



AEROSPACE MATERIAL SPECIFICATION

AMS03-3

Issued

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Protection of Aluminum Alloys by Sprayed Metal Coatings

RATIONALE

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FOREWORD

REVISION NOTE

This Defence Standard was raised to Issue 5 to update its content and incorporate the latest MoD/DStan policy in place at the time.

HISTORICAL RECORD

This standard supersedes the following:

Def Stan 03-3 / Issue 1 dated 28 December 1970

Def Stan 03-3 / Issue 2 dated 24 February 1995

Def Stan 03-3 / Issue 3 dated 24 May 2002

Def Stan 03-3 / Issue 4 dated 22 January 2008

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INTRODUCTION

In certain environments some high-strength aluminum alloys are more susceptible to surface corrosion, stress-corrosion or exfoliation corrosion than pure aluminum. The application of an adherent coating of pure aluminum, pure zinc, or certain alloys of these metals, will provide corrosion protection to the basis metal by exclusion of the corrosive environment and/or by sacrificial corrosion of the coating metal. The particular coating to be used shall be defined on the relevant drawing or contract but care must be taken in the choice of the most suitable coating for a particular alloy in a given set of conditions.

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1. SCOPE

This SAE Standard specifies the requirements for the application of sprayed metal coatings of aluminum, zinc, or aluminum-zinc based alloys for the protection of aluminum alloys against corrosion. It does not cover the metal spraying of aluminum armour materials, which should be treated in accordance with the requirements of Def Stan 08-39.

2. WARNING

This section which appeared in DEF STAN 03-3 Issue 5 has been deliberately deleted.

3. NORMATIVE REFERENCES

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

BS EN ISO 2063	Thermal Spraying. Metallic and Other Inorganic Coatings. Zinc, Aluminium and their Alloys
BS EN ISO 3882	Metallic and Other Inorganic Coatings. Review of Methods of Measurement of Thickness
BS EN 573-3	Aluminium and Aluminium Alloys. Chemical Composition and Form of Wrought Products. Chemical Composition and Form of Products.
BS EN 1179	Zinc and Zinc Alloys. Primary Zinc
BS EN ISO 11126-7	Preparation of Steel Substrates before Application of Paints and Related Products. Specification for Non-Metallic Blast Cleaning Abrasives. Part 7F: Fused Aluminium Oxide
Def Stan 03-2	Cleaning and Preparation of Metal Surfaces
AMS03-2	Cleaning and Preparation of Metal Surfaces
Def Stan 08-39	Cutting, Welding and Corrosion Protection of Aluminium Alloy Military Equipment.

3.2 This section which appeared in DEF STAN 03-3 Issue 5 has been deliberately deleted.

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4. DEFINITIONS

4.1 For the purposes of this part of the Standard, the following definitions apply:

4.2 PROCESS CONTROL SCHEDULE

The document which specifies/defines:

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

4.3 SIGNIFICANT SURFACE

The 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 AMS Material Specification or its superseded Defence Standard.
- b. The specification and metallurgical condition of the basis metal.
- c. The significant surface. This may be indicated on the drawing or by a marked sample.
- d. The details of the abrasive blasting process and surface roughness to be achieved.
- e. The coating process to be used.
- f. The details of any pre and post-deposition heat treatment.
- g. The thickness of the coating required and details of any other test criteria.
- h. The details and thickness of any necessary undercoat to be applied.
- i. The details of any finishing treatment required.
- j. The details of any special requirements (e.g., masking).

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, thickness of coating, significant surfaces, 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. PROCESS REQUIREMENTS

7.1 General

- 7.1.1 The protection afforded by any given coating depends to a large extent on its adhesion to the basis metal. The degree of adhesion depends on the thoroughness of preparation of the basis metal, the avoidance of delay in the subsequent application of the specified coating and the spraying technique.
- 7.1.2 The composition and structure of the deposit determines the general corrosion rate and hence the life of the coating. They are closely dependent on the metal spray process and the parameters employed. Therefore, the process and parameters must be defined and referenced in the Process Control Schedule and carefully controlled during spray deposition.

NOTE: There can be large differences in composition between the coating and the feedstock if one of the elements of the feedstock has a high vapor pressure, leading to preferential elemental loss (e.g., zinc).

7.2 Pre-Cleaning

All surfaces shall be free from solids such as soap, drawing compounds, oil, grease, machine fluid, polishing compounds, etc., discoloration or other foreign matter. All items shall be degreased prior to the commencement of a cleaning sequence, which shall be in accordance with AMS03-2/Def Stan 03-2, to produce a chemically clean surface. Drying by means of chlorinated solvents shall not be permitted.

7.3 Abrasive Blasting

7.3.1 Immediately following pre-cleaning (see 7.2) the surface shall be roughened, to provide an adequate key, by blasting with Aluminum Oxide Grit (e.g., BS EN ISO 11126-7 N/FA-A/G 0.5-1). The abraded surface shall present an even matt appearance.

NOTE: The alumina shall not have been used on any other type of material (e.g., steel, copper rich alloys or otherwise externally contaminated).

7.3.2 Care shall be taken to avoid using abrasives which are insufficiently coarse or which have lost angularity with use in re-circulating blast cabinets. The coarseness and angularity of the abrasive used have a great effect on the adhesion of the coating. Direct pressure blasting methods shall be used (with a maximum pressure limitation of 3.5 bar to avoid excessive breakdown of alumina) except in the case of thin sections.

NOTE: Direct pressure blasting is preferable to suction blasting because of the slowness and poor roughening characteristics of the latter.

7.3.3 Immediately following the abrasive blasting, residual grit shall be removed from the metal surface by a jet of clean, dry air which shall be free from oil and dust.

7.3.4 Items which have been abraded shall be handled with clean rubber, cotton or smooth plastic gloves only. All contamination with dust, dirt, oil, grease, and water shall be avoided.

7.3.5 Operations may sometimes have to be carried out on local areas only. In such cases suitable masking will be necessary. For abrasive blasting, the masking shall consist of metal shields, plugs, cloth or strong paper tapes, or any other suitable material which affords protection from the abrasive blasting. Care should be taken in the choice of masking materials for local areas, so that the removal of masks is not impeded by over-spray.

7.3.6 The abraded surface will be in a very active state and any deterioration will very readily affect the performance of the sprayed metal coating. Metal spraying, therefore, shall be applied as soon as possible after abrasive blasting and before visible deterioration of the surface has occurred. Under good workshop conditions an interval of 4 hours shall not be exceeded and under on-site conditions spraying shall follow abrasive blasting within a few minutes. In the event of contamination, the surface shall be re-prepared as necessary.

7.4 Coating Materials

The metals used for coating shall conform to the compositional requirements detailed below. Additionally every precaution must be taken to prevent their contamination prior to and during processing. In particular the re-use of metal powders is prohibited. The coating metal to be applied shall be in the form of wire or powder appropriate to the particular spraying apparatus employed and shall normally be chosen from the following grades:

7.4.1 Aluminum

7.4.1.1 Grade ALG

The chemical composition of the coating metal shall be in accordance with the requirements of BS EN 573-3, EN AW 1050A (99.5% aluminum).

7.4.1.2 Grade ALS

This grade is suitable for more severe service conditions than grade ALG (e.g., for the protection of high-strength alloys against stress-corrosion when stressed in the short transverse direction). The chemical composition of the coating metal shall be in accordance with the requirements of BS EN 573-3, EN AW 1080A, but the copper impurity level shall be limited to 0.01% max.