

SÜSINIKTÄRASEST JA LEGEERITUD TÄRASEST
KINNITITE MEHAANILISED OMADUSED. OSA 1:
SPETSIFITSEERITUD OMADUSKLASSIDEGA POLDID,
KRUVID JA TIKKPOLDID. JÄMEKEERE JA PEENKEERE

Mechanical properties of fasteners made of carbon
steel and alloy steel - Part 1: Bolts, screws and studs
with specified property classes - Coarse thread and fine
pitch thread (ISO 898-1:2013)

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN ISO 898-1:2013 sisaldab Euroopa standardi EN ISO 898-1:2013 ingliskeelset teksti.	This Estonian standard EVS-EN ISO 898-1:2013 consists of the English text of the European standard EN ISO 898-1:2013.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation and Accreditation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 23.01.2013.	Date of Availability of the European standard is 23.01.2013.
Standard on kättesaadav Eesti Standardimis-ja Akrediteerimiskeskusest.	The standard is available from the Estonian Centre for Standardisation and Accreditation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 21.060.10

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardimis- ja Akrediteerimiskeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardimis-ja Akrediteerimiskeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardimis-ja Akrediteerimiskeskusega: Koduleht www.evs.ee; telefon 605 5050; e-post info@evs.ee

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation and Accreditation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation and Accreditation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation and Accreditation:

Homepage www.evs.ee; phone +372 605 5050; e-mail info@evs.ee

English Version

Mechanical properties of fasteners made of carbon steel and
alloy steel - Part 1: Bolts, screws and studs with specified
property classes - Coarse thread and fine pitch thread (ISO 898-
1:2013)

Caractéristiques mécaniques des éléments de fixation en
acier au carbone et en acier allié - Partie 1: Vis, goujons et
tiges filetées de classes de qualité spécifiées - Filetages à
pas gros et filetages à pas fin (ISO 898-1:2013)

Mechanische Eigenschaften von Verbindungselementen
aus Kohlenstoffstahl und legiertem Stahl - Teil 1:
Schrauben mit festgelegten Festigkeitsklassen -
Regelgewinde und Feingewinde (ISO 898-1:2013)

This European Standard was approved by CEN on 14 January 2013.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



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

Management Centre: Avenue Marnix 17, B-1000 Brussels

Foreword

This document (EN ISO 898-1:2013) has been prepared by Technical Committee ISO/TC 2 "Fasteners" in collaboration with Technical Committee CEN/TC 185 "Fasteners" the secretariat of which is held by DIN.

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 July 2013, and conflicting national standards shall be withdrawn at the latest by July 2013.

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 ISO 898-1:2009.

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, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of ISO 898-1:2013 has been approved by CEN as EN ISO 898-1:2013 without any modification.

Contents

Page

Foreword	iv
1 Scope	1
2 Normative references	2
3 Terms and definitions	3
4 Symbols and abbreviated terms	4
5 Designation system for property classes	6
6 Materials	6
7 Mechanical and physical properties	8
8 Applicability of test methods	12
8.1 General	12
8.2 Loadability of fasteners	12
8.3 Manufacturer's test/inspection	13
8.4 Supplier's test/inspection	13
8.5 Purchaser's test/inspection	13
8.6 Feasible tests for groups of fasteners and machined test pieces	14
9 Test methods	21
9.1 Tensile test under wedge loading of finished bolts and screws (excluding studs)	21
9.2 Tensile test for finished bolts, screws and studs for determination of tensile strength, R_m	25
9.3 Tensile test for full-size bolts, screws and studs for determination of elongation after fracture, A_f , and stress at 0,0048d non-proportional elongation, R_{pf}	27
9.4 Tensile test for bolts and screws with reduced loadability due to head design	31
9.5 Tensile test for fasteners with waisted shank	32
9.6 Proof load test for finished bolts, screws and studs	33
9.7 Tensile test for machined test pieces	35
9.8 Head soundness test	38
9.9 Hardness test	39
9.10 Decarburization test	41
9.11 Carburization test	44
9.12 Retempering test	46
9.13 Torsional test	46
9.14 Impact test for machined test pieces	47
9.15 Surface discontinuity inspection	48
10 Marking	48
10.1 General	48
10.2 Manufacturer's identification mark	49
10.3 Marking and identification of fasteners with full loadability	49
10.4 Marking and designation of fasteners with reduced loadability	53
10.5 Marking of packages	53
Annex A (informative) Relationship between tensile strength and elongation after fracture	54
Annex B (informative) Influence of elevated temperatures on mechanical properties of fasteners	55
Annex C (informative) Elongation after fracture for full-size fasteners, A_f	56
Bibliography	57

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 2.

The main task of technical committees is to prepare International Standards. 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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 898-1 was prepared by Technical Committee ISO/TC 2, *Fasteners*, Subcommittee SC 11, *Fasteners with metric external thread*.

This fifth edition cancels and replaces the fourth edition (ISO 898-1:2009), of which it constitutes a minor revision.

ISO 898 consists of the following parts, under the general title *Mechanical properties of fasteners made of carbon steel and alloy steel*:

- *Part 1: Bolts, screws and studs with specified property classes — Coarse thread and fine pitch thread*
- *Part 2: Nuts with specified property classes — Coarse thread and fine pitch thread*
- *Part 5: Set screws and similar threaded fasteners with specified hardness classes — Coarse thread and fine pitch thread*
- *Part 7: Torsional test and minimum torques for bolts and screws with nominal diameters 1 mm to 10 mm¹⁾*

¹⁾ It is intended that, upon revision, the main element of the title of Part 7 will be aligned with the main element of the titles of Parts 1 to 5.

Mechanical properties of fasteners made of carbon steel and alloy steel

Part 1: Bolts, screws and studs with specified property classes — Coarse thread and fine pitch thread

1 Scope

This part of ISO 898 specifies mechanical and physical properties of bolts, screws and studs made of carbon steel and alloy steel when tested at an ambient temperature range of 10 °C to 35 °C. Fasteners (the term used when bolts, screws and studs are considered all together) that conform to the requirements of this part of ISO 898 are evaluated at that ambient temperature range. They might not retain the specified mechanical and physical properties at elevated temperatures (see Annex B) and/or lower temperatures.

NOTE 1 Fasteners conforming to the requirements of this part of ISO 898 are used in applications ranging from –50 °C to +150 °C. Users are advised to consult an experienced fastener metallurgist for temperatures outside the range of –50 °C to +150 °C and up to a maximum temperature of +300 °C when determining appropriate choices for a given application.

NOTE 2 Information for the selection and application of steels for use at lower and elevated temperatures is given, for example, in EN 10269, ASTM F2281 and in ASTM A320/A320M.

Certain bolts and screws might not fulfil the tensile or torsional requirements of this part of ISO 898 because the geometry of their heads reduces the shear area in the head compared to the stress area in the thread. These include bolts and screws having a low or countersunk head (see 8.2).

This part of ISO 898 is applicable to bolts, screws and studs

- made of carbon steel or alloy steel,
- having triangular ISO metric screw thread in accordance with ISO 68-1,
- with coarse pitch thread M1,6 to M39, and fine pitch thread M8×1 to M39×3,
- with diameter/pitch combinations in accordance with ISO 261 and ISO 262, and
- having thread tolerances in accordance with ISO 965-1, ISO 965-2 and ISO 965-4.

It is not applicable to set screws and similar threaded fasteners not under tensile stress (see ISO 898-5).

It does not specify requirements for such properties as

- weldability,
- corrosion resistance,
- resistance to shear stress,

- torque/clamp force performance (for test method, see ISO 16047), or
- fatigue resistance.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable to its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 68-1, *ISO general purpose screw threads — Basic profile — Part 1: Metric screw threads*

ISO 148-1, *Metallic materials — Charpy pendulum impact test — Part 1: Test method*

ISO 225, *Fasteners — Bolts, screws, studs and nuts — Symbols and descriptions of dimensions*

ISO 261, *ISO general purpose metric screw threads — General plan*

ISO 262, *ISO general purpose metric screw threads — Selected sizes for screws, bolts and nuts*

ISO 273, *Fasteners — Clearance holes for bolts and screws*

ISO 724, *ISO general-purpose metric screw threads — Basic dimensions*

ISO 898-2, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 2: Nuts with specified property classes — Coarse thread and fine pitch thread*

ISO 898-5, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 5: Set screws and similar threaded fasteners with specified hardness classes — Coarse thread and fine pitch thread*

ISO 898-7, *Mechanical properties of fasteners — Part 7: Torsional test and minimum torques for bolts and screws with nominal diameters 1 mm to 10 mm¹⁾*

ISO 965-1, *ISO general-purpose metric screw threads — Tolerances — Part 1: Principles and basic data*

ISO 965-2, *ISO general purpose metric screw threads — Tolerances — Part 2: Limits of sizes for general purpose external and internal screw threads — Medium quality*

ISO 965-4, *ISO general purpose metric screw threads — Tolerances — Part 4: Limits of sizes for hot-dip galvanized external screw threads to mate with internal screw threads tapped with tolerance position H or G after galvanizing*

ISO 4042, *Fasteners — Electroplated coatings*

ISO 6157-1, *Fasteners — Surface discontinuities — Part 1: Bolts, screws and studs for general requirements*

ISO 6157-3, *Fasteners — Surface discontinuities — Part 3: Bolts, screws and studs for special requirements*

ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method*

ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method*

ISO 6508-1, *Metallic materials — Rockwell hardness test — Part 1: Test method (scales A, B, C, D, E, F, G, H, K, N, T)*

ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

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 10683, *Fasteners — Non-electrolytically applied zinc flake coatings*

ISO 10684:2004, *Fasteners — Hot dip galvanized coatings*

ISO 16426, *Fasteners — Quality assurance system*

3 Terms and definitions

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

3.1

finished fastener

fastener for which all manufacturing steps have been completed, with or without any surface coating and with full or reduced loadability, and which has not been machined into a test piece

3.2

machined test piece

test piece machined from a fastener to evaluate material properties

3.3

full-size fastener

finished fastener with a shank diameter of $d_s \approx d$ or $d_s > d$, or screw threaded to the head, or fully threaded stud

3.4

fastener with reduced shank

finished fastener with a shank diameter of $d_s \approx d_2$

3.5

fastener with waisted shank

finished fastener with a shank diameter of $d_s < d_2$

3.6

base metal hardness

hardness closest to the surface (when traversing from core to outside diameter) just before an increase or decrease occurs, denoting, respectively, carburization or decarburization

3.7

carburization

result of increasing surface carbon to a content above that of the base metal

3.8

decarburization

loss of carbon at the surface of a steel fastener

3.9

partial decarburization

decarburization with sufficient loss of carbon to cause a lighter shade of tempered martensite and a significantly lower hardness than that of the adjacent base metal, without, however, showing ferrite grains under metallographic examination

3.10

ferritic decarburization

decarburization with sufficient loss of carbon to cause a lighter shade of tempered martensite and a significantly lower hardness than that of the adjacent base metal, with the presence of ferrite grains or grain boundary network under metallographic examination