INTERNATIONAL STANDARD

ISO 898-1

Fifth edition
2013-01-15

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

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

Reference number
ISO 898-1:2013(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

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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 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 mm*[1)]

[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 mm*[1)]

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

3.11
complete decarburization
decarburization with sufficient carbon loss to show only clearly defined ferrite grains under metallographic examination

4 Symbols and abbreviated terms

For the purposes of this document, the symbols and abbreviated terms given in ISO 225 and ISO 965-1, and the following apply.

A	Percentage elongation after fracture (of machined test piece), %
A_f	Elongation after fracture for full-size fastener
$A_{s,nom}$	Nominal stress area in thread, mm^2
A_{ds}	Cross-sectional area of waisted shank, mm^2
b	Thread length, mm
b_m	Thread length of stud metal end, mm
d	Nominal thread diameter, mm
d_0	Diameter of machined test piece, mm
d_1	Basic minor diameter of external thread, mm
d_2	Basic pitch diameter of external thread, mm
d_3	Minor diameter of external thread, mm
d_a	Transition diameter (internal diameter of the bearing face), mm
d_h	Hole diameter of wedge or block, mm
d_s	Diameter of unthreaded shank, mm
E	Height of non-decarburized zone in thread, mm
F_m	Ultimate tensile load, N
$F_{m,min}$	Minimum ultimate tensile load, N
F_p	Proof load, N
F_{pf}	Load at 0,0048d non-proportional elongation for full-size fastener, N
G	Depth of complete decarburization in thread, mm
H	Height of fundamental triangle, mm
H_1	Height of external thread in maximum material condition, mm
k	Height of the head, mm
K_v	Impact strength, J