BS EN 4689:2012

BSI Standards Publication

Aerospace series — Paints and varnishes — Two components cold curing polyurethane finish — High flexibility and chemical agent resistance for military application

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National foreword

This British Standard is the UK implementation of EN 4689:2012.

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

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Foreword

This document (EN 4689:2012) 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of an identical text or by endorsement, at the latest by September 2012, and conflicting national standards shall be withdrawn at the latest by September 2012.

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Introduction

The requirements concerning fibre reinforced composite substrates are established in Clause 7.

1 Scope

This European Standard specifies the requirements for a two components flexible polyurethane top coat to be applied over EN 4687 and/or EN 4688 primers mainly for exterior aerospace applications.

The primer and the finish tested to this specification will be from the same manufacturer applied in accordance with (i.a.w.) their instruction / Table 1.

2 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 2101, *Aerospace series — Chromic acid anodizing of aluminium and wrought aluminium alloys*

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

EN 2437, *Aerospace series — Chromate conversion coatings (yellow) for aluminium and aluminium alloys*

EN 2436-006, *Aerospace series — Paints and varnishes — Corrosion resistant chromate-free two component cold curing epoxy primer — Part 006: High corrosion resistance for military application*

EN 3212, *Aerospace series — Paints and varnishes — Corrosion test by alternate immersion in a buffered sodium chloride solution*

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 3847, *Aerospace series — Paints and varnishes — Determination of sedimentation rating* [1)]

EN 4160, *Aerospace series — Non-metallic materials — Paints and varnishes — Test methods — Determination of the effect of thermal exposure* [1)]

EN 4687, *Aerospace series — Paints and varnishes — Chromate free non corrosion inhibiting two components cold curing primer for military application*

EN 4688, *Aerospace series — Paints and varnishes — Corrosion inhibiting two components cold curing primer for military application*

EN 6042, *Aerospace series — Organic compounds — Test method — Analysis by infrared spectroscopy* [1)]

EN ISO 1513, *Paints and varnishes — Examination and preparation of test samples*

1) Published as ASD-STAN Prestandard at the date of publication of this standard (www.asd-stan.org).

EN ISO 1518, *Paints and varnishes — Scratch test*

EN ISO 1519, *Paints and varnishes — Bend test (cylindrical mandrel)*

EN ISO 1520, *Paints and varnishes — Cupping test*

EN ISO 1524, *Paints, varnishes and printing inks — Determination of fineness of grind*

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 2811-1, *Paints and varnishes — Determination of density — Part 1: Pyknometer method*

EN ISO 2811-2, *Paints and varnishes — Determination of density — Part 2: Immersed body (plummet) method*

EN ISO 2811-3, *Paints and varnishes — Determination of density — Part 3: Oscillation method*

EN ISO 2811-4, *Paints and varnishes — Determination of density — Part 4: Pressure cup method*

EN ISO 2812-1, *Paints and varnishes — Determination of resistance to liquids — Part 1: Immersion in liquids other than water*

EN ISO 2812-2, *Paints and varnishes — Determination of resistance to liquids — Part 2: Water immersion method*

EN ISO 2813, *Paints and varnishes — Determination of specular gloss of non-metallic paint films at 20°, 60° and 85°*

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

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

EN ISO 3678, *Paints and varnishes — Print-free test*

EN ISO 3679, *Determination of flash point — Rapid equilibrium closed cup method*

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

EN ISO 4628-2, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 2: Assessment of degree of blistering*

EN ISO 4628-8, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 8: Assessment of degree of delamination and corrosion around a scribe*

EN ISO 6270-1, *Paints and varnishes — Determination of resistance to humidity — Part 1: Continuous condensation*

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

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

EN ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests*

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

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

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

EN ISO 11909, *Binders for paints and varnishes — Polyisocyanate resins — General methods of test*

ISO 7724-1, *Paints and varnishes — Colorimetry — Part 1: Principles*

ISO 7724-2, *Paints and varnishes — Colorimetry — Part 2: Colour measurement*

ISO 7724-3, *Paints and varnishes — Colorimetry — Part 3: Calculation of colour differences*

MIL-PRF-5606H, *Performance specification: Hydraulic fluid, petroleum base; aircraft, missile, and ordnance. (NATO H-515)* [2)]

MIL-PRF-6081D, *Performance specification: Lubricating oil, jet engine. (NATO O-133)* [2)]

MIL-PRF-23699F, *Performance specification: Lubricating oil, aircraft turbine engine, synthetic base, NATO code number O-156* [2)]

MIL-DTL-83133G, *Detail specification: Turbine fuel, aviation, kerosene type, JP-8 (NATO F-34), NATO F-35, and JP-8+100 (NATO F-37)* [2)]

AMS 1526B, *Cleaner for aircraft exterior surfaces water-miscible, pressure- spraying type* [3)]

AMS 1527B, *Cleaner for aircraft exterior surfaces water-miscible, foam-on, pressure-spraying* [3)]

AMS 1533A, *Cleaner for exterior aircraft surfaces gel-type, solvent-base* [3)]

DEF STAN 68-10, *Corrosion Preventive, Water Displacing NATO Code: C-634 Joint Service Designation: PX-24*

STANAG 4477, *Specification for Paints and Paint Systems, Resistant to Chemical Agents and Decontaminants, for the Protection of Aerospace Military Equipment* [4)]

BS 1595-1:1986, *Propan-2-ol (isopropyl alcohol) for industrial use — Part 1: Specification for propan-2-ol (isopropyl alcohol).*

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2) Published by: DoD National (US) MIL. Department of Defense http://www.defenselink.mil/

3) Published by: SAE National (US) Society of Automotive Engineers http://www.sae.org/.

4) Published by: NATO EU MIL. - National (US) Mil. North Atlantic Treaty Organization http://www.nato.int/docu/standar d.htm.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 3840 apply.

4 Surface pretreatments

In accordance with EN 3837, the surface pretreatments applicable to aluminium alloy test panels are the following:

EN 3837 — Procedure A : Sulfochromic pickling in accordance with EN 2334;

EN 3837 — Procedure B : Chromate acid anodizing in accordance with EN 2101;

EN 3837 — Procedure C : Chromate conversion coating in accordance with EN 2437.

5 Classification

The top coat is classified according to the following types:

TYPE I: Standard solvent content (≤ 680 g/l);

TYPE II: Low volatile organic content (≤ 420 g/l);

TYPE III: Waterborne (≤ 350 g/l).

6 Batch release and qualification testing

6.1 General

The general requirements for qualification and batch release testing shall be in accordance with EN 3840. A minimum of three batches shall be tested for qualification purposes.

6.2 Qualification tests

For product qualification, all tests defined in this standard, in the Tables 2 to 10, shall be performed.

The test work to be undertaken for product qualification shall be in accordance with this specification.

In addition, the requirements for qualification of coatings in specific colours/gloss levels, shall be as defined in EN 3840.

6.3 Batch release testing

The Manufacturer shall give evidence on the Test Report or the Certificate of Conformance that all the tests marked with the symbol * in this specification shall be performed for batch acceptance tests.

6.4 Compatibility of waterborne paints to solvent borne paints

The waterborne top coat type III according to this specification shall be compatible to all primers qualified to EN 4687 and EN 4688. All tests to demonstrate the compatibility is defined in Tables 8 to 10 shall be performed.

Table 1 — General requirements

	Material description	Two components cold curing polyurethane top coat
	Formulation	Base: hydroxyl functional polyester or acrylic resins Activator: a polyisocyanate activator solution Thinner: if required
	Preparation	These components shall be mixed in simple whole number proportions, by volume or weight, in accordance with the manufacturers's instructions.
	Technical specification	EN 3840
	Marking	EN 3840
	Storage stability	EN 3840
	Application and use	Dry film thickness of (50 ± 5) µm (with primer SP-J-513-A-0013 or SP-J-513-A-0016 (25 ± 5) µm will be 65 µm to 85 µm)
	Drying conditions	(23 ± 2) °C / (50 ± 5) % RH for 7 (seven) days before testing. Finish is applied to the primer (EN 4687 or EN 2436-006) following drying up the primer for 4 (four) hours to 6 (six) hours as specified.
	Quality assurance	EN 3840
	Designation	Flexible polyurethane top coat
	Packaging	EN 3840
	Health and safety	EN 3840

Table 2 — Physical and chemical characteristics – Delivery conditions

Tests according to EN 3840	Test	Test criteria	Test requirements			
— *	Condition	Test method	EN ISO 1513 (As received in original container)			
		Requirements	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. The base material and curing agent shall each be in a condition such that stirring easily produces a smooth, uniform material which, after mixing in the proportion specified by the manufacturer, shall be suitable for spray application.			
1	Non volatile matter	Test method	EN ISO 3251			
		Requirements	% m/m	Base	Activator	Thinner
				± 2 % ref. value [a b]	± 2 % ref. value [a b]	—
49	Volatile organic content (VOC)	Test method	EN ISO 11890-1			
		Test condition	Base + Activator + Thinner			
		Requirements	g/l	< values stated in Clause 5 [b]		
7	Flash point	Test method	EN ISO 3679 or EN ISO 3680			
		Requirements	°C	Base	Activator	Thinner
				≥ reference value [a]	≥ reference value [a]	≥ reference value [a]
8 *	Flow time	Test method	EN ISO 2431 (cup 3 or cup 4)			
		Test condition	Base + Activator + Thinner			
		Requirements	s	± 10 % reference value [a b]		
5	Sedimentation rating	Test method	EN 3847			
		Test condition	Base + Activator + Thinner			
		Requirements	ml/4 h	≤ 30		
3 *	Density	Test method	EN ISO 2811-1 to EN ISO 2811-4			
		Test condition	(23 ± 2) °C / (50 ± 5) % RH			
		Requirements	g/cm^3	Base	Activator	Thinner
			Type I Type II Type III	≤ 1,6 ≤ 1,7 ≤ 1,5	≤ 1,0 ≤ 1,1 ≤ 1,1	— — —

continued

Table 2 — Physical and chemical characteristics – Delivery conditions *(continued)*

Tests according to EN 3840	Test	Test criteria	Test requirements			
4 *	Density hydrometer	Test method	EN ISO 3675			
		Test condition	(23 ± 2) °C / (50 ± 5) % RH			
		Requirements	g/cm^3	Base	Activator	Thinner
			Type I Type II Type III	— — —	≤ 1,0 ≤ 1,1 ≤ 1,1	≤ 0,9 — —
16	Isocyanate value	Test method	EN ISO 11909			
		Test condition	—			
		Requirements	—	Base	Activator	Thinner
				—	Reference value [b]	—
12	IR spectroscopy	Test method	EN 6042			
		Test condition	—			
		Requirements	—	Base	Activator	Thinner
				Reference value [b]	Reference value [b]	—
10	Fineness of grind	Test method	EN ISO 1524			
		Requirements	µm	Base	Activator	Thinner
				[c]	[c]	—
— *	Application properties and finish	Test method	None			
		Panel	EN 3837 — A_1 or EN 3837 — A_2 (2024-T3 unclad or 2024-T3 clad)			
		Pretreatment	EN 3837 — Procedure A or B or C			
		Coating	Primer according to EN 4687 and EN 4688 and coating to this standard.			
		Test condition	(23 ± 2) °C / (50 ± 5) % RH			
		Requirements	The paint film applied shall result in an opaque even finish free from runs, sags, wrinkling, pinholing or other defect.			
20 *	Pot life To be discussed with paint supplier	Test method	EN ISO 9514 (cup 3 or cup 4)			
		Test condition	Base + Activator + Thinner (23 ± 2) °C / (50 ± 5) % RH			
		Requirements	s or Pa s	Equal to the reference value after 4 (four) hours, and shall still meet or fulfil all specification requirement.		

continued

Table 2 — Physical and chemical characteristics – Delivery conditions *(concluded)*

Tests according to EN 3840	Test	Test criteria	Test requirements	
21 *	Drying time at the surface To be discussed with paint supplier	Test method	EN ISO 9117-3	
		Panel	EN 3837 — A_1 or EN 3837 — A_2 (2024-T3 unclad or 2024-T3 clad)	
		Pretreatment	EN 3837 — Procedure A or B or C	
		Coating	Primer according to EN 4687 and EN 4688 and coating to this standard.	
		Test condition	(23 ± 2) °C / (50 ± 5) % RH	
		Requirements	h	≤ reference value
22 *	Drying time – Print free test To be discussed with paint supplier	Test method	EN ISO 3678	
		Panel	EN 3837 — A_1 or EN 3837 — A_2 (2024-T3 unclad or 2024-T3 clad)	
		Pretreatment	EN 3837 — Procedure A or B or C	
		Coating	Primer according to EN 4687 and EN 4688 and coating to this standard.	
		Test condition	(23 ± 2) °C / (50 ± 5) % RH	
		Requirements	h	≤ 6 h using a mass of 1 000 g
23 *	Through dry time To be discussed with paint supplier	Test method	EN ISO 9117-1	
		Panel	EN 3837 — A_1 or EN 3837 — A_2 (2024-T3 unclad or 2024-T3 clad)	
		Pretreatment	EN 3837 — Procedure A or B or C	
		Coating	Primer according to EN 4687 and EN 4688 and coating to this standard.	
		Test condition	(23 ± 2) °C / (50 ± 5) % RH	
		Requirements	h	≤ 16 h using a mass of 1 500 g

* See 6.3.

[a] The deviation is that compared to the reference value (see [b]).

[b] The reference value is that established during.

[c] To meat the gloss level between manufacturer and customer.

Table 3 — Mechanical and physical characteristics – Dried film

Tests according to EN 3840	Test	Test criteria	Test requirements
24 *	Cross cut adhesion	Test method	EN ISO 2409
		Panel	EN 3837 — A_1 or EN 3837 — A_2 (2024-T3 unclad or 2024-T3 clad)
		Pretreatment	EN 3737 — Procedures B and C (CAA and CCC)
		Coating	Primer according to EN 4687 and EN 4688 and coating to this standard.
		Test condition	(23 ± 2) °C / (50 ± 5) % RH
		Requirements	Classification ≤ 1
29 *	Scratch resistance	Test method	EN ISO 1518
		Panel	EN 3837 — A_1 or EN 3837 — A_2 (2024-T3 unclad or 2024-T3 clad)
		Pretreatment	EN 3737 — Procedures B and C (CAA and CCC)
		Coating	Primer according to EN 4687 and EN 4688 and coating to this standard.
		Test condition	(23 ± 2) °C / (50 ± 5) % RH
		Requirements	≥ 1 800 g [a]
46 *	Slow deformation	Test method	EN ISO 1520
		Panel	EN 3837 — A_1 or EN 3837 — A_2 (2024-T3 unclad or 2024-T3 clad)
		Pretreatment	EN 3737 — Procedures B and C (CAA and CCC)
		Coating	Primer according to EN 4687 and EN 4688 and coating to this standard.
		Test condition	(23 ± 2) °C / (50 ± 5) % RH
		Requirements	≥ 4 mm [b]

continued

Table 3 — Mechanical and physical characteristics – Dried film *(concluded)*

Tests according to EN 3840	Test	Test criteria	Test requirements
30 *	Colour	Test method	ISO 7724-1 to ISO 7724-3
		Panel	EN 3837 — A_1 or EN 3837 — A_2 (2024-T3 unclad or 2024-T3 clad)
		Pretreatment	EN 3837 — Procedure A or B or C
		Coating	Primer according to EN 4687 and EN 4688 and coating to this standard.
		Test condition	(23 ± 2) °C / (50 ± 5) % RH
		Requirements	[c]
27 *	Specular gloss	Test method	EN ISO 2813
		Panel	EN 3837 — A_1 or EN 3837 — A_2 (2024-T3 unclad or 2024-T3 clad)
		Pretreatment	EN 3837 — Procedure A or B or C
		Coating	Primer according to EN 4687 and EN 4688 and coating to this standard.
		Test condition	(23 ± 2) °C / (50 ± 5) % RH
		Requirements	[c]
25	Bend test cylindrical mandrel	Test method	EN ISO 1519
		Panel	EN 3837 — A_6 2024-T3 clad
		Pretreatment	EN 3837 — Procedure B
		Coating	Primer according to EN 4687 and EN 4688 and coating to this standard.
		Test condition	(– 55 ± 2) °C
		Requirements	Mandrel: Ø 100 mm [a]

* See 6.3.

[a] Substrate not exposed.

[b] No cracking or detachment (×10 magnification).

[c] To be agreed between manufacturer and customer.

Table 4 — Environmental exposure/testing – Dried film

Tests according to EN 3840	Test	Test criteria	Test requirements
38	Thermal exposure (resistance to high temperature)	Test method	EN 4160
		Panel	EN 3837 — A_1 or EN 3837 — A_2 (2024-T3 unclad or 2024-T3 clad)
		Pretreatment	EN 3837 — Procedures B and C
		Coating	Primer according to EN 4687 and EN 4688 and coating to this standard.
		Exposure	(150 ± 2) °C 24 h [a]
		Requirements	EN 3840 test 24 — Classification ≤ 1 EN 3840 test 29 ≥ 1 500 g [b] EN 3840 test 46 ≥ 4 mm [c]
38	Thermal exposure (resistance to low temperature)	Test method	EN 4160
		Panel	EN 3837 — A_1 or EN 3837 — A_2 (2024-T3 unclad or 2024-T3 clad)
		Pretreatment	EN 3837 — Procedures B and C
		Coating	Primer according to EN 4687 and EN 4688 and coating to this standard.
		Exposure	(– 55 ± 2) °C 24 h
		Requirements	EN 3840 test 24 — Classification ≤ 1 EN 3840 test 46 ≥ 4 mm [c]
37	Resistance to humidity	Test method	EN ISO 6270-1
		Panel	EN 3837 — A_1 (2024-T3 unclad)
		Pretreatment	EN3837 — Procedures B and C
		Coating	Primer according to EN 4687 and EN 4688 and coating to this standard.
		Exposure	(40 ± 2) °C (95 to 100) % RH 1 000 h [a]
		Requirements	EN 3840 test 24 — Classification ≤ 1 EN 3840 test 29 ≥ 1 500 g [b] EN 3840 test 46 ≥ 4 mm [c] EN ISO 4628-2, degree of blistering 0

continued

Table 4 — Environmental exposure/testing – Dried film *(concluded)*

Tests according to EN 3840	Test	Test criteria	Test requirements
34	Water behaviour	Test method	EN ISO 2812-2
		Panel	EN 3837 — A_1 (2024-T3 unclad)
		Pretreatment	EN 3837 — Procedures B and C
		Coating	Primer according to EN 4687 and EN 4688 and coating to this standard.
		Exposure	(40°± 2) °C 168 h [a]
		Requirements	EN 3840 test 24 — Classification ≤ 1 EN 3840 test 29 ≥ 1 500 g [b] EN 3840 test 46 ≥ 4 mm [c] EN ISO 4628-2, degree of blistering 0
40	Artificial weathering	Test method	EN ISO 11507
		Panel	EN 3837 — A_1 (2024-T3 unclad)
		Pretreatment	EN 3837 — Procedure A or B or C
		Coating	Primer according to EN 4687 and EN 4688 and coating to this standard.
		Exposure	UVB 313, light 4 h, humidity 4 h, for 500 h
		Requirements	Test 27 ≤ 20 % reduction from initial value Test 30 Δ^* E ab ≤ 2 units

* See 6.3.

[a] Test to be performed at (23 ± 2) °C / (50 ± 5) % RH, within 30 min after end of exposure.

[b] Substrate not exposed.

[c] No cracking or detachment (×10 magnification).

Table 5 — Corrosion tests – Dried film

Tests according to EN 3840	Test	Test criteria	Test requirements
42	Resistance to neutral salt spray	Test method	EN ISO 9227
		Panel	EN 3837 — A_1 2024-T3 unclad
		Pretreatment	EN 3837 — Procedure (A and C) or (B and C)
		Coating	Primer according to EN 4687 and EN 4688 and coating to this standard.
		Exposure	EN 3837 — Procedures A and C: (35 ± 2) °C 1 000 h EN 3837 — Procedure B: (35 ± 2) °C 3 000 h
		Requirements	EN 3840 test 24 — Classification ≤ 1 EN 3840 test 29 ≥ 1 500 g [a] EN 3840 test 46 ≥ 4 mm [b] EN ISO 4628-8 No corrosion more than 1,25 mm from the scratch EN ISO 4628-2, degree of blistering 0
41	Resistance to alternate immersion	Test method	EN 3212
		Panel	EN 3837 — A_1 2024-T3 unclad
		Pretreatment	EN 3837 — Procedures B and C
		Coating	Primer according to EN 4687 and EN 4688 and coating to this standard.
		Exposure	(35 ± 2)°C (1 500 h)
		Requirements	EN 3840 test 24 — Classification ≤ 1 EN 3840 test 29 ≥ 1 500 g EN ISO 4628-8 No corrosion more than 1,25 mm from the scratch [a] EN ISO 4628-2, degree of blistering 0

[a] Substrate not exposed.

[b] No cracking or detachment (×10 magnification).

Table 6 — Exposure to system fluids and corrosion generating environment/testing – Dried film

Tests according to EN 3840	Test	Test criteria	Test requirements
35	Resistance to fluids – Hydraulic oil MIL-PRF-5606H (NATO H-515)	Test method	EN ISO 2812-1
		Panel	EN 3837 — A_1 or EN 3837 — A_2 (2024-T3 unclad or 2024-T3 clad)
		Pretreatment	EN 3837 — Procedure B or C
		Coating	Primer according to EN 4687 and EN 4688 and coating to this standard.
		Exposure	(70 ± 2) °C 300 h [a]
		Requirements	EN 3840 test 24 — Classification ≤ 1 [b] EN 3840 test 29 ≥ 1 500 g [c] EN ISO 4628-2, degree of blistering 0
35	Resistance to fluids – Jet fuel MIL-DTL-83133G (NATO F-34)	Test method	EN ISO 2812-1
		Panel	EN 3837 — A_1 or EN 3837 — A_2 (2024-T3 unclad or 2024-T3 clad)
		Pretreatment	EN 3837 — Procedure B or C
		Coating	Primer according to EN 4687 and EN 4688 and coating to this standard.
		Exposure	(40 ± 2) °C 1 000 h [a]
		Requirements	EN 3840 test 24 — Classification ≤ 1 [b] EN 3840 test 29 ≥ 1 500 g [c] EN 3840 test 46 ≥ 4 mm [d] EN ISO 4628-2, degree of blistering 0
35	Resistance to fluids – Engine oil MIL-PRF-23699F (NATO O-156)	Test method	EN ISO 2812-1
		Panel	EN 3837 — A_1 or EN 3837 — A_2 (2024-T3 unclad or 2024-T3 clad)
		Pretreatment	EN 3837 — Procedure B or C
		Coating	Primer according to EN 4687 and EN 4688 and coating to this standard.
		Exposure	(70 ± 2) °C 300 h [a]
		Requirements	EN 3840 test 24 — Classification ≤ 1 [c] EN 3840 test 29 ≥ 1 500 g [d] EN 3840 test 46 ≥ 4 mm [d] EN ISO 4628-2, degree of blistering 0

continued

Table 6 — Exposure to system fluids and corrosion generating environment/testing – Dried film *(continued)*

Tests according to EN 3840	Test	Test criteria	Test requirements
35	Resistance to fluids – De-icing fluid BS 1595-1:1986 (NATO S-737) To define correct de-icing fluid	Test method	EN ISO 2812-1
		Panel	EN 3837 — A_1 or EN 3837 — A_2 (2024-T3 unclad or 2024-T3 clad)
		Pretreatment	EN 3837 — Procedure B or C
		Coating	Primer according to EN 4687 and EN 4688 and coating to this standard.
		Exposure	[a]
		Requirements	EN 3840 test 24 — Classification ≤ 1 EN 3840 test 29 ≥ 1 500 g [c] EN 3840 test 46 ≥ 4 mm [d] EN ISO 4628-2, degree of blistering 0
35	Resistance to fluids – engine corrosion inhibiting fluid MIL-PRF-6081D (NATO O-133)	Test method	EN ISO 2812-1
		Panel	EN 3837 — A_1 or EN 3837 — A_2 (2024-T3 unclad or 2024-T3 clad)
		Pretreatment	EN 3837 — Procedure B or C
		Coating	Primer according to EN 4687 and EN 4688 and coating to this standard.
		Exposure	(60 ± 2) °C 168 h [a]
		Requirements	EN 3840 test 24 — Classification ≤ 1 EN 3840 test 29 ≥ 1 500 g [c] EN 3840 test 46 ≥ 4 mm [d] EN ISO 4628-2, degree of blistering 0
35	Resistance to fluids – Aircraft washing agents (AMS 1527B)	Test method	EN ISO 2812-1
		Panel	EN 3837 — A_1 or EN 3837 — A_2 (2024-T3 unclad or 2024-T3 clad)
		Pretreatment	EN 3837 — Procedure B or C
		Coating	Primer according to EN 4687 and EN 4688 and coating to this standard.
		Exposure	(23 ± 2) °C 24 h [a]
		Requirements	EN 3840 test 24 — Classification ≤ 1 EN 3840 test 29 ≥ 1 500 g [c] EN 3840 test 46 ≥ 4 mm [d] EN ISO 4628-2, degree of blistering 0

continued

Table 6 — Exposure to system fluids and corrosion generating environment/testing – Dried film *(continued)*

Tests according to EN 3840	Test	Test criteria	Test requirements
35	Resistance to fluids – Aircraft cleaning compound (AMS 1526B/ AMS 1533A)	Test method	EN ISO 2812-1
		Panel	EN 3837 — A_1 or EN 3837 — A_2 (2024-T3 unclad or 2024-T3 clad)
		Pretreatment	EN 3837 — Procedure B or C
		Coating	Primer according to EN 4687 and EN 4688 and coating to this standard.
		Exposure	(23 ± 2) °C 24 h [a]
		Requirements	EN 3840 test 24 — Classification ≤ 1 EN 3840 test 29 ≥ 1 500 g [c] EN 3840 test 46 ≥ 4 mm [d] EN ISO 4628-2, degree of blistering 0
35	Resistance to fluids – Corrosion preventive compound DEF STAN 68-10 (NATO C-634)	Test method	EN ISO 2812-1
		Panel	EN 3837 — A_1 or EN 3837 — A_2 (2024-T3 unclad or 2024-T3 clad)
		Pretreatment	EN 3837 — Procedure B or C
		Coating	Primer according to EN 4687 and EN 4688 and coating to this standard.
		Exposure	(40 ± 2) °C 1 000 h [a]
		Requirements	EN 3840 test 24 — Classification ≤ 1 EN 3840 test 29 ≥ 1 500 g [c] EN 3840 test 46 ≥ 4 mm [d] EN ISO 4628-2, degree of blistering 0
—	Resistance to B&C agents	Test method	STANAG 4477
		Panel	EN 3837 — A_1 or EN 3837 — A_2 (2024-T3 unclad or 2024-T3 clad)
		Pretreatment	EN 3837 — Procedure B or C
		Coating	Primer according to EN 4687 and EN 4688 and coating to this standard.
		Exposure	STANAG 4477 method 8C
		Requirements	STANAG 4477

continued

Table 6 — Exposure to system fluids and corrosion generating environment/testing – Dried film *(concluded)*

Tests according to EN 3840	Test	Test criteria	Test requirements
—	Resistance to decontaminants	Test method	STANAG 4477
		Panel	EN 3837 — A_2 2024-T3 clad
		Pretreatment	EN 3837 — Procedure B or C
		Coating	Primer according to EN 4687 and EN 4688 and coating to this standard.
		Exposure	STANAG 4477 method 7C
		Requirements	STANAG 4477

[a] Test to be performed at (23 ± 2) °C / (50 ± 5) % RH.

[B] Degrease surface before application the tape.

[C] Substrate not exposed.

[D] No cracking or detachment (10× magnification).

Table 7 — Requirements for fibre reinforced composites

Tests according to EN 3840	Test	Test criteria	Test requirements
24	Cross cut adhesion	Test method	EN ISO 2409
		Panel	Fibre reinforced composite material i.a.w. Clause 7.
		Surface preparation	i.a.w. Clause 7.
		Coating	Primer according to EN 4687 and coating to this standard.
		Test condition	(23 ± 2) °C (50 ± 5) % RH
		Requirements	Classification ≤ 1
29	Scratch resistance	Test method	EN ISO 1518
		Panel	Fibre reinforced composite material i.a.w. Clause 7.
		Surface preparation	i.a.w. Clause 7.
		Coating	Primer according to EN 4687 and coating to this standard.
		Test condition	(23 ± 2) °C (50 ± 5) % RH
		Requirements	≥ 1 500 g

continued

Table 7 — Requirements for fibre reinforced composites *(concluded)*

Tests according to EN 3840	Test	Test criteria	Test requirements
34	Water behaviour	Test method	EN ISO 2812-2
		Panel	Fibre reinforced composite material i.a.w. Clause 7.
		Surface preparation	i.a.w. Clause 7.
		Coating	Primer according to EN 4687 and coating to this standard.
		Exposure	(40 ± 2) °C 168 h [a]
		Requirements	EN 3840 test 24 — Classification ≤ 1 EN 3840 test 29 ≥ 1 500 g [b] EN ISO 4628-2, degree of blistering 0

[a] Test to be performed at (23 ± 2) °C / (50 ± 5) % RH, within 30 min after exposure.

[b] Substrate not exposed.

Table 8 — Demonstration of compatibility of waterborne top coat to solvent borne top coat, mechanical and physical characteristics – Coatings soventborn primers and solvent borne top coats type I and II plus top coat type III

Tests according to EN 3840	Test	Test criteria	Test requirements
24 *	Cross cut adhesion	Test method	EN ISO 2409
		Panel	EN 3837 — A_2 2024-T3 clad
		Pretreatment	EN 3837 — Procedure A or B or C plus coating (see next line)
		Coating	Primer Type I or II according to EN 4687 or EN 4688 plus Top Coat Type I / II [a] and Type III according to this standard
		Test condition	(23 ± 2) °C (50 ± 5) % RH
		Requirement	Classification 0

continued

Table 8 — Demonstration of compatibility of waterborne top coat to solvent borne top coat, mechanical and physical characteristics – Coatings soventborn primers and solvent borne top coats type I and II plus top coat type III *(concluded)*

Tests according to EN 3840	Test	Test criteria	Test requirements
29 *	Scratch resistance	Test method	EN ISO 1518
		Panel	EN 3837 — A_2 2024-T3 clad
		Pretreatment	EN 3837 — Procedure A or B or C plus coating (see next line)
		Coating	Primer Type I or II according to EN 4687 or EN 4688 plus Top Coat Type I / II [a] and Type III according to this standard
		Test condition	(23 ± 2) °C (50 ± 5) % RH
		Requirement	≥ 1 500 g substrate not exposed
46 *	Slow deformation	Test method	EN ISO 1520
		Panel	EN 3837 — A_2 2024-T3 clad
		Pretreatment	EN 3837 — Procedure A or B or C plus coating (see next line)
		Coating	Type I or II according to EN 4687 or EN 4688 plus Top Coat Type I / II [a] and Type III according to this standard
		Test condition	(23 ± 2) °C (50 ± 5) % RH
		Requirement	≥ 3 mm [b]
34	Water behaviour	Test method	EN ISO 2812-2
		Panel	EN 3837 — A_2 2024-T3 clad
		Pretreatment	EN 3837 — Procedure A or B or C plus coating (see next line)
		Coating	Type I or II according to EN 4687 or EN 4688 plus Top Coat Type I / II [a] and Type III according to this standard
		Test condition	(40 ± 2) °C 168 h
		Requirement	EN 3840 test 24 — Classification ≤ 1 EN 3840 test 29 ≥ 1 500 g EN ISO 4628-2, degree of blistering 0

* See 6.3.

[a] Coatings to be tested are Primer with Type I and Type II Top Coats each additionally coated with waterborn Type III Top Coat according to this standard.

[b] No cracking or detachment (×10 magnification).

Table 9 — Demonstration of compatibility of waterborne top coat to solvent borne primers – Mechanical and physical characteristics – Primer type I and II according to EN 4687 and EN 4688 plus top coat type III according to this standard

Tests according to EN 3840	Test	Test criteria	Test requirements
24 *	Cross cut adhesion	Test method	EN ISO 2409
		Panel	EN 3837 — A_2 2024-T3 clad
		Pretreatment	EN 3837 — Procedure (A and C) or (B and C) plus coating (see next line)
		Coating	Primer Type I / II [a] according to EN 4687 or EN 4688 plus Top Coat Type III according to this standard
		Test condition	(23 ± 2) °C (50 ± 5) % RH
		Requirement	Classification 0
29 *	Scratch resistance	Test method	EN ISO 1518
		Panel	EN 3837 — A_2 2024-T3 clad
		Pretreatment	EN 3837 — Procedure A or B or C
		Coating	Primer Type I / II [a] according to EN 4687 or EN 4688 plus Top Coat Type III according to this standard
		Test condition	(23 ± 2) °C (50 ± 5) % RH
		Requirement	≥ 1 500 g substrate not exposed
46 *	Slow deformation	Test method	EN ISO 1520
		Panel	EN 3837 — A_2 2024-T3 clad
		Pretreatment	EN 3837 — Procedure (A and C) or (B and C) plus coating (see next line)
		Coating	Primer Type I / II [a] according to EN 4687 or EN 4688 plus Top Coat Type III according to this standard
		Test condition	(23 ± 2) °C (50 ± 5) % RH
		Requirement	≥ 3 mm [b]
34	Water behaviour	Test method	EN ISO 2812-2
		Panel	EN 3837 — A_2 2024-T3 clad
		Pretreatment	EN 3837 — Procedure (A and C) or (B and C) plus coating (see next line)
		Coating	Primer Type I / II [a] according to EN 4687 or EN 4688 plus Top Coat Type III according to this standard
		Test condition	(40 ± 2) °C 168 h
		Requirement	EN 3840 test 24 — Classification ≤ 1 EN 3840 test 29 ≥ 1 500 g EN ISO 4628-2, degree of blistering 0

* See 6.3.

[a] Coatings to be tested are solvent borne Type I and Type II Primers according to EN 4678 and EN 4688 plus waterborn Top Coat Type III according to this specification.

[b] No cracking or detachment (×10 magnification).

Table 10 — Demonstration of compatibility of solvent borne top coat to waterborne top coat, mechanical and physical characteristics. coatings primer and waterborne top coat type III plus top coats type I and II

Tests according to EN 3840	Test	Test criteria	Test requirements
24 *	Cross cut adhesion	Test method	EN ISO 2409
		Panel	EN 3837 — A_2 2024-T3 clad
		Pretreatment	EN 3837 — Procedure (A and C) or (B and C) plus coating (see next line)
		Coating	Primer Type III according to EN 4687 or EN 4688 and Top Coat Type III plus Type I and II [a] Top Coat according to this standard
		Test condition	(23 ± 2) °C (50 ± 5) % RH
		Requirement	Classification 0
29 *	Scratch resistance	Test method	EN ISO 1518
		Panel	EN 3837 — A_2 2024-T3 clad
		Pretreatment	EN 3837 — Procedure A or B or C
		Coating	Type I or II according to EN 4688 plus Type III according to this standard
		Test condition	(23 ± 2) °C (50 ± 5) % RH
		Requirement	≥ 1 500 g substrate not exposed
46 *	Slow deformation	Test method	EN ISO 1520
		Panel	EN 3837 — A_2 2024-T3 clad
		Pretreatment	EN 3837 — Procedure (A and C) or (B and C) plus coating (see next line)
		Coating	Type I or II according to EN 4688 plus Type III according to this standard
		Test condition	(23 ± 2) °C (50 ± 5) % RH
		Requirement	≥ 3 mm [b]
34	Water behaviour	Test method	EN ISO 2812-2
		Panel	EN 3837 — Procedure (A and C) or (B and C) plus coating (see next line)
		Pretreatment	EN 3837 — Procedure B or C
		Coating	Type I or II according to EN 4688 plus Type III according to this standard
		Test condition	(40 ± 2) °C 168 h
		Requirement	EN 3840 test 24 — Classification ≤ 1 EN 3840 test 29 ≥ 1 500 g EN ISO 4628-2, degree of blistering 0

* See 6.3.

[a] Coatings to be tested are waterborne Primer with waterborne Type III Top Coat plus solvent borne Type I and Type II Top Coats according to this specification.

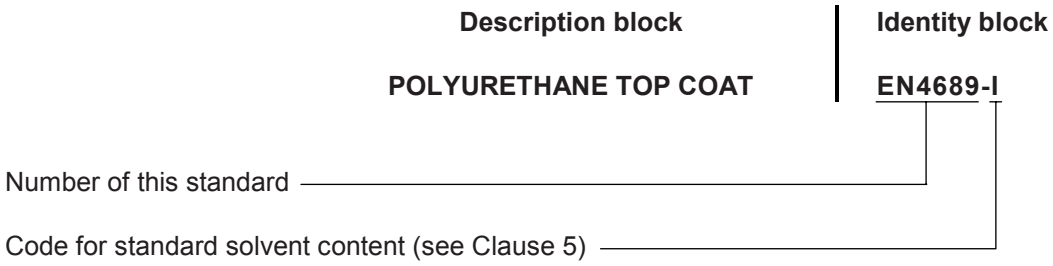
[b] No cracking or detachment (×10 magnification).

7 Requirements for fibre reinforced composites

The primer coating according to this specification applied on fibre reinforced composites shall fulfil the requirements established in Table 7. The customer shall specify the composite and surface preparation.

8 Designation

EXAMPLE



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