Deutsches Institut für Bautechnik

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Bautechnisches Prüfamt

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European Technical Assessment ETA-07/0157 of 9 February 2018

English translation prepared by DIBt - Original version in German language

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 52,5 N-SR/LA "Dortmund"
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 hydrataion (LH)
Manufacturer	Holcim HüttenZement GmbH Im Karrenberg 36 44329 Dortmund DEUTSCHLAND
Manufacturing plant	Holcim HüttenZement GmbH Im Karrenberg 36 44329 Dortmund DEUTSCHLAND
This European Technical Assessment contains	11 pages including 6 annexes 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
This version replaces	ETA-07/0157 issued on 20 June 2013

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Specific Part

1 Technical description of the product

The blast furnace cement CEM III/A 52,5 N-SR/LA "Dortmund" is a cement which fulfils all requirements given in EN 197-1[1] for a common cement of strength class 52,5 N.

Furthermore the blast furnace cement CEM III/A 52,5 N-SR/LA "Dortmund" 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) and "low effective alkali content" (LA) was done on a blast furnace cement CEM III/A with a blast furnace slag content of 50 % by mass and a specific surface of the cement of 548 m²/kg.

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

- Blast furnace slag content of ≥ 50 % by mass and Na_2O_{equ} ≤ 1,10 % by mass

The blast furnace cement CEM III/A 52,5 N-SR/LA "Dortmund" can be manufactured by combined grinding of a Portland cement clinker, a blast furnace slag and an addition of gypsum or anhydrite or any mixture of them to control setting or by separately grinding of the raw materials and subsequent mixing with a specific surface (Blaine) of at least 548 m²/kg with following cement composition:

Portland cement clinker:	35 to 50 % by mass
Blast furnace slag:	50 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 52,5 N-SR/LA "Dortmund" is intended to be used for preparation of concrete, mortar, grouts and other mixes for construction and for the manufacturing of construction products.

Especially the blast furnace cement CEM III/A 52,5 N-SR/LA "Dortmund" is characterized by an evidently high resistance against sulfate attack on concrete.

The blast furnace cement CEM III/A 52,5 N-SR/LA "Dortmund" 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 52,5 N-SR/LA "Dortmund" 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

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 (Basicity = B)	B = 1,4
Glass content of the blast furnace slag	GC = 98 %
Specific surface of the cement (Blaine)	S_m = 548 m²/kg
Sulfate resistance	see Annex A (A1 to A4)
Characteristics for a common cement (CEM III/A)	
Early strength (2 days)	Class N (≥ 20,0 N/mm²)
Standard strength (28 days)	Class 52,5 (≥ 52,5 N/mm²)
Initial setting time	Passed (145 min)
Soundness	Passed (0 mm)
Loss on ignition	Passed (0,9 % by mass)
Insoluble residue	Passed (0,3 % by mass)
Sulfate content (as SO_3)	Passed (2,5 % by mass)
Chloride content	Passed (0,0 % by mass)
Composition of the cement: Clinker (K): Blast furnace slag (S):	CEM III/A: K = 50 % by mass (35 – 50 % by mass) S = 50 % by mass (50 – 65 % by mass)
Alkali-Content of the cement Na_2O-equivalent	Na_2O_{equ} = 0,73 % by mass

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

According to Decision 97/555/EC[2] of the European Commission amended by the Commission Decision 2010/683/EU[3], the assessment and verification of constancy of performance system (AVCP system) (see Annex V to Regulation (EU) 305/2011 as amended by the Commission Delegated Regulation (EU) No 568/2014) given in table 1 applies.

Table 1: AVCP system

Product	Intended use(s)	Level(s) or Classe(s) of performance	AVCP system
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)	Preparation of concrete, mortar, grouts and other mixes for construction and for the manufacture of construction products	----	1+

[2] Official Journal of the European Communities L 229 of 20 August 1997
[3] 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 9 February 2018 by Deutsches Institut für Bautechnik

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beglaubigt:
Schröder

Deutsches Institut für Bautechnik DIBt

Testing of sulfate resistance of blast furnace cement CEM III/A – Flat prism method S_{FPM}

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

Table A1: Expansion of length of mortar flat prisms

	Expansion of length [mm/m] after				
	14 days	28 days	56 days	90 days	180 days
CEM III/A 52,5 N-SR/LA "Dortmund" – storage at 20 °C					
$Ca(OH)_2$-solution	0,05	0,08	0,03	0,12	0,13
Na_2SO_4-solution	0,11	0,18	0,19	0,30	0,53
ΔL	**0,06**	**0,10**	**0,16**	**0,18**	**0,40**
CEM III/A 52,5 N-SR/LA "Dortmund" – storage at 5 °C					
$Ca(OH)_2$-solution	-0,14	-0,12	-0,11	-0,14	-
Na_2SO_4-solution	-0,09	-0,03	0,06	0,12	-
ΔL	**0,05**	**0,09**	**0,17**	**0,26**	**-**
CEM III/B 42,5 N-LH/SR – storage at 20 °C					
$Ca(OH)_2$-solution	0,06	0,08	0,03	0,08	0,13
Na_2SO_4-solution	0,10	0,13	0,14	0,21	0,32
ΔL	**0,04**	**0,05**	**0,11**	**0,13**	**0,19**
CEM III/B 42,5 N-LH/SR – storage at 5 °C					
$Ca(OH)_2$-solution	-0,14	-0,13	-0,13	-0,14	-
Na_2SO_4-solution	-0,09	-0,04	0,04	0,11	-
ΔL	**0,05**	**0,09**	**0,17**	**0,25**	**-**
CEM I 42,5 R-SR3 – storage at 20 °C					
$Ca(OH)_2$-solution	0,00	0,00	-0,06	-0,03	-0,01
Na_2SO_4-solution	0,07	0,14	0,23	0,69	3,11
ΔL	**0,07**	**0,14**	**0,29**	**0,72**	**3,12**
CEM I 42,5 R-SR3 – storage at 5 °C					
$Ca(OH)_2$-solution	-0,13	-0,14	-0,14	-0,17	-
Na_2SO_4-solution	-0,10	-0,06	0,01	0,16	-
ΔL	**0,03**	**0,08**	**0,15**	**0,33**	**-**

Blast furnace cement CEM III/A 52,5 N-SR/LA "Dortmund"	**Annex A1**
Results of the assessment "sulfate resistance (Flat prism method) – S_{FPM}" Expansion of length	

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Testing of sulfate resistance of blast furnace cement CEM III/A – Flat prism method S_{FPM}

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

Table A2: Dynamic modulus of elasticity of 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 52,5 N-SR/LA "Dortmund" – storage at 20 °C						
$Ca(OH)_2$-solution	31,23	34,17	35,89	38,59	39,99	41,29
Na_2SO_4-solution	31,11	38,11	38,86	39,63	38,12	34,96
CEM III/A 52,5 N-SR/LA "Dortmund" – storage at 5 °C						
$Ca(OH)_2$-solution	31,11	31,93	32,77	34,17	35,44	-
Na_2SO_4-solution	31,23	34,57	35,47	36,30	35,75	-
CEM III/B 42,5 N-LH/SR – storage at 20 °C						
$Ca(OH)_2$-solution	29,53	33,11	35,17	37,79	39,06	40,07
Na_2SO_4-solution	29,60	35,67	37,42	38,48	37,55	34,44
CEM III/B 42,5 N-LH/SR – storage at 5 °C						
$Ca(OH)_2$-solution	30,64	31,61	32,11	33,50	35,06	-
Na_2SO_4-solution	30,58	34,64	34,92	35,96	36,11	-
CEM I 42,5 R-SR3 – storage at 20 °C						
$Ca(OH)_2$-solution	36,36	37,61	37,88	38,60	38,83	39,01
Na_2SO_4-solution	36,21	38,16	39,15	39,49	39,17	37,12
CEM I 42,5 R-SR3 – storage at 5 °C						
$Ca(OH)_2$-solution	34,47	36,57	36,76	37,92	37,94	-
Na_2SO_4-solution	35,72	37,86	38,20	39,37	38,84	-

Blast furnace cement CEM III/A 52,5 N-SR/LA "Dortmund"	**Annex A2**
Results of the assessment "sulfate resistance (Flat prism method) – S_{FPM}" Dynamic modulus of elasticity	

Deutsches Institut für Bautechnik DIBt

Testing of sulfate resistance of blast furnace cement CEM III/A – Flat prism method S_{FPM}

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

Table A3: Mass of mortar flat prisms

	Mass in g after					
	0 days	14 days	28 days	56 days	90 days	180 days
CEM III/A 52,5 N-SR/LA "Dortmund" – storage at 20 °C						
$Ca(OH)_2$-solution	146,79	146,98	147,27	147,48	147,57	147,90
Na_2SO_4-solution	146,77	146,84	147,44	148,00	148,39	149,87
CEM III/A 52,5 N-SR/LA "Dortmund" – storage at 5 °C						
$Ca(OH)_2$-solution	146,10	146,73	147,28	147,59	147,40	-
Na_2SO_4-solution	147,39	147,94	148,00	148,65	148,93	-
CEM III/B 42,5 N-LH/SR – storage at 20 °C						
$Ca(OH)_2$-solution	146,63	146,96	146,92	14677	147,45	147,74
Na_2SO_4-solution	146,75	146,99	146,89	146,89	147,39	147,95
CEM III/B 42,5 N-LH/SR – storage at 5 °C						
$Ca(OH)_2$-solution	146,01	146,22	146,20	146,88	146,97	-
Na_2SO_4-solution	146,20	146,39	146,53	146,74	147,00	-
CEM I 42,5 R-SR3 – storage at 20 °C						
$Ca(OH)_2$-solution	146,54	146,75	147,14	146,96	147,13	147,40
Na_2SO_4-solution	147,19	147,32	147,51	147,45	148,41	150,54
CEM I 42,5 R-SR3 – storage at 5 °C						
$Ca(OH)_2$-solution	146,55	147,01	147,11	147,37	147,47	-
Na_2SO_4-solution	146,64	147,16	147,39	147,87	148,26	-

Blast furnace cement CEM III/A 52,5 N-SR/LA "Dortmund"	**Annex A3**
Results of the assessment "sulfate resistance (Flat prism method) – S_{FPM}" Mass of the mortar flat prisms	

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Testing of Sulfate Resistance of Blast-furnace cement CEM III/A – Flat prism method S_{FPM}

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

After a testing period of 180 days the specimens show no expansion damages, cracks or flaking based on formation of thaumasite, see figures A1 to A6.

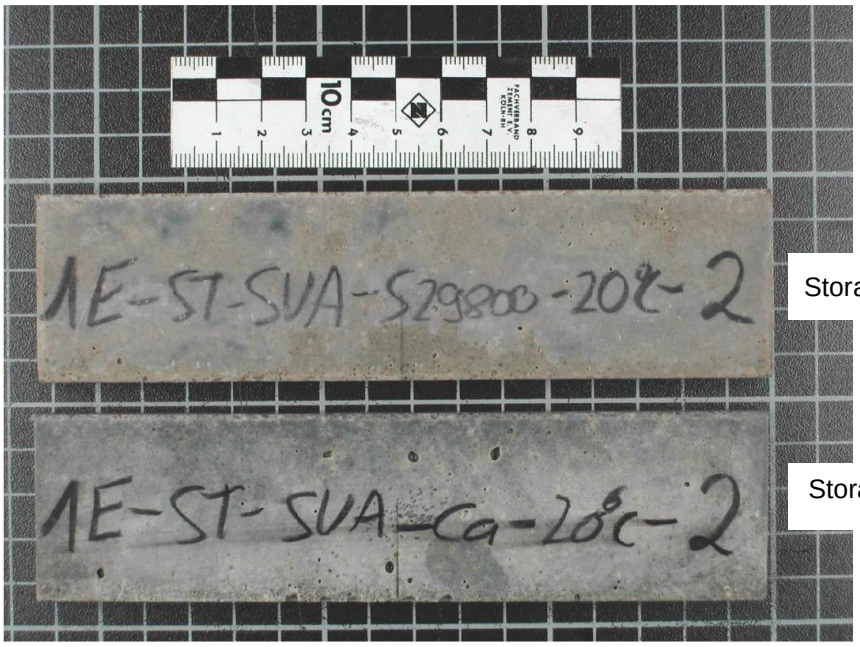

Figure A1: Specimens with CEM III/A 52,5 N-SR/LA "Dortmund" after 180 days; Storage: 20 °C in Na_2SO_4-Solution (top) and in $Ca(OH)_2$-Solution (bottom)

Figure A2: Specimens with CEM III/A 52,5 N-SR/LA "Dortmund" after 180 days; Storage: 5 °C in $Ca(OH)_2$-Solution (top) and in Na_2SO_4-Solution (bottom)

Blast furnace cement CEM III/A 52,5 N-SR/LA "Dortmund"	**Annex A4** **Page 1 of 3**
Results of the assessment "sulfate resistance (flat prism method) – S_{FPM}" Visual examination of the flat prims with blast furnace cement CEM III/A 52,5 N-SR/LA "Dortmund"	

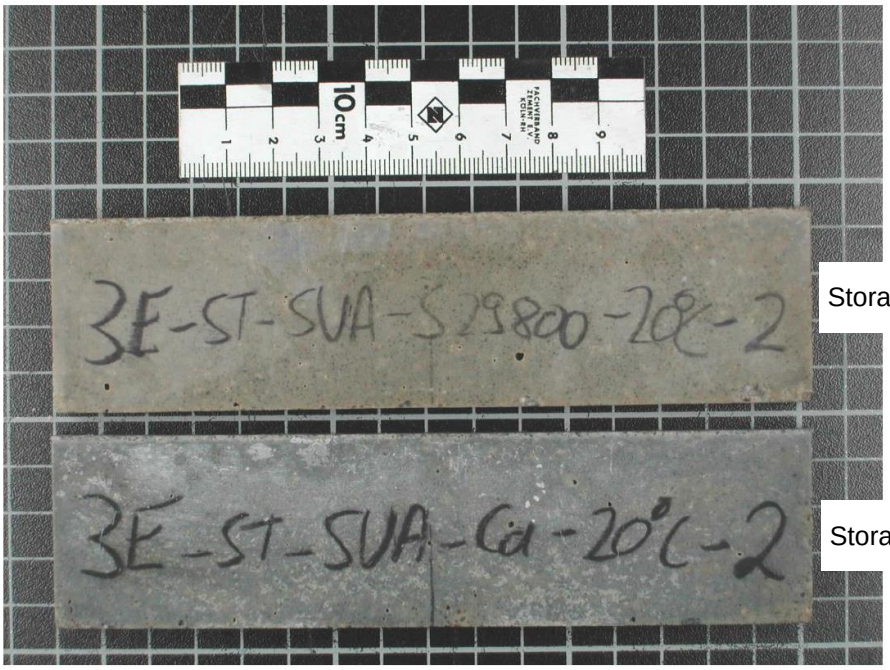

Figure A3: Specimens with CEM III/B 42,5 N-LH/SR after 180 days; Storage: 20 °C in Na_2SO_4-Solution (top) and in $Ca(OH)_2$-Solution (bottom)

Figure A4: Specimens with CEM III/B 42,5 N-LH/SR after 180 days; Storage: 5 °C in $Ca(OH)_2$-Solution (top) and in Na_2SO_4-Solution (bottom)

Blast furnace cement CEM III/A 52,5 N-SR/LA "Dortmund"	**Annex A4** **Page 2 of 3**
Results of the assessment "sulfate resistance (flat prism method) – S_{FPM}" Visual examination of the flat prims with blast furnace cement CEM III/B 42,5 N-LH/SR	

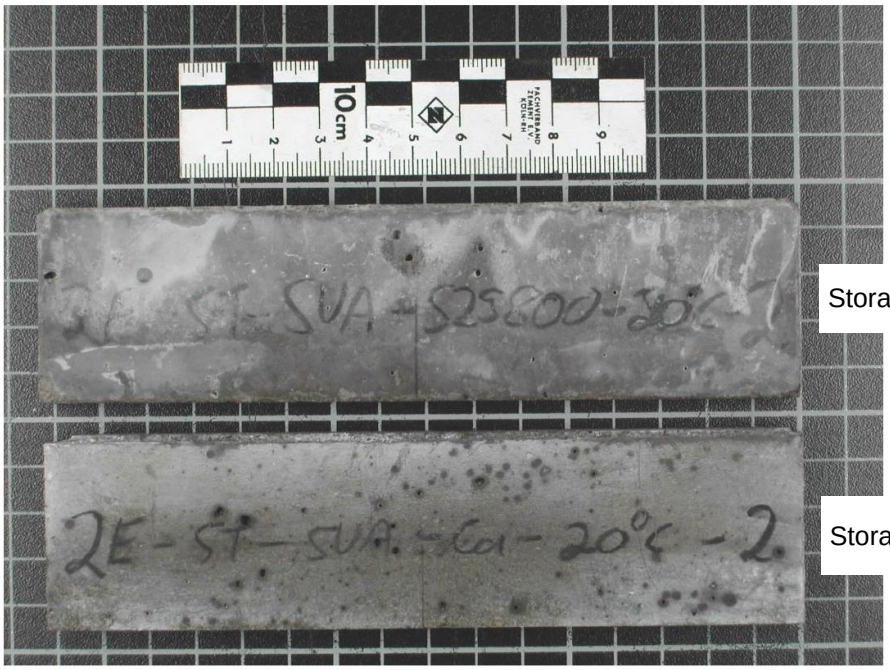

Figure A5: Specimens with CEM I 42,5 R-SR3 after 180 days; Storage: 20 °C in Na_2SO_4-Solution (top) and in $Ca(OH)_2$-Solution (bottom)

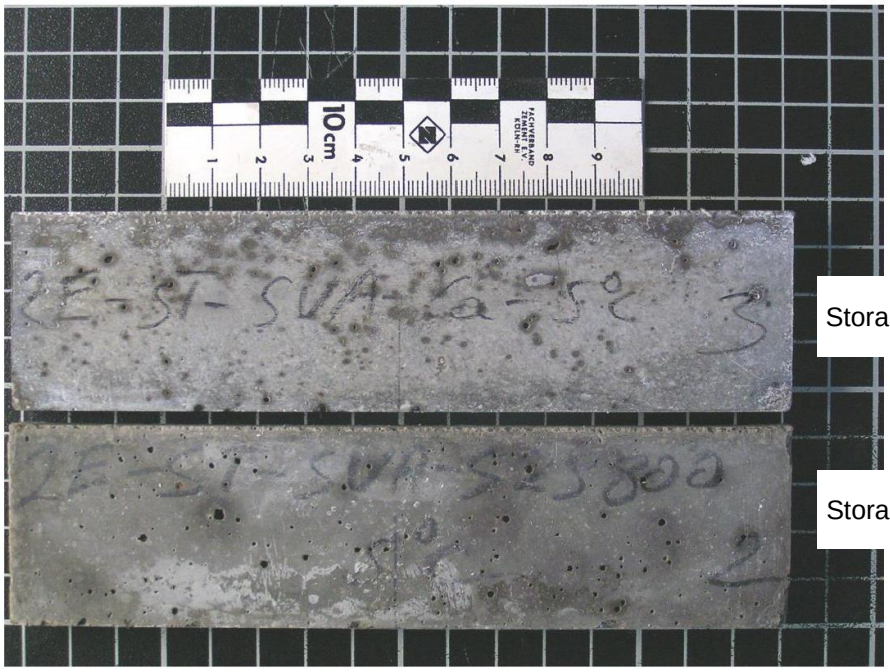

Figure A6: Specimens with CEM I 42,5 R-SR3 after 180 days; Storage: 5 °C in $Ca(OH)_2$-Solution (top) and in Na_2SO_4-Solution (bottom)

Blast furnace cement CEM III/A 52,5 N-SR/LA "Dortmund"	**Annex A4** **Page 3 of 3**
Results of the assessment "sulfate resistance (flat prism method) – S_{FPM}" Visual examination of the flat prims with Portland cement CEM I 42,5 R-SR3	