INTERNATIONAL STANDARD

ISO 4136

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Destructive tests on welds in metallic materials — Transverse tensile test

Essais destructifs des soudures sur matériaux métalliques — Essai de traction tansversale

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 4136 was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 5, *Testing and inspection of welds*.

This second edition cancels and replaces the first edition (ISO 4136:1989) which has been technically revised.

Annex A of this International Standard is for information only.

Destructive tests on welds in metallic materials — Transverse tensile test

1 Scope

This International Standard specifies the sizes of test specimen and the procedure for carrying out transverse tensile tests in order to determine the tensile strength and the location of fracture of a welded butt joint.

This International Standard applies to metallic materials in all forms of product with joints made by any fusion welding process.

Unless otherwise specified for specific points in this International Standard, the general principles of ISO 6892 apply.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 4063:1998, *Welding and allied processes — Nomenclature of processes and reference numbers.*

ISO 6892, *Metallic materials — Tensile testing at ambient temperature.*

3 Principle

An increasing tensile load is continuously applied until rupture occurs in a test specimen taken transversely from a welded joint.

Unless otherwise specified, the test shall be carried out at ambient temperature (23 ± 5) °C

4 Symbols and abbreviated terms

The symbols and abbreviated terms to be used for the transverse tensile tests are specified in Table 1 and represented in Figures 1 to 3.

Table 1 — Symbols and abbreviated terms

Symbol	Term	Unit
b	Width of the parallel length	mm
b_1	Width of shoulder	mm
d	Diameter of the plug	mm
D	Outside diameter of the pipe [a]	mm
L_c	Parallel length	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 shoulder	mm
t	Thickness of the welded joint	mm
t_s	Thickness of the test specimen	mm

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

5 Preparation of test specimens

5.1 Location

The test specimen shall be taken transversely from the welded joint in such a way that, after machining, the weld axis remains in the middle of the parallel length of the test specimen. For small diameter pipes, the test may be carried out on whole pipe (see Figure 3). If not specified by the application standards or agreed upon between the contracting parties, “small diameters” means $D < 18$ mm.

5.2 Marking

Each test piece shall be marked in order to identify its exact location in the manufactured product or in the joint from which it has been removed.

If required by the relevant application standard, the direction of working (e.g. rolling or extrusion) shall be marked.

Each test specimen shall be marked in order to identify its exact location in the test piece from which it has been removed.

When removed from the test piece, each test specimen shall be marked.

5.3 Heat treatment and/or ageing

No heat treatment shall be applied to the welded joint or to the test specimen unless it is specified or allowed by the relevant application standard dealing with the welded joint to be tested. Details of any heat treatment shall be recorded in the test report. If natural ageing of aluminium alloys takes place, the time between welding and testing shall be recorded.

NOTE The presence of hydrogen in ferrous weld metals may adversely affect the test results and suitable hydrogen release treatment may be necessary.

5.4 Extraction

5.4.1 General

The mechanical or thermal processes used to extract the test specimen shall not change the properties of the test specimen in any way.

5.4.2 Steel

Shearing is excluded for thicknesses > 8 mm. If thermal cutting or other cutting methods which could affect the cut surfaces are used to cut the test specimen from the welded plate or from the test piece, the cuts shall be made at a distance ⩾ 8 mm from the surfaces of the final parallel length of the test specimen. Thermal cutting shall not be used parallel to the original surface of the welded plate or of the test piece.

5.4.3 Other metallic materials

Shearing and thermal cutting are excluded, and only machining (e.g. sawing or milling) shall be used.

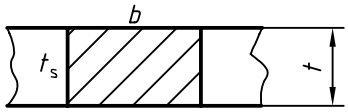
5.5 Machining

5.5.1 General

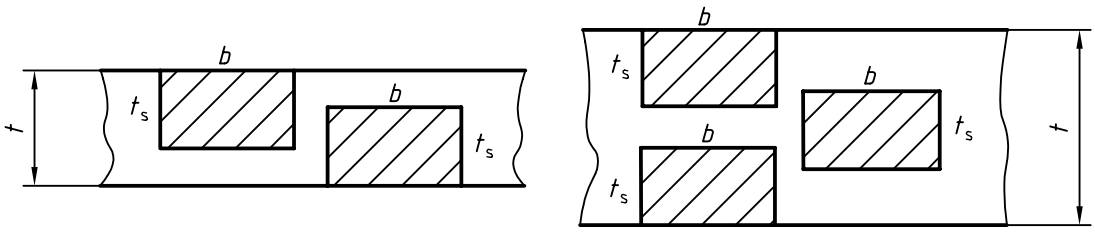
The tolerances specified in ISO 6892 shall apply.

5.5.2 Location

In general, the thickness of the test specimen, t_s, shall be equal to the thickness of the parent metal near the welded joint [see Figure 1a)]. When a relevant application standard requires testing of the full thickness > 30 mm, several test specimens may be taken to cover the full thickness of the joint [see Figure 1b)]. In such cases, the location of the test specimen in the welded joint thickness shall be identified.



a) Full section test



NOTE The test pieces may overlap.

b) Multi specimen test

Figure 1 — Examples of the location of test specimens in joints

5.5.3 Dimensions

5.5.3.1 Plates and pipes

The thickness of the test specimen shall be constant along the parallel length, L_c; the shape and dimensions shall conform to those given in Table 2 with reference to the symbols shown in Figure 2.

For the test specimen machined from pipe, flattening of the gripped ends may be necessary; however, this flattening and the possible resulting variation in thickness shall not affect the parallel length, L_c.

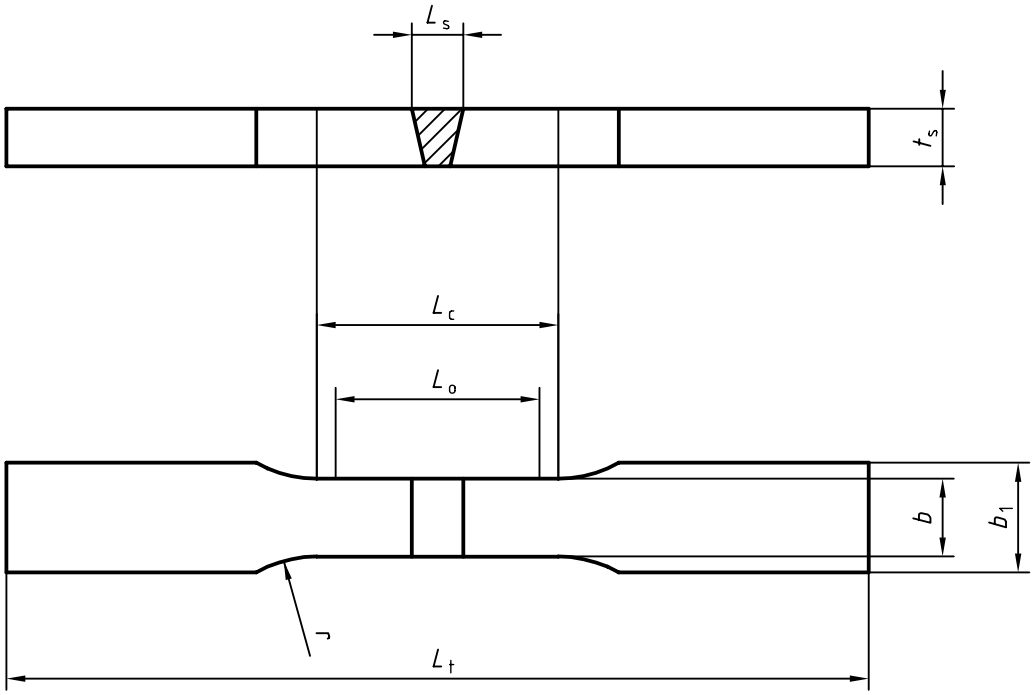
Table 2 — Dimensions for plates and pipes

Dimensions in millimetres

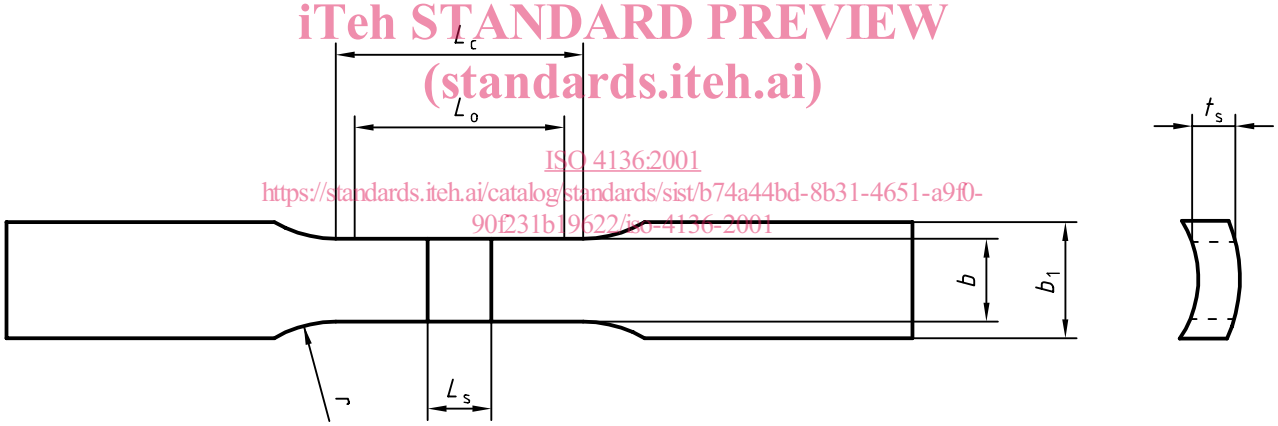
Denomination		Symbol	Dimensions
Total length of the test specimen		L_t	to suit particular testing machine
Width of shoulder		b_1	$b + 12$
Width of the parallel length	plates	b	12 for $t_s \leqslant 2$ 25 for $t_s > 2$
	pipes	b	6 for $D \leqslant 50$ 12 for $50 < D \leqslant 168{,}3$ 25 for $D > 168{,}3$
Parallel length [a] [b]		L_c	$\geqslant L_s + 60$
Radius at shoulder		r	$\geqslant 25$

[a] For pressure welding and beam welding (process groups 2, 4, 51 and 52 in accordance with ISO 4063:1998), $L_s = 0$.

[b] For some other metallic materials (e.g. aluminium, copper and their alloys) $L_c \geqslant L_s + 100$ may be necessary.



a) Test specimen for plates



b) Test specimen for pipes

Figure 2 — Test specimens for plates and pipes

5.5.3.2 Full section pipes

The dimensions for full section pipe test specimens are shown in Figure 3.