UDC 678.5

Ref. No.: ISO/R 179-1961 (E)

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION
R 179

PLASTICS

DETERMINATION OF THE CHARPY IMPACT RESISTANCE OF RIGID PLASTICS

(CHARPY IMPACT FLEXURAL TEST)

1st EDITION

February 1961

For each individual country the only valid standard is the national standard of that country.

Printed in Switzerland

Also issued in French and Russian. Copies to be obtained through the national standards organizations.

BRIEF HISTORY

The ISO Recommendation R 179, *Determination of the Charpy Impact Resistance of Rigid Plastics* (*Charpy Impact Flexural Test*), was drawn up by Technical Committee ISO/TC 61, *Plastics*, the Secretariat of which is held by the American Standards Association, Incorporated (ASA).

Work on this matter which the Technical Committee had begun since 1956, came to an end in 1957, with the adoption of a proposal as a Draft ISO Recommendation.

On 8 May 1959, the Draft ISO Recommendation (No. 213) was distributed to all the ISO Member Bodies and was approved by the following Member Bodies:

Austria	India	Sweden
Belgium	Israel	Switzerland
Burma	Italy	Turkey
Czechoslovakia	Japan	United Kingdom
Finland	Netherlands	U.S.A.
Germany	Portugal	U.S.S.R.
Greece	Romania	
Hungary	Spain	

One Member Body opposed the approval of the Draft: France.

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in February 1961, to accept it as an ISO RECOMMENDATION.

ISO Recommendation R 179 February 1961

PLASTICS

DETERMINATION OF THE CHARPY* IMPACT RESISTANCE OF RIGID PLASTICS

(CHARPY IMPACT FLEXURAL TEST)

1. DEFINITIONS

1.1 *Impact strength of unnotched specimens.* The impact energy consumed by the unnotched specimen, referred to the cross section of the specimen (see clause 9.1).

1.2 *Impact strength of notched specimens.* The impact energy consumed by the notched specimen (see Fig. 1 and 2), referred to the cross section of the specimen at the notch before the test (see clause 9.2).

1.3 *Relative impact strength.* The ratio of the impact strength of notched specimens to the impact strength of unnotched specimens (see clause 10.2.4).

1.4 *Rigid plastics.* For the purpose of this ISO Recommendation, plastics that break under the conditions of this test.

2. SCOPE

2.1 The impact flexural test is used for the determination of the behaviour of specified specimens under specified impact stresses and for the estimation of the brittleness or of the toughness of the specimens within the limitations applied by the conditions of the test.

2.2 The impact flexural test specified by this method is applied to specimens prepared from moulding materials or taken from mouldings (including laminates). The test is particularly suited for the control of the production and manufacture, as well as for the inspection and acceptance of moulding materials and mouldings.

The test results obtained by testing specimens separately prepared from moulding materials cannot be simply related to mouldings of other shapes, since the results of these tests depend on the shape of the moulding and the conditions of their production.

A comprehensive estimation of the behaviour of moulded materials under impact flexural stresses is only possible if the test described here is accompanied by other tests carried out with differently shaped and dimensioned specimens and with different impact speeds of the striker, as well as with different specimen arrangements and at different temperatures.

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* For the determination of the Izod impact resistance, see ISO Recommendation R 180, *Determination of the Izod Impact Resistance of Rigid Plastics (Izod Impact Flexural Tests).*

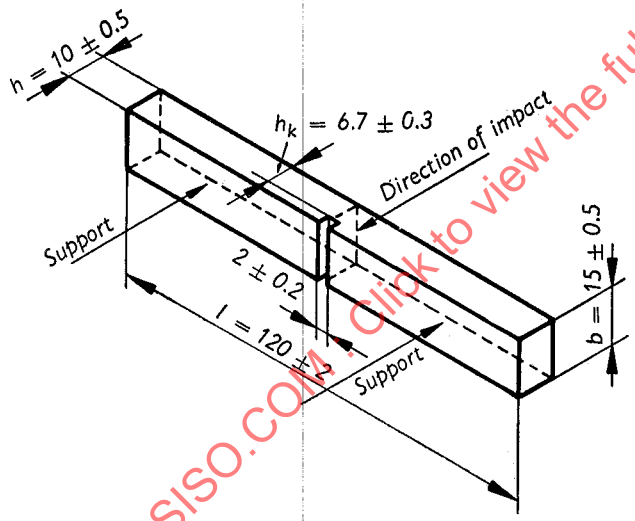
3. TEST SPECIMENS

3.1 Unnotched specimens. The determination of the impact strength of unnotched specimens should be effected with the specimen shapes according to Table 1, below. Specimens of laminated sheets should be taken so that the impact flexural test can be carried out with impact direction lengthwise, as well as crosswise to the laminations.

3.2 Notched specimens. Notched specimens should be taken from the unnotched specimens in accordance with Table 1, notches being milled in accordance with Figures 1 and 2, below.

TABLE 1.—**Dimensions of specimens**

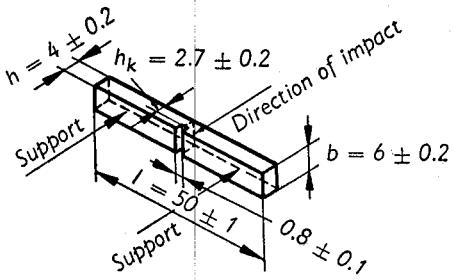
Shape of specimen	Length l	Breadth b	Thickness h (height)
	mm	mm	mm
Standard bar	120 ± 2	15 ± 0.5	10 ± 0.5*
Standard small bar	50 ± 1	6 ± 0.2	4 ± 0.2



Rounding off of the notch base < 0.2

FIG. 1.—**Standard bar with notch**

Dimensions in millimetres



Rounding off of the notch base < 0.1

FIG. 2.—**Standard small bar with notch**

* See Note 1, page 7.

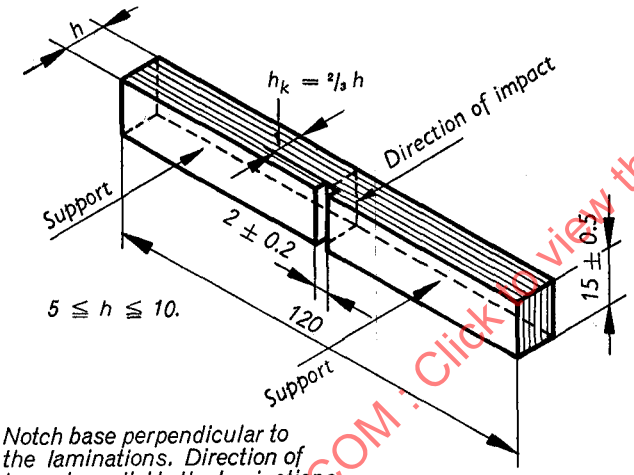
The specimens are provided with a U-notch vertical to the axis of the bar. Position and dimensions of the notch are indicated in Figures 1 and 2. The depth of the notch should be selected so that the remaining cross-section amounts to about 2/3 of the original total cross-section of the bar, in the case of the standard test bar, for instance, about 1 cm². The edges of the notch base should not be rounded, if possible. The rounding radius of these edges in standard test bars should remain below 0.2 mm, while in the standard small bar it should not reach 0.1 mm (see Fig. 1 and 2).

3.2.1 In the case of specimens taken from laminated sheets, the notch should be cut into one of the surfaces of 15 mm width as well as into one of the surfaces of 10 mm width, as indicated in Figures 3 and 4.*

NOTES

1. In the case of specimens cut from laminated sheets, the thickness up to 10 mm is the same as that of the sheets. Specimens taken from sheets thicker than 10 mm should be milled off uniformly from both sides to a thickness of 10 ± 0.5 mm. Specimens are not taken from sheets less than 5 mm thick.

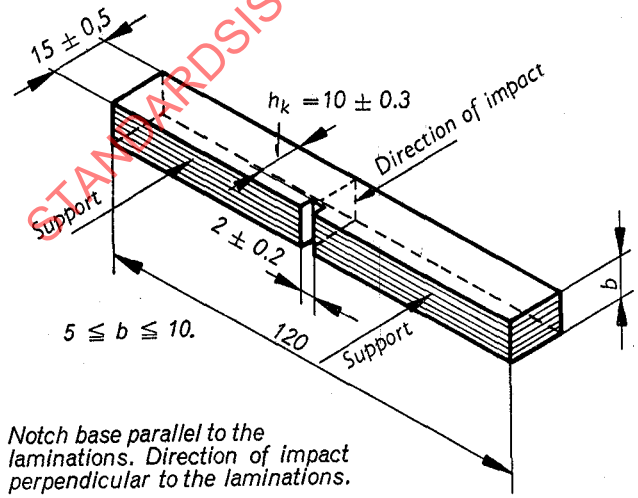
2. The dimension indicating the length of the notch is added as index value to a_k.



Notch base perpendicular to the laminations. Direction of impact parallel to the laminations.

FIG. 3.—**Notched standard bar taken from laminated materials for the determination of the impact strength a_k 15 ***

Dimensions in millimetres



Notch base parallel to the laminations. Direction of impact perpendicular to the laminations.

FIG. 4.—**Notched standard bar taken from laminated materials for the determination of the impact strength a_k 10 ***

* See Note 2.

3.3 **Application of different specimen shapes.** The specimen shape to be selected should be subject to agreement. Lacking agreement, the following specimens are used for comparative investigations, e.g., as basis for the classification of moulding materials and mouldings:

(*a*) *the standard bar*, without or with notch, usually used for moulded specimens and specimens from laminated sheets;

(*b*) *the standard small bar*, without or with notch, for specimens cut from mouldings (otherwise usually only for specimens prepared by injection moulding).

4. NUMBER OF TEST SPECIMENS

4.1 The number of specimens to be tested should be subject to agreement. Lacking agreement, five specimens should be tested.

4.2 For materials whose strength values are clearly dependent on direction, five specimens should be taken and tested for each main direction, for instance, for the lengthwise and crosswise directions (see also Fig. 3 and 4, page 7, and clause 8.2).

5. APPARATUS

5.1 **Pendulum impact apparatus.** Testing of the impact strength of notched and unnotched bars should be carried out with one of the pendulum impact apparatus, indicated in Table 2, below. The dimensions of the striking edge of the pendulum and of the supports are indicated in Figures 5 and 6, below.

TABLE 2.—**Characteristic features of pendulum impact apparatus**

Maximum impact energy kgf · cm	Impact velocity of the striker when hitting centre of specimen m/s
5	2.9
10	
40	
150	3.8

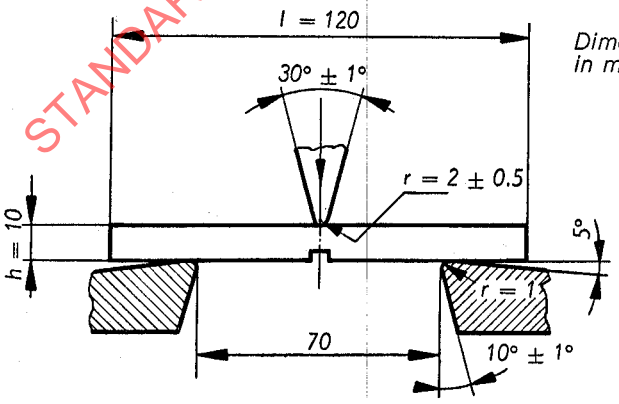


FIG. 5.—**Striking edge and anvil for standard bar without and with notch**

Dimensions in millimetres

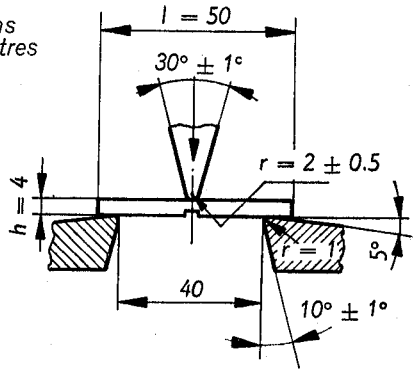


FIG. 6.—**Striking edge and anvil for standard small bar without and with notch**

5.2 **Application of the various pendulum impact apparatus.** The selection of the pendulum impact apparatus to be used depends on the type of plastics to be tested and on the shape of the specimens, and should be subject to agreement.

The pendulum impact apparatus selected should consume at least 10 per cent, but not more than 80 per cent of its stored energy in the testing of impact strength of notched and unnotched bars.

In comparative investigations of plastics, the impact strength values of notched and unnotched bars should, however, be determined by pendulum impact apparatus, ensuring equal impact velocities of the pendulum when hitting the centre of the specimens, since the impact velocity usually exerts a strong influence on the result obtained.

6. CONDITIONING OF TEST SPECIMENS

The specimens should be preconditioned and tested in accordance with the relevant ISO Recommendation.*

7. PROCEDURE

7.1 Previous to the test, measure, to an accuracy of 0.1 mm, breadth and thickness of the specimen in the centre. Notched specimens should be measured in the centre of the notch.

7.2 Fasten rigidly the pendulum impact apparatus to a rigid base and adjust it so that the striking edge hits the specimen over its entire width.

7.3 In testing the standard bar (see Fig. 5, page 8, and Fig. 3 and 4, page 7) and the standard small bar (see Fig. 6, page 8) with and without notch, the specimens are placed on the supports in such a manner that the striking edge hits the centre of the specimen. Notched bars should be placed so that the centre of the notch is located directly in the plane of impact, with the notch on the rear side.

If, in the testing of thin laminated sheets, the specified thickness of 10 mm cannot be attained, hard packing pieces, with thickness supplementing that of the specimen to a total of 10 mm, should be placed behind the supports. These pieces should be adapted to the supports in accordance with Figure 5, page 8.

7.4 The pointer of the pendulum impact apparatus should be adjusted so that it touches the driving pin when the pendulum is hanging vertically. Blank tests should be carried out to ensure that the total friction loss, including the friction of the pointer, does not exceed the following percentages of the maximum impact energy when the pendulum is swinging up to the maximum amplitude:

Pendulum with a maximum impact energy of $\geqq$ 40 kgf · cm : 0.5 per cent
Pendulum with a maximum impact energy of $\geqq$ 10 kgf · cm : 1 per cent
Pendulum with a maximum impact energy of $\geqq$ 5 kgf · cm : 2 per cent

7.5 The pendulum is lifted and arrested, the specimen is arranged according to the instructions offered in clause 7.3 and the pendulum released carefully (not suddenly).

* The ISO Recommendation relating to standard atmospheres for conditioning and testing plastics materials is being prepared.