



Fasteners—Electroplated coatings



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 - Australasian Corrosion Association
 - Australian Chamber of Commerce and Industry
 - Australian Engineered Fasteners and Anchors Council
 - Australian Industry Group
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 - National Association of Steel-Framed Housing
 - National Association of Testing Authorities Australia
 - New Zealand Heavy Engineering Research Association
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-

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Australian Standard[®]

Fasteners—Electroplated coatings

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PREFACE

This Standard was prepared by the Australian members of Joint Standards Australia/Standards New Zealand Committee ME-029, Fasteners, to supersede AS 1897—1976, *Electroplated coatings on threaded components (metric coarse series)*. After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian Standard rather than an Australian/New Zealand Standard.

The objective of this Standard is to specify dimensional requirements for electroplated fasteners of steel or copper alloy. It specifies coating thicknesses and gives recommendations for hydrogen embrittlement relief for fasteners with high tensile strength or hardness and for surface-hardened fasteners.

This Standard is identical with, and has been reproduced from ISO 4042:1999, *Fasteners—Electroplated coatings*.

As this Standard is reproduced from an International Standard, the following applies:

- (a) In the source text ‘this International Standard’ should read ‘this Australian Standard’.
- (b) A full point substitutes for a comma when referring to a decimal marker.
- (c) The unit ‘ml’ used in the source text for millilitres should read ‘mL’.

None of the normative references in the source document have been adopted as Australian or Australian/New Zealand Standards.

The terms ‘normative’ and ‘informative’ are used to define the application of the annex to which they apply. A ‘normative’ annex is an integral part of a Standard, whereas an ‘informative’ annex is only for information and guidance.

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NOTES

AUSTRALIAN STANDARD

Fasteners—Electroplated coatings**1 Scope**

This International Standard specifies dimensional requirements for electroplated fasteners of steel or copper alloy. It specifies coating thicknesses and gives recommendations for hydrogen embrittlement relief for fasteners with high tensile strength or hardness and for surface-hardened fasteners.

This International Standard primarily concerns the electroplating of threaded fasteners, but it may also be applied to other threaded parts. For the applicability to screws that cut or form their own mating threads, see clause 8.

The specifications given in this International Standard may also be applied to non-threaded parts such as washers and pins.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 965-1:1999, *ISO general purpose metric screw threads — Tolerances — Part 1: Principles and basic data*.

ISO 965-2:1999, *ISO general purpose metric screw threads — Tolerances — Part 2: Limits of sizes for general purpose bolt and nut threads — Medium quality*.

ISO 965-3:1999, *ISO general purpose metric screw threads — Tolerances — Part 3: Deviations for constructional threads*.

ISO 1456:1988, *Metallic coatings — Electrodeposited coatings of nickel plus chromium and of copper plus nickel plus chromium*.

ISO 1458:1988, *Metallic coating — Electrodeposited coatings of nickel*.

ISO 1502:1996, *ISO general purpose metric screw threads — Gauges and gauging*.

ISO 2064:1996, *Metallic and other non-organic coatings — Definitions and conventions concerning the measurement of thickness*.

ISO 2081:1986, *Metallic coatings — Electroplated coatings of zinc on iron or steel*.

ISO 2082:1986, *Metallic coatings — Electroplated coatings of cadmium on iron or steel*.

ISO 3269:—¹⁾, *Fasteners — Acceptance inspection*.

ISO 4520:1981, *Chromate conversion coatings on electroplated zinc and cadmium coatings*.

ISO 9227:1990, *Corrosion tests in artificial atmospheres — Salt spray tests*.

ISO 9587:—²⁾, *Metallic and other inorganic coatings — Pre-treatments of iron or steel for reducing the risk of hydrogen embrittlement*.

ISO 15330:—²⁾, *Fasteners — Preloading test for the detection of hydrogen embrittlement — Parallel bearing surface method*.

3 Terms and definitions

For the purposes of this International Standard, the definitions given in ISO 2064 (in particular, the definitions of significant surface, measuring area, local thickness and minimum local thickness) and ISO 3269 together with the following, apply.

3.1

batch

quantity of identical fasteners from the same manufacturing lot processed together at one time

3.2

production run

those batches of parts processed continuously without any changes in coating techniques or constituents

3.3

batch average thickness

calculated average thickness of a coating if it was uniformly distributed over the surface of the parts of the batch

3.4

baking

process of heating parts for a definite time at a given temperature in order to minimize the risk of hydrogen embrittlement

3.5

baking duration

time at which the parts are held at the specified temperature which they shall have completely reached

¹⁾ To be published. (Revision of ISO 3269:1988)

²⁾ To be published.

4 Dimensional requirements and gauging

4.1 Dimensional requirements before electroplating

Before coating, parts shall comply with the relevant International Standards if applicable or other standards as specified, except where threads or other features are specifically manufactured to allow, for functional reasons, the application of thicker coatings than are possible on normal threads.

Coating thicknesses which can be applied on ISO metric threads in accordance with ISO 965-1, ISO 965-2 and ISO 965-3 depend on the fundamental deviation available, which itself depends on the screw thread and the following tolerance positions:

- g, f, e for external threads;
- G for internal threads or H if required.

The tolerance positions apply prior to application of the electroplated coating.

4.2 Dimensional requirements after electroplating

After coating, ISO metric screw threads shall be gauged in accordance with ISO 1502 with a GO gauge of tolerance position h for external threads and H for internal threads.

Other product dimensions apply only before coating.

NOTE Care should be exercised where relatively thick coatings may affect dimensions with small tolerances as in the case of internal drives; in these cases an agreement should be made between the supplier and the purchaser.

The applicability of the recommended coatings to ISO metric threads is limited by the fundamental deviation of the threads concerned and hence, by the pitch and tolerance positions. The coating shall not cause the zero line (basic size) to be exceeded in the case of external threads, nor shall it fall below this line in the case of internal threads. This means that for an internal thread of tolerance position H, a measurable coating thickness can only be applied to the threads if the tolerance zone is not taken up to the zero line (basic size).

5 Other coating requirements

The electroplated coating shall comply with the provisions of the relevant International Standards (ISO 1456, ISO 1458, ISO 2081, ISO 2082) for the coating concerned in respect of appearance, adhesion, ductility, corrosion resistance, etc.

6 Hydrogen embrittlement relief

In cases of parts

- with high tensile strength or hardness or which have been surface hardened,
- which have absorbed hydrogen and
- are under tensile stress

there is the risk of failure due to hydrogen embrittlement.

When the core or surface hardness is above 320 HV, process investigation shall be conducted using a test to detect hydrogen embrittlement, for example the "Parallel bearing surface method" in accordance with ISO 15330, to be sure that the process with regard to embrittlement is under control. If embrittlement is discovered, modification of the manufacturing process will be necessary, such as the inclusion of a baking process (see informative annex A for more information).

For fasteners of hardness in excess of 365 HV, a written agreement should exist between the customer and manufacturer to define how to manage the risk. If written agreement does not exist, the manufacturer shall process the parts in accordance with his recommended practices to reduce the risk of hydrogen embrittlement.

Complete elimination of hydrogen embrittlement cannot be assured. If a reduced probability of encountering hydrogen embrittlement is desired, alternative procedures should be evaluated.

NOTE Investigations are proceeding to develop methods for the reduction of hydrogen embrittlement.

7 Corrosion protection

The corrosion protection of an electroplated coating depends to a considerable extent on its thickness. In addition to greater coating thickness, a chromate conversion treatment can be specified for increased corrosion protection on zinc and cadmium coatings.

Contact with other metals and materials, the frequency and duration of wetting and service temperatures may influence the protective performance of coatings and expert advice is essential when uncertainties of choice arise.

Coatings of Zn and Cd applied to ferrous substrates are less electropositive than the steel base metal and consequently provide cathodic protection. In contrast, Ni and Cr coatings are more electropositive than the steel base metal and may intensify part corrosion where the coating is damaged or pitted.

Cadmium coatings are dealt with in ISO 2082.

Zinc coatings are dealt with in ISO 2081.

Nickel coatings are dealt with in ISO 1458.

Nickel + chromium and copper + nickel + chromium coatings are dealt with in ISO 1456.

Chromate conversion treatments are dealt with in ISO 4520.

NOTE Information on salt spray corrosion protection performance of metallic coatings is given in informative annex B.

8 Applicability to fasteners that cut or form their own mating threads

All recommended coatings may be applied to screws that cut or form their own mating threads such as wood screws, self tapping screws, self drilling screws and thread forming screws. The maximum value for batch average thickness given in Table 1 may be ignored unless otherwise specified.

9 Specification of coating thickness

The local and batch average thicknesses corresponding to the nominal coating thicknesses recommended in the relevant International Standards for electroplating are given in Table 1.

In order to reduce the risk of interference on assembly of threads with electroplated coatings, the coating thickness shall not exceed one-quarter of the fundamental deviation of the thread. These values are specified in Table 2.

NOTE For accommodation of thick coatings guidance is given in informative annex C.

The effective coating thicknesses measured according to one of the methods specified in clause 10 shall comply with the values specified in Table 1.