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European Technical Assessment

ETA-17/0292
of 10.05.2017

General part

Technical Assessment Body issuing the European Technical Assessment	Österreichisches Institut für Bautechnik (OIB) Austrian Institute of Construction Engineering
Trade name of the construction product	Greenflex
Product family to which the construction product belongs	Point connector made of glass fibre reinforced polymer for sandwich walls
Manufacturer	Flexcomp s.r.l Via Padergnone 21/1 24050 Zanica (BG) Italy
Manufacturing plant	FlexComp D.o.o Ul. Sarajevska bb 76250 Gradacac Bosnia and Herzegovina
This European Technical Assessment contains	17 pages including Annexes 1 to 8, which form an integral part of this assessment.
This European Technical Assessment is issued in accordance with Regulation (EU) № 305/2011, on the basis of	EAD 330389-00-0601, European Assessment Document for Point connector made of glass fibre reinforced polymer for sandwich walls.

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Remarks

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Specific parts

1 Technical description of the product

1.1 General

The European Technical Assessment – ETA – applies to a product, the point connector

Greenflex

of glass fibre reinforced polymer for precast concrete sandwich walls.

The point connector for precast concrete sandwich walls, made of glass fibre reinforced polymer (GFRP), is produced by a pultrusion process. For the shape of the connector see Annex 1.

NOTE Sandwich walls are wall elements that consists of a base panel, a thermal insulation layer, a possible air space, and a facing panel. These sandwich walls are standardised in EN 14992[1], however, that does not imply the point connectors of GFRP are intended to be exclusively used in sandwich walls according to that standard.

One end of the point connector is fastened to the reinforcement of the facing panel before concreting, the other end is embedded into the concrete of the base panel, see Figure 1. The installation of the connector can be carried out in horizontal and vertical direction.

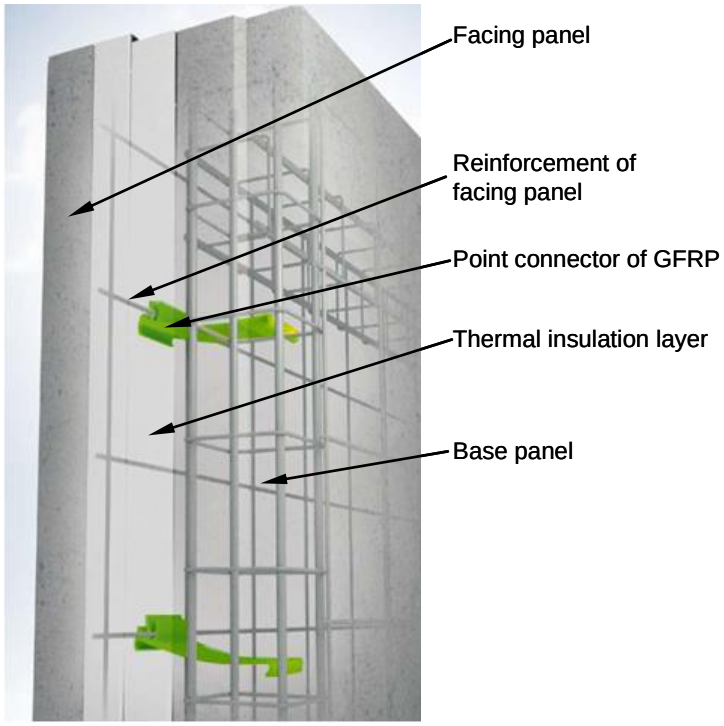


Figure 1 Sandwich wall with point connector of GFRP

[1] Standards and other documents referred to in the European Technical Assessment are listed in Annex 7 and Annex 8.

Concrete strength of base panel and facing panel is minimum C30/37 and maximum C50/60.

The insulation material of the thermal insulation layer is soft insulation material e.g. EPS, mineral wool, etc.

Sandwich walls manufactured with the point connector are precast concrete products, delivered as a whole piece to the construction site.

2 Specification of the intended use in accordance with the applicable European Assessment Document (hereinafter EAD)

2.1 Intended use

The point connector of GFRP for sandwich walls is intended to join base panel and facing panel, with a thermal insulation layer in between, see Figure 1. The sandwich wall is subject to predominantly static and quasi-static loads only. The intended use of the point connector considers three configurations in terms of structural function of the sandwich walls.

1 Sandwich walls with structural base panel and non-structural facing panel

Building with a structure independent from the sandwich wall:

2 Sandwich wall fastened as facade to the structure of the building. Horizontal loads perpendicular to the wall are carried by the base panel only.

3 Sandwich wall fastened as facade to the structure of the building. Horizontal loads perpendicular to the wall are carried as a composite system of base panel and facing panel.

Configurations 2 and 3 are non-structural sandwich walls.

The maximum dimensions of the sandwich wall are approximately 3.3 m × 14 m.

The point connector is intended to transfer the actions on the facing panel into the base panel. The facing panel can be installed unsupported or supported. The facing panel is always non-structural whereas the structural function of the base panel is depending on the requirements of the specific project. However, facing panel and base panel of the sandwich wall are not part of the ETA.

2.2 Assumptions

2.2.1 General

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 transport, storage, maintenance, replacement, and repair of the product, as he considers necessary.

2.2.2 Installation

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.

2.3 Assumed working life

The European Technical Assessment is based on an assumed working life of the point connector of GFRP for sandwich walls of 50 years, provided that the point connector of GFRP for sandwich walls is subject to appropriate installation, use, and maintenance, see Clause 2.2. The indications given as to the working life of the point connector of GFRP for sandwich walls cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by the Technical Assessment Body, but are regarded only as a means for selecting the appropriate products in relation to the expected economically reasonable working life of the works.

In normal use conditions the real working life may be considerably longer without major degradation affecting the basic requirements for works[2].

3 Performance of the product and references to the methods used for its assessment

3.1 Essential characteristics

The performances of the point connector of GFRP for sandwich walls for the essential characteristics are given in Table 1.

Table 1: Essential characteristics and performances of the product

№	Essential characteristic	Product performance
Basic requirement for construction works 1: Mechanical resistance and stability		
—	Not relevant. No characteristic assessed.	—
Basic requirement for construction works 2: Safety in case of fire		
1	Reaction to fire	See Annex 2
Basic requirement for construction works 3: Hygiene, health and the environment		
—	No characteristic assessed.	—
Basic requirement for construction works 4: Safety and accessibility in use		
2	Shape	See Annex 1
3	Dimensions and tolerances	See Annex 1
4	Fibre content	See Annex 4
5	Density	See Annex 4
6	Tensile strength (Axis 1)	See Annex 2
7	Tensile strength (Axis 2)	See Annex 2
8	Tensile modulus of elasticity (Axis 1)	See Annex 2
9	Tensile modulus of elasticity (Axis 2)	See Annex 2
10	Compression strength (Axis 1)	See Annex 2
11	Compression strength (Axis 2)	See Annex 2
12	Compressive modulus of elasticity (Axis 1)	See Annex 2
13	Compressive modulus of elasticity (Axis 2)	See Annex 2
14	Tensile strain at tensile strength	See Annex 2
15	Axial, inter-laminar shear strength (Axis 2, 3)	See Annex 2
16	In-plane shear strength (Axis 1, 2)	See Annex 2

[2] The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works are subject, as well as on the particular conditions of 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 indicated above.

№	Essential characteristic	Product performance
17	In-plane shear modulus (Axis 1, 2)	See Annex 2
18	Tensile strength under high temperature (Axis 1)	See Annex 3
19	Tensile strength under high temperature (Axis 2)	See Annex 3
20	Tensile modulus of elasticity under high temperature (Axis 1)	See Annex 3
21	Tensile modulus of elasticity under high temperature (Axis 2)	See Annex 3
22	Compression strength under high temperature (Axis 1)	See Annex 3
23	Compression strength under high temperature (Axis 2)	See Annex 3
24	Compressive modulus of elasticity under high temperature (Axis 1)	See Annex 3
25	Compressive modulus of elasticity under high temperature (Axis 2)	See Annex 3
26	In-plane shear strength under high temperature (Axis 1, 2)	See Annex 3
27	Alkali resistance in high pH solution	See Annex 3
28	Alkali resistance in high pH solution under load	See Annex 3
29	Creep deformation	See Annex 3
30	Thermal actions – Cyclic test in concrete	See Annex 5
31	Coefficient of thermal expansion (Axis 1 and Axis 2)	See Annex 4
32	Voids content	See Annex 4
33	Cure ratio	See Annex 4
34	Water absorption	See Annex 4
35	Thermogravimetry	See Annex 5
36	Glass transition temperature	See Annex 4
37	Connector embedded in concrete – Resistance to tension	See Annex 5
38	Connector embedded in concrete – Resistance to shear	See Annex 5
39	Edge distance	See Annex 6
40	Centre spacing	See Annex 6
Basic requirement for construction works 5: Protection against noise		
—	Not relevant. No characteristic assessed.	—

№	Essential characteristic	Product performance
Basic requirement for construction works 6: Energy economy and heat retention		
41	Thermal conductivity	See Annex 4
Basic requirement for construction works 7: Sustainable use of natural resources		
—	No characteristic assessed.	—

3.2 Assessment methods

The assessment of the essential characteristics in Clause 3.1 of the Point connector made of glass fibre reinforced polymer for sandwich walls for the intended use and in relation to the requirements for safety in case of fire, safety and accessibility in use, and energy economy and heat retention in the sense of the basic requirements for construction works № 2, 4, and 6 of Regulation (EU) № 305/2011 has been made in accordance with EAD 330389-00-0601, Point connector of glass fibre reinforced polymer for sandwich walls.

3.3 Identification

The European Technical Assessment for the point connector of GFRP for sandwich walls is issued on the basis of agreed data[3] that identify the assessed product. Changes to materials, to composition or characteristics of the product, or to the production process could result in these deposited data being incorrect. Österreichisches Institut für Bautechnik should be notified before the changes are introduced, as an amendment of the European Technical Assessment is possibly necessary.

4 Assessment and verification of constancy of performance (hereinafter AVCP) system applied, with reference to its legal base

4.1 System of assessment and verification of constancy of performance

According to Commission Decision 97/463/EC the system of assessment and verification of constancy of performance to be applied to the point connector of GFRP for sandwich walls is System 2+. System 2+ is detailed in Commission Delegated Regulation (EU) № 568/2014 of 18 February 2014, Annex, point 1.3, and provides for the following items.

(a) The manufacturer shall carry out

(i) an assessment of the performance of the construction product on the basis of testing (including sampling), calculation, tabulated values, or descriptive documentation of that product;

(ii) factory production control;

(iii) testing of samples taken at the manufacturing plant by the manufacturer in accordance with the prescribed test plan[4].

[3] The technical file of the European Technical Assessment is deposited at Österreichisches Institut für Bautechnik and is handed over only to the notified factory production control certification body involved in the procedure for the assessment and verification of constancy of performance.

[4] The prescribed test plan has been deposited with Österreichisches Institut für Bautechnik and is handed over only to the notified factory production control certification body involved in the procedure for the assessment and verification of constancy of performance. The prescribed test plan is also referred to as control plan.

(b) The notified factory production control certification body shall decide on the issuing, restriction, suspension, or withdrawal of the certificate of conformity of the factory production control on the basis of the outcome of the following assessments and verifications carried out by that body

(i) initial inspection of the manufacturing plant and of factory production control;

(ii) continuing surveillance, assessment, and evaluation of factory production control.

4.2 AVCP for construction products for which a European Technical Assessment has been issued

Manufacturers undertaking tasks under System 2+ shall consider the European Technical Assessment issued for the construction product in question as the assessment of the performance of that product. Manufacturers shall therefore not undertake the tasks referred to in Clause 4.1, point (a) (i).

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

5.1 Tasks for the manufacturer

5.1.1 Factory production control

In the manufacturing plant the manufacturer establishes and continuously maintains a factory production control. All procedures and specifications adopted by the manufacturer are documented in a systematic manner. Purpose of factory production control is to ensure the constancy of performances of the point connector of GFRP for sandwich walls with regard to the essential characteristics.

The manufacturer only uses raw materials supplied with the relevant inspection documents as laid down in the control plan. The incoming raw materials are subjected to controls by the manufacturer before acceptance. Check of incoming materials includes control of inspection documents presented by the manufacturer of the raw materials.

Testing within factory production control is in accordance with the prescribed test plan. The results of factory production control are recorded and evaluated. The records are kept at least for ten years after the construction product has been placed on the market and are presented to the notified factory production control certification body involved in continuous surveillance. On request the records are presented to Österreichisches Institut für Bautechnik.

If test results are unsatisfactory, the manufacturer immediately implements measures to eliminate the defects. Products or components that are not in conformity with the requirements are removed. After elimination of the defects, the respective test – if verification is required for technical reasons – is repeated immediately.

5.1.2 Declaration of performance

The manufacturer is responsible for preparing the declaration of performance. When all the criteria of the assessment and verification of constancy of performance are met, including the certificate of conformity of the factory production control issued by the notified factory production control certification body, the manufacturer draws up the declaration of performance. Essential characteristics to be included in the declaration of performance for the corresponding intended use are given in Table 1.

5.2 Tasks for the notified factory production control certification body

5.2.1 Initial inspection of the manufacturing plant and of factory production control

The notified factory production control certification body verifies the ability of the manufacturer for a continuous and orderly manufacturing of the point connector of GFRP for sandwich walls

according to the European Technical Assessment. In particular the following items are appropriately considered.

- Personnel and equipment
- Suitability of the factory production control established by the manufacturer
- Full implementation of the prescribed test plan

5.2.2 Continuing surveillance, assessment, and evaluation of factory production control

The notified factory production control certification body visits the factory at least once a year for routine inspection. In particular the following items are appropriately considered.

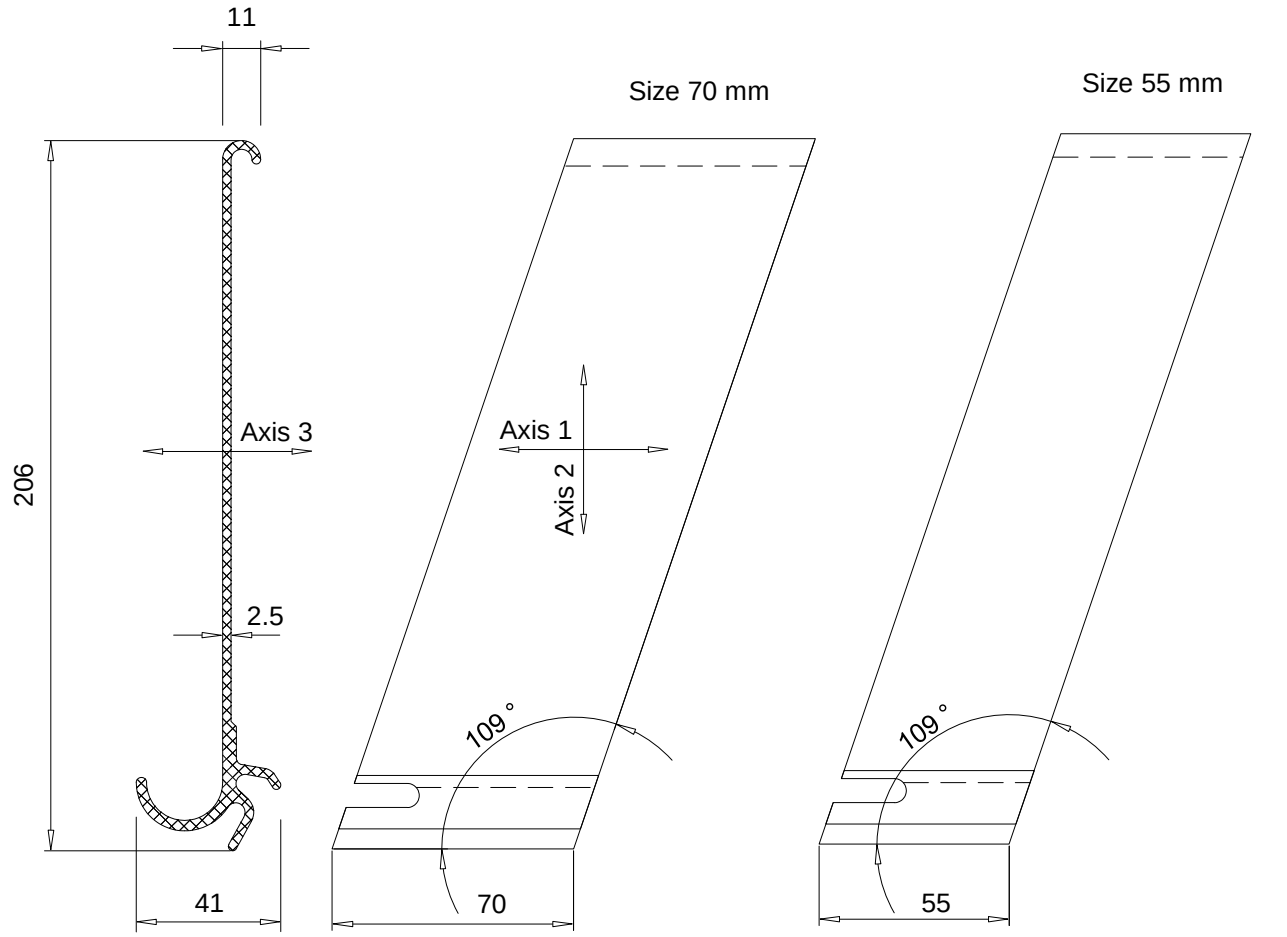
- Manufacturing process including personnel and equipment
- Factory production control
- Implementation of the prescribed test plan

The results of continuous surveillance are made available on demand by the notified factory production control certification body to Österreichisches Institut für Bautechnik. When the provisions of the European Technical Assessment and the prescribed test plan are no longer fulfilled, the certificate of conformity of the factory production control is withdrawn by the notified factory production control certification body.

Issued in Vienna on 10 May 2017
by Österreichisches Institut für Bautechnik

The original document is signed by

Rainer Mikulits
Managing Director



Dimensions in mm

Axis 1, 2, and 3 for mechanical characteristics

Figure 2 Shape and dimensions of the point connector of GFRP

Tolerances on dimensions of the cross section are according to EN 13706-2

Thickness ..... (2.5 ± 0.2) mm

Length and width ..... { at least ± 0.2 mm / in general ± 0.5 % / not more than ± 0.75 mm

Example for dimensions of Figure 2

206 mm .....± 0.75 mm

Tolerance on dimension parallel to axis 1 is (70 ± 1.0) mm and (55 ± 1.0) mm

Angular tolerances are addressed by triangles and the linear tolerances above, measured with full dimensions of the point connecter of GFRP.

FLEXCOMP	Point connector of GFRP Greenflex	**Annex 1** of European Technical Assessment ETA-17/0292 of 10.05.2017
Point connector of GFRP – Shape and dimensions		

Table 1: Performance of the point connector of GFRP

BRCW [1]	Essential characteristic	Verification method	Performance	
2	**Safety in case of fire**			
	Reaction to fire Point connector of GFRP	2016/364	Class E	—
4	**Safety and accessibility in use**			
	Tensile strength (Axis 1) [2), 3)]	EN ISO 527-4	113	MPa
	Tensile strength (Axis 2) [2), 3)]	EN ISO 527-4	360	MPa
	Tensile modulus of elasticity (Axis 1) [3), 4)]	EN ISO 527-4	6 200	MPa
	Tensile modulus of elasticity (Axis 2) [3), 4)]	EN ISO 527-4	11 600	MPa
	Tensile strain at tensile strength Axis 1 [3), 5)] Axis 2	EN ISO 527-4	1.9 3.1	% %
	Compression strength (Axis 1) [2), 3)]	EN ISO 14126	135	MPa
	Compression strength (Axis 2) [2), 3)]	EN ISO 14126	215	MPa
	Compressive modulus of elasticity (Axis 1) [3), 4)]	EN ISO 14126	13 700	MPa
	Compressive modulus of elasticity (Axis 2) [3), 4)]	EN ISO 14126	24 800	MPa
	In-plane shear strength (Axis 1, 2) [2), 3)]	ASTM D7078	85	MPa
	In-plane shear modulus (Axis 1, 2) [3), 4)]	EN ISO 15310	5 000	MPa
	Axial, inter-laminar shear strength (Axis 2, 3) [2), 3)]	EN ISO 14130	24.7	MPa

1) Basic requirement for construction works
2) Indicated as 5 % fractile
3) At a temperature of 23 °C
4) Indicated as mean value
5) Indicated as 10 % fractile

Table 2: Performance of the point connector of GFRP

BRCW [1]	Essential characteristic	Verification method	Performance	
4	**Safety and accessibility in use**			
	Tensile strength under high temperature (Axis 1) [2), 3)]	EN ISO 527-4	105	MPa
	Tensile strength under high temperature (Axis 2) [2), 3)]	EN ISO 527-4	277	MPa
	Tensile modulus of elasticity under high temperature (Axis 1) [3), 4)]	EN ISO 527-4	5 300	MPa
	Tensile modulus of elasticity under high temperature (Axis 2) [3), 4)]	EN ISO 527-4	8 500	MPa
	Compression strength under high temperature (Axis 1) [2), 3)]	EN ISO 14126	81	MPa
	Compression strength under high temperature (Axis 2) [2), 3)]	EN ISO 14126	84	MPa
	Compressive modulus of elasticity under high temperature (Axis 1) [3), 4)]	EN ISO 14126	10 300	MPa
	Compressive modulus of elasticity under high temperature (Axis 2) [3), 4)]	EN ISO 14126	24 100	MPa
	In-plane shear strength under high temperature (Axis 1, 2) [2), 3)]	ASTM D7078	41	MPa
	Alkali resistance in high pH solution. Reduction in strength after 50 years in full immersion [5)]	EAD 330389-00-0601	by 58	%
	Alkali resistance in high pH solution under load. Reduction in strength after 50 years in full immersion under stationary stress of 30 % of characteristic strength [5), 6)]	EAD 330389-00-0601	by 71	%
	Creep deformation after 50 years under stationary stress of 60 % characteristic strength [4), 7)]	EN ISO 899-1	0.68	—

1) Basic requirement for construction works
2) Indicated as 5 % fractile
3) At a temperature of 80 °C
4) Indicated as mean value
5) At a temperature of 23 °C
6) Bending stress
7) Given as creep coefficient $\varphi(50)$ along axis 1

$\varphi(t)$ is defined by $\varepsilon(t) = \frac{\sigma}{E} \cdot (1 + \varphi(t))$

$\varepsilon(t)$ ..... Strain at time t
$\varphi(t)$ ..... Creep coefficient at time t
σ ..... Stationary stress
E ..... Modulus of elasticity
T ..... Time

FLEXCOMP

Point connector of GFRP
Greenflex

Annex 3
of European Technical Assessment
ETA-17/0292 of 10.05.2017

Mechanical characteristics at high temperature
Alkali resistance – Creep

Table 3: Performance of the point connector of GFRP

BRCW [1]	Essential characteristic	Verification method	Performance	
4	**Safety and accessibility in use**			
	Fibre content glass fiber [2] filler	EN ISO 1172	60.7 11.9	% %
	Density [2]	EN ISO 1183-1	1 760	kg/m^3
	Coefficient of thermal expansion Axis 1 [2] Axis 2	ISO 11359-2	$18 \cdot 10^{-6}$ $12 \cdot 10^{-6}$	K^{-1} K^{-1}
	Voids content [3]	ASTM D2734	8.90 4.40	% %
	Cure ratio	CSA-S807-10	100	%
	Water absorption [3]	EN ISO 62	1.27 0.94	% %
	Thermogravimetry	EN ISO 11358-1	See Annex 5.	
	Glass transition temperature [2]	EN ISO 11357-2	85	°C
6	**Energy economy and heat retention**			
	Thermal conductivity	EN ISO 10456	0.3	$\frac{W}{m \cdot K}$

[1] Basic requirement for construction works
[2] Indicated as mean value
[3] Indicated as upper and lower 90 % confidence interval of mean value.

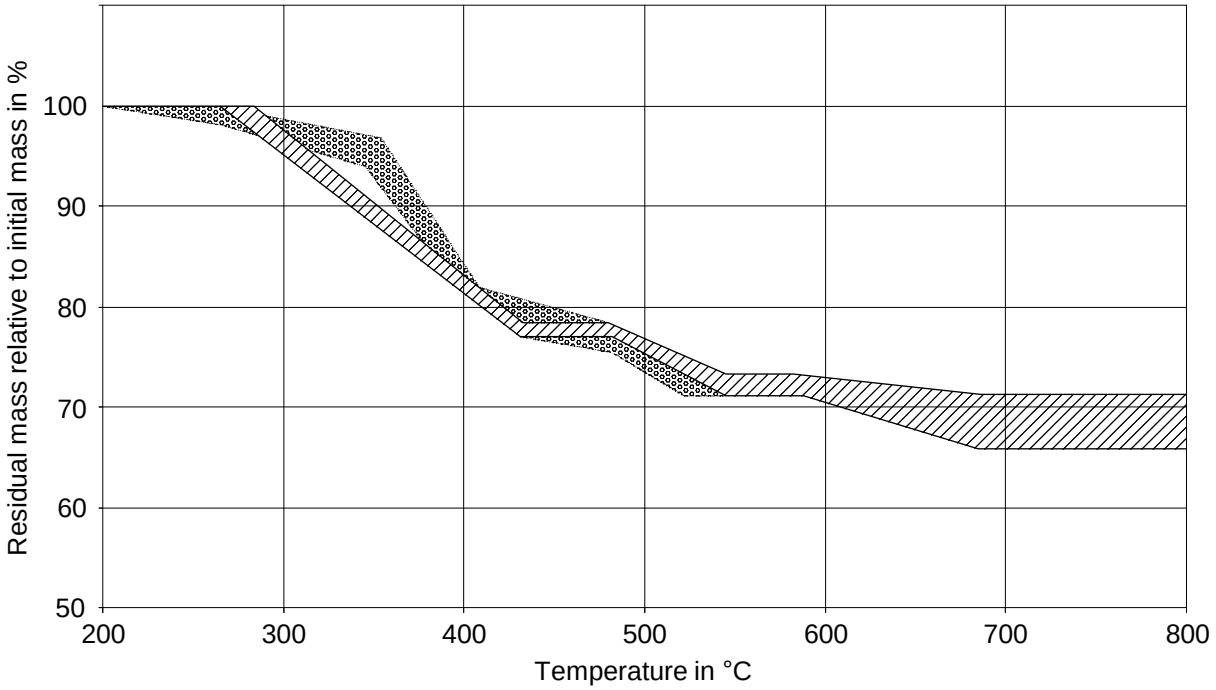
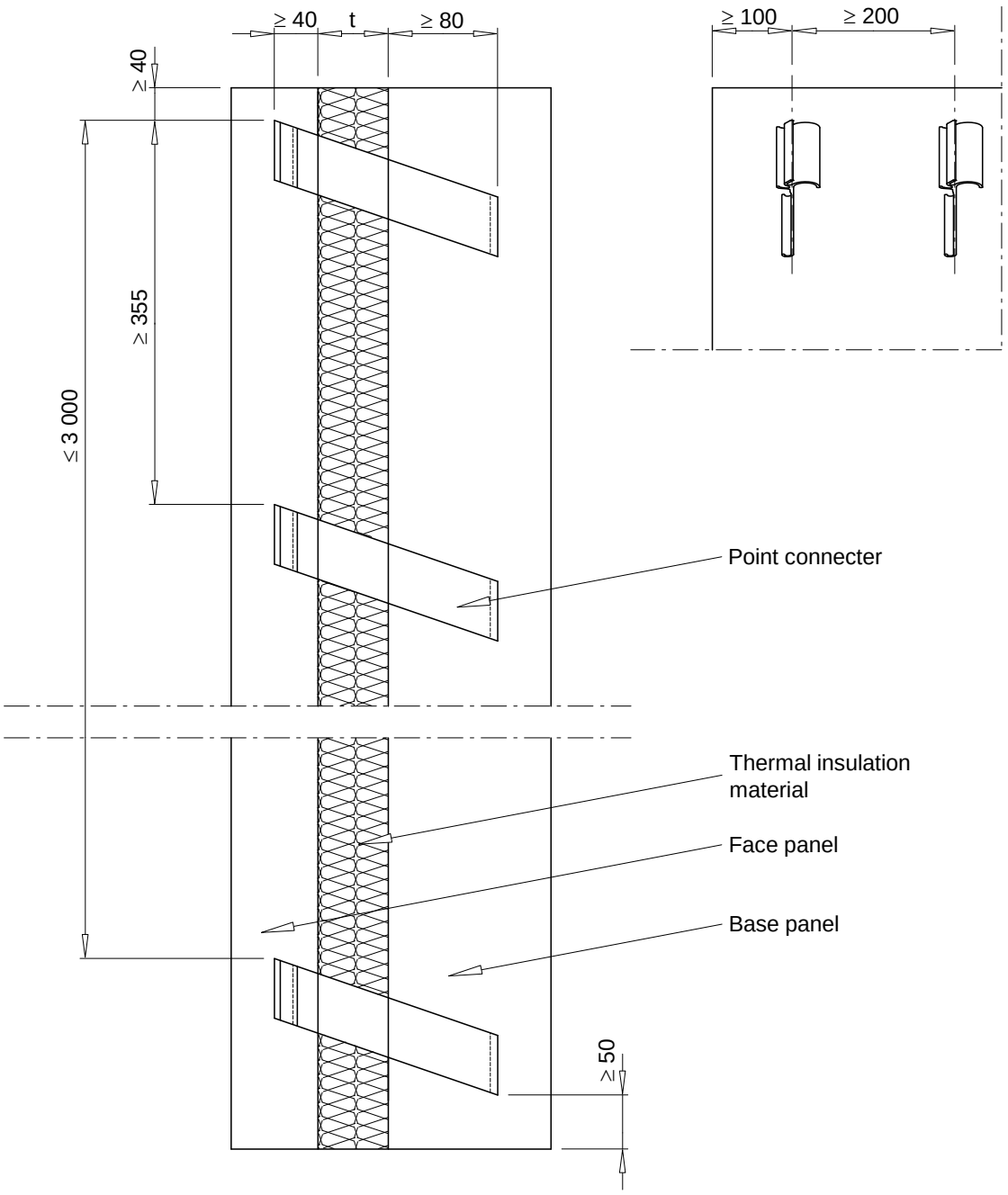


Figure 3 Thermogravimetry-curve of the point connector of GFRP

Table 4: Performance of the point connector of GFRP

BRCW [1]	Essential characteristic		Verification method	Performance	
4	**Safety and accessibility in use**				
	Thermal actions – Cyclic test in concrete [2]		EAD 330389-00-0601	4.17	kN
	Connector embedded in concrete – Resistance to tension [3]	55 mm		10.0	kN
		70 mm		5.6	kN
	Connector embedded in concrete – Resistance to shear [4]			3.4	kN

1) Basic requirement for construction works
2) Load bearing capacity after cycling loading. Indicated as single value and not a characteristic value. 65 mm thickness of layer of thermal insulation material. Concrete strength 65 MPa. Maximum centre spacing of point connector ≤ 3 000 mm.
3) Indicated as 5 % fractile for concrete failure with concrete compressive strength 30 MPa, cube 150 mm. 55 and 70 mm designate the connector sizes according to Annex 1.
4) Indicated as 5 % fractile. 55 mm connector, 65 mm thickness of layer of thermal insulation material, concrete strength 65 MPa.



Dimensions in mm

Table 5: Thickness of thermal insulation material

Size of point connector, see Annex 1	Thickness of thermal insulation material
55 mm	t ≥ 65 mm
70 mm	t ≥ 80 mm

FLEXCOMP	Point connector of GFRP Greenflex	**Annex 6** of European Technical Assessment ETA-17/0292 of 10.05.2017
Centre and edge distance		

EAD 330389-00-0601	European Assessment Document for Point connector of glass fibre reinforced polymer for sandwich walls
EN 13706-2, 10.2002	Reinforced plastic composites - Specification for pultruded profiles - Part 2: Methods of test and general requirements
EN 14992+A1, 06.2012	Precast concrete products - Wall elements
EN ISO 62, 02.2008	Plastics - Determination of water absorption
EN ISO 527-4, 04.1997	Plastics - Determination of tensile properties - Part 4: Test conditions for isotropic and orthotropic fibre-reinforced plastic composites
EN ISO 899-1, 06.2003 EN ISO 899-1/A1, 03.2015	Plastics - Determination of creep behaviour - Part 1: Tensile creep
EN ISO 1172, 08.1998	Textile-glass-reinforced plastics - Prepregs, moulding compounds and laminates - Determination of the textile-glass and mineral-filler content - Calcination methods
EN ISO 1183-1, 12.2012	Plastics - Methods for determining the density of non-cellular plastics - Part 1: Immersion method, liquid pyknometer method and titration method
EN ISO 10456, 12.2007 EN ISO 10456/AC, 12.2009	Building materials and products - Hygrothermal properties - Tabulated design values and procedures for determining declared and design thermal values
EN ISO 11357-2, 03.2014	Plastics - Differential scanning calorimetry (DSC) - Part 2: Determination of glass transition temperature and glass transition step height
EN ISO 11358-1, 07.2014	Plastics - Thermogravimetry (TG) of polymers - Part 1: General principles
EN ISO 14125, 03.1998 EN ISO 14125 Corrigendum, 05.1998 EN ISO 14125/AC, 07.2002 EN ISO 14125/A1, 02.2011	Fibre-reinforced plastic composites - Determination of flexural properties
EN ISO 14126, 09.1999 EN ISO 14126/AC, 07.2002	Fibre-reinforced plastic composites - Determination of compressive properties in the in-plane direction
EN ISO 14130, 12.1997	Fibre-reinforced plastic composites - Determination of apparent interlaminar shear strength by short-beam method
EN ISO 15310, 07.2005	Fibre-reinforced plastic composites - Determination of the in-plane shear modulus by the plate twist method
ISO 11359-2, 10.1999	Plastics - Thermomechanical analysis (TMA) - Part 2: Determination of coefficient of linear thermal expansion and glass transition temperature

CSA-S807-10, 2015	Canadian Standards Association, Specification for fibre-reinforced polymers
ASTM D2734	Standard Test Methods for Void Content of Reinforced Plastics
ASTM D7078	Standard Test Method for Shear Properties of Composite Materials by V-Notched Rail Shear Method
97/463/EC	Commission Decision 97/463/EC of 27 June 1997 on the procedure for attesting the conformity of construction products pursuant to Article 20 (2) of Council Directive 89/106/EEC as regards plastic anchors for use in concrete and masonry, OJ L 198 of 25 July 1997, p. 31
305/2011	Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011, laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC, OJ L 88 of 4 April 2011, p. 5, Amended by Commission Delegated Regulation (EU) No 568/2014 of 18 February 2014, OJ L 157 of 27 May 2014, p. 76, and Commission Delegated Regulation (EU) No 574/2014 of 21 February 2014, OJ L 159 of 28 May 2014, p. 41
2016/364	Commission delegated regulation (EU) 2016/364 of 1 July 2015 on the classification of the reaction to fire performance of construction products pursuant to Regulation (EU) № 305/2011 of the European Parliament and of the Council, OJ L 68 of 15 March 2016, p. 4