

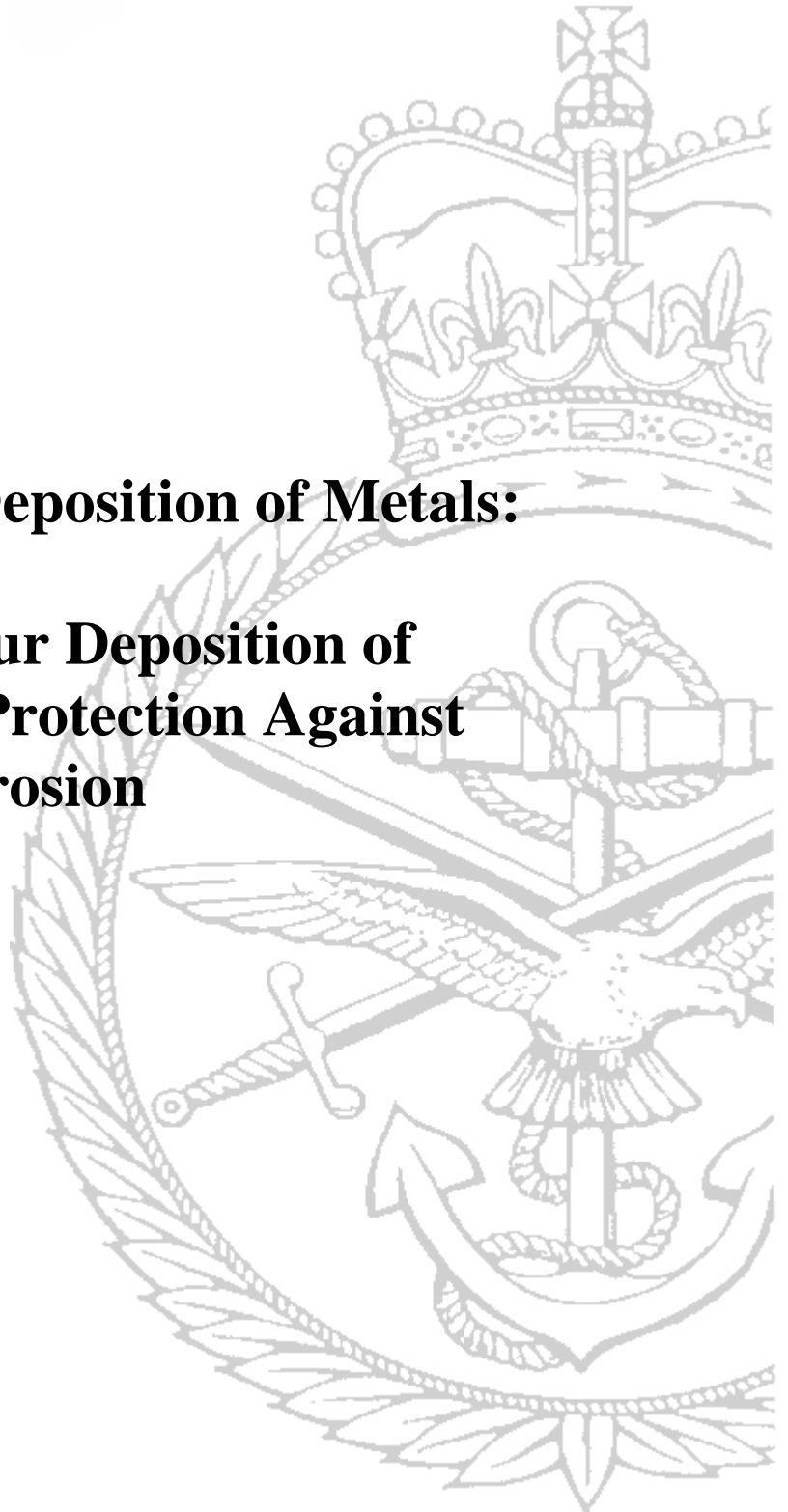


**Ministry of Defence
Defence Standard 03-28(Part 1)**

Issue 4 Publication Date 11 April 2008

Physical Vapour Deposition of Metals:

**Physical Vapour Deposition of
Aluminium for Protection Against
Corrosion**



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Foreword

AMENDMENT RECORD

Amd No	Date	Text Affected	Signature and Date

REVISION NOTE

This standard is raised to Issue 4 to update its content.

HISTORICAL RECORD

This standard supersedes the following:

Def Stan 03-28 (Part 1) / Issue 1 dated 15 March 1988

Def Stan 03-28 (Part 1) / Issue 1 dated 27 January 1995

Def Stan 03-28 (Part 1) / Issue 1 dated 16 December 2003

- a) This standard provides requirements for the physical vapour deposition of aluminium.
- b) This standard has been produced on behalf of the Defence Material Standardization Committee (DMSC) 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, UK Defence 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.

Introduction

Physical vapour deposited aluminium is applied to improve resistance to corrosion. It may be applied to corrosion-resisting steels, titanium and other materials to provide dissimilar metal compatibility with aluminium and as a possible alternative to the cadmium plating of steels.

Standards for Defence - Physical Vapour Deposition of Metals. - Physical Vapour Deposition of Aluminium for Protection Against Corrosion

1 Scope

This Part of the Defence Standard covers the requirements for coatings of high purity aluminium on low alloy steels, high strength steels, corrosion-resisting steels, aluminium alloys and titanium alloys and other materials where appropriate.

2 Warning

The Ministry of Defence (MOD), like its contractors, is subject to both United Kingdom and European laws regarding Health and Safety at Work. 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 and Safety at Work.

3 Normative References

3.1 The publications shown below are referred to in the text of this standard. Publications are grouped and listed in alpha-numeric order.

3.2 Reference in this Standard to any normative references 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 clause **3.2** above, users shall be fully aware of the issue and amendment status of all normative references, 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 regarding where normative references documents are obtained from. 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.

Designation	Title
BS EN ISO 9227	Corrosion Tests In Artificial Atmospheres. Salt Spray Tests
BS EN 60454-2	Pressure Sensitive Adhesive Tapes for Electrical Purposes. Methods of Test.
BS ISO 6344-1	Coated Abrasives – Grain Size Analysis. Grain Size Distribution Test
BS 5599	Specification for Hard Anodic Oxidation Coatings on Aluminium and Its Alloys for Engineering Purposes
Def Stan 03-2	Cleaning and Preparation of Metal Surfaces
Def Stan 03-4	The Pretreatment and Protection of Steel of Specified Maximum Tensile Strength Exceeding 1450 N/mm ²
Def Stan 03-18	Chromate Conversion Coatings (Chromate Filming Treatments) for Aluminium and Aluminium Alloys
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
Def Stan 03-25	Sulphuric Acid Anodizing of Aluminium and Aluminium Alloys

4 Definitions

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

4.2 Design authority

The approved firm, establishment or branch responsible for the detailed design of material to approved specifications and authorised to sign a certificate of design or to certify sealed drawings.

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 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 specification and metallurgical condition of the basis metal and any process temperature limitations.
- (c) The significant surface (see **4.4**), including the coating of holes and recesses (see **13 (a)**).
- (d) The minimum thickness of aluminium on the finished item (see clause **10**); the maximum thickness may also be specified.
- (e) The requirements for coating adhesion (see clause **17**).
- (f) Supplementary chromate treatment (see **11.3**).

In addition, if any of the following are required, they shall be stated on the drawing, contract or order:

- (g) Details of any sensitive material and whether ultra high purity argon is required.
- (h) Abrasion-resistant anodic oxide coating (see **11.4**).
- (i) Supplementary organic finish, such as paint - details of the specification concerning organic finish shall also be stated (see **11.5**).
- (j) Consolidation, e.g. by glass bead peening (see **11.2**).

6 Process Control

6.1 A Process Control Schedule suitable of 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 and post coating treatments, processing, chemical composition of the aluminium to be deposited, chemical composition and thickness of the coating required, processing temperature range, significant surface, tests and all other processes and treatments shall be included in the Process Control Schedule.

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

7 Preparation for Coating

All items to be coated shall be treated in accordance with the General Requirements Section of Def Stan 03-2 or Def Stan 03-4, as appropriate.

8 Physical Preparation

8.1 Cold working

All cold working processes (e.g. forming, straightening, grinding and machining) where required, shall be completed before any preparation, stress relieving and coating unless otherwise specified in the drawing, contract or order.

8.2 Heat Treatment

8.2.1 If required, steel items shall be stress relieved in accordance with Def Stan 03-2 or Def Stan 03-4 as appropriate, prior to the deposition of aluminium.

8.2.2 All heat treatment operations, including those designed to reduce the susceptibility to hydrogen embrittlement as a consequence of cleaning operations, must be completed prior to the deposition of aluminium, in accordance with the requirements of this Part of the Standard.

8.3 Surface condition

8.3.1 Surfaces to be coated shall be smooth and free from oxides, tool marks, pitting, intergranular attack or other defects.

8.3.2 Due allowance must be made for surface preparation (especially abrasive cleaning) and the application of a uniform coating thickness in order to obtain the specified surface finish and dimensional tolerance quoted in the drawing, contract or order.

8.3.3 Any shot peening of the basis metal shall be carried out in accordance with Def Stan 03-21 before final cleaning and the application of the coating.

8.4 Cleaning

8.4.1 All surfaces shall be free from soils, such as soap, drawing compounds, oil, grease, machining fluid, polishing compounds etc, discolouration, oxide, scale or other foreign matter. All items shall be degreased prior to the commencement of a cleaning sequence which shall be in accordance with Def Stan 03-2 or Def Stan 03-4, as appropriate, to produce a chemically clean surface. Drying by means of chlorinated solvents is not permitted.

8.4.2 Abrasives used on any metal or alloy shall not have been used on any dissimilar metals or alloys. Separate abrasive cleaning media shall be used for different alloy families, e.g. iron and its alloys, aluminium and its alloys etc. After abrasive cleaning, residues shall be removed from the surfaces of items prior to subsequent processing.

NOTE Extra care should be taken in cleaning partially closed fabrications and lapped joints to reduce the risk of residue retention. Care should also be taken in abrasive cleaning of thin sections to avoid distortion.

8.4.3 Areas which are not required to be coated shall be kept free from aluminium by masking prior to the application of the coating. Aluminium or corrosion-resisting steel masking, foil or plugs shall be used to cover areas where the coating is not required. Organic masking materials unstable at high temperatures shall not be used.

8.4.4 Contamination of cleaned items (e.g. handling with bare skin) shall be avoided (e.g. by the use of clean and dry lint free cotton gloves or any other suitable gloves).

9 Process Requirements

9.1 Only items of a similar basis metal, e.g. corrosion resisting steels, shall be processed together.

9.2 Equipment

9.2.1 The equipment, process and materials used to produce physical vapour deposited aluminium shall be capable of producing a uniform coating in accordance with the detailed requirements of this Part of the Standard. The equipment used shall consist of a coating chamber with associated pumps, controls and power supplies containing:

- (a) Means of producing energetic bombardment of the substrate prior to coating and at a suitable intensity, throughout deposition of the growing film.
- (b) Means of producing a coating flux of aluminium, such as an evaporative or sputtering source. According to the technique used it may be necessary to include a shutter, which may be interposed between the aluminium source and the items to be coated except during coating.

NOTE A shutter may be necessary to reduce radiant substrate heating from the aluminium source.

- (c) Means of holding and manipulating the items to ensure specified coating uniformity.
- (d) Means of ensuring the substrate temperature of the items is controlled within the specified limits.

NOTE Substrate temperature is controlled by suitable modification of the process parameters.

9.2.2 The equipment and process shall be capable of covering completely all significant surfaces, including roots of threads, recesses, sharp corners and other areas specified in the drawing, contract or order. Suitable rotating and revolving jigs may be used to ensure that all significant surfaces are cleaned and coated to the specified thickness limits.

9.2.3 The equipment shall be capable of producing a vacuum of 7×10^{-4} Pa (5×10^{-6} torr), or better, in the coating chamber.

NOTE Where water-cooled surfaces are present in the chamber, including chamber walls, then a means of heating the circulating water shall be used to ensure that the chamber surfaces are warm enough to prevent condensation when open to the atmosphere.

9.2.4 High purity argon (at least 99.995% pure) shall be used during substrate conditioning and coating as required. The aluminium metal used shall contain not less than 99.95% aluminium by weight.

NOTE When coating material sensitive to oxidation ultra high purity argon (at least 99.998% pure) shall be used.

9.3 Substrate conditioning

9.3.1 After cleaning (and drying as necessary) items shall be transferred as soon as practicable into the coating chamber. Items shall only be handled by operators wearing suitable gloves (see **8.4.4**).

9.3.2 The coating chamber shall then be pumped to the vacuum specified in the Process Control Schedule.

9.3.3 Items will then be subjected to substrate conditioning to remove absorbed and chemically bound contaminants and thus ensure adequate coating adhesion. Substrate conditioning may be achieved by

intimate contact with a glow discharge plasma (sputter cleaning), bombardment with energetic ions, radicals or atoms or by reactive plasma cleaning or by other suitable methods. Certain conditioning treatments may require the coating chamber to be back filled with argon or other gas of sufficiently high purity. In addition manipulation of the items to ensure complete exposure may be required.

9.3.4 When the specified substrate conditioning has been completed, there shall be a smooth, uninterrupted transition to the coating deposition stage of the process.

NOTE The chamber shall not be vented to the atmosphere after substrate conditioning prior to coating. Should this occur, the substrate conditioning stage shall be repeated. In some circumstances, it may be necessary to unload and re-clean the items before restarting the process.

9.4 Aluminium coating

9.4.1 The equipment and process shall be such that any temperature rise in the items will have no adverse effects on the properties of the basis metal or the coating, or on the adhesion characteristics between the basis metal and the coating.

9.4.2 The coating process shall be carried out in the evacuated coating chamber in which the items have just been surface conditioned. At the conclusion of the substrate conditioning, a smooth transition shall be effected by introducing the aluminium coating flux (for example by opening the shutter, see **9.2.1 (b)**) and adjusting the process conditions.

9.4.2.1 It is essential that a sufficiently energetic ion / radical / atom bombardment of the growing film occurs throughout the deposition process according to the technique used, for example by maintaining the glow discharge. Where necessary the items shall be rotated and/or revolved to ensure uniform coating deposition.

9.4.3 The aluminium source shutter (if fitted) should then be closed, the aluminium sources switched off and the coated items and sources allowed to cool before air is admitted to the coating chamber. The items shall then be removed from the coating chamber (see **10.4**). Masking material shall then be carefully removed from the items prior to examination.

9.4.4 The substrate conditioning techniques and the coating conditions will vary with the nature, size and shape of the items to be coated. These variable factors shall be determined experimentally for each type of item, to ensure that the requirements for thickness and adhesion of the coating are met.

10 Coating Requirements

10.1 The coating shall contain not less than 99.9% aluminium by weight.

10.2 The coating shall be smooth, continuous, uniform, adherent, fine-grained and free from stains, burns, blisters, pits, nodules, cracks, porosity, uncoated areas, edge build-up or other defects. The aluminium coating shall show no indication of contamination or improper operation of equipment, such as powdered or darkened areas. The coating shall completely cover all significant surfaces, which may include roots of threads, recesses, holes and sharp corners, and shall conform to the thickness requirements detailed in **Table 1**, see also **16 (b)**. Masked areas shall be clean, free from aluminium and free from surface or other defects.

NOTE 1 Unavoidable jig marks may be permitted with prior agreement of the Design Authority.

NOTE 2 Difficulty may be experienced in coating small holes and recesses to specified depth.

Table 1 Coating Thickness Requirements

Application	Thickness Range (μ m)
General purpose coatings for corrosion protection, outdoor application etc	25 and Over

Coatings for corrosion protection in indoor or interior applications, or where dimensional tolerances will not allow the application of minimum 25 μm thickness 13 to < 25

Coatings where only dissimilar metal compatibility is required for close tolerance or threaded items 8 to < 13

10.3 Allowances shall be made in the manufacture of threaded and close tolerance items for dimensional tolerance to obtain the necessary coating thickness.

10.4 Coated items should be removed from the equipment and handled in such a way as to avoid contamination (e.g. skin contact) by wearing clean and dry lint-free cotton gloves, or any other suitable gloves and examined in accordance with clauses **12** to **20** of this Part of the Standard.

11 Supplementary Treatments

11.1 Prior to the application of any supplementary coating, the aluminium coated surface may require solvent degreasing in accordance with Def Stan 03-2. No other method of cleaning is permitted.

11.2 Treatment with glass beads

If required the physical vapour deposited coating may be glass bead peened. The process can improve the compactness of the coating, give additional corrosion resistance and provide a check for the adhesion of the coating. For example, peening may be carried out by using glass beads measuring 50-100 μm diameter at a pressure of 2.8×10^5 Pa (40 psi) to produce a satin finish on the surface.

NOTE Thicker coatings deposited at relatively high pressure often develop a coarse grained structure which can be converted to a fine grained structure by glass bead peening.

11.3 Chromate conversion coatings

11.3.1 Unless otherwise specified, a chromate conversion coating shall be applied in accordance with the requirements of Def Stan 03-18.

NOTE The following process shall not be used for chromate conversion coatings:-

- (a) Any alkaline chromate process.
- (b) Any chromate process containing phosphate.

11.3.2 The chromate films shall be adherent, continuous and free from any flaws or defects. For applications where chromate-filmed surfaces are not subsequently painted, tests for corrosion resistance of the conversion coating shall be carried out in accordance with **Annex A**.

NOTE 1 The presence of a conversion film may be verified by the spot check described in Def Stan 03-18.

NOTE 2 In the absence of information to the contrary it is to be assumed that the surface will be unpainted.

11.4 Anodizing

Physical vapour deposited aluminium coatings have a low abrasion resistance. To enhance abrasion and corrosion resistance, aluminium coated items may be anodized. The thickness of the physical vapour deposited aluminium coating shall be at least 20 μm , to permit anodizing in accordance with Def Stan 03-24. Thicker physical vapour deposited coatings will be required for sulphuric acid anodizing in accordance with Def Stan 03-25. If anodizing is required, items shall be treated in accordance with Def Stan 03-24, 03-25 or BS 5599, as appropriate.

NOTE Anodising substrates other than aluminium or titanium alloys may lead to damage of the substrate during processing. Care must be taken to ensure that jig points do not leave the basis metal exposed.

11.5 Organic Coatings

If specified, physical vapour deposited items shall be given an organic protective coating in accordance with the requirements of approved paint schemes.

12 Process Control

Inspection shall verify that the mandatory requirements of the clauses included in this Part of the Standard have been carried out in accordance with the agreed Process Control Schedule.

13 Inspection

All coated items shall be visually inspected for appearance. Inspection shall be carried out to ensure that:

- (a) All coated items conform to the mandatory requirements of clauses **10** and **11**. Coating shall be present in all significant areas and shall extend into holes and recesses to a distance as specified in the drawing, contract or order.
- (b) All masking material is removed. Masked areas shall be clean and free from any defect and aluminium coating. The line of demarcation between the coated and uncoated areas shall be clear cut. Lifting of the deposit at the edges shall not be acceptable.
- (c) The adhesion of the coating is satisfactory and meets the requirements of the drawing, contract or order.
- (d) The composition of the coating shall be as detailed in the Process Control Schedule.
- (e) The thickness of the coating conforms to the requirements of **Table 1** and the finished items are in accordance with the drawing, contract or order.
- (f) The corrosion resistance of aluminium coated ferrous items 'in an accelerated environment' conforms to the requirements of clause **18**.

14 Provision of Test Samples

14.1 Each batch, or lot, of the coating material shall be tested for purity.

14.2 A sample comprising 1% from each batch of coated items, but not less than two items for each test, prepared and processed together, shall be selected for coating thickness and coating adhesion tests, as specified in clauses **16** and **17**. The items shall be selected from all positions in the mounting jig. The number of items for each test shall be approximately equal.

14.3 In exceptional circumstances, such as the coating of single large items, the sampling procedure specified in **14.2** 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.

14.4 If any coated item fails a test (or tests), a further 1% sample shall be selected in accordance with **14.2** and the whole of this sample shall be subjected to the relevant test (or tests). If any part of this sample fails, the whole batch shall be rejected.

14.5 A sample comprising not less than two items, from each class of coating, shall be selected and subjected to the salt spray test as specified in clause **18**. This test shall be carried out on a monthly basis.

14.6 A number of samples shall be randomly selected and subjected to the coating composition test as specified in clause **19**. This test shall be carried out at not less than three monthly intervals.

15 Testing for Composition of Aluminium Source Material

Composition of aluminium shall be determined by using chemical or other acceptable techniques. The referee method is the mass spectrometric method. A certificate of conformity may also be deemed acceptable.

16 Thickness Testing

The thickness of the coating on the significant surface shall conform to the requirements of **Table 1**. The samples shall be tested in accordance with the following:

- a) The referee method is metallographic sectioning (see **Annex B**).
- b) The thickness of aluminium coating shall be determined by eddy current, beta back scatter, magnetic test, metallographic sectioning or any other suitable method. Where practicable, not less than six measurements shall be made at places which are widely separated and which may be expected to be comparatively thinly coated. These alternative methods shall be calibrated against the metallographic sectioning method.
- c) On fasteners or threaded items where non-destructive methods of thickness measurements in accordance with **16 (b)** are not practicable, average thickness shall be determined by the stripping and weighing method (see **Annex C**). This technique of measurement shall be calibrated against the metallographic sectioning method.

17 Adhesion

17.1 Adhesion shall meet the requirements specified in the drawing, contract or order. For example, adhesion may be determined by one of the following methods specified below.

- a) Adhesion shall be determined by scoring the surface of the coated item to expose the basis metal and examining at a minimum of 4X magnification for evidence of non-adhesion.
- b) A clean surface of the item or test panel shall be scored at 2 mm intervals in crosshatched pattern. A strip (e.g. 100 mm long by 25 mm wide) of pressure sensitive adhesive tape having a peel force for adhesion to steel of at least 3.5 N/10 mm (determined in accordance with BS EN 60454-2), shall be applied firmly to the prepared surface. After 5 minutes, it shall be removed by peeling back at 180° as rapidly as possible. This test shall be carried out at $20 \pm 5^\circ\text{C}$. There shall be no sign of separation of the coating from the surface when examined as in **17.1 (a)**.
- c) Items shall be clamped in a vice and the projecting part bent back and forth until rupture occurs. If the edge of the ruptured coating can be peeled back, or if the separation between the coating and the basis metal can be seen at the point of rupture when examined as in **10.6 (a)**, adhesion is unsatisfactory.
- d) A small area of the plated surface shall be rubbed rapidly and firmly with a suitable tool for about 15 seconds at a pressure sufficient to burnish the coating at each stroke but not to cut the deposit. The coating shall not become blistered or otherwise detached from the basis metal. A suitable tool is a steel rod of 6 mm diameter with a smooth hemispherical end.
- e) Items may be peened in accordance with **11.2**. There shall be no separation of the coating from the basis metal.

18 Salt Spray Test

Items shall be subjected to the neutral salt spray test described in BS EN ISO 9227, as specified in the drawing, contract or order and shall show no evidence of corrosion of the basis metal when exposed for the duration of the test as shown in **Table 2**.

Table 2 Duration of Salt Spray Tests for Coatings

Thickness Range	Test Duration (Hours)
-----------------	-----------------------

of Coating (μm)	Without Chromate Conversion Coating	With Chromate Conversion Coating
25 and Over	504	672
13 to < 25	336	504
8 to < 13	168	336

NOTE The results obtained in this test should not be regarded as a direct guide to the corrosion resistance of the tested coatings in all environments where these coatings may be used.

19 Testing for Composition of the Coating

Composition of the coating shall be determined by using chemical or other acceptable techniques. The referee method is the mass spectrometric method.

20 Treatment of Items Rejected During Final Inspection and Test

20.1 If the deposited aluminium coating does not meet the thickness or adhesion requirements, then the items may be coated a second time in accordance with the requirements detailed in this Part of the Standard.

20.2 If the coating is required to be stripped, the method of removal shall not damage the substrate.

20.3 If the coating is stripped by the wet process then steel items shall be baked in accordance with the Reprocessing Section of Def Stan 03-4 immediately after stripping and subsequently treated in accordance with the requirements detailed in this Part of the Standard. Items of high strength steels shall not be chemically stripped or coated more than twice.

Annex A

Corrosion Resistance of Chromate Conversion Coatings Exposed to a Salt Fog Environment

A.1 Test Requirement

The test shall be carried out in accordance with BS EN ISO 9227 on coated items. The test shall commence 24 to 36 hours after chromate filming. After exposure to the test environment for 96 hours, the items shall be removed from the test cabinet and visually examined.

A.2 Test Result

No corrosion product of the aluminium coating shall be visible on the chromate-filmed items.

Annex B

Metallographic Sectioning Method for the Determination of Local Coating Thickness

B.1 Mounting and Preparation of Sections

B.1.1 Before sectioning, the coated surface may be protected by over-plating with a harder deposit, if required (e.g. by a layer of electroless nickel). Mount the section by moulding in a suitable material so that the plated surface is perpendicular to the face which is to be prepared for examination. Care is to be taken that the section is rigidly held and that there shall be no voids between the plated surface and the mounting material.

NOTE A deviation of 10° from the perpendicular introduces an error of approximately $\pm 2\%$ in thickness.

B.1.2 Polish the mounted section, using successively finer abrasives, the last of which is not to be coarser than Grade 600 (to BS ISO 6344-1). Final polishing may be carried out on a low speed metallurgical polishing disc, using suitable polishing media.

B.1.3 It is recommended that the surfaces should be lightly etched with a suitable reagent, in order to improve the contrast between the deposit and the basis metal.

B.2 Measurement of the Thickness of the Coating

B.2.1 Measure the thickness of each coating with a metallurgical microscope fitted with a calibrated micrometer eyepiece.

B.2.2 Alternatively, project the image of the section on to the screen of a metallographic microscope at a known and properly calibrated magnification. Using a graduated linear scale, measure accurately the thickness of each coating on the projected image and determine the actual thickness of the deposited metal by dividing this measurement by the magnification.

B.2.3 In either case the magnification shall be sufficient to allow the actual thickness of deposit to be determined to $\pm 0.5 \mu\text{m}$.

Annex C

Determination of Average Thickness of Aluminium Coating

C.1 Average Thickness Determination

Weigh the clean item and then immerse it in an aqueous solution containing 10-30% w/v sodium hydroxide at room temperature with occasional stirring until the aluminium coating is dissolved (usually about 10 minutes). Remove the item, wash, dry and reweigh.

$$\text{Average aluminium thickness } (\mu\text{m}) = \frac{\text{Loss of weight (g)} \times 10^4}{\text{Area (cm}^2\text{)} \times 2.702}$$

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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.