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Destructive tests on welds in metallic materials — Longitudinal tensile test on weld metal in fusion welded joints

Essais destructifs des soudures sur matériaux métalliques — Essai de traction longitudinale du métal fondu des assemblages soudés par fusion

Reference number
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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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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

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

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This second edition cancels and replaces the first edition (ISO 5178:2001), which has been technically revised. The main changes compared to the previous edition are as follows:

— the normative reference has been revised from ISO 6892 to ISO 6892-1;

— new mandatory Clause 3 has been added;

— Clauses 5 and 9 have been improved.

Destructive tests on welds in metallic materials — Longitudinal tensile test on weld metal in fusion welded joints

1 Scope

This document specifies the sizes of test specimens and the test procedure for carrying out longitudinal tensile tests on cylindrical test specimens in order to determine the mechanical properties of weld metal in a fusion welded joint.

This document applies to metallic materials in all forms of product with joints made by any fusion welding process, having joint sizes that are sufficient to obtain cylindrical test specimens with dimensions in accordance with ISO 6892-1.

Unless specified otherwise for specific points in this document, the general principles of ISO 6892-1 apply.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. 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 Terms and definitions

No terms and definitions are listed in this document.

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

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

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

4 Symbols and abbreviated terms

The symbols and abbreviated terms to be used for the longitudinal tensile tests shall be as specified in ISO 6892-1.

5 Principle

An increasing tensile load is continuously applied until rupture occurs in a cylindrical test specimen taken longitudinally from the weld metal in a welded joint.

The test shall be carried out at room temperature between 10 °C and 35 °C, unless otherwise specified.

Tests carried out under controlled conditions shall be made at a temperature of 23 °C ± 5 °C.

6 Removal of test specimens

6.1 Location

The test specimen shall be taken longitudinally from the welded joint of the manufactured product or from the test piece. After machining, the parallel length of the test specimen shall consist only of weld metal (see Figures 1 and 2).

To enable correct positioning of the test specimen in the joint, the joint cross-section at both ends of the test specimen can be macroetched.

6.2 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.

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

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

6.3 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. 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 can adversely affect the test results and suitable hydrogen release treatment.

6.4 Extraction

6.4.1 General

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

6.4.2 Steel

Shearing is excluded for thicknesses greater than 8 mm. If thermal cutting or other cutting methods which can 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 greater than or equal to 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.

6.4.3 Other metallic material

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

6.5 Machining of test specimens

Unless otherwise specified in the particular application standard dealing with the welded joint under examination, the test specimens shall be taken from the centre of the weld metal as shown in Figure 1 and the cross-section as shown in Figure 2. In the case where the test specimen is not taken from mid-thickness, the distance from the surfaces, t_1, shall be recorded [see Figures 2 a) and b)]. In the case of very thick or double-sided welded joints, more than one test specimen may be taken at different

locations through the thickness [see Figure 2 c)], in which case the distances, t_1 and t_2, of each test specimen in the joint cross-section shall be recorded.

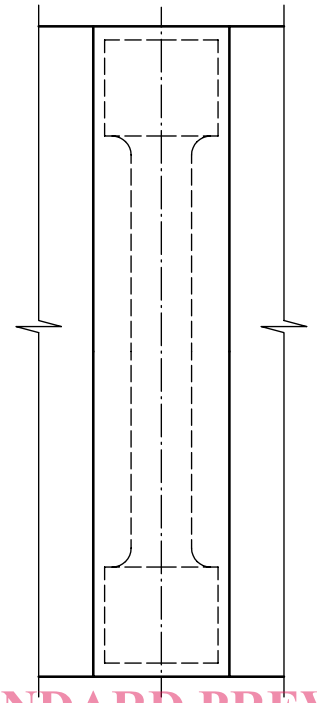
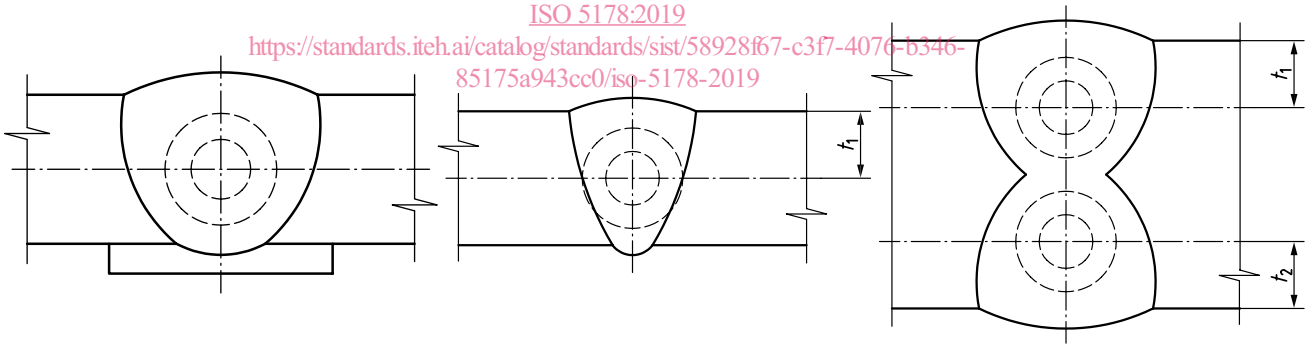


Figure 1 — Examples of location of test specimens — Longitudinal plane section



a) All-weld metal test specimen for welding consumable classification

b) Test specimen from a joint welded from one side only

c) Test specimen from a joint welded from both sides

Figure 2 — Examples of location of test specimens — Cross-section

6.6 Dimensions

Each test specimen shall have a circular cross-section, and its dimensions, expressed as functions of the diameter, d_0, of the parallel length shall conform to ISO 6892-1.

It shall have a normal diameter, d_0, of 10 mm. If this is not possible, the diameter shall be as large as possible but not less than 4 mm. The actual size shall be recorded in the test report.

The gripped ends of the test specimens shall be compatible with the tensile testing machine used.

6.7 Surface quality

The tolerances specified in ISO 6892-1 shall apply.

Strain-hardening or excessive heating of the material shall be avoided.

7 Conditions of testing

The test specimen shall be loaded gradually and continuously in accordance with ISO 6892-1.

8 Test results

8.1 General

The test results shall be determined in accordance with ISO 6892-1.

8.2 Examination of fracture surfaces

After rupture of the test specimen, the fracture surfaces shall be examined and the existence of any imperfections that can have adversely affected the test shall be recorded, including their type, size and quantity. If fish eyes are present, they shall be recorded and only their central regions shall be considered as imperfections.

9 Test report

The test report shall include the following information in addition to that given in ISO 6892-1:

a) a reference to this document, i.e. ISO 5178;

b) the location of test specimen, sketch if required (see Figures 1 and 2);

c) the test temperature, if different from the ambient temperature;

d) the type and dimensions of imperfections observed;

e) the diameter, d_0.

An example of a typical test report is given in Annex A. The proof strength plastic extension, R_p, and the force corresponding to the desired proof strength plastic extension, F_p, in Table A.1 may be replaced with the upper yield strength, lower yield strength, proof strength total extension and the force corresponding to each property according to the requirement.

Annex A
(informative)

Example of a test report

No.

According to WPS

According to test result “tensile test”

test result “ ”

Manufacturer:

Purpose of the examination:

Form of product:

Parent metal:

Filler metal:

Table A.1 — Longitudinal tensile test in accordance with ISO 5178

Test specimen No./ position	**Dimension/ diameter** mm	F_p N	F_m N	R_p N/mm²	R_m N/mm²	L_0 mm	A %	Z %	**Test temperature** °C	**Remark e.g. fracture appearance**

Examiner or test body:

(name, date and signature)

Certified by:

(name, date and signature)