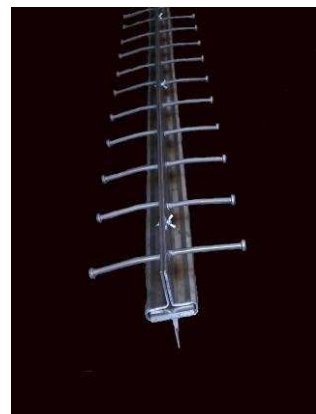


HC-Delta (+) (SinusSlide®) Expansion joint for industrial floor Technical sheet



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Description

The **HC-Delta (+) (Sinus Slide®)** construction and dilatation joint is composed of two continuous cold-rolled symmetrical profiles in SJ235JRG2 steel with a thickness of 5 mm.

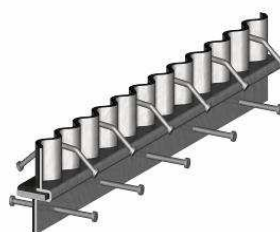
When it is put together, a steel plate of 70 x 10 mm is inserted between these two profiles.

To anchor them in the concrete, these profiles are fitted on both sides with anchor bolts $\varnothing 10$ and 125 mm long, which are automatically welded on, every 200 mm with upset butt welding.

In the **HC-Delta +** and **Sinus Slide®** range, the anchor bolts are welded to the top **and** bottom as standard.



HC-Delta +



HC-Delta Sinus Slide®

The profiles are connected with wing bolts with plastic nuts that should not be removed after installation.

When installing at the yard, the steel plate, which protrudes by 15 mm, is inserted into the previous profile, to achieve a perfect join.

The profile is manufactured in standard lengths of 3 m and is available in heights of between 120 and 300 mm. We supply customised solutions from 300 mm upwards.

Due to their continuous form, these profiles prevent stress concentrations during the load transfer. ***Compared with discontinuous profiles, this means a better load transfer can be achieved.***

Description

The patent pending Sinus Slide® joint with corrugated upper side in 5 mm thick steel ensures continuous support of passing wheels regardless of the direction, size and form of the wheel, from the placement of the joint to its maximum opening of 20 mm. By neutralising the striking impact of the wheels, forklift drivers experience unprecedented **comfort**. At the same time, maximum **edge protection** and **load transfer** are achieved, significantly reducing the chance of damage to the floor, the vehicle, or the goods being transported. **This Sinus Slide® solution** is especially recommended in thoroughfares and/or other areas of the floor that experience high forklift traffic. **The Sinus Slide® Joints** enables not only joint free floor slabs but the whole floor is experienced as Joint free. You can still see a joint but you don't feel it anymore. This is a new age in industrial flooring technology. This shock-and vibration free crossing will prevent any damage on your floor and save the investor huge amounts on wear and tear of forklifts. Only with the replacement costs of wheels the payback period of the investment is less than one year.

Features

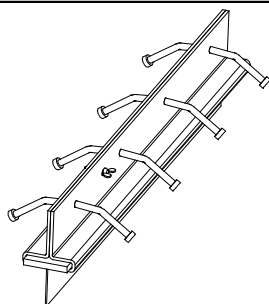
- **Free horizontal movement** of the industrial floor. When drying the poured concrete, the inevitable shrinkage is compensated for by the horizontal expansion of the HC-Delta (+) (Sinus Slide®) dilatation joint. This prevents cracks caused by the drying process. This cracking also occurs if the floor has been cut into too late, which is superfluous when fitting an expansion joint.
- **Preventing vertical movement.** The minuscule tolerance between the profiles and the connection with the 70 x 10 mm steel plate prevents any vertical movement between the various parts of the floor. The steel profiles also ensure the elastic behaviour of the joint.
- **Load transfer** With forklift traffic, the HC-Delta expansion joints provides a transfer of loads from one floor section to another. This means that the floor is less subject to wear, the chance of damage is reduced, and the lifetime of the industrial floor is lengthened considerably. The Sinus Slide® version realize this load transfer is a noiseless and smoothly way. The wheels of the forklifts are sliding shock- and vibration free from one floor section to another. This creates an unprecedented level of comfort.
- **Maximum load** The rigid steel structure ensures that the floor can withstand maximum load with minimum distortion.
- **Edge protection.** The 5 mm thick steel profiles and especially the Sinus Slide® solution give maximum edge protection. The Sinus Slide® solution will not only create an unprecedented level of comfort but will also avoid any crumbling of the edges of the floor sections.
- **Easy installation and compatible.** The HC-Delta expansion joints are quite easy and quick to install according to the installation instructions given below in this technical documentation. The HC-Delta (+) is 100% compatible with the HC-Delta Sinus Slide® Joint for almost every available height.
- **Concrete formwork** The HC-Delta profiles are fitted according to a layout plan with limited dimensions separating the various floor parts. The areas can then be poured and finished according to the day's schedule.
- **Compliant with the European directive 2002/44/EC.** The Sinus Slide® solution guarantees shock- and even vibration free transfer between two floor sections even with forklifts with very small and hard wheels. With this feature the HC-Sinus Slide® Joint is compliant with the European directive 2002/44/EC concerning exposures of workers to whole body vibrations.

HC-Delta (+) (SinusSlide®)

Expansion joint for industrial floor

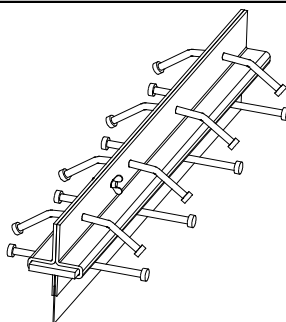
Technical sheet

Product overview



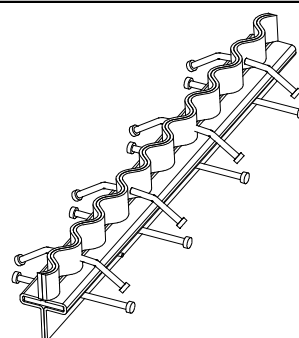
1

HC-Delta joint
2 x 1 row of anchor bolts



2

HC-Delta + dilatation joint
2 x 2 rows of anchor bolts and adjustable strip



3

HC-Delta Sinus Slide® joint
2 x 2 rows of anchor bolts and adjustable strip

Technical properties of HC-Delta (+) Sinus Slide® joint

	1	2	3
Thickness	2 x 5 mm		
Steel quality	SJ235 JRG2		
Length	3 m	3 m	2.997 m
Anchor bolts	Ø10 length 125 2 x 5 per m Automatically welded	Ø10 length 125 2 x 10 per m Automatically welded	Ø10 length 125 2 x 10 per m Automatically welded
Production method	Cold-rolled symmetrical profiles to achieve optimal tolerance 70 x 10 mm steel plate in accordance with EN 10025		
Steel finish	Natural Electrolytic galvanisation		
Profile height	85-300 mm Other dimensions on request	105-300 mm Other dimensions on request	105-300 mm Other dimensions on request
Securing	Connected with M6 x 20 wing bolts and polyamide plastic nut. These connections should not be removed after fitting. The tensile force of the concrete breaks the connection with the polyamide nut.		
Concrete reinforcement	Both concrete with reinforcement mesh and glass fibre-reinforced concrete.		
Accessories	Intersections in L, T or X shape		
Helping tool	Device for height adjustment and installation		
Variance in straightness of horizontal surface	1 mm / 3 m		
Variance in straightness of vertical surface	2 mm / 3m		

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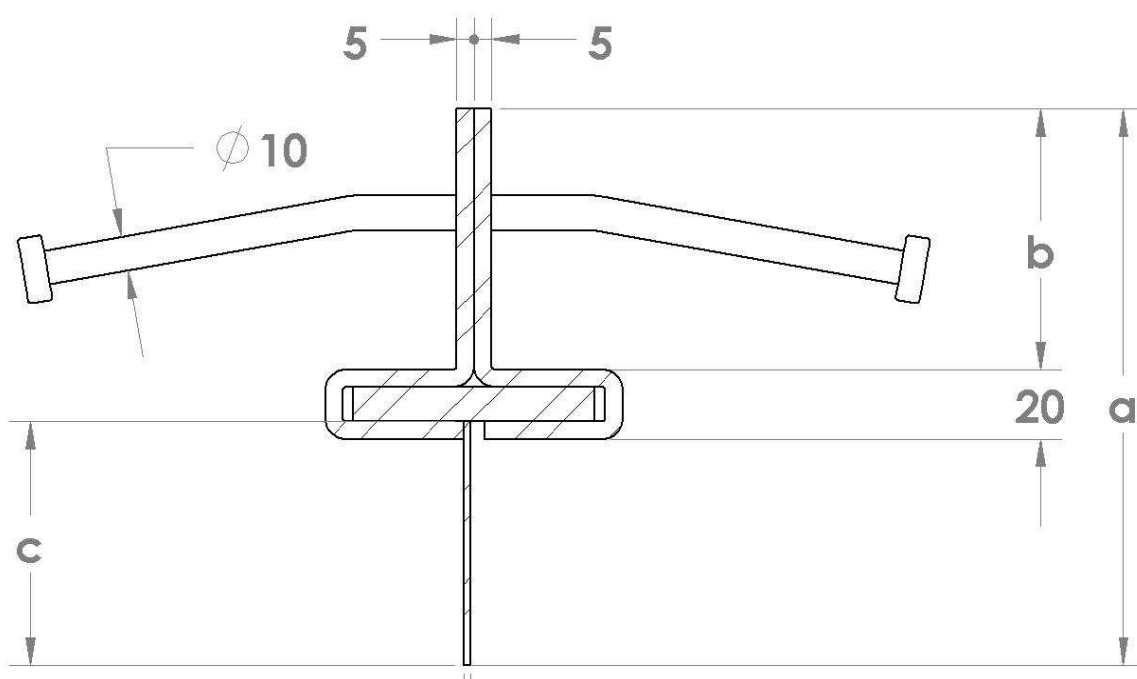
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Technical characteristics HC-Delta standard



Type	Profile-height a (mm)	Floor thickness (mm)	b (mm)	c (mm)	Weight (kg/meter)	Maximum metres pro pallet	Compatible with
HC-Delta 85	85	90-100	50	20	16.51	144	
HC-Delta 95	95	100-110	50	30	16.68	144	
HC-Delta 105	105	110-120	50	40	16.84	126	
HC-Delta 120	120	130-140	60	45	17.50	126	
HC-Delta 130	130	140-150	60	55	17.76	126	HC-Delta Sinus Slide®
HC-Delta 140	140	150-160	60	65	17.92	108	HC-Delta Sinus Slide®
HC-Delta 150	150	160-170	60	75	18.08	108	HC-Delta Sinus Slide®
HC-Delta 160	160	170-180	75	70	19.27	108	HC-Delta Sinus Slide®
HC-Delta 180	180	190-200	75	90	19.59	108	HC-Delta Sinus Slide®
HC-Delta 200	200	205-220	90	95	20.74	90	HC-Delta Sinus Slide®
HC-Delta 220	220	225-240	90	115	21.06	90	HC-Delta Sinus Slide®
HC-Delta 240	240	245-260	116	110	23.03	75	HC-Delta Sinus Slide®
HC-Delta 260	260	265-280	116	130	23.35	75	HC-Delta Sinus Slide®
HC-Delta 280	280	285-300	116	150	23.67	60	HC-Delta Sinus Slide®
HC-Delta 300	300	305-320	116	170	23.99	60	HC-Delta Sinus Slide®

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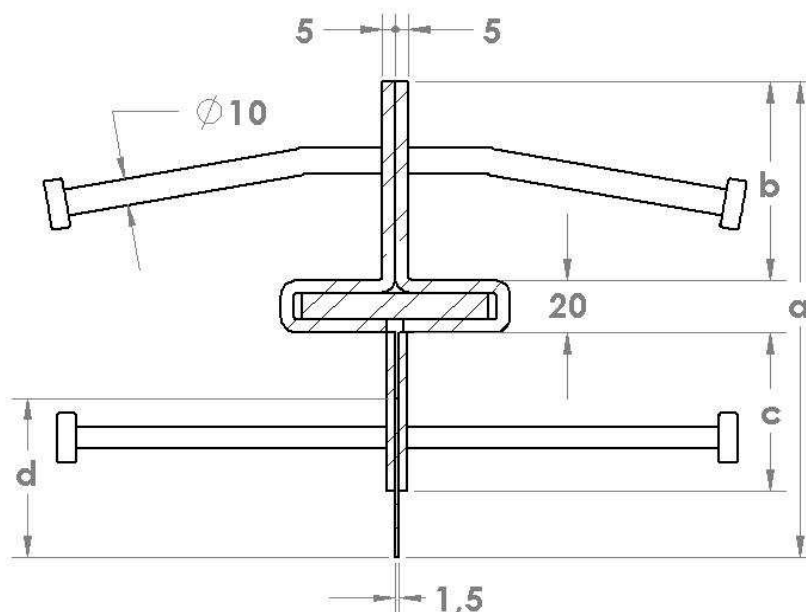
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HC-Delta (+) (SinusSlide®) Expansion joint for industrial floor Technical sheet

Technical characteristics HC-Delta +



Profile height a (mm)	Type	Floor thickness (mm)	b (mm)	c (mm)	d (mm)	Weight (kg/meter)	Maximum metres pro pallet	Compatible with
105	HC-Delta+ 105	110-120	50	35	/	18,96	126	
120	HC-Delta+ 120	130-140	60	40	/	19,76	126	
130	HC-Delta+ 130	140-150	60	40	30	20,23	108	HC-Delta Sinus Slide® 130
140	HC-Delta+ 140	150-160	60	40	40	20,39	108	HC-Delta Sinus Slide® 140
150	HC-Delta+ 150	160-170	60	40	60	20,54	108	HC-Delta Sinus Slide® 150
160	HC-Delta+ 160	170-180	75	40	60	21,50	90	HC-Delta Sinus Slide® 160
180	HC-Delta+ 180	190-200	75	60	60	22,43	90	HC-Delta Sinus Slide® 180
200	HC-Delta+ 200	205-220	90	60	60	23,56	90	HC-Delta Sinus Slide® 200
220	HC-Delta+ 220	225-240	90	60	80	23,8	75	HC-Delta Sinus Slide® 220
240	HC-Delta+ 240	245-260	116	60	80	25,9	60	HC-Delta Sinus Slide® 240
260	HC-Delta+ 260	265-280	116	70	80	26,6	60	HC-Delta Sinus Slide® 260
280	HC-Delta+ 280	285-300	116	70	100	26,83	60	HC-Delta Sinus Slide® 280
300	HC-Delta+ 300	305-320	116	80	120	27,53	60	HC-Delta Sinus Slide® 300

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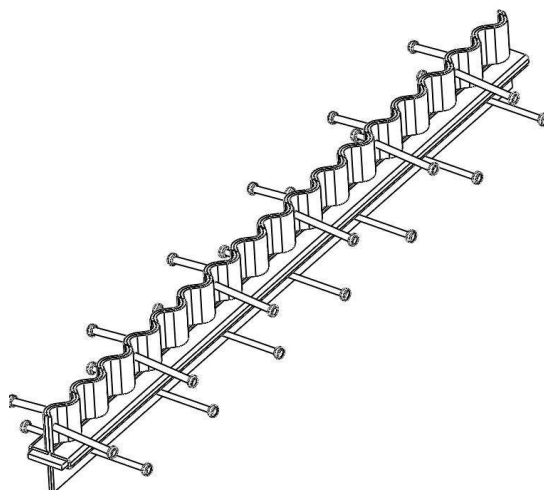
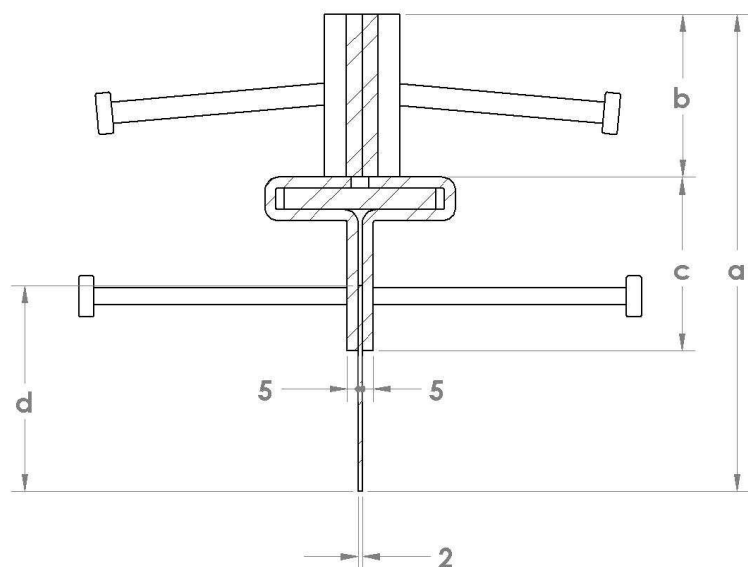
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Technical Characteristics HC-Delta Sinus Slide®



Profile height a (mm)	Type	Floor- thickness (mm)	b (mm)	c (mm)	d (mm)	Weight (kg/meter)	Maximum metres pro pallet	Compatible with
105	HC-Delta Sinus Slide® 105	110-120	35	70	/	20,31	108	
120	HC-Delta Sinus Slide® 120	130-140	50	70	/	21,76	108	
130	HC-Delta Sinus Slide® 130	140-150	60	70	/	22,73	108	HC-Delta +
140	HC-Delta Sinus Slide® 140	150-160	60	80	30	23,89	90	HC-Delta +
150	HC-Delta Sinus Slide® 150	160-170	60	80	40	24,04	90	HC-Delta +
160	HC-Delta Sinus Slide® 160	170-180	75	80	30	25,33	90	HC-Delta +
180	HC-Delta Sinus Slide® 180	190-200	75	80	55	25,73	90	HC-Delta +
200	HC-Delta Sinus Slide® 200	205-220	90	80	65	27,34	81	HC-Delta +
220	HC-Delta Sinus Slide® 220	225-240	90	80	80	27,58	81	HC-Delta +
240	HC-Delta Sinus Slide® 240	245-260	116	95	55	30,96	81	HC-Delta +
260	HC-Delta Sinus Slide® 260	265-280	116	95	75	31,12	81	HC-Delta +
280	HC-Delta Sinus Slide® 280	285-300	116	95	95	31,60	60	HC-Delta +
300	HC-Delta Sinus Slide® 300	305-320	116	95	105	31,76	60	HC-Delta +

Accessoires

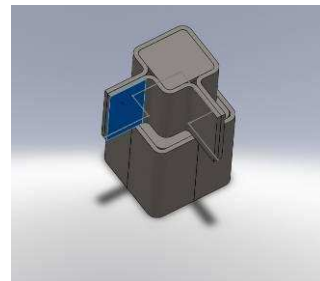
Crossings

These are available in all dimensions in proportion to the profile used.

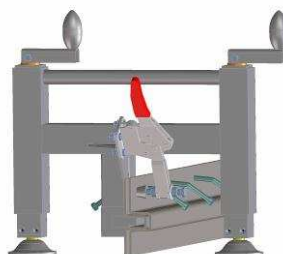
X and T- crossings for traditional joints



X, T and L-crossings for Sinus Slide® joints



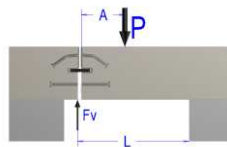
Assembly assistance



Load transfer

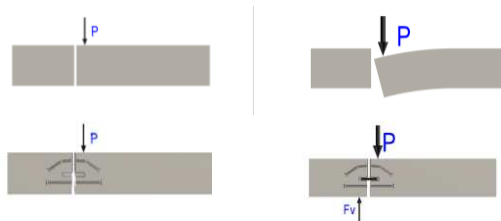
The load transfer by the profile depends on a number of factors

- The first factor is a position variable. This characterises the position of the load in relation to the joint and support.



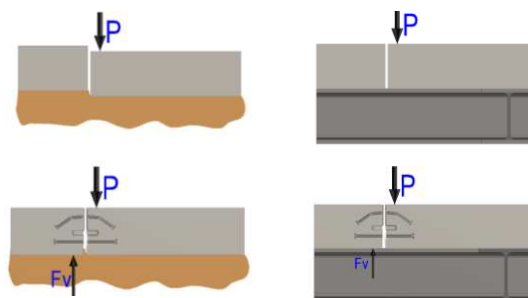
$$- F_v = \frac{P \times (L-A)}{L}$$

- A second factor is the size of the load in relation to the thickness of the floor. Load transfer is only realised from the moment that the load is great enough to move or distort the floor part until any play between the parts is eliminated.



Small load Large load

- A third factor that influences load transfer is the foundation. If the foundation is solid, the loads will be supported by the foundation. If the floor is on bearing piles, the entire load has to be borne by the profile.



Unstable foundation Solid foundation

If a load hits the edge of a plate, then the concrete tensions are roughly 50% higher than when a load is in the middle of the plate. The dilation joint compensates for this increase in height and, depending on the foundation and the position and size of the load, will transfer this load to the adjoining plate.

Tests

The capacity of these joints has been tested by the Magnef laboratory at the University of Ghent.

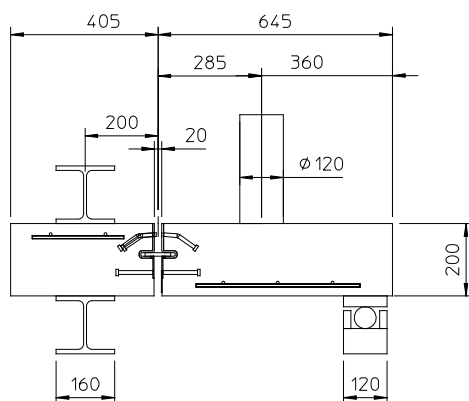
Test set-up

It was decided to test the joint without support to maximise the load transfer through the joint.

The joint was fitted into a test specimen measuring 1 m x 1.05m.

The joint opening measured 10 mm or 20 mm.

For the concrete, one test was conducted with unreinforced concrete (c30/37) and another with glass fibre-reinforced concrete with 45 kg fibre/m³.

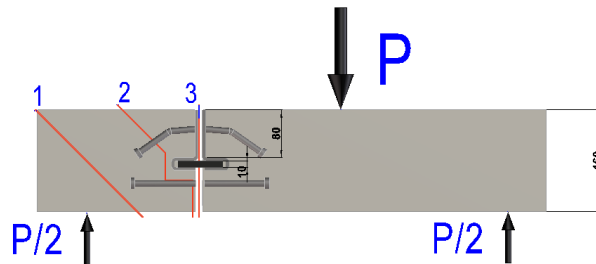


Test results

Type	Anchors On top/bottom	Opening (mm)	Concrete height (mm)	Steel fibre- reinforced concrete (y/n)	Breaking strain kN
Hc-delta 140	On top	10	150	N	99
Hc-delta 140	On top	20	150	N	90.5
Hc-delta + 160	Top/bottom	10	200	Y	235
Hc-delta + 160	Top/bottom	20	200	Y	199.5

Calculation example

Analysis of the various types of fracture the joint



Technical details

- Concrete thickness H: 160 mm
- Profile height: h= 140 mm.
- Anchor breaking strength: $\sigma_{\text{ank}} 450 \text{ N/mm}^2$
- Steel breaking strength $\sigma_{\text{st}} = 350 \text{ N/mm}^2$
- Characteristic compression strength of the concrete $f_{\text{ck}} = 25 \text{ N/mm}^2$
- Anchor diameter $\phi 10 \text{ mm}$
- Load transfer 50%
- P = strength per length unit
- n_{ank} = Number of anchors per length unit
- ζ = shear stress

Various kinds of fractures

Hc-delta Hp with 2 x 1 row of pins

1. Concrete fracture due to shearing:

$$P = 1/\text{Load transfer} * H * \sqrt{2} * \zeta \text{ where } \zeta = 0.05 * f_{\text{ck}} / 1.5$$

$$P = 1/0.5 * 160 * \sqrt{2} * 0.05 * 25 / 1.5$$

$$= 377 \text{ kN}$$

2. Anchor fracture

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$$P = 1/\text{load transfer} * (a * \sqrt{2} * \zeta + A_{\text{ank}} * n_{\text{ank}} * \zeta_{\text{ank}})$$

$$\text{where } \zeta_{\text{ank}} = 0.8 * \sigma_{\text{ank}}$$

$$P = 1/0.5 * (60 * \sqrt{2} * 0.05 * 25 / 1.5 + 10^2 * \pi/4 * 5 * 0.8 * 0.45)$$

$$P = 424 \text{ kN}$$

3. Profile fracture:

$$P = 1/\text{load transfer} * A * \zeta_{\text{st}}$$

$$\text{where } \zeta_{\text{st}} = 0.8 * \sigma_{\text{st}}$$

$$P = 1/0.5 * (1000 * 10 * 0.8 * 0.350)$$

$$P = 5,600 \text{ kN}$$

The maximum value in the event of fracture is 377 kN allowing for a load transfer of 50%.

Hc-Delta + with 2 x 2 row of pins

1. Concrete fracture due to shearing:

$$P = 1/\text{Load transfer} * H * \sqrt{2} * \zeta \text{ where } \zeta = 0.05 * f_{\text{ck}} / 1.5$$

$$P = 1/0.5 * 160 * \sqrt{2} * 0.05 * 25 / 1.5$$

$$= 377 \text{ kN}$$

2. Anchor fracture

$$P = 1/\text{load transfer} * (a * \sqrt{2} * \zeta + A_{\text{ank}} * n_{\text{ank}} * \zeta_{\text{ank}})$$

$$\text{where } \zeta_{\text{ank}} = 0.8 * \sigma_{\text{ank}}$$

$$P = 1/0.5 * (60 * \sqrt{2} * 0.05 * 25 / 1.5 + 10^2 * \pi/4 * 10 * 0.8 * 0.45)$$

$$P = 707 \text{ kN}$$

3. Profile fracture:

$$P = 1/\text{load transfer} * A * \zeta_{st}$$

where $\zeta_{st} = 0.8 * \sigma_{st}$

$$P = 1/0.5 * (5 * 4 * 0.8 * 350)$$
$$P = 5,600 \text{ kN}$$

The maximum value in the event of fracture is 707 kN allowing for a load transfer of 50%. The fracture due to the concrete shearing only amounts to 377 kN, however.

The values given in this example are only guideline values and should always be verified by a constructional engineer.

The safety factors should be selected according to the application. Dynamic loads require higher safety factors than static loads. For floors on bearing poles we always recommend dilation joints with two rows of anchors.

Installation instruction

The floor slab should be divided into square sections as much as possible. If this is not possible, the proportion of 3/2 for the width/length of the floor slab should be respected as much as possible.

The distance between the joints is determined in function of the expected shrinkage of the concrete. The shrinkage of a floor slab is strongly dependent on a number of thermal variables as well as the quality of the concrete. Shrinkage can vary between 0,3 to 0,5 mm/meter. In any case, an attempt must be made to limit the opening of the joints to a maximum of 20 mm. An indication in normal conditions would be floor sections of 30 to 40 metres. However, the advice of the project leader or expert is always recommended because shrinkage can vary considerably from country to country due to local environmental factors and concrete quality.

For intensively loaded floor sections, such as floors at loading bays and thoroughfares, we advise the use of the patent pending Sinus Slide® joint. The added cost is minimal relative to the total project investment, and is quickly recovered in view of the many advantages. Only with savings on the replacement costs of forklift's wheels the payback period is less than one year.

Fixed structures in the building such as columns and walls must be isolated with compressible material.

Ensure that no fixed connections are placed between 2 different floor slabs that could hinder the movement of these floor slabs, e.g. racks, conveyor belts, crash barriers, etc.

For some floors that are placed on a watertight membrane or insulation for example, the use of anchoring in the ground is not permitted. As an alternative we have adjustable placement feet available or other custom made solutions in our product range that do not require drilling through the foundation.

For floors on supporting piles, we always advise dilatation joints with a double row of anchors.

Check the presence of utilities and underground lines when using anchoring with pins in the ground.

Installation instructions

1. Stretch a piece of string across the place where the profiles are to be installed.
2. Lay out the joints along this string.
3. Place the first joint parallel with the string.
4. Raise them to the right height with wedges or using height adjustment (see accessories).
5. Drive or drill pickets vertically into the ground along the end of the anchors, two on each side of the end of the profile. If required, a further picket also can be placed in the middle.
6. Check the height of the profile with a laser and check that it is parallel to the string.
7. Check the flatness of the profile across the width all along the length.
8. Weld the pickets to the profile. If welding is not permitted at the yard, then there are special adjustment feet available.
9. Slide the following profile with the 15-mm protruding plate into the first profile. As the 70 x 10 plate is inserted by 15mm, the beginning of this profile is automatically at the right height.
10. Adjust the end of the second profile to the right height with wedges or by using the height adjustment.
11. Repeat this step from point 5 up to an intersection, wall or column.

For intersections

1. Place the intersection in the place indicated on the layout plan.
2. Measure the distance between the last joint fitted and the intersection. Cut a new piece of joint to the right length with a grinding disc.
3. Insert the length of joint cut to measure according to the method described above.
4. Then adjust the intersection to the right level and weld it to the joint.

Maintenance and finishing

The HC-Delta dilatation joint is designed to protect the edges of concrete slabs that are automatically formed when the joint opens due to the shrinkage that occurs in the drying process.

We advise filling the openings that are created with a joint or sealing product to prevent the accumulation of dirt and dust in the joint. Sealing the joint is possible for traditional HC-Delta (+) joints as for HC-Delta Sinus Slide® Joint.

The final sealing may only be done once the expansion of the joint is stabilised.