



SLOVENSKI STANDARD
SIST EN 197-6:2023

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Cement - 6. del: Cement z recikliranim gradbenim materialom

Cement - Part 6: Cement with recycled building materials

Zement - Teil 6: Zement mit rezyklierten Baustoffen

Ciment - Partie 6 : Ciment à base de matériaux de construction recyclés

Ta slovenski standard je istoveten z: EN 197-6:2023

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ICS:

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

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English Version

Cement - Part 6: Cement with recycled building materials

Ciment - Partie 6 : Ciment à base de matériaux de construction recyclés

Zement - Teil 6: Zement mit rezyklierten Baustoffen

This European Standard was approved by CEN on 24 April 2023.

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

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European foreword

This document (EN 197-6:2023) has been prepared by Technical Committee CEN/TC 51 “Cement and building lime”, 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of an identical text or by endorsement, at the latest by December 2023, and conflicting national standards shall be withdrawn at the latest by December 2023.

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

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EN 197-6:2023 (E)**Introduction**

The purpose of this document is to specify the requirements for cement with recycled concrete fines.

Different cements have different properties and performance. The performance tests available at the time of publication of this document (i.e. for the determination of setting time, strength, soundness and heat of hydration) have been included in this document. In addition, work is being carried out by CEN/TC 51 to identify any additional tests which are needed to specify further performance characteristics of cement. Until further performance tests are available, it is necessary that the choice of cement, especially the type and/or strength class in relation to the requirements for durability depending on exposure class and type of construction in which it is incorporated, follows the appropriate standards and/or regulations for concrete, mortar, grout, etc. valid in the place of use.

The fitness of cement with recycled concrete fines for the intended use to produce structural concrete (reinforced or not) has been experimentally assessed by testing programs, the results of which have been included in a dossier [1] approved by CEN/TC 51.

The cement types and strength classes defined in this document allow the specifier and/or the user to contribute to objectives of sustainability for cement-based constructions and of circular economy and to minimize the use of natural resources in accordance with local conditions of production.

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1 Scope

This document specifies cement with recycled concrete fines whose intended use is the preparation of concrete, mortar, grout, etc.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 196-2, *Method of testing cement — Part 2: Chemical analysis of cement*

EN 196-6, *Methods of testing cement — Part 6: Determination of fineness*

EN 196-7:2007, *Methods of testing cement — Part 7: Methods of taking and preparing samples of cement*

EN 197-1:2011, *Cement — Part 1: Composition, specifications and conformity criteria for common cements*

EN 197-2:2020, *Cement — Part 2: Assessment and verification of constancy of performance*

EN 206:2013+A2:2021, *Concrete — Specification, performance, production and conformity*

EN 933-9, *Tests for geometrical properties of aggregates — Part 9: Assessment of fines — Methylene blue test*

EN 13639, *Determination of total organic carbon in limestone*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 197-1:2011 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

4 Constituents and composition

4.1 General

Cement covered by this document contains recycled concrete fines and cement constituents covered by EN 197-1.

The requirements on constituents are specified in 4.2 and 4.3.

The composition of cement covered by this document is specified in Table 1.

Provisions valid in the place of use may specify requirements for the content and the release of dangerous substances from recycled concrete fines.

EN 197-6:2023 (E)**4.2 Recycled concrete fines**

Recycled concrete fines is a specially selected and prepared mineral material

- coming from plants or units producing coarse, all-in and/or fine recycled concrete aggregates; or
- reclaimed from concrete production operations; or
- coming from reclaimed crushed aggregates as defined in EN 206:2013+A2:2021.

NOTE Recycled concrete fines can be considered to be suitable if the recycled coarse concrete aggregates produced in the recycling plants or units fulfil the constituent requirements for R_{CU90} , R_{b10} , R_{a1} , FL_2 and XR_{g1} according to EN 12620:2002+A1:2008, Table 20:

- R_{CU90} : ≥ 90 % by mass concrete, concrete products, mortar, concrete masonry units, unbound aggregate, natural stone, hydraulically bound aggregate;
- R_{b10} : ≤ 10 % by mass clay masonry units (i.e. bricks and tiles), calcium silicate masonry units, aerated non-floating concrete;
- R_{a1} : ≤ 1 % by mass bituminous materials;
- FL_2 : ≤ 2 cm³/kg floating material in volume;
- XR_{g1} : ≤ 1 % by mass glass and other materials.

Recycled concrete fines are mainly non-reactive. A residual hydraulic or pozzolanic reactivity is possible but does not contribute substantially to the cement reactivity.

The recycled concrete fines may be further processed in the cement plant, if necessary.

Recycled concrete fines shall fulfil the following requirements:

- a) TOC content $\leq 0,8$ % by mass, tested in accordance with EN 13639;
- b) Sulfate content (as SO_3) $\leq 2,0$ % by mass, tested in accordance with EN 196-2;
- c) the clay content, determined by the methylene blue test in accordance with EN 933-9, shall not exceed 1,20 g/100 g. For this test, the recycled concrete fines shall be ground to a fineness of approximately 5 000 cm²/g determined as specific surface in accordance with EN 196-6.

4.3 Other cement constituents

The constituents of cement covered by this document, other than recycled concrete fines, shall fulfil the requirements specified in EN 197-1:2011, Clause 5.

However, the following requirement for limestone (L, LL) replacing 5.2.6 a) of EN 197-1:2011 shall apply:

The calcium carbonate ($CaCO_3$) content calculated from the calcium oxide content shall be at least 40 % by mass and the sum of calcium carbonate and magnesium carbonate ($CaCO_3$ and $MgCO_3$) content calculated from the calcium oxide and magnesium oxide content respectively shall be at least 75 % by mass.

Table 1 — Cement with recycled concrete fines

Main types	Notation of the products (types of cement)		Composition (percentage by mass) ^a												
			Main constituents										Minor additional constituents		
			Clinker	Recycled concrete fines	Blast-furnace slag	Silica fume	Pozzolana		Fly ash		Burnt shale	Limestone			
							natural	natural calcined	siliceous	calcareous		L ^c		LL ^c	
Type name	Type notation	K	F	S	D ^b	P	Q	V	W	T	L ^c	LL ^c			
CEM II	Portland-recycled-fines cement	CEM II/A-F	80-94	6-20	—	—	—	—	—	—	—	—	—	0-5	
		CEM II/B-F	65-79	21-35	—	—	—	—	—	—	—	—	—	0-5	
	Portland-composite cement ^d	CEM II/A-M	80-88	6-14	←----- 6-14 -----→										0-5
		CEM II/B-M	65-79	6-29	←----- 6-29 -----→										0-5
		CEM II/C-M	50-64	6-20	←----- 16-44 -----→										0-5
CEM VI	Composite cement	CEM VI	35-49	6-20	31-59	—	—	—	—	—	—	—	—	0-5	
<p>^a The values in the table refer to the sum of the main and minor additional constituents.</p> <p>^b In case of the use of silica fume, the proportion of silica fume is limited to 6 % to 10 % by mass.</p> <p>^c In case of the use of limestone, the proportion of the sum of limestone and recycled concrete fines (sum of L, LL and F) is limited to 35 % by mass.</p> <p>^d The number of main constituents other than clinker is limited to two and these main constituents shall be declared by designation of the cement (for examples, see Clause 6). In case of the use of both F and (L or LL) in the composition, the number of main constituents other than clinker is limited to three and these main constituents shall be declared by designation of the cement.</p>															

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5 Requirements

Cements covered by this document shall fulfil the requirements specified in EN 197-1:2011, 7.1, 7.2 and 7.4.1.

The requirements listed in EN 197-1:2011, Table 3 for low early strength, indicated by L, are applicable for cements covered by this document.

In addition, cement covered by this document shall conform to the requirements listed in Table 2.

Table 2 — Additional requirements and Limit values for single results for cement with recycled building materials

1	2	3	4	5
Property	Test reference	Strength class	Requirements given as characteristic values ^a	Limit values for single results ^a
Sulfate content (as SO ₃)	EN 196-2	all	≤ 4,0 ^b	≤ 4,5
Chloride content	EN 196-2	all	≤ 0,10	≤ 0,10
^a Requirements are given as percentage by mass of the final cement. ^b Cement with a T content > 20 % may contain up to 4,5 % sulfate (as SO ₃) for all strength classes.				

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Information on the total alkali content of cements might be necessary for certain applications and conditions. In such cases the maximum total alkali content shall be determined according to EN 196-2. The declared value shall be expressed as a percentage by mass with two decimal places. The declared value shall be the limit value for single results unless specified in a different way in the appropriate standards and/or regulations for concrete or mortar valid in the place of use.

6 Standard designation

Cements covered by this document shall be designated by at least the notation of the cement type as specified in Table 1 and the figures 32,5, 42,5 or 52,5 indicating the strength class. In order to indicate the early strength class, the letter L, N or R shall be added as appropriate.

When in the same factory a manufacturer produces different cements complying with the same standard designation, these cements receive an additional identification in the form of a number or of two lower case letters, between brackets, in order to distinguish these cements from each other. For the numbering system, this number should be 1 for the second certified cement, 2 for the next, and so on. For the lettering system, the letters shall be chosen in such a way as to avoid confusion.

Low heat cement in accordance with EN 197-1:2011, 7.2.3 shall be additionally designated by the notation LH.