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NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 9018

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English Version

Destructive tests on welds in metallic materials - Tensile test on cruciform and lapped joints (ISO 9018:2015)

Essais destructifs des soudures sur matériaux métalliques - Essai de traction des assemblages en croix et à recouvrement (ISO 9018:2015)

Zerstörende Prüfung von Schweißverbindungen an metallischen Werkstoffen - Zugversuch am Doppel-T-Stoß und Überlappstoß (ISO 9018:2015)

This European Standard was approved by CEN on 26 September 2015.

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European foreword

This document (EN ISO 9018:2015) has been prepared by Technical Committee ISO/TC 44 “Welding and allied processes” in collaboration with Technical Committee CEN/TC 121 “Welding and allied processes” the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2016, and conflicting national standards shall be withdrawn at the latest by May 2016.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

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Endorsement notice

The text of ISO 9018:2015 has been approved by CEN as EN ISO 9018:2015 without any modification.

INTERNATIONAL STANDARD

ISO 9018

Second edition
2015-10-15

Destructive tests on welds in metallic materials — Tensile test on cruciform and lapped joints

Essais destructifs des soudures sur matériaux métalliques — Essai de traction des assemblages en croix et à recouvrement

Reference number
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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.

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 44, *Welding and allied processes*, SC 5, *Testing and inspection of welds*.

This second edition cancels and replaces the first edition (ISO 9018:2003), of which it constitutes a minor revision.

Requests for official interpretations of any aspect of this standard should be directed to the Secretariat of ISO/TC 44/SC 5 via your national standards body, a complete listing which can be found at www.iso.org.

Destructive tests on welds in metallic materials — Tensile test on cruciform and lapped joints

1 Scope

This International Standard specifies the sizes of test pieces and test specimens, and the procedure for carrying out tensile tests, for determining the tensile strength and location of fractures in welded joints with transverse stressed fillet welds.

It is applicable to metallic materials with welded cruciform and lapped joints on plates, where the term *plate* — alone or in combination — refers to plates, sheets, extruded bars or other solid sections.

Information concerning the evaluation of test results is not included in this International Standard.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

3 Symbols and abbreviated terms

The symbols used for the tensile tests are specified in Table 1 and Figures 1 to 5.

Table 1 — Symbols and abbreviated terms

Symbol	Designation	Unit
a, a_1, a_2, a_3, a_4	Fillet weld throat thickness	mm
A_f	Fracture area ($w_f \times b$)	mm^2
b	Width of the test specimen equal to the length of fracture surface	mm
c	Free length between section to be tested and grips of testing device	mm
d	Length of test plates used	mm
f	Gap width for lapped specimens	mm
F_m	Maximum load sustained by the test specimen during testing	N
L_t	Total length of the test specimen	mm
R_m	Tensile strength (F_m/A_f)	MPa
t_1, t_2, t_3	Thicknesses of the materials used to prepare test pieces and test specimens	mm
w_f	Width of the fracture surface [a]	mm

[a] See Figure 1.

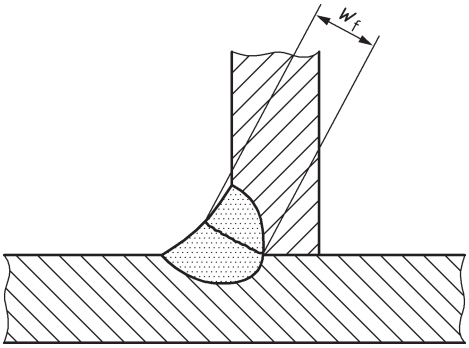


Figure 1 — Definition of width of fracture surface

4 Principle

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

Unless otherwise specified, the test shall be carried out at 23 °C ± 5 °C.

Unless otherwise stated, the general principles of ISO 6892-1 apply.

5 Test pieces and test specimens

5.1 Test pieces

The test pieces shall be prepared and welded in accordance with the relevant application standard and Figures 2 and 4. Linear misalignment and angular distortion of the test pieces should be kept to a minimum and recorded on the test report.

5.2 Test specimens

5.2.1 Dimensions

The dimensions of the test specimens shall be in accordance with Figures 3 and 5. The weld axis shall remain perpendicular to the longitudinal direction of the specimen.

5.2.2 Marking

Each test specimen shall be marked to identify its exact location in the test piece. If required by the relevant application standard, the direction of working (e.g. rolling or extrusion) 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 permitted 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; see Annex A for an example of a test report. If natural ageing of aluminium alloys takes place, the time between welding and testing shall be recorded.

5.4 Extraction of test pieces

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

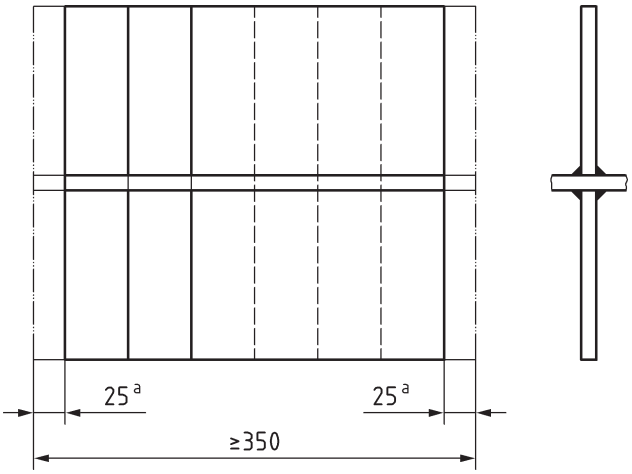
Sawing or milling shall be used.

If thermal cutting or other cutting methods that could affect the cut surface are used to cut the test specimen from the test piece, the cuts shall be at least 8 mm from the edge surface of the test specimen.

5.4.3 Surface preparation

The final stages of preparation shall be obtained by machining or grinding, suitable precautions being taken to avoid superficial strain hardening or excessive heating of the material. The surfaces shall be free from scratches or notches transverse to the test specimen direction in the free length to be tested, except for undercut which shall not be removed unless required by the relevant application standard.

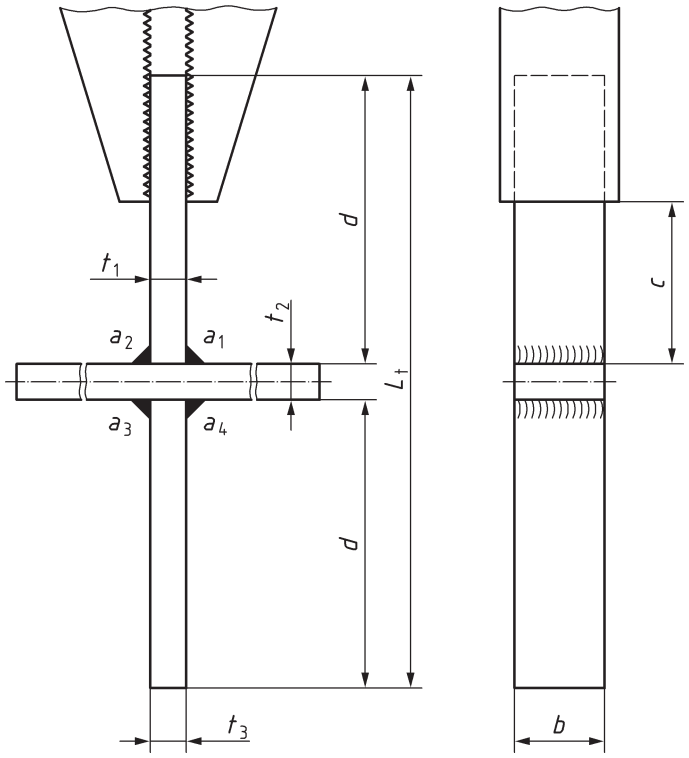
Dimensions in millimetres



a End pieces are to be discarded.

Figure 2 — Location of specimen from a cruciform connection

Dimensions in millimetres

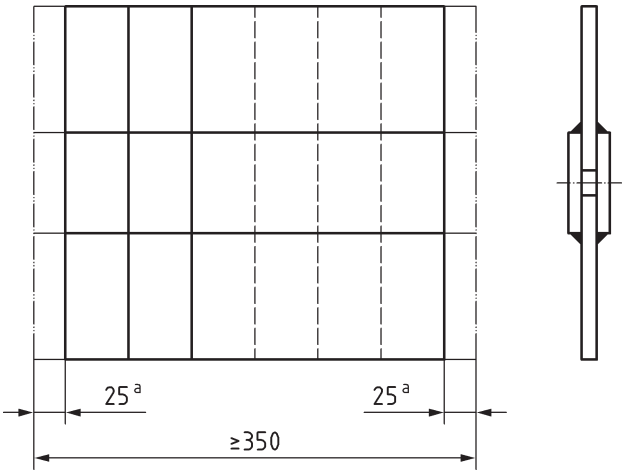


Key

t	production test: thickness of product	$d \geq 150$
	procedure test: $t_1 = t_2 = t_3$	$30 \leqslant b \leqslant 50$; $3t \leqslant b \leqslant 50$
a	procedure test:	$c \geqslant 2b$
	according to requirement of application standard	$L_t = 2 \times d + t_2$
	or, if not given:	
	$\alpha \approx 0{,}5 \times t_1$	
	$a_1 \approx a_2 \approx a_3 \approx a_4$	
	production test: as delivered	

Figure 3 — Cruciform test specimen

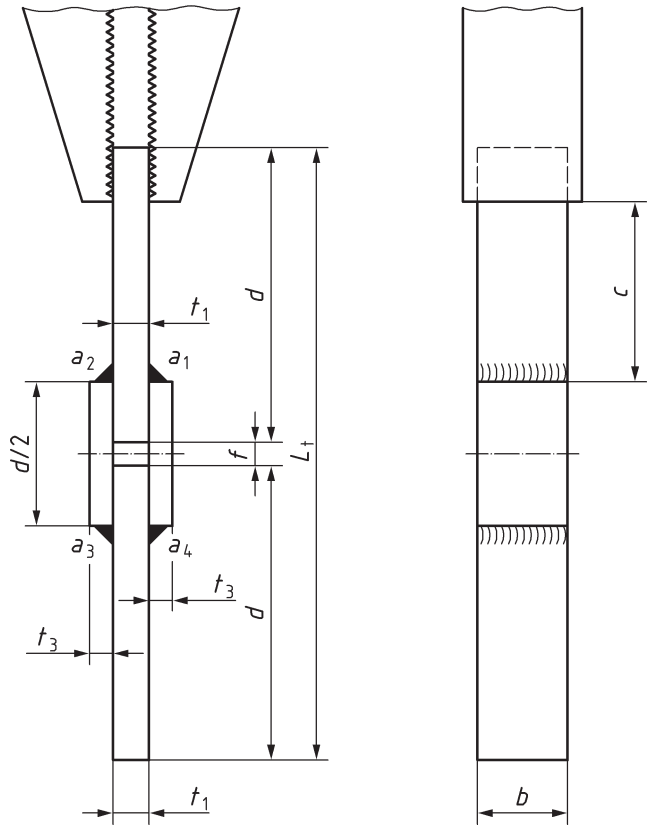
Dimensions in millimetres



a End pieces are to be discarded.

Figure 4 — Location of specimen from a lapped connection

Dimensions in millimetres



Key

t	production test: thickness of product	$d \geq 150$
	procedure test: $t_1 = t_2$	$30 \leqslant b \leqslant 50$; $3t \leqslant b \leqslant 50$
a	procedure test:	$c \geqslant 2b$
	according to requirement of application standard	$L_t = 2 \times d + f$
	or, if not given:	
	$\alpha \approx 0{,}5 \times t_1$	
	$a_1 \approx a_2 \approx a_3 \approx a_4$	
	production test: as delivered	

Figure 5 — Lapped test specimen

6 Method of testing

Prior to testing, the dimensions of the test piece shall be measured and recorded.

The test specimen shall be loaded gradually and continuously in a direction perpendicular to the weld axis until rupture occurs. The speed of loading shall be as uniform as possible; testing shall be progressive and without abrupt changes (see ISO 6892-1).

After testing, the following shall be measured and/or the result/information recorded (see Clause 7):

— the test temperature, T;

— the fracture surfaces shall be examined and the existence of any imperfections, including their type, size and amount shall be recorded. If fish eyes are present, their location shall be recorded. Only the central regions of fish eyes shall be considered as imperfections;

— the average width of the fracture surface w_f (see Figure 1) shall be determined by measuring at several points across the fracture at a spacing of approximately 3 × a and dividing by the total number of measurements;

— the tensile strength, R_m, calculated as the ratio of the maximum load, F_m, sustained by the test specimen during testing and the fracture area, A_f, expressed in MPa.

If the plate delaminates, the test should be considered as being void.

7 Test report

The test report shall include the following information:

a) reference to this International Standard, i.e. ISO 9018;

b) date of testing;

c) details concerning the examiner or test body;

d) dimensions of the test specimens before fracture (a_1, a_2, a_3, a_4, t_1, t_2, t_3, b);

e) amount of misalignment and angular distortion;

f) location of the fracture;

g) location, type, size and amount of any imperfections (see Clause 6 regarding fish eyes);

h) average width of the fracture surface, w_f;

i) tensile strength, R_m;

j) load per unit length, F_m/b;

k) test temperature, if it is outside the temperature range 23 °C ± 5 °C;

l) details of any heat treatment in accordance with the relevant application standard (see also 5.3).

An example of a typical test report is given in Annex A.

8 Evaluation of results

The results of the test shall be evaluated in accordance with the appropriate application standard.

Annex A
(informative)

Example of a test report

No.: _____ Date: _____

According to: WPS _____

According to: test result "tensile test"

test result "_____"

Manufacturer: .....

Purpose of examination: .....

Plate: .....

Parent metal: .....

Filler metal: .....

Welding process: .....

Table A.1 — Tensile test in accordance with ISO 9018

Test specimen no.	Dimension mm										Width of fracture surface mm	Fracture area mm²	F_m N	R_m MPa	Location of fracture	Remarks
	a_1	a_2	a_3	a_4	b	c	d	t_1	t_2	t_3	w_f	A_f				

Examiner or test body:

Name: _____ Date: _____ Signature: _____