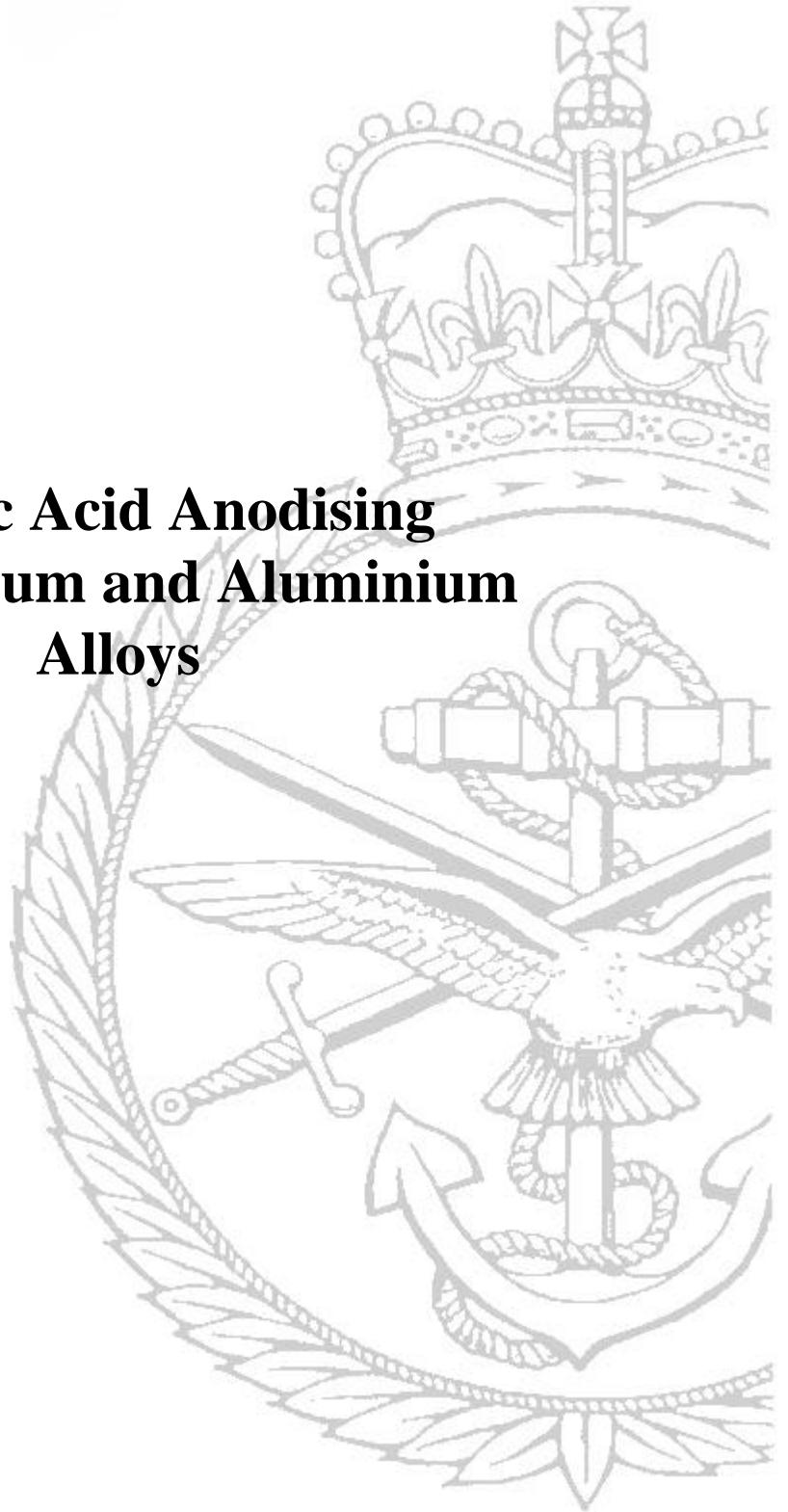




# Ministry of Defence Defence Standard 03-25

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## Sulfuric Acid Anodising of Aluminium and Aluminium Alloys



**AMENDMENT RECORD**

<b>Amd No</b>	<b>Date of Issue</b>	<b>Text Affected</b>	<b>Signature and Date</b>

**REVISION NOTE**

This Defence Standard has been reviewed to incorporate the latest technical developments and to align it with current MOD Policy.

**HISTORICAL RECORD**

- Def 151 dated March 1965
- Def Stan 03-25 / Issue 1 dated 6 September 1984
- Def Stan 03-25 / Issue 2 dated 14 September 1988
- Def Stan 03-25 / Issue 3 dated 22 August 1997

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**PREFACE**

**SULFURIC ACID ANODIZING OF ALUMINIUM AND ALUMINIUM ALLOYS**

- a.** This Defence Standard specifies the requirements for the Sulfuric Acid Anodizing of Aluminium and Aluminium Alloys.
- b.** This standard has been produced on behalf of the Standardization Advisory Group (SAG) by the Corrosion Prevention and Metallic Materials Standards Production Group (E3).
- c.** This standard has been agreed by the authorities concerned with its use and is intended to be used whenever relevant in all future designs, contracts, orders etc and whenever practicable by amendment to those already in existence. If any difficulty arises which prevents application of the Defence Standard, the Directorate of Standardization (DStan) shall be informed so that a remedy may be sought.
- d.** Any enquiries regarding this standard in relation to an invitation to tender or a contract in which it is incorporated are to be addressed to the responsible technical or supervising authority named in the invitation to tender or contract.
- e.** Compliance with this Defence Standard shall not in itself relieve any person from any legal obligations imposed upon them.
- f.** This standard has been devised solely for the use of the Ministry of Defence (MOD) and its contractors in the execution of contracts for the MOD. To the extent permitted by law, the MOD hereby excludes all liability whatsoever and howsoever arising (including, but without limitation, liability resulting from negligence) for any loss or damage however caused when the standard is used for any other purpose.

TEXT

**Sulfuric Acid Anodizing of Aluminium and Aluminium Alloys**

**SECTION 1 GENERAL REQUIREMENTS**

**1 SCOPE**

This Standard specifies the properties of sulfuric acid anodizing of aluminium and aluminium alloys.

**2 WARNING**

The Ministry of Defence (MOD), like its contractors, is subject to both United Kingdom and European laws regarding Health & Safety at Work, without exemption. All Defence Standards either directly or indirectly invoke the use of processes and procedures that could be injurious to health if adequate precautions are not taken. Defence Standards or their use in no way absolves users from complying with statutory and legal requirements relating to Health & Safety at Work.

**3 RELATED DOCUMENTS**

**3.1** The following documents and publications are referred to in the text of this Standard:

<b>Designation</b>	<b>Title</b>
BS EN ISO 2360	Eddy Current Method for Measurement of Coating Thickness of Non-conductive Coatings on Non-magnetic Basis Metals.
BS EN ISO 3696	Water for Analytical Laboratory Use: Specification and Test Methods
BS EN 12373-2	Aluminium and Aluminium Alloys. Anodizing. Determination of Mass Per Unit Area (Surface Density) of Anodic Oxidation Coatings. Gravimetric Method
BS EN 12373-5	Aluminium and Aluminium Alloys. Anodizing. Assessment of Surface Quality of Sealed Anodic Oxidation Coatings by Measurement of Admittance
BS EN 12373-8	Aluminium and Aluminium Alloys. Anodizing. Determination of the Comparative Fastness to Ultra-Violet Light and Heat of Coloured Anodic Coatings.
BS EN 12373-9	Aluminium and Aluminium Alloys. Anodizing. Measurement of Wear Resistance and Wear Index of Anodic Oxidation Coatings Using an Abrasive Wheel Wear Test Apparatus
BS EN 12373-10	Aluminium and Aluminium Alloys. Anodizing. Measurement of Mean Specific Abrasion Resistance of Anodic Oxidation Coatings Using an Abrasive Jet Test Apparatus
BS 6161 Part 15	Methods of Test for Anodic Oxidation Coatings on Aluminium and Its Alloys. Determination of Electrical Breakdown Potential

**SECTION 1 GENERAL REQUIREMENTS**

<b>Designation</b>	<b>Title</b>
BS 6161 Part 18	Methods of Test for Anodic Oxidation Coatings on Aluminium and Its Alloys. Determination of Surface Abrasion Resistance
BS 7479	Method for Salt Spray Corrosion Tests in Artificial Atmospheres
Def Stan 03-2	Cleaning and Preparation of Metal Surfaces
Def Stan 03-21	Mechanical Methods for the Inducement of Compressive Surface Residual Stresses.
Def Stan 03-24	Chromic Acid Anodizing of Aluminium and Aluminium Alloys.

**3.2** Reference in this standard to any related document means in any invitation to tender or contract the edition and all amendments current at the date of such tender or contract unless a specific edition is indicated.

**3.3** In consideration of **3.2** above, users shall be fully aware of the issue and amendment status of all related documents, particularly when forming part of an invitation to tender or contract. Responsibility for the correct application of standards rests with users.

**3.4** DStan can advise from where related documents can be obtained. Requests for such information can be made to the DStan Helpdesk. How to contact the helpdesk is shown on the outside rear cover of Def Stans.

**4 DEFINITIONS**

**4.1** For the purposes of this Part of the Standard the following definitions apply:

**4.2 Batch**

A batch consists of items of the same material specification processed together in the same anodizing bath.

**4.3 Process Control Schedule**

The document which specifies / defines:

- (a) The sequence of manufacturing operations and processes.
- (b) The control parameters and their tolerances for each individual process within the total sequence.

**4.4 Purified Water**

Water which has been produced by distillation, deionization or reverse osmosis, having a conductivity measurement not greater than 30  $\mu\text{S}/\text{cm}$  at 20°C and a silica content of not greater than 5 ppm w/w (as  $\text{SiO}_2$ ).

## **SECTION 1 GENERAL REQUIREMENTS**

### **4.5 Significant surface**

That area of the item covered, or to be covered by the coating, and for which the coating is essential for serviceability and / or appearance.

## **5 INFORMATION TO BE SUPPLIED TO THE PROCESSOR**

The following information shall be given on the drawing, contract or order:

- (a) The number of this Defence Standard.
- (b) The required film thickness (see **11.2**).
- (c) The specification, heat treatment and surface condition of the aluminium alloy.
- (d) The sealing requirements (see clause **14**).
- (e) The significant surface. This may be indicated on the drawing or by a marked sample.
- (f) Any preference for position of contacts.
- (g) The surface finish where there is a special requirement.
- (h) The colour, where articles are to be dyed. This may be by the provision of an anodized and dyed sample.
- (i) Any special conditions of service, e.g. contact or close proximity to Explosives, Propellants or Pyrotechnics or Hydrogen Peroxide (HTP)
- (j) Any special condition of service, e.g. Aerospace Applications requiring Mandatory Process Control Schedules (see clause **6**).with HTP
- (k) Any limit on the number of retreatments (see clause **16**).
- (l) Any special test requirements (see clauses **21** to **26**).

## **6 PROCESS CONTROL**

**6.1** A Process Control Schedule suitable for achieving the requirements of this Standard shall be prepared by the processing contractor(s) prior to the commencement of production.

**6.2** Details of the coating process, including all preparatory treatments, coating treatment and processing, significant surface, tests and all other treatments shall be included in the Process Control Schedule.

**6.3** All stages in the complete Schedule shall follow each other without delay.

## SECTION 2 APPLICATIONS AND LIMITATIONS

### 7 APPLICATIONS

**7.1** The sulfuric acid anodizing process is capable of yielding a range of coating thicknesses on most aluminium alloys. It is suitable for general protective purposes and for the production of a suitable surface for subsequent painting or adhesive bonding.

**7.2** The process produces coatings suitable for colouring with organic dyestuffs or certain inorganic compounds.

**7.3** The process produces coatings which are electrically insulating. Where anodizing is being used to impart this property it may be necessary to specify a maximum surface roughness for the items prior to anodizing, as the initial surface finish will affect the electrical resistance of the coating.

**7.4** It is the preferred process for anodizing those aluminium alloy castings containing more than 5% but less than 7% of copper, or containing a specified maximum total of 7% of (copper + nickel + iron).

**7.5** The process shall be specified where anodizing is required on aluminium alloy items which are liable to be used in contact with concentrated hydrogen peroxide (HTP).

### 8 COMPATIBILITY WITH EXPLOSIVES, PROPELLANTS OR PYROTECHNICS

**8.1** Whilst anodizing is not essential to render aluminium or aluminium alloys compatible with explosives, propellants or pyrotechnics, anodized surfaces may be expected to be compatible provided that all residues of reagents used in anodizing and sealing are removed by the final washing process

**8.2** Sulfuric acid anodizing of items of explosive stores will normally be permitted when the treated surfaces are not to be placed in contact or close proximity with explosives, propellants or pyrotechnics. Otherwise chromic acid anodizing (Def Stan 03-24) shall be used.

**8.3** Advice regarding the choice of process for applications where compatibility with explosives, propellants or pyrotechnics is a requirements, may be obtained from the responsible Technical or Supervising Authority named in the tender, contract or order.

**SECTION 2 APPLICATIONS AND LIMITATIONS**

**9 LIMITATIONS**

**9.1** The process is unsuitable for items having riveted, lap or folded joints, tubes, or other items where there is a risk of electrolyte becoming entrapped.

**9.2** The process is not suitable for items of less than 250  $\mu\text{m}$  section except for applications where a coating thickness of not more than 2  $\mu\text{m}$  will suffice.

**9.3** The process shall not be used on alloys containing more than 7% copper.

**9.4** The fatigue strength may be significantly reduced by the anodizing process. This may be restored to some extent by sealing the coating in aqueous dichromate solution at the cost of some loss of abrasion resistance or by shot peening in accordance with Def Stan 03-21 before anodizing.

**9.5** Composite items which include non-aluminium materials, which would be attacked by the process, or would prevent satisfactory formation of the anodic coating on the aluminium alloy, or would cause attack of the aluminium alloy, shall not be anodized as assemblies unless the non-aluminium surface are effectively masked.

**9.6** All heat treatment procedures shall be completed prior to anodizing.

## SECTION 3 PROCESS REQUIREMENTS

### 10 SURFACE PREPARATION

Surfaces shall be cleaned and free from grease, oil, oxide, scale or other foreign matter. All items shall be degreased prior to commencement of a cleaning sequence which shall be in accordance with Def Stan 03-2 to produce a chemically clean surface.

### 11 ANODIZING

#### 11.1 Process

The standard process described in **Annex A** and method of analysis of the electrolyte described in **Annex B** shall be used.

#### 11.2 Coating thickness

Unless otherwise stated on the drawing, contract or order, the coating thickness shall be 8 to 13  $\mu\text{m}$ , except that items which are to be dyed black may have a coating thickness of not greater than 25  $\mu\text{m}$ .

### 12 WASHING

**12.1** Immediately after removal from the anodizing bath all items shall be washed to remove electrolyte as follows:

**12.1.1** Items which have been anodized, other than for painting or adhesive bonding, shall be washed in clean cold running water. They shall be finally rinsed in purified water at a temperature not exceeding 60°C and shall then be sealed in accordance with clause **14**.

**12.1.2** Items which have been anodized for painting or adhesive bonding shall be washed in clean cold running water. They shall then be finally rinsed in purified water at a temperature not exceeding 60°C.

**12.1.3** Water used for final rinsing shall be discarded or retreated when the conductivity Exceeds 100  $\mu\text{S}/\text{cm}$  and/or when the silica content becomes greater than 5 ppm w/w (as  $\text{SiO}_2$ ).

### 13 DYEING

Items to be dyed shall be transferred to the dye bath immediately after washing and without allowing the items to dry. After dyeing, the items shall be rinsed in purified water prior to any sealing operation required.

## SECTION 3 PROCESS REQUIREMENTS

## 14 SEALING

**14.1** Items other than those to be dyed, or required to retain the natural anodized colour, or liable to be used in contact with concentrated HTP, or to be subsequently painted or adhesive bonded, shall be sealed by immersion in one of the solutions from **Table 1**.

<b>Table 1: Sealing Solutions</b>		
<b>Solution</b>	<b>Component Part</b>	<b>Measure</b>
A	Potassium dichromate ( $K_2Cr_2O_7$ ) or Sodium dichromate ( $Na_2Cr_2O_7 \cdot H_2O$ )	70 – 100 g
	Sodium carbonate ( $Na_2CO_3$ ) or Sodium hydroxide (NaOH)	18 g 13 g
	Purified Water	1 Litre
	pH (glass electrode) or pH (bromothymol blue)	6.3 to 7.4
B	Potassium dichromate ( $K_2Cr_2O_7$ ) or Sodium dichromate ( $Na_2Cr_2O_7 \cdot H_2O$ )	40 – 60 g
	Purified Water	1 Litre
	pH (glass electrode) or pH (bromothymol blue)	5.6 – 6.0 5.9 – 6.4

**14.1.1** The temperature of the solution shall be maintained at not less than 96°C. Items shall be immersed for not less than the anodizing time. The pH value of the solution shall be maintained by the addition of chromic acid or sodium hydroxide as necessary. After sealing, the items shall be thoroughly washed in clean cold running water.

### SECTION 3 PROCESS REQUIREMENTS

**14.2** Items which are liable to be used in contact with concentrated HTP, shall be sealed by immersion in purified water at not less than 96°C for not less than 20 minutes, at a pH of 5.5-7.0 (corrected to 20°C), adjusted by the addition of one of the following: sodium hydroxide, ammonium hydroxide or acetic acid as necessary.

**14.3** Items which have been dyed or are required to retain the natural anodized colour shall be sealed by the treatment described in **14.2**.

**14.4** Items anodized as a pre-treatment for painting or adhesive bonding shall not be sealed.

### 15 DRYING

**15.1** Items other than those anodized as a preparation for painting or adhesive bonding may be dried at elevated temperatures; the temperature shall not exceed 110°C. The duration at this temperature shall not exceed 10 minutes.

**15.2** Items to be subsequently painted or adhesive bonded shall be dried at a temperature not exceeding 60°C. Suitable precautions shall be taken to prevent contamination.

**15.3** Drying by means of chlorinated solvents containing surface active agents shall not be used.

### 16 RE-ANODIZING

**16.1** Items which are to be re-anodized shall have the anodic coating removed before re-treatment.

**16.2** The use of stripping solutions for the removal of anodic coatings may result in an attack on the substrate which, in finished items, may adversely effect their fatigue strength. Suitable chemical methods are described in **Annex C**.

**16.3** Attention is also drawn to the desirability of abrasive blasting (Def Stan 03-2, Method D) before re-anodizing. Some measure of compressive stress is introduced into the surface by this method.

## **SECTION 4 INSPECTION AND TEST**

### **17 PROCESSING**

The processing methods employed shall comply with the Process Control Schedule where specified (see clause 6).

### **18 FREQUENCY OF TESTING**

**18.1** Visual examination shall be applied to all items. The test for thickness of coating (see clause 20) and, where specified, any of the tests in clauses 21 to 26, which may be applicable shall be carried out on not less than 2% of the items represented, with a minimum of one item per anodizing batch.

**18.2** In exceptional circumstances, e.g. the treatment of a small number of large items or a large number of small items, the frequency of such tests may be modified. Coupon samples coated together with the items may be used, due consideration being given to their shape, size and material. The treatment of the coupon samples shall be representative of that applied to the items being coated.

### **19 APPEARANCE**

The significant surface of all items shall be completely anodized and shall be of uniform colour. All items except those which have been dyed, or are required to retain the natural anodized colour, or are to be used in contact with concentrated hydrogen peroxide (HTP), or are to be subsequently painted or adhesive bonded, shall have a yellow colour indicating that chromate sealing has been carried out. The colour will be affected by alloying constituents. The colour of dyed items shall match that of an agreed standard or sample. Minor variations in colour shall not normally be cause for rejection. The presence of processing residues shall be cause for rejection.

### **20 THICKNESS OF COATING**

The average thickness shall be determined either by the gravimetric stripping method described in BS EN 12373-2 or the eddy current instrument method described in BS EN ISO 2360.

### **21 DYED COATINGS**

#### **21.1 Resistance to leaching**

The samples of dyed and sealed items shall be immersed for 30 minutes in a gently boiling aqueous solution of 0.1% (m/v) borax. They shall then show no perceptible loss of colour when compared with an untested sample from the same batch of anodized items.

## **SECTION 4 INSPECTION AND TEST**

### **21.2 Fastness to light**

The fastness to light determined by the method described in BS EN 12373-8 shall be not less than the values specified on the drawing, contract or order.

## **22 SEALING ASSESSMENT**

**22.1** Undyed coatings on wrought alloy sealed by the method specified in **14.2** shall be tested by the method described in BS EN 12373-5. This method shall not be used on castings for other sealed coatings.

**22.2** The staining intensity for 1000, 3000, 5000 and 6000 series alloys shall not be greater than 1 according to the annex of BS EN 12373-5.

**22.3** For 2000, 7000 and 8000 series wrought alloys, the staining intensity shall be agreed between the contractor and purchaser.

## **23 ELECTRICAL INSULATION**

The electrical breakdown voltage, determined by the method described in BS 6161: Part 15, shall be not less than the values specified on the drawing, contract or order.

## **24 ABRASION RESISTANCE**

**24.1** The abrasion resistance, assessed by the method described in BS EN 12373-9 or BS EN 12373-10, shall comply with the standard of acceptance stated on the drawing, contract or order.

**24.2** For production control purposes, the method described in BS 6161: Part 18 may be used for 1000, 3000, 5000 and 6000 series wrought alloys only.

## **25 REFLECTIVITY**

The total light reflectivity, specular light reflectivity, image clarity and infrared reflectivity, determined by the appropriate method described in BS EN 12373 or BS 6161 series, shall comply with the standards of acceptance stated on the drawing, contract or order.

## **26 CORROSION TEST**

Where the Process Control Schedule requires a corrosion test, a test panel (minimum dimensions 120 mm x 60 mm) of the same material specification as the components shall be anodized and sealed along with the components. The test panel shall be subjected to the neutral salt spray test as described in BS 7479. Where the components are of a form other than plate or sheet, the actual component shall be subjected to the test. The duration of the test shall be 336 hours with no corrosion spots or staining evident following test.

**ANNEX A**

**SULFURIC ACID ANODIZING PROCESS FOR ALUMINIUM AND ALUMINIUM ALLOYS**

**A.1 ELECTROLYTE**

The electrolyte shall consist of an aqueous solution of sulfuric acid at a concentration of 90 to 400 g/l which may contain additives. The concentration shall be maintained within 10% of the nominal. The chloride content, expressed as NaCl, shall be less than 0.20 g/l. The aluminium content depends on the nominal concentration of the solution. It shall be less than 25 g/l for minimum concentration and less than 12 g/l for the maximum concentration of sulfuric acid. The sulfuric acid anodizing bath shall be made up with purified water. The electrolyte shall be agitated by air or mechanical means to maintain a uniform temperature throughout the bath, and should be kept clean and free from suspended matter by filtration or other means.

**NOTE:** The nominal electrolyte concentration will depend on the type of finish required. The lower the concentration, the harder and less porous the coating.

**A.2 CATHODE**

The cathode material shall be lead or antimonial lead. Where the tank is lined with one of these materials this may be used as the cathode. The sides and bottom of the tank may, if desired, be partially covered by glass or other chemically inert insulating material.

**A.3 SUSPENSION OR JIGGING**

The items to be anodized shall be suspended by such means that good electrical contact is maintained throughout the treatment. Any metallic parts of a suspension device which makes contact with the electrolyte shall be of aluminium or titanium. Suspension devices with spring or screw contacts are recommended. Where possible, items shall be suspended in the bath so that air or evolved oxygen cannot become entrapped, causing incomplete coating. Where such trapping is unavoidable multiple treatment shall be acceptable. Rigid items which are too small to be held in jigs may be packed in perforated aluminium or titanium canisters which shall incorporate means of maintaining electrical contact between the items and shall permit adequate circulation of the electrolyte through their interiors. Items with flat faces, such as washers, tend to nest together and cannot normally be effectively treated in canisters unless adequately dispersed by treating them with other items. Care shall be taken that items undergoing treatment do not come into contact with the tank, stirrer, heating or cooling pipes or cathodes, as this may cause breakdown of the film and damage to the items.

**ANNEX A**

**SULFURIC ACID ANODIZING PROCESS FOR ALUMINIUM AND ALUMINIUM ALLOYS**

**A.4 ANODIZING PROCEDURE**

**A.4.1** The operational temperature of the electrolyte shall be  $(20\pm 2)^{\circ}\text{C}$ . The items to be treated shall be immersed in the electrolyte and connected as the anode to a suitable electrical source for a time sufficient to obtain the required coating thickness. The treatment is preferably controlled by current density (normally 100 to 200  $\text{A}/\text{m}^2$  of anode surface) but may be controlled by maintaining a predetermined voltage.

**A.4.2** The anodizing conditions (temperature, voltage, time) shall be suitable for the type of alloy being processed and bath composition and shall be defined in the PCS.

## ANNEX B

### ANALYSIS OF SULFURIC ACID ELECTROLYTE

**B.1** The electrolyte shall be analysed by any reputable method which shall be comparable with or better than the following referee method.

**NOTE:** The reagents used shall be of recognized British Standard analytical quality. All laboratory equipment used shall be of British Standard quality. Water complying with BS EN ISO 3696 Grade 3 should be used throughout.

### B.2 ANALYSIS FOR FREE SULFURIC ACID

#### B.2.1 Reagents

**B.2.1.1** Sodium hydroxide, M solution.

**B.2.1.2** Thymol blue indicator, 0.1% (m/v) in ethanol, methylated spirit or isopropanol.

**B.2.1.3** Potassium fluoride, solid reagent.

#### B.2.2 Procedure

Dilute a 50 ml sample of the electrolyte to 250 ml in a calibrated flask. To 10 ml of the diluted sample in a 250 ml conical flask, add 90 ml of water, 1 g of the potassium fluoride and 1 ml of the thymol blue indicator. Titrate the solution with the sodium hydroxide solution to a permanent blue end point. Let (a) ml be the amount of sodium hydroxide solution required.

#### B.2.3 Calculation

Sulfuric acid in grams per litre = 24.5(a).

### B.3 ANALYSIS FOR ALUMINIUM

#### B.3.1 Reagents

**B.3.1.1** Nitric acid, M solution.

**B.3.1.2** Sodium hydroxide, M solution.

**B.3.1.3** Thymol blue indicator, 0.1% (m/v) in ethanol, methylated spirit or isopropanol.

**ANNEX B****ANALYSIS OF SULFURIC ACID ELECTROLYTE****B.3.2 Procedure**

Dilute a 50 ml sample of the electrolyte to 250 ml in a calibrated flask. Add 25 ml of the diluted solution to an excess of the sodium hydroxide solution - (b) ml –contained in a 250 ml conical flask. Add 1 ml of the thymol blue indicator and titrate the solution with the nitric acid solution to a yellow end point. Let (c) ml be the amount of nitric acid solution required and let (a) ml be the free acid titre from clause 1 above.

**B.3.3 Calculation**

Aluminium, in grams per litre =  $1.8\{(b)-(c)\} - 4.5(a)$ .

**B.4 ANALYSIS FOR CHLORIDE****B.4.1 Reagents**

**B.4.1.1** Nitric acid (SG = 1.42).

**B.4.1.2** Nitric acid wash water. Diluted nitric acid (1 + 50).

**B.4.1.3** Silver nitrate, 1% (m/v) solution.

**B.4.2 Procedure**

To 100ml of the electrolyte contained in a 300 ml flask add 10 ml of the nitric acid. Heat the solution to boiling point, add 50 ml of the silver nitrate solution and agitate the solution vigorously to coagulate the precipitate. Allow the silver chloride to settle and filter on a dried, weighed Gooch crucible, transferring the precipitate completely. Wash first with hot nitric acid and then with water. Dry the crucible and its contents in an air oven at 110°C, allow to cool in a dessicator and weigh until a constant weight of silver chloride is achieved. Let (d) be the amount of silver chloride.

**B.4.3 Calculation**

Chloride, calculated as NaCl, in grams per litre =  $4.1(d)$ .

ANNEX C

STRIPPING SOLUTIONS FOR THE REMOVAL OF ANODIC COATINGS

C.1 PREFERRED SOLUTION

Phosphoric acid	(SG = 1.75)	3.5% (v/v)
Chromic acid		2.0% (m/v)

Stripping is most effective when the solution is used at or near boiling point.

C.2 ALTERNATIVE SOLUTIONS

C.2.1	Sulfuric acid	(SG = 1.84)	15% (v/v)
	Chromic Acid		5% (m/v)

The solution should be used at about 50°C.

C.2.2	Sulfuric acid	SG = 1.84)	10% (v/v)
	Potassium fluoride		4% (m/v)

The solution should be used at room temperature.

C.2.3	Sulfuric acid	(SG = 1.84)	10% (v/v)
	Hydrofluoric acid, commercial	(50/60% HF)	1% (v/v)

The solution should be used at room temperature.

**NOTE:** The solutions listed in clause C.2 will cause slightly greater attack of the base metal than that given in clause C.1

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**Contract Requirements**

When Defence Standards are incorporated into contracts users are responsible for their correct application and for complying with contractual and statutory requirements. Compliance with a Defence Standard does not in itself confer immunity from legal obligations.

**Revision of Defence Standards**

Defence Standards are revised as necessary by up issue or amendment. It is important that users of Defence Standards should ascertain that they are in possession of the latest issue or amendment. Information on all Defence Standards is contained in Def Stan 00-00 Standards for Defence Part 3 , Index of Standards for Defence Procurement Section 4 'Index of Defence Standards and Defence Specifications' published annually and supplemented regularly by Standards in Defence News (SID News). Any person who, when making use of a Defence Standard encounters an inaccuracy or ambiguity is requested to notify the Directorate of Standardization (DStan) without delay in order that the matter may be investigated and appropriate action taken.