SLOVENSKI STANDARD
SIST EN 4827:2019

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Nadomešča:
SIST EN 4827:2017

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 4827:2019**

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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

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Contents

Page

European foreword **3**

1 Scope **4**

2 Normative references **4**

3 Terms and definitions **5**

4 General principles of the process **6**

5 Process requirements **8**

6 Engineering requirements **11**

7 Quality requirements **13**

Annex A (normative) **Engineering requirements** **15**

Annex B (normative) **Quality requirements** **16**

B.1 Quality requirements **16**

B.2 Dye-spot test **17**

Annex C (informative) **Standard evolution form** **20**

European foreword

This document (EN 4827:2019) 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, 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of an identical text or by endorsement, at the latest by March 2020, and conflicting national standards shall be withdrawn at the latest by March 2020.

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1 Scope

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

Hard anodizing and plasma electrolytic anodizing (micro-arc oxidation) are not covered by this document.

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 processors 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 alloy without hexavalent chromium*[1)]

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*

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

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

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

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

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

EN ISO 10289, *Methods for corrosion testing of metallic and other inorganic coatings on metallic substrates — Rating of test specimens and manufactured articles subjected to corrosion tests*

1) Published as ASD-STAN Prestandard at the date of publication of this standard by AeroSpace and Defence industries Association of Europe - Standardization (ASD-STAN), http://www.asd-stan.org/

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 http://www.iso.org/obp
- IEC Electropedia: available at http://www.electropedia.org/

3.1 General terms

3.1.1
OEM
producer who 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, fabricates, 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, it comprises parts of the same type (i.e. 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,
- 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 shall exhibit at least two of the above characteristics.

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) is applied to close the pores produced by the acid anodizing process

Note 1 to entry: It is usually applied in 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 an electrochemical process voltage controlled allowing transforming the aluminium (and its alloys) surface 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 the corrosion, and/or to be used as an adhesion base before bonding or before painting. Anodizing is generally sealed for corrosion protection application (with or without painting or bonding) and can remain unsealed when the part is bonded or painted.

This specification is applicable on aluminium and aluminium alloys generally on single parts.

Hard anodizing and plasma electrolytic anodizing (micro-arc oxidation) dedicated to wear protection are not covered by this specification.

4.2 Applicability

4.2.1 Type A: unsealed anodizing

It shall be used either as surface preparation before the application of painting/bonding 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.

Table 1 — Different application cases

<table>
<tr><th></th><th colspan="3">Unsealed (type A)</th><th colspan="2">Sealed (type B)</th></tr>
<tr><th></th><th>Unpainted</th><th>Painted</th><th>Bonding (structural)</th><th>Unpainted</th><th>Painted</th></tr>
<tr><td>Sulphuric acid anodizing (SAA)
EN 2284</td><td rowspan="6">Not applicable</td><td rowspan="6">Applicable</td><td rowspan="4">Not applicable</td><td rowspan="4">Applicable</td><td rowspan="2">Applicable</td></tr>
<tr><td>Thin film sulphuric acid anodizing (TFSAA)</td></tr>
<tr><td>Tartaric sulphuric acid anodizing (TSA)
EN 4704</td><td>Not defined yet with chromate VI free sealing</td></tr>
<tr><td>Boric sulphuric acid anodizing (BSAA)</td><td rowspan="3">Not applicable</td></tr>
<tr><td>Phosphoric acid anodizing (PAA)</td><td rowspan="2">Applicable</td><td rowspan="2">Not applicable</td></tr>
<tr><td>Sulphuric phosphoric acid anodizing (PSA)</td></tr>
</table>

4.3 Limitations

All processes that can compromise the anodic film such as forming, or heat-treatment shall be performed prior to surface preparation of the parts to be anodized.

Anodizing shall not be applied:

- in electric conductivity zones/areas;
- for tubes, pipes and open holes with a length to diameter ratio higher than 10:1 (unless using specific cathode);
- for trapped holes with a length to a diameter ratio greater than 5:1;
- for parts or assemblies (e.g. spot-welded and riveted), which can permanently entrap treatment solutions;
- for components which can permanently entrap treatment solutions, except components that can be adequately masked.

NOTE The formation of oxide layer influences the dimensions of the part and is to be considered for close tolerance parts.

4.4 Protection system classification

4.4.1 System types

Anodizing layer is classified by the two following types:

- type A: unsealed anodizing: It shall be used as surface preparation before the application of painting/ bonding or any other finish;
- type B: sealed anodizing: It is intended for corrosion protection. It shall be with or without dyeing and used with or without additional painting.

4.4.2 Layer thickness

See Table 2.

Table 2 — Layer thicknesses corresponding to the class type

Class type	Typical thickness	Anodizing process
Class 1	≤ 1 µm	Phosphoric acid anodizing (PAA) Sulphuric phosphoric acid anodizing (PSA) [a]
Class 2	2 µm to 8 µm	Tartaric sulphuric acid anodizing (TSA) Boric sulphuric acid anodizing (BSAA) Thin film sulphuric acid anodizing (TFSAA)
Class 3	8 µm to 25 µm	Sulphuric acid anodizing (SAA)
[a] ≤ 5 µm for some aluminium alloys under agreement between the processor and the OEM/manufacturer.		

5 Process requirements

5.1 Information for the processor

- type and class designation,
- substrate standard reference and heat treatment,
- areas to be anodized,
- anodizing thickness measuring points,
- electrical contact points or areas where these are inadmissible,
- specification for testing on parts and/or samples.

5.2 Condition of parts prior to the treatment

Welding, soldering/brazing, mechanical operations and heat treatments shall have been completed.

- the parts shall be free of oil, grease, marking inks and other surface contaminations;
- the surface shall be free from precipitations or smut from alloying elements or pre-processes indicated by the bright and uniform appearance of the surface;
- mechanically disturbed layer shall be removed either by mechanical or chemical processes;
- in case of re-anodizing all residuals from the previous anodizing shall be completely removed.

5.3 Process conditions

5.3.1 Tooling

The tools, bars, electrical contact systems, and metal masking tooling shall be free of oxidation/corrosion or any other damage which may be detrimental to the treatment during use. The part racks and tools shall be designed and set up in such a manner as to:

- avoid any retention of air or treatment solution in the parts,
- facilitate neutralization and removal of solutions during rinsing operations,
- the electrical contacts shall be kept in good condition for the correct passage of the current,
- electrical contact points should be defined between the processor and the OEM/manufacturer,
- the contact is preferably achieved at several points in order to ensure better current distribution,
- avoid any accidental contact between the parts to be treated and the tank equipment or electrodes, and between the different parts during all the process,
- the fixturing tools (e.g. made of aluminium alloy or titanium) shall provide effective electrical contact with the parts.

5.3.2 Masking

The parts shall be at least degreased prior to masking.

Component areas which shall not be coated shall be masked with suitable material.

5.3.3 Surface pre-treatment

Surface preparation means any method able to eliminate completely all surface contaminations.

In case of chemical pre-treatment, the final step prior to anodizing shall be acidic pickling, preferably chromate-free.

Anodizing shall be performed immediately after pickling (in accordance with aluminium and aluminium alloys pickling standard EN 4707).

5.3.4 Anodizing

During the anodizing process:

- distance between electrode and parts and between parts shall be adopted to avoid damage of parts by short-circuits and electric arc discharge ;
- parts should be fully immersed;
- the parts shall not be subjected to any tensile, flexure, torsion or other stress;
- the process shall be performed in such a way that parts remain wet between each step of the process;