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ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION

R 398

BEND TEST FOR COPPER AND COPPER ALLOYS

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BRIEF HISTORY

The ISO Recommendation R 398, *Bend Test for Copper and Copper Alloys*, was drawn up by Technical Committee ISO/TC 26, *Copper and Copper Alloys*, the Secretariat of which is held by the Deutscher Normenausschuss (DNA).

Work on this question by the Technical Committee began in 1958 and led, in 1961, to the adoption of a Draft ISO Recommendation.

In February 1962, this Draft ISO Recommendation (No. 496) was circulated to all the ISO Member Bodies for enquiry. It was approved by the following Member Bodies:

Australia	India	Sweden
Bulgaria	Italy	Switzerland
Burma	Japan	Turkey
Canada	Netherlands	United Kingdom
Denmark	Poland	U.S.S.R.
Finland	Portugal	Yugoslavia
France	Republic of South Africa	
Germany	Spain	

Two Member Bodies opposed the approval of the Draft:

Belgium, U.S.A.

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in November 1964, to accept it as an ISO RECOMMENDATION.

ISO Recommendation R 398 November 1964

BEND TEST FOR COPPER AND COPPER ALLOYS

1. SCOPE

This ISO Recommendation relates to the bend testing of wrought products of copper and copper alloys excluding wires and tubes.

2. PRINCIPLE OF TEST

A straight solid prismatic or round section test piece is subjected to plastic deformation by bending 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, page 6). The axes of the two legs of the test piece remain in a plane perpendicular to the axis of bending.

Unless otherwise specified, the test is carried out at ambient temperature.

3. SYMBOLS AND DESIGNATIONS

Number	Symbol	Designation
1	a	Thickness or diameter of test piece
2	b	Width of test piece
3	—	Distance between support rollers (Figs. 1 and 2) or, for a V-block, the opening of the vee (Fig. 3)
4	α	Angle of bend
5	R	Radius of support rollers
6	D	Diameter of mandrel
7	—	Radius of curvature of forming tool
8	r	Internal radius of bend of the test piece after bending

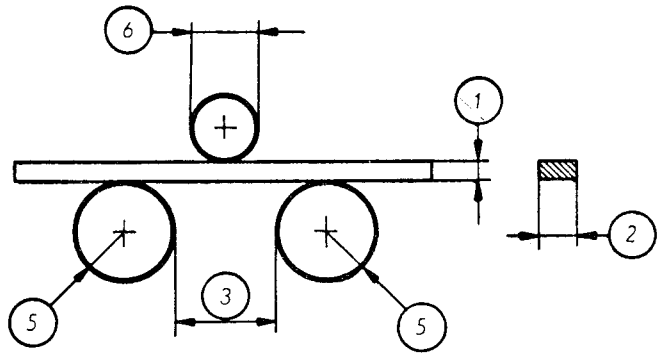

FIG. 1

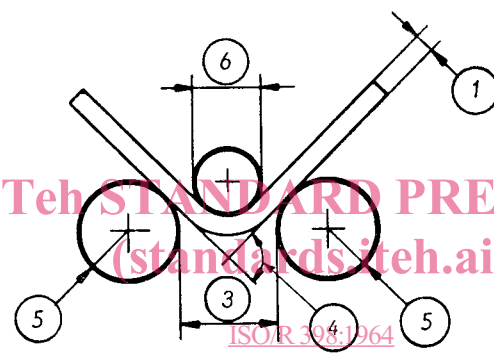

FIG. 2

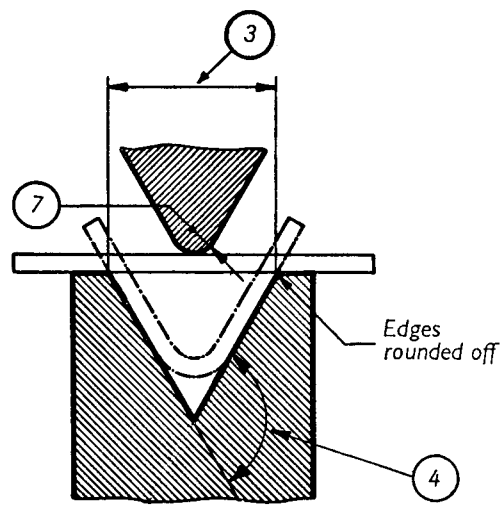

FIG. 3

4. TEST PIECE

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 that the result of the test satisfies the requirements of the material specification. The width should not normally exceed 50 mm (2 in). Products having a finished width less than 50 mm (2 in) should be tested at full width.

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) $\pm$ 5 mm (0.2 in), unless another thickness is specified.

4.2.2 For specimens cut from sheet, strip, plate and special sections the thickness of the test piece is the thickness of the material to be tested. If the thickness of the rolled product 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 unmachined surface will be on the outside of the bend.

4.3 For bars of round or polygonal section, the test may be carried out on the full section of the bar. Where a test piece is machined from the bar it should contain some of the original surface of the bar and in the test the original surface should be on the outside of the bend. The dimensions of such machined test pieces should comply with the requirements of Clause 4.1.

5. ANGLE AND RADIUS OF BEND

The angle of bend α should be stated in the specification for the product. It should always be specified as a minimum. In cases where the internal radius of bend r is specified, it should be specified as maximum internal radius.

6. PROCEDURE

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

6.1 Lay the test piece on two parallel support rollers and bend it in the middle by means of a mandrel, as illustrated in Fig. 1 and 2, page 6.

6.1.1 The widths of the support rollers and of the mandrel should be greater than that of the test piece. The radii of the support rollers and of the mandrel are determined by the requirements of the material specification.

6.1.2 If the distance between the support rollers is not also specified, this distance should be taken as approximately $D + 3\ a$.

6.1.3 The length of the test piece should be at least the distance between support rollers + 4 R.

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

6.2 Alternatively, the bending may be effected by the use of a V-block, as illustrated in Figure 3, page 6.

6.2.1 The dihedral angle between the surfaces of the V-block should be the supplement of the specified angle of bend α to within a tolerance of $\pm 1°$, and the opening should be at least 6 times the thickness of the test piece. The supporting edges should be slightly rounded. The shape of the forming tool should be stated in the material specification.

6.2.2 The length of the test piece for use in this method of bending should be at least twice the opening of the V-block.

6.3 The bending force should be applied slowly to permit free plastic flow of the material.

7. INTERPRETATION OF TEST RESULTS

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

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

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