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INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION R 85

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ISO/R 85:1959

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BRIEF HISTORY

The ISO Recommendation R 85, *Bend Test for Steel*, was drawn up by Technical Committee ISO/TC 17, *Steel*, the Secretariat of which is held by the British Standards Institution (B.S.I.).

At the first meeting of ISO/TC 17, held in London, in June 1950, the Secretariat submitted a first draft proposal for the bend test, based on a document which had been drawn up by the former International Federation of the National Standardizing Associations (ISA). The Technical Committee instructed its Working Group No. 1, *Methods of Mechanical Testing for Steel*, to examine this draft proposal and to prepare a new version of it, taking into account certain observations put forward by Member Bodies.

In April 1952, the Working Group submitted a second draft proposal, which was discussed at the second plenary meeting of ISO/TC 17, held in New York, in June 1952, and which was passed back to the Working Group so that it might include therein data on tolerances.

The third draft proposal, submitted by the Working Group in August 1953, was studied by the Technical Committee during its third plenary meeting, held in London, in December 1953, along with the comments of the Member Bodies. The ISO/TC 17 Secretariat was then assigned to draw up a fourth draft proposal incorporating the changes voted during the meeting, and this was circulated in April 1954.

The comments of the Member Bodies on this fourth draft proposal were discussed at the fourth plenary meeting, held in Stockholm, in June 1955, and the Technical Committee decided to adopt it, subject to a few amendments, as a Draft ISO Recommendation.

On 31 October 1956, this Draft ISO Recommendation (No. 136) was distributed to all the ISO Member Bodies and was approved, subject to a few modifications of details, by the following Member Bodies:

Australia	*Greece	Spain
Belgium	Hungary	Sweden
*Canada	*Ireland	Turkey
Czechoslovakia	Italy	*Union of
Denmark	Japan	South Africa
Finland	Netherlands	U.S.S.R.
France	Poland	Yugoslavia
Germany	Portugal	

No Member Body opposed the approval of the Draft.

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in February 1959, to accept it as an ISO RECOMMENDATION.

These Member Bodies stated that they had no objection to the Draft being approved.

BEND TEST FOR STEEL

1. SCOPE

For the bend testing of certain products such as sheets, strips, wires and tubes, particular specifications are applicable.

2. PRINCIPLE OF TEST

The test consists in submitting to plastic deformation by bending a straight, solid, prismatic- or round-section test piece without reversing the direction of flexure during the test. The bending is carried out until one leg of the test piece makes, under load, a specified angle α with the extension of the other (see Fig. 2). The axes of the two legs of the test piece remain in a plane perpendicular to the axis of bending. In the case of 180° bend, the two lateral surfaces may, depending on the requirements of the specification, lie flat against each other, or may be parallel at a specified distance; an intermediate piece may be used for the control of this distance (see Fig. 4).

ISO/R 85:1959

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3. SYMBOLS AND DESIGNATIONS

Number	Symbol	Designation
1	a	Thickness or diameter of test piece
2	b	Width of test piece
3	—	Distance between supports (see Fig. 1 and 2) or the opening of a block, U-shaped or V-shaped (see Fig. 3)
4	α	Angle of bend
5	R	Radius of supports
6	D	Diameter of mandrel
7	—	Radius of curvature of pressure piece
8	r	Internal radius of the bent portion of the test piece after bending

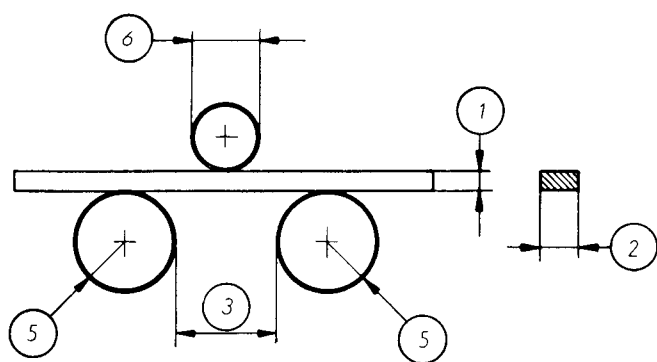


FIG. 1

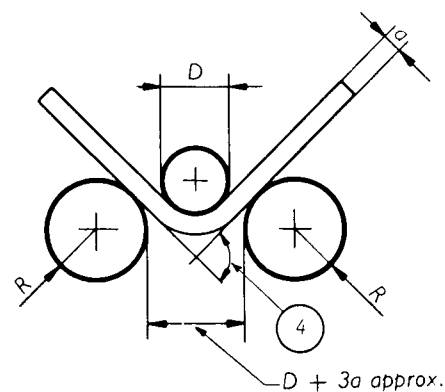


FIG. 2

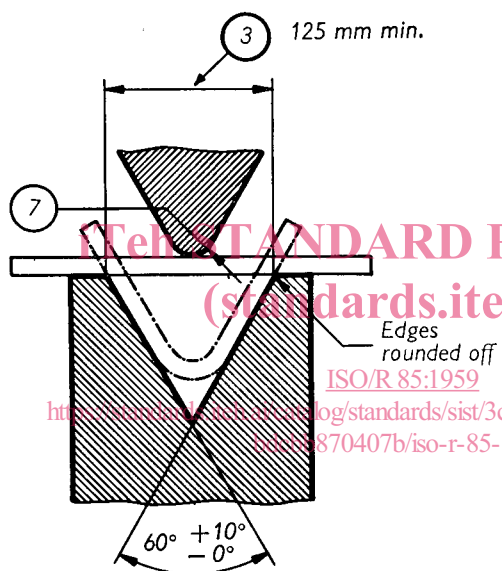


FIG. 3

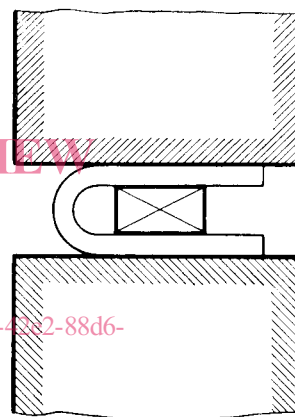


FIG. 4

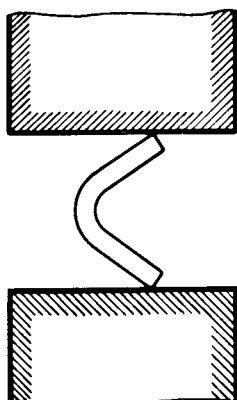


FIG. 5

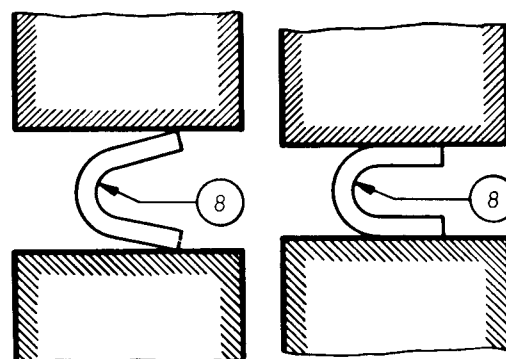


FIG. 6

4. TEST PIECES

4.1 The test piece is generally of rectangular cross-section. The edges are rounded to a radius not exceeding 1/10 of the thickness. However, a test on a test piece, the edges of which have not been rounded, is acceptable, provided the resultant bend is satisfactory. The width is fixed at a value normally between 25 and 50 mm (1 and 2 in), with a tolerance of ± 5 mm (0.20 in).

4.2 The thickness is chosen as follows:

4.2.1 For semi-finished products and forged pieces, the thickness of the test piece is 20 mm (0.8 in) ± 5 mm (0.20 in), unless another thickness is specified.

4.2.2 For specimens cut from sheets, plates and structural sections, the thickness of the test piece is the thickness of the material to be tested. If the rolled thickness is greater than 25 mm (1 in), it may be reduced by machining on one side to a specified thickness not less than 25 mm (1 in). In bending, the machined surface will be on the outside.

4.3 For steel of round or polygonal section, the test may be carried out on a piece as cut from the bar, if the diameter (of a round cross-section) or the diameter of the inscribed circle (for a polygonal cross-section) does not exceed 50 mm (2 in).

4.3.1 Material over 30 mm (1.2 in) may, and over 50 mm (2 in) should, be reduced to a convenient size of approximately 20 mm (0.8 in) to 50 mm (2 in) in diameter.

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5. PROCEDURE

The common method of carrying out the test includes the following operations:

5.1 Lay the test piece on two parallel supports and bend it in the middle by means of a mandrel.

5.1.1 The widths of the supports and of the mandrel should be greater than that of the test piece (see Fig. 1 and 2, page 5). The radii of the supports and of the mandrel are determined by the specification for the material.

5.1.2 The same applies to the distance between the supports, but if not, this distance is taken as approximately $D + 3a$ (see Fig. 2, page 5).

5.1.3 If it is necessary to observe the point at which cracking begins, the outer surface of the test piece should remain clearly visible in the portion being bent during the conduct of the test.

5.2 Lay the test piece on a block, U-shaped or V-shaped, according to the pressure piece used and apply the bending force slowly, with the objective of permitting free plastic flow of the material.

5.2.1 The tapered surfaces of the U-or the V-block (see Fig. 3, page 5) should form an angle of $60^\circ \begin{smallmatrix} + 10^\circ \\ - 0^\circ \end{smallmatrix}$ and the opening should be at least 125 mm (5 in).

5.2.2 In this case, the length of the test piece is generally 250 mm (10 in). The supporting edges should be slightly rounded off.

5.3 If it is not possible to bend the test piece to the specified angle in the manner described above, the bend is completed by pressing directly on the ends of the two legs of the test piece.

5.3.1 In this method of test, it is very difficult to maintain the specified radius of bend indicated by the symbol r (see number 8 on Fig. 6, page 5).

5.3.2 The angle of bend is always specified as a minimum. In cases where the internal radius of the bend is specified, it is specified as a maximum.

5.4 If the test is to be effected by bringing the two legs of the test piece parallel to each other, two methods are permissible.

5.4.1 One method is based on the method described above (see Fig. 1 to 4, page 5).

5.4.2 The second method implies two periods:

(a) The test piece is supported at the ends on supports or cylinders or laid across a block, U-shaped or V-shaped. The widths of the supports and of the pressure piece should be greater than that of the test piece. The bending is started by the application of a steady pressure.

(b) The specimen is then placed in a press (see Fig. 5, page 5) and pressure is applied until the internal radius of the specimen and the angle between the legs reach those specified for the bend (see Fig. 6, page 5).

6. TEST REQUIREMENTS

6.1 It should be specified whether the test is to be carried out hot or cold.

6.2 After bending, the sides and the outside of the bent portion should be examined.

6.3 The interpretation of the appearance of the bent portion is a matter for the material specification.

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