SLOVENSKI STANDARD
SIST EN 4868:2019

01-november-2019

Aeronavtika - Anodno potopno barvanje s temeljno barvo brez šestvalentnega kroma

Aerospace series - Anodic electrodeposition of hexavalent chromium free primer

Luft- und Raumfahrt - Anodische Elektrotauchlackierung von sechswertigem chromfreiem Grundierung

Série aérospatiale - Electrodéposition anodique d'un primaire sans chrome hexavalent

Ta slovenski standard je istoveten z: EN 4868:2019

ICS:

49.040	Prevleke in z njimi povezani postopki, ki se uporabljajo v letalski in vesoljski industriji	Coatings and related processes used in aerospace industry
87.020	Postopki za nanašanje barvnih premazov	Paint coating processes

SIST EN 4868:2019 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 4868

September 2019

ICS 49.040

English Version

Aerospace series - Anodic electrodeposition of hexavalent chromium free primer

Série aérospatiale - Electrodéposition anodique d'un primaire sans chrome hexavalent

Luft- und Raumfahrt - Anodische Elektrotauchlackierung von sechswertigem chromfreiem Grundierung

This European Standard was approved by CEN on 5 May 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

This document (EN 4868:2019) 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 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 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.

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, Turkey and the United Kingdom.

1 Scope

This document defines the requirements for hexavalent chromium free anodic electrodeposition of organic coatings on aluminium and aluminium alloys for corrosion protection of parts.

The purpose of this standard is to give design, quality and manufacturing requirements. It doesn't give complete in-house process instructions; these shall be given in the processor 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 3840, *Aerospace series — Paints and varnishes — Technical specification*

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

EN ISO 1518-1, *Paints and varnishes — Determination of scratch resistance — Part 1: Constant-loading method*

EN ISO 1519, *Paints and varnishes — Bend test (cylindrical mandrel)*

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 2812-1, *Paints and varnishes — Determination of resistance to liquids — Part 1: Immersion in liquids other than water*

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

EN ISO 4623-2, *Paints and varnishes — Determination of resistance to filiform corrosion — Part 2: Aluminium substrates*

EN ISO 4628-8, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 8: Assessment of degree of delamination and corrosion around a scribe or other artificial defect*

EN ISO 4628-10, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 10: Assessment of degree of filiform corrosion*

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 17872, *Paints and varnishes — Guidelines for the introduction of scribe marks through coatings on metallic panels for corrosion testing*

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:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
Mechanically Disturbed Layer
MDL
layer that is present at the surface resulting from the rolling process of the material

3.2
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 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 2 (two) of the above characteristics.

3.3
process instruction
document that describes the application scopes, detailed process (key parameters, detailed steps, etc.), quality management, environmental and safety regulations, etc.

3.4
rework
repetition of the anodic electrodeposition process step after complete stripping of the layer

3.5
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

3.6
anodic electrodeposition
industrial coating method in which negatively charged organic coating particles in aqueous solution migrate (electrophoresis) toward the anode of a direct-current electrical circuit passing through the solution, so that electrolysis of water creates a localized pH gradient, precipitating a uniform layer of coating on the anode

3.7
ultra-filtrate
effluent generated from an electrocoat bath passing across an ultrafilter membrane

Note 1 to entry: The effluent is mainly composed of water and water soluble species.

4 Purpose of process

4.1 General

This specification establishes the requirements for a waterborne, hexavalent chromium free corrosion inhibiting, chemical and solvent resistant, anodic electrodeposition of organic coating capable of curing at 110 °C to 120 °C.

The anodic electrodeposition process applies a protective coating with uniform film thickness control, complete coverage of recessed areas, minimal surface defects and high transfer efficiency. Once the film is deposited on the substrate, a thermal cure is required to achieve the final properties of the coated parts.

4.2 Applicability

It can be used as a protection against corrosion, as a painting primer before top coating application, for electrical insulation, and as a masking before anodizing and/or conversion.

4.3 Limitations

4.3.1 All processes that can compromise the anodic electrodeposition film (e.g. forming, blasting, shot peening, heat-treatment) shall be performed prior to surface preparation of the parts to be coated).

4.3.2 Anodic electrodeposition shall not be applied:

- in areas where electrical conductivity is required;
- for high temperature applications (> 180 °C);
- for components which can permanently entrap treatment solutions, except components that can be adequately masked;
- for assemblies with overlap areas (e.g. spot-welded and riveted parts) containing tight tolerances that cannot provide adequate pre-treatment and/or coating penetration between the overlap area.

5 Protection system classification

Coating layer is classified by the three following types:

- Type A: thin layer thicknesses (4 μm to 12 μm);
- Type B: medium layer thicknesses (12 μm to 30 μm);
- Type C: thick layer thicknesses (> 30 μm).

6 Process requirements

6.1 Information for the processor

- system type;
- substrate standard reference and heat treatment;
- areas to be coated;
- coating thickness measurement inspection points;
- electrical contact points or areas where these are inadmissible;
- specification for testing parts and/or samples.

6.2 Condition of parts prior to the treatment

All prior operations such as welding, soldering/brazing, blasting, shot peening, machining and heat treatments shall have been completed.

- the parts shall be free of oil, grease, marking inks and other surface contaminations;
- if needed/required, mechanically disturbed layer shall be removed either by mechanical or chemical processes;
- surface treatments prior electrodeposition process are possible. In case of anodic electrodeposition rework, all organic coatings residues from the previous coating shall be completely removed.

6.3 Process conditions

6.3.1 Tooling

The tools, bars, electrical contact systems, and metal masking tooling shall be free of corrosion or any other damage which may be detrimental to the treatment during use. The part racks and tools must 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 flow of the current;
- electrical contact point locations should be defined between purchaser and processor, 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 contact is preferably achieved at several points in order to ensure better current distribution. Contacts shall be cleaned before each treatment;
- the fixturing tools (e.g. in aluminium alloy, titanium, stainless steel) shall provide effective electrical contact with the parts.

6.3.2 Masking

The parts shall be at least degreased prior to masking.

Component areas which shall not be coated shall be masked with suitable material compatible with curing coating temperature (120 °C maximum) and treatment baths.

6.3.3 Surface pre-treatment

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

In case of soda etching, the final step prior to anodic electrodeposition shall be chromate-free acidic pickling.

The rinsing shall be carried out in order to avoid acid residues. It shall be carried out as quickly as possible after pickling in running water at room temperature. The water used for final rinsing is recommended to have a conductivity less than 20 μS/cm.

6.3.4 Anodic electrodeposition

During the electrodeposition process:

- distance between parts and electrodes shall be defined to avoid electrical arcing;
- the process parameters (temperature, voltage, time) shall be adapted to the material and in accordance with the customer requirements.

6.3.5 Anodic electrodeposition post treatments

After the electrodeposition process:

- parts have to be adequately rinsed according to 6.4 or in ultra-filtrate (a double-rinsing is recommended);
- afterwards, the parts shall be cured (a previous air drying before curing is allowed);
- after curing, a final top coat could be applied.

6.4 Water quality

The water shall comply with the following requirements:

- pH value at 25 °C: 5,5 to 7,5
- total residue [mg/l]: ≤ 5
- conductivity [µS/cm]: ≤ 10
- bacteriology: 10^3 cfu

6.5 Rework

One rework is allowed; any further rework shall be agreed between the interested parties.

7 Required characteristics

The primer is expected to meet the main requirements summed-up in Table A.1.

7.1 Visual aspect

The requirements for visual aspect are described in Table C.1.

7.2 Film thickness

The requirements for film thickness of the electrodeposited primer are described in Table C.1.

7.3 Physical properties of the film

The requirements for adhesion and scratch resistance are described in Table A.2.

7.4 Corrosion performance of coated parts

7.4.1 Filiform corrosion

The requirements for filiform corrosion are described in Table A.3.

7.4.2 Corrosion resistance

The requirements for corrosion (neutral salt spray test) are described in Table A.3.

7.5 Fatigue requirements and test methods

Fatigue requirements and test methods shall be validated between the prime and the processor.

7.6 Fluid resistance

The requirements for fluid resistance are described in Table A.4.

8 Quality requirements

8.1 Process approval

The processor shall carry out:

- the anodic electrodeposition on pre-production parts and/or samples determined by agreement between the processor and the purchaser;
- the tests specified in this standard, unless otherwise agreed between the processor and the purchaser.

The process chart defined in the processor detailed process instructions shall not be changed without any previous agreement from the purchaser.

8.2 General points

During all the process operations, the operating conditions shall be within the parameters defined in the processor detailed process instructions.