



SLOVENSKI STANDARD
SIST EN 2535:2022

01-junij-2022

Nadomešča:
SIST EN 2535:2011

Aeronavtika - Usedline kadmija v vakuumu

Aerospace series - Vacuum deposition of cadmium

Luft- und Raumfahrt - Aufdampfen von Kadmium im Vakuum

Série aérospatiale - Cadmiage sous vide

Ta slovenski standard je istoveten z: EN 2535:2022

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ICS:

49.025.99

Drugi materiali

Other materials

SIST EN 2535:2022

en,fr,de

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EUROPEAN STANDARD

EN 2535

NORME EUROPÉENNE

EUROPÄISCHE NORM

April 2022

ICS 49.040

Supersedes EN 2535:2011

English Version

Aerospace series - Vacuum deposition of cadmium

Série aérospatiale - Cadmiage sous vide

Luft- und Raumfahrt - Aufdampfen von Kadmium im Vakuum

This European Standard was approved by CEN on 17 January 2022.

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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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EN 2535:2022 (E)**European foreword**

This document (EN 2535:2022) 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of an identical text or by endorsement, at the latest by October 2022, and conflicting national standards shall be withdrawn at the latest by October 2022.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.

This document supersedes EN 2535:2011.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this document: 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.

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1 Scope

This document specifies the method for depositing cadmium layers according to the vacuum deposition process, for use in aerospace construction.

According to this process, cadmium metal is vaporized under vacuum and deposited directly on the base material with an interlayer. The coating produced in this way is ductile and electrically conductive.

This document is applicable whenever referenced.

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 2437, *Aerospace series — Chromate conversion coatings (yellow) for aluminium and aluminium alloys*

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

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

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

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

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

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

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

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

ISO 4520, *Chromate conversion coatings on electroplated zinc and cadmium coatings*¹

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological 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/>

¹ Published by: ISO International Organization for Standardization <http://www.iso.ch/>.

EN 2535:2022 (E)**3.1****batch**

parts of the same nature (form, size, material), treated at the same time

3.2**customer**

organization or person that receives a product or service

[SOURCE: ISO 18295-1:2017, 3.7, modified — Note 1 to entry omitted]

3.3**manufacturer**

company or person who manufactures parts or assembles components in accordance with the relevant standards and declares the compliance of the delivered products with all applicable provisions of the relevant standard(s)

Note 1 to entry: The manufacturer can also apply the process.

3.4**Original Equipment Manufacturer****OEM**

manufacturer who has the design authority and manufactures parts or components which are purchased and retailed by the manufacturer's company under the purchasing company's brand name

Note 1 to entry: The OEM can also apply the process.

3.5**pre-production part**

part manufactured according to a given definition and which is representative of the production process

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3.6**processor**

company or person who applies the process

3.7**ultimate tensile strength**

R_m

tensile strength at the moment failure occurs

Note 1 to entry: The ultimate tensile strength is specified in the steel material standard of the “to be plated” part.

4 General principles of the process

4.1 Purpose of process

This process enables any hydrogen absorption to be avoided.

It ensures protection against corrosion, in particular for steels of $R_m > 1\,450$ MPa. It may be beneficial to tensile bolts of $R_m > 1\,250$ MPa.

4.2 Thickness

Unless otherwise specified in the product standard or definition document, the thicknesses are:

- class A: 10 μm to 20 μm (normal thickness);
- class B: 7 μm to 14 μm (for parts with close tolerances or for bolts with a thread diameter $> 3,2$ mm);
- class C: 5 μm to 10 μm (for bolts with a thread diameter $\leq 3,2$ mm).

4.3 Indications for use of cadmium coatings

Direct contact of cadmium plated parts with titanium, titanium alloy surfaces shall be avoided, due to "Solid Cadmium Embrittlement" of titanium, titanium alloys by solid metal diffusion.

Direct contact of cadmium plated parts with carbon fibre reinforced laminates shall be avoided.

Direct contact of cadmium plated parts with fuel shall be avoided due to fuel contamination with $\text{Cd}(\text{OH})_2$ cadmium corrosion residues.

Use of cadmium plated and primer coated parts is limited to 150 °C service temperature.

Use of cadmium plated, chromated fasteners (6.5.1) and close tolerance parts is limited to 235 °C service temperature.

If available, preferentially use a non-chromium (VI) passivation as post-treatment.

5 Apparatus and materials

5.1 Vacuum enclosure

The vacuum enclosure shall contain the following equipment:

- a variable heating system for vaporization of the cadmium;
- a rotating device to achieve a regular coating;
- a vaporizing dish;
- a glow system and a vacuum gauge as well as an inspection window.

Furthermore, a pump system is required, allowing a vacuum of at least $(6,65 \times 10^{-3})$ Pa to be reached.

5.2 Deposition material

The cadmium used for deposition shall be at least 999,5 g/kg pure. The mercury content shall not exceed the maximum level of 0,04 g/kg.

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The quality shall be confirmed by certificate.

5.3 Masking material

The masking materials used, such as masking varnishes, lead or textile tapes, paper or aluminium foils shall not release gases during the process.

6 Process requirements**6.1 Information for the processor**

In addition to the designation in Clause 11, the following information shall be stated:

- a) number of the substrate standard and metallurgical condition of the substrate;
- b) surface to be treated;
- c) non specific coating thicknesses of the cadmium coating and tolerances;
- d) post-treatment process, if post-treatment by chromating does not have to be carried out;
- e) additional surface protection, preservation.

6.2 Process schedule

Unless otherwise specified, the following process schedule is mandatory:

- a) degreasing;
- b) abrasive blasting;
- c) degreasing (if necessary, e.g. to remove any abrasive residues);
- d) suspension in the device;
- e) evacuation of the enclosure;
- f) ionic etching (sputter cleaning) (if necessary);
- g) deposition;
- h) flooding and venting of the enclosure;
- i) removal;
- j) post-treatment, additional protection, preservation according to 6.5.

6.3 Pre-treatment**6.3.1 General**

Chemical or electrochemical process such as acid pickling, electrolytic cathodic degreasing or processes causing hydrogen embrittlement are not permitted for steels of $R_m > 1\,450$ MPa.

6.3.2 Degreasing

The parts shall be cleaned by appropriate and qualified organic solvents.