
**Fasteners — Mechanical properties
of corrosion-resistant stainless steel
fasteners —**

**Part 1:
Bolts, screws and studs with specified
grades and property classes**

*Fixations — Caractéristiques mécaniques des fixations en acier
inoxydable résistant à la corrosion —*

*Partie 1: Vis, goujons et tiges filetées de grades et classes de qualité
spécifiés*



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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

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Contents

Page

Foreword	v
Introduction	vii
1 Scope	1
2 Normative references	2
3 Terms and definitions	2
4 Symbols	3
5 Designation system for stainless steel grades and property classes	4
5.1 General	4
5.2 Designation of stainless steel grades (first block)	5
5.3 Designation of property classes (second block)	6
6 Materials	6
6.1 Chemical composition	6
6.2 Heat treatment for martensitic stainless steel fasteners	7
6.3 Finish	8
6.4 Corrosion resistance	8
7 Mechanical and physical properties	8
8 Applicability of test methods and inspection	14
8.1 Applicability of test methods	14
8.2 Loadability of fasteners	14
8.2.1 Fasteners with full loadability	14
8.2.2 Fasteners which have reduced loadability due to their geometry	15
8.3 Manufacturer's inspection	16
8.4 Supplier's inspection	16
8.5 Purchaser's inspection	16
8.6 Delivery of test results	17
9 Test methods	17
9.1 Tensile test for fasteners	17
9.1.1 General	17
9.1.2 Test procedure for the simultaneous determination of R_{mf} , R_{pf} and A	18
9.1.3 Reference test procedure for the determination of stress at 0,2 % non-proportional elongation, R_{pf}	19
9.1.4 Alternative test procedure for the determination of elongation, A	21
9.1.5 Test results and requirements for tensile strength, R_{mf}	22
9.1.6 Test results and requirements for stress at 0,2 % non-proportional elongation, R_{pf}	22
9.1.7 Test results and requirements for elongation after fracture, A	23
9.2 Tensile test for bolts and screws with reduced loadability due to head design	23
9.2.1 General	23
9.2.2 Test procedure	23
9.2.3 Test results and requirements for ultimate tensile load, F_{mf}	23
9.3 Tensile test for fasteners with reduced loadability due to shank design	23
9.3.1 General	23
9.3.2 Test procedure	24
9.3.3 Test results for tensile strength	24
9.4 Wedge tensile test	24
9.4.1 General	24
9.4.2 Test procedure	26
9.4.3 Test results and requirements	26
9.5 Torsional test	26
9.5.1 General	26
9.5.2 Test procedure	27

9.5.3	Test results and requirements	28
9.6	Hardness test	28
9.6.1	General	28
9.6.2	Test procedure	28
9.6.3	Test results and requirements	28
10	Fastener marking and labelling	29
10.1	Fastener marking	29
10.1.1	General requirements for marking	29
10.1.2	Marking of property class for fasteners with full loadability	29
10.1.3	Marking of property class for fasteners with reduced loadability	29
10.1.4	Additional marking	30
10.2	Manufacturer's identification mark	30
10.3	Marking on the fasteners	30
10.3.1	Hexagon head bolts and screws	30
10.3.2	Hexagon socket or hexalobular socket bolts and screws	31
10.3.3	Other types of bolts and screws	32
10.3.4	Studs (one-end and double-end studs)	32
10.3.5	Fully threaded studs	33
10.3.6	Left-hand thread marking	33
10.4	Marking of the packages (labelling)	34
Annex A (informative) Mechanical properties at elevated temperatures — Application at low temperatures		35
Bibliography		37

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 2, *Fasteners*.

This third edition cancels and replaces the second edition (ISO 3506-1:2009), which has been technically revised.

The main changes compared to the previous edition are as follows:

- annexes common to several parts of the ISO 3506 series have been withdrawn from this document and are now included in a new document (ISO 3506-6);
- duplex (austenitic-ferritic) stainless steels for property classes 70, 80 and 100 have been added (see [Figure 1](#));
- property class 100 for austenitic stainless steel grades as well as grade A8 have been added (see [Figure 1](#));
- finish (see [6.3](#)) has been added;
- the matching of stainless steel bolt and nut grades (see [6.4](#)) has been added;
- calculated minimum ultimate tensile loads and minimum loads at 0,2 % non-proportional elongation (see [Tables 4 to 7](#)) and rounding rules have been added;
- reduced loadability for fasteners due to head or shank design (see [8.2](#)) has been added;
- requirements and guidance for inspection procedures (see [8.3](#) to [8.6](#)) have been added;
- operational temperature ranges (see [Clause 1](#)) have been clarified;
- the applicability of test methods (see [Clause 8](#)), also in relation to full and reduced loadability, has been added;
- the tensile test procedure (see [9.1](#)) has been entirely amended, and application to fasteners with reduced loadability (see [9.2](#) and [9.3](#)) has been added;

- the wedge tensile test (see [9.4](#)) and hardness test (see [9.6](#)) have been improved;
- marking and labelling (see [Clause 10](#)) have been improved, and fasteners with reduced loadability have been included;
- mechanical properties at elevated temperatures and application at low temperatures (see [Annex A](#)) have been improved;
- the structure and content of this document have been brought in line with ISO 898-1.

A list of all parts in the ISO 3506 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The ISO 3506 series consists of the following parts, under the general title *Fasteners — Mechanical properties of corrosion-resistant stainless steel fasteners*:

- Part 1: Bolts, screws and studs with specified grades and property classes
- Part 2: Nuts with specified grades and property classes
- Part 3¹⁾: Set screws and similar fasteners not under tensile stress
- Part 4¹⁾: Tapping screws
- Part 5²⁾: Special fasteners (also including fasteners from nickel alloys) for high temperature applications
- Part 6: General rules for the selection of stainless steels and nickel alloys for fasteners

The properties of stainless steel fasteners result from the chemical composition of the material (especially corrosion resistance) and from the mechanical properties due to the manufacturing processes. Ferritic, austenitic and duplex (austenitic-ferritic) stainless steel fasteners are generally manufactured by cold working; they consequently do not have homogeneous local material properties when compared to quenched and tempered fasteners.

Austenitic-ferritic stainless steels referred to as duplex stainless steels were originally invented in the 1930s. Standard duplex grades used today have been developed since the 1980s. Fasteners made of duplex stainless steels have been long established in a range of applications. This document was revised to reflect their standardization.

All duplex stainless steel grades show improved resistance to stress corrosion cracking compared to the commonly used A1 to A5 austenitic grades. Most duplex grades also show higher levels of pitting corrosion resistance, where D2 matches at least A2 and where D4 matches at least A4.

Complementary detailed explanations about definitions of stainless steel grades and properties are specified in ISO 3506-6.

1) It is intended to revise ISO 3506-3 and ISO 3506-4 in the future in order to include the reference to ISO 3506-6.
2) Under preparation.

Fasteners — Mechanical properties of corrosion-resistant stainless steel fasteners —

Part 1: Bolts, screws and studs with specified grades and property classes

1 Scope

This document specifies the mechanical and physical properties of bolts, screws and studs, with coarse pitch thread and fine pitch thread, made of corrosion-resistant stainless steels, when tested at the ambient temperature range of 10 °C to 35 °C. It specifies property classes in relation to austenitic, martensitic, ferritic and duplex (austenitic-ferritic) steel grades for fasteners.

The term “fasteners” is used in this document when bolts, screws and studs are considered all together.

ISO 3506-6 provides general rules and additional technical information on suitable stainless steels and their properties.

Fasteners conforming to the requirements of this document are evaluated at the ambient temperature specified in paragraph 1. It is possible that they do not retain the specified mechanical and physical properties at elevated and/or lower temperatures.

NOTE 1 Fasteners conforming to the requirements of this document are used without restriction in applications ranging from –20 °C to +150 °C; however, fasteners conforming to this document are also used for applications outside this range down to –196 °C and up to +300 °C. For more details, see [Annex A](#) and ISO 3506-6.

Outside the temperature range of –20 °C to +150 °C, it is the responsibility of the user to determine the appropriate choice for a given application in consultation with an experienced fastener metallurgist and by taking into account e.g. stainless steel composition, duration of exposure at elevated or low temperature, the effect of the temperature on the fasteners mechanical properties and clamped parts, and the corrosive service environment of the bolted joint.

NOTE 2 ISO 3506-5 is developed in order to assist in the selection of appropriate stainless steel grades and property classes intended for use at temperatures up to +800 °C.

This document applies to bolts, screws and studs:

- with ISO metric thread in accordance with ISO 68-1,
- with diameter/pitch combinations in accordance with ISO 261 and ISO 262,
- with coarse pitch thread M1,6 to M39, and fine pitch thread M8×1 to M39×3,
- with thread tolerances in accordance with ISO 965-1 and ISO 965-2,
- with specified property classes, and
- of any shape.

Stainless steel grades and property classes can be used for sizes outside the diameter limits of this document (i.e. for $d < 1,6$ mm or $d > 39$ mm), provided that all applicable chemical, mechanical and physical requirements are met.

Certain bolts, screws and studs might not fulfil the tensile or torsional requirements of this document because of the geometry of their head or unthreaded shank, thus resulting in reduced loadability (e.g. when shear area in the head is less than the stress area in the thread; see 8.2.2).

This document does not apply to set screws and similar threaded fasteners not under tensile stress (see ISO 3506-3).

It does not specify requirements for functional properties such as:

- torque/clamp force properties,
- shear strength,
- fatigue resistance, or
- weldability.

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.

ISO 1891-4, *Fasteners — Vocabulary — Part 4: Control, inspection, delivery, acceptance and quality*

ISO 3506-6, *Fasteners — Mechanical properties of corrosion-resistant stainless steel fasteners — Part 6: General rules for the selection of stainless steels and nickel alloys for fasteners*

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*

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

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 9513, *Metallic materials — Calibration of extensometer systems used in uniaxial testing*

ISO 16228, *Fasteners — Types of inspection documents*

3 Terms and definitions

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

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

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

3.1

stainless steel bolt and screw with full loadability

bolt and screw with head stronger than the threaded and unthreaded shanks (with unthreaded shank diameter $d_s \approx d_2$ or $d_s > d_2$) or screw threaded to the head, and fulfilling the minimum ultimate tensile load

3.2

stainless steel stud with full loadability

stud with unthreaded shank diameter $d_s \approx d_2$ or $d_s > d_2$, and fulfilling the minimum ultimate tensile load