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 No (EU) 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 concrete admixture is a concentrated air entraining paste consisting of water and a high number of specifically sized and evenly distributed elastic synthetic micro hollow spheres acting as air voids.

The "elastic micro hollow spheres as concrete admixture" increase the freeze and freeze-thaw resistance.

The admixture is free of silicon dioxide.

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 products' intended use is plain, reinforced and pre-stressed concrete used as site-mixed, ready-mixed concrete or concrete for precast products as well as sprayed concrete.

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 "elastic micro hollow spheres as concrete admixture" for the intended use of 50 years when installed in the works (provided that the concrete incorporating the "elastic micro hollow spheres as concrete admixture" 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 works[1].

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 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 "elastic micro hollow spheres as concrete admixture" is assessed in relation to the essential characteristics.

The essential characteristics 1 to 8 cover the general requirements for concrete admixtures in accordance with EN 934-1[2] and essential characteristics 9 and 10 cover the special requirements in accordance with EN 934-2. Since the "elastic micro hollow spheres" are a physically effective admixture, compatibility tests with different types of cement are not required. The specific requirement which characterises the performance of the admixture in a cementitious mix is represented by essential characteristic 11.

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	Particle size distribution	2.2.1	Level
2	Absolute density	2.2.2	Level
3	Conventional dry material content	2.2.3	Level
4	pH value	2.2.4	Level
5	Total chlorine	2.2.5	Level
6	Water soluble chloride	2.2.6	Level
7	Alkali content (Na_2O equivalent)	2.2.7	Level
8	Corrosion behaviour	2.2.8	Description
9	Compressive strength	2.2.9	Description
10	Air content and bulk density (fresh concrete)	2.2.10	Description
11	Air content of freshly mixed concrete by the volumetric method and Freeze thaw resistance of hardened concrete	2.2.11	Description

[2] *All undated references to standards or to EADs in this Chapter are to be understood as references to the dated versions listed in clause 4*.

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

2.2.1 Particle size distribution

The particle size distribution is analysed by laser diffraction method in accordance with ISO 13320.

The value of particle diameter d50 and the tolerance shall be stated.

2.2.2 Absolute density

The absolute density of liquid admixtures is determined in accordance with EN 934-1, Table 1 and shall be stated in g/cm³.

2.2.3 Conventional dry material content

The conventional dry material content is determined in accordance with EN 934-1, Table 1 and shall be stated in % by mass.

2.2.4 pH value

The pH value of the liquid admixture is determined in accordance with EN 934-1, Table 1 and shall be stated.

2.2.5 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.

2.2.6 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.

2.2.7 Alkali content (Na_2O equivalent)

The alkali content of the admixture is determined in accordance with EN 934-1, Table 1 and shall be calculated and stated as Na_2O equivalent.

2.2.8 Corrosion behaviour

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

2.2.9 Compressive strength

The compressive strength of concrete with and without "elastic micro hollow spheres as concrete admixture" is determined by the method described in EN 12390-3 using a reference concrete III according to EN 480-1 (3 test specimen/concrete mix). Also the bulk density of the hardened concrete is determined.

At 28 days the compressive strength of the test mix shall be at least 75 % of the compressive strength of the control mix acc. to EN 934-2, Table 5.

2.2.10 Air content and bulk density of fresh concrete

The air content of fresh concrete and the bulk density of concrete with and without "elastic micro hollow spheres as concrete admixture" is determined by the methods described in EN 12350-7, clause 3.3 and EN 12350-6 using a reference concrete III according to EN 480-1. If a liquid admixture is being tested, the amount of mixing water is decreased by the water content of the admixture. The air content shall be determined 5 min. after mixing.

The air content of the test mix shall not be greater than 2,0 % by volume above the control mix acc. to EN 934-2.

NOTE
In contrast to air entraining admixtures the volume of the elastic micro hollow spheres is not determined but the negatively acting compaction pores. Therefore, the same test than for other types of admixtures is used.

2.2.11 Air content of freshly mixed concrete by the volumetric method and Freeze thaw resistance of hardened concrete

2.2.11.1 Air content of freshly mixed concrete by the volumetric method

The tests are carried out with a concrete composition acc. to a reference concrete III acc. to EN 480-1, but with a given w/c-value of 0,50. To reach the given consistency, a water reducing admixture may be used.

The following cement types, admixture contents and mixing times are tested:

Concrete	Cement	Admixture content [kg/m³]	Mixing time [min]	Flow table Consistency [mm]
I A	CEM I 42,5 R	*	2	420 ± 50
I B		*	10***	
I C		**-****	2	
II A	CEM III/A 42,5 N	*	2	
II B		*	10***	
II C		**-****	2	
*: Compliance dosage [in kg/m³ concrete] **: Reference concrete with air entraining admixture acc. to EN 934-2 ***: Only concrete I B or II B is necessary.				

The volume of elastic micro hollow spheres in fresh concrete is determined with a Roll-a-Meter according to ASTM C173/C173M-01. Furthermore the air content and the bulk density are determined. The stability of the concrete admixture shall be determined by testing after mixing for 2 and 10 minutes.

The compliance dosage of elastic micro hollow spheres and the volume of the elastic micro hollow spheres in fresh concrete shall be stated.

2.2.11.2 Freeze thaw resistance of hardened concrete

The freeze-thaw resistance of concrete with and without "elastic micro hollow spheres as concrete admixture" is determined on 5 test specimen/concrete mix according to CEN/TS 12390-9, clause 7 (CDF-test: Capillary suction of De-icing chemicals and Freeze-thaw test). The internal structural damage is determined according to CEN/TR 15177.

The specimens are immersed in water after de-moulding until the age of 7 days. Afterwards the specimens are stored in normal climate 20/65 until the age of 28 days. The relative dynamic modulus of elasticity (RDM) and scaling is measured after 4, 6, 14 and 28 freeze-thaw cycles according to CEN/TS 12390-9.

Furthermore the compressive strength of the concretes is determined according to EN 12390-3 after 28 days (3 test cubes/concrete mix).

The development of the relative dynamic modulus of elasticity (RDM) and the scaling shall be stated.

NOTE:
In contrast to concrete with air entraining admixtures no general minimum value for the required content of elastic micro hollow spheres can be defined. Therefore, a testing for each case of application of the concrete with elastic micro hollow spheres including CDF-test is always required.

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 is: 2+.

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	Particle size distribution	2.2.1	see manufac-turer's control plan	1	every batch
2	Absolute density (for liquid admixtures only)	2.2.2		1	every batch
3	Conventional dry material content	2.2.3		1	every batch
4	pH value (for liquid admixtures only)	2.2.4		1	every batch
5	Total chlorine	2.2.5		1	4/year
6	Water soluble chloride	2.2.6		1	4/year
7	Alkali content (Na_2O equivalent)	2.2.7		1	2/year
8	Compressive strength	2.2.9		1	1/year
9	Air content and bulk density (fresh concrete)	2.2.10		1	1/year

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					
1	acc. to EN 934-6	acc. to manufacturer's control plan			
Continuous surveillance, assessment and evaluation of factory production control					
2	acc. to EN 934-6	acc. to manufacturer's control plan			

4 REFERENCE DOCUMENTS

ASTM C173/C173M-01	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method (2001)
EN 480-1:2014	Admixtures for concrete, mortar and grout — Test methods — Part 1: Reference concrete and reference mortar for testing
EN 480-8:2012	Admixtures for concrete, mortar and grout — Test methods — Part 8: Determination of the conventional dry material content
EN 480-10:2009	Admixtures for concrete, mortar and grout — Test methods — Part 10: Determination of water soluble chloride content
EN 480-11:2005	Admixtures for concrete, mortar and grout — Test methods — Part 11: Determination of air void characteristics in hardened concrete
EN 480-12:2005	Admixtures for concrete, mortar and grout — Test methods — Part 12: Determination of the alkali content of admixtures
EN 480-14:2006	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
ISO 758:1976-11	Liquid chemical products for industrial use; Determination of density at 20 degrees C
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 934-6:2017	Admixtures for concrete, mortar and grout — Part 6: Sampling, conformity control and evaluation of conformity
EN ISO 1158:1998	Plastics — Vinyl chloride homopolymers and copolymers — Determination of chlorine content (ISO 1158:1998)
ISO 4316:1977-08	Surface active agents; Determination of pH of aqueous solutions; Potentiometric method
EN 12350-6:2009	Testing fresh concrete - Part 6: Density
EN 12350-7:2009	Testing fresh concrete - Part 7: Air content - Pressure methods
EN 12390-3:2009	Testing hardened concrete - Part 3: Compressive strength of test specimens
CEN/TS 12390-9:2016	Testing hardened concrete - Part 9: Freeze-thaw resistance, Scaling
ISO 13320:2009-10	Particle size analysis -- Laser diffraction methods
CEN/TR 15177:2006	Testing the freeze-thaw resistance of concrete - Internal structural damage