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Mechanical properties of corrosion-resistant stainless steel fasteners - Part 1: Bolts, screws and studs with specified property classes - Coarse pitch thread and fine pitch thread (ISO/DIS 3506-1:2018)

Mechanische Eigenschaften von Verbindungselementen aus korrosionsbeständigen nichtrostenden Stählen - Teil 1: Schrauben mit festgelegten Festigkeitsklassen - Regelgewinde und Feingewinde (ISO/DIS 3506-1:2018)

Caractéristiques mécaniques des fixations en acier inoxydable résistant à la corrosion - Partie 1: Vis, goujons et tiges filetées de classes de qualité spécifiées - Filetage à pas gros et filetage à pas fin (ISO/DIS 3506-1:2018)

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Mechanical properties of corrosion-resistant stainless steel fasteners —

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

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

Partie 1: Vis, goujons et tiges filetées de classes de qualité spécifiées — Filetage à pas gros et filetage à pas fin

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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**
6 Materials **6**
6.1 Chemical composition 6
6.2 Heat treatment for martensitic stainless steels 7
6.3 Finish 7
6.4 Corrosion resistance 8
7 Mechanical and physical properties **8**
8 Applicability of test methods **14**
8.1 General 14
8.2 Loadability of fasteners 14
8.2.1 Fasteners with full loadability 14
8.2.2 Fasteners which, due to their geometry, have reduced loadability 14
8.3 Manufacturer's inspection 15
8.4 Supplier's inspection 15
8.5 Purchaser's inspection 15
8.6 Delivery of test results 15
8.7 Applicability of tests 15
9 Test methods **17**
9.1 Tensile test 17
9.1.1 General 17
9.1.2 Test procedure for the simultaneous determination of R_{mf}, R_{pf}, and A_f 19
9.1.3 Alternative test procedure for the determination of lower yield stress, R_{pf} 20
9.1.4 Alternative test procedure for the determination of elongation, A 21
9.1.5 Test results for tensile strength, R_m 22
9.2 Tensile test for bolts and screws with reduced loadability due to head design 22
9.2.1 General 22
9.2.2 Test procedure 23
9.2.3 Test result for tensile load, F_m 23
9.3 Tensile test on fasteners with reduced loadability due to shank design 23
9.3.1 General 23
9.3.2 Test procedure 23
9.3.3 Test result for tensile strength, R_m 24
9.4 Wedge tensile test 24
9.4.1 General 24
9.4.2 Test procedure 26
9.4.3 Test results 26
9.5 Torsional test 26
9.5.1 General 26
9.5.2 Test procedure 27
9.5.3 Test result 27
9.6 Hardness test 28
9.6.1 General 28
9.6.2 Test procedure 28
9.6.3 Test result 28

10 Fastener marking and labelling **28**
10.1 General 28
10.1.1 Marking of property class for fasteners with full loadability 29
10.1.2 Marking of property class for fasteners with reduced loadability 29
10.1.3 Additional marking 29
10.2 Manufacturer's identification mark 30
10.3 Marking of the fasteners 30
10.3.1 Hexagon head bolts and screws 30
10.3.2 Hexagon socket and hexalobular bolts and screws 30
10.3.3 Other bolts and screws 31
10.3.4 Studs (one end and double end studs) 31
10.3.5 Fully threaded studs 32
10.3.6 Left-hand thread marking 32
10.4 Marking of the packages (labelling) 32

Annex A (informative) **Mechanical properties at elevated temperatures Application at low temperatures** **34**

Bibliography **36**

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 on 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 the following URL: www.iso.org/iso/foreword.html.

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

This third edition together with ISO 3506-6, 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:

— duplex (austenitic-ferritic) stainless steels for property classes 70, 80 and 100 (see Figure 1) have been added;

— grade A8 has been added;

— property class 100 for austenitic stainless steel grades has been added;

— annexes common to several parts of ISO 3506 withdrawn from Part 1 and now included in a new ISO 3506 Part 6;

— finish (6.3) has been added;

— matching of stainless steel bolt and nut grades (6.4) has been added;

— calculated minimum ultimate tensile loads and minimum loads at 0,2 % non-proportional elongation (Tables 4 to 7) and rounding rules have been added;

— reduced loadability for fasteners due to head or shank design (8.2) have been added;

— requirements and guidance for inspection procedures (8.3 to 8.6) have been added;

— operational temperature ranges (clause 1) have been added;

— applicability of test methods (clause 8), also in relation to full or reduced loadability has been added;

— tensile test procedure entirely (9.1: use of electronic devices, simultaneous determination of tensile resistance, yield strength and elongation), application to fasteners with reduced loadability (9.2, 9.3 and 9.5) has been entirely amended;

— breaking torque data for M12 and M16 sizes has been removed from table 8;

— symbols to distinguish between tensile and elongation testing of specimens or finished fasteners have been redefined;

— wedge tensile test and hardness test have been improved, on the basis of ISO 898-1, (9.4 and 9.6);

— marking and labelling, especially for fasteners with reduced loadability (Clause 10) have been added;

— structure and content have been brought in line with ISO 898-1;

— the standard has also been editorially revised and particularly on the basis of ISO 898-1.

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

Introduction

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

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

— Part 2: *Nuts with specified property classes – Coarse pitch thread and fine pitch thread*

— Part 3: *Set screws and similar fasteners not under tensile stress*

— Part 4: *Tapping screws*

— Part 5: *Special fasteners (including fasteners from nickel alloys) for high temperature applications*[1)]

— Part 6: *Guidance for the selection of stainless steels and nickel alloys for fasteners*

Stainless steel fasteners result from the properties of the material (especially corrosion resistance) and mechanical properties of the finished fasteners.

When ferritic, austenitic and duplex (austenitic-ferritic) stainless steel fasteners are manufactured by cold working, they will consequently 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 1930's. Standard grades used today have been developed since the 1980's.

Fasteners made of duplex stainless steels have been long established in a range of applications, their standardisation for fasteners was the basic reason for revision of this international standard. All duplex steel grades show improved resistance to stress corrosion cracking compared to the commonly used A1 to A5 austenitic grades. Some duplex grades also show higher levels of pitting corrosion resistance.

1) Under preparation.

Mechanical properties of corrosion-resistant stainless steel fasteners —

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

1 Scope

This part of ISO 3506 specifies the mechanical properties of bolts, screws and studs made of corrosion-resistant stainless steels, when tested at an 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 when bolts, screws and studs are considered all together).

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

Fasteners conforming to the requirements of this standard are evaluated at that ambient temperature range. 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 standard are used in applications ranging from – 40 °C to + 150 °C. For application outside this range and up to a temperature range of – 196 °C to + 300 °C, see Annex A and ISO 3506-6. It is the responsibility of the user to determine the appropriate choice for a given application, and consulting an experienced fastener metallurgist is recommended for temperatures outside this range. However, several factors need to be taken into account, e.g. stainless steel composition, time 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 It is intended to develop ISO 3506-5[2)] in order to assist in the selection of appropriate stainless steel grades and property classes intended for use at high temperatures up to + 800 °C.

This part of ISO 3506 applies to bolts, screws and studs:

— with 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,

— with thread tolerances in accordance with ISO 965-1 and ISO 965-2,

— with specified property classes, and

— of any shape.

NOTE 3 The designation system of this standard can be used for sizes outside the limits given in this clause (e.g. $d > 39$ mm), provided that all applicable mechanical and physical requirements of the property classes are met.

Certain bolts, screws and studs might not fulfil the tensile or torsional requirements of this standard 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).

2) Under preparation.

This standard is not applicable to set screws and similar threaded fasteners not under tensile stress (see ISO 3506-3).

It does not specify requirements for such properties 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 68-1, *ISO general purpose screw threads — Basic profile — Part 1: Metric screw threads*

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 3506-6, *Mechanical properties of corrosion-resistant stainless steel fasteners — Part 6: Guidance 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 — Verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Verification and calibration of the force-measuring system*

ISO 16048, *Passivation of corrosion-resistant stainless-steel fasteners*

ISO 16228, *Fasteners — Inspection documents*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 3506-6 and the following 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
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

