BS EN 14227-4:2013

BSI Standards Publication

Hydraulically bound mixtures — Specifications

Part 4: Fly ash for hydraulically bound mixtures

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National foreword

This British Standard is the UK implementation of EN 14227-4:2013. It supersedes BS EN 14227-4:2004 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/510/4, Cementitious bound materials, unbound granular materials, waste materials and marginal materials.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN 14227-4:2013) 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of an identical text or by endorsement, at the latest by November 2013, and conflicting national standards shall be withdrawn at the latest by November 2013.

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

This document supersedes EN 14227-4:2004.

Compared with EN 14227-4:2004, the following changes have been made:

— Revision of Clause 4.2 "Requirements for siliceous fly ash";

— Revision of Clause 4.3 "Requirements for calcareous fly ash".

This standard is one of a series of parts for EN 14227, *Hydraulically bound mixtures — Specifications*:

— *Part 1: Cement bound granular mixtures*

— *Part 2: Slag bound granular mixtures*

— *Part 3: Fly ash bound granular mixtures*

— *Part 4: Fly ash for hydraulically bound mixtures*

— *Part 5: Hydraulic road binder bound granular mixtures*

— *Part 10: Soil treated by cement*

— *Part 11: Soil treated by lime*

— *Part 12: Soil treated by slag*

— *Part 13: Soil treated by hydraulic road binder*

— *Part 14: Soil treated by fly ash*

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1 Scope

This European Standard specifies siliceous and calcareous fly ash used in hydraulically bound mixtures for roads, airfields and other trafficked areas. This European Standard applies to fly ash produced by the combustion of pulverised coal or lignite in energy generating plants.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 196-7, *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 450-1, *Fly ash for concrete — Part 1: Definition, specifications and conformity criteria*

EN 451-1, *Method of testing fly ash — Part 1: Determination of free calcium oxide content*

EN 451-2, *Method of testing fly ash — Part 2: Determination of fineness by wet sieving*

EN 933-10, *Tests for geometrical properties of aggregates — Part 10: Assessment of fines — Grading of filler aggregates (air jet sieving)*

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

3 Terms and definitions

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

3.1
fly ash
fine powder produced by the combustion of pulverised coal or lignite with or without co-combustion materials (as defined in EN 450-1) in energy generating plants and captured by mechanical or electrostatic precipitators

3.2
siliceous fly ash
(alumino-silicate fly ash)
fly ash where the essential chemical components are silicates, aluminates and iron oxides, expressed as SiO_2, Al_2O_3 and Fe_2O_3 and which has pozzolanic properties

Note 1 to entry: It may be stored, supplied and used either in a wet or dry condition.

3.3
calcareous fly ash
(sulfo-calcitic fly ash)
fly ash where the essential chemical components are silicates, aluminates, calcium oxide and sulfates, expressed as SiO_2, Al_2O_3, CaO and SO_3 and which has hydraulic and pozzolanic properties

Note 1 to entry: It is stored and supplied in a dry condition.

3.4
pozzolanic material
material which mixed with lime [$Ca(OH)_2$ or CaO] in the presence of water sets and hardens to form stable and durable compounds

3.5
hydraulic material
material which sets and hardens in the presence of water, to form stable and durable compounds

3.6
dry fly ash
fly ash with a very low water content, see 4.2.5 and 4.3.4

Note 1 to entry: Normally supplied directly from dry storage.

4 Requirements

4.1 General

Chemical characteristics shall be expressed as a percentage by mass of the dry product which is obtained by drying a laboratory sample in a well-ventilated oven at (110 ± 5) °C to constant mass, and allowing to cool in a dry atmosphere.

For dry fly ash, samples shall be taken and prepared in accordance with EN 196-7. For wet fly ash, samples shall be taken and prepared in accordance with EN 13286-1.

4.2 Requirements for siliceous fly ash

4.2.1 Particle size

The fineness of fly ash shall be expressed as the mass proportion in percent of the ash retained when sieved on a 0,045 mm mesh sieve and shall not exceed 60 %.

The sieving shall be carried out in accordance with EN 451-2 (wet sieving) or by air-jet sieving in accordance with EN 933-10.

4.2.2 Loss on ignition

The loss on ignition measured in accordance with EN 196-2, but using an ignition time of 1 h, or equivalent method, shall not exceed 15,0 % by mass.

4.2.3 Sulfuric anhydride

The content of sulfuric anhydride, SO_3 shall be determined in accordance with EN 196-2 and shall not be greater than 4,0 % by mass.

4.2.4 Free calcium oxide and soundness

If the free calcium oxide content, measured in accordance with EN 451-1, exceeds 1,5 % by mass, soundness shall be measured according to EN 196-3 and the expansion shall not exceed 10 mm with a 30:70 blend of fly ash and cement.

4.2.5 Water content

Dry siliceous fly ash shall contain not more than 1,0 % by mass of water.

NOTE Siliceous fly ash can be stored, used and supplied either in a wet or a dry condition.

4.2.6 Pozzolanic activity of siliceous fly ash

If required at the place of use, the pozzolanic activity shall be declared.

This may be determined by the measurement of the compressive strength of a mixture of lime, the ash in question and standard aggregate.

4.3 Requirements for calcareous fly ash

4.3.1 Particle size

The fineness of fly ash shall be expressed as the mass proportion in percent of the ash retained when sieved on a 0,090 mm mesh sieve and shall not exceed 30 %.

The sieving shall be carried out in accordance with EN 451-2 (wet sieving) or by air-jet sieving in accordance with EN 933-10.

4.3.2 Soundness

The expansion of calcareous fly ash shall be less than 10 mm, when tested in accordance with EN 196-3, using a mixture of 30 % by mass of ground fly ash and 70 % by mass of reference cement.

4.3.3 Reactive calcium oxide

The total value of reactive CaO determined in accordance with EN 197-1 shall not be less than 5 % by mass.

4.3.4 Water content

Dry calcareous fly ash shall contain not more than 1 % by mass of water. Calcareous fly ash shall be stored and supplied in a dry condition.

4.3.5 Hydraulic activity of calcareous fly ash

If required at the place of use, the hydraulic activity shall be declared.

This may be determined by the measurement of compressive strength development over time of mixtures of fly ash and a standard aggregate.

The test procedure shall be in accordance with EN 196-1 except that the specimens should be stored in the mould at least 7 days.[1)]

1) BAST: Suitability of mixtures for hydraulically bound base courses according to European Standards for applications in Germany, Research Project No. FE 08.0181/2004/NGB, Bundesanstalt für Straßenbau (BAST), 2008.

5 Production control

Fly ash shall be controlled according to Table 1. The manufacturer shall establish and maintain a production control manual, setting out the procedures by which the requirements for production control are satisfied.

Table 1 — Production control

Column	1	2	3	4
Line	**Property**	**Minimum test frequency**[a]	**Clause reference**	
			Siliceous fly ash	**Calcareous fly ash**
1	Particle size	2 per month or 1 per 5 000 t	4.2.1	4.3.1
2	Loss on ignition	2 per month or 1 per 5 000 t	4.2.2	Not applicable
3	Sulphuric anhydride	1 per month or 1 per 10 000 t	4.2.3	Not applicable
4	Free calcium oxide	1 per month or 1 per 10 000 t	4.2.4	Not applicable
5	Soundness[b]	1 per month or 1 per 10 000 t	4.2.4	4.3.2
6	Reactive calcium oxide	1 per month or 1 per 10 000 t	Not applicable	4.3.3
7	Water content	2 per month or 1 per 5 000 t	4.2.5	4.3.4
8	Pozzolanic activity[b]	2 per year or 1 per 50 000 t	4.2.6	Not applicable
9	Hydraulic activity[b]	2 per year or 1 per 50 000 t	Not applicable	4.3.5

[a] Which ever is more frequent.

[b] If required.

6 Marking and labelling

The delivery ticket shall contain at least the following:

a) reference to this European Standard;

b) type of fly ash;

c) origin;

d) manufacturer.

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BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

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