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Aerospace series — Aluminium pigmented coatings — Coating methods

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National foreword

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European foreword

This document (EN 4474:2016) has been prepared by the Aerospace and Defence Industries Association of Europe - Standardization (ASD-STAN).

After enquiries and votes carried out in accordance with the rules of this Association, this Standard has received the approval of the National Associations and the Official Services of the member countries of ASD, prior to its presentation to CEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2017, and conflicting national standards shall be withdrawn at the latest by January 2017.

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1 Scope

This European Standard defines the coating methods and characteristics of aluminium pigmented coatings to EN 4473 which may be applied to fasteners in titanium, titanium alloys, heat resisting nickel base or cobalt base alloys and corrosion resisting steels.

2 Purpose of process

To reduce galvanic corrosion, friction and risk of seizing.

3 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 2516, *Aerospace series — Passivation of corrosion resisting steels and decontamination of nickel base alloys*

EN 3032, *Aerospace series — Test method for dry film lubricants — Thickness measurement*

EN 4473, *Aerospace series — Aluminium pigmented coatings — Technical specification*

EN 9100, *Quality Management Systems — Requirements for Aviation, Space and Defence Organizations*

EN ISO 1463, *Metallic and oxide coatings — Measurement of coating thickness — Microscopical method*

EN ISO 2409, *Paints and varnishes — Cross-cut test*

EN ISO 2431, *Paints and varnishes — Determination of flow time by use of flow cups*

EN ISO 2884-1, *Paints and varnishes — Determination of viscosity using rotary viscometers — Part 1: Cone-and-plate viscometer operated at a high rate of shear*

ISO 2859-1, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 8080, *Aerospace — Anodic treatment of titanium and titanium alloys — Sulphuric acid process*

4 Terms and definitions

For the purposes of this standard, the following terms and definitions apply.

4.1
batch
parts subjected to the same aluminium pigmented coating application at the same time under the same condition

4.2
pre-production parts
parts representing future production parts

4.3
definition document
document specifying directly or indirectly all the requirements for the parts

4.4
scratch
gouged out or scoring of metallic coating

4.5
run
localized excess amount of coating to the extent of creating a drip or running of coating

4.6
indentation
indent or uneven surface thickness (orange peel)

4.7
flaking
particles of coating falling off due to poor adhesion or excess coating

4.8
crack
separation of coating due to improper mix or poor adhesion of material

4.9
sampling plan
plan according to which one or more samples are taken in order to obtain information and to reach a decision, if possibly

4.10
Acceptable Quality Limit (AQL)
maximum percent defective (or the maximum number of defects per hundred units) that, for purposes of sampling inspection, can be considered satisfactory as a process average

Note 1 to entry: Variant: quality level which in a sampling plan corresponds to a specified but relatively high probability of acceptance.

5 Apparatus

5.1 For application by dipping

Container with a lid, stirring device and temperature control.

The apparatus shall be capable of applying the specified thickness, for example by controlling the speed of immersion and removal and by draining or centrifuging the parts.

5.2 For application by spraying

A dry, oil free air fed gun shall be used, with settings adapted to the characteristics of the aluminium pigmented coating used and to the shape of the parts to be coated.

Preferably a mechanical stirring device in the reservoir.

NOTE 1 A device allowing for rotation of the parts to be coated and the automatic displacement of the gun will give a more uniform application.

NOTE 2 Use of an aerosol spray is not suitable as it does not always ensure acceptable reproducibility.

5.3 For curing

An oven capable of curing temperatures prescribed by the coating manufacturer and controlled by periodical calibration.

6 Information for the processor

The following information is to be given:

— designation of the aluminium pigmented coating to EN 4473;

— percentage of solvent plus reference of the solvent product;

— number of the material standard and metallurgical condition of the latter;

— areas to be processed;

— thickness of the pigmented coating, if necessary, (see Table 1);

— duration and temperature of curing.

7 Surface roughness of parts prior to application

It shall be specified on the drawing or in the definition documents.

NOTE The surface roughness is an important factor affecting adhesion and behaviour of the coating in service.

8 Surface preparation

8.1 Parts in titanium and titanium alloys

Unless otherwise specified, degreasing followed by abrasive blasting.

8.2 Parts in corrosion resisting steel

Unless otherwise specified, or degreasing followed by abrasive blasting.

9 Coating

9.1 General

It is recommended to apply the coating:

— if possible within 24 h, after surface preparation ; precautions shall be taken to prevent contamination or corrosion of the parts awaiting treatment;

— in a clean and dry environment, avoiding any operations liable to contaminate the surfaces to be treated.

9.2 Application by dipping

Dipping can be performed as follows:

— adjust the viscosity of the solution (see EN ISO 2431 or EN ISO 2884-1) to the value given by the manufacturer of the product to be deposited;

— if necessary, pre-heat the parts to about 50 °C;

— immerse the parts at a speed determined by tests on pre-production parts;

— keep the parts immersed for 2 s to 10 s;

— remove the parts at a speed determined by tests on pre-production parts;

— drain parts;

— dry parts avoiding handling them;

— if necessary, cure the coating in an oven. The temperature and duration shall comply with the values given by the manufacturer of the product used.

9.3 Application by spraying

Spaying can be performed as follows:

— adjust the viscosity of the solution (see ISO 2431 or ISO 2884-1) to the value given by the manufacturer;

— if necessary, pre-heat the parts to approx. 50 °C;

— produce the coating by applying successive passes, the gun setting and its distance being determined by tests on pre-production parts;

— dry parts avoiding handling them;

— if necessary, cure the coating in an oven. The temperature and duration shall comply with the values given by the manufacturer of the product to be used.

9.4 Other applications

Other application methods producing the same quality of deposit may be used (for example: barrel deposition).

10 Post-treatment

If the tolerances of the parts necessitate mechanical finishing, it shall be performed by honing, burnishing, barrel finishing or manual brushing according to the size of parts or the batch size.

11 Removal of the coating

The following processes are generally used separately or as a combination:

— removal by dry or wet abrasive blasting with appropriate media;

— chemical removal (by pickling or solvents) using products well known for being compatible with the base metal.

Following removal of the coating, the parts shall be subjected to a visual and dimensional inspection.

12 Characteristics, requirements and test methods

See Table 1.

Table 1

Subclause	Characteristic	Requirement [a]	Inspection and test method
12.1	Appearance	Uniform colour, a variation of this indicates incorrect distribution of the fillers in the coating. Absence of defects such as: scratches, pits, blisters, runs, indentations, foreign bodies, accumulation of particles, lack of uniformity or any other surface imperfection.	Visual inspection
12.2	Thickness	Unless otherwise specified: — 5 µm to 13 µm on externally threaded fasteners; — 5 µm to 20 µm on internally threaded fasteners.	Suitable method Qualification: EN ISO 1463 Acceptance: EN 3032 or with the purchaser's agreement, a method based on measurement of the mass of the dry coating deposited In the case of dispute, EN ISO 1463 shall be applied.
12.3	Adhesion	No flaking, blisters, cracks: EN ISO 2409, class 1 or less	EN ISO 2409
12.4	Curing verification	The coating shall not be damaged by a brief contact with a solvent. There shall be no evidence of deposit on the pad.	Move three times back and forward with a pad of cotton-wool impregnated with a solvent (for example methyl-ethyl-ketone).

[a] On parts, if not possible, on accompanying test pieces.

13 Quality assurance

13.1 Approval of the processor

See EN 9100.

13.2 Process approval

Before beginning production, the processor shall apply the coating on pre-production parts and/or test pieces as agreed between the purchaser and processor. All the tests required by this standard (see Clause 12) shall be carried out on these coated pre-production parts and/or test pieces, unless otherwise agreed between the purchaser and processor.

If the test results are satisfactory for the purchaser, he shall give his written approval to commence production.

The process schedule shall not be changed thereafter without the prior agreement of the purchaser.

14 Acceptance

14.1 Appearance and thickness

See Table 1.

Unless otherwise specified, sampling in accordance with ISO 2859-1:

— sample size code letter, Table 1, special inspection level S3;

— simple sampling plan for normal inspection;

— Acceptance Quality Limit (AQL) 1,5.

14.2 Adhesion

See Table 1.

The inspection level, the sampling plan and the acceptance quality level according to ISO 2859-1 shall be defined by the purchaser.

14.3 Curing verification

See Table 1.

The inspection level, the sampling plan and the acceptance quality level according to ISO 2859-1 shall be defined by the purchaser.

15 Re-coating

After agreement of the user, the coated parts not meeting the requirements may be reprocessed. The coating not meeting the requirements shall be removed by the appropriate methods maintaining the diameter tolerance before protection (see Clause 11).

Annex A
(informative)
Standard evolution form

The main changes with respect to the previous editions are listed in Table A.1.

Table A.1 — Main changes to previous editions

prEN/EN Number	Edition	Publication Date	Modification	Reason and validation
prEN 4474	P2	10/2014	§ 8.1: removed anodization per ISO 8080	Poor adhesion of aluminium pigmented coating on anodised titanium
			§ 9.1 a): "within 24 h after surface preparation" replaced by "if possible within 24 h after surface preparation"	24 h between surface preparation and coating application is recommended but not mandatory. If parts are stored in dry and clean environment, this time can be longer without affecting coating quality.
			§ 9.1 b): removed requirements for humidity and temperature	Humidity and temperature requirements of previous version are not achievable in regular application shop and are not influential parameters on coating application quality.
			§ 12.3: added 5 µm to 20 µm on internally threaded fasteners.	In order to be consistent with EN 4473 related requirements

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