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HALFEN

Halfen HIT Insulated Balcony Connector for Post Tensioning Applications

Technical Product Information

UK Edition

HIT-TP 22.1-E

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Halfen HIT Post Tensioned Balcony Connector System

Halfen HIT is a high performance structural connection system which can now be used to join post tensioned concrete balconies to a post tensioned concrete slab. The system is suitable for use with all types of proprietary bonded and unbonded post tensioning systems currently available on the market.

The Halfen HIT Post Tensioned Balcony Connector system, which incorporates our established Halfen HIT Structural Thermal Break, allows balconies to be cast together with the main slab and then simultaneously tensioned. Formwork installation and removal on balconies and the main slab can therefore take place at the same time, driving significant efficiencies on construction sites and enabling a faster, more efficient build programme.

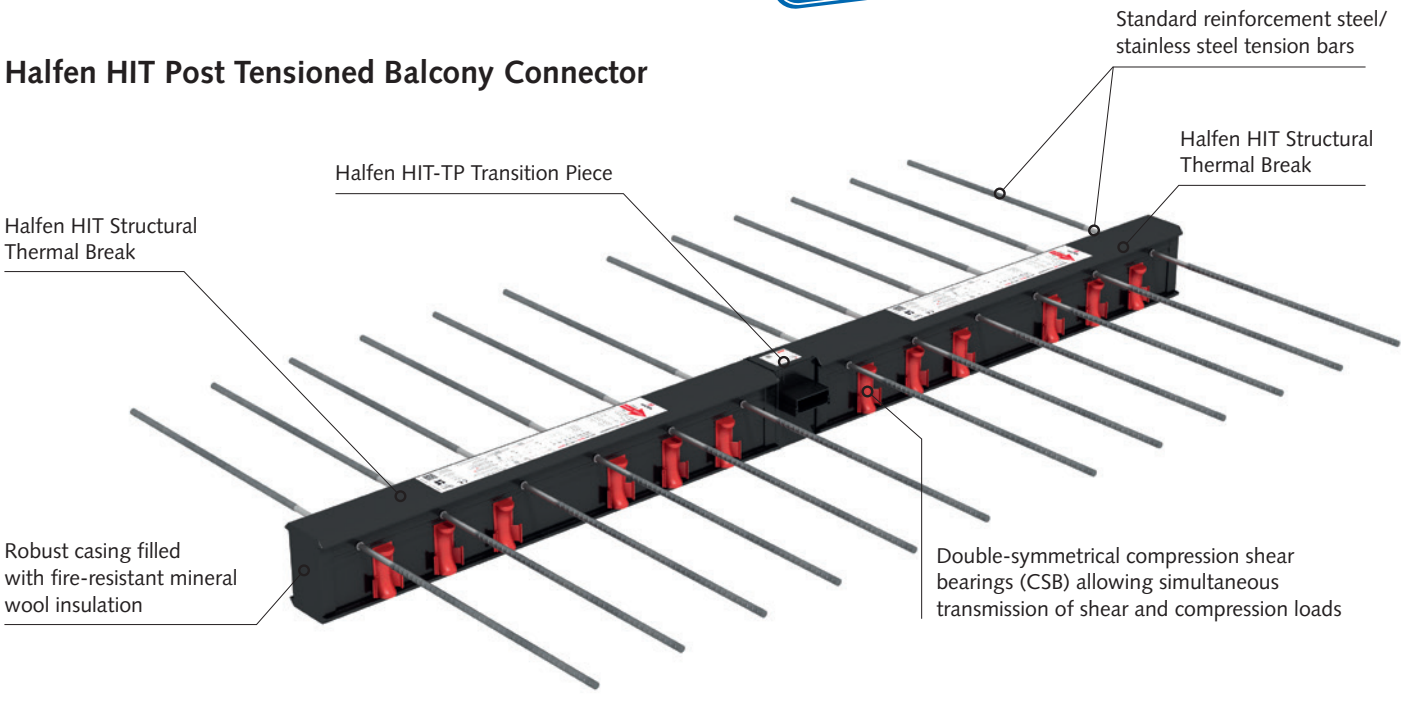
The new system transfers tension and compression forces in addition to bending moments and shear forces. It provides continuity to both the concrete reinforcement and the thermal insulation of the wall protecting the building against the effects of cold bridging. Furthermore, the product offers REI 120 fire protection.

System benefits

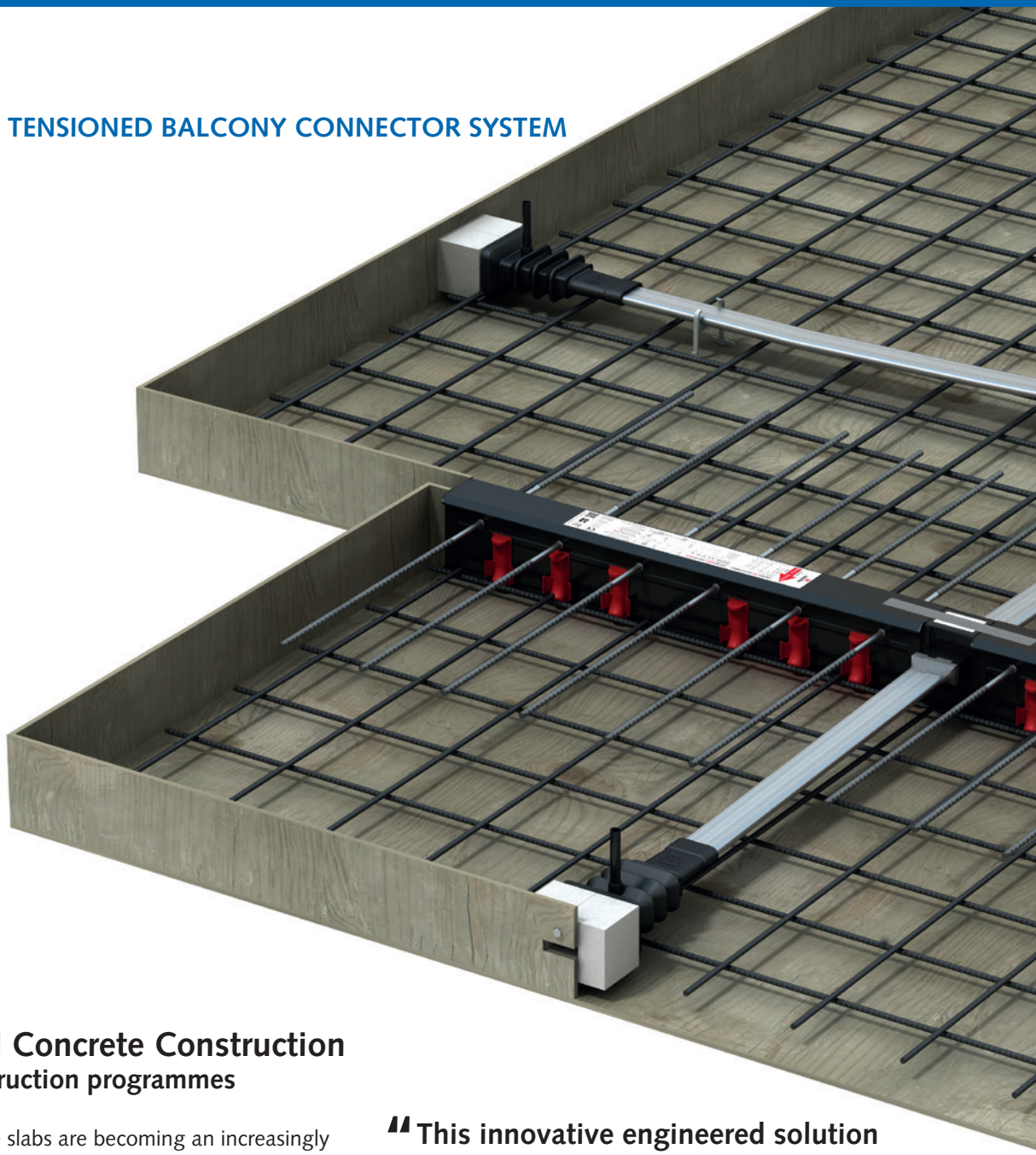
- Suitable for use with all post tensioning systems currently available on the market
- Transfers tension and compression forces in addition to bending moments and shear forces
- Two insulation thicknesses available (HIT-HP: 80mm and HIT-SP: 120mm) offering exceptional thermal efficiency
- Fully integrated REI 120 fire protection
- All support elements are sufficiently secured in a sturdy housing to ensure safe delivery, transport and easy on-site handling
- Symmetrical connector simplifies installation

Solution enabled by UKTA-0836-22/6015 - Annex D

Halfen HIT Post Tensioned Balcony Connector



European patent application: 19809909.5
United States patent application: US2022/0127837 A1



Post Tensioned Concrete Construction
Accelerating construction programmes

Post tensioned concrete slabs are becoming an increasingly popular method of construction. They allow thinner slabs, longer spans, reduced deflections, reduced costs and can result in a more sustainable design solution.

Until now, balconies on post tensioned concrete frames are typically constructed of conventionally reinforced concrete. Although a viable method, designers can encounter rebar congestion and clashes at the joint between the balcony and main slab.

By using the Halfen HIT in post tensioning applications, balconies and the main slab are treated as one area, resulting in multiple benefits:

- ✓ Formwork is installed/removed at the same time and can be re-used on the next level/phase
- ✓ Concrete is poured all at once
- ✓ Simultaneous stressing of the concrete takes place at the balcony edge, rather than at the thermal break location

"This innovative engineered solution allows designers to include balconies in the post tensioning process for the first time ever."

Design Partner
Leviat engineers worked closely with market leading engineering specialists, CCL, to develop the Halfen HIT Insulated Balcony Connector for post tensioning applications.

CCL offered comprehensive post tensioning design and loading advice in the early stages of product development. They also provided the expertise and components required for the creation and testing of prototypes.

HALFEN HIT POST TENSIONED BALCONY CONNECTOR SYSTEM
System Components

The Halfen HIT Post Tensioned Balcony Connector combines the robust Halfen HIT Structural Thermal Break, available in 250mm, 500mm and 1000mm lengths, with the new Halfen HIT-TP Transition Piece, to create a solution for post tensioned concrete applications.

The system is available for two insulation thicknesses: 80mm (HIT-HP) and 120mm (HIT-SP).

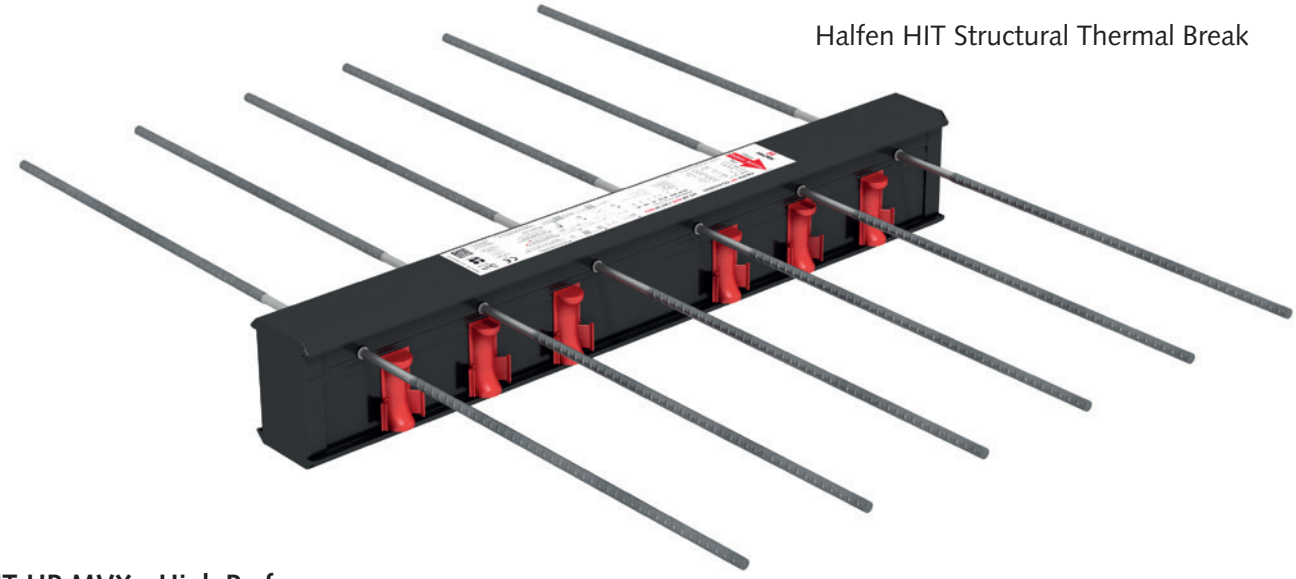
Halfen HIT Structural Thermal Break

When combined with the Halfen HIT-TP Transition Piece, the Halfen HIT Structural Thermal Break serves as the load bearing element of the system and carries the following loads:

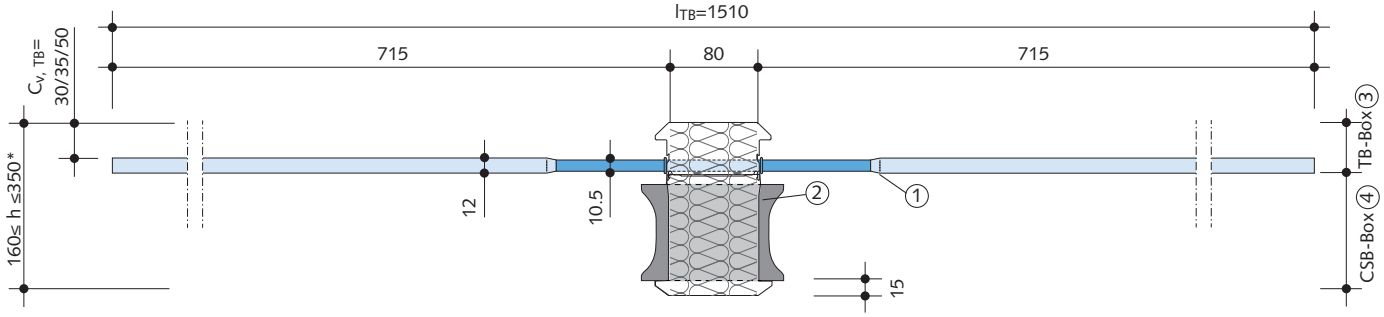
- dead loads of the balcony itself,
- live loads applied on the balcony
- horizontal tensioning force applied to the slabs

For load capacity values, please see pages 15-36 of the 'Halfen HIT Insulated Connection' technical brochure. Please note, the load capacities do not make any allowance for reductions resulting from the application of the tensioning force, which must be advised by Leviat at the time of the structural thermal break design on each specific project.

Halfen HIT Structural Thermal Break



HIT-HP MVX - High Performance



All dimensions in mm.
① Tension bars ø12mm/10.5mm in the joint
② Double-symmetrical compression shear bearings CSB
③ Tension bar box
④ Compression shear bearings box

Notes: For several balcony heights, a Distance Box (DB) may also be installed between the CSB box and the TB Box.
*Heights up to 500mm are available on request.

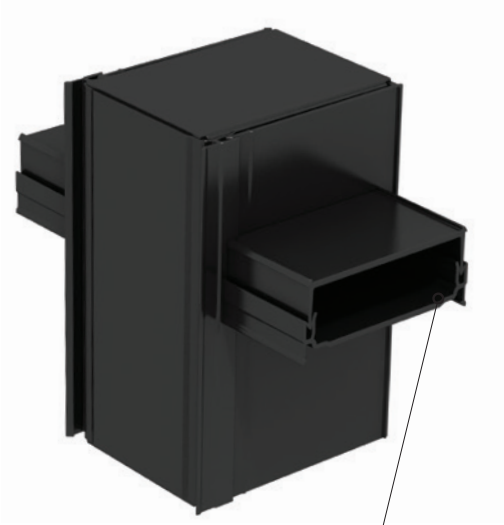
HALFEN HIT POST TENSIONED BALCONY CONNECTOR SYSTEM
System Components

Halfen HIT-TP Transition Piece

The Halfen HIT-TP Transition Piece is available in two sizes - HIT-HP TP2 and HIT-HP TP3. The 100mm or 150mm wide plastic box is filled with 80mm mineral wool insulation. A plastic transition tube, with an adapted section, passes through the box and allows the passage of the post tensioning duct. The duct size will determine which size Transition Piece is required.

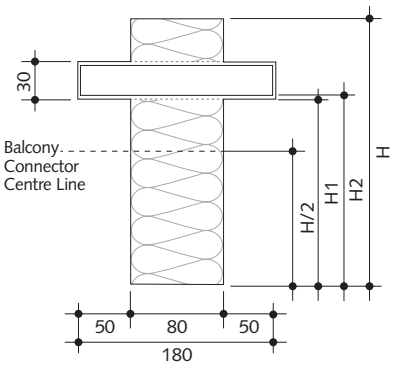
The system is also available for 120mm (HIT-SP) insulation thickness. Please contact Leviat for more information.

Halfen HIT-TP Transition Piece



Transition Tube - allows the passage of the post tensioning duct

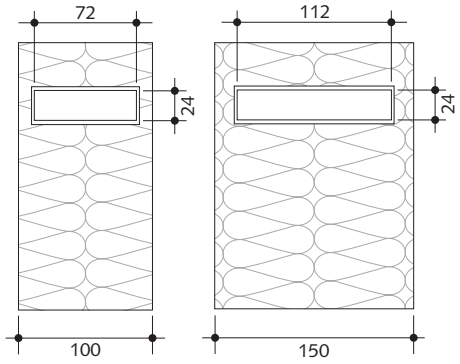
Dimensions of HIT-HP-TP2 / HIT-HP-TP3



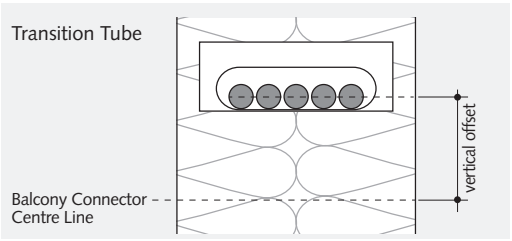
Side View

Internal Dimensions of Transition Tube

HIT-HP-TP2 **HIT-HP-TP3**



Front View



Notes: All dimensions in mm.
H1 measurement is taken from the underside of the transition tube.
The duct is placed at the bottom of the transition tube.

Transition Piece Dimensions

H (mm)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350
Vertical Offset (mm)	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
H1 (mm)	78.5	88.5	98.5	108.5	118.5	128.5	138.5	148.5	158.5	168.5	178.5	188.5	198.5	208.5	218.5	228.5	238.5	248.5	258.5	268.5
H2 (mm)	81	91	101	111	121	131	141	151	161	171	181	191	201	211	221	231	241	251	261	271

Strand Configuration Suitability

Transition tubes within the Transition Piece vary in size and are suitable for **3 x 13mm**, **5 x 13mm**, **2 x 15mm** or **4 x 15mm** strand configurations. Please see drawings above for the internal dimensions of the transition tube.

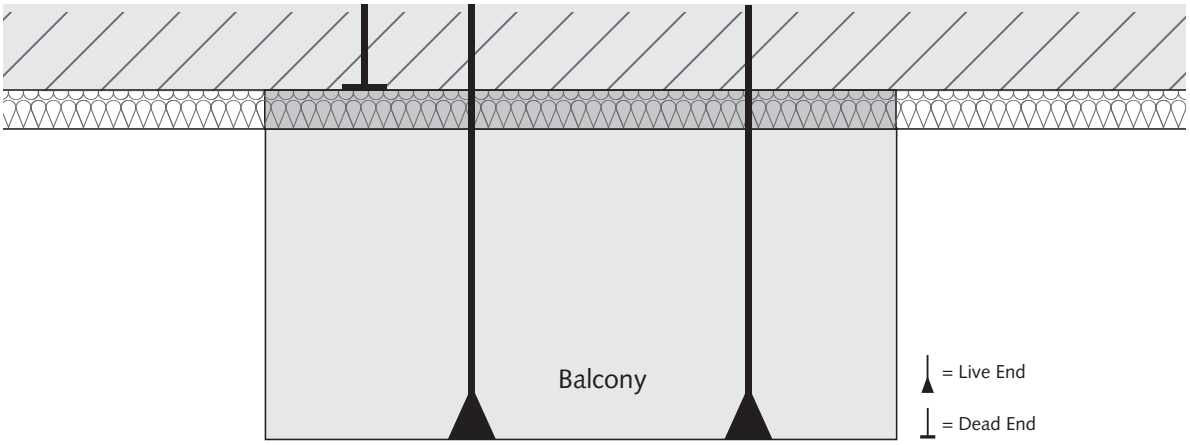
Typical Strand Configurations

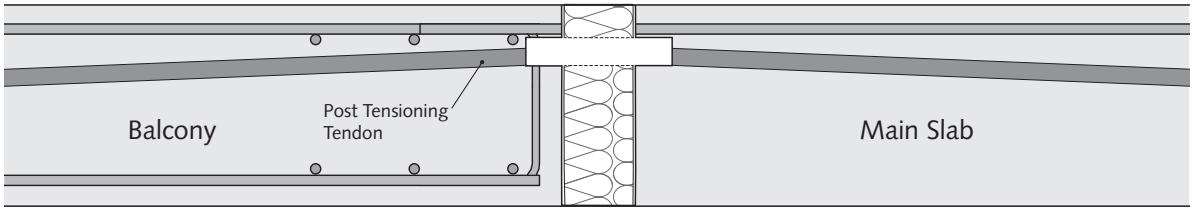
TP2	3 x Ø13mm	2 x Ø15mm	5 x Ø13mm	4 x Ø15mm
TP3	6 x Ø13mm	5 x Ø15mm	–	–

Position of Transition Tube

Allowing a positive vertical offset of the tendon from the centre line of the balcony connector is beneficial for the load capacity of the HIT solution. Therefore, offset values will depend upon the height of the structural thermal break. Please refer to the table above for dimensions.

Application for Cantilevered Balcony Slabs





HIT-HP MVX/HIT-SP MVX

- Transfers bending moments and positive and negative shear forces, in addition to horizontal compression forces.
- Insulation thickness 80mm/120mm.

See pages 15-36 of the 'Halfen HIT Insulated Connection' technical brochure for more information.

Other Available System Types

In addition to the HIT-MVX, other HIT element configurations are also available, including HIT-MVXL, HIT-DD, HIT-DVL and HIT-DDL for higher load requirements. Further details can be found in the 'Halfen HIT Insulated Connection' brochure. Please contact us for guidance on selecting the correct system for your project.

Concrete Cover to Reinforcement

The dimensions of the HIT-TP Transition Piece, as shown on page 7, are suitable for a concrete cover to reinforcement of 30mm and 35mm. If a larger concrete cover is required, up to and including 50mm, please contact the Leviat team on 0114 275 5224 or email reinforcement.uk@leviat.com.

HALFEN HIT POST TENSIONED BALCONY CONNECTOR SYSTEM
Typical Post Tensioning Components

Halfen HIT-TP Transition Pieces are designed for use with all types and configurations of post tensioning systems currently available on the market. The shape and dimensions of components may differ from those featured below. Please contact Leviat in the early stages of the design.

Live End Anchorage

Flat system used mainly in slabs. The system connects 13 or 15mm strands which run through a flat steel duct. The strands are tensioned individually using a monostrand jack.

Monostrand Jack

Monostrand jack for stressing strands of the tendon. Jacks automatically grip the wedges on the strand, partially stressing the tendons in the first instance and later stressing up to the final values of the prestressing force.

Flat Ducting

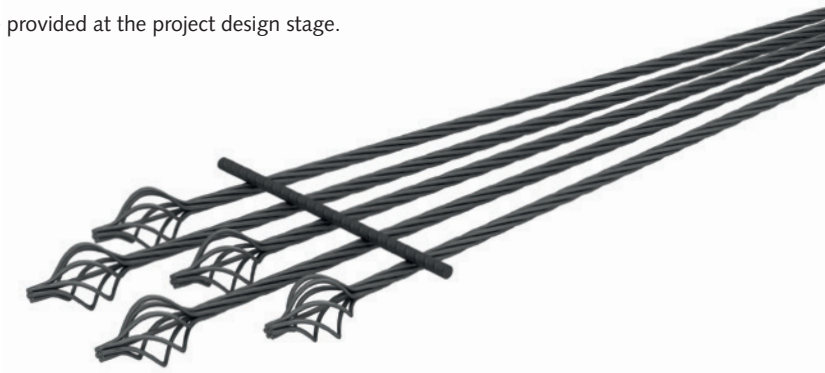
Corrugated duct made from rolled sheet typically used to house 13mm or 15mm strands.

HIT-HP/HIT-SP Transition Piece	No. Strands 13mm/15mm	Duct Height Inner mm	Duct Width Inner mm	Duct Wall Thickness mm	Duct Area mm^2
TP2	3 x Ø13 / 2 x Ø15	18	42	0.4	684
	5 x Ø13 / 4 x Ø15	18	69	0.4	1174
TP3	6 x Ø13 / 5 x Ø15	18	86	0.4	1484

Note: Dimensions may vary depending on supplier. Exact details will be provided at the project design stage.

Dead End Anchorage

Basket dead-end anchorages can be used in place of standard dead-end anchorages. The prestressing force is transferred to the concrete by bind. A rebar net is required to act as a spacer for the individual strands. Basket dead ends are constructed on site using an extrusion ring.

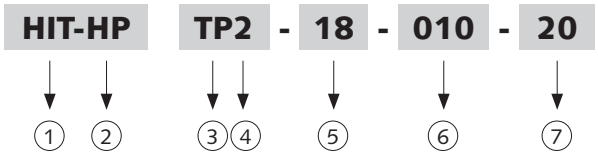


The post tensioning components shown here are typical examples, for illustrative purposes only, and are not supplied by Leviat.

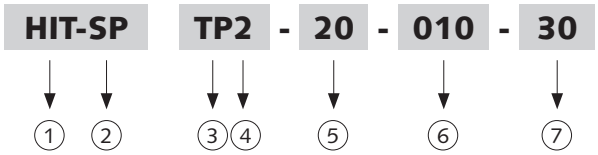
HALFEN HIT POST TENSIONED BALCONY CONNECTOR SYSTEM
Product Specification

Halfen HIT-HP Transition Piece Product Specification Structure

Example for HIT-HP TP2



Example for HIT-SP TP2



Reference Item	Description	Possible Values
①	Balcony Connector name	HIT
②	Insulation thickness	HP: 80mm insulation SP: 120mm insulation
③	Transition Piece	TP
④	Anchor head and duct size	2 - anchor head 10 & 20 3 - anchor head 30
⑤	Height of the HIT-HP Transition Piece	Standard heights from 16cm to 35cm. Heights of up 50cm are available on request.
⑥	Width of the HIT-HP Transition Piece	10cm or 15cm
⑦	Vertical offset between the HIT centre line and the tendon centre line	From 10mm to 105mm, depending on the height of the HIT element

Material Specification and Test Certification

Material Specification: HIT Structural Thermal Break	
Tension Bars	Flash butt welded bar connection, consisting of a combination of two reinforcing steel bars B500 according to DIN 488 and a stainless steel bar of strength class S 690 or stainless steel B500NR.
Shear Bars	Stainless bar steel of strength B500NR or flash butt welded bar connection, consisting of a combination of stainless steel bar B500NR and reinforcing steel bars B500B.
Compression Shear Bearings	High-performance mortar with increased compressive and tensile strength as well as optimised thermal conductivity.
Casing	Plastic according to EN ISO 1163
Insulating Material	Mineral wool (WLG 035) of Building Material Class A1, non-flammable insulation according to DIN 4102-14 or Euro Class A1 according to EN 13501-1.
Connecting Components	Suitable for concrete strengths ≥ C20/25
On-site Reinforcement	Reinforcement steel B500B/B500C

Test Certificates
Technical Approvals
EOTA: ETA-18/0189 including fire protection, thermal values and noise reduction DoP no. H10-18/0189
British Board of Agrement: UKTA-0836-22/6015

HALFEN HIT POST TENSIONED BALCONY CONNECTOR SYSTEM
Design Considerations

Leviat can provide guidance on the optimum Halfen HIT thermal break layout to be used on your project. Early involvement of Leviat will ensure the most suitable and cost-effective solution.

It is important to specify the Halfen HIT solution for post tensioned applications at the time the slab is being designed, as the sizes and position of the post tensioning tendons will significantly influence the thermal break design.

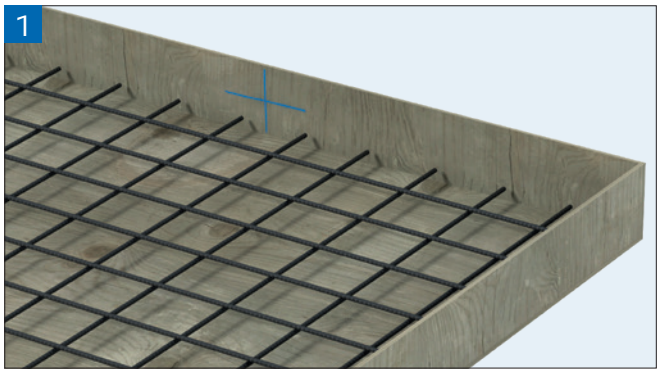
In particular, the guidelines below must be followed:

- The system applies to moment-resisting connections, with balconies designed as cantilevers or propped cantilevers. Balconies designed as simply-supported along the balcony insulation joint are excluded.
- The position of the tendons inside the balcony insulation joint is crucial to load performance.
- The tendons must be kept perpendicular to the balcony insulation joint.
- The sequence in which the tendons are stressed must be clearly defined in the design plan and strictly adhered to.
- The vertical position of the tendons highly affects the loads applied on the HIT load bearing elements: it must be clearly defined and strictly adhered to.
- Non-symmetrical tendon layouts are best avoided as they may cause non-uniform deflection and uneven load distribution on the Halfen HIT balcony connector system.

For technical advice, please contact the Leviat team on 0114 275 5224 or email reinforcement.uk@leviat.com.

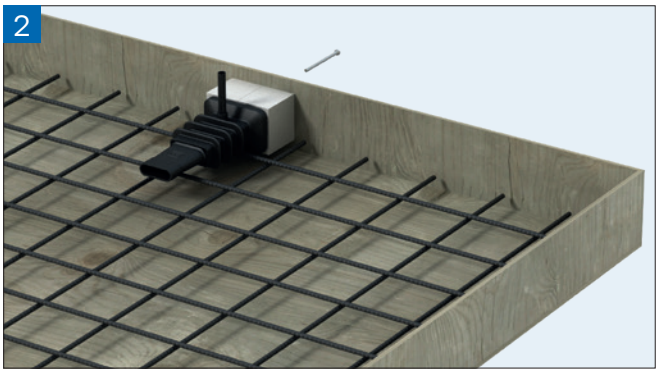
HALFEN HIT POST TENSIONED BALCONY CONNECTOR SYSTEM
Installation Guidance

1



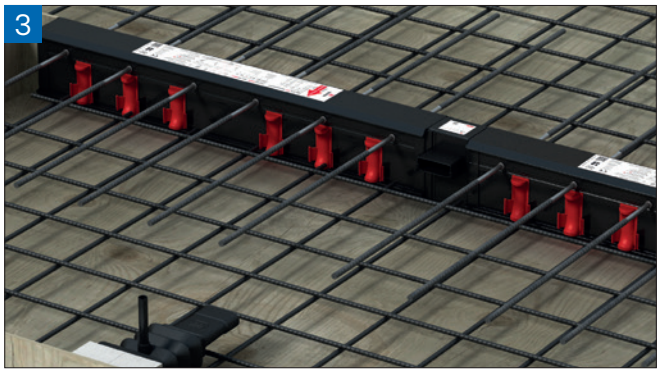
Install formwork for the main slab and balcony. With side shutters in place, mark the position of the post tension anchors. Position all necessary lower reinforcement.

2



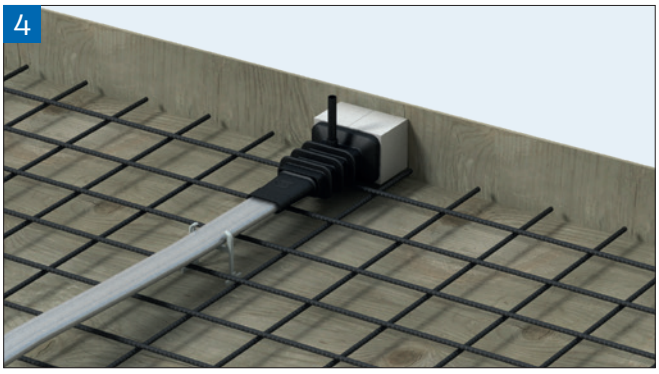
Fix the post tension anchor, through the EPS block, to the side shutters with bolts.

3



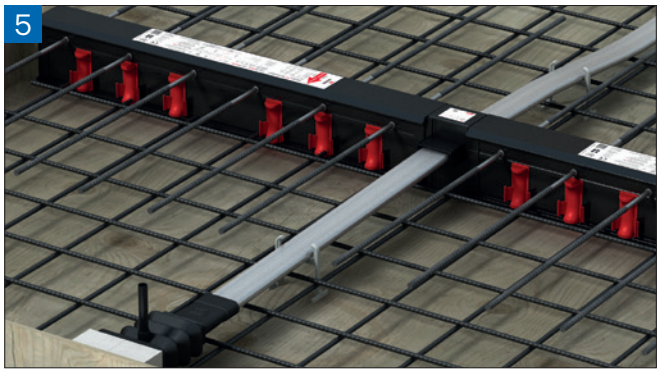
Place the HIT system on the formwork in line with the project drawings, ensuring all elements are positioned and orientated as indicated on the product label.

4



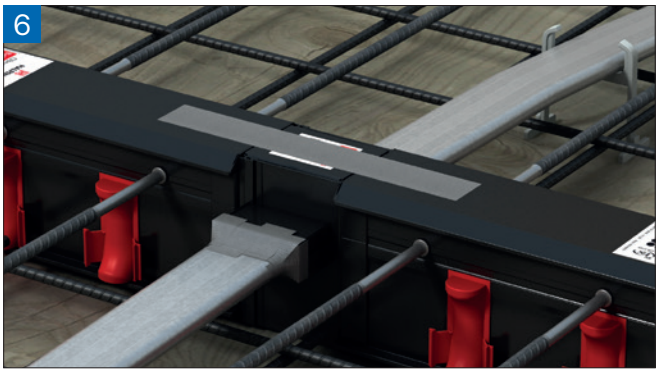
Position the post tension ducts in line with the project drawings and adjust height by using plastic chairs.

5



Insert the duct through the transition tube.

6

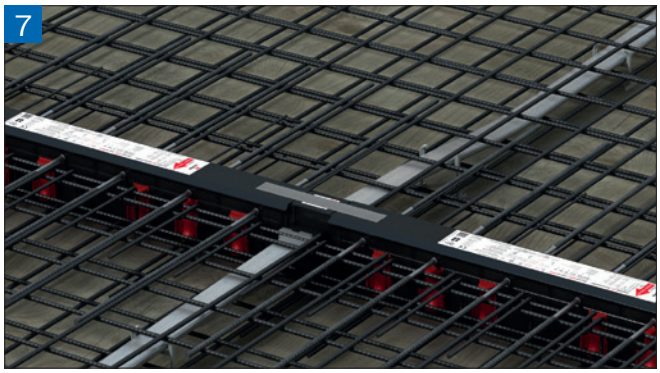


To ensure the HIT-TP Transition Piece remains in position during the concrete pour, carry out the following steps:

- Secure the position of the tube on the duct with tape at each end of the tube. This will also prevent ingress of concrete.
- Apply additional tape to the top of the Transition Piece and HIT structural connectors to prevent movement and /or rotation.

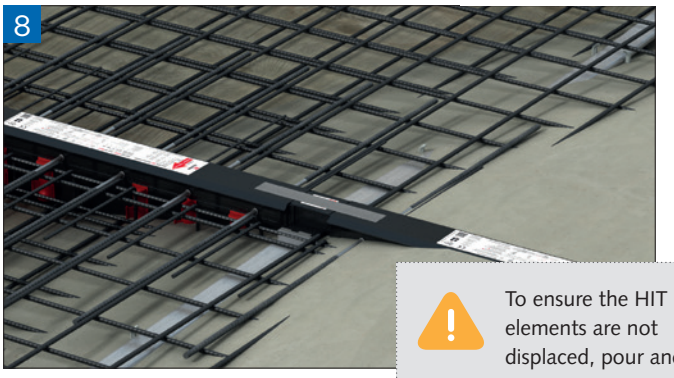
HALFEN HIT POST TENSIONED BALCONY CONNECTOR SYSTEM
Installation Guidance

7



Position all necessary upper reinforcement in the slab and add any additional reinforcement as per the Halfen HIT installation instructions.

8



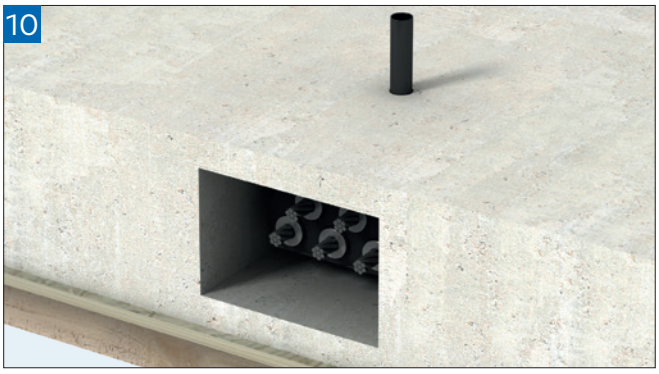
Simultaneously pour concrete to the main slab and the balcony slab.

To ensure the HIT elements are not displaced, pour and compact the concrete evenly. Secure the HIT elements against movement.

9

Stressing of the concrete takes place in two phases. An initial stress of 25% at 10N/mm^2 is applied to the concrete. Typically between 48-72 hours after the concrete has been poured, and when the concrete has reached the required design strength, the final stressing of 100% at 25N/mm^2 takes place.

10



Trim strands off to the specified length in line with project drawings.

11

Fill stressing pockets with non-shrink grout/mortar. Remove temporary supports/props, formwork and scaffolding.

12

Insert cementitious grout through the grout tube to ensure bonding of the internal strands.

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