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Authorised and notified according to Article 29 of the Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011

European Technical Assessment ETA-23/0293 of 2023/11/03

I General Part

Technical Assessment Body issuing the ETA and designated according to Article 29 of the Regulation (EU) No 305/2011: ETA-Danmark A/S

Trade name of the construction product:	GC PIN
Product family to which the above construction product belongs:	Glass fibre reinforced plastic (GFRP)
Manufacturer:	Green Code GmbH Zeil 127 DE - 60313 Frankfurt Tel. + 49 69 77044046 Internet www.green-code.com
Manufacturing plant:	Green Code GmbH Zeil 127 DE-60313 Frankfurt am Main
This European Technical Assessment contains:	16 pages including 5 annexes which form an integral part of the document
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of:	EAD 330387-00-0601 Glass Fibre Reinforced Plastics (GFRP) connectors for use in sandwich and element walls made of concrete
This version replaces:	-

II SPECIFIC PART OF THE EUROPEAN TECHNICAL ASSESSMENT

1 Technical description of product

The construction product GC Pin with a nominal diameter of 16 mm is an anchor consisting of a glass fibre reinforced plastic rod for connecting precast concrete element or sandwich walls.

The anchor has a profiling in the form of thickenings up to a diameter of 20 mm. The ends of the anchors are pointed.

The anchor is set in concrete at both ends.

The anchor connects the two concrete shells with each other and transfers forces from dead load of the facing shell as well as forces caused by wind and temperature, to the load-bearing shell.

Geometry and Material
Annex 1 shows the geometry and the material properties.

Detailed specifications for identification and performance criteria relevant regard to the construction product are given in table 3.

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

The GC Pins are used when producing core insulated reinforced concrete wall panels, such as sandwich panels or element or double walls. The layers of these panels consist of a cover and a load bearing layer made of standard concrete of strength classes in the range of C20/25 to C50/60 in accordance with EN 206 and an insulation layer in between.

The load bearing layer consists of a precast part (sandwich panel), or a precast part and a layer of concrete filled in in-situ (double wall). The GC Pins are used to connect the cover layer with the load bearing layer.

There are two types of pins, the GC Pin type H, and the GC Pin type D.

The alignment of type H is perpendicular to the wall shells. For element or sandwich wall panels, where the cover layer is supported (floor-mounted) only type H are necessary. The type H absorb the forces acting perpendicular on the cover layer (e.g. from wind, temperature) and transfer them to the load bearing layer.

The type H pins are evenly distributed in a grid while maintaining the edge and center distances of the pins (see section 3.1 or Annex 3).

The number of type H pins required depends on the forces by temperature, wind or by concrete pressure during pouring of the in-situ concrete layer.

The facing shell may also impress temporary forced deformations parallel to the wall (transporting of wall) into anchors type H.

If the cover layer is freely suspended, type D pins are also required in addition to the evenly distributed type H pins.

The type D pins are installed at an angle of 45° (± 5°). The downward dead load of the outer shell (and any superimposed loads on the outer shell) is absorbed by the type D anchors in conjunction with compression-resistant insulation or additional type H-anchors (truss model). Thus, the type D pins are stressed in tension. The insulation or alternatively additional type H pins are stressed in compression. If additional type H pins are used to take up the horizontal part of the dead load of the cover layer, these must be provided below the type D pins.

The number of type D pins required depends on the weight of the outer shell (and any superimposed loads).

If type H pins are provided to hold the horizontal pressure component of the truss model, enough pins must be provided. The edge and center distances to each other and to other GC Pins must be observed.

The length of the type D pins can be calculated as:

$L_{type\ D}$ = (insulation thickness + 2 x 60) x $\sqrt{2}$

All measurements in mm.

When using type D pins in double walls, they can be installed in such a way that they are only embedded in the facing layer on one side during production. The integration into the other side occurs during the addition of the in-situ concrete layer.

If compression-resistant insulation is provided to hold the horizontal pressure component of the truss model (instead of the additional H anchors), it must meet the following requirements:

With a support anchor system, the compression-resistant thermal insulation must be installed centrally at the inclined anchor's bonding point in the transition area of core insulation and facing shell. For the compression resistant thermal insulation, a material with a minimum long-term pressure elasticity modulus value of E = 2,400 kPa and a surface of 500 x 500 mm = 250 000 mm² must be used.

If a hard foam is used, it must have a short-term compressive strength of 100 kPa for 10% compression according to e.g. EN 13163 for polystyrene. If an EPS hard foam is used, the insulating material's bulk density must be at least 20 kg/m³. The short-term elasticity modulus with a compressive load must have a minimum value of 3600 kPa.

Reinforced concrete wall panels up to size 12 x 6 m can be manufactured with the GC Pins. The direction of installation of the finished-part walls with freely suspended facing shells must be clearly indicated, for instance by using transport anchors.

The GC Pin can be used for internal and external walls.

The temperature on the surface of the concrete cover layer may between +65 °C and -20 °C (max. short term temperature). The maximum long-term temperature is 40 °C.

The pin is anchored in concrete by mechanical interlock or bond. The pin may be cast in only once. The pins are intended to be used subject to static or quasi-static loads. The loads may be permanent. The pin is used to transmit tensile or compression loads, shear loads or any combination of these loads into the concrete.

The pins are intended to be used for design analogous to EN 1992-4.

The performances in section 3 can only be assumed if the GC Pin is used according to the specifications and under the boundary conditions according to appendix B.

The provisions made in this European Technical Assessment are based on an assumed working life of the GC Pin of 50 years when installed in the works (provided that the connector is subject to appropriate installation).

The indications given on the working life cannot be interpreted as a guarantee given by the manufacturer nor by the Technical Assessment Body issuing the ETA but are to be regarded only for expressing the economically reasonable working life of the product.

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

Characteristic	Assessment of characteristic
3.1 Mechanical resistance and stability (BWR 1)	
Resistance to connector material (GFRP) failure under compression load $N_{Rk,\ GFRP,D}$ [kN]	**$N_{Rk,\ GFRP,D}$: 11.8 kN**
Resistance to concrete failure under compression load $N_{Rk,c,D}$ [kN]	**$N_{Rk,c,D}$: 13.5 kN**
Resistance to connector material (GFRP) failure under tension load $N_{Rk,GFRP}$ [kN]	**$N_{Rk,GFRP}$: 10.0 kN**
Resistance to concrete failure (cracked and uncracked concrete) under tension load	
Concrete cone or pull-out failure in low strength concrete: $N_{Rk,c,ucr}$ [kN]	**$N_{Rk,c,ucr\ (C20/25)}$: 12.7 kN**
Concrete cone or pull-out failure in high strength concrete: $N_{Rk,c,ucr}$ [kN]	**$N_{Rk,c,ucr\ (C50/60)}$: 16.3 kN**
Concrete cone or pull-out failure in cracked concrete: $N_{Rk,c,cr}$ [kN]	**No performance assessed**
Resistance after cyclic shear deformation $\alpha_{N,c,w}$	**$\alpha_{N,c,w}$: 0.864**
Concrete failure of connectors after cyclic tension load $\alpha_{N,c,N}$	**$\alpha_{N,c,N}$: 1.189**
Characteristic resistance to concrete failure under tension load $N_{Rk,c}$ [kN]	$N_{Rk,c:}$ **12.7 kN**
Resistance to connector material (GFRP) failure under shear load	
Bending or interlaminar short-term failure $V_{Rk,mat,ref}$ [kN]	**$V_{Rk,mat,ref}$: 2.7 kN**
Sustained load $h_{D,min}$ & $h_{D,max}$	**$h_{D,min}$: 60 mm** **$h_{D,max}$: 240 mm**
Resistance after cyclic shear deformation $V_{Rk,mat,w}$ [kN]	**$V_{Rk,mat,w}$: 1.5 kN**
Characteristic resistance to connector material (GFRP) failure under shear load $V_{Rk,mat}$ [kN]	**$V_{Rk,mat,ref}$: 2.7 kN**

Characteristic	Assessment of characteristic
Resistance to concrete failure under shear load	
Pry-out failure $V_{Rk,c,0}$ [kN]	**$V_{Rk,c,0}$: 2,9 kN**
Pry-out failure of connectors after cyclic shear deformation $V_{Rk,c,w}$ [kN]	**$V_{Rk,c,w}$: 2.5 kN**
Characteristic resistance to concrete failure under shear load $V_{Rk,c}$ [kN]	**$V_{Rk,c}$: 2.8 kN**
Maximum acceptable shear deformation w_{max} [mm]	**w_{max} : 2.73 mm**
Minimum edge distances and spacing c_{min} [mm], s_{min} [mm]	**c_{min} : 90 mm** **s_{min} : 180 mm**
Durability $N_{Rk,mat}$ and $V_{Rk,mat}$	**$N_{Rk,mat}$: 10.0 kN** **$V_{Rk,mat}$: 1.3 kN**
Modulus of tensile and elasticity E_M [N/mm^2]	See table below
Geometric parameters A [mm^2], I_y, I_z [mm^4]	**A : 201 [mm^2]** **I_y, I_z : 3.215[mm^4]**

Span [mm]	E_M [N/mm²]	E_N [N/mm²]
318	**1.470**	**5.400**
220	**2.372**	
120	**4.731**	

3.8 Methods of verification

The assessment of the performance of GC PIN in relation to the applicable BWR's has been made in accordance with the European Assessment Document (EAD) no. EAD 330387-00-0601 Glass fibre reinforced plastics (GFRP) connectors for use in sandwich and element walls made of concrete.

3.9 General aspects related to the fitness for use of the product.

The European Technical Assessment is issued for the product based on agreed data/information, deposited with ETA-Danmark, which identifies the product that has been assessed and judged.
Changes to the product or production process, which could result in this deposited data/information being incorrect, should be notified to ETA-Danmark before the changes are introduced.

ETA-Danmark will decide if such changes affect the ETA and consequently the validity of the CE marking based on the ETA and if so whether further assessment or alterations to the ETA, shall be necessary.

The GC PIN is manufactured in accordance with the provisions of this European Technical Assessment using the manufacturing processes as identified in the inspection of the plant by the notified inspection body and laid down in the technical documentation.

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

4.1 AVCP system

According to the decision 97/463/EC of the European Commission, the system(s) of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) is **2+**.

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

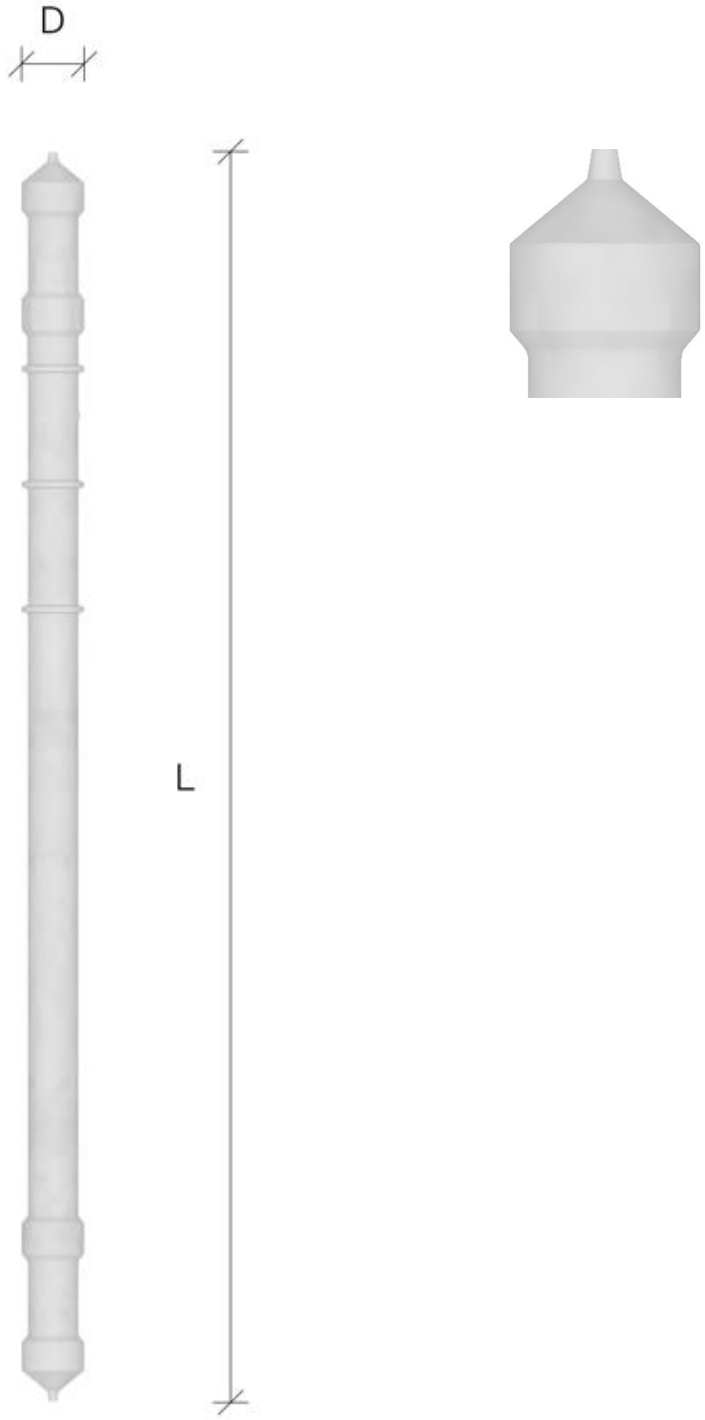
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at ETA-Danmark prior to CE marking.

Issued in Copenhagen on 2023-11-03 by

Thomas Bruun
Managing Director, ETA-Danmark

Annex 1 – Product description GC Pin, material and dimensions

Figure 1: Product description, material and dimensions



Physical properties			
Density	1350	kg/m³	ISO 1183
Water absorption (saturation)	6,7	%	ISO 62
Water absorption (equilibrium)	2,1	%	ISO 62
Mechanical properties (minimum values)			
Tensile modulus	5400	MPa	ISO 527-1,-2
Stress at break	95	Mpa	ISO 527-1,-2
Strain at break	5	%	ISO 527-1,-2

Annex 2 – GC Pin in installed condition

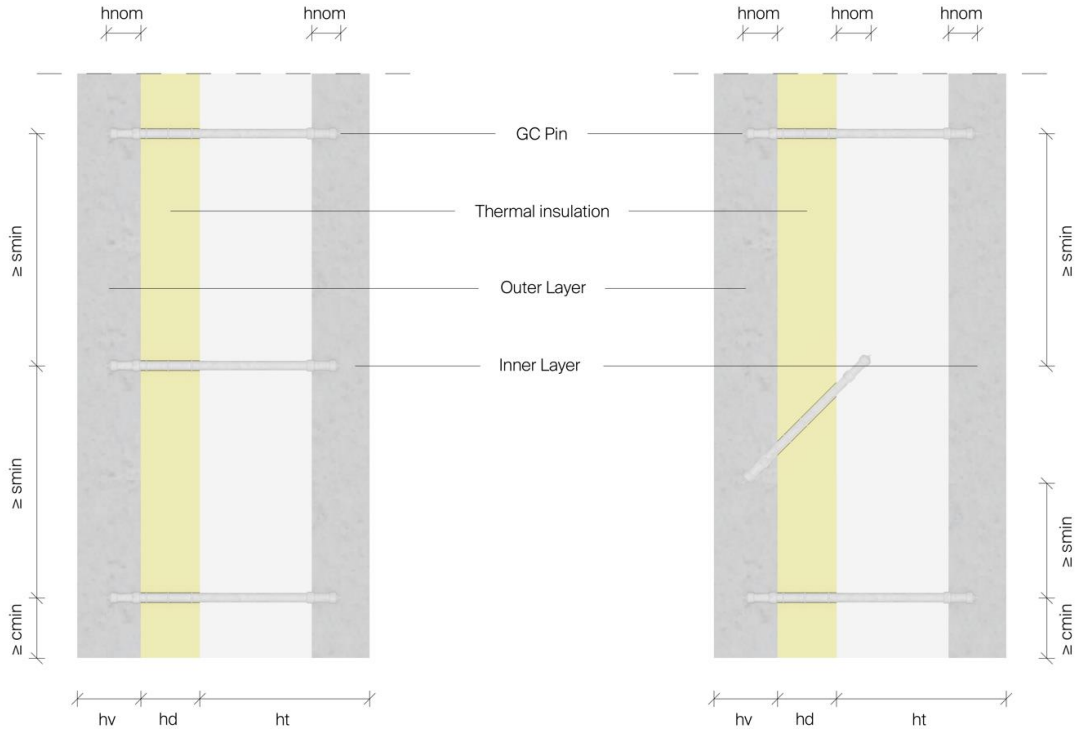


Figure 2: Vertical section insolated double wall with GC Pin in installed condition, different layers, left GC Pins type H, right GC Pin type D

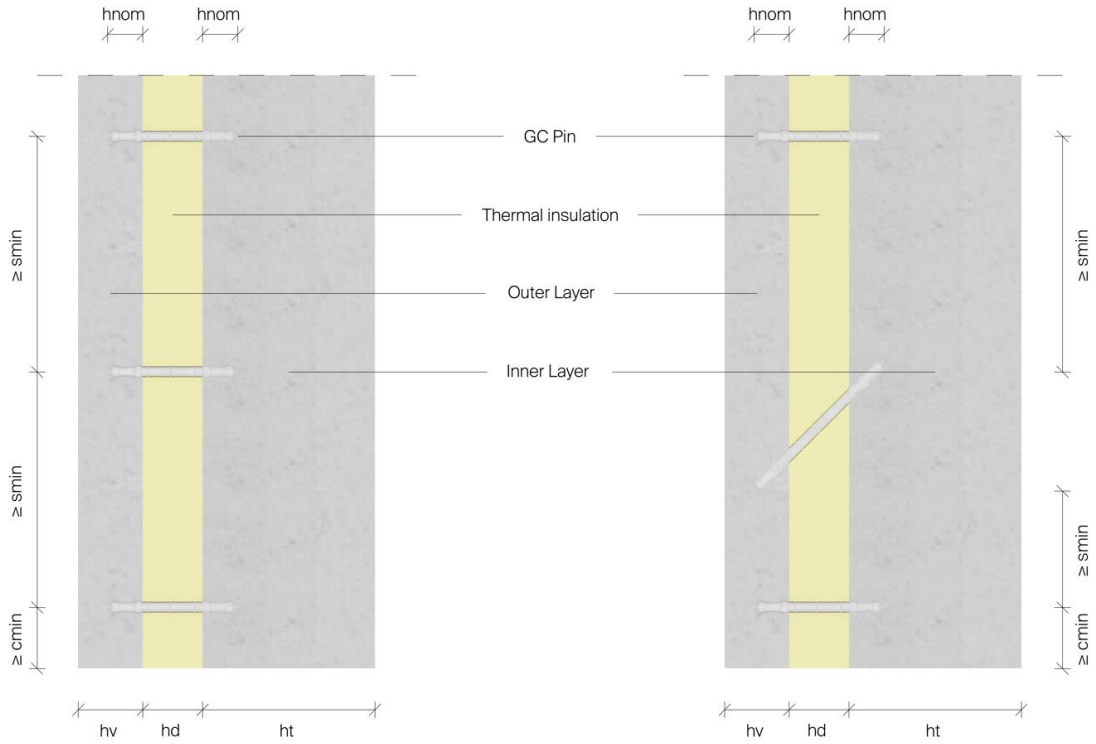


Figure 3: Vertical section sandwich wall with GC Pin in installed condition, different layers, left GC Pins type H, right GC Pin type D

Annex 3 – Application limits

Description	**Symbol**	**Value**	**Unit**
Concretes with strength class	f_{ck} / $f_{ck,cube}$	C20/25 – C50/60	N/mm²
Minimum reinforcement of both shells	$a_{s,min}$	188	mm²/m
Overall GC Pin embedment depth in the concrete	h_{nom}	≥ 60 [1)]	mm
Minimum thickness of cover layer	$h_{V,min}$	60	mm
Minimum thickness of insulation layer	$h_{D,min}$	60	mm
Maximum thickness of insulation layer	$h_{D,max}$	240	mm
Minimum thickness of structural layer – element wall	$h_{T,min}$	60 [2)] / 140 [3)]	mm
Minimum thickness of structural layer – sandwich wall	$h_{T,min}$	100	mm
Edge distance of GC Pin type H	$c_{min,H}$	≥ 90	mm
Spacing of GC Pin type H	$s_{min,H}$	≥ 180	mm
Installation angle of type D (inclined connectors)	a	45 ± 5	°
Edge distance of GC Pin type D	$c_{min,D}$	≥ 180	mm
Minimum spacing between GC Pin type H and type D	$s_{min,H-D}$	≥ 90	mm
Minimum spacing of GC Pin type D	$s_{min,D}$	≥ 180	mm
Minimum surface of the insulating material as pressure component in the support anchor system [4)]	a x b	500 x 500	mm

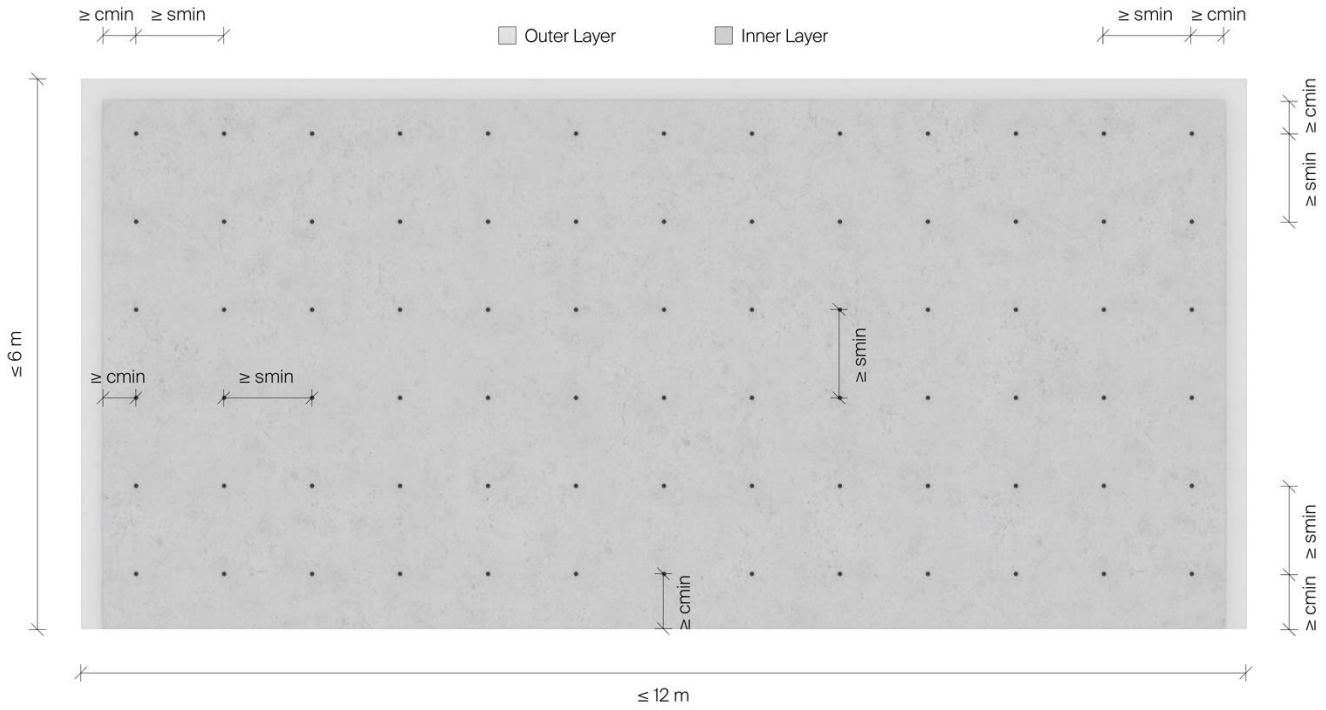
[1)] measured rectangular to the concrete surface

[2)] 60 mm: semi-precast layer

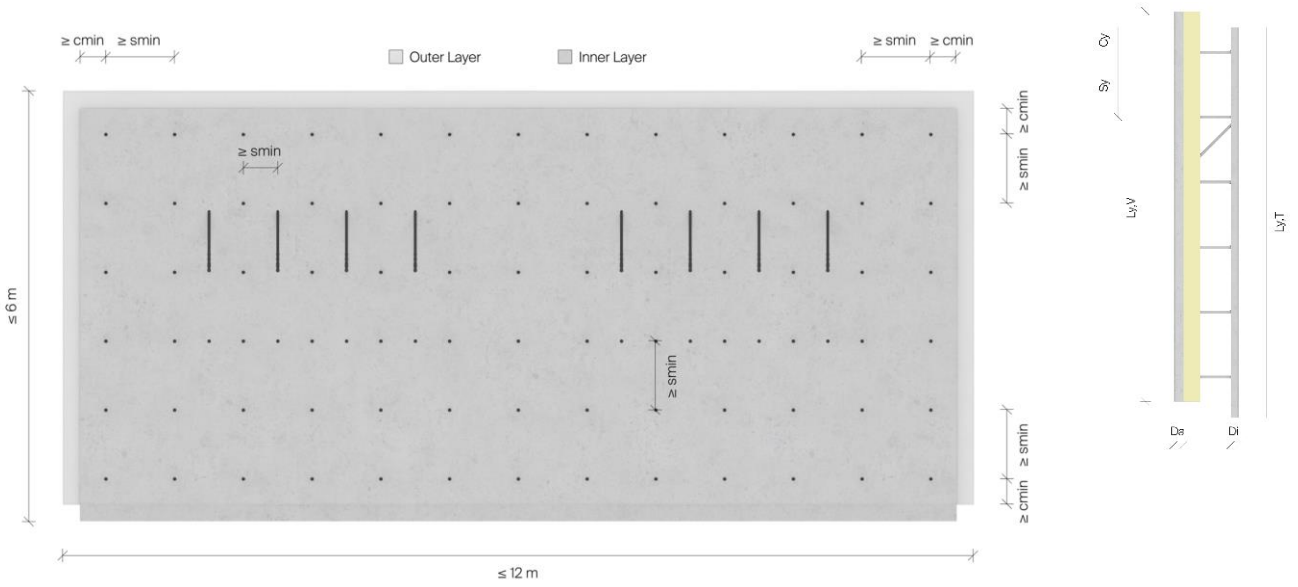
[3)] 140 mm: semi precast and in-situ concrete

[4)] See section 2 for demands on the properties of insulation

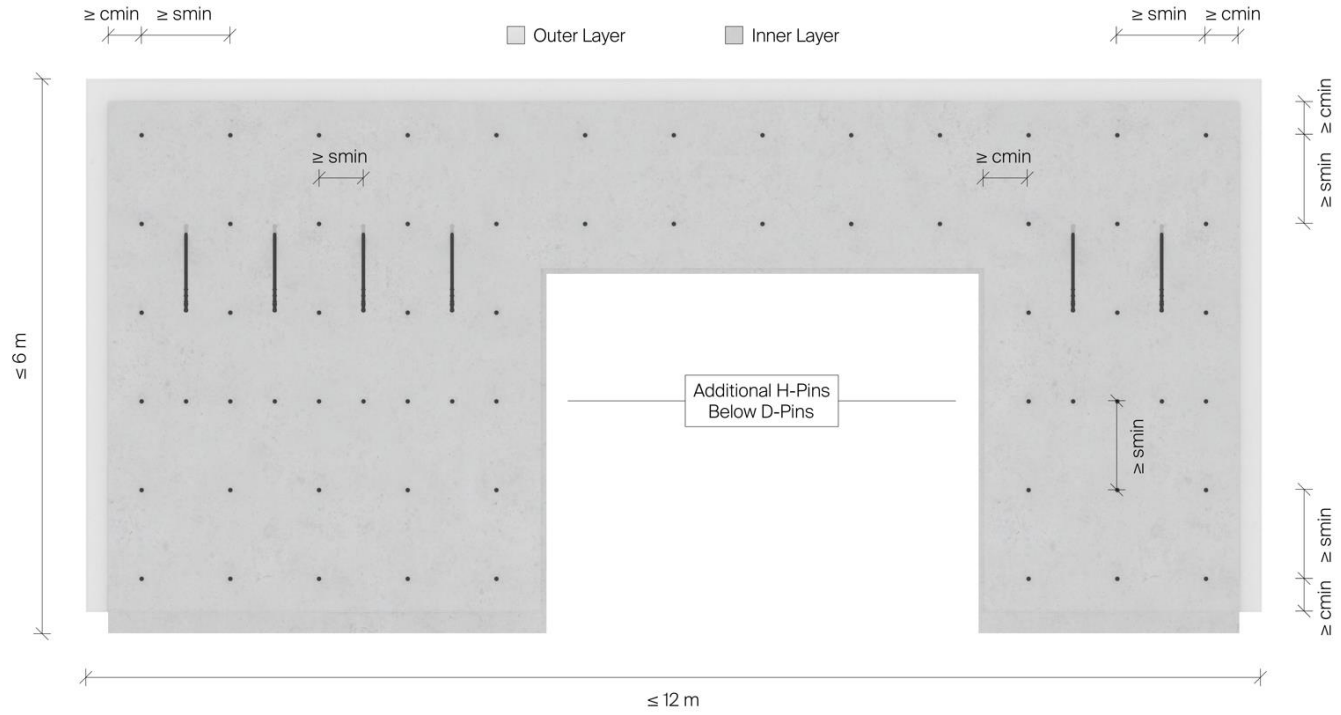
Annex 4 – Arrangement of the GC pins in compliance with the edge and centre distances



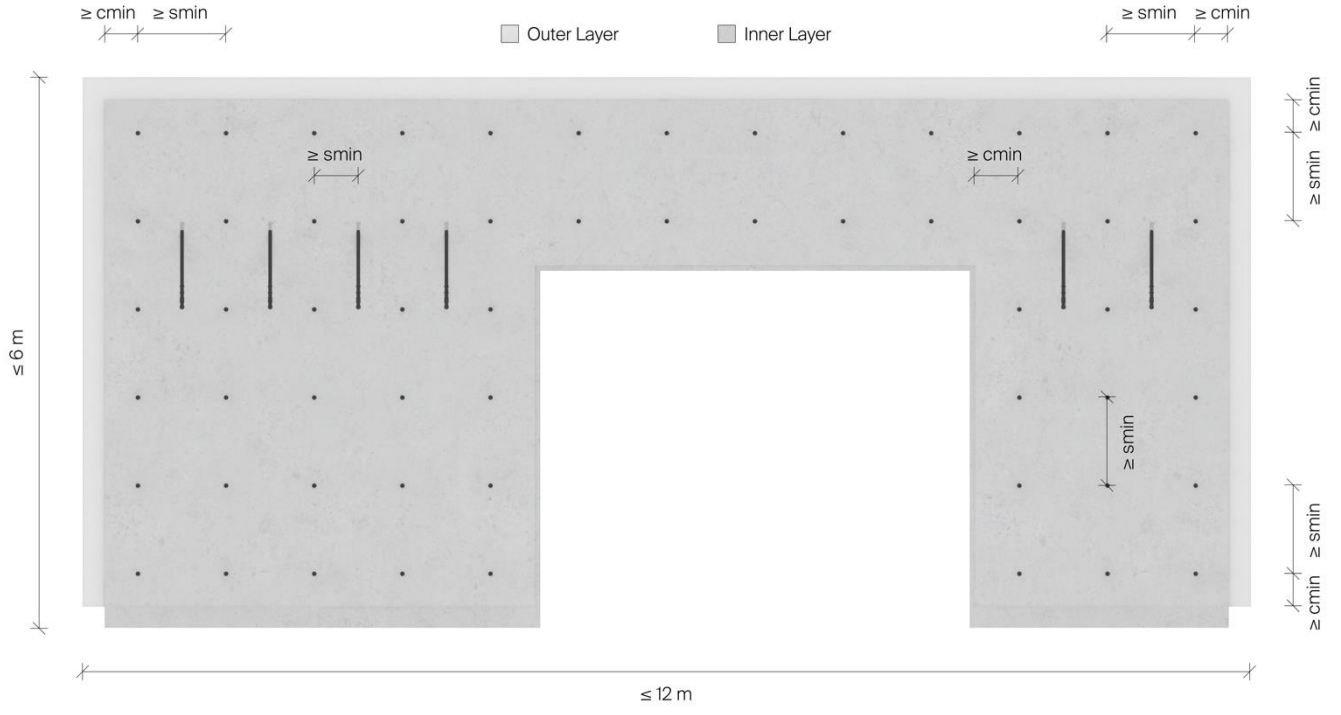
Outer layer supported



Outer layer free hanging: Use of pressure resistant insulation (No additional H-pins required)



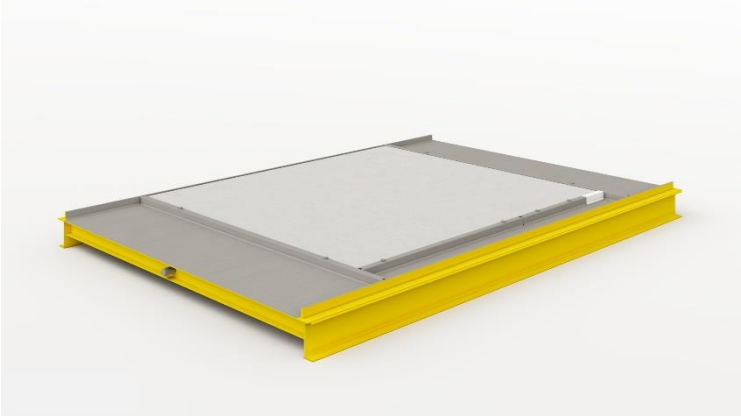
Outer layer free hanging: Use of non-pressure resistant insulation (additional H-Pins below the D-pins required).



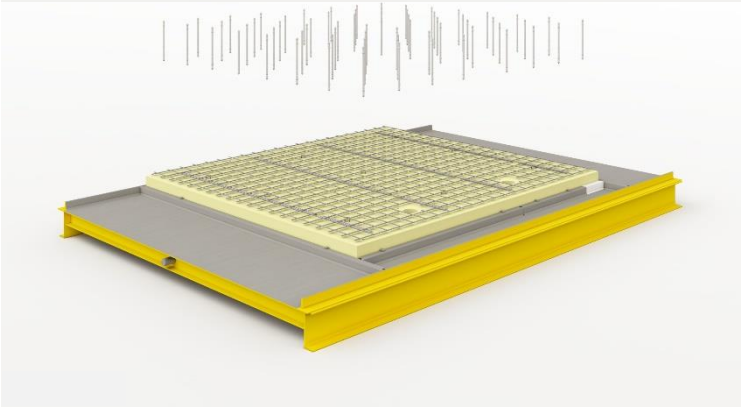
Outer layer free hanging: Use of pressure resistant insulation (No additional H-pins required)

Annex 5 – Installation instructions

Thermo wall / double wall / element wall



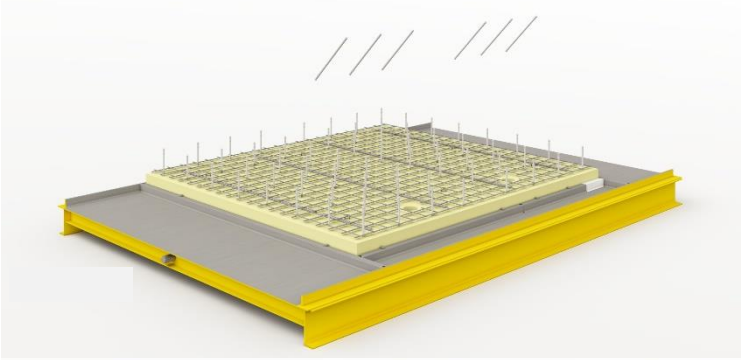
Concreting and compacting of the first layer.



Apply the insulation material to the fresh concrete of the first shell.

Insert GC pins type H in a uniform grid according the design through the insulation layer into the fresh concrete.

The GC pins must be inserted within 60 minutes after the addition of the concrete water.
Compacting the concrete of the first layer. Secure insulation against lateral displacement.



Only for free-hanging outer shells: Setting the GC pins type D under a angle of 45° ± 5° according the design.

The GC pins must be inserted within 60 minutes after the addition of the concrete water.

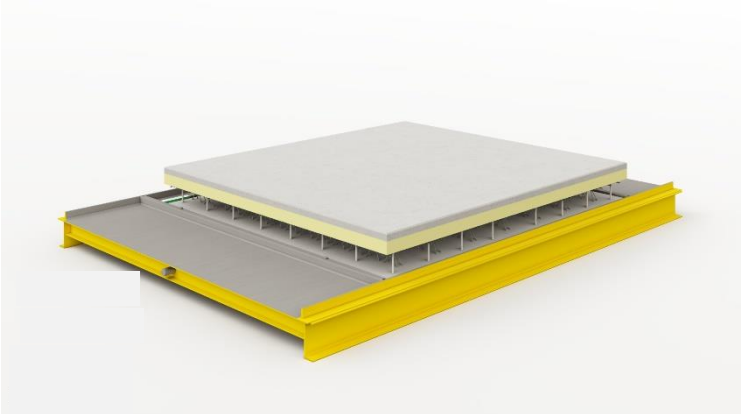
Compacting the concrete of the first layer. Secure insulation against lateral displacement.

Production of the second concrete shell.

Turn the hardened first shell with insulation GC pins and insert them into the still liquid concrete of the second shell.

Turn the hardened first shell with the GC pins and install it in the still fresh concrete of the second shell.

The GC pins must be inserted within 60 minutes after the addition of the concrete water of the second shell.

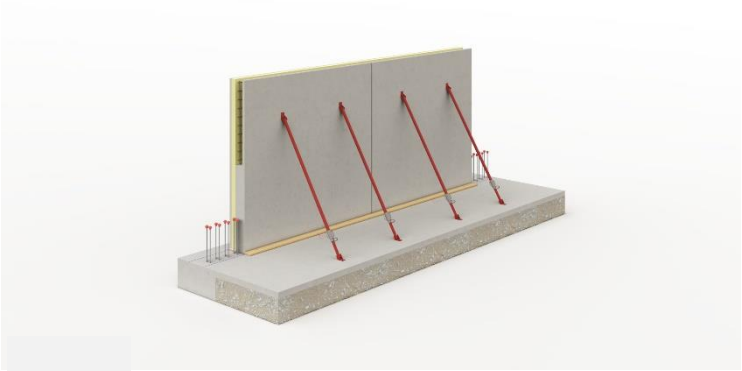


Compacting the concrete of the second layer.

Finished double wall.

Erecting the wall with tilti-up table.

Transporting the wall to the construction site.

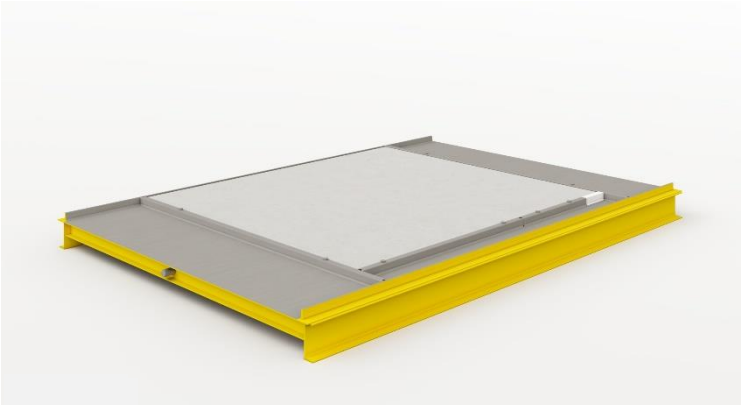


Install wall, in-situ concrete layer is added on site.

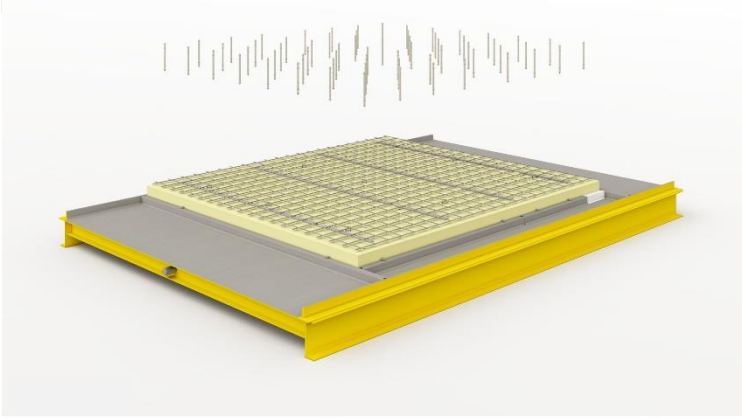
Observe concreting speed / maximum filling height according to dimensioning.

Concreting in sections may be necessary.

Sandwich wall



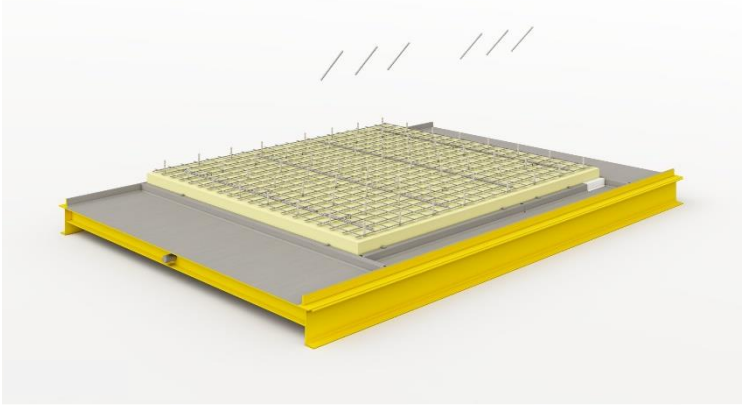
Concreting and compacting of the first layer.



Apply the insulation material to the fresh concrete of the first shell.

Insert GC pins type H in a uniform grid according the design through the insulation layer into the fresh concrete.

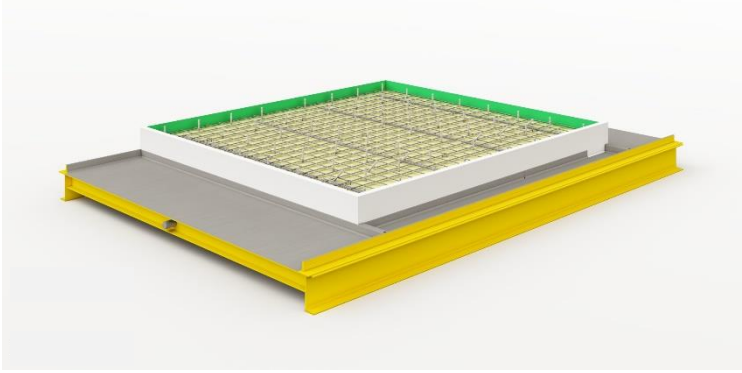
The GC pins must be inserted within 60 minutes after the addition of the concrete water.
Compacting the concrete of the first layer. Secure insulation against lateral displacement.



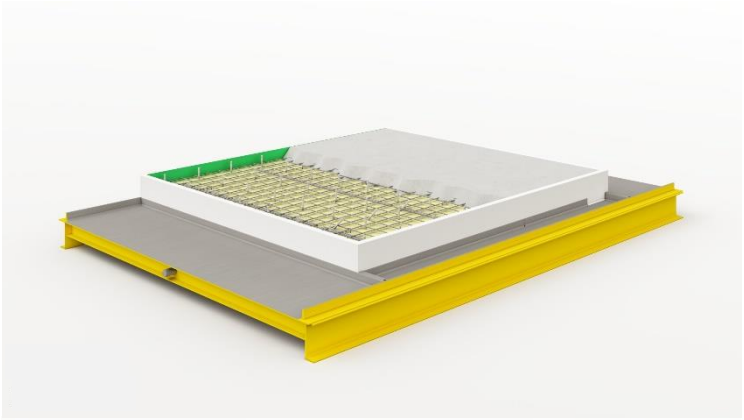
Only for free-hanging outer shells: Setting the GC pins type D under a angle of 45° ± 5° according the design.

The GC pins must be inserted within 60 minutes after the addition of the concrete water.

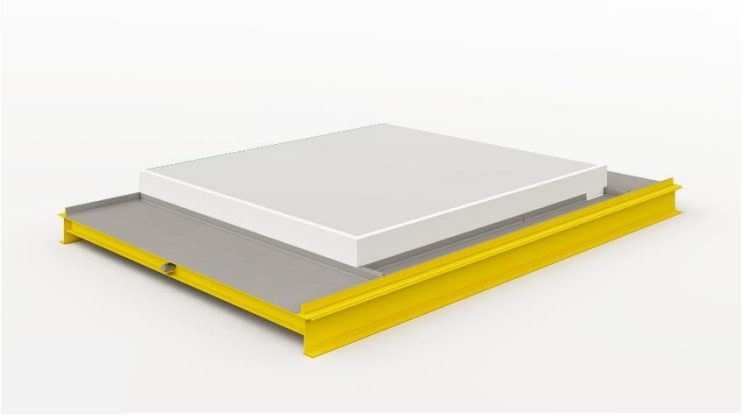
Compacting the concrete of the first layer. Secure insulation against lateral displacement.



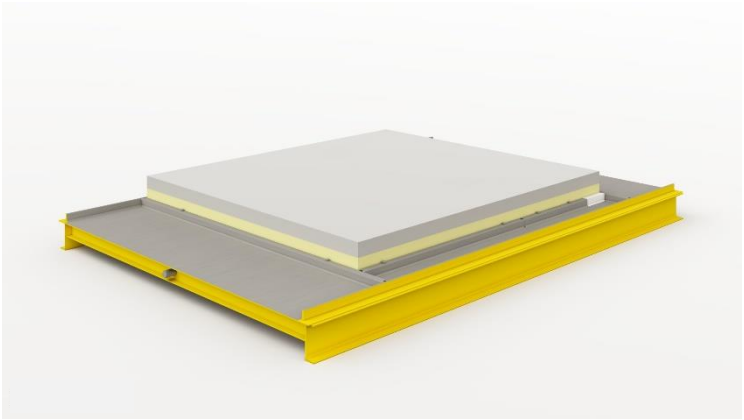
Provide formwork and reinforcement for second concrete layer



Concreting of the second layer.



Compacting of the second layer.



Remove formwork.

Finished sandwich wall.

Erecting the wall and transport to the construction site.