



SLOVENSKI STANDARD

SIST EN 15646:2009

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Galvansko nanasene prevleke - Galvanske prevleke aluminija in aluminijevih zlitin z dodatno obdelavo - Zahteve in preskusne metode

Electrodeposited coatings - Electroplated coatings of aluminium and aluminium alloys with supplementary treatment - Requirements and test methods

Galvanische Überzüge - Galvanische Aluminium- und Aluminium-Legierungs-Überzüge mit zusätzlicher Behandlung - Anforderungen und Prüfverfahren

Revetements électrolytiques - Revêtements électrolytiques d'aluminium et d'alliages d'aluminium avec traitement supplémentaire - Exigences et méthodes d'essai

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EUROPEAN STANDARD

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Electrodeposited coatings - Electroplated coatings of aluminium and aluminium alloys with supplementary treatment - Requirements and test methods

Revêtements électrolytiques - Dépôts électrolytiques
d'aluminium et d'alliages d'aluminium avec traitement
complémentaire - Exigences et méthodes d'essai

Galvanische Überzüge - Galvanische Aluminium- und
Aluminium-Legierungs-Überzüge mit zusätzlicher
Behandlung - Anforderungen und Prüfverfahren

This European Standard was approved by CEN on 14 February 2009.

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

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Foreword

This document (EN 15646:2009) has been prepared by Technical Committee CEN/TC 262 “Metallic and other inorganic coatings”, the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by September 2009, and conflicting national standards shall be withdrawn at the latest by September 2009.

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

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Introduction

Electroplating of aluminium and aluminium alloy coatings provides several advantages:

- coating temperature (approximately 80 °C to 100 °C);
- no hydrogen embrittlement due to the electrodeposition of aluminium.

Prevention of hydrogen embrittlement results from the (process) technology of electroplating, because it is conducted in aprotic, organic solvents, in which the aluminium is dissolved as an aluminium-organic complex. To protect these electroplating solutions from humidity (water) and air oxygen, the electroplating of aluminium is performed under an inert gas atmosphere of nitrogen or argon. For anodic material aluminium is used, which has a purity of > 99,7 %. During electroplating of aluminium a purification (electrolytic refining) takes place, which results in an aluminium coating with a purity of 99,99 % Al percentage by mass. The high level of purity of the aluminium forms the basis for corrosion protection. The corrosion protection of the aluminium coating can be increased by common procedures of aluminium after-treatment, e.g. conversion coatings. The corrosion behaviour in chlorine-containing media is based on the fact that pure aluminium has a low self-corrosion because the aluminium is passivated by a thin oxide layer due to air oxygen. The oxide layer of the pure-aluminium coating is stable in the pH range from 4,0 to 8,5. Corrosion damage does not result in voluminous corrosion products.

The electrodeposited aluminium coatings cathodically protect iron materials. However, polarization effects in chlorine-free media, e.g. condensed water, may result in an anodic protective behaviour in such electrolytes. This effect can be reduced by alloying, for example, zinc or magnesium to the aluminium. Due to low dissolution current densities and extensive freedom of pores, the coatings can be suitable as galvanic corrosion protection on less reactive (more precious) materials like stainless steels and copper alloys. For adhesion reasons the application of a nickel strike may become necessary.

High ductility of the coatings allows an extreme deformation of the work pieces in the electroplated state.

The European Committee for Standardization (CEN) draws attention to the fact that it is claimed that compliance with this document may involve the use of a patent concerning the use of individual electrolyte (electroplating solution) formulations to electrodeposit aluminium and/or aluminium alloys as given in Subclause 3.2 and Annex C. CEN takes no position concerning the evidence, validity and scope of this patent right.

The holder of this patent right has assured CEN that he is willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of this patent right is registered with CEN. Information may be obtained from:

Aluminal Oberflächentechnik GmbH & Co.KG
Auf der Birke 2
D-56412 Heiligenroth

Rasant-Alotec Beschichtungstechnik GmbH
Zur Kaule 1
D-51491 Overath

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

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WARNING — When using this standard, the legal safety regulations, e.g. ordinance on hazardous substances, list of MAC values, list of the values of technical limit concentration (TRK-Werte) and other technical regulations, shall be observed.

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1 Scope

This European Standard specifies requirements for electrodeposited aluminium and aluminium alloy coatings on iron materials, plastic substrates, titanium materials, nickel materials and non-metallic substrate materials rendered conductive, such as plastics. The coatings serve either as corrosion or galvanic corrosion protection, as well as for other technical applications.

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 10025-2, *Hot rolled products of structural steels – Part 2: Technical delivery conditions for non-alloy structural steels*

EN 12487:2000, *Corrosion protection of metals – Rinsed and non-rinsed chromate conversion coatings on aluminium and aluminium alloys*

EN 12508:2000, *Corrosion protection of metal and alloys – Surface treatment, metallic, and other inorganic coatings – Vocabulary*

EN 12540, *Corrosion protection of metals – Electrodeposited coatings of nickel, nickel plus chromium, copper plus nickel and copper plus nickel plus chromium*

EN ISO 2819:1994, *Metallic coatings on metallic substrates – Electrodeposited and chemically deposited coatings – Review of methods available for testing adhesion* (ISO 2819:1980)

EN ISO 4527, *Metallic coatings – Autocatalytic (electroless) nickel-phosphorous alloy coatings – Specification and test methods* (ISO 4527:2003)

EN ISO 9227:2006, *Corrosion tests in artificial atmospheres – Salt spray tests* (ISO 9227:2006)

EN ISO 10289, *Methods for corrosion testing of metallic and other inorganic coatings on metallic substrates – Rating of test specimens and manufactured articles subjected to corrosion tests* (ISO 10289:1999)

EN ISO 11130:1999, *Corrosion of metals and alloys – Alternate immersion test in salt solution* (ISO 11130:1999)

ISO 554:1976, *Standard atmospheres for conditioning and/or testing – Specifications*

ISO 4519, *Electrodeposited metallic coatings and related finishes – Sampling procedures for inspection by attributes*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12508:2000 and the following apply.

3.1

aprotic solution

solution using non-aqueous inert solvent

EXAMPLE Aromatic hydrocarbons.

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3.2 complex aluminium compound
 compound based on trialkylaluminium compounds (AlR_3 with $R = H, CH_3, C_2H_5$ or higher homolog(ue)s as well as mixtures of these) with at least one alkaline metal (Li, Na, K, Cs, Rb) or one ammonium ion (NH_4^+)

4 Information to be supplied by the purchaser**4.1 Essential information**

The purchaser shall supply the following information:

- a) the designation (see Clause 5) of the particular coating required;
- b) the requirements for tensile strength of steel and any requirement for heat treatment before (see 5.4) and/or after (see C.2.2) electrodeposition;
- c) the significant surface, indicated by drawings of the articles or by suitably marked samples;
- d) the nature, condition and finish of the substrate, if any of these could affect the serviceability and/or the appearance of the coating;
- e) the position on the surface for unavoidable defects, such as rack or contact marks and the limits for acceptable defects on the refined and non-refined product (see 7.2);
- f) the finish required, for example bright, dull, satin or other finish, preferably with a sample of the finish;
- g) sampling methods, acceptance levels or any other inspection requirements, if different from those given in ISO 4519 (see Clause 9);
- h) the standards for any thickness, corrosion or adhesion test requirements (see Clause 8);
- i) requirements for supplementary treatment if applicable (see 5.5);
- j) any requirements for a mass fraction of alloy elements greater than 30 % (see 6.2).

4.2 Additional information

When applicable, the following additional information shall be supplied by the purchaser:

- a) any special requirements for, or restrictions on, preparation of the articles to be coated;
- b) any special requirements for recovering rejected articles;
- c) any special requirements that depend on the shape or method of manufacturing of the component;
- d) any other special requirements (e.g. roughness and tolerances).

5 Designation**5.1 General**

The designation shall comprise the following:

- a) electrodeposited coating;

- b) the number of the European Standard to which the required coating shall conform;
- c) a hyphen;
- d) the substrate code (see 5.2);
- e) a solidus;
- f) the additional applicable codes separated by solidi for every stage of the coating sequence, in the order of application (see 5.3, 5.4 and 5.5).

NOTE 1 Examples of codes are given in Table 1 and examples of full designations are given in 5.6.

Double separators shall be used to indicate any missing stages (i.e. when a particular stage is not required).

NOTE 2 The purchaser should be guided in his choice of designation by the severity of service conditions to be withstood by the coating, expressed as the service condition number (see ISO 27830 [1]).

5.2 Substrate

For the designation of the substrate Table 1 shall apply. Additionally nickel materials shall be identified with the chemical symbol Ni and titanium materials with the chemical symbol Ti.

Table 1 — Code examples

Substrate code (see 5.2)		Electrodeposited coating code (see 5.3)		Chromate conversion code (see 5.5)	
Fe	iron or steel	Al	Aluminium	A	colourless
Ti	titanium			C1	yellow iridescent
Ni	nickel			E1	light green
PL	plastics				
NM	non-metallic materials				

NOTE If the standard designation of the metal is to be provided, references to the appropriate literature can be found in Bibliography references [2], [3], [4], [5], [6] and [7].

The letters PL shall be used for electroplatable plastics and the letters NM for other non-metallic materials.

The intermediate layers shall be designated in accordance with EN 12540 and EN ISO 4527.

5.3 Metallic coatings

5.3.1 General

The designation of electrodeposited aluminium coatings shall be its chemical symbol Al.

The designation of aluminium alloy coatings shall be as follows.

The metal coating layer is designated by the chemical symbol(s) for the electrodeposited metal, or metals (in the case of an alloy coating), immediately followed by:

- a) a number indicating the minimum local thickness of the layer in micrometres (see Clause 6);
- b) upper case letters indicating the type of coating, if applicable (see below).