

# INTERNATIONAL STANDARD

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**5178**

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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  
ISO 5178:2001(E)

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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 5178 was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 5, *Testing and inspection of welds*.

Annex A of this International Standard is for information only.

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

## 1 Scope

This International Standard 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 International Standard 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.

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

## 2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, this publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the normative document 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 6892, *Metallic materials — Tensile testing at ambient temperature.*

## 3 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.

Unless otherwise specified, the test shall be carried out at ambient temperature ( $23 \pm 5$ ) °C.

## 4 Symbols and abbreviated terms

The symbols and abbreviated terms to be used for the longitudinal tensile tests are specified in ISO 6892.

## 5 Removal of test specimens

### 5.1 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.

### 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.

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.

### 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. 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  $\geq 8$  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 and turning) shall be used.

## 5.5 Machining of test specimens

### 5.5.1 Location

Unless specified otherwise 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.

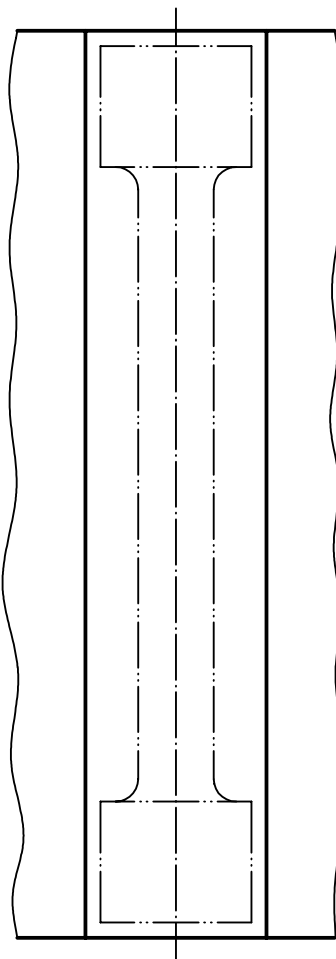
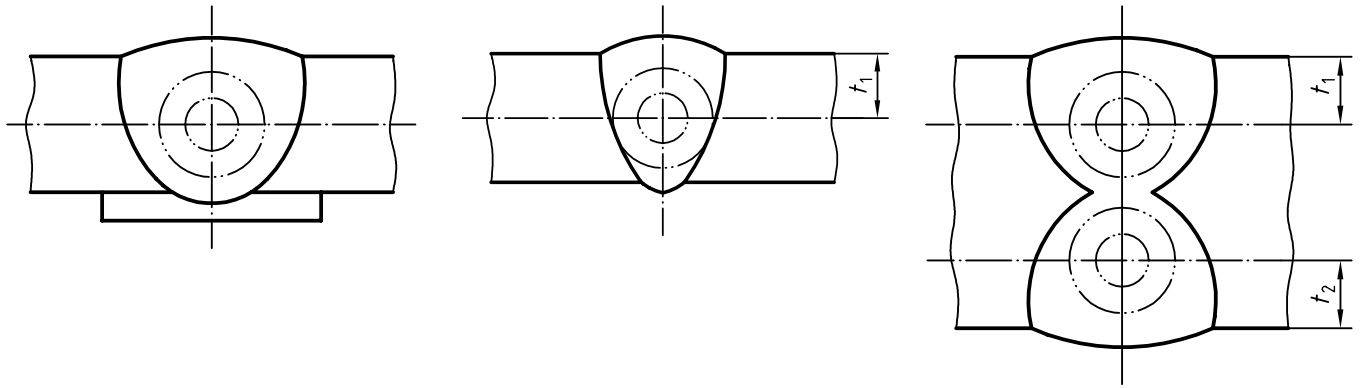


Figure 1 — Examples of location of test specimens — Longitudinal plane section



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

### 5.6 Dimensions

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

It shall have a normal diameter  $d$  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.

### 5.7 Surface quality

The tolerances specified in ISO 6892 shall apply.

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

## 6 Conditions of testing

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



## 7 Test results

### 7.1 General

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

### 7.2 Examination of fracture surfaces

After rupture of the test specimen, the fracture surfaces shall be examined and the existence of any imperfections that may 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.

## 8 Test report

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

- a) reference to this International Standard, i.e. ISO 5178;
- b) location of test specimen, sketch if required (see Figures 1 and 2);
- c) test temperature, if different from the ambient temperature;
- d) type and dimensions of imperfections observed;
- e) the diameter  $d$ .

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

**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/mm <sup>2</sup>	$R_m$ N/mm <sup>2</sup>	$L_0$ 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)



