

DIN EN ISO 6892-1



ICS 77.040.20

Supersedes
DIN EN 10002-1:2001-12

**Metallic materials –
Tensile testing –
Part 1: Method of test at room temperature (ISO 6892-1:2009)
English version of DIN EN ISO 6892-1:2009-12**

Metallische Werkstoffe –
Zugversuch –
Teil 1: Prüfverfahren bei Raumtemperatur (ISO 6892-1:2009)
Englische Fassung DIN EN ISO 6892-1:2009-12

Document comprises 76 pages



National foreword

This standard has been prepared by Technical Committee ISO/TC 164 “Mechanical testing of metals”, Subcommittee SC 1 “Uniaxial testing” in collaboration with Technical Committee ECISS/TC 1 “Steel — Mechanical testing” (Secretariat: AFNOR, France).

The responsible German body involved in its preparation was the *Normenausschuss Materialprüfung* (Materials Testing Standards Committee), Technical Committee NA 062-01-42 AA *Zug- und Duktilitätsprüfung für Metalle*.

The principle difference between this standard and DIN EN 10002-1:2001 is the introduction of a test method based on strain rates (including the crosshead separation rate) (method A).

The strain rate (controlled by means of an extensometer) should be used when strain rate sensitive parameters are determined and a reduction in measurement uncertainty (as regards the testing rate) is desirable. Extensive information on the application and control of the strain rate is provided here, and information is given on the calculation of the crosshead separation rate necessary for maintaining the strain rate while neglecting, but also in consideration of, the compliance of the testing machine. The previous method based on the stress rate (now method B) has been slightly modified. The responsibility for the choice of method and rates is now specified and a simple means of reporting the chosen methods and rates — which is now required — is recommended.

After many discussions and extensive investigations carried out in various projects, the responsible national body NA 062-01-42 AA strongly recommends use of method A as specified in this standard. Where parameters deviate, it is also recommended that the strain rate be determined at the same moment the parameters are determined. In most cases the digital data files (see Figure A.1) can be used for this purpose if the time channel has also been recorded.

The DIN Standards corresponding to the International Standards referred to in this document are as follows:

ISO 377	DIN EN ISO 377
ISO 2566-1	DIN EN ISO 2566-1
ISO 2566-2	DIN EN ISO 2566-2
ISO 3183	DIN EN ISO 3183
ISO 7500-1	DIN EN ISO 7500-1
ISO 9513	DIN EN ISO 9513
ISO 11960	DIN EN ISO 11960

Amendments

This standard differs from DIN EN 10002-1:2001-12 as follows:

- a) The standard has been revised in form and substance.
- b) The terms, definitions and symbols specified in clauses 4 and 5 have been brought in line with ISO 10113 and ISO 10275.
- c) A differentiation is made between the modulus of elasticity and the slope of the elastic line.
- d) Clause 17 and Annex I: A distinction is made between percentage plastic extension at maximum force (A_g) and plastic elongation without necking (A_{wn}).
- e) Clauses 4, 16, 17, 18, 19, 20: A distinction is made between extensions and properties determined by means of an extensometer (e.g. A_g) or on the test piece (e.g. A).
- f) Clause 4 and Figures 8a) to 8c): Parameter designations in cases where the upper yield strength is greater than the tensile strength.

- g) Clauses 4 and 10: A differentiation is made between two methods relating to the test rates, definitions of different test rates, associated information and documentation.
- h) Clause 6: Reference is made to further national standards and product standards relating to the test piece geometries.
- i) Clause 7: The determination of the original cross-sectional area has been clarified, with the average cross-sectional area along the parallel length being used.
- j) Clause 9: The requirements for the testing apparatus have been brought in line with current standards.
- k) Clause 10: The maximum permissible preliminary force has been specified.
- l) Clause 15: The method and the procedure of verification of permanent set strength have been revised.
- m) All figures have been editorially revised.
- n) New Figures 7, 8, 9 and 10 have been added.
- o) Annex B: Test piece type 3 has been added (from JIS Z2205) and a corresponding note has been included.
- p) Annexes B and D: The machining tolerances and tolerances on shape have been specified with general measurement uncertainties of $\leq 0,5\%$.
- q) Annex E: The simplified equation $S_o = a_o b_o$ can be used for longitudinal test pieces.
- r) The former Annex F relating to the calculation of the gauge length of test pieces with rectangular cross-section has been deleted.
- s) A new Annex F "Estimation of the crosshead separation rate in consideration of the stiffness (or compliance) of the testing machine" has been included.
- t) Annex J "Estimation of the uncertainty of measurement" has been completely revised.
- u) Annex K "Precision of tensile testing — Results from interlaboratory programmes" has been completely revised.

Previous editions

DIN DVM 125 = DIN 50125: 1940-08
 DIN DVM A 114: 1935-12
 DIN 50112: 1935xx-12
 DIN 50114: 1944x-01, 1960-07, 1965-12, 1980-12, 1981-08
 DIN 50125: 1951-04, 1986-03, 1991-04
 DIN 50140: 1965-11, 1980-09
 DIN 1602: 1924-06, 1927-04, 1929-08, 1936-03, 1944x-02
 DIN 1605-2: 1936-02
 DIN 50143: 1944-10
 DIN 50144: 1944-10
 DIN 50145: 1952-06, 1975-05
 DIN 50146: 1951-05
 DIN 51210: 1961-08
 DIN 51210-1: 1976-04
 DIN 51210-2: 1976-04
 DIN EN 10002-1: 1991-04, 2001-12

Annex NA (informative)

Indices for the percentage elongation after fracture

As a rule, a differentiation is made between proportional and non-proportional test pieces as regards gauge length and percentage elongation. In the case of proportional pieces, the gauge length L_0 is proportional to the square root of the original cross-section S_0 (of any geometrical shape, e.g. round, oval, square, rectangular, etc.).

$$L_0 = k \times \sqrt{S_0}$$

To ensure comparability with previous data, the coefficient of proportionality has been internationally specified as $k = 5,65$. When the percentage elongation has been calculated on the basis of this coefficient, no index is added to the symbol A . If another coefficient of proportionality has been used, this is to be indicated in the index to A , e. g. if $k = 11,3$, then the percentage elongation is to be indicated as $A_{11,3}$. (The coefficients 5,65 and 11,3 are derived from the conversion of gauge length L_0 for circular cross-sections to other cross-sections.)

In the case of non-proportional test pieces, a differentiation is made between three different test piece geometries, according to Annex B:

- Original gauge length $L_0 = 50$ mm
for a test piece width $b_0 = 12,5$ mm
- Original gauge length $L_0 = 80$ mm
for a test piece width $b_0 = 20$ mm
- Original gauge length $L_0 = 50$ mm
for a test piece width $b_0 = 25$ mm (JIS Z 2205-Probe)

The original gauge length, along with the unit mm, is to be added as an index to the symbol A : e.g. $A_{50 \text{ mm}}$, $A_{80 \text{ mm}}$. Because the unit “mm” is included in the index, it is clear that the number does not refer to the coefficient of proportionality k .

**Table NA.1 — Equivalent indices for percentage elongation
as specified in previous standards**

Percentage elongation as in DIN EN ISO 6892	Original gauge length L_0	Simple equation for L_0 for a circular cross-section	Equivalent symbol for percentage elongation as in withdrawn standards
A	$L_0 = 5,65 \times \sqrt{S_0}$	$L_0 = 5 \times d_0$	DIN 50145, 04.1975: A_5
$A_{11,3}$	$L_0 = 11,3 \times \sqrt{S_0}$	$L_0 = 10 \times d_0$	DIN 50145, 04.1975: A_{10}
$A_{50 \text{ mm}}$	$L_0 = 50 \text{ mm}$		DIN 50114, 08.1981: $A_L = 50$
$A_{80 \text{ mm}}$	$L_0 = 80 \text{ mm}$		DIN 50114, 08.1981: $A_L = 80$

Annex NB (informative)

Table NB.1 — Comparison of international symbols used in tensile testing

Symbol as in this standard	English	French	German	German symbol	Anglo-American symbol	Unit
e	Engineering strain	Allongement conventionnel	Dehnung	ε	e	%
R	Engineering stress	Contrainte conventionnelle	Spannung oder Nennspannung	σ	S	MPa
ε	True strain (logarithmic strain)	Déformation vraie	Wahre Dehnung oder Umformgrad	φ	ε	—
σ	True stress	Contrainte vraie	Wahre Spannung	k_f	σ or R	MPa

Annex NC (informative)

Bibliography

DIN EN ISO 377, *Steel and steel products — Location and preparation of samples and test pieces for mechanical testing*

DIN EN ISO 2566-1, *Steel — Conversion of elongation values — Part 1: Carbon and low alloy steels*

DIN EN ISO 2566-2, *Steel — Conversion of elongation values — Part 2: Austenitic steels*

DIN EN ISO 3183, *Petroleum and natural gas industries — Steel pipe for pipeline transportation systems*

DIN EN ISO 7500-1, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Verification and calibration of the force-measuring system*

DIN EN ISO 9513, *Metallic materials — Calibration of extensometers used in uniaxial testing*

DIN EN ISO 11960, *Petroleum and natural gas industries — Steel pipes for use as casing or tubing for wells*

English Version

**Metallic materials - Tensile testing - Part 1: Method of test at
room temperature (ISO 6892-1:2009)**

Matériaux métalliques - Essai de traction - Partie 1:
Méthode d'essai à température ambiante (ISO 6892-
1:2009)

Metallische Werkstoffe - Zugversuch - Teil 1: Prüfverfahren
bei Raumtemperatur (ISO 6892-1:2009)

This European Standard was approved by CEN on 13 March 2009.

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Foreword

This document (EN ISO 6892-1:2009) has been prepared by Technical Committee ISO/TC 164 “Mechanical testing of metals” in collaboration with Technical Committee ECISS/TC 1 “Tensile testing” the secretariat of which is held by AFNOR.

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 February 2010, and conflicting national standards shall be withdrawn at the latest by February 2010.

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.

This document supersedes EN 10002-1:2001.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Endorsement notice

The text of ISO 6892-1:2009 has been approved by CEN as a EN ISO 6892-1:2009 without any modification.

Introduction

During discussions concerning the speed of testing in the preparation of ISO 6892:1998, it was decided to recommend the use of strain rate control in future revisions.

In this part of ISO 6892, there are two methods of testing speeds available. The first, method A, is based on strain rates (including crosshead separation rate) and the second, method B, is based on stress rates. Method A is intended to minimize the variation of the test rates during the moment when strain rate sensitive parameters are determined and to minimize the measurement uncertainty of the test results.

1 Scope

This part of ISO 6892 specifies the method for tensile testing of metallic materials and defines the mechanical properties which can be determined at room temperature.

NOTE Annex A indicates complementary recommendations for computer controlled testing machines.

2 Normative references

The following referenced documents are indispensable for the application 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 377, *Steel and steel products — Location and preparation of samples and test pieces for mechanical testing*

ISO 2566-1, *Steel — Conversion of elongation values — Part 1: Carbon and low alloy steels*

ISO 2566-2, *Steel — Conversion of elongation values — Part 2: Austenitic steels*

ISO 7500-1, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Verification and calibration of the force-measuring system*

ISO 9513, *Metallic materials — Calibration of extensometers used in uniaxial testing*

3 Terms and definitions

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

3.1 gauge length

L

length of the parallel portion of the test piece on which elongation is measured at any moment during the test

[ISO/TR 25679:2005^[3]]

3.1.1 original gauge length

L_0

length between **gauge length** (3.1) marks on the piece measured at room temperature before the test

NOTE Adapted from ISO/TR 25679:2005^[3].