



ALMATIS

PREMIUM ALUMINA



Global Product Data

Calcium Aluminate Cements



Think alumina, think Almatris.

GP-RCP/005/R06/1207/MSDS 993



Calcium Aluminate Cements

Products

Almatis produces high purity Calcium Aluminate Cements with 70 and 80 % Al_2O_3 content. The products are widely used throughout the refractory industry, but also in other areas such as the construction industry.

The **70 % alumina cements** are represented by two product types, CA-14 and CA-270. In the refractory industry they find their use especially in low and ultra-low cement, low moisture castables with gunning, vibration or self-flowing placement.

CA-14 is a well established product line. Our process enables us to produce CA-14 cement with three distinct setting time ranges, which provide the opportunity to develop products with consistent and predictable properties.

CA-270 is a product (2nd generation of 70 % alumina cements) characterized by very low water demand, excellent flowability, and high strength development.

Almatis 70 % alumina cements do not contain any organic additives in order to give full flexibility in product design without any potential chemical mismatches.

Our **80 % alumina cements** are represented by CA-25 R (Regular Grade), CA-25 M (Medium Grade) and CA-25 C (Casting Grade). They are used in the refractory industry in conventional and low cement castables, which require fast setting, high early strength development, and good strength at intermediate temperatures. Our process enables us to produce CA-25 cement with three distinct setting time ranges, which provide the opportunity to develop products with consistent and predictable properties. CA-25 C has a lower water demand when compared to CA-25 M and CA-25 R.

The Almatis cement production process is designed to achieve maximum consistency. We have the ability to precisely control the cement setting times by tight control of the cement phases. The Almatis Production System (APS) allows us to give better service by dramatically decreasing our response time and improving production flexibility.

Cement Tests & Cement Quality

Almatis Calcium Aluminate Cements are tested to reflect customer's needs. Consistency in setting, flow, strength, particle size distribution, and chemical composition are all essential for good cement performance.

The Almatis cement testing procedures of flow, set, and strength are as nearly as possible based on the European Norm EN-196 parts 1, 2, 3 and 6. The Normsand based grog was modified to a grog based on Tabular Alumina (NORTAB). Testing was extended by the exothermic reaction and the particle size distribution analysis by Laser-granulometer. Chemical analysis is made by X-Ray Fluorescence Spectrometry.

Our quality control is designed and carried out to ensure high product consistency, which results in the high performance and reliability of our customers' products.

Calcium Aluminate Cements

70 % Al₂O₃ Cements – Product Data

Product	CA-14 W*			CA-14 M*			CA-14 S*			CA-270		
Setting	short			medium			long			long		
	Typical	min.	max.	Typical	min.	max.	Typical	min.	max.	Typical	min.	max.

Cement Properties as Pure Cement

Chemical Composition													
CaO	[%]	28	26	30	28	26	30	28	26	30	27	25	29
Al ₂ O ₃	[%]	71	69		71	69		71	69		72	70	
Na ₂ O	[%]			0.3			0.3			0.3			0.3
SiO ₂	[%]			0.3			0.3			0.3			0.3
Fe ₂ O ₃	[%]			0.2			0.2			0.2			0.2
MgO	[%]			0.4			0.4			0.4			0.4
Fineness (Cilas)													
-45 µm	[%]	82	79		82	79		82	79		88	85	
d50	µm	13			13			13			6		

Cement Properties in NORTAB Mortar

Water addition	[%]	10 %										9 %	
Vicat Setting Time													
Initial Setting	[min]		150			230			320			310	
Final Setting	[min]	220	170	250	300	250	350	400	350	480	370		480
Exothermic Reaction Time													
EXO+5	[min]	270			320			400			370		
EXO max	[min]	360			400			480			450		
Vibration Flow													
F10	[cm]	17	15		18	15		18	15		18	15	
F30	[cm]	16	13		17	14		17	14		17	15	
F60	[cm]	16	12		17	13		17	13		17	14	
Cold Modulus of Rupture (CMOR)													
24 h Cured 20 °C	[MPa]**	8	6		8	6		8	6		9	5	
24 h Dried 105 °C	[MPa]	12	8		12	8		12	8		12	9	
5 h Fired 1000 °C	[MPa]	6	3		6	3		6	3		7	5	
Cold Crushing Strength (CCS)													
24 h Cured 20 °C	[MPa]	48	35		48	35		48	35		52	35	
24 h Dried 105 °C	[MPa]	70	55		70	55		70	55		74	55	
5 h Fired 1000 °C	[MPa]	37	25		37	25		37	25		44	35	

*] CA-14 W stands for CA-14 Winter; CA-14 M stands for CA-14 Medium; CA-14 S stands for CA-14 Summer
CA-270 stands for second generation of 70 % alumina cements

**] 1 MPa = 145 psi

The typical product properties are based upon the actual averages from production data. The min-max data show our standard product specification for these products.



Calcium Aluminate Cements

80 % Al₂O₃ Cements – Product Data

Product	CA-25 R*			CA-25 M*			CA-25 C*		
Setting	short			medium			long		
	Typical	min.	max.	Typical	min.	max.	Typical	min.	max.

Cement Properties as Pure Cement

Chemical Composition										
CaO	[%]	18	17	19	18	17	19	18	17	19
Al ₂ O ₃	[%]	81	78		81	78		81	78	
Na ₂ O	[%]			0.6			0.8			0.8
SiO ₂	[%]			0.3			0.3			0.3
Fe ₂ O ₃	[%]			0.2			0.2			0.2
MgO	[%]			0.4			0.4			0.4
Fineness (Cilas)										
-45 µm	[%]	83	80		83	80		87	81	
d50	[µm]	9			9			6		

Cement Properties in NORTAB Mortar

Water addition	[%]	10 %			10 %			9 %		
Vicat Setting Time										
Initial Setting	[min]		50			80			100	
Final Setting	[min]	70		90	110		150	140		180
Vibration Flow										
F10	[cm]	18	15		18	16		18	16	
F30	[cm]	13	10		17	15		17	15	
F60	[cm]	9		13	14	12		15	12	
Cold Modulus of Rupture (CMOR)										
24 h Cured 20 °C	[MPa]**	6	4		5	4		6	5	
24 h Dried 105 °C	[MPa]	8	5		8	5		10	7	
5 h Fired 1000 °C	[MPa]	6	5		6	5		8	6	
Cold Crushing Strength (CCS)										
24 h Cured 20 °C	[MPa]	35	21		30	21		38	25	
24 h Dried 105 °C	[MPa]	40	26		45	26		50	28	
5 h Fired 1000 °C	[MPa]	30	22		30	22		40	27	

*) CA-25 R stands for CA-25 Regular Grade; CA-25 M stands for Medium Grade;
CA-25 C stands for CA-25 Casting Grade.

**) 1 MPa = 145 psi

The typical product properties are based upon the actual averages from production data. The min-max data show our standard product specification for these products.

Standard packaging

- Paper bags
- Big bags
- Bulk (CA-14 W, CA-14 S)

Calcium Aluminate Cements

Brief Descriptions of Almatis Cement Test Methods

Tests of Pure Cement

• Chemical Composition

CaO, Al₂O₃ and impurities, such as Fe₂O₃, Na₂O, SiO₂ and MgO, are determined by X-Ray Fluorescence (XRF).

• Fineness (Cilas)

The Particle Size Distribution (PSD) is measured on a Cilas Laserdiffractometer 1064. Reported are -45 µm in [%] and d50 in [µm].

Tests of cement in NORTAB Mortar

All mechanical and hydration reactivity data are tested in NORTAB, a Tabular Alumina T60/T64 based mortar. For NORTAB grog sieve analysis and mortar composition see table. All laboratory equipment, conditions and procedures are as nearly as possible based on the EN-196. All tests are conducted at 20 ± 1.0 °C. All cement grades have individual water additions according to their typical flow characteristics.

• Vicat Setting Properties

Setting properties in NORTAB are determined with a Vicat apparatus as described in EN-196, part 3. The total needle weight is 1000 g, the needle diameter 1.13 mm. After mixing, the mortar is filled in Vicat moulds and covered. At required time intervals the setting behavior is determined by checking the needle penetration into the mortar. The value for Initial Setting represents the time when the needle stops penetrating the mortar 10 mm above the bottom plate. At Final Setting the needle stops >30 mm above the bottom plate (total Vicat mould height 40 mm).

• Exothermic Reaction

Hydration Reactivity Properties in NORTAB are tested by recording the exothermic heat development during cement hydration. 1.5 kg mortar is put in a plastic box and a thermocouple is inserted. The box is covered and held at 20 ± 1.0 °C. The time when the mix temperature has increased by +5°C is recorded as EXO+5. The time when the mix has reached its maximum temperature is recorded as EXO max. It corresponds to the time when there is sufficient green strength development for demoulding.

• Flow Properties

Flow Properties in NORTAB are tested on a Vibration table on a steel plate. After mixing the mortar is filled in 3 Vicat moulds and covered. The starting diameter is given by the inner bottom diameter of the Vicat mould of 80 mm. After time intervals of 10, 30, and 60 min a sample is placed on the table and vibrated for 30 sec at 0.5 mm amplitude. The average diameter after vibration is noted as Flow F. (i.e. F30: Flow diameter 30 min after start of mixing).

• Strength Properties

Cold Strength Properties in NORTAB are determined with bars sized 40 x 40 x 160 mm as described in EN-196, part 1. After mixing the mortar is filled in bar moulds and compacted by vibration. The bars are cured in the moulds for 24 h in a moist atmosphere at 20 °C and then demoulded. The bars will be tested directly after demoulding for cured strength, be dried another 24 h at 105 °C for dried strength, and be fired another 5 h at 1000 °C for fired strength.

NORTAB PSD	
Square mesh size [mm]	Sieve Residue [%]
+ 2.0	3 ± 2
+ 1.4	13 ± 3
+ 1.0	14 ± 5
+ 0.5	35 ± 5
+ 0.125	29 ± 5
+ 0.063	4 ± 3
- 0.063	2 ± 2
Raw Material: Tabular Alumina T60/T64	
NORTAB Mortar Composition:	
80 % NORTAB and 20 % cement plus	
- 10 % H ₂ O for CA-14 cements	
- 10 % H ₂ O for CA-25 R and CA-25M	
- 9 % H ₂ O for CA-270	
- 9 % H ₂ O for CA-25 C	



Calcium Aluminate Cements

Shelf life

Stored under adequate dry conditions, the properties of all Almatris Calcium Aluminate Cements remain stable for a period of 12 months. Experience has shown that even after longer storage time the properties are not impaired.

For more detailed information on Cement Testing please refer to the brochure "Cement Test Methods".



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