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Aerospace process — Chemical conversion coating for aluminium alloys — General purpose

Procédés de traitement dans l'industrie aérospatiale — Revêtement par conversion chimique des alliages d'aluminium — Utilisation courante

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 18, *Materials*.

This second edition cancels and replaces the first edition (ISO 8081:1985), which has been technically revised.

The main changes compared to the previous edition are as follows:

— updated the normative references in Clause 2;

— added different types of chemical conversion coatings description, including hexavalent chromium-free chemical conversion coating (see 4.1);

— deleted chemical conversion solution requirements;

— changed air temperature of drying parts from (60 °C to 65 °C) to not more than 60 °C for type I, not more than 65 °C for type II (see 4.6.6.2);

— made the requirements of process control tests and process qualification tests clearer (see 5.3 and 5.4);

— changed the previous paint adhesion test method (see 5.6.4);

— deleted coating adhesion tests.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document provides the general purpose of chemical conversion coating for aluminium alloys in the aerospace field. The revision of ISO 8081:1985 will meet the current manufacturing requirements to introduce hexavalent chromium-free conversion coating. At the same time, several specific test panels' material in the performance test would be recommended. Some parameters in the process would also be optimized according to the actual application of aerospace field.

This document guides the surface treatment process of aerospace products to control the product quality and reduce the cost.

Aerospace process — Chemical conversion coating for aluminium alloys — General purpose

1 Scope

This document specifies the requirements for producing and testing a general purpose chemical conversion coating on aluminium alloys.

The chemical conversion coating is used in the manufacture of aerospace products in order to improve paint adhesion and resistance to corrosion.

This process can also be used for touch-up of anodic coatings.

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.

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

ISO 3892, *Conversion coatings on metallic materials — Determination of coating mass per unit area — Gravimetric methods*

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

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 https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
lot
all parts treated in the same bath at the same time

3.2
water-break-free surface
surface that maintains a continuous water film for a period of at least 30 s after being sprayed or rinsed by immersion in clean water at ambient temperature

4 Technical requirements

4.1 Classification

The chemical conversion coatings shall be classified as follows.

— Type I – Compositions containing hexavalent chromium.

— Type II – Compositions containing hexavalent chromium-free.

The type of chemical conversion coating is specified by the engineering drawing and interrelated standard.

4.2 Material to be coated

All aluminium alloys, including casting alloys, may be coated providing the colour of the coating (see 5.6.1) is acceptable.

4.3 Coating materials

For aerospace products, by far the most widely used chemical conversion coatings are chromates. However, ingredients may be used to produce other chemical conversion coatings provided that they meet the requirements of this document without adverse effects on the base material.

4.4 Process requirements

The process shall consistently produce coatings to the requirements of this document.

The process shall permit adequate solution control by recognized methods of chemical analysis.

It shall be the responsibility of the vendor of proprietary processing chemicals to supply the processor, in writing, with methods of analysis and directions for the maintenance of the solution.

4.5 Preparation of aluminium material to be coated

All fabrication and thermal treatment processes (for example forming, machining, heating, welding, etc.), insofar as is practicable, shall be completed before the conversion coating is applied.

Corrosion, mill marks and identification markings shall be removed before chemical treatment. The parts shall have clean surfaces with no water breaks and be free from pits, scratches and mechanical damage. Final cleaning by a process to give a slightly etched surface is preferred.

4.6 Process details

4.6.1 Water characteristics

For make-up water and the rinse water used after the coating process, the total dissolved solids shall be not greater than 75 mg/kg with chloride ion and sulfate ion being not greater than 15 mg/kg and 25 mg/kg, respectively. The pH range should be 5,5 to 7,5. Tap water may be used for the rinsing following the cleaning (see 4.6.2) and the deoxidizing (see 4.6.3) processes.

4.6.2 Cleaning

The cleaning method used shall produce a clean surface with no water breaks and be free from pits and abrasion marks. Solvent degreasing and cleaning in a non-etching or inhibited alkaline cleaner may be used, followed by a cold tap water rinse. If the alkaline cleaner is silicated, the bath composition and the subsequent rinsing shall be controlled to prevent the formation of a siliceous residue on work surfaces which may interfere with the deposition of a satisfactory conversion coating.

The surface after being alkaline-cleaned and rinsed shall be a water-break-free surface, otherwise the surface shall be re-cleaned and rinsed.

4.6.3 Deoxidizing

After cleaning, parts shall be immersed in a deoxidant, followed by a cold tap water rinse, to remove natural oxides and provide a slightly etched surface. The deoxidant used shall not degrade metallurgical properties, initiate pitting, alter dimensions or increase roughness beyond defined limits.

4.6.4 Racking of parts

The racking and suspension of parts shall be by such means as to permit free circulation of the solution to all work areas. Small parts may be placed in perforated containers of suitable material which shall permit adequate circulation of the solution to the parts within the container.

4.6.5 Coating procedures

The coating shall be applied by immersion in the solution, contained in a suitable tank equipped to agitate or circulate the solution to all work areas. Spray may be used as an alternative means of application. The application time and temperature of the solution shall produce a coating capable of meeting the requirements of Clause 5. For touch-up of parts, an alternative method of application, such as brush or swab, may be used.

4.6.6 Rinsing and drying

4.6.6.1 Rinsing

Immediately after removal from the coating solution, parts shall be thoroughly rinsed by immersion in cold, running water complying with 4.6.1. Spray rinsing may be used as an alternative to immersion rinsing. If desired, a final, warm water rinse may be used, provided that the water temperature does not exceed 60 °C and the time in the warm rinse is kept to a minimum.

4.6.6.2 Drying

The parts shall be dried in circulating, warm air not more than 60 °C for Type I, not more than 65 °C or at the temperature recommended in accordance with the instructions of supplier (whichever is lower) for Type II, taking care not to abrade the soft, wet coating.

If warm air is not employed, the parts may be dried at ambient temperature before further processing.

5 Quality assurance provisions

5.1 Responsibility for inspection

Unless otherwise negotiated, the processor is responsible for the performance of all quality assurance requirements of this document.

5.2 Lot acceptance tests

A visual inspection of all parts shall be made in accordance with 5.6.1.

5.3 Process control tests

Process control tests shall be completed in accordance with Table 1.

Table 1 — Requirements of process control tests

Property	Material of test panels	Number of test panels	Test method and requirements	Test frequency
Visual appearance	N/A	N/A	5.6.1	All test panels
Corrosion resistance	The same[a]	5	ISO 9227 and 5.6.3	Once a month
Paint adhesion	The same[a]	See 5.6.4	ISO 2409 and 5.6.4	Once every three months

If the process is inoperative for a period of longer than one month, this test shall be conducted at the beginning of reuse.

[a] Test panels shall be of the same composition, heat treatment and surface finish as the parts being processed or be made from 2024-T3 bare.

5.4 Process qualification tests

Process qualification tests shall be completed in accordance with Table 2.

Table 2 — Requirements of process qualification tests

Property	Material of test panels	Number of test panels	Test method and requirements
Visual appearance	N/A	N/A	5.6.1
Coating mass per unit area	The same[a]	3 or according to ISO 3892	ISO 3892 and 5.6.2
Corrosion resistance	The same[b]	5	ISO 9227 and 5.6.3
Paint adhesion	The same[b]	See 5.6.4	ISO 2409 and 5.6.4

Whenever there is a change in a major processing parameter (for example different proprietary solution, new equipment), a qualification corrosion test on a representative part (unpainted) shall be carried out to requalify the process.

[a] Test panels shall be of the same composition, heat treatment and surface finish as the parts being processed or be made from 2024-T3 bare.

[b] Test panels shall be of the same composition and heat treatment as the parts being processed or be made from 2024-T3 bare.

5.5 Solution control

Periodically analyse the chemical conversion solution. The analysis period shall be determined by concentration of solution, volume, production capacity and experience. If production is interrupted, the chemical analysis can be carried out before re-start working.

5.6 Inspection and testing of coatings

5.6.1 Visual appearance

When examined without magnification, the coating shall be free from uncoated streaks, shall be continuous and free from powder or loose coating areas, and shall be free from breaks, scratches which penetrate the metal substrate, flaws, or other defects and damages which will reduce the serviceability of parts.

Variations in colour are due to the nature of the substrate, method of observation and lighting conditions. Colour variation within a part (or batch to batch) is not a cause for rejection.

The colour range of coatings shall be from clear or colourless to iridescent yellow, brown, grey, or blue.

If powdery coatings are suspected, the surface shall be tested for powder by wiping with a soft white cotton wiper, or equivalent, using moderate pressure. The wiper shall show no significant discoloration.