SLOVENSKI STANDARD
SIST EN 196-6:2010

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Metode preskušanja cementa - 6. del: Določanje finosti

Methods of testing cement - Part 6: Determination of fineness

Prũfverfahren fũr Zement - Teil 6: Bestimmung der Mahlfeinheit

Méthodes d’essai des ciments - Partie 6: Détermination de la finesse

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ICS:

91.100.10	Cement. Mavec. Apno. Malta	Cement. Gypsum. Lime. Mortar

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EUROPEAN STANDARD

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EUROPÄISCHE NORM

EN 196-6

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English Version

Methods of testing cement - Part 6: Determination of fineness

Méthodes d'essai des ciments - Partie 6: Détermination de la finesse

Prüfverfahren für Zement - Teil 6: Bestimmung der Mahlfeinheit

This European Standard was approved by CEN on 21 December 2009.

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

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

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Foreword

This document (EN 196-6:2010) has been prepared by Technical Committee CEN/TC 51 “Cement and building limes”, the secretariat of which is held by NBN.

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of an identical text or by endorsement, at the latest by July 2010, and conflicting national standards shall be withdrawn at the latest by July 2010.

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 196-6:1989.

EN 196, *Methods of testing cement*, consists of the following parts:

— *Part 1: Determination of strength*

— *Part 2: Chemical analysis of cement*

— *Part 3: Determination of setting times and soundness*

— *Part 5: Pozzolanicity test for pozzolanic cement*

— *Part 6: Determination of fineness*

— *Part 7: Methods of taking and preparing samples of cement*

— *Part 8: Heat of hydration — Solution method*

— *Part 9: Heat of hydration — Semi-adiabatic method*

— *Part 10: Determination of the water-soluble chromium (VI) content of cement*

NOTE A previous part, EN 196-21, *Methods of testing cement — Determination of the chloride, carbon dioxide and alkali content of cement*, has been revised and incorporated into EN 196-2.

Another document, ENV 196-4, *Methods of testing cement — Quantitative determination of constituents*, has been published as CEN/TR 196-4, *Methods of testing cement — Part 4: Quantitative determination of constituents*.

This edition introduces the following technical changes based on comments received by the Secretariat:

a) A method to determine the residue on sieving by air-jet equipment is included;

b) The method for calibration of the air permeability equipment has been clarified and an alternative method, avoiding the use of mercury, added;

c) The factors used in the air permeability (Blaine) method have been corrected for errors introduced in the conversion to SI units.

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, Croatia, 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 European Standard describes three methods of determining the fineness of cement.

The sieving method serves only to demonstrate the presence of coarse cement particles. This method is primarily suited to checking and controlling the production process.

The air-jet sieving method measures the retention on sieving and is suitable for particles which substantially pass a 2,0 mm test sieve. It may be used to determine the particle size distribution of agglomerates of very fine particles. This method may be used with test sieves in a range of aperture sizes, e.g. 63 µm and 90 µm.

The air permeability method (Blaine) measures the specific surface (mass related surface) by comparison with a reference cement sample. The determination of the specific surface serves primarily to check the consistency of the grinding process of one and the same plant. This method only enables a limited assessment to be made of the properties of the cement in use.

NOTE The air permeability method may not give significant results for cements containing ultrafine materials.

The methods are applicable to all the cements defined in EN 197.

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*

ISO 383:1976, *Laboratory glassware — Interchangeable conical ground joints*

ISO 565, *Test sieves — Metal wire cloth, perforated metal plate and electroformed sheet — Nominal sizes of openings*

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

ISO 4803, *Laboratory glassware — Borosilicate glass tubing*

3 Sieving method

3.1 Principle

The fineness of cement is measured by sieving it on standard sieves. The proportion of cement of which the grain sizes are larger than the specified mesh size is thus determined.

A reference sample having a known proportion of material coarser than the specified mesh size is used for checking the specified sieve.

3.2 Apparatus

3.2.1 Test sieve, comprising a firm, durable, non-corrodible, cylindrical frame of 150 mm to 200 mm nominal diameter and 40 mm to 100 mm depth, fitted with, e.g. 90 µm, mesh sieve cloth of woven stainless steel, or other abrasion-resisting and non-corrodible metal wire.

The sieve cloth shall conform to the requirements of ISO 565 and ISO 3310-1 and shall be free of visible irregularities in mesh size when inspected optically by the methods of ISO 3310-1. A tray fitting beneath the sieve frame and a lid fitting above it shall be provided to avoid loss of material during sieving.

NOTE Sieving may be carried out manually or on a sieving machine.

3.2.2 Balance, capable of weighing up to 25 g to the nearest 0,01 g.

3.3 Material for checking the sieve

A reference material of known sieve residue shall be provided for checking the sieve.

The material shall be stored in sealed, airtight containers to avoid changes in its characteristics due to absorption or deposition from the atmosphere. The containers shall be marked with the sieve residue of the reference material.

3.4 Procedure

3.4.1 Determination of the cement residue

Agitate the sample of cement to be tested by shaking for 2 min in a stoppered jar to disperse agglomerates. Wait 2 min. Stir the resulting powder gently using a clean dry rod to distribute the fines throughout the cement.

Fit the tray under the sieve. Weigh (25 ± 0,5) g of cement to the nearest 0,01 g and place it in the sieve, being careful to avoid loss. Disperse any agglomerates. Fit the lid over the sieve. Agitate the sieve by swirling, planetary and linear movements until no more fine material passes through it.

Remove and weigh the residue. Express its mass as a percentage, R_1 of the quantity first placed in the sieve to the nearest 0,1 %. Gently brush all the fine material off the base of the sieve into the tray.

Repeat the whole procedure using a fresh 25 g sample to obtain R_2. Then calculate the residue of the cement R as the mean of R_1 and R_2 as a percentage, expressed to the nearest 0,1 %.

When the results differ by more than 1 % absolute, repeat the whole procedure a third time and calculate the mean of the three values.

Sieving by the manual process requires a skilled and experienced operator.

3.4.2 Checking the sieve

Sieves should be cleaned and checked for damage after each sieving (e.g. that the mesh is taut and is not dented or perforated). In addition, check the sieve after every 100 sievings as follows:

Agitate the sample of reference material, to be used for checking the sieve, by shaking for 2 min in a stoppered jar to disperse agglomerates. Wait 2 min. Stir the resulting powder gently using a clean dry rod to distribute the fines throughout the reference material.

Fit the tray under the sieve. Weigh (25 ± 0,5) g of the reference material (3.3) to the nearest 0,01 g and place it in the sieve, being careful to avoid loss. Sieve the material in accordance with 3.4.1 including the repeat determination of residue to yield two values P_1 and P_2 expressed to the nearest 0,1 %.

The two values of P_1 and P_2 for a satisfactory sieve should differ by not more than 0,6 %. Their mean P characterizes the state of the sieve.

Given the known residue on the sieve of the reference material, R_0, calculate R_0/P as the sieve factor, F, expressed to the nearest 0,01. The residue, R, determined as in 3.4.1 shall be corrected by multiplying by F, which may have a value of 1,00 ± 0,20.

When the factor *F* exceeds the permitted value, 1,00 ± 0,20, the sieve shall be discarded.

NOTE Any other checking procedure, such as the optical methods described in ISO 3310-1 may be used. All sieves will wear slowly and consequently their sieve factor, *F,* will slowly change.

3.5 Expression of results

Report the value of *R* to the nearest 0,1 %, as the residue, the sieve mesh size and details of the cement tested.

The standard deviation of the repeatability is about 0,2 % and of the reproducibility is about 0,3 %.

NOTE Where there is local difficulty in obtaining ISO standard sieves, the same procedure can be followed with the nearest available standard sieve but the report should state on which standard sieve mesh the cement residue has been determined.

4 Air permeability method (Blaine method)

4.1 Principle

The fineness of cement is measured as specific surface by observing the time taken for a fixed quantity of air to flow through a compacted cement bed of specified dimensions and porosity. Under standardized conditions the specific surface of cement is proportional to $\sqrt{t}$ where *t* is the time for a given quantity of air to flow through the compacted cement bed. The number and size range of individual pores in the specified bed are determined by the cement particle size distribution, which also determines the time for the specified air flow.

The method is comparative rather than absolute and therefore a reference sample of known specific surface is required for calibration of the apparatus.

4.2 Apparatus

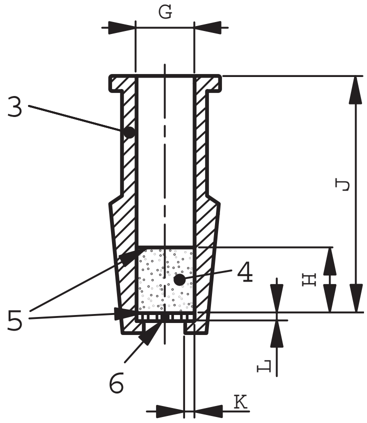
4.2.1 Permeability cell. The cell shall be a rigid right cylinder of the dimensions and tolerances shown in Figure 1 a). It shall be of austenitic stainless steel or other abrasion-resisting, non-corrodible material. The top and bottom faces shall be flat and normal to the axis of the cylinder, as shall the upper surface of the ledge at the bottom of the cell. The outer surface of the cylinder shall be tapered to form an airtight fit with the conical socket of the manometer (ISO 383:1976, Joint 19/34).

4.2.2 Perforated disc. The disc shall be of non-corrodible metal, perforated with 30 to 40 holes of 1 mm diameter, and shall have the dimensions and tolerances shown in Figure 1 b). When in position on the ledge in the cell, its plane surfaces shall be normal to the axis of the cell.

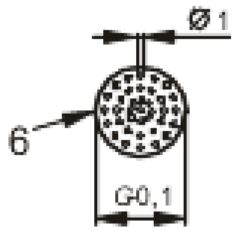
4.2.3 Plunger. The plunger is a piston, capable of sliding freely in the measuring cell by means of a clearance to be applied in such a way that, when the cap of the plunger comes to rest on the upper face of the cell cylinder, a distance of (15 ± 1) mm will be maintained between the upper face of the perforated disc and the lower face of the piston.

This piston shall be provided with a flat connected to an annulus around the head to enable air to escape.

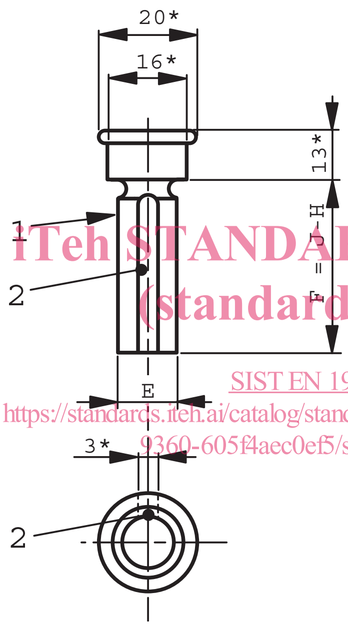
Dimensions in millimetres



a) Cell

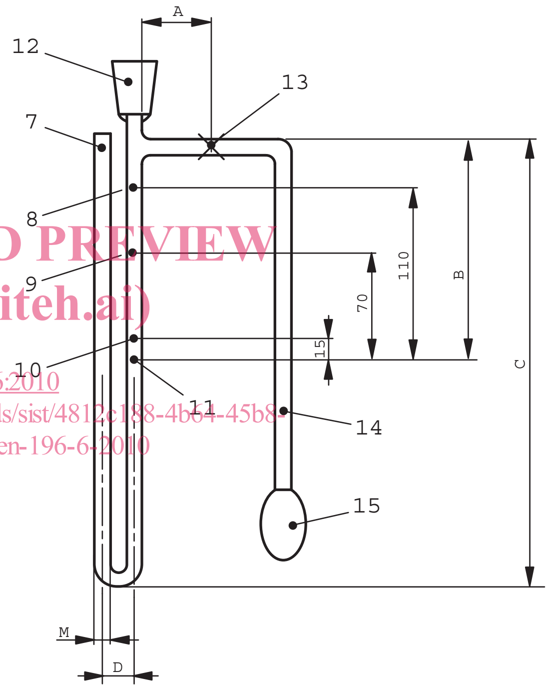


b) Perforated disc



* Recommended

c) Plunger



d) Manometer

Item	Description
1	Piston
2	Flat for air vent
3	Cell
4	Compacted cement disc
5	Filter paper disc
6	Perforated disc
7	Manometer
8, 9, 10, 11	Etched lines
12	Conical joint for cell
13	Stopcock
14	Rubber tube
15	Aspirator bulb

Key		Recommended mm	Key		Obligatory mm
A	Minimum dimension between conical joint and stopcock	≤ 50	G	Cell diameter at base of cell	12,7 ± 0,1
B	Dimension between upper arm of T-joint and lowest etched line on arm of manometer tube	135 ± 10	E	Diameter of plunger/piston	G - 0,1
C	Dimension between upper arm of T-joint and base of U-tube	275 ± 25	H	Height of cement bed	15 ± 1
D	Dimension between centre lines of arms of U-tube	23 ± 1	F	Dimension/depth between tip of plunger and shoulder	J - H
J	Inner dimension/height of the cell	50 ± 15			
K	Width of cell ledge	0,8 ± 0,2			
L	Thickness of perforated disc	0,9 ± 0,1			
M	Diameter of arms of manometer tube	9,0 ± 0,4			

Figure 1 — Blaine permeability apparatus

The plunger shall be of austenitic stainless steel or other abrasion-resisting and non-corrodible material; it shall have the dimensions and tolerances shown in Figure 1 c). A plunger shall only be used with a cell of the specified dimensions and tolerances such that, when used together, the specified distance between the upper face of the perforated disc and the lower face of the piston is satisfied.

4.2.4 Manometer. The manometer shall be a rigidly and vertically mounted U-tube of borosilicate glass tubing conforming to ISO 4803 arranged as in Figure 1 d) and having the dimensions and tolerances shown in that figure.

One arm of the manometer shall be provided at the top with a conical socket conforming to ISO 383:1976, Joint 19/34 to form an airtight fit with the conical surface of the cell. The same arm shall also have four etched lines and a T-joint whose positions shall have the dimensions and tolerances shown in Figure 1 d). The side branch of the T-joint shall lead to an airtight stopcock beyond which shall be attached a suitable aspiration device such as the rubber tube and bulb shown in Figure 1 d).

Fill the manometer tube with the liquid (4.2.5) to wet the inner surface. Empty the tube and refill it so that the manometer liquid is level with the lowest etched line (11 in Figure 1 d)). This manometer liquid shall be changed (or cleaned) after servicing or before a new calibration.

NOTE Other forms of cell and plunger and other arrangements of the joint between cell and manometer may be used provided that they can be shown to give the same results as the specified apparatus.

4.2.5 Manometer liquid. The manometer shall be filled to the level of the lowest etched line (11 in Figure 1 d)) with a non-volatile, non-hygroscopic liquid of low viscosity and density, such as dibutyl phthalate or light mineral oil.