

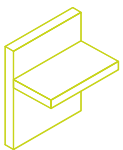


HALFEN

Leviat[®]
A CRH COMPANY

Halfen HIT-PI for Post-Installed Balconies

Technical Product Information



Structural Connections
Insulated balcony Connections

English / International

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.

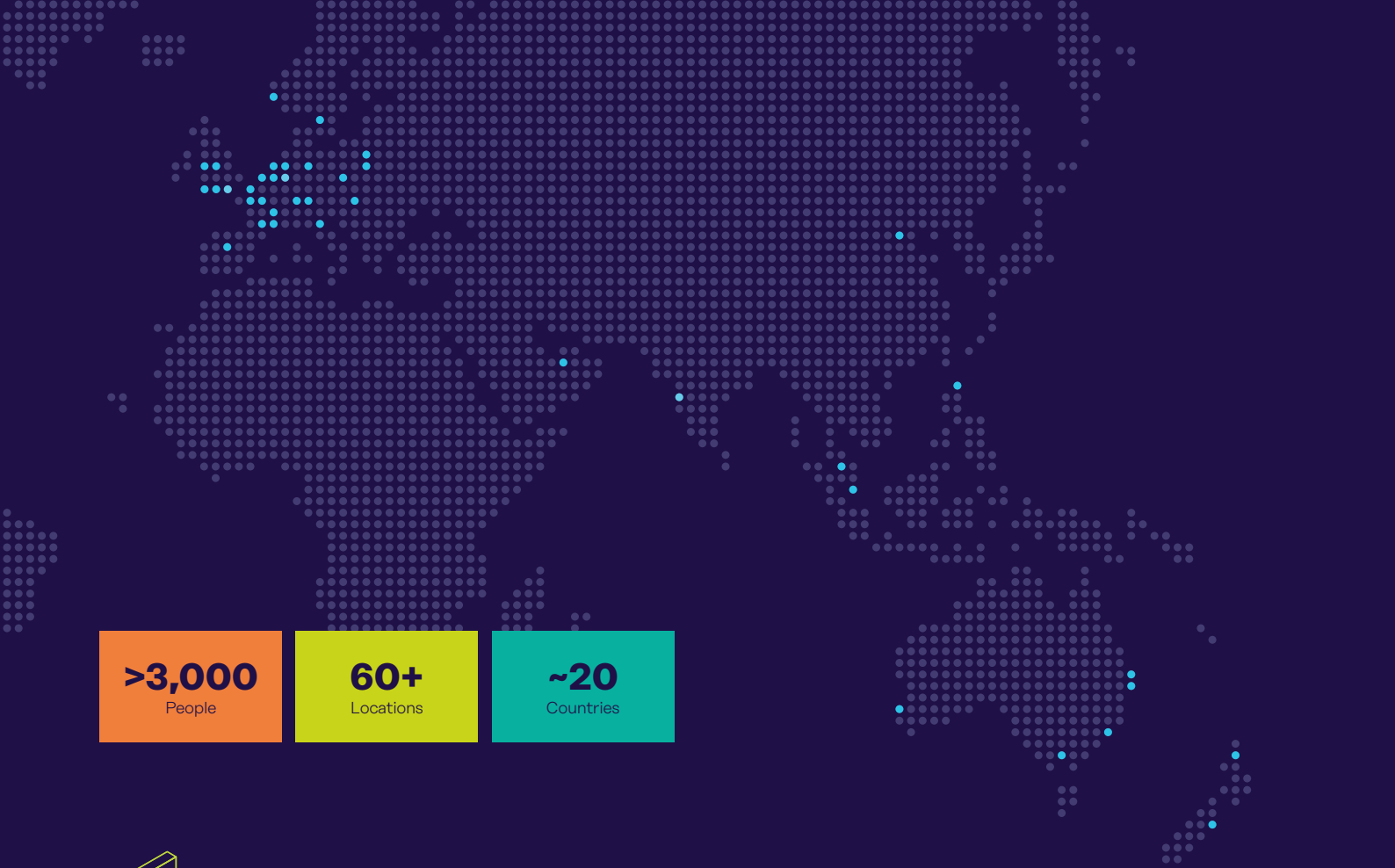
We provide technical design assistance at every stage of a project, from initial planning to installation and beyond.

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.

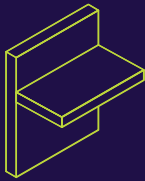




>3,000
People

60+
Locations

~20
Countries

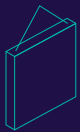


Structural Connections

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 Connections
- Reinforcing bar couplers
- Concrete Connections
- Reinforcement continuity systems
- Punching shear reinforcement
- Shear load Connections
- 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.



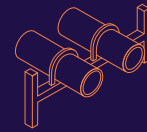
Anchoring & Fixing

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

Halfen HIT-PI

The new concept of dry connection for precast balconies

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HIT-PI standard solution



HIT-PI solution for larger balconies



HIT-PI installation aid



HIT-PI shimming concept

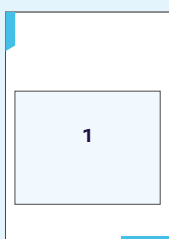


Photo acknowledgements:
Cover Image 1: Installation Halfen HIT-PI-B
 (Screenshot of Animation of fixing from the balcony side)

Approved by the German Institute of Construction Engineering
 (DIBt *Deutsches Institut für Bautechnik*) **Z-15.7-379**

Halfen HIT-PI

The new concept of dry connection for precast balconies

HIT-PI innovation concept

Halfen Iso-ElementT HIT-PI – Features

Time and efficiency have become the major key features in bringing solutions on building sites. This is the reason why precast companies are so successful nowadays.

Taking this market trend as a base for its developments, Leviat, the partner of precast companies and building contractors, have designed a new way to fix precast balconies quickly and easily to a building frame, while keeping thermal insulation as key parameter.



Our structural thermal breaks Halfen Iso-ElementT HIT-PI consists of two sets of parts:

- Balcony components, delivered to the precast company, will be integrated in the balcony mould.
- Floor slab components, delivered to the building site, for inclusion in the floor slab.

During the installation phase on the building site, balconies are lifted from the truck and connected to the building in a few minutes. Protruding bars with threaded ends are connected to the other side using counterplates and nuts.

A smart installation aid and our advanced adjustment concept enables the contractor to align the balcony connections perfectly and ensure adequate compensation during the assembly.

Halfen HIT-PI

The new concept of dry connection for precast balconies

HIT-PI innovation concept

Advantages in comparison with traditional concrete-to-concrete structural thermal breaks

“Pick, Connect and Go”

- Zero curing time. This significant advantage eliminates the need for temporary supports. Balconies are lifted from the truck and installed within minutes while suspended by the crane.
- Moreover, the system ensures immediate load-bearing capacity and allows precise and instantaneous balcony deflection compensation during installation.

Thermal efficiency

- The use of individual connectors means that surface contact with the inner structure is limited, ensuring optimal thermal efficiency across the whole width of the balcony.

High load capacity

- Small-to-medium size, as well as large balconies, can be supported with HIT-PI connectors, providing exceptional load bearing capacities.

Sustainability and efficiency

- To connect balconies to the main building structure, recesses must be shaped in the concrete elements. Made from durable polyurethane, the HIT-PI recess formers can be reused multiple times, reducing environmental impact, and minimising stripping time.

Modular and standardised concept

- A wide range of standard connection modules is available, covering a broad range of loads and ensuring versatility and ease of integration.

Higher adjustment possibilities

Essential for a trouble-free installation, the system has extensive adjustment capabilities:

- An easy and safe shimming concept enables tolerance compensation in all three directions, for a precise and secure installation.
- A proprietary reusable installation aid is available, guaranteeing accuracy and efficiency.

Higher flexibility in the building process

- With the HIT-PI system, balconies become elements that can be connected to the structure when it best suits the building contractor.
- No need to find space on-site for storage and a reduced risk of damage to the balconies.

Two fixing possibilities: On the balcony side or on the floor slab side



Take a look at our short HIT-PI animation on YouTube!



Halfen HIT-PI

The new concept of dry connection for precast balconies

HIT-PI features

A smart and standardised concept

HIT-HP PI has been designed as a modular concept, with a specific range of possible configurations, but covering a wide load range.



Each connection has two or three tension bars

This makes the work on site easy and fast:
Only two or three nuts to tighten per module.

In all cases, each module has 3 compression components, in particular very short studs

The space at the floor slab side remains free, allowing easy installation of the lower reinforcement and the slab edge stirrups, leaving the necessary space for the placement of a filigree slab.

Support bracket on the main floor slab side: one size fits all

The support brackets have the same dimensions for all HIT-HP PI modules, which again shows the high level of standardisation. The full adjustment concept remains the same for all types.

Available connection heights

For balcony side connections, which are the most common, the available connection heights range from 200 mm to 280 mm, in 10 mm increments. Other heights are available on request.

Most HIT-PI connection components are already assembled in the factory, prior the delivery to site

HIT-PI is defined as a standard configured module that is already partly assembled in our production facility, allowing for time savings on-site.

Shims and nuts are already mounted on the system, reducing the quantity of loose parts and subsequently the possibility of mistakes on-site.

Leviat recommends using our proprietary, reusable and adjustable installation aid, guaranteeing accuracy and efficiency. This installation aid has two important functions:

- It guarantees the assembly of all parts of one module at the right location.
- It simplifies the relative positioning of each connecting HIT-PI module with respect to one another.

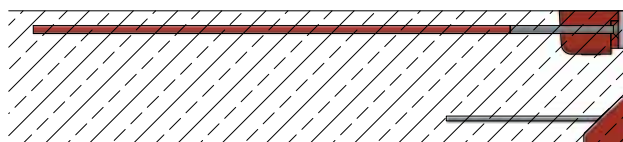
Halfen HIT-PI

The new concept of dry connection for precast balconies

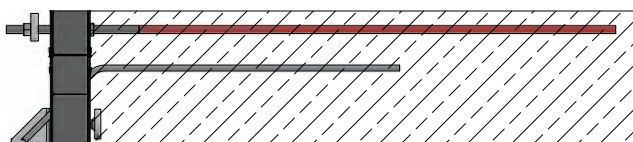
Connection variants

Halfen HIT-PI exists in two variants. Fixing can take place from either the balcony side or the inner floor slab side.

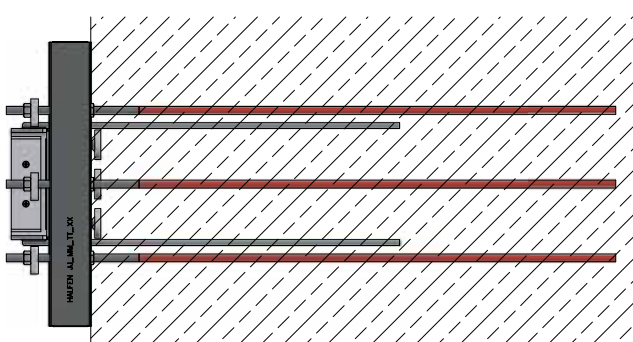
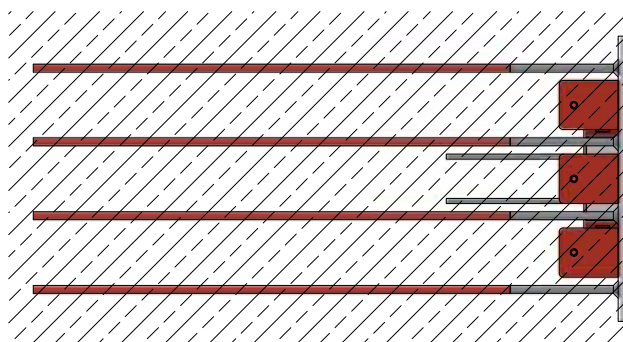
B Fixing from the balcony side



Balcony



Floor slab



In this variant, the recesses enabling the connection between the balcony components and the floor slab element are located in the balcony side.

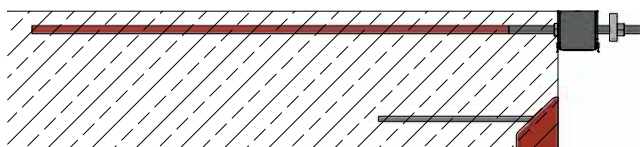
With this variant, the contractor can complete facade construction before connecting the precast balconies.

Halfen HIT-PI

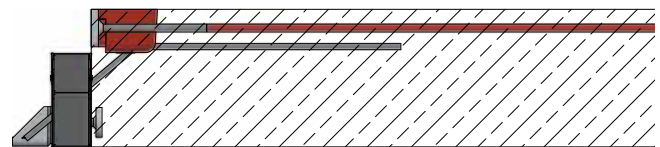
The new concept of dry connection for precast balconies

Connection variants

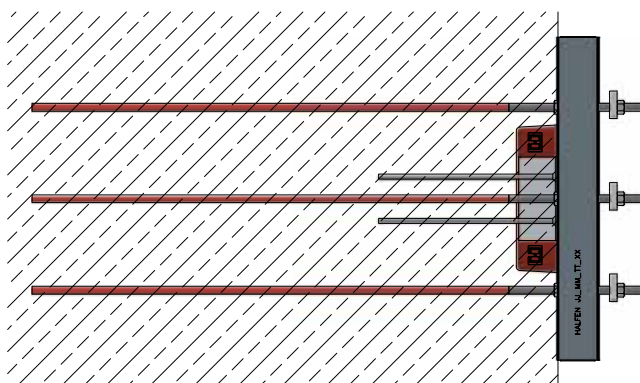
F Fixing at the side of the inner floor slab



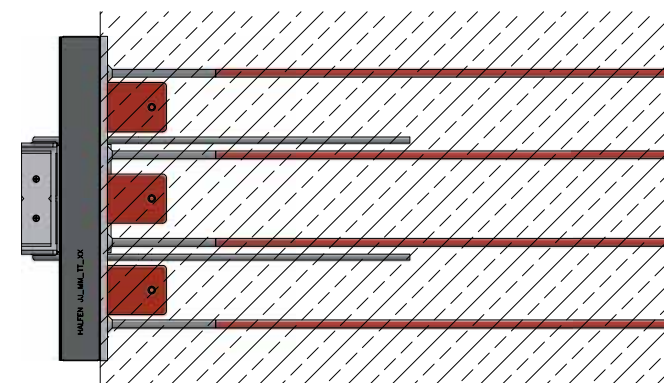
Balcony



Floor slab



In some circumstances, the connection cannot be fixed from the balcony side.



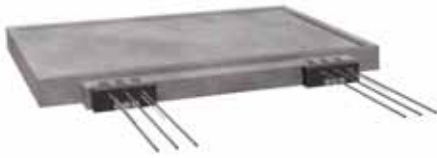
In the variant illustrated above, the recesses enabling the connection between the balcony components and the floor slab element are located in the inner floor slab side.

Halfen HIT-PI

The new concept of dry connection for precast balconies

Load distribution

A smart concept – two-point connections per balcony



For the main balconies, two HIT-PI modules will have the capacity to carry the full load.

Limiting point connections to only two, minimises any subsequent adjustments.

As per the traditional HIT structural thermal breaks, the type and geometry of the relevant HIT-PI module will depend on the following series of parameters:

Geometry:

- Balcony dimensions (B x L)
- Possible inclusion of perimeter upstands and downstands
- Available connection height at the interface balcony – inside slab



For larger balconies, two pairs of HIT-PI are used.

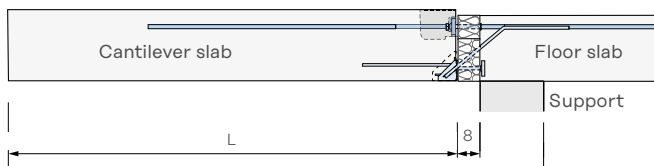
For large balconies and if the inner slab is of sufficient stiffness, the HIT-PI modules can be distributed evenly across the width of the balcony.

Loads

- Linear loads (balustrades, ...)
- Surface loads (static and dynamic loads)
- Point loads

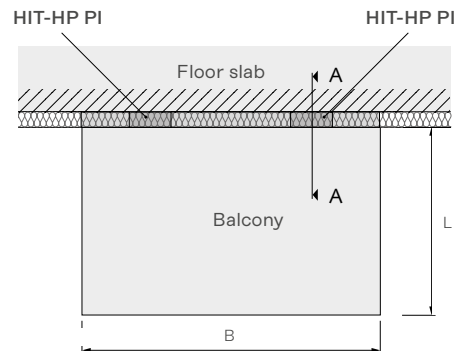
Cross-section A-A

HIT-HP PI



L = Cantilever length [m]

Plan view

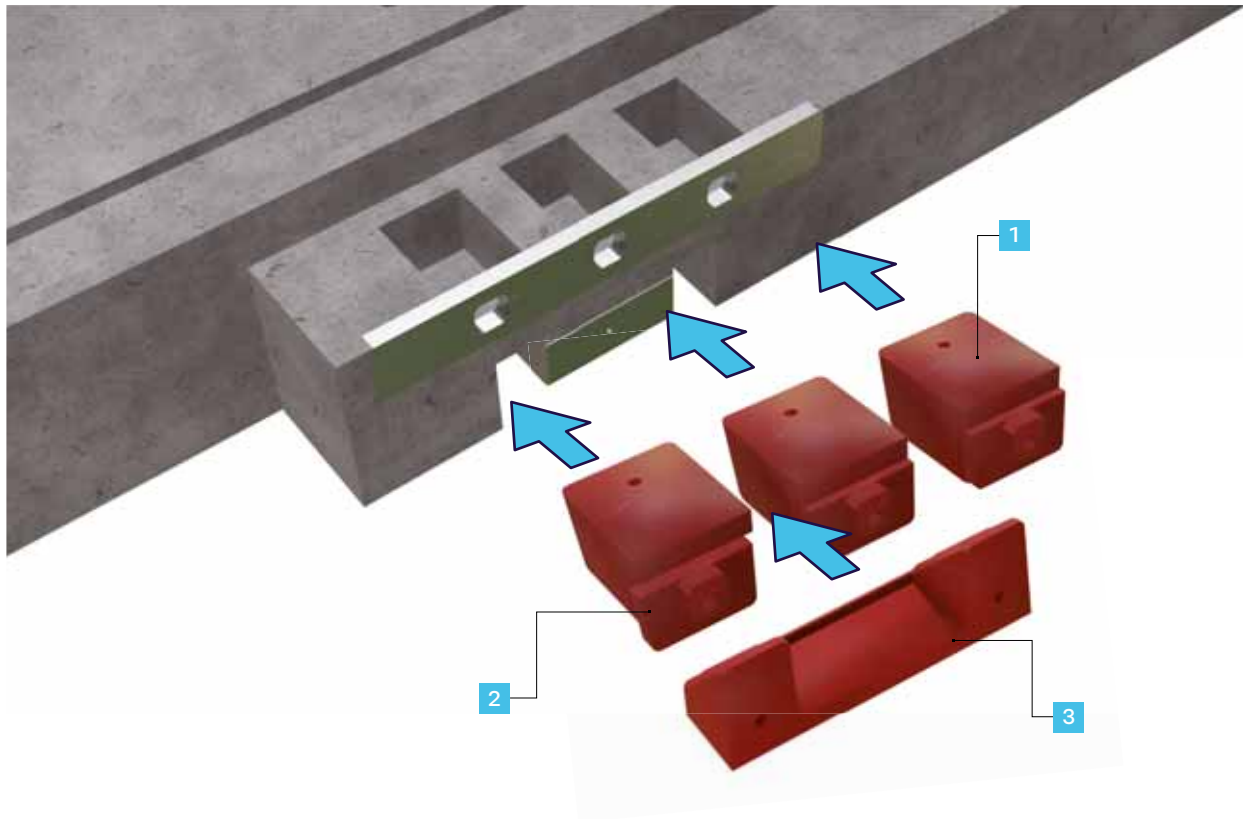


Halfen HIT-PI

The new concept of dry connection for precast balconies

Benefits of the HIT-PI solution

Main benefits of the Halfen HIT-PI solution at a glance



1 Tension Bar recess former:

Made from high-quality polyurethane, allows the former to be reused many times. This base body has one unique size that fits all tension bar diameters. The void created by the recess formers provides the necessary space for an easy connection.

2 Tension Bar adaptor plate:

Made out of the same PU material as the Tension Bars recess former, the adaptor plate perfectly fits the holes in the tension bar plate and is also tailored to the diameter of the tension bars. The adaptor is clearly marked with the relevant thread dimension, as an easy visual check.

3 Recess former for load bearing bracket

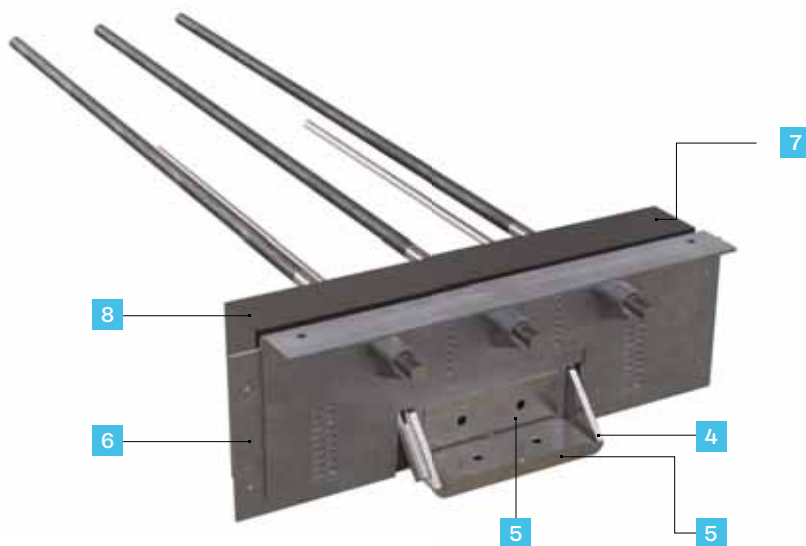
Creates the necessary space at the bottom soffit of the balcony, allowing the insertion of the support bracket located at the main slab side. This recess allows for a 20mm longitudinal adjustment (+10mm / -10mm) across the width of the balcony.

Halfen HIT-PI

The new concept of dry connection for precast balconies

Benefits of the HIT-PI solution

Main benefits of the Halfen HIT-PI solution at a glance



4 Bracket support:

A corrosion-resistant stainless steel bracket provides a safe and reliable load-bearing support for the balcony. With built-in tolerance compensation along the balcony length, installation is simplified, making the process faster and more efficient.

5 Shimming concept:

The concept is based on several layers of shims of 2 mm each, placed on the horizontal flange of the support bracket for vertical adjustment, and against the vertical flange of the same bracket for horizontal compensation. The shims are secured with 2 countersunk bolts. By slightly loosening these bolts, removing or adding shims to the supporting bracket is easy, due to the two slots in the shims.

6 Installation aid:

The proprietary reusable integrated installation aid enables the connection of several components to the module, guaranteeing an easy, fast and reliable installation. This installation aid also serves as a supporting guide for the necessary levelling tools.

7 Modular system based on standardised connections:

Unlock the power of efficiency with our modular system based on a reduced number of standardised modules. Simplify your construction process as by easily locating the balcony systems, including all relevant components and accessories together, eliminating the need to search for specific components.

8 Preassembly of the main components in our factory:

Experience the efficiency of construction with our partly preassembled components! Say goodbye to the hassle of too many loose parts on-site, boost productivity and save time with our smart solution, making your building projects faster, more organised, and hassle-free!

Halfen HIT-PI

The new concept of dry connection for precast balconies

Benefits of the HIT-PI solution

Installation aid

Our reusable "installation aid" is the secret to achieving pinpoint precision during installation of the components on your building site. With its adjustable height feature, it effortlessly adapts to the concrete slab thickness, ensuring a perfect fit for every project.

This reusable and robust tool connects all your components securely, reducing the need for later tolerance adjustments, reducing the risk of on-site issues when connecting precast balconies to floor slabs.

Trust in our installation aid to streamline your construction process and elevate your project's precision.

Fixing from the balcony side

The installation aid is adaptable to connection heights from 200 mm to 280 mm, in increments of 10 mm.

Example for 2 tension bars: reference HIT-PI-B-I2A-02

Example for 3 tension bars: reference HIT-PI-B-I2A-03

Where:

- HIT-PI: product range
- B: Fixing from the balcony side
- I2A: Installation aid
- 02 or 03: quantity of tension bars per HIT-PI module



Installation aid – fixing from the balcony side



For tension bars with thread dimensions smaller than M24, special inserts must be introduced in the tubes of the installation aid. They will ensure that the tension bars are perfectly positioned. These inserts are part of the installation aid set of components.



Inserts

Fixing from the floor slab side

The installation aid for the floor slab connection is also height adjustable. It can be adjusted in increments of 10 mm from 250 mm to 280 mm.

Example for 3 tension bars: reference HIT-PI-F-I2A-03

Where:

- HIT-PI: product range
- F: Fixing from the floor slab side
- I2A: Installation aid
- 03: quantity of tension bars per HIT-PI module



Installation aid – fixing from the floor slab side

Halfen HIT-PI

The new concept of dry connection for precast balconies

Benefits of the HIT-PI solution

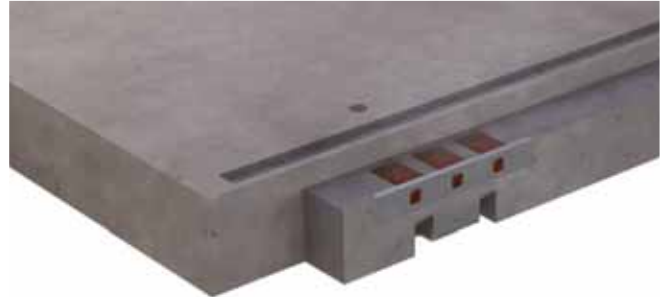
Tolerance compensation

As the components must be cast separately in the precast balcony and, on the building site, in the inner floor slab, tolerance compensation is vital ensuring that both precast and building site parts fit perfectly.

For this reason, adjustment is guaranteed in three directions:

In the direction of the balcony width

By means of the recess former for the bracket, space is created below and at both sides of the reinforcing compression bracket, allowing a 20 mm lateral adjustment (+10 mm / -10 mm).

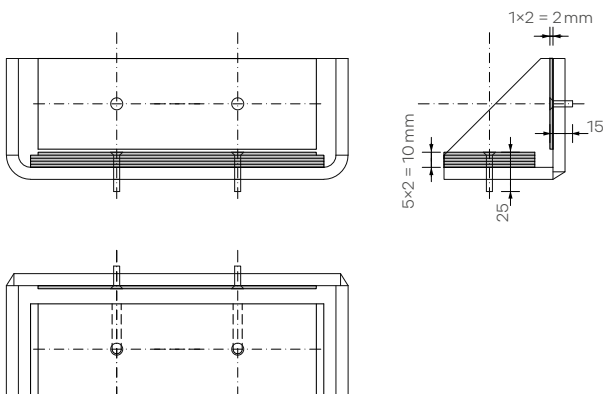


In the vertical and in -depth direction: shimming concept

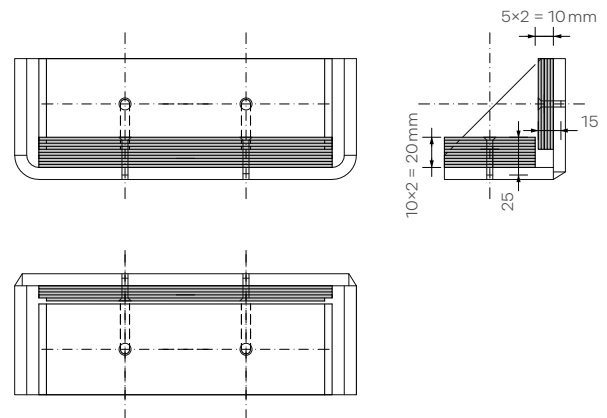
The bracket at the floor slab side enables the installation of stainless steel shims, to allow for vertical and in -depth compensation. Shims are secured in position using two countersunk bolts.

Thanks to the slot holes, shims can be easily added or removed from the side, without having to remove the bolts completely.

Adjustment possibilities: -2 mm / +18 mm in the depth ;
+10 mm / -10 mm in the height.



Standard configuration, as delivered to site



Maximum possible configuration



This drawing shows the configuration for the maximum height adjustment. Other configurations, not represented here, will allow more adjustment in the depth direction.

Halfen HIT-PI

The new concept of dry connection for precast balconies

Reference names

Reference of the product

A full Halfen HIT-PI connection is represented by the following name structure:

BC HIT - HP PI - B - 2 M24 - 02 14 - 20

① ② ③ ④ ⑤ ⑥ ⑦ ⑧

- ① BC = Product range;
HIT = Product brand; HP = Joint spacing 80 mm
- ② PI = "Post-installed" application
- ③ Side of the connection
(B = Fixing from the balcony side /
F = Fixing from the floor slab side)
- ④ Quantity of tension bars (2 or 3)
- ⑤ Thread size of the tension bars [mm] (M16, M20, M24)
- ⑥ Quantity of shear bars (2)
- ⑦ Diameter of the shear bars [mm] (12, 14)
- ⑧ Element height [cm] (from 20 to 28)

To define the set of parts that will be sent to each location, a distinction must be made between :

■ A connection that will be fixed at the balcony side

■ A connection that will be fixed at the floor slab side



HIT-HP PI-B – Fixing from the balcony side



HIT-HP PI-F – Fixing from the floor slab side



Halfen HIT-PI

The new concept of dry connection for precast balconies

Reference names

Fixing from the balcony side (BC HIT-HP PI-B)

BC HIT-HP PI-B comprises 2 separate sets of parts:

- One, dedicated to the balcony, is a set of components delivered to the precast company.
- The other set of parts is delivered to the building site, as it will be integrated into the floor slab.

Set of parts delivered to the precast factory are listed below:

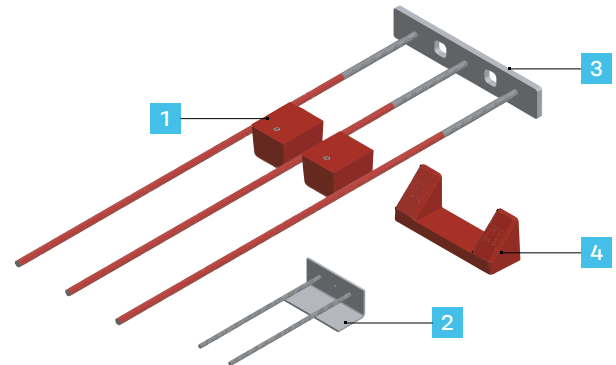
BC HIT-HP PI-B - xxxx - SET-B

Where:

xxxx = Quantity of tension bars and thread dimension

The parts delivered to the precast company are listed below:

- 1 PU recess formers for the tension bars (recess body + adaptor plate) can be used multiple times and must be ordered separately
- 2 reinforcement angle
- 3 tension bar plate
- 4 PU recess former for the load-bearing bracket (can be used multiple times, must be ordered separately)



Example: BC HIT - HP PI - B - 2 M16 - SET-B

① ② ③ ④ ⑤ ⑥ ⑦ ⑧

- ① BC = Product range
- ② HIT = Product brand
- ③ HP = Joint spacing 80 mm
- ④ PI = "Post-installed" application
- ⑤ Side of the connection (B = Fixing from the balcony side)
- ⑥ Quantity of tension bars
- ⑦ Thread dimension of the tension bars (M16, M20, M24)
- ⑧ SET-B: Set of parts for the balcony

Set of parts delivered to the building site

BC HIT-HP PI-B - xxxx - yyyy - hh - SET-F

Where:

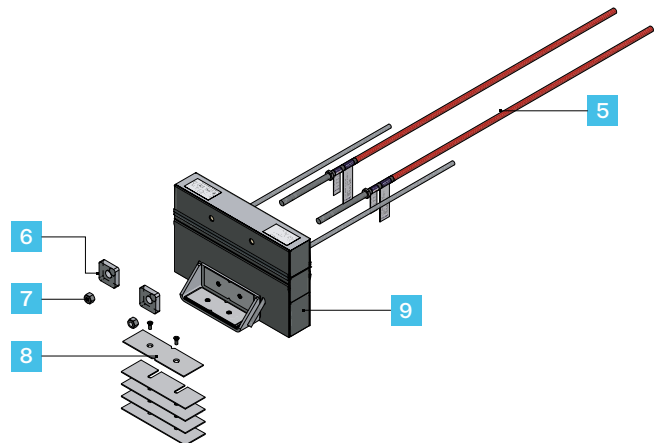
xxxx = Quantity of the Tension Bars and thread dimension

yyyy = Quantity (O2) and diameter (12 or 14 mm) of the shear bars

hh = Connection height [cm]

The parts delivered to the building site are listed below

- 8 9 the insulation block with pre-assembled compression elements and shear bars, with a set of levelling shims already fixed onto the load-bearing bracket
- 5 7 the tension bars, with nuts and protection caps already mounted on the tension bars
- 6 the counterplates are delivered in a separate box



Example: BC HIT - HP PI - B - 2 M16 - O212 - 20 - SET-F

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

- ① BC = Product range;
- ② HIT = Product brand;
- ③ HP = Joint spacing 80 mm
- ④ PI = "Post-installed" application
- ⑤ Side of the connection (B = Fixing from the balcony side)
- ⑥ Quantity of tension bars

- ⑦ Thread dimension of the tension bars (M16, M20, M24)
- ⑧ Quantity and diameter of the shear bars
- ⑨ Connection height [cm]
- ⑩ SET-F: Set of parts for the floor slab

Halfen HIT-PI

The new concept of dry connection for precast balconies

Reference names

Fixing from the floor slab side (BC HIT-HP PI-F)

BC HIT-HP PI-F comprises two separate sets of parts:

- One, dedicated to the balcony, is a set of components delivered to the precast company.
- The other set of parts is delivered to the building site, as it will be integrated into the main slab.

The parts delivered to the precast company are listed below:

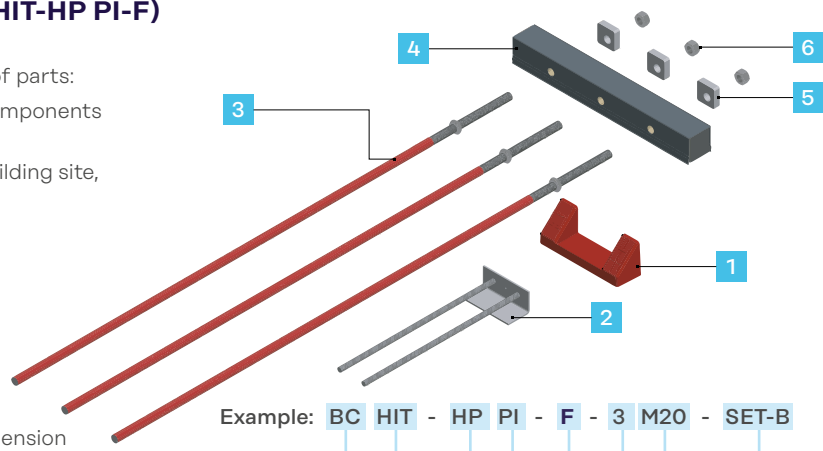
BC HIT-HP PI-F - xxxx - SET-B

Where:

xxxx = number of Tension Bars and thread dimension

This set includes:

- 1** PU recess former for the load-bearing angle (can be used multiple times, must be ordered separately)
- 2** reinforcement angle
- 3 6** the tension bars, with nuts and protection caps already mounted on the tension bars
- 4** the upper insulation box
- 5** the counterplates, delivered in a separate box



Example: BC HIT - HP PI - F - 3 M20 - SET-B

① ② ③ ④ ⑤ ⑥ ⑦ ⑧

- ① BC = Product range
- ② HIT = Product brand
- ③ HP = Joint spacing 80mm
- ④ PI = "Post-installed" application
- ⑤ Side of the connection (F = Fixing from the floor slab side)
- ⑥ Quantity of tension bars
- ⑦ Thread dimension of the tension bars (M16, M20, M24)
- ⑧ SET-B: Set of parts for the balcony

Set of parts delivered to the building site

BC HIT-HP PI-F - xxxx - yyyy - hh - SET-F

Where:

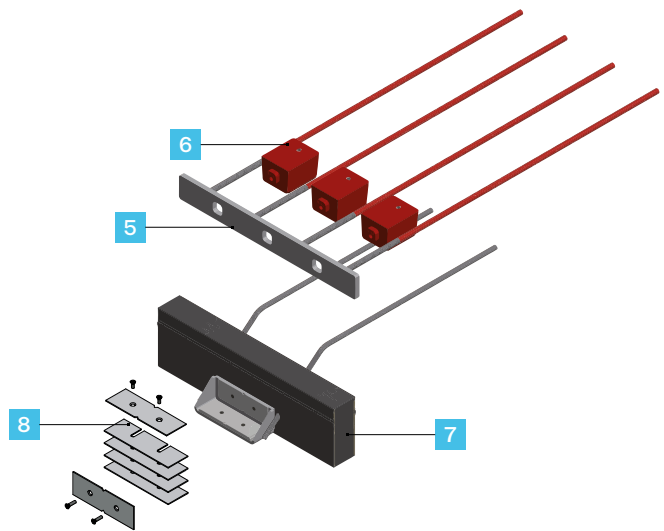
xxxx = Quantity and thread dimension of the Tension Bars

yyyy = Quantity (2) and diameter (12 or 14 mm) of the shear bars

hh = Connection height [cm]

The parts delivered to the building site are listed below:

- 5** the tension bar plate
- 6** the recess formers (recess body + adaptor plate) which create the necessary voids in the floor slab, to enable the connection of the balcony
- 7 8** the insulation block with already assembled compression parts and shear bars, including a set of levelling shims already fixed onto the bearing bracket with countersunk bolts



Example: BC HIT - HP PI - F - 3 M20 - 0214 - 25 - SET-F

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

- ① BC = Product range
- ② HIT = Product brand
- ③ HP = Joint spacing 80mm
- ④ PI = "Post-installed" application
- ⑤ Side of the connection (F = Fixing from the floor slab side)
- ⑥ Quantity of tension bars

- ⑦ Thread dimension of the tension bars (M16, M20, M24)
- ⑧ Quantity and diameter of the shear bars
- ⑨ Connection height [cm]
- ⑩ SET-F: Set of parts for the floor slab

Halfen HIT-PI

The new concept of dry connection for precast balconies

Product range

The Product range

Halfen HIT-PI system is a connection between a set of parts cast into the balcony into the precast factory and a set of parts cast into the floor slab, on-site. These modules are defined by several parameters:

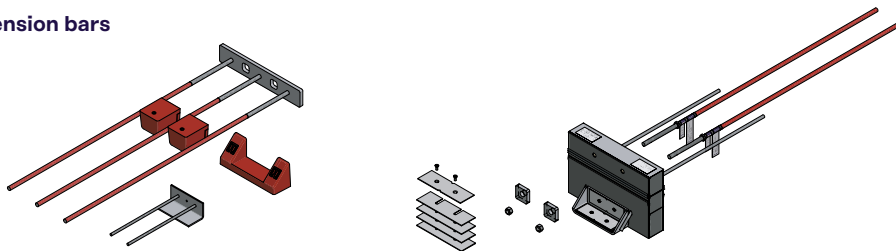
- The side of the connection (Fixing from the balcony side or the floor slab side)
- Quantity and diameter of the tension bars
- Diameter of the shear bars

Fixing from the balcony side

In the case of a connection at the balcony side, the modules are available with 2 or 3 tension bars, as indicated in the table below.

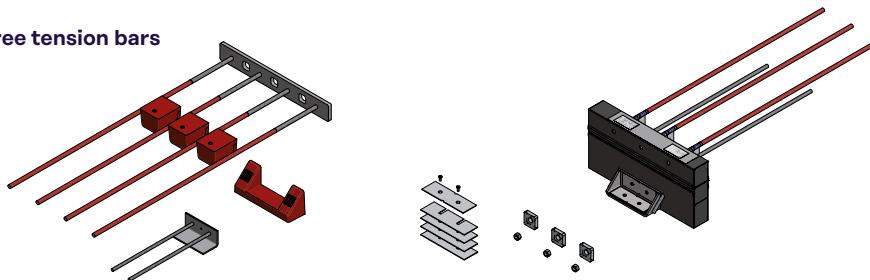
- Tension bars are available with a diameter of 16 mm (M16 thread), 20 mm (M20 thread) and 25 mm (M24 thread).
- Shear bars can be provided with a diameter of 12 mm or 14 mm.

Modules with two tension bars



| Connection HIT-HP PI-B with 2 tension bars | | | |
|--|--|---------------------------|---------------------------|
| Tension bars | | | |
| Number and diameter | 2x M16 / \varnothing 16 | 2x M20 / \varnothing 20 | 2x M24 / \varnothing 25 |
| Tension bars length [mm] | 1268 | 1556 | 1866 |
| Compression | | | |
| Compression studs | 3x M16 | 3x M16 | 3x M20 |
| Shear | | | |
| Shear bars | 2x \varnothing 12 or 2x \varnothing 14 | | |
| Tension bar plate | | | |
| Number and diameter of anchoring bars | 3x \varnothing 16 mm | 3x \varnothing 20 mm | 3x \varnothing 25 mm |
| Length of the anchoring bars [mm] | 1210 | 1490 | 1790 |
| Width of the HIT-PI connector | 430 mm | | |

Modules with three tension bars



| Connection HIT-HP PI-B with 3 tension bars | | | |
|--|--|---------------------------|--|
| Tension bars | | | |
| Number and diameter | 3x M16 / \varnothing 16 | 3x M20 / \varnothing 20 | |
| Tension bars length [mm] | 1268 | 1556 | |
| Compression | | | |
| Compression studs | 3x M16 | 3x M20 | |
| Shear | | | |
| Shear bars | 2x \varnothing 12 or 2x \varnothing 14 | | |
| Tension bar plate | | | |
| Number and diameter of anchoring bars | 4x \varnothing 16 mm | 4x \varnothing 20 mm | |
| Length of the anchoring bars [mm] | 1210 | 1490 | |
| Width of the HIT-PI connector | 580 mm | | |

Halfen HIT-PI

The new concept of dry connection for precast balconies

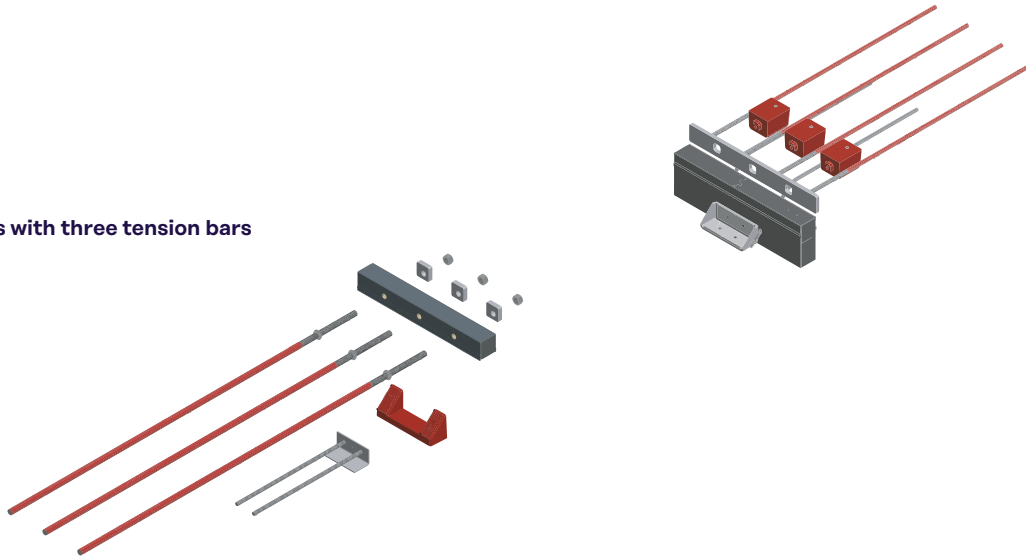
Product range

Fixing from the inner floor slab side

Where balconies must be connected from the floor slab side, the modules are available with 3 tension bars, as indicated in the table below.

- Tension bars are available with a diameter of 16 mm (M16 thread) and 20 mm (M20 thread).

Modules with three tension bars



| Connection HIT-HP PI-F with 3 tension bars | | |
|--|--|---------------------------|
| Tension bars | | |
| Number and diameter | 3× M16 / \varnothing 16 | 3× M20 / \varnothing 20 |
| Tension bars length [mm] | 1268 | 1556 |
| Compression | | |
| Compression studs | 3× M16 | 3× M20 |
| Shear | | |
| Shear bars | 2× \varnothing 12 or 2× \varnothing 14 | |
| Tension bar plate | | |
| Number and diameter of anchoring bars | 4× \varnothing 16 mm | 4× \varnothing 20 mm |
| Length of the anchoring bars [mm] | 1210 | 1490 |
| Width of the HIT-PI connector | 660 mm | |

Halfen HIT-PI

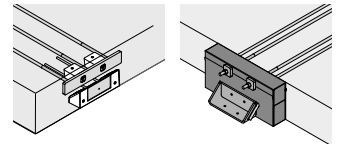
The new concept of dry connection for precast balconies

Load capacity ranges HIT-HP PI-B

Fixing from the balcony side HIT-HP PI-B



Standard connection heights: From 200 to 280mm



| HIT-HP PI-B | Bending moment | | | Shear load | | | |
|-------------|-------------------|-------------------|-------------------|------------------|------------------|------------------|------------------|
| | HIT-HP PI-B-2M16 | | | -0212-hh | | -0214-hh | |
| | C20/25 | C25/30 | C30/37 | C20/25 | ≥ C25/30 | C20/25 | ≥ C25/30 |
| hh [mm] | M_{Rd} [kNm] | M_{Rd} [kNm] | M_{Rd} [kNm] | V_{Rd} [kN] | V_{Rd} [kN] | V_{Rd} [kN] | V_{Rd} [kN] |
| 200 | 19.6 | 19.6 | 19.6 | 60.0 | 69.5 | 85.9 | 94.7 |
| 210 | 21.3 | 21.3 | 21.3 | 60.0 | 69.5 | 85.9 | 94.7 |
| 220 | 23.1 | 23.1 | 23.1 | 60.0 | 69.5 | 85.9 | 94.7 |
| 230 | 24.8 | 24.8 | 24.8 | 60.0 | 69.5 | 85.9 | 94.7 |
| 240 | 26.6 | 26.6 | 26.6 | 60.0 | 69.5 | 85.9 | 94.7 |
| 250 | 28.3 | 28.3 | 28.3 | 60.0 | 69.5 | 85.9 | 94.7 |
| 260 | 30.1 | 30.1 | 30.1 | 60.0 | 69.5 | 85.9 | 94.7 |
| 270 | 31.8 | 31.8 | 31.8 | 60.0 | 69.5 | 85.9 | 94.7 |
| 280 | 33.6 | 33.6 | 33.6 | 60.0 | 69.5 | 85.9 | 94.7 |

| HIT-HP PI-B | Bending moment | | | Shear load | | | |
|-------------|-------------------|-------------------|-------------------|------------------|------------------|------------------|------------------|
| | HIT-HP PI-B-3M16 | | | -0212-hh | | -0214-hh | |
| | C20/25 | C25/30 | C30/37 | C20/25 | ≥ C25/30 | C20/25 | ≥ C25/30 |
| hh [mm] | M_{Rd} [kNm] | M_{Rd} [kNm] | M_{Rd} [kNm] | V_{Rd} [kN] | V_{Rd} [kN] | V_{Rd} [kN] | V_{Rd} [kN] |
| 200 | 29.2 | 29.4 | 29.4 | 60.0 | 69.5 | 85.9 | 94.7 |
| 210 | 31.8 | 32.0 | 32.0 | 60.0 | 69.5 | 85.9 | 94.7 |
| 220 | 34.4 | 34.6 | 34.6 | 60.0 | 69.5 | 85.9 | 94.7 |
| 230 | 37.0 | 37.2 | 37.2 | 60.0 | 69.5 | 85.9 | 94.7 |
| 240 | 39.6 | 39.9 | 39.9 | 60.0 | 69.5 | 85.9 | 94.7 |
| 250 | 42.2 | 42.5 | 42.5 | 60.0 | 69.5 | 85.9 | 94.7 |
| 260 | 44.8 | 45.1 | 45.1 | 60.0 | 69.5 | 85.9 | 94.7 |
| 270 | 47.4 | 47.7 | 47.7 | 60.0 | 69.5 | 85.9 | 94.7 |
| 280 | 50.0 | 50.3 | 50.3 | 60.0 | 69.5 | 85.9 | 94.7 |

Halfen HIT-PI

The new concept of dry connection for precast balconies

Load capacity ranges HIT-HP PI-B

Fixing from the balcony side HIT-HP PI-B

| HIT-HP PI-B | Bending moment | | | Shear load | | | |
|-------------|-------------------|-------------------|-------------------|------------------|------------------|------------------|------------------|
| | HIT-HP PI-B-2M20 | | | -0212-hh | | -0214-hh | |
| | C20/25 | C25/30 | C30/37 | C20/25 | ≥ C25/30 | C20/25 | ≥ C25/30 |
| hh [mm] | M_{Rd} [kNm] | M_{Rd} [kNm] | M_{Rd} [kNm] | V_{Rd} [kN] | V_{Rd} [kN] | V_{Rd} [kN] | V_{Rd} [kN] |
| 200 | 27.0 | 28.8 | 28.8 | 60.0 | 69.5 | 85.9 | 94.7 |
| 210 | 28.9 | 31.5 | 31.5 | 60.0 | 69.5 | 85.9 | 94.7 |
| 220 | 30.8 | 34.1 | 34.1 | 60.0 | 69.5 | 85.9 | 94.7 |
| 230 | 32.8 | 36.7 | 36.7 | 60.0 | 69.5 | 85.9 | 94.7 |
| 240 | 34.7 | 39.3 | 39.3 | 60.0 | 69.5 | 85.9 | 94.7 |
| 250 | 36.6 | 42.0 | 42.0 | 60.0 | 69.5 | 85.9 | 94.7 |
| 260 | 38.5 | 44.6 | 44.6 | 60.0 | 69.5 | 85.9 | 94.7 |
| 270 | 40.5 | 47.2 | 47.2 | 60.0 | 69.5 | 85.9 | 94.7 |
| 280 | 42.4 | 49.5 | 49.8 | 60.0 | 69.5 | 85.9 | 94.7 |

| HIT-HP PI-B | Bending moment | | | Shear load | | | |
|-------------|-------------------|-------------------|-------------------|------------------|------------------|------------------|------------------|
| | HIT-HP PI-B-3M20 | | | -0212-hh | | -0214-hh | |
| | C20/25 | C25/30 | C30/37 | C20/25 | ≥ C25/30 | C20/25 | ≥ C25/30 |
| hh [mm] | M_{Rd} [kNm] | M_{Rd} [kNm] | M_{Rd} [kNm] | V_{Rd} [kN] | V_{Rd} [kN] | V_{Rd} [kN] | V_{Rd} [kN] |
| 200 | 39.9 | 44.2 | 45.1 | 60.0 | 69.5 | 85.9 | 94.7 |
| 210 | 42.7 | 48.2 | 49.2 | 60.0 | 69.5 | 85.9 | 94.7 |
| 220 | 45.6 | 52.2 | 53.3 | 60.0 | 69.5 | 85.9 | 94.7 |
| 230 | 48.5 | 56.2 | 57.4 | 60.0 | 69.5 | 85.9 | 94.7 |
| 240 | 51.4 | 60.2 | 61.5 | 60.0 | 69.5 | 85.9 | 94.7 |
| 250 | 54.3 | 63.6 | 65.6 | 60.0 | 69.5 | 85.9 | 94.7 |
| 260 | 57.2 | 66.9 | 69.7 | 60.0 | 69.5 | 85.9 | 94.7 |
| 270 | 60.1 | 70.3 | 73.8 | 60.0 | 69.5 | 85.9 | 94.7 |
| 280 | 62.9 | 73.6 | 77.9 | 60.0 | 69.5 | 85.9 | 94.7 |

| HIT-HP PI-B | Bending moment | | | Shear load | | | |
|-------------|-------------------|-------------------|-------------------|------------------|------------------|------------------|------------------|
| | HIT-HP PI-B-2M24 | | | -0212-hh | | -0214-hh | |
| | C20/25 | C25/30 | C30/37 | C20/25 | ≥ C25/30 | C20/25 | ≥ C25/30 |
| hh [mm] | M_{Rd} [kNm] | M_{Rd} [kNm] | M_{Rd} [kNm] | V_{Rd} [kN] | V_{Rd} [kN] | V_{Rd} [kN] | V_{Rd} [kN] |
| 200 | 37.6 | 44.1 | 44.1 | 60.0 | 69.5 | 85.9 | 94.7 |
| 210 | 40.5 | 47.8 | 48.2 | 60.0 | 69.5 | 85.9 | 94.7 |
| 220 | 43.5 | 51.2 | 52.2 | 60.0 | 69.5 | 85.9 | 94.7 |
| 230 | 46.4 | 54.6 | 56.3 | 60.0 | 69.5 | 85.9 | 94.7 |
| 240 | 49.4 | 58.1 | 60.4 | 60.0 | 69.5 | 85.9 | 94.7 |
| 250 | 52.3 | 61.5 | 64.5 | 60.0 | 69.5 | 85.9 | 94.7 |
| 260 | 55.3 | 64.9 | 68.6 | 60.0 | 69.5 | 85.9 | 94.7 |
| 270 | 58.2 | 68.3 | 72.7 | 60.0 | 69.5 | 85.9 | 94.7 |
| 280 | 61.2 | 71.8 | 76.8 | 60.0 | 69.5 | 85.9 | 94.7 |

Halfen HIT-PI

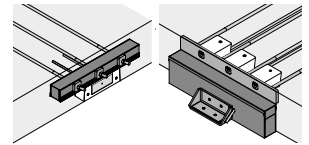
The new concept of dry connection for precast balconies

Load capacity ranges HIT-HP PI-F

Fixing from the floor side HIT-HP PI-F



Standard connection heights: From 250 to 280mm



| HIT-HP PI-F | Bending moment | | | Shear load | | | |
|-------------|-------------------|-------------------|-------------------|------------------|------------------|------------------|------------------|
| | HIT-HP PI-F-3M16 | | | -0212-hh | | -0214-hh | |
| | C20/25 | C25/30 | C30/37 | C20/25 | ≥ C25/30 | C20/25 | ≥ C25/30 |
| hh [mm] | M_{Rd} [kNm] | M_{Rd} [kNm] | M_{Rd} [kNm] | V_{Rd} [kN] | V_{Rd} [kN] | V_{Rd} [kN] | V_{Rd} [kN] |
| 250 | 42.2 | 42.5 | 42.5 | 54.5 | 63.2 | 78.1 | 86.0 |
| 260 | 44.8 | 45.1 | 45.1 | 54.5 | 63.2 | 78.1 | 86.0 |
| 270 | 47.4 | 47.7 | 47.7 | 54.5 | 63.2 | 78.1 | 86.0 |
| 280 | 50.0 | 50.3 | 50.3 | 54.5 | 63.2 | 78.1 | 86.0 |

| HIT-HP PI-F | Bending moment | | | Shear load | | | |
|-------------|-------------------|-------------------|-------------------|------------------|------------------|------------------|------------------|
| | HIT-HP PI-F-3M20 | | | -0212-hh | | -0214-hh | |
| | C20/25 | C25/30 | C30/37 | C20/25 | ≥ C25/30 | C20/25 | ≥ C25/30 |
| hh [mm] | M_{Rd} [kNm] | M_{Rd} [kNm] | M_{Rd} [kNm] | V_{Rd} [kN] | V_{Rd} [kN] | V_{Rd} [kN] | V_{Rd} [kN] |
| 250 | 55.0 | 64.4 | 65.6 | 54.5 | 63.2 | 78.1 | 86.0 |
| 260 | 57.9 | 67.7 | 69.7 | 54.5 | 63.2 | 78.1 | 86.0 |
| 270 | 60.8 | 71.1 | 73.8 | 54.5 | 63.2 | 78.1 | 86.0 |
| 280 | 63.7 | 74.4 | 77.9 | 54.5 | 63.2 | 78.1 | 86.0 |

Halfen HIT-PI

The new concept of dry connection for precast balconies

Installation instructions

For detailed installation instructions, please refer to:

the two animations on *Youtube* that explains the installation of all HIT-PI components. Follow the links below:

Type HIT-HP PI-B: Fixing from the balcony side



Type HIT-HP PI-F: Fixing from the floor slab side



Take a look at our HIT-HP PI-B animation on YouTube!

Take a look at our HIT-HP PI-F animation on YouTube!

our assembly instructions document for the Halfen HIT-PI system

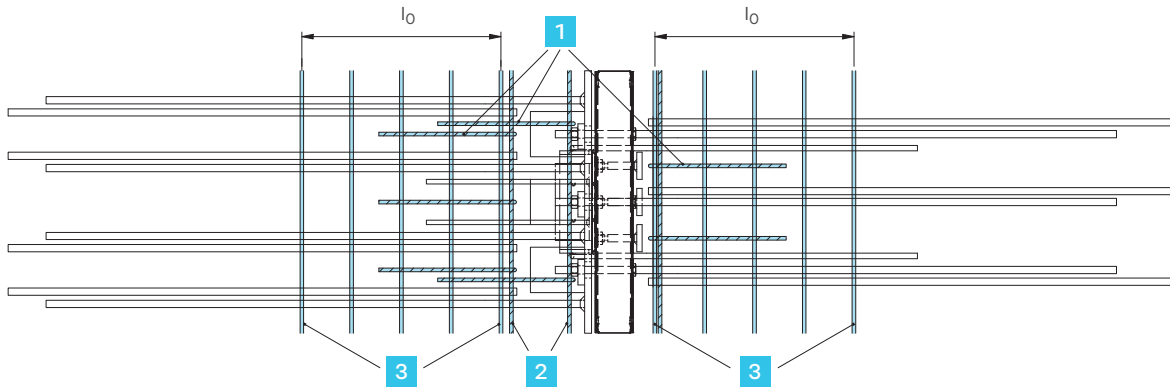
Please find the installation instructions document at our website

On-site additional reinforcement

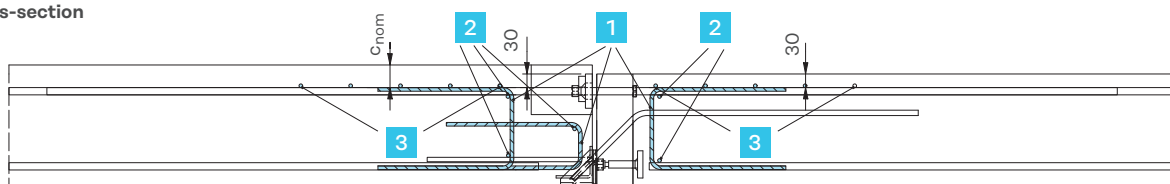
Tension bars with diameter 16mm
Threads M16, related to the following references:

| Balcony side fixing | Floor slab side fixing |
|--------------------------|--------------------------|
| HIT-HP PI-B-2M16-xxxx-hh | HIT-HP PI-F-3M16-xxxx-hh |
| HIT-HP PI-B-3M16-xxxx-hh | |

Plan view – on-site cast concrete



Cross-section



1 Vertical splitting tensile reinforcement $A_{sV,sp} \geq 0.6 \text{ cm}^2$ in the area of the element.
Constructive: $A_{sV,min} = \varnothing 6 / 25 \text{ cm}$. The minimum reinforcement may be added to $A_{sV,sp}$

2 Horizontal splitting tensile reinforcement $\geq \varnothing 8 \text{ mm}$
3 Transverse reinforcement in accordance with the static requirements, 20% of the longitudinal reinforcement, but at least $\varnothing 6 / 25 \text{ cm}$

Halfen HIT-PI

The new concept of dry connection for precast balconies

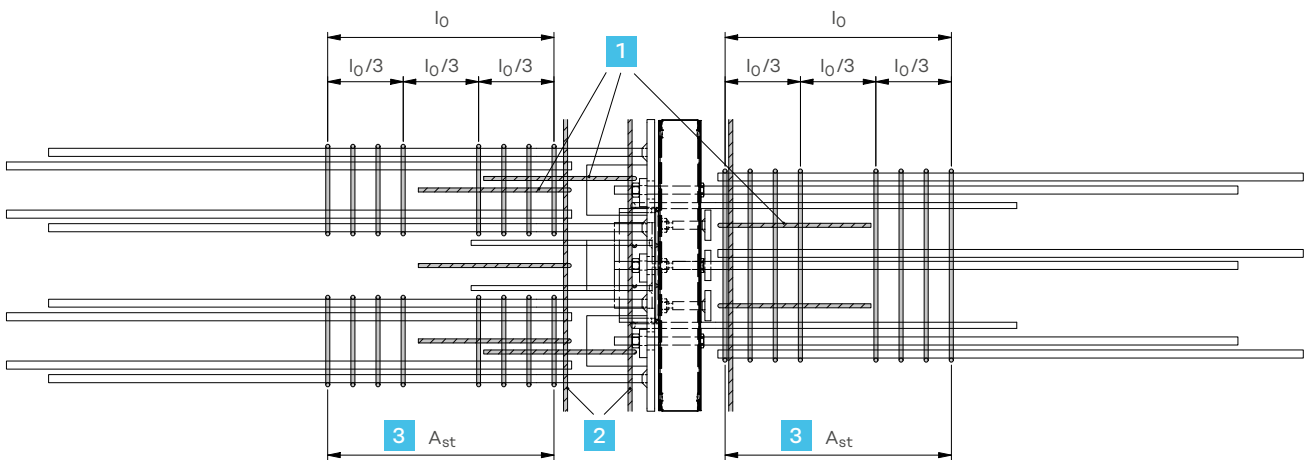
Installation instructions

On-site additional reinforcement

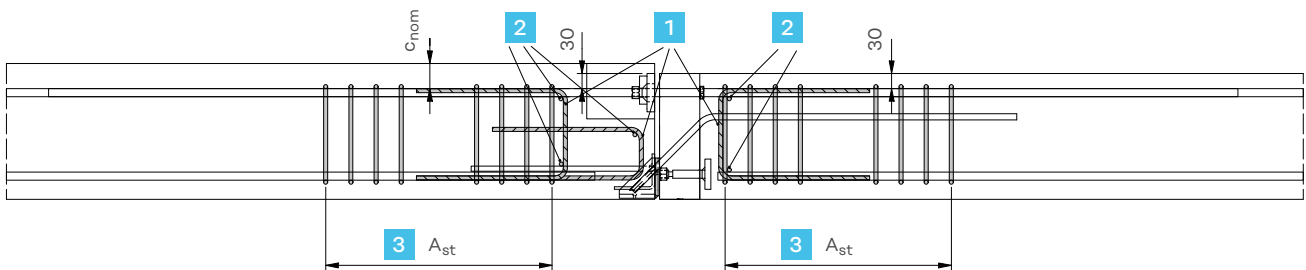
Tension bars with diameter 20 mm / Thread M20 and diameter 25 mm / Thread M24, related to the following references:

| Balcony side fixing | Floor slab side fixing |
|--------------------------|--------------------------|
| HIT-HP PI-B-2M20-xxxx-hh | HIT-HP PI-F-3M20-xxxx-hh |
| HIT-HP PI-B-3M20-xxxx-hh | |
| HIT-HP PI-B-2M24-xxxx-hh | |

Plan view – on-site cast concrete



Cross-section



1 Vertical splitting tensile reinforcement $A_{sV,sp} \geq 0.6\text{cm}^2$ in the area of the element.

Constructive: $A_{sV,min} = \varnothing 6 / 25\text{cm}$. The minimum reinforcement may be added to $A_{sV,sp}$

2 Horizontal splitting tensile reinforcement $\geq \varnothing 8\text{mm}$

3 Transverse reinforcement A_{st} as stirrups $\varnothing 8\text{mm}$:

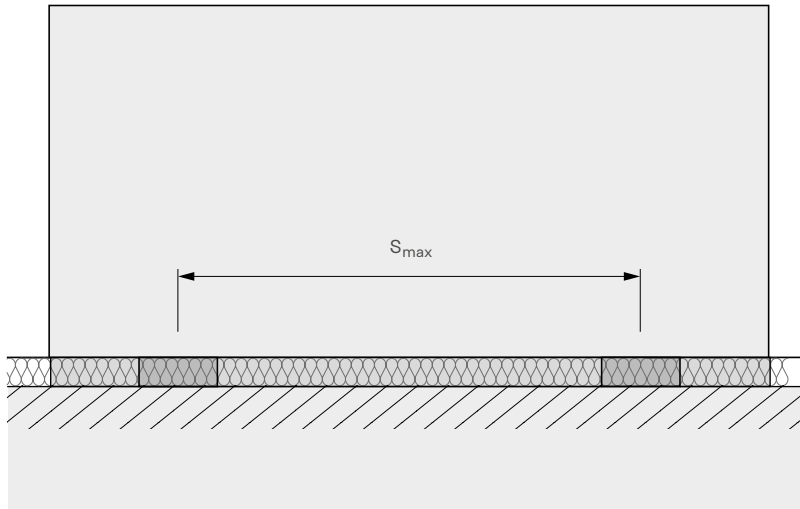
| Tension bars | $A_{st,req}$ [cm ²] | $A_{st,min}$ [-] |
|------------------------|---------------------------------|--------------------|
| M20 / $\varnothing 20$ | 3.14 | 8 $\varnothing 8$ |
| M24 / $\varnothing 25$ | 4.91 | 10 $\varnothing 8$ |

Halfen HIT-PI

The new concept of dry connection for precast balconies

Installation instructions

Maximum HIT-HP PI element spacing



Maximal centre distance S_{max} HIT-HP PI



For the external concrete components, in order to limit the stresses from temperature, the maximum element spacing between the outer elements of a balcony must be observed in accordance with the table below.

| Insulation joint | Thread dimension in the joint [mm] | | |
|---------------------|------------------------------------|-------------------------|-------------------------|
| | M16 | M20 | M24 |
| HIT-HP PI [80mm] | $S_{max} = 9.8\text{m}$ | $S_{max} = 8.5\text{m}$ | $S_{max} = 7.0\text{m}$ |



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