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Destructive tests on welds in metallic materials — Bend tests

Essais destructifs des soudures sur matériaux métalliques — Essais de pliage

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 5, *Testing and inspection of welds,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 121, *Welding and allied processes,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fourth edition cancels and replaces the third edition (ISO 5173:2009) which has been technically revised. It also incorporates the Amendment ISO 5173:2009/Amd 1:2011.

The main changes are as follows:

— scope has been updated to introduce guided transverse bend tests with a roller and longitudinal bend tests as alternative methods of testing for heterogeneous assemblies;

— in Clause 4, the testing temperature has been removed;

— Subclause 7.2.2 has been modified accordingly;

— figures have been corrected;

— document has been aligned with the latest ISO/IEC Directives, Part 2.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html. Official interpretations of ISO/TC 44 documents, where they exist, are available from this page: https://committee.iso.org/sites/tc44/home/interpretation.html.

Destructive tests on welds in metallic materials — Bend tests

1 Scope

This document specifies a method for making transverse root, face and side bend tests on test specimens taken from butt welds, butt welds with cladding (subdivided into welds in clad plates and clad welds) and cladding without butt welds, in order to reveal imperfections on or near the surface of the test specimen which is under tension during bend testing and/or assess ductility. It also gives the dimensions of the test specimen.

In addition, this document specifies methods to be used instead of transverse bend tests with a former for welded joints when base materials, heat affected zones and/or weld metal have a significant difference in their physical and mechanical properties in relation to bending.

This document applies to metallic materials in all forms of product with welded joints made by any welding process.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

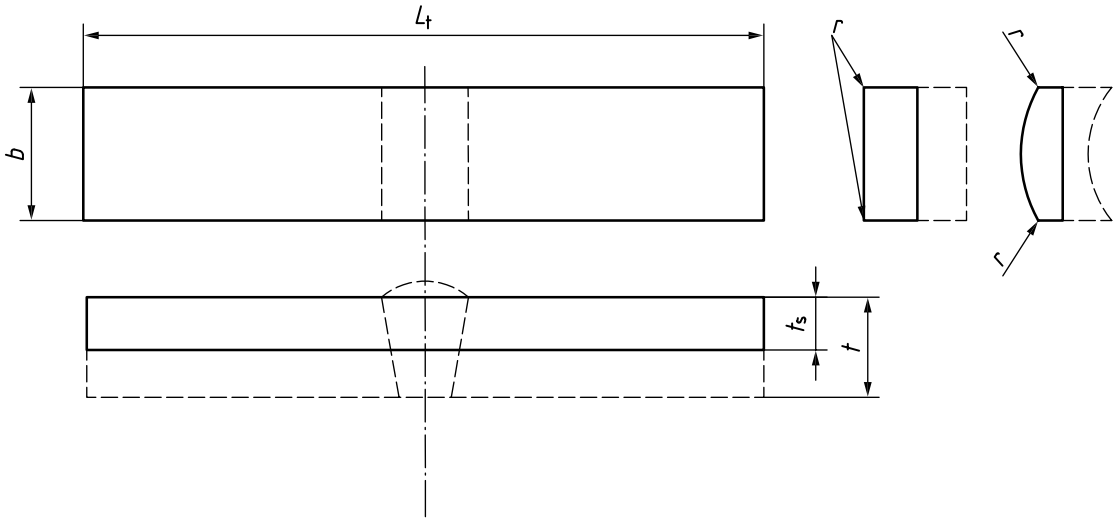
— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
transverse face bend test specimen for a butt weld
TFBB
transverse butt weld specimen where the face is in tension

Note 1 to entry: See Figure 1.

Dimensions in millimetres



Key

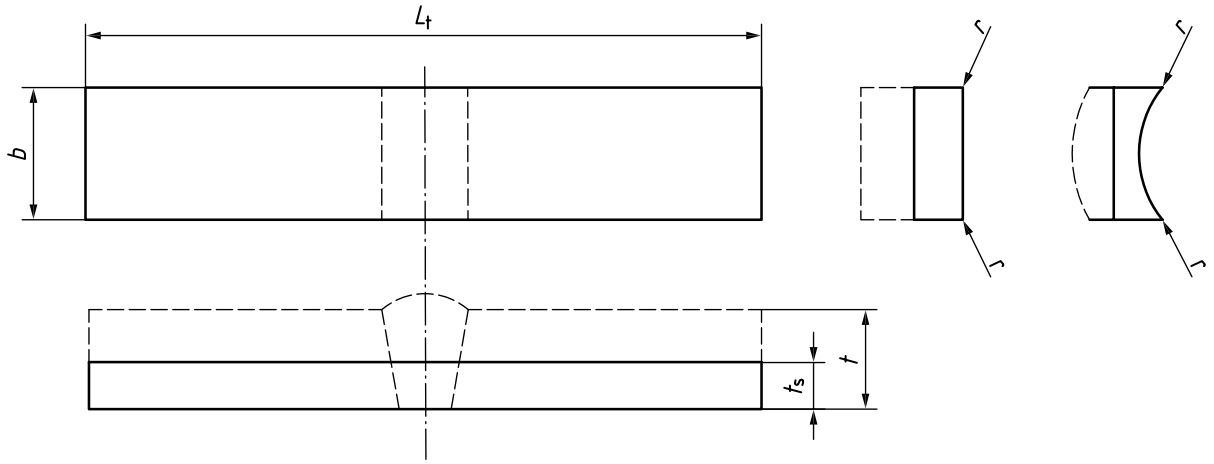
b width of the test specimen
L_t total length of the test specimen
r radius of the test specimen edges
t thickness of the test piece
t_s thickness of the test specimen

Figure 1 — Transverse face bend test specimen for a butt weld (TFBB)

3.2
transverse root bend test specimen for a butt weld
TRBB
transverse butt weld specimen where the root is in tension

Note 1 to entry: See Figure 2.

Dimensions in millimetres



Key

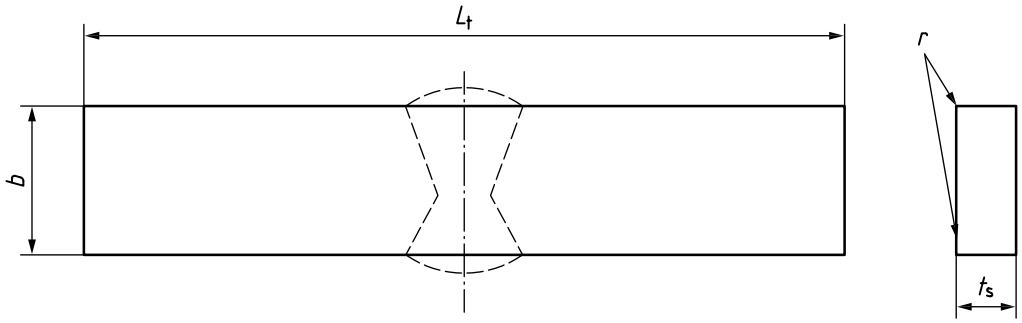
b width of the test specimen
L_t total length of the test specimen
r radius of the test specimen edges
t thickness of the test piece
t_s thickness of the test specimen

Figure 2 — Transverse root bend test specimen for a butt weld (TRBB)

3.3
transverse side bend test specimen for a butt weld
TSBB
specimen where the surface in tension is a cross-section of the weld

Note 1 to entry: See Figure 3.

Dimensions in millimetres



Key

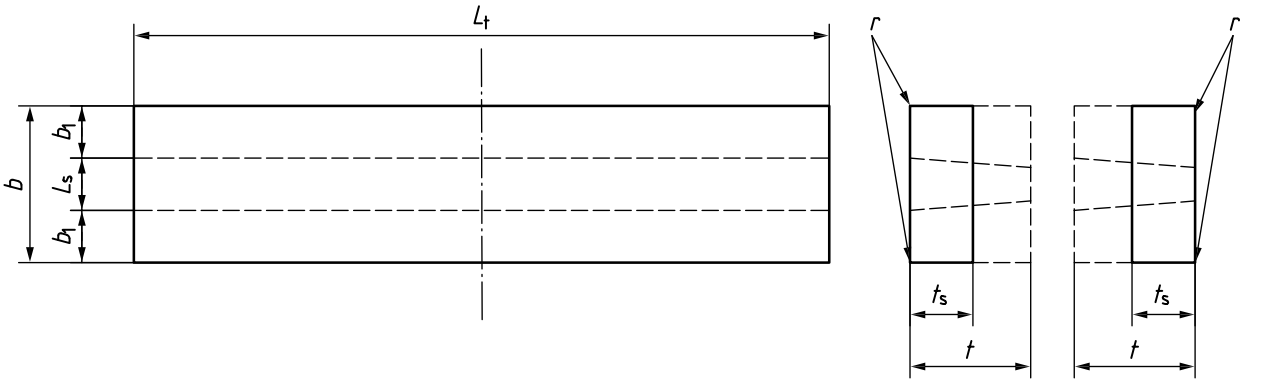
b width of the test specimen
L_t total length of the test specimen
r radius of the test specimen edges
t_s thickness of the test specimen

Figure 3 — Transverse side bend test specimen for a butt weld (TSBB)

3.4
longitudinal face bend test specimen for a butt weld
LFBB
specimen where the direction is parallel to the butt weld direction and where the face is in tension

Note 1 to entry: See Figure 4

Dimensions in millimetres



Key

b width of the test specimen
L_s maximum width after machining
L_t total length of the test specimen
r radius of the test specimen edges
t thickness of the test piece
t_s thickness of the test specimen
b_1 width of outside fusion line

Figure 4 — Longitudinal face/root bend test specimen for a butt weld (LFBB and LRBB)

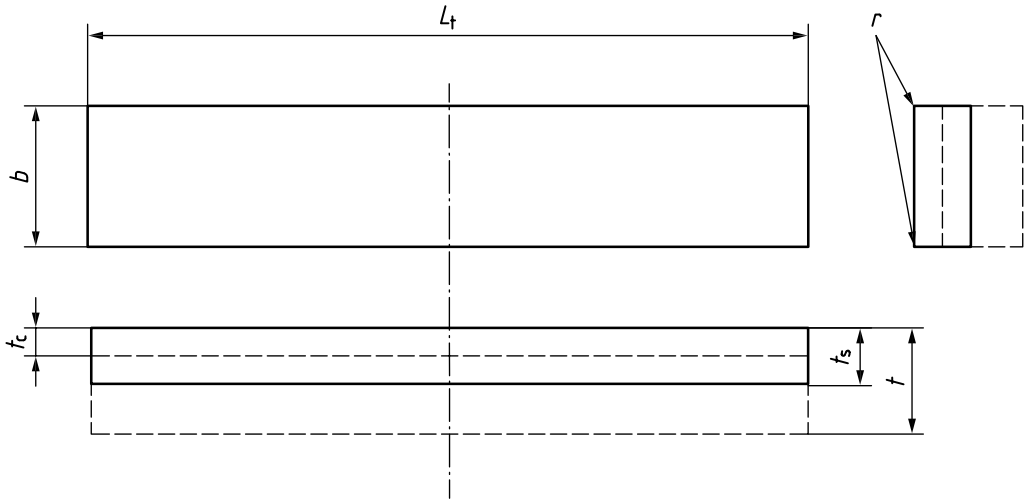
3.5
longitudinal root bend test specimen for a butt weld
LRBB
specimen where the direction is parallel to the butt weld direction and where the root is in tension

Note 1 to entry: See Figure 4.

3.6
face bend test specimen for cladding without a butt weld
FBC
specimen for which the cladding is in tension, applicable to both transverse and longitudinal specimens

Note 1 to entry: See Figure 5.

Dimensions in millimetres



Key

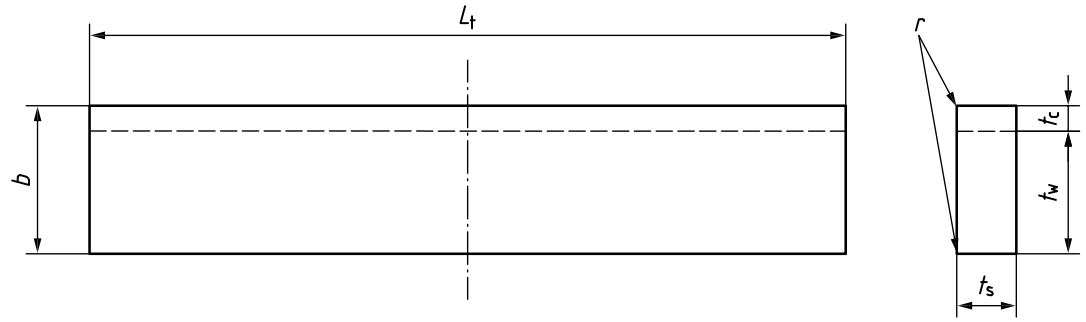
b width of the test specimen
L_t total length of the test specimen
r radius of the test specimen edges
t thickness of the test piece
t_s thickness of the test specimen
t_c thickness of the cladding

Figure 5 — Face bend test specimen for cladding without a butt weld (FBC)

3.7
side bend test specimen for cladding without a butt weld
SBC
specimen for which the cross-section of the cladding overlay is in tension, applicable to both transverse and longitudinal specimens

Note 1 to entry: See Figure 6.

Dimensions in millimetres



Key

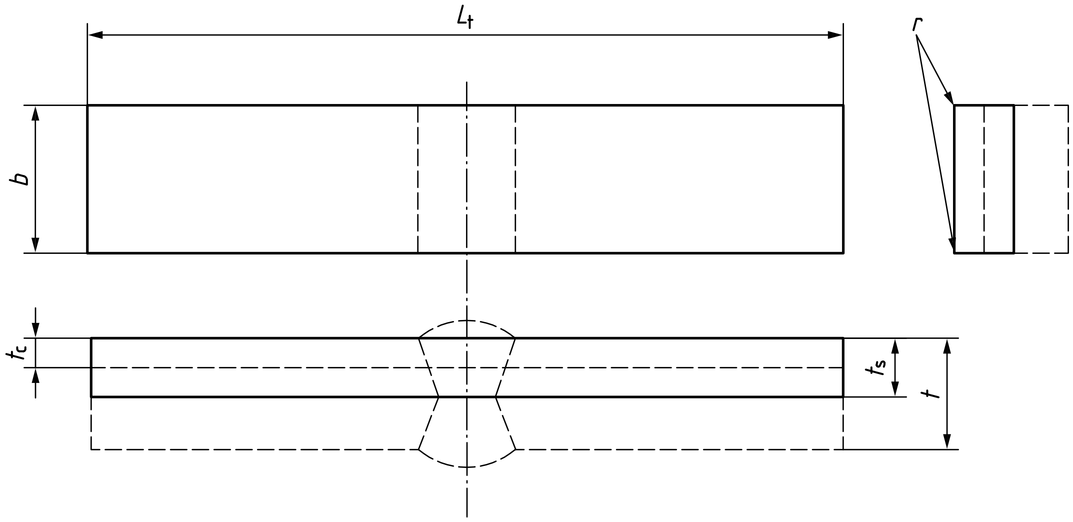
b width of the test specimen
L_t total length of the test specimen
r radius of the test specimen edges
t thickness of the test piece
t_s thickness of the test specimen
t_w thickness of parent material under cladding
t_c thickness of the cladding

Figure 6 — Side bend test specimen for cladding without a butt weld (SBC)

3.8
face bend test specimen for cladding with a butt weld
FBCB
specimen containing a butt weld where the cladding is in tension

Note 1 to entry: See Figure 7.

Dimensions in millimetres



Key

b width of the test specimen

L_t total length of the test specimen

r radius of the test specimen edges

t thickness of the test piece

t_s thickness of the test specimen

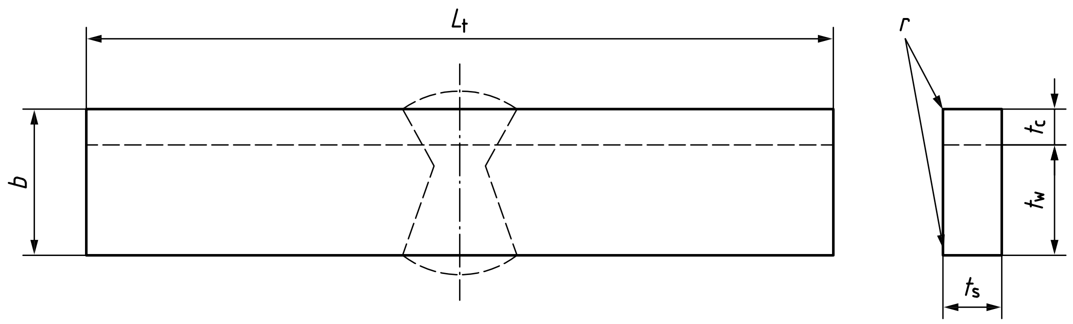
t_c thickness of the cladding

Figure 7 — Face bend test specimen for cladding with a butt weld (FBCB)

3.9
side bend test specimen for cladding with a butt weld
SBCB
specimen containing a butt weld where the cross-section of the cladding is in tension

Note 1 to entry: See Figure 8.

Dimensions in millimetres



Key

b width of the test specimen

L_t total length of the test specimen

r radius of the test specimen edges

t_s thickness of the test specimen

t_w thickness of parent material under cladding

t_c thickness of the cladding

Figure 8 — Side bend test specimen for cladding with a butt weld (SBCB)

4 Symbols and abbreviated terms

Table 1 — Symbols

Symbol	Designation	Unit
A	minimum percentage elongation after fracture required by the parent material specification	%
b	width of the test specimen	mm
b_1	width of outside fusion line	mm
d	diameter of the former or the inner roller	mm
D	outside diameter of the pipe[a]	mm
l	distance between the rollers	mm
L_b	length of additional backing plate	mm
L_f	initial distance between contact of the roller and the centre line of the weld	mm
L_o	original gauge length	mm
L_s	maximum width of the weld after machining	mm
L_t	total length of the test specimen	mm
r	radius of the test specimen edges	mm
r_P	plunger radius	mm
r_D	die radius	mm
R	radius of the rollers	mm
t	thickness of the test piece	mm
t_c	thickness of the cladding	mm
t_b	thickness of additional backing plate	mm
t_s	thickness of the test specimen	mm
t_w	thickness of parent material under cladding	mm
α	bending angle	°

[a] The term “pipe”, alone or in combination, is used to mean “pipe”, “tube” or “hollow section (without rectangular cross section)”.

5 Principle

Submitting a test specimen, taken transversely or longitudinally from a welded joint, to plastic deformation by bending it, without reversing the bending direction, in such a way that one of the surfaces or cross-sections of the welded joint is in tension.

The temperature at which the tests are carried out shall be recorded (see Clause 9).

The testing speed should be constant and recorded when known (see Clause 9).

The test shall be made in accordance with one of the methods described in Clause 7.

6 Preparation of test specimens

6.1 General

Specimens shall be prepared in such a manner that the preparation does not affect either the parent material or the weld metal.