



SLOVENSKI STANDARD
SIST EN 15167-1:2006

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Grobozrnata plavžna žindra za uporabo v betonu, malti in injekcijski malti – 1. del.
Definicije, specifikacije in merila skladnosti

Ground granulated blast furnace slag for use in concrete, mortar and grout - Part 1:
Definitions, specifications and conformity criteria

Hüttensandmehl zur Verwendung in Beton, Mörtel und Einpressmörtel - Teil 1:
Definitionen, Anforderungen und Konformitätskriterien

Laitier granulé de haut-fourneau moulu pour utilisation dans le béton, mortier et coulis -
Partie 1: Définitions, exigences et critères de conformité

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ICS 91.100.15; 01.040.91

English Version

Ground granulated blast furnace slag for use in concrete, mortar
and grout - Part 1: Definitions, specifications and conformity
criteria

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Hüttensandmehl zur Verwendung in Beton, Mörtel und
Einpressmörtel - Teil 1: Definitionen, Anforderungen und
Konformitätskriterien

This European Standard was approved by CEN on 26 June 2006.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (EN 15167-1:2006) has been prepared by Technical Committee CEN/TC 104 "Concrete and related products", 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of an identical text or by endorsement, at the latest by February 2007, and conflicting national standards shall be withdrawn at the latest by May 2008.

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 Construction Products Directive (89/106/EEC).

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

The standard EN 15167 is composed of two parts:

- Part 1: Definitions, specifications and conformity criteria
- Part 2: Conformity evaluation

The preparatory work was carried out by WG15 of CEN/TC 104 since November 2003 in which the following countries participated: Austria, Belgium, Czech Republic, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Poland, Spain, Sweden, Switzerland and the United Kingdom.

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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This European Standard specifies requirements for the chemical and physical properties as well as quality control procedures for ground granulated blastfurnace slag for use as a type II addition in the production of concrete, including in particular cast-in-situ or prefabricated structural concrete conforming to EN 206-1. Ground granulated blastfurnace slag conforming to this European Standard may also be used in mortars and grouts.

Ground granulated blastfurnace slag containing any added materials other than grinding aids, is not within the scope of this European Standard. It is also not within the scope of this European Standard to specify provisions governing the practical application of ground granulated blastfurnace slag in the production of concrete, mortar or grout, i.e. requirements concerning composition, mixing, placing, curing etc. As regards such provisions, reference should be made to other European or national standards, such as EN 206-1.

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

EN 196-2, *Methods of testing cement — Part 2: Chemical analysis of cement*

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

EN 196-6, *Methods of testing cement — Part 6: Determination of fineness*

EN 196-7, *Methods of testing cement — Part 7: Methods of taking and preparing samples of cement*

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

EN 15167-2:2006, *Ground granulated blast furnace slag for use in concrete, mortar and grout — Part 2: Conformity evaluation*

3 Terms and definitions

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

3.1 activity index

ratio (in percent) of the compressive strength of mortar prisms made from 50 % by mass test cement and 50 % by mass ground granulated blastfurnace slag, relative to the compressive strength of equivalent mortar prisms made from 100 % test cement, tested at the same age

3.2 allowable probability of acceptance CR

for a given sampling plan, the allowed probability of acceptance of ground granulated blastfurnace slag with a characteristic value outside the specified characteristic value

3.3**autocontrol**

continual statistical quality control of the ground granulated blastfurnace slag based on the testing of samples taken by the manufacturer or their agent at point(s) of release from the ground granulated blastfurnace slag factory

3.4**characteristic value**

value of the required property outside of which lies a specified percentage, the percentile P_k , of all the values of the population

3.5**control period**

period of manufacture and/or dispatch identified for the evaluation of the autocontrol test results

3.6**granulated blastfurnace slag**

vitrified material made by rapid cooling of a slag melt of suitable composition, obtained by smelting iron ore in a blastfurnace, consisting of at least two thirds by mass of glassy slag and possessing hydraulic properties when suitably activated

NOTE Rapid cooling includes quenching in water (granulation) and projecting through water and air (pelletisation).

3.7**ground granulated blastfurnace slag**

fine powder made by grinding granulated blastfurnace slag

3.8**sampling plan**

specific plan which states the (statistical) sample size(s) to be used, the percentile P_k (on which the characteristic value is based) and the allowable probability of acceptance CR

3.9**single result limit value**

value of a mechanical, physical or chemical property which – for any single test result – in the case of an upper limit is not to be exceeded or in the case of a lower limit is, as a minimum, to be reached

3.10**specified characteristic value**

characteristic value of a chemical or physical property which in the case of an upper limit is not to be exceeded or in the case of a lower limit is, as a minimum, to be reached

3.11**spot sample**

sample taken at the same time and from one and the same place, relating to the intended tests. It can be obtained by combining one or more immediately consecutive increments (see EN 196-7)

3.12**test cement**

selected batch of Portland cement, to be used for carrying out the tests needed to evaluate conformity to the requirements of 5.3.2.2 and 5.3.2.3

3.13**type II addition**

finely divided inorganic, pozzolanic or latent hydraulic material that may be added to concrete in order to improve certain properties or to achieve special properties (see EN 206-1)

4 Constituents

The main constituent shall be granulated blastfurnace slag, as defined in 3.6. Its chemical composition shall consist of at least two-thirds by mass of the sum of calcium oxide (CaO), magnesium oxide (MgO) and silicon dioxide (SiO₂). The remainder shall be aluminium oxide (Al₂O₃) together with small amounts of other compounds. The ratio by mass (CaO + MgO)/(SiO₂) shall exceed 1,0.

Ground granulated blastfurnace slag conforming to this European Standard shall contain no added materials except grinding aids to assist in the manufacture. The total quantity of grinding aid shall not exceed 1,0 % and the organic content of any grinding aid(s) shall not exceed 0,2% (both by mass of the ground granulated blastfurnace slag). Grinding aids shall not promote corrosion of the reinforcement or impair the properties of the ground granulated blastfurnace slag or the concrete, mortar or grout, made from it.

5 Specifications

5.1 General

The chemical and physical requirements in 5.2 and 5.3 are specified as characteristic values. Conformity to a characteristic value is assessed by means of a statistical quality control procedure as described in Clause 8. The test methods prescribed in this European Standard are reference methods. In factory production control (see EN 15167-2), other methods may be used provided they give results equivalent to those obtained with the reference method. In case of a dispute, only the reference method shall be used.

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5.2 Chemical requirements

The chemical properties of the ground granulated blastfurnace slag shall conform to the requirements in Table 1.

Table 1 — Chemical requirements given as characteristic values

Property	Test reference	Requirements ^a
magnesium oxide	EN 196-2	≤ 18 %
sulfide	EN 196-2	≤ 2,0 %
sulfate	EN 196-2	≤ 2,5 %
loss on ignition, corrected for oxidation of sulfide	EN 196-2	≤ 3,0 %
chloride ^b	EN 196-2	≤ 0,10 %
moisture content	Annex A	≤ 1,0 %
^a Requirements are given by mass of the ground granulated blastfurnace slag.		
^b Ground granulated blastfurnace slag may contain more than 0,10 % chloride but in that case the maximum chloride content, as a value not to be exceeded, shall be stated on the packages or the documents (see Clause 6).		

5.3 Physical requirements

5.3.1 Fineness

The specific surface determined in accordance with the air permeability method specified in EN 196-6, shall be not less than 275 m²/kg.

5.3.2 Requirements when combined with the test cement

5.3.2.1 Test cement

The test cement shall conform to EN 197-1 and shall be selected by the ground granulated blastfurnace slag manufacturer, subject to the following restrictions:

- it shall be a type CEM I, of strength class 42,5 or higher;
- the Blaine fineness shall be at least 300 m²/kg;
- the tricalcium aluminate shall be between 6 % and 12 %;
- the alkali (Na₂O equivalent) content shall be between 0,5 % and 1,2 %.

5.3.2.2 Initial setting time

When determined in accordance with EN 196-3, the initial setting time of a combination (by mass) of 50 % of ground granulated blastfurnace slag with 50 % of test cement, shall not be more than twice as long as that of the test cement on its own.

5.3.2.3 Activity index

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The activity index shall be expressed as the ratio (in percent) of the compressive strength of the combination (by mass) of 50 % of ground granulated blastfurnace slag with 50 % of test cement, to the compressive strength of the test cement on its own. The compressive strengths shall be determined in accordance with EN 196-1 and the water:combination ratio and the water:cement ratio shall both be 0,50.

The activity index at 7 days and at 28 days shall be not less than 45 % and 70 % respectively.

NOTE The activity index gives no direct information on the strength contribution of ground granulated blastfurnace slag in concrete, nor is the use of the ground granulated blastfurnace slag limited to the mixing ratio used in the activity index test.

5.4 Other requirements

5.4.1 Durability requirements

The composition and the performance of the ground granulated blastfurnace slag shall be such that durable concrete may be produced when using it. GGBS conforming to this European Standard is deemed to satisfy the durability requirements, provided that other requirements for durability of concrete in relevant standards and/or regulations valid in the place of use are fulfilled.

5.4.2 Release of dangerous substances and emission of radioactivity

NOTE In the absence of specific requirement with respect to substances, dangerous to health, hygiene and environment in this European Standard, Annex ZA.1, Note 1 applies.

5.5 Information to be supplied upon request

Information on the properties listed below shall be declared to the user upon request:

- a) 7- and 28-day activity index of a 50 % combination of the ground granulated blastfurnace slag with 50 % of test cement, determined in accordance with 5.3.2.3;
- b) initial setting time of a 50 % combination of the ground granulated blastfurnace slag with 50 % of test cement;
- c) initial setting time and 7- and 28-day strength of the test cement;
- d) chemical oxide composition of the ground granulated blastfurnace slag, comprising the contents of calcium oxide (CaO), silicon dioxide (SiO₂), aluminium oxide (Al₂O₃), magnesium oxide (MgO), titanium dioxide (TiO₂) and manganese (Mn₂O₃);
- e) total content of alkalis determined in accordance with EN 196-2, or other method agreed between manufacturer and user, and expressed as equivalent sodium oxide;
- f) fineness value determined in accordance with the air permeability method in EN 196-6;
- g) relative density determined in accordance with EN 196-6;
- h) glass content and the method used for its determination;
- i) the method(s) of rapid cooling used to produce the granulated blastfurnace slag(s) used in the manufacture of the ground granulated blastfurnace slag (see note to 3.6).

The format and the basis on which the information on the properties is declared, shall be as agreed between the manufacturer and user.

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6 Packaging and labelling

Ground granulated blastfurnace slag may be delivered in suitable packages or by means of suitable bulk-delivery transportation systems. The following information shall be marked on the packages or in the case of bulk delivery, on the documents:

- the number of this European Standard, i.e. EN 15167-1;
- description of the product, e.g. “ground granulated blastfurnace slag”;
- the name or identification mark of the factory where the ground granulated blastfurnace slag was manufactured;
- where appropriate, additional identification to distinguish between different certified ground granulated blastfurnace slag, produced in the same factory;
- where the chloride content is in excess of 0,10 %, the maximum chloride content (as a value that will not be exceeded).

NOTE For CE marking and labelling, ZA.3 ZA applies.

7 Sampling

Spot samples, equally distributed over the manufacturing period, shall be taken at the point of release into packages or a system for bulk-delivery transportation or, alternatively, directly from bulk-delivery transportation systems or packages, using the equipment and principles described in EN 196-7.

For the purpose of carrying out all the analyses and tests needed to show conformity or non-conformity to the requirements set out in 5, a representative laboratory sample of ground granulated blastfurnace slag of at least 1 kg is required. This sample shall be obtained by subdividing, such as quartering, a spot sample of at least 5 kg.

8 Evaluation of conformity

8.1 General requirements

The conformity of ground granulated blastfurnace slag to the requirements of this European Standard and to the stated values shall be demonstrated by:

- initial type testing;
- factory production control by the manufacturer, including product assessment.

Conformity of ground granulated blastfurnace slag to this European Standard shall be continually evaluated on the basis of testing of spot samples. The properties, test methods and the minimum testing frequencies for the autocontrol testing by the manufacturer are specified in Table 2.

In addition to the provisions of this clause, the initial type testing and the factory production control shall be carried out according to the relevant clauses in EN 15167-2.

NOTE 1 For attestation of conformity for CE marking, reference is made to Annex ZA.
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NOTE 2 EN 15167-2 does not deal with acceptance inspection at delivery.