



SLOVENSKI STANDARD
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j YnUbY`na Yg]

Hydraulically bound mixtures - Specifications - Part 3: Fly ash bound mixtures

Hydraulisch gebundene Gemische - Anforderungen - Teil 3: Flugaschegebundene Gemische

Mélanges traités aux liants hydrauliques - Specifications - Partie 3 : Mélanges traités a la cendre volante

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EUROPEAN STANDARD
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Hydraulically bound mixtures - Specifications - Part 3: Fly ash
bound mixtures

Mélanges traités aux liants hydrauliques - Spécifications -
Partie 3 : Mélanges traités à la cendre volante

Hydraulisch gebundene Gemische - Anforderungen - Teil 3:
Flugaschegebundene Gemische

This European Standard was approved by CEN on 16 April 2004.

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Foreword

This document (EN 14227-3:2004) has been prepared by Technical Committee CEN/TC 227 "Road materials", 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of an identical text or by endorsement, at the latest by January 2005, and conflicting national standards shall be withdrawn at the latest by January 2005.

This document is one of a series of standards for hydraulically bound mixtures.

prEN 14227-1, *Unbound and hydraulically bound mixtures — Specifications — Part 1: Cement bound granular mixtures*

EN 14227-2, *Hydraulically bound mixtures — Specifications — Part 2: Slag bound mixtures*

EN 14227-3, *Hydraulically bound mixtures — Specifications — Part 3: Fly ash bound mixtures*

EN 14227-4, *Hydraulically bound mixtures — Specifications — Part 4: Fly ash for hydraulically bound mixtures*

EN 14227-5, *Hydraulically bound mixtures — Specifications — Part 5: Hydraulic road binder bound mixtures*

prEN 14227-10, *Hydraulically bound mixtures — Specifications — Part 10: Soil treated by cement*

prEN 14227-11, *Unbound and hydraulically bound mixtures — Specifications — Part 11: Soil treated by lime*

prEN 14227-12, *Unbound and hydraulically bound mixtures — Specifications — Part 12: Soil treated by slag*

prEN 14227-13, *Unbound and hydraulically bound mixtures — Specifications — Part 13: Soil treated by hydraulic road binder*

prEN 14227-14, *Unbound and hydraulically bound mixtures — Specifications — Part 14: Soil treated by fly ash*

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.

1 Scope

This document specifies “fly ash bound mixtures” for roads, airfields and other trafficked areas and specifies the requirements for their constituents, composition and laboratory performance classification. In this document, fly ash refers to siliceous or calcareous fly ash complying with EN 14227-4. Where fly ash is part of cement or hydraulic road binder conforming to EN 197-1 or ENV 13282, then reference should be made to prEN 14227-1 and EN 14227-5 respectively.

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

EN 933-1, *Tests for geometrical properties of aggregates — Part 1: Determination of particle size distribution — Sieving method*

EN 1097-6, *Tests for mechanical and physical properties of aggregates — Part 6: Determination of particle density and water absorption*

EN 1097-7, *Tests for mechanical and physical properties of aggregates — Part 7: Determination of the particle density of filler — Pycnometer method*

EN 13242, *Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction*

EN 13286-1, *Unbound and hydraulically bound mixtures — Part 1: Test methods for laboratory reference density and water content — Introduction, general requirements and sampling*

EN 13286-2, *Unbound and hydraulically bound mixtures — Part 2: Test methods for the determination of the laboratory reference density and water content — Proctor compaction*

EN 13286-3, *Unbound and hydraulically bound mixtures — Part 3: Test methods for laboratory reference density and water content — Vibrocompression with controlled parameters*

EN 13286-4, *Unbound and hydraulically bound mixtures — Part 4: Test methods for laboratory reference density and water content — Vibrating hammer*

EN 13286-5, *Unbound and hydraulically bound mixtures — Part 5: Test methods for laboratory reference density and water content — Vibrating table*

EN 13286-40, *Unbound and hydraulically bound mixtures — Part 40: Test method for the determination of the direct tensile strength of hydraulically bound mixtures*

EN 13286-41, *Unbound and hydraulically bound mixtures — Part 41: Test method for the determination of the compressive strength of hydraulically bound mixtures*

EN 13286-42, *Unbound and hydraulically bound mixtures — Part 42: Test method for the determination of the indirect tensile strength of hydraulically bound mixtures*

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EN 13286-43, *Unbound and hydraulically bound mixtures — Part 43: Test method for the determination of the modulus of elasticity of hydraulically bound mixtures*

EN 13286-45, *Unbound and hydraulically bound mixtures — Part 45: Test method for the determination of the workability period of hydraulically bound mixtures*

EN 13286-47, *Unbound and hydraulically bound mixtures — Part 47: Test methods for the determination of California bearing ratio, immediate bearing index and linear swelling*

prEN 13286-50, *Unbound and hydraulically bound mixtures — Part 50: Method for the manufacture of test specimens of hydraulically bound mixtures using Proctor equipment or vibrating table compaction*

prEN 13286-51, *Unbound and hydraulically bound mixtures — Part 51: Method for the manufacture of test specimens of hydraulically bound mixtures by vibrating hammer compaction*

prEN 13286-52, *Unbound and hydraulically bound mixtures — Part 52: Method for the manufacture of test specimens of hydraulically bound mixtures by vibrocompression*

prEN 13286-53, *Unbound and hydraulically bound mixtures Methods for the manufacture of test specimens of hydraulically bound mixtures by axial compression*

EN 14227-2, *Hydraulically bound mixtures — Specifications — Part 2: Slag bound mixtures*

EN 14227-4, *Hydraulically bound mixtures — Specifications — Part 4: Fly ash for hydraulically bound mixtures*

prEN 14227-11, *Unbound and hydraulically bound mixtures — Specifications — Part 11: Soil treated by lime*

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3 Terms and definitions

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

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3.1**hydraulically bound mixture**

mixture which sets and hardens by hydraulic reaction

3.2**fly ash bound mixture**

hydraulically bound mixture in which siliceous or calcareous fly ash is the essential constituent of the binder

NOTE Hardening may be controlled by additional constituents.

3.3**slenderness ratio**

height to diameter ratio of the specimen

3.4**compacity**

ratio of the absolute volume of the solid to the apparent volume of the mixture (see annex A)

4 Symbols and abbreviations

For the purpose of this document, the following symbols and abbreviations apply.

R_c is the compressive strength, expressed in megapascals (MPa);

R_t is the direct tensile strength, expressed in megapascals (MPa);

- R_{it} is the indirect tensile strength, expressed in megapascals (MPa);
- E is the modulus of elasticity, expressed in megapascals (MPa);
- E_c is the E determined by compression, expressed in megapascals (MPa);
- E_t is the E determined in direct tension, expressed in megapascals (MPa);
- E_{it} is the E determined in indirect tension, expressed in megapascals (MPa).

5 Constituents

5.1 Fly ash

Siliceous or calcareous fly ash shall conform to EN 14227-4.

5.2 Lime

Quick lime (CaO) or hydrated lime [Ca(OH)₂] shall conform to prEN 14227-11.

5.3 Cement

Cement shall conform to EN 197-1.

5.4 Aggregates

Aggregates shall be selected from EN 13242.

The properties and the appropriate categories of the aggregates shall be specified depending on the position of the fly ash bound mixture in the pavement structure and the traffic to be carried.

Aggregates shall be volumetrically stable. When this is not the case, the use of the mixture shall be permitted provided there is a satisfactory performance record or a thorough laboratory evaluation of the mixture has been carried out in accordance with provisions valid at the place of use.

5.5 Gypsum

The percentage of (CaSO₄ · 2 H₂O) shall be higher than 90 %. The maximum size shall be less than 5 mm.

NOTE 1 Gypsum, natural or artificial, is a hardening activator.

NOTE 2 Unless the constituents and the mixture are well known and proven, it will be necessary to check the expansion of mixtures containing gypsum.

5.6 Granulated blast furnace slag

Granulated blast furnace slag shall conform to EN 14227-2.

5.7 Other constituents

Constituents, including calcium chloride and sodium carbonate can be used to enhance the setting and hardening of fly ash bound mixtures.

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5.8 Water

Water shall not contain components that adversely affect the hardening and performance of the fly ash bound mixture.

6 Fly ash bound mixtures

6.1 General

6.1.1 Types

Fly ash bound mixture shall be made from the constituents specified in 5.1.

The mixture shall be selected from the 5 types described below and shall conform to the specified requirements for the selected mixture.

6.1.2 Water content

The water content shall be selected to permit compaction on site by rolling and to optimize the mechanical performance of the mixture. The water content shall be determined by the Proctor test or other method in accordance with EN 13286-1 to -5 and limits set to give a workable range of water content on site compatible with the compaction and the desired mechanical performance of the mixture.

6.1.3 Proportioning of the constituents, grading and dry density

The proportioning of the constituents, expressed as a percentage by dry mass of the total dry mass of the mixture, the grading and the dry density of the mixture, shall be declared. The declared proportions shall be based on the laboratory mixture design and/or practical experiences with mixtures produced with the same constituents and under the same conditions in a way that the mixture complies with the requirements of this document.

6.1.4 Laboratory mechanical performance

The laboratory mechanical performance characterization and category shall be selected from clause 7.

6.2 Fly ash bound mixture 1

Fly ash bound mixture 1 shall be a 0/31,5 mm mixture with a grading, determined in accordance with EN 933-1, complying with Table 1.

Table 1 — Grading of fly ash bound mixture 1

Column	1	2	3
Line	Fly ash bound mixture	Grading envelopes	
		Mixture using siliceous fly ash	Mixture using calcareous fly ash
1	1 – 0/31,5	Figure 1	Figure 2

6.3 Fly ash bound mixture 2

6.3.1 Description

Fly ash bound mixture 2 shall be a granular mixture with compacity requirement where fly ash is part of the binder. There are 3 sub-types depending on the aggregate size.

6.3.2 Grading of the mixture

The grading of the mixture, determined in accordance with EN 933-1, shall comply with Table 2. According to the use of the mixture, either category G1 or category G2 of the grading envelope in Figures 3 to 8 shall be specified.

Table 2 — Gradings of fly ash bound mixture 2

Column	1	2	3	4
Line	Fly ash bound mixture	Grading category	Grading envelopes	
			Mixture using siliceous fly ash	Mixture using calcareous fly ash
1	2-0/20	G1 or G2	Figure 3	Figure 4
2	2-0/14	G1 or G2	Figure 5	Figure 6
3	2-0/10	G1 or G2	Figure 7	Figure 8

6.3.3 Compacity

The minimum compacity of the mixture at the maximum modified Proctor dry density shall be 0,80 calculated in accordance with annex A.

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6.3.4 Immediate bearing index of the mixture

In the case of fly ash bound mixture 2 – 0/10, the immediate bearing index, determined in accordance with EN 13286-47 using modified Proctor compaction, shall not be less than 50.

6.4 Fly ash bound mixture 3

6.4.1 Description

Fly ash bound mixture 3 shall be a 'fine aggregate' mixture with immediate bearing index requirement where fly ash is part of the binder.

6.4.2 Grading of the mixture

The grading of the mixture, determined in accordance with EN 933-1, shall comply with Table 3.

Table 3 — Grading of fly ash bound mixture 3

Column	1	2	3	4
Line	Sieve mm	12,5	6,3	0,063
1	Percentage passing by mass	100	≥85	≤35

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6.4.3 Immediate bearing index of the mixture

In order to facilitate site compaction and depending on trafficking, the immediate bearing index of the mixture, determined in accordance with EN 13286-47 using modified Proctor compaction, shall be selected from Table 4.

Table 4 — Immediate bearing index categories for fly ash bound mixture 3

Column	1	2
Line	Immediate bearing index requirement	Immediate bearing index category
1	≥ 40	IPI_{40}
2	≥ 25	IPI_{25}
3	No requirement	IPI_{NR}

NOTE Mixtures with an immediate bearing index less than 40 may not support immediate trafficking and should be used with care. The addition of another aggregate can be necessary to achieve the immediate bearing index required for immediate use.

6.5 Fly ash bound mixture 4

Fly ash bound mixture 4 shall be a mixture where the grading, determined in accordance with EN 933-1, is declared by the supplier.

NOTE If appropriate, other properties, such as immediate bearing index, may be declared.

6.6 Fly ash bound mixture 5

6.6.1 Description

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Fly ash bound mixture 5 shall be a mixture where fly ash is the main constituent of the mixture and part of the binder.

6.6.2 Fly ash

The fly ash shall be siliceous fly ash conforming to EN 14227-4.

6.6.3 Lime activated mixtures

In the case of lime activated mixtures containing gypsum, the proportion of gypsum shall not exceed 7 % by dry mass and the proportion of lime shall not exceed 5 % by mass in the case of quick lime (CaO) or 6 % by mass in the case of hydrated lime. Unless the constituents and the mixture are well known and proven, the mixture shall be checked for expansion in accordance with regulations at the place of use.

6.7 Examples of fly ash bound mixtures

Annexes B and C give examples of fly ash bound mixtures.

NOTE The examples are not exhaustive, nor the proportions intended to be restrictive, but illustrate the current use in Europe.