



SLOVENSKI STANDARD
oSIST prEN 2002-001:2021
01-april-2021

Aeronavtika - Kovinski materiali - Preskusne metode - 001. del: Natezni preskus pri temperaturi okolice

Aerospace series - Metallic materials - Test methods - Part 001: Tensile testing at ambient temperature

Luft- und Raumfahrt - Metallische Werkstoffe - Prüfverfahren - Teil 001: Zugversuch bei Raumtemperatur

Série aérospatiale - Matériaux métalliques - Méthodes d'essais - Partie 001 : Essais de traction à température ambiante

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EUROPEAN STANDARD
NORME EUROPÉENNE
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prEN 2002-001

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ICS

Will supersede EN 2002-001:2005

English Version

Aerospace series - Metallic materials - Test methods - Part 001: Tensile testing at ambient temperature

Série aérospatiale - Matériaux métalliques - Méthodes
d'essais - Partie 001 : Essais de traction à température
ambiante

Luft- und Raumfahrt - Metallische Werkstoffe -
Prüfverfahren - Teil 001: Zugversuch bei
Raumtemperatur

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee ASD-STAN.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (prEN 2002-001:2021) has been prepared by the Aerospace and Defence Industries Association of Europe — Standardization (ASD-STAN).

After enquiries and votes carried out in accordance with the rules of this Association, this document has received the approval of the National Associations and the Official Services of the member countries of ASD-STAN, prior to its presentation to CEN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 2002-001:2005.

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prEN 2002-001:2021 (E)

Introduction

This document is part of the series of EN metallic material standards for aerospace applications. The general organization of this series is described in EN 4258.

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1 Scope

This document specifies the requirements for the tensile testing of metallic materials at ambient temperature for aerospace applications.

It is applied when referred to in the EN technical specification or material standard unless otherwise specified on the drawing, order or inspection schedule.

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.

EN 4259, Aerospace series — Metallic materials — Definition of general terms ¹⁾

EN ISO 7500-1, *Metallic materials - Calibration and verification of static uniaxial testing machines - Part 1: Tension/compression testing machines - Calibration and verification of the force-measuring system (ISO 7500-1)*

EN ISO 9513, *Metallic materials - Calibration of extensometer systems used in uniaxial testing (ISO 9513)*

3 Terms, definitions and symbols

For the purposes of this document, the terms, definitions and symbols given in EN 4259 and the following given in Table 1 apply.

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

- ISO Online browsing platform: available at <http://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

test piece

portion of the test sample on which the tensile test is carried out

3.2

proportional test pieces

test piece with an original gauge length (L₀) having a specified relationship to the square root of the cross-sectional area (S₀)

Note 1 to entry: The proportionality coefficient, K, has the internationally recognized value of 5,65 for test pieces of circular cross-section. The gauge length of a proportional test piece is therefore equal to $5,65\sqrt{S_0}$. Certain material standards use proportional test pieces with other than the 5,65 proportionality coefficient. In this case, see A_x for the percentage elongation symbol used.

3.3

non-proportional test piece

test piece where the original gauge length is independent of the cross-sectional area

¹⁾ Published as ASD-STAN Standard at the date of publication of this standard by AeroSpace and Defence industries Association of Europe — Standardization (ASD-STAN), <http://www.asd-stan.org/>

prEN 2002-001:2021 (E)**3.4****extension**

increase of the extensometer gauge length (L_e) at any moment during the test

Note 1 to entry: The unit is mm.

3.5**limit of proportionality**

stress at which the stress-strain (or force-extension) relationship deviates from a straight line

Note 1 to entry: The unit is MPa.

3.6**percentage elongation (proportional test piece)**

A
elongation after fracture expressed as a percentage of the original gauge length (L_0) for a proportional test piece with an original gauge length of $L_0 = 5,65 \sqrt{S_0}$

Note 1 to entry: For non-standard proportional test piece, see A_x .

Note 2 to entry: $A = \frac{L_u - L_0}{L_0} \times 100$.

Note 3 to entry: The unit is %.

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3.7**percentage elongation (non-proportional test piece)**

A_{L0}
elongation after fracture expressed as a percentage of the original gauge length (L_0) for a non-proportional test piece with an original gauge length of L_0

Note 1 to entry: For a non-proportional test piece, the original gauge length is given in millimetres, e.g. $A_{50\text{mm}}$.

Note 2 to entry: $A_{L0} = \frac{L_u - L_0}{L_0} \times 100$.

Note 3 to entry: The unit is %.

3.8**percentage elongation (non standard proportional test piece)**

A_x
elongation after fracture expressed as a percentage of original gauge length (L_0) for a non-standard proportional test piece with an original gauge length of $L_0 = x$ (e.g.: A_{4D})

Note 1 to entry: A non-standard proportional test piece is one in which the proportionality coefficient has a value other than 5,65. In the example above the gauge length is four times the diameter, equivalent to a proportionality coefficient of 4,51.

Note 2 to entry: The unit is %.

3.9**test piece thickness*****a***

thickness of a test piece of rectangular cross-section or wall thickness of a tube

Note 1 to entry: The unit is mm.

3.10**test piece width*****b***

width of test pieces of rectangular cross-section, average width of the longitudinal strip taken from a tube or width of a flat wire

Note 1 to entry: The unit is mm.

3.11**tube external diameter*****D***

external diameter of a tube

Note 1 to entry: The unit is mm.

3.12**test piece diameter*****d***

diameter of the parallel length of a circular test piece or diameter of round wire or internal diameter of a tube

Note 1 to entry: The unit is mm.

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3.13**young's modulus of elasticity*****E***

value of the increment in stress divided by the corresponding increment in strain for the straight portion of the stress-strain (or force-extension) diagram

Note 1 to entry: The unit is GPa.

3.14**maximum force*****F_m***

greatest force which the test piece withstands during the test

Note 1 to entry: The unit is N.

3.15**gauge length*****L***

length of the cylindrical or prismatic portion of the test piece on which elongation is measured

Note 1 to entry: The unit is mm.

prEN 2002-001:2021 (E)**3.16****parallel length** L_c

length of the reduced section of the parallel portion of the test piece

Note 1 to entry: The concept of parallel length is replaced by the concept of distance between grips for non-machined test pieces.

Note 2 to entry: The unit is mm.

3.17**extensometer gauge length** L_e

length of the parallel portion of the test piece used for the measurement of extension by means of an extensometer at any moment during the test

Note 1 to entry: This length may differ from L_0 but can be of any value greater than b , d or D (see above) but shall be less than the parallel length (L_c). It is recommended that the extensometer gauge length is as large as possible.

Note 2 to entry: The unit is mm.

3.18**original gauge length** L_0

gauge length before the application of force

Note 1 to entry: The unit is mm.

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3.19**test piece length** L_t

total length of test piece

Note 1 to entry: The unit is mm.

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3.20**final gauge length** L_u

gauge length after fracture of the test piece

Note 1 to entry: The unit is mm.

3.21**elongation** $L_u - L_0$

elongation after fracture

Note 1 to entry: The permanent increase in the original gauge length (L_0) after fracture.

Note 2 to entry: The unit is mm.

3.22**tensile strength** **R_m** maximum force (F_m) divided by the original cross-sectional area (S_0) of the test piece

Note 1 to entry: The unit is MPa.

3.23**proof stress** **R_p** stress at which a non-proportional extension is equal to a specified percentage of the extensometer gauge length (L_e) (see Figure 1)Note 1 to entry: The symbol used is followed by a suffix giving the prescribed percentage of the original gauge length for example: $R_{p0,2}$.

Note 2 to entry: The unit is MPa.

3.24**test piece transition radius** **r**

radius at ends of parallel length

Note 1 to entry: The unit is mm.

3.25**original cross-sectional area** **S_0**

original cross-sectional area of the parallel length

Note 1 to entry: The unit is mm².**3.26****minimum cross-sectional area** **S_u**

minimum cross-sectional area of test piece after fracture

Note 1 to entry: The unit is mm².**3.27****percentage reduction of area after fracture** **Z** maximum decrease of the cross-sectional area ($S_0 - S_u$) expressed as a percentage of the original cross-sectional area (S_0) i.e. $Z = \frac{S_0 - S_u}{S_0} \times 100$

Note 1 to entry: The unit is %.

3.28**strain** **ϵ** extension of any moment during the test divided by the original gauge length (L_0) of the test piece

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prEN 2002-001:2021 (E)**3.29****stress** σ

force at any moment during the test divided by the original cross-section area (S_0) of the test piece

Note 1 to entry: The unit is MPa.

3.30**specified temperature** θ

temperature at which the test is to be carried out

Note 1 to entry: The unit is °C.

4 Health and safety

It is presupposed that resources, test pieces, test samples, test materials, test equipment and test procedures comply with the current health and safety regulations/laws of the countries where the test is to be carried out.

It is presupposed that where materials and/or reagents that may be hazardous to health are specified, appropriate precautions in conformity with local regulations and/or laws are to be taken.

5 Principle of tensile testing

The test involves straining a test piece by a tensile force at ambient temperature to fracture for the purpose of determining one or more of, Young's modulus of elasticity, proof stress, tensile strength, elongation, reduction of area.

6 Testing requirements**6.1 Resources****6.1.1 Equipment/plant****6.1.1.1 Testing machine**

Testing machine accuracy shall be verified at intervals not exceeding 12 months in accordance with EN ISO 7500-1 and shall be certified to Class 1 or better.

The design of the testing machine shall permit automatic loading alignment. The loading system alignment shall be checked at least annually with a strain-gauged test piece. The difference between the recorded maximum and minimum strains shall not exceed 10 % of the mean strain at an appropriate verification force relative to the forces expected during a subsequent series of tests. Reference may be made to ASTM E1012 for a verification method.

It may be computer controlled and capable of automatic calculation and recording of Young's modulus of elasticity, proof stress, tensile strength and elongation.