Façade Support & Restraints
Sandwich panel anchor

Leviat
A CRH COMPANY

Halfen Sandwich Panel Anchors

Technical Product Information

Imagine. Model. Make.

Leviat
A CRH COMPANY

We imagine, model and make engineered products and innovative construction solutions that help turn architectural visions into reality and enable our construction partners to build better, safer, stronger and faster.

Leviat is a world leader in connecting, fixing, lifting and anchoring technology.

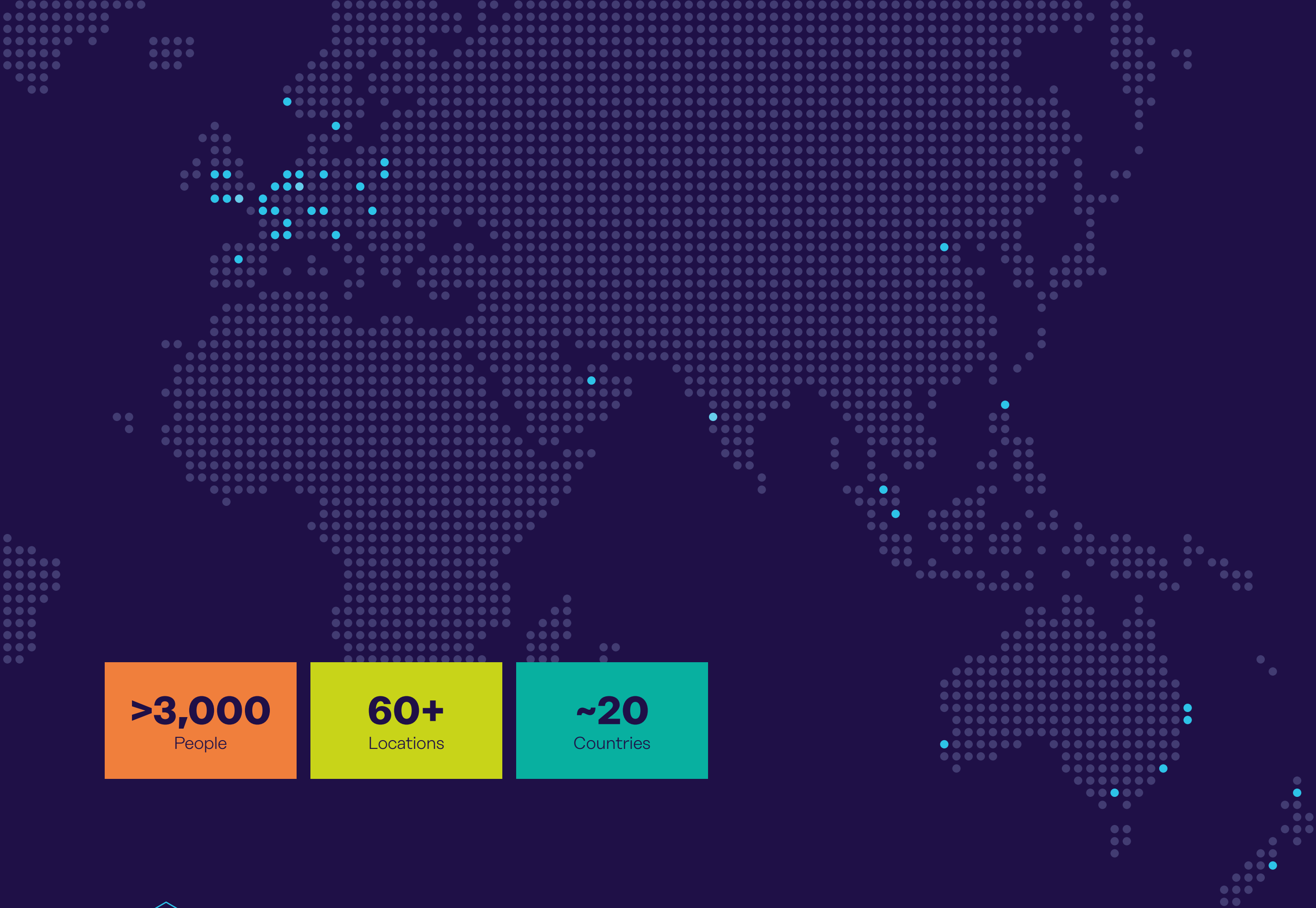
From the build of new schools, hospitals, homes and infrastructure, to the repair and maintenance of heritage structures, our engineering skills are making a difference around the world.

We provide technical design assistance at every stage of a project, from initial planning to installation and beyond.

Our technical support services range from simple product selection through to the development of a fully customised project-specific design solution.

Every promise we make locally, has the commitment and dedication of our global team behind it. We employ almost 3,000 people at 60 locations across North America, Europe and Asia-Pacific, providing an agile and responsive service worldwide.

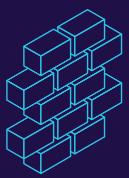
Leviat, a CRH company, is part of the world's leading building materials business.



>3,000
People

60+
Locations

~20
Countries

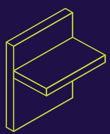


Façade Support & Restraint

Systems for the safe and thermally-efficient fixing of the external building envelope, including brick and natural stone, insulated sandwich panels, curtain walling and suspended concrete façades, and also the repair and strengthening of existing masonry installations.

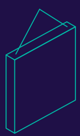
- Masonry Support Systems
- Windposts
- Lintels
- Brick Slip Systems
- Wall Ties & Restraints
- Masonry Reinforcement
- Natural Stone Façade Systems
- Cavity Trays
- Sandwich Panel anchor
- Suspended concrete façade
- Masonry Repair

Other areas of expertise:



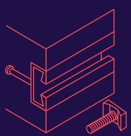
Structural Connections

Systems to form robust, efficient connections, and continuity of concrete reinforcement as necessary, between walls, slabs, columns, beams and balconies, providing structural integrity as well as enhanced thermal and acoustic performance.



Lifting & Bracing

Systems for the safe and efficient transportation, lifting and temporary bracing of cast concrete elements and tilt-up panels before permanent structural connections are made.

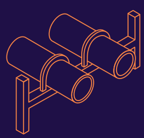


Anchoring & Fixing

Systems for fixing secondary fixtures to concrete, including anchor channels, bolts and inserts; also tension rod systems for roofs and canopies.

Formwork & Site Accessories

Non-structural accessories that complement our engineered solutions and help keep your construction environment operating safely and efficiently, including moulds for casting standard and special concrete elements and construction essentials such as reinforcing bar spacers.



Industrial Technology

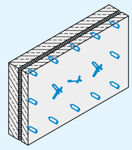
Mounting channels, pipe clamps and other versatile framing systems that provide safe fixing in a wide range of industrial applications.

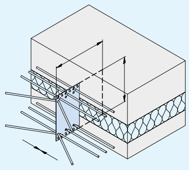
Leviat product ranges:

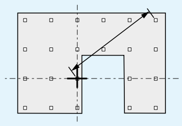
Ancon | Aschwanden | Connolly | Halfen | Helifix | Isedio | Meadow Burke | Modersohn | Moment | Plaka | Scaldex | Thermomass

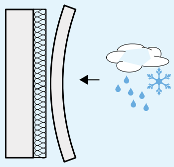
Halfen Sandwich Panel Anchors
Contents

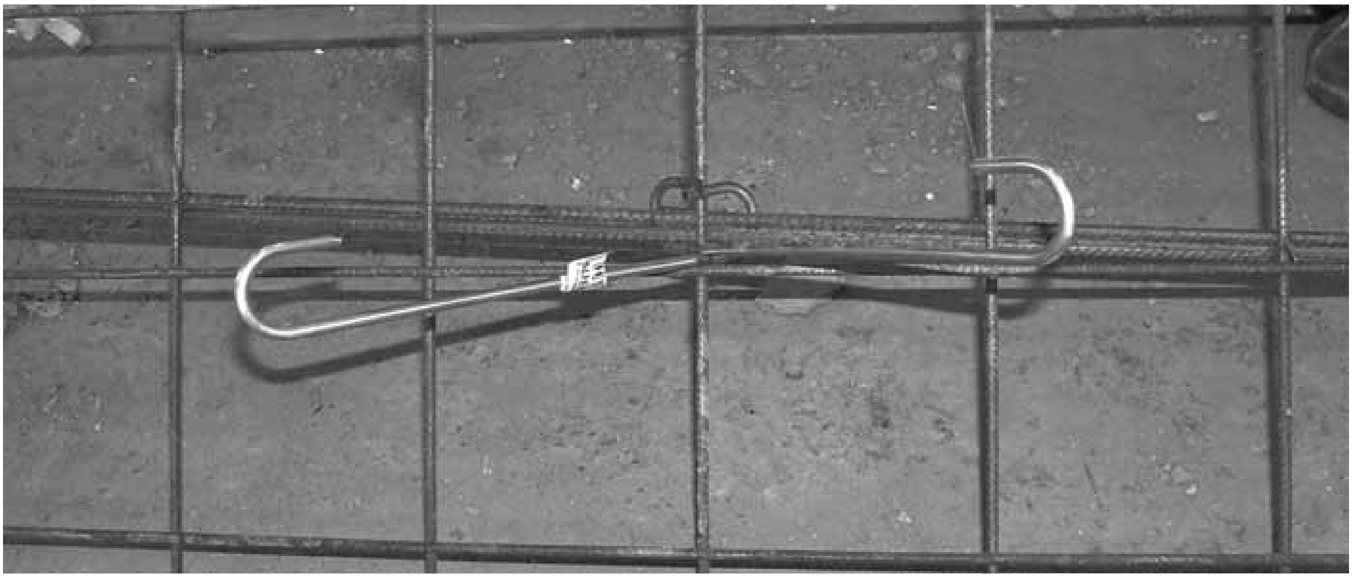
Contents











Halfen Sandwich Panel Anchors

Information

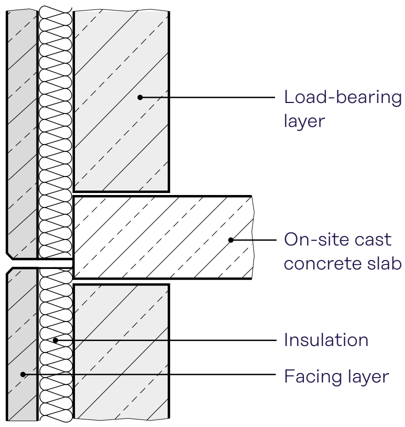
Sandwich panel system

Sandwich panels are multi-layered, large format reinforced concrete façade elements. They're made of a facing layer, a thermal insulation layer and a load-bearing layer (3 layer panel).

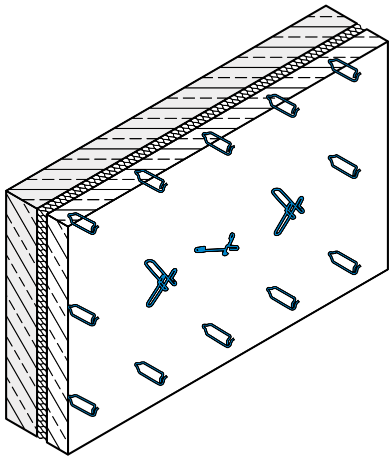
Building physics may require an air gap (ventilation gap) be designed between the thermal insulation layer and the facing layer (4 layer panel).

Sandwich panel anchors are used to connect the facing layer with the load supporting layer.

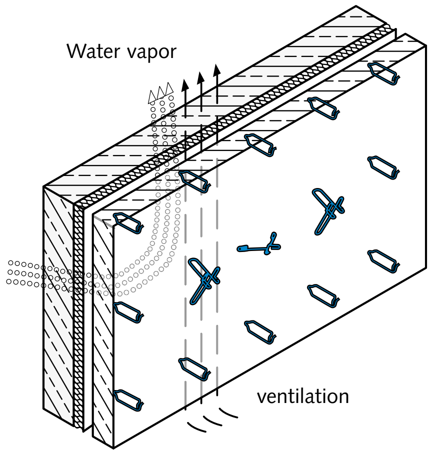
Typical section of a 3 layer panel



Sandwich panel - no ventilation gap 3 layer panel



Sandwich panel with ventilation gap 4 layer panel



Demands on the anchorage system

Halfen Sandwich panel anchor systems are used to connect the load-bearing and the facing layers of sandwich panels.

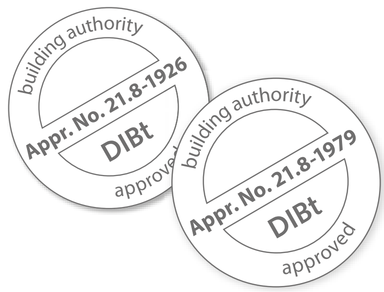
On the one hand, stresses acting on the facing layer must be safely transferred to the main support layer and, on the other hand, constraints in the facing layer must be prevented.

All connections in the system are exposed to corrosive environments and must therefore be made of stainless steel.

The following must be considered when designing the anchors in a sandwich panel:

- Dead weight of the facing layer
- Wind load
- Temperature difference in the facing layer (warping)
- Mean (medium) temperature change in the facing layer (change in length)
- Formwork adhesion
- Transport and installation loads
- Creepage and shrinkage

The Halfen SPA and FA Sandwich panel anchor systems are building authority approved.



Materials: Abbreviations and descriptions

A4/L4 = Steel, corrosion resistance class (CRC) III in accordance with DIN EN 1993-1-4: 2015-10, Table A.3

Halfen Sandwich PanelAnchors

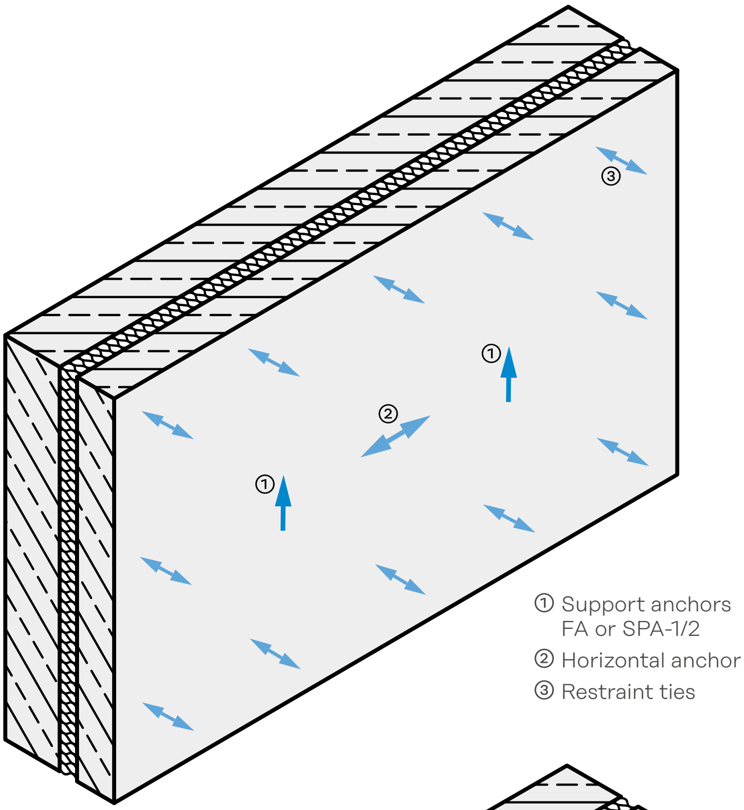
Overview of support systems

Support systems

Leviat supplies three different systems for connecting facing layers to the load-bearing layer in sandwich panels.

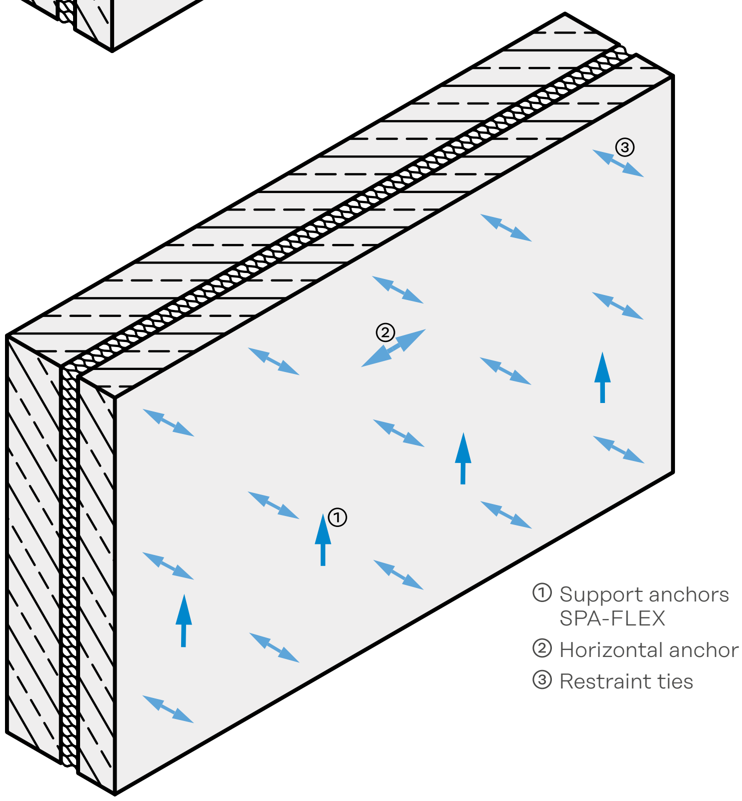
FA and SPA-1/-2 System

With the **FA** and **SPA-1/-2** systems, the dead-weight of the facing layer is transferred by two vertically aligned FA or SPA-1/-2 support anchor pair(s) ①. A horizontal anchor (pair) ② is arranged in the horizontal direction as close as possible to the centre of gravity of the sandwich panel to transfer loads, for example, from transport or assembly. In the remaining area, restraint ties ③ are arranged in as even a grid as possible to transfer the tension/compressive loads from wind and temperature.



SPA-FLEX System

In the **SPA-FLEX** system, the dead-weight of the facing layer is transferred by at least two vertically aligned SPA-FLEX load-bearing anchors ①. A horizontal anchor (pair) ② is arranged in the horizontal direction as close as possible to the centre of gravity of the sandwich panel to transfer loads, for example, from transport or assembly. Restraint ties are arranged over the remaining panel, in as even a grid as possible, to transfer tension/compressive loads resulting from wind and temperature. Restraint ties ③ arranged around the SPA-FLEX Support anchors must also be dimensioned for the resultant pressure load as the SPA-FLEX Anchors are installed at 45° from the vertical.

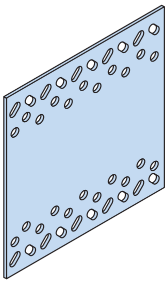


Halfen Sandwich Panel Anchors

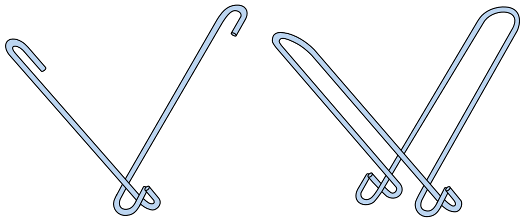
Overview of support systems

Support anchor

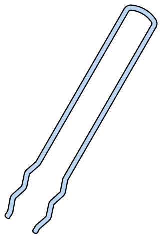
FA, SPA-1/-2 and SPA-FLEX can be used as support anchors and are dimensioned primarily to support vertical loads from the dead weight of the facing layer.
In addition, FA and SPA-1/-2 Flat anchors must also be designed for the transfer of proportional horizonal loads (for example, from wind, warping).



FA see page 6



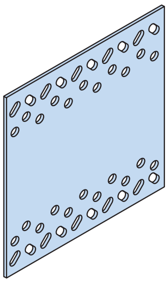
SPA-1/-2 see page 10



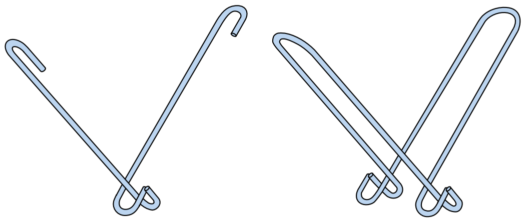
SPA-FLEX see page 14

Horizontal anchor

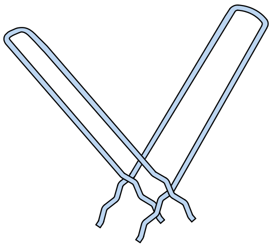
FA, SPA-1/-2 and anchor pairs consisting of SPA-FLEX Anchors arranged opposite each other can be used as horizontal anchors and must be dimensioned to transfer horizontal loads from transport and assembly as well as the transfer of proportional horizontal loads from wind and warping.



FA see page 6



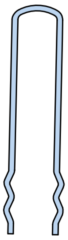
SPA-1/-2 see page 10



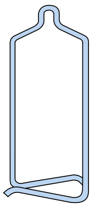
SPA-FLEX see page 14

Restraint ties

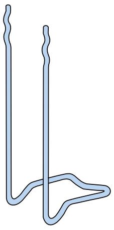
SPA-N Connector pins, SPA-B Stirrups ties and SPA-A Clip-on pins can be used as restraint ties and must be designed for loads acting perpendicular to the layer surface caused by temperature-warping, by wind or adhesion to the formwork.



SPA-N see page 18



SPA-B see page 18



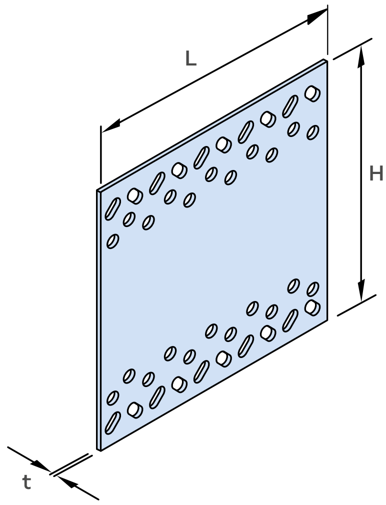
SPA-A see page 18

Halfen Sandwich Panel Anchors

Flat anchor FA

Description, identification

Article name: SP-FA-1 - height [mm] - length [mm]
SP-FA-2 - height [mm] - length [mm]
SP-FA-3 - height [mm] - length [mm]



Flat anchors are available in the following thicknesses:
t = 1.5 mm / 2.0 mm / 3.0 mm

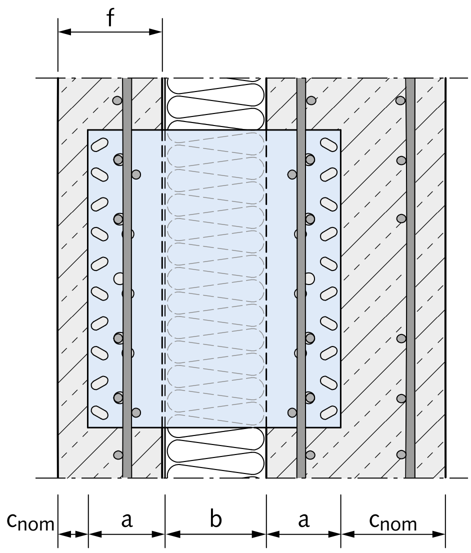
Round and oval holes are located on the two opposite sides of this anchor. The round holes are used to accommodate anchorage bars, the oval holes are used to bond with the concrete. The flat anchor can be used as a support anchor or horizontal anchor. The anchors are marked for easy identification showing the plate thickness, anchor height and anchor length.

Material: A4/L4
(Material specification → page 3)

Order example:

SP - FA - 2 - 225 - 240
① ② ③ ④ ⑤

① Article group
② Anchor type
③ Material thickness t
④ Anchor height H [mm]
⑤ Anchor length L [mm]



Anchor selection, embedment depths

Selecting the FA anchor height
The height (H) of the flat anchor depends on the thickness of the insulation layer (b) and the embedment depth (a).

$$H \geq 2 \times a + b$$

Embedment depths a, Concrete cover c_{nom} [mm]		
f [mm]	b = 30–250 mm	
	a [mm]	c_{nom} [mm]
60 ①	≥ 50	≥ 10
70 – 120	≥ 55	≥ 15

① In acc. with EN 1992-1-1/NA:2013-04 applies for slab thickness: f_{min} ≥ 70 mm.

Anchor heights H [mm]															
f [mm]	b [mm]														
	30	40	50	60	70	80	90	100	120	140	160	180	200	230	250
60 ①	150	150	175	175	175	200	200	225	225	260	280	300*	325*	350*	375*
70 – 120	150	150	175	175	200	200	200	225	260	260	280	300*	325*	350*	375*

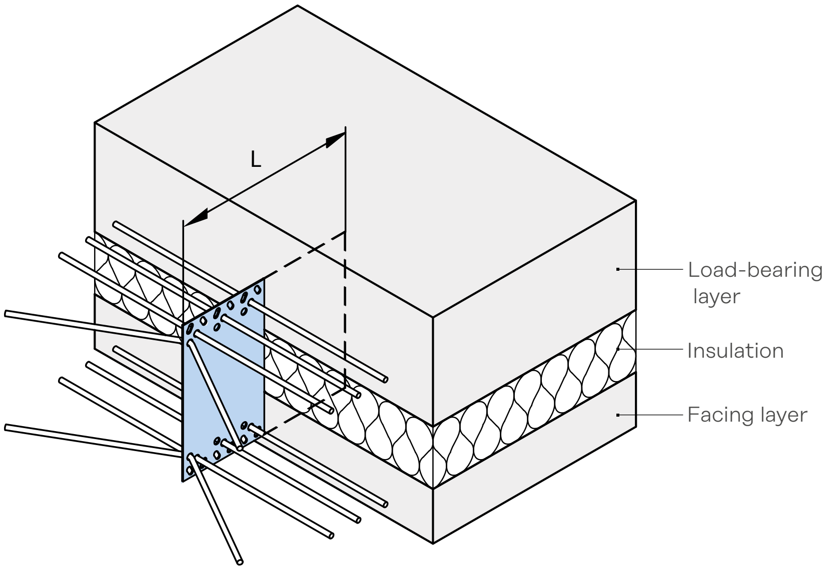
① In acc. with EN 1992-1-1/NA:2013-04 applies for slab thickness: f_{min} ≥ 70 mm.
* on request

Halfen Sandwich Panel Anchors

Flat anchor FA

Installation

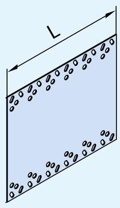
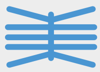
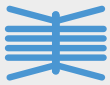
FA Flat anchors must be fixed to the panel reinforcement with anchorage bars. For a more detailed description of the installation procedure please refer to the installation instruction SP at www.halfen.com.

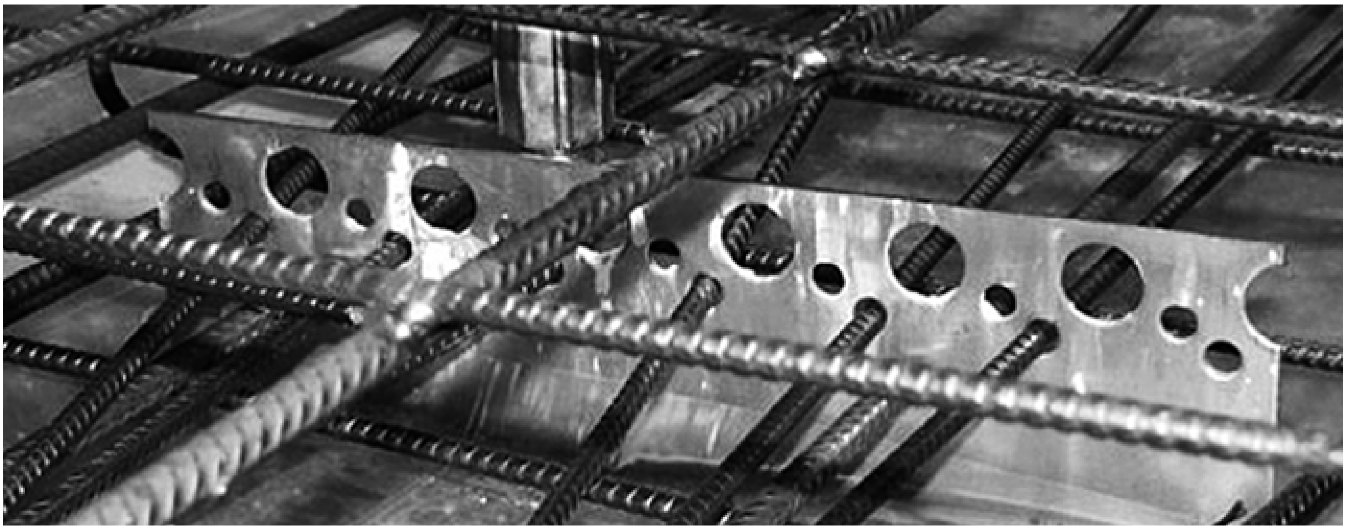


Additional reinforcement for FA

The anchorage bars must be placed in the facing and load-bearing layers. The number of reinforcement bars depends on the length of the flat anchor.

Additional reinforcement

Flat anchor	Length L [mm]	Symbol	Reinforcement bars B500A, B500B
	80		2 × 4 ø 6 mm l = 400 mm
	120		2 × 5 ø 6 mm l = 400 mm
	160, 200, 240, 280		2 × 6 ø 6 mm l = 400 mm
	320, 360, 400		2 × 7 ø 6 mm l = 400 mm



Installation of SP-FA-3 at the precast plant: The round holes in the anchor type provide bond with the concrete.

Halfen Sandwich Panel Anchors

Flat anchor FA

Anchor design

To calculate the load actions, the dead weight of the facing layer, if required ground pressure as well as the wind, and warping loads from temperature (only ΔT), have to be considered. Input values required for calculation of load capacities are, anchor type, thickness of the insulation (b) and the thickness of the facing layer (f). The allowable spacings from the fulcrum e_{max} depend on the thermal insulation thickness (b).

The following verifications are required:

- pull-out failure
- concrete cone failure
- concrete failure under the anchor
- steel failure

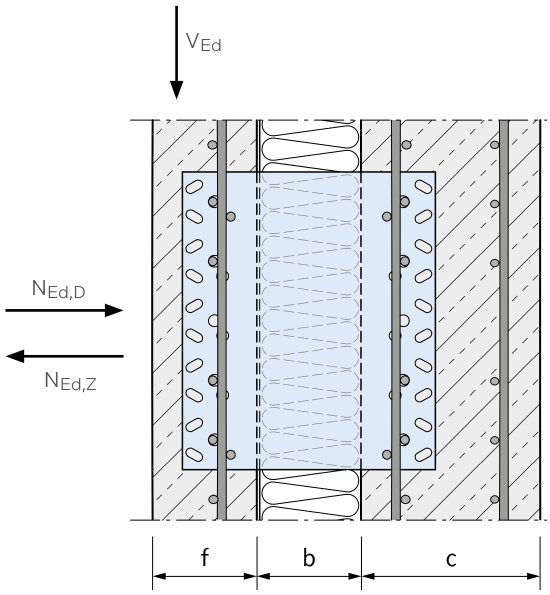
Requirements

Concrete grade:

≥ C30/37 (facing and supporting layer)

Minimum reinforcement of the concrete layer:

Mesh or bar reinforcement in B500A/B
Crosswise ≥ 1.88 cm²/m in each layer,
double layer if f or c ≥ 10 cm



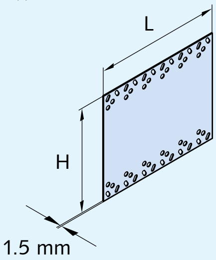
We recommend calculating the anchors using the Halfen Sandwich panel anchor calculation software:
Download at www.halfen.com.

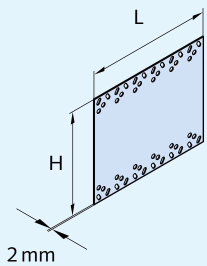
Design equations and load capacities or the FA Flat anchor can be found in the building authority approval.

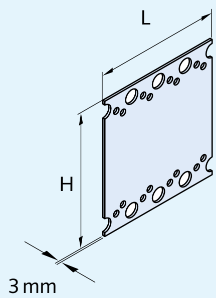
Halfen Sandwich Panel Anchors

Flat anchor FA

Available anchor sizes

Anchor type	Order-no.: 0771.010-	H=150 mm	Order-no.: 0771.010-	H=175 mm	Order-no.: 0771.010-	H=200 mm	Order-no.: 0771.010-	H=225 mm
FA-1 	00002	80	00012	80	00022	80	00032	80
	00003	120	00013	120	00023	120	00033	120
	00004	160	00014	160	00024	160	00034	160
	00005	200	00015	200	00025	200	00035	200
			00016	240	00026	240	00036	240
			00017	280	00027	280	00037	280
			00018	320	00028	320	00038	320
			00019	360	00029	360	00039	360

Anchor type	Order-no.: 0771.020-	H=175 mm	Order-no.: 0771.020-	H=200 mm	Order-no.: 0771.020-	H=225 mm	Order-no.: 0771.020-	H=260 mm
FA-2 	00002	80	00012	80	00022	80	00032	80
	00003	120	00013	120	00023	120	00033	120
	00004	160	00014	160	00024	160	00034	160
	00005	200	00015	200	00025	200	00035	200
	00006	240	00016	240	00026	240	00036	240
	00007	280	00017	280	00027	280	00037	280
	00008	320	00018	320	00028	320	00038	320
	00009	360	00019	360	00029	360	00039	360
	00010	400	00020	400	00030	400	00040	400

Anchor type	Order-no.: 0771.030-	H=260 mm	Order-no.: 0771.030-	H=280 mm	Order-no.: 0771.030-	H=300 mm	Order-no.: 0771.030-	H=350 mm
FA-3 	00001	80	00010	80	00018	80	00026	80
	00002	120	00011	120	00019	120	00033	120
	00003	160	00012	160	00020	160	on request	160
	00004	200	00013	200	00021	200	00027	200
	00005	240	00014	240	00022	240	00028	240
	00006	280	00016	280	00023	280	00029	280
	00007	320	00017	320	00024	320	00030	320
	00008	360	00039	360	00025	360	00031	360
	00009	400	00040	400	on request	400	00032	400

Subject to design changes
Note: Larger anchor heights on request

Halfen Sandwich Panel Anchors

Sandwich panel anchor SPA-1/-2

Description, identification

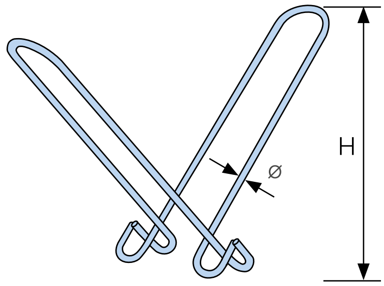
Article name: SP-SPA-1 - ø* [mm] - height [mm]
SP-SPA-2 - ø* [mm] - height [mm]

*rounded value

SP-SPA-1 and SP-SPA-2 Sandwich panel anchors are V-shape anchors manufactured in round wire and are available in the following diameters:

5.0 mm / 6.5 mm / 8.5 mm / 10.0 mm.

The bent ends help to bond with the concrete, and to fix and secure the reinforcement bars. The Sandwich panel anchors SPA-1/-2 can be used as support or as horizontal anchors.



Material: A4 / L4
(Material specification → page 3)

The anchors are delivered with coloured identification labels displaying the type, diameter and height.

Order example:

SP - SPA - 1 - 09 - 220

① ② ③ ④

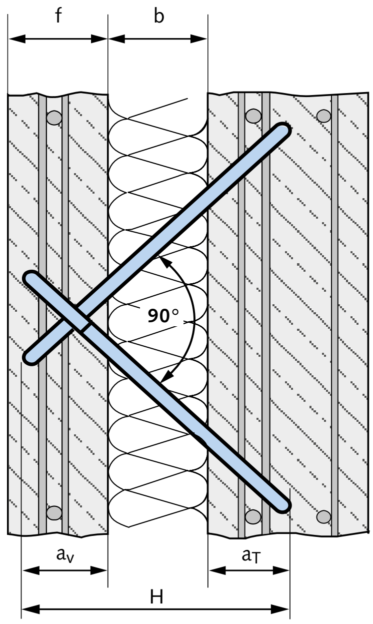
① Article group
② Anchor type
③ Wire-ø
④ Anchor height H [mm]

Colour coding	
Anchor sizes SPA-1/-2	**Colour**
05	red
07	blue
09	orange
10	yellow

Anchor selection, embedment depths

Selecting the SPA-1/-2 anchor height
The height (H) for the sandwich panel anchor depends on the thickness of the insulation layer (b) and the embedment depth (a_V, a_T).

$$H \geq a_V + b + a_T$$



Embedment depth a, insulation layer thickness b [mm]

Type	SP-SPA-1-05 SP-SPA-2-05	SP-SPA-1-07 SP-SPA-2-07	SP-SPA-1-09 SP-SPA-2-09	SP-SPA-1-10 SP-SPA-2-10
ø	5,0	6,5	8,5	10,0
b	30 - 80	40 - 150	60 - 250	200 - 320
a_V	≥49	≥50	≥53	≥54
a_T	≥55	≥55	≥55	≥55
f ①	≥60	≥60	≥60	≥60

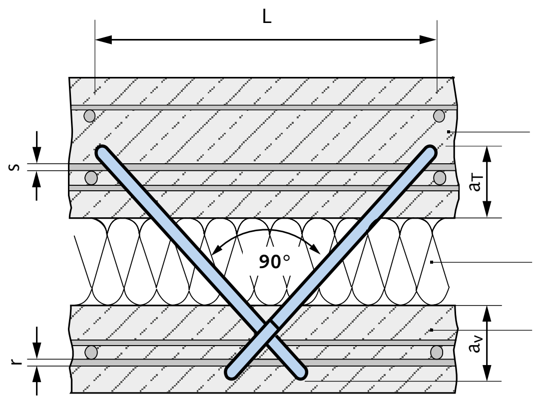
① In acc. with EN 1992-1-1/NA:2013-04 applies for slab thickness: $f_{min} \geq 70$ mm.

Halfen Sandwich Panel Anchors

Sandwich panel anchor SPA-1/-2

Installation

SPA-1/-2 Sandwich panel anchors must be fixed to the panel reinforcement with anchorage bars.
For a more detailed description of the installation procedure please refer to the SP installation instructions at www.halfen.com.



→ page 7 for L value

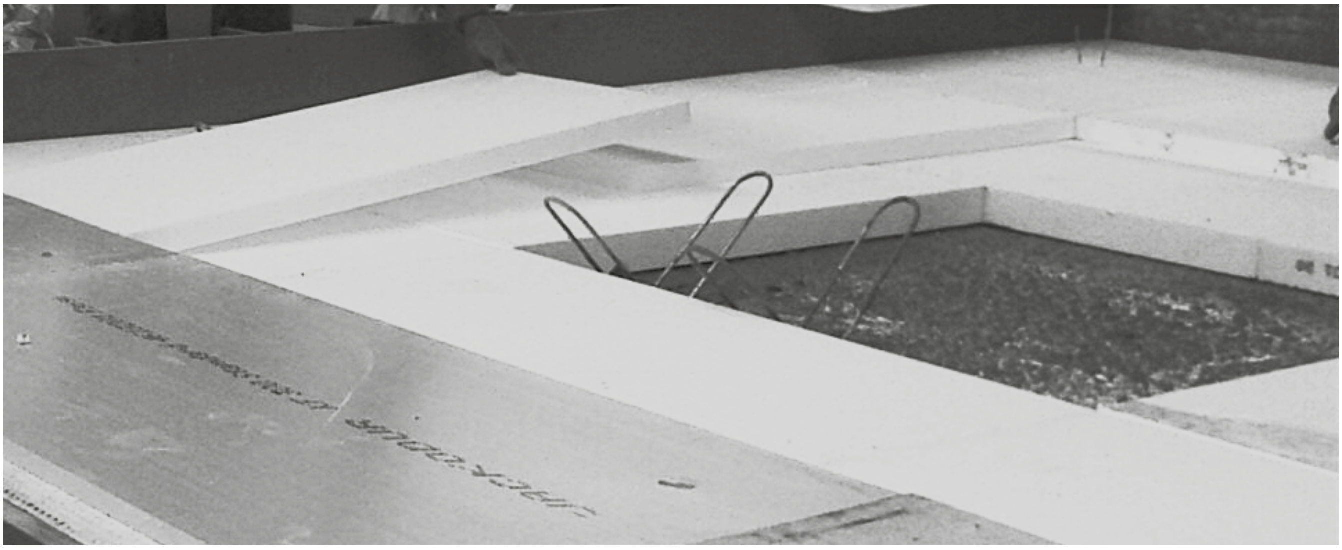
Additional reinforcement for SPA-1/-2

The anchorage bars must be placed in the facing and load-bearing layers. The length and the diameter of the reinforcement bars depends on the anchor size.

Additional reinforcement

Type	SPA-1-05	SPA-1-07	SPA-1-09	SPA-1-10
r	1 ø 8 l = 450	1 ø 8 l = 450	1 ø 8 l = 700	1 ø 8 l = 700
s	1 ø 8 l = 700	1 ø 8 l = 700	1 ø 10 l = 700 ②	1 ø 10 l = 700 ②
Type	**SPA-2-05**	**SPA-2-07**	**SPA-2-09**	**SPA-2-10**
r	2 ø 8 l = 450	2 ø 8 l = 450	2 ø 8 l = 700	2 ø 8 l = 700
s	2 ø 8 l = 700	2 ø 8 l = 700	2 ø 10 l = 700 ②	2 ø 10 l = 700 ②

All dimensions in [mm].
② select l = 900 mm if L > 500 mm, select l = 1100 mm if L > 800 mm.



Installation of SP-SPA-2 at a precast plant.

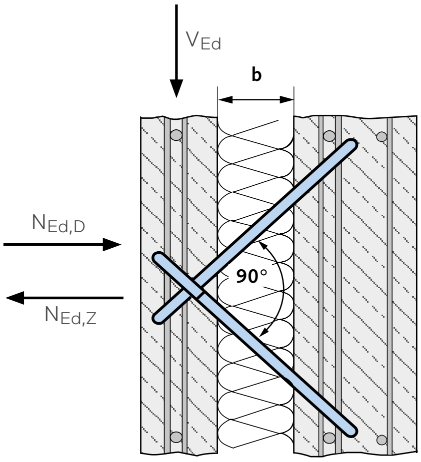
Halfen Sandwich Panel Anchors

Sandwich panel anchor SPA-1/-2

Anchor Design

To calculate the load actions, the dead weight of the facing layer, if required ground pressure as well as the wind, and warping loads from temperature (only ΔT), have to be considered.

Key input values for calculation are the anchor type and the thickness of the thermal insulation (b). The allowable spacings from the fulcrum e_{max} depend on the thermal insulation thickness (b). The following example demonstrates the steel load-bearing capacity and the limit of concrete load-bearing capacity for SPA-1-09 sandwich panel anchors. The procedure for calculating vertical load-bearing resistances for a thermal insulation layer thickness (b) = 12 cm and an acting horizontal force N_{Ed} = 3.0 kN are shown.



Requirements

Concrete grade

≥ C30/37 (facing and supporting layer)

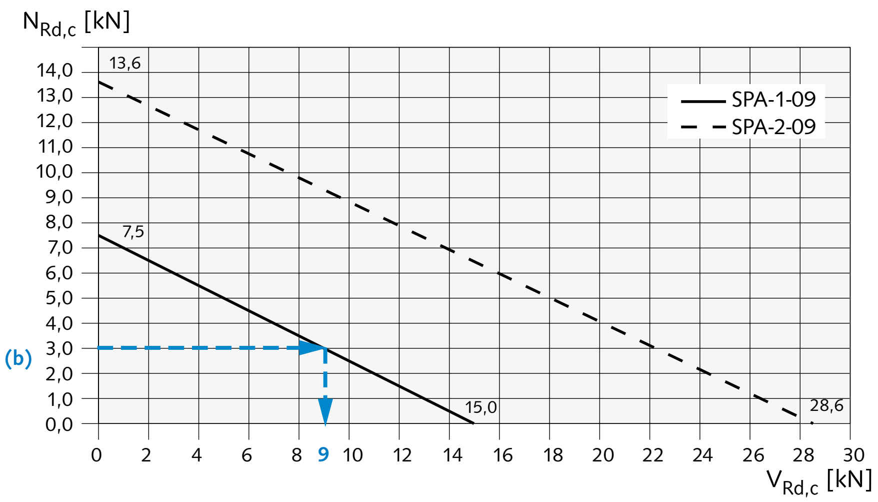
Minimum reinforcement of the concrete layer:

Mesh or bar reinforcement in B500A/B
Crosswise ≥ 1.3 cm²/m in each layer

Example: Load resistances for SP-SPA ø 1-09 mm

Load-bearing capacities $F_{VR,d}$ [kN]			
b [cm]	e_{max} [cm]	SP-SPA-1-09 $V_{Rd,s} = N_{Rd,s,D}$	SP-SPA-2-09 $V_{Rd,s} = N_{Rd,s,D}$
6	102	26.59	53.18
7	132	25.29	50.57
8	166	24.02	48.03
9	204	22.78	45.56
10	246	21.58	43.16
11	292	20.42	40.84
(a) 12	342	19.30	38.61
13	395	18.23	36.46
14	453	17.21	34.41
15	515	16.23	32.47
16	580	15.31	30.62

Concrete load-bearing capacity line SPA-09



More tables and diagrams, including these, can be found in the SPA General Building Authority Approval, annex 7 to 11.

Example

Insulation layer thickness = 12 cm

decisive horizontal load N_{Ed} = 3.0 kN

1. Vertical steel load-bearing capacity
   → $V_{Rd,s}$ = 19.30 – 3.0 = 16.30 kN **(a)**
2. Vertical concrete load-bearing capacity
   → $V_{Rd,c}$ = 9.0 kN **(b)**

→ **Concrete load-bearing capacity is decisive!**
V_{Rd} = 9.0 kN

We recommend using our free Sandwich-panel anchor software to calculate the anchors at www.halfen.com.

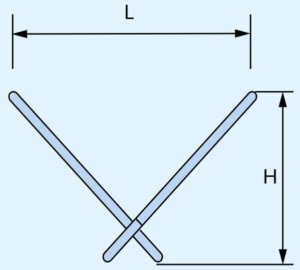
Note:
The Software verifications correspond with the equations in the Building Authority Approval, these deviate only in method from the example shown on this page. The results are identical.

Halfen Sandwich Panel Anchors

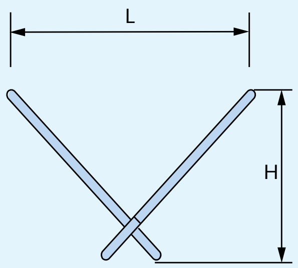
Sandwich panel anchor SPA-1/-2

Available anchor sizes

Anchor type	Wire-ø 05			Wire-ø 07		
	Order-no.: SPA-1 0270. SPA-2 0271.	H	L	Order-no.: SPA-1 0270. SPA-2 0271.	H	L
SPA-1/SPA-2	010-00001	160	265	010-00003	160	260
	010-00002	180	305	010-00004	180	300
	010-00110	200	345	010-00005	200	340
				010-00006	220	380
				010-00007	240	420
				010-00008	260	460



Anchor type	Wire-ø 09			Wire-ø 10		
	Order-no.: SPA-1 0270. SPA-2 0271.	H	L	Order-no.: SPA-1 0270. SPA-2 0271.	H	L
SPA-1/SPA-2	010-00138 ①	220	375			
	010-00139 ①	240	415			
	010-00111	260	455			
	010-00112	280	495			
	010-00113	300	535			
	010-00114	320	575			
	010-00115	340	615	010-00015	340	610
	010-00116	360	655	010-00016	360	650
				010-00103	380	690
				010-00105	400	730
				010-00107	420	770
				010-00109	440	810



① Only applies for SPA-1. See price list for SPA-2 order numbers.

Halfen Sandwich Panel Anchors

Sandwich panel anchor SPA-FLEX

Description, identification

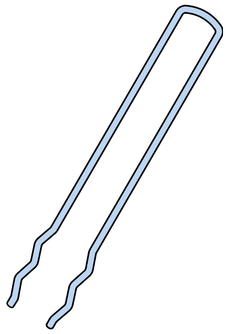
Article name: SP-SPA-FLEX-ø* - [mm] - height [mm]

*rounded value

The SP-SPA-FLEX Sandwich panel anchors are U-shaped anchors made from round wire and are available in the following diameters:

4.0 mm / 5.0 mm / 6.5 mm

Both the rounded and waved ends serve as anchorage in the concrete. The Sandwich panel anchors can be used as support or as horizontal anchors.

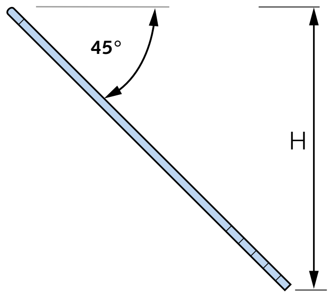


Order example:

SP - SPA - FLEX - 05 - 330

① ② ③ ④

① Article group
② Anchor type
③ Wire-ø
④ Anchor height H [mm]



Material: A4 / L4
(Material specification → page 3)

Anchor selection, embedment depths

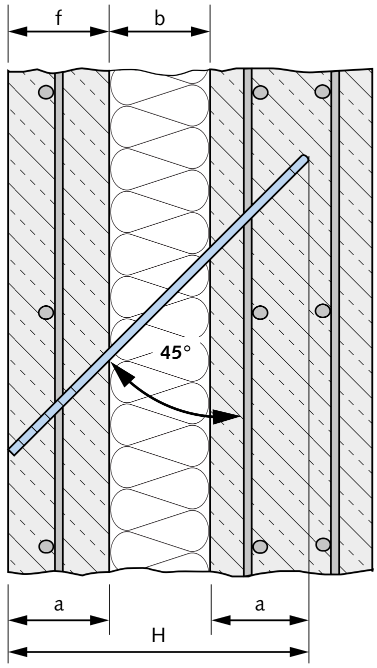
Anchor height selection for the SPA-FLEX
The height (H) of the SPA-FLEX Anchor depends on the thickness of the insulation (b) and the embedment depths (a).

$$H \geq 2 \times a + b$$

Embedment depth a, insulation layer thickness b [mm]

Type	SP-SPA-FLEX-04	SP-SPA-FLEX-05	SP-SPA-FLEX-07
b	30- 250	30- 250	30- 230
a	≥60	≥70	≥80
f	≥60 ①	≥70	≥80

① In acc. with EN 1992-1-1/NA:2013-04 applies for slab thickness: f ≥ 70 mm.

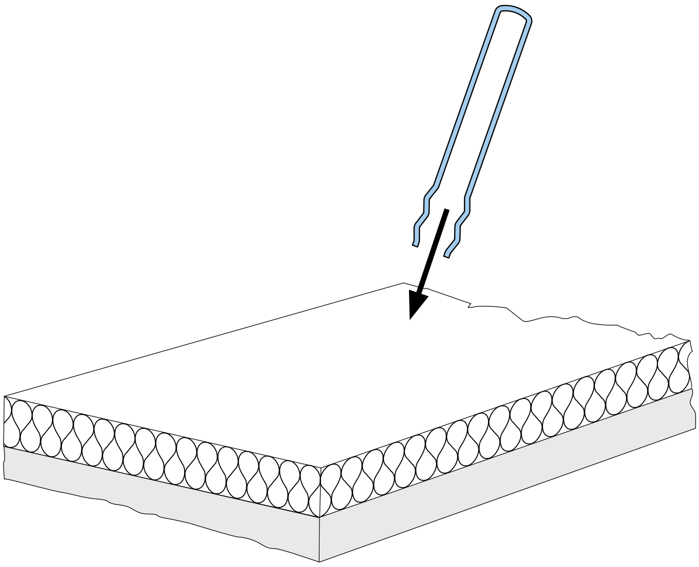


Halfen Sandwich Panel Anchors

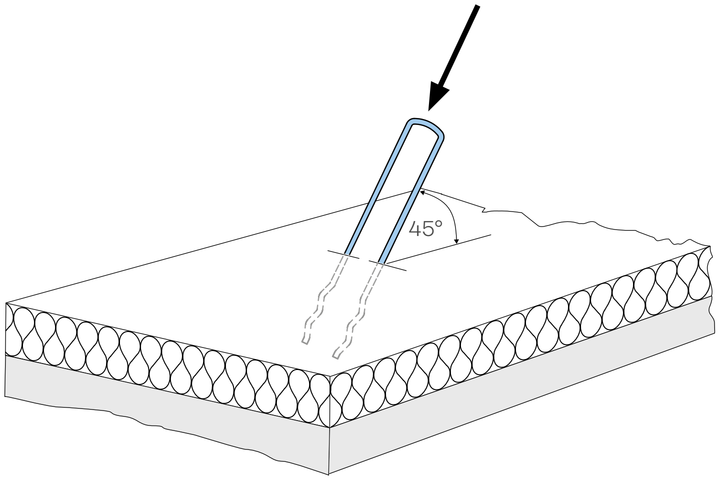
Sandwich panel anchor SPA-FLEX

Installation

The SPA-FLEX Anchors must be pressed through the previously placed insulation at 45° to the required embedment depth in the concrete.



Additional reinforcement is not required in applications using the SPA-FLEX Sandwich panel anchor: fixing to the on-site reinforcement is not required! For a more detailed description of the SP-FLEX installation procedure please refer to the SP installation instruction at www.halfen.com.



Halfen Sandwich Panel Anchors

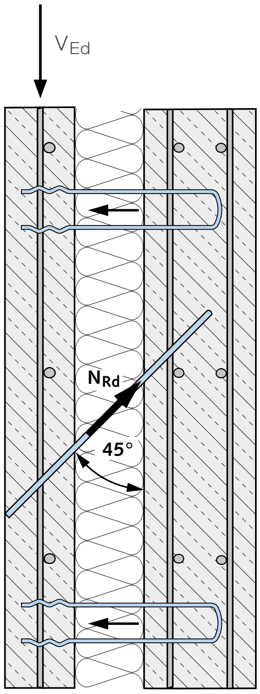
Sandwich panel anchor SPA-FLEX

Anchor design

The vertically installed SPA-FLEX Sandwich panel anchors must be verified for the transfer of the dead weight of the facing layer. The resulting tension loads in the anchors installed at 45° are 41% higher than the dead-weight.

SPA-FLEX Anchors can also be used horizontally as opposing anchor-pairs for transfer of horizontal loads (for example, from transport loads).

The resulting contact pressure from the diagonal installation direction from the dead-weight of the facing layer must be transferred by the neighbouring restraint ties. The total pressure load is identical to the action (dead load)! The allowable spacings from the fulcum e_{max} depend on the thermal insulation thickness (b).



Requirements

Concrete grade

≥ C30/37 (facing and supporting layer)

Mininmum reinforcement in the concrete layer:

Mesh or bar reinforcement in B500A/B
Crosswise ≥ 1.88 cm²/m in each layer,

Verification has been provided for the SPA-FLEX Sandwich panel anchors if:

$$V_{Ed} \leq N_{Rd}/\sqrt{2}$$

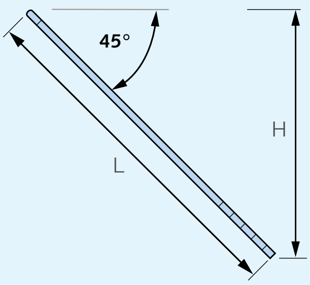
Load resistances NRd [kN]		
SP-SPA-FLEX-04	SP-SPA-FLEX-05	SP-SPA-FLEX-07
6.9	9.7	13.4

Halfen Sandwich Panel Anchors

Sandwich panel anchor SPA-FLEX

Available anchor sizes

Anchor type	Insulation layer thickness b	SPA-FLEX-04		SPA-FLEX-05		SPA-FLEX-07	
		H	L	H	L	H	L
SPA-FLEX	≤50	170	240	190	270	210	300
	≤70	190	270	210	300	230	325
	≤90	210	300	230	325	250	355
	≤110	230	325	250	355	270	380
	≤130	250	355	270	380	290	410
	≤150	270	380	290	410	310	440
	≤170	290	410	310	440	330	465
	≤190	310	440	330	465	495	350
	≤210	330	465	350	495	370	525
	≤230	350	495	370	525	390	550
	≤250	370	525	390	550		



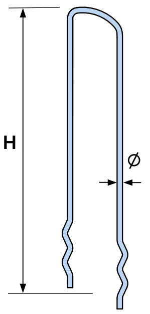
Halfen Sandwich Panel Anchors

Restraint ties SPA-N/-B/-A

Description, identification

Connector pins (SPA-N)
Article name:
SP-SPA-N - ø* [mm]
height [mm]

*rounded value

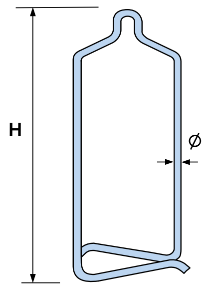


Connector pins are U-shaped bent wire and are available in the following diameters:

3.0 mm / 4.0 mm / 5.0 mm / 6.5 mm.

Anchorage in the concrete is with both the rounded and waved ends of the anchor.

Stirrup ties (SPA-B)
Article name:
SP-SPA-B - ø [mm]
height [mm]

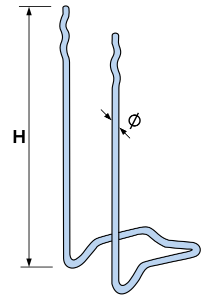


Stirrups ties are bent from wire and are available in the following diameters:

3.0 mm / 4.0 mm / 5.0 mm

Anchorage in the concrete is achieved by both clamping to the panel reinforcement and with the closed bent shape of the anchor.

Clip-on pins (SPA-A)
Article name:
SP-SPA-A - ø [mm]
height [mm]



Clip-on pins are U-shaped restraint ties where the closed end of the anchor is bent 90°. Available in the following diameters:

3.0 mm / 4.0 mm / 5.0 mm

Anchorage in the concrete is achieved with both the waved ends and by clamping around the panel reinforcement.

Order example:

SP - SPA - N - 04 - 220

① ② ③ ④

① Artikel group
② Anchor type
③ Wire-ø
④ Anchor height H [mm]

Material: A4 / L4
(Material specification → page 3)

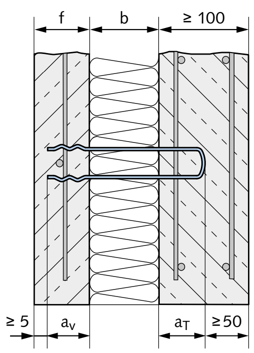
Anchor selection, embedment depths

Selection the anchor height
The height (H) depends on the thickness of the insulation (b), the embedment depth (av, a_T) and for anchor types SPA-A and SPA-B, the wire diameter.

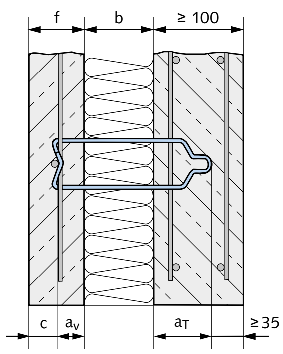
Minimum embedment depth a_v, a_T [mm]

	Type	SPA-N	SPA-B	SPA-A
60 ≤f<70 ①	a_v	55	30②	30②
f≥70	a_v	55	35②	35②
-	a_T	50	65	55

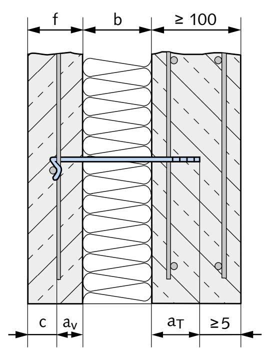
① In acc. with EN 1992-1-1/NA:2013-04 applies for layer thickness: f_{min} ≥70 mm.
② Relative to the axis of the reinforcement mesh.



$H \geq b + a_v + a_T$



$H \geq b + a_v + a_T + ø_{SPA\text{-}B}$



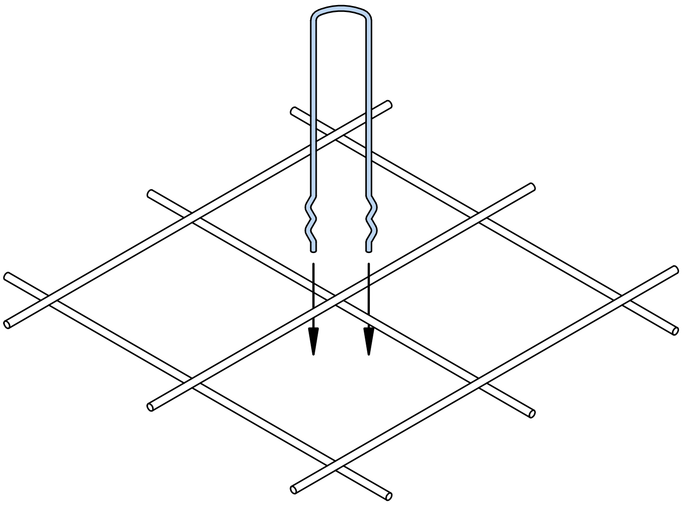
$H \geq b + a_v + a_T + ø_{SPA\text{-}A}$

Halfen Sandwich Panel Anchors

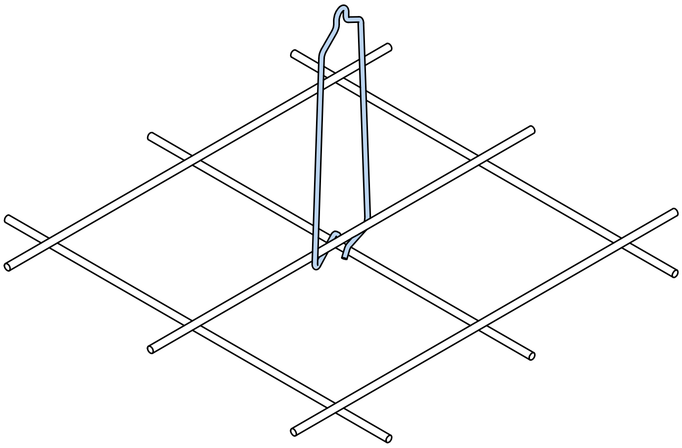
Restraint ties SPA-N/-B/-A

Installation

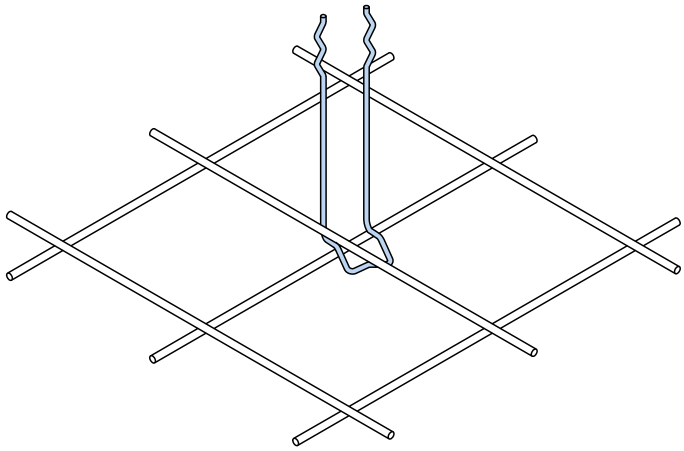
SPA-N Connector pins are pushed through the previous placed insulation layer to the required embedment depth. Additional reinforcement or fixing to the on-site reinforcement is not required.



SPA-B Stirrups ties are clamped onto the panel reinforcement before pouring the concrete.



SPA-A Clip-on pins are clamped around the panel reinforcement before pouring the concrete.



Please refer to the SP installation instructions for a more detailed description of the installation: Download at at www.halfen.com.

Halfen Sandwich Panel Anchors

Restraint ties SPA-N/-B/-A

Anchor design

SPA-N/-B/-A Restraint ties must be verified for the transfer of wind and temperature actions (tension and compression). When using SPA-FLEX as a load-bearing or as horizontal anchor, the resultant contact pressure must also be transferred by the neighbouring restraint ties.

Verification has been provided for the SPA-N/-B/-A Sandwich panel anchors if: $N_{Ed} \leq N_{Rd}$

The distance e of the restraint ties from the resting point F must be less than or equal to the design limit e_{max}: $e \leq e_{max}$

Requirements

Concrete grade

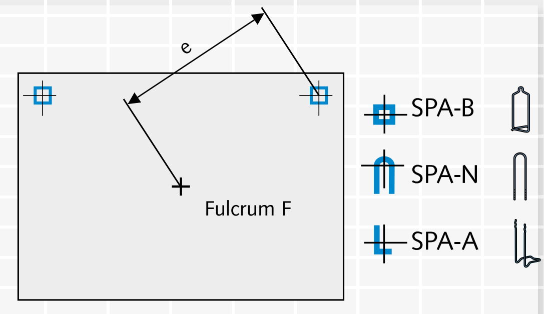
≥ C30/37 (facing and supporting layer)

Minimum reinforcement in the concrete layer

Mesh or bar reinforcement in B500A/B
Crosswise ≥ 1.3 cm²/m in each layer

e_{max} [cm], N_{Rd} for f ≥ 70 mm

	SPA-N-03 SPA-A-03 SPA-B-03				SPA-N-04 SPA-A-04 SPA-B-04					SPA-N-05 SPA-A-05 SPA-B-05						SPA-N-06				
N_{Rd} [kN]	1.5	2.4	3.0	3.8	3.0	3.6	4.3	5.1	6.6	3.9	4.5	5.1	5.8	6.7	7.2	4.3	5.1	5.8	6.6	7.2
b [cm]																				
3	162	155	146	135	144	141	138	135	129	139	138	137	136	135	132					
4	265	253	238	220	230	226	221	216	206	218	216	215	213	210	206					
5	392	375	353	**327**	336	329	322	315	301	313	311	309	306	303	297					
6	545	520	490	**454**	462	453	443	434	414	426	423	421	417	412	404					
7	722	690	**650**	**602**	608	596	583	570	**545**	557	553	549	544	539	528					
8	925	883	**832**	**770**	774	758	742	726	**694**	705	699	695	689	682	668					
9	1000	**1000**	**998**	**960**	960	940	920	900	**860**	870	863	858	850	842	825					
10	1000	**1000**	**1000**	**1000**	1000	1000	1000	**1000**	**1000**	1000	1000	1000	1000	1000	998					
11	1000	**1000**	**1000**	**1000**	1000	1000	1000	**1000**	**1000**	1000	1000	1000	1000	1000	1000					
12	1000	**1000**	**1000**	**1000**	1000	1000	**1000**	**1000**	**1000**	1000	1000	1000	1000	1000	1000					
13	1000	**1000**	**1000**	**1000**	1000	1000	**1000**	**1000**	**1000**	1000	1000	1000	1000	1000	1000					
14	**1000**	**1000**	**1000**	**1000**	1000	**1000**	**1000**	**1000**	**1000**	1000	1000	1000	1000	1000	**1000**					
15	**1000**	**1000**	**1000**	**1000**	1000	**1000**	**1000**	**1000**	**1000**	1000	1000	1000	1000	**1000**	**1000**	1000	1000	1000	1000	1000
16					1000	**1000**	**1000**	**1000**	**1000**	1000	1000	1000	1000	**1000**	**1000**	1000	1000	1000	1000	1000
17					**1000**	**1000**	**1000**	**1000**	**1000**	1000	1000	1000	**1000**	**1000**	**1000**	1000	1000	1000	1000	1000
18					**1000**	**1000**	**1000**	**1000**	**1000**	1000	1000	1000	**1000**	**1000**	**1000**	1000	1000	1000	1000	1000
19										1000	1000	**1000**	**1000**	**1000**	**1000**	1000	1000	1000	1000	1000
20										1000	1000	**1000**	**1000**	**1000**	**1000**	1000	1000	1000	1000	1000
21										1000	**1000**	**1000**	**1000**	**1000**	**1000**	1000	1000	1000	1000	1000
22										1000	**1000**	**1000**	**1000**	**1000**	**1000**	1000	1000	1000	1000	1000
23										1000	**1000**	**1000**	**1000**	**1000**	**1000**	1000	1000	1000	1000	1000
24										**1000**	**1000**	**1000**	**1000**	**1000**	**1000**	1000	1000	1000	1000	1000
25										**1000**	**1000**	**1000**	**1000**	**1000**	**1000**	1000	1000	1000	1000	1000
26										**1000**	**1000**	**1000**	**1000**	**1000**	**1000**	1000	1000	1000	1000	1000
27																1000	1000	1000	1000	1000
28																1000	1000	1000	1000	1000
29																1000	1000	1000	1000	**1000**
30																1000	1000	1000	1000	**1000**
31																1000	1000	1000	**1000**	**1000**
32																1000	1000	1000	**1000**	**1000**
33																1000	1000	1000	**1000**	**1000**
34																1000	1000	**1000**	**1000**	**1000**
35																1000	1000	**1000**	**1000**	**1000**
36																1000	1000	**1000**	**1000**	**1000**
37-40																1000	**1000**	**1000**	**1000**	**1000**

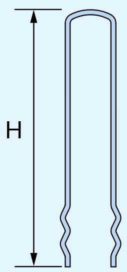
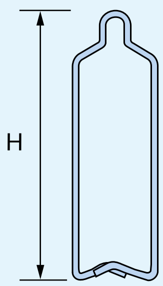
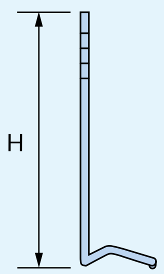


The values in the dark grey cells, white text, are only approved for tension loads!
Load-bearing capacities N_{Rd}, e_{max} for 6 cm ≤ f < 7 cm: See General Building Authority Approval.

Halfen Sandwich Panel Anchors

Restraint ties SPA-N/-B/-A

Available anchor sizes

Anchor type	Wire-ø03		Wire-ø04		Wire-ø05		Wire-ø06	
	Order no.: 0274.010-	**H**	**Order no.: 0274.020-**	**H**	**Order no.: 0274.030-**	**H**	**Order no.: 0274.040-**	**H**
SPA-N	00001	120						
	00002	140						
	00003	160	00001	160				
	00004	180	00002	180				
	00005	200	00003	200				
			00004	220				
			00005	240	0001	240		
					0002	260		
					0003	280		
					0004	300		
					0005	320		
							0001	340
							0002	360
							0003	380
							0004	400
							0005	420
SPA-B	**Order no.: 0773.010-**	**H**	**Order no.: 0773.020-**	**H**	**Order no.: 0773.020-**	**H**		
	00001	160	0001	160				
	00002	180	0002	180				
			0003	200				
			0004	220				
			0005	240				
					0001	240		
					0002	260		
					0003	280		
					0004	300		
					0005	320		
SPA-A	**Order no.: 0272.010-**	**H**	**Order no.: 0272.030-**	**H**	**Order no.: 0272.050-**	**H**		
	00001	120			00018	80		
	00002	140			00019	120		
	00003	160	0001	160	00020	160		
	00004	180			00021	200		
			0002	200	0001	200		
			0003	250	0002	250		
					0003	280		
					0004	320		

Subject to design changes.

Halfen Sandwich Panel Anchors

Rules for anchor layout

System FA/SPA-1/-2

Observe the following when positioning anchors:

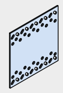
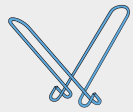
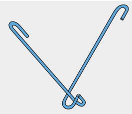
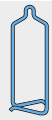
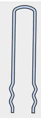
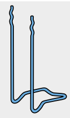
1. Support and horizontal anchors

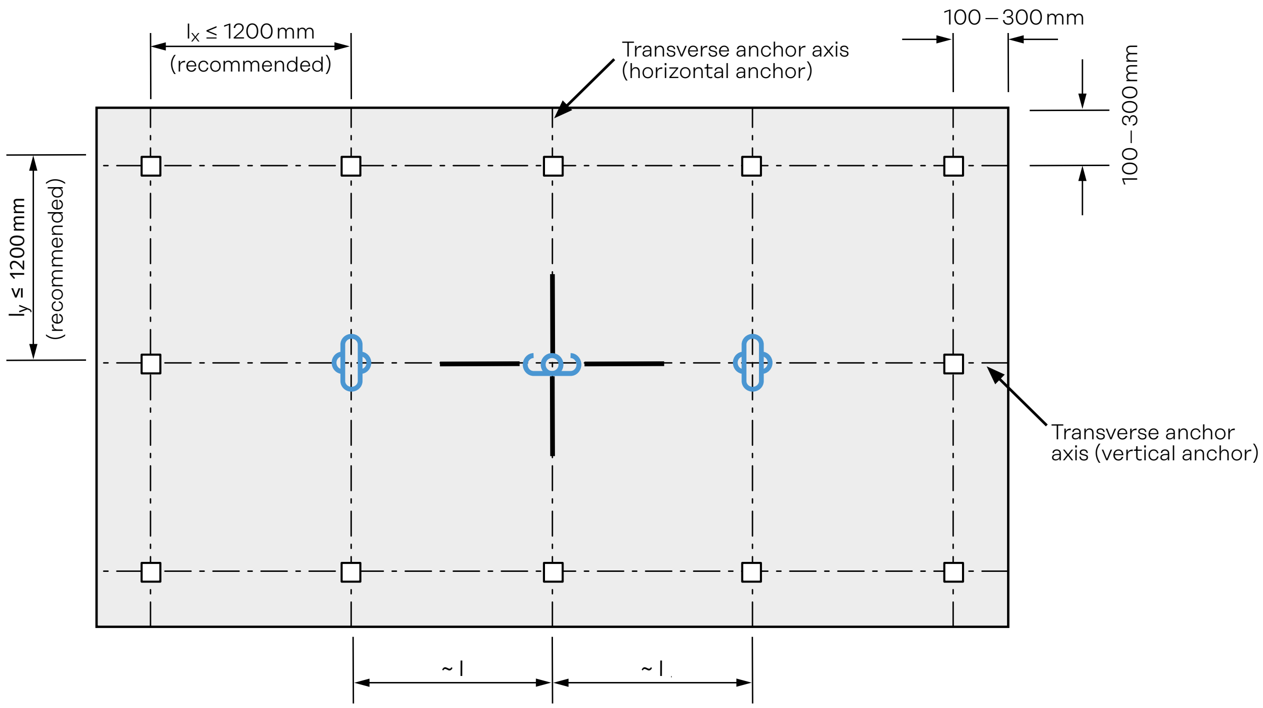
- Two support anchors (pairs) must be positioned in the lower portion of each panel* as symmetrically as possible to the fulcrum axis.
- Horizontal anchors must be placed as close as possible to the fulcrum. If two or more horizontal anchors are required, they are to be placed symmetrically to the centre of gravity on a vertical axis.
- The anchors in each direction of support must be located on the same axis (transverse anchor axis) and if possible, be placed at grid nodes.
- Observe the allowable spacing e_{max} from the fulcrum as well as the allowable edge distances and axial spacings.

* placing the support anchors in the lower half of the panel reduces tensile stresses and therefore the risk of cracking in the facing layer!

2. Restraint ties

- Place restraint ties in as even a grid as possible.
- Observe the allowable spacing e_{max} from the fulcrum.
- Observe the allowable edge distances and axial spacings.
- Place 2 restraint ties spaced at approximately 20 cm in grid nodes subjected to high loads (example, with overhangs).

Symbols for Sandwich panel anchors		
	FA	
	SPA-2	
	SPA-1	
	SPA-B	
	SPA-N	
	SPA-A	



If possible, the ratio of the grid lengths l_x/l_y should be between 0.75 and 1.33!

Halfen Sandwich Panel Anchors

Rules for anchor layout

System SPA-FLEX

Observe the following when positioning anchors:

1. Support and horizontal anchors

- Depending on static specifications, at least two support anchors must be placed in the lower half of each layer* between two horizontal rows of restraint ties.
- The spacing between the SPA-FLEX Anchors is not restricted to the grid of the restraint ties; the anchors must be evenly spaced.
- Horizontal anchors should be placed as close as possible to the centre of gravity in the middle of a grid square. If two or more horizontal anchors are required, they are to be placed symmetrically to the centre of gravity on a vertical axis.
- Observe the allowable spacing e_{max} from the fulcrum as well as the allowable edge distances and axial spacings.

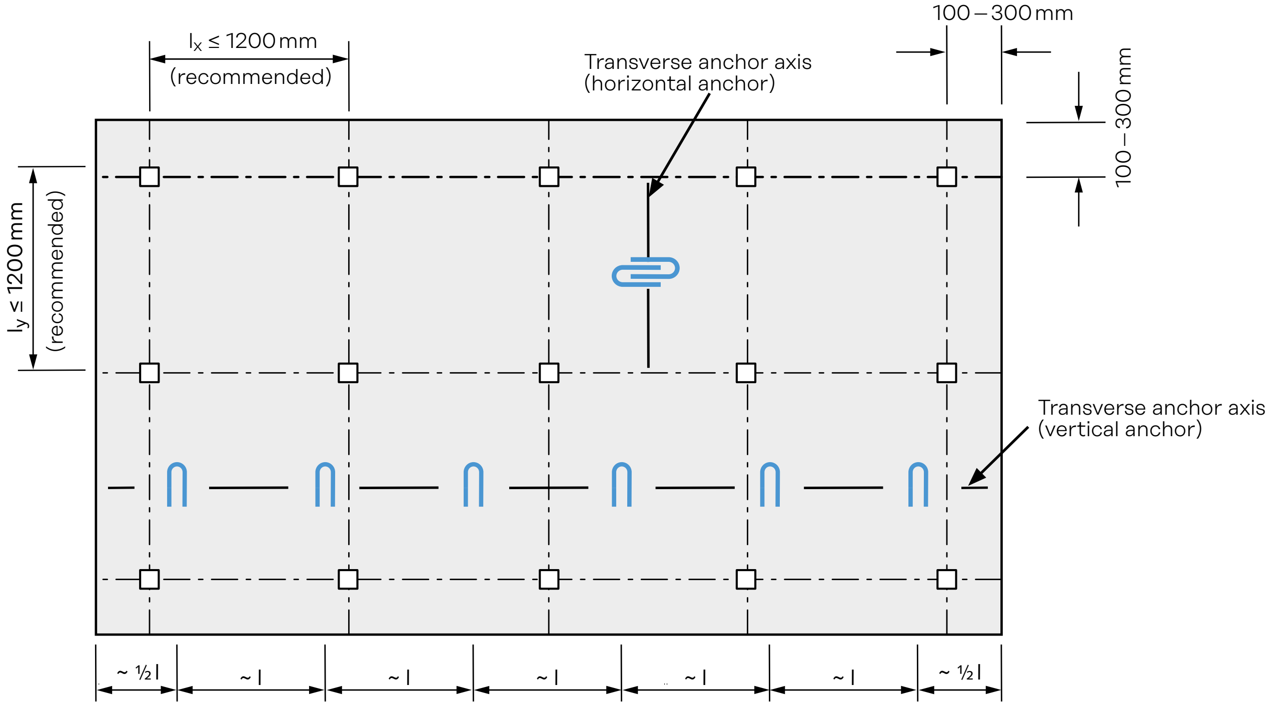
* placing the support anchors in the lower half of the panel reduces tensile stresses and therefore the risk of cracking in the facing layer!

2. Restraint ties

- Place restraint ties in as even a grid as possible.
- Observe the allowable spacing e_{max} from the fulcrum.
- Observe the allowable edge distances and axial spacings.
- Place 2 restraint ties spaced at approximately 20 cm in grid nodes subjected to high loads (example, with overhangs).

Symbols for Sandwich panel anchors

	SPA-FLEX	
	SPA-FLEX Anchor pair	
	SPA-B	
	SPA-N	
	SPA-A	



If possible, the ratio of the grid lengths l_x/l_y should be between 0.75 and 1.33!

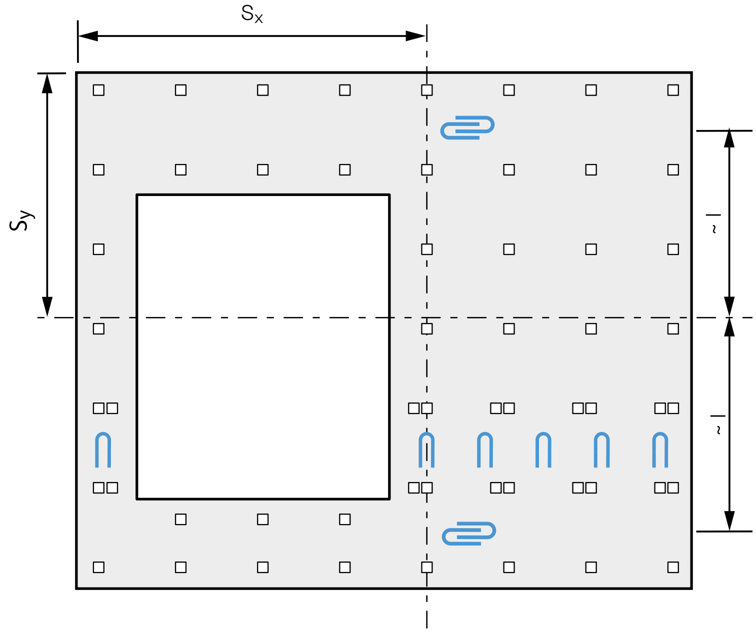
Halfen Sandwich Panel Anchors

Rules for anchor layout

Further examples:

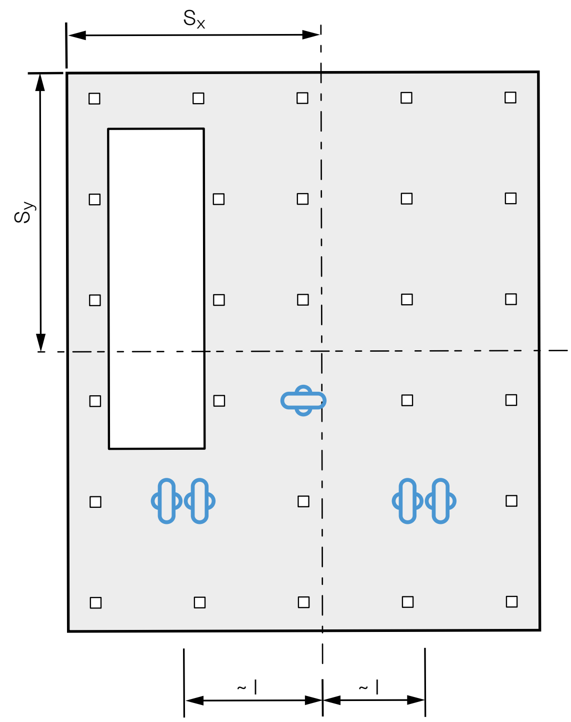
Panel with low opening

Example: SPA-FLEX System with double pins close to the vertical load-bearing anchors and the symmetrically arranged horizontal anchor pair.



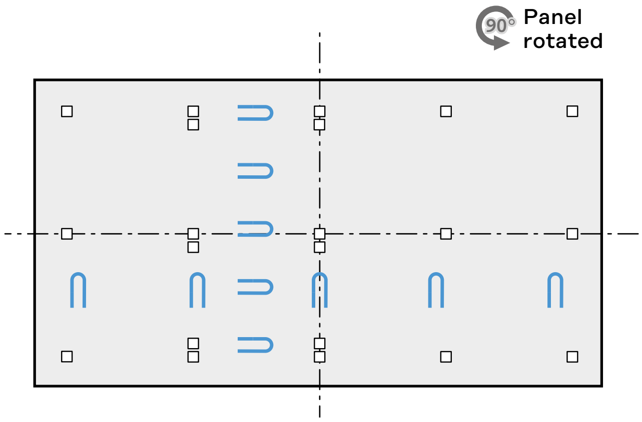
Panel with high opening

Example: System SPA-1/-2 with support anchor pair



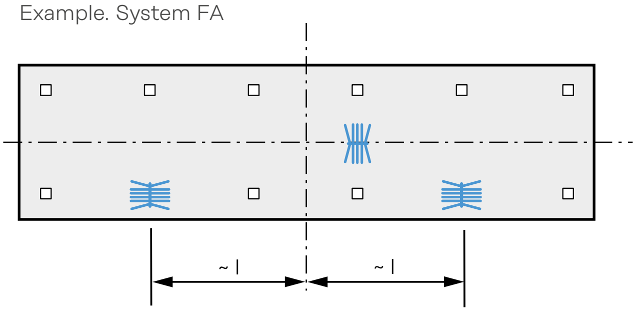
Rotated panel

Example: SPA-FLEX Systems with double pins in accordance with static requirements. Rotated panels do not require installation of additional horizonal anchors.



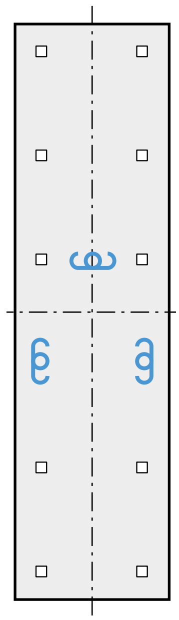
Base panel

Example. System FA



Minimal width, long panel

Example: System SPA-1/-2



S_x/S_y = centre of gravity

See page 22 for explanation of the symbols

Halfen Sandwich Panel Anchors

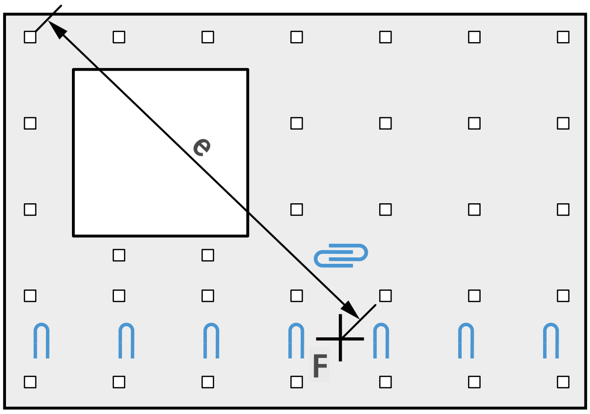
Rules for anchor layout

Fulcrum and constraints

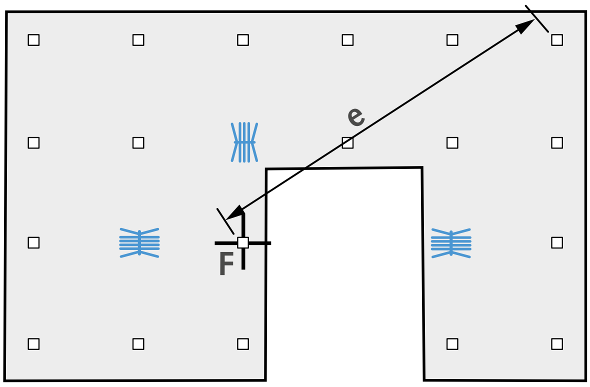
- Temperature warping causes deformations in facing layers.
- A fulcrum (fixed point) in a sandwich panel is the point around which the facing layer contracts or expands with changes in temperature.
- The constraint stresses resulting from changes in temperature may cause cracks in the facing layer.
- To keep the constraint stresses as low as possible, the anchors must be installed with their weaker axis towards the fulcrum of the sandwich panel.
- As the fulcrum is located at the intersection of the transverse anchor axes of the support and horizontal anchors, means that support anchors must be installed on a horizontal axis and horizontal anchors on a vertical axis.
- When installing the anchors, it must also be ensured that the spacings between the anchors and the fulcrum don't exceed the limit values e_{max}. (Depends on the thickness of the insulation layer)!

Further examples :

Example: SPA-FLEX System

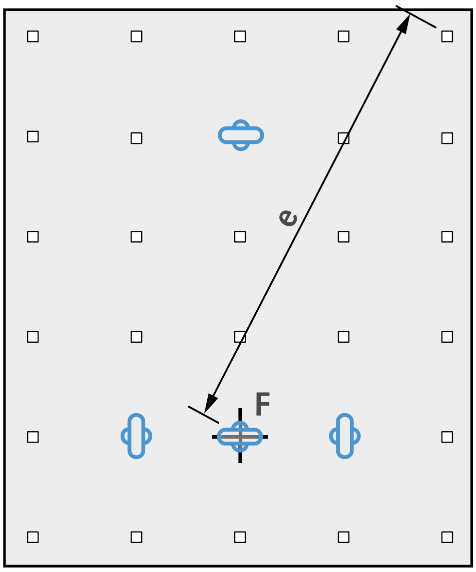


Example: FA System



Example: SPA-1/-2 System

90° Panel rotated



F = Fulcrum

Halfen Sandwich Panel Anchors

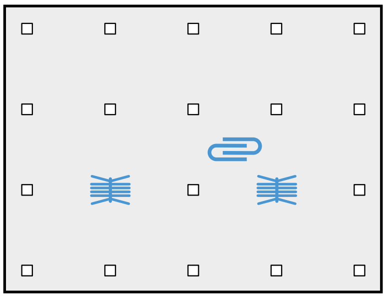
Rules for anchor layout

Mixed systems and special solutions

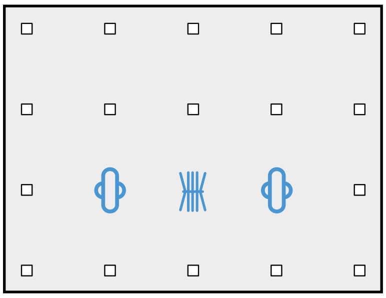
In principle, all support anchor types can be combined with all available horizontal and restaint anchor types.

Examples for mixed system

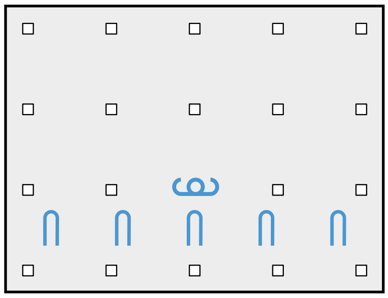
Example: FA System with an SPA-FLEX Anchor pair as horizontal anchors



Example: System SPA-1/-2 with an FA as horizontal anchor

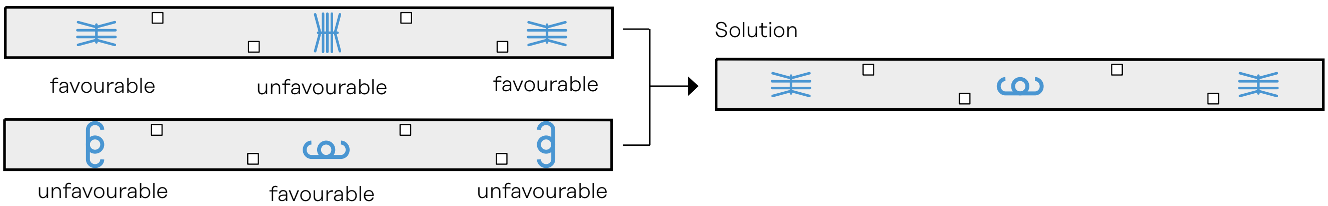


Example: SPA-FLEX System with SPA-1 as horizontal anchor



Minimum width panels

In panels with minimal widths, because of the anchor height and the direction of the reinforcement, it is preferable to install the SP-FA as a support anchor and the SP-SPA as a horizontal anchor. (The same applies to narrow, high panels).

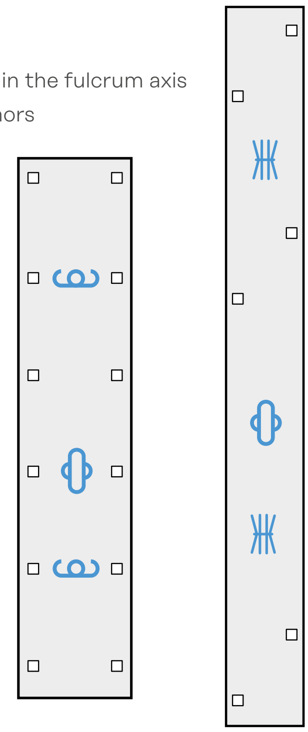


Restraint ties may be staggered in minimum width panels and in narrow, high panels to ensure minimum spacings are not compromised.

Special cases:

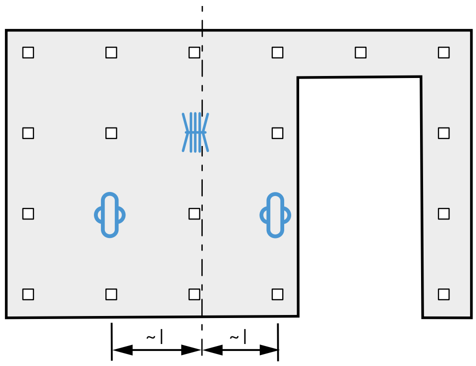
1 support anchor in the fulcrum axis

2 horizontal ·anchors

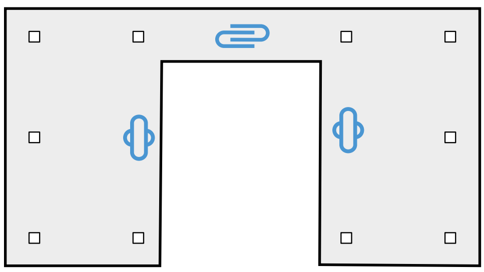


Panel with minimum lintel height

small widths adjacent to openings



Panel with minimum lintel height

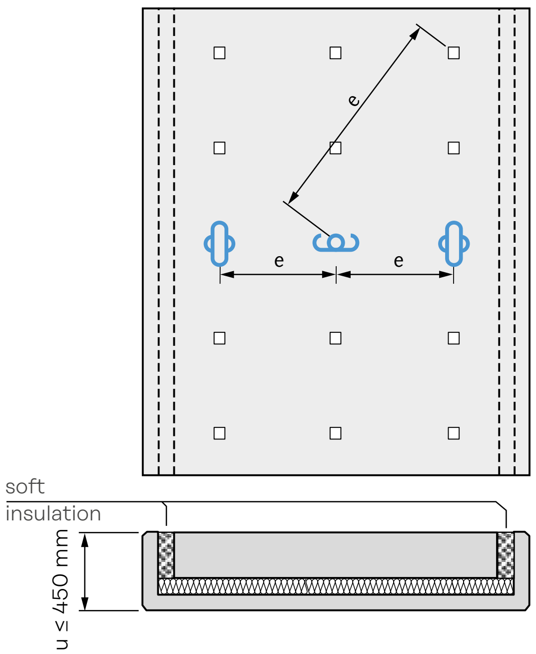


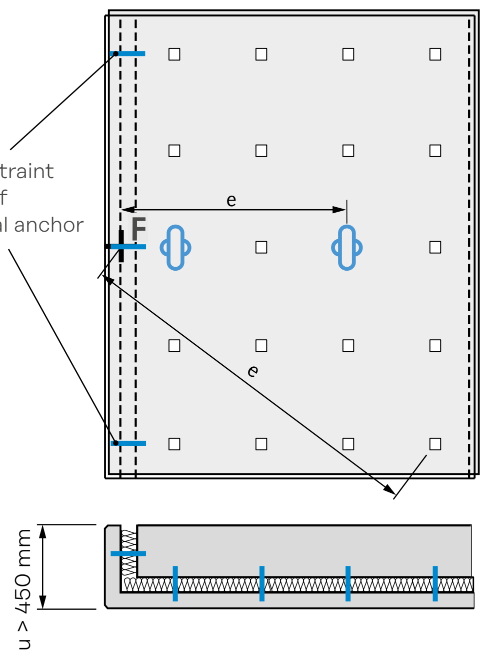
Mixed systems and special solutions (continued)

L-shape and U-shape panels

Ensure that no connecting elements, neither support anchors nor retaining anchors, are installed in the short legs in L-shaped or U-shaped panels where the leg u ≤ 450 mm.

If u > 450 mm, restraint ties must be installed in the leg. In this case, the horizontal anchor is omitted and the distance e must be measured from the inner leg (see illustration below).





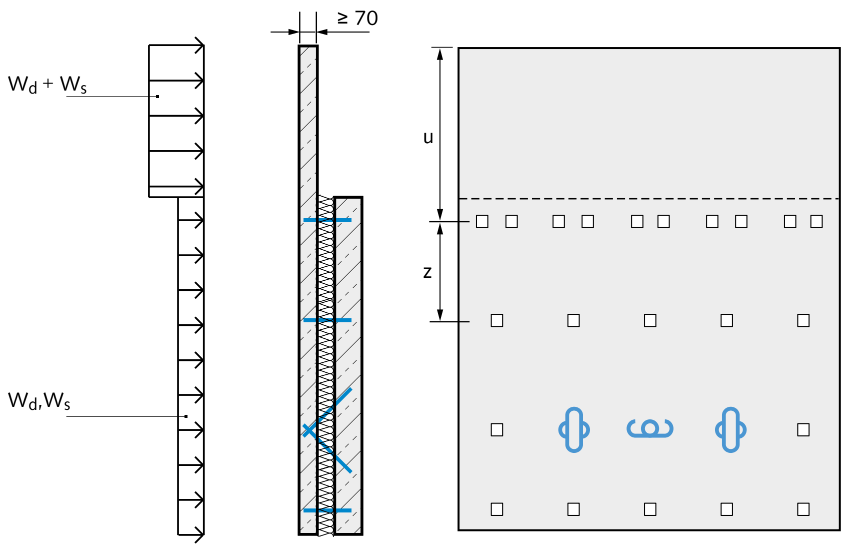
Note: Sample illustration for a SPA-1/-2 sytem

Facing layers with large projections

Large projections u in facing layers (approx. 300 to 900 mm) cause high stresses in the outermost row of restraint ties as a result of wind loads. Two restraint ties per grid point should be spaced at about 20 cm apart to support these loads.

Wind loads in facing layers with large projections cause rotation in the region of the edge supports (last row of restraint ties) and therefore to comparatively large displacement at the edge of the facing layer.

As a countermeasure, we recommend selecting a lower z value than the maximum admissible value for the first field next to the projection.



See page 22 for explanation of the symbols.

Halfen Sandwich Panel Anchors

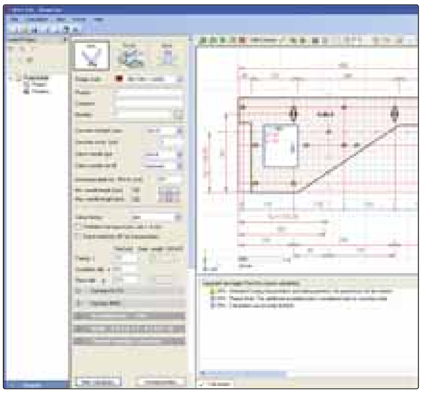
Design software

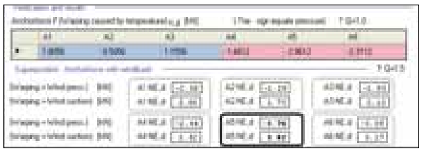
Dedicated software for easy calculation/selection of the correct anchor types

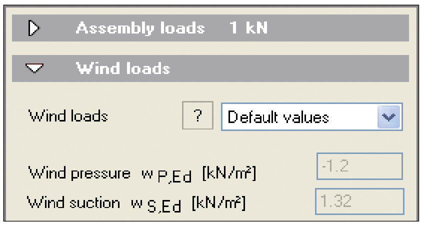
Main benefits of the software

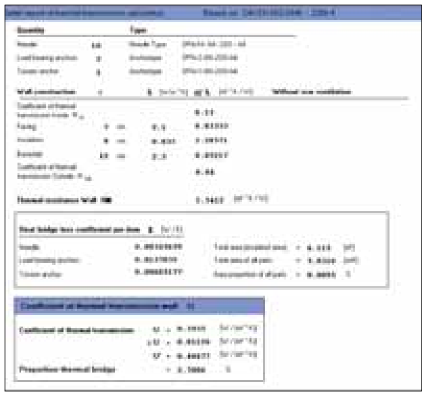
- interactive, easy to use graphical user interface
- time efficient, quick, and easy input of virtually any panel geometry
- user selectable support-anchor positions
- design calculation of each individual restraint tie, support and horizontal anchor
- only statically required anchors and pins are placed
- cost effective economical design suggestions
- verifiable printout with detailed results
- anchor and pin positions remain freely adjustable
- variable wind-load input
- actual wind loads (project/country specific) can be used instead of using a standard generic value
- lower wind loads increase anchor residual load-bearing capacities resulting in more cost-effective design
- U-value heat transmission calculation evaluates thermal bridging effects of anchors
- accurate calculation of thermal bridges avoids having to apply unfavourable, standard DIN 4108 calculation methods

Finite element calculation to optimize anchor design is also possible!









Notes:

All software calculations, especially the load bearing capacities, refer exclusively to Halfen SP-systems.

The basis for calculation is approval Z-21.8-1926 and approval Z-21.8-1979.

Apparently identical third-party products can differ substantially in their performance, and may not have adequate safety.

We therefore accept no liability when using our Software to calculate for third party products.

Please contact our Technical Support Team to calculate our SPA-FLEX system for your projects.

→ see back of this catalogue for contact information.

Halfen Sandwich Panel Anchors

Design software

Basics

The design load-bearing capacities V_{Rd}, N_{Rd} and M_{Rd} are resistance values that already take the partial safety factors for the materials into account.

V_{Rd}, N_{Rd}, M_{Rd} need to be compared with the partial safety coefficient increased action V_{Ed} (vertical loads, for example, dead load of the facing layer and if required any present additional loads), N_{Ed} (horizontal loads, for example, from wind loads and thermal warping) and M_{Ed} (only for the FA system) as specified in the appropriate approval.

The horizontal loads are primarily affected by the geometry of the panel, the grid spacing as well as the position of the anchors.

Design loads for the Software

1. Vertical Loads

The dead weight of the facing layer plus any existing additional loads are to be taken into account as acting vertical loads.

Finite element calculation to optimize anchor design is also possible!

2. Warping loads

Warp loads are normally verified according to Utescher; whereby the following factors are considered:

- anchor layout as a grid with a side-ratio of $0.75 \leq l_X/l_Y \leq 1.33$
- facing layer thickness f = 70 – 120 mm (further verification is required for thicker facing layers)
- temperature stresses according to DIBt Guidelines 5/1995: temperature gradient for three-layer panel without ventilation gap (dark surface) $\Delta T = \pm 5°K$

3. Wind loads in accordance with DIN EN 1991-1-4/NA Germany for the SP-FA and SP-SPA

A sandwich panel with an grid layout of the anchors of max. $l_x \times l_y$ = 1.20 m × 1.20 m.

The wind design loads in the table [kN/m²] take the following assumptions into account:

- simplified wind pressure for building heights up to 25 m
- applicable for inland regions and wind zones 1 and 2
- wind action area ≤ 1 m² (unfavourable assumption)
- h/d ≥ 5 (unfavourable assumption)
- "Standard region" includes zone D (for pressure) and B (for suction)
- "Periphery region" includes zone D (for pressure) and A (for suction)

The default wind loads in the Design software are for a building with a height ≤ 18 m in a standard region for wind zone 2 ($w_{D,k}$ = 0.80 kN/m² and $w_{S,k}$ = −0.88 kN/m²).

Other wind loads variables are user selectable.

Selected combination

Building height	Wind zone 1		Wind zone 2	
	Standard region	Periphery region	Standard region	Periphery region
≤ 10 m	$w_{D,k}$ = 0.50	$w_{D,k}$ = 0.50	$w_{D,k}$ = 0.65	$w_{D,k}$ = 0.65
	$w_{S,k}$ = - 0.55	$w_{S,k}$ = - 0.85	$w_{S,k}$ = - 0.72	$w_{S,k}$ = - 1.11
≤ 18 m	$w_{D,k}$ = 0.65	$w_{D,k}$ = 0.65	$w_{D,k}$ = 0.80	$w_{D,k}$ = 0.80
	$w_{S,k}$ = - 0.72	$w_{S,k}$ = - 1.11	$w_{S,k}$ = - 0.88	$w_{S,k}$ = - 1.36
≤ 25 m	$w_{D,k}$ = 0.75	$w_{D,k}$ = 0.75	$w_{D,k}$ = 0.90	$w_{D,k}$ = 0.90
	$w_{S,k}$ = - 0.83	$w_{S,k}$ = - 1.28	$w_{S,k}$ = - 0.99	$w_{S,k}$ = - 1.53

4. Distance from anchors to the fulcrum e

The following influencing factors are taken into account when calculating the allowable distances e.

- Heat insulation layer b
- Temperature stress in accordance with DIBt guidelines 5/1995:

Load-bearing layer temperature (inner, total year)	ϑ_i = +20°C
Facing layer temperature in summer	ϑ_a = +65°C
Facing layer temperature in winter	ϑ_a = −20°C
Temperature difference compared to condition at installation	ΔT = ±45°K

Halfen Sandwich Panel Anchors

General Information

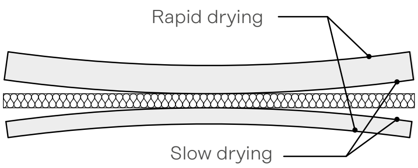
Warping caused by shrinkage

Large panels, in particular, with a length of more than 6 m, may display signs of warping caused by shrinkage.

Shrinkage is mainly dependent on the drying of the concrete. This drying proceeds from the exterior inwards. This causes the inner and outer layers of the sandwich element to warp in different directions. The quicker the surface dries and the slower the layer-core dries the more exaggerated the warping.

Deformations can be expected in sandwich panels exposed to direct sunlight or wind in the first few days after production.

Use appropriate measures to prevent the concrete from drying too quickly. For example, watering the concrete during curing. Also, use good quality insulation with low water absorption characteristics.



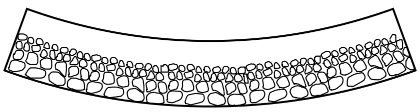
Insulation materials with a high-water absorption capacity transfer moisture to the concrete during the curing process. This increases the differences in drying in the external and internal layers in sandwich elements.

Concrete technology (additives etc.) can also be used to reduce shrinkage and keep any detrimental effects to a minimum.

- A low water/cement ratio is preferable.
- The grading curve of the additive-mix should be conservative.
- The maximum aggregate size should be selected according to the reinforcement and dimensions of the sandwich panel.
- Keep cement paste and fine sand to a minimum.

The use of concrete additives, especially wetting agents, air-entraining agents, damp-proofing, and permeability reducing agents and retarders can have a very detrimental effect on concrete shrinkage. Aggregate separation may occur when compacting the concrete.

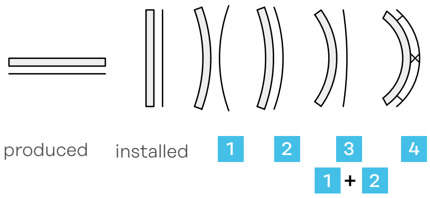
Segregated concrete



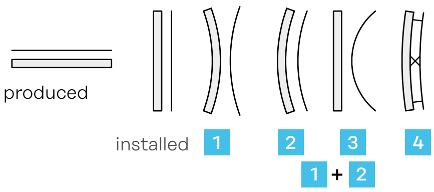
Larger and heavy aggregate in the concrete mix sink to the bottom during vibration. The smaller, lighter, and wetter components rise to the top. This results in a higher shrinkage value at the top than at the bottom ('top' and 'bottom' refer to the position of the panel during concreting).

The nature and intensity of the warping in a sandwich panel also depends on whether the precast element was produced using the negative or positive process. (See installation instructions for sandwich panels at www.halfen.com).

With Sandwich panels produced in the negative process the warping tendency in the load-bearing layer caused by time dependent shrinkage (1 drying out) is increased by mix dependent shrinkage (2 mix separation). In the facing layer the warping tendencies from 1 and 2 counteract each other 3 and the layer remains virtually flat. The stiffer load-bearing layer imposes its warping on the facing layer via the connecting anchors 4 .



In sandwich panels produced in the positive process, the warping tendencies 1 - 2 are counteractive and the load-bearing layer remains virtually flat 3 . The warping tendencies from the facing layer 1 - 2 accumulate. Warping in the facing layer is prevented by sandwich panel anchors 4 .



Preventing warping by using sandwich panel anchors cause stresses that can lead to cracks in the facing layer. Care should be taken to prevent this warping. Apart from the described technical measures during production, correct planning and tried and tested construction methods should be used when designing prefabricated elements.

Halfen Sandwich Panel Anchors

General Information

Warping caused by temperature differences

With a rapid increase in temperature the outer surface of the facing layer is subjected to greater expansion than the non-exposed surface nearest to the insulation layer. This can be caused by direct sunlight in winter **(fig. 1).** In summer the facing layer can contract when heavy rain causes sudden cooling of the surface **(fig. 2).**

The resulting warping in the facing layer is largely contained by load transfer via the sandwich panel anchors to the rigid support layer.

The magnitude of the resulting restraint forces depends on the following factors:

- temperature gradient in the facing layer
- thickness of the facing layer
- concrete grade of the facing layer
- geometry of the facing layer
- type and arrangement (grid layout) of the anchors

Favourable conditions are:

- light coloured facing layers
- thin facing layer thicknesses (f = 70 – 80 mm
- evenly distributed anchors grid (Ratio ~ 1:1)

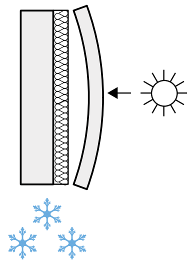


Fig 1: sudden heat increase in winter

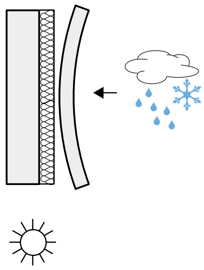
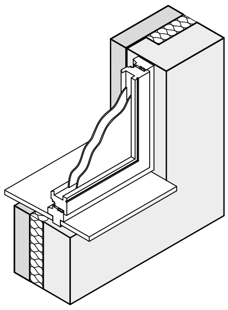


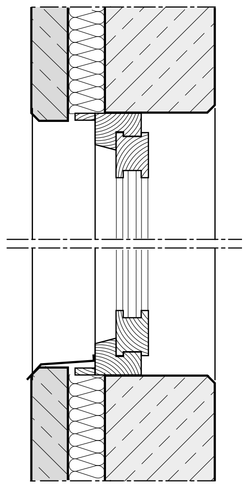
Fig 2: sudden cooling in summer

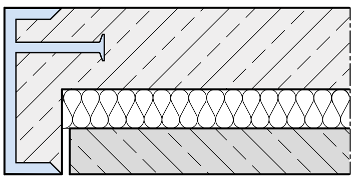
Window and door fixings

To avoid cracks, the connection of the facing layer to the load-bearing layer must allow for movement. Additional fixing points such as windows or doors connected to the facing layer lead to constraints that may cause cracks.

Window and door elements should only be fixed to one layer (standard is to the load-bearing layer).

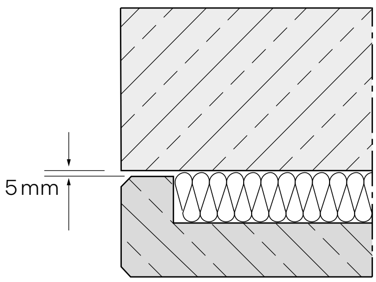






Reveals

Concrete connection between a load-bearing layer and a facing layer must be strictly avoided.
To allow movement (expansion and contractions), panel edges, reveals at window and door frames must be separated from the load-bearing layer with an expansion joint (min. 5 mm).



Halfen Sandwich Panel Anchors

General information

Forming the facing layer

In accordance with DIN EN 1992-1-1/NA (section 10.9.9), the miminum thickness of a facing layer is 7 cm.

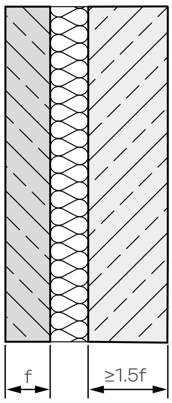
Minimum requirement is a reinforcement mesh with:
a_s = 1.31 cm²/m (SPA-1/-2) i.e.
a_s = 1.88 cm²/m (FA i.e. SPA-FLEX).

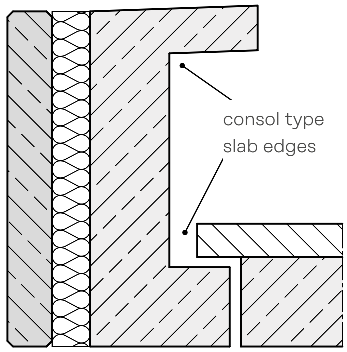
Refer to the appropriate approval for required additional reinforcement in the sandwich panel layer (see also → pages 7–11).

Forming the load-bearing layer

To effectively counter deformations resulting from the facing layer we recommend that the load-bearing layer be at least 50% thicker than the facing layer.

Rigidity can be further increased for special requirements by designing windows sills and panels edges as consoles.

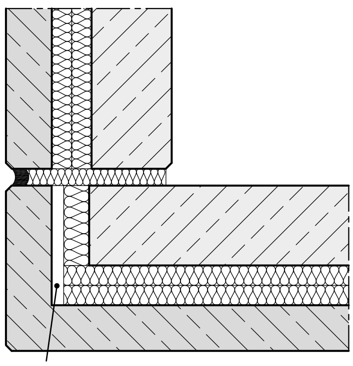


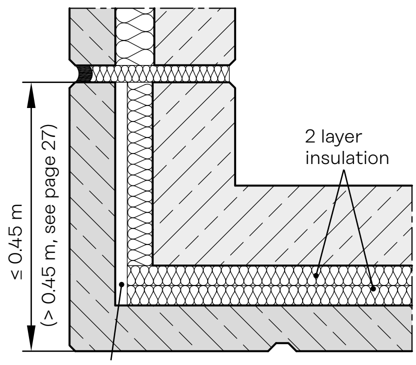


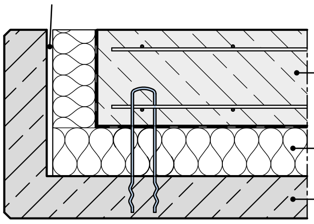
Corner design

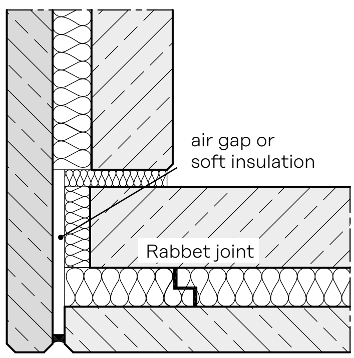
The following points should be noted if the facing layer is continued round a corner at building edges or at window or door openings:

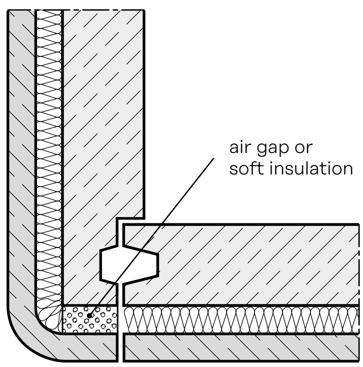
- An air gap must be left between the facing layer and the heat insulation layer in the shorter leg. Alternatively, the insulation can be soft fibre insulation (e.g. mineral wool).
- No restraint ties are to be placed in a short leg that extents around a corner.











Halfen Sandwich Panel Anchors

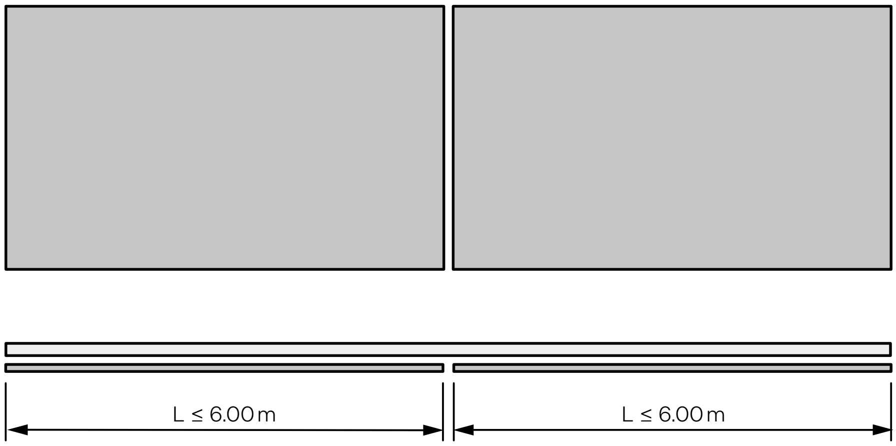
General information

Panel lengths

To keep crack widths small, technical publications recommend the following maximum dimensions for weather exposed layers in sandwich elements.

For structured weather panels, L_{max} should be ≤ 8.0 resp. A ≤ 15 m².
With smooth surfaces the maximum area can be kept to 15 m² but the length should be reduced to 5 to 6 m.

If longer elements cannot be avoided, it is recommended that the facing layer be divided into smaller elements. However, the supporting layer can be produced as one piece.



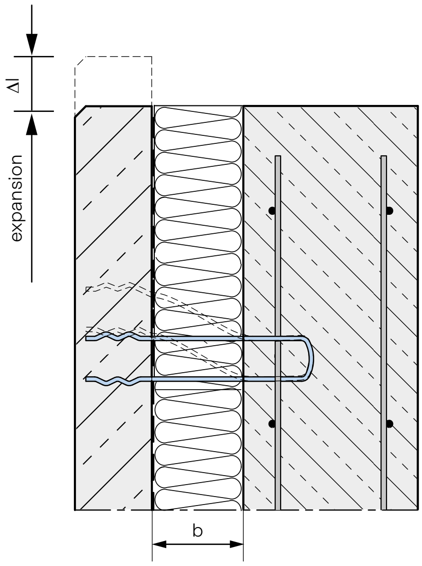
If for aesthetical, architectural reasons longer panels cannot be avoided, deviating from these recommendations is possible if certain measures are taken (see right). These measures should restrict shrinkage and changes in length caused by temperature fluctuation and keep the resulting constraint stresses to a minimum.

Favourable methods are:

- low water/cement ratio of the concrete
- correct storage and subsequent treatment of the precast elements
- light colour facing layer
- two layers of insulation with offset or rabbet joints
- using a seperating foil between the facing layer and the insulation
- sufficient thickness of the insulation layer
- reinforcing the support layer
- designing sufficiently wide expansion joints

With a standard insulation layer thickness (b ≥ 80 mm) the possible facing layer dimensions are not normally limited by the anchor spacing e (see Building Authority Approval).

In this case, the decisive factors for the facing layers are normally the recommendations stated above for the outer concrete layer dimensions and the required joint design (joint width and the selected material).



Insulation layer thickness b

- less elongation of the restraint tie in cases of expansions in the facing layer
- larger allowable distance e of the restraint ties to the fulcrum F

The specifications in DIN 18540 must be observed when designing panels with elastic expansion joints.

These joints must be designed to allow constraint-free expansion of the facing layer.

Leviat®

Innovative engineered products and construction solutions that allow the industry to build safer, stronger and faster.

Contact Leviat worldwide

Australia
98 Kurrajong Avenue,
Mount Druitt, Sydney, NSW 2770
Tel: +61 - 2 8808 3100
Email: info.au@leviat.com

Austria
Leonard-Bernstein-Str. 10
Saturn Tower, 1220 Wien
Tel: +43 - 1 - 259 6770
Email: info.at@leviat.com

Belgium
Industrielaan 2
1740 Ternat
Tel: +32 - 2 - 582 29 45
Email: info.be@leviat.com

China
Room 601 Tower D,
Vantone Centre
No. A6 Chao Yang Men Wai Street
Chaoyang District
Beijing P.R. China 100020
Tel: +86 - 10 5907 3200
Email: info.cn@leviat.com

Czech Republic
Pekařská 695/10a
155 00 Praha 5
Tel: +420 - 311 - 690 060
Email: info.cz@leviat.com

Finland
Vädursgatan 5
412 50 Göteborg / Sweden
Tel: +358 (0)10 6338781
Email: info.fi@leviat.com

France
6, Rue de Cabanis
31240 L'Union
Tel: +33 (0) 5 34 25 54 82
Email: info.fr@leviat.com

Germany
Liebigstrasse 14
40764 Langenfeld
Tel: +49 - 2173 - 970 - 0
Email: info.de@leviat.com

India
Unit S4, 902, A Wing,
Lodha iThink Techno Campus Building,
Panchpakhadi, Pokharan Road 2,
Thane, 400606
Tel: +91-022 695 33700
Email: info.in@leviat.com

Italy
Via F.lli Bronzetti 28
24124 Bergamo
Tel: +39 - 035 - 0760711
Email: info.it@leviat.com

Malaysia
28 Jalan Anggerik Mokara 31/59
Kota Kemuning,
40460 Shah Alam Selangor
Tel: +603 - 5122 4182
Email: info.my@leviat.com

Netherlands
Oostermaat 3
7623 CS Borne
Tel: +31 - 74 - 267 14 49
Email: info.nl@leviat.com

New Zealand
2/19 Nuttall Drive, Hillsborough,
Christchurch 8022
Tel: +64 - 3 376 5205
Email: info.nz@leviat.com

Norway
Vestre Svanholmen 5
4313 Sandnes
Tel: +47 - 51 82 34 00
Email: info.no@leviat.com

Philippines
27F Office A, Podium West Tower,
12 ADB Avenue, Ortigas Center
Mandaluyong City, 1550
Tel: +63 - 2 7957 6381
Email: info.ph@leviat.com

Poland
Ul. Obornicka 287
60-691 Poznań
Tel: +48 - 61 - 622 14 14
Email: info.pl@leviat.com

Singapore
10 Benoi Sector,
Singapore 629845
Tel: +65 - 6266 6802
Email: info.sg@leviat.com

Spain
Polígono Industrial Santa Ana
c/ Ignacio Zuloaga, 20
28522 Rivas-Vaciamadrid
Tel: +34 - 91 632 18 40
Email: info.es@leviat.com

Sweden
Vädursgatan 5
412 50 Göteborg
Tel: +46 - 31 - 98 58 00
Email: info.se@leviat.com

Switzerland
Grenzstrasse 24
3250 Lyss
Tel: +41 (0) 800 22 66 00
Email: info.ch@leviat.com

United Arab Emirates
RA08 TB02, PO Box 17225
JAFZA, Jebel Ali, Dubai
Tel: +971 (0)4 883 4346
Email: info.ae@leviat.com

United Kingdom
President Way,
President Park,
Sheffield S4 7UR
Tel: +44 - 114 275 5224
Email: info.uk@leviat.com

USA / Canada
6467 S Falkenburg Road
Riverview, FL 33578
Tel: (800) 423-9140
Email: info.us@leviat.us

For countries not listed
Email: info@leviat.com

A CRH COMPANY

© 2024 F-040-EN – 04/24 PDF 04/24

Imagine. Model. Make.

Leviat.com