



SLOVENSKI STANDARD
SIST EN 14431:2004

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Vitreous and porcelain enamels - Characteristics of the enamel coatings applied to steel panels intended for architecture

Emails und Emailierungen - Merkmale von Email-Überzügen auf Architektur-Stahlpaneelen

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Emaux vitrifiés - Caractéristiques des couches d'email appliquées sur les panneaux d'acier destinés a l'architecture

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25.220.50 Emailne prevleke Enamels

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 14431

September 2004

ICS 25.220.50

English version

Vitreous and porcelain enamels - Characteristics of the enamel coatings applied to steel panels intended for architecture

Emaux vitrifiés - Caractéristiques des couches d'émail appliquées sur les panneaux d'acier destinés à l'architecture

Emails und Emailierungen - Merkmale von Email-Überzügen auf Architektur-Stahlpaneelen

This European Standard was approved by CEN on 9 July 2004.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 14431:2004) 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 March 2005, and conflicting national standards shall be withdrawn at the latest by March 2005.

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

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EN 14431:2004 (E)**1 Scope**

This document specifies the requirements for enamel coated, plane, cold rolled, heavy and light gauge steel panels intended for interior and exterior architectural use.

It includes the functional and aesthetic characteristics and resistance to graffiti of these panels and the related coatings.

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 101, *Ceramic tiles — Determination of scratch hardness of surface according to Mohs*

EN 10209:1996 *Cold rolled low carbon steel flat products for vitreous enamelling — Technical delivery conditions.*

EN 14430, *Vitreous and porcelain enamels — High voltage test*

EN 14483-1:2004, *Vitreous and porcelain enamels — Determination of resistance to chemical corrosion — Part 1: Determination of resistance to chemical corrosion by acids at room temperature*

EN ISO-105-J03, *Textiles — Tests for colour fastness — Part J03: Calculation of colour differences (ISO 105-J03:1995, including Technical Corrigendum 1:1996)*

EN ISO 2178, *Non magnetic coatings on magnetic substrates — Measurement of coating thickness — Magnetic method (ISO 2178:1982)*

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 8289, *Vitreous and porcelain enamels — Low voltage test for detecting and locating defects (ISO 8289:2000)*

EN ISO 15695, *Vitreous and porcelain enamels — Determination of the scratch resistance of enamel finishes (ISO 15695:2000, including Technical Corrigendum 1:2000)*

ISO 4532, *Vitreous and porcelain enamels — Determination of the resistance of enamelled articles to impact — Pistol test*

ISO 2742, *Vitreous and porcelain enamels — Determination of resistance to boiling citric acid*

ASTM C501, *Standard test method for relative resistance to wear of unglazed ceramic tile by the Taber Abraser*

3 Terms and definitions

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

3.1

vitreous and porcelain enamel

substantially vitreous, or glassy inorganic coating bonded to metal by fusion at a temperature above 500 °C for application on steel

NOTE 1 This coating can be applied for protective, functional and/or decorative purposes.

NOTE 2 It is produced by the application of powdered inorganic glass, dry or suspended in water on to the metal surface, and its subsequent fusion bonding. The fused coating exhibits cubic thermal expansion of between $150 \times 10^{-7} /K$ and $450 \times 10^{-7} /K$ in the temperature range 20 °C to 100 °C, the actual value varying specifically with the type of substrate and field of application.

3.2

heavy gauge steel enamelled panel

cold rolled steel panel that is first formed and then enamelled, either individually or in batches

NOTE Commonly the thickness of steel substrate for heavy gauge steel enamelled panels is greater than 0,75 mm.

3.3

light gauge steel enamelled panel

panel made by cutting the porcelain or vitreous enamelled top skin material produced in the enamelled condition on a continuous coil coating line, and laminating it on to a suitable core material or sandwich which provides its shape and strength

NOTE Commonly the thickness of the steel for the top skin for light gauge steel enamelled panels is 0,30 mm to 0,75 mm.

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4 Requirements for heavy and light gauge steel enamelled panels

4.1 Steel

The steel for enamelling shall conform to the requirements of EN 10209, unless agreed by interested parties.

The steel thickness shall be more than 0,75 mm for heavy gauge steel enamelled panels and from 0,30 mm to 0,75 mm for light gauge steel enamelled panels.

4.2 Application of coating

A minimum of two layers of enamel shall be applied over the external panel surface and minimum one layer for the internal panel surface.

4.3 Final thickness of fired enamel

When determined using the method given in EN ISO 2178, the final enamel thickness of the outer side panel shall be as given in Table 1.

Table 1 — Final thickness of fired enamel

Type of panel	Final enamel thickness µm	
	External surface	Internal surface
Heavy gauge	180 to 500	≥ 100
Light gauge	75 to 275	≥ 60

NOTE The maximum thicknesses may be exceeded to achieve a particular aesthetic appearance, subject to agreement between interested parties.

5 Functional characteristics of enamel coating

5.1 Adherence test

When determined in accordance with the procedure given in EN 10209:1996, Annex D, the adherence of the enamel to the metallic substrate shall be at least Class 3.

The test shall be carried out on pieces fired in parallel to the production panels. Because the adherence is influenced by refiring processes, the test shall be performed after the final firing.

5.2 Porosity test

The enamel coat shall not contain defects which could give rise to localized corrosion. When tested in accordance with EN 14430, or method A or B of EN ISO 8289 the number of open pores detected shall have the limits given in Table 2.

NOTE No open pore limit is specified for dry interior applications.

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Table 2 — Limits for open pores

Method	pores/m ²
EN 14430	max 10
EN ISO 8289 method A:	max 5
EN ISO 8289 method B:	max 10

When used for exterior building parts back and edges of the panel shall be adequately protected from corrosion. In case of heavy gauge panels, particular attention shall be given to the protection or concealment of edges within the design and the enamel application. For light gauge panels, particular attention shall be given to the protection or concealment of cut edges during the panel assembling or installation.

5.3 Abrasion resistance

When determined using the Taber apparatus in accordance with ASTM C501, using emery paper S 33, and a mass of 1 kg the resistance to abrasion, given as a loss in mass after 1,000 revolutions, shall be a maximum of 0,1 g.

NOTE This test cannot serve as guidance for assessing loss in gloss.

5.4 Impact resistance

Determine the resistance to impact using the method given in ISO 4532.

When activating the pistol with a force of 20 N, there shall be no damage over 2 mm in diameter after 24 h.

NOTE The mark of the striking bolt is not regarded as damage (see ISO 4532).

5.5 Surface hardness (Mohs)

When determined using the method given in EN 101 the Mohs surface hardness shall be a minimum of 5.

5.6 Scratch resistance

When determined using the method given in EN ISO 15695 the scratch resistance shall be a minimum of 7 N.

NOTE The limit for metallic finishes and silk screened finishes is minimum 4 N.

5.7 Flatness

Finished flat heavy gauge panel faces with core material shall have a maximum deflection of 0,5 % in a convex direction when measured perpendicular to the nominal plane of the panel face. Deflection in the concave direction shall be limited to less than 0,25 % from the actual plane of the panel face.

These percentages shall refer to the values of the largest diagonal or to the diameter of the panel. Panels are measured in the position in which they will be installed.

For finished flat light gauge panel faces with core material these deflections shall be restricted to 0,15 % maximum in both directions.

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5.8 Acid resistance

When tested in accordance with Clause 9 of EN 14483-1:2004 enamel coatings for exterior and interior environments shall have a minimum of class A acid resistance.

When tested in accordance with ISO 2742 enamel coatings for exterior environments shall have a maximum mass loss of 18,5 g/m².

6 Aesthetic characteristics of enamel coating

6.1 Surface appearance

All aspects of surface conditions (such as orange peel and mottling) shall be specified by agreement between the interested parties.

The enamelled surface shall be visually examined either in natural light or in artificial daylight D 65 in accordance with EN ISO 105-J03. The surface shall be examined from a minimum distance of 1,5 m, or at the distance at which the fixed panel would normally be viewed, whichever is the greater. The enamelled surface exposed to the atmosphere shall be free from defects liable to change the general appearance of the panel.