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

**Part 2:
Nuts**

*Caractéristiques mécaniques des éléments de fixation en acier
inoxydable résistant à la corrosion —*

Partie 2: Écrous

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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 3506-2 was prepared by Technical Committee ISO/TC 2, *Fasteners*, Subcommittee SC 1, *Mechanical properties of fasteners*.

This second edition cancels and replaces the first edition (ISO 3506-2:1997), which has been technically revised.

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
- Part 2: Nuts
- Part 3: Set screws and similar fasteners not under tensile stress
- Part 4: Tapping screws

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Introduction

In the preparation of this part of ISO 3506, special attention has been given to the fundamentally different property characteristics of the stainless steel fastener grades compared with those of carbon steel and low-alloy steel fasteners. Ferritic and austenitic stainless steels are strengthened only by cold working and consequently, the components do not have as homogeneous local material properties as hardened and tempered parts. These special features have been recognized in the elaboration of the property classes and the test procedures for mechanical properties. The latter differ from the carbon steel and low-alloy steel fastener test procedures with regard to the measurement of the stress at 0,2 % permanent strain (yield stress) and ductility (total elongation after fracture).

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Mechanical properties of corrosion-resistant stainless steel fasteners —

Part 2: Nuts

1 Scope

This part of ISO 3506 specifies the mechanical properties of nuts made of austenitic, martensitic and ferritic steel grades of corrosion-resistant stainless steels, when tested over an ambient temperature range of 10 °C to 35 °C. Properties vary at higher or lower temperatures.

This part of ISO 3506 applies to nuts:

- with nominal thread diameter $D \leq 39$ mm;
- of triangular ISO metric threads with diameters and pitches in accordance with ISO 68-1, ISO 261 and ISO 262;
- of any shape;
- with width across flats as specified in ISO 272;
- with nominal heights $m \geq 0,5D$.

It does not apply to nuts requiring properties such as

- locking abilities, and
- weldability.

NOTE The designation system of this part of ISO 3506 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.

This part of ISO 3506 does not define corrosion or oxidation resistance in particular environments. However, some information on materials for particular environments is given in Annex D. Regarding definitions of corrosion and corrosion resistance, see ISO 8044.

The aim of this part of ISO 3506 is the classification of corrosion-resistant stainless steel nuts into property classes. Some materials can be used at temperatures down to -200 °C, some can be used at temperatures up to $+800$ °C in air. Information on the influence of temperature on mechanical properties is found in Annex E.

Corrosion and oxidation performances and mechanical properties for use at elevated or sub-zero temperatures can be agreed on between the user and the manufacturer in each particular case. Annex F shows how the risk of intergranular corrosion at elevated temperatures depends on the carbon content.

All austenitic stainless steel fasteners are normally non-magnetic in the annealed condition; after cold working, some magnetic properties can be evident (see Annex G).

2 Normative references

The following referenced documents are indispensable for the application 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 272, *Fasteners — Hexagon products — Widths across flats*

ISO 898-2, *Mechanical properties of fasteners — Part 2: Nuts with specified proof load values — Coarse thread*

ISO 898-6, *Mechanical properties of fasteners — Part 6: Nuts with specified proof load values — Fine pitch thread*

ISO 3651-1, *Determination of resistance to intergranular corrosion of stainless steels — Part 1: Austenitic and ferritic-austenitic (duplex) stainless steels — Corrosion test in nitric acid medium by measurement of loss in mass (Huey test)*

ISO 3651-2, *Determination of resistance to intergranular corrosion of stainless steels — Part 2: Ferritic, austenitic and ferritic-austenitic (duplex) stainless steels — Corrosion test in media containing sulfuric acid*

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

ISO 16426, *Fasteners — Quality assurance system*

3 Symbols

D	nominal thread diameter
m	height of the nut (nominal value)
P	pitch of the thread
R_{eL}	lower yield stress
$R_{p0,2}$	stress at 0,2 % permanent strain
s	width across flats
S_p	stress under proof load
μ_r	permeability value in a magnetic field

4 Designation, marking and finish

4.1 Designation

The designation system for stainless steel grades and property classes for nuts is given in Figure 1. The designation of the material consists of two blocks, which are separated by a hyphen. The first block designates the steel grade and the second block, the property class.

The designation of the steel grade (first block) consists of the letters

- **A** for austenitic steel,
- **C** for martensitic steel, or
- **F** for ferritic steel

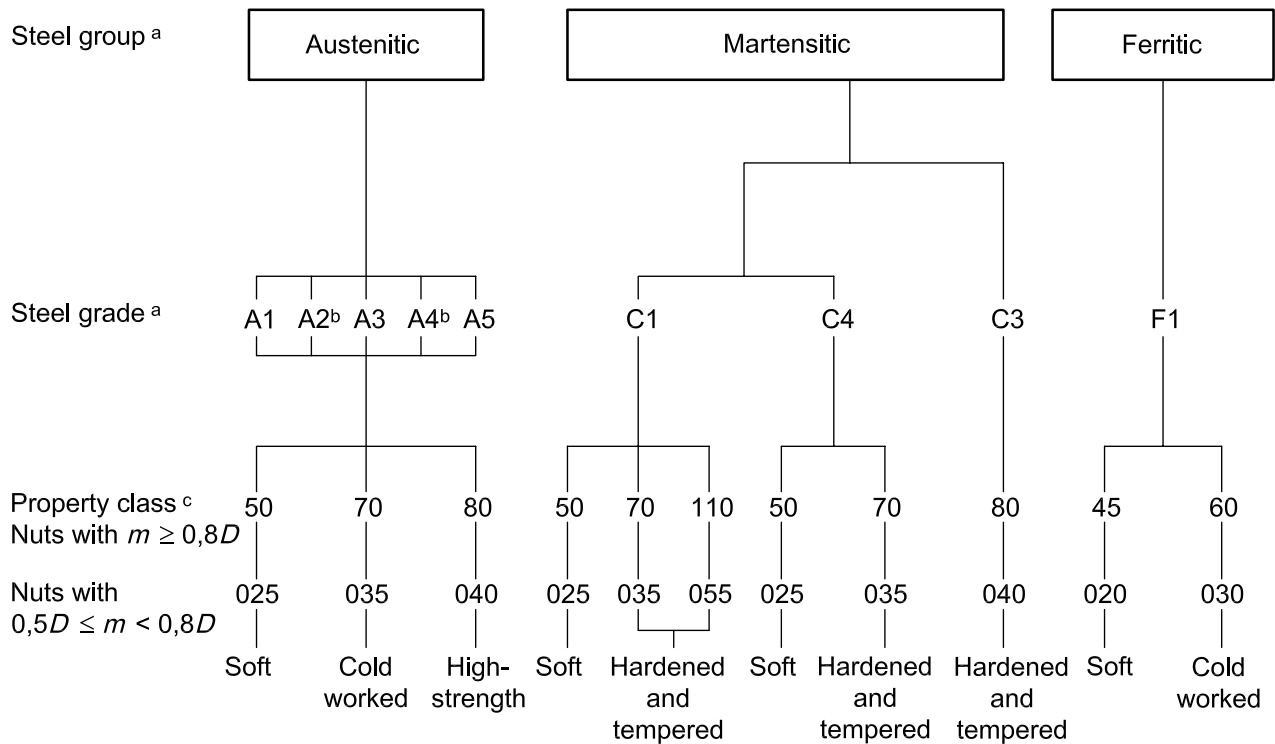
which indicates the group of steel and a digit, which indicates a range of chemical compositions within this steel group (see Table 1).

The designation of the property class (second block) consists of two digits for nuts with height $m \geq 0,8D$ (style 1 or style 2 or hexagon flange nuts), representing 1/10 of the stress under proof load, and three digits for nuts with height $0,5D \leq m < 0,8D$ (thin nuts/style 0), the first digit "0" indicating that the nut has a reduced loadability and the following digits representing 1/10 of the stress under proof load. The following are examples for the designation of material.

EXAMPLE 1 **A2-70** indicates: austenitic steel, cold worked, minimum 700 MPa stress under proof load (nut with $m \geq 0,8D$).

EXAMPLE 2 **C4-70** indicates: martensitic steel, hardened and tempered, minimum 700 MPa stress under proof load (nut with $m \geq 0,8D$).

EXAMPLE 3 **A2-035** indicates: austenitic steel, cold worked, minimum 350 MPa stress under proof load (nut with $0,5D \leq m < 0,8D$).



^a The steel groups and steel grades classified in Figure 1 are described in Annex A and specified by the chemical composition given in Table 1.

^b Low carbon austenitic stainless steels with carbon content not exceeding 0,03 % may additionally be marked with an "L".

EXAMPLE **A4L-80**

^c Nuts passivated in accordance with ISO 16048 may additionally be marked with a "P".

EXAMPLE **A4-80P**

Figure 1 — Designation system for stainless steel grades and property classes for nuts

4.2 Marking

4.2.1 General

Nuts manufactured according to the requirements of this part of ISO 3506 shall be designated in accordance with the designation system described in 4.1 and marked in accordance with 4.2.2 and 4.2.3. However, the designation system described in 4.1 and the provisions for marking according to 4.2.3 shall be used only if all relevant requirements of this part of ISO 3506 are met.

NOTE For marking of left-hand threads, see ISO 898-2.

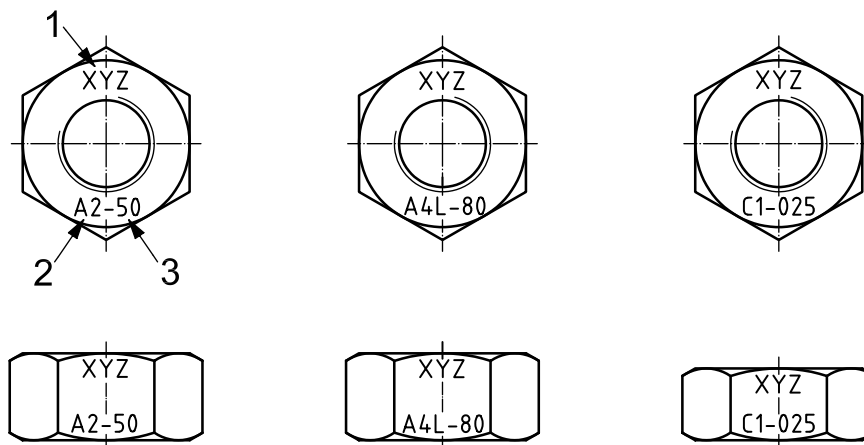
4.2.2 Manufacturer's identification mark

A manufacturer's identification mark shall be included during the manufacturing process on all nuts which are marked with a property class symbol, provided this is possible for technical reasons. Manufacturer's identification marking is also recommended on nuts which are not marked with a property class symbol.

4.2.3 Nuts

All nuts of nominal thread diameter $D \geq 5$ mm shall be clearly marked in accordance with 4.1, Figure 1 and Figure 2 or Figure 3. The marking is mandatory and shall include the steel grade and property class. Marking

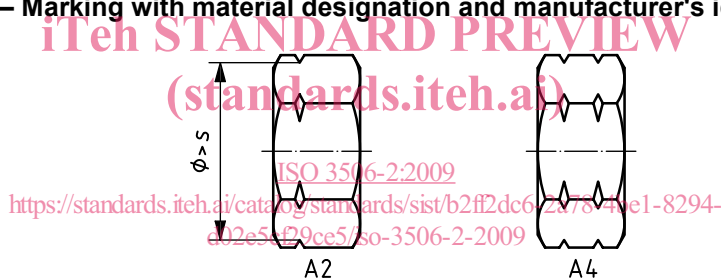
of only one nut face is acceptable and shall be by indentation only, when applied to the bearing surface of the nuts. Alternatively, marking on one side of the nuts is permissible.



Key

- 1 manufacturer's identification mark
- 2 steel grade
- 3 property class

Figure 2 — Marking with material designation and manufacturer's identification mark



Key

- s width across flats

Figure 3 — Alternative groove marking (for steel grades A2 and A4 only)

When the marking is made with grooves (see Figure 3) and the property class is not indicated, property class 50 or 025 will apply.

It is possible that certain nuts would not fulfil the proof load requirements because of fine pitch thread or the geometry of the nut. These nuts may be marked with the steel grade, but shall not be marked with the property class.

4.2.4 Packages

All packages for all types of nuts of all sizes shall be marked (e.g. through labelling). The marking or labelling shall include the manufacturer's and/or distributor's identification and the marking symbol for the steel grade and property class according to Figure 1 and the manufacturing lot number, as defined in ISO 16426.