuous production of pipe.

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

ISO 3126, *Plastics piping systems — Plastics components — Determination of dimensions*

ISO 9854-2:—,[1)] *Thermoplastics pipes for the transport of fluids — Determination of Charpy impact properties — Part 2: Test conditions for pipes of various materials*

ISO 13802, *Plastics — Verification of pendulum impact-testing machines — Charpy, Izod and tensile impact-testing*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 179-1 and the following apply.

1) Under preparation. Stage at the time of ISO/FDIS 9854-2:2023.

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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
Charpy impact strength of notched specimens
a_{cN}
impact energy absorbed in breaking a notched specimen, referring to the original cross–sectional area of the specimen at the notch

Note 1 to entry: Within this document, this is expressed in kJ/m^2.

3.2
nominal outside diameter
d_n
specified outside diameter, assigned to a nominal size DN/OD

Note 1 to entry: Within this document, this is expressed in mm.

3.3
nominal wall thickness
e_n
numerical designation of the wall thickness of a component, which is a convenient round number, approximately equal to the manufacturing dimension

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Note 1 to entry: Within this document, this is expressed in mm.

3.4
remaining thickness
h_N
thickness at the notch tip of test pieces which have been notched

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Note 1 to entry: Within this document, this is expressed in mm.

4 Principle

A short length of pipe, or a strip specimen machined therefrom, is conditioned at a selected temperature, T_c, and then supported near its ends as a horizontal beam. The specimen is impacted by a single blow of a striker at a high, nominally constant, velocity, with the line of impact midway between the supports.

In the case of edgewise/flatwise impact with notched specimens, the line of impact is directly opposite the notch.

5 Apparatus

5.1 Pendulum impact-testing machine

5.1.1 The principles, characteristics and verification of a suitable pendulum impact-testing machine shall conform to ISO 13802.

5.1.2 When applicable, the pendulum impact-testing machine may consist of a temperature control device capable of maintaining test temperature as specified.

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5.1.3 The pendulum impact-testing machine shall have the following characteristics for Methods A and B, respectively:

a) **Method A**

1) Velocity at impact: 3,8 m/s.

2) Pendulums providing maximum impact energies of 15 J and 50 J respectively, with a tapered tip of 30° ± 1° and a tip radius of 2,0 mm ± 0,5 mm.

3) Specimen supports in accordance with Figure 1 and Figure 2 for longitudinal plane specimens.

4) Specimen supports in accordance with Figure 3 for circumferential plane specimens. Fixed point of anvils and specimen supports should be adjustable in the horizontal plane parallel to the plane of the swing of the pendulum. The top of the convex specimen should be in line with the centre of percussion at the moment of impact.

b) **Method B**

1) Velocity at impact: 2,9 m/s.

2) Check that the impact machine is able to perform the test at the specified velocity of impact and that the absorbed energy is within the correct range, which shall be between 10 % and 80 % of the total available energy from the pendulum at impact, with a tapered tip of 30° ± 1°and a tip radius of 2,0 mm ± 0,5 mm. If more than one of the pendulums conforms to these requirements, the pendulum having the highest energy shall be used.

3) Specimen supports in accordance with Figure 4 for longitudinal plane notched specimens.

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5.2 Micrometres and gauges

Micrometres and gauges capable of measuring the essential dimensions of test specimens to an accuracy of 0,02 mm are required. For measuring the dimension h_N of notched specimens, the micrometre shall have a spindle with a measuring tip having a suitable profile to fit the type of the notch.

NOTE A method of determining the notch tip radius using a charge-coupled device (CCD) microscope is provided in ISO 179-1.

5.3 Ambient equipment

Ambient equipment, comprising either a thermostatically controlled enclosure or a liquid bath capable of bringing the specimens to the specified temperature, T_c (see Clause 7). When a liquid bath is used, the liquid used shall not have a detrimental effect on the physical properties of the specimens.

5.4 Temperature measuring equipment

Temperature measuring equipment, capable of checking conformity to the specified temperature with an accuracy to within ±0,5 °C.

6 Test specimen

6.1 Preparation

The specimens shall be cut from pipe, in accordance with the procedure of ISO 2818 and with 6.2.1 (Method A) or 6.2.2 (Method B), as appropriate, so that any surface which comes into contact with the anvil, comprising the specimen supports, or with the pendulum at the moment of impact, is smooth and free from burrs. Chamfering shall be avoided during specimen preparation.

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6.2 Cutting and dimensions

6.2.1 Method A

6.2.1.1 Each specimen for pipes up to 25 mm nominal outside diameter, d_n, shall consist of a length of pipe 100 mm ± 2 mm long. See Table 1, specimen type 1.

6.2.1.2 Each specimen for pipes greater than or equal to 25 mm and less than 75 mm d_n shall be cut from pipe in the longitudinal direction and shall conform to the dimensions of one of the types given in Table 1. See Table 1, specimen type 2 or type 3.

NOTE For d_n 25 mm pipes, product standards can potentially define different specimen types for pipe impact tests based on application.

6.2.1.3 Each specimen for pipes greater than or equal to 75 mm and less than 160 mm d_n shall be cut from pipe in the longitudinal and circumferential directions and shall conform to the dimensions of one of the types given in Table 1. See Table 1, specimen type 2 or type 3 for longitudinal cut specimens, and specimen type 4 for circumferential cut specimens.

6.2.1.4 Each specimen for pipes greater than or equal to 160 mm d_n shall be cut from pipe in the longitudinal and circumferential directions and shall conform to the dimensions of one of the types given in Table 1. See Table 1, specimen type 2 or type 3 for longitudinal cut specimens, and specimen type 4 or type 5 for circumferential cut specimens.

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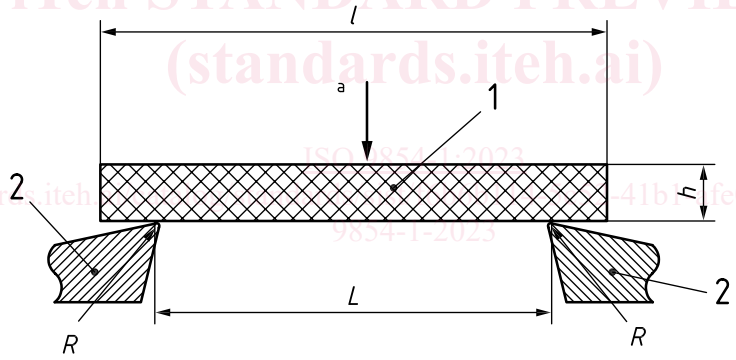

Key

1 specimen
2 anvils
h specimen thickness (coincides with the outside diameter)
l specimen length, (100 ± 2) mm
L span, the distance between the supports, see ISO 179-1:2023, Figure 6, (70 ± 0,5) mm
R radius of curvature of anvils, (1 ± 0,1) mm
a Direction of blow.

Figure 1 — Supports for specimen type 1

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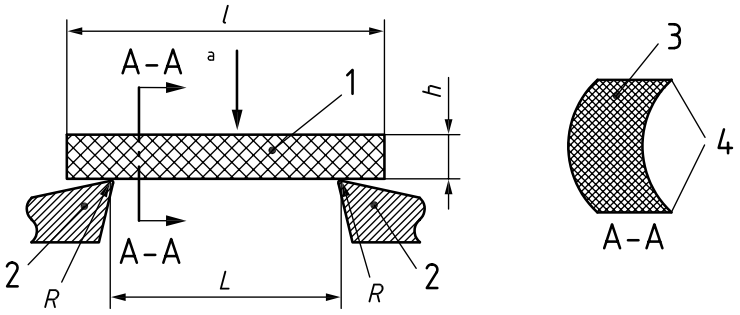

Key

1 specimen
2 anvils
3 cross section
4 edge of specimen
h specimen thickness
l specimen length, (50 ± 1) mm or (120 ± 2) mm
L span, the distance between the supports, see ISO 179-1:2023, Figure 6, (40 ± 0,5) mm or (70 ± 0,5) mm
R radius of curvature of anvils, (1 ± 0,1) mm
[a] Direction of blow.

Figure 2 — Supports for specimen type 2 and type 3

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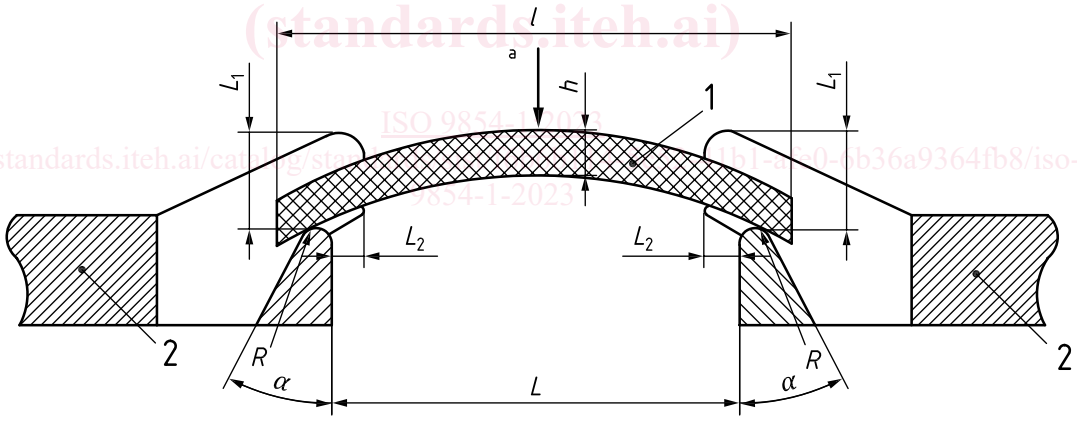

Key

1 specimen
2 anvils
α angle of anvils, 30°
h specimen thickness
l specimen length, (50 ± 1) mm or (120 ± 2) mm
L supports spacing, (40 ± 0,5) mm or (70 ± 0,5) mm
L_1 extend distance of supports parallel to the direction of blow, ≥ 25 mm
L_2 extend distance of supports perpendicular to the direction of blow, ≥ 8 mm
R radius of curvature of anvils, (2 ± 0,1) mm
[a] Direction of blow.

Figure 3 — Supports for specimen type 4 and type 5

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