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# International Standard



# 5173

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INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

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## Fusion welded butt joints in steel — Transverse root and face bend test

*Jointes soudés bout à bout par fusion dans l'acier — Essais de pliages transversaux, à l'endroit et à l'envers*

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**Descriptors** : butt joints, butt welds, welded joints, fusion welding, tests, mechanical tests, bend tests, test specimens, dimensions.

## Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 5173 was developed by Technical Committee ISO/TC 44, *Welding and allied processes*, and was circulated to the member bodies in February 1978.

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The member body of the following country expressed disapproval of the document on technical grounds :

Germany, F.R.

# Fusion welded butt joints in steel — Transverse root and face bend test

## 1 Scope

This International Standard specifies two methods for making transverse root and face bend tests on test pieces taken from a fusion welded butt joint in order to assess ductility or absence of defects on the surface in tension of the joint itself. It also gives the dimensions of the test piece.

## 2 Field of application

This International Standard applies to ferrous materials with butt joints made by any fusion welding process.

## 3 Principle

Submitting a test piece, taken transversely from a welded joint, to plastic deformation by bending it, without reversing the bending direction, in such a way that one of the surfaces of the weld is in tension.

The test may be made according to either of two methods described in clauses 6 (bending test using a former) and 7 (bending test using a roller).

## 4 Taking of test pieces

**4.1** The test piece shall be taken from a part of a welded fabrication or a welded test assembly<sup>1)</sup> transversely to the welded joint in such a way that after machining the weld axis will remain in the middle of the length of the specimen.

**4.2** Each test piece shall be marked in such a way that after its removal it is possible to identify its exact position in the fabrication or in the test assembly from which it has been taken. No heat treatment shall be applied to the test assemblies unless it is specified or allowed by the application standard for the welded joint to be tested. Details of any heat treatment shall be recorded in the test report.

**4.3** The test piece shall be taken by appropriate means. Shearing is excluded for thicknesses of more than 8 mm. If thermal cutting or other methods which could affect the cut

surfaces are used, the cuts shall be at a distance from the test piece greater than or equal to 8 mm but in any case sufficient, according to the process used, not to induce alterations which could modify the test results. An exception to this may be the case when the bend test is made only to ascertain the possible presence of weld defects, in which case the edges of the specimen shall be dressed smooth.

## 5 Machining of the test piece

**5.1** The test piece shall be finished by machining or grinding, suitable precautions being taken to avoid superficial strain-hardening or excessive heating of the material. Within the length  $L$  (see figures 3 and 4) the surfaces shall be free from scratches or notches transverse to the test piece direction.

**5.2** The test piece shall have a rectangular cross-section practically constant for all its length. The cross-sectional shape shall conform to figure 1.

When the weld is made from one side only, the bend test pieces are called :

- face bend test pieces, when the surface in tension contains the largest width of the weld;
- root bend test pieces, when the surface in tension contains the root of the weld.

When the joint is made from both sides, then the side from which welding commenced first is called the face. The other side is called the root.

**5.3** The upper and lower surfaces of the weld shall be dressed flush with the original surfaces of the parent metal. Machining of any undercuts is not permitted unless otherwise specified in the application standard.

**5.4** For plate material, the width  $b$  of the test piece shall not be less than 1,5 times  $a$ , with a minimum of 20 mm.

1) "Test assemblies" are welded joints which do not belong to a construction but are made for purposes of approval (for example procedure qualification), control (for example production test coupons) or studies and research.

For tubes, the width  $b$  of the specimen shall be :

- for tube diameters  $\leq 50$  mm :  $S + 0,1 D$  (with a minimum of 8 mm);
- for tube diameters  $> 50$  mm :  $S + 0,05 D$  (with a minimum of 8 mm and a maximum of 40 mm);

where  $S$  is the tube thickness, and  $D$  is the outside diameter of the tube.

**5.5** Generally, the test piece thickness  $a$  shall be equal to the thickness of the parent metal near the welded joint.

When the joint thickness exceeds 30 mm, it is permissible, instead of a single test piece having the full joint thickness, to take several test pieces from the welded joint, provided the thickness  $a$  of each test piece is not less than 30 mm and that they cover the full thickness of the joint (see figure 2).<sup>1)</sup> In such a case the position of the test piece in the welded joint thickness shall be identified.

**5.6** The corners of the test piece on the face in tension shall be rounded by machining to a radius  $R$  not exceeding  $0,2 a$  (maximum : 3 mm).

## 6 Method of bend testing using a former (see figure 3)

**6.1** The test shall be carried out by placing the test piece on two supports consisting of parallel rollers. The test piece shall be slowly and continuously bent by applying in the middle of the span, on the axis of the weld, a concentrated load (three point bending) perpendicularly to the test piece surface.

**6.2** The load shall be applied by means of a former having an end diameter  $D$  that conforms to the requirements of the application standard concerning the welded joint under examination.

**6.3** The distance  $L$  (see figure 3) between rollers shall be not greater than  $L = D + 3 a$ .

**6.4** The test is completed when the bending angle  $\alpha$  (see figure 3) reaches the value given in the application standard concerning the welded joint under examination.

## 7 Method of bend testing using a roller (see figure 4)

**7.1** The test shall be carried out by firmly clamping one end of the test piece in a testing device having two parallel rollers. The test piece shall be slowly and continuously bent by applying a concentrated load on the test piece by means of the rotation of the outer roller, having a radius  $R$ , through an arc centred on the axis of the inner roller.

**7.2** The diameter  $D$  of the inner roller shall conform to the requirements of the application standard concerning the welded joint under examination.

**7.3** The test is completed when the bending angle  $\alpha$  (see figure 4) reaches the value given in the application standard concerning the welded joint under examination.

## 8 Results

After bending, both the external surface and the sides of the test piece shall be examined.

The evaluation of the bent test piece shall be made in accordance with the appropriate application standard for the welded joint under examination.

In the test report the method of bending shall be recorded.

1) A reduced number of test pieces or test pieces taken in different positions may be required by the application standard concerning the welded joint to be tested.

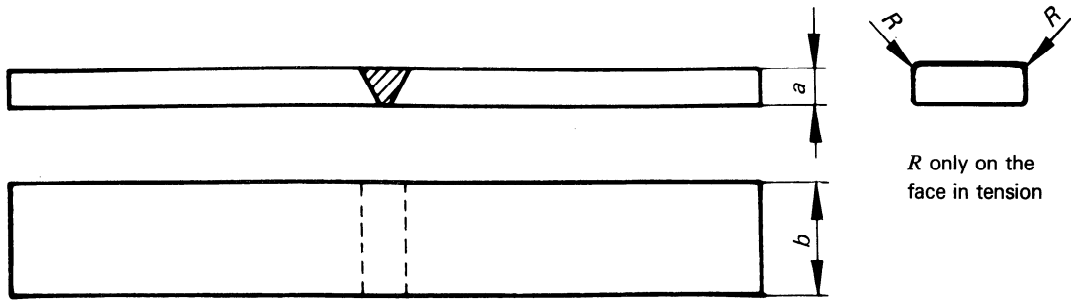


Figure 1

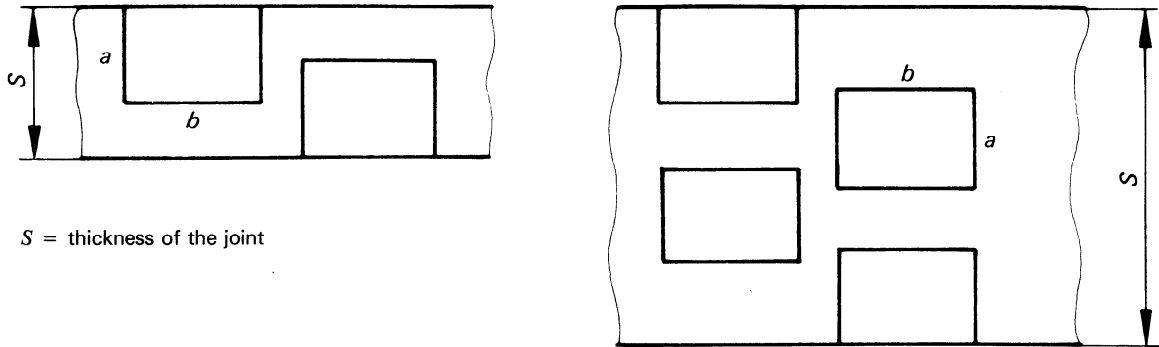


Figure 2

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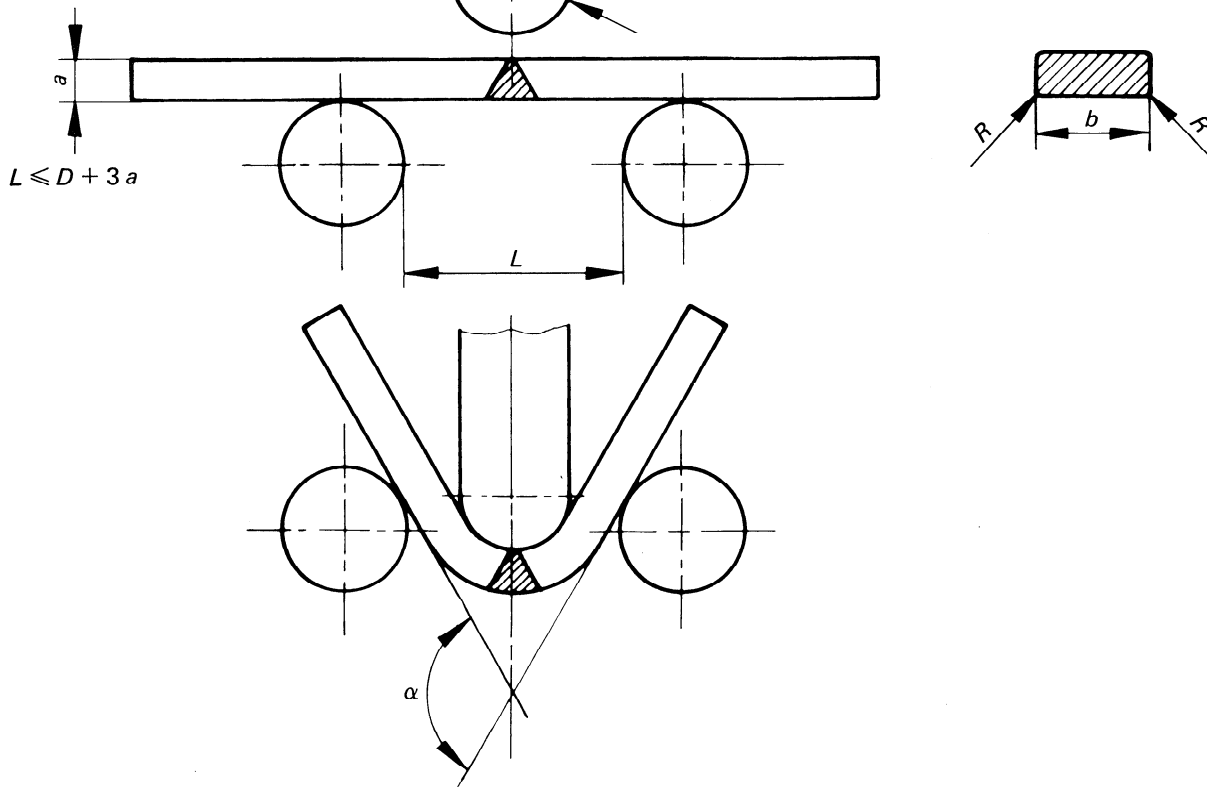


Figure 3

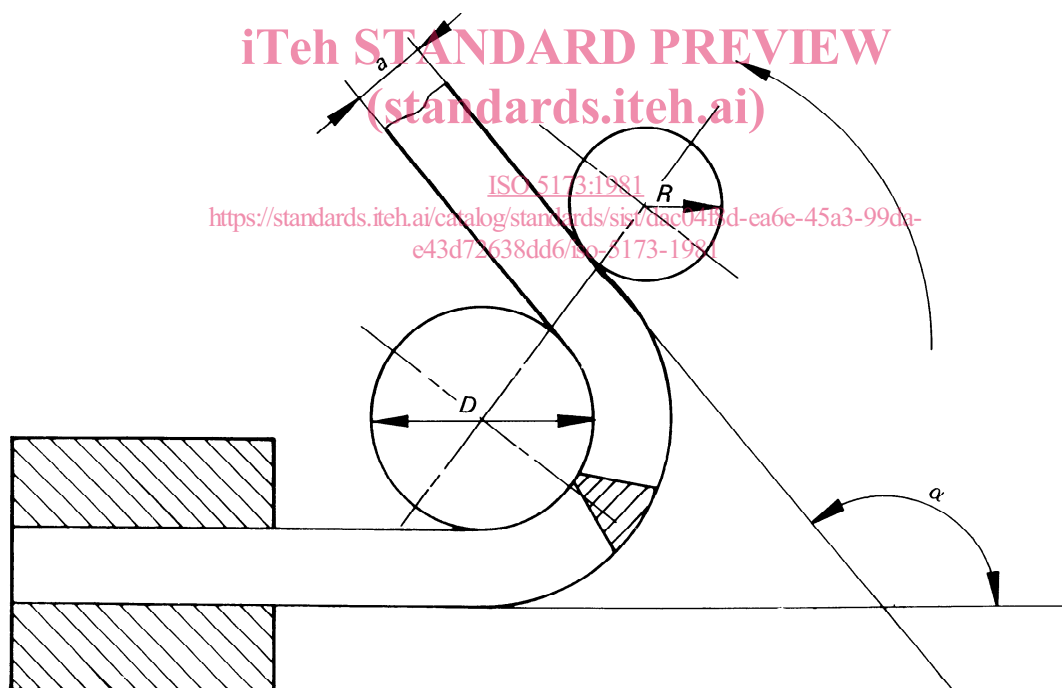
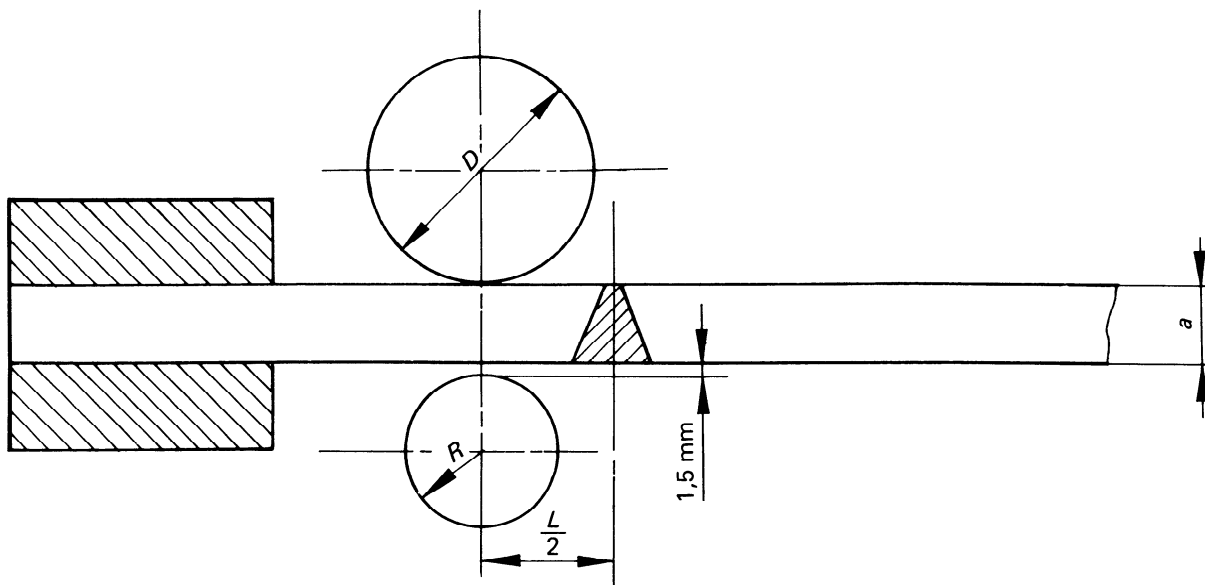


Figure 4

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