

**SULFURIC ACID ANODIZING**  
**KJ-06.02**  
**ANNEX TO KJ-06**

**Compiled by:**

Technical Department DTT-8

**Approved by:**

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## 1. Purpose

The purpose of this document is to regulate the basic requirements for sulfuric acid anodizing process of aluminum and aluminum alloys, performed by suppliers on parts delivered to Polskie Zakłady Lotnicze Sp. z o.o.

## 2. Subject

The subject of this document are requirements regarding sulfuric acid anodizing process and control of parts subject to anodizing process.

## 3. Scope

The requirements specified herein apply to all suppliers and should be met in the scope specified in a purchase order / agreement / contract.

## 4. Related documents

Scope of application of related documents refers to their current revisions.

ITT-09-602.01	Sulfuric Acid Anodizing of Aluminum and Aluminum Alloys
ASTM B 244	Standard Test Method for Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments
FED-STD-141	Paints, Varnish, Lacquers and Related Materials: Inspection Methods, Sampling and Testing
ASTM B 137	Standard Test Method for Measurement of Coating Mass per Unit Area on Anodically Coated Aluminum
Instruction 265-72	Anodic Oxidation of Aluminum Alloys
MIL-A-8625	Anodic Coatings on Aluminum and Aluminum Alloys
ASTM B 117	Standard Practice for Operating Salt Spray (Fog) Apparatus

## 5. Additional information

### 5.1. Classification of coatings

ITT- 09.602.01 defines the following types and classes of coatings:

Type	Description
TYPE II	Sulfuric acid anodizing, conventional coatings
Class	Description
Class 1	Non-dyed
Sealing classes	Description
Class A	Unsealed coating
Class B	Coating sealed in hot demineralized water with natural color of substrate

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Polskie Zakłady Lotnicze Spółka z o.o.	<b>SULFURIC ACID ANODIZING</b> Annex to KJ-06	<b>KJ-06.02</b>	Page 3 of 8
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<b>Class C</b>	Sealed coating in chromate solution or trivalent chromium salts, not dyed.
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If design documentation contains a record which requires anodizing in accordance with PN-EN 2284, then the process requirements should refer to the above record.

## 5.2. General notes

- a) A detailed process should be developed for each part
- b) Parts subject to anodizing should be free from foreign substances, oxides and dirt like greases, oils, paint, welding flux. Apply a preparation process in order to get a water break free surface before anodizing. Using abrasive materials with iron content for mechanical cleaning is forbidden, as it could accelerate corrosion of aluminum alloys
- c) Parts shall be anodized after complete machining, heat treatment, welding, and penetrant inspection. The surface of the parts subject to anodizing shall be free from surface defects which may cause the produced anodic coating not to satisfy the requirements of this specification. The surface defects may be caused by machining, cutting, scratching, polishing, bending, stretching, etching, chemical composition imbalance and inclusions.
- d) Before anodizing, non-aluminum elements should be removed or protected against contact with the solution. Surfaces not subject to anodizing shall be masked with plugs, Turco varnish or aluminum tape.
- e) Devices directly used in anodizing process as controllers, temperature indicators, ammeters, voltmeters shall be periodically checked.
- f) Contact points with the device shall be limited to minimum.
- g) Subsequent process operations shall be carried out without excessive delays in order to avoid parts drying.
- h) Compressed air used to mix the solution and water in rinse baths shall be free from oil, water and solid particles.
- i) Before anodizing, non-aluminum elements should be removed or protected against contact with the solution.
- j) Use additional internal cathodes to anodize parts with deep cavities or to internal surface of tubes, when length- to internal diameter ratio is bigger than 15:1.
- k) It is allowed to handle wet parts only in rubber gloves, while dry parts only in clean cotton gloves.
- l) Keep cathode and anode bars clean.
- m) It is recommended to anodize the alloys of different grade separately.
- n) Anodized surfaces should be completely immersed in the bath.
- o) Re-anodizing may be performed after removal of the previous anodic coating and verification of its removal.
- p) Priming after anodizing shall be performed within the shortest time possible to reduce exposure of parts to contamination to a minimum.
- q) Thickness of the anodic coating shall be in compliance with the requirements specified in the conditions of supply.
- r) In the quality report, record the date and hour of anodizing process finish and anodic coating thickness results.

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- s) Anodized parts shall be protected against damage. Recommended packing material: clean, soft non-waxed paper, special pallets. There should be no contact between the parts.

### **5.3. Non-conforming parts**

Follow the requirements defined in KJ-06 para.8.3.

## **6. PROCEDURE**

### **6.1. Process qualification**

Sulfuric acid anodizing is a special process and requires qualification under production conditions. It is acceptable to approve the special process at the supplier on the basis of his manufacturing process upon previous acceptance by the design engineer of Polskie Zakłady Lotnicze Sp. z o.o. Then, such a special process at the supplier is granted the status of a frozen process. Any change to the approved process requires re-acceptance by the design engineer.

During initial qualification of a supplier, Polskie Zakłady Lotnicze Sp. z o.o. reserves the right to participate in the process performed on parts and specimens at a new supplier and the possibility to perform control quality tests on parts or specimens processed by this supplier.

A qualification team at Polskie Zakłady Lotnicze Sp. z o.o. shall conduct a qualification audit of the special process at the supplier, following the below procedure:

#### **a) Inspection of devices and review of the metrological confirmation records**

Verification if:

- The devices have equipment to control working parameters of the special process with required accuracy
- All measuring equipment used to control the correct course of the process (or some parameters) is in proper place secured from aggressive atmospheric conditions
- Used materials meet technical and quality requirements
- There is a record regarding periodical review of the devices and metrological confirmation of used measuring equipment
- The process does not violate the requirements of the standards regarding environment protection and safety of work.

#### **b) Review of documents and special process instructions**

The Qualification Team shall check if:

- Technical documentation necessary to perform the process is complete and current
- Process engineering and quality instructions regarding the process are accurate

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and intelligible, including the related requirements; the instructions shall be available on the work stand

- Products identification is ensured by their recording on the work stand.

### c) Knowledge and personnel practical skills

The Qualification Team shall check if:

- The personnel involved in the process have the required qualification documentation
- The personnel is authorized to carry out special processes
- All changes to the personnel are recorded. Change of the personnel may cause necessity to repeat first article inspection.

### d) Realization of the special process on a specimen or product

Special process is performed on specimens or products in accordance with the requirements set out by Polskie Zakłady Lotnicze Sp. z o.o. It is required to check the sequence of performed activities and correct determination of the process parameters. It is required also to verify if the tests of specimens and products are performed on controlled and calibrated equipment.

### e) Results analysis

The Qualification Team heaving authorization of auditors prepares a report from audit performed at supplier's facilities. Documents prepared by the supplier during internal qualification are also attached.

#### 6.1.1. Change in the special process

Any change in the devices, conditions of use, instructions, personnel at the supplier must be reported by the process owner to the manager of Supplier Quality Assurance at Polskie Zakłady Lotnicze Sp. z o.o. who will decide on a necessity to carry out a new qualification. The change cannot be introduced until the approval is obtained.

Audit performed by the Qualification Team at the supplier is not required in the case, when a special process conducted on a new equipment has been already qualified on the equipment used previously. In this case a decision about qualification may be issued based on the review of internal qualification documents submitted by the process supplier.

#### 6.2. Quality inspection of the production batch

- a) Inspection processes and the final acceptance of parts shall confirm compliance with the parameters of the qualification process
- b) Conduct visual inspection of parts
- c) Conduct register of records of quality acceptance
- d) The quality records (test sheets, reports of tests, registers, etc.) shall be retained for 10 years

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- e) Periodical analyses of the baths shall be conducted with a frequency to guarantee good quality of coating. Analysis results, make ups and bath replacements shall be recorded
- f) Control current and temperature parameters
- g) Conduct coating thickness tests on the parts
- h) Conduct corrosion resistance tests, paint coating adhesion tests, coating weight tests on specimens within the process control
- i) Control the compressed air used in the process for lack of contamination like water, oil, dust, etc.

### **6.2.1. Inspection methods and requirements**

- a) Parts are subject to visual inspection and coating thickness inspection
- b) The following tests for the process approval and process control are conducted on the specimens:
  - Corrosion resistance
  - Painting coating adhesion
  - Coating weightThe test results are compiled in the test reports.
- c) Definition of specimens

Specimens shall be processed with the production parts. Specimens for tests before anodizing shall be carefully visually inspected. They shall not have visible contaminants, defects such as corrosion, inclusions and delamination.

### **6.2.2. Inspection of parts**

Note: Wear clean cotton gloves when inspecting the parts.

#### **6.2.2.1. Visual inspection of parts**

- a) Conduct visual inspection on 100% parts of every production batch.
- b) Anodic coating before sealing shall have a light, metallic color with a shade and uniformity depending on the condition of the part's surface and the alloy grade. After sealing in hot water, metallic coating does not change the appearance in a visible way. Sealing in chromium salts gives the coating a yellow-green shade with intensity depending on the coating thickness. The coating shall be continuous, smooth and uniform without powdery areas.
- c) The following defects are not acceptable on parts: deep scratches injuring anodic coating, loose coating, blurring when wiped (a light deposit of salt removed with wiping is not a defect), spot scale, white spots, dark spots which are evidence of the welding - if not specified in the job card, various shades of the coating or dark coating which indicates incorrect heat treatment or a missing heat treatment (does not apply to AMc and AMg alloys). In questionable cases, parts suspected of being welded or improperly heat treated shall be passed to the laboratory tests.

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- d) Missing coating is acceptable in places of contact with the racks, different shades of the coating depending on the alloy grade and in places with a specific surface condition i.e. welding, rubbing, cold working, drawing, rolling or surfaces with damaged clad coating are also acceptable. Missing coating is also acceptable in blind holes and places of gas blisters arising during anodizing of parts with complex shapes provided that these places are primed. Light discoloration as a result of draining of the sealing solution from constructional gaps in the parts is acceptable.

### 6.2.2.2. Anodic coating thickness inspection

Anodic coating thickness should be measured on 3÷5 pieces from the load. The measurement shall be taken in several places on the part's surface with a non-destructive eddy current method in accordance with ASTM B244, using eddy-current device or other device accepted by Polskie Zakłady Lotnicze Sp. z o.o. The coating thickness can also be measured in the laboratory at the lateral microsection by a microscopic method.

### 6.2.3. Inspection of specimens

Compilation of tests on witness specimens of sulfuric acid anodizing process for the production batch and process control is presented below:

Type of test	Tests frequency	Specimens dimensions [mm]	Quantity	Material
Corrosion resistance	Once per month	254 x 76 x 0,64 ÷ 1,60	5	2024 T3 per AMS-QQ-A-250/4 or AMS 4037
Coating adhesion	Once per month	254 x 76 x 0,64 ÷ 1,60	2	2024 T3 per AMS-QQ-A-250/4 or AMS 4037
Weight of non-sealed coating	Once per month	76 x 76 x 0,64 ÷ 1,60	3	2024 T3 per AMS 4037

#### 6.2.3.1. Corrosion resistance inspection

Specimens for corrosion resistance inspection shall be anodized to the thickness of 5-8 µm and sealed. Perform the test in the salt chamber, using 5% solution of NaCl for 336 hours in accordance with ASTM B117. The tested surface of the specimens shall be deflected by 6 degrees from vertical. After the test, there shall be no more than 15 separate pits of diameter not larger than 0.8 mm (1/32 inch) on a total surface of 967,5 cm<sup>2</sup> (150 square inch) and not more than 5 separate pits of diameter not larger than 0,8 mm (1/32 inch) on the surface of 193,5 cm<sup>2</sup> (30 square inch).

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### 6.2.3.2. Paint coating adhesion inspection

Adhesion test shall be performed on anodized test specimens finished with organic coating of the primer used at Polskie Zakłady Lotnicze Sp. z o.o. Adhesion test shall be conducted in accordance with FED-STD-141 method 6301. During the test, there shall be no separation between the paint and anodic coating or between anodic coating and the base metal.

### 6.2.3.3. Coating weight inspection

Coating weight should be inspected in accordance with ASTM B137.

### 6.2.4. Process control

Process control should be conducted once in a month. Additionally, if the process is not performed for one month or longer, test specimens should be controlled at the start of production.

The inspection includes the following tests for compliance with the requirements:

1. process course parameters
2. coating appearance
3. coating thickness
4. corrosion resistance
5. paint coating adhesion
6. coating weight

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