



EUROPEAN ASSESSMENT DOCUMENT

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WATERPROOFING ADMIXTURE FOR CONCRETE

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This European Assessment Document (EAD) has been developed taking into account up-to-date technical and scientific knowledge at the time of issue and is published in accordance with the relevant provisions of Regulation (EU) No 305/2011 as a basis for the preparation and issuing of European Technical Assessments (ETA).

Contents

1	Scope of the EAD	4
1.1	Description of the construction product	4
1.2	Information on the intended use of the construction product	4
1.2.1	Intended use.....	4
1.2.2	Working life/Durability.....	4
2	Essential characteristics and relevant assessment methods and criteria	6
2.1	Essential characteristics of the product	6
2.2	Methods and criteria for assessing the performance of the product in relation to essential characteristics of the product	7
2.2.1	Homogeneity	7
2.2.2	Total chlorine	7
2.2.3	Water soluble chloride	7
2.2.4	Alkali content (Na ₂ O equivalent)	7
2.2.5	Corrosion behaviour	7
2.2.6	Air content and bulk density of fresh concrete	7
2.2.7	Compressive strength	7
2.2.8	Increase of water impermeability of concrete.....	8
2.2.9	Freeze-thaw resistance	9
2.2.10	Freeze-thaw resistance with de-icing agent.....	10
3	Assessment and verification of constancy of performance	12
3.1	System of assessment and verification of constancy of performance to be applied	12
3.2	Tasks of the manufacturer	12
3.3	Tasks of the notified body	13
4	Reference documents	14

1 SCOPE OF THE EAD

1.1 Description of the construction product

The product is a "waterproofing admixture for concrete". The admixture is a powder. It reduces the water penetration into the concrete and increases the water impermeability of the concrete.

Active chemicals of the product react with the moisture in fresh concrete and with the by-products of cement hydration to cause a catalytic reaction. This reaction generates a non-soluble crystalline formation throughout the pores and capillary tracts of the concrete that permanently seals the concrete and prevents the penetration of water from any direction.

The product is not fully covered by a harmonised European standard (hEN).

Although some assessment methods specified in chapter 2.2 are covered by hEN 934-2¹, the product is not one of the admixture types covered by the standard. The "waterproofing admixture for concrete" is one of two types of "permeability reducing admixtures".

"Permeability reducing admixtures" can be divided in "water resisting admixtures" according to hEN 934-2, where absorption is the critical parameter, and "waterproofing concrete admixtures", where the critical parameter is an additional high hydrostatic water pressure.

The product is not a "water resisting admixture" according to hEN 934-2. The test for capillary absorption in hEN 934-2 is not appropriate for the assessment of this type of "permeability reducing admixtures". The product reduces the concrete permeability under pressure but does not show the same effect in an absorption test. There is a need for an assessment method for "waterproofing concrete admixtures" where the performance assessment requires substantial water pressure. This hydrostatic pressure is an integral part of the permeability reduction performance test method in EN 12390-8.

Concerning product packaging, transport, storage, maintenance, replacement and repair it is the responsibility of the manufacturer to undertake the appropriate measures and to advise his clients on the transport, storage, maintenance, replacement and repair of the product as he considers necessary.

It is assumed that the product will be installed according to the manufacturer's instructions or (in absence of such instructions) according to the usual practice of the building professionals.

Relevant manufacturer's stipulations having influence on the performance of the product covered by this European Assessment Document shall be considered for the determination of the performance and detailed in the ETA.

1.2 Information on the intended use of the construction product

1.2.1 Intended use

The "waterproofing admixture for concrete" is intended to be used for preparation of concrete, mortar and other cementitious mixes for construction and for the manufacturing of precast construction products.

1.2.2 Working life/Durability

The assessment methods included or referred to in this EAD have been written based on the manufacturer's request to take into account a working life of concrete incorporating the "waterproofing admixture for concrete" for the intended use of 50 years when installed in the works (provided that the concrete incorporating the "waterproofing admixture for concrete" is subject to appropriate installation (see 1.1)). These provisions are based upon the current state of the art and the available knowledge and experience.

¹ All undated references to standards or to EADs in this European Assessment Document are to be understood as references to the dated versions listed in clause 4.

When assessing the product, the intended use as foreseen by the manufacturer shall be taken into account. The real working life may be, in normal use conditions, considerably longer without major degradation affecting the basic requirements for works².

The indications given as to the working life of the construction product cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by EOTA when drafting this EAD nor by the Technical Assessment Body issuing an ETA based on this EAD, but are regarded only as a means for expressing the expected economically reasonable working life of the product.

² The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject, as well as on the particular conditions of the design, execution, use and maintenance of that works. Therefore, it cannot be excluded that in certain cases the real working life of the product may also be shorter than referred to above.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 1 shows how the performance of the "waterproofing admixture for concrete" is assessed in relation to the essential characteristics.

The essential characteristics 1 to 5 cover the general requirements for concrete admixtures in accordance with EN 934-1 and essential characteristics 6 to 10 cover the special requirements in accordance with EN 934-2.

The specific requirement which characterises the performance of the admixture deviating from EN 934-2 is represented by essential characteristic 8 in combination with 9 and 10.

Table 1 Essential characteristics of the product and methods and criteria for assessing the performance of the product in relation to those essential characteristics

No	Essential characteristic	Assessment method	Type of expression of product performance
Basic Works Requirement 1: Mechanical resistance and stability			
1	Homogeneity	2.2.1	Description
2	Total chlorine	2.2.2	Level
3	Water soluble chloride	2.2.3	Level
4	Alkali content (Na ₂ O equivalent)	2.2.4	Level
5	Corrosion behaviour	2.2.5	Description
6	Air content and bulk density of fresh concrete	2.2.6	Level
7	Compressive strength	2.2.7	Level
8	Increase of water impermeability of concrete	2.2.8	Level
9	Freeze-thaw resistance	2.2.9	Level [FT _{CIF} : kg/m ² ; RDM _{CIF} : %] Level [FT _{slab} : kg/m ² ; RDM _{slab} : %]
10	Freeze-thaw resistance with de-icing agent	2.2.10	Level [FTS _{CDF} : kg/m ² ; RDM _{CDF} : %] Level [FTS _{slab} : kg/m ² ; RDM _{slab} : %]
FT _{CIF} = Freeze-thaw resistance – CIF procedure FT _{slab} = Freeze-thaw resistance – Slab procedure FTS _{CDF} = Freeze thaw resistance with de-icing agent – CDF procedure FTS _{slab} = Freeze thaw resistance with de-icing agent – Slab procedure RDM _{CIF} = Relative dynamic modulus of elasticity – CIF procedure RDM _{CDF} = Relative dynamic modulus of elasticity – CDF procedure RDM _{slab} = Relative dynamic modulus of elasticity – Slab procedure			

2.2 Methods and criteria for assessing the performance of the product in relation to essential characteristics of the product

This chapter is intended to provide instructions for TABs. Therefore, the use of wordings such as “shall be stated in the ETA” or “it has to be given in the ETA” shall be understood only as such instructions for TABs on how results of assessments shall be presented in the ETA. Such wordings do not impose any obligations for the manufacturer and the TAB shall not carry out the assessment of the performance in relation to a given essential characteristic when the manufacturer does not wish to declare this performance in the Declaration of Performance.

2.2.1 Homogeneity

The powdered admixture shall be examined visually.

It shall be stated whether the powdered admixture tends to segregate during handling.

2.2.2 Total chlorine

The total chlorine content of the admixture is determined in accordance with EN 934-1, Table 1 and shall be stated in % by mass.

2.2.3 Water soluble chloride

The water soluble chloride content of the admixture is determined in accordance with EN 934-1, Table 1 and shall be stated in % by mass.

2.2.4 Alkali content (Na₂O equivalent)

The alkali content of the admixture is determined in accordance with EN 934-1, Table 1 and shall be calculated and stated as Na₂O equivalent.

2.2.5 Corrosion behaviour

The effect on corrosion susceptibility is determined in accordance with EN 934-1, Table 1 and shall be stated accordingly.

2.2.6 Air content and bulk density of fresh concrete

The air content and the bulk density of concrete with and without "waterproofing admixture for concrete" is determined by the methods described in EN 12350-7, clause 3.3 and EN 12350-6 using-concrete Ia and concrete Ib (see clause 2.2.8). The air content of fresh concrete is determined for each mixture in accordance with EN 12350-7, section 5 (Pressure gauge method) immediately after the end of mixing. The bulk density of fresh concrete shall also be determined immediately after mixing in accordance with EN 12350-6. The concrete must be compacted on the vibrating table.

The air content of the test mix and the control mix shall be stated in % by volume.

2.2.7 Compressive strength

The compressive strength of concrete with and without "waterproofing admixture for concrete" is determined by the method described in EN 12390-3 at the age of 28 days using concrete Ia and concrete Ib (see clause 2.2.8). Three cubes (150 mm) of each mixture are to be produced and stored according to EN 12390-2. Also the bulk density of the hardened concrete is determined.

The compressive strength of the test mix and the control mix shall be stated in N/mm².

2.2.8 Increase of water impermeability of concrete

The water impermeability of concrete with and without "waterproofing admixture for concrete" is determined by the method described in EN 12390-8 and tested at 28 days on the following concrete compositions:

	Composition per m ³ fresh concrete																	
concrete Ia without "waterproofing admixture for concrete"	c = 300 kg CEM I 32,5 R according to EN 197-1																	
	g = kg aggregates ¹																	
	w = 180 kg water																	
	$\frac{w}{c} = 0,60$																	
concrete Ib with "waterproofing admixture for concrete"	c = 300 kg CEM I 32,5 R according to EN 197-1																	
	g = kg aggregates ¹ with the compliance dosage* of the admixture																	
	w = 180 kg water																	
	$\frac{w}{c} = 0,60$																	
1 Aggregates according to EN 12620 with the following grading curve shall be used:																		
<table border="1"> <tbody> <tr> <td>Size [mm]</td> <td>0,25</td> <td>0,5</td> <td>1</td> <td>2</td> <td>4</td> <td>8</td> <td>16</td> </tr> <tr> <td>Passing [% by mass]</td> <td>6</td> <td>14</td> <td>22</td> <td>32</td> <td>46</td> <td>68</td> <td>100</td> </tr> </tbody> </table>			Size [mm]	0,25	0,5	1	2	4	8	16	Passing [% by mass]	6	14	22	32	46	68	100
Size [mm]	0,25	0,5	1	2	4	8	16											
Passing [% by mass]	6	14	22	32	46	68	100											
*compliance dosage according to the general definition 3.1.2 of hEN 934-2																		

The temperature of the test room, equipment, storage room and raw materials shall be maintained between 18 and 22 °C.

The specimens are produced in the laboratory compulsory mixer. First cement, aggregates and concrete admixture are premixed for 1,5 minutes to ensure uniform distribution of the concrete admixture. After adding the water, the concrete is mixed for a further 2 minutes.

The flow of fresh concrete Ia and Ib shall be tested for each mixture in accordance with EN 12350-5 immediately after the end of mixing.

The test specimens must be stored in a test room climate at 20 °C and ≥ 95% relative humidity until demoulding (age of test specimens: 24 h).

The specimens are then stored under the following conditions, depending on the intended test:

- H28: up to the age of 28 days in a climate of 20 °C and relative humidity ≥ 95%

- W28: under water at 20 °C until tested.

The water penetration depth shall be determined on 2 x 3 concrete slabs of concrete Ia and 3 concrete slabs of concrete Ib with the dimensions 120 mm x 200 mm x 200 mm. Concrete Ia is stored according to storage types H28 and W28. Concrete Ib is stored in accordance with storage type H28. The test is carried out according to EN 12390-8 at the age of 28 d.

The flow values and the water penetration depths for concrete Ia and Ib shall be stated.

2.2.9 Freeze-thaw resistance

One of the two equivalent methods shall be used as agreed between TAB and manufacturer.

Method 1: CIF-Procedure

The freeze-thaw resistance of concrete with and without "waterproofing admixture for concrete" is determined according to CEN/TS 12390-9 clause 7 (CF-Procedure) to determine the loss of material (scaling). The internal structural damage (I) is determined according to CEN/TR 15177 clause 9 (Relative Dynamic Modulus of elasticity – RDM).

The freeze-thaw resistance is tested on the following concrete compositions:

	Composition per m ³ fresh concrete																	
concrete IIa without "waterproofing admixture for concrete"	c = 320 kg CEM I 32,5 R according to EN 197-1																	
	g = kg aggregates ¹																	
	w = 160 kg water																	
	$\frac{w}{c} = 0,50$																	
concrete IIb with "waterproofing admixture for concrete"	c = 320 kg CEM I 32,5 R according to EN 197-1																	
	g = kg aggregates ¹																	
	with the maximum recommended dosage of the admixture																	
	w = 160 kg water																	
	$\frac{w}{c} = 0,50$																	
¹ Aggregates according to EN 12620 with the following grading curve shall be used:																		
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Size [mm]	0,25	0,5	1	2	4	8	16											
Passing [% by mass]	6	14	22	32	46	68	100											

The specimens are immersed in water after demoulding until the age of 7 days. Afterwards the specimens are stored in normal climate T = (20 ± 2) °C, RH = (65 ± 5) %.

The compressive strength of concrete IIa and IIb is determined on 3 specimens (150x150x150 mm) according to EN 12390-3 at 28 days and shall be stated.

The scaling and relative dynamic modulus of elasticity (RDM) is measured on 5 specimens with a total testing surface of 0,08 m² and a height of the specimen of 70 mm (150x150x70 mm) after 7, 14, 28, 42 and 56 freeze-thaw cycles and shall be stated.

Method 2: Slab-Procedure (Reference method)

The freeze-thaw resistance of concrete made with "waterproofing admixture for concrete" shall be tested according to:

- CEN/TS 12390-9 clause 5 to determine the loss of material (scaling) and
- CEN/TR 15177 clause 8 to determine the internal structural damage as Relative Dynamic Modulus of elasticity - RDM.

Both test methods shall be applied on concrete IIa (see Method 1).

The loss of material - scaling – of the concrete IIa tested according to CEN/TS 12390-9 clause 5 – (Slab Test) - after 28 freeze-thaw cycles shall be reported in the ETA.

The Relative Dynamic Modulus of elasticity - RDM of concrete IIa tested according to CEN/TR 15177 clause 8 shall be measured after 7, 14 and 28 freeze-thaw cycles; the results of the RDM after 28 freeze-thaw cycles shall be stated in the ETA, together with any information about visual defects of the specimens.

2.2.10 Freeze-thaw resistance with de-icing agent

One of the two equivalent methods shall be used as agreed between TAB and manufacturer.

Method 1: CDF-Procedure

The freeze-thaw resistance with de-icing agent of concrete with the "waterproofing admixture for concrete" is determined according to CEN/TS 12390-9 (CDF-Procedure). Furthermore, the internal structural damage shall be determined according to CEN/TR 15177.

The freeze-thaw resistance with de-icing agent (CDF-Procedure) is tested on the following concrete compositions:

	Composition per m ³ fresh concrete																
concrete IIIa without "waterproofing admixture for concrete"	c = 320 kg CEM I 32,5 R according to EN 197-1 g = kg aggregates ¹ w = 160 kg water Concrete with air entraining agent. The air content of the fresh concrete shall be 4,5 ± 0,5 Vol.-%. $\frac{w}{c} = 0,50$																
concrete IIIb with "waterproofing admixture for concrete"	c = 320 kg CEM I 32,5 R according to EN 197-1 g = kg aggregates ¹ with the maximum recommended dosage of the admixture w = 160 kg water Concrete with air entraining agent. The air content of the fresh concrete shall be 4,5 ± 0,5 Vol.-%. $\frac{w}{c} = 0,50$																
¹ Aggregates according to EN 12620 with the following grading curve shall be used:																	
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Size [mm]	0,25	0,5	1	2	4	8	16										
Passing [% by mass]	6	14	22	32	46	68	100										

The specimens are immersed in water after demoulding until the age of 7 days. Afterwards the specimens are stored in normal climate T = (20 ± 2) °C, RH = (65 ± 5) %.

The compressive strength of concrete IIIa and IIIb is determined on 3 specimens (150x150x150 mm) according to EN 12390-3 at 28 days and shall be stated.

The scaling is measured on 5 specimens with a total testing surface of 0,08 m² and a height of the specimen of 70 mm (150x150x70 mm) after 4, 7, 14 and 28 freeze-thaw cycles (CDF-procedure) and shall be stated.

The relative dynamic modulus of elasticity (RDM) is measured after 0, 4, 7, 14 and 28 freeze-thaw cycles (CDF-procedure) and shall also be stated.

Method 2: Slab-Procedure (Reference method)

The freeze-thaw and de-icing resistance of concrete made with "waterproofing admixture for concrete" shall be tested according to:

- CEN/TS 12390-9 clause 5 to determine the loss of material (scaling) and
- CEN/TR 15177 clause 8 to determine the internal structural damage as Relative Dynamic Modulus of elasticity - RDM.

Both test methods shall be applied on concrete IIIa (see Method 1). De-icing solution shall be used as freezing medium.

The loss of material - scaling – of the concrete IIIa tested according to CEN/TS 12390-9 clause 5 – (Slab Test) - after 28 freeze-thaw cycles shall be reported in the ETA.

The Relative Dynamic Modulus of elasticity - RDM of concrete IIIa tested according to CEN/TR 15177 clause 8 shall be measured after 7, 14 and 28 freeze-thaw cycles; the results of the RDM after 28 freeze-thaw cycles shall be stated in the ETA, together with any information about visual defects of the specimens.

3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

3.1 System of assessment and verification of constancy of performance to be applied

For the products covered by this EAD the applicable European legal act is Commission Decision 1999/469/EC, as amended by Commission Decision 2001/596/EC.

The system is 2+.

3.2 Tasks of the manufacturer

The cornerstones of the actions to be undertaken by the manufacturer of the "waterproofing admixture for concrete" in the procedure of assessment and verification of constancy of performance are laid down in Table 2.

Table 2 Control plan for the manufacturer; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]					
1	Homogeneity	2.2.1	See control plan	1	each batch
2	Total chlorine ^a	2.2.2	See control plan	1	4*
3	Water soluble chloride	2.2.3	See control plan	1	4*
4	Alkali content (Na ₂ O equivalent)	2.2.4	See control plan	1	2*
5	Air content and bulk density of fresh concrete	2.2.6	See control plan	1	1*
6	Compressive strength	2.2.7	See control plan	1	1*
7	Increase of water impermeability of concrete	2.2.8	See control plan	1	Every 1000 t with a maximum of 3 times a year, but a minimum of 2 times a year
^a If there is no significant difference between total chlorine and water soluble chloride content, only the water soluble chloride content should be determined in subsequent tests on the admixture involved. * Numbers denote minimum frequency of test per year, spread according to production; if the production is less frequent, every batch has to be tested.					

3.3 Tasks of the notified body

The cornerstones of the actions to be undertaken by the notified body of the "waterproofing admixture for concrete" in the procedure of assessment and verification of constancy of performance are laid down in Table 3.

Table 3 Control plan for the notified body; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Initial inspection of the manufacturing plant and of factory production control					
1	according to EN 934-6:2019, clause 5.4.4	see FPC according to Table 2 and control plan	see control plan	-	2/year
Continuous surveillance, assessment and evaluation of factory production control					
2	according to EN 934-6:2019, clause 5.4.5	see FPC according to Table 2 and control plan	see control plan	-	2/year

4 REFERENCE DOCUMENTS

EN 197-1:2011	Cement - Part 1: Composition, specification and conformity criteria for common cements
EN 480-1:2014	Admixtures for concrete, mortar and grout — Test methods — Part 1: Reference concrete and reference mortar for testing
EN 934-1:2008	Admixtures for concrete, mortar and grout — Part 1: Common requirements
EN 934-2:2009+A1:2012	Admixtures for concrete, mortar and grout — Part 2: Concrete admixtures — Definitions, requirements, conformity, marking and labelling
EN 934-6:2019	Admixtures for concrete, mortar and grout — Part 6: Sampling, conformity control and evaluation of conformity
EN 12350-5:2019	Testing fresh concrete - Part 5: Flow table test
EN 12350-6:2019	Testing fresh concrete - Part 6: Density
EN 12350-7:2019	Testing fresh concrete - Part 7: Air content - Pressure methods
EN 12390-2:2019	Testing hardened concrete - Part 2: Making and curing specimens for strength tests
EN 12390-3:2019	Testing hardened concrete - Part 3: Compressive strength of test specimens
EN 12390-8:2019	Testing hardened concrete - Part 8: Depth of penetration of water under pressure
CEN/TS 12390-9:2016	Testing hardened concrete - Part 9: Freeze-thaw resistance, Scaling
EN 12620:2002 + A1:2008	Aggregates for concrete
CEN/TR 15177:2006	Testing the freeze-thaw resistance of concrete - Internal structural damage