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European Assessment Document for

White high alumina calcium aluminate cement

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Contents

1 SCOPE OF THE EAD

1.1 Description of the construction product

This EAD covers White High Alumina Calcium Aluminate Cement *(hereinafter referred to as "WHACAC")* which is to be used as a constituent material for mortar or formulated mixes (e.g., dry mixes).

Its constituents are grinding aids (according to EN 14647[1], clause 5.2) and calcium aluminate cement clinker.

Calcium Aluminate cement clinker is produced by fusing or sintering a precisely specified mixture of aluminous and calcareous material, as specified by EN 14647, clause 5.1.

The main hydraulic phase is monocalcium aluminate ($CaO.Al_2O_3$). Other mineralogical compounds include other calcium aluminate phases as alumino-ferrites, dicalcium silicates and calcium silico aluminate or gehlenite.

The product is not fully covered by the following harmonised technical specification EN 14647 and EAD 150002-00-0301, for the following reasons:

- EN 14647 does not fully cover the product (with particular reference to Table 2 of EN 14647). All characteristics of the product and of cements falling in the scope of EN 14647 are similar except for the alumina content and alkali content (see table 1.1.1).

Table 1.1.1: Comparison between cement characteristics and specifications of EN 14647

WHACAC properties	**Specifications of EN 14647 table 2**
Alumina content (as Al_2O_3): 65 % ≤ Al_2O_3 ≤ 75 %	*Alumina content (as Al_2O_3): 35 % ≤ Al_2O_3 ≤ 58 %*
Alkali content (as Na_2O): can be > 0,4 %	*Alkali content (as Na_2O): ≤ 0,4 %*

The composition targets high alumina content in order that concentration of oxides other than calcium and aluminum oxides are minimized to ensure high whiteness of the cement. The alumina content (as Al_2O_3) of WHACAC therefore exceeds the EN 14647 specification. This high content of aluminum oxides may also result in an alkali content (as Na_2O) higher than EN 14647 specification.

In addition, in order to ensure the high whiteness of the cement, the EAD applies for products having the following colorimetry properties:

- $L^* \geq 92$;
- $-1.0 \leq a^* \leq +1.0$
- and $0 \leq b^* \leq 2$).

With L*, a* and b* the axis of the color space used to calculate the lightness of a product according to ISO 11664-4 where:

- L*, the lightness of the product,
- a* the red-green axis,
- b* the yellow-blue axis.

Compared to the EAD 150002-00-0301, the following changes are:

- The intended use of EAD 150002-00-0301 is not adapted to WHACAC. Indeed, WHACAC is not to be used in applications where high refractoriness is needed and cannot claim any refractoriness characteristic.
- The chemical requirements (alumina content and alkali content) of EAD 150002-00-0301 do not cover WHACAC's properties.
- The use of Alumina-rich material (ARM), as the main component of the cement covered by EAD 150002-00-0301 is not relevant for the WHACAC.

[1] All undated references to standards in this EAD are to be understood as references to the dated versions listed in chapter 4.

The performance assessment of mortars or formulated mixes prepared with White High Calcium Aluminate Cement is not considered in the EAD. These performances strongly depend on the other binders and additives used in the mix and the installation process.

Guidance for the use of Calcium Aluminate Cements used as the sole binder in mortars or formulated mixes, can be taken into account, as stated in EN 14647, when applicable.

Concerning product packaging, transport, storage, maintenance, replacement and repair it is the responsibility of the manufacturer to undertake the appropriate measures and to advise his clients on the transport, storage, maintenance, replacement and repair of the product as he considers necessary.

It is assumed that the product will be installed according to the manufacturer's instructions or (in absence of such instructions) according to the usual practice of the building professionals.

Relevant manufacturer's stipulations, e.g., with regard to the intended end use conditions, having influence on the performance of the product covered by this European Assessment Document shall be considered for the determination of the performance and detailed in the ETA as long as the details of the assessment methods as laid down in this EAD are respected.

1.2 Information on the intended use(s) of the construction product

1.2.1 Intended use(s)

The WHACAC is used as a constituent material for mortar or formulated mixes for specific applications (e.g., dry mixes). It is exclusively intended to be used for:

- Tile adhesive and mastics described in EN 12004 and ISO 13007-1.
- Tile grouts described in EN 13888-1.
- Mortars for masonry described in EN 998-1.
- Screeds described in EN 13318 or EN 13813.
- Products for the protection and repair of concrete structures described in EN 1504-1.

Structural concretes are excluded from the intended used due to the conversion process (see EN 14647 section A.2.2).

WHACAC is not intended to be used as a general replacement for the common cements in accordance with EN 197-1. Its use is in specialised areas which stem from its special properties:

- Normal setting time but rapid hardening.
- Resistance to temperature, abrasion and chemical attack resistance.
- Normal hardening rate in cold weather.

1.2.2 Working life/Durability

The assessment methods included or referred to in this EAD have been written based on the manufacturer's request to take into account a working life of concrete incorporating WHACAC for the intended use of 50 years when installed in the works (provided that the WHACAC is subject to appropriate installation). These provisions are based upon the current state of the art and the available knowledge and experience.

When assessing the product, the intended use as foreseen by the manufacturer shall be taken into account. The real working life may be, in normal use conditions, considerably longer without major degradation affecting the basic requirements for works[2].

The indications given as to the working life of the construction product cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by EOTA when drafting this EAD nor

[2] The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject, as well as on the particular conditions of the design, execution, use and maintenance of that works. Therefore, it cannot be excluded that in certain cases the real working life of the product may also be shorter than referred to above.

by the Technical Assessment Body issuing an ETA based on this EAD, but are regarded only as a means for expressing the expected economically reasonable working life of the product.

1.3 Specific terms used in this EAD

WHACAC White High Alumina Calcium Aluminate Cement

Abbreviations:

f_{c6h} = Compressive (mortar) strength after 6 h

f_{c24h} = Compressive (mortar) strength after 24 h

Al_2O_3 = Alumina content

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

All undated references to standards in this EAD are to be understood as references to the dated versions listed in chapter 4.

2.1 Essential characteristics of the product

Table 2.1.1 shows how the performance of WHACAC is assessed in relation to the essential characteristics.

Table 2.1.1 Essential characteristics of the product and methods and criteria for assessing the performance of the product in relation to those essential characteristics

No	Essential characteristic	Assessment method	Type of expression of product performance
Basic Works Requirement 1: Mechanical resistance and stability			
1	Compressive strength after 6 h after 24 h	2.2.1	 *Level* *Level*
2	Initial setting time	2.2.2	*Level*
3	Chloride content	2.2.3	*Level*
4	Alkali content (as Na_2O_{eq})	2.2.4	*Level*
5	Sulphate content (as SO_3)	2.2.5	*Level*
6	Sulphide content (as S^{2-})	2.2.6	*Level*
7	Alumina Content (as Al_2O_3)	2.2.7	*Level*

2.2 Methods and criteria for assessing the performance of the product in relation to essential characteristics of the product

This chapter is intended to provide instructions for TABs. Therefore, the use of wordings such as “shall be stated in the ETA” or “it has to be given in the ETA” shall be understood only as such instructions for TABs on how results of assessments shall be presented in the ETA. Such wordings do not impose any obligations for the manufacturer and the TAB shall not carry out the assessment of the performance in relation to a given essential characteristic when the manufacturer does not wish to declare this performance in the Declaration of Performance.

2.2.1 Compressive strength

Assessment method

The compressive strength of WHACAC is determined in accordance with EN 196-1, clause 9.2, at 6 hours and 24 hours.

For the tests following mortar composition shall be used:

Method	Reference method (EN 14647, clause 7.1)	Alternative method
WHACAC:	500 g	450 g
CEN Standard sand:	1350 g	1350 g
Water:	200 g	225 g

The alternative method is to be used in cases where the formulation of the mortar defined in the reference method does not allow its characterisation at the given time e.g., due to a too rapid setting.

All specimens (12 specimens) shall be demoulded after 6 h ± 15 min. Specimens (6 specimens) to be tested at 6 h shall be tested immediately after demoulding. Specimens (6 specimens) to be tested at 24 h shall be stored in water, after demoulding, in accordance with EN 196-1.

The compressive strength shall not be less than 18.0 MPa at 6 h and 40.0 MPa at 24 h, see EN 14647, clause 7.1.

Expression of results

The mortar composition (according to reference or alternative method) and the compressive strength, expressed in accordance with EN 196-1, clause 10, after 6 h (f_{c6h}) and 24 h (f_{c24h}) are given in the ETA.

2.2.2 Initial setting time

Initial setting time shall be determined according to the methods stated below:

- Initial setting time shall be tested according to Method 1 stated in clause 2.2.2.1 (Reference method).
- If the reference method is not suitable, because the setting time was too short for this measurement to be carried out on pure cement paste, setting time on mortar shall be tested according to Method 2 stated in clause 2.2.2.2

Results and the assessment method shall be stated in the ETA.

2.2.2.1 Initial setting time

Assessment method

The initial setting time of WHACAC is determined in accordance with EN 196-3. The initial setting time of "WHACAC" shall not be less than 90 min, see EN 14647, clause 7.2.

Expression of results

The initial setting time (in min) of WHACAC is to be stated in the ETA.

2.2.2.2 Setting time on mortar

Assessment method

The setting time on mortar of WHACAC is determined in accordance with annex A. The setting time of "WHACAC" shall not be less than 90 min.

Expression of results

The setting time on mortar (in min) of WHACAC is to be stated in the ETA.

2.2.3 Chloride content

Assessment method

The chloride content (as Cl^-) of WHACAC is determined in accordance with EN 196-2, clause 4.5.16 (reference method) or clause 5 (alternative method). The chloride content (as Cl^-) of WHACAC shall be ≤ 0.10% by mass (according to EN 14647 clause 7.3 table 2).

Expression of results

The chloride content (in % by mass) and the assessment method shall be stated in the ETA.

2.2.4 Alkali content (as Na_2O equivalent)

Assessment method

The alkali content[3] of WHACAC is determined in accordance with EN 196-2, clause 4.5.19 (reference method) or clause 5 (alternative method).

Expression of results

The alkali content[3] (in % by mass) and the selected assessment method shall be stated in the ETA .

2.2.5 Sulphate content (as SO_3)

Assessment method

The sulphate content (as SO_3) of WHACAC is determined in accordance with EN 196-2, clause 4.4.2 (reference method) or clause 5 (alternative method). The sulphate content (as SO_3) of WHACAC shall be ≤ 0.5% by mass (according to EN 14647 clause 7.3 table 2).

Expression of results

The sulphate content (in % by mass) and the selected assessment method shall be stated in the ETA .

2.2.6 Sulphide content (as S^{-2})

Assessment method

The sulphide content (as S^{-2}) of WHACAC is determined in accordance with EN 196-2, clause 4.4.5 (reference method) or clause 5 (alternative method). The sulphide content (as S^{-2}) of WHACAC shall be ≤ 0.10% by mass (according to EN 14647 clause 7.3 table 2).

Expression of results

The sulphide content (in % by mass) and the selected assessment method shall be stated in the ETA .

[3] Expressed as Na_2O equivalent (Na_2O + 0.658 K_2O)

2.2.7 Alumina content (as Al_2O_3)

Assessment method

The Alumina content (as Al_2O_3) of WHACAC is determined in accordance with EN 196-2, clause 4.5.11 (reference method) or clause 5 (alternative method).

Expression of results

The Alumina content (in % by mass) and the selected assessment method shall be stated in the ETA.

3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

3.1 System(s) of assessment and verification of constancy of performance to be applied

For the products covered by this EAD the applicable European legal act is: Decision 97/555/EC as amended by Decision 2010/683/EU.

The system(s) is (are): **1+**.

3.2 Tasks of the manufacturer

The cornerstones of the actions to be undertaken by the manufacturer of the product in the procedure of assessment and verification of constancy of performance are laid down in Table 3.2.1.

Table 3.2.1 Control plan for the manufacturer; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]					
1	Compressive strength	2.2.1	f_{c6h} ≥ 18.0 MPa according to EN 14647, table 1 f_{c24h} ≥ 40.0 MPa according to EN 14647, table 1	1	4/ week[1)] 2 / week[2)]
2	Initial setting time	2.2.2	≥ 90 min according to EN 14647, table 1	1	4/ week[1)] 2 / week[2)]
3	Chloride content	2.2.3	≤ 0.10 % by mass according to EN 14647, table 2	1	1 / week[1)] 2/ month[2) 3)]
4	Alkali content (as Na_2O eq: Na_2O + 0.658 K_2O)	2.2.4	Declared level	1	1 / week[1)] 1/ month[2)]
5	Sulphate content (as SO_3)	2.2.5	≤ 0.5% by mass according to EN 14647, table 2	1	1 / week[1)] 1/ month[2)]
6	Sulphide content (as S^{-2})	2.2.6	≤ 0.10% by mass according to EN 14647, table 2	1	1 / week[1)] 1/ month[2)]
7	Alumina content (as Al_2O_3)	2.2.7	Declared level 65% by mass ≤ Al_2O_3 ≤ 75% by mass	1	1 / week[1)] 2/ month[2)]
8	Colour	ISO 18314-1	Declared value L* ≥ 92 -1.0 ≤ a* ≤ +1.0 0 ≤ b* ≤ 2	1	1 / week

Note 1: Chemical requirements are given as percentages by mass of the final cement.

Note 2: Controls 1 to 7 are according to stipulations of EN 14647, clause 9.1 and conformity criteria as stated in clause 9.2 shall be taken into account.

[1)] Initial period (3 months, according to EN 197-1)

[2)] Routine situation

[3)] Chloride content: when none of the test results within a period of 12 months exceeds 50% of the characteristic value, the frequency may be reduced to one per month.

3.3 Tasks of the notified body

The cornerstones of the actions to be undertaken by the notified body of the product in the procedure of assessment and verification of constancy of performance are laid down in Table 3.3.1.

Table 3.3.1 Control plan for the notified body; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Initial inspection of the manufacturing plant and of factory production control					
1	Notified Body will ascertain that the factory production control with the staff and equipment are suitable to ensure a continuous and orderly manufacturing of the WHACAC.	Verification of the complete FPC as described in the control plan agreed between the TAB and the manufacturer	According to Control plan	According to Control plan	When starting the production or a new line
Continuous surveillance, assessment and evaluation of factory production control					
2	The Notified Body will ascertain that the system of factory production control and the specified manufacturing process are maintained taking account of the control plan.	Verification of the controls carried out by the manufacturer as described in the control plan agreed between the TAB and the manufacturer with reference to the raw materials, to the process and to the product as indicated in Table 3.	According to Control plan	According to Control plan	Once a year (as indicated in EN 197-2)
Audit-testing of samples taken by the notified product certification body at the manufacturing plant or at the manufacturer's storage facilities *(for system 1+ only)*					
3	Compressive strength	2.2.1	f_{c6h} ≥ 18.0 MPa according to EN 14647, table 1 f_{c24h} ≥ 40.0 MPa according to EN 14647, table 1	1	6/year* (as indicated in EN 197-2)
4	Initial setting time	2.2.2	≥ 90 min according to EN 14647, table 1	1	
5	Chloride content	2.2.3	≤ 0.10 % by mass according to EN 14647, table 2	1	
6	Alkali content (as Na_2O eq: Na_2O + 0.658 K_2O)	2.2.4	Declared level	1	
7	Sulphate content (as SO_3)	2.2.5	≤ 0.5% by mass according to EN 14647, table 2	1	
8	Sulphide content (as S^{-2})	2.2.6	≤ 0.10% by mass according to EN 14647, table 2	1	
9	Alumina content (as Al_2O_3)	2.2.7	Declared level	1	

*) The frequency of control shall be at least 6 per year for each certified cement dispatched continuously from the factory. When certain certified cements are not dispatched continuously, this frequency and the point of sampling may be altered by mutual agreement between the certification body and the manufacturer.

The frequency of control during the initial period (3 months according to EN 197-2) shall be at least one per month.

Note 1: Chemical requirements (No 5 to 8) are given as percentages by mass of the final cement.

4 REFERENCE DOCUMENTS

EN 14647:2005/AC:2006	Calcium aluminate cement - Composition, specifications and conformity criteria
EN 196-1:2016	Methods of testing cement – Part 1: Determination of strength
EN 196-2:2013	Methods of testing cement – Part 2: Chemical analysis of cement
EN 196-3:2017	Methods of testing cement – Part 3: Determination of setting time and soundness
EN 197-1:2011	Cement - Part 1: composition, specifications and conformity criteria for common cements
EN 197-2:2020	Cement – Part 2: Conformity evaluation
ISO 18314-1:2015	Analytical colorimetry - Part 1: Practical colour measurement
EN 12004:2007 +A1:2012	Adhesives for ceramic tiles - Part 1: Requirements, assessment and verification of constancy of performance, classification and marking
ISO 13007-1:2014	Ceramic tiles — Grouts and adhesives — Part 1: Terms, definitions and specifications for adhesives
EN 13888-1:2022	Grout for tiles. Requirements, evaluation of conformity, classification and designation
EN 998-1:2016	Specification for mortar for masonry Rendering and plastering mortar
EN 13318:2000	Screed material and floor screeds. Definitions
EN 13813:2002	Screed material and floor screeds - Screed materials - Properties and requirements
EN 1504-1:2005	Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity - Part 1: Definitions
EN ISO CIE 11664-4:2019	Colorimetry - Part 4: CIE 1976 L*a*b* colour space

ANNEX A – INITIAL SETTING TIME (ALTERNATIVE METHOD): SETTING TIME ON MORTAR

A.1 PRINCIPLE OF THE TEST

The "initial setting" is determined using the Vicat apparatus, as described in EN 196-3, paragraph 6.1.3.

The initial setting is the moment when the needle stops to penetrate into the mortar and stops at a distance from the bottom of the truncated cone mould greater than 2.5 mm, which is the size of the largest grains of sand.

The test is performed on a normal mortar as defined in EN 196-1 clause 6.1.

The test is normally carried out with a test piece immersed in water under the conditions defined in EN 196-3, paragraph 6.2.

It may also be carried out by placing the test piece in a humidity cabinet where the air temperature is maintained at (20 ± 1) °C and the humidity is at least 90%, provided that it can be shown that the same test results are obtained.

A.2 LABORATORY AND EQUIPEMENT

Vicat apparatus, as described in EN 196-3, clause 5.1, but with a total mass of the moving parts of (1000 ± 2) g, which amounts to operating with an overload on the plate.

A water bath, wet room or humidity cabinet that maintains the conditions specified in EN 196-3, paragraph 6.1.2.

A.3 TEST PROCEDURE

A.3.1 Preparation and storage of the specimen

Once the mortar has been prepared in accordance with EN 196-1, immediately fill the truncated cone mould to the top of the mould, without undue compaction or vibration. Remove excess mortar by carefully moving back and forth with a tool having a straight edge, so that the mortar fills the mould with a smooth top surface.

Immediately immerse the filled mould and base plate container and add water so that the surface is submerged or place it in the humidity cabinet and remove it only for the time required for each observation.

A.3.2 Determination of setting time

Set the Vicat machine with the needle in place by lowering it to the base plate and adjusting the mark to zero on the scale. Raise the needle to the standby position.

After a suitable time, place the filled mould and the base plate under the needle of the Vicat machine. Carefully lower the needle until it contacts the mortar. Allow a pause of 1 to 2 seconds at this position to avoid initial speed or forced acceleration of the moving parts. Then quickly release the moving parts and allow the needle to penetrate vertically into the mortar. Record the scale reading at the end of the penetration.

Repeat the test until Initial set as defined in section A.1, is established on the same specimen at suitably spaced positions more than 10 mm from the edge of the mould or from each other and at suitably spaced time intervals, e.g., at 10 min intervals. Clean the Vicat needle immediately after each penetration. The required accuracy can be achieved by reducing the time interval between penetration tests.