Deutsches Institut für Bautechnik

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European Technical Assessment

ETA-20/0934 of 14 July 2022

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General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	CEM III/A xx-SR "Eisenhüttenstadt" CEM III/A xx-LH/SR "Eisenhüttenstadt" CEM III/A xx-LH/SR/LA "Eisenhüttenstadt" CEM III/A xx-SR/LA "Eisenhüttenstadt" CEM III/A xx-LH/LA "Eisenhüttenstadt" CEM III/A xx-LA "Eisenhüttenstadt"
Product family to which the construction product belongs	Blast Furnace Cement CEM III/A with assessment of sulfate resistance (SR) and optional with low effective alkali content (LA) and/or low heat of hydration (LH)
Manufacturer	CEMEX Zement GmbH Frankfurter Chaussee 15562 Rüdersdorf bei Berlin DEUTSCHLAND
Manufacturing plant	CEMEX Zement GmbH Werk Eisenhüttenstadt Oderlandstraße 1 15890 Eisenhüttenstadt DEUTSCHLAND
This European Technical Assessment contains	10 pages including 1 annex which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 150009-01-0301
This version replaces	ETA-20/0934 issued on 30 June 2021

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Specific part

1 Technical description of the product

The blast furnace cement CEM III/A "Eisenhüttenstadt" is a cement which fulfils all requirements given in EN 197-1[1] for a common cement of strength classes 32,5 N, 32,5 R, 42,5 L respectively 42,5 N.

The notation "LH" identifies the blast furnace cement CEM III/A[2] as low heat common cement according to EN 197-1, clause 7.2.3.

The notation "SR" identifies the blast furnace cement CEM III/A[2] as a sulfate resisting common cement.

The notation "LA" identifies the blast furnace cement CEM III/A[2] as a low alkali cement.

The assessment of "sulfate resisting property" (SR), low heat of hydration" (LH) and "low effective alkali content" (LA) was done on a blast furnace cement CEM III/A[2] with a strength class of 32,5 N with a blast furnace slag content of 55 % by mass and a specific surface of the cement of 350 m²/kg.

The low effective alkali content (LA) can be verified by the Na_2O-equivalent (Na_2O_{eq}) and the blast furnace slag content of the blast furnace cement CEM III/A[2]:

- Blast furnace slag content between 45 to 49 % by mass and $Na_2O_{eq} \leq 0{,}95$ % by mass or
- Blast furnace slag content of ≥ 50 % by mass and $Na_2O_{eq} \leq 1{,}10$ % by mass

The cement is produced at the plant Eisenhüttenstadt by simultaneously using unground granulated blastfurnace slag[3] in cement grinding and mixing of ground granulated blastfurnace slag[3] as semi-finished product by using a two-chamber mill. The ratio of unground granulated blastfurnace slag to ground granulated blastfurnace slag is around 1 : 1. The combined grinding of the components clinker[3], calcium sulfate and granulated blastfurnace slag takes place in the first grinding chamber. Loading and homogenization of the pre-ground granulated blast furnace slag takes place in the second chamber.

The blast furnace cement does not contain any minor additional constituents.

The specific surface (Blaine) of the cement shall be at least 350 m²/kg.

The cement composition shall be in the following range:

Portland cement clinker:	35 to 45 % by mass
Blast furnace slag:	55 to 65 % by mass

2 Specification of the intended use in accordance with the applicable European Assessment Document

The blast furnace cement CEM III/A[2] "Eisenhüttenstadt" is intended to be used for preparation of concrete, mortar, grouts and other mixes for construction and for the manufacturing of construction products.

If the cement is marked with the notation "LH", the blast furnace cement CEM III/A[2] shows a low heat of hydratation (LH).

If the cement is marked with the notation "SR", the blast furnace cement CEM III/A[2] is characterized by an evidently high resistance against sulfate attack on concrete.

If the cement is marked with the notation "LA", the blast furnace cement CEM III/A[2] can be used to avoid a damaging alkali-silica reaction in concrete.

1 EN 197-1 Cement - Part 1: Composition, specification and conformity criteria for common cement
2 The cement can be produced in strength classes 32,5 N, 32,5 R, 42,5 L and 42,5 N.
3 The manufacturing plant of the Portland cement clinker and of the granulated blast furnace slag is deposited.

The verification and assessment methods on which the European Technical Assessment is based lead to the assumption of a working life of concrete incorporating the blast furnace cement CEM III/A[2] "Eisenhüttenstadt" of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for its assessment

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Specific surface (Blaine)	ρ = 350 m²/kg
Early (Compressive) strength (7 days)	Class N for 32,5 N and Class L for 42,5 L (28,9 N/mm²)
Early (Compressive) strength (2 days)	Class R for 32,5 N and Class N for 42,5 N (12,9 N/mm²)
Standard (Compressive) strength (28 days)	Class 32,5 N, 32,5 R, 42,5 L and 42,5 N (47,2 N/mm²)
Initial setting time	Passed (205 min)
Soundness	Passed (0 mm)
Loss on ignition	Passed (1,54 % by mass)
Insoluble residue	Passed (0,27 % by mass)
Sulfate content (as SO_3)	Passed (2,93 % by mass)
Chloride content	Passed (0,077 % by mass)
Sulfate resistance	see Annex A
Alkali content (Na_2O_{eq})	0,78 % by mass
Low heat of hydration (LH)	Passed (247 J/g)

3.2 Hygiene, health and the environment (BWR 3)

Essential characteristic	Performance
Content, emission and/or release of dangerous substances: Water-soluble chromium (VI) content	K=0,0 mg/kg

4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with EAD No. 150009-01-0301, the applicable European legal act is: 97/555/EC[4] amended by the Commission Decision 2010/683/EU[5].

The system to be applied is: 1+

[4] Official Journal of the European Communities L 229 of 20 August 1997
[5] Official Journal of the European Communities L 293 of 11 November 2010

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 14 July 2022 by Deutsches Institut für Bautechnik

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beglaubigt:
Schröder

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ANNEX A: Sulfate resistance – Flat prism method

The testing procedure was done according to EAD 150009-01-0301, Annex A.

The difference in elongation between the sulfate storage (4,4 % Na_2SO_4-solution) and the reference storage (saturated $Ca(OH)_2$-solution) was calculated as specific change in length.

The specific change in length of the three mortars (one with CEM III/A XX-LH/SR/LA "Eisenhüttenstadt", one with CEM III/B 42,5 L-LH/SR and one with CEM I 42,5 R-SR0) and storage temperatures (20 °C and 5 °C) depending on the storage time and of the respective test solutions are given in Table A1. The expansion of length of the flat prisms was calculated as mean value from 3 specimens.

Table A1: Expansion of length of the mortar flat prisms

	Expansion of the length [mm/m] after …. storage in				
	14 days	28 days	56 days	91 days	182 days
CEM III/A XX-LH/SR/LA "Eisenhüttenstadt" – storage at 20 °C					
Na_2SO_4-solution ($\Delta l_{NS;t,20}$)	0,13	0,19	0,32	0,45	0,84
$Ca(OH)_2$-solution ($\Delta l_{CH;t,20}$)	0,04	0,05	0,10	0,11	0,11
$\Delta l_{t,20}$	0,09	0,14	0,22	0,34	0,73
CEM III/A XX-LH/SR/LA "Eisenhüttenstadt" – storage at 5 °C					
Na_2SO_4-solution ($\Delta l_{NS;t,5}$)	-0,04	0,00	0,04	0,20	-
$Ca(OH)_2$-solution ($\Delta l_{CH;t,5}$)	-0,12	-0,12	-0,14	-0,13	-
$\Delta l_{t,5}$	0,08	0,12	0,18	0,33	-
CEM III/B 42,5 L-LH/SR – storage at 20 °C					
Na_2SO_4-solution ($\Delta l_{NS;t,20}$)	0,07	0,11	0,19	0,31	0,50
$Ca(OH)_2$-solution ($\Delta l_{CH;t,20}$)	0,05	0,07	0,08	0,13	0,11
$\Delta l_{t,20}$	0,02	0,04	0,11	0,18	0,39
CEM III/B 42,5 L-LH/SR – storage at 5 °C					
Na_2SO_4-solution ($\Delta l_{NS;t,5}$)	-0,05	-0,03	-0,02	0,08	-
$Ca(OH)_2$-solution ($\Delta l_{CH;t,5}$)	-0,07	-0,10	-0,11	-0,10	-
$\Delta l_{t,5}$	0,02	0,07	0,09	0,18	-
CEM I 42,5 R-SR0 – storage at 20 °C					
Na_2SO_4-solution ($\Delta l_{NS;t,20}$)	0,06	0,11	0,19	0,21	0,22
$Ca(OH)_2$-solution ($\Delta l_{CH;t,20}$)	-0,05	-0,02	-0,03	-0,03	-0,04
$\Delta l_{t,20}$	0,11	0,13	0,21	0,24	0,26
CEM I 42,5 R-SR0 – storage at 5 °C					
Na_2SO_4-solution ($\Delta l_{NS;t,5}$)	0,10	0,00	0,05	0,35	-
$Ca(OH)_2$-solution ($\Delta l_{CH;t,5}$)	-0,10	-0,12	-0,16	-0,15	-
$\Delta l_{t,5}$	0,09	0,12	0,21	0,50	-

The dynamic moduli of elasticity of the three mortars (one with CEM III/A XX-LH/SR/LA "Eisenhüttenstadt", one with CEM III/B 42,5 L-LH/SR and one with CEM I 42,5 R-SR0) and storage temperatures (20 °C and 5 °C) depending on the storage time and of the respective test solutions are given in Table A2. The dynamic modulus of elasticity was calculated as mean value from the measured values of 3 specimens.

Table A2: Dynamic modulus of elasticity of the mortar flat prisms

	Dynamic modulus of elasticity in kN/mm² after … storage in					
	0 days	14 days	28 days	56 days	91 days	182 days
CEM III/A XX-LH/SR/LA "Eisenhüttenstadt" – storage at 20 °C						
$Ca(OH)_2$-solution ($E_{d,CH;t,20}$)	28,08	30,71	32,71	35,00	36,50	38,94
Na_2SO_4-solution ($E_{d,NS;t,20}$)	28,81	35,05	36,69	38,57	40,12	40,50
CEM III/A XX-LH/SR/LA "Eisenhüttenstadt" – storage at 5 °C						
$Ca(OH)_2$-solution ($E_{d,CH;t,5}$)	27,67	28,81	29,62	30,97	32,24	-
Na_2SO_4-solution ($E_{d,NS;t,5}$)	28,16	32,90	34,44	35,84	36,66	-
CEM III/B 42,5 L-LH/SR – storage at 20 °C						
$Ca(OH)_2$-solution ($E_{d,CH;t,20}$)	30,00	33,43	35,88	37,94	39,18	40,03
Na_2SO_4-solution ($E_{d,NS;t,20}$)	29,97	34,98	36,92	37,97	38,27	38,32
CEM III/B 42,5 L-LH/SR – storage at 5 °C						
$Ca(OH)_2$-solution ($E_{d,CH;t,5}$)	28,94	29,43	29,97	31,27	33,09	-
Na_2SO_4-solution ($E_{d,NS;t,5}$)	28,93	31,84	33,58	34,60	35,37	-
CEM I 42,5 R-SR0 – storage at 20 °C						
$Ca(OH)_2$-solution ($E_{d,CH;t,20}$)	33,59	35,04	35,16	35,63	35,86	36,38
Na_2SO_4-solution ($E_{d,NS;t,20}$)	34,19	36,10	36,82	37,74	38,78	39,27
CEM I 42,5 R-SR0 – storage at 5 °C						
$Ca(OH)_2$-solution ($E_{d,CH;t,5}$)	34,22	34,43	34,59	34,98	35,03	-
Na_2SO_4-solution ($E_{d,NS;t,5}$)	33,76	34,59	35,41	36,45	37,28	-

The mass of the test specimens of the three mortars (one with CEM III/A XX-LH/SR/LA "Eisenhüttenstadt", one with CEM III/B 42,5 L-LH/SR and one with CEM I 42,5 R-SR0) and storage temperatures (20 °C and 5 °C) depending on the storage time and of the respective test solutions are given in Table A3. The mass of the test specimens was calculated as mean value from the measured values from 3 specimens.

Table A3: Mass of the mortar flat prisms

	Mass in g after …. storage in					
	0 days	14 days	28 days	56 days	91 days	182 days
CEM III/A XX-LH/SR/LA "Eisenhüttenstadt" – storage at 20 °C						
$Ca(OH)_2$-solution ($w_{CH;t,20}$)	146,41	147,19	147,14	147,30	148,05	147,97
Na_2SO_4-solution ($w_{NS;t,20}$)	146,87	147,24	147,37	147,69	148,57	148,75
CEM III/A XX-LH/SR/LA "Eisenhüttenstadt" – storage at 5 °C						
$Ca(OH)_2$-solution ($w_{CH;t,5}$)	146,17	146,82	147,05	147,15	147,52	-
Na_2SO_4-solution ($w_{NS;t,5}$)	146,71	147,13	147,30	147,58	148,65	-
CEM III/B 42,5 L-LH/SR – storage at 20 °C						
$Ca(OH)_2$-solution ($w_{CH;t,20}$)	146,17	146,82	147,05	147,15	147,52	147,57
Na_2SO_4-solution ($w_{NS;t,20}$)	146,80	146,95	147,06	147,57	148,13	149,04
CEM III/B 42,5 L-LH/SR – storage at 5 °C						
$Ca(OH)_2$-solution ($w_{CH;t,5}$)	145,73	146,39	146,34	146,50	147,08	-
Na_2SO_4-solution ($w_{NS;t,5}$)	146,02	146,30	146,29	146,42	147,27	-
CEM I 42,5 R-SR0 – storage at 20 °C						
$Ca(OH)_2$-solution ($w_{CH;t,20}$)	146,32	146,38	146,39	146,43	147,01	147,07
Na_2SO_4-solution ($w_{NS;t,20}$)	146,83	146,84	147,10	147,29	147,79	147,81
CEM I 42,5 R-SR0 – storage at 5 °C						
$Ca(OH)_2$-solution ($w_{CH;t,5}$)	146,03	146,39	146,50	146,60	146,98	-
Na_2SO_4-solution ($w_{NS;t,5}$)	146,56	146,62	146,99	147,36	148,11	-

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Visual description of the specimens after sulfate storage

After a testing period of 182 days respectively 91 days the specimens show no expansion damages, cracks or flaking based on formation of ettringite and thaumasite, see Figures A1 to A3.

Figure A1: Specimens with CEM III/A XX-LH/SR/LA "Eisenhüttenstadt" after sulfate storage; on the left: after 182 days at 20 °C; on the right: after 91 days at 5 °C

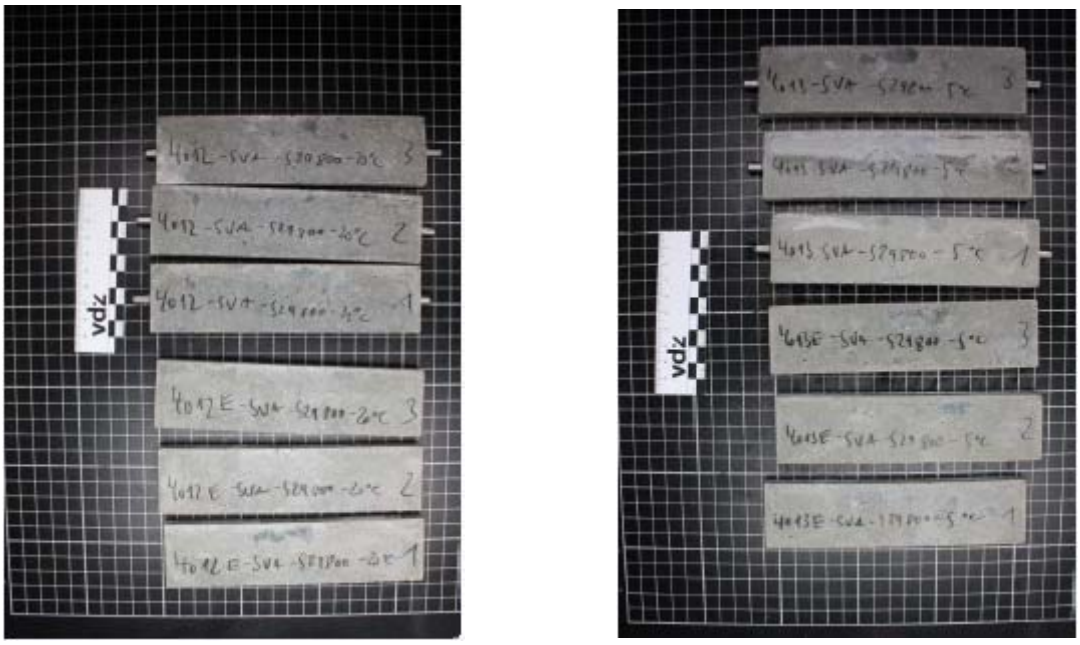

Figure A2: Specimens with CEM III/B 42,5 L-LH/SR after sulfate storage; on the left: after 182 days at 20 °C; on the right: after 91 days at 5 °C

Figure A3: Specimens with CEM I 42,5 R-SR0 after sulfate storage;
on the left: after 182 days at 20 °C; on the right: after 91 days at 5 °C