SLOVENSKI STANDARD
oSIST prEN 2002-001:2024

01-november-2024

Aeronavtika - Kovinski materiali - Preskusne metode - 1. del: Natezni preskus pri temperaturi okolice

Aerospace series - Metallic materials - Test methods - Part 1: Tensile testing at ambient temperature

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

Série aérospatiale - Matériaux métalliques - Méthodes d'essais applicables - Partie 1 : Essais de traction à température ambiante

Ta slovenski standard je istoveten z: **prEN 2002-001**

ICS:

49.025.05	Železove zlitine na splošno	Ferrous alloys in general
49.025.15	Neželezove zlitine na splošno	Non-ferrous alloys in general

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EUROPEAN STANDARD

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prEN 2002-001

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ICS 49.025.05; 49.025.15

Will supersede EN 2002-001:2005

English Version

Aerospace series - Metallic materials - Test methods - Part 1: Tensile testing at ambient temperature

Série aérospatiale - Matériaux métalliques - Méthodes d'essais applicables - Partie 1 : 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

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European foreword

This document (prEN 2002-001:2024) has been prepared by 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 prEN 2002-001:2019.

The main changes with respect to the previous edition are as follows:

— prEN 2002-001 (P5), 03/2019:

- o overall editorial improvements;
- o subclause 6.3.6.2:
  - 0,003 to 0,007 (0,3 % to 0,7 %) per min., a strain rate of 0,005 (0,5 %) per min is preferred;
  - changed to: “The test shall be performed at a strain rate as required in Table 2 and Table 3”.

  The strain-rate, mentioned in 6.3.6.2, of 0,003/min to 0,007/min is too low. ASTM B557 and EN 485-2 work with a rate of stress application of maximum 12 MPa/s. For aluminium with an E-Modulus of about 72 000 MPa this results to a strain-rate of 0,01/min. All testing machines work with a stressing rate in this range of 12 MPa/s. So consequently, beginning with leaving the Hooke's line (linear relationship between stress and strain) up to achieving the yield strength $R_{p0,2}$ significant higher strainrates of 0,04/min to 0,05/min at simultaneously significant decreasing stressing rates are determined;
- o subclause 6.3.6.3: if the test is to be continued to fracture, the strain rate of the parallel length may be increased beyond the proof stress but shall not exceed a value of 0,1 (10 %) per min. Changed to: “If the test is to be continued to fracture, the strain rate of the parallel length may be increased beyond the proof stress but shall not exceed a value required in Table 2 and Table 3”.

  The strain-rate, mentioned in 6.3.6.3, of 0,1 (10 %)/min is significantly too low. All other relevant specifications (ASTM B557, EN 485-2 and EN 10002-1:2001) allow a strain rate up to 0,5 (50 %)/min. That means conversely, one tensile test would take five times longer by application of EN 2002-001. The throughput of one test-machine would decrease to 1/5;
- o subclauses 6.3.6.2 and 6.3.6.3: Table 2 with required test speeds implemented for the following both groups: aluminium and aluminium alloys; engineering steels and stainless steels; all other metallic materials.

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.

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*

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 and definitions

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

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

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

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

3.1
test piece
portion of the test sample on which the tensile test is carried out

3.2
proportional test piece
test piece with an original gauge length (L_0) having a specified relationship to the square root of the cross-sectional area (S_0)

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√(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

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
A
<proportional test piece> 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 %.

3.7
percentage elongation
***A*$_{L0}$**
<non-proportional test piece> 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
***A*$_x$**
<non-standard proportional test piece> elongation after fracture expressed as a percentage of the original gauge length (L_0) for a non-standard proportional test piece with an original gauge length of L_0 = x

EXAMPLE $L_0 = A_{4D}$

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.

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.

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).

Note 2 to entry: It is recommended that the extensometer gauge length is as large as possible.

Note 3 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.

3.19
test piece length
L_t
total length of test piece

Note 1 to entry: The unit is mm.

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)

Note 1 to entry: See Figure 1.

Note 2 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 3 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 mm^2.

3.26
minimum cross-sectional area
S_u
minimum cross-sectional area of test piece after fracture

Note 1 to entry: The unit is mm^2.

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 %.