EUROPEAN ASSESSMENT DOCUMENT

EAD 260067-00-0301

September 2020

POLYMER MACRO FIBRES REINFORCED WITH BASALT FIBRE FOR THE USE IN CONCRETE

www.eota.eu

The reference title and language for this EAD is English. The applicable rules of copyright refer to the document elaborated in and published by EOTA.

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 polymer macro fibres reinforced with basalt fibre for the use in concrete (in the following referred to as polymer macro fibres reinforced with basalt fibre) are made of a polymeric matrix coating a basalt fibre thread. The moisture content of the basalt thread with sizing is ≤ 0,50 % by mass. The basalt fibres are twisted using a sacrificial thread and saturated and coated with a vinyl ester resin. Thereby the macro fibres possess a helix structure. The fibres are manufactured from specified constituents in a production plant and produced as chopped strands in different lengths.

The product is not fully covered by hEN 14889-2[1]. hEN 14889-2 covers polymer fibres that consists exclusively of one polymer or a mixture of polymers. Fibres with basalt reinforcement are not covered by the scope of the hEN and have, to some extent, to be assessed differently than polymer macro fibres according to hEN 14889-2.

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.

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 polymer macro fibres reinforced with basalt fibre are intended to be used for preparation of concrete, mortar and other cementitious mixes for structural use in construction and for the manufacturing of precast construction products for structural use. The polymer macro fibres reinforced with basalt fibre are used in concrete to reduce the formation of early age shrinkage cracks. The long-term durability of the fibres in hardened concrete is not assessed.

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 concrete incorporating the polymer macro fibres reinforced with basalt fibre for the intended use of 50 years when installed in the works (provided that the Polymer macro fibres reinforced with basalt fibre for the use in 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.

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].

---

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.

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.

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

Unless stated otherwise the terms used in EN 14889-2 apply.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 2.1 shows how the performance of Polymer macro fibres reinforced with basalt fibre for the use in concrete is assessed in relation to the essential characteristics.

Table 2.1 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	Shape/cross section	2.2.1	Description
2	*(*Equivalent*)* diameter	2.2.2	Level
3	Length	2.2.3	Level
4	Density	2.2.4	Level
5	Content of resin (coating)	2.2.5	Level
6	Tensile strength	2.2.6	Level
7	Modulus of elasticity	2.2.7	Level
8	Softening temperature (Melting point)	2.2.8	Level
9	Point of ignition (Decomposition point)	2.2.9	Level
10	IR analysis of coating	2.2.10	Description
11	Effect on the consistency of concrete	2.2.11	Description
12	Effect on the strength of concrete (Residual flexural tensile strength)	2.2.12	Description

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 Shape/cross section

The longitudinal (e.g. straight/ deformed) and cross-sectional (e.g. circular/ elliptical/ rectangular/ irregular) shape shall be determined on at least 10 specimens using a magnifying glass (3x) and described in the ETA by wording and sketch or photo.

2.2.2 *(*Equivalent*)* diameter

The *(*equivalent*)* diameter d_e shall be measured in accordance with EN 14889-2, *5.3.3* on at least 30 specimens and stated in the ETA (average value in mm).

2.2.3 Length

The length shall be measured in accordance with EN 14889-2*, 5.3.2* on at least 30 specimens and stated in the ETA (average value in mm).

The length shall be measured with a ruler or Vernier calliper with a resolution of at least of 0,5 mm

2.2.4 Density

The density shall be measured by helium gas pyknometer method according to EN ISO 1183-3 on at least 10 specimens. The result shall be stated in the ETA (average value in g/cm³).

A sample cell with a diameter and height of approximately 25 mm (volume = 12,285 cm³) shall be used. The fibres shall be conditioned previously for at least 24 hours at (20±2)°C and (65±5)% relative humidity, then roughly cut to fit well into the sample cell. Samples of (5,00± 0,25) g shall be weighed out. Other test equipment or method may be used provided it gives equivalent results.

2.2.5 Content of resin (coating)

The content of vinyl ester resin (coating) shall be defined by determination of the loss on ignition in accordance with EN 196-2, clause 5.4, at a temperature of 600°C for 3 hours, on at least 5 specimens and shall be stated in % by mass in the ETA (average value in % by mass).

2.2.6 Tensile strength

The tensile strength, R_m, shall be determined on 30 individual filaments by EN ISO 2062 (method A), and shall be stated in the ETA (average value in N/mm²). The distance between the clamping points shall be 250 mm, the strain rate shall be 50 % per minute.

The tensile strength R_m shall be calculated from the breaking force divided by the cross sectional area $\pi \cdot d_e^2/4$.

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 ISO 5079 or ISO 3341). This is especially applied if the method above cannot be used due to specific manufacturing conditions of a specific product.

2.2.7 Modulus of elasticity

The secant modulus of elasticity of the filament shall be determined by testing 30 individual filaments by EN ISO 2062 (method A). The secant modulus of elasticity shall be calculated from the tensile strength (clause 2.2.6) divided by the elongation at break of the filament and shall be stated in the ETA (average value in N/mm²). The initial distance between the clamping points shall be 250 mm. The strain rate shall be 50 % per minute. The strain rate can be measured by the relative movement of the clamps, provided that slippage is prevented. Alternatively, the strain can be determined by an extensometer over a length of at least 50 mm.

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 ISO 5079).

2.2.8 Softening temperature (Melting point)

The softening temperature (melting point) shall be determined in accordance with EN ISO 11357-3 on one specimen and shall be stated in the ETA.

For calibration indium with an accuracy of 0.001°C shall be used. In addition, a sensitivity calibration of both chambers shall be carried out in order to compare them. The measurement shall be carried out in aluminum crucibles, with an empty aluminum crucible being used as a reference in the second chamber. The heating rate shall be 10 K/min (dynamic mode). The sample mass shall be between 5 and 10 mg. Other test equipment or method may be used provided it gives equivalent results.

2.2.9 Point of ignition (Decomposition point)

The point of ignition (decomposition point) shall be determined in accordance with EN ISO 11358-1 on one specimen and shall be stated in the ETA.

The isothermal method shall be used, while the sample is kept in a controlled oxidizing atmosphere (20% oxygen and 80% inert gas, flow rate 50 ml/min). The shape, dimensions and mass of the sample depend on crucible (e.g. 190 µl crucibles, 40 mg corundum as reference for calibration, approx. 40 mg sample mass). Before testing the sample shall be dried at 40-60°C and cooled in a desiccator with drying gel. The heating rate shall be between 5 and 10 K/min (up to approximately 450°C) and onset shall be determined graphically or by software. Other test equipment or method may be used provided it gives equivalent results.

2.2.10 IR analysis of coating

The chemical composition of the coating (vinyl ester resin) shall be analysed by IR analysis in accordance with EN 1767, clause 7.2, on one specimen (sampling technique ATR - deviating from section 6 and 7.2 the specimen to be examined may stay in solid state and be put on an ATR crystal without further preparation).

2.2.11 Effect on the consistency of concrete

The effect of fibres on the consistency (workability) of fresh concrete shall be determined in accordance with EN 14889-2, clause 5.7 on a reference concrete (mandatory mix according to EN 14845-1, Table 1, footnote a – other mixes according to EN 14845-1, Table 1 may be used provided they give results correlated and equivalent to those obtained with the mandatory mix). The consistency according to EN 12350-3 shall be determined on the reference concrete without fibres and then on an identical mix with fibres. The effect on consistency with and without fibres shall be stated in the ETA.

In case the manufacturer does not specify amount of fibres, a default amount of fibres of 10 kg/m³ concrete shall be used. If additional testing is necessary the amount of fibres shall be adjusted in steps of 0,5 or 1,0 kg depending on the results obtained.

2.2.12 Effect on the strength of concrete (Residual flexural tensile strength)

The effect of fibres on the strength of concrete shall be determined in accordance with EN 14889-2, clause 5.8 on a reference concrete (mandatory mix according to EN 14845-1, Table 1, footnote a – other mixes according to EN 14845-1, Table 1 may be used provided they give results correlated and equivalent to those obtained with the mandatory mix) and shall be stated in the ETA.

In case the manufacturer does not specify amount of fibres, a default amount of fibres of 10 kg/m³ concrete shall be used. If additional testing is necessary the amount of fibres shall be adjusted in steps of 0,5 or 1,0 kg depending on the results obtained.

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 1.

3.2 Tasks of the manufacturer

The cornerstones of the actions to be undertaken by the manufacturer of the polymer macro fibres reinforced with basalt fibre in the procedure of assessment and verification of constancy of performance are laid down in Table 3.1.

Table 3.1 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]					
Basalt fibre					
1	Density	According to EAD 260002-00-0301, clause 3.2	See control plan	1	every batch
2	Size content			2	every batch
3	Moisture content			2	every batch
4	Average diameter of filaments			2	every batch
5	Linear density of roving (Roving tex)			1	every batch
6	Tensile strength of strands			10	every batch
Polymer macro fibres reinforced with basalt fibre					
7	Shape/cross section	2.2.1	See control plan	According to EN 14889-2	
8	Equivalent diameter	2.2.2	See control plan		
9	Length	2.2.3	See control plan		
10	Content of resin	2.2.5	See control plan		
11	Tensile strength	2.2.6	See control plan		
12	Modulus of elasticity	2.2.7	See control plan		
13	Softening temperature (Melting point) of resin	2.2.8	See control plan	1	every batch
14	Point of ignition (Decomposition point)	2.2.9	See control plan	1	every batch
15	IR analysis of coating	2.2.10	See control plan	1	every batch
16	Density	2.2.4	See control plan	1	every batch

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 for polymer macro fibres reinforced with basalt fibre are laid down in Table 3.2.

Table 3.2 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	Control of the manufacturing plant and of the factory production control carried out by the manufacturer regarding the constancy of performance (according to control plan)	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
Continuous surveillance, assessment and evaluation of factory production control					
2	Continuous surveillance, assessment and evaluation of the factory production control carried out by the manufacturer regarding the constancy of performance (according to 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 3.1	According to control plan	According to control plan	1/year

4 REFERENCE DOCUMENTS

EN 196-2:2013	Method of testing cement - Part 2: Chemical analysis of cement
EN 1767:1999	Products and systems for the protection and repair of concrete structures - Test methods - Infrared analysis
EN 12350-3:2019	Testing fresh concrete – Part 3: Vebe test
EN 14845-1:2007	Test methods for fibres in concrete - Part 1: Reference concretes
EN 14889-2:2006	Fibres for concrete - Part 2: Polymer fibres - Definitions, specifications and conformity
EN ISO 1183-3:1999	Plastics - Methods for determining the density of non-cellular plastics - Part 3: Gas pyknometer method (ISO 1183-3:1999)
EN ISO 2062:2009	Textiles - Yarns from packages - Determination of single-end breaking force and elongation at break using constant rate of extension (CRE) tester (ISO 2062:2009)
EN ISO 5079:1995	Textiles - Fibres - Determination of breaking force and elongation at break of individual fibres (ISO 5079:1995) / prEN ISO 5079:2020
EN ISO 11357-3:2018	Plastics - Differential scanning calorimetry (DSC) - Part 3: Determination of temperature and enthalpy of melting and crystallization (ISO 11357-3:2018)
EN ISO 11358-1:2014	Plastics - Thermogravimetry (TG) of polymers - Part 1: General principles (ISO 11358-1:2014)
ISO 3341:2000	Textile glass - Yarns - Determination of breaking force and breaking elongation
EAD 260002-00-0301:2017	Alkali resistant glass fibres containing zirconium dioxide for the use in concrete (March 2016), OJEU 2017/C 343/06