



BSI Standards Publication

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

National foreword

This British Standard is the UK implementation of EN 4827:2019. It supersedes BS EN 4827:2017, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee ACE/61, Metallic materials for aerospace purposes.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2019

Published by BSI Standards Limited 2019

ISBN 978 0 539 04517 8

ICS 49.025.20; 49.040

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 October 2019.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------

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 European Standard was approved by CEN on 14 July 2019.

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.

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.



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	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.

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 4827:2017.

According to the CEN-CENELEC Internal Regulations, the national standards organisations 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, Turkey and the United Kingdom.

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 chromium¹⁾*

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.