SLOVENSKI STANDARD
SIST EN 4689:2021

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Nadomešča:
SIST EN 4689:2012

Aeronavtika - Barve in laki - Dvokomponentni poliuretanski lak, ki se strdi pri temperaturi okolja - Zelo elastičen in odporen proti kemikalijam, za vojaško uporabo

Aerospace series - Paints and varnishes - Two-components room temperature curing polyurethane finish - High flexibility and chemical agent resistance for military application

Luft- und Raumfahrt - Beschichtungsstoffe - Zweikomponenten-Polyurethan-Deckbeschichtung, raumtemperaturhärtend - Hohe Verformbarkeit und Beständigkeit gegen Chemikalien für militärische Anwendung

Série aérospatiale - Peintures et vernis - Peinture de finition polyuréthane à deux composants polymérisant à température ambiante - Haute flexibilité et résistance aux substances chimiques pour applications militaires

Ta slovenski standard je istoveten z: **EN 4689:2021**

ICS:

49.040	Prevleke in z njimi povezani postopki, ki se uporabljajo v letalski in vesoljski industriji	Coatings and related processes used in aerospace industry
87.040	Barve in laki	Paints and varnishes
95.020	Vojaštvo na splošno	Military in general

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Aerospace series - Paints and varnishes - Two-components room temperature curing polyurethane finish - High flexibility and chemical agent resistance for military application

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This European Standard was approved by CEN on 2 November 2020.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN 4689:2021) 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 document 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 document shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 2021, and conflicting national standards shall be withdrawn at the latest by July 2021.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 4689:2012.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this document: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This document specifies the requirements for a two-components flexible polyurethane topcoat to be applied over EN 4687 and/or EN 4688 primers mainly for exterior aerospace applications.

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

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 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 3837, *Aerospace series — Paints and varnishes — Nature and method for surface preparation of test pieces in aluminium alloys*

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

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

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

EN 4687, *Aerospace series — Paints and varnishes — Chromate free (non corrosion inhibiting) two-components room temperature curing primer — Chromate free primer for military application*

EN 4688, *Aerospace series — Paints and varnishes — Corrosion resistant chromated two-components room temperature curing epoxy primer — High corrosion resistance for military application*

EN 4704, *Aerospace series — Tartaric-Sulphuric-Acid anodizing of aluminium and aluminium wrought alloys for corrosion protection and paint pre-treatment (TSA)*

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*

EN ISO 1518-1, *Paints and varnishes — Determination of scratch resistance — Part 1: Constant-loading method*

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: Pycnometer method*

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1) Published as ASD-STAN Standard at the date of publication of this document by AeroSpace and Defence industries Association of Europe — Standardization (ASD-STAN), http://www.asd-stan.org/

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 gloss value 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 3679, *Determination of flash no-flash and flash point — 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 or other artificial defect*

EN ISO 6270-1, *Paints and varnishes — Determination of resistance to humidity — Part 1: Condensation (single-sided exposure)*

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 9117-6, *Paints and varnishes — Drying tests — Part 6: Print-free test*

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 11664- *, *Colorimetry*

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*

EN ISO 16474-1, *Paints and varnishes — Methods of exposure to laboratory light sources — Part 1: General guidance*

EN ISO 16474-3, *Paints and varnishes — Methods of exposure to laboratory light sources — Part 3: Fluorescent UV lamps*

* And all its parts quoted in this document.

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 Issue 5, *Corrosion Preventive, Water Displacing NATO Code: C-634 Joint Service Designation: PX-24*

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

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at http://www.iso.org/obp
- IEC Electropedia: available at http://www.electropedia.org/

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

EN 3837 — Procedure D: Tartaric-Sulphuric-Acid anodizing in accordance with EN 4704

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

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

5 Classification

The topcoat 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 (≤ 250 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 3 (three) batches shall be tested for qualification purposes.

6.2 Qualification tests

For product qualification, all tests defined in this document, in Table 2 to Table 8, shall be performed. The test work to be undertaken for product qualification shall be in accordance with this document.

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 document shall be performed for batch acceptance tests.

Table 1 — General requirements

Material description	Two components cold curing polyurethane topcoat
Formulation	Base: hydroxyl functional polyester or acrylic resins Curing agent: a polyisocyanate activator solution Thinner: if required
Preparation	These components shall be mixed in simple proportions, by volume or weight, in accordance with the manufacturers' instructions.
Technical specification	EN 3840
Marking	EN 3840
Storage stability	EN 3840
Application and use	In accordance with manufacturers' instructions.
Drying conditions	(23 ± 2) °C/(50 ± 5) % RH for 7 (seven) days before testing. Finish is applied to the primer (EN 4687 or EN 4688) following drying of the primer for 4 (four) hours to 6 (six) hours as specified.
Quality assurance	EN 3840
Designation	Flexible polyurethane topcoat
Packaging	EN 3840
Health and safety	EN 3840

Table 2 — Physical and chemical characteristics — Delivery conditions *(1 of 3)*

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	Curing agent	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 + Curing agent + Thinner			
		Requirements	g/l	< values stated in Clause 5 [b]		
7	Flash point	Test method	EN ISO 3679			
		Requirements	°C	Base	Curing agent	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 + Curing agent + Thinner			
		Requirements	s	± 10 % Reference value [a,b]		
5	Sedimentation rating	Test method	EN 3847			
		Test condition	Base + Curing agent + Thinner			
		Requirements	ml/4 h	≤ 30		
3 *	Density	Test method	EN ISO 2811-1 to EN ISO 2811-4 or ISO 3675			
		Test condition	(23 ± 2) °C/(50 ± 5) % RH			
		Requirements	g/cm³	Base	Curing agent	Thinner
			± 0,03 g/cm³ ref value	± 0,03 g/cm³ ref value	± 0,03 g/cm³ ref value	± 0,03 g/cm³ ref value
16	Isocyanate value	Test method	EN ISO 11909			
		Test condition	—			
		Requirements	—	Base	Curing agent	Thinner
				—	Reference value[b]	—

* See Subclause 6.3.

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

[b] The reference value is that established during qualification.

Table 2 — Physical and chemical characteristics — Delivery conditions *(2 of 3)*

Tests according to EN 3840	Test	Test criteria	Test requirements			
12	IR spectroscopy	Test method	EN 6042			
		Test condition	—			
		Requirements	—	Base	Curing agent	Thinner
				Reference value [b]	Reference value [b]	—
10	Fineness of grind	Test method	EN ISO 1524			
		Requirements	µm	Base	Curing agent	Thinner
				Reference value [b]	Reference value [b]	—
– *	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 or D			
		Coating	Primer according to EN 4687 and EN 4688 and coating to this document.			
		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	Test method	EN ISO 9514			
		Test condition	Base + Curing agent + Thinner (23 ± 2) °C/(50 ± 5) % RH			
		Requirements	h	> Reference value [b]		
21 *	Drying time at the surface	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 or D			
		Coating	Primer according to EN 4687 and EN 4688 and coating to this document.			
		Test condition	(23 ± 2) °C/(50 ± 5) % RH			
		Requirements	h	≤ Reference value		
22 *	Drying time – Print free test	Test method	EN ISO 9117-6			
		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 or D			
		Coating	Primer according to EN 4687 and EN 4688 and coating to this document.			
		Test condition	(23 ± 2) °C/(50 ± 5) % RH			
		Requirements	h	≤ Reference value		

* See Subclause 6.3.

[b] The reference value is that established during qualification.