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Vitreous and porcelain enamels — Enamel coatings applied to steel for writing surfaces — Specification

Émaux vitrifiés — Revêtements en émail appliqués sur l'acier de surfaces d'écriture — Spécification

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 28762 was prepared by the European Committee for Standardization (CEN) (as EN 14864) and was adopted, under a special “fast-track procedure”, by Technical Committee ISO/TC 107, *Metallic and other inorganic coatings*, in parallel with its approval by the ISO member bodies.

Vitreous and porcelain enamels — Enamel coatings applied to steel for writing surfaces — Specification

1 Scope

This International Standard specifies the requirements for the functional and aesthetic characteristics of vitreous and porcelain enamel coatings applied to plain steel for use as writing surfaces (whiteboards and chalkboards).

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.

ISO 2178, *Non-magnetic coatings on magnetic substrates — Measurement of coating thickness — Magnetic method*

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

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

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

ISO 28706-1:2008, *Vitreous and porcelain enamels — Determination of resistance to chemical corrosion — Part 1: Determination of resistance to chemical corrosion by acids at room temperature*

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*

ASTM C 501, *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 enamel
porcelain enamel
substantially vitreous, or glassy, inorganic coating bonded to metal by fusion at a temperature above 500 °C

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 a cubic thermal expansion of between 150×10^{-7}/K and 450×10^{-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
vitreous or porcelain enamel writing surface
facing material or component of a chalkboard or whiteboard

NOTE Writing boards can have vitreous- or porcelain-enamelled sheets laminated to any of a variety of substrates, and perhaps framed, or can be made from fabricated vitreous- or porcelain-enamelled panels.

4 Steel substrate requirements

The steel for enamelling shall conform to the requirements of EN 10209.

The interested parties shall determine by mutual agreement the required thickness of the steel.

The steel shall be free from all defects that may affect the appearance of the surface finish.

5 Final thickness of fired enamel

When determined in accordance with ISO 2178, the thickness of the enamel on the outer face of the product shall be 250 µm maximum for whiteboards and 200 µm maximum for chalkboards.

6 Functional characteristics of the coating

6.1 Adherence test

The adherence of the enamelled coating shall be determined in accordance with EN 10209:1996, Annex D. For steel thicknesses less than 0,6 mm, a drop height of 300 mm shall be used.

The adherence of the enamel shall be at least level 3 as defined in EN 10209:1996, Annex D.

NOTE The test can be performed on pieces fired in parallel to the production panels.

Because refire bonding is important, the test shall be performed on the final cover coat.

6.2 Wear resistance

The resistance to abrasion of enamelled surfaces shall be determined using the Taber apparatus in accordance with ASTM C 501, using S 33 emery paper and a weight of 1 kg.

The loss in mass after 1 000 revolutions shall be a maximum of 0,10 g.

This test shall not serve as guidance for assessing loss in gloss.

6.3 Impact resistance

When the resistance to impact is determined in accordance with ISO 4532, with the pistol activated with a load 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).

6.4 Surface hardness (Mohs)

When determined in accordance with EN 101, the Mohs surface hardness shall be a minimum of 5 for whiteboard and a minimum of 3 for chalkboard.

6.5 Scratch resistance

When determined in accordance with ISO 15695, the scratch resistance of whiteboard shall be a minimum of 7 N.

The scratch resistance of silk-screened whiteboard shall be a minimum of 4 N.

6.6 Flatness

Flatness deviations which are not perturbing to the viewer when the finished writing surface is observed from normal distances are acceptable.

6.7 Acid and chemical resistance

When determined in accordance with Clause 9 of ISO 28706-1:2008, the citric acid resistance shall be a minimum of class A for whiteboards.

When determined in accordance with Clause 11 of ISO 28706-1:2008 for a test time of 15 min ± 30 s, the chemical resistance shall be a minimum of class A for whiteboards and chalkboards for each of the following liquids: deionized water, ethanol, methylethylketone, xylene and toluene.

7 Aesthetic characteristics of coating

7.1 Colour

Colour shall form the subject of an agreement between the contracting parties.

Conformity can be determined visually, in accordance with an agreed method, or using suitable equipment such as a colorimeter or a spectrometer.

NOTE The colour of the enamelled surface is characterized by constancy over time.

7.2 Gloss

The gloss of the enamelled coating shall be the subject of an agreement between the contracting parties.

Compliance can be determined visually, in accordance with an agreed method, or measured with a gloss meter using an appropriate method such as ISO 2813.

In all cases, the gloss shall be in the range 2 units to 20 units (at an angle of incidence of 60° in accordance with ISO 2813) for chalkboards and at least 35 units (at an angle of incidence of 60° in accordance with ISO 2813) for whiteboards.

7.3 Surface appearance

Every other aspect of the surface (such as orange peel and silk-screened patterns) shall form the subject of an agreement between the contracting parties.

8 Writability and erasability

8.1 Chalkboards

The surface of chalkboards shall be suitable and easy to write on. Removal of writing shall be possible smoothly with a dry felt eraser or latex sponge.

8.2 Whiteboards

The surface shall be easy to write on with dry-erasable, water-soluble or permanent felt markers.

Writing with dry-erasable felt markers shall be easy to wipe off dry with a felt eraser or a cotton cloth.

Water-erasable writing shall be easy to wipe off with water. Permanent felt marker writing shall be easy to remove with alcohol or another suitable solvent without any visible change in the colour or gloss of the surface.

After thorough cleaning, the surface contamination or colour fading under influence of the marker pigment shall not exceed $\Delta E^* = 0{,}5$ (see ISO 7724-1, ISO 7724-2, ISO 7724-3 and CIELAB).

NOTE CIELAB is an abbreviation for the colour difference formula CIE 1976 ($L^*a^*b^*$) recommended by the International Commission on Illumination (CIE).

9 Resistance to graffiti

After eight days of ageing at room temperature, inks, varnishes, lacquers and paints shall be easily removable with suitable solvents without any visible change in the gloss or colour of the enamel surface.