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European Technical Assessment

ETA-22/0160 of 1 December 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	Blastfurnace cement CEM III/A 32,5 N-LH/SR/LA "Lägerdorf" Holcim ECOPlanet A3 LH/SR/NA
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	Holcim (Deutschland) GmbH Troplowitzstraße 5 22529 Hamburg DEUTSCHLAND
Manufacturing plant	Holcim (Deutschland) GmbH Werk: Lägerdorf Sandweg 10 25566 Lägerdorf DEUTSCHLAND
This European Technical Assessment contains	9 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-22/0160 issued on 14 July 2022

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Specific Part

1 Technical description of the product

The blast furnace cement CEM III/A 32,5 N-LH/SR/LA "Lägerdorf"[1] is a cement which fulfils all requirements given in EN 197-1[2] for a common cement of strength class 32,5 N and low heat "LH".

Furthermore, the blast furnace cement CEM III/A 32,5 N-LH/SR/LA "Lägerdorf" has a high resistance against sulfate attack on concrete (SR) and a low effective alkali content (LA).

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 32,5 N-LH/SR/LA "Lägerdorf":

- 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 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 32,5 N-LH/SR/LA "Lägerdorf" with a strength class of 32,5 N with a blast furnace slag content of 52 % by mass and a maximum content of defined minor additional constituents of 3,0 % by mass and a specific surface of the cement of 380 m²/kg.

The cement was produced at the plant Lägerdorf by mixing of ground granulated blastfurnace slag[3] and a pre-cement[3].

The cement composition shall be in the following range:

Portland cement clinker:	35 to 48 % by mass
Blast furnace slag:	52 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 32,5 N-LH/SR/LA "Lägerdorf" is intended to be used for preparation of concrete, mortar, grouts and other mixes for construction and for the manufacturing of construction products.

Furthermore, the blast furnace cement CEM III/A 32,5 N-LH/SR/LA "Lägerdorf" shows a low heat of hydration (LH).

Especially the blast furnace cement CEM III/A 32,5 N-LH/SR/LA "Lägerdorf" is characterized by an evidently high resistance against sulfate attack on concrete (SR) and can be used to avoid a damaging alkali silica reaction in concrete (LA).

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of concrete incorporating the blast furnace cement CEM III/A 32,5 N-LH/SR/LA "Lägerdorf" 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.

1 The cement will also be offered under the trade name "Holcim ECOPlanet A3 LH/SR/NA"
2 EN 197-1 Cement - Part 1: Composition, specification and conformity criteria for common cement
3 The manufacturing plant of the pre-cement, the sources of the granulated blast furnace slag and minor additional constituents are deposited.

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 = 380 m²/kg
Early (Compressive) strength (7 days)	Class 32,5 N: $R_{c,7d}$ = 30,4 N/mm²
Standard (Compressive) strength (28 days)	Class 32,5 N: $R_{c,28d}$ = 50,2 N/mm²
Initial setting time	Passed (IST = 195 min)
Soundness	Passed (S = 0 mm)
Loss on ignition	Passed (LOI = 1,53 % by mass)
Insoluble residue	Passed (IR = 0,39 % by mass)
Sulfate content (as SO_3)	Passed (SO_3 = 1,47 % by mass)
Chloride content	Passed (Cl^- = 0,039 % by mass)
Sulfate resistance	see Annex A
Alkali content (Na_2O_{eq})	Na_2O_{eq} = 0,65 % by mass
Low heat of hydration (LH)	Passed (LH = 216 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+

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 1 December 2022 by Deutsches Institut für Bautechnik

Dr.-Ing. Wilhelm Hintzen
Head of Section

beglaubigt:
Schröder

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

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 32,5 N-LH/SR/LA "Lägerdorf", one with CEM III/B 32,5 N-LH/SR and one with CEM I 42,5 R-SR3) and storage temperatures (20 °C and 5 °C) depending on the storage time and on 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 32,5 N-LH/SR/LA "Lägerdorf" – storage at 20 °C					
Na_2SO_4-solution ($\Delta l_{NS;t,20}$)	0,20	0,21	0,19	0,29	0,46
$Ca(OH)_2$-solution ($\Delta l_{CH;t,20}$)	0,07	0,06	0,01	0,08	0,10
$\Delta l_{t,20}$	0,13	0,15	0,18	0,21	0,36
CEM III/A 32,5 N-LH/SR/LA "Lägerdorf" – storage at 5 °C					
Na_2SO_4-solution ($\Delta l_{NS;t,5}$)	-0,07	-0,05	0,05	0,30	-
$Ca(OH)_2$-solution ($\Delta l_{CH;t,5}$)	-0,05	0,00	0,05	0,06	-
$\Delta l_{t,5}$	-0,02	-0,05	0,00	0,24	-
CEM III/B 32,5 N-LH/SR – storage at 20 °C					
Na_2SO_4-solution ($\Delta l_{NS;t,20}$)	0,08	0,12	0,19	0,27	0,34
$Ca(OH)_2$-solution ($\Delta l_{CH;t,20}$)	0,07	0,09	0,04	0,12	0,15
$\Delta l_{t,20}$	0,01	0,03	0,15	0,15	0,19
CEM III/B 32,5 N-LH/SR – storage at 5 °C					
Na_2SO_4-solution ($\Delta l_{NS;t,5}$)	-0,01	-0,03	0,06	0,30	-
$Ca(OH)_2$-solution ($\Delta l_{CH;t,5}$)	-0,06	-0,11	-0,13	-0,04	-
$\Delta l_{t,5}$	0,05	0,08	0,19	0,34	-
CEM I 42,5 R-SR3 – storage at 20 °C					
Na_2SO_4-solution ($\Delta l_{NS;t,20}$)	0,07	0,23	0,34	0,68	2,99
$Ca(OH)_2$-solution ($\Delta l_{CH;t,20}$)	0,06	0,04	-0,01	0,05	0,05
$\Delta l_{t,20}$	0,01	0,19	0,35	0,63	2,94
CEM I 42,5 R-SR3 – storage at 5 °C					
Na_2SO_4-solution ($\Delta l_{NS;t,5}$)	-0,05	-0,02	0,26	0,79	-
$Ca(OH)_2$-solution ($\Delta l_{CH;t,5}$)	-0,09	-0,06	-0,12	-0,08	-
$\Delta l_{t,5}$	0,04	0,04	0,38	0,87	-

The dynamic moduli of elasticity of the three mortars (one with CEM III/A 32,5 N-LH/SR/LA "Lägerdorf", one with CEM III/B 32,5 N-LH/SR and one with CEM I 42,5 R-SR3) and storage temperatures (20 °C and 5 °C) depending on the storage time and on 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 32,5 N-LH/SR/LA "Lägerdorf" – storage at 20 °C						
$Ca(OH)_2$-solution ($E_{d,CH;t,20}$)	30,8	33,9	35,9	38,3	39,2	40,9
Na_2SO_4-solution ($E_{d,NS;t,20}$)	30,7	36,6	38,3	39,4	37,5	36,1
CEM III/A 32,5 N-LH/SR/LA "Lägerdorf" – storage at 5 °C						
$Ca(OH)_2$-solution ($E_{d,CH;t,5}$)	30,2	30,2	31,2	32,0	33,2	-
Na_2SO_4-solution ($E_{d,NS;t,5}$)	30,5	33,1	34,8	35,7	36,6	-
CEM III/B 32,5 N-LH/SR – storage at 20 °C						
$Ca(OH)_2$-solution ($E_{d,CH;t,20}$)	28,4	30,2	31,4	33,6	34,9	35,9
Na_2SO_4-solution ($E_{d,NS;t,20}$)	28,5	32,2	33,8	34,8	34,5	32,8
CEM III/B 32,5 N-LH/SR – storage at 5 °C						
$Ca(OH)_2$-solution ($E_{d,CH;t,5}$)	29,0	28,6	28,8	29,3	30,2	-
Na_2SO_4-solution ($E_{d,NS;t,5}$)	28,6	30,2	31,2	32,0	32,5	-
CEM I 42,5 R-SR3 – storage at 20 °C						
$Ca(OH)_2$-solution ($E_{d,CH;t,20}$)	36,6	37,4	37,6	37,3	37,2	37,0
Na_2SO_4-solution ($E_{d,NS;t,20}$)	36,5	38,6	38,9	38,7	39,2	39,5
CEM I 42,5 R-SR3 – storage at 5 °C						
$Ca(OH)_2$-solution ($E_{d,CH;t,5}$)	36,7	37,3	37,6	38,2	38,0	-
Na_2SO_4-solution ($E_{d,NS;t,5}$)	36,6	37,8	38,6	37,6	36,0	-

The mass of the test specimens of the three mortars (one with CEM III/A 32,5 N-LH/SR/LA "Lägerdorf", one with CEM III/B 32,5 N-LH/SR and one with CEM I 42,5 R-SR3) and storage temperatures (20 °C and 5 °C) depending on the storage time and on 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 32,5 N-LH/SR/LA "Lägerdorf" – 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 32,5 N-LH/SR/LA "Lägerdorf" – 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 32,5 N-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 32,5 N-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-SR3 – storage at 20 °C						
$Ca(OH)_2$-solution ($w_{CH;t,20}$)	147,83	148,23333	148,25	148,43	148,40	149,03
Na_2SO_4-solution ($w_{NS;t,20}$)	147,53	147,83	148,12	148,48	148,45	149,63
CEM I 42,5 R-SR3 – storage at 5 °C						
$Ca(OH)_2$-solution ($w_{CH;t,5}$)	147,18	147,80	147,62	147,75	147,68	-
Na_2SO_4-solution ($w_{NS;t,5}$)	146,88	147,30	147,30	147,85	148,25	-

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.

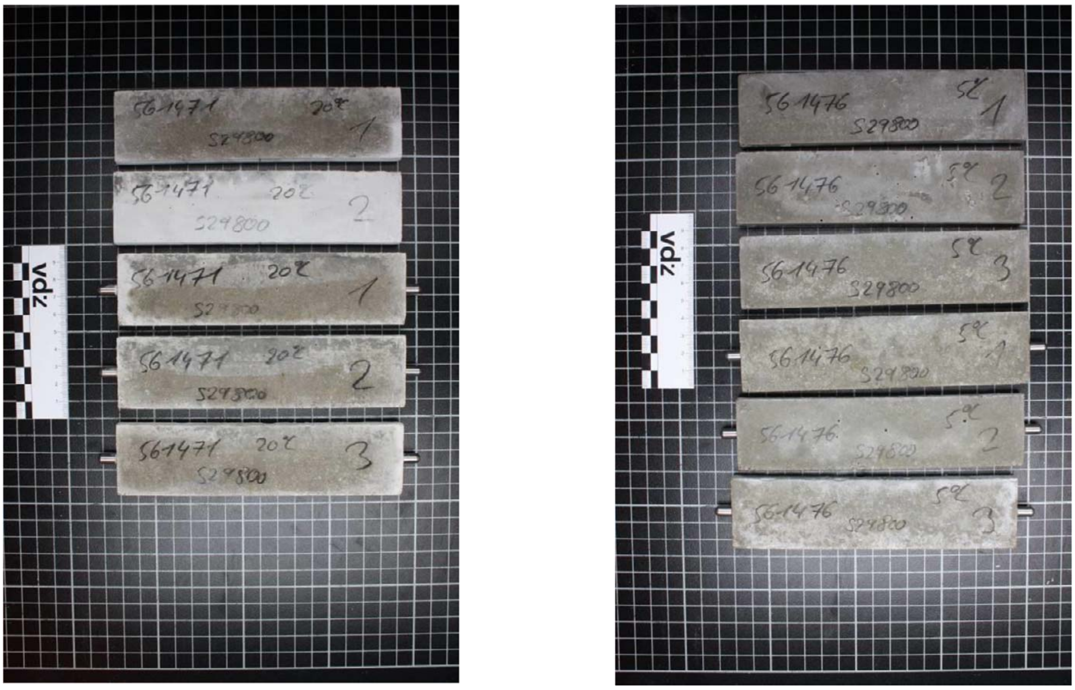

Figure A1: Specimens with CEM III/A 32,5 N-LH/SR/LA "Lägerdorf" after sulfate storage;
on the left: after 182 days at 20 °C; on the right: after 91 days at 5 °C

Figure A2: Specimens with CEM III/B 32,5 N-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-SR3 after sulfate storage;
on the left: after 182 days at 20 °C; on the right: after 91 days at 5 °C