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European Assessment Document for

Shrinkage reducing admixture for concrete

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) 305/2011 as a basis for the preparation and issuing of European Technical Assessments (ETA).

Contents

1 SCOPE OF THE EAD

1.1 Description of the construction product

The product is a shrinkage reducing admixture for concrete (hereinafter “SRA”) based on aliphatic glycols.

The product is a chloride-free liquid admixture with the ability to reduce hydraulic shrinkage in the cementitious conglomerates. Products with a chloride ion content exceeding 0.10% by mass are not included within the scope of the EAD.

The product is added, during mixing, to concrete. The SRA is added to concrete mix with a dosage less than 5% by weight of cement (generally, in common applications, the maximum dosage of SRA is equal to 2% by weight of cement).

The admixture is formulated to reduce the formation of cracks induced by hygrometric shrinkage. It works by reducing the surface tension of the water present in the capillary pores and, as a result, the forces which act upon the walls of the pores is reduced.

The product is not fully covered by the following harmonised technical specification: EN 934-2[1], because this harmonised standard does not include the shrinkage reducing admixtures and it does not provide for any assessment method for the evaluation of the effect of admixtures on shrinkage of concrete. This is why the European Assessment Document introduces the relevant assessment method for the essential characteristic Shrinkage of concrete, not present in Table ZA.1 of EN 934-2. Furthermore, the harmonised standard, § 4.1, states that all admixtures shall conform the general requirements in EN 934-1 Table 1, which prescribes, among the others, the experimental verification of a value of Absolute density stated by the manufacturer, only for liquid admixtures. The European Assessment Document assumes the Absolute Density as a specific essential characteristic, and defines the same assessment method given in Table 1 of EN 934-1.

In comparison to EN 934-2, Annex ZA, table ZA.1, the following characteristics are not included:

- Air void characteristic, since this essential characteristic applies to air entraining admixtures only, according to EN 934-2;
- Water reduction, since this essential characteristic applies to water reducing/plasticizing, high range water reducing/super-plasticizing, set retarding/water reducing/plasticizing, set retarding/high range water reducing/super-plasticizing and set accelerating/water reducing/plasticizing admixtures only, according to EN 934-2;
- Bleeding, since this essential characteristic applies to water retaining admixtures only, according to EN 934-2;
- Setting time, since this essential characteristic applies to set accelerating, set retarding admixtures, set retarding/water reducing/plasticizing admixtures, set retarding/high range water reducing/super-plasticizing and set accelerating/water reducing/plasticizing admixtures only, according to EN 934-2;
- Hardening time/strength development, since this essential characteristic applies to set accelerating, hardening accelerating, set retarding admixtures, set retarding/water reducing/plasticizing and set retarding/high range water reducing/super-plasticizing admixtures only, according to EN 934-2;
- Capillary absorption, since this essential characteristic applies to water resisting admixtures only, according to EN 934-2;
- Consistency, since this essential characteristic applies to high range water reducing/super-plasticizing and set retarding/high range water reducing/super-plasticizing admixtures only, according to EN 934-2;
- Segregated portion, since this essential characteristic applies to cohesion improving admixtures only, according to EN 934-2.

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.

[1] All undated references to standards in this EAD are to be understood as references to the dated versions listed in chapter 4.

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, e.g., with regard to the intended end use conditions, 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 as long as the details of the assessment methods as laid down in this EAD are respected.

1.2 Information on the intended use(s) of the construction product

1.2.1 Intended use(s)

The product is intended to be used for the production of concrete in which the formation of cracks induced by hygrometric shrinkage needs to be limited.

The main applications are, for example, the construction and repair of:

- floor joists and motorway viaduct piers,
- external and internal industrial floors,
- multi-storey car parks,
- hydraulic works, such as canals, overflow channels, tanks, etc.,
- prefabricated concrete elements,
- lining road and railway tunnels.

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 the SRA for the intended use of 50 years when installed in the works. 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[2].

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.

1.3 Specific terms used in this EAD

1.3.1 Symbols and acronyms

AEA	-	Air-Entraining Admixture
$A_{AEA,ref}$	[%]	Air content of air-entrained reference fresh concrete
$A_{AEA+SRA}$	[%]	Air content of air-entrained fresh concrete with the SRA

[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.

A_{ref}	[%]	Air content of reference fresh concrete
A_{SRA}	[%]	Air content of fresh concrete with the SRA
$f_{c,ref,x}$	[MPa]	Compressive strength of reference concrete at x age (where x is equal to 7, 28 days)
$f_{c,SRA,x}$	[MPa]	Compressive strength of concrete with SRA at x age (where x is equal to 7, 28 days)
J	[µA/cm^2]	Maximum current density for corrosion behaviour
L	[mm]	Nominal length of the specimen (test for the determination of the shrinkage of concrete)
$(Na_2O)eq$	[%]	Alkali content expressed as total Na_2O equivalent content
SiO_2	[%]	Silicon dioxide content
SRA	-	Shrinkage Reducing Admixture
w_{cl}	[%]	Water-soluble chloride content
$\Delta A_{AEA+SRA}$	[%]	Ratio between the air content of air-entrained concrete with SRA and the air content of the air-entrained reference concrete
ΔA_{SRA}	[%]	Ratio between the air content of concrete with SRA and the air content of the reference concrete
$\Delta f_{c,x}$	[%]	Ratio between the compressive strength of concrete with SRA and the compressive strength of reference concrete at x age (where x is equal to 7, 28 days)
$\Delta \varepsilon_x$	[%]	Ratio between the shrinkage of concrete with SRA and the shrinkage of reference concrete at x age (where x is equal to 7, 28 days)
$\varepsilon_{x,ref}$	[%]	Shrinkage of reference concrete at x age (where x is equal to 7, 28 days)
$\varepsilon_{x,SRA}$	[%]	Shrinkage of concrete with SRA at x age (where x is equal to 7, 28 days)
ρ	[g/ml]	Absolute density

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 2.1.1 shows how the performance of SRA is assessed in relation to the essential characteristics.

Table 2.1.1 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	Absolute density	2.2.1	*Level* ρ [g/ml]
2	Chloride ion content	2.2.2	*Level* w_{cl} [%]
3	Alkali content	2.2.3	*Level* $(Na_2O)eq$ [%]
4	Corrosion behaviour	2.2.4	*Level and description* J [µA/cm²]
5	Shrinkage of concrete	2.2.5	*Level* $\Delta\varepsilon_x$ [%] $\varepsilon_{x,SRA}$ [%], *with x=7,28 days*
6	Compressive strength	2.2.6	*Level* $\Delta f_{c,x}$ *[%]* $f_{c,SRA,x}$ $[MPa]$ *with x=7,28 days*
7	Air content	2.2.7	*Level* ΔA_{SRA} [%] A_{SRA}[%]
8	Air content (entrained air)	2.2.8	*Level* $\Delta A_{AEA+SRA}$ [%] $A_{AEA+SRA}$[%]
Basic Works Requirement 3: Hygiene, health and the environment			
9	Content, emission and/or release of dangerous substances - Leachable substances of SRA - Leachable substances of concrete with the SRA - SVOC and VOC (concrete with the SRA)	2.2.9	*Level*
Aspects of durability			
10	Durability	Table ZA.1 of EN 934-2	-

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 Absolute density

Purpose of the assessment

The purpose of the assessment is the evaluation of the absolute density of SRA.

Assessment method

The test shall be carried out according to ISO 758.

A minimum of three tests shall be performed, with each test carried out on a different specimen.

Expression of results

The average value of the density ρ [g/ml] shall be stated in the ETA.

2.2.2 Chloride ion content

Purpose of the assessment

The purpose of the assessment is the evaluation of the chloride ion content of SRA.

Assessment method

The test shall be carried out in accordance with EN 480-10. The test methods mentioned by EN 480-10 shall be used under the conditions specified in that standard (depending upon the composition of the admixture). The method used for the assessment shall be stated in the ETA.

A minimum of three tests shall be performed, with each test carried out on a different specimen.

Expression of results

The average value of chloride ion content w_{cl} [%] and the method used for the assessment shall be stated in the ETA.

2.2.3 Alkali content

Purpose of the assessment

The purpose of the assessment is the evaluation of the alkali content of SRA.

Assessment method

The test shall be carried out in accordance with EN 480-12.

A minimum of three tests shall be performed, with each test carried out on a different specimen.

Expression of results

The average value of the alkali content, expressed as total Na_2O equivalent content $(Na_2O)eq$ [%], shall be stated in the ETA.

2.2.4 Corrosion behaviour

Purpose of the assessment

The purpose of the assessment is the evaluation of the corrosion behaviour of the SRA.

Assessment method

The assessment shall be carried out in accordance with EN 934-1 Section 5. In particular, if the SRA contains only the substances included in Annex A.1 and A.2 of EN 934-1, the testing of corrosion behaviour is not relevant.

If the SRA contains any substances not included in Annex A.1 and A.2 of EN 934-1, the corrosion behaviour shall be evaluated in accordance with EN 480-14. In this case, a minimum of three tests shall be performed, with each test carried out on a different specimen.

Expression of results

The average value of the maximum current density J [µA/cm^2], calculated as defined in Section 5.3 of EN 480-14, shall be stated in the ETA.

ETA shall include one or more of the following statements according to the requirements in EN 934-1 Section 5:

- Contains components only from EN 934-1:2008, Annex A.1.
- Contains the following components from EN 934-1:2008 Annex A.2: …
- Maximum corrosion current density … µA/cm^2 and in conformity to EN 934-1:2008, 5.2.

2.2.5 Shrinkage of concrete

Purpose of the assessment

The purpose of the assessment is the evaluation of the effect of SRA on shrinkage of concrete, compared to the shrinkage of a reference concrete without SRA.

Assessment method

The test shall be carried out according to EN 12390-16 on a reference concrete (type I defined by EN 480-1) and on concrete with the SRA added.

The test shall be performed with specific dosages of SRA. Dosage of SRA equal to the compliance dosage as defined in § 3.1.2 of EN 934-2 is suggested. The performance can be assessed for several SRA dosages.

The concrete containing the SRA shall be at the same water/cement ratio and the same aggregate/cement ratio of the reference concrete. Compared to the reference concrete, the amount of mixing water shall be decreased by the volume of the liquid admixture.

Each measurement shall be performed on points along the principal axis of the specimen as illustrated in Section 3.5 of EN 12390-16 and on at least 3 specimens for each concrete composition.

Expression of results

The effect of the SRA on the shrinkage of concrete at x age ($\Delta\varepsilon_x$) is represented by the ratio between the shrinkage of concrete with SRA and the shrinkage of reference concrete, defined as follows:

$$\Delta\varepsilon_x = \frac{\varepsilon_{x,SRA}}{\varepsilon_{x,ref}} \cdot 100\ [\%] \quad \text{with } x = 7 \text{ and } 28 \text{ days} \qquad (2.2.5.1)$$

where:

$\varepsilon_{x,SRA}$ [%] is the average value (obtained on minimum 3 individual specimens) of the shrinkage of concrete with SRA at x age, calculated as defined in Section 8 of EN 12390-16.

$\varepsilon_{x,ref}$ [%] is the average value (obtained on minimum 3 individual specimens) of the shrinkage of reference concrete at x age, calculated as defined in Section 8 of EN 12390-16.

The value of $\Delta\varepsilon_x$ [%] and of $\varepsilon_{x,SRA}$ [%], with x=7 and 28 days, shall be stated in the ETA together with the concrete compositions and SRA dosages used for the tests.

2.2.6 Compressive strength

Purpose of the assessment

The purpose of the assessment is the evaluation of the effect of SRA on compressive strength of concrete, compared to the compressive strength of a reference concrete without SRA.

Assessment method

The test shall be carried out according to EN 12390-3 on a reference concrete (type I defined by EN 480-1) and on concrete with the SRA added.

The test shall be performed with specific dosages of SRA. Dosage of SRA equal to the compliance dosage as defined in § 3.1.2 of EN 934-2 is suggested. The performance can be assessed for several SRA dosages.

The concrete containing the SRA shall be at the same water/cement ratio and the same aggregate/cement ratio of the reference concrete. Compared to the reference concrete, the amount of mixing water shall be decreased by the volume of the liquid admixture.

A minimum of three tests shall be performed for each concrete composition.

Expression of results

The effect of the SRA on the compressive strength at x age ($\Delta f_{c,x}$) is represented by the ratio between the compressive strength of concrete with SRA and the compressive strength of reference concrete, defined as follows:

$$\Delta f_{c,x} = \frac{f_{c,SRA,x}}{f_{c,ref,x}} \cdot 100\ [\%] \qquad \text{with } x = 7 \text{ and } 28 \text{ days} \qquad (2.2.6.1)$$

where:

$f_{c,SRA,x}$ $[MPa]$ is the average value (obtained on minimum 3 individual specimens) of the compressive strength of concrete with SRA at x age.

$f_{c,ref,x}$ $[MPa]$ is the average value (obtained on minimum 3 individual specimens) of the compressive strength of reference concrete at x age.

The value of $\Delta f_{c,x}$ [%] and of $f_{c,SRA,x}$ $[MPa]$, with x=7 and 28 days, shall be stated in the ETA together with the concrete compositions and SRA dosages used for the tests.

2.2.7 Air content

Purpose of the assessment

The purpose of the assessment is the evaluation of the air content of a fresh concrete with and without the SRA.

Assessment method

The test shall be carried out according to EN 12350-7 on a reference concrete (Type I defined by EN 480-1) and on a concrete with the SRA. The method used for the assessment (water column method or pressure gauge method) shall be stated in the ETA. The water column method is the reference method.

The test shall be performed with specific dosages of SRA. Dosage of SRA equal to the compliance dosage as defined in § 3.1.2 of EN 934-2 is suggested. The performance can be assessed for several SRA dosages.

The concrete with the SRA shall be at the same water/cement ratio and the same aggregate/cement ratio of the reference concrete. Compared to the reference concrete, the amount of mixing water shall be decreased by the volume of the liquid admixture.

Minimum 3 tests shall be performed for each concrete composition.

Expression of results

The air content [%] shall be calculated as defined in Clause 7 of EN 12350-7.

The effect of the SRA on the air content ($\Delta A_{C,SRA}[\%]$) is represented by the ratio between the air content of fresh concrete with SRA, $A_{\mathrm{C,SRA}}\,[\%]$ and the content of fresh reference concrete, $\mathrm{A_{C,ref}}$ [%] defined as follows:

$$\Delta A_{C,SRA} = \frac{A_{\mathrm{C,SRA}}}{\mathrm{A_{C,ref}}} \cdot 100\ [\%] \qquad (2.2.7.1)$$

where:

$A_{\mathrm{C,SRA}}[\%]$ is the average value (obtained on minimum 3 individual specimens) of the air content of fresh concrete with SRA.

$A_{\mathrm{C,ref}}\,[\%]$ is the average value (obtained on minimum 3 individual specimens) of the air content of fresh reference concrete.

The value of $\Delta A_{C,SRA}$ [%] and of $\mathrm{A_{C,SRA}}\,[\%]$ shall be stated in the ETA together with the concrete compositions and SRA dosages used for the tests.

2.2.8 Air content (entrained air)

Purpose of the assessment

The purpose of the assessment is the evaluation of the interaction between SRA and air-entraining admixture (hereinafter “AEA”).

Assessment method

The test shall be carried out according to EN 12350-7 on an air-entrained reference concrete with an air content between 4-6% and on a concrete with both AEA and SRA.

The test shall be performed with specific dosages of SRA. Dosage of SRA equal to the compliance dosage as defined in § 3.1.2 of EN 934-2 is suggested. The performance can be assessed for several SRA dosages.

The air-entrained reference concrete is obtained from a type I concrete according to EN 480-1, to which the AEA is added to obtain an air content between 4-6%. The air-entrained reference concrete shall be at the same water/cement ratio and the same aggregate/cement ratio of the Type I concrete according to EN 480-1.

The concrete with both AEA and SRA shall be at the same water/cement ratio, the same aggregate/cement ratio and the same content of AEA of the air-entrained reference concrete. Compared to the air-entrained reference concrete, the amount of mixing water shall be decreased by the volume of the liquid admixture.

The test shall be performed with two different types of AEA, in particular with an AEA based on natural resin (for example wood resin) and with a synthetic AEA.

For each type of AEAs, minimum 3 tests shall be performed for each concrete composition.

Expression of results

The air content of fresh concrete [%] shall be calculated as defined in Clause 7 of EN 12350-7.

The effect of the SRA on the air content of air-entrained fresh concrete ($\Delta A_{C,AEA+SRA}[\%]$) is represented by the ratio between the air content of air-entrained fresh concrete with SRA, $A_{\mathrm{C,AEA+SRA}}$ [%] and the content of air-entrained fresh reference concrete, $A_{\mathrm{C,AEA,ref}}$ [%] defined as follows:

$$\Delta A_{\mathrm{C,AEA+SRA}} = \frac{A_{\mathrm{C,AEA+SRA}}}{A_{\mathrm{C,AEA,ref}}} \cdot 100\ [\%] \qquad (2.2.8.1)$$

where:

$A_{\mathrm{C,AEA+SRA}}[\%]$ is the average value (obtained on minimum 3 individual specimens) of the air content of air-entrained fresh concrete with SRA.

$A_{\mathrm{C,AEA,ref}}[\%]$ is the average value (obtained on minimum 3 individual specimens) of the air content of air-entrained fresh reference concrete.

The values of $\Delta A_{C,AEA+SRA}$ [%] and of $A_{\mathrm{C,AEA+SRA}}$ [%] shall be stated in the ETA together with the concrete compositions and SRA dosages and a description of the type of AEA used for the test.

2.2.9 Content, emission and/or release of dangerous substances

2.2.9.1 General

The performance of the SRA related to the emissions and/or release and, where appropriate, the content of dangerous substances will be assessed on the basis of any information provided by the manufacturer[3] after identifying the release scenarios taking into account the intended use of the product and the Member States where the manufacturer intends his product to be made available on the market.

The identified intended release scenarios for SRA and intended use with respect to dangerous substances are:

IA2: Product with indirect contact to indoor air.

IA3: Product with no contact to indoor air.

S/W1: Product with direct contact to soil, ground- and surface water.

S/W2: Product with indirect contact to soil, ground- and surface water.

S/W3: Product with no contact to soil, ground- and surface water.

2.2.9.2 Leachable substances of SRA

For the identified release scenarios S/W1 and S/W2, the performance of the SRA regarding leachable substances shall be assessed.

For the following parameters, the total content shall be determined on three representative samples of the SRA after aqua regia digestion in accordance with EN 17196:

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[3] The manufacturer may be asked to provide to the TAB the REACH related information which shall accompany the DoP (cf. Article 6(5) of Regulation (EU) No 305/2011).

The manufacturer is **not** obliged to:
- provide the chemical constitution and composition of the product (or of constituents of the product) to the TAB, or
- provide a written declaration to the TAB stating whether the product (or constituents of the product) contain(s) substances which are classified as dangerous according to Directive 67/548/EEC and Regulation (EC) No 1272/2008 and listed in the "Indicative list on dangerous substances" of the SGDS, taking into account the installation conditions of the construction product and the release scenarios resulting from there.

Any information provided by the manufacturer regarding the chemical composition of the products is not to be distributed to EOTA to other TABs or beyond.

antimony (Sb), arsenic (As), barium (Ba), lead (Pb), cadmium (Ca), total chromium (Cr), cobalt (Co), copper (Cu), molybdenum (Mo), nickel (Ni), mercury (Hg), thallium (TI), vanadium (V), zinc (Zn).

The analysis of the parameters shall be in accordance with EN 17201. The average of the measured values of each parameter shall be expressed in mg/kg and stated in the ETA.

Three representative samples of the SRA shall be eluted in accordance with EN 12457-2. The following parameters in the eluate shall be determined using the methods for analysis in accordance with EN 17195:

chloride (Cl-) [mg/l], sulphate (SO_4^{2-}) [mg/l], fluoride (F^-) [mg/l], TOC [mg/l of carbon], pH value, electrical conductivity [mS/m].

The average of the measured values shall be stated in the ETA.

2.2.9.3 Leachable substances of concrete with the SRA

For the identified release scenarios S/W1 and S/W2, the performance of the concrete with SRA regarding leachable substances shall be assessed.

The test shall be performed with specific dosages of SRA. Dosage of SRA equal to the compliance dosage as defined in § 3.1.2 of EN 934-2 is suggested. The performance can be assessed for several SRA dosages.

Concrete cubes with dimensions of 100 mm x 100 mm x 100 mm shall be made in accordance with EN 12390-2 (form oil shall not be used). Usually, the cubes are removed from the forms after one day.

After removal from the forms, the test specimens are tightly packaged and stored at a temperature of (20 ± 2) °C. The test specimens shall be stored for 56 days. The requirements for storage are fulfilled, when the cubes, for instance, are immediately double-wrapped in plastic foil (at least 0.3 mm thick), and all free edges of the plastic foil are stuck down with adhesive tape.

A leaching test with subsequent eluate analysis shall take place, each in duplicate. Leaching tests of the concrete with the SRA shall be conducted according to EN 16637-2. The leachant shall be pH-neutral demineralised water and the ratio of liquid volume to surface area shall be (80 ± 10) l/m². The eluates taken after 6 hours, 1 day, 2 days and 6 hours, 4 days, 9 days, 16 days, 36 days and 64 days shall be analysed for the following environmentally relevant parameters using the methods for analysis in accordance with EN 17195:

antimony (Sb) [mg/l], arsenic (As) [mg/l], barium (Ba) [mg/l], lead (Pb) [mg/l], cadmium (Ca) [mg/l], total chromium (Cr) [mg/l], cobalt (Co) [mg/l], copper (Cu) [mg/l], molybdenum (Mo) [mg/l], nickel (Ni) [mg/l], mercury (Hg) [mg/l], thallium (TI) [mg/l], vanadium (V) [mg/l], zinc (Zn) [mg/l], chloride (Cl-) [mg/l], sulphate (SO42-) [mg/l], fluoride (F-) [mg/l], TOC [mg/l of carbon], pH value, electrical conductivity [mS/m].

In eluates of “6 hours” and “64 days”, the following biological tests shall be conducted:

- acute toxicity test with Daphnia magna Straus according to EN ISO 6341;
- toxicity test with algae according to EN ISO 15799;
- luminescent bacteria test according to EN ISO 11348-1, EN ISO 11348-2 or EN ISO 11348-3.

For each biological test, EC20-values shall be determined for dilution ratios 1:2, 1:4, 1:6, 1:8 and 1:16.

The average of the measured values shall be stated in the ETA, together with the concrete compositions and SRA dosages used for the tests.

2.2.9.4 SVOC and VOC (concrete with the SRA)

For the identified release scenario IA2, the performance of the concrete with the SRA regarding SVOC and VOC shall be determined.

Volatile organic compounds and semi-volatile organic compounds (respectively: VOC and SVOC) shall be determined in accordance with EN 16516. In particular, clause 8.2 of EN 16516 which describes the

determination of VOCs and SVOCs in test chamber air, is of concern. The loading factors for emission testing for the intended uses of the concrete with the SRA according to EN 16516 shall be:

- 1.0 m^2/m^3 for walls;
- 0.4 m^2/m^3 for floors or ceilings.

The preparation of the test specimen is performed by using a representative sample of the product installed in accordance with the manufacturer's product installation instructions. The size of the test specimen shall be chosen in consideration of the test chamber size and the intended loading factor. The test shall be performed with specific dosages of SRA. Dosage of SRA equal to the compliance dosage as defined in § 3.1.2 of EN 934-2 is suggested.

A description of specific emission rates [µg/(m^2*h)] and respective air concentrations in the reference room [µg/m^3] of the compounds, together with the information regarding the product loading factor used [m^2/m^3], in accordance with clause 10.6 of EN 16516, shall be stated in the ETA, together with the concrete compositions and SRA dosages used for the tests.

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: **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 product in the procedure of assessment and verification of constancy of performance are laid down in Table 3.2.1.

Table 3.2.1 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	Incoming materials	Supplier's data check	Control Plan	-	Each batch
2	Homogeneity/Colour	Control Plan	Control Plan	1	Each batch
3	Absolute density	2.2.1	Control Plan	1	Each batch
4	pH value	Control Plan	Control Plan	1	Each batch
5	Chloride ion content	2.2.2	Control Plan	1	4 per year
6	Alkali content	2.2.3	Control Plan	1	2 per year
7	Shrinkage of concrete	2.2.5	Control Plan	1	1 every 1000 ton with a maximum of 3 per year and a minimum of 1 per year
8	Compressive strength of concrete	2.2.6	Control Plan	1	1 per year
9	Air content (fresh concrete)	2.2.7	Control Plan	1	1 per year
10	Air content (entrained air)	2.2.8	Control Plan	1	1 per year

3.3 Tasks of the notified body

The cornerstones of the actions to be undertaken by the notified body in the procedure of assessment and verification of constancy of performance for the SRA are laid down in Table 3.3.1.

Table 3.3.1 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	Notified body will ascertain that, the factory production control with the staff and equipment are suitable to ensure a continuous and orderly manufacturing of the "**SRA**".	Verification of the complete FPC as described in the control plan agreed between the TAB and the manufacturer.	According to control plan	According to control plan	When starting the production of a new line
Continuous surveillance, assessment and evaluation of factory production control					
2	The Notified Body will ascertain that the system of factory production control and the specified manufacturing process are maintained taking account of the control plan.	Verification of the controls carried out by the manufacturer as described in the control plan agreed between the TAB and the manufacturer with reference to the raw materials, to the process and to the product as indicated in Table 3.2.1.	According to control plan	According to control plan	Once per year

4 REFERENCE DOCUMENTS

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 480-1:2023	Admixtures for concrete, mortar and grout - Test methods - Part 1: Reference concrete and reference mortar for testing.
EN 480-10:2009	Admixtures for concrete, mortar and grout - Test methods - Part 10: Determination of water-soluble chloride content.
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.
EN 12350-7:2019	Testing fresh concrete - Part 7: Air content - Pressure methods.
EN 12390-3:2019	Testing hardened concrete - Part 3: Compressive strength of test specimens.
EN 12390-16:2019	Testing hardened concrete - Part 16: Determination of the shrinkage of concrete.
EN 17196:2023	Construction products: Assessment of release of dangerous substances – Digestion by aqua regia for subsequent analysis of inorganic substances.
EN 17201:2023	Construction products: Assessment of release of dangerous substances – Content of inorganic substances – Methods for analysis of aqua regia digests.
EN 12457-2:2002	Characterisation of waste. Leaching. Compliance test for leaching of granular waste materials and sludges. One stage batch test at a liquid to solid ratio of 10 l/kg for materials with particle size below 4 mm (without or with size reduction).
EN 17195:2023	Construction products: Assessment of release of dangerous substances – Analysis of inorganic substances in eluates.
EN 12390-2:2019	Testing hardened concrete - Part 2: Making and curing specimens for strength tests
EN 16637-2:2023	Construction products: Assessment of release of dangerous substances - Part 2: Horizontal dynamic surface leaching test
EN ISO 6341:2012	Water quality - Determination of the inhibition of the mobility of Daphnia magna Straus (Cladocera, Crustacea) - Acute toxicity test
EN ISO 15799:2022	Soil quality - Guidance on the ecotoxicological characterization of soils and soil materials
EN ISO 11348-1:2008/ A1:2018	Water quality - Determination of the inhibitory effect of water samples on the light emission of Vibrio fischeri (Luminescent bacteria test) - Part 1: Method using freshly prepared bacteria - Amendment 1 (ISO 11348-1:2007/Amd 1:2018)
EN ISO 11348-2:2008/ A1:2018	Water quality - Determination of the inhibitory effect of water samples on the light emission of Vibrio fischeri (Luminescent bacteria test) - Part 2: Method using liquid-dried bacteria - Amendment 1 (ISO 11348-2:2007/Amd 1:2018)
EN ISO 11348-3:2008/ A1:2018	Water quality - Determination of the inhibitory effect of water samples on the light emission of Vibrio fischeri (Luminescent bacteria test) - Part 3: Method using freeze-dried bacteria - Amendment 1 (ISO 11348-3:2007/Amd 1:2018)
EN 16516:2017+A1:2020	Construction products: Assessment of release of dangerous substances - Determination of emissions into indoor air
ISO 758:1976	Liquid chemical products for industrial use - Determination of density at 20 degrees C.