EUROPEAN ASSESSMENT DOCUMENT

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ALKALI RESISTANT GLASS FIBRES CONTAINING ZIRCONIUM DIOXIDE FOR THE USE IN 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 No (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 "alkali resistant glass fibres" ("AR glass fibres") are made of glass containing zirconium dioxide to achieve a high alkali resistance. The fibres are produced as roving or are chopped strands. The glass fibres have a particular sizing. The strand-in-cement-strength (SIC strength) of the "alkali resistant glass fibres" is greater than 250 N/mm². The zirconium dioxide content (ZrO_2) shall be at least 16 % (≥ 16 %). The AR glass fibres are manufactured from specified constituents in a production plant.

For each case of application assessment tests shall be carried out with the intended concrete composition and the intended addition to demonstrate that the concrete may be processed reliably with the intended consistency provided under the conditions of the site and that the required properties are achieved.

The product is not covered by a harmonised European standard.

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 shall 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 "alkali resistant glass fibres" ("AR glass fibres") are intended to be used for preparation of 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 "alkali resistant glass fibres" for the intended use of 50 years when installed in the works provided that the concrete incorporating the "alkali resistant glass fibres" 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[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.

[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 the working life referred to above.

1.3 Specific terms used in this EAD

Unless stated otherwise the terms used in EN 15422 and EN 14649 apply.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 1 shows how the performance of alkali resistant glass fibres 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 *(level, class, description)*
Basic Works Requirement 1: Mechanical resistance and stability			
1	Tensile strength of strands	2.2.10	Level
2	Alkali resistance (SIC strength)	2.2.11	Description
3	Effect on consistence (workability) of fresh concrete	2.2.12	Level
4	Effect on strength of concrete (Residual flexural tensile strength)	2.2.13	Description
5	Effect on strength of GRC products (Bending strength) - premix process (3 % fibres) - spray process (5 % fibres) (percentage of weight of total weight of GRC)	2.2.14	Description
Basic Works Requirement 2: Safety in case of fire			
6	Reaction to fire	2.2.15	Class

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

2.2.1 General provisions

Verification and assessment shall be performed on samples representative for the kit components unless otherwise specified below. The specified performance for each characteristic shall be representative for the product as placed on the market.

2.2.2 Characterization

2.2.2.1 General

Characterization of products to be assessed shall be done in accordance with available specifications, notably the following properties shall be determined *zirconium dioxide content (ZrO_2)* (see 2.2.2.2), density (see 2.2.2.3), *size content of the fibres* (see 2.2.2.4), *moisture content* (see 2.2.2.5), *average diameter of the filaments* (see 2.2.2.6), *length of the chopped strands* (see 2.2.2.7) and *linear density of strands and rovings* (see 2.2.2.8 and 2.2.2.9).

2.2.2.2 Zirconium dioxide content (ZrO_2)

The zirconium dioxide content (ZrO_2) shall be determined by X-ray fluorescence method (XRF) with appropriate standards.

2.2.2.3 Density

The density of the filament shall be measured according to EN 196-6, 4.5.3, or EN ISO 1183-3.

Other methods than the one indicated may be used provided they give results correlated and equivalent to those obtained with the reference method (e.g. ASTM D3800). Regular control may be done indirect through the glass composition analysis.

2.2.2.4 Size content

The size content shall be determined in accordance with ISO 1887. The size content of the alkali resistant glass fibres complies with the combustible organic matter content or loss on ignition.

2.2.2.5 Moisture content

The moisture content shall be determined in accordance with EN ISO 3344.

2.2.2.6 Average diameter of filaments

The average diameter of the filaments shall be determined according to ISO 1888.

Other methods than the one indicated may be used provided they give results correlated and equivalent to those obtained with the reference method. Regular control may be done indirect through measurement of the bushing throughput (die) during manufacturing.

2.2.2.7 Length of chopped strands

The length of chopped strands shall be measured with optical equipment, with an accuracy of 0,1 mm.

2.2.2.8 Linear density of strand (Strand tex)

The linear density of the strand shall be determined in accordance with EN ISO 1889.

2.2.2.9 Linear density of roving (Roving tex)

The linear density of the roving shall be determined in accordance with EN ISO 1889.

2.2.3 Tensile strength of strands

The tensile strength of strands shall be determined in accordance with ISO 3341.

Other methods than the one indicated may be used provided they give results correlated and equivalent to those obtained with the reference method (e.g. EN 14649). This is especially applied if the method above cannot be used due to specific manufacturing conditions of a specific product.

2.2.4 Alkali resistance (SIC strength)

The alkali resistance shall be determined in accordance with the strand-in-cement (SIC) test method according to EN 14649.

2.2.5 Effect on consistence (workability) of fresh concrete

The consistence according to EN 12350-3 shall be determined on a reference concrete, conforming to EN 14845-1, without fibres, and then on an identical mix with fibres. The reference concrete shall obtain a Vébé time of 10 to 6 s (V3). The amount of fibres added shall be the same than used for determination of the effect on flexural tensile strength according to 2.4.13. If the effect on flexural tensile strength is not determined, the required dosage of fibres shall be declared.

The effect on consistence and, if used, the amount and type of plasticizer or superplasticizer shall be declared by the manufacturer.

The consistence for the concrete with a range of dosages of fibres (5 to 20 kg/m^3) may also be assessed.

2.2.6 Effect on strength of concrete (Residual flexural tensile strength)

The effect on strength shall be determined according to EN 14845-2 and respectively EN 14651 using a reference concrete conforming to EN 14845-1.

The producer shall declare the required dosage of fibres to achieve the following average residual flexural strength:

- F(CMOD 0,5 mm) = 1,5 MPa (at least) and
- F(CMOD 3,5 mm) = 1,0 MPa (at least)

2.2.7 Effect on strength of GRC products (Bending strength)

The effect on strength shall be determined according to EN 1170-5 using a reference GRC conforming to EN 15191.

After 28 days the limit of proportionality (LOP) and a modulus of rupture (MOR) of a premix GRC with a fibre content in weight of 3,0 % and 5,0 % shall be assessed.

2.2.8 Reaction to fire

The concrete incorporating the "alkali resistant glass fibres" is considered to satisfy the requirements for performance class A1 of the characteristic reaction to fire, in accordance with the provisions of EC Decision 96/603/EC, amended by 2000/605/EC, without the need for further testing, on the basis of the stipulations of these decisions.

3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

3.1 Systems 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[3], as amended[4].

The systems are: 1 (for structural uses in concrete, mortar and grout) and 3 (for other uses in concrete, mortar and grout)

3.2 Tasks of the manufacturer

The cornerstones of the actions to be undertaken by the manufacturer of the product in the procedure of verification of constancy of performance are laid down in Table 3.

Table 3 Control plan for the manufacturer; cornerstones

No	Subject/type of control *(product, raw/constituent material, component - indicating characteristic concerned)*	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	Zirconium dioxide content (ZrO_2)	2.2.2.2		1 sample	once a week
2	Density	2.2.2.3*		1 sample	once a week
3	Size content	2.2.2.4		2 samples**	once a day
4	Moisture content	2.2.2.5		2 samples**	once a day
5	Average diameter of filaments	2.2.2.6		30 filaments** 2 samples** (indirect measure)	once a week once a day
6	Length of chopped strands	2.2.2.7		30 fibres**	once a day
7	Linear density of strand (Strand tex) - continuous products - direct chopped strands	2.2.2.8		 2 samples** 2 samples	 once a day once a month
8	Linear density of roving (Roving tex)	2.2.2.9		1 sample**	once a day
9	Tensile strength of strands	2.2.2.10*		10 fibres**	once a month
10	Alkali resistance (SIC strength)	2.2.4		10 fibres**	once a month

*) Other methods than the one indicated may be used provided they give results correlated and equivalent to those obtained with the reference method.

**) Fibres or samplings of fibres shall be sampled one by one, regularly during the minimum period of control.

[3] OJ L184, 17.7.1999, p. 27

[4] Commission Decision 2001/596/EC of 8 January 2001, OJ L 209, 2.8.2001, p. 33

3.3 Tasks of the notified body (for structural uses in concrete, mortar and grout only)

The cornerstones of the actions to be undertaken by the notified body in the procedure of verification of constancy of performance for the alkali resistant glass fibres containing zirconium dioxide are laid down in Table 4.

Table 4 Control plan for the notified body; cornerstones

No	Subject/type of control *(product, raw/constituent material, component - indicating characteristic concerned)*	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					
Assessment of the factory production control system is the responsibility of the notified body. An assessment of each production unit shall be carried out to demonstrate that the factory production control is in conformity with the ETA and any subsidiary information. This assessment shall be based on an initial inspection of the factory according to EN 14889-1.					
Continuous surveillance, assessment and evaluation of factory production control					
Subsequently continuous surveillance of factory production control according to EN 14889-1 is necessary to ensure continuing conformity with the ETA.					1/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 196-6 Methods of testing cement - Part 6: Determination of fineness

EN 1170-5 Precast concrete products – Test method for glass-fibre reinforced cement – Part 5: Measuring bending strength, "Complete bending test" method

ISO 1887 Textile glass - Determination of combustible-matter content

ISO 1888 Textile glass - Staple fibres or filaments - Determination of average diameter

EN ISO 1183-3 Plastics - Methods for determining the density of non-cellular plastics - Part 3: Gas pyknometer method (ISO 1183-3:1999)

EN ISO 1889 Reinforcement yarns - Determination of linear density

EN 3341 Textile glass - Yarns - Determination of breaking force and breaking elongation

EN ISO 3344 Reinforcement products - Determination of moisture content

EN 12350-3 Testing fresh concrete - Part 3: Vebe test

EN 12350-4 Testing fresh concrete - Part 4: Degree of compactability

EN 12350-5 Testing fresh concrete - Part 5: Flow table test

EN 14020-2 Reinforcements – Specification for textile glass rovings - Part 2: Methods of test and general requirements

EN 14649 Precast concrete products - Test method for strength retention of glass fibres in cement and concrete (SIC TEST)

EN 14651 Test method for metallic fibre concrete - Measuring the flexural tensile strength (limit or proportionality (LOP), residual)

EN 14845-1 Test methods for fibres in concrete - Part 1: Reference concretes

EN 14845-2 Test methods for fibres in concrete - Part 2: Effect on concrete

EN 14889-1 Fibres for concrete - Part 1: Steel fibres - Definitions, specifications and conformity

EN 15191 Precast concrete products - Classification of glassfibre reinforced concrete performance

EN 15422 Precast concrete products - Specification of glassfibres for reinforcement of mortars and concretes