

Methods of testing cement - Part 9: Heat of hydration - Semiadiabatic method

Methods of testing cement - Part 9: Heat of hydration - Semiadiabatic method

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN 196-9:2004 sisaldab Euroopa standardi EN 196-9:2003 ingliskeelset teksti. Käesolev dokument on jõustatud 28.01.2004 ja selle kohta on avaldatud teade Eesti standardiorganisatsiooni ametlikus väljaandes. Standard on kättesaadav Eesti standardiorganisatsioonist.	This Estonian standard EVS-EN 196-9:2004 consists of the English text of the European standard EN 196-9:2003. This document is endorsed on 28.01.2004 with the notification being published in the official publication of the Estonian national standardisation organisation. The standard is available from Estonian standardisation organisation.
--	---

Käsitlusala: This European Standard describes a method of measuring the heat of hydration of cements by means of semi-adiabatic calorimetry, also known as the Langavant method. The aim of the test is the continuous measurement of the heat of hydration of cement during the first few days. The heat of hydration is expressed in joules per gram of cement.	Scope: This European Standard describes a method of measuring the heat of hydration of cements by means of semi-adiabatic calorimetry, also known as the Langavant method. The aim of the test is the continuous measurement of the heat of hydration of cement during the first few days. The heat of hydration is expressed in joules per gram of cement.
--	--

ICS 91.100.10

Võtmesõnad:

ICS 91.100.10

English version

Methods of testing cement - Part 9: Heat of hydration - Semi-adiabatic method

Méthodes d'essai des ciments - Partie 9: Chaleur d'hydratation - Méthode semi-adiabatique

Prüfverfahren für Zement - Teil 9: Hydratationswärme - Teildiabetisches Verfahren

This European Standard was approved by CEN on 25 March 2003.

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 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 Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.



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

Management Centre: rue de Stassart, 36 B-1050 Brussels

Contents

	page
Foreword	3
1 Scope	1
2 Normative references	4
3 Principle	4
4 Apparatus	4
5 Determination of the heat of hydration	7
5.1 Laboratory	7
5.2 Procedure	8
5.2.1 Mortar composition	8
5.2.2 Mixing	8
5.2.3 Positioning of the test sample	8
5.3 Measurement of heating	8
6 Calculation of the heat of hydration	9
6.1 Principles of calculations	9
6.2 Calculation of the heat accumulated in the calorimeter	9
6.3 Calculation of heat lost into ambient atmosphere	10
6.4 Calculation of heat of hydration	11
7 Expression of results	11
7.1 Reporting of results	11
7.2 Precision	11
7.2.1 Repeatability	11
7.2.2 Reproducibility	11
Annex A (normative) Calibration of the calorimeter	12
A.1 Principle	12
A.2 Apparatus and power supply	12
A.3 Calibration procedure	13
A.3.1 Determination of the coefficient of total heat loss, α	13
A.3.2 Determination of the thermal capacity	16
Annex B (informative) Worked example of determination of heat of hydration	18
B.1 General test conditions	18
B.2 Basic calculations	18
B.3 Determination of test results	18
Bibliography	21

Foreword

This document (EN 196-9:2003) has been prepared by Technical Committee CEN/TC 51, 'Cement and building limes', the secretariat of which is held by IBN.

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 April 2004, and conflicting national standards shall be withdrawn at the latest by April 2004.

This European Standard on the methods of testing cement comprises the following Parts:

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 time and soundness*

EN 196-5 *Methods of testing cement — Part 5: Pozzolanicity test for pozzolanic cements*

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 196-8: *Methods of testing cement — Part 8: Heat of hydration — Solution method*

EN 196-9: *Methods of testing cement — Part 9: Heat of hydration — Semi-adiabatic method*

EN 196-21: *Methods of testing cement — Part 21: Determination of the chloride, carbon dioxide and alkali content of cement*

EN 196-21 is currently being revised and incorporated into EN 196-2.

Another document, ENV 196-4 *Methods of testing cement — Part 4: Quantitative determination of constituents*, has been drafted and will be published as a CEN Technical Report.

Annex A is normative and annex B is informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard describes a method of measuring the heat of hydration of cements by means of semi-adiabatic calorimetry, also known as the Langavant method. The aim of the test is the continuous measurement of the heat of hydration of cement during the first few days. The heat of hydration is expressed in joules per gram of cement.

This standard is applicable to all cements and hydraulic binders, whatever their chemical composition, with the exception of quick-setting cements.

NOTE 1 An alternative procedure, called the solution method, is described in EN 196-8. Either procedure can be used independently.

NOTE 2 It has been demonstrated that the best correlation between the two methods is obtained at 41 h for the semi-adiabatic method (EN 196-9) compared with 7 days for the heat of solution method (EN 196-8).

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 196-1, *Methods of testing cement - Part 1: Determination of strength*.

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

EN 573-3, *Aluminium and aluminium alloys - Chemical composition and form of wrought products - Part 3: Chemical composition*

3 Principle

The semi-adiabatic method consists of introducing a sample of freshly made mortar into a calorimeter in order to determine the quantity of heat emitted in accordance with the development of the temperature. At a given point in time the heat of hydration of the cement contained in the sample is equal to the sum of the heat accumulated in the calorimeter and the heat lost into the ambient atmosphere throughout the period of the test.

The temperature rise of the mortar is compared with the temperature of an inert sample in a reference calorimeter. The temperature rise depends mainly on the characteristics of the cement and is normally between 10 K and 50 K.

4 Apparatus

4.1 Calorimeter, consisting of an insulated flask sealed with an insulated stopper and encased in a rigid casing which acts as its support (see Figure 1). Both the calorimeter used for the test and that for the reference (see 4.2) shall have the following construction and characteristics:

- a) *an insulated flask* (e.g. Dewar flask), made of silver plated borosilicate glass; cylindrical in shape with a hemispherical bottom. The internal dimensions shall be approximately 95 mm in diameter and 280 mm in depth; and external diameter of approximately 120 mm. A rubber disc of