SANDWICH PANEL ANCHORS

Technical Product Information and Product Range

PEC Sandwich Panel Anchors

pec EUROPE

The best of both worlds!

PEC – Your expert for high-end fixing applications

We develop, produce and distribute technically sophisticated and approved products for the construction industry. The PEC product range includes anchoring, façade and system components as well as an extensive range of accessories. We combine German technical know-how with the advantageous production conditions in China. This benefits the customers of PEC, as we can not only realize high-end fixing standard applications with a wide range of ETA approved products at highly competitive costs we are also flexible to optimize a product according to your needs with the support of production and engineering.

Since December 2016 we belong to the Hilti Group in Liechtenstein. This gives our customers even more reliability and performance. Benefit from: optimized quality control, competent technical advice and training, worldwide sales and service support as well as simple and fast order processing through the expansion of our sales warehouses.

PEC – Quality management

A comprehensive quality management system according to European standards ensures technical high-end products

All testing of PEC Group Cast-in Channels and other products is performed in Germany according to European standards. Moreover continuous in-house testing is conducted and recorded on a regular basis. Third party-monitoring of ongoing production procedures is done as per relevant approval specifications which results in consistently high quality products.

PEC – Application areas

High-end fixing solutions for various application areas in the construction industry.

Office & Apartment Buildings

- Façade: Curtain Wall, Concrete facades, Brick facades
- Elevators fastening
- Supply lines fastening

Industrial Buildings

- Façade
- Machine and shelf fastening
- Supply lines fastening
- Elevators fastening

Sub- and Railway Construction

- Supply lines fastening in tunnels and stations
- Traffic signs fastening
- Evacuation platform fastening

Plant & Power Plant Construction

- Supply lines fastening
- Machine fastening
- Repair plank fastening
- Transfer conveyor fastening

Road & Bridge Construction

- Supply lines fastening in bridges
- Traffic signs fastening
- Security fence fastening
- Noise & Safety barrier fastening

Other Applications

- Stadium construction (seat fastening, fastening of precast elements & supply lines)
- Cable Cars & Airports
- Water Treatment Plants

PEC Europe GmbH | Obere Kaiserswerther Straße 56 | 47249 Duisburg / Deutschland | Phone: +49 (0) 203 - 45 65 99 0 | Fax: +49 (0) 203 - 45 65 99 25 | info@pec-europe.com

pec EUROPE The best of both worlds!

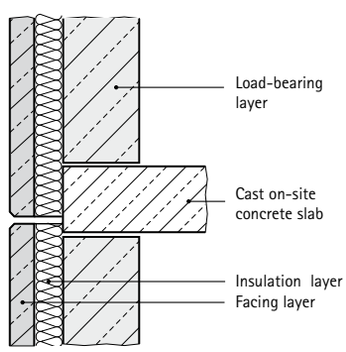
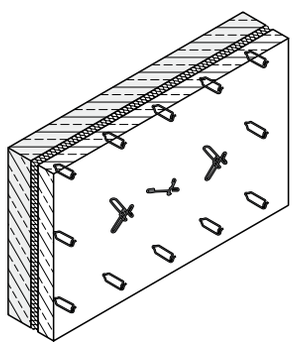
Contents

Products	Page
The PEC Group	2
Sandwich Panel Anchors	4–12
Overview	4
PEC-SPA-1/2	5
Product range overview	5
Technical details	6-7
PEC-SPA-N/B/A	8
Product range overview	9
Technical details	10
Assembly and installation	11
PEC SPA-1/2	11
PEC-SPA-N/B/A	12

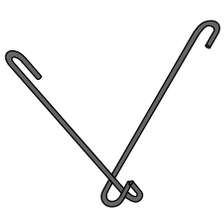
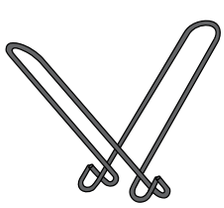
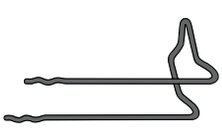
PEC Europe GmbH | Obere Kaiserswerther Straße 56 | 47249 Duisburg / Deutschland | Phone: +49 (0) 203 - 45 65 99 0 | Fax: +49 (0) 203 - 45 65 99 25 | info@pec-europe.com

PEC Sandwich panel anchors

Sandwich panels are large multilayer, reinforced concrete façade elements. They consist of a facing layer, an insulation and a load-bearing layer. The main function of the PEC sandwich anchor system is to connect the load-bearing and facing layers of sandwich panels and to transfer the forces acting on the facing layer to the load-bearing layer. In addition, restricting the expansion and contraction of the facing layer is avoided.

Typical structure of 3-layer panel	Typical application of SPAs
	

PEC-SPA Product range

SPA-1	SPA-2	Connector pin SPA-N	Stirrup SPA-B	Clip-on pin SPA-A
				

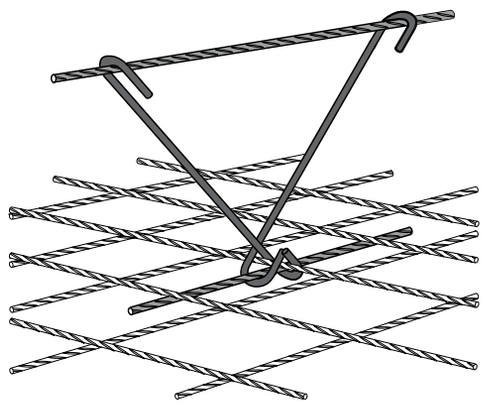
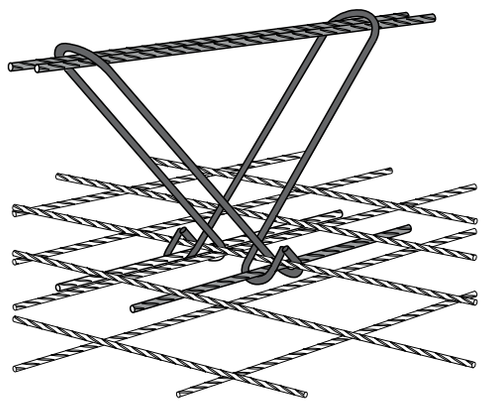
PEC-SPA Benefits

- Quick and easy installation of anchors and pins
- Reduction of mounting and planning effort
- Safety through building authority approvals
- EnEV-compatible with minimal thermal bridges through the fastening system
- Sustainability through stainless steel (materials A4 and D4 acc. to approval Z-21.8-2053, A2 on demand)
- Allows production of sandwich panels in positiv and negativ procedure
- Insulation layer thickness up to 400 mm possible

PEC Europe GmbH | Obere Kaiserswerther Straße 56 | 47249 Duisburg / Deutschland | Phone: +49 (0) 203 - 45 65 99 0 | Fax: +49 (0) 203 - 45 65 99 25 | info@pec-europe.com

PEC Supporting and horizontal anchors: PEC-SPA-1 / PEC-SPA-2

Product description

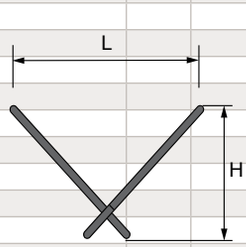
PEC-SPA-1	PEC-SPA-2
	
General information	
The Sandwich panel anchors PEC-SPA-1 and PEC-SPA-2 are V-shaped anchors of round steel bar. The bent ends secure the reinforcement bar and the anchorage in the concrete. An easy distinction is ensured due to different colour paintings. PEC supporting anchors are mainly used for carrying the resulting vertical loads from the dead load of the facing layer. Planned or unplanned eccentric loads and horizontal loads due to e.g. wind and temperature deformation should also be considered.	The PEC-SPA system SPA-1 can also be used as a horizontal anchor (if necessary the PEC-SPA-2 is as well suitable as a horizontal anchor). Primarily the horizontal anchor functions as a carrier of the horizontally acting forces (e.g. impact forces during lifting, wind forces on soffits or from panels hanging askew on the crane). To enable loads when panels are rotated for transport these anchors have to be dimensioned carefully.

Overview of available anchor heights H and lengths L (mm)

Sandwich panel anchors SPA-1 / SPA-2

Available anchor heights H and anchor lengths L (mm)

Steel bars Ø (mm) 5,0			Steel bars Ø (mm) 6,5			Steel bars Ø (mm) 8,0			Steel bars Ø (mm) 8,5			Steel bars Ø (mm) 10		
Order no. SPA-1: 401-01- SPA-2: 401-02-	H	L	Order no. SPA-1: 401-01- SPA-2: 401-02-	H	L	Order no. SPA-1: 401-01- SPA-2: 401-02-	H	L	Order no. SPA-1: 401-01- SPA-2: 401-02-	H	L	Order no. SPA-1: 401-01- SPA-2: 401-02-	H	L
04-05-140	140	225	04-07-140	140	220									
04-05-160	160	265	04-07-160	160	260									
04-05-180	180	305	04-07-180	180	300									
04-05-200	200	345	04-07-200	200	340									
			04-07-220	220	380	04-08-220	220	380	04-09-220	220	375			
			04-07-240	240	420	04-08-240	240	420	04-09-240	240	415			
			04-07-260	260	460	04-08-260	260	460	04-09-260	260	455			
						04-08-280	280	500	04-09-280	280	495			
						04-08-300	300	540	04-09-300	300	535			
						04-08-320	320	580	04-09-320	320	575			
									04-09-340	340	615	04-10-340	340	610
									04-09-360	360	655	04-10-360	360	650
										380	695	04-10-380	380	690
										400	735	04-10-400	400	730
												04-10-420	420	770
												04-10-440	440	810
												04-10-460	460	850

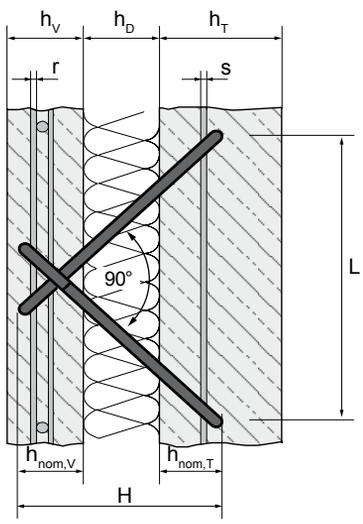


Note: Additional dimensions are available on request

PEC Europe GmbH | Obere Kaiserswerther Straße 56 | 47249 Duisburg / Deutschland | Phone: +49 (0) 203 - 45 65 99 0 | Fax: +49 (0) 203 - 45 65 99 25 | info@pec-europe.com

Technical details

Sandwich panel anchors SPA



Material
Stainless steel according to approval Z-21.8-2053
- A4: 1.4571 / 1.4401 / 1.4404
- D4: 1.4362 (Lean duplex steel)

Other steel types A2 on demand

Concrete quality
Facing layer ≥ C 30/37
Load-bearing layer ≥ C 30/37

Reinforcement
Reinforcement mesh B500A, B500B
Ribbed reinforcing bars B500A, B500B

The facing layer's minimum reinforcement
$a_S \geq 1{,}31\ cm^2/m$ per direction

Additional reinforcement for SPA
The anchoring bars must be placed in the facing and load-bearing layer. The anchor size indicates the diameter and length of the reinforcing bars.

Additional reinforcement

Type		SPA-1-05	SPA-1-07	SPA-1-08	SPA-1-09	SPA-1-10
r	Diameter [mm]	1Ø8	1Ø8	1Ø8	1Ø8	1Ø8
	Length [mm]	450	450	700	700	700
s	Diameter [mm]	1Ø8	1Ø8	1Ø8	1Ø8	1Ø8
	Length [mm]	700	700	700 *)	700 *)	700 *)
Type		SPA-2-05	SPA-2-07	SPA-2-08	SPA-2-09	SPA-2-10
r	Diameter [mm]	2Ø8	2Ø8	2Ø8	2Ø8	2Ø8
	Length [mm]	450	450	700	700	700
s	Diameter [mm]	2Ø8	2Ø8	2Ø10	2Ø10	2Ø10
	Length [mm]	700	700	700 *)	700 *)	700 **)

*) $l_S \geq 900$ mm for L > 500 mm **) 950 mm for L > 500 mm

Sandwich panel anchors' minimum embedding depth
The diameter of the supporting anchor indicates the minimum embedding depth $h_{nom,T}$ and $h_{nom,V}$ in the load-bearing and facing layer.

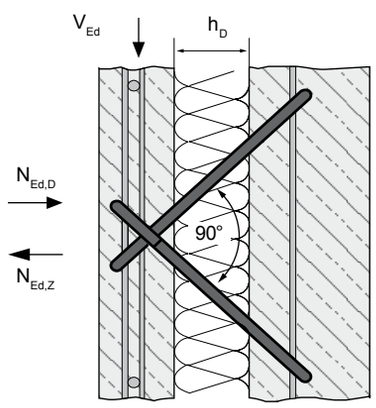
Minimum embedding depth and selection of the anchor heights [mm]

Type	SPA-1-05 SPA-2-05	SPA-1-07 SPA-2-07	SPA-1-08 SPA-2-08	SPA-1-09 SPA-2-09	SPA-1-10 SPA-2-10
Ø	5	6,5	8	8,5	10
$h_{V,min}$	70	70	70	70	70
$h_{T,min}$	100	100	100	100	100
h_D	30-150	40-200	60-250	60-300	200-400
$h_{nom,V}$	49	50	52	53	54
$h_{nom,T}$	55	55	55	55	55
i_{min}	25	25	25	25	25
H	$h_D + h_{nom,V} + h_{nom,T}$				

Further information can be found on **www.pec-europe.com**
PEC Europe GmbH | Obere Kaiserswerther Straße 56 | 47249 Duisburg / Deutschland | Phone: +49 (0) 203 - 45 65 99 0 | Fax: +49 (0) 203 - 45 65 99 25 | info@pec-europe.com

Example Anchor Calculation

Sandwich panel anchors SPA



For determining the allowable load-bearing capacity one has to consider anchor type, current horizontal loads and insulation layer thickness h_D. The permissible distances e max depend on this insulation layer thickness h_D.

The following example calculation explains and illustrates the steel load-bearing capacity and the limit of the concrete load-bearing capacity for sandwich panel anchor SPA-1-07 as well as the calculation process. Therefore the example assumes a vertical load-bearing capacity for an insulation layer thickness h_D=10 cm and an acting horizontal force of N_{Ed} [kN] = 2,5.

Determination of steel load-bearing capacity (vertical):

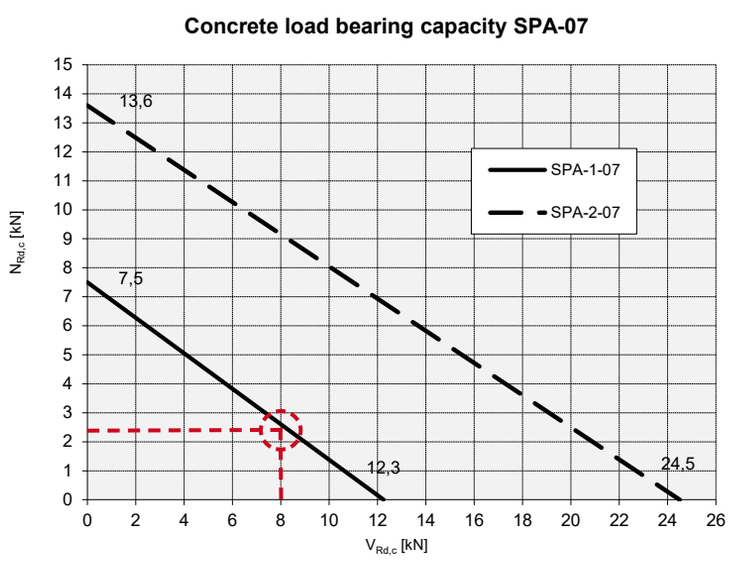
$V_{Rd,s}$ [kN] = 11,39-2,50=8,89

Extract from the load bearing capacity for PEC-SPA with Ø 6,5 mm

h_D [mm]	e_{max} [m]	SPA-1-07 Ø 6,5 mm $V_{Rd,s} = N_{Rd,s,D}$ [kN]	SPA-2-07 Ø 6,5 mm $V_{Rd,S} = N_{Rd,s,D}$ [kN]
80	2,04	13,35	26,70
90	2,52	12,34	24,68
100	3,06	11,39	22,78
110	3,64	10,50	21,00
120	4,28	9,68	19,36
130	4,97	8,93	17,86
140	5,71	8,24	16,48
150	6,50	7,61	15,23
160	7,34	7,04	14,09

Determination of concrete load-bearing capacity (vertical):

$V_{Rd,C}$ = 8,0 [kN]



PEC Europe GmbH | Obere Kaiserswerther Straße 56 | 47249 Duisburg / Deutschland | Phone: +49 (0) 203 - 45 65 99 0 | Fax: +49 (0) 203 - 45 65 99 25 | info@pec-europe.com

PEC Restraint ties: PEC-SPA-N/B/A

Product description

The PEC restraint ties are used when forces act perpendicular to the panel surface as a result from wind, temperature deformation or adhesion to formwork. See below the available product range.

PEC Restraint ties

Diameter
See measures next to the products

Material
Stainless steel according to approval Z-21.8-2053
- A4: 1.4571 / 1.4401 / 1.4404
- D4: 1.4362 (Lean duplex steel)

Other steel types A2 on demand /request

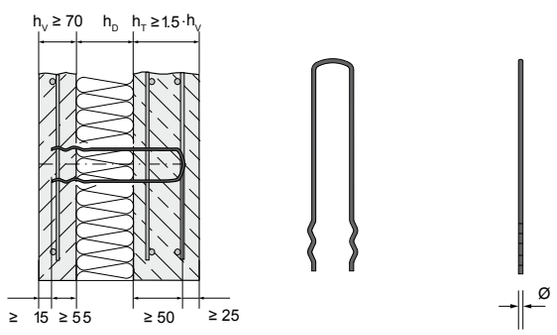
Concrete quality
Facing layer ≥ C 30/37
Load-bearing layer ≥ C 30/37

Reinforcement
Reinforcement mesh B500A, B500B
Ribbed reinforcing bars B500A, B500B

The facing layer's minimum reinforcement
$a_S \geq 1{,}31\ cm^2/m$ per direction

Product range of PEC restraint ties

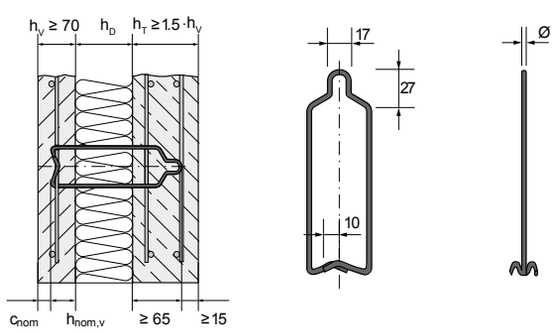
PEC Connector pins SPA-N



Diameter
3.0 mm / 4.0 mm / 5.0 mm / 6,5 mm

PEC Connector pins SPA-N are U-shaped bent wires. Not only the round end of the anchor but also the corrugated ends are anchored in the concrete.

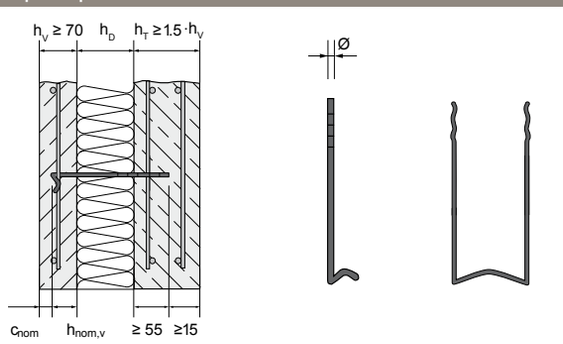
PEC Stirrup ties SPA-B



Diameter
3.0 mm / 4.0 mm / 5.0 mm

PEC Stirrup ties SPA-B are bent wires. They are anchored and positioned by hooking the bars around the reinforcement mat. Both ends are anchored in the concrete.

PEC Clip-on pins SPA-A



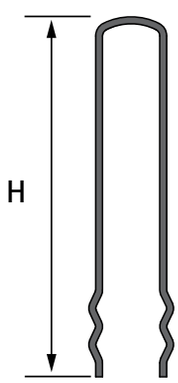
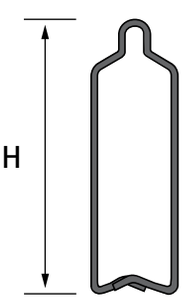
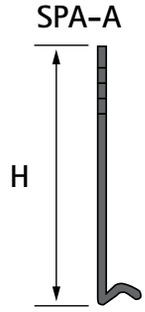
Diameter
3.0 mm / 4.0 mm / 5.0 mm

PEC Clip-on pins SPA-A are connector pins with the addition that the U-shaped end is bent 90 degrees. The corrugated end is anchored in the concrete. On the other side the end is hooked to bars in the reinforcement mesh.

PEC Europe GmbH | Obere Kaiserswerther Straße 56 | 47249 Duisburg / Deutschland | Phone: +49 (0) 203 - 45 65 99 0 | Fax: +49 (0) 203 - 45 65 99 25 | info@pec-europe.com

Overview of available anchor heights H (mm)

Connector pins SPA-N, stirup ties SPA-B, clip-on pins SPA-A

Anchor type	Round bar Ø 3,0 mm		Round bar Ø 4,0 mm		Round bar Ø 5,0 mm		Round bar Ø 6,5 mm	
	Order no. SPA-N: 401-03-	H	Order no. SPA-N: 401-03-	H	Order no. SPA-N: 401-03-	H	Order no. SPA-N: 401-03-	H
SPA-N 	04-03-120	120						
	04-03-140	140						
	04-03-160	160	04-04-160	160				
	04-03-180	180	04-04-180	180				
	04-03-200	200	04-04-200	200	04-05-200	200		
			04-04-220	220	04-05-220	220		
			04-04-240	240	04-05-240	240		
			04-04-260	260	04-05-260	260		
			04-04-280	280	04-05-280	280		
			04-04-300	300	04-05-300	300		
					04-05-320	320	04-06-320	320
					04-05-340	340	04-06-340	340
							04-06-360	360
							04-06-380	380
							04-06-400	400
							04-06-420	420
							04-06-440	440
							04-06-460	460
SPA-B 	Order no. SPA-B: 401-04-	H	Order no. SPA-B: 401-04-	H	Order no. SPA-B: 401-04-	H		
	04-03-160	160	04-04-160	160				
	04-03-180	180	04-04-180	180				
			04-04-200	200				
			04-04-220	220				
			04-04-240	240	04-05-240	240		
			04-04-250	250	04-05-250	250		
					04-05-260	260		
					04-05-280	280		
					04-05-300	300		
					04-05-320	320		
SPA-A 	Order no. SPA-A: 401-05-	H	Order no. SPA-A: 401-05-	H	Order no. SPA-A: 401-05-	H		
	04-03-120	120						
	04-03-140	140						
	04-03-160	160	04-04-160	160	04-05-160	160		
	04-03-180	180	04-04-180	180	04-05-180	180		
			04-04-200	200	04-05-200	200		
			04-04-220	220	04-05-220	220		
			04-04-240	240	04-05-240	240		
			04-04-250	250	04-05-250	250		
			04-04-280	280	04-05-280	280		
			04-04-300	300	04-05-300	300		
					04-05-320	320		
					04-05-340	340		

Subject to design changes

Note: Additional dimensions are available on request

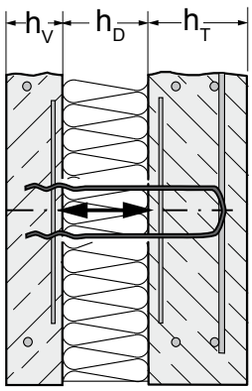
Further information can be found on **www.pec-europe.com**

PEC Europe GmbH | Obere Kaiserswerther Straße 56 | 47249 Duisburg / Deutschland | Phone: +49 (0) 203 - 45 65 99 0 | Fax: +49 (0) 203 - 45 65 99 25 | info@pec-europe.com

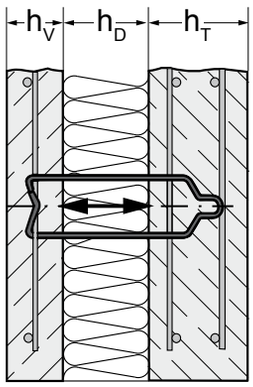
Technical details

The insulation layer thickness h_D is the indicator for determining the maximal admissible distances (e_{max}) as you can see below as well as the admissible horizontal load-bearing strengths N(rd).

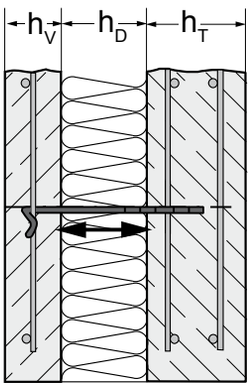
SPA-N



SPA-B



SPA-A



Overview of technical data

	SPA-N/A/B-03, Ø3 mm				SPA-N/A/B-04, Ø4 mm					SPA-N/A/B-05, Ø5 mm					SPA-N-06, Ø6,5 mm			
N_{Rd} [kN]	1,50	2,40	3,00	3,80	3,00	3,60	4,30	5,10	6,60	3,90	4,50	5,10	5,80	6,70	4,30	5,10	5,80	6,60
h_D [mm]	e_{max} [m]																	
30	1,62	1,55	1,46	1,35	1,44	1,41	1,38	1,35	1,29	1,39	1,38	1,37	1,36	1,35	1,36	1,36	1,36	1,36
40	2,65	2,53	2,38	2,20	2,30	2,26	2,21	2,16	2,06	2,18	2,16	2,15	2,13	2,10	2,07	2,07	2,07	2,07
50	3,92	3,75	3,53	3,27	3,36	3,29	3,22	3,15	3,01	3,13	3,11	3,09	3,06	3,03	2,93	2,93	2,93	2,93
60	5,45	5,20	4,90	+4,54	4,62	4,53	4,43	4,34	4,14	4,26	4,23	4,21	4,17	4,12	3,93	3,93	3,93	3,93
70	7,22	6,90	6,50	+6,02	6,08	5,96	5,83	5,70	5,45	5,57	5,53	5,49	5,44	5,39	5,08	5,08	5,08	5,08
80	9,25	8,83	+8,32	+7,70	7,74	7,58	7,42	7,26	+6,94	7,05	6,99	6,95	6,89	6,82	6,38	6,38	6,38	6,38
90	10,00	10,00	+10	+9,60	9,60	9,40	9,20	9,00	+8,60	8,70	8,63	8,58	8,50	8,42	7,82	7,82	7,82	7,82
100	10,00	+10	+10	+10	10,00	10,00	10,00	10,00	+10	10,00	10,00	10,00	10,00	10,00	9,41	9,41	9,41	9,41
110	10	+10	+10	+10	10	10	10	+10	+10	10	10	10	10	10	10	10	10	10
120	10	+10	+10	+10	10	10	10	+10	+10	10	10	10	10	10	10	10	10	10
130	10	+10	+10	+10	10	10	+10	+10	+10	10	10	10	10	10	10	10	10	10
140	+10	+10	+10	+10	10	10	+10	+10	+10	10	10	10	10	10	10	10	10	10
150	+10	+10	+10	+10	10	+10	+10	+10	+10	10	10	10	10	10	10	10	10	10
160					10	+10	+10	+10	+10	10	10	10	10	+10	10	10	10	10
170					+10	+10	+10	+10	+10	10	10	10	10	+10	10	10	10	10
180					+10	+10	+10	+10	+10	10	10	10	+10	+10	10	10	10	10
190										10	10	10	+10	+10	10	10	10	10
200										10	10	+10	+10	+10	10	10	10	10
210										10	10	+10	+10	+10	10	10	10	10
220										10	+10	+10	+10	+10	10	10	10	10
230										10	+10	+10	+10	+10	10	10	10	10
240										+10	+10	+10	+10	+10	10	10	10	10
250										+10	+10	+10	+10	+10	10	10	10	10
260										+10	+10	+10	+10	+10	10	10	10	10
270															10	10	10	10
280															10	10	10	10
290															10	10	10	10
300															10	10	10	10
310															10	10	10	+10
320															10	10	10	+10
330															10	10	10	+10
340															10	10	+10	+10
350															10	10	+10	+10
360															10	10	+10	+10
370															10	+10	+10	+10
380															10	+10	+10	+10
390															10	+10	+10	+10
400															10	+10	+10	+10

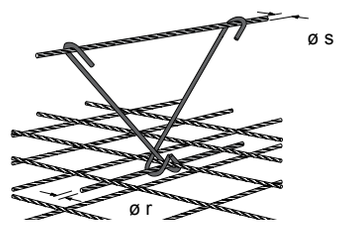
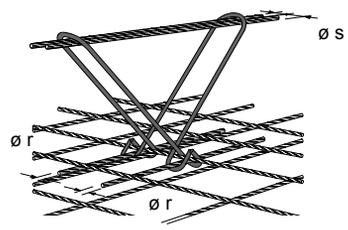
Values marked with "+" in dark cells are only allowable with tensile stress

PEC Europe GmbH | Obere Kaiserswerther Straße 56 | 47249 Duisburg / Deutschland | Phone: +49 (0) 203 - 45 65 99 0 | Fax: +49 (0) 203 - 45 65 99 25 | info@pec-europe.com

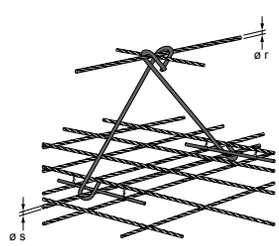
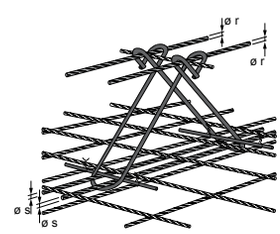
Assembly and installation

Supporting and horizontal anchor: PEC-SPA-1/2

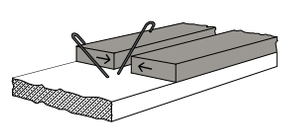
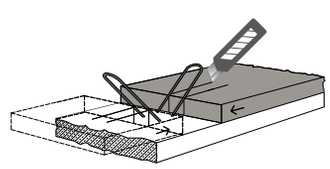
Negative installation process

Installation steps	Drawings
Step 1 The support anchors must be placed on the reinforcement mesh and secured under the mesh using one or two reinforcing bars. **Step 2** After pouring the bottom facing layer concrete, the insulation can be installed and the bottom reinforcing layer can be laid for the load-bearing layer. **Step 3** Tie 1 or 2 reinforcing bars to the inside of the top loops of the support anchor. The amount of ties depends on the anchor type. **Step 4** Fix towards the centre of a grid square.	PEC-SPA-1  PEC-SPA-2 

Positive installation process

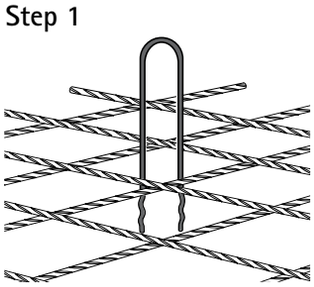
Installation steps	Drawings
Step 1 Install the supporting anchors in the top reinforcement mesh of the load-bearing layer. **Step 2** Wire the welded bars to the mesh and secure the same with the secondary rebars. **Step 3** After pouring the concrete and fitting the insulation, place the facing layer mesh under the exposed hook in the anchor and secure it together with the secondary rebars. Connector pins type SPA-N are used for horizontal anchoring.	PEC-SPA-1  PEC-SPA-2 

Installation of heat insulation layer

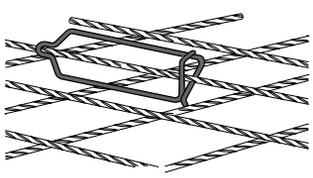
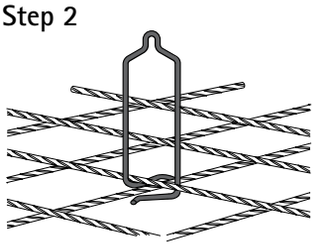
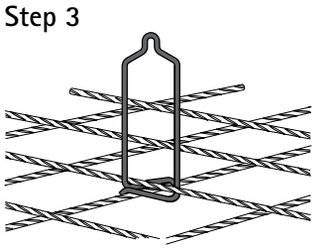
Type	Installation steps	Drawings
PEC-SPA-1	1. Cut the insulation along the longitudinal axis of the anchor. 2. Push the segments back together.	
PEC-SPA-2	1. Make two cuts in the insulation to position the anchor bars, the space between two bars. 2. Push the halves over the bars of the anchor from each side to close the gap.	

Restraint ties: PEC-SPA-N/B/A

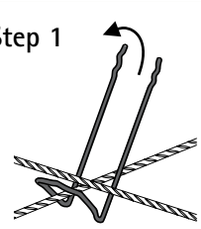
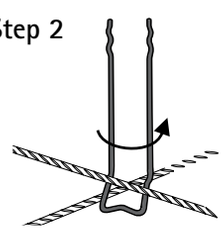
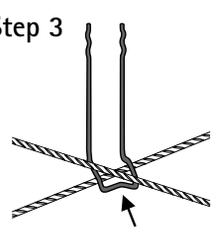
PEC Connector pin SPA-N

Installation steps	Drawings
Step 1 The connector pin must be pressed into the soft concrete of the facing layer. Observe the minimum depth of 55 mm (see the minimum embedding depth for the round end of the connector pin.) Connector pins has to be pushed through the insulation layer.	Step 1 

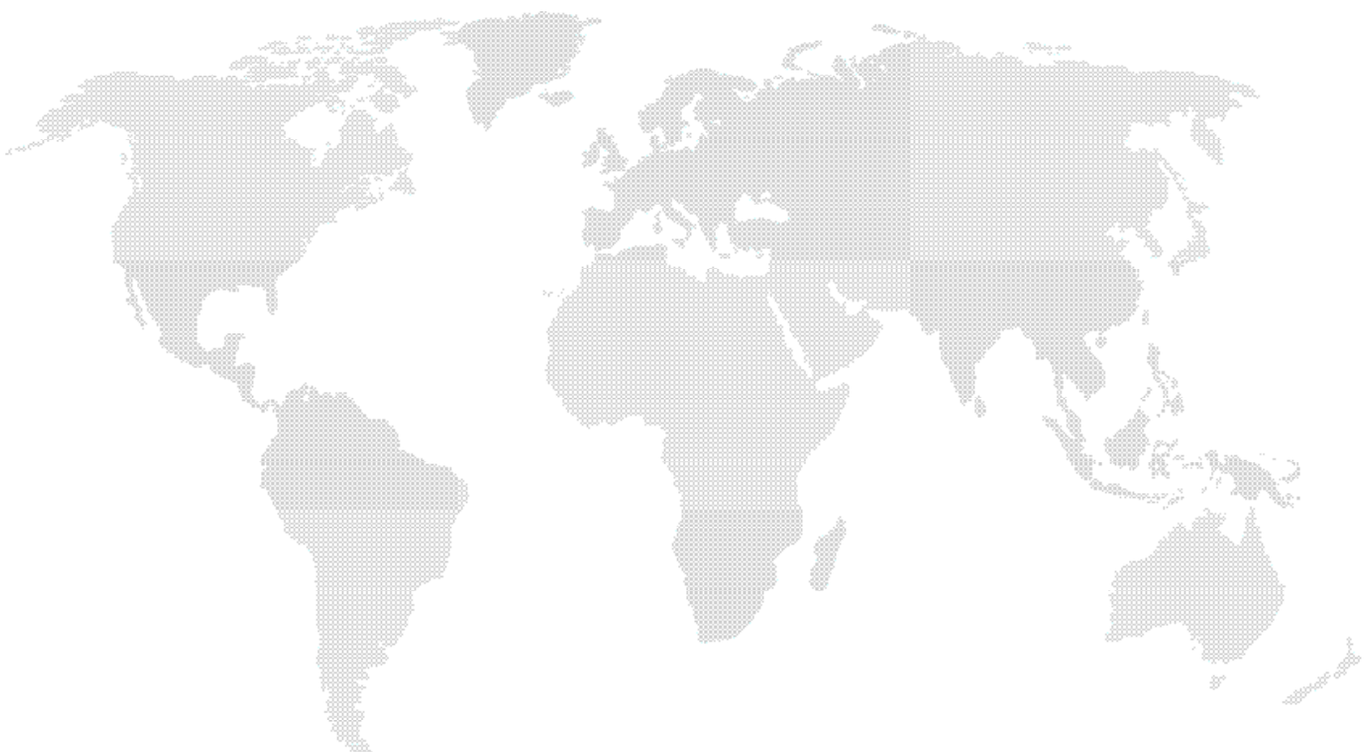
PEC Stirrup tie SPA-B

Installation steps	Drawings
Step 1 Hook under the top reinforcing bar as shown below. **Step 2** Turn it to an upright position. **Step 3** Turn it clockwise while pressing the legs together and clip onto the bottom reinforcing bar at the same time. Styropor can be pressed over the stirrups. When using extruded hard foam, the insulation should be cut at the anchor positions to avoid bending.	Step 1  Step 2  Step 3 

PEC Clip-on pin SPA-A

Installation steps	Drawings
Step 1 Pass the clip-on pin under the top reinforcing bar and swing to an upright position. **Step 2** Twist the clip on pin to the left over the bottom reinforcing bar. **Step 3** Clip the clip-on pin firmly to the mat node. The insulation can pressed over the corrugated ends.	Step 1  Step 2  Step 3 

PEC Europe GmbH | Obere Kaiserswerther Straße 56 | 47249 Duisburg / Deutschland | Phone: +49 (0) 203 - 45 65 99 0 | Fax: +49 (0) 203 - 45 65 99 25 | info@pec-europe.com



www.pec-europe.com

PEC Europe GmbH

Obere Kaiserswerther Straße 56
47249 Duisburg / Germany
Phone: +49 (0) 203 - 45 65 99 0
Fax: +49 (0) 203 - 45 65 99 25
info@pec-europe.com

pec EUROPE
The best of both worlds!

For more information, please visit our website at www.pec-europe.com

PEC SPA 12 / 2016 E