



EUROPEAN ASSESSMENT DOCUMENT

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POLYMERIC CONCRETE ADDITION

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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).

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1 SCOPE OF THE EAD

1.1 Description of the construction product

The "polymeric concrete addition" is a copolymer-based, aqueous, saponification resistant plastic dispersion.

The "polymeric concrete addition" reduces the concrete permeability against substances hazardous to water as well as enhances the tensile strength of concrete.

The "polymeric concrete addition" is manufactured from specified constituents in a production plant.

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

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(s) of the construction product

1.2.1 Intended use(s)

The product is a "polymeric concrete addition" for use in concrete, mortar and other mixes for construction and for the manufacturing of 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 "polymeric concrete addition" for the intended use of 50 years when installed in the works provided that the concrete incorporating the "polymeric concrete addition" 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.

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 works¹.

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.

¹ 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 the working life 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 "polymeric concrete addition" is assessed in relation to the essential characteristics.

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	Colour	2.2.2	Description
3	Analysis of dry residue (infrared analysis)	2.2.3	Description
4	Analysis of dry residue (thermogravimetric analysis)	2.2.4	Description
5	Absolute density	2.2.5	Level
6	Conventional dry material content	2.2.6	Level
7	Dynamic viscosity	2.2.7	Level
8	pH value	2.2.8	Level
9	Total chlorine	2.2.9	Level
10	Water soluble chloride	2.2.10	Level
11	Setting time	2.2.11	Level
12	Soundness	2.2.12	Level
13	Air content of fresh concrete	2.2.13	Level
14	Corrosion behaviour	2.2.14	Description
15	Compressive strength of mortar	2.2.15	Level
16	Compressive strength of concrete	2.2.16	Level
17	Tensile splitting strength	2.2.17	Level

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

Characterisation of products to be assessed shall be done in accordance with available specifications.

2.2.1 Homogeneity

The homogeneity is determined visually. A sample of the liquid addition is put in a 1-litre-glas-cylinder and covered for three months. The segregation of the addition is observed daily during the first 5 days, twice a week during the next 3 weeks, and once a week during the rest of the time (dust-like sedimentation at the bottom of the cylinder can be disregarded).

The results of the assessment shall be stated in the ETA.

2.2.2 Colour

The colour is determined visually.

The results of the assessment shall be stated in the ETA.

2.2.3 Analysis of dry residue (infrared analysis)

The dry residue is analysed by infrared analysis in accordance with EN 480-6.

The results of the assessment shall be stated in the ETA.

2.2.4 Analysis of dry residue (thermogravimetric analysis)

The dry residue is analysed by thermogravimetry according to EN ISO 11358 in nitrogen atmosphere. The dynamic method shall be used, with a heating rate of 10 K/min and a temperature range from room temperature to at least 700 °C.

The results of the assessment shall be stated in the ETA.

2.2.5 Absolute density

The absolute density is determined in accordance with EN ISO 2811-1 without further restrictions.

The absolute density shall be stated in the ETA on manufacturers' request. Deviation to the density is tolerated when being within $\pm 0,02 \text{ g/cm}^3$ from the level acc. to EN 934-1.

2.2.6 Conventional dry material content

The conventional dry material content is determined in accordance with EN ISO 3251 (method B).

The conventional dry material content shall be stated in the ETA on manufacturers' request. Deviation of the conventional dry material content is tolerated when being within $\pm 2 \%$ by mass from the level acc. to EN 934-1.

2.2.7 Dynamic viscosity

The dynamic viscosity is determined in accordance with EN ISO 3219 without further restrictions to the measuring system. Two specimens shall be tested in a rotational viscometer at 23°C. The shear rate shall be increased to a maximum of 300 s^{-1} within 3 minutes.

The viscosity of the addition shall be stated in the ETA on manufacturers' request. Deviation of viscosity is tolerated when being within $\pm 20 \%$ from the level acc. to EN 1504-5.

2.2.8 pH value

The pH value is determined in accordance with ISO 976.

The pH value of the addition shall be stated in the ETA on manufacturers' request. Deviation of the pH value is tolerated when being within ± 1 from the level acc. to EN 934-1.

2.2.9 Total chlorine

The total chlorine content of the addition is determined in accordance with EN ISO 1158.

The procedure in EN ISO 1158 shall be modified as follows: The sample size in method B shall be increased to 0,1 g of dry addition. Silver nitrate and ammonium thiocyanate solutions shall be used at 0,01 N.

The total chlorine content is not higher than 0,10 % by mass acc. to EN 934-1.

If there is no significant difference between the total chlorine and the water soluble chloride content, only the water soluble chloride content should be determined in subsequent tests on the addition (acc. to EN 934-1).

2.2.10 Water soluble chloride

The water soluble chloride content of the addition is determined in accordance with EN 480-10 without further restrictions to the method.

The water soluble chloride content is not higher than 0,10 % by mass acc. to EN 934-1.

2.2.11 Setting time

The initial setting time shall be determined in accordance with EN 196-3. The cement paste consists of 100 % by mass test cement plus 20 % by mass polymeric concrete addition as well as the required amount of water to reach standard consistence. The entire polymeric concrete addition shall be taken into account for the water.

The test cement shall be a Portland cement CEM I 42,5 R according to EN 197-1. The test cement shall fulfil the following:

- Tricalcium aluminate: 6 to 12 % by mass
- Alkalis (Na₂O eqv): 0,5 % to 1,2 % by mass
- Fineness: > 300 m²/kg

The initial setting time is at least 60 min; the final setting time is less than 12 h acc. to EN 197-1.

2.2.12 Soundness

The soundness shall be determined through the expansion in accordance with EN 196-3. A reference cement paste in accordance with EN 196-3 and a cement paste in accordance with clause 2.2.11 shall be used.

The absolute expansion of the reference cement paste or cement paste in accordance with clause 2.2.11 is not higher than 10 mm acc. to EN 197-1. The additional expansion of the cement paste with "polymeric concrete addition" does not exceed 4 mm when compared to the reference cement paste.

2.2.13 Air content of fresh concrete

The air content of fresh concrete shall be determined by the method described in EN 12350-7, clause 5 (Pressure gauge method) using a concrete with the following composition:

	Composition per m ³ fresh concrete																													
concrete I without "polymeric concrete addition"	c = 320 kg CEM I 42,5 R according to EN 197-1 g = kg aggregates ¹ w = 160 kg water $\left(\frac{w}{c} = 0,50\right)$																													
concrete II with "polymeric concrete addition"	c = 320 kg CEM I 42,5 R according to EN 197-1 pca = 64 kg "polymeric concrete addition" g = kg aggregates ¹ w = 96 kg water $\left(\frac{w + pca}{c} = 0,50\right)$																													
¹ Aggregates according to EN 12620 with the following grading curve shall be used:																														
<table border="1"> <thead> <tr> <th>Size [mm]</th> <th>0,125</th> <th>0,25</th> <th>0,5</th> <th>1</th> <th>2</th> <th>4</th> <th>8</th> <th>16</th> <th>32</th> </tr> </thead> <tbody> <tr> <td>Passing [% by mass]</td> <td>1,5*)</td> <td>5</td> <td>12</td> <td>18</td> <td>26</td> <td>35</td> <td>50</td> <td>71</td> <td>100</td> </tr> </tbody> </table>											Size [mm]	0,125	0,25	0,5	1	2	4	8	16	32	Passing [% by mass]	1,5*)	5	12	18	26	35	50	71	100
Size [mm]	0,125	0,25	0,5	1	2	4	8	16	32																					
Passing [% by mass]	1,5*)	5	12	18	26	35	50	71	100																					
*) recommended value																														

The recommended maximum dosage of "polymeric concrete addition" is 20 % by cement mass.

The air content of the concrete with polymeric concrete addition is not higher than 2 % by volume above the control mix acc. to EN 934-2.

2.2.14 Corrosion behaviour

The effect on corrosion susceptibility is determined in accordance with EN 480-14.

The mortar compositions are given below:

	Mortar composition for 3 test specimen									
mortar I without "polymeric concrete addition"	c = 450 g CEM I 42,5 R according to EN 197-1 g = 1.350 g standard sand w = 225 g water $\left(\frac{w}{c} = 0,50\right)$									
mortar II with "polymeric concrete addition"	c = 450 g CEM I 42,5 R according to EN 197-1 pca = 90 g "polymeric concrete addition" g = 1.350 g standard sand w = 135 g water $\left(\frac{w + pca}{c} = 0,50\right)$									

The recommended maximum dosage of "polymeric concrete addition" is 20 % by cement mass.

Acc. to EN 934-1 the determination of the corrosion behaviour shall show no corrosion-promoting effect. The calculated current density of each of three test specimens does not exceed $10 \mu\text{A}/\text{cm}^2$ at any time between 1 h and 24 h. In addition there is a similar trend in the progression of the current density vs. time curves for the control mix and the test mix.

2.2.15 Compressive strength of mortar

Preparation of standard mortar bars and determination of the compressive strength at 7, 28 and 90 days shall be carried out in accordance with the method described in EN 196-1.

The mortar compositions are given in 2.2.14.

The consistence of the fresh mortar shall be determined by flow table method according to EN 1015-3.

The compressive strength of the specimens with "polymeric concrete addition" is at least 90 % of the compressive strength of the reference specimens when tested at 7, 28 and 90 days acc. to EN 934-2.

2.2.16 Compressive strength of concrete

The compressive strength of concrete made with and without "polymeric concrete addition" shall be determined according to EN 12390-3 after 7, 28 and 90 days.

The consistence of the fresh concrete shall be determined by flow table method according to EN 12350-5 and the air content by the method described in EN 12350-7.

The test specimens are made according to EN 12390-2. The concrete compositions are given in 2.2.13.

The concretes made with and without "polymeric concrete addition" are demoulded after 24 h and immersed in water until the age of 7 days. Afterwards they are stored in normal climate 20/65.

The compressive strength of the concrete with "polymeric concrete addition" is at least 90 % of the compressive strength of the reference concrete when tested at 7, 28 and 90 days acc. to EN 934-2.

2.2.17 Tensile splitting strength

The tensile splitting strength of the concrete with "polymeric concrete addition" shall be determined according to EN 12390-6 after 7, 28 and 90 days.

The concrete compositions are given in 2.2.13.

The concretes made with and without "polymeric concrete addition" are demoulded after 24 h and immersed in water until the age of 7 days. Afterwards they are stored in normal climate 20/65.

The tensile splitting strength of the concrete with "polymeric concrete addition" is at least 110 % of the tensile splitting strength of the reference concrete when tested at 7, 28 and 90 days acc. to EN 934-2.

3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

3.1 System(s) of assessment and verification of constancy of performance to be applied

For the products covered by this EAD the applicable European legal act is: Decision 1999/469/EC.

The system to be applied is: 1+.

3.2 Tasks of the manufacturer

The cornerstones of the actions to be undertaken by the manufacturer of the product 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	2.2.1	1	C
2	Colour	2.2.2	2.2.2	1	C
3	Absolute density	2.2.5	2.2.5	1	A
4	Conventional dry material content	2.2.6	2.2.6	1	A
5	Dynamic viscosity	2.2.7	2.2.7	1	B
6	pH value	2.2.8	2.2.8	1	A
7	Total chlorine	2.2.9	2.2.9	1	A
8	Water soluble chloride	2.2.10	2.2.10	1	A
9	Setting time	2.2.11	2.2.11	1	B
10	Soundness	2.2.12	2.2.12	1	B
11	Air content of fresh concrete	2.2.13	2.2.13	1	B
12	Compressive strength of mortar (only at 7 and 28 days)	2.2.15	2.2.15	1	B
13	Compressive strength of concrete (only at 7 and 28 days)	2.2.16	2.2.16	1	B
A at least every day of production B at least every 7th day of production C at least every batch as defined in EN 934-6					

3.3 Tasks of the notified body

The cornerstones of the actions to be undertaken by the notified body of the product 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 <i>(for systems 1+, 1 and 2+ only)</i>					
1	acc. to EN 934-6				
Continuous surveillance, assessment and evaluation of factory production control <i>(for systems 1+, 1 and 2+ only)</i>					
2	acc. to EN 934-6				1/year
Audit-testing of samples taken by the notified product certification body at the manufacturing plant or at the manufacturer's storage facilities <i>(for system 1+ only)</i>					
3	Analysis of dry residue (infrared analysis)	2.2.3	2.2.3	1	1/year
4	Analysis of dry residue (thermogravimetric analysis)	2.2.4	2.2.4	1	1/year
5	Absolute density	2.2.5	2.2.5	1	2/year
6	Conventional dry material content	2.2.6	2.2.6	1	2/year
7	Dynamic viscosity	2.2.7	2.2.7	1	2/year
8	pH value	2.2.8	2.2.8	1	2/year
9	Total chlorine	2.2.9	2.2.9	1	2/year
10	Water soluble chloride	2.2.10	2.2.10	1	2/year
11	Setting time	2.2.11	2.2.11	1	2/year
12	Soundness	2.2.12	2.2.12	1	2/year
13	Air content of fresh concrete	2.2.13	2.2.13	1	2/year
14	Corrosion behaviour	2.2.14	2.2.14	1	1/year
15	Compressive strength of mortar (only at 7 and 28 days)	2.2.15	2.2.15	1	2/year
16	Compressive strength of concrete (only at 7 and 28 days)	2.2.16	2.2.16	1	2/year

4 REFERENCE DOCUMENTS

As far as no edition date is given in the list of standards thereafter, the standard in its current version at the time of issuing the European Technical Assessment is of relevance.

EN 196-1	Methods of testing cement — Determination of strength
EN 196-3	Methods of testing cement — Determination of setting time and soundness
EN 197-1	Cement — Part 1: Composition, specification and conformity criteria for common cements
EN 447	Grout for prestressing tendons - Basic requirements
EN 480-6	Admixtures for concrete, mortar and grout — Test methods — Part 6: Infrared analysis
EN 480-10	Admixtures for concrete, mortar and grout — Test methods — Part 10: Determination of water soluble chloride content
EN 480-14	Admixtures for concrete, mortar and grout — Test methods — Part 14: Determination of the effect on corrosion susceptibility of reinforcing steel by potentiostatic electro-chemical test
EN 934-1	Admixtures for concrete, mortar and grout – Part 1: Common requirements
EN 934-2	Admixtures for concrete, mortar and grout – Part 2: Concrete admixtures – Definitions, requirements, conformity, marking and labelling
EN 934-6	Admixtures for concrete, mortar and grout — Part 6: Sampling, conformity control and evaluation of conformity
EN 1015-3	Methods of test for mortar for masonry — Part 3: Determination of consistence of fresh mortar (by flow table)
EN ISO 1158	Plastics — Vinyl chloride homopolymers and copolymers — Determination of chlorine content
EN 1504-5	Products and systems for the protection and repair of concrete structures – Definitions, requirements, quality control and evaluation of conformity – Part 5: Concrete injection
EN ISO 2555	Plastics - Resins in the liquid state or as emulsions or dispersions - Determination of apparent viscosity by the Brookfield test method
EN ISO 2811-1	Paints and varnishes - Determination of density - Part 1: Pyknometer method
EN ISO 3251	Paints, varnishes and plastics - Determination of non-volatile-matter content
EN ISO 11358	Plastics - Thermogravimetry (TG) of polymers - General principles
EN 12350-5	Testing fresh concrete - Part 5: Flow table test
EN 12350-7	Testing fresh concrete - Part 7: Air content - Pressure methods
EN 12390-2	Testing hardened concrete — Part 2: Making and curing specimens for strength tests
EN 12390-3	Testing hardened concrete — Part 3: Compressive strength of test specimens
EN 12390-6	Testing hardened concrete — Part 6: Tensile splitting strength of test specimens
EN 12620	Aggregates for concrete
ISO 976	Rubber and plastics - Polymer dispersions and rubber latices - Determination of pH