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GB/T 232-2010

Replacing GB/T 232-1999

Metallic Materials - Bend Test

金属材料 弯曲试验方法
(ISO 7438:2005, MOD)

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Foreword

The modification of this Standard adopts international standard ISO 7438:2005 *Metallic Materials - Bend Test* (English version) as a reference.

This Standard was re-drafted in accordance with ISO 7438:2005. In order to make it convenient for comparison, Appendix A provides a comparison list between the chapter No. in this national standard and the Chapter No. in the international standard.

The main technical differences between this Standard and the international standard are as follows:

- Chapter 2 “Normative References” is added;
- Figure 3 and Figure B.1 are added to Chapter 3;
- 5.5 “other bending devices (for example, flap-type bending device) that comply with the principle of bend test may also be adopted” is added;
- “The cutting location and direction of test piece shall comply with the requirements of relevant product standards. If it is not specifically stipulated, steel products shall comply with the requirements in GB/T 2975.” is added to 6.1.

In order to make it convenient to be used, this Standard makes the following editorial modifications:

- The phrase “this International Standard” is modified into “this Standard”;
- Decimal point “.” is used to replace comma “,”, which serves as decimal point;
- The foreword in the international standard is deleted.

This Standard serves as a replacement of GB/T 232-1999 *Metallic Materials - Bend Test*.

This amendment of this Standard makes the following modifications in technical content based on GB/T 232-1999:

- The term “flexural center” is deleted;
- The formula that determines test piece’s length is deleted;
- The stipulations of test piece’s thickness are modified;
- The stipulations of fillet radius value of rectangular test piece are added;

Metallic Materials - Bend Test

1 Scope

This Standard stipulates the test method for the determination of metallic materials' ability of withstanding plastic deformation in bending.

This Standard is applicable to bend test of test pieces of metallic materials stipulated in relevant product standards. However, it is not applicable to bend test of metal pipes and metal welded joints. The bend test of metal tubes and metal welded joints shall be stipulated by other standards.

2 Normative References

Through the reference in this Standard, clauses of the following documents become clauses of this Standard. In terms of references with a specific date, all the subsequent modification sheets (excluding the corrected content) or the revised editions are not applicable to this Standard. However, all parties that reach an agreement in accordance with this Standard are encouraged to explore the possibility of adopting the latest version of these documents. In terms of references without a specific date, the latest version is applicable to this Standard.

GB/T 2975 Steel and Steel Products - Location and Preparation of Test Pieces for Mechanical Testing (GB/T 2975-1998, eqv ISO 377: 1997)

3 Symbols and Instructions

The symbols adopted in this Standard, and the instructions of the symbols are shown in Table 1, Figure 1, Figure 2, Figure 3 and Figure B.1.

Table 1 -- Symbols and Instructions

Symbols	Instructions	Unit
a	Test piece's thickness or diameter (or inscribed circle diameter of polygonal cross section)	mm
b	Test piece's width	mm
L	Test piece's length	mm
l	Distance between rollers	mm
D	Diameter of bent indenter	mm
α	Bending angle	(°)
r	Bending radius of test piece after bending	mm
f	Displacement distance of bent indenter	mm
c	Before test, the distance between the horizontal plane where the roller's	mm

5.3 V-shaped Mold Bending Device

The angle of V-shaped groove of the mold shall be $(180^\circ - \alpha)$ (see Figure 2). Bending angle α shall be stipulated in relevant product standards.

The supporting edges of the mold shall be rounded; the rounding radius shall be $(1 \sim 10)$ times of the test piece's thickness. The width of the mold and bent indenter shall be more than the width or diameter of the test piece. In addition, the mold and bent indenter shall have sufficient hardness.

5.4 Clamp-type Bending Device

The device is constituted of clamp and bent indenter, which has sufficient hardness (see Figure 3). A lever of force application may be allocated. The diameter of bent indenter shall comply with the requirements of relevant product standards; the width of bent indenter shall be more than the width or diameter of test pieces.

Since the position of the left end face of the clamp will affect the test result, the left end face (see Figure 3) of the clamp cannot reach or exceed the bent indenter's central vertical line.

5.5 Other bending devices (for example, flap-type bending device) that comply with the principle of bend test may also be adopted.

6 Test Pieces

6.1 General Requirements

Test pieces of circular, square, rectangular or polygonal cross section shall be used in test. The cutting location and direction of test piece shall comply with the requirements of relevant product standards. If it is not specifically stipulated, steel products shall comply with the requirements in GB/T 2975. Parts where material performance is affected by shearing or flame cutting, or similar operations, shall be removed. If the test result is not affected, it is allowed to retain the affected parts.

6.2 Edges of Rectangular Test Pieces

The surface of test pieces shall not manifest any scratch or damage. The edges of square, rectangular and polygonal cross section test pieces shall be rounded; the rounding radius cannot exceed the following numerical values:

- 1 mm, when test piece's thickness is less than 10 mm;
- 1.5 mm, when test piece's thickness is more than or equals to 10 mm, and less than 50 mm;
- 3 mm, when test piece's thickness is not less than 50 mm.

7.3 In the test that bends test piece to the stipulated bending angle, the test piece shall be placed on the two rollers (see Figure 1) or the V-shaped mold (see Figure 2); test piece's axes shall be vertical to the bent indenter's axes. In the midpoint between the two supports, the bent indenter continuously applies force on the test piece to make it bent, till the stipulated bending angle is reached. Bending angle (α) may be calculated through the measurement of the displacement of the bent indenter, as it is shown in Appendix B.

The method shown in Figure 3 may be adopted to conduct the bend test. Fixate one end of the test piece; bend it around the bent indenter. It may be bent across the bent indenter, till it reaches the stipulated bending angle (see 5.4 for details).

In bend test, slowly apply the bending force, so that materials can freely conduct plastic deformation.

When there is a dispute, test rate shall be (1 ± 0.2) mm/s.

If it is impossible to directly reach the stipulated bending angle through the above-mentioned methods, place the test piece between two parallel pressing plates (see Figure 5); continuously apply force onto both ends, so that the test piece would further bend, till it reaches the stipulated bending angle.

7.4 In test that test piece is bent till its two arms are mutually parallel, firstly, preliminarily bend the test piece; then, place the test piece between two parallel pressing plates (see Figure 5); continuously apply force onto both ends, so that the test piece would further bend, till the two arms become parallel (see Figure 6). In the test, an internal insert may, or, may not be added. The thickness of the insert equals to the stipulated diameter of bent indenter, unless it is otherwise stipulated in product standards.

7.5 In test that test piece is bent till its two arms directly contact with each other, firstly, preliminarily bend the test piece; then, place the test piece between two parallel pressing plates; continuously apply force onto both ends, so that the test piece would further bend, till the two arms directly contact with each other (see Figure 7).

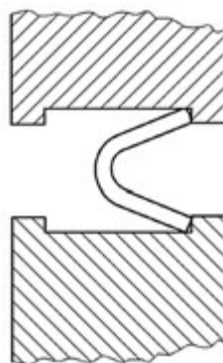


Figure 5

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