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Preskusi mehanskih in fizikalnih lastnosti agregatov - 7. del: Določevanje prostorninske mase zrn kamene moke - Postopek s piknometrom

Tests for mechanical and physical properties of aggregates - Part 7: Determination of the particle density of filler - Pyknometer method

Prüfverfahren für mechanische und physikalische Eigenschaften von Gesteinskörnungen - Teil 7: Bestimmung der Rohdichte von Füller - Pyknometer-Verfahren

Essais pour déterminer les caractéristiques mécaniques et physiques des granulats - Partie 7: Détermination de la masse volumique absolue du filler - Méthode au picnomètre

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EUROPEAN STANDARD

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English Version

Tests for mechanical and physical properties of aggregates - Part 7: Determination of the particle density of filler - Pyknometer method

Essais pour déterminer les caractéristiques mécaniques et physiques des granulats - Partie 7: Détermination de la masse volumique absolue du filler - méthode au picnomètre

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This European Standard was approved by CEN on 4 February 2008.

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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 CEN Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Foreword

This document (EN 1097-7:2008) has been prepared by Technical Committee CEN/TC 154 “Aggregates”, the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by September 2008, and conflicting national standards shall be withdrawn at the latest by September 2008.

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 1097-7:1999.

This European Standard forms part of a series of standards for tests for mechanical and physical properties of aggregates. Test methods for other properties of aggregates will be covered by parts of the following European Standards:

EN 932, Tests for general properties of aggregates

EN 933, Tests for geometrical properties of aggregates

EN 1367, Tests for thermal and weathering properties of aggregates

EN 1744, Tests for chemical properties of aggregates

EN 13179, Tests for filler aggregate used in bituminous mixtures

The other parts of EN 1097 will be:

Part 1: Determination of the resistance to wear (micro-Deval)

Part 2: Methods for the determination of resistance to fragmentation

Part 3: Determination of loose bulk density and voids

Part 4: Determination of the voids of dry compacted filler

Part 5: Determination of the water content by drying in a ventilated oven

Part 6: Determination of particle density and water absorption

Part 8: Determination of the polished stone value

Part 9: Determination of the resistance to wear by abrasion from studded tyres - Nordic test

Part 10: Determination of water suction height

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, 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 the United Kingdom.

1 Scope

This standard describes the reference method used for type testing and in cases of dispute for the determination of the particle density of filler by means of a pyknometer. For other purposes, in particular factory production control, other methods may be used provided that an appropriate working relationship with the reference method has been established.

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 932-2, *Tests for general properties of aggregates - Part 2: Methods for reducing laboratory samples*

EN 932-5, *Tests for general properties of aggregates - Part 5: Common equipment and calibration*

ISO 3507, *Laboratory glassware - Pyknometers*

3 Terms and definitions

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

3.1
laboratory sample
reduced sample derived from a bulk sample for laboratory testing

3.2
test portion
sample used as a whole in a single test

3.3
test specimen
sample used in a single determination when a test method requires more than one determination of a property

3.4
constant mass
successive weighings after drying at least 1 h apart not differing by more than 0,1 %

NOTE In many cases constant mass can be achieved after a test portion has been dried for a pre-determined period in a specified oven (see 6.6) at (110 ± 5) °C. Test laboratories can determine the time required to achieve constant mass for specific types and sizes of sample dependent upon the drying capacity of the oven used.

3.5
particle density of filler
mass per volume unit of filler excluding any trapped air

3.6
filler aggregate
aggregate, most of which passes a 0,063 mm sieve, which can be added to construction materials to provide certain properties

4 Principle

The pyknometer method is a well known method for determining the volume of irregularly formed samples, e.g., aggregate. When the mass of the sample is known, the density can be calculated.

The principle is based on the replacement of a certain amount of liquid of known density with the test portion. A pyknometer with known volume, containing the test portion, is topped up with the liquid. The volume of this liquid is calculated by dividing the mass of the liquid added by the liquid density. The volume of the test portion is then calculated by subtraction of this volume from the pyknometer volume.

5 Materials

5.1 Suitable liquid, in which the filler does not dissolve and with which the filler does not react.

NOTE Water, denatured ethanol, redistilled kerosene or toluene have been found to be suitable for different types of filler.

5.2 Demineralized water, boiled and cooled, for calibration (see Annex A).

5.3 Acetone, for calibration (see Annex A).

6 Apparatus

6.1 All apparatus, unless otherwise stated, shall conform to the general requirements of EN 932-5.

6.2 Pyknometer, of nominal capacity 50 ml, conforming to ISO 3507. The stopper shall be concave at the underside, and shall include a thick-walled capillary (riser pipe) whose top has been ground to a level surface.

NOTE The pyknometer can be fitted with a thermometer.

6.3 Water bath, capable of being maintained at (25 ± 0,1) °C.

6.4 Balance, accurate to the nearest 0,001 g for the determination.

6.5 Balance, accurate to the nearest 0,000 1 g for calibration (see Annex A).

6.6 Drying oven, thermostatically controlled to maintain a temperature of (110 ± 5) °C.

6.7 Desiccator, filled with an appropriate amount of desiccant.

6.8 Vacuum desiccator.

6.9 Vacuum pump, capable of achieving a residual pressure of less than 3,0 kPa.

6.10 Spatula.

6.11 Test sieve, 0,125 mm and suitable receiver.

7 Preparation of test portion

Reduce the size of the laboratory sample in accordance with EN 932-2. The test portion before drying shall have a minimum mass of 50 g.

Dry the test portion at (110 ± 5) °C to constant mass and leave it to cool down in the desiccator (see 6.7) for at least 90 min. Check the test portion for the presence of lumps and, if present, pulverize them carefully with the spatula and mix the pulverized lumps.

Dry sieve the filler using the 0,125 mm sieve. Retain all the particles which pass the sieve.

8 Procedure

Carry out the determination of density using three separate test specimens, using a calibrated pyknometer or pyknometers (see Annex A) and a liquid of a known density (see Annex B). Carry out all weighing with an accuracy of 0,001 g.

Proceed as follows for each of the three determinations.

Weigh the clean and dry pyknometer with stopper (m_o). Fill the pyknometer with (10 ± 1) g of filler taken from the test portion and weigh it again (m_1). Add sufficient liquid to completely submerge the test specimen.

NOTE Add the liquid very carefully allowing it to percolate through the filler in the pyknometer.

Put the stopper in the pyknometer, place the pyknometer in the vacuum desiccator and evacuate it with the vacuum pump in approximately 5 min to less than 3,0 kPa. Leave the pyknometer for at least 30 min in the vacuum desiccator at a pressure less than 3,0 kPa.

After restoring the air pressure in the desiccator, take the pyknometer out and fill it with liquid. Place the pyknometer without stopper in the water bath at (25 ± 0,1) °C so that the top protrudes between 2 mm to 3 mm above the water level in the bath. After 60 min, put the stopper in the pyknometer causing an amount of liquid to come out of the capillary.

Dry the top of the capillary and remove the pyknometer from the water bath. Quickly cool the pyknometer in cold (running) water, to prevent liquid expanding out of the capillary due to warm handling. Carefully dry the outside and weigh the pyknometer filled with test specimen and liquid (m_2).

9 Calculation and expression of results

Calculate the particle density of the filler, in megagrams per cubic metre, in accordance with the following equation:

$$\rho_f = \frac{m_1 - m_0}{V - \dfrac{m_2 - m_1}{\rho_l}} \qquad (1)$$

where

m_0 is the mass of the empty pyknometer with stopper, in grams;

m_1 is the mass of the pyknometer with the filler test portion, in grams;

m_2 is the mass of the pyknometer with the filler test portion, topped up with liquid (see 5.1), in grams;

V is the volume of the pyknometer, in millilitres (see Annex A);

ρ_l is the density of liquid at 25 °C, in megagrams per cubic metre (see Annex B);

ρ_f is the particle density of the filler at 25 °C, in megagrams per cubic metre.

Calculate the particle density of the filler as the mean of the three determinations, and round off to the nearest 0,01 Mg/m^3.

NOTE A statement on the precision of this test is given in Annex C.

10 Test report

10.1 Required data

The test report shall include the following information:

a) particle density ρ_f of the filler;

b) reference to this European Standard (EN 1097-7:2008);

c) brand name or type/source of the filler;

d) name and location of the sample source;

e) liquid used for the determination and its density ρ (see Annex B);

f) date of the determination.

10.2 Optional data

The test report can include the following information:

a) description of the material;

b) description of the sampling procedure;

c) weighing data and the densities from the three individual determinations.