



SLOVENSKI STANDARD
SIST EN 12878:2005

01-julij-2005

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SIST EN 12878:2000

**Pigmenti za obarvanje gradbenih materialov na osnovi cementa in/ali apna -
Specifikacije in metode preskušanja**

Pigments for the colouring of building materials based on cement and/or lime -
Specifications and methods of test

Pigmente zum Einfärben von zement- und/oder kalkgebundenen Baustoffen -
Anforderungen und Prüfverfahren

Pigments de coloration des matériaux de construction a base de ciment et/ou de chaux -
Spécifications et méthodes d'essai

Ta slovenski standard je istoveten z: EN 12878:2005

ICS:

| | | |
|-----------|----------------------------|---------------------------------|
| 87.060.10 | Pigmenti in polnila | Pigments and extenders |
| 91.100.10 | Cement. Mavec. Apno. Malta | Cement. Gypsum. Lime. Mortar |

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English version

Pigments for the colouring of building materials based on cement and/or lime - Specifications and methods of test

Pigments de coloration des matériaux de construction à
base de ciment et/ou de chaux - Spécifications et
méthodes d'essai

Pigmente zum Einfärben von zement- und/oder
kalkgebundenen Baustoffen - Anforderungen und
Prüfverfahren

This European Standard was approved by CEN on 25 March 2005.

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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Foreword

This document (EN 12878:2005) has been prepared by Technical Committee CEN/TC 298 “Pigments and extenders”, the secretariat of which is held by DIN.

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 November 2005, and conflicting national standards shall be withdrawn at the latest by February 2007.

This document supersedes EN 12878:1999.

Annex A gives further information regarding the test methods.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA which is an integral part of this document.

This document includes a Bibliography with currently existing International Standards for particular pigments suitable for use in building materials based on cement and/or lime.

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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1 Scope

This European Standard specifies the requirements and the test methods for pigments for use in the colouring of building materials based on cement and cement/lime combinations.

Pigments covered by this European Standard can also be used in pure lime mortar. For this application see EN 459-1 and EN 459-2.

Pigments for this purpose can be single pigments, blends of pigments, or blends of pigments and extenders, in powder or granular form, or aqueous preparations.

Pigments typically belong to one of the following classes of compounds:

- synthetic or natural oxides and hydroxides of iron;
- oxides of chromium, titanium and manganese;
- complex inorganic pigments, for example combinations of the above mentioned metal oxides and hydroxides with cobalt, aluminium, nickel and antimony oxides and hydroxides;
- ultramarine pigments;
- phthalocyanine blue and green;
- elemental carbon (should be regarded as an inorganic pigment);
- blends of the above materials (which may also include extenders).

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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 196-1:2005, *Methods of testing cement — Part 1: Determination of strength*

EN 196-3, *Methods of testing cement — Part 3: Determination of setting times and soundness*

EN 197-1, *Cement — Part 1: Composition, specifications and conformity criteria for common cements*

EN 934-2, *Admixtures for concrete, mortar and grout — Part 2: Concrete admixtures – Definitions, requirements, conformity, marking and labelling*

EN ISO 787-3, *General methods of test for pigments and extenders - Part 3: Determination of matter soluble in water - Hot extraction method (ISO 787-3:2000)*

EN ISO 787-9, *General methods of test for pigments and extenders — Part 9: Determination of pH value of aqueous suspension (ISO 787-9:1981)*

EN ISO 787-13, *General methods of test for pigments and extenders - Part 13: Determination of water-soluble sulfates, chlorides and nitrates (ISO 787-13:2002)*

EN ISO 1158, *Plastics - Vinyl chloride homopolymers and copolymers - Determination of chlorine content (ISO 1158:1998)*

EN ISO 15528, *Paints, varnishes and raw materials for paints and varnishes — Sampling (ISO 15528:2000)*

ISO 787-7, *General methods of test for pigments and extenders — Part 7: Determination of residue on sieve — Water method — Manual procedure*

ISO 3310-1, *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth*

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

ISO 9277, *Determination of the specific surface area of solids by gas adsorption using the BET method*

3 Terms and definitions

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

3.1

pigment

substance, generally in the form of fine particles, which is insoluble in the application medium and whose sole purpose is to colour cement- and/or lime-based building materials

3.2

single pigment

pigment of singular (chemical) composition containing no substances other than those originating from the pigment manufacturing process

NOTE Surface treatment of the primary pigment particles is considered as a part of the pigment manufacturing process.

3.3

pigment blend

blend of at least two single pigments, or at least one single pigment and an extender

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3.4

aqueous pigment preparation

preparation in which a pigment (single pigment or pigment blend) is dispersed in water, with or without a dispersion or other agent

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NOTE

Examples of agents are:
 - dispersants;
 - binding agents (resins);
 - solvents;
 - wetting agents;
 or combinations thereof.

3.5

pigment in granular form

preparation in which a pigment (single pigment or pigment blend) is converted into granules, by the use of a binding agent which retains the integrity of the granule

3.6

reference sample standard pigment

sample of a single pigment or a blend (powder, or preparation) retained by the interested parties for comparison for the evaluation of the product properties

3.7

extender

inorganic substance, generally a material in granular or powder form, which is insoluble in the application medium and has no inherent colour properties

4 Requirements

4.1 Effects on concrete properties

4.1.1 General

In addition to all other requirements, pigments for steel reinforced concrete shall meet the Category B requirements given in 4.1.3, 4.2.3 to 4.2.5.

The inorganic pigment dosage shall be 5,0 % solids, carbon black and organic pigment dosage of 2,0 % solids, by mass, based on the cement amount for testing according to 5.1.

If a higher dosage of pigment is recommended the tests shall be carried out with that dosage.

The dosage in percent by mass shall be specified by the manufacturer.

4.1.2 Setting time

4.1.2.1 Initial setting time

The initial setting time of cement with the single pigment or a blend (both as powder, granulate or preparation), determined in accordance with 5.1.1, shall not be less than 60 min.

The maximum difference between the initial setting time of mixes with and without the single pigment or a blend (both as powder, granulate or preparation) shall not be greater than 60 min.

4.1.2.2 Final setting time

The final setting time of cement with the single pigment or a blend (both as powder, granulate or preparation), determined in accordance with 5.1.1, shall not be longer than 720 min.

4.1.3 Compressive strength

The 28 day compressive strength of mixes with the single pigment or a blend (both as powder, granulate or preparation), determined in accordance with 5.1.2, shall not be reduced in comparison with the mix without pigment more than

Category A: the manufacturer's declared value

Category B: 8 %.

4.2 Composition

4.2.1 General

Where dispersion agents, binding agents and/or grinding aids are used, their total content shall be equal to or less than 5,0 % by mass, based on pigment solids. If admixtures are used for the preparation of single pigments or blends in the form of granulates or preparations they shall conform to EN 934-2. Admixture type according to EN 934-2 shall be reported.

The stability of a pigment with respect to colour shall be linked to the intended end use conditions.

The solids content, as a percentage (%) of aqueous preparations, shall be declared by the manufacturer.

4.2.2 Composition of the pigment

The main constituents of the pigments are determined in accordance with 5.2.2.

4.2.3 Water soluble substances

The content of water soluble substances, determined in accordance with 5.2.3, shall not be greater than

Category A: the manufacturer's declared value

Category B: 0,5 % by mass.

For pigment blends in powder form, evidence of compliance may be calculated from data recorded for constituent single pigments.

4.2.4 Soluble chloride

The soluble chloride content of a single pigment or a blend (powder, granulate or preparation), determined in accordance with 5.2.4, shall not be greater than

Category A: the manufacturer's declared value

Category B: 0,10 % by mass.

For pigment blends in powder form, evidence of compliance may be calculated from data recorded for constituent single pigments.

NOTE Where pigment blends, pigment/extender mixtures, or granulates or aqueous preparations thereof, are used in excess of 5 % based on cement, the total content of halides and of anions precipitated by Ag⁺ which are admitted into the concrete should not exceed 0,005 % based on the cement.

4.2.5 Total chlorine

The total chlorine content of a single pigment or a blend (powder, granulate or preparation), determined in accordance with 5.2.5, shall not be greater than

Category A: the manufacturer's declared value

Category B: 0,10 % by mass.

For pigment blends in powder form, evidence of compliance may be calculated from data recorded for constituent single pigments.

4.3 Loss on ignition

The loss on ignition of a single pigment or a blend (powder, granulate or preparation), determined in accordance with 5.3, shall be declared by the manufacturer.

4.4 Emission of radioactivity

Where subject to regulatory requirements, the emission of radioactivity by the pigment shall be declared.

NOTE See Annex ZA.

4.5 Release of dangerous substances

Where subject to regulatory requirements, the release of dangerous substances by the pigment shall be declared.

NOTE See Annex ZA.

4.6 Relative colour strength

The relative colour strength in comparison with the standard pigment, determined in accordance with 5.6, shall be 100 % ± 5 %.

4.7 Residue on sieve

The residue on the sieve of pigment in powder form, determined in accordance with 5.7, shall be declared by the manufacturer.

4.8 pH value

The pH value, determined in accordance with 5.8, shall conform with the manufacturer's specified value ± 2 .

4.9 Alkali stability

The manufacturer shall declare that the pigment, tested in accordance with 5.9, is alkali stable.

4.10 Resistance to weathering

The manufacturer shall declare that the pigment, tested in accordance with 5.10, is resistant to weathering.

4.11 Thermal stability

The manufacturer shall declare that the pigment, tested in accordance with 5.11, is thermally stable.

4.12 Colour comparison against standard pigment

The manufacturer shall declare the ΔE value, compared against the standard pigment, tested in accordance with 5.12.

NOTE Research into the repeatability and reproducibility of this test method has shown that samples prepared using the same pigments at five separate laboratories produced results within a ΔE range of 0,5.

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5 Test methods

5.1 Effect on concrete properties

5.1.1 Setting time

The influence on the setting time of cement shall be tested using the test method described in EN 196-3, using a paste made with Portland cement CEM I 42,5 R conforming to EN 197-1, with and without the addition of pigment.

5.1.2 Compressive strength

The influence of a pigment on the 28-day compressive strength of the mortar shall be tested in accordance with EN 196-1. The mortar shall be made with Portland cement CEM I 42,5 R conforming to EN 197-1 (same cement as in 5.1.1) with and without the addition of pigment.

The water content of aqueous pigment preparations shall be taken into account.

5.2 Composition

5.2.1 General

Any physical effects are determined by way of comparative tests on pigmented and unpigmented cement paste, mortar or concrete mixes, as appropriate. When using pigment preparations (3.4 and 3.5), the pigment solids content shall be taken into consideration in the mix composition.

Generally, an amount of not more than 10,0 % pigment should be added to cement or lime.

Sampling shall be in accordance with 6.2.

5.2.2 Composition of the pigments

Determine the chemical composition of the pigments (4.2.2) in accordance with the relevant standard (see Bibliography). Where no standard exists, appropriate up-to-date analytical procedures shall be used.

5.2.3 Water soluble substances

The determination of the water soluble content shall be performed in accordance with EN ISO 787-3. In pigment preparations (3.4 and 3.5) the quantity to be used is chosen so that it contains the amount of solids indicated in EN ISO 787-3.

5.2.4 Soluble chloride

Conduct the test for water-soluble chloride in accordance with EN ISO 787-13. For pigment preparations (3.4 and 3.5), the quantity to be used is chosen so that it contains the amount of solids indicated in EN ISO 787-3.

5.2.5 Total chlorine

The test shall be carried out in accordance with the test procedure of EN ISO 1158 except that the accurately weighed sample shall be approximately 0,25 g of the dry material and that the silver nitrate and ammonium thiocyanate solutions are 0,01 mol/l (0,01 N).

5.3 Loss on ignition

Weigh 2 g to 5 g (to an accuracy of 1 mg) of pigment (m_1) that has been dried to constant mass at $105\text{ °C} \pm 5\text{ °C}$ and calcine it to constant mass at $1000\text{ °C} \pm 50\text{ °C}$. Cool in a desiccator to room temperature and weigh again (m_2). Calculate the loss on ignition L as a percentage by mass using the following equation:

$$L = \frac{m_1 - m_2}{m_1} \times 100 \quad \text{SIST EN 12878:2005} \quad (1)$$

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where

m_1 mass, in gram, of the pigment under test;

m_2 mass, in gram, of the residue after ignition and cooling.

5.4 Emission of radioactivity

Where required a relevant test method should be used.

NOTE See Annex ZA.

5.5 Release of dangerous substances

Where required a relevant test method should be used.

NOTE See Annex ZA.

5.6 Relative colour strength

5.6.1 General remarks

The relative colour strength attained in coloured cement or cement/lime bound construction materials is determined by means of the following special test methods:

Pigments in powder form shall be tested by dry mixing with a white material in fine powder form, in accordance with 5.6.2, or by wet mixing, in accordance with 5.6.3 or 5.6.4. The relative colour strength of aqueous pigment

preparations and granulates shall be tested in accordance with 5.6.3 or in a wet mix with cement in accordance with 5.6.4. Testing may be carried out in accordance with alternative test methods with a proven correlation to the standard methods.

The test method 5.6.4 shall be the reference method.

The measurement of colour strength shall be carried out well below the point of colour saturation in a given formulation. This is the point at which an increase in pigment loading produces no noticeable change in colour intensity.

5.6.2 Relative colour strength in barytes or white Portland cement CEM I (dry mix)

5.6.2.1 Equipment and test materials

5.6.2.1.1 **Analytical balance**, capable of weighing to the nearest 0,1 mg.

5.6.2.1.2 **200 ml jars**, thick-walled, for shaking the mix.

5.6.2.1.3 **Stainless steel balls**, 5 mm \pm 0,5 mm in diameter.

5.6.2.1.4 **Stopwatch**.

5.6.2.1.5 **Sieve**, for separating the stainless steel balls.

5.6.2.1.6 **Spatula**.

5.6.2.1.7 **Paper** with rough surface texture.

5.6.2.1.8 **Barytes** of 1 m²/g to 2 m²/g specific surface area measured by the BET method as described in ISO 9277, or white Portland cement CEM I.

5.6.2.1.9 **Pigment** in powder form, to be used as a reference sample.

5.6.2.1.10 **Mechanical sieve machine or shaker**.

5.6.2.2 Test procedure

The pigment sample (0,1 g to 0,5 g weighed to the nearest 0,1 mg) and 10,00 g of the white material are weighed into the shaker jar. After adding 200 stainless steel balls, mix for 3 min with either the mechanical sieve machine or shaker. If a suitable machine is not available the jar may be hand-shaken until a thorough mix is obtained. Abraded glass shaking jars and corroded steel balls shall be discarded.

Sieve the contents of the jar to remove the stainless steel balls. The resultant dry powder mix has to appear without streaks when spread and smoothed out with the spatula on the rough paper. If streaks are apparent the test shall be repeated using a longer shaking time.

Prepare a mix of the reference sample in a similar manner.

To determine the colour strength, place the mixes alongside each other on the paper and draw down with the spatula, so that the mixes touch but do not intermix.

Compare the drawdowns visually and, if different, adjust the amount of pigment in the test mix and repeat until parity with the reference sample mix is achieved.