



SLOVENSKI STANDARD
oSIST prEN 4827:2020
01-december-2020

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

iTeh STANDARD PREVIEW
(standards.iten.ai)

Ta slovenski standard je istoveten z: prEN 4827
oSIST prEN 4827:2020
<http://standards.iten.ai/catalog/standards/sist/3527ac-734d-4016-9dc9-990ceda0c960/osist-pren-4827-2020>

ICS:

49.025.99 Drugi materiali Other materials

oSIST prEN 4827:2020 **en,fr,de**

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[oSIST prEN 4827:2020](#)

<https://standards.iteh.ai/catalog/standards/sist/cff840ac-734d-4016-9dc9-990eeda0c960/osist-pren-4827-2020>

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

DRAFT
prEN 4827

October 2020

ICS

Will supersede 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 - Anodisieren von Aluminium und Aluminiumlegierungen ohne hexavalentem Chrom

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee ASD-STAN.

If this draft becomes a European Standard, 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.

This draft European Standard was established by CEN 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.

CEN members are the national standards bodies of 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 United Kingdom.

<https://standards.iteh.ai/catalog/standards/sist/cff840ac-734d-4016-9dc9-990eeda0c960/osist-pr-en-4827-2020>

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.



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

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

Contents

Page

European foreword	4
1 Scope	6
2 Normative references	6
3 Terms and definitions	7
3.1 General terms	7
3.2 Technical terms	7
4 General principles of the process	9
4.1 Purpose of the process	9
4.2 Applicability	9
4.2.1 Type A: unsealed anodizing	9
4.2.2 Type B: sealed anodizing	9
4.3 Limitations	9
4.4 Classification	10
4.4.1 System types	10
4.4.2 Layer thickness	10
5 Process requirements	10
5.1 Information for the processor	10
5.2 Process conditions	11
5.2.1 Tooling	11
5.2.2 Masking	11
5.2.3 Surface pre-treatment	11
5.2.4 Anodizing	11
5.2.5 Anodizing post-treatments	12
5.3 Water quality	12
5.3.1 General	12
5.3.2 Anodizing bath	12
5.3.3 Sealing and dyeing baths	12
5.3.4 Final rinsing bath	12
5.4 Periodic bath chemical analysis	13
5.5 Re-anodizing	13
6 Test specimens requirements	13
6.1 Definition of test specimens	13
6.1.1 General	13
6.1.2 For the qualification	13
6.1.3 For periodic tests	13
6.2 Tests for the qualification	19
6.3 Periodic tests	19
7 Parts requirements	19
7.1 Condition of parts prior to the treatment	19
7.2 Inspections before the treatment	20
7.3 Inspections during the treatment	20
7.4 Inspections on parts after anodizing	20

8	Quality assurance	20
8.1	Process approval.....	20
8.2	General points.....	20
8.3	Qualification procedure	21
	Annex A (normative) Tests on specimens for the qualification.....	22
	Annex B (normative) Periodic tests on test specimens.....	27
	Annex C (normative) Levels of requirements for corrosion resistance of thin film anodizing on unpainted test specimens.....	31
	Annex D (normative) Tests on parts	32
	Annex E (normative) Dye-spot test.....	33
E.1	Dye-spot	33
E.2	Dye solution A.....	33
E.3	Dye solution B.....	33
	Bibliography	35

iTeh STANDARD PREVIEW (standards.iteh.ai)

[oSIST prEN 4827:2020](https://standards.iteh.ai/catalog/standards/sist/cff840ac-734d-4016-9dc9-990eeda0c960/osist-pren-4827-2020)

<https://standards.iteh.ai/catalog/standards/sist/cff840ac-734d-4016-9dc9-990eeda0c960/osist-pren-4827-2020>

European foreword

This document (prEN 4827:2020) 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 Standard 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 is currently submitted to the CEN Enquiry.

This document will supersede EN 4827:2019.

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

prEN/EN number	Edition	Publication date	Changes introduced
4827	1	01/2015	-
	2	05/2018	Refer to Table C.1 of the edition 2 of EN 4827.
	3	Xx/2020	<p>All of the document:</p> <ul style="list-style-type: none"> - Modification of the format and of some wordings of the document, including the following. <ul style="list-style-type: none"> - Previous Annex A “Engineering requirements” has been recalled “Tests on test specimens for the qualification” for more clarity. - Previous Annex B “Quality requirements” has been recalled “Periodic tests on test specimens” for more clarity.- Within the document, test specimens requirements (Clause 6) and parts requirements (Clause 7) have been separated in two separate clauses for more clarity. - Requirements relating to the test specimens materials, numbers, dimensions and periodicity are in Table 3 to Table 8. <p>3.2.4 – Pit:</p> <ul style="list-style-type: none"> - Addition of Figure 1. <p>Table 3 to Table 5:</p> <ul style="list-style-type: none"> - Changes and addition of requirements for the definition of test specimens for the qualification. <p>Table 6 to 8:</p> <ul style="list-style-type: none"> - Changes and addition of requirements for the definition of periodic tests. <p>Table A.1 - Tests on test specimens for the qualification:</p> <ul style="list-style-type: none"> - Main changes are for visual appearance, anodic layer thickness, corrosion resistance, paint adhesion.

			<ul style="list-style-type: none"> - Sealing quality was missing. - Addition of levels of requirements for corrosion resistance of thin film anodizing on unpainted test specimens (Table C.1). <p><u>Table B.1 - Periodic tests on test specimens:</u></p> <ul style="list-style-type: none"> - Main changes are for visual appearance, anodic layer thickness, corrosion resistance, paint adhesion. - Addition of levels of requirements for corrosion resistance of thin film anodizing on unpainted test specimens (Table C.1). <p><u>Table C.1 - Levels of requirements for corrosion resistance of thin film anodizing on unpainted test specimens:</u></p> <ul style="list-style-type: none"> - Addition of Table C.1. <p><u>Table D.1 - Minimum parts acceptance inspections after anodizing:</u></p> <p>Changes for visual appearance.</p>
--	--	--	--

iTeh STANDARD PREVIEW (standards.iteh.ai)

[oSIST prEN 4827:2020](https://standards.iteh.ai/catalog/standards/sist/cff840ac-734d-4016-9dc9-990eeda0c960/osist-pren-4827-2020)

<https://standards.iteh.ai/catalog/standards/sist/cff840ac-734d-4016-9dc9-990eeda0c960/osist-pren-4827-2020>

prEN 4827:2020 (E)**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 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)*

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 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

iTeh STANDARD PREVIEW
(standards.iteh.ai)

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

[oSIST prEN 4827:2020
https://standards.iteh.ai/catalog/standards/sist/cff840ac-734d-4016-9dc9-990eeda0c960/osist-pren-4827-2020](https://standards.iteh.ai/catalog/standards/sist/cff840ac-734d-4016-9dc9-990eeda0c960/osist-pren-4827-2020)

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

prEN 4827:2020 (E)**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 shall exhibit at least two of the above characteristics.

Note 2 to entry: See Figure 1.



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

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

Figure 1 — Example of corrosion on an aluminium alloy after exposure to salt spray

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.

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

	Unsealed (type A)			Sealed (type B)	
	Unpainted	Painted	Bonding (structural)	Unpainted	Painted
Sulphuric acid anodizing (SAA) EN 2284	Not applicable	Applicable	Not applicable	Applicable	Applicable
Thin film sulphuric acid anodizing (TFSAA)					
Tartaric sulphuric acid anodizing (TSA) EN 4704					
Boric sulphuric acid anodizing (BSAA)			Applicable	Not applicable	Not applicable
Phosphoric acid anodizing (PAA)					
Sulphuric phosphoric acid anodizing (PSA)					

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;

prEN 4827:2020 (E)

- 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 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	$\leq 1 \mu\text{m}$	Phosphoric acid anodizing (PAA) Sulphuric phosphoric acid anodizing (PSA) ^a
Class 2	$2 \mu\text{m}$ to $8 \mu\text{m}$ ^{b, c}	Tartaric sulphuric acid anodizing (TSA) Boric sulphuric acid anodizing (BSAA) Thin film sulphuric acid anodizing (TFSAA)
Class 3	$8 \mu\text{m}$ to $25 \mu\text{m}$	Sulphuric acid anodizing (SAA)

^a $\leq 5 \mu\text{m}$ for some aluminium alloys under agreement between the processor and the OEM/manufacturer.
^b For wrought allows.
^c $12 \mu\text{m}$ maximum for castings.

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;