BS EN 4476:2011

BSI Standards Publication

Aerospace series — Paints and varnishes — Cold curing intermediate coat

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National foreword

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A list of organizations represented on this committee can be obtained on request to its secretary.

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Luft- und Raumfahrt - Beschichtungsstoffe - Zwischenbeschichtung, kalthärtend

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Contents

Foreword

This document (EN 4476:2011) 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of an identical text or by endorsement, at the latest by November 2011, and conflicting national standards shall be withdrawn at the latest by November 2011.

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Introduction

This European Standard has been prepared in accordance with AECMA TR 7000-9.

1 Scope

This European Standard specifies the requirements for a two component polyurethane, topcoat, with a medium degree of resistance to erosion by the effects of rain, available in a range of colours and levels of gloss, to be applied over a primer for aerospace applications on areas where rain erosion at subsonic speeds may be a problem, e.g. leading edges and air intakes.

The properties specified in this European Standard are obtained on defined aluminium alloy test pieces prepared in accordance with EN 3837 Procedure A and EN 23270 and painted with primer to EN 2435-001 and -002. The ability of the material to be used for a specific application (e.g. alternative substrate, alternative primer, specific drying conditions, etc.) should be determined by supplementary tests to confirm that the requirements of this European Standard are met.

2 Normative references

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

EN 2334, *Aerospace series — Chromic-sulphuric acid pickle of aluminium and aluminium alloys*

EN 2379, *Aerospace series — Fluids for assessment of non-metallic materials*[1]

EN 2434-004, *Aerospace series — Paints and varnishes — Two component cold curing polyurethane finish — Part 004: High flexibility*

EN 2435-002, *Aerospace series — Paints and varnishes — Corrosion resistant chromated two component cold curing primer — Part 002: High corrosion resistance*

EN 3696, *Aerospace series — Washers in heat resisting steel*

EN 3837, *Aerospace series — Paints and varnishes — Nature and method for surface preparation of test pieces in aluminium alloys*[1)]

EN 3840, *Aerospace series — Paints and varnishes — Technical specification*

EN 4160, *Aerospace series — Paints and varnishes — Determination of the effect of thermal exposure*

EN 23270, *Paints and varnishes and their raw materials — Temperatures and humidities for conditioning and testing (ISO 3270:1984)*

EN ISO 1513, *Paints and varnishes — Examination and preparation of test samples (ISO 1513:2010)*

EN ISO 1518, *Paints and varnishes — Scratch test (ISO 1518:1992)*

EN ISO 1520, *Paints and varnishes — Cupping test (ISO 1520:2006)*

EN ISO 2409, *Paints and varnishes — Cross-cut test (ISO 2409:2007)*

EN ISO 2431, *Paints and varnishes — Determination of flow time by use of flow cups (ISO 2431:1993, including Technical Corrigendum 1:1994)*

EN ISO 2811 (all parts), *Paints and varnishes — Determination of density (ISO 2811 series)*

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[1] In preparation at the date of publication of this European Standard.

EN ISO 2813, *Paints and varnishes — Determination of specular gloss of non-metallic paint films at 20°, 60° and 85° (ISO 2813:1994, including Technical Corrigendum 1:1997)*

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 2884-1:1999)*

EN ISO 3251, *Paints, varnishes and plastics — Determination of non-volatile-matter content (ISO 3251:2008)*

EN ISO 3675, *Crude petroleum and liquid petroleum products — Laboratory determination of density — Hydrometer method (ISO 3675:1998)*

EN ISO 3679, *Determination of flash point — Rapid equilibrium closed cup method (ISO 3679:2004)*

EN ISO 3680, *Determination of flash/no flash — Rapid equilibrium closed cup method (ISO 3680:2004)*

EN ISO 6272-1, *Paints and varnishes — Rapid-deformation (impact resistance) tests — Part 1: Falling-weight test, large-area indenter (ISO 6272-1:2002)*

EN ISO 9117-1, *Paints and varnishes — Drying tests — Part 1: Determination of through-dry state and through-dry time (ISO 9117-1:2009)*

EN ISO 9117-3, *Paints and varnishes — Drying tests — Part 3: Surface-drying test using ballotini (ISO 9117-3:2010)*

EN ISO 9514, *Paints and varnishes — Determination of the pot life of multicomponent coating systems — Preparation and conditioning of samples and guidelines for testing (ISO 9514:2005)*

EN ISO 11507, *Paints and varnishes — Exposure of coatings to artificial weathering — Exposure to fluorescent UV lamps and water (ISO 11507:2007)*

EN ISO 11890-1, *Paints and varnishes — Determination of volatile organic compound (VOC) content — Part 1: Difference method (ISO 11890-1:2007)*

ISO 3847, *Liquid flow measurement in open channels by weirs and flumes — End-depth method for estimation of flow in rectangular channels with a free overfall*

ISO 7724 (all parts), *Paints and varnishes — Colorimetry*

3 Terms and definitions

For the purposes of this document gloss finish is defined as ≥ 80 units measured at 60° according to EN 3840 test 27.

4 Classification

Not applicable.

5 Batch release and qualification testing

5.1 Batch release testing

For batch acceptance the tests marked with an * shall be performed.

5.2 Qualification tests

For product qualification, all tests mentioned in this European Standard, in Table 1 to Table 4, shall be performed.

Table 1 — General requirements

Characteristic number	Characteristic	Requirements			
1.001	Material description	Single or two component cold curing intermediate coat			
1.002	Formulation	Not restricted Thinner — if required			
1.003	Preparation	If more than one component these components shall be mixed in simple whole number proportions, by volume or by mass, in accordance with the manufacturer's instructions			
1.004	Technical specification	See EN 3840			
1.007	Visual colour	See EN 3840			
1.008	Freedom from defects	See EN ISO 1513			
1.009	Application and use	Dry film thickness of (15 ± 5) µm unless otherwise specified.			
1.010	Storage stability	See EN 3840			
1.011	Shelf life	See EN 3840			
1.013	Drying conditions	EN 23270 for seven days before testing unless otherwise specified. Intermediate coat is applied to the primer and the finish to the intermediate coat following drying for 4 h to 16 h unless otherwise specified.			
1.093	Quality assurance	See EN 3840			
1.094	Designation	Intermediate Coat EN 4476			
1.095	Packaging	See EN 3840			
1.096	Identification marking	See EN 3840			
1.097	Flash point	EN 3840			
		Test 7 EN ISO 3679 or EN ISO 3680			
			base	activator[f]	thinner[f]
		°C	≥ reference value[c]	≥ reference value[c]	≥ reference value[c]
1.098	Health and safety	See EN 3840			
1.999	Notes	[f] Test only if component is present. [c] The reference value is that established during qualification.			

Table 2 — Physical and chemical characteristics

Characteristic number	Characteristic	Requirements				
2.008	Condition	1	EN ISO 1513			
		6	As received in original container			
	*	7	Shall be free from extraneous matter and show no skinning, gelling, hard settlement or other defect which will prevent satisfactory application to produce a defect free film			
		1	None			
		3	EN 3837 — A_2	2024-T3 clad		
		4	EN 3837 — Process A or B or C	EN 2334 Pickle or CAA or CCC		
		5	EN 2435 Primer + Intermediate coat to this European Standard			
	*	7	Liquid paint shall result in an opaque even finish, free from runs, sags, wrinkling, pinholing or other defect			
2.113	Sedimentation rating	–	EN 3840			
		1	Test 5 ISO 3847			
		6	base + activator[f] + thinner[f]			
		7	ml	V = ≤ 30 after 4 h		
2.106	Reactivity Pot life	–	EN 3840			
		1	Test 20 EN ISO 9514 followed by Test 8[a] EN ISO 2431 or Test 9[a] EN ISO 2884-1			
		6	base + activator[f] + thinner[f]			
	*	7	s or Pa s	≤ 2 × initial value after 4 h		
2.107	Viscosity	–	EN 3840			
		1	Test 8 EN ISO 2431[a] or Test 9 EN ISO 2884-1[a]			
		6	base + activator[f] + thinner[f]			
		7	s or Pa s	± 10 %[b, c]		
2.104	Composition — Non volatile matter	–	EN 3840			
		1	Test 1 EN ISO 3251			
		7		base	Activator[f]	
		–	%	± 2[b, c]	± 2[b, c]	
2.104	Composition — Volatile organic compound (VOC) content	–	EN 3840			
		1	Test 49 EN ISO 11890-1			
		6	base + activator [f] + thinner [f]			
		7	g/l	≤ reference value [b c]		
2.301	Density	–	EN 3840			
		7		base	activator[f]	thinner[f]
		1		Test 3[e] EN ISO 2811	Test 4 EN ISO 3675	Test 4 EN ISO 3675
	*	7	of ref. value	± 2[b, c]	± 2[b, c]	± 2[b, c]

(*continued*)

Table 2 (*continued*)

Characteristic number	Characteristic	Requirements			
2.106	Reactivity — surface dry — through-dry	–	EN 3840		
		1		Test 21 EN ISO 9117-3	Test 23 EN ISO 9117-1 Mass = 1 500 g
		3	EN 3837 — A_2	2024-T3 clad	
		4	EN 3837 Process A or B or C EN 2334 Pickle or CAA or CCC		
		5	EN 2435 primer + Intermediate coat to this European Standard		
		6	EN 23270		
		7	h	≤ 1[d]	≤ 6[d]
2.111	Optical properties colour *	–	EN 3840		
		1	Test 30 ISO 7724		
		3	EN 3837 — A_2	2024-T3 clad	
		4	EN 3837 Process A or B or C	EN 2334 Pickle or CAA or CCC	
		5	EN 2435-002 primer + Intermediate coat to this European Standard		
		6	EN 23270		
		7	ΔE	shall match the colour specified	
2.111	Optical properties gloss 60° *	–	EN 3840		
		1	Test 27 EN ISO 2813		
		3	EN 3837 — A_2	2024-T3 clad	
		4	EN 3837 Process A or B or C	EN 2334 Pickle or CAA or CCC	
		5	EN 2435-002 primer + Intermediate coat to this European Standard + Finish EN 2434-004		
		6	EN 23270		
		7	Gloss units	shall match the gloss specified	
2.999	Notes	[a] Test 8 shall be used for non-thixotropic paints and test 9 for thixotropic paints. [b] The deviation is that compared to the reference value. [c] The reference value is that established during qualification. [d] Unless otherwise specified. [e] Test could also be used for activator and thinner if required. [f] Test only if component is present.			

Table 3 — Mechanical characteristics

Characteristic number	Characteristic	Requirements		
3.304	Adhesion	–	EN 3840	
		1	Test 24 EN ISO 2409	
		3	EN 3837 — A_2	2024-T3 clad
		4	EN 3837 Process A	EN 2334 Pickle
		5	EN 2435-002 Primer + Intermediate coat to this European Standard + Finish EN 2434-004	
		6	EN 23270	
		7	Classification ≤ 1	
3.304	Scratch resistance	–	EN 3840	
		1	Test 29 EN ISO 1518	
		3	EN 3837 — A_2	2024-T3 clad
		4	EN 3837 Process A or B or C [a]	EN 2334 Pickle or CAA & CCC
		5	EN 2435-002 Primer + Intermediate coat to this European Standard + Finish EN 2434-004	
		6	EN 23270	
	*	7	≥ 1 500 g primer not exposed	
3.317	Impact resistance	–	EN 3840	
		1	Test 26 EN ISO 6272-1 — 3,8 mm spacing	
		3	EN 3837 — A_2	2024-T3 clad
		4	EN 3837 Process A	EN 2334 Pickle
		5	EN 2435-002 Primer + Intermediate coat to this European Standard + Finish EN 2434-004	
		6	EN 23270	
	*	7	no detachment or cracking	
3.321	Bend test — Slow deformation	–	EN 3840	
		1	Test 46 EN ISO 1520	
		3	EN 3837 Process A	EN 2334 Pickle
		4	EN 3837 Process A	EN 2334 Pickle
		5	EN 2435-002 Primer + Intermediate coat to this European Standard + Finish EN 2434-004	
		6	EN 23270	
	*	7	≥ 4 mm no detachment or cracking	
3.999	Notes	[a] Velocity 223 m/s, artificial rain 25 mm/h, impact angle 90°, drop diameter 2 mm.		

Table 4 — Environmental characteristics

Characteristic number	Characteristic	Requirements		
4.503	Heat	–	EN 3840	
		1	Test 38 EN 4160	
		3	EN 3837 — A_2	2024-T3 clad
		4	EN 3837 Process A	EN 2334 Pickle
		5	EN 2435-002 Primer + Intermediate coat to this European Standard + Finish EN 2434-004	
		6	150 °C 24 h	
	*	7	Test 46 ≥ 4 mm (EN 23270)	
4.503	Cold	–	EN 3840	
		1	Test 38 EN 4160	
		3	EN 3837 — A_2	2024-T3 clad
		4	EN 3837 Process A	EN 2334 Pickle
		5	EN 2435-002 Primer + Intermediate coat to this European Standard + Finish EN 2434-004	
		6	– 40 °C 24 h	
	*	7	Test 46 ≥ 4 mm (EN 23270)	
4.501	Resistance to fluids[a]	–	EN 3840	
		1	Test 35	
		3	EN 3837 — A_2	2024-T3 clad
		4	EN 3837 Process A	EN 2334 Pickle
		5	EN 2435-002 Primer + Intermediate coat to this European Standard + Finish EN 2434-004, panel scribed to substrate immediately before testing	
		6	A	tri-n-butyl phosphate to EN 2379 G2 for 168 h (EN 23270)[a]
			B	tri-n-butyl phosphate to EN 2379 G2 for 168 h at (70 ± 2) °C[a]
	*	7	No blistering, softening, lifting or other film defect Test 29 ≥ 1 000 g primer not exposed	
4.515	Water behaviour	–	EN 3840	
		1	Test 34	
		3	EN 3837 — A_2	2024-T3 clad
		4	EN 3837 Process A	EN 2334 Pickle
		5	EN 2435-002 Primer + Intermediate coat to this European Standard + Finish EN 2434–004, panel scribed to substrate immediately before testing	
		6	Water to EN 3696 Grade 2 for 168 h at (40 ± 2) °C	
	*	7	No blistering, softening, lifting or other film defect Test 24 Classification ≤ 1 Test 29 ≥ 1 500 g primer not exposed	

(*continued*)

Table 4 (*continued*)

Characteristic number	Characteristic		Requirements	
4.508	Artificial weathering	–	EN 3840	
		1	Test 40 EN ISO 11507	
		3	EN 3837 — A_2	2024-T3 clad
		4	EN 3837 Process A or B or C EN 2334 Pickle or CAA or CCC	
		5	EN 2435-002 Primer + Intermediate coat to this European Standard + Finish EN 2434-004	
		6	UVB 313, light 4 h humidity 4 h for 500 h	
	*	7	Test 27 ≤ 20 % reduction from initial value Test 30 ΔE ≤ 2 units	
4.501	Selective removal of finish	1	Annex A	
		3	EN 3837 — A_2	2024-T3 clad
		4	EN 3837 Process A or B or C EN 2334 Pickle or CAA or CCC	
		5	EN 2435-002 Primer + Intermediate coat to this European Standard + Finish EN 2434-004	
		6	96 h at (70 ± 2) °C	
	*	7	h	≤ 2 Finish or finish and intermediate coat shall be removable without permanent damage to remaining coating.
4.009	Scheme restoration	–	EN 3840	
		1	Annex B	
		5	Panel after selective removal as above and restore the scheme in accordance with manufacturer's instructions.	
		6	Test 24	Test 34
		–		Water to EN 3696 Grade 2 for 168 h at (40 ± 2) °C
		7	Classification ≤ 1	No blistering, softening, lifting or other film defect Test 24 Classification ≤ 1 Test 29 ≥ 1 500 g primer not exposed
4.999	Notes	[a]	Additional fluids shall be subject of agreement between the manufacturer and the user.	

6 Designation

EXAMPLE

Description block	Identity block
INTERMEDIATE COAT	**EN 4476**

Number of this European Standard

Annex A
(normative)

Method for the determination of ability to selectively remove the finish

A.1 Prepare test panels in accordance with Table 1 and age in accordance with Table 4 test 4.501 (Selective removal of finish).

A.2 With the panel held horizontally evenly apply reference paint remover conforming to Annex C, by means of a brush, at a coverage of approximately 300 g/m^2. Leave surfaces up to approximately 20 mm from the panel edges uncoated. Determine the time required to degrade the adhesion of the finish to a condition that permits its removal with a polystyrene scraper. Remove the degraded material and clean remaining paint film in accordance with the manufacturer's instructions.

A.3 If required, apply one additional coat of stripper not less than 1 h after the first, and repeat the removal procedure specified in A.2.

A.4 Allow the panel to stand horizontally for 15 min with free air access, but not exposed to draughts. Wash the face of the panel under tap water not exceeding 25 °C, swabbing the surface gently with clean cotton wool. After 24 h, examine remaining film of primer or primer and intermediate coat for effectiveness of removal of the finish and any indications of degradation following a recovery period of 24 h.

Annex B
(normative)

Method for the determination of ability to restore the paint system after removal

After panels have been stripped and cleaned in accordance with A.2, restore the system on the panels in accordance with the manufacturer's instructions.

Annex C
(normative)

Composition of reference paint remover

Ingredient	Proportion by mass % (m/m)
Benzyl alcohol	37
Thickener	2 (approx.)
Wetting agent	1 (approx.)
Water	60 (approx.)

Bibliography

EN 2435-001, *Aerospace series — Paints and varnishes — Corrosion resistant chromated two component cold curing primer — Part 001: Minimum requirements*

EN 3847, *Aerospace series — Paints and varnishes — Determination of sedimentation rating*

AECMA TR 7000-9, *Aerospace series — Non-metallic materials; Rules for the drafting and presentation of material standards — Part 9: Paints and varnishes*

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