Leviat®
A CRH COMPANY

PLAKA

Plaka Titan

Dowel for transferring shear load in expansion joints
ATec n° 3.1/15-819_V2

CCFAT Avis Technique 3.1/15-819_V2

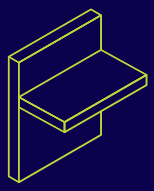
Structural Connections
Shear load connectors

English

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.

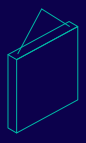


Structural Connections

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.

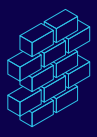
- Insulated balcony connectors
- Reinforcing bar couplers
- Concrete Connections
- Reinforcement continuity systems
- Punching shear reinforcement
- Shear load connectors
- Floor Joint Systems
- Precast / Reinforced Columns
- Infrastructure Products
- Precast Connections
- Acoustic dowels and bearings
- Prestress

Other areas of expertise:



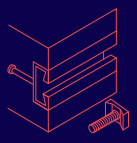
Lifting & Bracing

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.



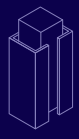
Façade Support & Restraint

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.



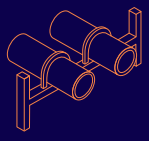
Anchoring & Fixing

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

Plaka Titan

Shear load connector for expansion joints

Content

Plaka Titan

Shear load connector for expansion joints

Description

System covered by Avis Technique – ATec n° 3.1/15-819_V2

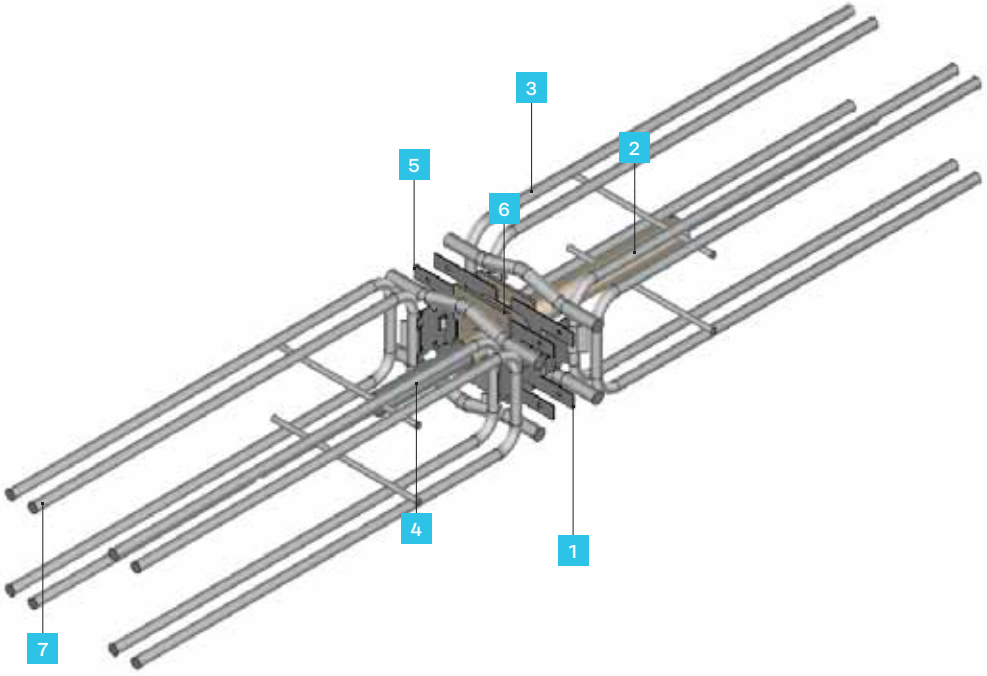
Titan dowel are used to transfer shear loads across movement joints while allowing movement parallel to the dowel or sideways. The system eliminating vertical relative displacement of the adjacent concrete components. In addition to connections between two concrete slabs or between a concrete slab and a concrete wall, Titan dowels can also be used with half precast slabs, walls with permanent formworks, or for connecting beams. Loads are transferred in between the cncrete components through a dowel with diameter of 20, 22, 25, 30 or 40 mm, manufactured in either stainless steel or hot-dip galvanized steel, depending on the application. This dowel is inserted into a cylindrical or rectangular sleeve on one side of the joint, and embedded directly in the concrete on the opposite side; this arrangement allows the joint to expand freely while the applied loads are transferred through the dowel.

The load is transferred to the concrete by a set of reinforcements placed in the vicinity of the dowel. These reinforcements are either prefabricated cages supplied by Leviat, known as TITAN integrated reinforcements, or customised reinforcements designed by Leviat or by the design engineer and fabricated by the customer.

The components of the Titan dowel are as follows:

- On the first pour side: mounting flange 1, sleeve 2, possibly an integrated TITAN reinforcement 3.
- On the second pour side: dowel 4, mounting flange 5 , centering cap 6 and, if required, integrated TITAN reinforcement 7

Refer to page 9 or contact Leviat for more details on prefabricated TITAN reinforcement cages.



Field of application

- Replace traditional double structure at expansion joints
- Replace corbels at expansion joints
- Compatible with precast half slabs
- For use at beam and wall connections
- Any application that requires shear load transfer at expansion joints

The Titan dowel is suitable for the transfer of primarily static loads and for reinforced or prestressed concrete structures, whether cast in situ or prefabricated. It can be used for administrative, commercial, educational, hospital, residential, office buildings, and car parks for light vehicles with a maximum axle load of 30 kN. It is also suitable for interior slabs of industrial buildings equipped with handling equipment with a maximum axle load of 130 kN.

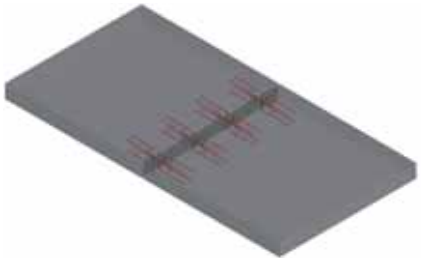
The use of the Titan dowel is not permitted under Avis Technique for buildings subject to seismic requirements, in floors made of prestressed prefabricated elements except when these reach the level of the joint, or in the case of anchoring in an existing structure unless the implementation is carried out by pocketing.

Plaka Titan

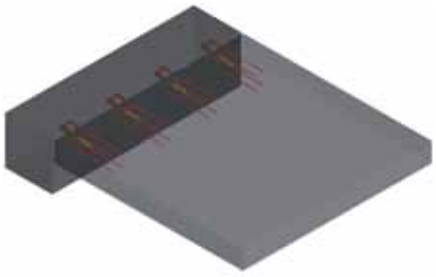
Shear load connector for expansion joints

Possible types of application

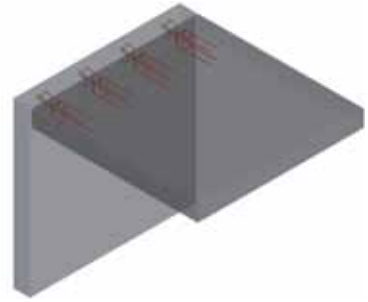
Slab – Slab



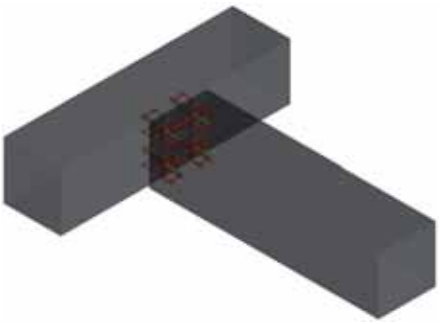
Slab – Beam



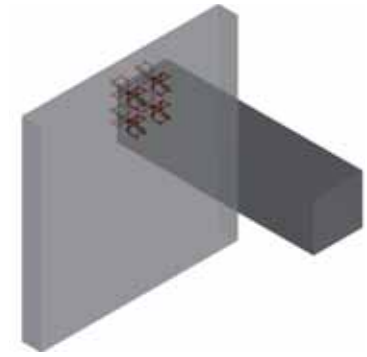
Slab – Wall



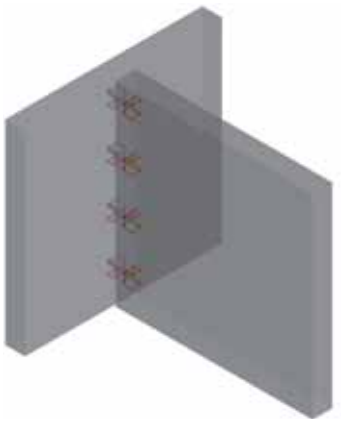
Beam – Beam



Wall – Beam



Wall – Wall



Plaka Titan

Shear load connector for expansion joints

System components / dimensions

Dowels

The Titan dowel is available in two finishes: hot-dip galvanised 42CD4 grade carbon steel, and EN4462 grade stainless steel. The stainless steel version is used in aggressive environments, and in any environment where a stainless steel load transfer mechanism is required; either for vertical or lateral load transfer.

Dowels

Diameter ø mm	Length mm	$Rp_{0.2}$ N/mm²	Rm N/mm²	Finish type	Steel grade	Product code
20	300	780	900	Galvanized	42CD4	TITG020N
				Stainless	EN4462	TITI020N
22	326	780	900	Galvanized	42CD4	TITG022N
				Stainless	EN4462	TITI022N
25	365	780	900	Galvanized	42CD4	TITG025N
				Stainless	EN4462	TITI025N
30	430	780	900	Galvanized	42CD4	TITG030N
				Stainless	EN4462	TITI030N
40	560	780	900	Galvanized	42CD4	TITG040N
				Stainless	EN4462	TITI040N

- 42CD4 steel (DIN:42CrMo4) is an improved chromium-molybdenum steel to EN 10083. Hot-dip galvanising is carried out in accordance with current standards, with a minimum average zinc thickness of 55 microns.
  Average chemical analysis: C: 0,38 / 0,45 %; Cr: 0,90 / 1,20 %; Mo: 0,15/0,30 %; Mn: 0,50 / 0,80 %; Si: 0,10 / 0.40 %; P: 0,035% maxi; S: 0,035% maxi.
- EN4462 steel (DIN:1.4462) is a high-strength duplex stainless steel with improved anti-corrosion performance to EN10088-3.
  Average chemical analysis: C: 0,03% max.; Si: 1,00% maxi; Mn: 2,00% maxi; Ni: 4,50 / 6,50%; Cr: 21,00 / 23,00%; Mo: 2,50 / 3,50%; N: 0,08 / 0,20%; S: 0,02% maxi; P: 0,03% maxi. Cet acier est magnétique.
- Stainless steel dowel have a corrosivity class CRC II according to NF EN 1993-1-4, enabling them to be used in highly aggressive environments.

Sleeves

Round polyethylene sleeve

The polyethylene round sleeve is used for applications that do not require lateral movement.

Round polyethylene sleeve

Dowel diameter ø mm	Length mm	Product code
20	185	TITFR20N
22	200	TITFR22N
25	220	TITFR25N
30	250	TITFR30N
40	320	TITFR40N

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Shear load connector for expansion joints

Stainless steel round sleeve

The stainless steel round sleeve is used for applications that require lateral load transfer as the round sleeve doesn't allow any sideways movement.

Stainless steel round sleeve		
Dowel diameter ø mm	**Length mm**	**Product code**
20	170	TITFRI20N
22	183	TITFRI22N
25	203	TITFRI25N
30	235	TITFRI30N
40	300	TITFRI40N

The short version is designed for connections to thin walls.

Stainless steel round sleeve – short version		
Dowel diameter ø mm	**Length mm**	**Product code**
20	140	TITFRI20NC
25	180	TITFRI25NC
30	200	TITFRI30NC
40	235	TITFRI40NC

- Stainless steel round sleeves must always be used with stainless steel dowels.
- Stainless steel round sleeves are made of Z6CN18-09 quality steel (AISI 304, WR 1.4301 or 1.4303). This steel has a CRC II corrosivity class according to NF EN 1993-1-4, enabling it to be used in highly aggressive environments.

Rectangular stainless steel sleeve

The stainless steel rectangular sleeve is used for applications requiring lateral movement.

Rectangular stainless steel sleeve			
Dowel diameter ø mm	**Length mm**	**Lateral movement mm**	**Product code**
20	170	± 11.0	TITFOI20N
22	183	± 11.0	TITFOI22N
25	203	± 10.5	TITFOI25N
30	235	± 10.5	TITFOI30N
40	300	± 12.0	TITFOI40N

The short version is designed for connections to thin walls.

Rectangular stainless steel sleeve – short version			
Dowel diameter ø mm	**Length mm**	**Lateral movement mm**	**Product code**
20	140	± 11.0	TITFOI20NC
25	180	± 10.5	TITFOI25NC
30	200	± 10.5	TITFOI30NC
40	235	± 12.0	TITFOI40NC

- Stainless steel rectangular sleeves must always be used with stainless steel dowels.
- Stainless steel rectangular sleeves are made of Z6CN18-09 quality steel (AISI 304, WR 1.4301 or 1.4303). This steel has a CRC II corrosivity class according to NF EN 1993-1-4, enabling it to be used in highly aggressive environments.

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Shear load connector for expansion joints

Mounting flange

On the first pour side, the flange ensures the fixation of the sleeve to the formwork. When the system is equipped with integrated TITAN reinforcements, the prefabricated cage is secured to the flange using the clips provided for this purpose.

On the second pour side, and only when the device is equipped with integrated TITAN reinforcements, the flange is fixed to the dowel using the centring cap; the reinforcements are then secured to the flange using the clips provided for this purpose.

A uniform flange is suitable for all sizes and configurations of dowels.

Mounting flange				
Dowel diameter ø mm	**Length mm**	**Height mm**	**Thickness mm**	**Product code**
20 to 40	148	70	1.0	TITFLO40

■ Mounting flanges are made of S235JR quality steel strip.

Centering cap

When the system is equipped with integrated TITAN reinforcements, the dowel is inserted into a centring cap, onto which a flange is fixed. The reinforcements are then secured to the flange using the clips provided for this purpose.

The centering cap is made of self-lubricating polyethylene.

Centering cap				
Dowel diameter ø mm	**Length mm**	**Height mm**	**Depth mm**	**Product code**
20	82	59	23	TITCC20N
22	82	59	23	TITCC22N
25	82	59	23	TITCC25N
30	82	59	23	TITCC30N
40	82	59	23	TITCC40N

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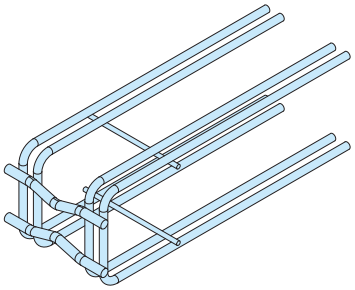
Shear load connector for expansion joints

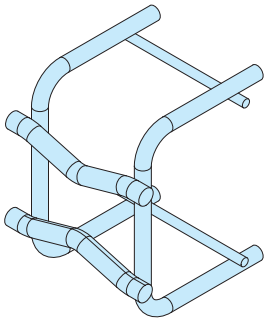
TITAN integrated reinforcements

The integrated TITAN reinforcements are welded assemblies of shaped reinforcements. The main steels are grade B500B, NF certified. The mounting bars, which are located outside the coating zone, are made of AISI 304 stainless steel.

There are two types of reinforcements, available in various sizes: integrated TITAN reinforcements for slabs and integrated TITAN reinforcements for walls.



TITAN integrated reinforcement for slabs

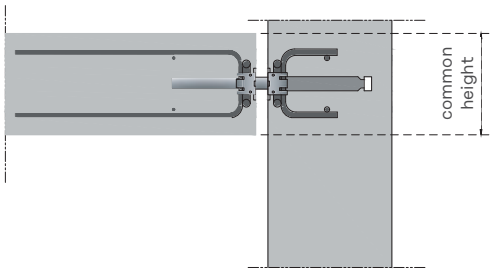


TITAN integrated reinforcement for walls

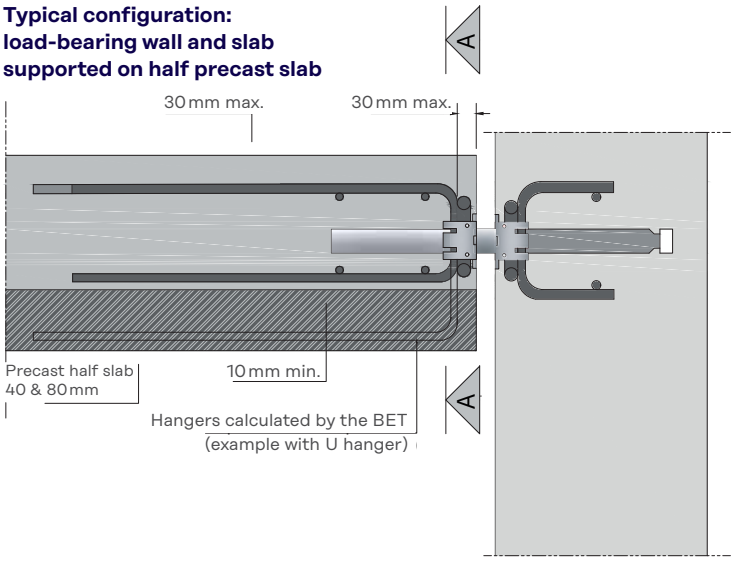
TITAN integrated reinforcements

Application	Dowel diameter ø mm	Length mm	Height mm	Width mm	Stirrups mm	Product code
Thin slab / half precast slab	**20 and 22**	410	100	160	2 x 2HA10	TITPD201001010
Slab	**20 and 22**	410	140	160	2 x 2HA10	TITRD221401010
Veil / thin veil	**20 and 22**	100	140	110	2 x 1HA10	TITRV2214010
Veil / thin veil	**25, 30 and 40**	100	190	110	2 x 1HA10	TITRV4019010

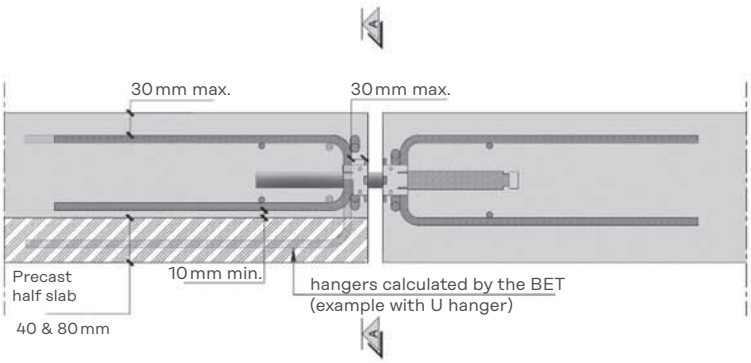
Typical configuration: load-bearing wall and in situ slab



Typical configuration: load-bearing wall and slab supported on half precast slab



Typical configuration: in situ slab and slab supported on precast half slab



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Shear load connector for expansion joints

Design values (from ATec no. 3.1/15-819_V2)

Ultimate Limit State resistance capacities $V_{Rd,s,ELU}$

Uni-axial movements

$V_{Rd,s,ELU}$ in kN as a function of design joint width						
Dowel diameter ø mm	Calculation joint [mm]					
	10	15	20	25	30	35
20	38,4	34,7	31,6	29,0	26,8	24,9
22	50,5	45,7	41,7	38,4	35,5	33,0
25	66,9	61,1	56,2	52,0	48,4	45,2
30	99,4	92,0	85,6	79,9	74,9	70,5
40	228,6	212,9	198,6	186,5	175,5	165,6

Bi-axial movements

$V_{Rd,s,ELU}$ in kN as a function of design joint width						
Dowel diameter ø mm	Calculation joint [mm]					
	10	15	20	25	30	35
20	34,6	31,2	28,4	26,1	24,1	22,4
22	45,5	41,2	37,6	34,5	31,9	29,7
25	60,2	55,0	50,6	46,8	43,5	40,7
30	89,5	82,8	77,0	71,9	67,4	63,5
40	205,7	191,6	179,0	167,9	157,9	149,0

The above tables apply to slab-slab or slab-wall connections; for the particular case of beams, refer to paragraph 2.9.2. of ATec n° 3.1/15-819_V2.

Calculation of slab resistance forces $V_{Rd,ct}$ and $V_{Rd,ce}$

- $V_{Rd,ct}$; resisting force due to slab punching failure
- $V_{Rd,ce}$; resisting force due to slab failure caused by the formation of a concrete cone

Use the equations in paragraphs 2.4.2 and 2.4.3 of ATec n° 3.1/15-819_V2.

The tables below give $V_{Rd,ct}$ and $V_{Rd,ce}$ values for a 20 mm diameter dowel fitted with a polyethylene or stainless steel round sleeve, in a 20 cm thick slab and for a 30 mm stirrup embedment.

The reinforcements for which the steel cross-sections and dimensional parameters are given in the table are either TITAN integrated reinforcements supplied by Leviat, or customised reinforcements installed on site. For details of the TITAN integrated reinforcements available from Leviat, please refer to the information on page 10 of this documentation.

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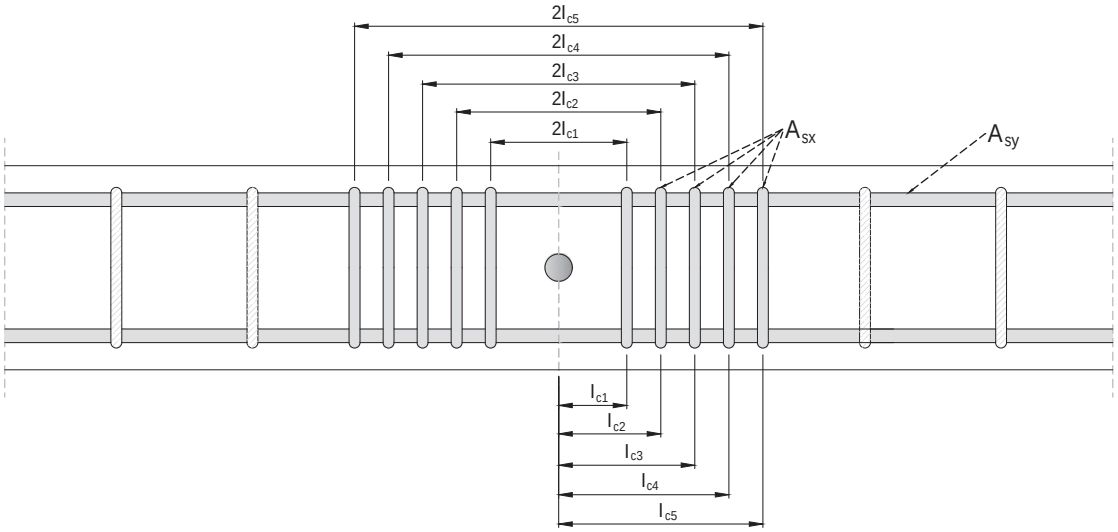
For each dowel configuration, the resisting force V_{Rd} to be retained is the minimum of the three values $V_{Rd,s}$ $V_{Rd,ct}$ and $V_{Rd,ce}$.

Reinforcement diagram:



TITAN integrated reinforcements (supplied by Leviat)

Reinforcement configuration A_{sx}	Reinforcement configuration A_{sy}	TITAN integrated reinforcements available	Dim. $2l_{c1}$ mm	Dim. $2l_{c2}$ mm	$V_{Rd,ct}$ kN	$V_{Rd,ce}$ kN	Note
2 × 1HA10	1HA6 top / 1HA6 bottom	TITRV2214010 ; TITRV4019010	85.5	–	–	–	[A]
2 × 2HA10	1HA6 top / 1HA6 bottom	TITPD201001010	85.5	133.5	18.8	27.1	[B]
2 × 2HA10	1HA6 top / 1HA6 bottom	TITRD221401010	85.5	133.5	21.7	45.1	[C]
2 × 2HA10	1HA8 top / 1HA8 bottom	TITPD201001010	85.5	133.5	18.8	29.7	[B]
2 × 2HA10	1HA8 top / 1HA8 bottom	TITRD221401010	85.5	133.5	21.7	49.5	[C]
2 × 2HA10	1HA10 top / 1HA10 bottom	TITPD201001010	85.5	133.5	18.8	31.8	[B]
2 × 2HA10	1HA10 top / 1HA10 bottom	TITRD221401010	85.5	133.5	21.7	53.1	[C]
2 × 2HA10	1HA12 top / 1HA12 bottom	TITPD201001010	85.5	133.5	18.8	33.6	[B]
2 × 2HA10	1HA12 top / 1HA12 bottom	TITRD221401010	85.5	133.5	21.7	56.2	[C]

[A] This TITAN integrated reinforcement is a cage reinforcement, designed for a slab-slab connection or a slab-beam connection; for the strength of this connection, please refer to the value given for the reinforcement on the slab side, which determines the overall dimensions.

[B] This TITAN integrated reinforcement is designed for a 200 mm thick cast-in-place concrete slab on a 40 mm thick half precast slab.

[C] This TITAN integrated reinforcement is designed for a 200 mm thick cast-in-place concrete slab.

The resistance values given in the table above are for reference only.
Applicable for TITAN integrated reinforcements installed in in situ slabs (all connections), or in slabs with 40 mm thick pracast half slab (slab-to-slab connection – wall or slab-to-slab connection – beam).

For all other slab thicknesses, other precast half slab applications, widths of joints, dowel sizes and reinforcement configurations, please contact Leviat's Technical Department.

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Shear load connector for expansion joints

Adapted reinforcements (to be made by the customer)						
A_{sx} reinforcement configuration	A_{sy} reinforcement configuration	Dim. $2l_{c1}$ mm	Dim. $2l_{c2}$ mm	Dim. $2l_{c3}$ mm	$V_{Rd,ce}$ kN	$V_{Rd,ct}$ kN
2 x 1HA10	1HA6 top / 1HA6 bottom	42.0	–	–	16.7	38.8
2 x 1HA12	1HA6 top / 1HA6 bottom	42.0	–	–	21.2	40.7
2 x 1HA10	1HA8 top / 1HA8 bottom	42.0	–	–	16.7	42.5
2 x 1HA12	1HA8 top / 1HA8 bottom	42.0	–	–	21.2	44.7
2 x 1HA10	1HA10 top / 1HA10 bottom	42.0	–	–	16.7	45.6
2 x 1HA12	1HA10 top / 1HA10 bottom	42.0	–	–	21.2	47.9
2 x 1HA10	1HA12 top / 1HA12 bottom	42.0	–	–	16.7	48.3
2 x 1HA12	1HA12 top / 1HA12 bottom	42.0	–	–	21.2	50.7
2 x 2HA10	1HA6 top / 1HA6 bottom	42.0	70.0	–	30.7	43.5
2 x 2HA12	1HA6 top / 1HA6 bottom	42.0	70.0	–	39.2	45.7
2 x 2HA10	1HA8 top / 1HA8 bottom	42.0	70.0	–	30.7	47.7
2 x 2HA12	1HA8 top / 1HA8 bottom	42.0	70.0	–	39.2	50.1
2 x 2HA10	1HA10 top / 1HA10 bottom	42.0	70.0	–	30.7	51.2
2 x 2HA12	1HA10 top / 1HA10 bottom	42.0	70.0	–	39.2	53.8
2 x 2HA10	1HA12 top / 1HA12 bottom	42.0	70.0	–	30.7	54.2
2 x 2HA12	1HA12 top / 1HA12 bottom	42.0	70.0	–	39.2	57.0
2 x 3HA10	1HA6 top / 1HA6 bottom	42.0	70.0	134.0	39.9	46.6
2 x 3HA12	1HA6 top / 1HA6 bottom	42.0	70.0	134.0	52.4	48.9
2 x 3HA10	1HA8 top / 1HA8 bottom	42.0	70.0	134.0	39.9	51.1
2 x 3HA12	1HA8 top / 1HA8 bottom	42.0	70.0	134.0	52.4	53.6
2 x 3HA10	1HA10 top / 1HA10 bottom	42.0	70.0	134.0	39.9	54.8
2 x 3HA12	1HA10 top / 1HA10 bottom	42.0	70.0	134.0	52.4	57.6
2 x 3HA10	1HA12 top / 1HA12 bottom	42.0	70.0	134.0	39.9	58.0
2 x 3HA12	1HA12 top / 1HA12 bottom	42.0	70.0	134.0	52.4	69.0

The resistance values given in the table above only apply to suitable reinforcements installed in in situ slabs (all connections).

For other slab thicknesses, other precast half slab applications, joint widths, dowel sizes and reinforcement configurations, please contact Leviat's Technical Department.

Edge Distance and Spacings – slab connection

Minimum horizontal and vertical distances to be observed:			
Dowel diameter ø mm	Min. edge distance cm	Min. horizontal c/c spacing cm	Minimum slab thickness cm
20	15	20	20
22	15	20	20
25	19	25	25
30	19	25	25
40	19	25	25

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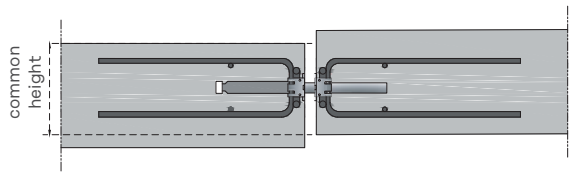
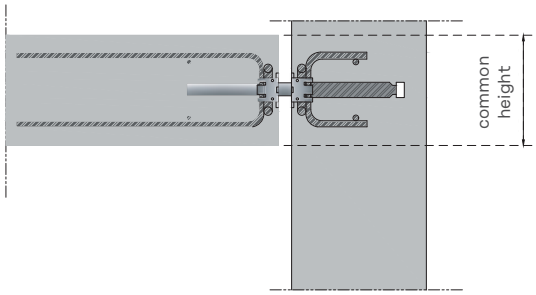
Shear load connector for expansion joints

For all slab connections, ensure the common slab height is considered for the calculations.

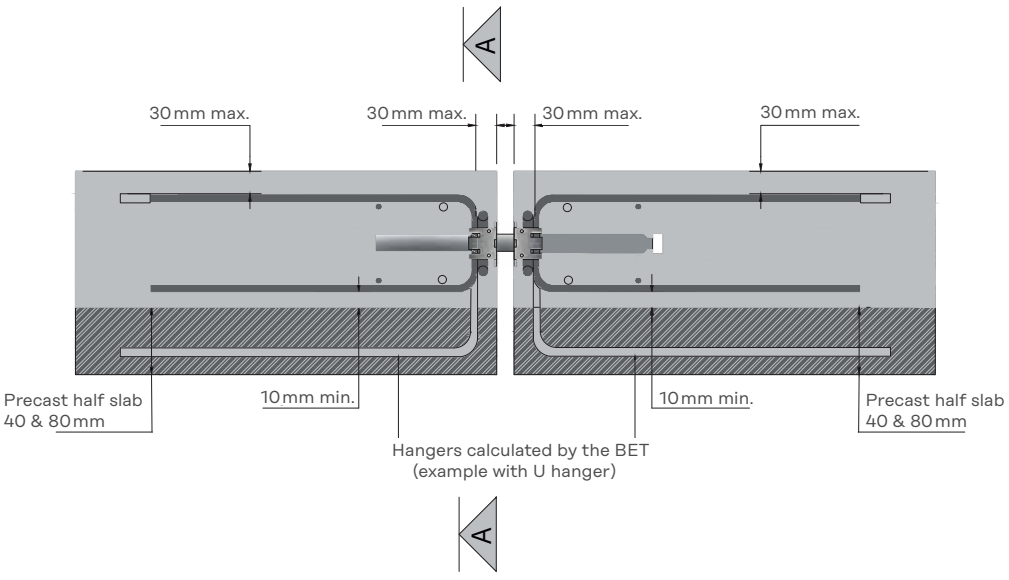


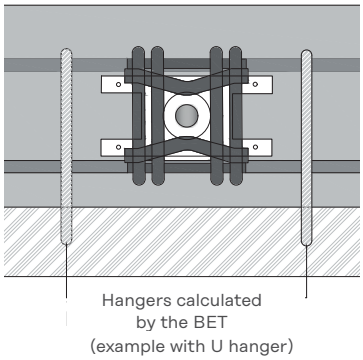
Slab-to-Slab connection



Slab-Wall or Slab-Beam connection

Requirements for half precast slabs connections:





Section A – A

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Shear load connector for expansion joints

Constructive provisions – beam connection

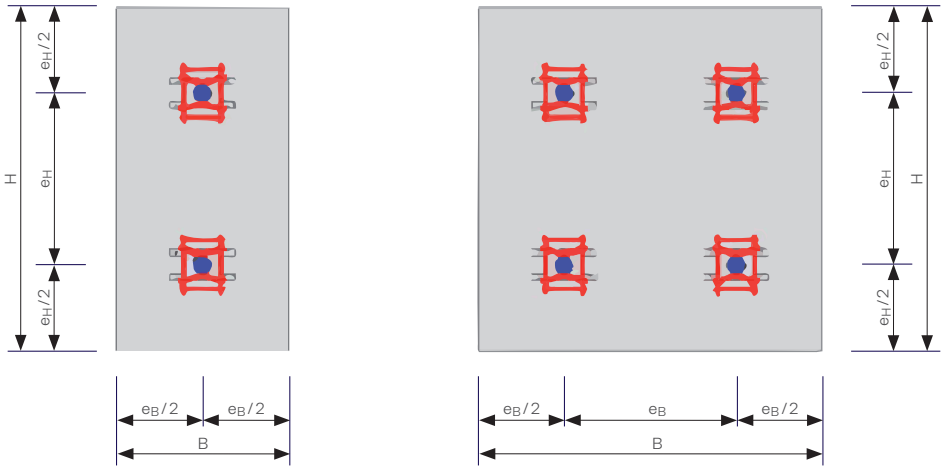
The rules mentioned below are also applicable to the following structural elements:

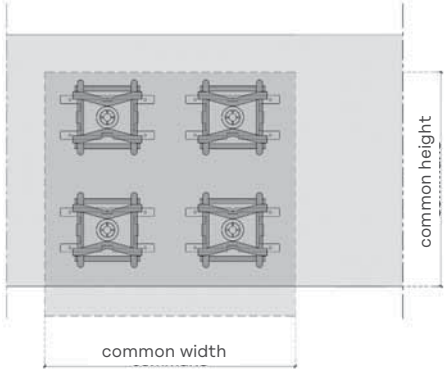
- Ground beams
- Stiffened footings
- Band beams in a slab or a raft foundation
- Stair steps

Minimum horizontal and vertical distances

The parameters mentioned below do not take into account the technical specifications specific to each project, such as required concrete cover, structural reinforcement of beams and reinforcement dimensions.

Minimum horizontal and vertical distances		
Dowel diameter ø mm	**Min. horizontal center distance $E_{B,min}$ cm**	**Min. vertical center distance $E_{H,min}$ cm**
20	15	20
22	15	20
25	18	25
30	20	25
40	25	25





For all beam connections, consider the common height and width.

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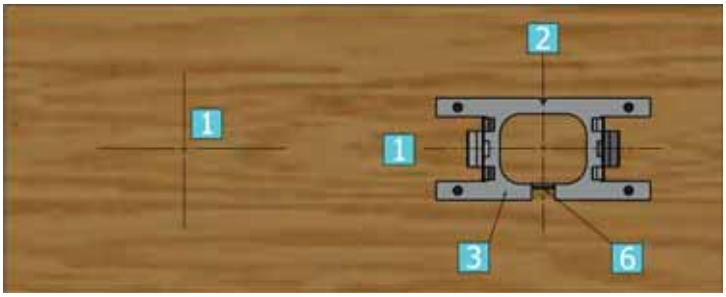
Shear load connector for expansion joints

Installation instructions

Step 1

First phase of concreting; nailing of fastening flange

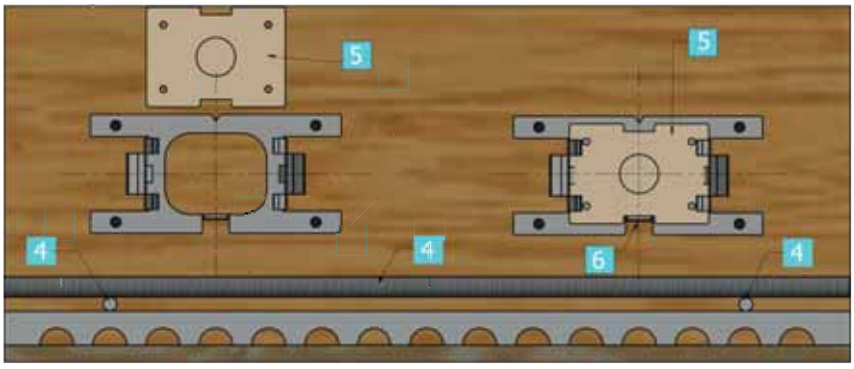
- Level and secure the abutment formwork.
- Mark the axes 1 and nail the flange 3 to the mark 2 ; stop 6 facing downwards.



Step 2

First concreting phase ;
installation of sleeves

- Lay the lower reinforcement for slab 4.
- Slide the sleeves 5 without removing the labels, into the flange guides as far as the stop 6.



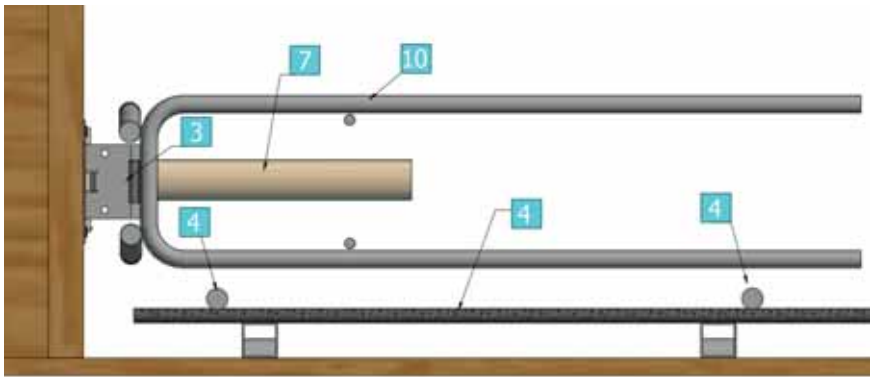
Plaka Titan

Shear load connector for expansion joints

Step 3

First concreting phase; installation of TITAN integrated reinforcement on flange – if applicable

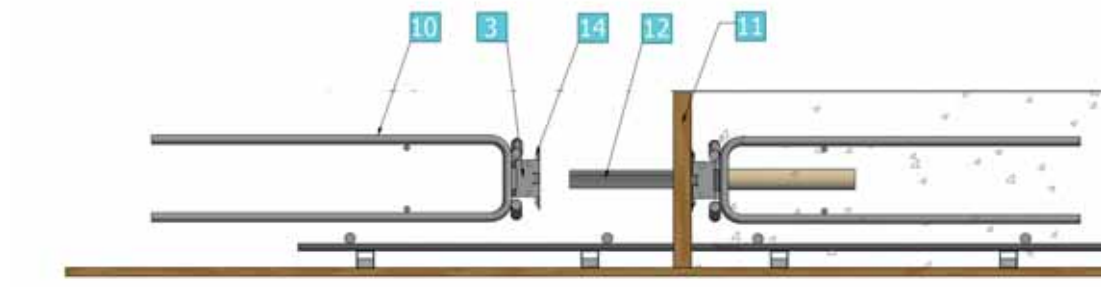
- Slide on the TITAN integrated reinforcement 10 and clip it onto the flange 3.
- The levelness of the sleeve 7 will be checked.
- Install the remaining reinforcement and pour concrete on the sleeve side.



Step 4

Second concreting phase

- Remove the abutment formwork and lay the compressible material 11.
- If needed, create a perforated section at the bottom of the compressible panel to fit the dimensions of the fire stop seal.
- Lay the lower reinforcement for the slab.
- Insert the TITAN dowel 12 up to the sleeve depth stop.
- If applicable, clip the TITAN integrated reinforcement 10 on the flange 3 equipped with its centring capsule, slide the assembly onto the dowel 12.
- Install the other recommended reinforcement and, if an integrated TITAN reinforcement is used, tie it to the slab reinforcement before concreting the second phase.
- If necessary, remove the lower portion of the compressible panel after dismantling the formwork to create a recess where the firestop seal will be inserted, following the installation instructions.



Plaka Titan

Shear load connector for expansion joints

Related products

Self Supporting Joint Plakasteel

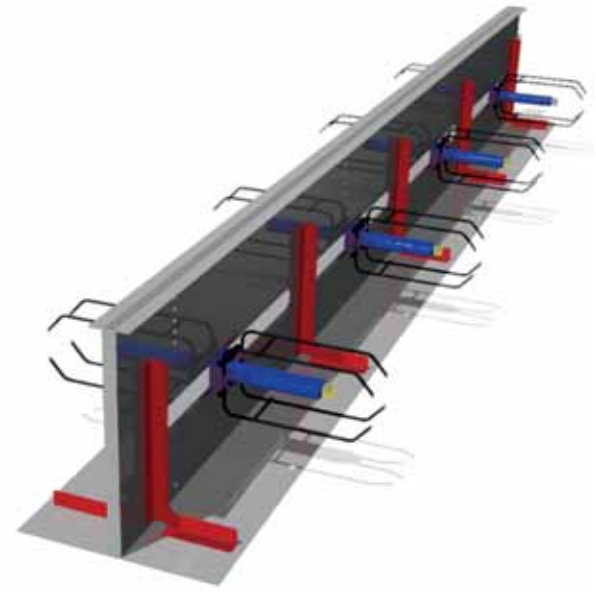
Plakasteel RBT

Plakasteel RBT is used as lost formwork to form expansion joints in raft foundations or slabs. Plakasteel RBT is self-supporting and is designed for concreting on both sides simultaneously, which accelerates the worksite stages and limits the leasing of concrete pumps. Horizontal concrete pressure on the RBT element is compensated by the weight of the concrete on the base.

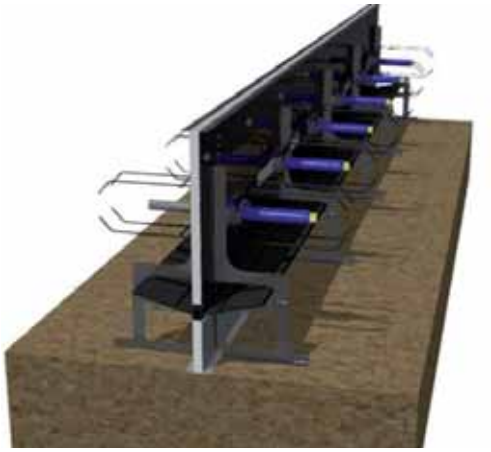
Plakasteel RBC

Plakasteel RBC is used as lost formwork to form watertight expansion joints in raft foundations or slabs, watertightness being internal. Plakasteel RBC must be held on the ground by means of the appropriate holes, and then the PVC joint is placed on the lower part of the formwork. Finally, the upper part of the formwork is placed and bolted to the lower part so that the assembly is sturdy. It is designed for concreting on both sides simultaneously, which accelerates the worksite stages and limits the leasing of concrete pumps. When concreting on a single side, it is advised to reinforce the formwork temporarily to take up the concrete pressure.

The Plakasteel continuous support is mentioned in paragraph 2.2.4. of ATec no. 3.1/15-819_V2.



Plakasteel RBT

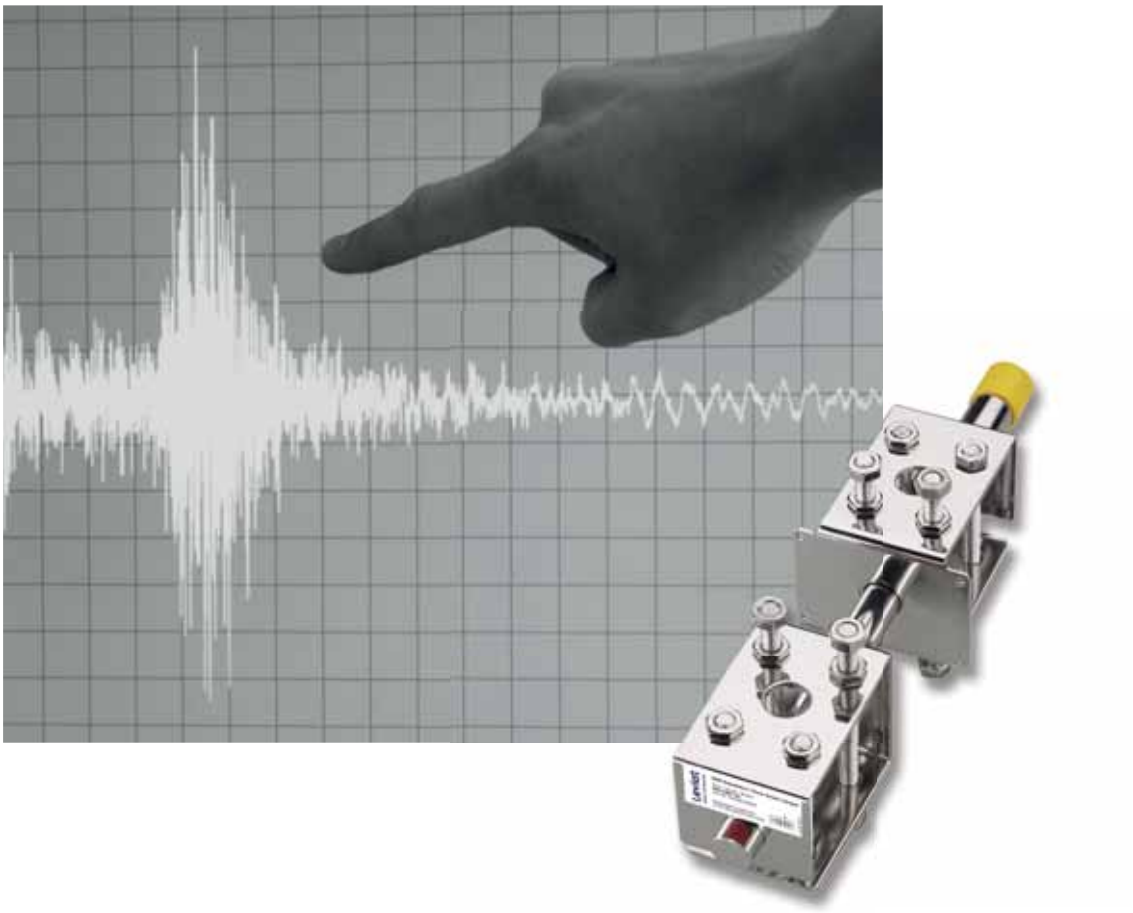


Plakasteel RBC

Plaka Titan

Shear load connector for expansion joints

CRET Seismic dowel



In the event of an earthquake, the horizontal loads applied to the building may cause the parts of the building separated by expansion joints to undergo significant horizontal displacement.

The CRET Sismique range of dowels has been specially designed for expansion joints subject to seismic loads.

These dowels ensure that the transverse force can be transmitted even when the structures are subjected to the large displacements observed in earthquakes.

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
246D James Fletcher Drive, Otahuhu,
Auckland 2024
Tel: +64 - 9 276 2236
Email: info.nz@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

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