

Test report no. 172848

English version

1st copy of 9 June 2017

Ordering party: Schomburg GmbH & Co. KG
Aquafinstraße 2 - 8
32760 Detmold

Date of commission: 02.03.2016 / Mr Beyer

Subject of commission: Tests regarding the efficiency of water resisting admixture
for concrete – Chloride migration resistance

Product: BETOCRETE CL 210-WP

The test report contains 6 pages.

The testing material is used up.



Remark: This test report is the English version of original German version of 9 June 2017.

In case of any dispute the German version is decisive. The test report shall be published unabridged. Any partial publishing requires written allowance by the testing institute. The test results refer only to the tested material.

1. General

The ordering party has assigned MPA HANNOVER to perform tests regarding the efficiency of water resisting admixture for concrete in comparison to a reference concrete. The scope of the tests to be carried out has been determined by the ordering party and is set out in section 3. This test report states the results of the tests.

2. Delivery of samples

On 19 September 2016 by an employee of the ordering party:

250 kg Cement CEM I/52,5R typ „Milke Classic“ in 5 drums à 50 kg
5 kg BETOCRETE F4 (SP), in a canister, produced by Schomburg

and on 25 January 2017:

1 kg BETOCRETE CL 210-WP, in a can, produced by Schomburg

The aggregate for manufacture the concrete was provided from the stock of MPA HANNOVER.

Weser sand 0/2
Weser gravel 2/8
Weser gravel 8/16

3. Scope

The scope of performed tests is listed in Table 1. The tests were performed each at the reference concrete (reference) and at the concrete produced with the water resisting admixture (CL 210-WP).

Table 1: Scope of testing

Test ID	Type of test	Standard	Age of sample	No. of samples
1	Bulk density of fresh concrete, Air content and Flow table test	DIN EN 12350-6:2011-03	20 min	1
		DIN EN 12350-7:2009-08	20 min	1
		DIN EN 12350-5:2009-08	5 min, 30 min	1
2	Chloride migration resistance	BAW-Merkblatt „Chlorideindringwiderstand von Beton (MCL)“, 2012	56 d	3

4. Results

4.1 Manufacture of samples

The samples were produced according to DIN EN 12390-2:2009-08. A forced mixer Zyklos ZK 150 was used for the mixing. The mixing time was 2 min after water addition. The superplasticizer was added together with the water; the water resisting admixture was added separately. The water content of the admixtures was taken into account with 70 M.-% for the calculation. The compositions of mixtures are listed in Table 2. From this mixture, all test specimens were prepared for the solid concrete tests, as well as the fresh concrete tests were carried out.

Table 2: Composition of mixtures

Raw material		Reference		CL 210-WP	
		Quantity	Mass kg/m ³	Quantity	Mass kg/m ³
Cement	-	-	350	-	350
Water	-	-	175	-	176
w/c-ratio	-	-	0.50	-	0.50
Sand 0-2 mm	M.-% of aggregate	35	630	35	630
Gravel 2-8 mm		30	526	30	536
Gravel 8-16 mm		35	627	35	627
Betocrete F 4 (SP)	M.-% of cement	0.7	2.45	1.15	4.03
Betocrete CL 210-WP		-	-	1.8	6.30

4.2 Bulk density of fresh concrete, air content and flow table test

The properties of fresh concrete were determined according to DIN EN 12350-5 (flow table test), DIN EN 12350-6 (bulk density) and 12350-7 (air content). The results are listed in Table 3.

Table 3: Results of test on fresh concrete

		Reference	CL 210-WP
		Air temperature	°C
Flow table test A after water addition in mm	5 min	450	460
	30 min	370	390
Fresh concrete temperature	°C	22.1	21.1
Bulk density of fresh concrete	kg/dm ³	2.35	2.36
Air content	Vol.- %	2.0	1.8

4.3 Chloride migration resistance

The determination of the chloride migration resistance was performed according to BAW-Merkblatt „Chlorideindringwiderstand von Beton“, version 2012. The cubes were continuously stored under water after manufacturing. Cylinders with a diameter of 100 mm were drilled out from the samples approx. 7 days before testing. A layer of 10 mm was removed from the upper edge by sawing. A test area parallel saw cut was made at a height of approx. 50 ± 5 mm measured from the test surface. The test specimens were stored in a water bath at 20 °C until testing and were installed and tested in migration cells at the start of the test. The chloride migration coefficients calculated from the test results shown in Appendix A1 are shown in Table 4. For comparison, the normatively required coefficients are given in Table 5.

Table 4: Chloride migration coefficients

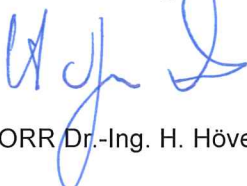
Probe	Chloride migration coefficient $\times 10^{-12}$ [m ² /s]	
	Reference	CL 210-WP
1	17.8	8.2
2	14.0	7.9
3	12.2	8.0
<i>Mean value D_{CL}</i>	<i>14.7</i>	<i>8.0</i>
<i>Max. individual value $D_{CL,max}$</i>	<i>17.8</i>	<i>8.2</i>

Depending on the given exposure class, the mean values and maximum individual values of migration coefficients given in Table 8 must be complied with in accordance with BAW-Merkblatt "Chlorideindringwiderstand von Beton", version 2012.

Table 5: Mean values to be complied with and the maximum permissible individual values of the migration coefficients as a function of the exposure class

Given exposure class acc. DIN EN 206-1 /DIN 1045-2	Migration coefficient	
	Mean value $\times 10^{-12}$ [m ² /s]	<i>Max. individual value</i> $\times 10^{-12}$ [m ² /s]
-		
XS 1, XD 1	≤ 10.0	≤ 12.0
XS 2, XD 2		
XS 3, XD 3	≤ 5.0	≤ 7.0

Hanover, 9 June 2017
Head of Testing Institute



(ORR Dr.-Ing. H. Höveling)



Contact



(Dipl.-Ing. A. Giese)

APPENDIX

Appendix A1: Chloride migration

Appendix A1-1: Measured values of the test, reference

Sample no.	Test start		Test end		Amperage start	Amperage end	Duration of test
	Date	Time	Date	Time	mA	mA	h
1	08.12.16	11:55	08.12.16	19:50	79.0	73.2	7.92
2	08.12.16	11:55	08.12.16	19:50	69.0	67.3	7.92
3	08.12.16	11:55	08.12.16	19:50	73.5	70.1	7.92

Sample no.	Test liquid Temperature		Height	Diameter	Test sample Mass after		Bulk density Water storage [kg/m ³]
	Start	End			Water storage	Testing	
	°C	°C	mm	mm	g	g	
1	19.5	19.7	49.95	99.51	911.86	-	2350
2	19.6	19.7	51.25	99.46	914.34	-	2300
3	19.7	19.7	50.58	99.48	918.58	-	2340

Penetration depths:							
[mm]	Sample 1 half 1	Sample 1 half 2	Sample 2 half 1	Sample 2 half 2	Sample 3 half 1	Sample 3 half 2	
Point 1	18.67	13.72	14.06	12.93	14.08	12.26	
Point 2	18.07	12.60	11.02	11.26	10.27	12.26	
Point 3	17.57	12.13	10.40	10.35	9.22	9.32	
Point 4	17.48	11.52	12.33	10.59	8.30	10.53	
Point 5	10.38	12.07	10.50	12.96	9.18	9.30	
Point 6	11.16	13.36	10.50	17.09	10.99	11.14	
Point 7	13.16	13.41	12.14	11.25	9.86	11.71	
Point 8	13.23	14.01	9.57	9.83	8.36	9.92	
Point 9	21.58	10.65	11.14	8.33	9.88	9.03	
Point 10	17.85	14.76	10.20	7.85	10.63	8.78	
Point 11	14.76	11.07	12.39	16.64	11.89	10.08	
Mean value x_d	15.23	12.87	10.87	11.06	9.63	9.97	
Max. value x_{max}	18.67	14.76	12.39	17.09	11.89	12.26	

Remark: Blue values were not included in the evaluation!



Appendix A1-2: Samples after testing, reference

Appendix A1-3: Measured values of the test, CL 210-WP

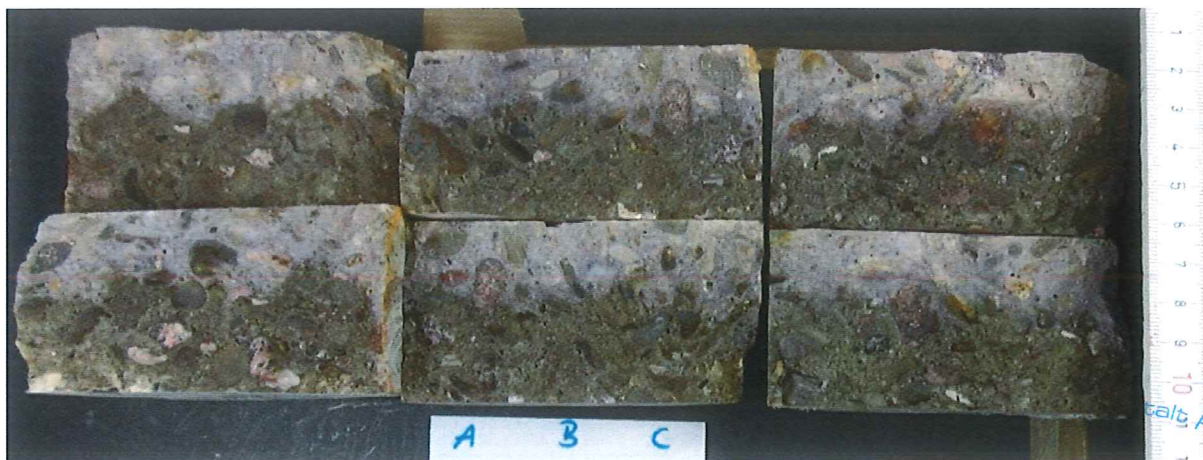
Sample no.	Test start		Test end		Amperage start	Amperage end	Duration of test
	Date	Time	Date	Time	mA	mA	h
1	27.03.17	10:40	28.03.17	12:40	62.0	52.9	26.00
2	27.03.17	10:40	28.03.17	12:40	62.3	56.0	26.00
3	27.03.17	10:40	28.03.17	12:40	64.3	55.1	26.00

Sample no.	Test liquid		Height	Diameter	Test sample		Bulk density Water storage [kg/m³]
	Temperature				Water storage	Testing	
	Start	End	g	g			
	°C	°C	mm	mm	g	g	
1	20.1	20.1	51.69	99.77	938.49	914.18	2320
2	20.1	20.1	50.06	99.76	926.97	928.89	2370
3	20.1	20.1	50.66	99.82	923.52	925.76	2330

Penetration depths:

[mm]	Sample 1 half 1	Sample 1 half 2	Sample 2 half 1	Sample 2 half 2	Sample 3 half 1	Sample 3 half 2
Point 1	24.47	23.74	22.52	22.42	21.68	24.19
Point 2	23.58	22.46	19.14	19.17	20.47	19.38
Point 3	19.39	16.61	18.29	19.24	22.99	19.79
Point 4	18.62	19.44	19.89	17.85	21.08	18.58
Point 5	24.29	20.06	20.33	17.41	18.43	18.40
Point 6	19.66	20.03	17.58	20.16	17.83	17.34
Point 7	18.31	22.89	17.00	21.91	21.22	18.47
Point 8	17.42	21.14	20.84	21.95	20.11	20.50
Point 9	18.74	20.17	19.38	25.36	19.41	19.33
Point 10	20.46	21.04	23.92	22.28	20.43	22.73
Point 11	23.48	24.42	21.90	21.49	24.19	23.93
Mean value x_d	19.61	20.43	19.37	20.39	20.37	19.39
Max. value x_{max}	24.29	22.89	21.90	25.36	22.99	22.73

Remark: Blue values were not included in the evaluation!



Appendix A1-4: Samples after testing, CL 210-WP