SLOVENSKI STANDARD
SIST EN 4827:2024

01-september-2024

Aeronavtika - Šestvalentni krom brez eloksacije aluminija in aluminijevih zlitin

Aerospace series - Hexavalent chromium free anodizing of aluminium and aluminium alloys

Luft- und Raumfahrt - Anodisieren von Aluminium und Aluminiumlegierungen ohne hexavalentem Chrom

Série aérospatiale - Anodisation sans chrome hexavalent de l'aluminium et des alliages d'aluminium

Ta slovenski standard je istoveten z: **EN 4827:2024**

ICS:

49.025.99	Drugi materiali	Other materials

SIST EN 4827:2024 **en,fr,de**

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 4827

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ICS 49.025.20; 49.040

Supersedes EN 4827:2019

English Version

Aerospace series - Hexavalent chromium free anodizing of aluminium and aluminium alloys

Série aérospatiale - Anodisation sans chrome hexavalent de l'aluminium et des alliages d'aluminium

Luft- und Raumfahrt - Chrom(VI)-freies Anodisieren von Aluminium und Aluminiumlegierungen

This European Standard was approved by CEN on 5 May 2024.

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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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European foreword

This document (EN 4827:2024) 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 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of an identical text or by endorsement, at the latest by January 2025, and conflicting national standards shall be withdrawn at the latest by January 2025.

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 4827:2019.

This document includes the following significant technical changes with respect to EN 4827:2019:

— normative references have been updated;

— Figure 1 and Figure 2 were added to 3.2.4;

— Clause 6 "Engineering requirements" has been restructured into the new Clause 6 "Test specimens requirements" and Clause 7 "Parts requirements";

— requirements relating to the test specimens materials, numbers, dimensions and periodicity have been included in Table 3 to Table 8;

— requirements for the definition of test specimens for the qualification have been changed and added to Table 3 to Table 5;

— requirements for the definition of periodic tests have been changed and added to Table 6 to Table 8;

— Annex A has been renamed;

— in Table A.1, changes were made or added to the items: "visual appearance", "anodic layer thicknesses", "corrosion resistance", "paint adhesion" and "sealing quality";

— Annex B has been renamed;

— in Table B.1, changes were made to the items "visual appearance", "anodic layer thicknesses", "corrosion resistance" and "paint adhesion";

— Table C.1 has been added concerning levels of requirements for corrosion resistance of thin film anodizing on unpainted test specimens;

— in Table D.1, changes were made to the item "visual appearance";

— document has been revised editorially.

Any feedback and questions on this document should be directed to the users' national standards body. A complete listing of these bodies can be found on the CEN website.

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, Türkiye and the United Kingdom.

1 Scope

This document specifies the requirements for hexavalent chromium free anodizing of aluminium and aluminium alloys for corrosion protection, bonding and painting.

This document does not apply to hard anodizing and plasma electrolytic anodizing (micro-arc oxidation).

The purpose of this document is to give design, quality and manufacturing requirements. It does not give complete in-house process instructions; these are given in the processor's detailed process instructions.

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 2284, *Aerospace series — Sulphuric acid anodizing of aluminium and wrought aluminium alloys*

EN 3665, *Aerospace series — Test methods for paints and varnishes — Filiform corrosion resistance test on aluminium alloys*

EN 4704, *Aerospace series — Tartaric-Sulphuric-Acid anodizing of aluminium and aluminium wrought alloys for corrosion protection and paint pre-treatment (TSA)*

EN 4707, *Aerospace series — Acid pickling of aluminium and aluminium alloys without hexavalent chromium*

EN 6072, *Aerospace series — Metallic materials — Test methods — Constant amplitude fatigue testing*

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

EN ISO 2085, *Anodizing of aluminium and its alloys — Check for continuity of thin anodic oxidation coatings — Copper sulfate test (ISO 2085)*

EN ISO 2360, *Non-conductive coatings on non-magnetic electrically conductive base metals — Measurement of coating thickness — Amplitude-sensitive eddy-current method (ISO 2360)*

EN ISO 2376, *Anodizing of aluminium and its alloys — Determination of breakdown voltage and withstand voltage (ISO 2376)*

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

EN ISO 2812-2, *Paints and varnishes — Determination of resistance to liquids — Part 2: Water immersion method (ISO 2812-2)*

EN ISO 9220, *Metallic coatings — Measurement of coating thickness — Scanning electron microscope method (ISO 9220)*

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

ASTM B 137, *Standard Test Method for Measurement of Coating Mass Per Unit Area on Anodically Coated Aluminum*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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 General terms

3.1.1
OEM
producer who has the design authority and manufactures products or components that are purchased by a company and retailed under that purchasing company's brand name

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

3.1.2
manufacturer
company or person who makes, manufactures, assembles components

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

3.1.3
processor
company or person who applies the process

3.1.4
process instruction
document that describes the application scopes, detailed process (key parameters, detailed steps, etc.), quality management, environmental and safety regulations, etc.

3.1.5
batch
unless otherwise specified, parts of the same type (shape, size, material), processed at the same time in the same bath

3.2 Technical terms

3.2.1
de-anodizing
process, which removes the anodic oxide

3.2.2
smut
precipitations of alloying elements (e.g. Cu, Fe, Zn, Si) on the surface of parts after a process step normally after alkaline etching step

3.2.3
Mechanically Disturbed Layer
MDL
layer that is present at the surface resulting from the rolling process of the material

3.2.4
pit
surface corrosion defect at which the anodic coating is penetrated and/or perforated

Note 1 to entry: Typical characteristics of corrosion pits are:

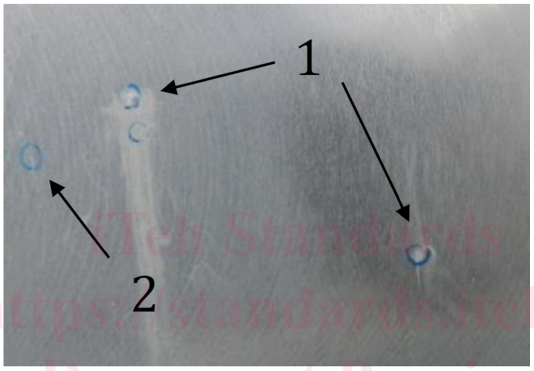
— rounded or irregular or elongated geometry;

— comet tail or line or halo that emerges from the cavity;

— some corrosion by-products inside pits (on aluminium the by-product may be granular, powdery or amorphous and white, grey or black in colour).

To be considered as a corrosion pit, a surface cavity exhibits at least two of the above characteristics.

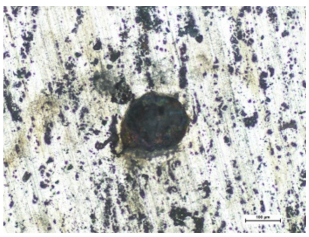
Note 2 to entry: See Figure 1 and Figure 2.



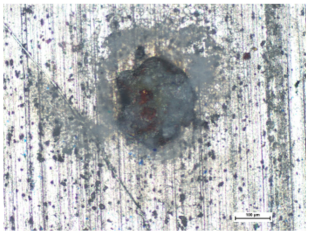
Key

1 pits with overflow
2 white spot without overflow

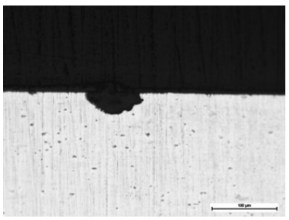
Figure 1 — Example of corrosion pits on an aluminium alloy after exposure to neutral salt spray (NSS)



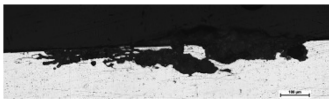
a) Corrosion pit with black corrosion by products



b) Corrosion pit with grey corrosion by products



c) Corrosion pit on machined 2024 T351



d) Corrosion pit on laminated 2024 T3

Figure 2 — Examples of analysis of corrosion pits on machined 2024 T351 and laminated 2024 T3 that have been SAA treated

3.2.5
re-anodizing
repetition of the anodizing process step after complete de-anodizing

3.2.6
sealing
chromate VI free sealing (of the anodized layers) which is applied to close the pores produced by the acid anodizing process

Note 1 to entry: It is usually applied in a hot demineralized water bath with or without additives at different temperatures. Sealing improves the corrosion resistance performance of the anodic film.

4 General principles of the process

4.1 Purpose of the process

The anodizing is a voltage controlled electrochemical process, allowing the transformation of the aluminium surface (and its alloys) in a nanoporous and amorphous oxide layer made of a structure close to alumina. The aim of this treatment is to ensure a protection against corrosion, and/or to be used as an adhesion base before bonding or before painting. Anodizing is generally sealed for corrosion protection applications (with or without painting or bonding) and can remain unsealed when the part is bonded or painted.

4.2 Applicability

4.2.1 Type A: unsealed anodizing

It shall be used either as surface preparation before the application of painting/bonding as specified in Table 1 or any other finishing.

4.2.2 Type B: sealed anodizing

It is intended for corrosion protection. It shall be with or without dyeing and used with or without additional painting, as specified in Table 1.