Deutsches Institut für Bautechnik

Approval body for construction products and types of construction

Bautechnisches Prüfamt

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European Technical Assessment

ETA-20/0243 of 15 April 2020

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General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	Blast furnace cement CEM III/A 42,5 N-LH/SR/LA "Bernburg"
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	SCHWENK Zement KG Werk Bernburg Altenburger Chaussee 06406 Bernburg DEUTSCHLAND
Manufacturing plant	Schwenk Zement KG Altenburger Chausee 06406 Bernburg DEUTSCHLAND
This European Technical Assessment contains	8 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 150009-00-0301

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Specific part

1 Technical description of the product

The blast furnace cement CEM III/A 42,5 N-LH/SR/LA "Bernburg" is a cement which fulfils all requirements given in EN 197-1[1] for a common cement of strength class 42,5 N and with low heat of hydration.

Furthermore the blast furnace cement CEM III/A 42,5 N-LH/SR/LA "Bernburg" has a high resistance against sulfate attack on concrete (SR) and a low effective alkali content (LA).

The assessment for the verification of the essential characteristic "sulfate resistance" (SR), low heat of hydration" (LH) and "low effective alkali content" (LA) was done on a blast furnace cement CEM III/A with a blast furnace slag content of 45 % by mass and a specific surface of the cement of 458 m²/kg.

The low effective alkali content (LA) can be verified by the Na_2O-equivalent (Na_2Oeq) and the blast furnace slag content of the blast furnace cement CEM III/A:

- Blast furnace slag content between 45 to 49 % by mass and $Na_2Oeq \leq 0{,}95$ % by mass or
- Blast furnace slag content of ≥ 50 % by mass and $Na_2Oeq \leq 1{,}10$ % by mass

The blast furnace cement CEM III/A 42,5 N-LH/SR/LA "Bernburg" is manufactured from Portland cement CEM I 42,5 R[2] and blast furnace slag[2] under addition of gypsum or anhydrite or any mixture of them to control setting by separate grinding of the raw materials and subsequent mixing with a static mixer[3] in the plant Bernburg.

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

The specific surface (Blaine) of the cement shall be at least 458 m²/kg.

The cement composition shall be in the following range:

Portland cement clinker:	35 to 55 % by mass
Blast furnace slag:	45 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 42,5 N-LH/SR/LA "Bernburg" is intended to be used for preparation of concrete, mortar, grouts and other mixes for construction and for the manufacturing of construction products. The blast furnace cement shows a low heat of hydratation (LH).

Especially the blast furnace cement CEM III/A 42,5 N-LH/SR/LA "Bernburg" is characterized by an evidently high resistance against sulfate attack on concrete.

The blast furnace cement CEM III/A 42,5 N-LH/SR/LA "Bernburg" can be used to avoid a damaging alkali-silica reaction in concrete.

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 42,5 N-LH/SR/LA "Bernburg" 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 EN 197-1 Cement - Part 1: Composition, specification and conformity criteria for common cement

2 The manufacturing plant of the Portland cement CEM I 42,5 R and of the granulated blast furnace slag is deposited.

3 For the manufacturing of batches up to 3.5 tons, a batch mixer can also be used at the Bernburg plant for the manufacturing of the cement.

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**
(CaO + MgO)/SiO_2-ratio of the blast furnace slag	B = 1,2
Glass content of the blast furnace slag	GC > 98 %
Specific surface of the cement (Blaine)	ρ = 458 m²/kg
Sulfate resistance	see Annex
Characteristics for a common cement (CEM III/A 42,5 N-LH)	
Early strength (2 days)	Class N (16,6 N/mm²)
Standard strength (28 days)	Class 42,5 (46,1 N/mm²)
Initial setting time	Passed (215 min)
Soundness	Passed (0 mm)
Loss on ignition	Passed (1,82 % by mass)
Insoluble residue	Passed (0,63 % by mass)
Sulfate content (as SO_3)	Passed (3,18 % by mass)
Chloride content	Passed (0,035 % by mass)
Composition of the cement : Clinker (K): Blast furnace slag (S):	 K = 55 % by mass S = 45 % by mass
Alkali-Content of the cement (Na_2Oeq)	0,75 % by mass
Low heat of hydration (LH)	Passed (266 J/g)

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

In accordance with EAD No. 150009-00-0301, the applicable European legal act is: 97/555/EC[4] amended by the Commission Decision 2010/683/EU[5].

The system(s) to be applied is (are): 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 15 April 2020 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow
Head of Department

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

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ANNEX: Assessment

Sulfate resistance – Flat prism method

The testing procedure was done according to EAD 150009-00-0301, Annex B.

The elongation of the flat prisms was calculated as mean value from 3 specimens. The difference in elongation between the sulfate storage and the reference storage was calculated as expansion of length. The expansion of length for the different mortars and storages are given in Table 1.

Table 1: Expansion of length of the mortar flat prisms

	Expansion of the length [mm/m] after				
	14 days	28 days	56 days	90 days	180 days
CEM III/A 42,5 N-LH/SR/LA "Bernburg" – storage at 20 °C					
Na_2SO_4-solution	0,09	0,21	0,32	0,42	0,62
$Ca(OH)_2$-solution	0,00	0,08	0,08	0,13	0,14
ΔL	0,09	0,13	0,24	0,29	0,48
CEM III/A 42,5 N-LH/SR/LA "Bernburg" – storage at 5 °C					
Na_2SO_4-solution	-0,02	0,06	0,13	0,39	-
$Ca(OH)_2$-solution	-0,05	-0,11	-0,16	-0,08	-
ΔL	0,03	0,17	0,29	0,47	-
CEM III/B 42,5 N-LH/SR – storage at 20 °C					
Na_2SO_4-solution	0,02	0,17	0,42	0,65	2,67
$Ca(OH)_2$-solution	0,00	0,03	0,03	0,01	0,06
ΔL	0,02	0,14	0,39	0,64	2,61
CEM III/B 42,5 N-LH/SR – storage at 5 °C					
Na_2SO_4-solution	-0,12	-0,09	-0,06	0,24	-
$Ca(OH)_2$-solution	-0,02	-0,04	-0,05	0,00	-
ΔL	-0,10	-0,05	-0,01	0,24	-
CEM I 42,5 N-SR3 – storage at 20 °C					
Na_2SO_4-solution	0,15	0,18	0,26	0,46	0,90
$Ca(OH)_2$-solution	0,09	0,09	0,12	0,11	0,09
ΔL	0,06	0,09	0,14	0,35	0,81
CEM I 42,5 N-SR3 – storage at 5 °C					
Na_2SO_4-solution	-0,09	0,02	0,06	0,36	-
$Ca(OH)_2$-solution	-0,13	-0,11	-0,06	-0,02	-
ΔL	0,04	0,09	0,12	0,38	-

Table 2: Dynamic modulus of elasticity of the mortar flat prisms

	Dynamic modulus of elasticity in kN/mm² after					
	0 days	14 days	28 days	56 days	90 days	180 days
CEM III/A 42,5 N-LH/SR/LA "Bernburg" – storage at 20 °C						
$Ca(OH)_2$-solution	30,5	31,7	33,7	35,1	36,8	38,2
Na_2SO_4-solution	31,0	33,7	36,9	38,0	38,4	39,3
CEM III/A 42,5 N-LH/SR/LA "Bernburg" – storage at 5 °C						
$Ca(OH)_2$-solution	30,5	31,9	32,2	32,9	34,0	-
Na_2SO_4-solution	31,1	34,8	36,1	36,9	36,2	-
CEM III/B 42,5 N-LH/SR – storage at 20 °C						
$Ca(OH)_2$-solution	32,9	33,2	34,8	34,9	35,3	35,4
Na_2SO_4-solution	33,3	34,4	36,9	36,5	36,0	34,4
CEM III/B 42,5 N-LH/SR – storage at 5 °C						
$Ca(OH)_2$-solution	33,3	34,4	34,5	35,6	35,6	-
Na_2SO_4-solution	33,7	35,6	36,5	37,4	37,5	-
CEM I 42,5 N-SR3 – storage at 20 °C						
$Ca(OH)_2$-solution	35,8	36,4	36,9	37,9	38,6	38,9
Na_2SO_4-solution	35,3	37,4	38,3	39,1	39,6	39,9
CEM I 42,5 N-SR3 – storage at 5 °C						
$Ca(OH)_2$-solution	35,3	36,2	36,4	36,9	37,5	-
Na_2SO_4-solution	36,2	37,8	38,3	38,7	38,6	-

Table 3: Mass of mortar flat prisms

	Mass in g after					
	0 days	14 days	28 days	56 days	90 days	180 days
CEM III/A 42,5 N-LH/SR/LA "Bernburg" – storage at 20 °C						
$Ca(OH)_2$-solution	145,2	145,3	145,5	145,9	145,8	146,1
Na_2SO_4-solution	145,3	146,0	146,4	147,0	147,1	147,4
CEM III/A 42,5 N-LH/SR/LA "Bernburg"– storage at 5 °C						
$Ca(OH)_2$-solution	145,2	145,7	145,7	145,8	146,2	-
Na_2SO_4-solution	145,4	146,2	146,3	146,6	147,1	-
CEM III/B 42,5 N-LH/SR – storage at 20 °C						
$Ca(OH)_2$-solution	145,7	145,9	146,1	146,3	146,1	146,6
Na_2SO_4-solution	146,2	146,7	147,3	147,9	148,4	149,3
CEM III/B 42,5 N-LH/SR – storage at 5 °C						
$Ca(OH)_2$-solution	145,6	146,2	146,0	146,2	146,4	-
Na_2SO_4-solution	145,7	146,4	146,7	147,1	147,3	-
CEM I 42,5 N-SR3 – storage at 20 °C						
$Ca(OH)_2$-solution	147,7	148,2	148,3	148,6	148,7	148,6
Na_2SO_4-solution	147,1	147,4	147,7	147,9	148,5	149,0
CEM I 42,5 N-SR3 – storage at 5 °C						
$Ca(OH)_2$-solution	147,6	148,2	148,3	148,6	149,1	-
Na_2SO_4-solution	146,8	147,5	147,5	147,8	148,0	-

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Visual description of the specimens after sulfate storage

After a testing period of 180 days respectively 90 days the specimens show no expansion damages, cracks or flaking based on formation of thaumasite, see figures 1 to 3.

Figure 1: Specimens with CEM III/A 42,5 N-LH/SR/LA "Bernburg" after sulfate storage; on the left: after 180 days at 20 °C; on the right: after 90 days at 5 °C

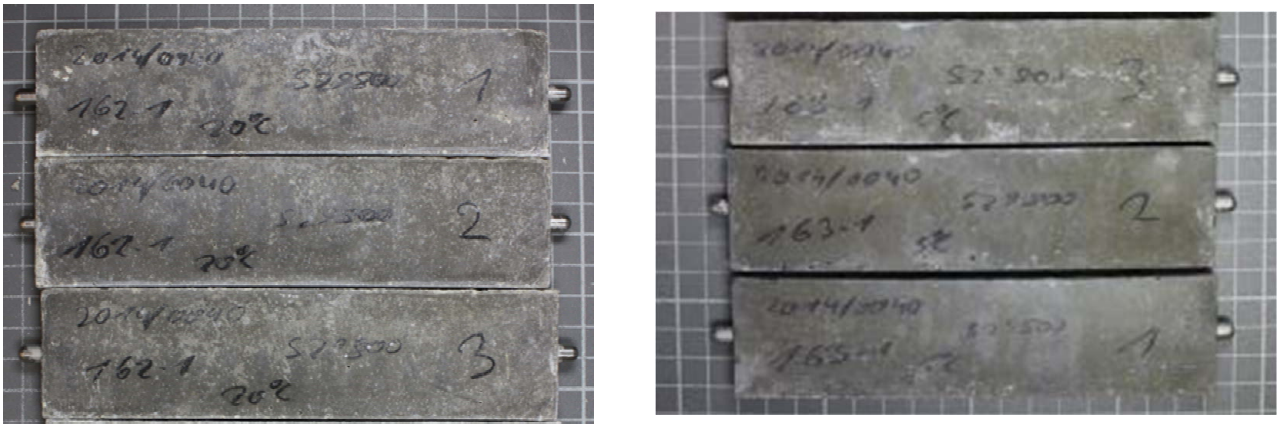

Figure 2: Specimens with CEM III/B 42,5 N-LH/SR/LA after sulfate storage; on the left: after 180 days at 20 °C; on the right: after 90 days at 5 °C

Figure 3: Specimens with CEM I 42,5 N-SR3 after sulfate storage; on the left: after 180 days at 20 °C; on the right: after 90 days at 5 °C