D.T.D.942

Ministry of Defence
Defence Procurement Agency, ADRP2
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OBSOLESCENCE NOTICE

All DTD specifications were declared obsolescent from 1st April 1999. All DTD 900 series approvals also lapsed at that time. The standards will no longer be updated but will be retained as obsolescent documents to provide for the servicing of existing equipment.

Further Guidance

The aim in declaring the specifications obsolescent is to recognise that the documents are not being updated and thus should be used with care by both purchaser and supplier. For example, a specification could contain valid technical information but may also contain type approval clauses that contradict procurement policy and/or use materials that do not comply with environmental legislation. The obsolescent specification can still be used as a basis for a purchase provided that the supplier and purchaser agree suitable changes to the specification within the purchase order/contract.

For the DTD 900 system, each specification has provided an MoD approved material and process. For these items, the declaration of obsolescence will constitute the termination of both the extant MoD approval and the continuing MoD assessment that had underpinned those approvals. Again, the technical content of the document remains valid and can be used by both purchaser and supplier as a basis for a contract but an acceptable (to the parties) approval/assessment procedure would be required.

PROCUREMENT EXECUTIVE,
MINISTRY OF DEFENCE

D.T.D. 942
August, 1973

Process Specification

ANODIZING OF TITANIUM AND TITANIUM ALLOYS

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1. Scope

This specification covers the requirements for the anodic oxidation of titanium and titanium alloy aerospatial parts primarily for the prevention of seizure, with or without the subsequent application of a heat cured solid film lubricant coating to the requirements of DEF. STAN 91-19/1.

2. General

2.1 The process shall not be used where there is any risk of the solutions used becoming entrapped.

2.2 Any flaw detection requirements shall be carried out prior to the commencement of this process.

3. Preparation

3.1 Parts may be suspended by means of screw or spring contacts on jigs, of which any metallic parts contacting the electrolyte shall be made of titanium. Alternatively, small parts, such as bolts, which are not liable to nest and so prevent the formation of anodic film on some surfaces, may be treated in titanium baskets. Since it is conductive, the anodic film formed on the jigs and baskets need not be removed between successive treatments.

3.2 Parts shall be cleaned in accordance with the requirements of DEF. STAN 03-2, Section 6, para. 34, using one or more of the methods A, B1, B2, C, D2 and D3 as detailed in the annex to that Standard. It should be noted that certain titanium alloys are susceptible to stress corrosion cracking when exposed to chlorinated hydrocarbons, and that cathodic cleaning processes may cause hydrogen embrittlement and must not be used. When any doubt exists about the suitability of a process for use on titanium parts the matter shall be referred to the Design Authority which shall be satisfied, in particular, that there will be no significant hydrogen embrittlement or stress corrosion arising from the treatment.

3.3 After cleaning, parts shall be pickled in a solution of the following composition at room temperature:

Nitric acid (d = 1.42) 180-200 ml/l

Hydrofluoric acid (40 per cent w/v HF) 15-25 ml/l

The time of pickling shall be from 5 to 20 seconds after the commencement of gassing. Parts shall then be rinsed thoroughly and kept immersed in clean cold water until they can be transferred to the anodizing bath.

4. Anodizing

4.1 The electrolyte normally used shall consist of a solution of sulphuric acid within the range of 200 to 400g/l. The concentration of free sulphuric acid shall be maintained within 10 per cent of the nominal, additions of sulphuric acid being made as necessary. Chloride in the electrolyte shall not exceed the equivalent of 0.20 g.NaCl per litre. Methods for determining free sulphuric acid and chloride are given in the appendix to this specification.

4.2 The electrolyte shall be contained in a suitable chemical resistant tank. Fume extraction will be required.

4.3 A D.C. electrical supply with voltage regulation from 2 to 25 volts shall be provided. Current consumption may rise initially to $0.5A/dm^2$ of the treated surface. In the case of a lead-lined processing tank, the tank lining may serve as the cathode. Otherwise sheet lead cathodes at the tank walls shall be provided.

4.4 The parts to be treated shall be immersed in the processing solution and connected as the anode to the electrical D.C. source.

4.5 The temperature of the bath shall be maintained in the range of 16° to 26°C throughout the duration of treatment.

4.6 The cell voltage between workpiece and cathode shall be maintained throughout the treatment in the range 18 to 20 volts, the current density dropping to a steady value which should be about $50mA/dm^2$.

4.7 The time of treatment will normally be from 5 to 15 minutes.

4.8 Any alternative process to that detailed above may be used subject to the prior approval of the Directorate of Research Materials 2.

4.9 Immediately after removal from the anodizing bath, parts shall be washed thoroughly in clean running water, rinsed in clean hot water and allowed to dry.

5. Process Control

The process shall be operated in accordance with a Control Schedule which has been agreed with the Quality Assurance Authority.

6. Inspection

After anodizing, all parts shall be visually examined and shall exhibit a uniform blue to violet colour and be free from untreated areas.

Approved for issue,

E. W. RUSSELL,

Director of Research Materials 2.

APPENDIX

Analysis of anodizing electrolyte

1. Free sulphuric acid

(a) Reagents

Sodium hydroxide	1N solution
Thymol blue indicator	0.1 per cent w/v in ethanol

(b) 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, and 1 ml of thymol blue indicator.

Titrate the solution with sodium hydroxide (1N) to a permanent blue end-point. Let A ml be the amount of sodium hydroxide solution required.

(c) Calculation of results

Sulphuric acid (w/v) g/l=24.5A

2. Chloride

(a) Reagents

Nitric acid	concentrated (d = 1.42)
Nitric acid	2 per cent v/v
Silver nitrate	1.0 per cent w/v solution

(b) Procedure

To 100 ml of the electrolyte contained in a 300 ml flask add 10 ml concentrated nitric acid. Heat the solution to boiling point, add 50 ml of the silver nitrate and agitate the solution vigorously to coagulate the precipitate. Allow the silver chloride to settle, filter on a weighed Gooch or sintered glass crucible, transferring the precipitate completely. Wash with hot dilute nitric acid (2% v/v), dry and weigh.

Let D be the weight of the silver chloride.

(c) Calculation of *results*

Chloride (as NaC1) g/l= 4.1D.

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