

Aerospace series - Cadmium plating of steels with  
**specified tensile strength  $\leq 1\,450$  MPa, copper, copper  
alloys and nickel alloys**

## EESTI STANDARDI EESSÕNA

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English Version

## Aerospace series - Cadmium plating of steels with specified tensile strength $\leq 1\,450$ MPa, copper, copper alloys and nickel alloys

Série aérospatiale - Cadmiage électrolytique des aciers de résistance  $\leq 1\,450$  MPa, du cuivre, des alliages de cuivre et des alliages de nickel

Luft- und Raumfahrt - Kadmieren von Stählen mit einer Zugfestigkeit  $\leq 1\,450$  MPa, von Kupfer, von Kupferlegierung und von Nickellegierungen

This European Standard was approved by CEN on 4 October 2020.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

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## European foreword

This document (EN 2133:2020) has been prepared by the Aerospace and Defence Industries Association of Europe — Standardization (ASD-STAN).

After enquiries and votes carried out in accordance with the rules of this Association, this document has received the approval of the National Associations and the Official Services of the member countries of ASD-STAN, prior to its presentation to CEN.

This document shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2021, and conflicting national standards shall be withdrawn at the latest by June 2021.

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.

This document supersedes EN 2133:2010.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

The main changes with respect to the previous edition are listed in the following table.

prEN/EN number	Edition	Publication date	Modifications
prEN 2133	1	02/2010	-
	2	09/2020	<p><u>1 – Scope:</u> This document specifies the electrolytic cadmium plating of parts and fasteners (addition of "and fasteners").</p> <p><u>2 – Normative references:</u> EN 9100 is not a normative reference anymore. EN 9100 has been added in bibliography. The reason is that according to CEN/CENELEC Internal regulations Part 3 (February 2017) (see 33 – Aspects of conformity assessment) "no document containing requirements for products, processes, services, persons, systems and bodies shall make conformity dependent on a quality management systems standard, i.e. it shall not, for example, make normative reference to ISO 9001".</p> <p><u>3.1 – batch:</u> Addition of "Note 1 to entry: For mechanical parts, hydrogen embrittlement relieved at the same time".</p> <p><u>4 – Purpose of process:</u> Introduction of three types: - Type 1: as plated,</p>

		<p>- Type 2: with hexavalent chromium based post-treatment,          - Type 3: without hexavalent chromium.</p> <p><u>8 – Information for the processor:</u>          "Requirements for finishing operations other than chromating, e.g. phosphating" has been replaced by "Requirements for finishing operations other than Type 2 or Type 3 post-treatment, e.g. phosphating".</p> <p><u>Table 1 – Stress relief heat treatment of steel parts:</u>          Removal of the tolerance of <math>\pm 10</math> °C.          Addition of the note b.          For 1 100 MPa &lt; UTS <math>\leq</math> 1 450 MPa: the duration is 4 h min. (instead of 1 h min.) and stress relief heat treatment is now from 175 °C to 215 °C (instead of 190 °C to 230 °C).          For carburized parts, stress relief heat treatment is now from 130 °C to 160 °C (instead of 130 °C to 150 °C).</p> <p><u>10 – Process schedule:</u>          Addition of a process flow chart (see Annex A).</p> <p><u>10.2 – Masking:</u>          Editorial change: masking (instead of covering).</p> <p><u>10.4 – Nickel strike:</u>          Nickel strike is mandatory on corrosion resisting steels and is necessary on other type of steels.</p> <p><u>10.5 – Cadmium plating:</u>          If brighteners are used, absence of hydrogen embrittlement shall be verified in accordance with ASTM F519.</p> <p><u>11.1 – Hydrogen-embrittlement-relief heat treatment:</u>          Editorial change: hydrogen-embrittlement-relief (instead of de-embrittlement).</p> <p><u>Table 2 – Hydrogen-embrittlement-relief of steel parts:</u>          Removal of the tolerance of <math>\pm 10</math> °C.          Addition of the note b.          For 1 100 MPa &lt; UTS <math>\leq</math> 1 450 MPa: the hydrogen-embrittlement-relief heat treatment is now from 175 °C to 215 °C (instead of 190 °C to 230 °C).          For carburized or nitrited parts, the hydrogen-embrittlement-relief heat treatment is now from 130 °C to 160 °C (instead of 130 °C to 150 °C).</p> <p><u>11.2 – Post-treatment:</u>          The term "Post-treatment" is used instead of "chromating".          Introduction of Types 1, 2 and 3 within this subclause.</p> <p><u>13.1 – Appearance:</u>          New requirements depending on the type.</p> <p><u>13.4 – Hydrogen embrittlement of steels:</u></p>
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			<p>Requirements are now detailed for parts and for fasteners.</p> <p><u>13.5 – Corrosion resistance:</u> New requirements depending on the type.</p> <p><u>14.1.2 – Adhesion:</u> Addition of other test description. Requirements are now detailed for burnishing test and for grid test.</p> <p><u>14.1.4 – Hydrogen embrittlement:</u> Full revision of the requirements of this subclause.</p> <p><u>14.1.5 – Corrosion resistance:</u> Requirements are now detailed for parts and for fasteners.</p> <p><u>14.2.3 – Coating thickness:</u> Addition of requirements regarding the measurement of the thickness in the hard-to-reach areas.</p> <p><u>15 – Periodic tests:</u> Addition of this clause.</p> <p><u>Table 3 – Minimum periodic tests requirements:</u> Addition of this table.</p> <p><u>16.3 – Acceptance:</u> Unless otherwise specified, the appearance test shall be performed on the whole batch.</p> <p><u>16.5 – Periodic chemical analysis:</u> Addition of this subclause.</p> <p><u>17 – Designation:</u> Addition of the Type in the designation.</p> <p><u>Annex A (normative) – Process flow:</u> Addition of this annex.</p> <p>***</p> <p><u>Note from the writers of this revision of this document:</u> New requirements for sampling plan are currently under investigation and may be changed in the next revision.</p>
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## 1 Scope

This document specifies the electrolytic cadmium plating of parts and fasteners in steel of tensile strength  $UTS \leq 1\,450$  MPa, copper, copper alloys and nickel alloys, whose temperature in service does not exceed 235 °C.

## 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.

EN 2828, *Aerospace series — Adhesion test for metallic coatings by burnishing*

EN 2831, *Aerospace series — Hydrogen embrittlement of steels — Test by slow bending*

EN 2832, *Aerospace series — Hydrogen embrittlement of steels — Notched specimen test*

EN ISO 1463:2004, *Metallic and oxide coatings — Measurement of coating thickness — Microscopical method* (ISO 1463:2003)

EN ISO 2082:2017, *Metallic and other inorganic coatings — Electroplated coatings of cadmium with supplementary treatments on iron or steel* (ISO 2082:2017)

EN ISO 2177:2004, *Metallic coatings — Measurement of coating thickness — Coulometric method by anodic dissolution* (ISO 2177:2003)

EN ISO 2178:2016, *Non-magnetic coatings on magnetic substrates — Measurement of coating thickness — Magnetic method* (ISO 2178:2016)

EN ISO 2409:2013, *Paints and varnishes — Cross-cut test* (ISO 2409:2013)

EN ISO 2819: 2018, *Metallic coatings on metallic substrates — Electrodeposited and chemically deposited coatings — Review of methods available for testing adhesion* (ISO 2819:2017)

EN ISO 3497:2001, *Metallic coatings — Measurement of coating thickness — X-ray spectrometric methods* (ISO 3497:2000)

EN ISO 9227:2017, *Corrosion tests in artificial atmospheres — Salt spray tests* (ISO 9227:2017)

ISO 2859-1: 1999, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

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

ASTM B117, *Standard Practice for Operating Salt Spray (Fog) Apparatus* <sup>1)</sup>

ASTM F519, *Standard test method for mechanical hydrogen embrittlement — Evaluation of plating/coating process and service environment* <sup>1)</sup>

NASM 1312-5, *Fastener Test Methods — Method 5 — Stress Durability* <sup>2)</sup>

NASM 1312-14, *Fastener Test Methods — Method 14 — Stress Durability, Internally Threaded Fasteners* <sup>2)</sup>

<sup>1)</sup> Published by: ASTM National (US) American Society for Testing and Materials, <http://www.astm.org/>.

<sup>2)</sup> Published by: AIA National (US) Aerospace Industries Association of America, <http://www.aia-aerospace.org/>