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Vezni elementi - Sistemi galvanskih prevlek veznih elementov (ISO 4042:2022)

Fasteners - Electroplated coating systems (ISO 4042:2022)

Verbindungselemente - Galvanisch aufgebrachte Überzugssysteme (ISO 4042: 2022)

Fixations - Systèmes de revêtements électrolytiques (ISO 4042: 2022)

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Supersedes EN ISO 4042:2018

English Version

Fasteners - Electroplated coating systems (ISO 4042:2022)

Fixations - Systèmes de revêtements électrolytiques
(ISO 4042: 2022)

Verbindungselemente - Galvanisch aufgebrachte
Überzugssysteme (ISO 4042: 2022)

This European Standard was approved by CEN on 4 February 2022.

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European foreword

This document (EN ISO 4042:2022) 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 BSI.

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of an identical text or by endorsement, at the latest by December 2022, and conflicting national standards shall be withdrawn at the latest by December 2022.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

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INTERNATIONAL STANDARD

**ISO
4042**

Fourth edition
2022-06

Fasteners — Electroplated coating systems

Fixations — Systèmes de revêtements électrolytiques

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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.

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*, Subcommittee SC 14, *Surface coatings*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 185, *Fasteners*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fourth edition cancels and replaces the third edition (ISO 4042:2018), which has been technically revised. The main changes are as follows:

- in [Clause 1](#), a statement has been added that the requirements of this document for electroplated fasteners have precedence over other documents dealing with electroplating;
- all references to ISO 2081 and ISO 19598 have been removed because ISO 4042 is a self-containing document for the purpose of fasteners;
- in [4.4](#), the measures to prevent internal hydrogen embrittlement for nuts, flat washers and case-hardened screws have been completely revised;
- in [6.4](#), the reference areas for thickness determination have been more clearly specified;
- wording in the whole document has been improved to be more accurate, especially for complex topics.

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.

ISO 4042:2022(E)**Introduction**

ISO 4042:1999 was completely revised to take into account new developments related to hexavalent chromium free passivations, application of sealants and top coats, requirements for functional properties as well as results of research work to minimize the risk of hydrogen embrittlement. This revision was published in 2018.

The last editions of ISO 2081:2018 as well as ISO 19598:2016, which are general standards for electroplating, are not adequate to cover the requirements for electroplated fasteners dealt with in ISO 4042, especially with regard to hydrogen embrittlement and baking. Therefore, a new revision of ISO 4042:2018 was necessary to delete all references to these two general standards to avoid any contradictions.

For electroplated nuts, flat washers, and case-hardened screws, measures to mitigate the risk of hydrogen embrittlement, especially in relation to baking, have been revised to be consistent with revisions of ISO 898-2 and ISO 2702, and to reflect findings from the latest research works. For electroplated flat washers in accordance with ISO 898-3, it is generally accepted that tensile stress resulting from intended and unintended bending in service may increase the risk of hydrogen embrittlement. An appropriate test method to simulate such a scenario is currently under investigation.

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Fasteners — Electroplated coating systems

1 Scope

This document specifies requirements for steel fasteners with electroplated coatings and coating systems. The requirements related to dimensional properties also apply to fasteners made of copper or copper alloys.

It also specifies requirements and gives recommendations to minimize the risk of hydrogen embrittlement, see [4.4](#) and [Annex B](#).

It mainly applies to fasteners with zinc and zinc alloy coating systems (zinc, zinc-nickel, zinc-iron) and cadmium, primarily intended for corrosion protection and other functional properties:

- with or without conversion coating,
- with or without sealant,
- with or without top coat,
- with or without lubricant (integral lubricant and/or subsequently added lubricant).

Specifications for other electroplated coatings and coating systems (tin, tin-zinc, copper-tin, copper-silver, copper, silver, copper-zinc, nickel, nickel-chromium, copper-nickel, copper-nickel-chromium) are included in this document only for dimensional requirements related to fasteners with ISO metric threads.

The requirements of this document for electroplated fasteners take precedence over other documents dealing with electroplating.

This document applies to steel bolts, screws, studs and nuts with ISO metric thread, to other threaded fasteners and to non-threaded fasteners such as washers, pins, clips and rivets.

NOTE Electroplating is also applied to stainless steel fasteners, e.g. for the purpose of lubrication in order to avoid galling.

Information for design and assembly of coated fasteners is given in [Annex A](#).

This document does not specify requirements for properties such as weldability or paintability.

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 1456, *Metallic and other inorganic coatings — Electrodeposited coatings of nickel, nickel plus chromium, copper plus nickel and of copper plus nickel plus chromium*

ISO 1463, *Metallic and oxide coatings — Measurement of coating thickness — Microscopical method*

ISO 1502, *ISO general-purpose metric screw threads — Gauges and gauging*

ISO 1891-2, *Fasteners — Terminology — Part 2: Vocabulary and definitions for coatings*

ISO 2082, *Metallic and other inorganic coatings — Electroplated coatings of cadmium with supplementary treatments on iron or steel*

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ISO 2093, *Electroplated coatings of tin — Specification and test methods*

ISO 2177, *Metallic coatings — Measurement of coating thickness — Coulometric method by anodic dissolution*

ISO 2178, *Non-magnetic coatings on magnetic substrates — Measurement of coating thickness — Magnetic method*

ISO 3497, *Metallic coatings — Measurement of coating thickness — X-ray spectrometric methods*

ISO 3613, *Metallic and other inorganic coatings — Chromate conversion coatings on zinc, cadmium, aluminium-zinc alloys and zinc-aluminium alloys — Test methods*

ISO 4521, *Metallic and other inorganic coatings — Electrodeposited silver and silver alloy coatings for engineering purposes — Specification and test methods*

ISO 8991, *Designation system for fasteners*

ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests*

ISO 15330, *Fasteners — Preloading test for the detection of hydrogen embrittlement — Parallel bearing surface method*

ISO 15726, *Metallic and other inorganic coatings — Electrodeposited zinc alloys with nickel, cobalt or iron*

ISO 16047, *Fasteners — Torque/clamp force testing*

ISO 16228, *Fasteners — Types of inspection documents*

ISO 21968, *Non-magnetic metallic coatings on metallic and non-metallic basis materials — Measurement of coating thickness — Phase-sensitive eddy-current method*

ASME B18.6.3, *Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series)*

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3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1891-2 and the following apply.

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

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

3.1 reference panel

reference material that is to be exposed to check the corrosivity level of the test cabinet used for fastener testing

4 General characteristics of the coating**4.1 Coating metals or alloys and main purposes**

Electroplated coating systems for steel fasteners are primarily applied for corrosion protection and functional properties, such as torque/clamp force relationship.

In addition, other functional properties or decorative properties can be specified; see [Annex A](#).

Commonly used electroplated coatings for fasteners are given in [Table 1](#) along with their main purpose(s). Additional information, such as designation or decorative aspects, can be found in other relevant ISO standards listed in the last column of [Table 1](#).

Table 1 — Electroplated coatings in accordance with their main purpose(s) and related ISO standards

| Coating metal(s) | | Nature | Main purpose of the coating for fasteners | ISO standard |
|--|------------------------|-------------|---|--------------|
| Symbol | Element | | | |
| Zn | Zinc | Metal | P/D/F | — |
| ZnNi | Zinc-nickel | Alloy | P/D/F | ISO 15726 |
| ZnFe | Zinc-iron | Alloy | P/D/F | ISO 15726 |
| Cd | Cadmium ^a | Metal | P/F | ISO 2082 |
| Ni | Nickel | Metal | D/F | ISO 1456 |
| Ni+Cr | Nickel+chromium | Multi-layer | D | ISO 1456 |
| Cu+Ni | Copper+nickel | Multi-layer | D | ISO 1456 |
| Cu+Ni+Cr | Copper+nickel+chromium | Multi-layer | D | ISO 1456 |
| CuZn | Brass | Alloy | D | — |
| CuSn | Copper-tin (bronze) | Alloy | F | — |
| Cu | Copper | Metal | F/D | — |
| Ag | Silver | Metal | F/D | ISO 4521 |
| CuAg | Copper-silver | Alloy | F | — |
| Sn | Tin | Metal | F | ISO 2093 |
| SnZn | Tin-zinc | Alloy | F/P | — |
| P corrosion protection F functional properties D decorative properties (colour, aspect) ^a Cadmium is restricted or prohibited for many applications (remaining cadmium users are predominantly military and aerospace industries). | | | | |

4.2 Build-up of basic electroplated coating systems

[Figure 1](#) shows basic electroplated coating systems.