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Flyg- och rymdteknik – Anodisering utan sexvärt krom av aluminium och aluminiumlegeringar

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

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The European Standard EN 4827:2017 has the status of a Swedish Standard. This document contains the official version of EN 4827:2017.

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 4827

February 2017

ICS 49.025.20; 49.040

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 - Hexavalentes chromfreies Anodisieren von Aluminium und Aluminiumlegierungen

This European Standard was approved by CEN on 24 September 2016.

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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Contents

European foreword

This document (EN 4827:2017) 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, 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of an identical text or by endorsement, at the latest by August 2017, and conflicting national standards shall be withdrawn at the latest by August 2017.

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1 Scope

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

Hard anodizing is not covered by this European Standard.

The purpose of this European Standard is to give design, quality and manufacturing requirements. It does not give complete in-house process instructions; these shall be given in the manufacturers detailed process instructions.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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*

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

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

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

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 basis materials — Measurement of coating thickness — Amplitude-sensitive eddy-current method* (ISO 2360)

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

3 Purpose of process

The anodizing is an electrochemical process voltage controlled allowing transforming the metal surface in a microporous oxide layer made of 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. This anodizing is generally sealed for protection corrosion application (with or without painting or bonding) and can stay 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 dedicated to wear protection are not covered by this specification.

3.1 Applicability

3.1.1 Type A: unsealed anodizing

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

3.1.2 Type B: sealed anodizing

It is intended for corrosion protection. It shall be with or without dyeing and used with or without additional painting.

See Table 1.

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>Sulfuric 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 sulfuric acid anodizing (TFSAA)</td></tr>
<tr><td>Tartaric sulfuric acid anodizing (TSA) EN 4704</td><td>Not defined yet with chromate free sealing</td></tr>
<tr><td>Boric sulfuric 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>Sulfuric phosphoric acid anodizing (PSA)</td></tr>
</table>

3.2 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 Terms and definitions

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

4.1
de-anodizing
process, which removes the anodic oxide

4.2
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

4.3
Mechanically Disturbed Layer
MDL
layer that is present at the surface resulting from the rolling process of the material

4.4
pit
surface corrosion defect at which the anodic coating is penetrated

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 specimens 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 must exhibit at least two of the above characteristics.

4.5
process instruction
document that describes the application scopes, detailed process (key parameters, detailed steps, etc.), quality management, environmental and safety regulations, etc.

4.6
alloys
all aluminium alloys, that are treated with the chromate free anodizing process in the specific shop

4.7
re-anodizing
repetition of the anodizing process step after complete de-anodizing

4.8
sealing
chromate 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.

4.9.
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

5 Protection system classification

5.1 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.

5.2 Layer thicknesses

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) Sulfuric phosphoric acid anodizing (PSA) [a]
Class 2	2 µm to 8 µm	Tartaric sulfuric acid anodizing (TSA) Boric sulfuric acid anodizing (BSAA) Thin film sulfuric acid anodizing (TFSAA)
Class 3	8 µm to 25 µm	Sulfuric acid anodizing (SAA)

[a] ≤ 5 µm for some Aluminium alloys under agreement between purchaser and supplier.