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# International Standard



# 8081

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INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

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

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

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**Descriptors** : aircraft industry, aluminium alloys, coating processes, conversion coatings, specifications, tests, quality control, packing, delivery.

## Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 8081 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*.

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

## 1 Scope and field of application

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

The chemical conversion coating specified in this International Standard is used in the manufacture of aerospace products in order to improve paint adhesion and resistance to corrosion. This process may also be used for touch-up of anodic coatings.

## 2 References

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

ISO 3768, *Metallic coatings — Neutral salt spray test (NSS test)*.

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

ISO 8076, *Aerospace process — Anodic treatment of aluminium alloys — Chromic acid process 40 V DC, undyed coating*.

## 3 Technical requirements

### 3.1 Material to be coated

All aluminium alloys, including casting alloys, may be coated providing the colour of the coating (see 4.7.1.1), is acceptable.

### 3.2 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 International Standard without adverse effects on the base material.

### 3.3 Process requirements

**3.3.1** The process shall consistently produce coatings to the requirements of this International Standard.

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

**3.3.3** 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.

### 3.4 Preparation of aluminium material to be coated

**3.4.1** All fabrication and thermal treatment processes, insofar as is practicable, shall be completed before the conversion coating is applied.

**3.4.2** 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.

### 3.5 Process details

#### 3.5.1 Water characteristics

The make-up water and the rinse water used after the coating process shall be such that the total dissolved solids shall not be greater than 75 ppm (mg/kg) with chloride ion and sulfate ion being not greater than 15 and 25 ppm (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 3.5.3) and the deoxidizing (see 3.5.4) processes.

#### 3.5.2 Chemical conversion solution

The chemical conversion solution shall be prepared using water complying with 3.5.1. The proprietary processing chemicals shall be added in such quantities as to provide conversion coatings capable of meeting the requirements of this International Standard. The pH value of the solution shall be maintained between 1,3 and 2,5 at a temperature of  $20 \pm 2^\circ\text{C}$ . Nitric acid or sodium hydroxide may be used to maintain the required pH level.

**3.5.3 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.

**3.5.4 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.

**3.5.5 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.

**3.5.6 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 be such as to produce a coating capable of meeting the requirements of clause 4. For touch-up of parts, an alternative method of application, such as brush or swab, may be used.

**3.5.7 Rinsing and drying**

**3.5.7.1 Rinsing**

Immediately after removal from the coating solution, parts shall be thoroughly rinsed by immersion in cold, running water complying with 3.5.1. A 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 time in the warm rinse is kept to a minimum.

**3.5.7.2 Drying**

The parts shall be dried in circulating, warm air at 60 to 65 °C, taking care not to abrade the soft, wet coating. If warm air is not employed, the parts shall be allowed to dry at ambient temperature (at least 18 °C) for 1 h before further processing.

**4 Quality assurance provisions**

A summary of the quality assurance schedule is given in the table.

**4.1 Responsibility for inspection**

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

**4.2 Definition**

For the purpose of this International Standard, the following definition applies.

**lot** : All parts treated in the same bath at the same time.

**4.3 Lot acceptance tests**

Tests to determine conformance to the requirements for visual appearance, paint adhesion and corrosion resistance (un-painted) shall be classed as "lot acceptance tests" or "routine process control tests".

**4.4 Process qualification tests**

Process qualification tests shall consist of a set of lot acceptance tests in accordance with 4.3, together with tests to determine the coating mass per unit area, in accordance with 4.7.2, and coating adhesion by bending in accordance with 4.7.5.

**Table — Quality assurance schedule**

Property	Process control test Sub-clause	Process qualification test Sub-clause	Part acceptance test Sub-clause	Test frequency <sup>1)</sup>
Visual appearance	4.5.1	4.7.1	4.7.1	All parts
Coating mass per unit area		4.7.2		Once a month
Corrosion resistance	4.5.3	4.7.3		Once a month
Paint adhesion	4.5.4	4.7.4		Once every three months
Coating adhesion		4.7.5		Once every three months

1) If the process is inoperative for a period longer than one month, each test shall be conducted at the beginning of re-use.

## 4.5 Sampling procedures

**4.5.1** A visual inspection of all parts shall be made in accordance with 4.7.1.

**4.5.2** The coating mass per unit area shall be determined in accordance with the requirements of 4.7.2. The test pieces shall be of the same material, heat treatment and surface finish as the parts they represent and shall be processed in the same lot. This test shall be conducted once a month or more frequently, as dictated by the volume, variation of size, shape and complexity of parts being produced.

**4.5.3** Corrosion resistance shall be determined in accordance with ISO 3768.

**4.5.3.1** Corrosion tests on representative test panels, as specified in 4.7.3, shall be carried out on a monthly basis for the purpose of bath control.

**4.5.3.2** 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.

**4.5.4** Paint adhesion tests, as specified in 4.7.4, shall be carried out as routine process control tests on test panels at least once every 3 months of continuous production. If the process is inoperative for a period of longer than 1 month, this test shall be conducted at the beginning of re-use.

**4.5.5** Coating adhesion tests, as specified in 4.7.5, shall be carried out as process qualification tests on test panels at least once every 3 months of continuous production. If the process is inoperative for a period of longer than 1 month, this test shall be conducted at the beginning of re-use.

## 4.6 Solution control

The composition of the coating bath shall be controlled by measurement of pH (values in accordance with 3.5.2), using an electrometric method. If a chromating bath is being used for coating, analysis for hexavalent chromium is also required. These tests shall be conducted once a week during continuous production. If the process is inoperative for 1 week or longer, in addition to the above requirements, tests shall be conducted at the beginning of re-use.

## 4.7 Inspection and testing of coatings

### 4.7.1 Visual appearance

**4.7.1.1** The coatings shall have a uniform appearance with no undue streaking or blotching. The colour of the coating may range from iridescent gold to dark olive green. Powdery coatings are unacceptable.

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

### 4.7.2 Coating mass per unit area

#### 4.7.2.1 Preparation

Within 3 h of coating application, test pieces conforming to ISO 3892 shall be used for determining coating mass per unit area. The length and width of the test pieces shall be measured to the nearest millimetre and their mass determined to the nearest 0,1 mg.

#### 4.7.2.2 Coating removal

Immediately after weighing, the conversion coating on the test pieces shall be removed.

For chromate coatings, the test pieces shall be immersed for 60 s in fresh nitric acid solution, composed of equal parts by volume of concentrated nitric acid ( $\rho$  1,42) and distilled water, maintained at room temperature. Coating removal may be facilitated by brushing the test piece with a clean, cotton swab. After removing the film, the test piece shall be rinsed thoroughly in demineralized or distilled water, blown dry with clean, filtered, oil-free air, and then reweighed.

For phosphate coatings, the coating removal shall be carried out in accordance with ISO 3892.

For other coatings, the coating removal process shall be agreed between the processor and the client.

#### 4.7.2.3 Calculation of coating mass per unit area

The coating mass per unit area shall be calculated in accordance with ISO 3892.

#### 4.7.2.4 Coating mass per unit area requirement

The coating mass per unit area shall be not less than 425 mg/m<sup>2</sup>.

### 4.7.3 Corrosion resistance

Aluminium alloy test panels of the same composition and heat treatment as the parts being processed, and at least 200 cm<sup>2</sup> in area, processed in accordance with this International Standard, shall withstand exposure to salt spray for 168 h, in accordance with ISO 3768, without showing more than a total of 15 scattered spots or pits, none larger than 0,8 mm in diameter, in a total of 1 000 cm<sup>2</sup> of test area grouped from five or more panels; nor more than five scattered spots or pits, none larger than 0,8 mm from one or more test panels; except in those areas within 1,5 mm of identification markings, fixture marks or edges.

NOTE — After processing, test panels shall be air dried for 24 h prior to salt spray testing.

#### 4.7.4 Paint adhesion

Aluminium alloy sheet panels (of composition specified in 4.7.3), processed in accordance with this International Standard, and painted, shall show paint adhesion equivalent to that on a similar panel which has been anodized in accordance with ISO 8076, primed and painted. The type of primer and paint and the method of application shall be the same in each case. The primer paint system shall be applied and cured in accordance with the manufacturer's instructions. The paint film shall then be scribed by a sharp instrument, such as a fine knife edge, with lines at right angles. The scribed panel shall be subjected to 500 h salt spray exposure and then dried for not less than 24 h. The salt-sprayed panel shall show no evidence of blisters or flaking in the areas adjacent to the scribing.

#### 4.7.5 Coating adhesion

Test pieces, prepared as specified in 4.7.4, shall be subjected to a bend test in accordance with ISO 1519, using type 2 apparatus fitted with a 6 mm mandrel. If any evidence of separation of the chemical film from the metal substrate has occurred, when the painted specimens are compared to unpainted specimens (prepared as specified in 4.7.3) which have been tested in the same way, it shall be considered a failure. Separation of the paint film from the chemical film shall not be considered a failure of the conversion coating.

#### 4.8 Approval

4.8.1 Sample coated parts and panels shall be approved by the purchaser and, if necessary, by the quality assurance authority

responsible, before production parts are supplied, unless such approval be waived.

4.8.2 Complete documentation of all quality control procedures and tests shall be made available to the purchaser upon request.

4.8.3 The processor shall use manufacturing procedures, processes and methods of inspection on production parts which are the same as those used on the approved sample parts. No deviation from the procedures shall be permitted without re-approval by the purchaser.

### 5 Packaging and delivery

#### 5.1 Packaging

Coated parts shall be packaged in such a manner as to ensure that the parts will be protected during shipment and storage against damage due to mishandling, exposure to the weather, or any normal hazard.

#### 5.2 Delivery

Parts shall be prepared for shipment and delivery in accordance with good standard practice prevailing in the industry to ensure carrier acceptance and safe transportation to the point of delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.

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