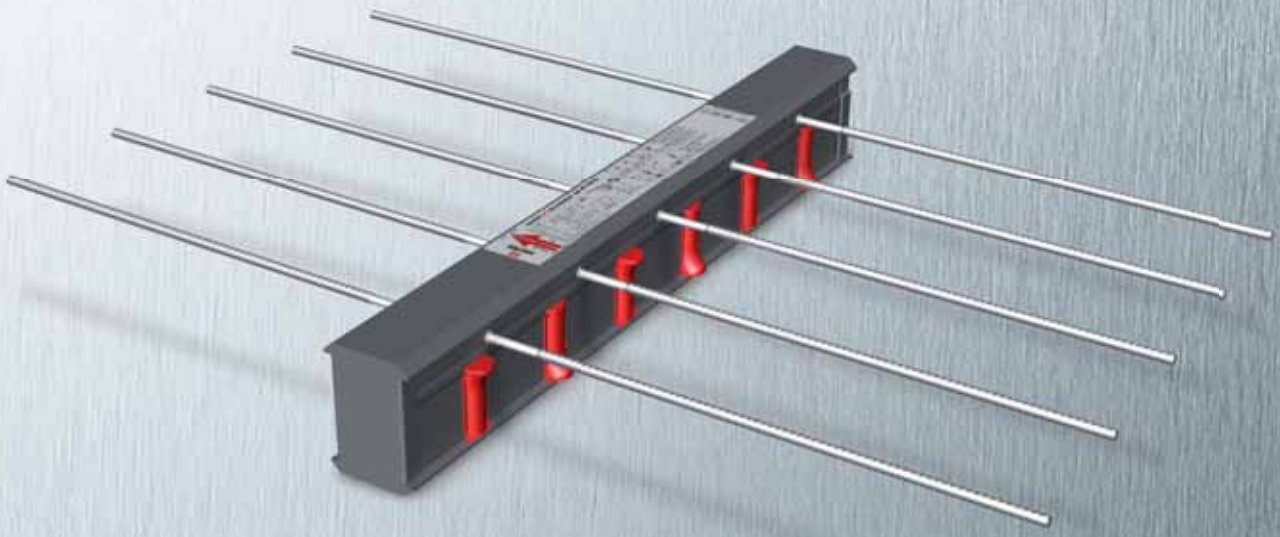
HALFEN HIT INSULATED CONNECTION
TECHNICAL PRODUCT INFORMATION



HALFEN HIT INSULATED CONNECTION

CONCRETE

HIT 15.1-E

NEW!

- the complete product range for balcony solutions
- with European Technical Approval
- with thermal Ψ-values and acoustic $\Delta L_{n,W}$-values according to European Approvals

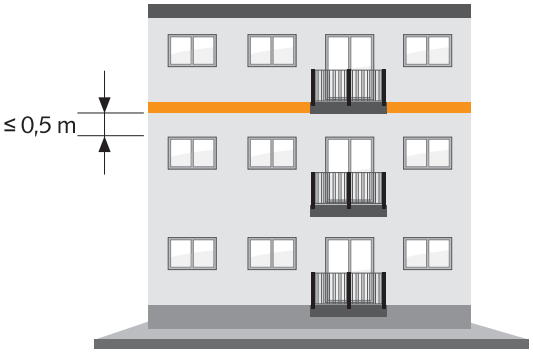
HALFEN

YOUR BEST CONNECTIONS

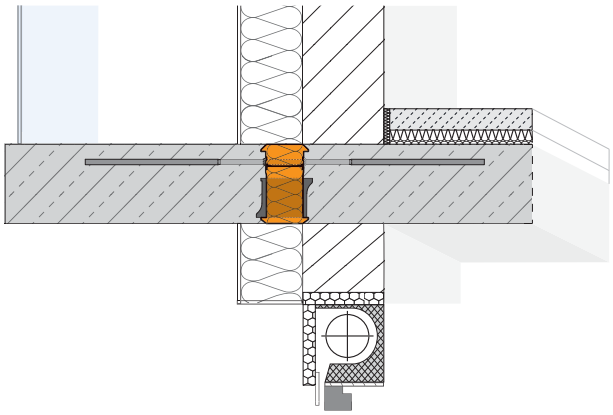
Be on the safe side.

We take fire protection seriously.

The fully enclosed HIT-HP and HIT-SP ensure compliance with the highest fire safety requirements in accordance with REI 120 according to EN 13501 as well as classification F120-AB according to DIN 4102 in compliance with ETA-13/0546 and numerous other approvals.
This is made possible by the special shape of the insulation in combination with the use of high-quality non-flammable mineral wool, Building Material Class A1 and Euro Class A1, respectively.



Circumferential fire barrier as an efficient fire barrier in the insulation layer with full balcony integration



Installation detail: HIT-HP and HIT-SP units as part of fire barrier

Additional fire protection measures, e.g. circumferential fire barrier or additional lintel fire protection, must be provided to increase the resistance of external thermal insulation composite system using expanded polystyrene (EPS) .

The HIT-HP and HIT-SP units work as a fire barrier around the area of balconies and porches and ensure the necessary fire-retardancy of ETIC-Systems.

This reduces additional costs for fire prevention.

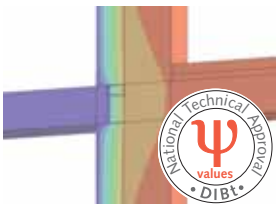
HALFEN
YOUR BEST CONNECTIONS

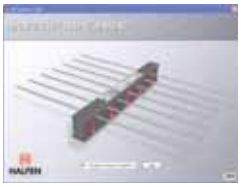
HALFEN HIT INSULATED CONNECTION

Contents

HIT-HP MD
HIT-SP MD

HIT-HP ZD
HIT-SP ZD





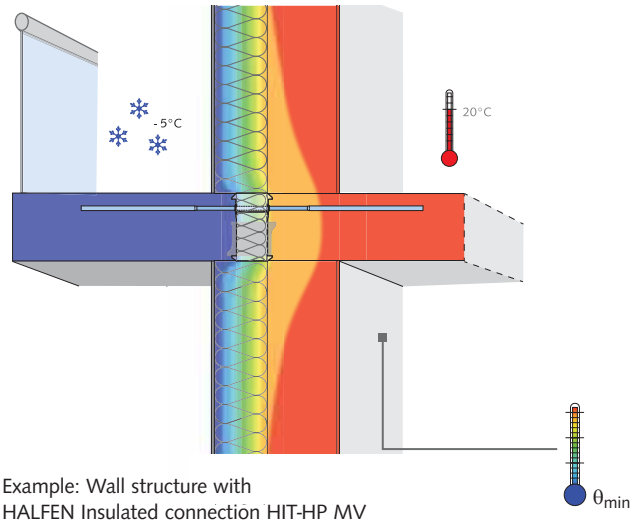
HALFEN HIT Insulated connection – always a good decision

HALFEN has done a lot to further improve the successful first generation of HIT.
The following is a summary of the most important benefits available to you with the HIT-HP MV and HIT-SP MV.

HP stands for High Performance with an insulation thickness of a 80 mm and SP means Superior Performance with an insulation thickness of 120 mm.
Convince yourself of the benefits in your next project.

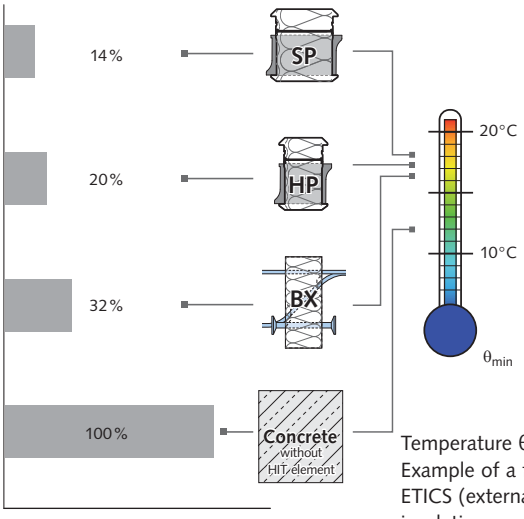
Thermal Insulation

Effective thermal separation of the balcony slab



Example: Wall structure with
HALFEN Insulated connection HIT-HP MV

Compliant with requirements by using HALFEN HIT Insulated connections



Δ Thermal transmission coefficient ψ

Temperature θ_{min};
Example of a façade with ETICS (external thermal insulation composite system)

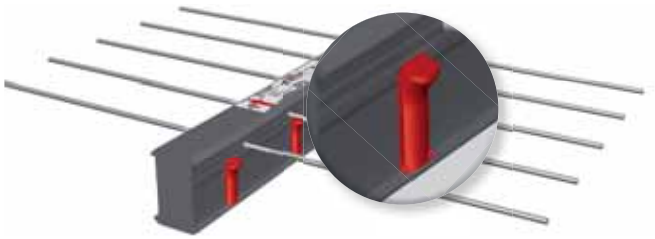
Certified by the Passive House Institute

- for HIT-HP: insulating joint from 80 mm
- also for max. load capacities with HIT-SP

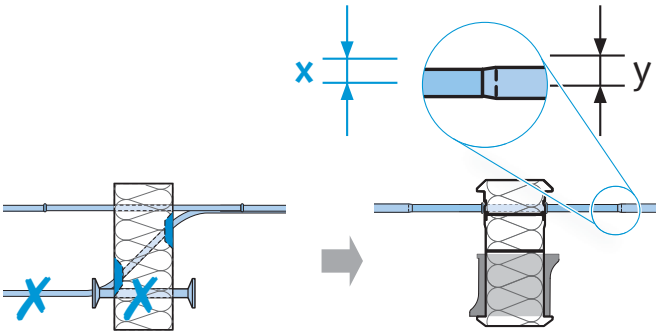
With building authority approved ψ values

- according to various DIBt and EOTA approvals

Improved thermal insulating properties



- innovative compression shear bearings CSB made of ultra-high strength fibre-reinforced mortar with increased thermal insulating properties and an optimized cross-section



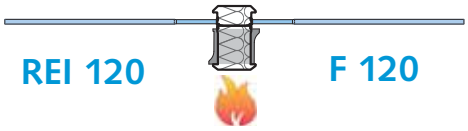
- reduced tension bar cross-section in the insulating joint
- substantial reduction of penetration points and continuous insulating material thickness
- mineral wool as thermally insulating fire protection material

General

Further advantages at a glance

Fire protection

- REI 120 (F120) as standard for all HIT-HP and HIT-SP elements
- non-flammable insulation material: Building material class A1
- no additional fire boards required
- no mix-up of elements, with and without fire protection requirement
- no additional installation time or work for REI 120 (F120)



RAL quality symbol

With RAL Quality Mark Anchoring- and Reinforcement technology RAL-GZ 658/2 awarded by RAL Quality control association for anchorage and reinforcement technology.

RAL GÜTEZEICHEN Verankerungs- und Bewehrungstechniken RAL-GZ 658/2

The RAL Quality Mark guarantees compliance with the technical product requirements and the related services regarding:

- Specification, quality management, logistics, competent technical advice, high-quality technical documentation and software and fulfilment of the guaranteed benefits.

Biannual monitoring provided by German Lloyd guarantees that the recommended requirements of the quality control association for anchor and reinforcement technology (Gütegemeinschaft Verankerungs- und Bewehrungstechnik e.V) are maintained.

Certification and software

- CE marking

CE European Technical Approval ETA-13/0546

- DIBt-approved and type-tested

National Technical Approval DIBt

- user friendly software with integrated cutoff waste optimization

Installation and functionality

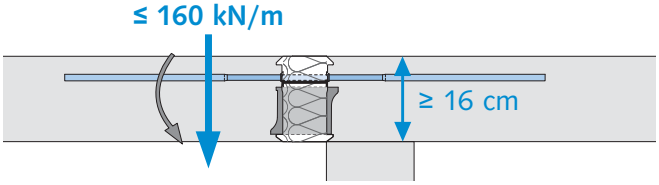
• robust plastic casing with 3D fixing of all structural members

• optimal protection of the thermal insulation against mechanical loads and moisture

• simplified installation of the HIT element even from above
• no welded assembly bars necessary

Statics

- transmissible shear forces of up to 160 kN/m with a slab thickness h ≥ 16 cm
- HALFEN's integrated safety concept: Load capacities are actual design values. Additional verifications by the engineer to limit the shear capacity are not required.

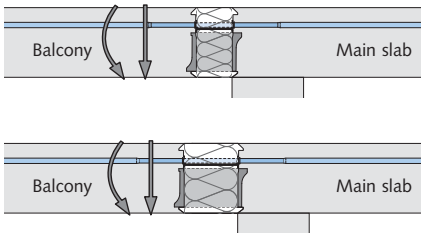


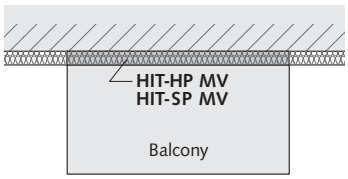
1 Cantilevered balcony slabs

One part application

HIT-HP MV / HIT-SP MV
- transfers bending moments and shear forces
- insulation thickness 80 mm / 120 mm

→ **page 11**

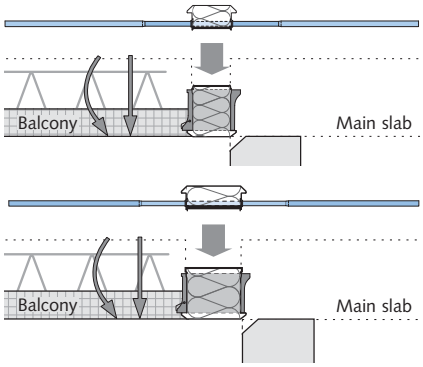


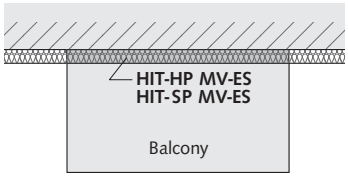


Multi-part application

HIT-HP MV-ES / HIT-SP MV-ES
- product type for element slabs
- transfers bending moments and shear forces
- insulation thickness 80 mm / 120 mm

→ **page 11**

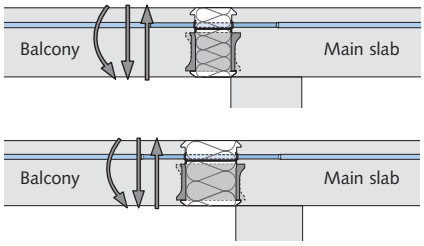




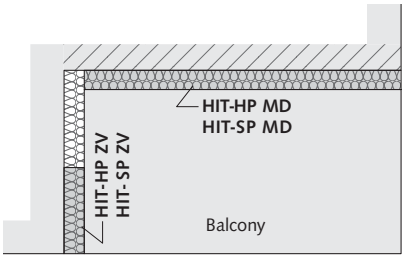
Application for cantilevered balcony slabs

HIT-HP MD / HIT-SP MD
- transfers bending moments and positive and negative shear forces
- insulation thickness 80 mm / 120 mm

→ **page 24**



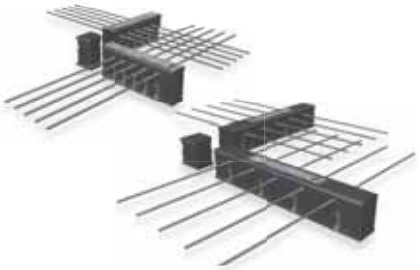
NEW!

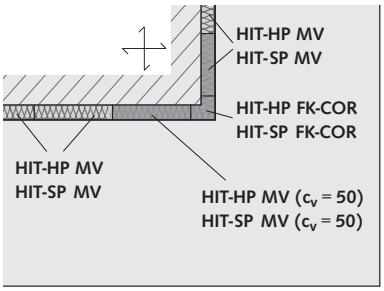


Implementation for cantilevered balcony slabs

HIT-HP COR / HIT-SP COR
- for cantilevered outside corner balconies designed with standard elements with the same load bearing capacity and a corner filler
- insulation thickness 80 mm / 120 mm

→ **page 31**



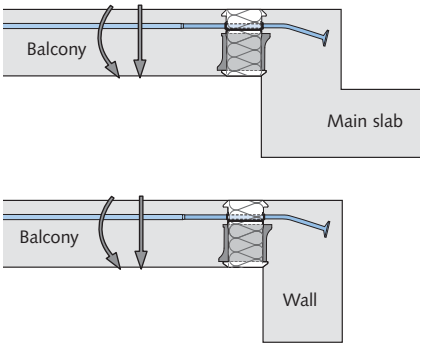


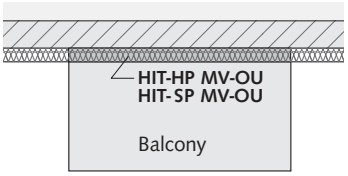
2 Cantilevered balcony slabs with height offset or wall connections

HIT-HP MV-OU / HIT-SP MV-OU

- height offset, balcony higher than main slab
- upward wall connection
- transfers bending moments and shear forces
- insulation thickness 80 mm / 120 mm

→ **page 42**

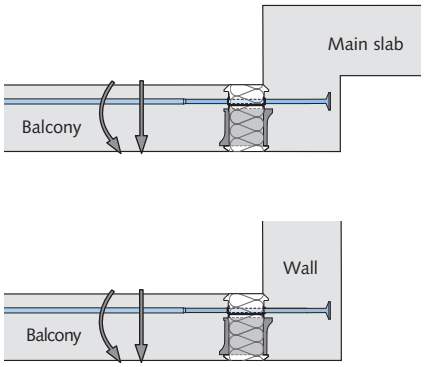


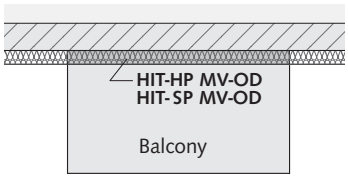


HIT-HP MV-OD / HIT-SP MV-OD

- height offset, balcony lower than main slab
- downward wall connection
- transfers bending moments and shear forces
- insulation thickness 80 mm / 120 mm

→ **page 42**



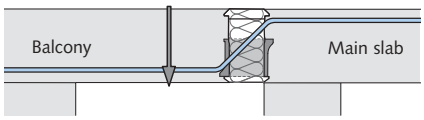


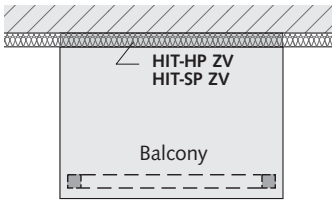
3 Simply-supported balcony slabs on columns

HIT-HP ZV / HIT-SP ZV

- transfers shear forces only
- insulation thickness 80 mm / 120 mm

→ **page 52**

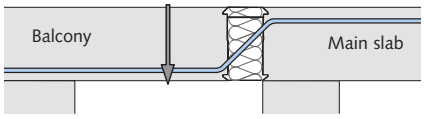




HIT-HP ZV / HIT-SP ZV without CSB

- transfers shear forces only for unrestrained simply supported connections, e.g. for loggias
- insulation thickness 80 mm / 120 mm

→ **page 52**

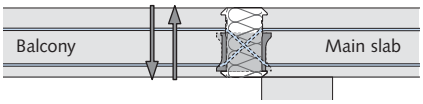


► further types → see following pages

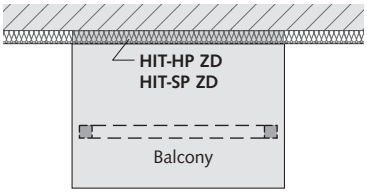
3 Simply-supported balcony slabs on columns

HIT-HP ZD / HIT-SP ZD
- transfers positive and negative shear forces
- insulation thickness 80 mm / 120 mm

→ **page 63**

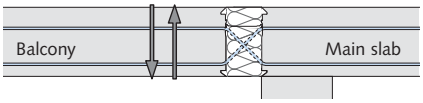


NEW!



HIT-HP ZD / HIT-SP ZD without CSB
- transfers positive and negative shear forces
- insulation thickness 80 mm / 120 mm

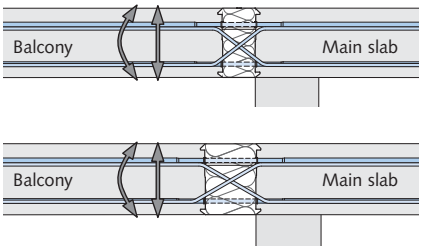
→ **page 63**

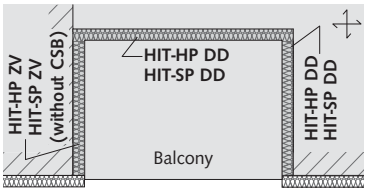


4 Continuous slabs

HIT-HP DD / HIT-SP DD
- transfers bending moments and positive and negative shear forces
- insulation thickness 80 mm / 120 mm

→ **page 75**

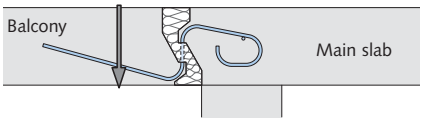


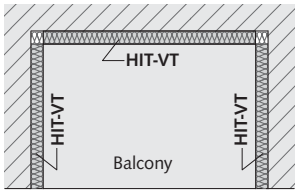


5 Simply-supported balcony slab

HIT-VT
- unrestrained connection of balcony slabs subjected only to shear loads

→ **page 85**

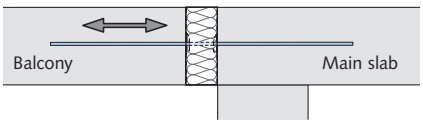


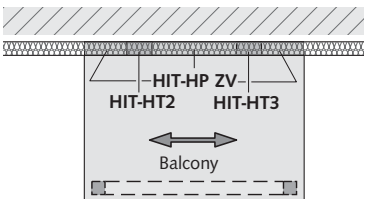


6 Absorbtion of horizontal forces

HIT-HT
- absorbs horizontal forces parallel and/or perpendicular to the insulation line

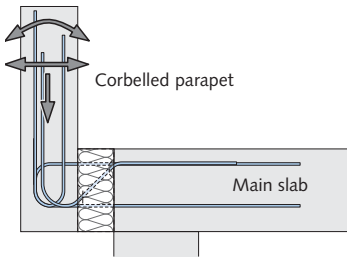
→ **page 88**

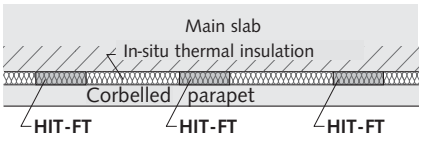




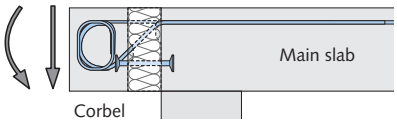
7 Parapets and corbels

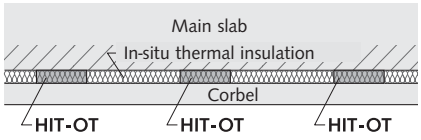
HIT-FT
Forms a thermal barrier between corbelled parapet and main slab for selective use. Unit spacing based on structural requirements.
→ **page 91**



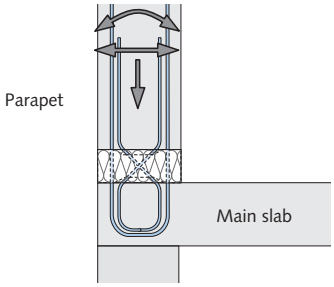


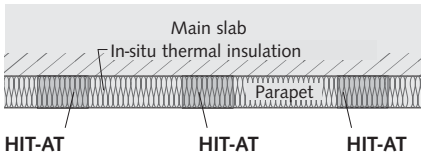
HIT-OT
Forms a thermal barrier between corbel and main slab for selective use. Unit spacing based on structural requirements.
→ **page 91**





HIT-AT
Forms a thermal barrier between parapet and main slab for selective use. Unit spacing based on structural requirements.
→ **page 91**

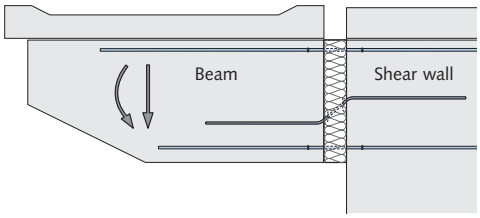


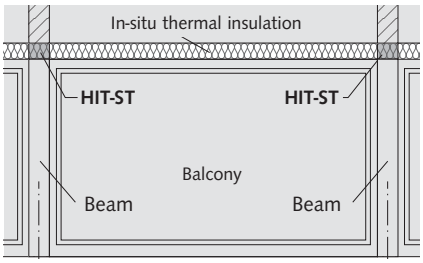


8 Shear walls and beams

HIT-ST
- insulates cantilevered beams
- transfers high bending moments and shear forces in selected areas

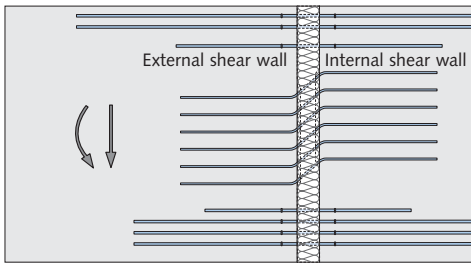
→ **page 95**

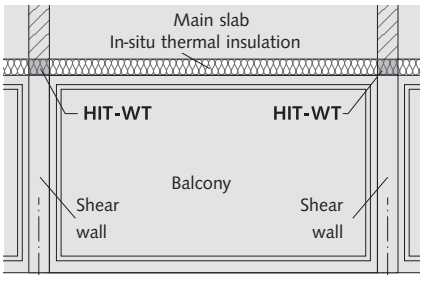




HIT-WT
- insulates storey-high, cantilevered shear walls
- transfers bending moments and shear forces in selected areas mainly in vertical direction

→ **page 95**





9 Building physics, technical information

Information on:
- thermal insulation, fire protection and noise reduction
- planning aid / HALFEN design software / tender specification

→ **page 99**

HALFEN HIT INSULATED CONNECTION HIGH & SUPERIOR PERFORMANCE

Material Specification and Test Certificates

Material specification

Tension bars	Flash butt welded bar connection, consisting of a combination of two reinforcing steel bars B500B according to DIN 488 and a stainless bar steel of strength class S 690
Shear bars	Stainless bar steel of strength B500NR or flash butt welded bars connection, consisting of a combination of stainless bar steel B500NR and reinforcing steel bars B500B
Compression shear bearings	High-performance mortar with increased compressive and tensile strength as well as optimized thermal conductivity
Casings	Rigid PVC 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	
Concrete	Suited for concrete strengths ≥ C20/25
On-site reinforcement	Reinforcing steel B500B

Test certificates

Technical Approvals	
HIT-HP/SP MV and MD **HIT-HP/SP ZV and ZD**	EOTA: ETA-13/0546 including fire protection, thermal values and noise reduction DoP No. H10-13/0546
HIT-HP/SP MV and MD **HIT-HP/SP ZV and ZD** **HIT-HP/SP DD**	DIBT Berlin: Approval no. Z-15.7-293 DIBT Berlin: Approval no. Z-15.7-312 DIBT Berlin: Approval no. Z-15.7-309

Type statics	
Type-tested by the Landesgewerbeanstalt Bayern	Test-No. S-WUE/100358, Type test report no. 1–10

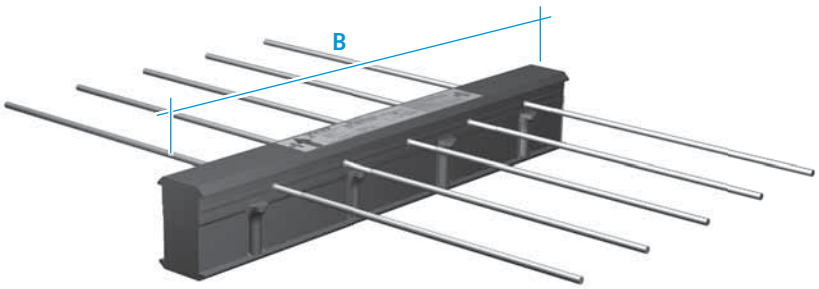
Certification	
Passive House Institute	Certification valid for slab thickness from 160 mm to 240 mm
RAL Quality Mark	RAL German Institute for Quality Assurance and Certification, RAL Quality Mark Anchoring- and Reinforcement technology RAL-GZ 658/2

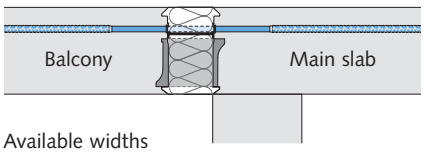
Approvals and type tests on the internet
The approvals and type tests can be found at **www.halfen.com/downloads/brochures**.
Or simply scan the code and then select the document to download a PDF file.

1 • Balcony connection for cantilevered balcony slabs • Transfers bending moments and shear forces

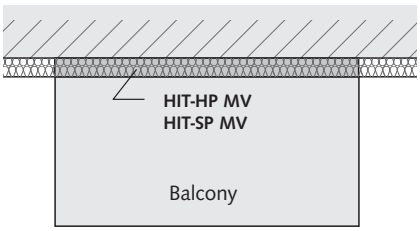
type-tested

Standard design:
HIT-HP MV – **High Performance** with insulation thickness 80 mm
HIT-SP MV – **Superior Performance** with insulation thickness 120 mm



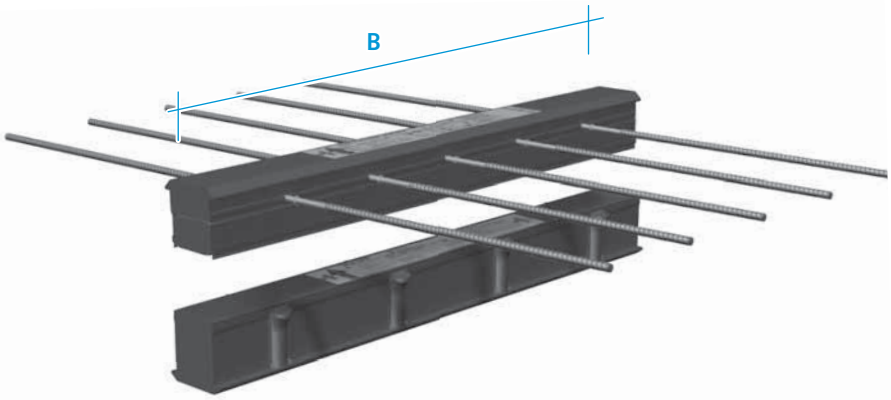


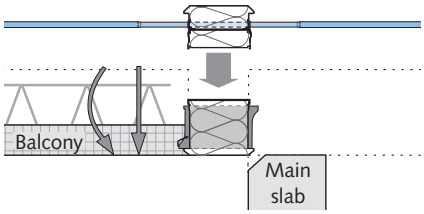
Available widths
B = 1.00 m / 0.50 m / 0.25 m



Application: Cantilevered balcony

Multi-part-design:
HIT-HP MV-ES – **High Performance** for element slabs
HIT-SP MV-ES – **Superior Performance** for element slabs





Available widths
B = 1.00 m / 0.50 m / 0.25 m

Load bearing behaviour of the HIT-HP MV and the HIT-SP MV

Cutting edge technology – made by HALFEN

As a world first, the HALFEN Insulated cantilever slab connections HIT-HP and HIT-SP feature the innovative and patented structural *CSB* Compression Shear Bearing system.
The load bearing compression bearings and stainless steel shear bars previously used, have been replaced by the innovative technology of using compression shear bearings made of ultra-high strength fibre-reinforced mortar.
The *CSB* act as a compression shear zone and transfer the compressive and shear forces in the HIT-HP and HIT-SP insulating elements.

Integrated safety concept

For the first time, the complete verification and design concept for balcony connections has been incorporated into a National Technical Approval. The ETA-13/0546 and the National Technical Approvals include verification of the moment/shear force interaction of the *CSB* as well as verification against concrete edge failure to ensure load transfer into adjacent components. This includes all respective verifications for slab connection regarding the force transmission. Consequently, time-consuming additional verifications such as the limitation of the concrete compressive strut are no longer necessary. The structural engineer is provided with maximum planning reliability.

In addition to the technical approval you will of course find the LGA Würzburg type test available for download on the HALFEN website. The type test includes the transferable bending moments M_{Rd} and shear forces V_{Rd} of normal load ranges for concrete strength classes C20/25, C25/30 and C30/37 as well as for the concrete covers for tension bars with c_v = 30 mm, 35 mm and 50 mm.

The load bearing capacities of selected elements are illustrated in more detail on pages 14 to 20 for HIT-HP/SP MV and on pages 27 to 30 for HIT-HP/SP MD. The component resistances of the elements with a width of 1.00 m, 0.50 m and 0.25 m are each stated per running metre. This allows easy selection and planning reliability for any connector length. With different concrete strength classes on the balcony and the main slab, the lower concrete strength is decisive when selecting load range capacity level.

The load bearing capacity of the elements is characterized by a moment/shear force interaction curve (see diagram).

The structural behaviour of HIT Elements

If the maximum vertical force bearing capacity $V_{Rd,1}$ is not fully exploited, the *CSB* technology provides the opportunity to increase the moment bearing capacity so that it exceeds $M_{Rd,1}$. $M_{Rd,2}$ is the maximum moment bearing capacity with the corresponding vertical force bearing capacity $V_{Rd,2}$.

This load bearing behaviour is considered in the HIT software. This software selects the optimum load range of the HIT elements.

HALFEN software is available at www.halfen.com.

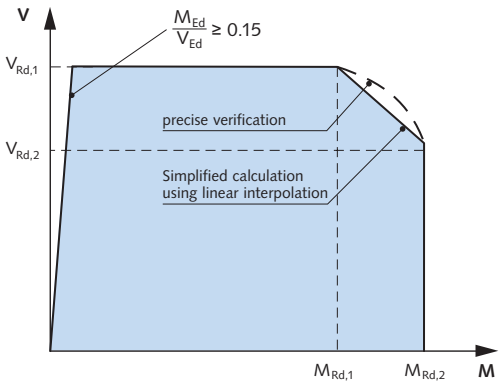


Diagram: moment/shear force interaction at the cantilever slab connection

With *CSB* technology shear forces of up to 160 kN per metre can be transferred safely and in accordance with the National Technical Approval (applies to slab thickness ≥ 160 mm).
To ensure these high load bearing capacities are kept within the application range for cantilever slab connection, the following **ratio of the external force variables** must be observed:

$$\frac{M_{Ed}}{V_{Ed}} \geq 0.15$$

Load range

The respective load range results from the corresponding combination of TB- (tension bar) and CSB- (compression shear bearings) Box. The combinations of TB- and CSB-Box illustrated in the following table are possible and type-tested.

Possible combinations of upper and lower parts

Element width B = 25 cm		No. of tension bars n_{TB}		
		1	2	3
Number of compression shear bearings n_{CSB}	1	●	●	
	2	×	●	●

Element width B = 50 cm		No. of tension bars n_{TB}					
		2	3	4	5	6	7
Number of compression shear bearings n_{CSB}	2	●	●	●			
	3	●	●	●	●	●	
	4	×	●	●	●	●	●
	5		×	●	●	×	×

Element width B = 100 cm		No. of tension bars n_{TB}									
		4	5	6	7	8	9	10	11	12	13	14
Number of compression shear bearings n_{CSB}	4	●	●	●	●	●	×					
	5	●	●	●	●	●	●	●	×			
	6	●	●	●	●	●	●	●	●	●	×	
	7	×	×	●	●	●	●	●	●	●	●	●
	8	×	×	●	●	●	●	●	●	●	●	●
	9		×	×	×	●	●	●	●	●	●	×
	10			×	×	●	●	●	×	×	×	

Values for the load bearing capacities for the elements highlighted in blue → see pages 14 – 20. ● = HP and SP × = HP only

The complete, type-tested load class range for concrete grades C20/25, C25/30 and C30/37 can be downloaded at **www.halfen.com**.

Basic types – Ordering example

HIT- HP MV - 0705 - 20 - 100 - 35
HIT- SP MV - 0404 - 18 - 050 - 50
HIT- HP MV - 0202 - 18 - 025 - 30 - ES

- Product group - type
- Load type
- Number of tension bars
- Number of compression shear units CSB
- Element height [cm]
- Element width [cm]
- Concrete cover [mm]
- For element slab design only

Custom designs are available on request. For further details please contact our regional sales companies → see inside back cover for contact details.

Available slab thickness h

Concrete cover [mm]	30	35	50
Available slab thickness h [cm]	16 – 35	16 – 35	16 – 35

Load bearing capacity values according to EN 1992-1-1 (EC2)

Shear capacity in one direction

Concrete strength: *C20/25* / ≥C25/30 — 80

Type / Element width		HP MV-0404	HP MV-0504	HP MV-0604	HP MV-0804	HP MV-0805
	B = 1.00 m					
	B = 0.50 m	HP MV-0202	–	HP MV-0302	HP MV-0402	–
	B = 0.25 m	HP MV-0101	–	–	HP MV-0201	–
Design values	v_{Rd} [kN/m]		***64.0*** **64.0**			***80.0*** **80.0**

Moment bearing capacity for all element widths

Type / Element width				HP MV-0404		HP MV-0504		HP MV-0604		HP MV-0804		HP MV-0805	
	B = 1.00 m												
	B = 0.50 m			HP MV-0202		–		HP MV-0302		HP MV-0402		–	
	B = 0.25 m			HP MV-0101		–		–		HP MV-0201		–	
Concrete cover [mm]	30	35	50										
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*16.9*	17.4	*20.0*	20.8	*22.7*	23.9	*24.7*	28.7	*29.5*	31.2
	160		180	*17.9*	18.4	*21.3*	22.1	*24.2*	25.4	*26.4*	30.6	*31.5*	33.2
		170		*18.9*	19.4	*22.5*	23.3	*25.6*	26.8	*28.0*	32.6	*33.5*	35.2
	170		190	*19.9*	20.4	*23.7*	24.5	*27.1*	28.3	*29.7*	34.6	*35.4*	37.1
		180		***20.8***	**21.4**	***24.9***	**25.8**	***28.6***	**29.8**	***31.4***	**36.5**	***37.4***	**39.1**
	180		200	*21.8*	22.4	*26.2*	27.0	*30.1*	31.3	*33.1*	38.5	*39.4*	41.1
		190		*22.8*	23.3	*27.4*	28.2	*31.5*	32.7	*34.8*	40.4	*41.3*	43.0
	190		210	*23.8*	24.3	*28.6*	29.5	*33.0*	34.2	*36.5*	42.4	*43.3*	45.0
		200		***24.8***	**25.3**	***29.9***	**30.7**	***34.5***	**35.7**	***38.2***	**44.3**	***45.3***	**47.0**
	200		220	*25.8*	26.3	*31.1*	31.9	*36.0*	37.2	*39.9*	46.3	*47.3*	48.9
		210		*26.7*	27.3	*32.3*	33.1	*37.4*	38.6	*41.6*	48.2	*49.2*	50.9
	210		230	*27.7*	28.3	*33.6*	34.4	*38.9*	40.1	*43.3*	50.2	*51.2*	52.9
		220		***28.7***	**29.2**	***34.8***	**35.6**	***40.4***	**41.6**	***45.0***	**52.1**	***53.2***	**54.8**
	220		240	*29.7*	30.2	*36.0*	36.8	*41.9*	43.1	*46.7*	54.1	*55.1*	56.8
		230		*30.7*	31.2	*37.2*	38.1	*43.4*	44.5	*48.3*	56.1	*57.1*	58.8
	230		250	*31.7*	32.2	*38.5*	39.3	*44.8*	46.0	*50.0*	58.0	*59.1*	60.7
		240		***32.6***	**33.2**	***39.7***	**40.5**	***46.3***	**47.5**	***51.7***	**60.0**	***61.0***	**62.7**
	240		260	*33.6*	34.2	*40.9*	41.8	*47.8*	49.0	*53.4*	61.9	*63.0*	64.7
		250		*34.6*	35.1	*42.2*	43.0	*49.3*	50.4	*55.1*	63.9	*65.0*	66.6
	250		270	*35.6*	36.1	*43.4*	44.2	*50.7*	51.9	*56.8*	65.8	*66.9*	68.6
	> 250			Available on request. Contact information see inside back cover.									

On-site reinforcement $A_{s,req}$ (→ page 35)

Edge frame	direct support	ø6 / 25 cm	
Suspension reinforcement	indirect support	ø6 / 12.5 cm	ø6 / 10 cm

All necessary verifications including verifying concrete strut shear pressure have been already considered.

HALFEN HIT software is available at www.halfen.com to calculate connections for balcony projects.

Load bearing capacity values according to EN 1992-1-1 (EC2)

Shear capacity in one direction

Concrete strength: *C20/25* / ≥C25/30 — 80

Type / Element width		HP MV-0506	HP MV-0606	HP MV-0806	HP MV-1006	HP MV-1106
	B = 1.00 m					
	B = 0.50 m	–	HP MV-0303	HP MV-0403	HP MV-0503	–
	B = 0.25 m	–	–	–	–	–
Design values	v_{Rd} [kN/m]			***96.0*** **96.0**		

Moment bearing capacity for all element widths

Type / Element width	B = 1.00 m	HP MV-0506	HP MV-0606	HP MV-0806	HP MV-1006	HP MV-1106
	B = 0.50 m	–	HP MV-0303	HP MV-0403	HP MV-0503	–
	B = 0.25 m	–	–	–	–	–

Concrete cover [mm]	30	35	50										
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*21.9*	22.4	*25.4*	26.1	*31.4*	32.8	*34.0*	38.5	*36.1*	41.0
	160		180	*23.1*	23.7	*26.8*	27.6	*33.4*	34.8	*36.2*	41.0	*38.6*	43.7
		170		*24.3*	24.9	*28.3*	29.1	*35.4*	36.8	*38.5*	43.4	*41.0*	46.4
	170		190	*25.6*	26.1	*29.8*	30.6	*37.3*	38.7	*40.7*	45.9	*43.4*	49.1
		180		***26.8***	**27.3**	***31.3***	**32.1**	***39.3***	**40.7**	***42.9***	**48.4**	***45.9***	**51.8**
	180		200	*28.0*	28.6	*32.7*	33.5	*41.3*	42.7	*45.1*	50.8	*48.3*	54.5
		190		*29.3*	29.8	*34.2*	35.0	*43.2*	44.7	*47.3*	53.3	*50.7*	57.2
	190		210	*30.5*	19.0	*35.7*	36.5	*45.2*	46.6	*49.5*	55.7	*53.2*	59.9
		200		***31.7***	**32.3**	***37.2***	**38.0**	***47.2***	**48.6**	***51.7***	**58.2**	***55.6***	**62.6**
	200		220	*32.9*	33.5	*38.6*	39.4	*49.2*	50.6	*54.0*	60.7	*58.0*	65.3
		210		*34.2*	34.7	*40.1*	40.9	*51.1*	52.5	*56.2*	63.1	*60.5*	68.0
	210		230	*35.4*	36.0	*41.6*	42.4	*53.1*	54.5	*58.4*	65.6	*62.9*	70.8
		220		***36.6***	**37.2**	***43.1***	**43.9**	***55.1***	**56.5**	***60.6***	**68.0**	***65.3***	**73.5**
	220		240	*37.9*	38.4	*44.5*	45.3	*57.0*	58.4	*62.8*	70.5	*67.8*	76.2
		230		*39.1*	39.6	*46.0*	46.8	*59.0*	60.4	*65.0*	73.0	*70.2*	78.9
	230		250	*40.3*	40.9	*47.5*	48.3	*61.0*	62.4	*67.2*	75.4	*72.6*	81.6
		240		***41.6***	**42.1**	***49.0***	**49.8**	***62.9***	**64.3**	***69.5***	**77.9**	***75.1***	**84.3**
	240		260	*42.8*	43.3	*50.5*	51.2	*64.9*	66.3	*71.7*	80.3	*77.5*	87.0
		250		*44.0*	44.6	*51.9*	52.7	*66.9*	68.3	*73.9*	82.8	*80.0*	89.7
	250		270	*45.2*	45.8	*53.4*	54.2	*68.8*	70.2	*76.1*	85.3	*82.4*	92.4
	> 250			Available on request. Contact information see inside back cover.									

On-site reinforcement $A_{s,req}$ (→ page 35)

Edge frame	direct support	ø6 / 25 cm
Suspension reinforcement	indirect support	ø8 / 15 cm

All necessary verifications including verifying concrete strut shear pressure have been already considered.

HALFEN HIT software is available at www.halfen.com to calculate connections for balcony projects.

Load bearing capacity values according to EN 1992-1-1 (EC2)

Shear capacity in one direction

Concrete strength: *C20/25* / ≥C25/30

80

Type / Element width		HP MV-0607	HP MV-0807	HP MV-1107	HP MV-1207	HP MV-1407
	B = 1.00 m					
	B = 0.50 m	–	–	–	–	–
	B = 0.25 m	–	–	–	–	–
Design values	v_{Rd} [kN/m]			*112.0* **112.0**		

Moment bearing capacity for all element widths

Type / Element width		HP MV-0607	HP MV-0807	HP MV-1107	HP MV-1207	HP MV-1407
	B = 1.00 m					
	B = 0.50 m	–	–	–	–	–
	B = 0.25 m	–	–	–	–	–

Concrete cover [mm]	30	35	50	HP MV-0607		HP MV-0807		HP MV-1107		HP MV-1207		HP MV-1407	
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*26.1*	26.8	*32.8*	34.0	*38.2*	43.2	*40.4*	45.8	*43.2*	50.2
	160		180	*27.6*	28.3	*34.8*	36.0	*40.6*	45.9	*43.1*	48.8	*46.1*	53.6
		170		*29.1*	29.8	*36.7*	37.9	*43.1*	48.6	*45.7*	51.7	*49.1*	57.0
	170		190	*30.6*	31.2	*38.7*	39.9	*45.5*	51.3	*48.4*	54.7	*52.0*	60.5
		180		***32.0***	**32.7**	***40.7***	**41.9**	***47.9***	**54.0**	***51.1***	**57.6**	***55.0***	**63.9**
	180		200	*33.5*	34.2	*42.6*	43.8	*50.4*	56.7	*53.7*	60.6	*58.0*	67.3
		190		*35.0*	35.7	*44.6*	45.8	*52.8*	59.4	*56.4*	63.5	*60.9*	70.7
	190		210	*36.5*	37.1	*46.6*	47.8	*55.2*	62.1	*59.0*	66.5	*63.9*	74.2
		200		***37.9***	**38.6**	***48.5***	**49.7**	***57.7***	**64.8**	***61.7***	**69.4**	***66.8***	**77.6**
	200		220	*39.4*	40.1	*50.5*	51.7	*60.1*	67.5	*64.3*	72.4	*69.8*	81.0
		210		*40.9*	41.6	*52.5*	53.7	*62.5*	70.2	*67.0*	75.3	*72.8*	84.4
	210		230	*42.4*	43.0	*54.4*	55.6	*65.0*	72.9	*69.7*	78.3	*75.7*	87.8
		220		***43.8***	**44.5**	***56.4***	**57.6**	***67.4***	**75.6**	***72.3***	**81.2**	***78.7***	**91.3**
	220		240	*45.3*	46.0	*58.4*	59.6	*69.9*	78.4	*75.0*	84.2	*81.6*	94.7
		230		*46.8*	47.5	*60.3*	61.6	*72.3*	81.1	*77.6*	87.1	*84.6*	98.1
	230		250	*48.3*	48.9	*62.3*	63.5	*74.7*	83.8	*80.3*	90.1	*87.6*	101.5
		240		***49.7***	**50.4**	***64.3***	**65.5**	***77.2***	**86.5**	***82.9***	**93.0**	***90.5***	**104.9**
	240		260	*51.2*	51.9	*66.3*	67.5	*79.6*	89.2	*85.6*	96.0	*93.5*	108.4
		250		*52.7*	53.4	*68.2*	69.4	*82.0*	91.9	*88.3*	98.9	*96.4*	111.8
	250		270	*54.2*	54.8	*70.2*	71.4	*84.5*	94.6	*90.9*	101.9	*99.4*	115.2
	> 250			Available on request. Contact information see inside back cover.									

On-site reinforcement $A_{s,req}$ (→ page 35)

Edge frame	direct support	ø6 / 25 cm	ø6 / 20 cm
Suspension reinforcement	indirect support	ø8 / 12.5 cm	

All necessary verifications including verifying concrete strut shear pressure have been already considered.

HALFEN HIT software is available at www.halfen.com to calculate connections for balcony projects.

Load bearing capacity values according to EN 1992-1-1 (EC2)

Shear capacity in one direction

Concrete strength: *C20/25* / ≥C25/30

Type / Element width		HP MV-0408	HP MV-0808	HP MV-1108	HP MV-0810	HP MV-1110
	B = 1.00 m					
	B = 0.50 m	HP MV-0204	HP MV-0404	–	HP MV-0405	–
	B = 0.25 m	HP MV-0102	HP MV-0202	–	–	–
Design values	v_{Rd} [kN/m]	*116.1* **120.9**	*128.0*	**128.0**	*160.0*	**160.0**

Moment bearing capacity for all element widths

Type / Element width				HP MV-0408		HP MV-0808		HP MV-1108		HP MV-0810		HP MV-1110	
	B = 1.00 m												
	B = 0.50 m			HP MV-0204		HP MV-0404		–		HP MV-0405		–	
	B = 0.25 m			HP MV-0102		HP MV-0202		–		–		–	
Concrete cover [mm]	30	35	50										
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*18.7*	18.9	*33.8*	34.9	*39.8*	44.8	*35.2*	36.1	*41.2*	47.1
	160		180	*19.7*	19.9	*35.8*	36.8	*42.2*	47.5	*37.2*	38.0	*43.6*	49.8
		170		*20.7*	20.9	*37.7*	38.8	*44.6*	50.2	*39.2*	40.0	*46.0*	52.5
	170		190	*21.6*	21.9	*39.7*	40.8	*47.1*	52.9	*41.1*	42.0	*48.4*	55.2
		180		***22.6***	**22.9**	***41.7***	**42.7**	***49.5***	**55.6**	***43.1***	**44.0**	***50.7***	**57.9**
	180		200	*23.6*	23.9	*43.7*	44.7	*51.9*	58.3	*45.1*	45.9	*53.1*	60.6
		190		*24.6*	24.9	*45.6*	46.7	*54.4*	61.0	*47.0*	47.9	*55.5*	63.3
	190		210	*25.6*	25.8	*47.6*	48.6	*56.8*	63.8	*49.0*	49.9	*57.9*	66.0
		200		***26.6***	**26.8**	***49.6***	**50.6**	***59.2***	**66.5**	***51.0***	**51.8**	***60.3***	**68.7**
	200		220	*27.5*	27.8	*51.5*	52.6	*61.7*	69.2	*52.9*	53.8	*62.7*	71.4
		210		*28.5*	28.8	*53.5*	54.5	*64.1*	71.9	*54.9*	55.8	*65.0*	74.1
	210		230	*29.5*	29.8	*55.5*	56.5	*66.5*	74.6	*56.9*	57.7	*67.4*	76.8
		220		***30.5***	**30.8**	***57.4***	**58.5**	***69.0***	**77.3**	***58.9***	**59.7**	***69.8***	**79.5**
	220		240	*31.5*	31.7	*59.4*	60.4	*71.4*	80.0	*60.8*	61.7	*72.2*	82.2
		230		*32.5*	32.7	*61.4*	62.4	*73.8*	82.7	*62.8*	63.6	*74.6*	84.9
	230		250	*33.4*	33.7	*63.3*	64.4	*76.3*	85.4	*64.8*	65.6	*77.0*	87.6
		240		***34.4***	**34.7**	***65.3***	**66.4**	***78.7***	**88.1**	***66.7***	**67.6**	***79.3***	**90.3**
	240		260	*35.4*	35.7	*67.3*	68.3	*81.2*	90.8	*68.7*	69.5	*81.7*	93.0
		250		*36.4*	36.7	*69.2*	70.3	*83.6*	93.5	*70.7*	71.5	*84.1*	95.7
	250		270	*37.4*	37.6	*71.2*	72.3	*86.0*	96.2	*72.6*	73.5	*86.5*	98.4
	> 250			Available on request. Contact information see inside back cover.									

On-site reinforcement $A_{s,req}$ (→ page 35)

Edge frame	direct support	ø6 / 25 cm	ø6 / 20 cm	ø6 / 15 cm
Suspension reinforcement	indirect support	ø8 / 12.5 cm	ø8 / 10 cm	ø8 / 10 cm

All necessary verifications including verifying concrete strut shear pressure have been already considered.

HALFEN HIT software is available at www.halfen.com to calculate connections for balcony projects.

Load bearing capacity values according to EN 1992-1-1 (EC2)

Shear capacity in one direction

Concrete strength: *C20/25* / ≥C25/30 — 120

Type / Element width		SP MV-0404	SP MV-0504	SP MV-0604	SP MV-0804	SP MV-0805
	B = 1.00 m					
	B = 0.50 m	SP MV-0202	–	SP MV-0302	SP MV-0402	–
	B = 0.25 m	SP MV-0101	–	–	SP MV-0201	–
Design values	v_{Rd} [kN/m]	*61.4* **64.0**	*62.0* **64.0**	*56.6* **64.0**	*27.9* **48.6**	*78.1* **80.0**

Moment bearing capacity for all element widths

Type / Element width				SP MV-0404		SP MV-0504		SP MV-0604		SP MV-0804		SP MV-0805	
	B = 1.00 m												
	B = 0.50 m			SP MV-0202		–		SP MV-0302		SP MV-0402		–	
	B = 0.25 m			SP MV-0101		–		–		SP MV-0201		–	
Concrete cover [mm]	30	35	50										
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*16.9*	17.4	*20.0*	20.8	*22.7*	23.9	*26.7*	28.8	*23.5*	31.2
	160		180	*17.9*	18.4	*21.3*	22.1	*24.2*	25.4	*28.7*	30.8	*24.9*	33.2
		170		*18.9*	19.4	*22.5*	23.3	*25.6*	26.8	*30.6*	32.7	*26.3*	35.2
	170		190	*19.9*	20.4	*23.7*	24.5	*27.1*	28.3	*32.6*	34.7	*27.7*	37.1
		180		***20.8***	**21.4**	***24.9***	**25.8**	***28.6***	**29.8**	***34.6***	**36.7**	***29.1***	**39.1**
	180		200	*21.8*	22.4	*26.2*	27.0	*30.1*	31.3	*36.5*	38.6	*30.5*	41.1
		190		*22.8*	23.3	*27.4*	28.2	*31.5*	32.7	*38.5*	40.6	*32.0*	43.0
	190		210	*23.8*	24.3	*28.6*	29.5	*33.0*	34.2	*40.5*	42.6	*33.4*	45.0
		200		***24.8***	**25.3**	***29.9***	**30.7**	***34.5***	**35.7**	***42.4***	**44.5**	***34.8***	**47.0**
	200		220	*25.8*	26.3	*31.1*	31.9	*36.0*	37.2	*44.4*	46.5	*36.2*	48.9
		210		*26.7*	27.3	*32.3*	33.1	*37.4*	38.6	*46.4*	48.5	*37.6*	50.9
	210		230	*27.7*	28.3	*33.6*	34.4	*38.9*	40.1	*48.3*	50.4	*39.0*	52.9
		220		***28.7***	**29.2**	***34.8***	**35.6**	***40.4***	**41.6**	***50.3***	**52.4**	***40.4***	**54.8**
	220		240	*29.7*	30.2	*36.0*	36.8	*41.9*	43.1	*52.3*	54.4	*41.8*	56.8
		230		*30.7*	31.2	*37.2*	38.1	*43.4*	44.5	*54.2*	56.4	*43.2*	58.8
	230		250	*31.7*	32.2	*38.5*	39.3	*44.8*	46.0	*56.2*	58.3	*44.7*	60.7
		240		***32.6***	**33.2**	***39.7***	**40.5**	***46.3***	**47.5**	***58.2***	**60.3**	***46.1***	**62.7**
	240		260	*33.6*	34.2	*40.9*	41.8	*47.8*	49.0	*60.1*	62.3	*47.5*	64.7
		250		*34.6*	35.1	*42.2*	43.0	*49.3*	50.4	*62.1*	64.2	*48.9*	66.6
	250		270	*35.6*	36.1	*43.4*	44.2	*50.7*	51.9	*64.1*	66.2	*50.3*	68.6
	> 250			Available on request. Contact information see inside back cover.									

On-site reinforcement $A_{s,req}$ (→ page 35)

Edge frame	direct support	ø6 / 25 cm	
Suspension reinforcement	indirect support	ø6 / 12.5 cm	ø6 / 10 cm

All necessary verifications including verifying concrete strut shear pressure have been already considered.

HALFEN HIT software is available at www.halfen.com to calculate connections for balcony projects.

Load bearing capacity values according to EN 1992-1-1 (EC2)

Shear capacity in one direction

Concrete strength: C20/25 / ≥C25/30 **120**

Type / Element width		SP MV-0606	SP MV-0906	SP MV-1006	SP MV-0907	SP MV-1007
	B = 1.00 m					
	B = 0.50 m	SP MV-0303	–	SP MV-0503	–	–
	B = 0.25 m	–	–	–	–	–
Design values	v_{Rd} [kN/m]	***92.1*** **96.0**	***90.8*** **96.0**	***84.8*** **96.0**	***109.3*** **112.0**	***107.7*** **112.0**

Moment bearing capacity for all element widths

Type / Element width				SP MV-0606		SP MV-0906		SP MV-1006		SP MV-0907		SP MV-1007	
	B = 1.00 m												
	B = 0.50 m			SP MV-0303				SP MV-0503		–		–	
	B = 0.25 m			–		–		–		–		–	
Concrete cover [mm]	30	35	50										
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*25.4*	26.1	*31.7*	35.8	*34.0*	38.5	*33.1*	37.3	*35.8*	40.3
	160		180	*26.8*	27.6	*33.7*	38.0	*36.2*	41.0	*35.1*	39.5	*38.0*	42.8
		170		*28.3*	29.1	*35.7*	40.2	*38.5*	43.4	*37.1*	41.7	*40.2*	45.3
	170		190	*29.8*	30.6	*37.7*	42.5	*40.7*	45.9	*39.1*	43.9	*42.4*	47.7
		180		***31.3***	**32.1**	***39.7***	**44.7**	***42.9***	**48.4**	***41.1***	**46.1**	***44.6***	**50.2**
	180		200	*32.7*	33.5	*41.7*	46.9	*45.1*	50.8	*43.1*	48.3	*46.8*	52.6
		190		*34.2*	35.0	*43.7*	49.1	*47.3*	53.3	*45.1*	50.6	*49.0*	55.1
	190		210	*35.7*	36.5	*45.7*	51.3	*49.5*	55.7	*47.1*	52.8	*51.2*	57.6
		200		***37.2***	**38.0**	***47.7***	**53.5**	***51.7***	**58.2**	***49.0***	**55.0**	***53.5***	**60.0**
	200		220	*38.6*	39.4	*49.6*	55.7	*54.0*	60.7	*51.0*	57.2	*55.7*	62.5
		210		*40.1*	40.9	*51.6*	58.0	*56.2*	63.1	*53.0*	59.4	*57.9*	64.9
	210		230	*41.6*	42.4	*53.6*	60.2	*58.4*	65.6	*55.0*	61.6	*60.1*	67.4
		220		***43.1***	**43.9**	***55.6***	**62.4**	***60.6***	**68.0**	***57.0***	**63.8**	***62.3***	**69.9**
	220		240	*44.5*	45.3	*57.6*	64.6	*62.8*	70.5	*59.0*	66.1	*64.5*	72.3
		230		*46.0*	46.8	*59.6*	66.8	*65.0*	73.0	*61.0*	68.3	*66.7*	74.8
	230		250	*47.5*	48.3	*61.6*	69.0	*67.2*	75.4	*63.0*	70.5	*69.0*	77.2
		240		***49.0***	**49.8**	***63.6***	**71.2**	***69.5***	**77.9**	***65.0***	**72.7**	***71.2***	**79.7**
	240		260	*50.5*	51.2	*65.6*	73.4	*71.7*	80.3	*67.0*	74.9	*73.4*	82.2
		250		*51.9*	52.7	*67.6*	75.7	*73.9*	82.8	*69.0*	77.1	*75.6*	84.6
	250		270	*53.4*	54.2	*69.6*	77.9	*76.1*	85.3	*71.0*	79.3	*77.8*	87.1
	> 250			Available on request. Contact information see inside back cover.									

On-site reinforcement $A_{s,req}$ (→ page 35)

Edge frame	direct support	ø6 / 25 cm	
Suspension reinforcement	indirect support	ø8 / 15 cm	ø8 / 12.5 cm

All necessary verifications including verifying concrete strut shear pressure have been already considered.

HALFEN HIT software is available at www.halfen.com to calculate connections for balcony projects.

Load bearing capacity values according to EN 1992-1-1 (EC2)

Shear capacity in one direction

Concrete strength: *C20/25* / ≥C25/30 — 120

Type / Element width	B = 1.00 m	SP MV-1107	SP MV-1207	SP MV-1208	SP MV-1308	SP MV-1010
	B = 0.50 m	–	–	SP MV-0604	–	SP MV-0505
	B = 0.25 m	–	–	SP MV-0302	–	–
Design values	v_{Rd} [kN/m]	*103.4* **112.0**	*96.3* **109.7**	*120.9* **120.7**	*109.9* **108.4**	*143.1* **145.3**

Moment bearing capacity for all element widths

Type / Element width	B = 1.00 m	SP MV-1107	SP MV-1207	SP MV-1208	SP MV-1308	SP MV-1010
	B = 0.50 m	–	–	SP MV-0604	–	SP MV-0505
	B = 0.25 m	–	–	SP MV-0302	–	–

Concrete cover [mm]	30	35	50									
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*38.2*	43.2	*40.4*	45.8	*42.3*	47.7	*43.5*	50.5	*38.8*	43.6
	160		180	*40.6*	45.9	*43.1*	48.8	*44.9*	50.7	*46.2*	53.7	*41.1*	46.0
		170		*43.1*	48.6	*45.7*	51.7	*47.6*	53.7	*49.0*	56.9	*43.3*	48.5
	170		190	*45.5*	51.3	*48.4*	54.7	*50.2*	56.6	*51.8*	60.1	*45.5*	51.0
		180		***47.9***	**54.0**	***51.1***	**57.6**	***52.9***	**59.6**	***54.5***	**63.3**	***47.7***	**53.4**
	180		200	*50.4*	56.7	*53.7*	60.6	*55.5*	62.5	*57.3*	66.5	*49.9*	55.9
		190		*52.8*	59.4	*56.4*	63.5	*58.2*	65.5	*60.1*	69.7	*52.1*	58.3
	190		210	*55.2*	62.1	*59.0*	66.5	*60.9*	68.4	*62.8*	72.9	*54.3*	60.8
		200		***57.7***	**64.8**	***61.7***	**69.4**	***63.5***	**71.4**	***65.6***	**76.1**	***56.6***	**63.3**
	200		220	*60.1*	67.5	*64.3*	72.4	*66.2*	74.3	*68.4*	79.3	*58.8*	65.7
		210		*62.5*	70.2	*67.0*	75.3	*68.8*	77.3	*71.1*	82.5	*61.0*	68.2
	210		230	*65.0*	72.9	*69.7*	78.3	*71.5*	80.2	*73.9*	85.7	*63.2*	70.6
		220		***67.4***	**75.6**	***72.3***	**81.2**	***74.1***	**83.2**	***76.7***	**88.9**	***65.4***	**73.1**
	220		240	*69.9*	78.4	*75.0*	84.2	*76.8*	86.1	*79.4*	92.1	*67.6*	75.6
		230		*72.3*	81.1	*77.6*	87.1	*79.4*	89.1	*82.2*	95.3	*69.8*	78.0
	230		250	*74.7*	83.8	*80.3*	90.1	*82.1*	92.0	*85.0*	98.5	*72.0*	80.5
		240		***77.2***	**86.5**	***82.9***	**93.0**	***84.7***	**95.0**	***87.7***	**101.7**	***74.3***	**82.9**
	240		260	*79.6*	89.2	*85.6*	96.0	*87.4*	97.9	*90.5*	104.9	*76.5*	85.4
		250		*82.0*	91.9	*88.3*	98.9	*90.1*	100.9	*93.2*	108.1	*78.7*	87.9
	250		270	*84.5*	94.6	*90.9*	101.9	*92.7*	103.8	*96.0*	111.3	*80.9*	90.3
	> 250			Available on request. Contact information see inside back cover.									

On-site reinforcement $A_{s,req}$ (→ page 35)

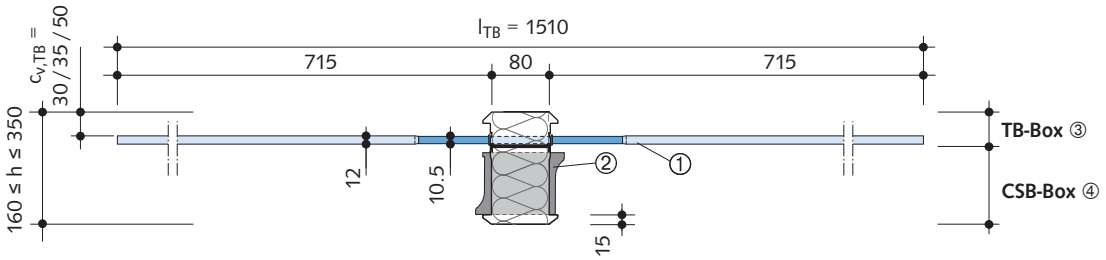
Edge frame	direct support	ø6 / 20 cm	
Suspension reinforcement	indirect support	ø8 / 12.5 cm	ø8 / 10 cm

All necessary verifications including verifying concrete strut shear pressure have been already considered.

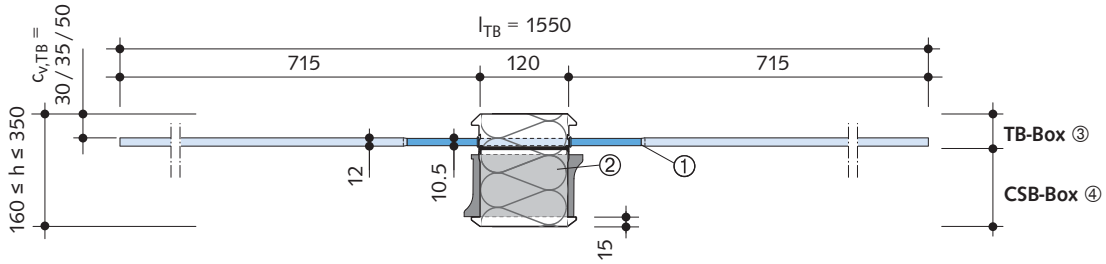
HALFEN HIT software is available at www.halfen.com to calculate connections for balcony projects.

Cross-sections

HIT-HP MV — High Performance



HIT-SP MV — Superior Performance



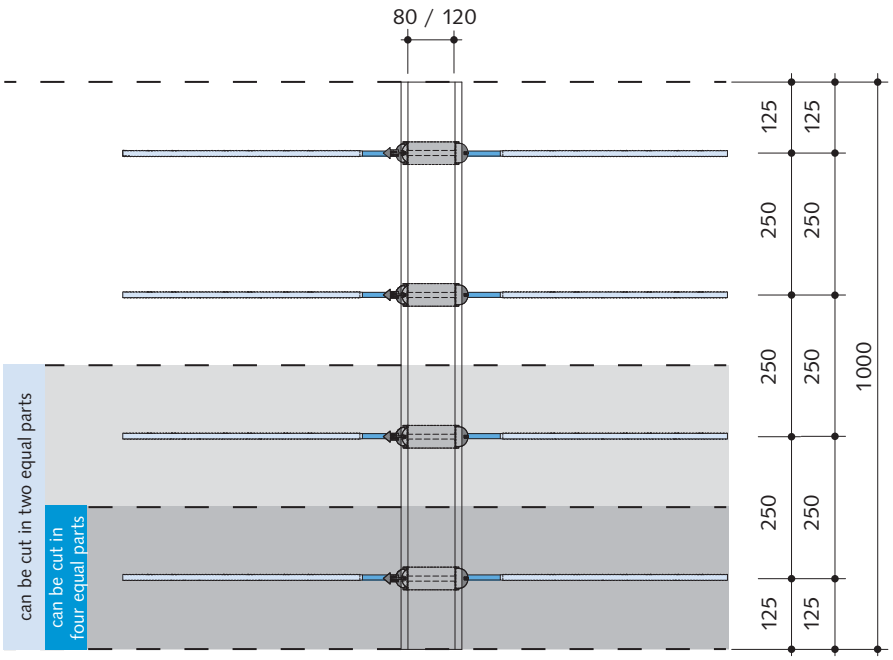
Dimensions in [mm]

① Tension bars ø12 mm / 10.5 mm in the joint
② Compression shear bearings CSB
③ Tension bar box
④ Compression shear bearings box

Top view (examples)

HIT-HP/SP - MV 0404 - ... - 100
HIT-HP/SP - MV 0202 - ... - 050
HIT-HP/SP - MV 0101 - ... - 025

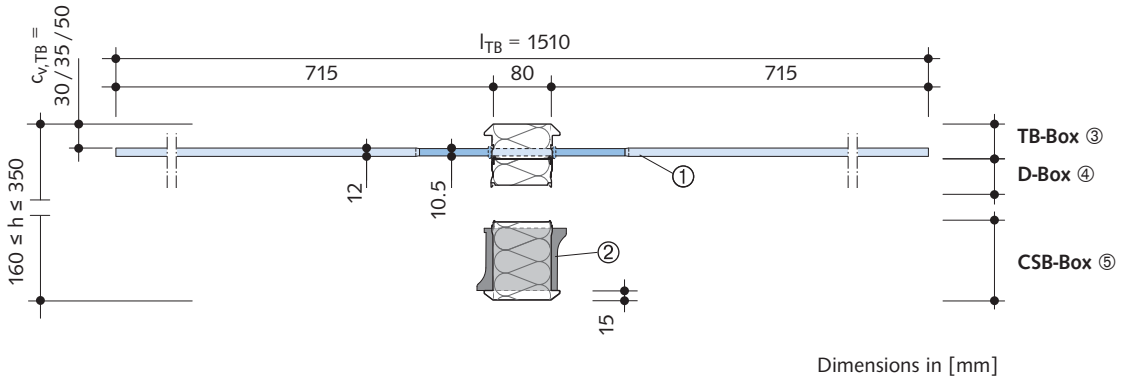
For a top view of other units with dimensions please refer to the type statics data sheets.



Application for element slabs – Cross sections

HIT-HP MV-ES – High Performance multi-part design for element slabs

See page 14 for load bearing capacities tables

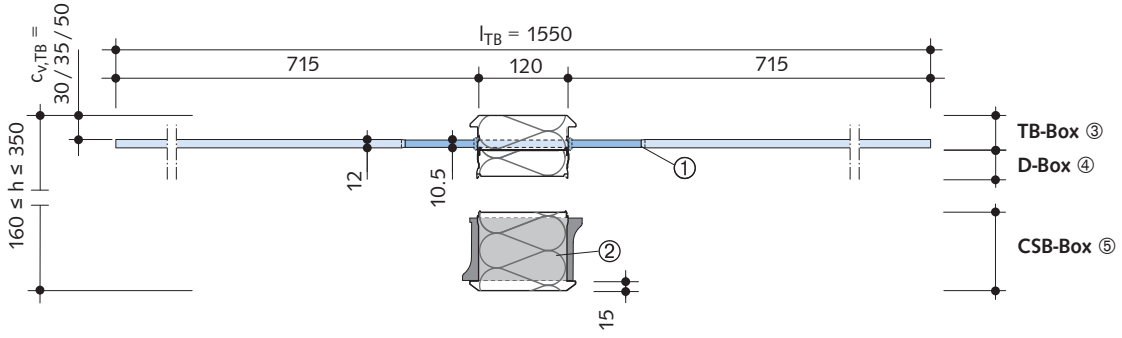


Dimensions in [mm]

① Tension bars ø12 mm / 10.5 mm in the joint
② Compression shear bearings CSB
③ Tension bar box
④ Distance box
⑤ Compression shear bearings box

HIT-SP MV-ES – Superior Performance multi-part design for element slabs

See page 18 for load bearing capacities tables

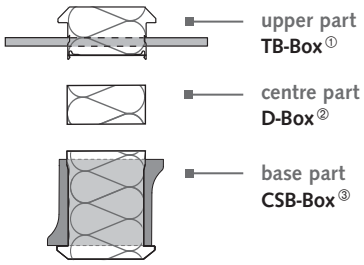


Dimensions in [mm]

① Tension bars ø12 mm / 10.5 mm in the joint
② Compression shear bearings CSB
③ Tension bar box
④ Distance box
⑤ Compression shear bearings box

Ordering example – Multi-part design

upper part	HIT- HP	M_	- 08	__	- 05	- 100	- 35	-	TB
+ centre part	HIT- HP	___	- __	__	- 04	- 100	-		- DB
+ base part	HIT- HP	_V	- __	05	- 11	- 100	-		- CSB
Σ (HIT-HP MV-ES)	HIT- HP	MV	- 08	05	- 20	- 100	- 35	-	ES



- Product group – type
- Transferable forces
- Number of tension bars
- No. of compression shear bearings CSB
- Element height [cm]
- Element width [cm]
- Concrete cover [mm]
- For element slab version only

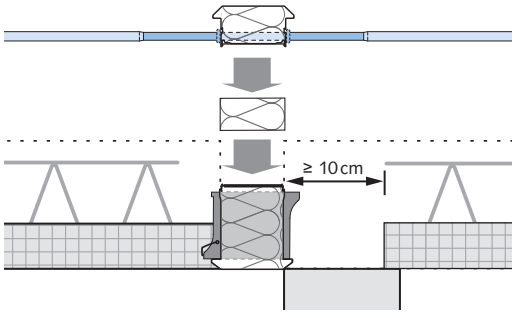
Height TB-Box [mm]	
c_v = 30/35	50
c_v = 50	70

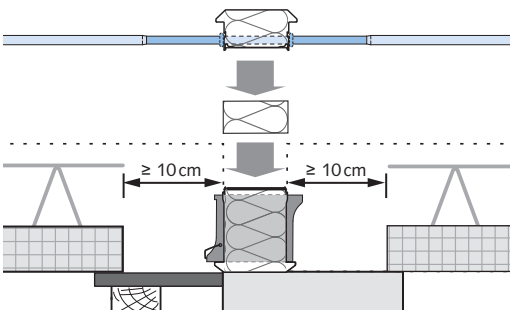
Height D-Box [mm]										
Slab height	160	170	180	190	200	210	220	230	240	250
c_v = 30/35	–	–	20	30	40	50	60	70	80	90
c_v = 50	–	–	–	–	20	30	40	50	60	70

Height CSB-Box [mm]					
Slab height	160	170	180	190	200 – 250
c_v = 30/35	110	120	110	110	110
c_v = 50	–	–	110	120	110

Pressure joints in element slabs

Typical connections for HIT-HP/SP MV and MD with element slabs with a structural cast-in-place concrete layer





To create a positive connection a total distance of at least 10 cm between insulation element and precast unit has to be maintained. Detailed information for reinforcement layout can be found in approvals ETA-13/0546 and Z-15.7-293. The approvals are available for download at **www.halfen.com**.

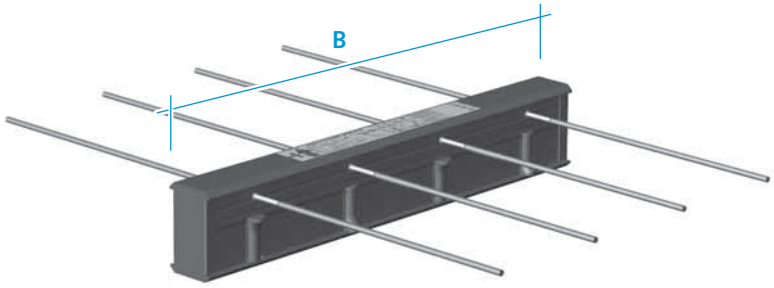
HALFEN HIT INSULATED CONNECTION HIGH & SUPERIOR PERFORMANCE

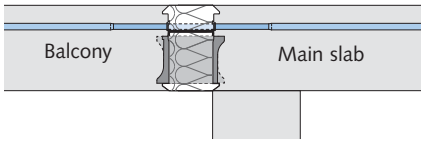
HIT-HP MD, HIT-SP MD

- Balcony connection for cantilevered balcony slabs
- Product type with reversed CSB
- Transfers bending moments and positive and negative shear forces

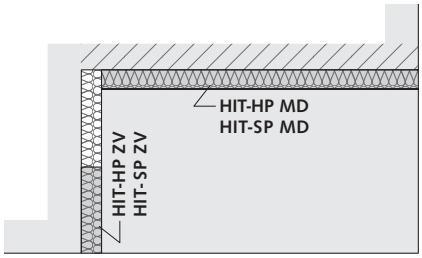
NEW!

Standard design:
HIT-HP MD – **High Performance** with insulation thickness 80 mm
HIT- SP MD – **Superior Performance** with insulation thickness 120 mm



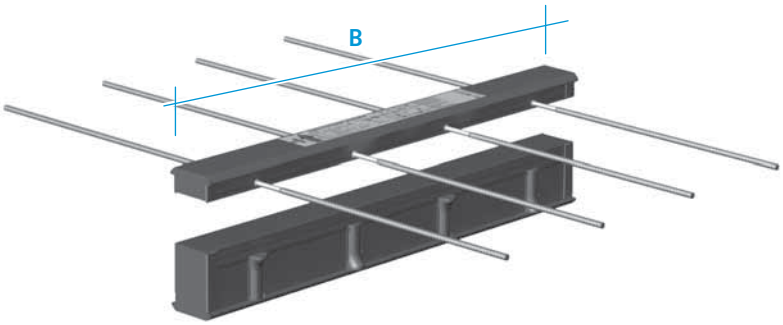


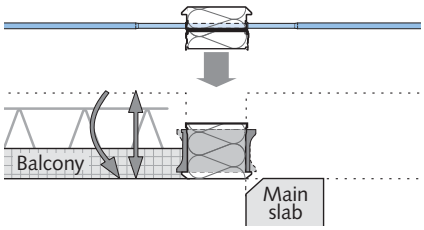
Available widths
B = 1.00 m / 0.50 m / 0.25 m



Application: Internal corner,
one-way spanning slab

Multi-part design:
HIT-HP MD-ES – **High Performance** for element slabs
HIT-SP MD-ES – **Superior Performance** for element slabs





Available widths
B = 1.00 m / 0.50 m / 0.25 m

Load range

The respective load range results from the corresponding combination of TB- (tension bar) and CSB- (compression shear bearings) Box. The combinations of TB- and CSB-Box shown in the following table are possible.

Possible combinations of upper and lower parts

Element width B = 25 cm		Number of tension bars n_{TB}			
		1	2	3	4
Number of compression shear bearings n_{CSB}	2	●	●	●	●

Element width B = 50 cm		Number of tension bars n_{TB}							
		2	3	4	5	6	7	8	9
Number of compression shear bearings n_{CSB}	2	●	●	●					
	4	●	●	●	●	●	●	●	●

Element width B = 100 cm		Number of tension bars n_{TB}												
		4	5	6	7	8	9	10	11	12	13	14	16	18
Number of compression shear bearings n_{CSB}	4	●	●	●	●	●	●							
	6	●	●	●	●	●	●	●	●	●	●			
	7	–	×	×	●	○	○	–	–	○	–	○		
	8	●	●	●	●	●	●	●	●	●	●	●	●	●
	9			×	×	●	×	●	–	○	–	○	–	–
	10			●	●	●	●	●	●	●	●	●	●	●
	11					×	×	×	×	×	–	○	○	○
	12							●	●	●	●	●	●	●

Values for the load bearing capacities for the elements highlighted in blue → see pages 27 – 30. ● = HP and SP ○ = SP only × = HP only

Basic types – Ordering example

HIT- HP MD - 0808 - 20 - 100 - 35
HIT- HP MD - 0404 - 18 - 050 - 50
HIT- HP MD - 0202 - 18 - 025 - 30 - ES

- Product group - type
- Load type
- Number of tension bars
- Number of compression shear units CSB
- Element height [cm]
- Element width [cm]
- Concrete cover [mm]
- For element slab design only

Custom designs are available on request. For further details please contact our regional sales companies.

See inside back cover for contact details.

Available slab thickness h

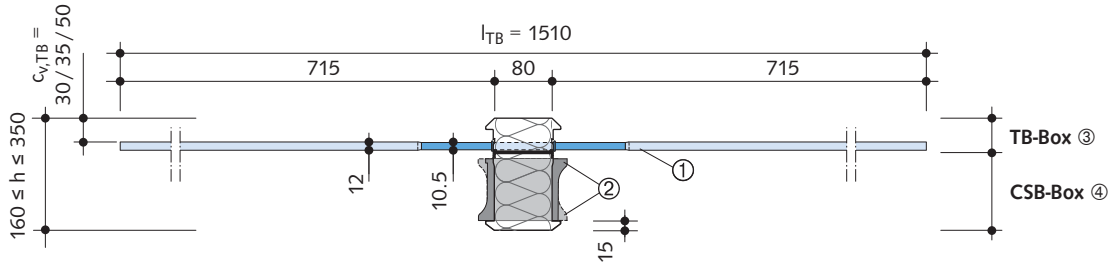
Concrete cover [mm]	30	35	50
Available slab thickness h [cm]	16 – 35	16 – 35	18 – 35

HIT-HP MD, HIT-SP MD

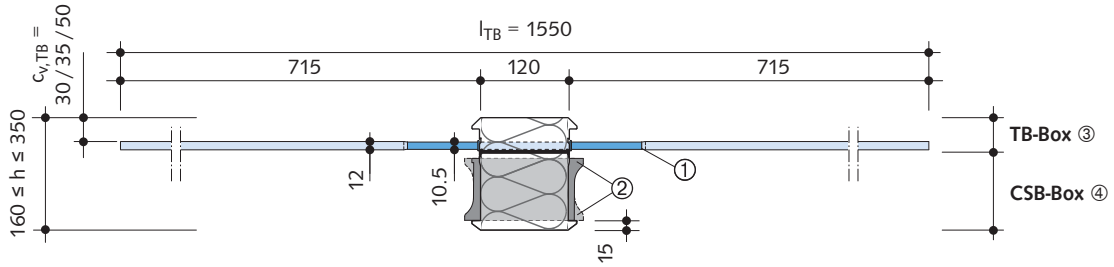
Cross-sections

HIT-HP MD — High Performance

Also available as a multi-part design



HIT-SP MD — Superior Performance

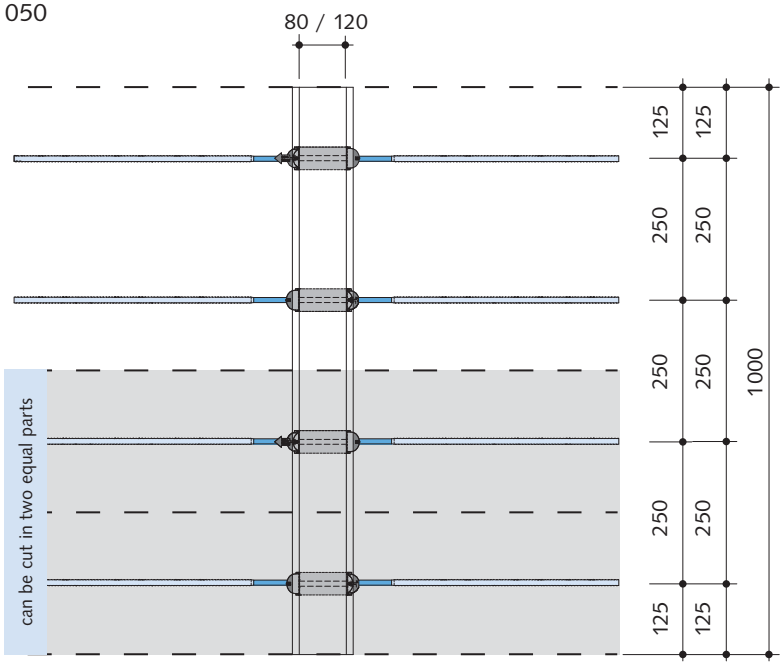


Dimensions in [mm]

① Tension bars ø12 mm / 10.5 mm in the joint
② Reversed compression shear bearings CSB
③ Tension bar box
④ Compression shear bearings box

Top view (example)

HIT-HP/SP - MD 0404 - ... - 100
HIT-HP/SP - MD 0202 - ... - 050



Load bearing capacity values according to EN 1992-1-1 (EC2)

Shear capacity in both directions

Concrete strength: *C20/25* / ≥C25/30

Type / Element width		HP MD-0604	HP MD-0806	HP MD-0608	HP MD-0708	HP MD-1010
	B = 1.00 m	**HP MD-0604**	**HP MD-0806**	**HP MD-0608**	**HP MD-0708**	**HP MD-1010**
	B = 0.50 m	**HP MD-0302**	–	HP MD-0304	–	–
	B = 0.25 m	–	–	–	–	–
Design values	v_{Rd} [kN/m]	*±32.0* ±32.0	*±48.0* ±48.0	*±64.0* ±64.0	*±64.0* ±64.0	*±80.0* ±80.0

Moment bearing capacity for all element widths

Type / Element width		HP MD-0604		HP MD-0806		HP MD-0608		HP MD-0708		HP MD-1010	
	B = 1.00 m	**HP MD-0604**		**HP MD-0806**		**HP MD-0608**		**HP MD-0708**		**HP MD-1010**	
	B = 0.50 m	**HP MD-0302**		–		HP MD-0304		–		–	
	B = 0.25 m	–		–		–		–		–	
Concrete cover [mm]	30	35	50								
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*22.7*	23.9	*31.4*	32.8	*26.7*	27.3	*30.4*	31.2	*39.2*	43.6
	160		180	*24.2*	25.3	*33.4*	34.8	*28.2*	28.7	*32.1*	32.9	*41.4*	46.0
		170		*25.6*	26.8	*35.4*	36.8	*29.6*	30.2	*33.8*	34.6	*43.7*	48.5
	170		190	*27.1*	28.3	*37.3*	38.7	*31.1*	31.7	*35.5*	36.3	*45.9*	50.9
		180		*28.6*	29.8	***39.3***	**40.7**	***32.6***	**33.2**	***37.2***	**38.0**	***48.1***	**53.4**
	180		200	*30.1*	31.2	*41.3*	42.7	*34.1*	34.6	*39.0*	39.8	*50.4*	55.8
		190		*31.5*	32.7	*43.2*	44.6	*35.5*	36.1	*40.7*	41.5	*52.6*	58.3
	190		210	*33.0*	34.2	*45.2*	46.6	*37.0*	37.6	*42.4*	43.2	*54.8*	60.8
		200		*34.5*	35.7	***47.2***	**48.6**	***38.5***	**39.1**	***44.1***	**44.9**	***57.1***	**63.2**
	200		220	*36.0*	37.1	*49.1*	50.5	*40.0*	40.5	*45.8*	46.6	*59.3*	65.7
		210		*37.4*	38.6	*51.1*	52.5	*41.4*	42.0	*47.6*	48.4	*61.5*	68.1
	210		230	*38.9*	40.1	*53.1*	54.5	*42.9*	43.5	*49.3*	50.1	*63.8*	70.6
		220		*40.4*	41.6	***55.0***	**56.4**	***44.4***	**45.0**	***51.0***	**51.8**	***66.0***	**73.1**
	220		240	*41.9*	43.0	*57.0*	58.4	*45.9*	46.4	*52.7*	53.5	*68.3*	75.5
		230		*43.3*	44.5	*59.0*	60.4	*47.3*	47.9	*54.4*	55.2	*70.5*	78.0
	230		250	*44.8*	46.0	*60.9*	62.3	*48.8*	49.4	*56.2*	57.0	*72.7*	80.4
		240		*46.3*	47.5	***62.9***	**64.3**	***50.3***	**50.9**	***57.9***	**58.7**	***75.0***	**82.9**
	240		260	*47.8*	48.9	*64.9*	66.3	*51.8*	52.3	*59.6*	60.4	*77.2*	85.4
		250		*49.2*	50.4	*66.8*	68.2	*53.2*	53.8	*61.3*	62.1	*79.4*	87.8
	250		270	*50.7*	*51.9*	*68.8*	70.2	*54.7*	55.3	*63.1*	63.9	*81.7*	90.3
	> 250			Available on request. Contact information see inside back cover.									

On-site reinforcement $A_{s,req}$ (→ Page 35)

Edge frame	direct support	ø6 / 25 cm				ø6 / 20 cm
Suspension reinforcement	indirect support	ø6 / 20 cm	ø6 / 13.5 cm	ø8 / 20.5 cm	ø8 / 19.5 cm	ø8 / 15.5 cm

All necessary verifications including verifying concrete strut shear pressure have been already considered.

Load bearing capacity values according to EN 1992-1-1 (EC2)

Shear capacity in both directions

Concrete strength: *C20/25* / ≥C25/30

80

Type / Element width	B = 1.00 m	HP MD-1610	HP MD-1612	HP MD-0911	HP MD-1011	HP MD-1211
	B = 0.50 m	–	–	–	–	–
	B = 0.25 m	–	–	–	–	–
Design values	v_{Rd} [kN/m]	*±80.0* ±80.0	*±96.0* ±96.0	*112.0* 112.0 *−64.0* −64.0	*112.0* 112.0 *−64.0* −64.0	*112.0* 112.0 *−64.0* −64.0

Moment bearing capacity for all element widths

Type / Element width	B = 1.00 m	HP MD-1610	HP MD-1612	HP MD-0911	HP MD-1011	HP MD-1211
	B = 0.50 m	–	–	–	–	–
	B = 0.25 m	–	–	–	–	–

Concrete cover [mm]	30	35	50	HP MD-1610		HP MD-1612		HP MD-0911		HP MD-1011		HP MD-1211	
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*55.6*	62.4	*57.8*	65.6	*36.5*	40.4	*39.8*	44.2	*45.8*	51.4
	160		180	*59.2*	66.3	*61.3*	69.6	*38.5*	42.7	*42.1*	46.7	*48.5*	54.4
		170		*62.8*	70.3	*64.8*	73.5	*40.5*	44.9	*44.3*	49.2	*51.1*	57.3
	170		190	*66.4*	74.2	*68.3*	77.4	*42.5*	47.1	*46.6*	51.6	*53.8*	60.3
		180		*69.9*	**78.1**	***71.8***	**81.4**	***44.5***	**49.3**	***48.8***	**54.1**	***56.4***	**63.2**
	180		200	*73.5*	82.1	*75.3*	85.3	*46.5*	51.5	*51.0*	56.5	*59.1*	66.2
		190		*77.1*	86.0	*78.8*	89.2	*48.5*	53.7	*53.3*	59.0	*61.7*	69.1
	190		210	*80.7*	89.9	*82.3*	93.2	*50.6*	55.9	*55.5*	61.5	*64.4*	72.1
		200		*84.3*	**93.9**	***85.8***	**97.1**	***52.6***	**58.1**	***57.7***	**63.9**	***67.0***	**75.0**
	200		220	*87.8*	97.8	*89.3*	101.0	*54.6*	60.4	*60.0*	66.4	*69.7*	78.0
		210		*91.4*	101.7	*92.8*	105.0	*56.6*	62.6	*62.2*	68.8	*72.4*	80.9
	210		230	*95.0*	105.7	*96.3*	108.9	*58.6*	64.8	*64.5*	71.3	*75.0*	83.9
		220		*98.6*	**109.6**	***99.8***	**112.8**	***60.6***	**67.0**	***66.7***	**73.7**	***77.7***	**86.8**
	220		240	*102.2*	113.5	*103.3*	116.8	*62.6*	69.2	*68.9*	76.2	*80.3*	89.8
		230		*105.7*	117.5	*106.8*	120.7	*64.7*	71.4	*71.2*	78.7	*83.0*	92.7
	230		250	*109.3*	121.4	*110.3*	124.7	*66.7*	73.6	*73.4*	81.1	*85.6*	95.7
		240		*112.9*	**125.3**	***113.8***	**128.6**	***68.7***	**75.8**	***75.6***	**83.6**	***88.3***	**98.6**
	240		260	*116.5*	129.3	*117.3*	132.5	*70.7*	78.1	*77.9*	86.0	*90.9*	101.6
		250		*120.1*	133.2	*120.8*	136.5	*72.7*	80.3	*80.1*	88.5	*93.6*	104.5
	250		270	*123.6*	137.1	*124.3*	140.4	*74.7*	82.5	*82.4*	91.0	*96.3*	107.5
	> 250			Available on request. Contact information see inside back cover.									

On-site reinforcement $A_{s,req}$ (→ Page 35)

		HP MD-1610	HP MD-1612	HP MD-0911	HP MD-1011	HP MD-1211
Edge frame	direct support	ø6 / 16.5 cm	ø6 / 14.5 cm	ø6 / 20 cm	ø6 / 19 cm	ø6 / 18 cm
Suspension reinforcement	indirect support	ø8 / 14 cm	ø8 / 12 cm			

All necessary verifications including verifying concrete strut shear pressure have been already considered.

Load bearing capacity values according to EN 1992-1-1 (EC2)

Shear capacity in both directions

Concrete strength: *C20/25* / ≥C25/30

Type / Element width	B = 1.00 m	SP MD-0404	SP MD-0508	SP MD-0608	SP MD-0708	SP MD-1208
	B = 0.50 m	SP MD-0202	–	SP MD-0304	–	SP MD-0604
	B = 0.25 m	–	–	–	–	SP MD-0302
Design values	v_{Rd} [kN/m]	*±32.0* **±32.0**	*±49.5* **±52.1**	*±55.0* **±58.7**	*±58.9* **±64.0**	*±62.4* **±64.0**

Moment bearing capacity for all element widths

Type / Element width	B = 1.00 m	SP MD-0404	SP MD-0508	SP MD-0608	SP MD-0708	SP MD-1208
	B = 0.50 m	SP MD-0202	–	SP MD-0304	–	SP MD-0604
	B = 0.25 m	–	–	–	–	SP MD-0302

Concrete cover [mm]	30	35	50										
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*17.4*	*17.4*	*22.8*	23.2	*26.7*	27.3	*30.4*	31.2	*38.4*	47.7
	160		180	*18.4*	*18.4*	*24.0*	24.4	*28.2*	28.7	*32.1*	32.9	*40.7*	50.7
		170		*19.4*	*19.4*	*25.3*	25.7	*29.6*	30.2	*33.8*	34.6	*43.0*	53.6
	170		190	*20.4*	*20.4*	*26.5*	26.9	*31.1*	31.7	*35.5*	36.3	*45.3*	56.6
		180		***21.4***	***21.4***	***27.7***	**28.1**	***32.6***	**33.2**	***37.2***	**38.0**	***47.6***	**59.5**
	180		200	*22.3*	*22.3*	*28.9*	29.3	*34.1*	34.6	*39.0*	39.8	*50.0*	62.5
		190		*23.3*	*23.3*	*30.2*	30.6	*35.5*	36.1	*40.7*	41.5	*52.3*	65.4
	190		210	*24.3*	*24.3*	*31.4*	31.8	*37.0*	37.6	*42.4*	43.2	*54.6*	68.4
		200		***25.3***	***25.3***	***32.6***	**33.0**	***38.5***	**39.1**	***44.1***	**44.9**	***56.9***	**71.3**
	200		220	*26.3*	*26.3*	*33.9*	34.3	*40.0*	40.5	*45.8*	46.6	*59.2*	74.3
		210		*27.3*	*27.3*	*35.1*	35.5	*41.4*	42.0	*47.6*	48.4	*61.6*	77.2
	210		230	*28.2*	*28.2*	*36.3*	36.7	*42.9*	43.5	*49.3*	50.1	*63.9*	80.2
		220		***29.2***	***29.2***	***37.5***	**38.0**	***44.4***	**45.0**	***51.0***	**51.8**	***66.2***	**83.1**
	220		240	*30.2*	*30.2*	*38.8*	39.2	*45.9*	46.4	*52.7*	53.5	*68.5*	86.1
		230		*31.2*	*31.2*	*40.0*	40.4	*47.3*	47.9	*54.4*	55.2	*70.8*	89.0
	230		250	*32.2*	*32.2*	*41.2*	41.6	*48.8*	49.4	*56.2*	57.0	*73.2*	92.0
		240		***33.2***	***33.2***	***42.5***	**42.9**	***50.3***	**50.9**	***57.9***	**58.7**	***75.5***	**94.9**
	240		260	*34.1*	*34.1*	*43.7*	44.1	*51.8*	52.3	*59.6*	60.4	*77.8*	97.9
		250		*35.1*	*35.1*	*44.9*	45.3	*53.2*	53.8	*61.3*	62.1	*80.1*	100.8
	250		270	*36.1*	*36.1*	*46.1*	46.6	*54.7*	55.3	*63.1*	63.9	*82.5*	103.8
	> 250			Available on request. Contact information see inside back cover.									

On-site reinforcement $A_{s,req}$ (→ Page 35)

Edge frame	direct support	ø6 / 25 cm				ø6 / 21 cm
Suspension reinforcement	indirect support	ø6 / 21.5 cm	ø68 / 13.5 cm	ø8 / 21.5 cm	ø8 / 19.5 cm	ø8 / 17.5 cm

All necessary verifications including verifying concrete strut shear pressure have been already considered.

Load bearing capacity values according to EN 1992-1-1 (EC2)

Shear capacity in both directions

Concrete strength: C20/25 / ≥C25/30 — 120

Type / Element width	B = 1.00 m	SP MD-0707	SP MD-1608	SP MD-0810	SP MD-1012	SP MD-1412
	B = 0.50 m	–	SP MD-0804	–	–	–
	B = 0.25 m	–	SP MD-0402	–	–	–
Design values	v_{Rd} [kN/m]	*61.4* / *−46.1* 64.0 / −48.0	*±62.4* ±64.0	*±70.9* ±76.3	*±82.4* ±93.7	*±92.8* ±96.0

Moment bearing capacity for all element widths

Type / Element width	B = 1.00 m	SP MD-0707	SP MD-1608	SP MD-0810	SP MD-1012	SP MD-1412
	B = 0.50 m	–	SP MD-0804	–	–	–
	B = 0.25 m	–	SP MD-0402	–	–	–

Concrete cover [mm]	30	35	50									
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*29.6*	30.5	*38.4*	54.4	*35.2*	36.1	*40.0*	44.8	*52.2*	59.2
	160		180	*31.3*	32.2	*40.7*	58.0	*37.2*	38.0	*42.2*	47.3	*55.3*	62.6
		170		*33.0*	33.9	*43.0*	61.6	*39.2*	40.0	*44.5*	49.7	*58.3*	66.1
	170		190	*34.7*	35.7	*45.3*	65.2	*41.1*	42.0	*46.7*	52.2	*61.4*	69.5
		180		***36.5***	**37.4**	***47.6***	**68.7**	***43.1***	**43.9**	***48.9***	**54.7**	***64.4***	**73.0**
	180		200	*38.2*	39.1	*50.0*	72.3	*45.1*	45.9	*51.1*	57.1	*67.5*	76.4
		190		*39.9*	40.8	*52.3*	75.9	*47.0*	47.9	*53.3*	59.6	*70.6*	79.9
	190		210	*41.6*	42.5	*54.6*	79.5	*49.0*	49.8	*55.5*	62.0	*73.6*	83.3
		200		***43.3***	**44.3**	***56.9***	**83.1**	***51.0***	**51.8**	***57.7***	**64.5**	***76.7***	**86.7**
	200		220	*45.1*	46.0	*59.2*	86.7	*52.9*	53.8	*59.9*	66.9	*79.8*	90.2
		210		*46.8*	47.7	*61.6*	90.2	*54.9*	55.7	*62.2*	69.4	*82.8*	93.6
	210		230	*48.5*	49.4	*63.9*	93.8	*56.9*	57.7	*64.4*	71.9	*85.9*	97.1
		220		***50.2***	**51.1**	***66.2***	**97.4**	***58.8***	**59.7**	***66.6***	**74.3**	***88.9***	**100.5**
	220		240	*51.9*	52.9	*68.5*	101.0	*60.8*	61.6	*68.8*	76.8	*92.0*	104.0
		230		*53.7*	54.6	*70.8*	104.6	*62.8*	63.6	*71.0*	79.2	*95.1*	107.4
	230		250	*55.4*	56.3	*73.2*	108.2	*64.7*	65.6	*73.2*	81.7	*98.1*	110.8
		240		***57.1***	**58.0**	***75.5***	**111.8**	***66.7***	**67.5**	***75.4***	**84.2**	***101.2***	**114.3**
	240		260	*58.8*	59.7	*77.8*	115.3	*68.7*	69.5	*77.6*	86.6	*104.3*	117.7
		250		*60.6*	61.5	*80.1*	118.9	*70.6*	71.5	*79.9*	89.1	*107.3*	121.2
	250		270	*62.3*	63.2	*82.5*	122.5	*72.6*	73.4	*82.1*	91.5	*110.4*	124.6
	> 250			Available on request. Contact information see inside back cover.									

On-site reinforcement $A_{s,req}$ (→ Page 35)

Edge frame	direct support	ø6 / 25 cm	ø6 / 19 cm	ø6 / 22.5 cm	ø6 / 18.5 cm	ø6 / 15.5 cm
Suspension reinforcement	indirect support	ø8 / 20.5 cm	ø8 / 17 cm	ø8 / 16.5 cm	ø8 / 13.5 cm	ø8 / 12.5 cm

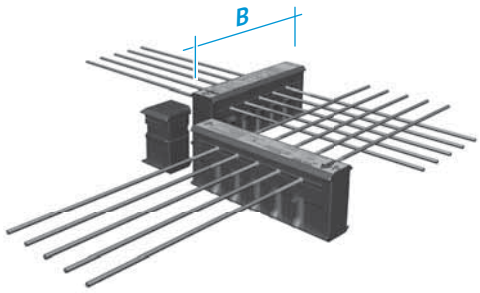
All necessary verifications including verifying concrete strut shear pressure have been already considered.

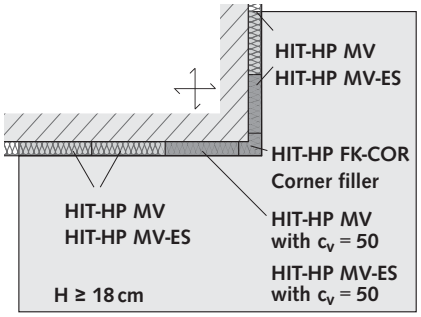
HIT-HP MV-COR, HIT-SP MV-COR

- Connection for cantilevered corner balcony slabs
- Transfer of bending moments and shear forces

HIT-HP MV-COR, including:
- HIT-HP MV → 1st Layer
- HIT-HP MV → 2nd Layer
- HIT-HP FK-COR Corner filler

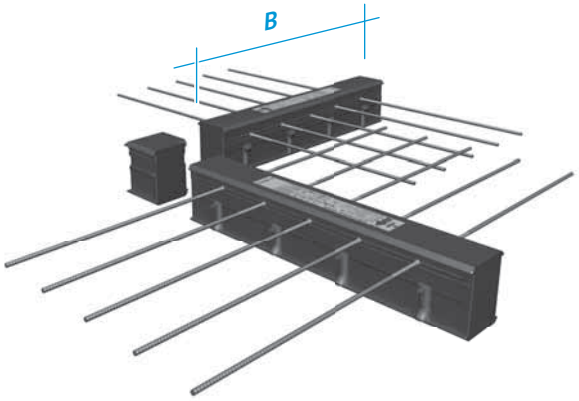
type-tested

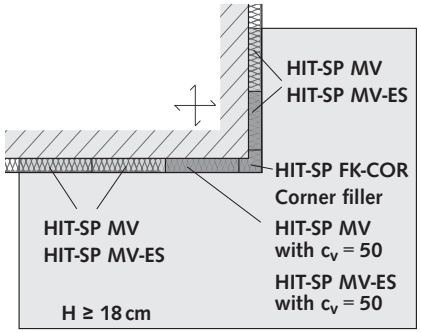




Application example
Insulation thickness 80 mm
Element widths: B = 1.00 m / 0.50 m

HIT-SP MV-COR, including:
- HIT-SP MV → 1st Layer
- HIT-SP MV → 2nd Layer
- HIT-SP FK-COR Corner filler





Application example
Insulation thickness 120 mm
Element widths: B = 1.00 m / 0.50 m

Ordering example for corner filler

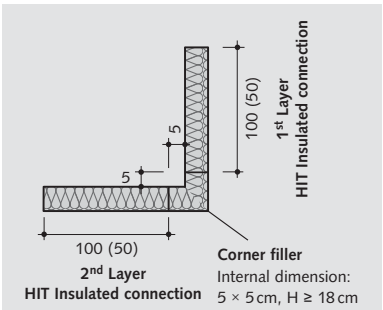
HIT-HP - FK - 18 - COR

- Product group
- Identification/component: **Corner filler**
- Element height
- Identification: **Corner element**

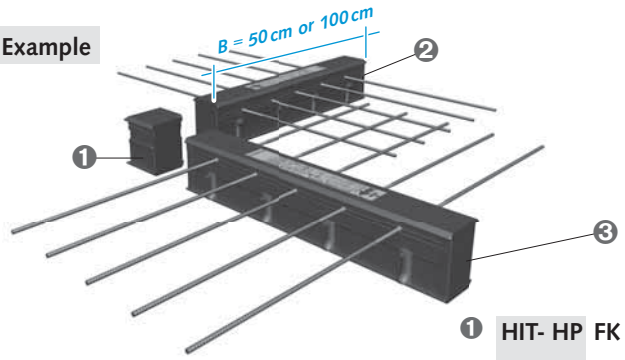
Basic Types for corner balconies according to type tests

Detailed structural design for type-tested connections
All standard types of HIT-HP MV and HIT-SP MV, in 0.50 m or 1.00 m lengths as well as multi-part types for filigree-elements are available for corner application.

80 120



Example



❶ HIT- HP FK - 18 - COR
❷ HIT- HP MV - 05 04 - 18 - 050 - 35
❸ HIT- HP MV - 05 04 - 18 - 050 - 50

- Product group – Type: ❷ + ❸ identical
- Transferable forces: ❷ + ❸ identical
- No. of tension bars: ❷ + ❸ identical
- No. of compression shear bearings: ❷ + ❸ identical
- Element height [cm]: ❷ + ❸ identical
- Element width [cm]: ❷ + ❸ identical (50/100 cm)
- Concrete cover [mm]: ❷ c_v=30/35 ❸ c_v=50

❶ Corner filler
❷ 1st layer reinforcement (c_v = 30 mm–35 mm)
❸ 2nd layer reinforcement (c_v = 50 mm)

❶ for corner application only
❷ + ❸ are HIT standard elements
❷ + ❸ are interchangeable

Example for type determination: HIT-HP MV-COR

For load bearing capacities tables see → pages 14–20 (value c_v = 50 mm decisive)

Concrete strength: *C20/25* / ≥C25/30

Shear capacity in one direction

Type / Element width						
	B = 1.00 m	**HP MV-0506**	**HP MV-0606**	**HP MV-0806**	**HP MV-1006**	**HP MV-1106**
	B = 0.50 m	–	**HP MV-0303**	**HP MV-0403**	**HP MV-0503**	–
	B = 0.25 m	–	–	–	–	–
Design values	**v_{Rd} [kN/m]**			*96.0* **96.0**		

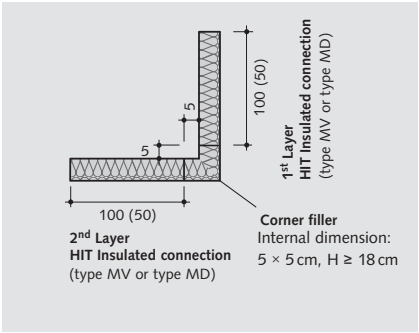
Moment bearing capacity for all element widths

Type / Element width		B = 1.00 m		HP MV-0506		HP MV-0606		HP MV-0806		HP MV-1006		HP MV-1106	
		B = 0.50 m		–		HP MV-0303		HP MV-0403		HP MV-0503		–	
		B = 0.25 m		–		–		–		–		–	
Concrete cover [mm]	30	35	50										
Design values m_{Rd} [kNm/m] for **slab thickness** [mm]		160		*21.9*	22.4	*25.4*	26.1	*31.4*	32.8	*34.0*	38.5	*36.1*	41.0
	160		180	*23.1*	23.7	*26.8*	27.6	*33.4*	34.8	*36.2*	41.0	*38.6*	43.7
		170		*24.3*	24.9	*28.3*	29.1	*35.4*	36.8	*38.5*	43.4	*41.0*	46.4

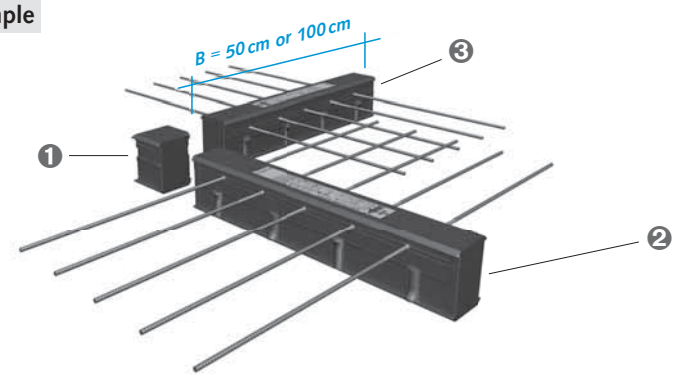
Connecting reinforcement see → pages 14 – 20

Detailed structural design for corner balconies

In addition to the type-tested connections a corner situation may be constructed (taking the occurring moments and the positive and negative shear forces into account) using HIT-HP/ SP MV or HIT-HP/SP MD standard elements in 0.5 m or 1.0 m lengths.



Example



❶ HIT- HP FK - 20 - COR
❷ HIT- HP MD - 0504 - 20 - 100 - 35
❸ HIT- HP MD - 0504 - 20 - 100 - 50

- Product group - type
- Load type
- Number of tension bars
- Number of compression shear units CSB
- Element height [cm]
- Element width [cm]
- Concrete cover [mm]

❶ Corner filler

❷ 1st layer reinforcement (c_v = 30 mm–35 mm)

❸ 2nd layer reinforcement (c_v = 50 mm)

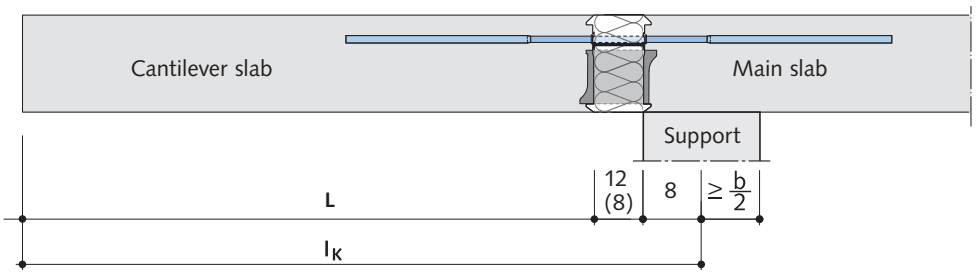
❶ for corner application only
❷ + ❸ are HIT standard elements

The load bearing capacity values for HIT-HP/SP MV standard elements and the correct connecting reinforcement can be found on pages 14 to 20.
Values for standard elements which transfer positive and negative shear forces (HIT-HP/SP MD) can be found on pages 27 to 30.

Span-to-depth ratio

The maximum cantilever lengths max. l_k [m] are shown in the table below; these are based on EN 1992-1-1 (EC2) and on DIN 1045-1, chapter 11.3.2 'Deformation limits'.
The cantilever length l_k should be calculated as shown in the diagram below. Interim values have to be interpolated.

Maximum cantilever length l_k [m]		Thickness h [cm] of concrete slab									
		16	17	18	19	20	21	22	23	24	25
Concrete cover [cm]	c_v = 3	1.82	1.97	2.11	2.26	2.41	2.55	2.70	2.84	2.99	3.14
	c_v = 4	1.68	1.82	1.97	2.11	2.26	2.41	2.55	2.70	2.84	2.99
	c_v = 5	–	1.68	1.82	1.97	2.11	2.26	2.41	2.55	2.70	2.84



l_k = Cantilever length [m]
b = support width [cm]

Connecting reinforcement

Selecting the connecting reinforcement

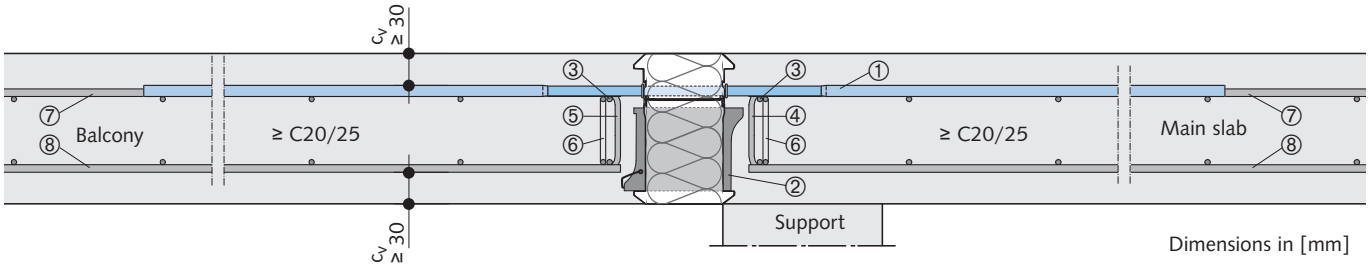
No. of tension bars n_{TB} / unit	Element width B [cm]			Slab thickness h 160 – 350 mm		
	100	50	25	Variation A: mesh	Variation B: steel bars	Variation C: combined mesh and steel bars
	4	2	1	R424A	ø8 / 12 cm	Q257A + ø6 / 15 cm
	5	–	–	R524A	ø10 / 15 cm	Q188A + ø8 / 15 cm
	6	3	–		ø10 / 12.5 cm	Q335A + ø8 / 15 cm
	7	–	–		ø10 / 10 cm	Q424A + ø8 / 15 cm
	8	4	2		ø10 / 9 cm	Q524A + ø8 / 15 cm
	9	–	–		ø10 / 8 cm	Q424A + ø10 / 15 cm
	10	5	–	–	ø10 / 7.5 cm	Q524A + ø10 / 15 cm
	11	–	–		ø10 / 6.5 cm	Q636A + ø10 / 15 cm
	12 *)	6	3		ø10 / 6 cm	Q636A + ø10 / 12.5 cm
	13 *)	–	–		ø10 / 5.5 cm	Q636A + ø10 / 10 cm
	14 *)	7	–		ø10 / 5 cm	Q636A + ø10 / 9 cm

*) Because of the small clearances we recommend limiting the size of the aggregate in the concrete to 16 mm and using concrete with a plastic consistency.

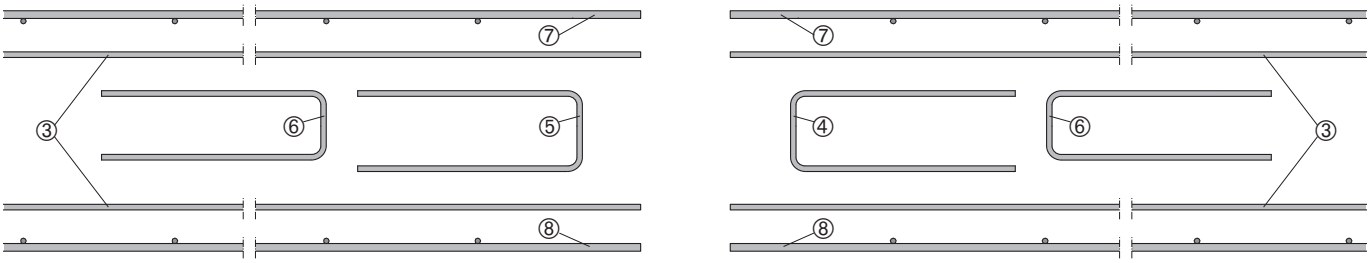
Refer to the guidelines in the type test report to calculate the overlap length l_s.
Reducing the required overlap length with a ratio of $a_{s,req.} / a_{s,actual}$ is permissable.

On-site reinforcement for direct and indirect support

Longitudinal section



Reinforcement detail



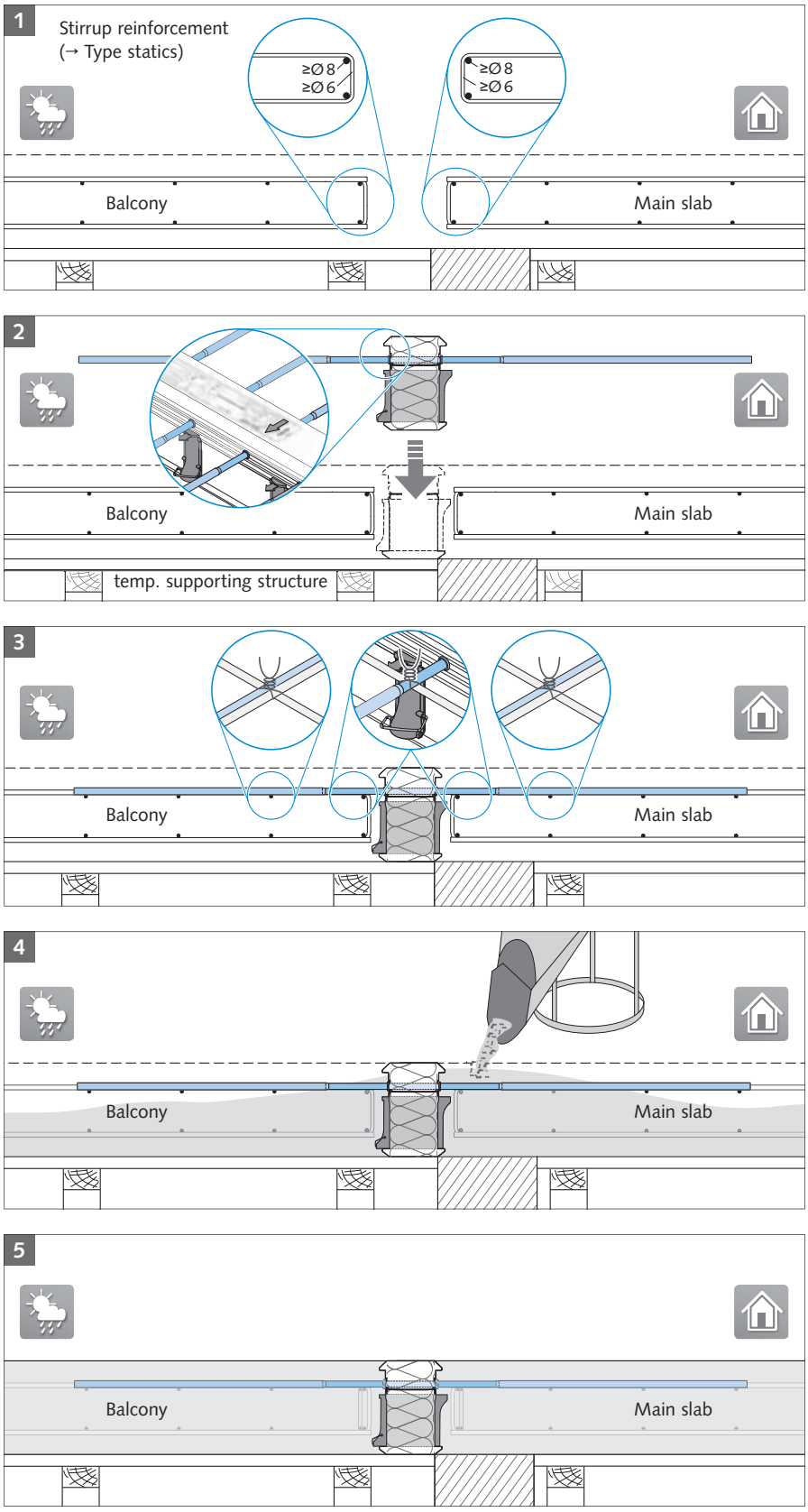
Legend: Section / Reinforcement detail

① HIT tension bar
② HIT CSB (compression shear bearing)
③ Horizontal transverse tensile reinforcement $A_{s,h}$ min. 2 ø8
④ Vertical tensile splitting reinforcement $A_{s,v}$ min. ø6 / 25, see also → pages 14–20 or 27–30
⑤ Vertical tensile splitting reinforcement $A_{s,v}$ min. ø6 / 25, see also → pages 14–20 or 27–30
⑥ Stirrups as end anchorage for the transverse tensile reinforcement → ③
⑦ Upper connecting reinforcement made of steel bars or mesh (→ page 34)
⑧ Lower connecting reinforcement made of steel bars or mesh

Stirrups as edge reinforcement
According to DIN 1045-1, section 13.3.2 / EN 1992-1-1 and EN 1992-1-1/NA, stirrups need to be installed in the outer edge of the balcony.

Indirect support
For indirect support a suspension reinforcement is placed in addition to the vertical tensile splitting reinforcement (Position ④).
Please note the respective load bearing capacity values (→ pages 14–20 and 27–30).

Installation diagram

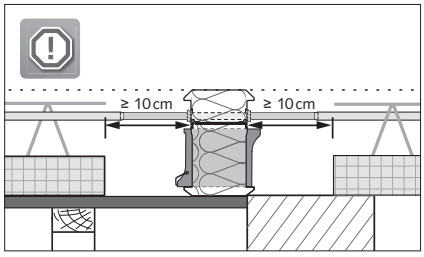


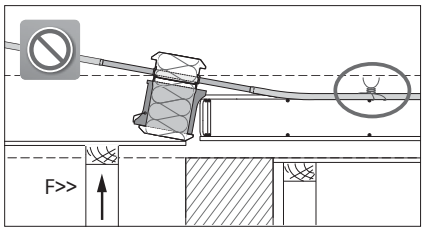
1 Installation of on-site reinforcement

The on-site reinforcement must be placed as specified by the structural engineer.

2 Installation of the HIT element from above

Check that the red arrows on the top of the HIT element and on the CSB are pointing towards the balcony.





Ensure that the formwork is at the correct height!

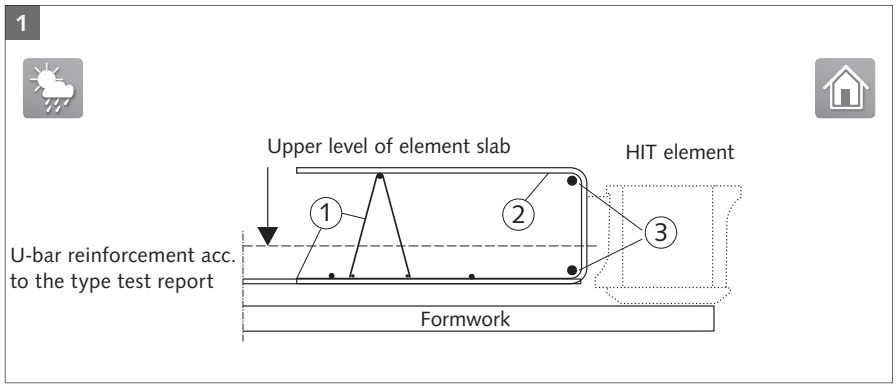
3 Fix the HIT tension bars to on-site reinforcement using tying wire

4 Pour the concrete

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

5 Freshly concreted balcony slab on supporting structure

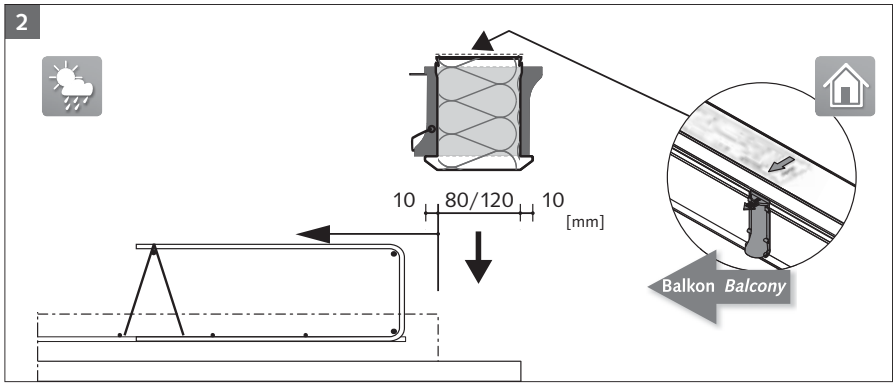
Installation diagram; precast plant



1 Installation of the element slab reinforcement

① Install the lower balcony slab reinforcement including lattice girder.
② Install the vertical tensile splitting reinforcement $A_{s,v}$.
③ Install the horizontal transverse tensile reinforcement $A_{s,h}$ (minimum ⌀8 mm), if required with end anchorage.

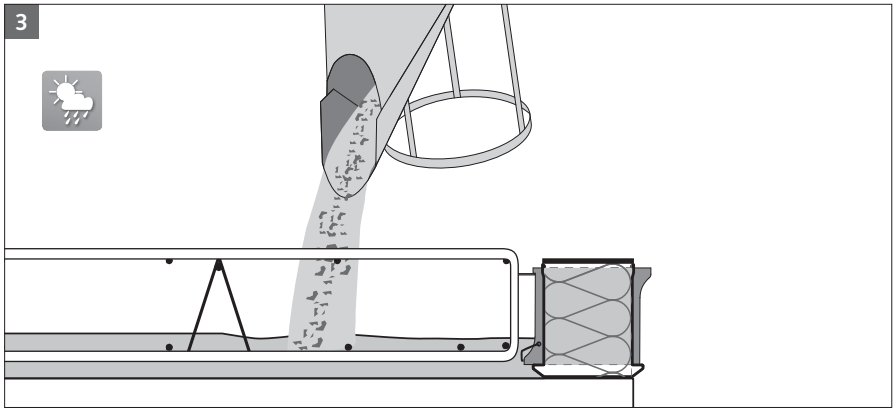
On-site reinforcement acc. to structural engineer specifications.



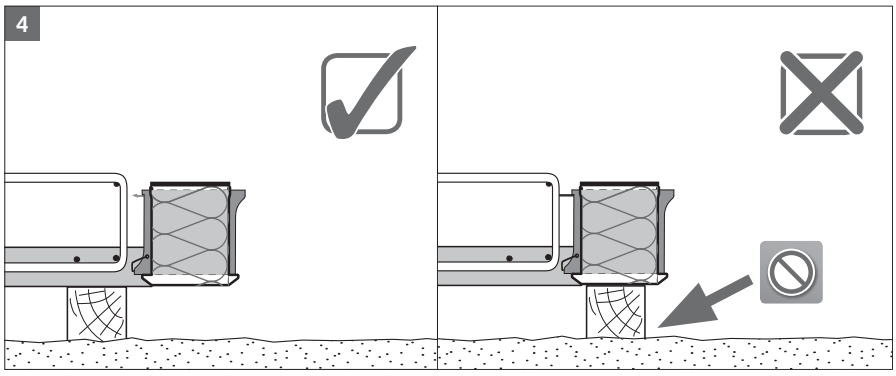
2 Installation of the CSB-Box

Check that the red arrows on the unit are pointing towards the balcony!

Ensure all HIT elements are securely positioned.



3 Pour the concrete for the element slab

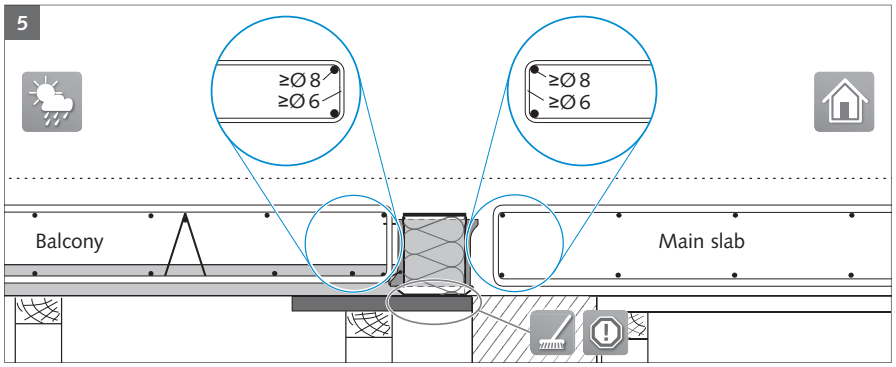


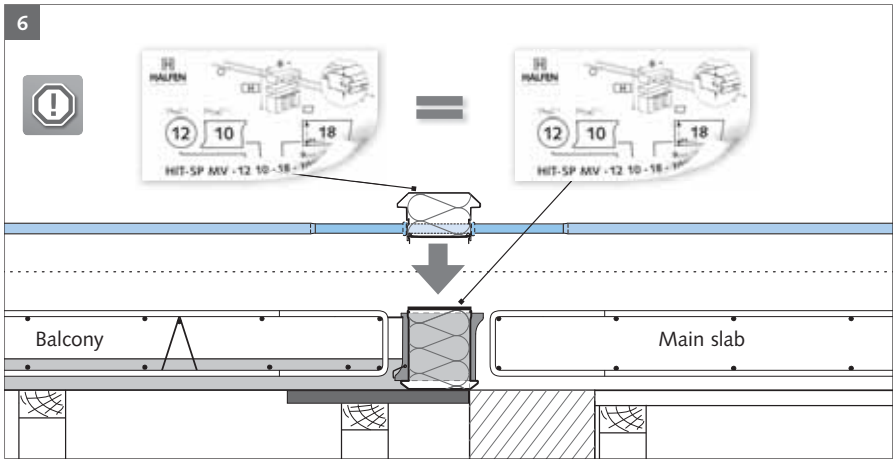
4 Transport to the construction site

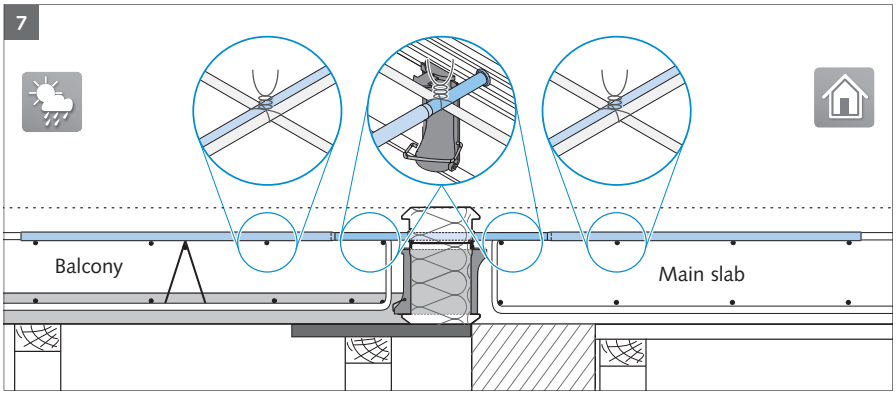
Ensure elements are properly secured during transport.
Do not rest concrete element slabs on other exposed HIT elements.

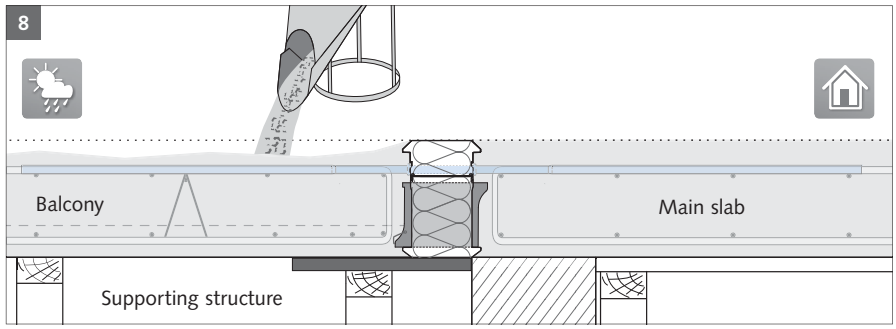
Never place timber supports under the HIT elements!

Installation diagram; construction site





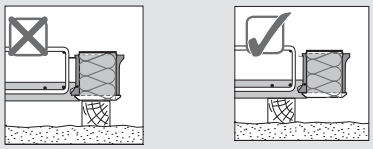




5 Install the on-site element slab reinforcement

The on-site reinforcement must be placed as specified by the structural engineer.

Storage and transport
Ensure elements are properly secured during transport.
Do not rest concrete element slabs on exposed HIT elements.



Never place timber supports under the HIT elements!

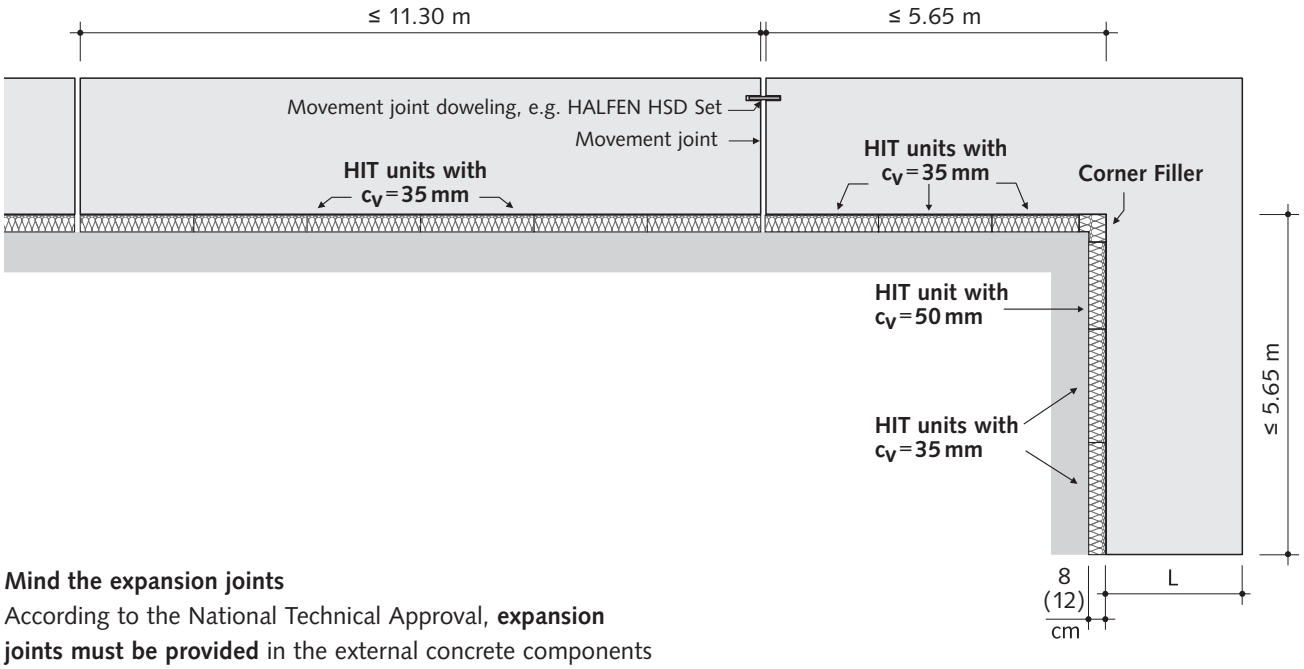
6 Install the tension bar box

CSB-Boxes and tension bar boxes may only be connected with each other if they are **identically marked**.
Make sure the CSB-Box is supported over its whole length during installation. First the tension bar box is fixed at one end then pressed against the CSB-Box until it snaps into place along the whole length of the element.

7 Fix the HIT Tension bars to on-site reinforcement using tying wire.

8 Pour the concrete
Freshly concreted balcony slab on supporting structure

Joint spacings



Mind the expansion joints
According to the National Technical Approval, **expansion joints must be provided** in the external concrete components at a right angle to the insulation line of the HIT elements. In straight, cantilevered balcony slabs the distance between joints must not exceed 11.30 m.

In balcony structures extending past an outer corner a joint must be planned at least every 11.3 m / 2 = 5.65 m.

For inside corners the limit is 5.65 m for each length.

Integrated safety concept

HALFEN´s integrated safety concept includes **all necessary verifications** including shear force analysis for concrete compressive struts – according to DIN 1045-1 / EN 1992-1-1 (EC2) – for design of HALFEN HIT Insulated connections.

The shear force verification above may become decisive, especially in minimal slab thicknesses.
Consequently, the steel load bearing capacities for the proposed insulated connections can only be partially applied.

Including the shear force verification of the concrete compressive strut in the load bearing capacity allows the structural engineer to make a statically and economically reasonable selection of elements, without requiring additional verifications for the insulated connections.
→ This helps to ensure that HALFEN HIT Insulated connections are selected and used in compliance with the approval.

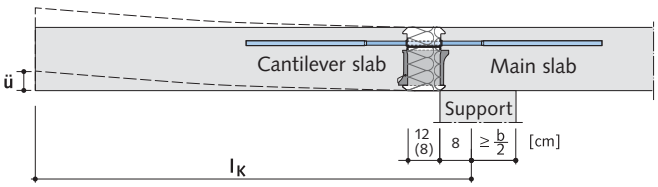
The HALFEN HIT Insulated connection integrated safety concept does not include the verification of any adjoining structural elements.

Deflection of the balcony slab

To limit flexure we recommend under-exaggerating the planned drainage flow when casting cantilevered slabs. The calculable increase in camber results from component deformation according to DIN 1045-1 / EN 1992-1-1 and EN 1992-1-1/NA plus the deformation ü of the HIT elements.

The coefficient factor for camber increase ü on page 41 refers **only to deformation** in HALFEN HIT elements HIT-HP/SP MV and HIT-HP/SP MD at maximum performance in a quasi-permanent load-combination for the following boundary limits:

- Gk = 0.6 (G_k + Q_k)
- Qk = 0.4 (G_k + Q_k)
- Ψ_2 = 0.3



When considering the partial safety factor this results in a ratio of the quasi-permanent load-combination $E_{d,perm}$ to the limit of load capacity R_d of:
$E_{d,perm}$ = 0.524 R_d.

The coefficient factor ü* for camber increase refers to maximum moment load capacity in the HALFEN Insulated connection. It is recommended to consider each present load-combination $E_{d,perm}$ when calculating the camber increase ü.

$$ü\ [mm] = ü^* \times l_k\ [m] \times 10 \times \frac{m_{Ed,perm}}{(0.524 \times m_{Rd})}$$

with
- ü — Camber from HIT components deformation in [mm]
- ü* — Camber coefficient → see page 41
- l_k — Span of cantilever slab in [m]
- m_{Rd} — Design value of the load bearing capacity in [kNm/m]
- $m_{d,perm}$ — Bending moment at maximum performance (quasi-permanent combination) in [kNm/m]

System assumptions			
Cantilever length balcony	l_K	[m]	1.9
Slab thickness	h	[cm]	18
Concrete cover	c_{nom}	[mm]	35
Concrete strength			C25/30
Load assumptions			
Dead load of balcony slab	g_k	[kN/m²]	4.5
Dead load of decking	$g_{k,Bel}$	[kN/m²]	1.5
Traffic load on balustrade	$g_{k,Gel}$	[kN/m]	1.5
Traffic load	q_k	[kN/m²]	4.0
Internal force variables			
Bending moment dead load	$m_{G,k}$	[kNm/m]	13.68
Bending moment live load	$m_{Q,k}$	[kNm/m]	7.22
Shear force dead load	$v_{k,EG}$	[kN/m]	12.9
Shear force traffic load	$v_{K,VL}$	[kN/m]	7.6
Bending moment	m_{Ed}	[kNm/m]	29.3
Shear force	v_{Ed}	[kN/m]	28.8

HALFEN HIT Insulated connection type **HIT-HP MV-0604-18-100-35**

Moment bearing capacity	m_{Rd}	[kNm/m]	29.8	> 29.3
Shear capacity	v_{Rd}	[kN/m]	64.0	> 28.8

Quasi-permanent load combination with Ψ_2 = 0.3

Bending moment

$m_{d,perm} = (g_k + g_{k,Bel} + 0.3 \times q_k) \times l_K^2 / 2 + g_{k,Gel} \times l_K$
$= (4.5 + 1.5 + 0.3 \times 4.0) \times 1.9^2 / 2 + 1.5 \times 1.9$
$= 15.8$ kNm/m

Camber ü* = 0.82 %
read from table for: h = 180 and n_{TB} = 6
→ 180 mm – 35 mm = 145 mm

Camber from HIT components deformation

$ü = ü^* \times l_K \times 10 \times m_{Ed,perm} / (0.524 \times m_{Rd})$
$= 0.82 \times 1.9 \times 10 \times 15.8 / (0.524 \times 29.8)$
$= 15.8$ mm
$= 1.6$ cm

Note:
Observe the deflections limits according to DIN 1045-1 chapter 11.3.2 / EN 1992-1-1/NA (EC2) → page 34

HIT-HP/SP MV, HIT-HP/SP MD

HIT-HP: Camber values [%] at maximum element load bearing capacity (M_{Rd})

Slab thickness h [mm]			Number of tension bars n_{TB} per metre of element			
			$n_{TB} \leq 8$ tension bars per metre at concrete strength		$n_{TB} > 8$ tension bars per metre at concrete strength	
Concrete cover [mm]						
30	**35**	**50**	*C20/25*	≥ C25/30	*C20/25*	≥ C25/30
	160		*0.95*	0.99	*0.83*	0.94
160		180	*0.90*	0.94	*0.78*	0.89
	170		*0.86*	0.89	*0.74*	0.85
170		190	*0.82*	0.85	*0.71*	0.81
	180		***0.79***	**0.82**	***0.68***	**0.77**
180		200	*0.75*	0.78	*0.65*	0.74
	190		*0.72*	0.75	*0.62*	0.71
190		210	*0.70*	0.72	*0.60*	0.68
	200		***0.67***	**0.70**	***0.58***	**0.65**
200		220	*0.65*	0.67	*0.55*	0.63
	210		*0.63*	0.65	*0.53*	0.61
210		230	*0.60*	0.63	*0.52*	0.59
	220		***0.59***	**0.61**	***0.50***	**0.57**
220		240	*0.57*	0.59	*0.48*	0.55
	230		*0.55*	0.57	*0.47*	0.53
230		250	*0.53*	0.56	*0.45*	0.52
	240		***0.52***	**0.54**	***0.44***	**0.50**
240		260	*0.50*	0.52	*0.43*	0.49
	250		*0.49*	0.51	*0.42*	0.47
250		270	*0.48*	0.50	*0.41*	0.46

HIT-SP: Camber values [%] at maximum element load bearing capacity (M_{Rd})

Slab thickness h [mm]			Number of tension bars n_{TB} per metre of element			
			$n_{TB} \leq 8$ tension bars per metre at concrete strength		$n_{TB} > 8$ tension bars per metre at concrete strength	
Concrete cover [mm]						
30	**35**	**50**	*C20/25*	≥ C25/30	*C20/25*	≥ C25/30
	160		*1.04*	1.11	*0.89*	1.05
160		180	*0.99*	1.05	*0.84*	0.99
	170		*0.95*	1.00	*0.80*	0.95
170		190	*0.90*	0.96	*0.76*	0.90
	180		***0.86***	**0.92**	***0.73***	**0.86**
180		200	*0.83*	0.88	*0.70*	0.83
	190		*0.79*	0.84	*0.67*	0.79
190		210	*0.76*	0.81	*0.65*	0.76
	200		***0.74***	**0.78**	***0.62***	**0.73**
200		220	*0.71*	0.75	*0.60*	0.71
	210		*0.69*	0.73	*0.58*	0.68
210		230	*0.66*	0.70	*0.56*	0.66
	220		***0.64***	**0.68**	***0.54***	**0.64**
220		240	*0.62*	0.66	*0.52*	0.62
	230		*0.60*	0.64	*0.51*	0.60
230		250	*0.58*	0.62	*0.49*	0.58
	240		***0.57***	**0.60**	***0.48***	**0.56**
240		260	*0.55*	0.59	*0.46*	0.55
	250		*0.54*	0.57	*0.45*	0.53
250		270	*0.52*	0.56	*0.44*	0.52

ⓘ The camber ü* is given for each slab thickness, for ≤ 8 tension bars per metre and > 8 per metre accordingly.

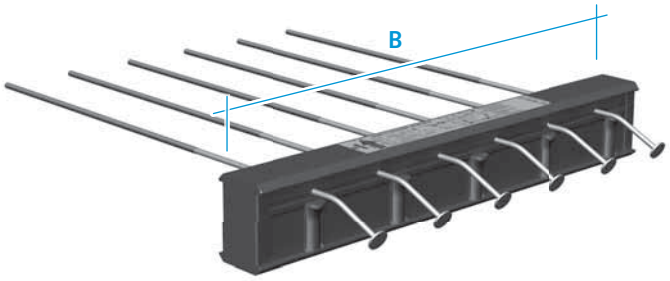
HIT-HP/SP MV-OU, HIT-HP/SP MV-OD

2

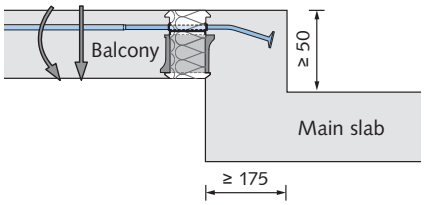
- For cantilevered balcony slabs with height offset or wall connections
- Transfer of bending moments and shear forces

type-tested

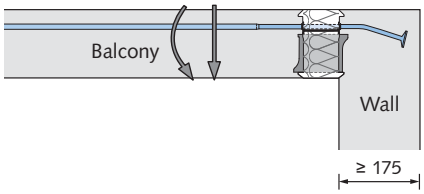
Standard- and multi-part-design:
HIT-HP MV-OU – **High Performance** with 80 mm insulation thickness
HIT-SP MV-OU – **Superior Performance** with 120 mm insulation thickness



Height offset, balcony higher than main slab

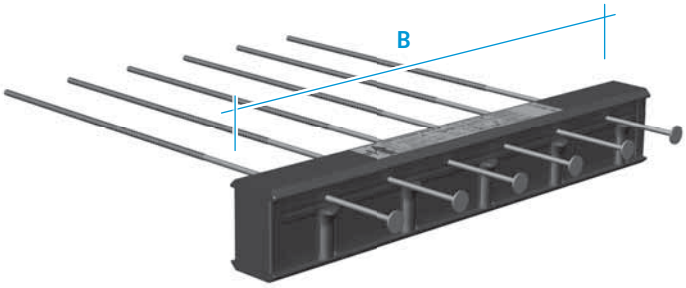


Upward wall connection

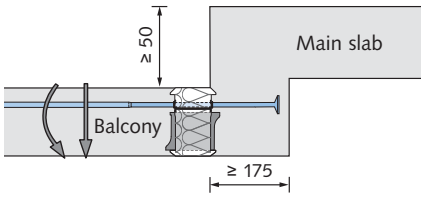


Dimensions in [mm]

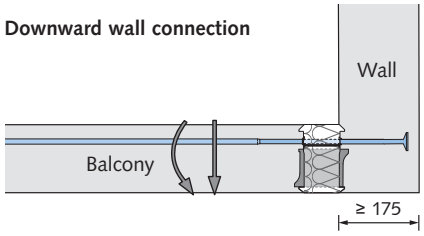
Standard- and multi-part-design:
HIT-HP MV-OD – **High Performance** with 80 mm insulation thickness
HIT-SP MV-OD – **Superior Performance** with 120 mm insulation thickness



Height offset, balcony lower than main slab



Downward wall connection



Dimensions in [mm]

Load range

The respective load range results from the corresponding combination of TB- (tension bar) and CSB- (compression shear bearings) Box. The combinations of TB- and CSB-Box shown in the following table are possible.

Possible combinations of TB-Boxes and CSB-Boxes

Element width B = 25 cm		Number of tension bars nTB		
		1	2	3
Number of compression shear bearings n_{CSB}	1	●	●	
	2	×	●	●

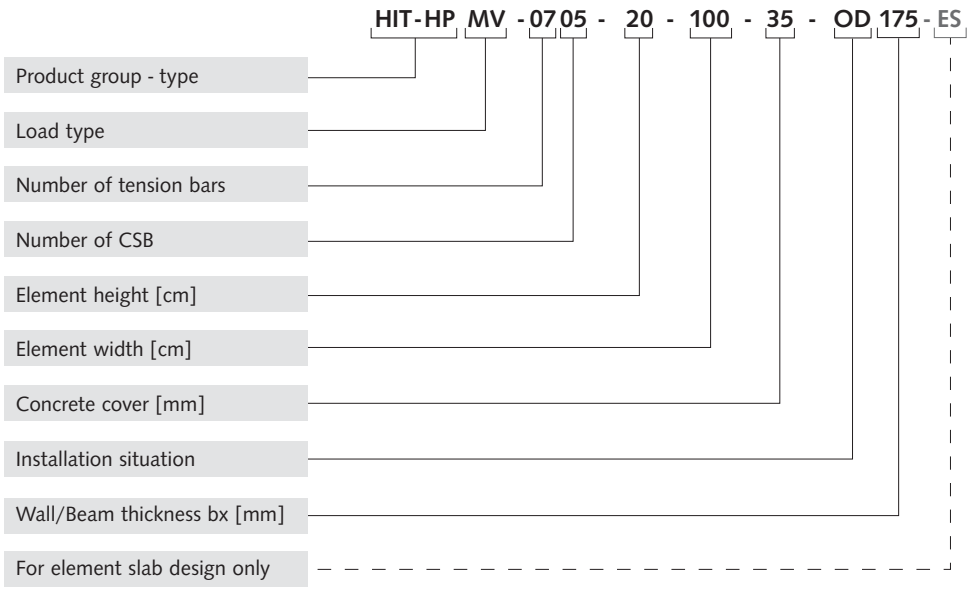
Element width B = 50 cm		Number of tension bars nTB				
		2	3	4	5	6
Number of compression shear bearings n_{CSB}	2	●	●	●		
	3	●	●	●	●	○
	4	×	●	●	●	●
	5		×	●	●	●

Element width B = 100 cm		Number of tension bars nTB								
		4	5	6	7	8	9	10	11	12
Number of compression shear bearings n_{CSB}	4	●	●	●	●	●	×			
	5	●	●	●	●	●	●	●	×	
	6	●	●	●	●	●	●	●	●	●
	7	×	×	●	●	●	●	●	●	●
	8	×	×	●	●	●	●	●	●	●
	9		×	×	●	●	●	●	●	●
	10			×	●	●	●	●	×	×

The load bearing capacity values for the selected elements can be found on pages 44 – 47. ● = HP and SP ○ = SP only × = HP only

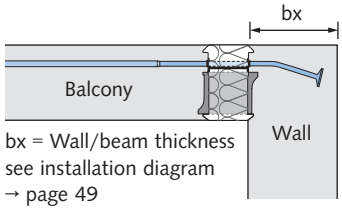
The complete, type-tested, load class range for concrete grades C20/25 and C25/30 can be downloaded at **www.halfen.com**.

Basic types – Ordering example



HIT OU/OD elements are also available as HIT-MD design. Please contact us for further information.

See inside back cover for contact details.



bx = Wall/beam thickness see installation diagram → page 49

bx for Standard design:
175 mm < bx < 330 mm (HP)
175 mm < bx < 290 mm (SP)

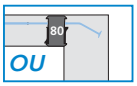
Possible slab thickness h

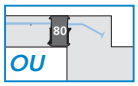
Concrete cover [mm]	30	35	50
Possible slab thickness h [cm]	16 – 35	16 – 35	18 – 35

Load bearing capacity values according to EN 1992-1-1 (EC2)

Shear capacity in one direction

Concrete strength: *C20/25* / ≥C25/30





Type / Element width		HP MV-0404-...-OU		HP MV-0504-...-OU		HP MV-0805-...-OU		HP MV-1006-...-OU		HP MV-1210-...-OU	
	B = 1.00 m										
	B = 0.50 m	HP MV-0202-...-OU		–		–		HP MV-0503-...-OU		HP MV-0605-...-OU	
	B = 0.25 m	HP MV-0101-...-OU		–		–		–		–	
Design values	v_{Rd} [kN/m]	*64.0*	64.0	*64.0*	64.0	*80.0*	80.0	*96.0*	96.0	*146.3*	147.6

Moment bearing capacity for all element widths

Type / Element width				HP MV-0404-...-OU		HP MV-0504-...-OU		HP MV-0805-...-OU		HP MV-1006-...-OU		HP MV-1210-...-OU	
	B = 1.00 m												
	B = 0.50 m			HP MV-0202-...-OU		–		–		HP MV-0503-...-OU		HP MV-0605-...-OU	
	B = 0.25 m			HP MV-0101-...-OU		–		–		–		–	
Concrete cover [mm]	30	35	50										
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*16.9*	17.4	*20.0*	20.8	*29.5*	31.2	*34.0*	38.5	*44.9*	50.5
	160		180	*17.9*	18.4	*21.3*	22.1	*31.5*	33.2	*36.2*	41.0	*47.5*	53.4
		170		*18.9*	19.4	*22.5*	23.3	*33.5*	35.2	*38.5*	43.4	*50.2*	56.4
	170		190	*19.9*	20.4	*23.7*	24.5	*35.4*	37.1	*40.7*	45.9	*52.8*	59.3
		180		***20.8***	**21.4**	***24.9***	**25.8**	***37.4***	**39.1**	***42.9***	**48.4**	***55.5***	**62.3**
	180		200	*21.8*	22.4	*26.2*	27.0	*39.4*	41.1	*45.1*	50.8	*58.2*	65.2
		190		*22.8*	23.3	*27.4*	28.2	*41.3*	43.0	*47.3*	53.3	*60.8*	68.2
	190		210	*23.8*	24.3	*28.6*	29.5	*43.3*	45.0	*49.5*	55.7	*63.5*	71.1
		200		***24.8***	**25.3**	***29.9***	**30.7**	***45.3***	**47.0**	***51.7***	**58.2**	***66.1***	**74.1**
	200		220	*25.8*	26.3	*31.1*	31.9	*47.3*	48.9	*54.0*	60.7	*68.8*	77.0
		210		*26.7*	27.3	*32.3*	33.1	*49.2*	50.9	*56.2*	63.1	*71.4*	80.0
	210		230	*27.7*	28.3	*33.6*	34.4	*51.2*	52.9	*58.4*	65.6	*74.1*	82.9
		220		***28.7***	**29.2**	***34.8***	**35.6**	***53.2***	**54.8**	***60.6***	**68.0**	***76.8***	**85.9**
	220		240	*29.7*	30.2	*36.0*	36.8	*55.1*	56.8	*62.8*	70.5	*79.4*	88.9
		230		*30.7*	31.2	*37.2*	38.1	*57.1*	58.8	*65.0*	73.0	*82.1*	91.8
	230		250	*31.7*	32.2	*38.5*	39.3	*59.1*	60.7	*67.2*	75.4	*84.7*	94.8
		240		***32.6***	**33.2**	***39.7***	**40.5**	***61.0***	**62.7**	***69.5***	**77.9**	***87.4***	**97.7**
	240		260	*33.6*	34.2	*40.9*	41.8	*63.0*	64.7	*71.7*	80.3	*90.0*	100.7
		250		*34.6*	35.1	*42.2*	43.0	*65.0*	66.6	*73.9*	82.8	*92.7*	103.6
	250		270	*35.6*	36.1	*43.4*	44.2	*66.9*	68.6	*76.1*	85.3	*95.4*	106.6
	> 250			Available on request. Contact information see inside back cover.									

On-site reinforcement $A_{s,req}$ on balcony side (→ page 49)

Edge frame	direct support	ø6 / 25 cm	ø6 / 15 cm

Minimum on-site stirrup reinforcement on main slab side (Stirrups are considered as single lap jointed)

Number of stirrups per metre	5	6	9	11	13
Cross section A_{SW} [cm²/m] per leg	5.7	6.8	10.2	12.4	14.7

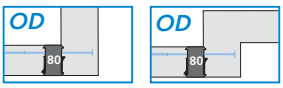
Minimum transverse reinforcement: At least one reinforcement bar ø 12 mm must be placed next to the anchor head on the side nearest to the element edge.

All necessary verifications including concrete shear pressure have already been considered.

Load bearing capacity values according to EN 1992-1-1 (EC2)

Shear capacity in one direction

Concrete strength: C20/25 / ≥C25/30



Type / Element width		HP MV-0404-...-OD	HP MV-0504-...-OD	HP MV-0806-...-OD	HP MV-1007-...-OD	HP MV-1210-...-OD
	B = 1.00 m					
	B = 0.50 m	HP MV-0202-...-OD	–	HP MV-0403-...-OD	–	HP MV-0605-...-OD
	B = 0.25 m	HP MV-0101-...-OD	–	–	–	–
Design values	v_{Rd} [kN/m]	*57.6* 64.0	*45.4* 51.8	*62.4* 71.0	*75.0* 75.0	*59.0* 59.0

Moment bearing capacity for all element widths

Type / Element width				HP MV-0404-...-OD		HP MV-0504-...-OD		HP MV-0806-...-OD		HP MV-1007-...-OD		HP MV-1210-...-OD	
	B = 1.00 m												
	B = 0.50 m			HP MV-0202-...-OD		–		HP MV-0403-...-OD		–		HP MV-0605-...-OD	
	B = 0.25 m			HP MV-0101-...-OD		–		–		–		–	
Concrete cover [mm]	30	35	50										
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*16.9*	17.4	*20.0*	20.8	*31.4*	32.8	*35.8*	40.3	*44.9*	50.5
	160		180	*17.9*	18.4	*21.3*	22.1	*33.4*	34.8	*38.0*	42.8	*47.5*	53.4
		170		*18.9*	19.4	*22.5*	23.3	*35.4*	36.8	*40.2*	45.3	*50.2*	56.4
	170		190	*19.9*	20.4	*23.7*	24.5	*37.3*	38.7	*42.4*	47.7	*52.8*	59.3
		180		***20.8***	**21.4**	***24.9***	**25.8**	***39.3***	**40.7**	***44.6***	**50.2**	***55.5***	**62.3**
	180		200	*21.8*	22.4	*26.2*	27.0	*41.3*	42.7	*46.8*	52.6	*58.2*	65.2
		190		*22.8*	23.3	*27.4*	28.2	*43.2*	44.7	*49.0*	55.1	*60.8*	68.2
	190		210	*23.8*	24.3	*28.6*	29.5	*45.2*	46.6	*51.2*	57.6	*63.5*	71.1
		200		***24.8***	**25.3**	***29.9***	**30.7**	***47.2***	**48.6**	***53.5***	**60.0**	***66.1***	**74.1**
	200		220	*25.8*	26.3	*31.1*	31.9	*49.2*	50.6	*55.7*	62.5	*68.8*	77.0
		210		*26.7*	27.3	*32.3*	33.1	*51.1*	52.5	*57.9*	64.9	*71.4*	80.0
	210		230	*27.7*	28.3	*33.6*	34.4	*53.1*	54.5	*60.1*	67.4	*74.1*	82.9
		220		***28.7***	**29.2**	***34.8***	**35.6**	***55.1***	**56.5**	***62.3***	**69.9**	***76.8***	**85.9**
	220		240	*29.7*	30.2	*36.0*	36.8	*57.0*	58.4	*64.5*	72.3	*79.4*	88.9
		230		*30.7*	31.2	*37.2*	38.1	*59.0*	60.4	*66.7*	74.8	*82.1*	91.8
	230		250	*31.7*	32.2	*38.5*	39.3	*61.0*	62.4	*69.0*	77.2	*84.7*	94.8
		240		***32.6***	**33.2**	***39.7***	**40.5**	***62.9***	**64.3**	***71.2***	**79.7**	***87.4***	**97.7**
	240		260	*33.6*	34.2	*40.9*	41.8	*64.9*	66.3	*73.4*	82.2	*90.0*	100.7
		250		*34.6*	35.1	*42.2*	43.0	*66.9*	68.3	*75.6*	84.6	*92.7*	103.6
	250		270	*35.6*	36.1	*43.4*	44.2	*68.8*	70.2	*77.8*	87.1	*95.4*	106.6
	> 250			Available on request. Contact information see inside back cover.									

On-site reinforcement $A_{s,req}$ on balcony side (→ page 50)

Edge frame	direct support	ø6 / 25 cm	ø6 / 15 cm

Minimum on-site stirrup reinforcement on main slab side (Stirrups are considered as single lap jointed)

Number of stirrups per metre	5	6	9	11	13
Cross section A_{SW} [cm²/m] per leg	5.7	6.8	10.2	12.4	14.7

Minimum transverse reinforcement: At least one reinforcement bar ø 12 mm must be placed next to the anchor head on the side nearest to the element edge.

All necessary verifications including concrete shear pressure have already been considered.

Load bearing capacity values according to EN 1992-1-1 (EC2)

Shear capacity in one direction

Concrete strength: *C20/25* / ≥C25/30

Type / Element width		SP MV-0404-...-OU	SP MV-0504-...-OU	SP MV-0705-...-OU	SP MV-0907-...-OU	SP MV-1209-...-OU
	B = 1.00 m	SP MV-0404-...-OU	SP MV-0504-...-OU	SP MV-0705-...-OU	SP MV-0907-...-OU	SP MV-1209-...-OU
	B = 0.50 m	SP MV-0202-...-OU	–	–	–	–
	B = 0.25 m	SP MV-0101-...-OU	–	–	–	–
Design values	v_{Rd} [kN/m]	*61.4* 64.0	*62.0* 64.0	*74.3* 80.0	*109.3* 112.0	*120.9* 120.7

Moment bearing capacity for all element widths

120

Type / Element width				SP MV-0404-...-OU		SP MV-0504-...-OU		SP MV-0705-...-OU		SP MV-0907-...-OU		SP MV-1209-...-OU	
	B = 1.00 m			SP MV-0404-...-OU		SP MV-0504-...-OU		SP MV-0705-...-OU		SP MV-0907-...-OU		SP MV-1209-...-OU	
	B = 0.50 m			SP MV-0202-...-OU		–		–		–		–	
	B = 0.25 m			SP MV-0101-...-OU		–		–		–		–	
Concrete cover [mm]	30	35	50										
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*16.9*	17.4	*20.0*	20.8	*27.1*	28.4	*33.1*	37.3	*43.7*	49.3
	160		180	*17.9*	18.4	*21.3*	22.1	*28.8*	30.1	*35.1*	39.5	*46.4*	52.2
		170		*18.9*	19.4	*22.5*	23.3	*30.5*	31.8	*37.1*	41.7	*49.0*	55.2
	170		190	*19.9*	20.4	*23.7*	24.5	*32.3*	33.6	*39.1*	43.9	*51.7*	58.1
		180		***20.8***	**21.4**	***24.9***	**25.8**	***34.0***	**35.3**	***41.1***	**46.1**	***54.4***	**61.1**
	180		200	*21.8*	22.4	*26.2*	27.0	*35.7*	37.0	*43.1*	48.3	*57.0*	64.0
		190		*22.8*	23.3	*27.4*	28.2	*37.4*	38.7	*45.1*	50.6	*59.7*	67.0
	190		210	*23.8*	24.3	*28.6*	29.5	*39.1*	40.4	*47.1*	52.8	*62.3*	69.9
		200		***24.8***	**25.3**	***29.9***	**30.7**	***40.9***	**42.2**	***49.0***	**55.0**	***65.0***	**72.9**
	200		220	*25.8*	26.3	*31.1*	31.9	*42.6*	43.9	*51.0*	57.2	*67.6*	75.8
		210		*26.7*	27.3	*32.3*	33.1	*44.3*	45.6	*53.0*	59.4	*70.3*	78.8
	210		230	*27.7*	28.3	*33.6*	34.4	*46.0*	47.3	*55.0*	61.6	*72.9*	81.7
		220		***28.7***	**29.2**	***34.8***	**35.6**	***47.8***	**49.0**	***57.0***	**63.8**	***75.6***	**84.7**
	220		240	*29.7*	30.2	*36.0*	36.8	*49.5*	50.8	*59.0*	66.1	*78.3*	87.6
		230		*30.7*	31.2	*37.2*	38.1	*51.2*	52.5	*61.0*	68.3	*80.9*	90.6
	230		250	*31.7*	32.2	*38.5*	39.3	*52.9*	54.2	*63.0*	70.5	*83.6*	93.5
		240		***32.6***	**33.2**	***39.7***	**40.5**	***54.6***	**55.9**	***65.0***	**72.7**	***86.2***	**96.5**
	240		260	*33.6*	34.2	*40.9*	41.8	*56.4*	57.7	*67.0*	74.9	*88.9*	99.4
		250		*34.6*	35.1	*42.2*	43.0	*58.1*	59.4	*69.0*	77.1	*91.5*	102.4
	250		270	*35.6*	36.1	*43.4*	44.2	*59.8*	61.1	*71.0*	79.3	*94.2*	105.4
	> 250			Available on request. Contact information see inside back cover.									

On-site reinforcement $A_{s,req}$ on balcony side (→ page 49)

Edge frame	direct support	ø6 / 25 cm	ø6 / 20 cm

Minimum on-site stirrup reinforcement on main slab side (Stirrups are considered as single lap jointed)

Number of stirrups per metre	5	6	8	10	13
Cross section A_{SW} [cm²/m] per leg	5.7	6.8	9.0	11.3	14.7

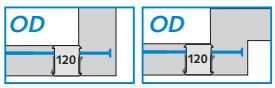
Minimum transverse reinforcement: At least one reinforcement bar ø 12 mm must be placed next to the anchor head on the side nearest to the element edge.

All necessary verifications including concrete shear pressure have already been considered.

Load bearing capacity values according to EN 1992-1-1 (EC2)

Shear capacity in one direction

Concrete strength: C20/25 / ≥C25/30



Type / Element width										
	B = 1.00 m	SP MV-0404-...-OD		SP MV-0504-...-OD		SP MV-0705-...-OD		SP MV-0907-...-OD		SP MV-1209-...-OD	
	B = 0.50 m	SP MV-0202-...-OD		–		–		–		–	
	B = 0.25 m	SP MV-0101-...-OD		–		–		–		–	
Design values	v_{Rd} [kN/m]	*47.9*	53.8	*36.0*	41.6	*35.7*	42.4	*71.0*	69.4	*44.7*	39.8

Moment bearing capacity for all element widths

120

Type / Element width											
	B = 1.00 m			SP MV-0404-...-OD		SP MV-0504-...-OD		SP MV-0705-...-OD		SP MV-0907-...-OD		SP MV-1209-...-OD	
	B = 0.50 m			SP MV-0202-...-OD		–		–		–		–	
	B = 0.25 m			SP MV-0101-...-OD		–		–		–		–	
Concrete cover [mm]	30	35	50										
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*16.9*	17.4	*20.0*	20.8	*27.1*	28.4	*33.1*	37.3	*43.7*	49.3
	160		180	*17.9*	18.4	*21.3*	22.1	*28.8*	30.1	*35.1*	39.5	*46.4*	52.2
		170		*18.9*	19.4	*22.5*	23.3	*30.5*	31.8	*37.1*	41.7	*49.0*	55.2
	170		190	*19.9*	20.4	*23.7*	24.5	*32.3*	33.6	*39.1*	43.9	*51.7*	58.1
		180		***20.8***	**21.4**	***24.9***	**25.8**	***34.0***	**35.3**	***41.1***	**46.1**	***54.4***	**61.1**
	180		200	*21.8*	22.4	*26.2*	27.0	*35.7*	37.0	*43.1*	48.3	*57.0*	64.0
		190		*22.8*	23.3	*27.4*	28.2	*37.4*	38.7	*45.1*	50.6	*59.7*	67.0
	190		210	*23.8*	24.3	*28.6*	29.5	*39.1*	40.4	*47.1*	52.8	*62.3*	69.9
		200		***24.8***	**25.3**	***29.9***	**30.7**	***40.9***	**42.2**	***49.0***	**55.0**	***65.0***	**72.9**
	200		220	*25.8*	26.3	*31.1*	31.9	*42.6*	43.9	*51.0*	57.2	*67.6*	75.8
		210		*26.7*	27.3	*32.3*	33.1	*44.3*	45.6	*53.0*	59.4	*70.3*	78.8
	210		230	*27.7*	28.3	*33.6*	34.4	*46.0*	47.3	*55.0*	61.6	*72.9*	81.7
		220		***28.7***	**29.2**	***34.8***	**35.6**	***47.8***	**49.0**	***57.0***	**63.8**	***75.6***	**84.7**
	220		240	*29.7*	30.2	*36.0*	36.8	*49.5*	50.8	*59.0*	66.1	*78.3*	87.6
		230		*30.7*	31.2	*37.2*	38.1	*51.2*	52.5	*61.0*	68.3	*80.9*	90.6
	230		250	*31.7*	32.2	*38.5*	39.3	*52.9*	54.2	*63.0*	70.5	*83.6*	93.5
		240		***32.6***	**33.2**	***39.7***	**40.5**	***54.6***	**55.9**	***65.0***	**72.7**	***86.2***	**96.5**
	240		260	*33.6*	34.2	*40.9*	41.8	*56.4*	57.7	*67.0*	74.9	*88.9*	99.4
		250		*34.6*	35.1	*42.2*	43.0	*58.1*	59.4	*69.0*	77.1	*91.5*	102.4
	250		270	*35.6*	36.1	*43.4*	44.2	*59.8*	61.1	*71.0*	79.3	*94.2*	105.4
	> 250			Available on request. Contact information see inside back cover.									

On-site reinforcement $A_{s,req}$ on balcony side (→ page 50)

Edge frame	direct support	ø6 / 25 cm	ø6 / 20 cm

Minimum on-site stirrup reinforcement on main slab side (Stirrups are considered as single lap jointed)

Number of stirrups per metre	5	6	8	10	13
Cross section A_{SW} [cm²/m] per leg	5.7	6.8	9.0	11.3	14.7

Minimum transverse reinforcement: At least one reinforcement bar ø 12 mm must be placed next to the anchor head on the side nearest to the element edge.

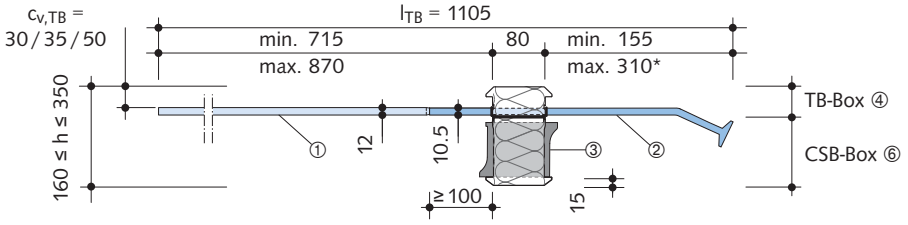
All necessary verifications including concrete shear pressure have already been considered.

HIT-HP/SP MV-OU, HIT-HP/SP MV-OD

Cross sections

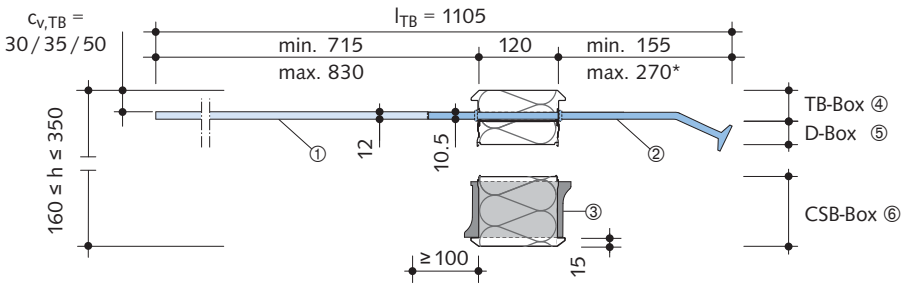
HIT-HP MV-OU;
with bent anchor head

Also available as multi-part design



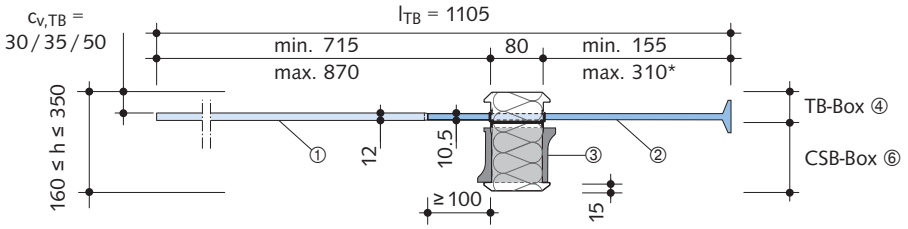
HIT-SP MV-OU ES;
with bent anchor head
in multi-part design
for element slabs

Dimensions in [mm]



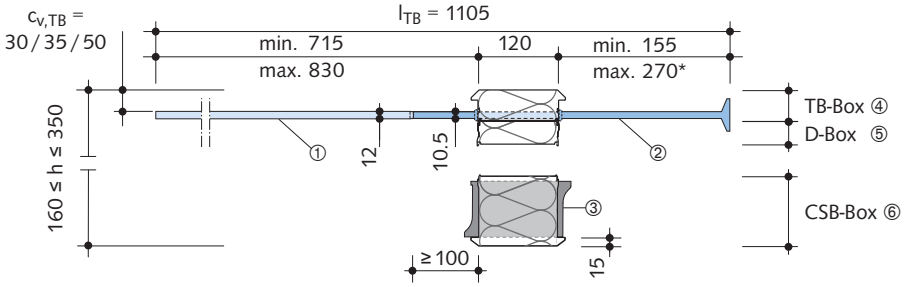
HIT-HP MV-OD;
with straight anchor head

Also available as multi-part design



HIT-SP MV-OD ES;
with straight anchor head
in multi-part design
for element slabs

Dimensions in [mm]



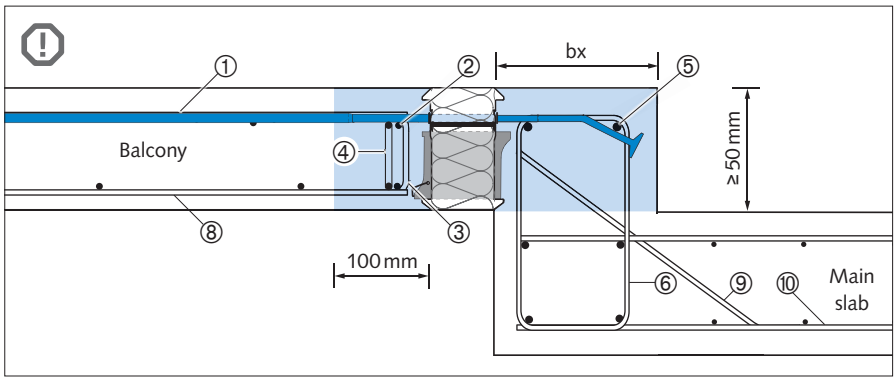
① Tension bar segment 1: ø12 mm
② Tension bar segment 2: ø10.5 mm, stainless steel
③ Compression shear bearing CSB
④ Tension bar box
⑤ Distance box as height compensation 20 mm to 110 mm
⑥ Compression shear bearings box

*maximum standard length of the tension bar on the main slab side results from the actual dimensions: element thickness bx – 20 mm concrete cover.
Other lengths are available on request → for contact information see inside back cover.

Example: with element thickness bx = 175 mm the length of the tension bar on the main slab side is 155 mm.
The tension bar is moved towards the balcony side at production site resulting in an overall length of 870 mm for type HIT-HP and 830 mm for type HIT-SP.

On-site connecting reinforcement

Upward height offset

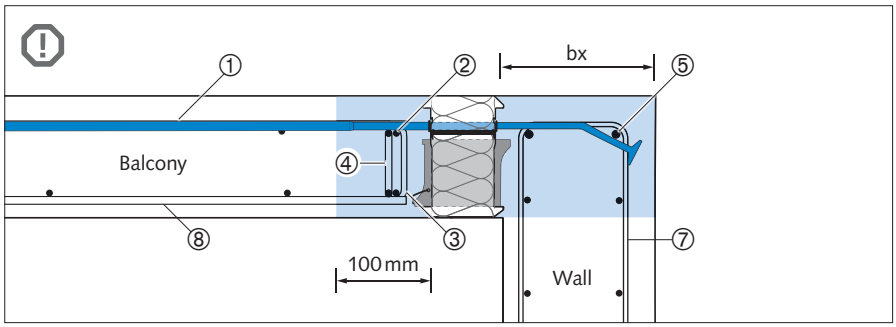


No construction joints permissable in this area:
On balcony side → vertical
On slab side → vertical and horizontal

bx = beam thickness

Design as frame corner!
bx ≥ HIT Element height

Upward wall connection

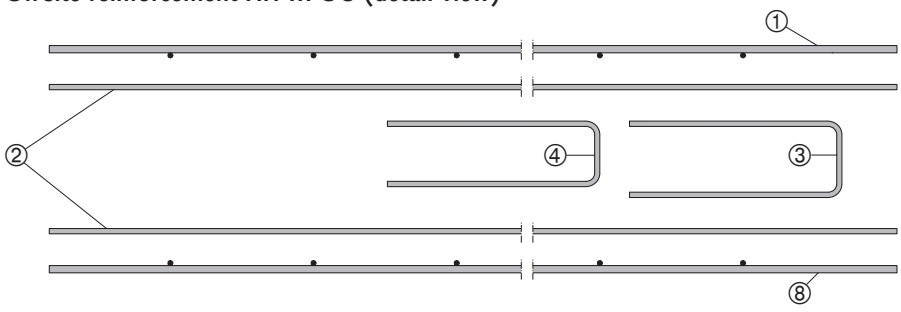


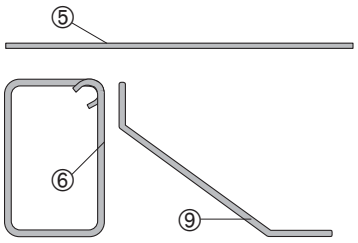
No construction joints permissable at this area:
On balcony side → vertical
On wall side → vertical and horizontal

bx = wall thickness

Design as frame corner!
bx ≥ HIT Element height

On-site reinforcement HIT-…-OU (detail view)





Structural design of on-site reinforcement for the HIT-HP/-SP MV-OU

① Upper connecting reinforcement made of bar steel or mesh, for reinforcement on the balcony side see also page 34

② Horizontal transverse tensile reinforcement $A_{s,h}$ min. 2 ø8, parallel to the joint

③ Vertical tensile splitting reinforcement As,v min. ø6 / 25 → see also pages 44 – 47

④ Stirrups at slab edge as end anchorage for the transverse tensile reinforcement ③

⑤ Transverse reinforcement, min. ø12, adjacent to the anchor bolts

⑥ Required minimum reinforcement for transmitting the loads from the HIT element → see also pages 44 – 47

⑦ Required minimum reinforcement as loop or mesh reinforcement with statically required edge enclosure for transmitting the loads from the HIT element → see also pages 44 – 47

To be designed by the engineer:

⑧ Connecting reinforcement made of steel-bar or mesh

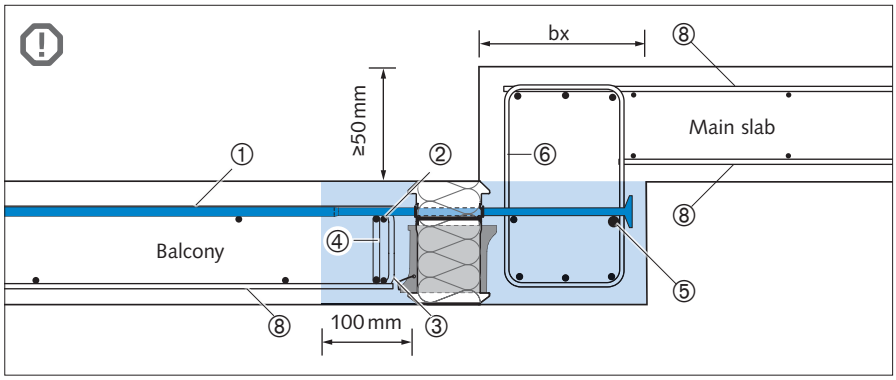
⑨ Diagonal structural reinforcement

⑩ Upper leg of shear bar as loop or mesh reinforcement with statically required edge enclosure on main slab side

Further reinforcement required due to additional load factors (e.g. beam shear reinforcement or bending reinforcement) must be verified by the structural engineer!

On-site connecting reinforcement

Downward height offset

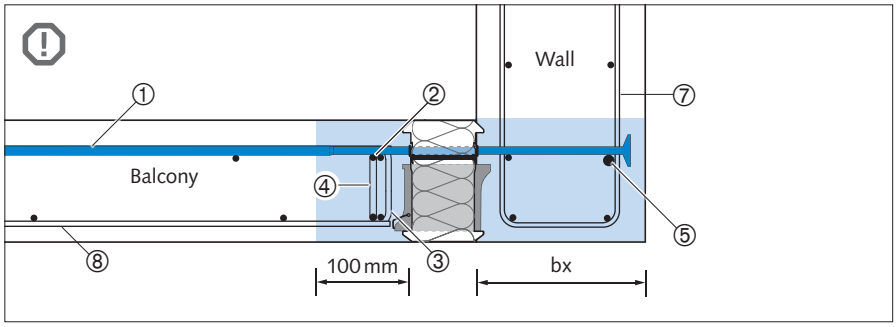


No construction joints permissable in this area:
On balcony side → vertical
On slab side → vertical and horizontal

bx = beam thickness

Design as frame corner!
bx ≥ HIT Element height

Downward wall connection

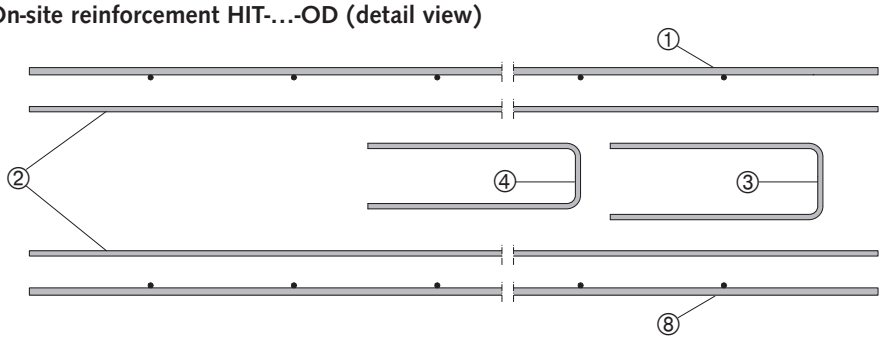


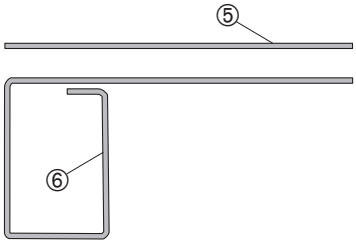
No construction joints permissable at this area:
On balcony side → vertical
On wall side → vertical and horizontal

bx = wall thickness

Design as frame corner!
bx ≥ HIT Element height

On-site reinforcement HIT-…-OD (detail view)





Structural design of on-site reinforcement for the HIT-HP/-SP MV-OD

① Upper connecting reinforcement made of bar steel or mesh,
for reinforcement on the balcony side see also page 34

② Horizontal transverse tensile reinforcement $A_{s,h}$ min. 2 ø8, parallel to the joint

③ Vertical tensile splitting reinforcement As,v min. ø6 / 25,
→ see also pages 44 – 47

④ Stirrups at slab edge as end anchorage for the transverse tensile reinforcement ③

⑤ Transverse reinforcement, min. ø12, adjacent to the anchor bolts

⑥ Required minimum reinforcement for transmitting the loads from the HIT element
→ see also pages 44 – 47

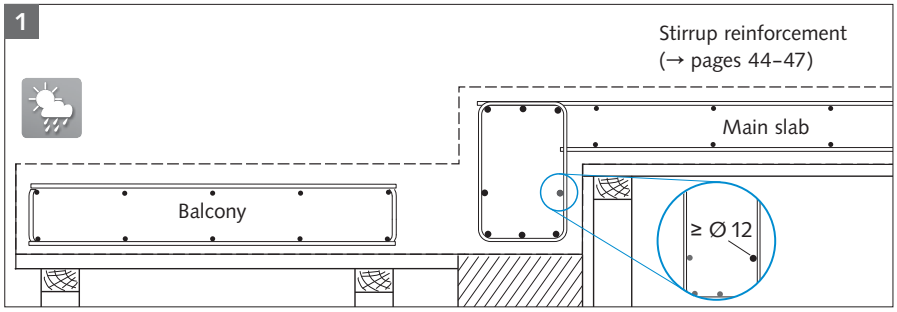
⑦ Required minimum reinforcement as loop or mesh reinforcement with statically required edge enclosure for transmitting the loads from the HIT element
→ see also pages 44 – 47

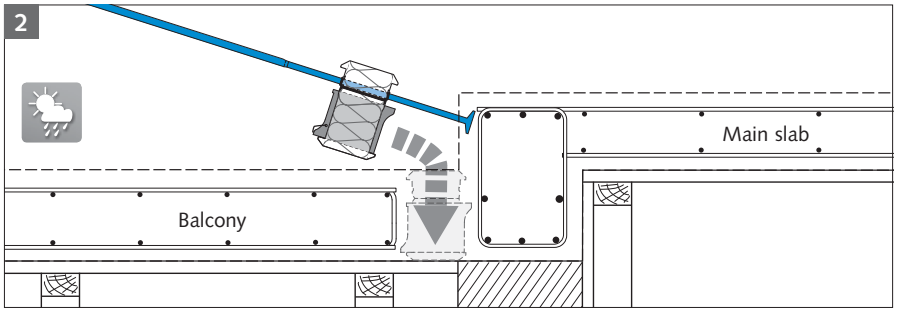
To be designed by the engineer:

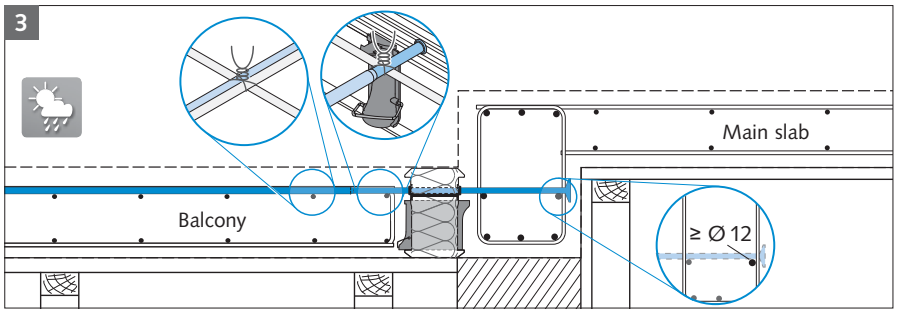
⑧ Connecting reinforcement made of steel-bar or mesh

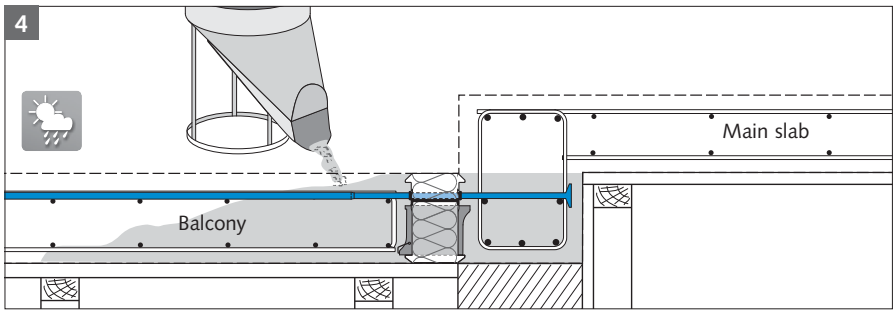
Further reinforcement required due to additional load factors (e.g. beam shear reinforcement or bending reinforcement) must be verified by the structural engineer!

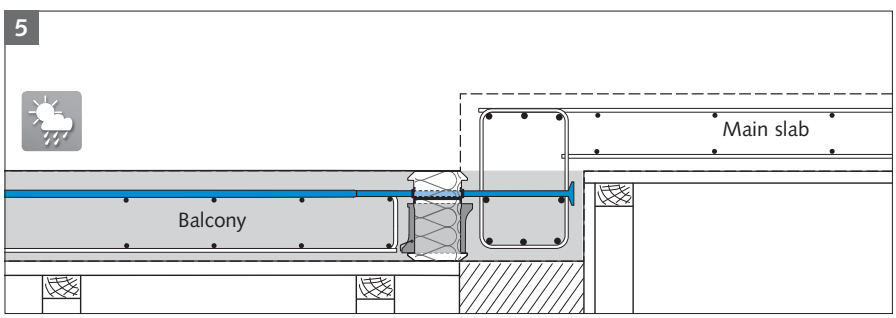
Installation diagram











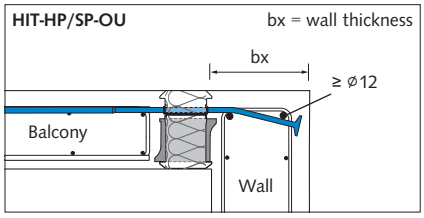
1 Installation of on-site reinforcement
See details on pages 49–50.

Ensure that the formwork is at the correct height!

The on-site reinforcement must be placed as specified by the structural engineer.

2 Installation of the HIT elements from above
Check that the red arrows on the HIT element and the CSB are pointing towards the balcony.
Ensure that the anchor bolts are placed behind the vertical structural reinforcement (e.g. stirrup).
Minimum concrete cover of the anchor bolts has to be 20 mm.

3 Fixing of HIT tension bars to on-site reinforcement using tying wire
The transverse reinforcement
(→ see also pages 44–47):
min. Ø12 mm, must to be placed directly under the anchor bolts.



4 Pouring the concrete
Consider the permissibility of construction joints
→ see figures on pages 49–50.

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

5 Freshly concreted balcony slab on supporting structure

For element slab design please consider the notes on page 23.

HIT-HP ZV, HIT-SP ZV

3

- For simply supported balcony slabs on columns
- Transfers shear forces only

HIT-HP ZV – High Performance (Insulation thickness 80 mm) with CSB
HIT-SP ZV – Superior Performance (Insulation thickness 120 mm) with CSB

type-tested

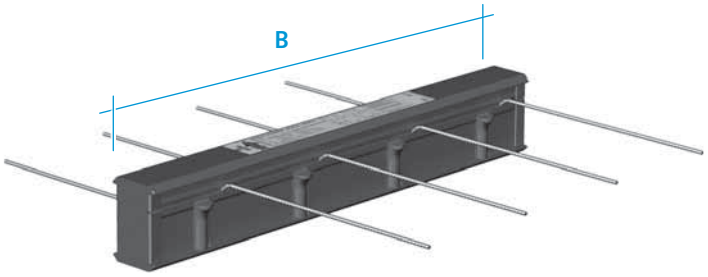
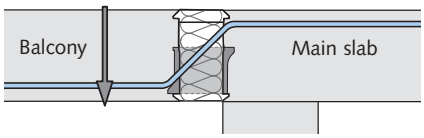
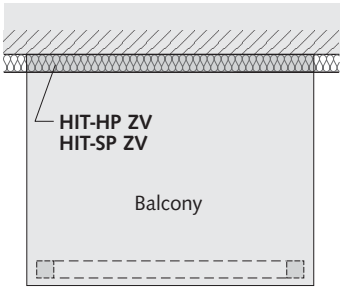


Illustration: HIT-HP ZV, design with straight shear bars, available in ⌀8, ⌀10, ⌀12
not illustrated: HIT-HP ZV, design with bent shear bars, available in ⌀6



Available widths
B = 1.00 m / 0.50 m / 0.25 m



Application: Simply supported balcony on columns

- For unrestrained connection of balcony slabs, e.g. loggias

HIT-HP ZV – High Performance (Insulation thickness 80 mm) without CSB
HIT-SP ZV – Superior Performance (Insulation thickness 120 mm) without CSB

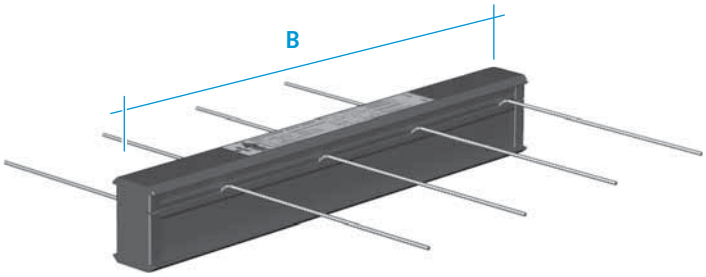
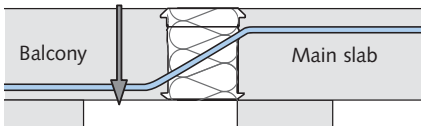


Illustration: HIT-HP ZV, design with straight shear bars, available in ⌀8, ⌀10, ⌀12
not illustrated: HIT-HP ZV, design with bent shear bars, available in ⌀6

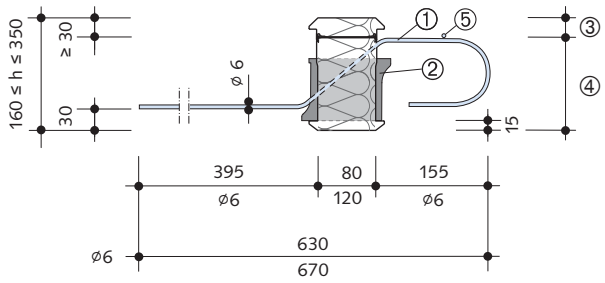


Available widths
B = 1.00 m / 0.50 m / 0.25 m

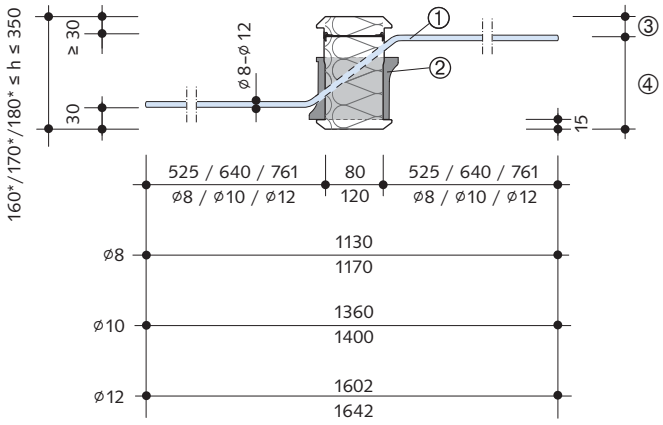
Cross sections (design examples)

with CSB

design with straight shear bars; ø6 mm

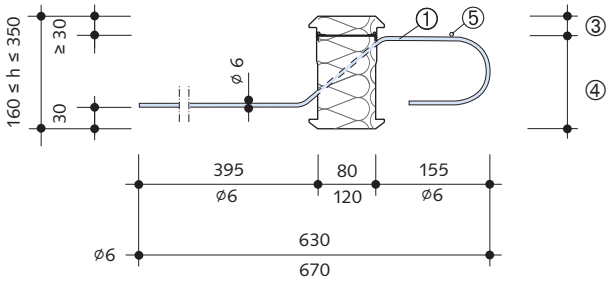


design with straight shear bars; ø8, ø10, ø12 mm
(also available as custom design in ø6 mm)

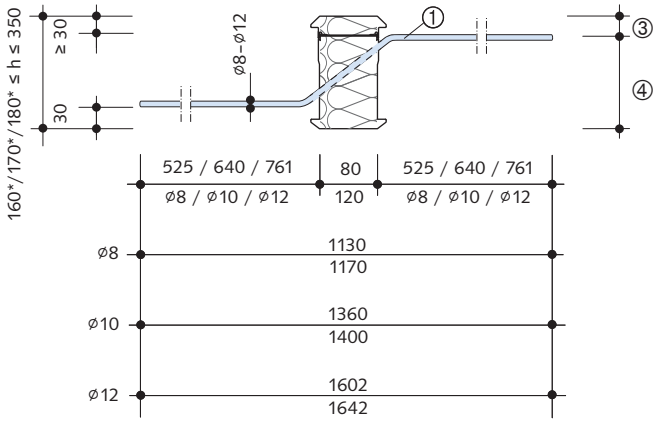


without CSB for unrestrained connection of balcony slabs, e.g. loggias

design with bent shear bars; ø6 mm



design with bent shear bars; ø8, ø10, ø12 mm
(also available as custom design in ø6 mm)



Dimensions in [mm]

① Shear bars
② Compression shear bearings CSB
③ Tension bar box
④ Compression shear bearings box
⑤ Load-bearing cross-bar for shear bars ø6

*smallest element height available, depending on shear bar diameter:
ø 6 from 160 mm
ø 8 from 160 mm
ø10 from 170 mm
ø12 from 180 mm

HIT-HP ZV, HIT-SP ZV

Load range

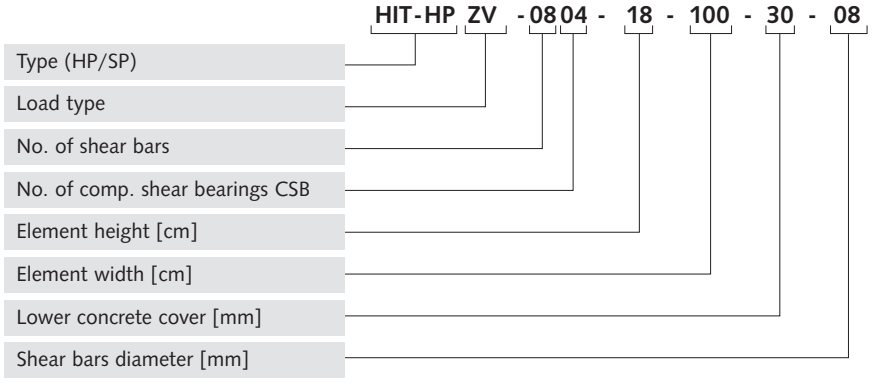
Possible combinations of Shear Bars (SB) and Compression Shear Bearings (CSB)

Diameter shear bars [mm]		ø 6						ø 8						ø 10					ø 12				
Element width B = 25 cm		Number of shear bars n_{SB}																					
		1	2	3				1	2	3				1	2	3							
Number of compression shear bearings n_{CSB}	0	●	●	●				●	●	●					●	●							
	1	●	●					●	●						●								
Element width B = 50 cm		Number of shear bars n_{SB}																					
		1	2	3	4	5	6	1	2	3	4	5	6		2	3	4	5	6		2	3	4	5	6
Number of compression shear bearings n_{CSB}	0		●	●	●	●	●		●	●	●	●	●		●	●	●	●	●		●	●	●	●	●
	1	●	●	●	●			●	●	●					●										
	2		●	●	●				●	●	●				●	●	●				●	●	●		
	3														●	●	●				●	●	●		
Element width B = 100 cm		Number of shear bars n_{SB}																							
		2	3	4	5	6	7	8	10	12	2	3	4	5	6	8	10	12	4	5	6	8	10	12	4	5	6	8	10	12
Number of compression shear bearings n_{CSB}	0			●		●		●	●	●			●		●	●	●	●	●		●	●	●	●	●		●	●	●	●
	2	●	●	●	●	●	●	●			●	●	●	●	●				●	●						●				
	3	●	●	●	●	●	●	●			●	●	●	●	●				●	●						●				
	4			●		●		●					●		●	●			●		●	●				●		●	●		
	6																		●		●	●				●		●	●		

Values for the load bearing capacities for the elements highlighted in blue → see pages 55 – 62. ● = HP and SP

The complete type-tested load class range for concrete grades C20/25 and ≥C25/30 can be downloaded at www.halfen.com.

Basic types



Customized designs
For detailed information on the feasibility of your custom designed HALFEN HIT Insulated connection please contact us.

For contact information:
→ see inside back cover

Possible slab thickness h

Concrete cover [mm]	bottom: 30		top: ≥ 30	
Diameter of shear bars [mm]	06	08	10	12
Possible slab thickness h [cm]	16 – 35	16 – 35	17 – 35	18 – 35

Load bearing capacity values according to EN 1992-1-1 (EC2) — **Bar diameters ⌀6 mm, ⌀8 mm and ⌀10 mm**

Shear capacity in one direction

Type / Element width	B = 1.00 m	ZV 0202-…-06 ①		ZV 0302-…-06 ①		ZV 0402-…-06 ①		ZV 0502-…-06 ①		ZV 0602-…-06 ①		ZV 0702-…-06 ①	
	B = 0.50 m	–		–		ZV 0201-…-06 ①		–		ZV 0301-…-06 ①		–	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* / ≥ C25/30											
Design values v_{Rd} [kN/m] for slab thickness [mm]	160 – 250	*29.0*	29.0	*42.8*	42.8	*55.9*	56.0	*68.4*	68.8	*79.4*	79.4	*87.3*	87.3
	> 250	Available on request. Contact information see inside back cover.											

Type / Element width	B = 1.00 m	ZV 0802-…-06 ①		ZV 0203-…-06		ZV 0303-…-06		ZV 0403-…-06		ZV 0503-…-06		ZV 0603-…-06	
	B = 0.50 m	ZV 0401-…-06 ①		–		–		–		–		–	
Lower concrete cover [mm]	30												
Design values v_{Rd} [kN/m] for slab thickness [mm]	160 – 250	*95.2*	95.2	*25.5*	29.4	*37.8*	43.5	*49.8*	57.4	*61.6*	70.9	*73.0*	84.0
	> 250	Available on request. Contact information see inside back cover.											

① acc. to Z-15.7-312

On-site reinforcement $A_{s,req}$

Balcony		⌀6 / 25 cm
Main slab	direct support	⌀6 / 20 cm
	indirect support	0.26 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 20 cm

Type / Element width	B = 1.00 m	ZV 0402-…-08 ①		ZV 0602-…-08 ①		ZV 0403-…-08		ZV 0503-…-08		B = 1.00 m	ZV 0403-…-10	
	B = 0.50 m	ZV 0201-…-08 ①		ZV 0301-…-08 ①		–		–		B = 0.50 m	–	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* / ≥ C25/30								30	*C20/25* / ≥ C25/30	
Design values v_{Rd} [kN/m] for slab thickness [mm]	160 – 250	*85.2*	85.2	*111.8*	111.8	*95.9*	96.5	*114.5*	114.5	170 – 250	*131.2*	131.2
	> 250	Available on request. Contact information see inside back cover.										

① acc. to Z-15.7-312

On-site reinforcement $A_{s,req}$

Balcony		⌀6 / 25 cm	
Main slab	direct support	⌀6 / 25 cm	⌀6 / 25 cm
	indirect support	0.31 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm	0.35 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm

All required verifications for load in the insulation including verifying the concrete compression strut have already been considered. Connecting elements must be verified by the planner.

Load bearing capacity values according to EN 1992-1-1 (EC2) — Bar diameters ⌀10 mm and ⌀12 mm

Shear capacity in one direction

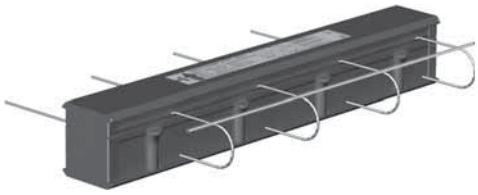
80

Type / Element width	B = 1.00 m	ZV 0404-...-10		ZV 0604-...-10		ZV 0804-...-10		ZV 0606-...-12		ZV 0806-...-12	
	B = 0.50 m	ZV 0202-...-10		ZV 0302-...-10		ZV 0402-...-10		ZV 0303-...-12		ZV 0403-...-12	
	B = 0.25 m	–		–		ZV 0201-...-10		–		–	
Lower concrete cover [mm]	30	Concrete strength: C20/25 / ≥ C25/30									
Design values v_{Rd} [kN/m] for slab thickness [mm]	170	146.9	147.2	165.3①	188.7	165.3①	190.7①	–	–	–	–
	180	146.9	147.2	178.7①	188.7	178.7①	207.3①	201.3①	239.3①	201.3①	239.3①
	190	146.9	147.2	188.7	188.7	192.0①	224.0①	221.7①	256.0①	221.7①	256.0①
	200	155.6	156.3	205.3①	208.9	205.3①	240.7①	237.3①	272.7①	237.3①	272.7①
	210	155.6	156.3	208.9	208.9	218.7①	257.2	250.7①	275.6	250.7①	289.3①
	220	155.6	156.3	208.9	208.9	232.0①	257.2	262.9①	304.6	262.9①	306.0①
	230	155.6	156.3	208.9	208.9	245.3①	257.2	277.3①	304.6	277.3①	322.7①
	240	155.6	156.3	208.9	208.9	257.2	257.2	290.7①	304.6	290.7①	339.3①
	250	162.4	162.4	231.8	231.8	272.0①	287.9	304.0①	304.6	304.0①	356.0①
	> 250	Available on request. Contact information see inside back cover.									

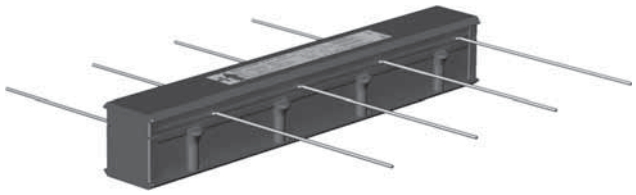
① For utilization of the HIT element´s steel-load-capacity → see table on page 61

On-site reinforcement $A_{s,req}$

Balcony		⌀6 / 25 cm	
Main slab	direct support	⌀6 / 25 cm	⌀6 / 25 cm
	indirect support	0.57 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm	0.81 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm



Shear bars ⌀ 6 mm with bent bars;
type shown: HIT-SP ZV-0404-...-06



Shear bars ⌀ 8 mm, 10 mm and 12 mm with straight bars;
type shown: HIT-SP ZV-0404-...-08

All required verifications for load in the insulation including verifying the concrete compression strut have already been considered. Connecting elements must be verified by the planner.

Load bearing capacity values according to EN 1992-1-1 (EC2) — **Bar diameters ø6 mm, ø8 mm, ø10 mm and ø12 mm**

Shear capacity in one direction

80

Type / Element width	B = 1.00 m	ZV 0400-...-06		ZV 0600-...-06		ZV 0800-...-06		ZV 1000-...-06		ZV 1200-...-06	
	B = 0.50 m	ZV 0200-...-06		ZV 0300-...-06		ZV 0400-...-06		ZV 0500-...-06		ZV 0600-...-06	
	B = 0.25 m	ZV 0100-...-06		–		ZV 0200-...-06		–		ZV 0300-...-06	
Lower concrete cover [mm]	30	Concrete strength: C20/25 / ≥ C25/30									
Design values v_{Rd} [kN/m] for slab thickness [mm]	160	31.6	31.6	47.4	47.4	63.2	63.2	79.0	79.0	88.0①	94.8
	170	31.6	31.6	47.4	47.4	63.2	63.2	79.0	79.0	94.8	94.8
	180	31.6	31.6	47.4	47.4	63.2	63.2	79.0	79.0	94.8	94.8
	190	31.6	31.6	47.4	47.4	63.2	63.2	79.0	79.0	94.8	94.8
	200	34.8	34.8	52.2	52.2	69.5	69.5	86.9	86.9	104.3	104.3
	210	34.8	34.8	52.2	52.2	69.5	69.5	86.9	86.9	104.3	104.3
	220	40.3	40.3	60.4	60.4	80.6	80.6	100.7	100.7	120.8	120.8
	230	40.3	40.3	60.4	60.4	80.6	80.6	100.7	100.7	120.8	120.8
	240	40.3	40.3	60.4	60.4	80.6	80.6	100.7	100.7	120.8	120.8
	250	40.3	40.3	60.4	60.4	80.6	80.6	100.7	100.7	120.8	120.8
	> 250	Available on request. Contact information see inside back cover.									

On-site reinforcement $A_{s,req}$

Balcony		ø6 / 25 cm
Main slab	direct support	ø6 / 20 cm
	indirect support	V_{Ed} / f_{yd} ≥ ø6 / 20 cm

Type / Element width	B = 1.00 m	ZV 0600-...-08		ZV 0800-...-08		ZV 0800-...-10		ZV 0600-...-12		ZV 0800-...-12	
	B = 0.50 m	ZV 0300-...-08		ZV 0400-...-08		ZV 0400-...-10		ZV 0300-...-12		ZV 0400-...-12	
	B = 0.25 m	–		ZV 0200-...-08		ZV 0200-...-10		–		–	
Lower concrete cover [mm]	30	Concrete strength: C20/25 / ≥ C25/30									
Design values v_{Rd} [kN/m] for slab thickness [mm]	160	79.8	79.8	88.0①	106.4	–	–	–	–	–	–
	170	79.8	79.8	101.3①	106.4	101.3①	126.7①	–	–	–	–
	180	79.8	79.8	106.4	106.4	114.7①	143.3①	114.7①	143.3①	114.7①	143.3①
	190	79.8	79.8	106.4	106.4	128.0①	160.0①	128.0①	160.0①	128.0①	160.0①
	200	92.7	92.7	123.6	123.6	141.3①	176.7①	141.3①	176.7①	141.3①	176.7①
	210	92.7	92.7	123.6	123.6	154.7①	193.2	154.7①	179.6	154.7①	193.3①
	220	92.7	92.7	123.6	123.6	168.0①	193.2	168.0①	208.6	168.0①	210.0①
	230	92.7	92.7	123.6	123.6	181.3①	193.2	181.3①	208.6	181.3①	226.7①
	240	107.4	107.4	143.2	143.2	193.2	193.2	194.7①	208.6	194.7①	243.3①
	250	107.4	107.4	143.2	143.2	208.0①	223.8	208.0①	208.6	208.0①	260.0①
	> 250	Available on request. Contact information see inside back cover.									

① For utilization of the HIT element´s steel-load-capacity → see table on page 61

On-site reinforcement $A_{s,req}$

Balcony		ø6 / 25 cm
Main slab	direct support	ø6 / 25 cm
	indirect support	V_{Ed} / f_{yd} ≥ ø6 / 25 cm

HIT-SP ZV with CSB

Load bearing capacity values according to EN 1992-1-1 (EC2) — **Bar diameters ø6 mm, ø8 mm, ø10 mm**

Shear capacity in one direction

120

Type / Element width		B = 1.00 m	ZV 0202-…-06 ①		ZV 0302-…-06 ①		ZV 0402-…-06 ①		ZV 0502-…-06 ①		ZV 0602-…-06 ①		ZV 0702-…-06 ①	
		B = 0.50 m	–		–		ZV 0201-…-06 ①		–		ZV 0301-…-06 ①		–	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* / ≥ C25/30												
Design values v_{Rd} [kN/m] for slab thickness [mm]	160 – 250	*23.6*	23.6	*34.6*	34.7	*45.0*	45.4	*55.0*	55.6	*64.3*	65.4	*73.2*	74.7
	> 250	Available on request. Contact information see inside back cover.											

① acc. to Z-15.7-312

Type / Element width		B = 1.00 m	ZV 0203-…-06		ZV 0303-…-06		ZV 0403-…-06		ZV 0503-…-06		ZV 0603-…-06		ZV 0703-…-06	
		B = 0.50 m	–		–		–		–		–		–	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* / ≥ C25/30												
Design values v_{Rd} [kN/m] for slab thickness [mm]	160 – 250	*20.7*	23.9	*30.6*	35.4	*40.3*	*46.6*	*49.7*	*57.5*	*58.9*	68.1	*67.8*	78.4
	> 250	Available on request. Contact information see inside back cover.											

On-site reinforcement $A_{s,req}$

Balcony		ø6 / 25 cm
Main slab	direct support	ø6 / 20 cm
	indirect support	0.28 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 20 cm

Type / Element width		B = 1.00 m	ZV 0402-…-08 ①		ZV 0503-…-08		B = 1.00 m	ZV 0402-…-10 ①		ZV 0403-…-10		ZV 0503-…-10	
		B = 0.50 m	ZV 0201-…-08 ①		–		B = 0.50 m	ZV 0201-…-10 ①		–		–	
Lower concrete cover [mm]	30	*C20/25* / ≥ C25/30					30	Concrete strength: *C20/25* / ≥ C25/30					
Design values v_{Rd} [kN/m] for slab thickness [mm]	160 – 250	*71.8*	73.4	*92.7*	94.3	170 – 250	*99.8*	100.3	*111.3*	114.0	*131.9*	133.4	
	> 250	Available on request. Contact information see inside back cover.				> 250	Available on request. Contact information see inside back cover.						

① acc. to Z-15.7-312

On-site reinforcement $A_{s,req}$

Balcony		ø6 / 25 cm	
Main slab	direct support	ø6 / 25 cm	
	indirect support	0.33 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 25 cm	0.42 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 25 cm

All required verifications for load in the insulation including verifying the concrete compression strut have already been considered. Connecting elements must be verified by the planner.

HIT-SP ZV with CSB

Load bearing capacity values according to EN 1992-1-1 (EC2) — **Bar diameters ⌀8 mm, ⌀10 mm and ⌀12 mm**

Shear capacity in one direction

120

Type / Element width		ZV 0804-...-08		ZV 0404-...-10		ZV 0604-...-10		ZV 0804-...-10		ZV 0806-...-12	
	B = 1.00 m										
	B = 0.50 m	ZV 0402-...-08		ZV 0202-...-10		ZV 0302-...-10		ZV 0402-...-10		ZV 0403-...-12	
	B = 0.25 m	ZV 0201-...-08		–		–		ZV 0201-...-10		–	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* / ≥ C25/30									
Design values v_{Rd} [kN/m] for slab thickness [mm]	160	*143.6*	146.9	–	–	–	–	–	–	–	–
	170	*143.6*	146.9	*117.0*	118.8	*160.6*①	166.4	*160.6*①	190.7①	–	–
	180	*143.6*	146.9	*117.0*	118.8	*162.6*	166.4	*176.1*①	200.6	*192.1*①	238.0①
	190	*143.6*	146.9	*117.0*	118.8	*162.6*	166.4	*190.4*①	200.6	*210.3*①	256.0①
	200	*160.2*	162.7	*129.2*	130.5	*183.0*	186.6	*201.6*①	230.3	*227.6*①	272.7①
	210	*160.2*	162.7	*129.2*	130.5	*183.0*	186.6	*216.3*①	230.3	*244.1*①	289.3①
	220	*160.2*	162.7	*129.2*	130.5	*183.0*	186.6	*229.5*	230.3	*249.8*①	306.0①
	230	*160.2*	162.7	*129.2*	130.5	*183.0*	186.6	*229.5*	230.3	*266.3*①	322.7①
	240	*174.1*	175.6	*129.2*	130.5	*183.0*	186.6	*229.5*	230.3	*282.3*①	335.5
	250	*174.1*	175.6	*139.1*	139.9	*200.1*	202.6	*255.3*	257.2	*297.8*①	335.5
	> 250	Available on request. Contact information see inside back cover.									

① For utilization of the HIT element´s steel-load-capacity → see table on page 62

On-site reinforcement $A_{s,req}$

Balcony		⌀6 / 25 cm		
Main slab	direct support	⌀6 / 25 cm	⌀6 / 25 cm	⌀6 / 25 cm
	indirect support	0.49 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm	0.75 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm	0.89 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm

All required verifications for load in the insulation including verifying the concrete compression strut have already been considered. Connecting elements must be verified by the planner.

HIT-SP ZV without CSB

Load bearing capacity values according to EN 1992-1-1 (EC2) — **Bar diameters ⌀6 mm, ⌀8 mm, ⌀10 mm and ⌀12 mm**

Shear capacity in one direction

Concrete strength: *C20/25* / ≥C25/30

120

Type / Element width	B = 1.00 m	ZV 0400-...-06		ZV 0600-...-06		ZV 0800-...-06		ZV 1000-...-06		ZV 1200-...-06	
	B = 0.50 m	ZV 0200-...-06		ZV 0300-...-06		ZV 0400-...-06		ZV 0500-...-06		ZV 0600-...-06	
	B = 0.25 m	ZV 0100-...-06		–		ZV 0200-...-06		–		ZV 0300-...-06	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* / ≥ C25/30									
Design values v_{Rd} [kN/m] for slab thickness [mm]	160	*26.1*	26.1	*39.1*	39.1	*52.1*	52.1	*65.1*	65.1	*78.2*	78.2
	170	*26.1*	26.1	*39.1*	39.1	*52.1*	52.1	*65.1*	65.1	*78.2*	78.2
	180	*26.1*	26.1	*39.1*	39.1	*52.1*	52.1	*65.1*	65.1	*78.2*	78.2
	190	*26.1*	26.1	*39.1*	39.1	*52.1*	52.1	*65.1*	65.1	*78.2*	78.2
	200	*29.9*	29.9	*44.9*	44.9	*59.9*	59.9	*74.8*	74.8	*89.8*	89.8
	210	*29.9*	29.9	*44.9*	44.9	*59.9*	59.9	*74.8*	74.8	*89.8*	89.8
	220	*34.8*	34.8	*52.2*	52.2	*69.5*	69.5	*86.9*	86.9	*104.3*	104.3
	230	*34.8*	34.8	*52.2*	52.2	*69.5*	69.5	*86.9*	86.9	*104.3*	104.3
	240	*34.8*	34.8	*52.2*	52.2	*69.5*	69.5	*86.9*	86.9	*104.3*	104.3
	250	*34.8*	34.8	*52.2*	52.2	*69.5*	69.5	*86.9*	86.9	*104.3*	104.3
	> 250	Available on request. Contact information see inside back cover.									

On-site reinforcement $A_{s,req}$

Balcony		⌀6 / 20 cm
Main slab	direct support	⌀6 / 20 cm
	indirect support	V_{Ed} / f_{yd} ≥ ⌀6 / 20 cm

Type / Element width	B = 1.00 m	ZV 0600-...-08		ZV 0800-...-08		ZV 0800-...-10		ZV 1200-...-10		ZV 0800-...-12	
	B = 0.50 m	ZV 0300-...-08		ZV 0400-...-08		ZV 0400-...-10		ZV 0600-...-10		ZV 0400-...-12	
	B = 0.25 m	–		ZV 0200-...-08		ZV 0200-...-10		ZV 0300-...-10		–	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* / ≥ C25/30									
Design values v_{Rd} [kN/m] for slab thickness [mm]	160	*65.6*	65.6	*87.4*	87.4	–	–	–	–	–	–
	170	*65.6*	65.6	*87.4*	87.4	*101.3*①	126.7①	*101.3*①	126.7①	–	–
	180	*65.6*	65.6	*87.4*	87.4	*114.7*①	136.6	*114.7*①	143.3①	*114.7*①	143.3①
	190	*65.6*	65.6	*87.4*	87.4	*128.0*①	136.6	*128.0*①	160.0①	*128.0*①	160.0①
	200	*79.8*	79.8	*106.4*	106.4	*141.3*①	166.3	*141.3*①	176.7①	*141.3*①	176.7①
	210	*79.8*	79.8	*106.4*	106.4	*154.7*①	166.3	*154.7*①	193.3①	*154.7*①	193.3①
	220	*79.8*	79.8	*106.4*	106.4	*166.3*	166.3	*168.0*①	210.0①	*168.0*①	210.0①
	230	*79.8*	79.8	*106.4*	106.4	*166.3*	166.3	*181.3*①	226.7①	*181.3*①	226.7①
	240	*92.7*	92.7	*123.6*	123.6	*166.3*	166.3	*194.7*①	243.3①	*194.7*①	239.5
	250	*92.7*	92.7	*123.6*	123.6	*193.2*	193.2	*208.0*①	260.0①	*208.0*①	239.5
	> 250	Available on request. Contact information see inside back cover.									

① For utilization of the HIT element´s steel-load-capacity → see table on page 62

On-site reinforcement $A_{s,req}$

Balcony		⌀6 / 25 cm
Main slab	direct support	⌀6 / 25 cm
	indirect support	V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm

Load bearing capacity values according to EN 1992-1-1 (EC2)

Maximum bearing capacity for all element widths — **Concrete strength:** *C20/25* / ≥C25/30 — 80

with CSB ø10 ①	B = 1.00 m	**ZV-0604-…-10**				**ZV-0804-…-10**			
	B = 0.50 m	**ZV-0302-…-10**				**ZV-0402-…-10**			
	B = 0.25 m	–				**ZV-0201-…-10**			
Design values $v_{Rd,\ Element}$ [kN/m] for slab thickness [mm]	170–190	*188.7*	188.7			*230.3*	230.3		
	200–240	*208.9*	208.9			*257.2*	257.2		
	250–350	*231.8*	231.8			*287.8*	287.9		

with CSB ø12 ①	B = 1.00 m	**ZV-0404-…-12**		**ZV-0406-…-12**		**ZV-0606-…-12**		**ZV-0806-…-12**	
	B = 0.50 m	**ZV-0202-…-12**		**ZV-0203-…-12**		**ZV-0303-…-12**		**ZV-0403-…-12**	
	B = 0.25 m	–		–		–		–	
Design values $v_{Rd,\ Element}$ [kN/m] for slab thickness [mm]	180–210	*183.7*	183.7	212.7	214.5	*275.6*	275.6	*335.5*	335.5
	220–350	*203.1*	203.1	224.9	225.8	*304.6*	304.6	*374.2*	374.2

① Bar diameter in [mm]

Maximum bearing capacity for all element widths — **Concrete strength:** *C20/25* / ≥C25/30 — 80

without CSB ø6 /ø8 ①	B = 1.00 m	**ZV-1200-…-06**				B = 1.00 m	**ZV-0800-…-08**	
	B = 0.50 m	ZV-0600-…-06				B = 0.50 m	ZV-0400-…-08	
	B = 0.25 m	ZV-0300-…-06				B = 0.25 m	ZV-0200-…-08	
Design values $v_{Rd,\ Element}$ [kN/m] for slab thickness [mm]	160–190	*94.8*	94.8			160–190	*106.4*	106.4
	200–210	*104.3*	104.3			200–230	*123.6*	123.6
	220–350	*120.8*	120.8			240–350	*143.2*	143.2

without CSB ø10 ①	B = 1.00 m	**ZV 0600-…-10**		**ZV 0800-…-10**		**ZV-1000-…-10**		**ZV-1200-…-10**	
	B = 0.50 m	ZV 0300-…-10		ZV 0400-…-10		ZV-0500-…-10		ZV-0600-…-10	
	B = 0.25 m	–		ZV 0200-…-10		–		ZV-0300-…-10	
Design values $v_{Rd,\ Element}$ [kN/m] for slab thickness [mm]	170–190	*124.7*	124.7	*166.3*	166.3	*207.9*	207.9	*231.6*	249.5
	200–240	*144.9*	144.9	*193.2*	193.2	*241.5*	241.5	*269.1*	289.8
	250–350	*167.8*	167.8	*223.8*	223.8	*279.7*	279.7	*311.7*	335.7

without CSB ø12 ①	B = 1.00 m	**ZV-0600-…-12**		**ZV-0800-…-12**		**ZV-1000-…-12**		**ZV-1200-…-12**	
	B = 0.50 m	**ZV-0300-…-12**		**ZV-0400-…-12**		**ZV-0500-…-12**		**ZV-0600-…-12**	
	B = 0.25 m	–		–		–		–	
Design values $v_{Rd,\ Element}$ [kN/m] for slab thickness [mm]	180–210	*179.6*	179.6	*239.5*	239.5	*278.0*	299.3	*333.6*	359.2
	220–350	*208.6*	208.6	*278.2*	278.2	*322.9*	347.7	*387.4*	417.2

① Bar diameter in [mm]

All necessary verifications (including concrete compression strut verification) have already been considered in the tables showing load bearing capacity values on pages 55 to 57.
For utilization of maximum load bearing capacities of some elements the load-capacity of these elements can be considered, if the appropriate concrete strength is selected or different geometrical boundary conditions are present.
These element load-capacities $v_{Rd,\ Element}$ are listed on this page.
The concrete compression strut must be verified by the planner separately.

HIT-SP ZV

Load bearing capacity values according to EN 1992-1-1 (EC2)

Maximum load capacity in one direction — **Concrete strength:** *C20/25* / ≥C25/30 — 120

with CSB ø10 ①	B = 1.00 m	**ZV-0404-…-10**		**ZV-0604-…-10**		**ZV-0804-…-10**		**ZV-0806-…-10**	
	B = 0.50 m	**ZV-0202-…-10**		**ZV-0302-…-10**		**ZV-0402-…-10**		**ZV-0403-…-10**	
	B = 0.25 m	**ZV-0101-…-10**		–		**ZV-0201-…-10**		–	
Design values $v_{Rd,\ Element}$ [kN/m] for slab thickness [mm]	170–190	*117.0*	118.8	*162.6*	166.4	*199.6*	200.6	*222.6*	227.9
	200–240	*129.2*	130.5	*183.0*	186.6	*229.5*	230.3	*248.8*	252.8
	250–350	*139.1*	139.9	*200.0*	202.6	*255.3*	257.2	*270.6*	273.4

with CSB ø12 ①	B = 1.00 m	**ZV-0606-…-12**		**ZV-0806-…-12**	
	B = 0.50 m	**ZV-0303-…-12**		**ZV-0403-…-12**	
	B = 0.25 m	–		–	
Design values $v_{Rd,\ Element}$ [kN/m] for slab thickness [mm]	180–210	*236.4*	242.8	*291.4*	292.7
	220–350	*265.3*	270.3	*333.8*	335.5

① Bar diameter in [mm]

Maximum load capacity in one direction — **Concrete strength:** *C20/25* / ≥C25/30 — 120

without CSB ø10 ①	B = 1.00 m	**ZV-0600-…-10**		**ZV-0800-…-10**		**ZV-1000-…-10**		**ZV-1200-…-10**	
	B = 0.50 m	**ZV-0300-…-10**		**ZV-0400-…-10**		**ZV-0500-…-10**		**ZV-0600-…-10**	
	B = 0.25 m	–		**ZV-0200-…-10**		–		**ZV-0300-…-10**	
Design values $v_{Rd,\ Element}$ [kN/m] for slab thickness [mm]	170–190	*102.4*	102.4	*136.6*	136.6	*170.7*	170.7	*190.3*	204.9
	200–240	*124.7*	124.7	*166.3*	166.3	*207.9*	207.9	*231.6*	249.5
	250–350	*144.9*	144.9	*193.2*	193.2	*241.5*	241.5	*269.1*	289.8

without CSB ø12 ①	B = 1.00 m	**ZV-0600-…-12**		**ZV-0800-…-12**		**ZV-1000-…-12**		**ZV-1200-…-12**	
	B = 0.50 m	**ZV-0300-…-12**		**ZV-0400-…-12**		**ZV-0500-…-12**		**ZV-0600-…-12**	
	B = 0.25 m	–		**ZV-0200-…-12**		–		–	
Design values $v_{Rd,\ Element}$ [kN/m] for slab thickness [mm]	180–210	*147.5*	147.5	*196.7*	196.7	*228.5*	245.9	*274.0*	295.0
	220–350	*179.6*	179.6	*239.5*	239.5	*278.0*	299.3	*333.6*	359.2

① Bar diameter in [mm]

All necessary verifications (including concrete compression strut verification) have already been considered in the tables showing load bearing capacity values on pages 58 to 60.
For utilization of maximum load bearing capacities of some elements the load-capacity of these elements can be considered, if the appropriate concrete strength is selected or different geometrical boundary conditions are present.
These element load-capacities $v_{Rd,\ Element}$ are listed on this page.
The concrete compression strut must be verified by the planner separately.

HIT-HP ZD, HIT-SP ZD

- For simply-supported balcony slabs on columns
- Transfers positive and negative shear forces

NEW!

HIT-HP ZD – High Performance (Insulation thickness 80 mm) with CSB
HIT-SP ZD – Superior Performance (Insulation thickness 120 mm) with CSB

type-tested

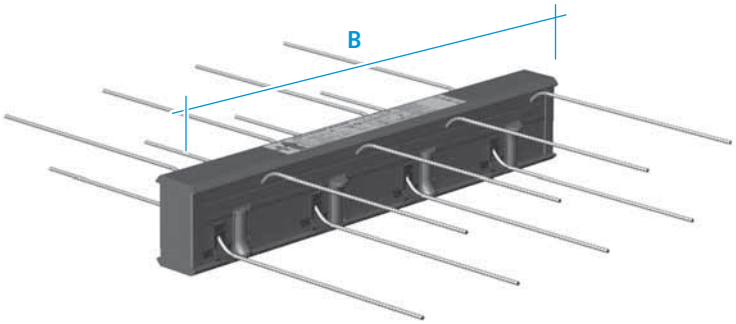
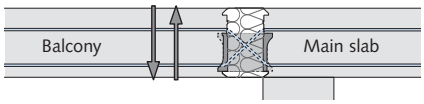


Illustration: Design with straight shear bars, available in ⌀ 8, ⌀ 10, ⌀ 12
not illustrated: Design with bent shear bars, available in ⌀ 6



Available widths
B = 1.00 m / 0.50 m / 0.33 m

HIT-HP ZD – High Performance (Insulation thickness 80 mm) without CSB
HIT-SP ZD – Superior Performance (Insulation thickness 120 mm) without CSB

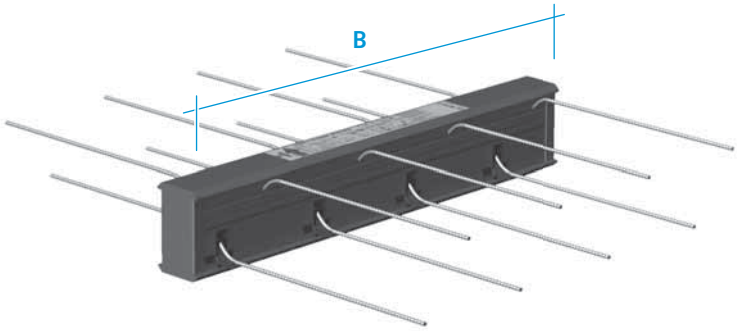
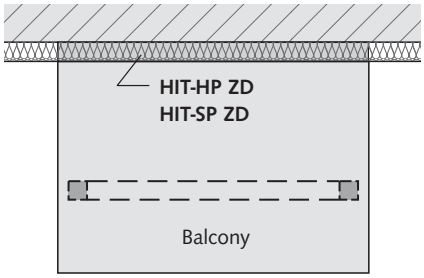
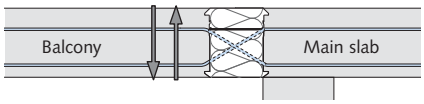


Illustration: Design with straight shear bars, available in ⌀ 8, ⌀ 10, ⌀ 12
not illustrated: Design with bent shear bars, available in ⌀ 6



Application: Simply supported balcony on columns



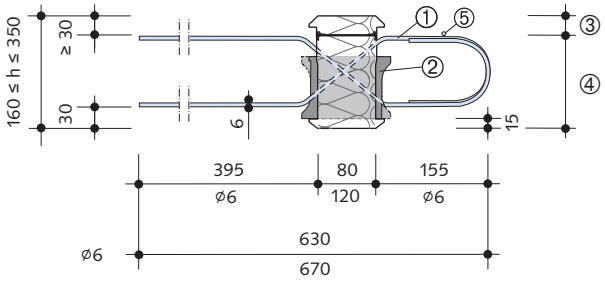
Available widths
B = 1.00 m / 0.50 m / 0.25 m

HIT-HP ZD, HIT-SP ZD

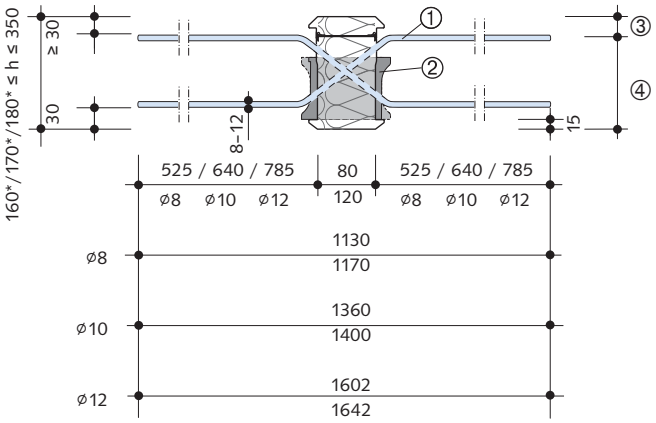
Cross sections (design examples)

with CSB

design with bent shear bars; ø6 mm

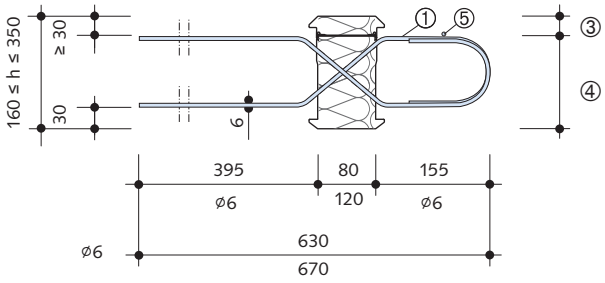


design with straight shear bars; ø8, ø10, ø12 mm
(also available as custom design in ø6 mm)

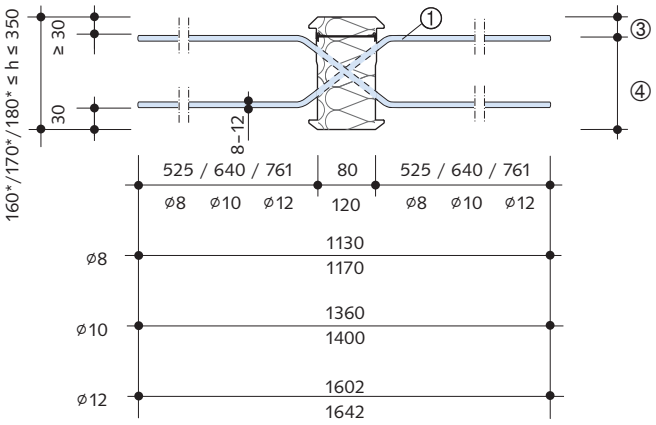


without CSB for unrestrained connection of balcony slabs, e.g. loggias

design with bent shear bars; ø6 mm



design with straight shear bars; ø8, ø10, ø12 mm
(also available as custom design in ø6 mm)



Dimensions in [mm]

① Shear bars
② Compression shear bearings CSB
③ Tension bar box
④ Compression shear bearings box
⑤ Load-bearing cross-bar for shear bars ø6

* smallest element height available, depending on shear bar diameter:
ø 6 from 160 mm
ø 8 from 160 mm
ø10 from 170 mm
ø12 from 180 mm

Load range

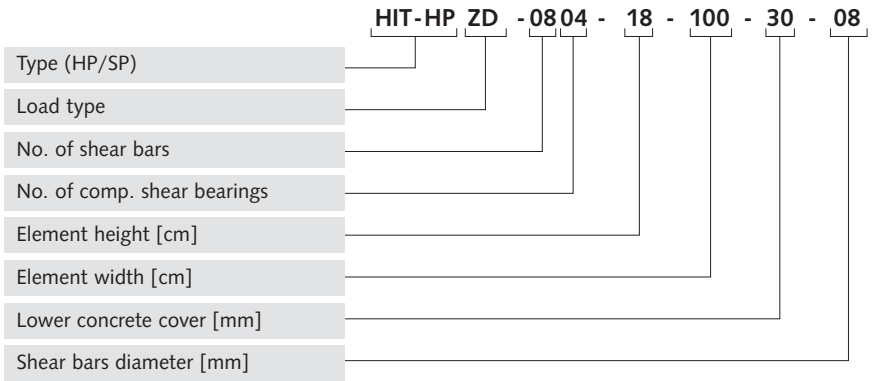
Possible combinations of Shear Bars (SB) and Compression Shear Bearings (CSB)

Diameter shear bars [mm]		ø 6						ø 8						ø 10						ø 12					
Element width B = 25 cm		Number of shear bars n_{SB} in one direction																							
		1	2	3				1	2	3				1	2	3				1					
Number of compression shear bearings n_{CSB}	0	●	●	●				●	●	●				●	●	●				●					
Element width B = 33 cm		Number of shear bars n_{SB} in one direction																							
								2	3					2	3					2	3				
Number of compression shear bearings n_{CSB}	2							●	●					●	●					●	●				
Element width B = 50 cm		Number of shear bars n_{SB} in one direction																							
		1	2	3	4	5	6	1	2	3	4	5	6	2	3	4	5	6		2	3	4	5	6	
Number of compression shear bearings n_{CSB}	0		●	●	●	●	●		●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	
	2	●	●	●	●			●	●	●	●			●	●	●									
Element width B = 100 cm		Number of shear bars n_{SB} in one direction																							
		2	3	4	5	6	7	8	10	12	2	3	4	5	6	8	10	12	4	5	6	7	8	10	12	4	5	6	7	8	10	12
Number of compression shear bearings n_{CSB}	0			●		●		●	●	●			●		●	●	●	●	●		●		●	●	●	●		●		●	●	●
	4	●	●	●	●	●	●	●			●	●	●	●	●	●			●	●	●	●	●			●	●	●	●	●		
	6																			●	●	●	●				●	●	●	●			

Values for the load bearing capacities for the elements highlighted in blue → see pages 66 to 70 ● = HP and SP

The complete type-tested load class range for concrete grades C20/25 and ≥C25/30 can be downloaded at www.halfen.com.

Basic types – Ordering example



Customized designs
For detailed information on the feasibility of your custom designed HALFEN HIT Insulated connection please contact us.

For contact information:
→ see inside back cover

Possible slab thickness h

Concrete cover [mm]		bottom: 30	top: ≥ 30	
Diameter of shear bars [mm]	06	08	10	12
Possible slab thickness h [cm]	16 – 35	16 – 35	17 – 35	18 – 35

Load bearing capacity values according to EN 1992-1-1 (EC2) — **Bar diameters ⌀6 mm, ⌀8 mm, ⌀10 mm and ⌀12 mm**

Shear capacity in both directions

80

Type / Element width	B = 1.00 m	ZD-0204-…-06	ZD-0404-…-06	ZD-0504-…-06	ZD-0704-…-06	ZD-0804-…-06	ZD-0604-…-08
	B = 0.50 m	ZD-0102-…-06	ZD-0202-…-06	–	–	ZD-0402-…-06	ZD-0302-…-08
Lower concrete cover [mm]	30	Concrete strength: C20/25 / ≥C25/30					
Design values v_{Rd} [kN/m] for slab thickness [mm]	160 – 250	±22.7 ±22.7	±44.9 ±44.9	±55.8 ±55.8	±77.2 ±77.2	±87.7 ±87.7	±111.2 ±111.4
	> 250	Available on request. Contact information see inside back cover.					

On-site reinforcement $A_{s,req}$

Balcony		⌀6 / 25 cm	⌀6 / 25 cm
Main slab	direct support	⌀6 / 20 cm	⌀6 / 25 cm
	indirect support	0.31 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 20 cm	0.39 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm

Shear capacity in both directions

80

Type / Element width	B = 1.00 m	ZD-0804-…-08		ZD-0604-…-10		ZD-0804-…-10		ZD-0504-…-12		ZD-0606-…-12	
	B = 0.50 m	ZD-0402-…-08		ZD-0302-…-10		ZD-0402-…-10		–		–	
Lower concrete cover [mm]	30	Concrete strength: C20/25 / ≥C25/30									
Design values v_{Rd} [kN/m] for slab thickness [mm]	160	±120.4①	±138.4	–	–	–	–	–	–	–	–
	170	±133.3①	±138.4	±133.3①	±156.7	±133.3①	±158.7①	–	–	–	–
	180	±138.4	±138.4	±146.7①	±156.7	±146.7①	±175.3①	±146.7①	±175.3①	±158.1①	±191.3①
	190	±138.4	±138.4	±156.7	±156.7	±160.0①	±192.0①	±160.0①	±181.7	±175.2①	±208.0①
	200	±138.4	±138.4	±156.7	±156.7	±173.3①	±198.3	±173.3①	±181.7	±189.3①	±224.7①
	210	±138.4	±138.4	±156.7	±156.7	±186.7①	±198.3	±181.7	±181.7	±202.7①	±227.6
	220	±138.4	±138.4	±156.7	±156.7	±198.3	±198.3	±181.7	±181.7	±216.0①	±227.6
	230	±138.4	±138.4	±156.7	±156.7	±198.3	±198.3	±181.7	±181.7	±227.6	±227.6
	240	±138.4	±138.4	±156.7	±156.7	±198.3	±198.3	±181.7	±181.7	±227.6	±227.6
	250	±138.4	±138.4	±156.7	±156.7	±198.3	±198.3	±181.7	±181.7	±227.6	±227.6
	> 250	Available on request. Contact information see inside back cover.									

① For utilization of the HIT element´s steel-load-capacity → see table on page 70

On-site reinforcement $A_{s,req}$

Balcony		⌀6 / 25 cm	⌀6 / 25 cm
Main slab	direct support	⌀6 / 25 cm	⌀6 / 25 cm
	indirect support	0.58 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm	0.74 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm

Load bearing capacity values according to EN 1992-1-1 (EC2) — Bar diameters ⌀8 mm, ⌀10 mm and ⌀12 mm

Shear capacity in both directions

short unit

80

Type / Element width	B = 0.33 m	ZD-0202-...-08		ZD-0302-...-08		ZD-0302-...-10		ZD-0302-...-12	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* / ≥C25/30							
Design values v_{Rd} [kN/m] for slab thickness [mm]	**160**	*±114.1*	±114.1	*±123.5*①	±154.3①	–	–	–	–
	170	*±114.1*	±114.1	*±141.0*①	±167.3	*±141.0*①	±174.7①	–	–
	180	*±114.1*	±114.1	*±158.1*①	±167.3	*±158.1*①	±191.4①	*±158.1*①	±191.4①
	190	*±114.1*	±114.1	*±167.0*	±167.3	*±175.2*①	±208.0①	*±175.2*①	±208.0①
	200	*±114.1*	±114.1	*±167.0*	±167.3	*±189.4*①	±224.7①	*±189.4*①	±224.7①
	210	*±114.1*	±114.1	*±167.0*	±167.3	*±202.7*①	±235.3	*±202.7*①	±241.4①
	220	*±114.1*	±114.1	*±167.0*	±167.3	*±216.0*①	±235.3	*±216.0*①	±258.0①
	230	*±114.1*	±114.1	*±167.0*	±167.3	*±229.4*①	±235.3	*±229.4*①	±274.7①
	240	*±114.1*	±114.1	*±167.0*	±167.3	*±235.3*	±235.3	*±242.7*①	±291.4①
	250	*±114.1*	±114.1	*±167.0*	±167.3	*±235.3*	±235.3	*±256.0*①	±308.0①
	> 250	Available on request. Contact information see inside back cover.							

① For utilization of the HIT element´s steel-load-capacity → see table on page 70

On-site reinforcement $A_{s,req}$

Balcony		⌀6/25 cm	
Main slab	direct support	⌀6/25 cm	
	indirect support	0.58 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6/25 cm	0.89 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6/25 cm

Load bearing capacity values according to EN 1992-1-1 (EC2) — Bar diameters ⌀6 mm, ⌀8 mm

Shear capacity in both directions

80

Type / Element width	B = 1.00 m	ZD 0400-...-06		ZD 0600-...-06		ZD 0800-...-06		ZD 0600-...-08	
	B = 0.50 m	ZD 0200-...-06		ZD 0300-...-06		ZD 0400-...-06		ZD 0300-...-08	
	B = 0.25 m	ZD 0100-...-06		–		ZD 0200-...-06		–	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* / ≥C25/30							
Design values v_{Rd} [kN/m] for slab thickness [mm]	160 – 250	*±31.6*	**±31.6**	*±47.4*	**±47.4**	*±63.2*	**±63.2**	*±79.8*	**±79.8**
	> 250	Available on request. Contact information see inside back cover.							

On-site reinforcement $A_{s,req}$

Balcony		⌀6/25 cm		⌀6/25 cm
Main slab	direct support	⌀6/20 cm		⌀6/25 cm
	indirect support	V_{Ed} / f_{yd} ≥ ⌀6/20 cm		V_{Ed} / f_{yd} ≥ ⌀6/25 cm

HIT-SP ZD with CSB

Load bearing capacity values according to EN 1992-1-1 (EC2) — **Bar diameters ⌀6 mm, ⌀8 mm, ⌀10 mm and ⌀12 mm**

Shear capacity in both directions

120

Type / Element width	B = 1.00 m	ZD-0304-...-06	ZD-0404-...-06	ZD-0504-...-06	ZD-0704-...-06	ZD-0804-...-06	ZD-0804-...-08
	B = 0.50 m	–	ZD-0202-...-06	–	–	–	ZD-0402-...-08
Lower concrete cover [mm]	30	Concrete strength: C20/25 / ≥C25/30					
Design values v_{Rd} [kN/m] for slab thickness [mm]	160 – 250	*±27.6* ±27.6	*±36.6* ±36.6	*±45.5* ±45.5	*±62.8* ±62.9	*±71.2* ±71.4	*±115.7* ±117.1
	> 250	Available on request. Contact information see inside back cover.					

On-site reinforcement $A_{s,req}$

Balcony		⌀6 / 25 cm	⌀6 / 25 cm
Main slab	direct support	⌀6 / 20 cm	⌀6 / 25 cm
	indirect support	0.33 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 20 cm	0.49 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 20 cm

Shear capacity in both directions

120

Type / Element width	B = 1.00 m	ZD 0604-...-10		ZD 0804-...-10		ZD 0806-...-10		ZD 0606-...-12		ZD 0806-...-12	
	B = 0.50 m	ZD 0302-...-10		ZD 0402-...-10		–		–		–	
Lower concrete cover [mm]	30	Concrete strength: C20/25 / ≥C25/30									
Design values v_{Rd} [kN/m] for slab thickness [mm]	170	*±131.0*①	±134.4	*±131.0*①	±158.7①	–	–	–	–	–	–
	180	*±132.7*	±134.4	*±145.4*①	±168.6	*±137.2*①	±170.7①	*±153.4*①	±190.6①	*±153.4*①	±190.6①
	190	*±132.7*	±134.4	*±159.2*①	±168.6	*±153.4*①	±182.1	*±169.2*①	±195.0	*±169.2*①	±208.0①
	200	*±132.7*	±134.4	*±168.4*	±168.6	*±169.2*①	±182.1	*±184.5*①	±195.0	*±184.5*①	±224.7①
	210	*±132.7*	±134.4	*±168.4*	±168.6	*±179.8*	±182.1	*±192.2*	±195.0	*±199.4*①	±241.3①
	220	*±132.7*	±134.4	*±168.4*	±168.6	*±179.8*	±182.1	*±192.2*	±195.0	*±213.9*①	±244.7
	230	*±132.7*	±134.4	*±168.4*	±168.6	*±179.8*	±182.1	*±192.2*	±195.0	*±227.9*①	±244.7
	240	*±132.7*	±134.4	*±168.4*	±168.6	*±179.8*	±182.1	*±192.2*	±195.0	*±241.5*①	±244.7
	250	*±132.7*	±134.4	*±168.4*	±168.6	*±179.8*	±182.1	*±192.2*	±195.0	*±244.4*	±244.7
	> 250	Available on request. Contact information see inside back cover.									

① For utilization of the HIT element´s steel-load-capacity → see table on page 70

On-site reinforcement $A_{s,req}$

Balcony		⌀6 / 25 cm	
Main slab	direct support	⌀6 / 25 cm	
	indirect support	0.61 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm	0.90 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm

All required verifications for load in the insulation including verifying the concrete compression strut have already been considered. Connecting elements must be verified by the planner.

HIT-SP ZD

Load bearing capacity values according to EN 1992-1-1 (EC2) — Bar diameters ⌀8 mm, ⌀10 mm and ⌀12 mm

Shear capacity in both directions

short unit

120

Type / Element width	B = 0.33 m	ZD-0202-...-08		ZD-0302-...-08		ZD-0302-...-10		ZD-0302-...-12	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* / ≥C25/30							
Design values v_{Rd} [kN/m] for slab thickness [mm]	**160**	*±92.1*	±92.3	*±120.6*①	±135.2	–	–	–	–
	170	*±92.1*	±92.3	*±134.2*	±135.2	±137.2①	±170.7①	–	–
	180	*±92.1*	±92.3	*±134.2*	±135.2	*±153.4*①	±190.6①	*±153.4*①	±190.6①
	190	*±92.1*	±92.3	*±134.2*	±135.2	*±169.2*①	±201.9	*±169.2*①	±208.0①
	200	*±92.1*	±92.3	*±134.2*	±135.2	*±184.5*①	±201.9	*±184.5*①	±224.7①
	210	*±92.1*	±92.3	*±134.2*	±135.2	*±199.3*	±201.9	*±199.4*①	±241.4①
	220	*±92.1*	±92.3	*±134.2*	±135.2	*±199.3*	±201.9	*±213.9*①	±258.0①
	230	*±92.1*	±92.3	*±134.2*	±135.2	*±199.3*	±201.9	*±227.9*①	±269.5
	240	*±92.1*	±92.3	*±134.2*	±135.2	*±199.3*	±201.9	*±241.6*①	±269.5
	250	*±92.1*	±92.3	*±134.2*	±135.2	*±199.3*	±201.9	*±254.7*①	±269.5
	> 250	Available on request. Contact information see inside back cover.							

① For utilization of the HIT element´s steel-load-capacity → see table on page 70

On-site reinforcement $A_{s,req}$

Balcony		⌀6 / 25 cm	
Main slab	direct support	⌀6 / 25 cm	
	indirect support	0.62 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm	0.94 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm

Load bearing capacity values according to EN 1992-1-1 (EC2) — Bar diameters ⌀6 mm, ⌀8 mm

Shear capacity in both directions

120

Type / Element width	B = 1.00 m	ZD-0400-...-06		ZD-0600-...-06		ZD-0800-...-06		ZD-0600-...-08		ZD-0800-...-08	
	B = 0.50 m	ZD-0200-...-06		ZD-0300-...-06		ZD-0400-...-06		ZD-0300-...-08		ZD-0400-...-08	
	B = 0.25 m	ZD-0100-...-06		–		ZD-0200-...-06		–		ZD-0200-...-08	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* / ≥C25/30									
Design values v_{Rd} [kN/m] for slab thickness [mm]	160 – 250	*±26.1*	**±26.1**	*±39.1*	**±39.1**	*±52.1*	**±52.1**	*±65.6*	**±65.6**	*±87.4*	**±87.4**
	> 250	Available on request. Contact information see inside back cover.									

On-site reinforcement $A_{s,req}$

Balcony		⌀6 / 25 cm	
Main slab	direct support	⌀6 / 20 cm	⌀6 / 25 cm
	indirect support	V_{Ed} / f_{yd} ≥ ⌀6 / 20 cm	V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm

HIT-HP ZD, HIT-SP ZD

Load bearing capacity values according to EN 1992-1-1 (EC2)

Maximum load capacity in both directions — **Concrete strength:** ≥C20/25

with CSB ø8 ①	B = 1.00 m	**ZD-0804-…-08**		–
	B = 0.50 m	**ZD-0402-…-08**		–
	B = 0.33 m	–		**ZD-0302-…-08**
Design values $v_{Rd,\ Element}$ [kN/m] for slab thickness [mm]	160–250	±138.4		±167.0
	260–350	±174.0		±198.0

with CSB ø10 ①	B = 1.00 m	**ZD-0604-…-10**	**ZD-0804-…-10**	–
	B = 0.50 m	**ZD-0302-…-10**	**ZD-0402-…-10**	–
	B = 0.33 m	–	–	**ZD-0302-…-10**
Design values $v_{Rd,\ Element}$ [kN/m] for slab thickness [mm]	170–250	±156.7	±198.3	±235.3
	260–350	±199.8	±255.8	±300.0

with CSB ø12 ①	B = 1.00 m	**ZD-0504-…-12**	**ZD-0606-…-12**	–
	B = 0.50 m	–	–	–
	B = 0.33 m	–	–	**ZD-0302-…-10**
Design values v_{Rd} [kN/m] for slab thickness [mm]	180–250	±181.7	±227.6	±317.7
	260–350	±205.9	±256.6	±361.3

① Bar diameter in [mm]

Maximum load capacity in both directions — **Concrete strength:** *C20/25* / ≥C25/30

with CSB ø8 ①	B = 1.00 m	–						
	B = 0.50 m	–						
	B = 0.33 m	**ZD-0302-…-08**						
Design values $v_{Rd,\ Element}$ [kN/m] for slab thickness [mm]	170–250	*±134.2*	±135.2					
	260–350	*±170.5*	±170.6					

with CSB ø10 ①	B = 1.00 m	**ZD-0604-…-10**		**ZD-0804-…-10**		**ZD-0806-…-10**		–
	B = 0.50 m	**ZD-0302-…-10**		**ZD-0402-…-10**		–		–
	B = 0.33 m	–		–		–		**ZD-0302-…-10**
Design values $v_{Rd,\ Element}$ [kN/m] for slab thickness [mm]	170–250	*±132.7*	±134.4	*±168.4*	±168.6	*±179.8*	±182.1	*±199.3*	±201.9
	260–350	*±172.7*	±173.7	*±224.6*	±225.3	*±232.2*	±233.0	*±259.4*	±260.6

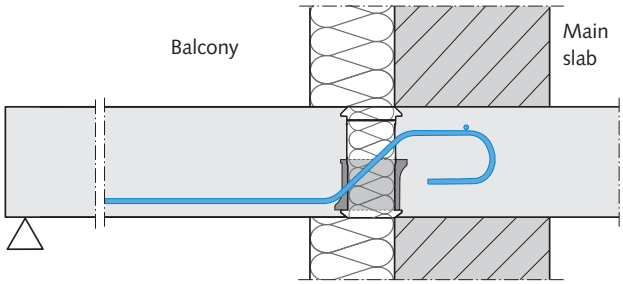
with CSB ø12 ①	B = 1.00 m	**ZD-0606-…-12**		**ZD-0806-…-12**		–	
	B = 0.33 m	–		–		**ZD-0302-…-12**	
Design values $v_{Rd,\ Element}$ [kN/m] for slab thickness [mm]	180–250	*±192.2*	±195.0	*±244.4*	±244.7	*±268.5*	±269.5
	260–350	*±222.8*	±224.7	*±287.1*	±287.5	*±317.7*	±317.7

① Bar diameter in [mm]

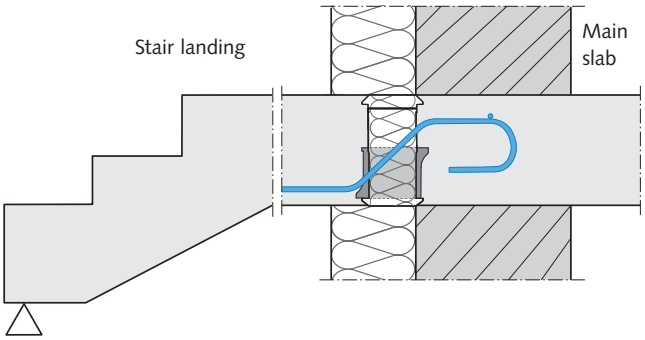
All necessary verifications (including concrete compression strut verification) have already been considered in the tables showing load bearing capacity values on pages 66 to 69.
For utilization of maximum load bearing capacities of some elements the load-capacity of these elements can be considered, if the appropriate concrete strength is selected or different geometrical boundary conditions are present.
These element load-capacities $v_{Rd,\ Element}$ are listed on this page.
The concrete compression strut must be verified by the planner separately.

Application examples in the cross-section of a wall

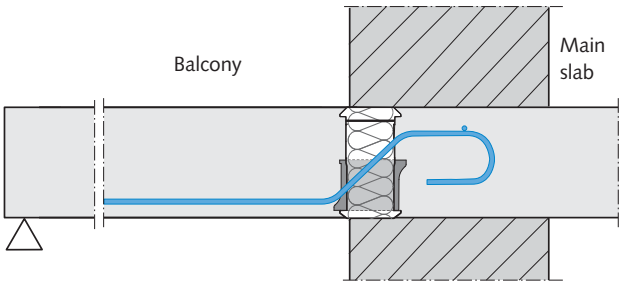
Installation diagram: Masonry cladded with ETICS (external thermal insulation composite system)



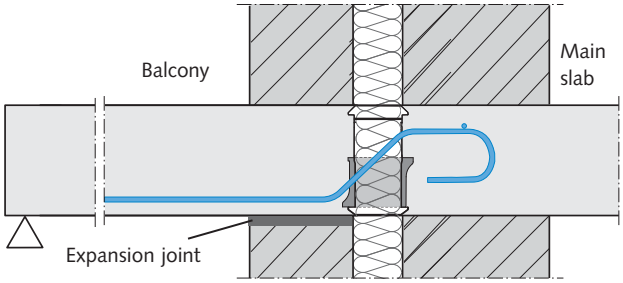
Installation diagram: Stair landing in an entrance area



Installation diagram: Single-leaf masonry with balcony at main slab level

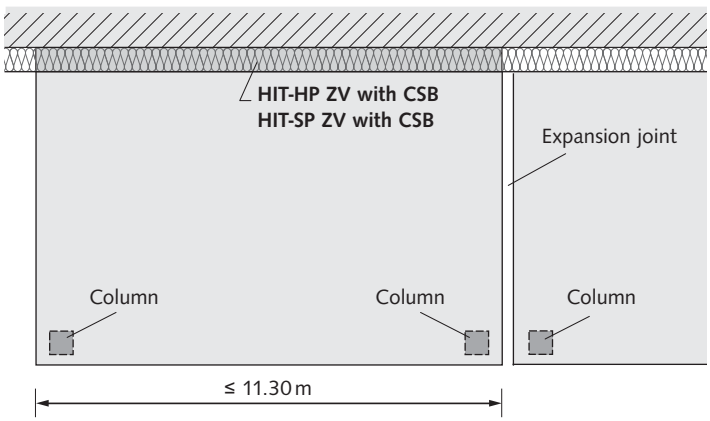


Installation diagram: Double-leaf masonry with balcony at main slab level

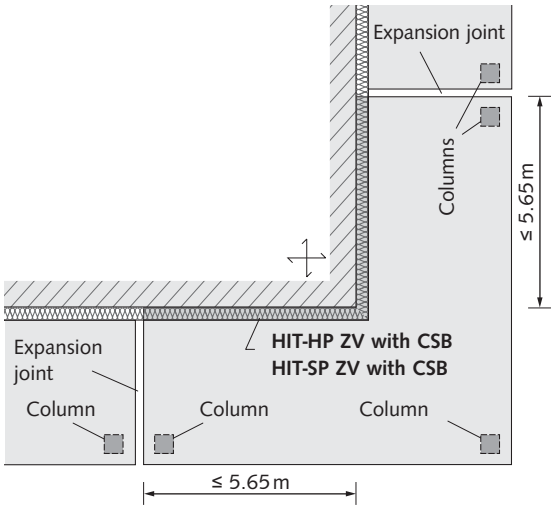


Application examples / Top view of joint spacings for HIT-HP ZV and HIT-SP ZV elements

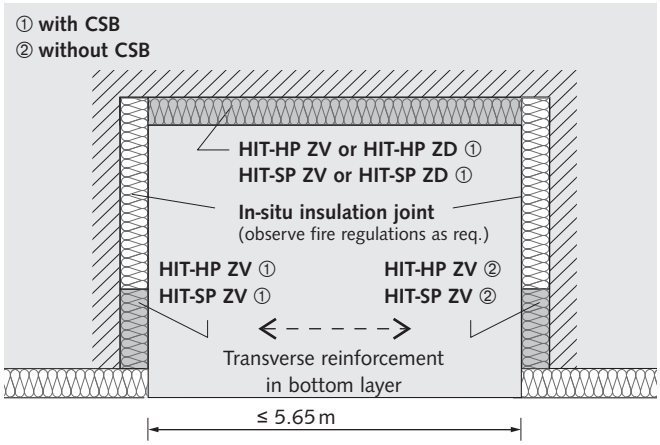
Application 1: Expansion joint location for straight balcony connection



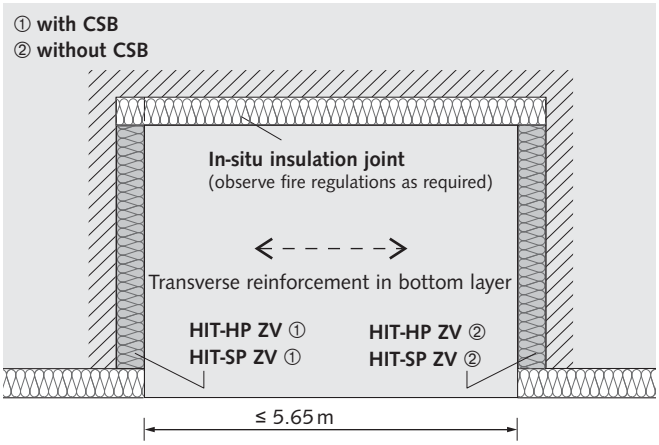
Application 2: Expansion joint location for cantilevered corner balconies



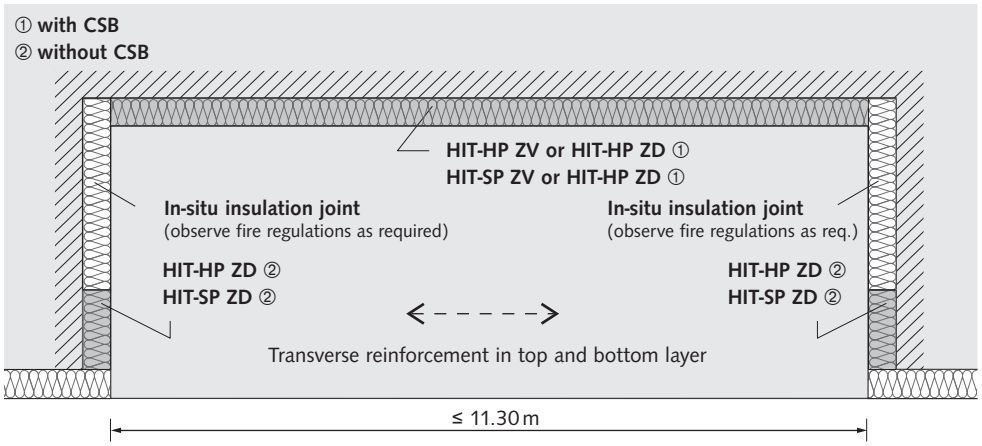
Application 3: Expansion joint location for three-side supported loggia (with CSB on the left or right)



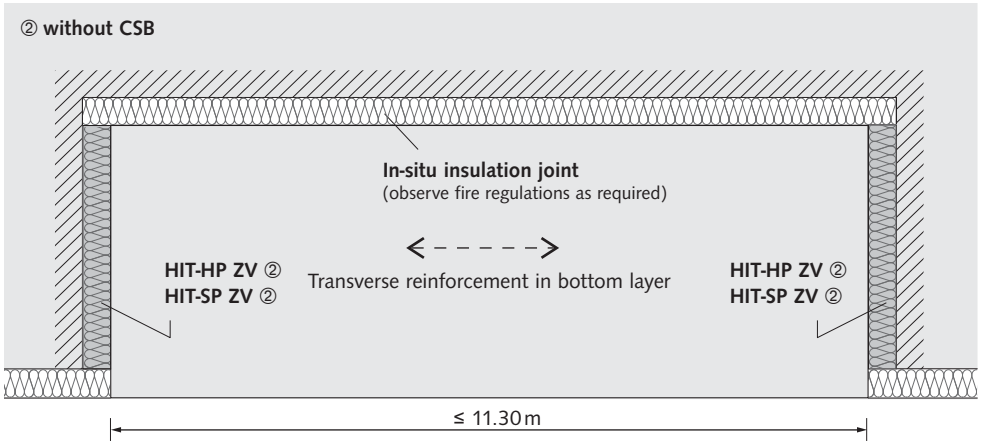
Anwendung 4: Expansion joint location for two-side supported loggia (with CSB on the left or right)



Application 6: Joint spacings three-side supported loggia (both sides without CSB)

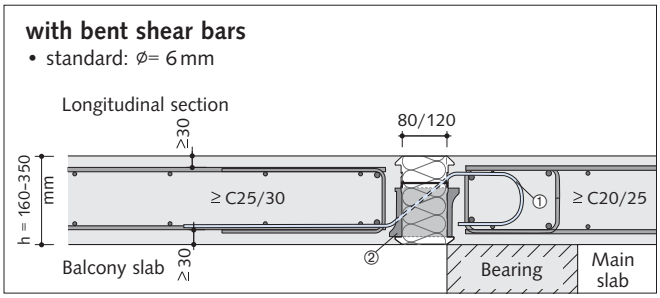


Application 6: Joint spacings two-side supported loggia (both sides without CSB)

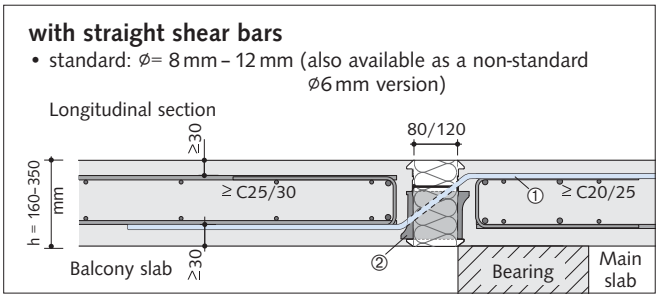


On-site reinforcement

with bent shear bars
- standard: ø= 6 mm



with straight shear bars
- standard: ø= 8 mm – 12 mm (also available as a non-standard ø6 mm version)



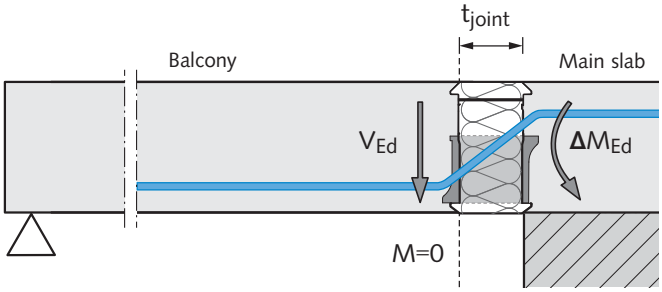
Dimensions in [mm]

① Shear bar (for ø6 mm with load-bearing cross bar)
② Compression shear bearing (CSB)
③ Top connecting reinforcement, steel bars or mesh
④ Bottom connecting reinforcement, steel bars or mesh
⑤ U-bar → $A_{s,req}$ see pages 66 to 69
⑥ Transverse tensile reinforcement ø8
⑦ Edge rebar stirrups (min. ø6/20)

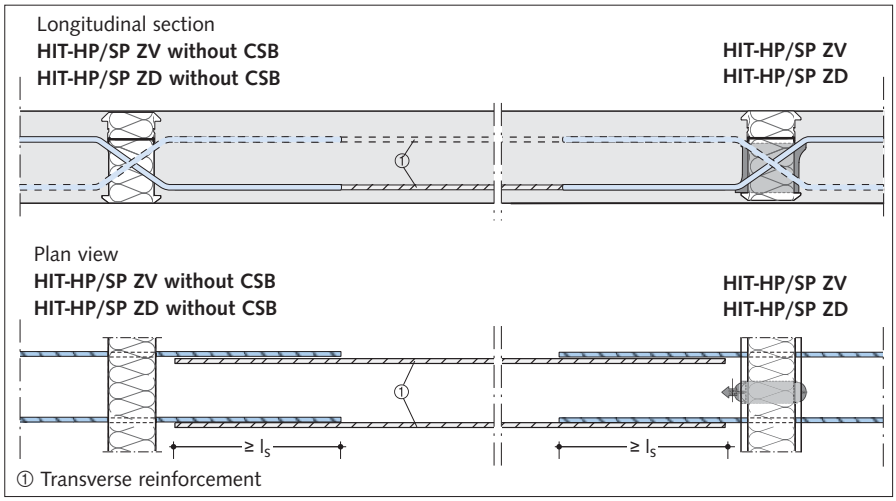
Moments from eccentric loads

Moments resulting from an eccentric load must be considered when calculating for **HIT-HP/SP ZV and ZD with CSB**.
The following applies:

$$\Delta M_{Ed} = V_{Ed} \cdot t_{joint}$$
with: t_{joint} = 0.08 m (HIT-HP ZV/ZD)
t_{joint} = 0.12 m (HIT-SP ZV/ZD)



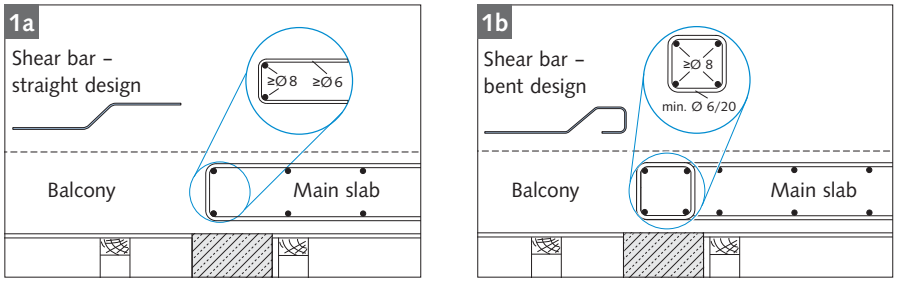
On-site transverse reinforcement



① Transverse reinforcement

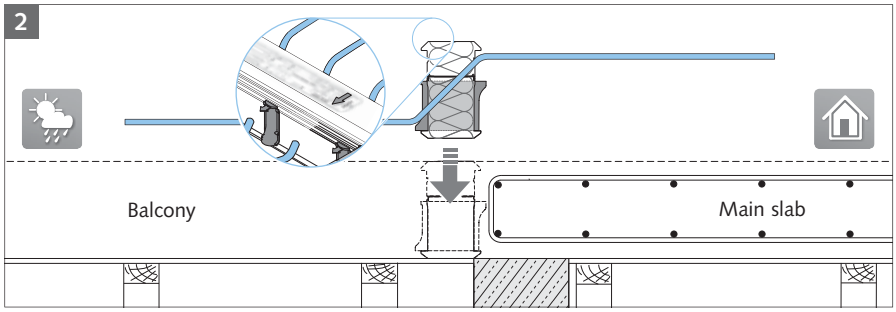
Transverse reinforcement
When placing the transverse reinforcement in the balcony slab, each shear bar in the HIT element (HP/SP ZV or ZD) must over-lap with an on-site reinforcement bar of the same diameter.
The on-site bar must extend to the opposite HIT element where it must also over-lap with the shear bars.

Installation diagram

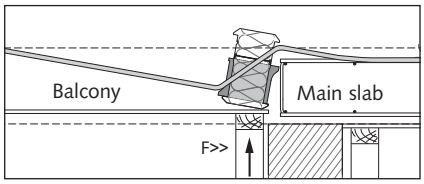


1 Installation of on-site reinforcement for floor slab

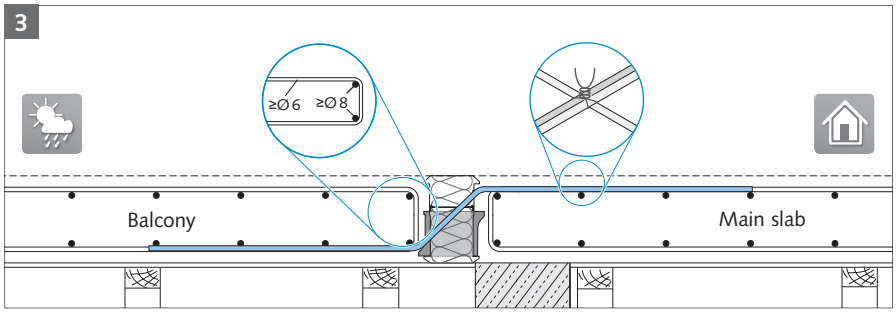
On-site reinforcement as specified by the structural engineer.



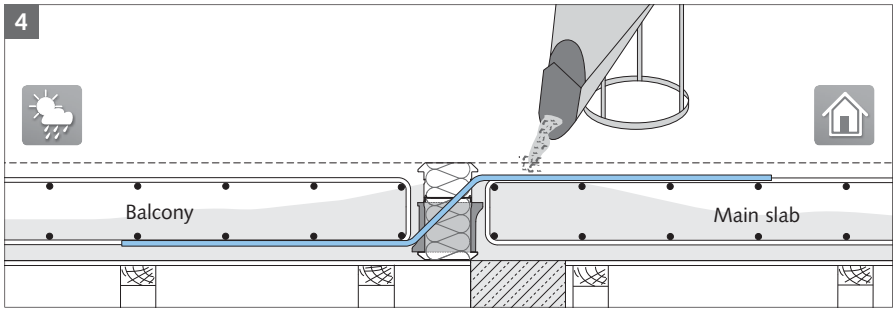
2 Installation of the HIT elements from above
Check that the red arrows on the HIT element and also on the CSB are pointing towards the balcony.



Ensure that the formwork is at the correct height!

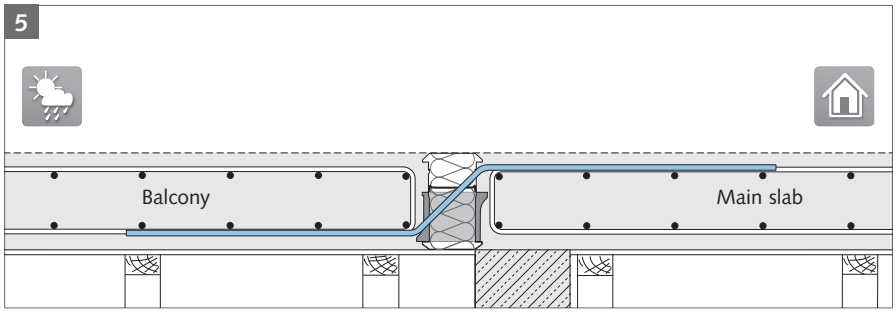


3 Installation of balcony slab on-site reinforcement
Fixing of the shear bars to on-site reinforcement using tying wire.



4 Pouring the concrete

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



5 Fresh-poured concreted balcony slab on supporting structure

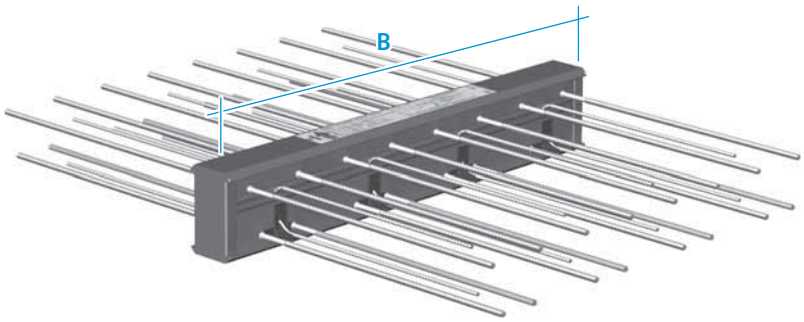
An installation diagram for the types **HIT-HP/SP ZD** can be found at our website www.halfen.com.

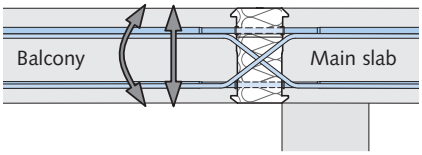
4

- For balcony slabs incorporated within the main slab
- Transfers positive and negative moments and shear forces

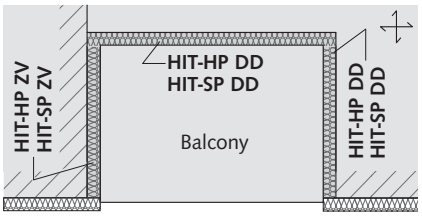
HIT-HP DD – High Performance with insulation thickness 80 mm

type-tested



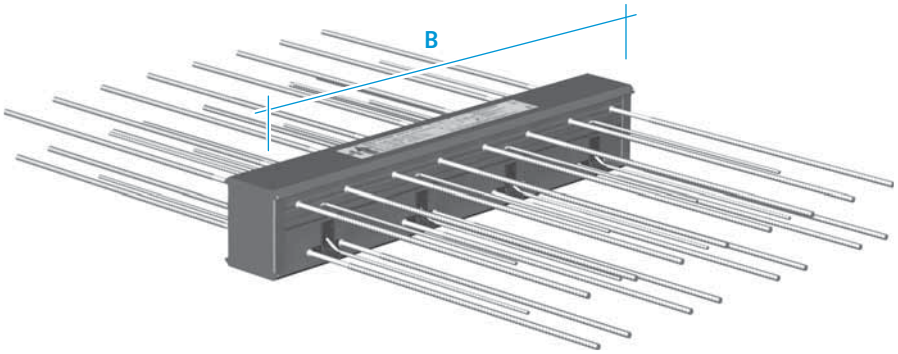


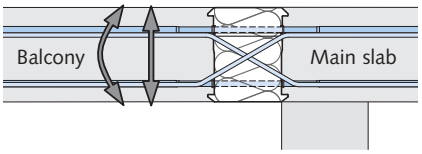
Available width
B = 1.00 m / 0.50 m / 0.25 m



Application example

HIT-SP DD – Superior Performance with insulation thickness 120 mm





Available width
B = 1.00 m / 0.50 m / 0.25 m

Load range

All types of shear bars are optionally available with diameters of 6 mm, 8 mm, 10 mm or 12 mm.

Following combinations of shear bars (SB) and tension bars (TB) are possible:

Possible combinations of structural elements

Element width B = 25 cm		Number of tension-/ compression bars n_{TB}	
		1	2
Number of shear bars n_{SB}	1	●	●

Element width B = 50 cm		Number of tension-/ compression bars n_{TB}				
		2	3	4	5	6
Number of shear bars n_{SB}	2	●	●	●		
	3	●	●	●	●	●

Element width B = 100 cm		Number of tension-/ compression bars n_{TB}							
		4	5	6	7	8	10	12	14
Number of shear bars n_{SB}	4	●		●		●			
	6	●	●	●	●	●	●	●	
	7		●		●		●	●	●

Values for the load bearing capacities for the elements highlighted in blue → see pages 77 – 81. ● = HP and SP

The complete type-tested load class range for concrete grades C20/25 and ≥ C25/30 can be downloaded at www.halfen.com.

Basic types – Ordering example

HIT-HP DD -10 07- 18 - 100 - 35 - 06
HIT-HP DD -xx yy - hh - bbb - cc - dd

- Type (HP/SP)
- Load type
- No. of tension-/ compression bars n_{TB}
- No. of shear bearings n_{SB}
- Element height h [cm]
- Element width B [cm]
- Upper concrete cover [mm]
- Shear bars diameter $\varnothing_{SB}$ [mm]

Customized designs
For detailed information on the feasibility of your custom designed HALFEN HIT Insulated connection please contact us.

For contact information:
→ see inside back cover

Possible slab thickness h

Concrete cover (bottom): 30 mm / Concrete cover (top): 30, 35 mm				
Diameter shear bars [mm]	06	08	10	12
possible slab thickness h [cm]	16 – 28 (35)	16 – 28 (35)	17 – 28 (35)	18 – 28 (35)
Concrete cover (bottom): 30 mm / Concrete cover (top): 50 mm				
Diameter shear bars [mm]	06	08	10	12
possible slab thickness h [cm]	18 – 28 (35)	18 – 28 (35)	19 – 28 (35)	20 – 28 (35)

Example for type determination: HIT-HP DD, tension-/compression bars

Number of tension-/compression bars xx				05		07		10		12		14	
Concrete cover [mm]	30	35	50	Concrete strength: C20/25 / ≥ C25/30:									
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		±20.4	±20.4	±28.6	±28.6	±40.8	±40.8	±49.0	±49.0	±55.5	±57.2
	160		180	±21.6	±21.6	±30.3	±30.3	±43.3	±43.3	±52.0	±52.0	±58.5	±60.6
		170		±22.9	±22.9	±32.0	±32.0	±45.8	±45.8	±54.6	±54.9	±61.5	±64.1
	170		190	±24.1	±24.1	±33.8	±33.8	±48.2	±48.2	±57.2	±57.9	±64.5	±67.5
		180		±25.3	±25.3	±35.5	±35.5	±50.7	±50.7	±59.8	±60.8	±67.5	±70.9

Conditions

Slab thickness:	18 cm	Bending moment:	m_{Rd} ≥ 50.7 kNm/m	Number of tension-/compression bars (xx):	10
Concrete strength:	C20/25	Shear force*:	v_{Rd} ≥ 55.3 kN/m	Number of shear bars (yy)*:	07
Concrete cover:	35 mm				

Determined type designation: HIT HP-DD-1007*-18-100-35-06

*Determining the number of shear bars HIT-HP DD: see table on page 78

Load bearing capacity values according to EN 1992-1-1 (EC2)

Moment bearing capacity in both directions

Number of tension-/compression bars xx				05		07		10		12		14	
Concrete cover [mm]	30	35	50	Concrete strength: C20/25 / ≥ C25/30:									
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		±20.4	±20.4	±28.6	±28.6	±40.8	±40.8	±49.0	±49.0	±55.5	±57.2
	160		180	±21.6	±21.6	±30.3	±30.3	±43.3	±43.3	±52.0	±52.0	±58.5	±60.6
		170		±22.9	±22.9	±32.0	±32.0	±45.8	±45.8	±54.6	±54.9	±61.5	±64.1
	170		190	±24.1	±24.1	±33.8	±33.8	±48.2	±48.2	±57.2	±57.9	±64.5	±67.5
		180		±25.3	±25.3	±35.5	±35.5	±50.7	±50.7	±59.8	±60.8	±67.5	±70.9
	180		200	±26.6	±26.6	±37.2	±37.2	±53.1	±53.1	±62.3	±63.8	±70.5	±74.4
		190		±27.8	±27.8	±38.9	±38.9	±55.6	±55.6	±64.9	±66.7	±73.5	±77.8
	190		210	±29.0	±29.0	±40.6	±40.6	±57.8	±58.1	±67.5	±69.7	±76.5	±81.3
		200		±30.3	±30.3	±42.4	±42.4	±60.0	±60.5	±70.0	±72.6	±79.4	±84.7
	200		220	±31.5	±31.5	±44.1	±44.1	±62.1	±63.0	±72.6	±75.6	±82.4	±88.2
		210		±32.7	±32.7	±45.8	±45.8	±64.3	±65.4	±75.2	±78.5	±85.4	±91.6
	210		230	±33.9	±33.9	±47.5	±47.5	±66.4	±67.9	±77.7	±81.5	±88.4	±95.1
		220		±35.2	±35.2	±49.2	±49.2	±68.5	±70.4	±80.3	±84.4	±91.4	±98.5
	220		240	±36.4	±36.4	±51.0	±51.0	±70.7	±72.8	±82.9	±87.4	±94.4	±101.9
		230		±37.6	±37.6	±52.7	±52.7	±72.8	±75.3	±85.5	±90.3	±97.4	±105.4
	230		250	±38.9	±38.9	±54.4	±54.4	±75.0	±77.7	±88.0	±93.3	±100.4	±108.8
		240		±40.1	±40.1	±56.1	±56.1	±77.1	±80.2	±90.6	±96.2	±103.4	±112.3
	240		260	±41.3	±41.3	±57.9	±57.9	±79.2	±82.7	±93.2	±99.2	±106.4	±115.7
		250		±42.6	±42.6	±59.6	±59.6	±81.4	±85.1	±95.7	±102.1	±109.4	±119.2
	250		270	±43.8	±43.8	±61.3	±61.3	±83.5	±87.6	±98.3	±105.1	±112.4	±122.6
	> 250			Available on request. Contact information see inside back cover.									

Load bearing capacity values according to EN 1992-1-1 (EC2)

Shear capacity in both directions

Concrete strength: *C20/25* / ≥C25/30

80

Number of shear bars yy				06		07		06		07	
Bar diameter dd				⌀6 mm				⌀8 mm			
Concrete cover [mm]	30	35	50								
Design values v_{Rd} [kN/m] for slab thickness [mm]	160–190	160–190	180–210	±47.4	±47.4	±55.3	±55.3	±79.9	±79.9	±83.6	±93.2
	200–230	200–230	220–250	±52.2	±52.2	±60.9	±60.9	±92.8	±92.8	±108.2	±108.2
	240–280	240–280	260–280	±60.5	±60.5	±70.5	±70.5	±107.5	±107.5	±125.4	±125.4

Number of shear bars yy				06		07		06		07	
Bar diameter dd				⌀10 mm				⌀12 mm			
Concrete cover [mm]	30	35	50								
Design values v_{Rd} [kN/m] for slab thickness [mm]	160	160	180	–	–	–	–	–	–	–	–
		170		± 97.8①	±122.2①	± 97.8①	±122.2①	–	–	–	–
	170		190	±104.8①	±124.8	±104.8①	±131.0①	–	–	–	–
		180		±111.9①	±124.8	±111.9①	±139.9①	±111.9①	±139.9①	±111.9①	±139.9①
	180		200	±119.0①	±124.8	±119.0①	±145.6	±119.0①	±148.8①	±119.0①	±148.8①
		190		±124.8	±124.8	±126.1①	±145.6	±126.1①	±157.6①	±126.1①	±157.6①
	190		210	±124.8	±124.8	±133.2①	±145.6	±133.2①	±166.5①	±133.2①	±166.5①
		200		±124.8	±124.8	±140.3①	±145.6	±140.3①	±175.3①	±140.3①	±175.3①
	200		220	±124.8	±124.8	±145.6	±145.6	±147.3①	±179.7	±147.3①	±184.2①
		210		±144.9	±144.9	±154.4①	±169.1	±154.4①	±179.7	±154.4①	±193.0①
	210		230	±144.9	±144.9	±161.5①	±169.1	±161.5①	±179.7	±161.5①	±201.9①
		220		±144.9	±144.9	±168.6①	±169.1	±168.6①	±208.7	±168.6①	±210.7①
	220		240	±144.9	±144.9	±169.1	±169.1	±175.7①	±208.7	±175.7①	±219.6①
		230		±144.9	±144.9	±169.1	±169.1	±182.8①	±208.7	±182.8①	±228.4①
	230		250	±144.9	±144.9	±169.1	±169.1	±189.8①	±208.7	±189.8①	±237.3①
		240		±144.9	±144.9	±169.1	±169.1	±196.9①	±208.7	±196.9①	±243.5
	240		260	±144.9	±144.9	±169.1	±169.1	±204.0①	±208.7	±204.0①	±243.5
		250		±167.9	±167.9	±195.9	±195.9	±208.7	±208.7	±211.1①	±243.5
	250		270	±167.9	±167.9	±195.9	±195.9	±208.7	±208.7	±218.2①	±243.5
	> 250			Available on request. Contact information see inside back cover.							

① For utilization of the HIT element´s steel-load-capacity → see table on page 81

Shear capacity values including verification of slab load bearing capacity (concrete compression strut).

Most of the elements are also available in lengths of 25 or 50 cm. For further details on load bearing capacities please contact us.
→ see inside back cover for contact details

Example for type determination: HIT-SP DD, tension-/compression bars

Number of tension-/compression bars xx				05		07		10		12		14	
Concrete cover [mm]	30	35	50	Concrete strength: C20/25 / ≥ C25/30:									
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		±20.4	±20.4	±28.6	±28.6	±40.8	±40.8	±49.0	±49.0	±55.5	±57.2
	160		180	±21.6	±21.6	±30.3	±30.3	±43.3	±43.3	±52.0	±52.0	±58.5	±60.6
		170		±22.9	±22.9	±32.0	±32.0	±45.8	±45.8	±54.6	±54.9	±61.5	±64.1
	170		190	±24.1	±24.1	±33.8	±33.8	±48.2	±48.2	±57.2	±57.9	±64.5	±67.5
		180		±25.3	±25.3	±35.5	±35.5	±50.7	±50.7	±59.8	±60.8	±67.5	±70.9

Conditions

Slab thickness:	18 cm	Bending moment:	m_{Rd} ≥ 50.7 kNm/m	Number of tension-/compression bars (xx):	10
Concrete strength:	C25/30	Shear force*:	v_{Rd} ≥ 45.6 kNm/m	Number of shear bars (yy)*:	07
Concrete cover:	35 mm				

Determined type designation: HIT SP-DD-1007-18-100-35-06

*Determining the number of shear bars HIT-SP DD: see table on page 80

Load bearing capacity values according to EN 1992-1-1 (EC2)

Moment bearing capacity in both directions

120

Number of tension-/compression bars xx				05		07		10		12		14	
Concrete cover [mm]	30	35	50	Concrete strength: C20/25 / ≥ C25/30:									
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		±20.4	±20.4	±28.6	±28.6	±40.8	±40.8	±49.0	±49.0	±55.5	±57.2
	160		180	±21.6	±21.6	±30.3	±30.3	±43.3	±43.3	±52.0	±52.0	±58.5	±60.6
		170		±22.9	±22.9	±32.0	±32.0	±45.8	±45.8	±54.6	±54.9	±61.5	±64.1
	170		190	±24.1	±24.1	±33.8	±33.8	±48.2	±48.2	±57.2	±57.9	±64.5	±67.5
		180		±25.3	±25.3	±35.5	±35.5	±50.7	±50.7	±59.8	±60.8	±67.5	±70.9
	180		200	±26.6	±26.6	±37.2	±37.2	±53.1	±53.1	±62.3	±63.8	±70.5	±74.4
		190		±27.8	±27.8	±38.9	±38.9	±55.6	±55.6	±64.9	±66.7	±73.5	±77.8
	190		210	±29.0	±29.0	±40.6	±40.6	±57.8	±58.1	±67.5	±69.7	±76.5	±81.3
		200		±30.3	±30.3	±42.4	±42.4	±60.0	±60.5	±70.0	±72.6	±79.4	±84.7
	200		220	±31.5	±31.5	±44.1	±44.1	±62.1	±63.0	±72.6	±75.6	±82.4	±88.2
		210		±32.7	±32.7	±45.8	±45.8	±64.3	±65.4	±75.2	±78.5	±85.4	±91.6
	210		230	±33.9	±33.9	±47.5	±47.5	±66.4	±67.9	±77.7	±81.5	±88.4	±95.1
		220		±35.2	±35.2	±49.2	±49.2	±68.5	±70.4	±80.3	±84.4	±91.4	±98.5
	220		240	±36.4	±36.4	±51.0	±51.0	±70.7	±72.8	±82.9	±87.4	±94.4	±101.9
		230		±37.6	±37.6	±52.7	±52.7	±72.8	±75.3	±85.5	±90.3	±97.4	±105.4
	230		250	±38.9	±38.9	±54.4	±54.4	±75.0	±77.7	±88.0	±93.3	±100.4	±108.8
		240		±40.1	±40.1	±56.1	±56.1	±77.1	±80.2	±90.6	±96.2	±103.4	±112.3
	240		260	±41.3	±41.3	±57.9	±57.9	±79.2	±82.7	±93.2	±99.2	±106.4	±115.7
		250		±42.6	±42.6	±59.6	±59.6	±81.4	±85.1	±95.7	±102.1	±109.4	±119.2
	250		270	±43.8	±43.8	±61.3	±61.3	±83.5	±87.6	±98.3	±105.1	±112.4	±122.6
	> 250			Available on request. Contact information see inside back cover.									

Load bearing capacity values according to EN 1992-1-1 (EC2)

Shear capacity in both directions

Concrete strength: C20/25 / ≥C25/30 **120**

Number of shear bars yy				06		07		06		07	
Bar diameter dd				⌀6 mm				⌀8 mm			
Concrete cover [mm]	30	35	50								
Design values v_{Rd} [kN/m] for slab thickness [mm]	160–190	160–190	180–210	±39.1	±39.1	±45.6	±45.6	±65.5	±65.5	±76.5	±76.5
	200–210	200–210	220–230	±44.9	±44.9	±52.4	±52.4	±65.5	±65.5	±76.5	±76.5
	220–230	220–230	240–250	±44.9	±44.9	±52.4	±52.4	±79.9	±79.9	±93.2	±93.2
	240–280	240–280	260–280	±52.2	±52.2	±60.9	±60.9	±92.8	±92.8	±108.2	±108.2

Number of shear bars yy				06		07		06		07	
Bar diameter dd				⌀10 mm				⌀12 mm			
Concrete cover [mm]	30	35	50								
Design values v_{Rd} [kN/m] for slab thickness [mm]		160		–	–	–	–	–	–	–	–
	160		180	-	–	–	–	–	–	–	–
		170		± 97.8①	±102.5	± 97.8①	±119.6	–	–	–	–
	170		190	±102.5	±102.5	±104.8①	±119.6	–	–	–	–
		180		±102.5	±102.5	±111.9①	±119.6	±111.9①	±139.9①	±111.9①	±139.9①
	180		200	±102.5	±102.5	±119.0①	±119.6	±119.0①	±147.6	±119.0①	±148.8①
		190		±102.5	±102.5	±119.6	±119.6	±126.1①	±147.6	±126.1①	±157.6①
	190		210	±102.5	±102.5	±119.6	±119.6	±133.2①	±147.6	±133.2①	±166.5①
		200		±102.5	±102.5	±119.6	±119.6	±140.3①	±147.6	±140.3①	±172.2
	200		220	±102.5	±102.5	±119.6	±119.6	±147.3①	±147.6	±147.3①	±172.2
		210		±102.5	±102.5	±119.6	±119.6	±147.6	±147.6	±154.4①	±172.2
	210		230	±102.5	±102.5	±119.6	±119.6	±147.6	±147.6	±161.5①	±172.2
		220		±124.8	±124.8	±145.6	±145.6	±168.6①	±179.7	±168.6①	±209.6
	220		240	±124.8	±124.8	±145.6	±145.6	±175.7①	±179.7	±175.7①	±209.6
		230		±124.8	±124.8	±145.6	±145.6	±179.7	±179.7	±182.8①	±209.6
	230		250	±124.8	±124.8	±145.6	±145.6	±179.7	±179.7	±189.8①	±209.6
		240		±124.8	±124.8	±145.6	±145.6	±179.7	±179.7	±196.9①	±209.6
	240		260	±124.8	±124.8	±145.6	±145.6	±179.7	±179.7	±204.0①	±209.6
	250–280	250–280	270–280	±144.9	±144.9	±169.1	±169.1	±179.7	±179.7	±209.6	±209.6

① For utilization of the HIT element´s steel-load-capacity → see table on page 81

Shear capacity values including verification of slab load bearing capacity (concrete compression strut).

Most of the elements are also available in lengths of 25 or 50 cm. For further details on load bearing capacities please contact us.
→ see inside back cover for contact details

Shear capacity as maximum capacity based on steel-load-capacity

Maximum load capacity HIT-HP DD

80

Number of shear bars yy				06	07	06	07
Bar diameter dd				ø10 mm		ø12 mm	
Concrete cover [mm]	30	35	50				
Design values $V_{Rd,Element}$ [kN/m] for slab thickness [mm]	160	160	180	–	–	–	–
	170	170	190	±124.8	±145.6	–	–
	180	180	200	±124.8	±145.6	±179.7	±209.6
	190	190	210	±124.8	±145.6	±179.7	±209.6
	200	200	220	±124.8	±145.6	±179.7	±209.6
	210	210	230	±144.9	±169.1	±179.7	±209.6
	220	220	240	±144.9	±169.1	±208.7	±243.5
	230	230	250	±144.9	±169.1	±208.7	±243.5
	240	240	260	±144.9	±169.1	±208.7	±243.5
	250	250	270	±167.9	±195.9	±208.7	±243.5
	260	260	280	±167.9	±195.9	±208.7	±243.5
	270	270		±167.9	±195.9	±208.7	±243.5
	280	280		±167.9	±195.9	±208.7	±243.5

Maximum load capacity HIT-SP DD

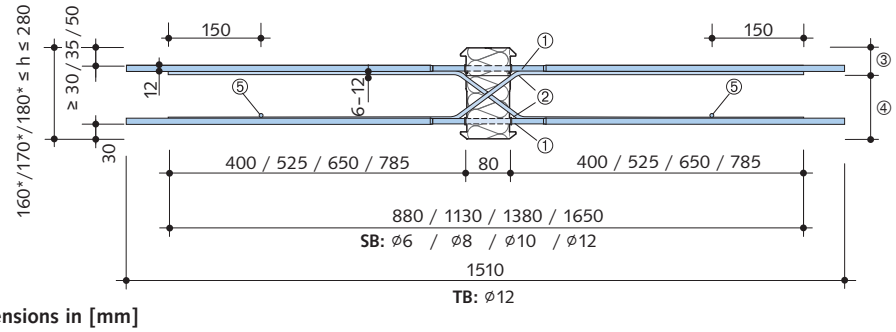
120

Number of shear bars yy				06	07	06	07
Bar diameter dd				ø10 mm		ø12 mm	
Concrete cover [mm]	30	35	50				
Design values $V_{Rd,Element}$ [kN/m] for slab thickness [mm]	160	160	180	–	–	–	–
	170	170	190	±102.5	±119.6	–	–
	180	180	200	±102.5	±119.6	±147.6	±172.2
	190	190	210	±102.5	±119.6	±147.6	±172.2
	200	200	220	±102.5	±119.6	±147.6	±172.2
	210	210	230	±102.5	±119.6	±147.6	±172.2
	220	220	240	±124.8	±145.6	±179.7	±209.6
	230	230	250	±124.8	±145.6	±179.7	±209.6
	240	240	260	±124.8	±145.6	±179.7	±209.6
	250	250	270	±144.9	±169.1	±179.7	±209.6
	260	260	280	±144.9	±169.1	±179.7	±209.6
	270	270		±144.9	±169.1	±179.7	±209.6
	280	280		±144.9	±169.1	±179.7	±209.6

All necessary verifications (including concrete compression strut verification) have already been considered in the tables showing load bearing capacity values on pages 78 and 80.
For utilization of maximum load bearing capacities of some elements the load-capacity of these elements can be considered, if the appropriate concrete strength is selected or different geometrical boundary conditions are present.
These element load-capacities $V_{Rd,\ Element}$ are listed on this page.
The concrete compression strut must be verified by the planner separately.

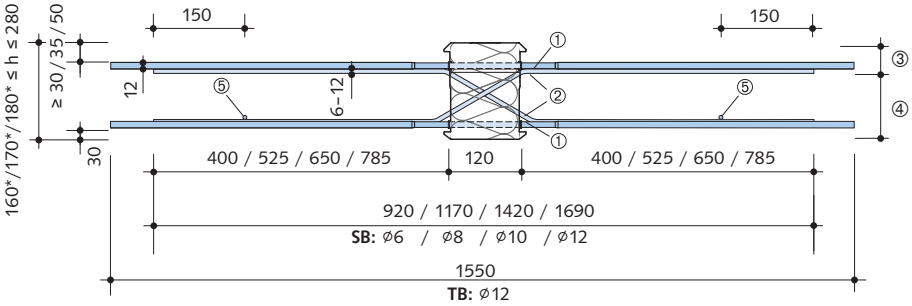
Cross sections

HIT-HP DD – High Performance



Dimensions in [mm]

HIT-SP DD – Superior Performance



Dimensions in [mm]

① Tension-/compression bar (ø 12 mm)
② Shear bars (ø 6 mm, ø 8 mm, ø 10 mm, ø 12 mm)
③ Tension bar box (TB-Box)
④ Shear bar box (SB-Box)
⑤ Transport bar (ø 6 mm) (structural)

* smallest available element height, depending on shear bar diameter: see table "Possible slab thickness h" (page 76)

On-site reinforcement: Bar diameters and pitch of stirrups depending on V_{Ed} [kN/m]

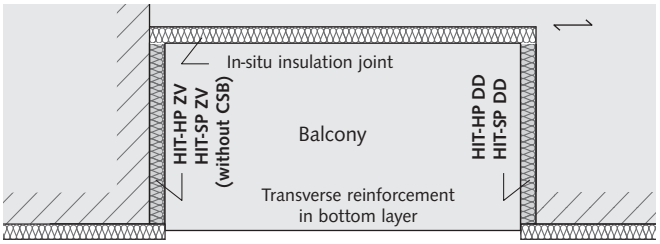
Pitch of stirrups s / Bar diameters [mm]	ø6	ø8	ø10
s ≤ 25 cm	49.9 kN/m	87.5 kN/m	137.0 kN/m
s ≤ 20 cm	61.5 kN/m	109.0 kN/m	171.0 kN/m
s ≤ 15 cm	82.0 kN/m	146.0 kN/m	228.0 kN/m
s ≤ 10 cm	123.0 kN/m	219.0 kN/m	342.0 kN/m

Vertical hanger reinforcement:

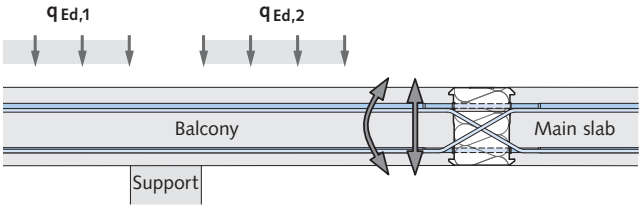
$$\min A_{s,req} = \frac{V_{Ed}}{f_{yd}}$$

Application examples

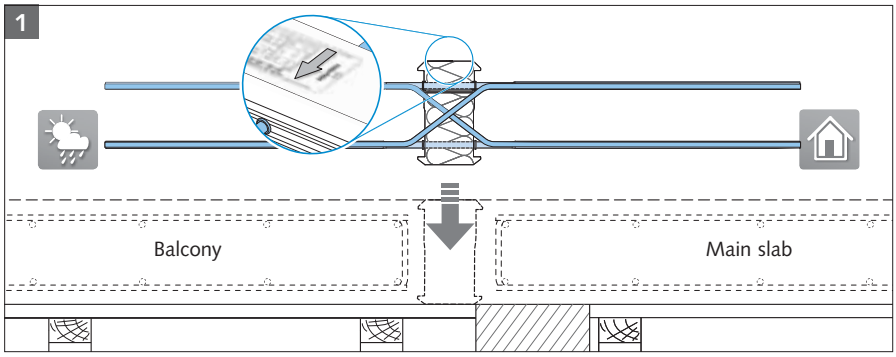
- **One-way slab**
  For balcony slabs incorporated within the main slab, e. g. a loggia. The insulated connection transfers positive moments, negative moments and shear forces.



- **Centrally supported cantilevered balcony**
  With variable load situations (see $q_{Ed,1}$ and $q_{Ed,2}$) positive and negative moments and shear forces in the balcony connection are to be expected.

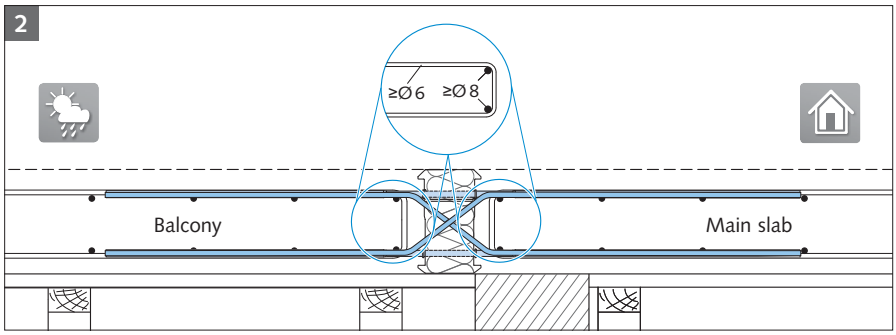


Installation diagram



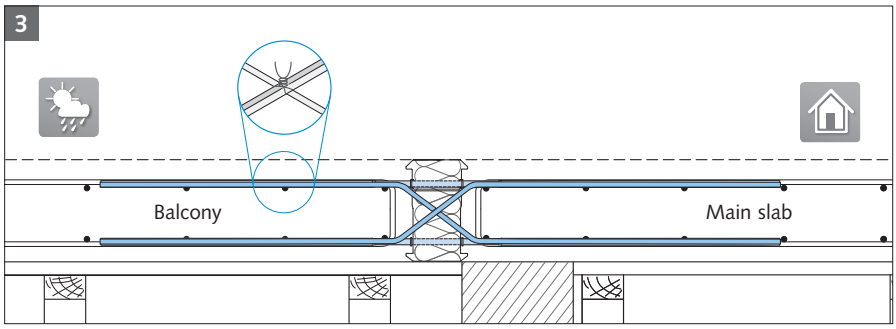
1 Positioning of the HIT element from above

Check that the red arrows on the HIT labels are pointing towards the balcony.

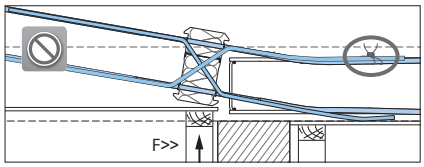


2 Installation on-site reinforcement

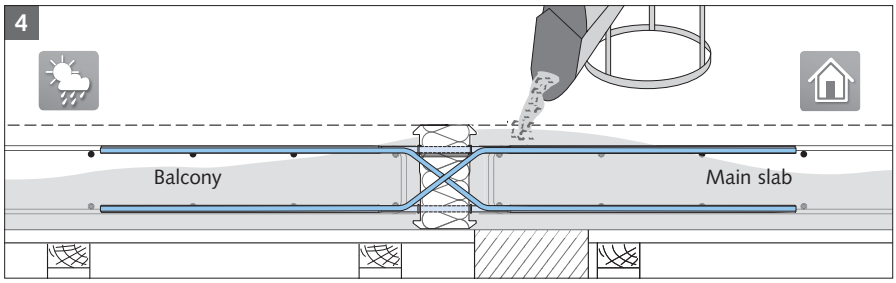
The on-site reinforcement must be placed as specified by the structural engineer.



3 Fixing the tension bars and the shear bars to on-site reinforcement using tying wire

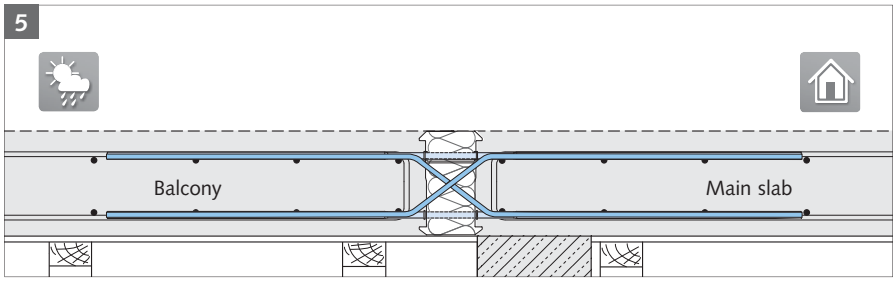


Ensure the formwork is correctly positioned!



4 Pour the concrete

To ensure the HIT elements are not displaced, pour and compact the concrete evenly. Ensure all HIT elements are securely positioned.



5 Freshly concreted balcony slab on supporting structure

HALFEN HIT INSULATED CONNECTION

Material Specification and Test Certificates

Material specification

Tension bars	Reinforcing stainless steel type B500 NR welded to reinforcing steel B500B or alternatively: welded stainless steel rod material no. W 1.4401, W 1.4404, W 1.4571 of strength class S 460 according to National Technical Approval no. Z-30.3-6 welded to B500B reinforcing steel according to DIN 488
Compression bearings	Stainless steel material no. W 1.4404, W 1.4362 according to National Technical Approval no. Z-30.3-6
Shear bars	Reinforcing stainless steel B500 NR (if required, welded to reinforcing steel B500B)
U-bars	B500B reinforcing steel
Transport bars	B500B reinforcing steel
Transport bars	WLG 035 expanded polystyrene foam
Fire boards (for F90 version)	Fibre cement board, Construction material class A1

Connecting components	
Concrete	General purpose concrete according to DIN 1045-2 / EN 206-1 with a raw density between 2000 kg/m³ and 2600 kg/m³ (light weight concrete is not permitted). Minimum concrete strength C20/25 and depending on exposure classes according to DIN 1045-1, table 3 / EN 1992-1-1/NA, table NA.E.1
On-site reinforcement	B500B reinforcing steel

Test certificates

Technical Approvals		
HALFEN HIT Insulated connection	DIBt Berlin, National Technical Approval no. Z-15.7-238 Connection for reinforced concrete slabs according to DIN 1045-1, EN 1992-1-1 and EN 1992-1-1/NA – including fire protection (Design F90)	

Type statics		
Type-tested by the German Institute Landesgewerbeanstalt Bayern	Type test report no. 1c / Type test report no. 2c / Type test report no. 3a / Type test report no. 4 / Type test report no. 5a / Type test report no. 6	

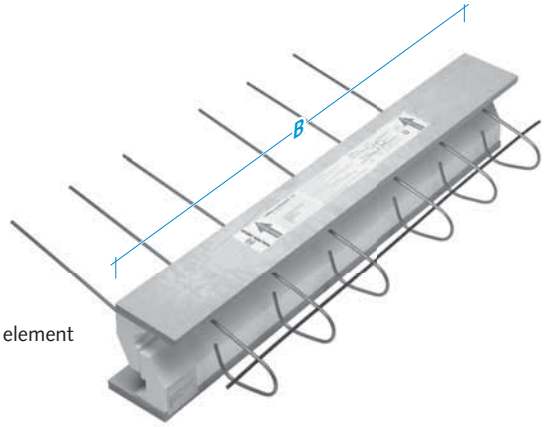
Certification		
RAL Quality Mark	RAL German Institut for Quality Assurance and Certification, RAL Quality Mark Anchoring- and Reinforcement technology RAL-GZ 658/2	

Approvals and type tests on the internet
The approvals and type tests can be found at **www.halfen.com/downloads/brochures**.
Or simply scan the code and then select the document to download a PDF file.

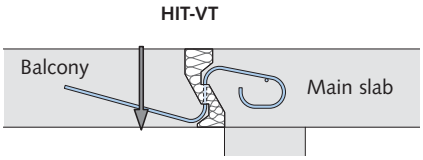
5

- For simply supported balconies or loggias
- For unrestrained connection and for shear capacity only

available until May 2015!



One-metre element
B = 1.0 m



Application examples HIT-VT

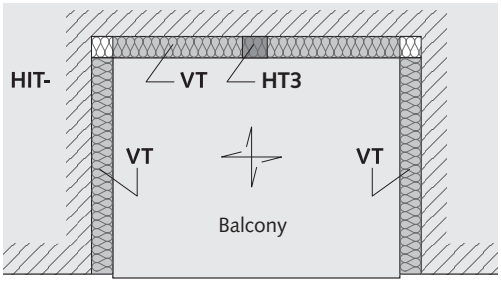
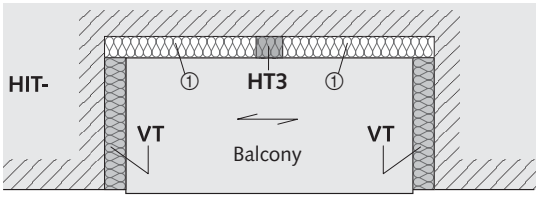


Fig. 1: Balcony / loggia, simply supported on three sides, two direction spanning slab. HIT-HT units are used to absorb the expected horizontal loads.



① = In-situ thermal insulation

Fig. 2: Balcony / loggia, simply supported on two sides, one direction spanning slab.
HIT-HT units are used to absorb the expected horizontal loads.

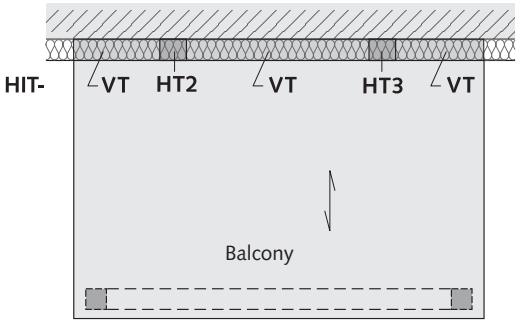


Fig. 3: Simply supported balcony on columns.
HIT-HT units are used to absorb the expected horizontal loads.

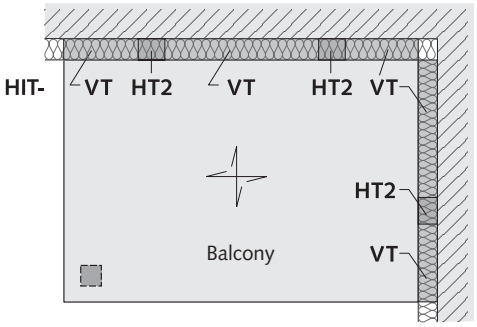
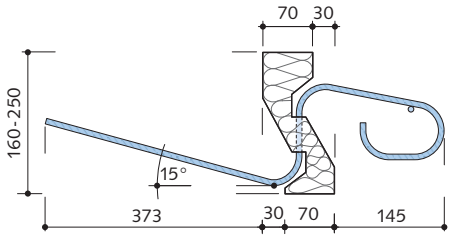


Fig. 4: Balcony simply supported on two sides on a column.
HIT-HT units are used to absorb the expected horizontal loads.

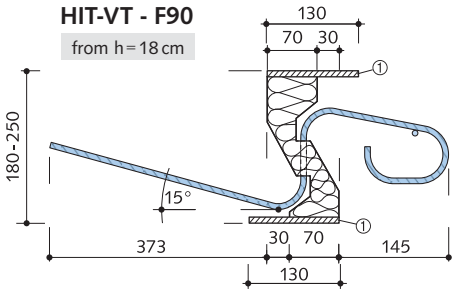
HALFEN HIT INSULATED CONNECTION

HIT-VT

HIT-VT



HIT-VT - F90
from h = 18 cm



available until May 2015!

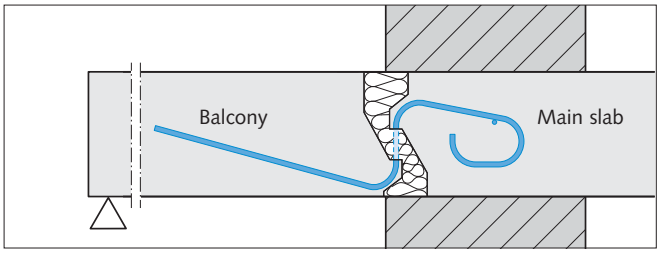
① F90 fire board

Dimensions in [mm]

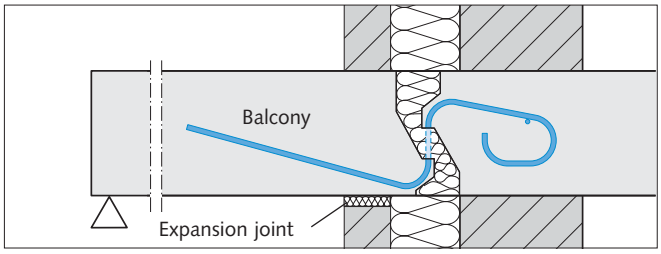
Note: For a top view of the units with dimensions, please refer to the diagrams included in the HIT-VT type statics.

Position of the HIT-VT units in the cross-section of a wall

Single-leaf masonry with balcony at main slab level



Double-leaf masonry with balcony at main slab level



Product description one-metre elements

Components	Load range:	0406	0506	0606	0806	1006
	width B [m]	1.00	1.00	1.00	1.00	1.00
Shear bars	n × ø[mm]	4 ø6	5 ø6	6 ø6	8 ø6	10 ø6
	length*) [mm]	316	316	316	316	316

*) Note: The length of the shear bars refers exclusively to the effective bond length.

Product variations

Ordering example

HIT - VT - 0506 - 18 - F90

- Type / version
- Load range
- Slab thickness h
- Fire protection ①

· standard	
· fireproof F90	F90

① When ordering the standard version, omit the reference from the specification. F90 version available from h = 18 cm.

Custom designs are available on request. For further details please contact our regional sales companies
→ see inside back cover for contact details.

Load bearing capacity values HIT-VT one-metre elements

Shear capacity in one direction

Design values	for slab thickness [cm]	Concrete strength: C20/25 / ≥ C25/30									
		0406		0506		0606		0806		1006	
V_{Rd} [kN/m]	16	40.4	47.0	50.5	58.7	60.6	70.5	80.8	94.0	101.0	117.4
	17–25	42.5	49.2	53.2	61.5	63.8	73.8	85.1	98.3	106.4	122.9

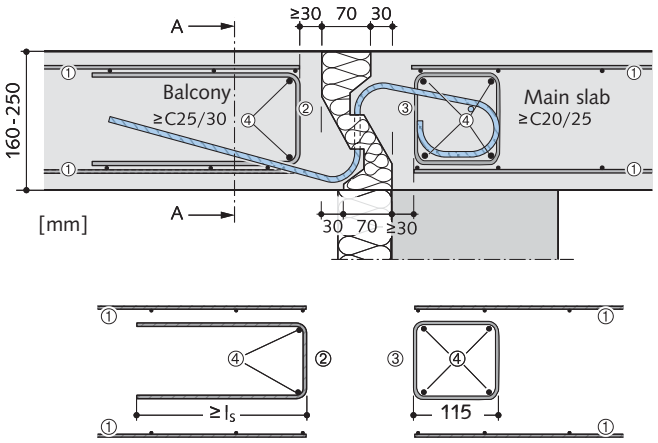
Concrete strength: C20/25 / ≥C25/30

All necessary verifications including verifying concrete strut shear pressure have been already considered.

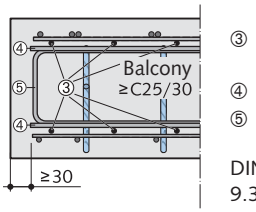
On-site reinforcement for balcony connections HIT-VT

available until May 2015!

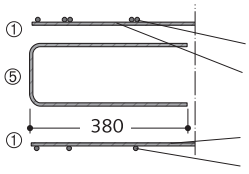
HIT-VT



Dimensions in [mm]



Section A-A



① On-site connecting reinforcement, see table A
② Required hanger reinforcement on balcony side, see table B
③ Structural hanger reinforcement on main slab side
④ Additional rebars 2 x ø8 mm
⑤ End U-bars ø8 mm

DIN 1045-1 chapter 13.3.2 / EN 1992-1-1 (EC2) 9.3.1.4 requires U-bars to be placed around the outer edge of the balcony slab as edge frame. In addition, item ⑤ must be installed.

The **overlap joints** between the shear bars of the HALFEN Insulated connection HIT-VT and the shear reinforcement of the adjacent slabs must be made according to DIN 1045-1, chapter 12.8 / EN 1992-1-1 (EC2) and the National Technical Approval no. Z-15.7-238. The calculation for on-site connecting reinforcement overlap length is for full load capacity of element if a connecting reinforcement of 6 mm diameter is placed for each shear bar. The same applies when the connecting reinforcement is calculated applying the effective reinforcement cross-section according to table A: Recommended on-site connecting reinforcement.
An overlap of 316 mm with the HALFEN Insulated connection HIT-VT can be applied when 6 mm diameter shear bars are used.

Connecting reinforcement

Table A: **Recommended on-site connecting reinforcement**

Variation	Connecting reinforcement	Effective reinforcement cross-section for ≥ C25/30: calculated as follows
A) On-site connecting reinforcement using only mesh B500A/B (BSt 500 M)	Q188A and R188A	$a_s = 1.0 \times a_{s,Mesh}$
	Q257A to Q513A/Q524A and R257A to R524A	$a_s = 0.75 \times a_{s,Mesh}$
B) On-site connecting reinforcement using only bar steel B500B (BSt 500 S)	ø6 mm	$a_s = 1.0 \times a_{s,ø6}$
	ø8 mm	$a_s = 0.75 \times a_{s,ø8}$
	ø10 mm	$a_s = 0.60 \times a_{s,ø10}$
C) On-site connecting reinforcement using a combination of mesh and bar	Reinforcing-steel mesh B500A/B (BSt 500 M) to Q 335 A and R 335 A	$a_s = 0.75 \times a_{s,Mesh}$
	Bar steel B500B (BSt 500 S), 6 mm ø	$a_s = 1.0 \times a_{s,ø6}$
	Bar steel B500B (BSt 500 S), 8 mm ø	$a_s = 0.75 \times a_{s,ø8}$
	Bar steel B500B (BSt 500 S), 10 mm ø	$a_s = 0.60 \times a_{s,ø10}$

Table B: **Required suspension reinforcement**

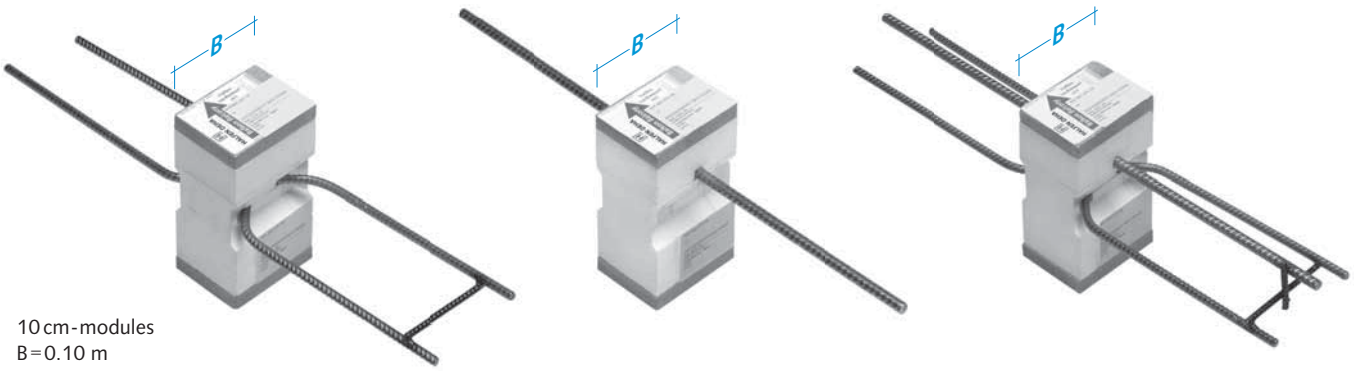
Type HIT-VT	For slab thickness [cm]	Concrete strength: *C20/25* / ≥ C25/30									
		0406		**0506**		**0606**		**0806**		**1006**	
a_s [cm²/m]	16	*0.93*	1.08	*1.16*	1.35	*1.39*	1.62	*1.86*	2.16	*2.32*	2.70
	17–25	*0.98*	1.13	*1.22*	1.41	*1.47*	1.70	*1.96*	2.26	*2.45*	2.83

Concrete strength: *C20/25* / ≥C25/30

6

- To absorb expected horizontal forces.
- HIT-HT1: Transfers horizontal forces parallel to the insulation plane.
  HIT-HT2: Transfers horizontal forces perpendicular to the insulation plane.
  HIT-HT3: Transfers horizontal forces parallel and perpendicular to the insulation plane.

HIT-HT1 **HIT-HT2** **HIT-HT3**



10 cm-modules
B = 0.10 m

Application examples HIT-HT1 / -HT2 / -HT3

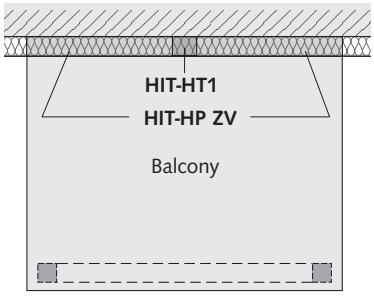


Fig. 1: Simply supported balcony on columns

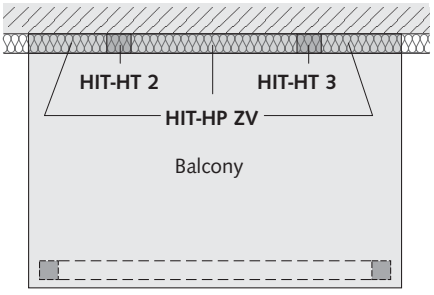


Fig. 2: Simply supported balcony on columns

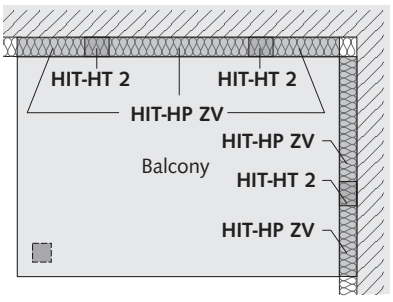


Fig. 3: Balcony supported on two sides with column

HIT-HT

Basic types – Ordering example

HIT - HT3 - 18 - F90 ①

- Type / version
- Slab thickness h
- Fire protection ①
  - · standard
  - · fireproof F90 — F90

① When ordering the standard version, omit the reference from the specification.

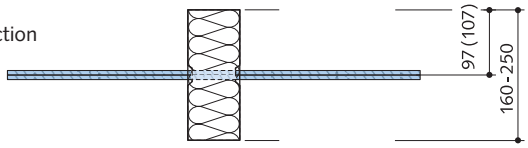
Horizontal forces parallel to the insulation plane

H_{Rd} ||

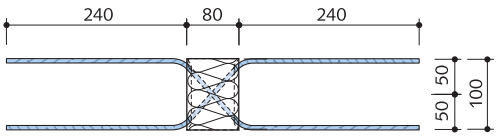
HIT-HT1 Components			Design values			
Reinforcement		Element length	*C20/25*		C25/30	
Shear force	Horizontal force	[mm]	*H_{Rd} ‖ [kN]*	*H_{Rd} ⊥ [kN]*	H_{Rd} ‖ [kN]	H_{Rd} ⊥ [kN]
2 × ø8	–	100	*±7.4*	*0*	±8.6	0

HIT-HT1

Vertical section



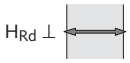
Top view



Dimensions in [mm]

Horizontal forces perpendicular to the insulation plane

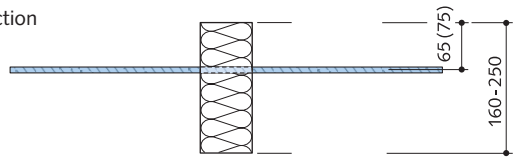
H_{Rd} ⊥



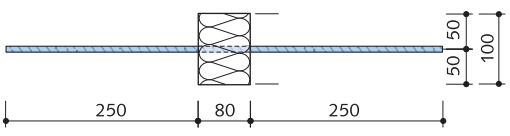
HIT-HT2 Components			Design values			
Reinforcement		Element length	*C20/25*		C25/30	
Shear force	Horizontal force	[mm]	*H_{Rd} ‖ [kN]*	*H_{Rd} ⊥ [kN]*	H_{Rd} ‖ [kN]	H_{Rd} ⊥ [kN]
–	1 × ø10	100	*0*	*±18.2*	0	±21.1

HIT-HT2

Vertical section



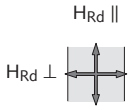
Top view



Dimensions in [mm]

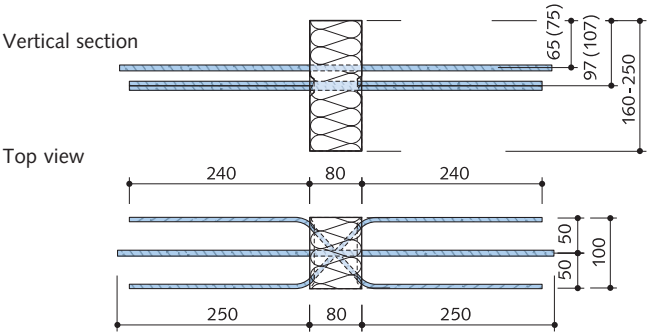
HIT-HT

Horizontal forces parallel and perpendicular to the insulation



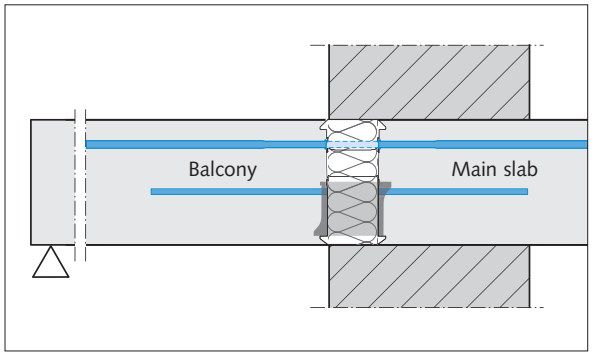
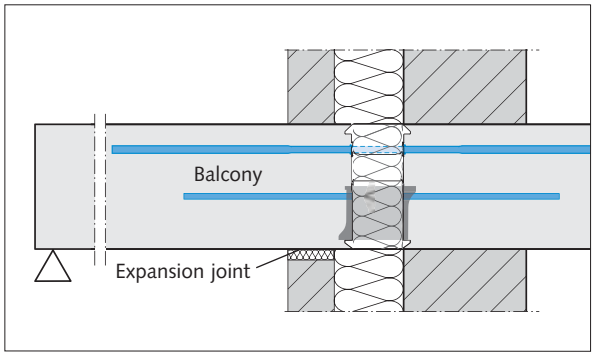
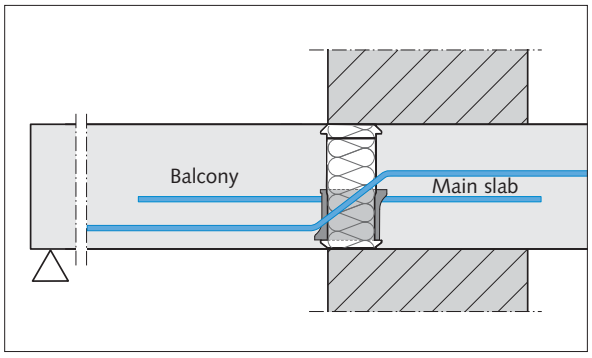
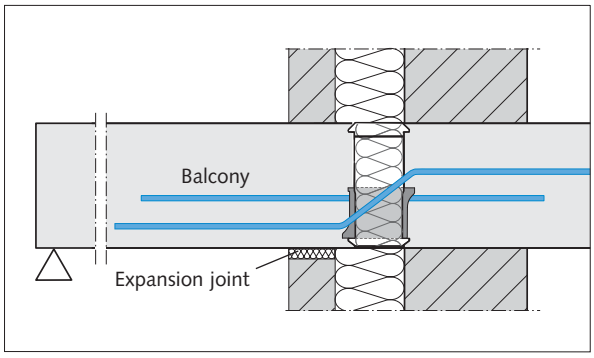
HIT-HT3 Components			Design values			
Reinforcement		Element length	*C20/25*		C25/30	
Shear force	Horizontal force	[mm]	*H_{Rd} ||* *[kN]*	*H_{Rd} ⊥* *[kN]*	H_{Rd} || [kN]	H_{Rd} ⊥ [kN]
2 × ø8	1 × ø10	100	*±7.4*	*±18.2*	±8.6	±21.1

HIT-HT3



Dimensions in [mm]

Position of the HIT-HT units in the cross-section of a wall in combination: Examples HIT-HT1 and HIT-HT2

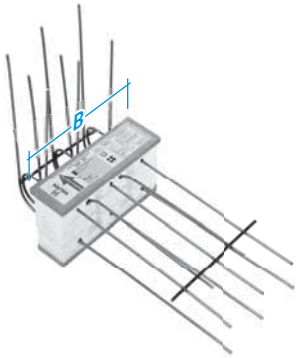
	Single-leaf masonry with balcony at main slab level	Double-leaf masonry with balcony at main slab level
HIT-HT1 in combination with HIT-HP MV or HIT-HP MD		
HIT-HT2 in combination with HIT-HP ZV or HIT-HP ZD		

7

HALFEN HIT Insulated connections to form a thermal barrier between main slab and

- a corbelled parapet → HIT-FT
  a corbel → HIT-OT
  a parapet → HIT-AT
- Select the unit spacing based on structural requirements.

HIT-FT
Element width
B = 0.30 m



Application examples Dimensions in [mm]

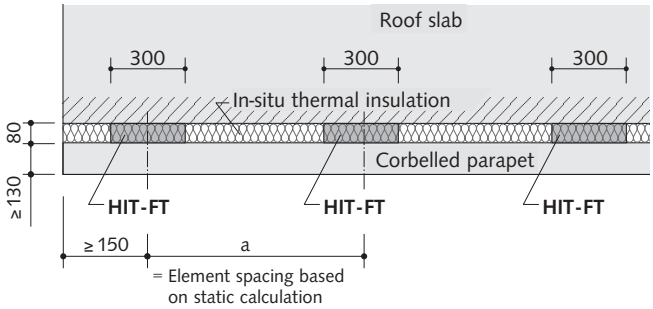
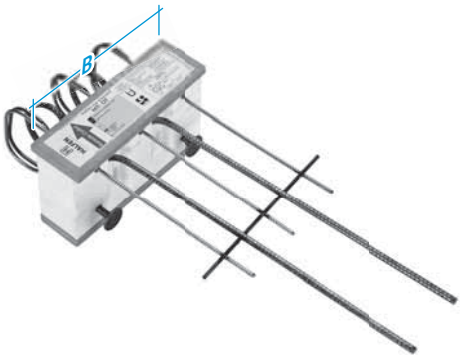


Fig. 1: Roof slab with a corbelled parapet connected.
The corbel is designed as a continuous beam.

HIT-OT
Element width
B = 0.30 m



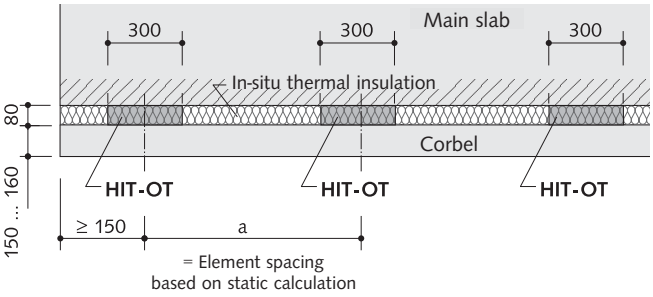
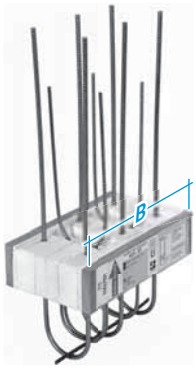


Fig. 2: Main slab with a corbel connected.
The corbel is designed as a continuous beam.

HIT-AT
Element width
B = 0.30 m



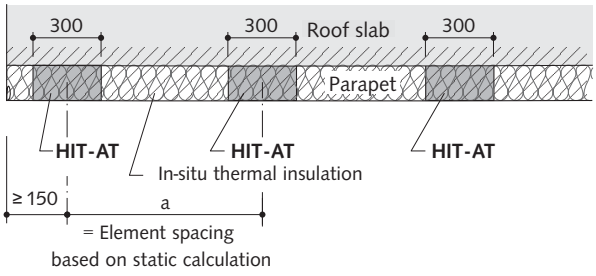
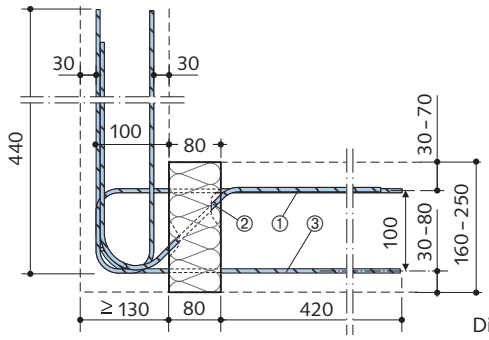


Fig. 3: Roof slab with a parapet connected.
The corbel is designed as a continuous beam.

HIT-FT

Product description

① Tension / compression bars 3 x ⌀6 mm, B500 NR
② Shear bars 2 x ⌀6 mm, B500 NR
③ Tension / compression bars 3 x ⌀6 mm, B500 NR



Dimensions in [mm]

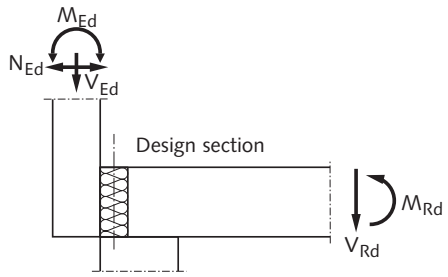
Ordering example

HIT - FT - 20 - F90

- Product group / type
- Slab thickness h [cm]
- Fire protection ①

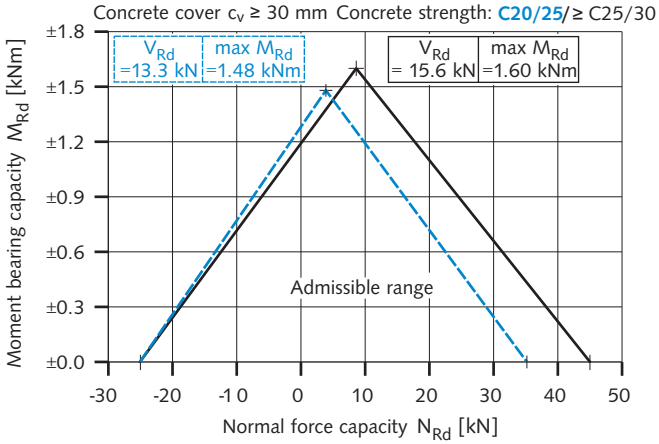
① When ordering the standard version, omit the reference from the specification.

Static system

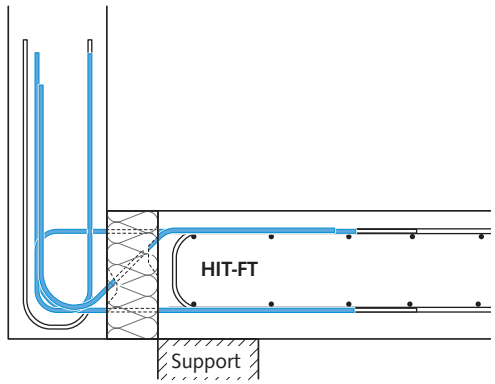


Load bearing capacity

Concrete cover $c_v \geq 30$ mm Concrete strength: C20/25/≥ C25/30

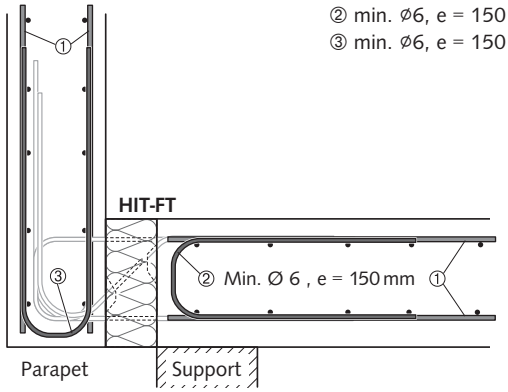


Installation diagram HIT-FT



On-site reinforcement HIT-FT

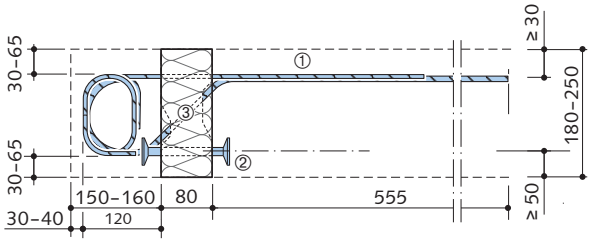
① On-site reinforcement
② min. ⌀6, e = 150 mm
③ min. ⌀6, e = 150 mm



HIT-OT

Product description

① Tension bars 3 x ø 6 mm, B 500 NR
② Shear bars 2 x ø10 mm, B 500 NR
③ Compression bearings 2 x ø12 mm, stainless steel



Dimensions in [mm]

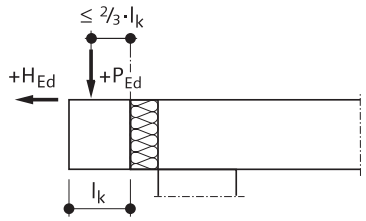
Ordering example

HIT - OT - 20 - F90

- Product group / type
- Corbel thickness h [cm]
- Fire protection ①

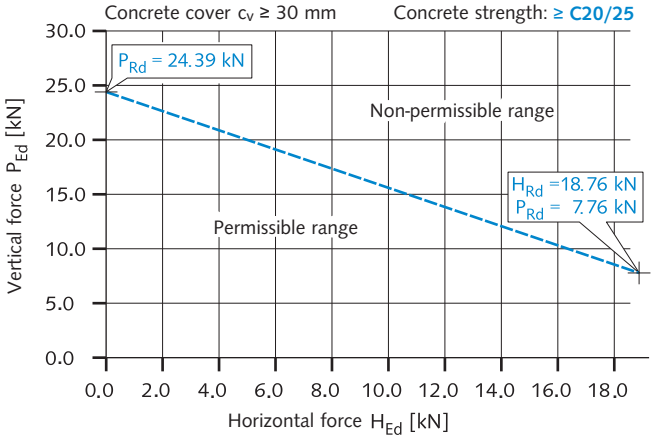
① When ordering the standard version, omit the reference from the specification.

Static system

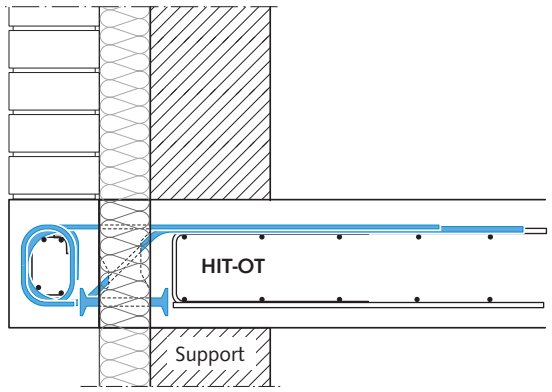


l_k = cantilever length of the bracket

Load bearing capacity

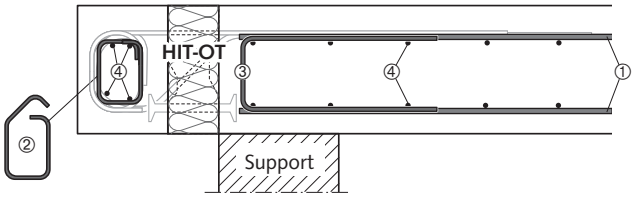


Installation diagram HIT-OT



On-site reinforcement HIT-OT

① On-site connecting reinforcement
② 2 × closed stirrup
③ 2 × U-bar
④ Additional rebars ≥ ø8

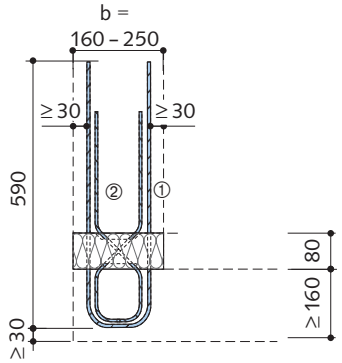


HALFEN HIT INSULATED CONNECTION

HIT-AT

Product description

① Tension / compression bars 2 × 3 ø8 mm, B500 NR
② Shear bars 2 × 2 ø6 mm, B500 NR



Dimensions in [mm]

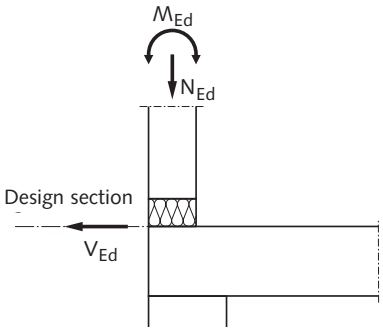
Ordering example

HIT - AT - 20 - F90

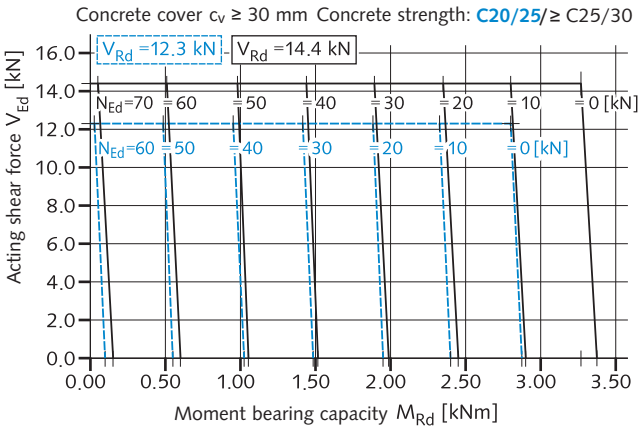
- Product group / type
- Parapet width b [cm]
- Fire protection ①

① When ordering the standard version, omit the reference from the specification.

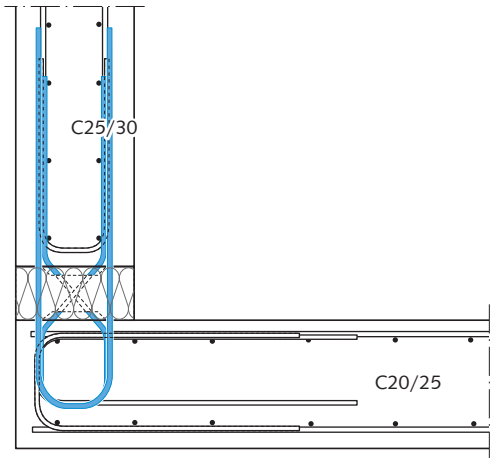
Static system



Load bearing capacity

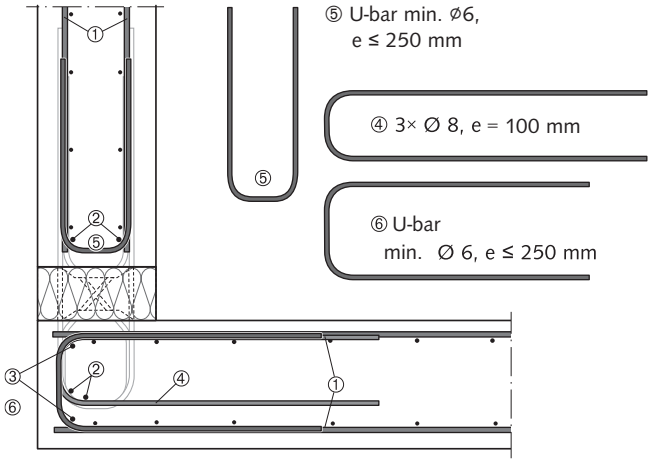


Installation diagram HIT-AT



On-site reinforcement HIT-AT

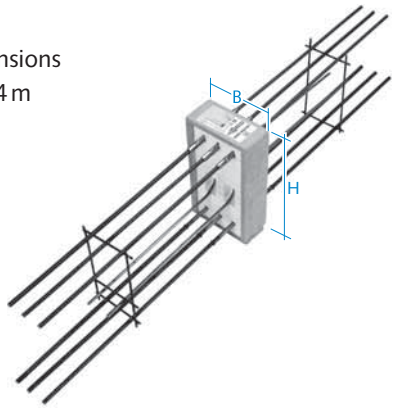
① On-site connecting reinforcement
② ø6
③ ø8
⑤ U-bar min. ø6, e ≤ 250 mm



8

HIT-ST:
- Cantilever connection for thermal separation of cantilevered reinforced concrete beams.
- Transfers high bending moments and shear forces.

HIT-ST
Standard dimensions
B / H = 0.2 / 0.4 m



Application example

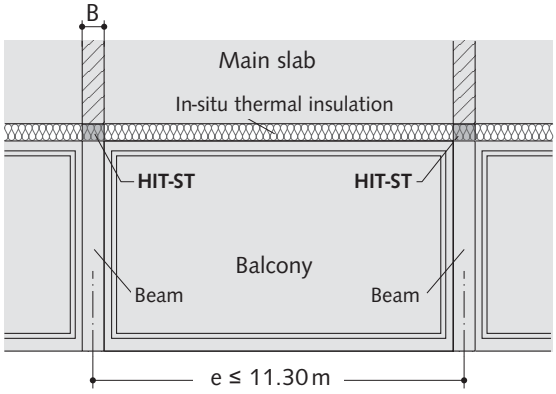
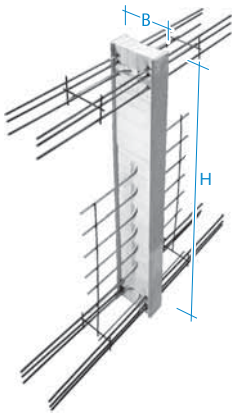


Fig. 1: Thermally insulated beam connections

HIT-WT:
- Wall connection for thermal separation of a cantilevered shear wall from the building.
- Transfers bending moments as well as vertical and horizontal shear forces.

HIT-WT
Element dimensions
B = 0.15 – 0.25 m
H = 1.5 – 3.5 m



Application example

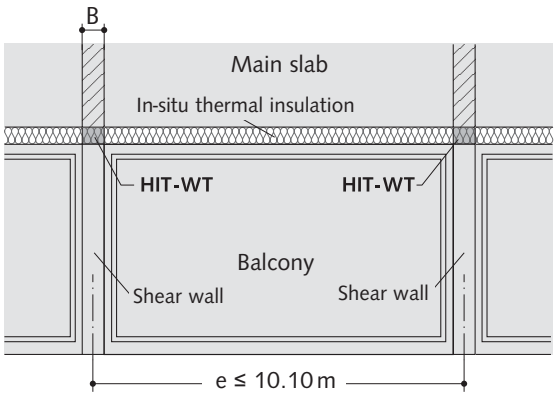
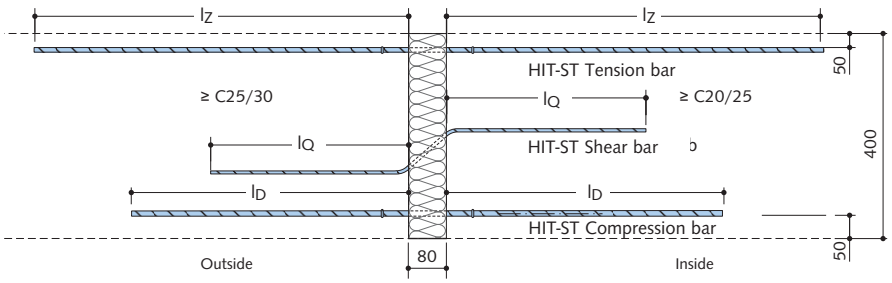


Fig. 2: Thermally insulated shear wall connections

HALFEN HIT INSULATED CONNECTION

HIT-ST

HIT-ST



Dimensions in [mm]

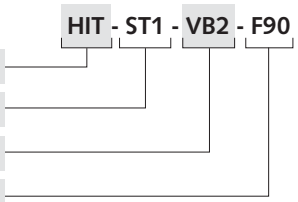
Product description

Components	Load range		HIT-ST 1	HIT-ST 2	HIT-ST 3	HIT-ST 4
	Width B	B [m]	0.20	0.20	0.20	0.20
Tension bars	n × ø[mm]	n × ø[mm]	3 ø10	3 ø12	3 ø14	3 ø16
	Standard/VB2	l_Z [mm]	700 / 900	740 / 1060	850 / 1220	1270 / 1760
Compression bars	n × ø[mm]	n × ø[mm]	3 ø12	3 ø14	3 ø16	3 ø20
	Standard/VB2	l_D [mm]	550 / 900	565 / 1035	635 / 1170	770 / 1435
Shear bars	n × ø[mm]	n × ø[mm]	2 ø8	2 ø10	2 ø12	2 ø14
	Standard/VB2	l_Q [mm]	505 / 695	565 / 765	625 / 875	695 / 975
On-site stirrups	req. A_s [cm²]		1.09	1.53	2.09	2.83
	n × ø[mm]	selected:	2 ø8	2 ø8	2 ø10	2 ø10

Load bearing capacities and product types

Load bearing capacity of the element		Concrete strength: *C20/25*			
Bending moment	**M_{Rd} [kNm]**	*24.1*	*33.3*	*43.6*	*60.8*
Shear force	**V_{Rd} [kN]**	*25.3*	*36.1*	*50.2*	*66.3*
Expansion joint spacing	**e [m]**	*11.3*	*10.1*	*9.2*	*8.0*

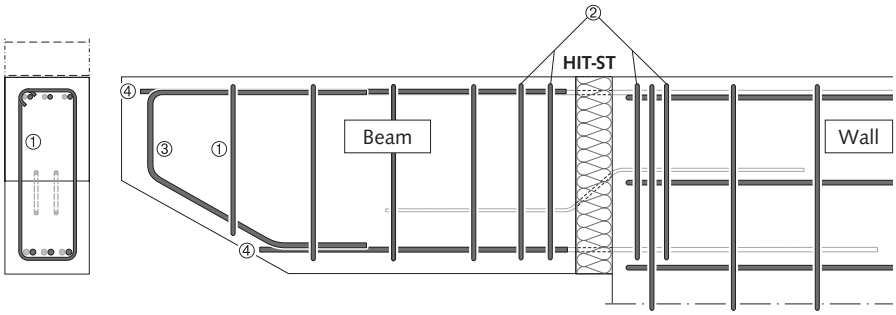
Ordering example

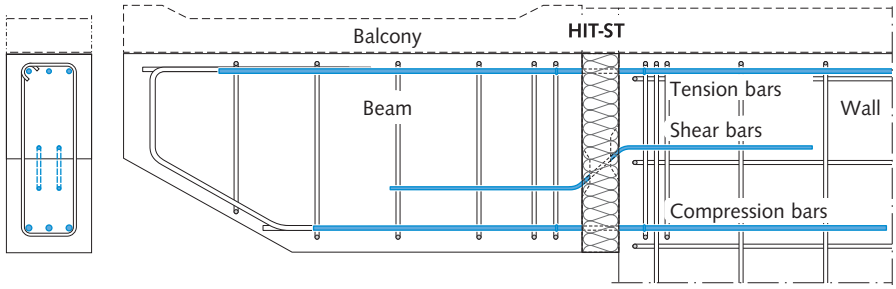


- Product group
- Beam type
- Bond quality ①
- Fire protection ①

① When ordering the standard version, omit VB2 and F90 from the specification.

On-site reinforcement / Installation diagram



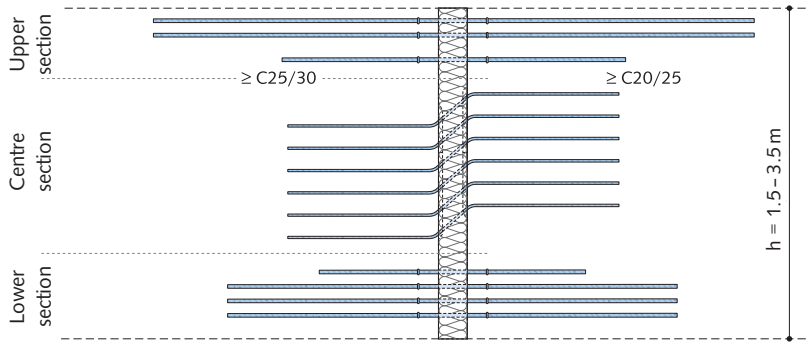


① U-bar reinforcement according to the structural engineer's specifications
② Suspension and tensile splitting reinforcement in accordance with the above table "Product description"
③ On-site edge frame
④ Connecting reinforcement of the tension and compression bars

Fix the on-site connecting reinforcement in accordance with the structural engineer's drawings and specifications. Observe the required A_S values specified in the table above.

HIT-WT

HIT-WT



Product description

Components	Load range	HIT-WT1	HIT-WT2	HIT-WT3	HIT-WT4
	for wall thickness [cm]	15–25	15–25	15–25	15–25
Tension bars	n × ø[mm]	4 ø8	4 ø8	4 ø10	4 ø12
Compression bars	n × ø[mm]	4 ø10	6 ø10	6 ø12	6 ø14
Shear bars					
- vertical	n × ø[mm]	6 ø6	6 ø8	6 ø10	6 ø12
- horizontal	n × ø[mm]	2 x 2 ø6	2 x 2 ø6	2 x 2 ø6	2 x 2 ø6

Load bearing capacities and product types

Load bearing capacity of the element		Concrete strength: *C20/25*			
Bending moment	**M_{Rd} [kNm]**				
for wall height h [cm]	150–200	*63.4*	*81.9*	*120.1*	*158.7*
	200–250	*87.0*	*113.4*	*166.4*	*219.9*
	> 250	*110.7*	*144.9*	*212.7*	*281.2*
Shear capacity	**V_{Rd} [kN]**	*33.9*	*68.1*	*116.0*	*146.3*
Expansion joint spacing	**e [m]**	*11.3*	*11.3*	*11.3*	*10.1*

Ordering example

HIT - WT2 - 19 - 225 - F90

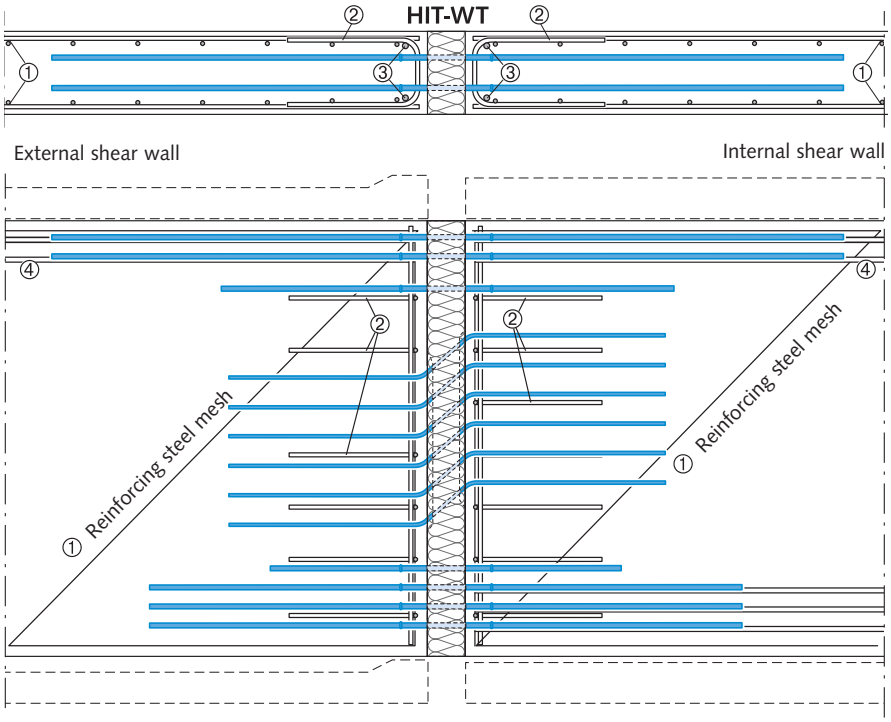
- Product group
- Wall type
- Wall thickness [cm]
- Wall height [cm]
- Fire protection ①

① When ordering the standard version, omit the reference from the specification.

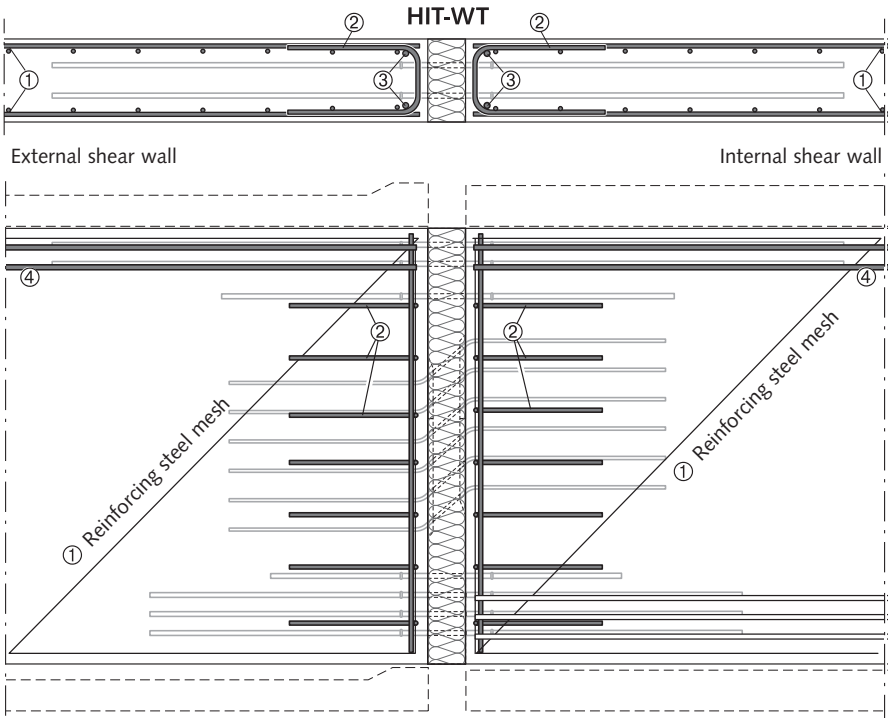
HALFEN HIT INSULATED CONNECTION

HIT-WT

Installation diagram



On-site connecting reinforcement



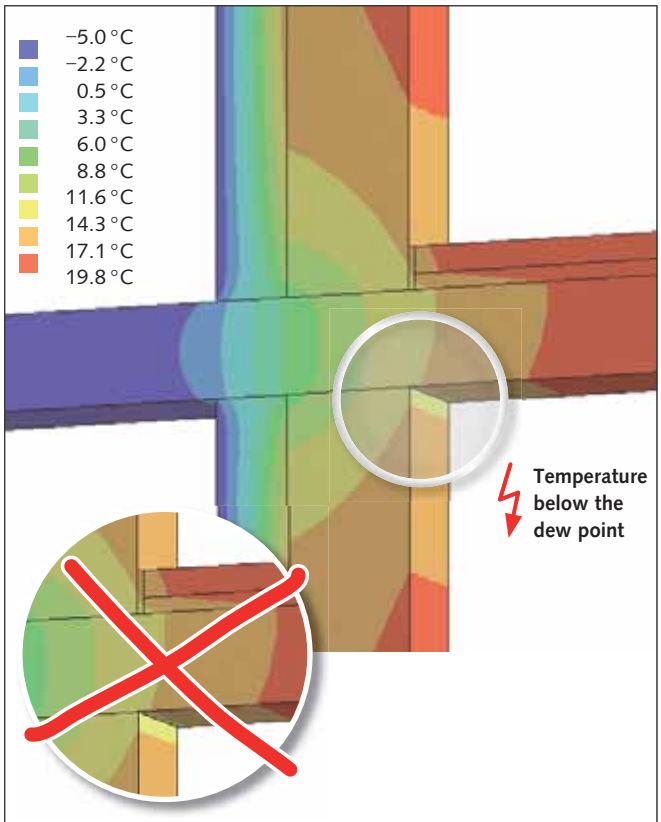
The thermally insulated HIT-WT wall connection is available for **wall heights h = 1.5 to 3.5 m.** For easy transportation and handling, the HIT-WT units are shipped **in multiple units, minimum of at least three separate component groups** (upper, centre and lower section).

① On-site wall reinforcement as defined by the structural engineer.
② U-bars as structural edge frame.
③ Minimal two 8 mm ø, rebar, in the inner and outer shear wall.
④ Connecting reinforcement of the HIT tension bars depends on the structural requirements.

Custom designs are available on request.
For further details, please contact us: → see inside back cover for contact details

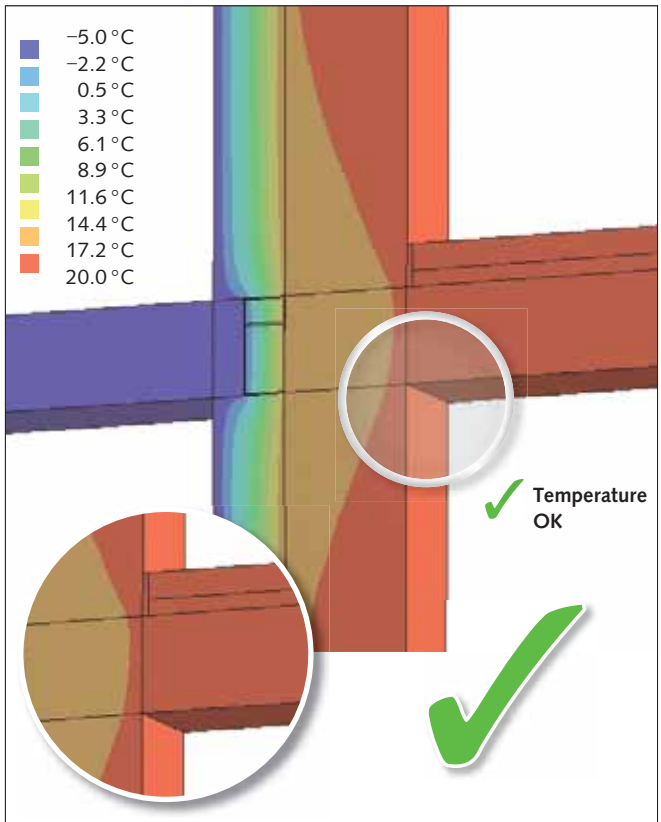
9

- The temperature field in the cross-section (shown as isotherms) illustrates the advantages of the HALFEN HIT Insulated connection for the required minimum thermal insulation: For instance no condensation and mould growth in critical areas.



Balcony slab – installed without insulation:

- thermal bridge
- condensation
- moisture penetration
- mould growth on ceiling and wall



Balcony slab with
HALFEN Insulated connection HIT-HP and HIT-SP:

- effective thermal insulation of the balcony slab
- no condensation, temperature above the dew point
- perfectly designed structural physics
- prevents cracks in the concrete resulting from extreme thermal expansions in the balcony connection

Contents **Page**

Thermal insulation

Structural thermal bridges such as balconies may lead to moisture problems resulting from lower temperatures on internal surfaces. Moreover, thermal bridges normally cause additional loss of heat.
Consequently, correct planning using thermally insulated balcony slab connections:

- prevent condensation and mould growth by fulfilling the minimum thermal insulation requirements according to DIN 4108-2
- reduce the transmission heat losses in the area of the connections

Prevention of condensation and mould growth by fulfilling the minimum thermal insulation requirements according to DIN 4108-2

Depending on the temperature, the air can retain different amounts of moisture. With a rise in air temperature, the amount of storable moisture increases. In a room, the air is constantly moving (room air flow). The water content in a defined flowing air volume remains nearly constant. However, the temperature of the air changes when the air flows along colder external components. The storage capacity of the air decreases as the air cools down, resulting in an increase in relative humidity. Condensation always occurs when the relative humidity reaches 100%. Assuming a room temperature of 20°C and a relative humidity of 50% condensation would occur when the air cools down to approx. 9°C (see dew point diagram on the right). If, under the given conditions, the temperature at the inner surface of an adjacent component, for instance the wall or the ceiling, is 9°C or colder, then condensation will form on this surface.

Correct application of HALFEN HIT Insulated connections prevents the surface of the wall/ceiling from falling below the dew point and therefore prevents condensation. An increased relative humidity of approx. 80% above the surface of the component promotes mould growth.
In a standard scenario with an indoor temperature of 20°C and a relative humidity of 50%, cooling down the air to approximately 13°C raises the relative humidity to 80%.

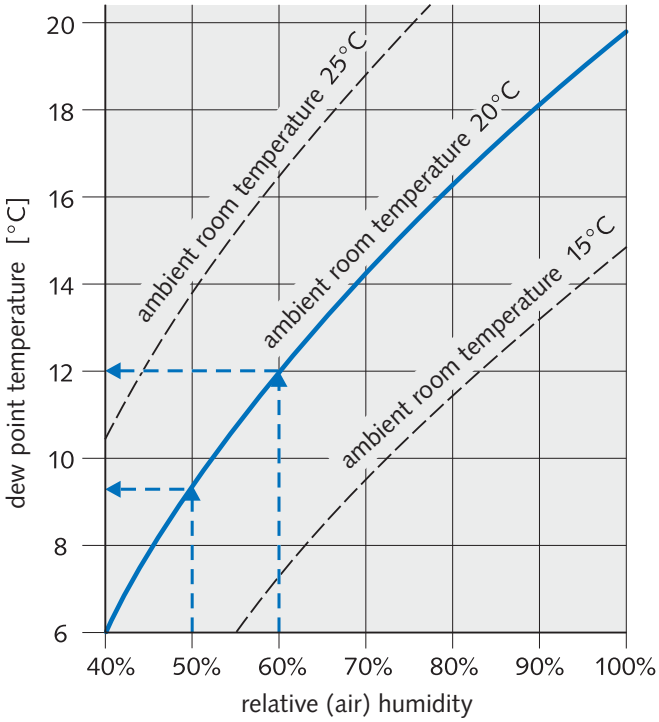


Fig.: Dew point diagram

HALFEN HIT Insulated connections prevent cooling of the adjacent components at the inside of the balcony below the critical temperatures for condensation and mould growth. The criterion to prevent mould growth is the temperature factor f_{Rsi}. It is defined as the ratio of the *lowest surface temperature minus outside temperature* to the total temperature difference (*inside temperature minus outside temperature*).

$$f_{Rsi} = \frac{\theta_{si} - \theta_e}{\theta_i - \theta_e}$$

DIN 4108-2 stipulates that the temperature factor f_{Rsi} must be higher than 0.7 for all component connections.

According to the National Technical Approvals Z-15.7-293, Z-15.7-309 and Z-15.7-312 the minimum thermal insulation requirement in accordance with DIN 4108-2 has already been proved and applies to the complete HALFEN HIT Insulated connections load range.

Reduction of transmission losses

The Energy Saving Regulation (EnEV) specifies that the primary energy demand required to heat a building must be limited. To calculate this energy demand, thermal bridges through concrete balcony slabs must also be taken into account. Monolithic balcony systems without thermal separation have the same effect as cooling fins due to their geometry and therefore they cause substantial heat losses.

Thermal bridges can be calculated in three different ways:

Method 1: An increase of all thermal transmission coefficients by ΔU_{WB} = 0.10 W/(m²K) for the entire heat transmitting outer surface without any further analysis of the thermal bridges.

Method 2: When consistently adhering to the regulations for energetically efficient component connections according to DIN 4108, supplementary sheet 2, the effect of the thermal bridge is taken into account with the increase of the thermal transmission coefficient for the total heat transmitting surface area by ΔU_{WB} = 0.05 W/(m²K).

Method 3: By a detailed verification of the specific transmission loss of the thermal bridges according to DIN V 4108-6 or DIN V 18599 or by the determination of an individual additional value for thermal bridges.

HALFEN HIT Insulated connections provide the engineer with every opportunity to determine the effect of thermal bridges by using all verification options mentioned above.

Method 1 is used to calculate the highest transmission losses. Engineers who don't consider the structural design of thermal bridges are "disciplined" by the regulations of the Energy Saving Regulation (EnEV) with high additional transmission losses.

The simplified verification method (**Method 2**) where ΔU_{WB} = 0.05 W/(m²K) is applied can be used because HALFEN HIT Insulated connections are classified in DIN 4108, supplementary sheet 2, according to National Technical Approval Z-15.7-293, Z-15.7-309 and Z-15.7-312. The respective verification has also been proven for the HALFEN HIT Insulated connections with the highest reinforcement content.

Method 3: In most cases even when conforming to the specifications stipulated in DIN 4108, the calculated specific transmission loss H_T (resulting from standard cross-sections and thermal bridges) is still so high that the max. thermal ceiling set by the EnEV is not easy to maintain. Planners have to deal with this problem when they have to meet predefined criteria.

In these cases it is necessary to determine the exact transmission losses of all thermal bridges in a detailed analysis. For structural component linear connections the linear thermal transmission coefficients (ψ-value) are defined by set standards.

Some building products manufacturers specify a λ_{eq}-value for the insulation capacity of thermal separation elements. λ_{eq} is the equivalent thermal conductivity of a replacement cross-section of inhomogeneous building products without any metallic penetration such as for a special insulation element at the base of the masonry. In this case, the ψ-value for the detailed analysis of the thermal bridges can be determined with the λ_{eq}-value by a two-dimensional calculation of the thermal bridges by the engineer without having to model a geometrically complex insulation element at the base of masonry.

This method is only applicable to a limited extent for structural components with metallic like penetrations as found in balcony slab connection as uniform standards for basic or boundary conditions calculation for equivalent thermal conductivity value have not been defined.

The thermal values for HALFEN Insulated connection types HIT-HP MV / HIT-SP MV and HIT-HP ZV / HIT-SP ZV are included in the European Technical Approval ETA-13/0546 and National Technical Approval Z-15.7-293 and Z-15.7-312.

Standard specification for non-residential buildings
The DIN V 18599 specifications regulates the calculation of annual primary energy demand of non-residential buildings, thermal bridges are calculated analogously, i.e. they can also be alternatively calculated using method 1, 2 or 3 to determine specific heat transmission loss H_T and the annual energy demand.

Standard specification for the calculation of thermal bridges to determine the annual primary energy demand according to the Energy Saving Regulation EnEV 2009

Residential building

Description/ basics standard	**Method 1** without verifications ΔU_{WB} = 0.10 W/(m²K)	**Method 2** specification details or equivalent details ΔU_{WB} = 0.05 W/(m²K)	**Method 3** Exact calculation of thermal bridges with linear thermal transmission coefficients (= ψ-values)
Restricting the annual primary energy demand to the permissible value required in the EnEV 2009	$\frac{Q_{P,\,act.}}{Q_{P,\,max}} < Q_{P,\,max.}$	Subject to reference building according to EnEV 2009, Annex 1 for residential buildings (or Annex 2 of EnEV 2009 for non-residential buildings)	
Actual annual primary energy demand for a residential building according to DIN V 4108-6 and DIN V 4701-10	$Q_{P,\,act.} = e_P\,(Q_h + Q_W)$ Q_h $Q_W = A_N \times 12.5\ kWh/(m^2a)$ e_P	Annual thermal heat demand Useful heat demand for water heating energy requirement value of a system related to primary energy	
Annual thermal heat demand Q_h according to DIN V 4108-6 (monthly balance)	$Q_h = \sum_M Q_{h,\,M/pos}$	The annual thermal heat demand is the sum of all monthly heat demands with a "positive" thermal heat demand value	
Monthly thermal heat demand $Q_{h,\,M}$	$Q_{h,\,M} = 0.024\,(H_T + H_V)\,(\theta_i - \theta_{e,M})\,t_M - \eta_M Q_{g,M}$ **Note:** the monthly thermal heat demand is positive when the losses exceed the gains		
Specific transmission heat loss H_T	$H_T = \sum U_i A_i F_{x,i} + \Delta U_{WB} \times A$		$H_T = \sum U_i A_i F_{x,i} + \sum l_j \psi_j$
Consideration of thermal bridges	ΔU_{WB} = 0.10 W/(m²K) fixed additional value	ΔU_{WB} = 0.05 W/(m²K) half the fixed additional value	Approved ψ-values for all component connections (e. g. building edges, window reveals, wall and ceiling connections, ceiling supports, thermally decoupled balcony slabs) ψ-values for different assembly situations of the HIT connections, see tables → pages 104 ff.

Thermal bridge characteristic values according to National Technical Approval

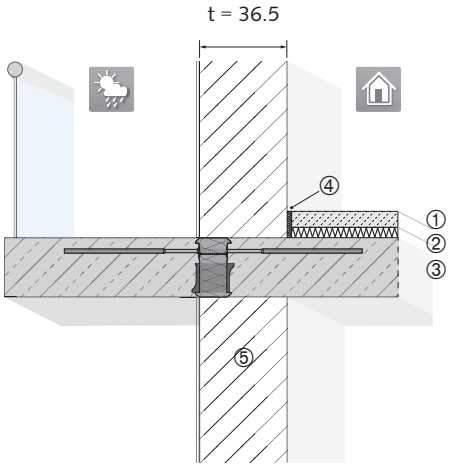
The physical properties for HALFEN Insulated connections HIT-HP MV / HIT-SP MV and HIT-HP ZV / HIT-SP ZV in various type of applications (based on a three-dimensional FEM calculation) were determined in tests by the Institute for Materials Research and Testing at the Bauhaus University MFPA in Weimar in accordance with EN ISO 10211 (linear coefficient of thermal transmission ψ, minimal surface temperature min and temperature factor f_{Rsi}).

These values were officially integrated into the European Technical Approval ETA-13/0546 and the national technical approvals Z-15.7-293 and Z-15.7-312.

For the first time building authority approved ψ-values for a detailed standard-compliant thermal bridge verification for insulated balcony connections are available throughout Europe.
Compliance with the approved physical properties for HALFEN Insulated connections HIT-HP and HIT-SP is guaranteed by third party monitoring.

The approved physical property values for HALFEN Insulated connections HIT-HP MV / HIT-SP MV and HIT-HP ZV / HIT-SP ZV are listed in the tables on the following pages.

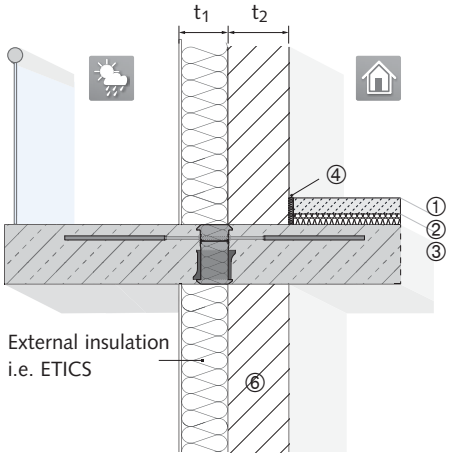
Thermal values according to Technical Approvals



Installation diagram für monolithic masonry

Thermal transmission coefficient, standard cross section "Exterior wall":
U = 0.311 W/(m² K)

- external wall (monolithic): width t = 36.5 cm (λ = 0.12 W/(mK))
- floor construction (indoor):
  - ① cement screed 5 cm (λ=1.35 W/(mK))
  - ② footfall insulation 3 cm (λ=0.035 W/(mK))
  - ③ reinforced concrete floor 18 cm (λ=2.3 W/(mK))
  - ④ edge insulation strips 1 cm (λ = 0.14 W/(mK))
  - ⑤ monolithic masonry



Installation diagram for masonry with ETICS

Standard cross section for thermal transmission coefficient "Exterior wall":

- thermal insulation exterior wall:
  thickness t_1 = 14 cm, 22 cm or 30 cm (λ = 0.035 W/(mK))
- exterior (lime-sandstone): thickness t_2 = 24 cm (λ = 0.99 W/(mK))
- floor construction (interior):
  - ① cement screed 5 cm (λ=1.35 W/(mK))
  - ② footfall insulation 3 cm (λ=0.035 W/(mK))
  - ③ reinforced concrete floor 18 cm (λ=2.3 W/(mK))
  - ④ edge insulation strips 1 cm (λ=0.14 W/(mK))
  - ⑥ lime-sandstone masonry

ETICS = External Thermal Insulation Composite Systems

Calculating Ψ-values with the HALFEN app

Calculations of thermal values for the HALFEN Insulated connection types HIT-HP MV, HIT-SP MV, HIT-HP ZV and HIT-SP ZV can be done quite simply by using the HIT-Calculator, a mobile application for your smartphone or tablet.

▸ Available at our website under Downloads/Apps/ HIT-Calculator Web App

HALFEN HIT app on the Internet
Just scan the QR Code on the left, if you would like to use the HALFEN app to calculate Ψ-values for your project.

Building Physics

Thermal bridge characteristic values for HIT-HP MV for monolithic masonry

Thermal conductivity ψ in [W/(mK)]	0.18			0.12			0.08		
Thermal transmission coefficient of standard cross section "External wall" U in W/(m²K)	0.455			0.311			0.211		
Load range	ψ ①	$\theta_{si,min}$ ②	f_{Rsi} ③	ψ ①	$\theta_{si,min}$ ②	f_{Rsi} ③	ψ ①	$\theta_{si,min}$ ②	f_{Rsi} ③
HIT-HP MV- 0404-18-100-35	0.168	15.49	0.819	0.180	15.91	0.836	0.186	16.21	0.848
HIT-HP MV- 0504-18-100-35	0.173	15.45	0.818	0.185	15.86	0.834	0.192	16.15	0.846
HIT-HP MV- 0604-18-100-35	0.178	15.41	0.817	0.190	15.82	0.833	0.197	16.10	0.844
HIT-HP MV- 0804-18-100-35	0.188	15.35	0.814	0.200	15.74	0.829	0.207	16.01	0.840
HIT-HP MV- 0505-18-100-35	0.186	15.31	0.813	0.199	15.70	0.828	0.207	15.97	0.839
HIT-HP MV- 0705-18-100-35	0.196	15.25	0.810	0.209	15.62	0.825	0.217	15.88	0.835
HIT-HP MV- 0805-18-100-35	0.201	15.21	0.809	0.214	15.58	0.823	0.222	15.83	0.833
HIT-HP MV- 0506-18-100-35	0.198	15.19	0.807	0.212	15.55	0.822	0.220	15.80	0.832
HIT-HP MV- 0606-18-100-35	0.203	15.15	0.806	0.217	15.50	0.820	0.226	15.75	0.830
HIT-HP MV- 0706-18-100-35	0.208	15.12	0.805	0.222	15.46	0.819	0.231	15.70	0.828
HIT-HP MV- 0906-18-100-35	0.217	15.06	0.802	0.232	15.39	0.816	0.241	15.62	0.825
HIT-HP MV- 1006-18-100-35	0.222	15.03	0.801	0.236	15.35	0.814	0.246	15.58	0.823
HIT-HP MV- 1106-18-100-35	0.226	15.00	0.800	0.241	15.32	0.813	0.251	15.54	0.821
HIT-HP MV- 0607-18-100-35	0.214	15.03	0.801	0.229	15.36	0.814	0.239	15.59	0.824
HIT-HP MV- 0707-18-100-35	0.219	15.00	0.800	0.234	15.33	0.813	0.244	15.55	0.822
HIT-HP MV- 0907-18-100-35	0.228	14.94	0.797	0.244	15.25	0.810	0.254	15.46	0.818
HIT-HP MV- 1007-18-100-35	0.233	14.91	0.796	0.249	15.22	0.809	0.259	15.42	0.817
HIT-HP MV- 1107-18-100-35	0.237	14.88	0.795	0.253	15.18	0.807	0.263	15.38	0.815
HIT-HP MV- 1207-18-100-35	0.242	14.85	0.794	0.258	15.15	0.806	0.268	15.35	0.814
HIT-HP MV- 1407-18-100-35	0.250	14.80	0.792	0.266	15.09	0.803	0.277	15.27	0.811
HIT-HP MV- 0408-18-100-35	0.215	14.99	0.799	0.230	15.31	0.812	0.240	15.53	0.821
HIT-HP MV- 0708-18-100-35	0.230	14.89	0.795	0.246	15.19	0.808	0.256	15.40	0.816
HIT-HP MV- 0808-18-100-35	0.234	14.85	0.794	0.251	15.16	0.806	0.261	15.35	0.814
HIT-HP MV- 1008-18-100-35	0.243	14.80	0.792	0.260	15.09	0.803	0.271	15.28	0.811
HIT-HP MV- 1208-18-100-35	0.252	14.74	0.790	0.269	15.02	0.801	0.280	15.20	0.808
HIT-HP MV- 1308-18-100-35	0.256	14.72	0.789	0.273	14.99	0.800	0.284	15.17	0.807
HIT-HP MV- 1309-18-100-35	0.266	14.61	0.784	0.284	14.87	0.795	0.295	15.04	0.801
HIT-HP MV- 0610-18-100-35	0.245	14.71	0.788	0.262	14.98	0.799	0.273	15.16	0.807
HIT-HP MV- 0910-18-100-35	0.259	14.62	0.785	0.276	14.88	0.795	0.288	15.05	0.802
HIT-HP MV- 1010-18-100-35	0.263	14.59	0.784	0.281	14.85	0.794	0.292	15.01	0.801
HIT-HP MV- 1210-18-100-35	0.272	14.54	0.782	0.290	14.79	0.792	0.301	14.94	0.798
HIT-HP MV- 1412-18-100-35	0.297	14.32	0.773	0.316	14.53	0.781	0.329	14.66	0.786

① ψ = Linear thermal transmission coefficient in W/(mK)
② $\theta_{si,min}$ = Minimum roomside surface temperature in °C
③ f_{Rsi} = Temperature factor in [-]

Thermal bridge characteristic values for HIT-SP MV for monolithic masonry

Thermal conductivity ψ in [W/(mK)]	0.18			0.12			0.08		
Thermal transmission coefficient of standard cross section "External wall" U in W/(m²K)	0.455			0.311			0.211		
Load range	ψ ①	$\theta_{si,min}$ ②	f_{Rsi} ③	ψ ①	$\theta_{si,min}$ ②	f_{Rsi} ③	ψ ①	$\theta_{si,min}$ ②	f_{Rsi} ③
HIT-SP MV- 0404-18-100-35	0.132	15.86	0.835	0.142	16.33	0.853	0.147	16.69	0.868
HIT-SP MV- 0504-18-100-35	0.136	15.83	0.833	0.147	16.30	0.852	0.152	16.64	0.866
HIT-SP MV- 0604-18-100-35	0.141	15.80	0.832	0.151	16.26	0.850	0.157	16.60	0.864
HIT-SP MV- 0804-18-100-35	0.149	15.74	0.830	0.160	16.18	0.847	0.166	16.51	0.860
HIT-SP MV- 0505-18-100-35	0.148	15.71	0.828	0.159	16.15	0.846	0.165	16.48	0.859
HIT-SP MV- 0705-18-100-35	0.156	15.65	0.826	0.168	16.08	0.843	0.175	16.39	0.856
HIT-SP MV- 0805-18-100-35	0.161	15.62	0.825	0.172	16.04	0.842	0.179	16.35	0.854
HIT-SP MV- 0506-18-100-35	0.158	15.59	0.824	0.170	16.02	0.841	0.178	16.32	0.853
HIT-SP MV- 0606-18-100-35	0.163	15.56	0.823	0.175	15.98	0.839	0.182	16.28	0.851
HIT-SP MV- 0706-18-100-35	0.167	15.53	0.821	0.180	15.94	0.838	0.187	16.24	0.849
HIT-SP MV- 0906-18-100-35	0.175	15.48	0.819	0.188	15.87	0.835	0.196	16.16	0.846
HIT-SP MV- 1006-18-100-35	0.180	15.45	0.818	0.193	15.84	0.834	0.201	16.12	0.845
HIT-SP MV- 1106-18-100-35	0.184	15.42	0.817	0.197	15.81	0.832	0.205	16.08	0.843
HIT-SP MV- 0607-18-100-35	0.173	15.45	0.818	0.186	15.85	0.834	0.194	16.13	0.845
HIT-SP MV- 0707-18-100-35	0.177	15.42	0.817	0.191	15.81	0.833	0.199	16.09	0.844
HIT-SP MV- 0907-18-100-35	0.186	15.37	0.815	0.199	15.75	0.830	0.208	16.01	0.841
HIT-SP MV- 1007-18-100-35	0.190	15.34	0.814	0.204	15.71	0.829	0.212	15.98	0.839
HIT-SP MV- 1107-18-100-35	0.194	15.32	0.813	0.208	15.68	0.827	0.216	15.94	0.838
HIT-SP MV- 1207-18-100-35	0.198	15.29	0.812	0.212	15.65	0.826	0.221	15.90	0.836
HIT-SP MV- 1407-18-100-35	0.206	15.24	0.810	0.220	15.59	0.824	0.229	15.84	0.833
HIT-SP MV- 0408-18-100-35	0.174	15.41	0.816	0.187	15.80	0.832	0.196	16.08	0.843
HIT-SP MV- 0708-18-100-35	0.187	15.32	0.813	0.201	15.69	0.828	0.210	15.96	0.838
HIT-SP MV- 0808-18-100-35	0.191	15.29	0.812	0.206	15.66	0.826	0.214	15.92	0.837
HIT-SP MV- 1008-18-100-35	0.200	15.24	0.810	0.214	15.60	0.824	0.223	15.84	0.834
HIT-SP MV- 1208-18-100-35	0.208	15.19	0.807	0.222	15.53	0.821	0.232	15.77	0.831
HIT-SP MV- 1308-18-100-35	0.212	15.16	0.807	0.226	15.50	0.820	0.236	15.74	0.830
HIT-SP MV- 1309-18-100-35	0.221	15.07	0.803	0.236	15.39	0.816	0.246	15.61	0.825
HIT-SP MV- 0610-18-100-35	0.201	15.15	0.806	0.216	15.50	0.820	0.226	15.73	0.829
HIT-SP MV- 0910-18-100-35	0.214	15.07	0.803	0.229	15.40	0.816	0.239	15.63	0.825
HIT-SP MV- 1010-18-100-35	0.218	15.05	0.802	0.234	15.37	0.815	0.244	15.59	0.824
HIT-SP MV- 1210-18-100-35	0.226	15.00	0.800	0.242	15.31	0.813	0.252	15.53	0.821
HIT-SP MV- 1412-18-100-35	0.250	14.78	0.791	0.267	15.06	0.802	0.279	15.24	0.810

① ψ = Linear thermal transmission coefficient in W/(mK)
② $\theta_{si,min}$ = Minimum roomside surface temperature in °C
③ f_{Rsi} = Temperature factor in [-]

Thermal bridge characteristic values for HIT-HP MV for masonry with ETICS

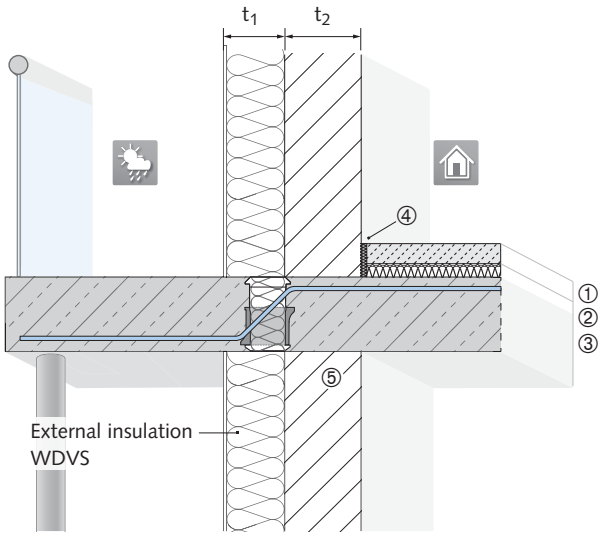
Insulating material thickness in mm (ETICS)	140			220			300		
Thermal transmission coefficient of standard cross section "External wall" U in W/(m²K)	0.227			0.149			0.111		
Load range	ψ ①	$\theta_{si.min}$ ②	f_{Rsi} ③	ψ ①	$\theta_{si.min}$ ②	f_{Rsi} ③	ψ ①	$\theta_{si.min}$ ②	f_{Rsi} ③
HIT-HP MV- 0404-18-100-35	0.168	17.80	0.912	0.187	18.08	0.923	0.194	18.25	0.930
HIT-HP MV- 0504-18-100-35	0.175	17.76	0.910	0.193	18.05	0.922	0.200	18.21	0.929
HIT-HP MV- 0604-18-100-35	0.181	17.73	0.909	0.199	18.02	0.921	0.206	18.18	0.927
HIT-HP MV- 0804-18-100-35	0.194	17.66	0.906	0.211	17.95	0.918	0.217	18.12	0.925
HIT-HP MV- 0505-18-100-35	0.194	17.64	0.906	0.211	17.94	0.918	0.216	18.11	0.924
HIT-HP MV- 0705-18-100-35	0.207	17.57	0.903	0.223	17.87	0.915	0.228	18.05	0.922
HIT-HP MV- 0805-18-100-35	0.213	17.54	0.902	0.229	17.84	0.914	0.233	18.02	0.921
HIT-HP MV- 0506-18-100-35	0.212	17.53	0.901	0.228	17.83	0.913	0.231	18.02	0.921
HIT-HP MV- 0606-18-100-35	0.219	17.49	0.900	0.234	17.80	0.912	0.237	17.99	0.919
HIT-HP MV- 0706-18-100-35	0.225	17.46	0.898	0.240	17.77	0.911	0.243	17.96	0.918
HIT-HP MV- 0906-18-100-35	0.238	17.39	0.896	0.251	17.71	0.908	0.253	17.90	0.916
HIT-HP MV- 1006-18-100-35	0.244	17.36	0.894	0.257	17.68	0.907	0.258	17.87	0.915
HIT-HP MV- 1106-18-100-35	0.249	17.33	0.893	0.262	17.65	0.906	0.263	17.85	0.914
HIT-HP MV- 0607-18-100-35	0.236	17.38	0.895	0.249	17.70	0.908	0.251	17.90	0.916
HIT-HP MV- 0707-18-100-35	0.243	17.35	0.894	0.255	17.67	0.907	0.257	17.87	0.915
HIT-HP MV- 0907-18-100-35	0.255	17.29	0.891	0.267	17.61	0.904	0.267	17.81	0.912
HIT-HP MV- 1007-18-100-35	0.261	17.26	0.890	0.272	17.58	0.903	0.272	17.79	0.911
HIT-HP MV- 1107-18-100-35	0.267	17.23	0.889	0.278	17.56	0.902	0.277	17.76	0.910
HIT-HP MV- 1207-18-100-35	0.272	17.20	0.888	0.283	17.53	0.901	0.282	17.73	0.909
HIT-HP MV- 1407-18-100-35	0.283	17.14	0.886	0.293	17.48	0.899	0.292	17.68	0.907
HIT-HP MV- 0408-18-100-35	0.239	17.35	0.894	0.252	17.68	0.907	0.253	17.87	0.915
HIT-HP MV- 0708-18-100-35	0.259	17.25	0.890	0.270	17.58	0.903	0.270	17.79	0.911
HIT-HP MV- 0808-18-100-35	0.265	17.22	0.889	0.276	17.55	0.902	0.275	17.76	0.910
HIT-HP MV- 1008-18-100-35	0.277	17.16	0.886	0.287	17.49	0.900	0.285	17.70	0.908
HIT-HP MV- 1208-18-100-35	0.289	17.10	0.884	0.297	17.44	0.898	0.295	17.65	0.906
HIT-HP MV- 1308-18-100-35	0.294	17.07	0.883	0.302	17.41	0.897	0.300	17.63	0.905
HIT-HP MV- 1309-18-100-35	0.309	16.98	0.879	0.316	17.33	0.893	0.312	17.55	0.902
HIT-HP MV- 0610-18-100-35	0.283	17.09	0.884	0.292	17.44	0.898	0.289	17.66	0.906
HIT-HP MV- 0910-18-100-35	0.301	17.00	0.880	0.308	17.35	0.894	0.304	17.58	0.903
HIT-HP MV- 1010-18-100-35	0.307	16.97	0.879	0.314	17.33	0.893	0.309	17.56	0.902
HIT-HP MV- 1210-18-100-35	0.318	16.92	0.877	0.324	17.28	0.891	0.319	17.51	0.900
HIT-HP MV- 1412-18-100-35	0.356	16.70	0.868	0.357	17.08	0.883	0.349	17.33	0.893

① ψ = Linear thermal transmission coefficient in W/(mK)
② $\theta_{si,min}$ = Minimum roomside surface temperature in °C
③ f_{Rsi} = Temperature factor in [-]

Thermal bridge characteristic values for HIT-SP MV for masonry with ETICS									
Insulating material thickness in mm (ETICS)	140			220			300		
Thermal transmission coefficient of standard cross section "External wall" U in W/(m²K)	0.227			0.149			0.111		
Load range	ψ ①	$\theta_{si.min}$ ②	f_{Rsi} ③	ψ ①	$\theta_{si.min}$ ②	f_{Rsi} ③	ψ ①	$\theta_{si.min}$ ②	f_{Rsi} ③
HIT-SP MV- 0404-18-100-35	0.115	18.12	0.925	0.134	18.40	0.936	0.145	18.54	0.942
HIT-SP MV- 0504-18-100-35	0.121	18.09	0.924	0.140	18.37	0.935	0.150	18.51	0.941
HIT-SP MV- 0604-18-100-35	0.126	18.06	0.922	0.145	18.34	0.934	0.155	18.48	0.939
HIT-SP MV- 0804-18-100-35	0.137	18.00	0.920	0.156	18.28	0.931	0.165	18.43	0.937
HIT-SP MV- 0505-18-100-35	0.137	17.99	0.919	0.155	18.27	0.931	0.164	18.42	0.937
HIT-SP MV- 0705-18-100-35	0.148	17.92	0.917	0.166	18.21	0.929	0.175	18.37	0.935
HIT-SP MV- 0805-18-100-35	0.154	17.89	0.916	0.171	18.19	0.927	0.179	18.34	0.934
HIT-SP MV- 0506-18-100-35	0.153	17.89	0.916	0.170	18.18	0.927	0.178	18.34	0.933
HIT-SP MV- 0606-18-100-35	0.158	17.86	0.914	0.176	18.15	0.926	0.183	18.31	0.932
HIT-SP MV- 0706-18-100-35	0.164	17.83	0.913	0.181	18.12	0.925	0.188	18.28	0.931
HIT-SP MV- 0906-18-100-35	0.175	17.77	0.911	0.191	18.07	0.923	0.198	18.23	0.929
HIT-SP MV- 1006-18-100-35	0.180	17.74	0.910	0.196	18.04	0.922	0.203	18.20	0.928
HIT-SP MV- 1106-18-100-35	0.186	17.71	0.908	0.201	18.01	0.921	0.207	18.18	0.927
HIT-SP MV- 0607-18-100-35	0.174	17.76	0.910	0.190	18.06	0.922	0.196	18.23	0.929
HIT-SP MV- 0707-18-100-35	0.179	17.73	0.909	0.195	18.03	0.921	0.201	18.20	0.928
HIT-SP MV- 0907-18-100-35	0.190	17.67	0.907	0.205	17.98	0.919	0.211	18.15	0.926
HIT-SP MV- 1007-18-100-35	0.196	17.65	0.906	0.210	17.95	0.918	0.215	18.12	0.925
HIT-SP MV- 1107-18-100-35	0.201	17.62	0.905	0.215	17.93	0.917	0.220	18.10	0.924
HIT-SP MV- 1207-18-100-35	0.206	17.59	0.904	0.220	17.90	0.916	0.225	18.08	0.923
HIT-SP MV- 1407-18-100-35	0.216	17.54	0.902	0.229	17.85	0.914	0.233	18.03	0.921
HIT-SP MV- 0408-18-100-35	0.177	17.73	0.909	0.192	18.04	0.921	0.198	18.21	0.928
HIT-SP MV- 0708-18-100-35	0.194	17.64	0.906	0.208	17.95	0.918	0.213	18.12	0.925
HIT-SP MV- 0808-18-100-35	0.199	17.61	0.905	0.214	17.92	0.917	0.218	18.10	0.924
HIT-SP MV- 1008-18-100-35	0.210	17.56	0.902	0.224	17.87	0.915	0.228	18.05	0.922
HIT-SP MV- 1208-18-100-35	0.220	17.50	0.900	0.233	17.82	0.913	0.237	18.00	0.920
HIT-SP MV- 1308-18-100-35	0.226	17.48	0.899	0.238	17.79	0.912	0.241	17.98	0.919
HIT-SP MV- 1309-18-100-35	0.239	17.39	0.896	0.251	17.72	0.909	0.253	17.90	0.916
HIT-SP MV- 0610-18-100-35	0.216	17.50	0.900	0.229	17.82	0.913	0.232	18.00	0.920
HIT-SP MV- 0910-18-100-35	0.232	17.42	0.897	0.244	17.74	0.910	0.246	17.93	0.917
HIT-SP MV- 1010-18-100-35	0.237	17.39	0.896	0.249	17.71	0.909	0.250	17.91	0.916
HIT-SP MV- 1210-18-100-35	0.248	17.34	0.893	0.258	17.67	0.907	0.259	17.86	0.914
HIT-SP MV- 1412-18-100-35	0.283	17.13	0.885	0.290	17.48	0.899	0.288	17.69	0.908

① ψ = Linear thermal transmission coefficient in W/(mK)
② $\theta_{si,min}$ = Minimum roomside surface temperature in °C
③ f_{Rsi} = Temperature factor in [-]

Thermal values according to Technical Approvals



Installation diagram for masonry with ETICS

Standard cross section for thermal transmission coefficient "Exterior wall"

- thermal insulation exterior wall:
  thickness t_1 = 14 cm, 22 cm or 30 cm (λ = 0.035 W/(mK))
- exterior (lime-sandstone): thickness t_2 = 24 cm (λ = 0.99 W/(mK))
- floor construction (interior):
  ① cement screed 5 cm (λ = 1.35 W/(mK))
  ② footfall insulation 3 cm (λ = 0.035 W/(mK))
  ③ reinforced concrete floor 16 cm or 18 cm (λ = 2.3 W/(mK))
  ④ edge insulation strips 1 cm (λ = 0.14 W/(mK))
  ⑤ lime-sandstone masonry

Thermal values are valid for the given configuration and boundary conditions.

Thermal values of HIT-HP ZV for masonry using ETICS

Thermal insulation exterior wall / ETICS thickness [mm]	140			220			300		
Thermal transmission coefficient of standard cross section "External wall" U in W/(m²K)	0.227			0.149			0.111		
Load range	ψ ①	$\theta_{si,min}$ ②	f_{Rsi} ③	ψ ①	$\theta_{si,min}$ ②	f_{Rsi} ③	ψ ①	$\theta_{si,min}$ ②	f_{Rsi} ③
HIT-HP ZV-0404-16-100-30-06	0.148	17.91	0.916	0.161	18.22	0.929	0.168	18.38	0.935
HIT-HP ZV-0604-16-100-30-06	0.152	17.85	0.914	0.172	18.09	0.924	0.185	18.19	0.927
HIT-HP ZV-0804-16-100-30-06	0.157	17.85	0.914	0.183	18.09	0.924	0.201	18.19	0.927
HIT-HP ZV-0404-16-100-30-08	0.155	17.86	0.914	0.168	18.18	0.927	0.174	18.35	0.934
HIT-HP ZV-0604-16-100-30-08	0.163	17.76	0.910	0.182	18.01	0.920	0.195	18.10	0.924
HIT-HP ZV-0804-16-100-30-08	0.171	17.76	0.910	0.197	18.01	0.920	0.215	18.10	0.924
HIT-HP ZV-0404-18-100-30-10	0.161	17.82	0.913	0.180	18.11	0.924	0.187	18.27	0.931
HIT-HP ZV-0604-18-100-30-10	0.175	17.65	0.906	0.201	17.86	0.914	0.211	17.99	0.920
HIT-HP ZV-0804-18-100-30-10	0.190	17.65	0.906	0.222	17.86	0.914	0.235	17.99	0.920
HIT-HP ZV-0404-18-100-30-12	0.171	17.77	0.911	0.189	18.06	0.922	0.196	18.23	0.929
HIT-HP ZV-0604-18-100-30-12	0.190	17.56	0.902	0.215	17.78	0.911	0.224	17.91	0.916
HIT-HP ZV-0804-18-100-30-12	0.209	17.56	0.902	0.240	17.78	0.911	0.253	17.91	0.916
HIT-HP ZV-0202-16-100-30-06	0.098	18.21	0.928	0.120	18.48	0.939	0.130	18.62	0.945
HIT-HP ZV-0402-16-100-30-06	0.103	18.17	0.927	0.124	18.45	0.938	0.135	18.59	0.944
HIT-HP ZV-0602-16-100-30-06	0.108	18.14	0.926	0.129	18.42	0.937	0.139	18.56	0.942
HIT-HP ZV-0802-16-100-30-06	0.113	18.11	0.925	0.134	18.39	0.936	0.143	18.54	0.941
HIT-HP ZV-0603-16-100-30-06	0.128	18.02	0.921	0.147	18.30	0.932	0.156	18.46	0.938
HIT-HP ZV-0803-16-100-30-06	0.133	18.00	0.920	0.152	18.28	0.931	0.160	18.44	0.937

– continue next page –

① ψ = Linear thermal transmission coefficient in W/(mK)
② $\theta_{si,min}$ = Minimum roomside surface temperature in °C
③ f_{Rsi} = Temperature factor [-]

Thermal values of HIT-HP ZV for masonry using ETICS – continued from previous page									
Thermal insulation exterior wall / ETICS thickness [mm]	140			220			300		
Thermal transmission coefficient of standard cross section "External wall" U in W/(m²K)	0.227			0.149			0.111		
Load range	ψ ①	$\theta_{si,min}$ ②	f_{Rsi} ③	ψ ①	$\theta_{si,min}$ ②	f_{Rsi} ③	ψ ①	$\theta_{si,min}$ ②	f_{Rsi} ③
HIT-HP ZV-0202-16-100-30-08	0.102	18.18	0.927	0.123	18.45	0.938	0.133	18.60	0.944
HIT-HP ZV-0402-16-100-30-08	0.111	18.13	0.925	0.131	18.40	0.936	0.141	18.55	0.942
HIT-HP ZV-0602-16-100-30-08	0.119	18.07	0.923	0.139	18.35	0.934	0.148	18.50	0.940
HIT-HP ZV-0802-16-100-30-08	0.128	18.02	0.921	0.147	18.31	0.932	0.156	18.46	0.938
HIT-HP ZV-0603-16-100-30-08	0.139	17.96	0.918	0.158	18.24	0.930	0.165	18.40	0.936
HIT-HP ZV-0803-16-100-30-08	0.147	17.91	0.916	0.165	18.20	0.928	0.172	18.36	0.934
HIT-HP ZV-0402-18-100-30-10	0.123	18.05	0.922	0.145	18.32	0.933	0.155	18.47	0.939
HIT-HP ZV-0602-18-100-30-10	0.136	17.97	0.919	0.156	18.25	0.930	0.166	18.40	0.936
HIT-HP ZV-0802-18-100-30-10	0.148	17.90	0.916	0.169	18.18	0.927	0.177	18.34	0.933
HIT-HP ZV-0603-18-100-30-10	0.155	17.86	0.914	0.174	18.14	0.926	0.182	18.30	0.932
HIT-HP ZV-0803-18-100-30-10	0.167	17.79	0.912	0.186	18.08	0.923	0.193	18.24	0.930
HIT-HP ZV-0402-18-100-30-12	0.133	18.01	0.920	0.154	18.28	0.931	0.164	18.43	0.937
HIT-HP ZV-0602-18-100-30-12	0.151	17.90	0.916	0.170	18.17	0.927	0.179	18.33	0.933
HIT-HP ZV-0802-18-100-30-12	0.168	17.81	0.912	0.186	18.09	0.924	0.193	18.26	0.930
HIT-HP ZV-0603-18-100-30-12	0.169	17.80	0.912	0.187	18.08	0.923	0.194	18.25	0.930
HIT-HP ZV-0803-18-100-30-12	0.185	17.70	0.908	0.203	18.00	0.920	0.208	18.17	0.927

① ψ = Linear thermal transmission coefficient in W/(mK)
② $\theta_{si,min}$ = Minimum roomside surface temperature in °C
③ f_{Rsi} = Temperature factor [-]

Thermal values of HIT-SP ZV for masonry using ETICS									
Thermal insulation exterior wall / ETICS thickness [mm]	140			220			300		
Thermal transmission coefficient of standard cross section "External wall" U in W/(m²K)	0.227			0.149			0.111		
Load range	ψ ①	$\theta_{si,min}$ ②	f_{Rsi} ③	ψ ①	$\theta_{si,min}$ ②	f_{Rsi} ③	ψ ①	$\theta_{si,min}$ ②	f_{Rsi} ③
HIT-SP ZV-0404-16-100-30-06	0.095	18.23	0.929	0.120	18.47	0.939	0.137	18.58	0.943
HIT-SP ZV-0604-16-100-30-06	0.099	18.18	0.927	0.124	18.42	0.937	0.143	18.51	0.940
HIT-SP ZV-0804-16-100-30-06	0.103	18.18	0.927	0.128	18.42	0.937	0.149	18.51	0.940
HIT-SP ZV-0404-16-100-30-08	0.101	18.19	0.928	0.127	18.43	0.937	0.144	18.54	0.941
HIT-SP ZV-0604-16-100-30-08	0.108	18.11	0.924	0.134	18.35	0.934	0.153	18.43	0.937
HIT-SP ZV-0804-16-100-30-08	0.115	18.11	0.924	0.141	18.35	0.934	0.162	18.43	0.937

– continue next page –

① ψ = Linear thermal transmission coefficient in W/(mK)
② $\theta_{si,min}$ = Minimum roomside surface temperature in °C
③ f_{Rsi} = Temperature factor [-]

Thermal values of HIT-SP ZV for masonry using ETICS – continued from previous page									
Thermal insulation exterior wall / ETICS thickness [mm]	140			220			300		
Thermal transmission coefficient of standard cross section "External wall" U in W/(m²K)	0.227			0.149			0.111		
Load range	ψ ①	$\theta_{si,min}$ ②	f_{Rsi} ③	ψ ①	$\theta_{si,min}$ ②	f_{Rsi} ③	ψ ①	$\theta_{si,min}$ ②	f_{Rsi} ③
HIT-SP ZV-0404-18-100-30-10	0.109	18.14	0.926	0.136	18.38	0.935	0.153	18.48	0.939
HIT-SP ZV-0604-18-100-30-10	0.119	18.02	0.921	0.142	18.31	0.932	0.165	18.34	0.934
HIT-SP ZV-0804-18-100-30-10	0.129	18.02	0.921	0.148	18.31	0.932	0.177	18.34	0.934
HIT-SP ZV-0404-18-100-30-12	0.117	18.10	0.924	0.145	18.33	0.933	0.163	18.43	0.937
HIT-SP ZV-0604-18-100-30-12	0.132	17.94	0.918	0.155	18.23	0.929	0.180	18.25	0.930
HIT-SP ZV-0804-18-100-30-12	0.147	17.94	0.918	0.165	18.23	0.929	0.196	18.25	0.930
HIT-SP ZV-0202-16-100-30-06	0.058	18.45	0.938	0.079	18.73	0.949	0.091	18.86	0.954
HIT-SP ZV-0402-16-100-30-06	0.063	18.43	0.937	0.083	18.70	0.948	0.095	18.84	0.953
HIT-SP ZV-0602-16-100-30-06	0.067	18.40	0.936	0.087	18.68	0.947	0.099	18.81	0.952
HIT-SP ZV-0802-16-100-30-06	0.071	18.38	0.935	0.091	18.65	0.946	0.103	18.79	0.952
HIT-SP ZV-0603-16-100-30-06	0.084	18.30	0.932	0.103	18.58	0.943	0.114	18.72	0.949
HIT-SP ZV-0803-16-100-30-06	0.088	18.28	0.931	0.107	18.56	0.942	0.117	18.70	0.948
HIT-SP ZV-0202-16-100-30-08	0.062	18.43	0.937	0.082	18.71	0.948	0.094	18.84	0.954
HIT-SP ZV-0402-16-100-30-08	0.069	18.39	0.936	0.089	18.67	0.947	0.101	18.80	0.952
HIT-SP ZV-0602-16-100-30-08	0.076	18.34	0.934	0.096	18.62	0.945	0.107	18.76	0.950
HIT-SP ZV-0802-16-100-30-08	0.084	18.30	0.932	0.103	18.58	0.943	0.114	18.72	0.949
HIT-SP ZV-0603-16-100-30-08	0.093	18.24	0.930	0.112	18.53	0.941	0.122	18.67	0.947
HIT-SP ZV-0803-16-100-30-08	0.100	18.20	0.928	0.118	18.49	0.940	0.128	18.63	0.945
HIT-SP ZV-0402-18-100-30-10	0.078	18.33	0.933	0.099	18.61	0.944	0.111	18.74	0.949
HIT-SP ZV-0602-18-100-30-10	0.088	18.26	0.930	0.109	18.54	0.941	0.121	18.67	0.947
HIT-SP ZV-0802-18-100-30-10	0.099	18.20	0.928	0.120	18.48	0.939	0.131	18.62	0.945
HIT-SP ZV-0603-18-100-30-10	0.105	18.17	0.927	0.125	18.45	0.938	0.135	18.59	0.943
HIT-SP ZV-0803-18-100-30-10	0.115	18.11	0.924	0.135	18.39	0.935	0.145	18.53	0.941
HIT-SP ZV-0402-18-100-30-12	0.087	18.29	0.931	0.108	18.56	0.942	0.119	18.69	0.948
HIT-SP ZV-0602-18-100-30-12	0.101	18.20	0.928	0.122	18.47	0.939	0.133	18.61	0.944
HIT-SP ZV-0802-18-100-30-12	0.117	18.12	0.925	0.136	18.40	0.936	0.146	18.54	0.942
HIT-SP ZV-0603-18-100-30-12	0.118	18.11	0.924	0.137	18.38	0.935	0.147	18.53	0.941
HIT-SP ZV-0803-18-100-30-12	0.132	18.02	0.921	0.151	18.31	0.932	0.160	18.46	0.938

① ψ = Linear thermal transmission coefficient in W/(mK)
② $\theta_{si,min}$ = Minimum roomside surface temperature in °C
③ f_{Rsi} = Temperature factor [-]

Certificates by the Passive House Institute

The Passive House Standard sets very high standards– on the thermal insulation of the building envelope as well as on the individual components. HALFEN HIT Insulated connections with an insulation thickness from 80 mm are certified by the Passive House Institute as a "Low Energy Component" in the category balcony connection.

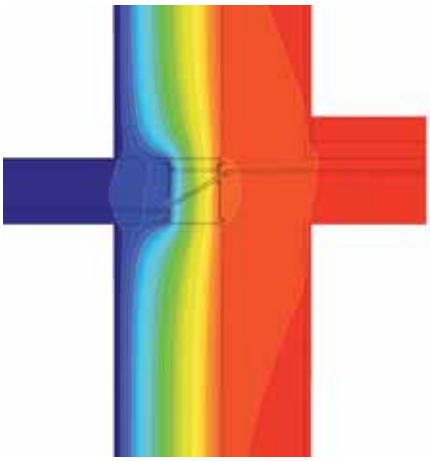


Figure: Isothermal diagram of the HIT-SP ZV-0202-16-100-30-08

The following criteria were used in awarding this certificate

- **Efficiency Criterion**
  In two typical applications (a terrace-house and an apartment) the construction fulfills the requirement of

$$\Delta U_{WB} < 0.025 \text{ W/(m}^2\text{K)}$$

- **Comfort Criterion**
  The inner surface must be warm enough to prevent mould and uncomfortable down-draught and radiation losses.

$$\theta_{i,min} > 17.00 \text{ °C}$$

Low Energy Component / HIT-HP ZV

Insulation thickness 80 mm for simply-supported balcony slabs on columns	Slab thickness [mm]	Thermal transmission coefficient ψ [W/(m K)]
HIT-HP ZV- 0404-18-100-30-06	180	0.18
HIT-HP ZV- 0804-18-100-30-08	180	0.20
HIT-HP ZV- 0404-24-100-30-06	240	0.20
HIT-HP ZV- 0804-24-100-30-08	240	0.21

Low Energy Component / HIT-SP ZV

Insulation thickness 120 mm for simply-supported balcony slabs on columns	Slab thickness [mm]	Thermal transmission coefficient ψ [W/(m K)]
HIT-SP ZV-0302-18-100-30-08	180	0.11
HIT-SP ZV-0404-18-100-30-06	180	0.14
HIT-SP ZV-0804-18-100-30-08	180	0.15
HIT-SP ZV-0502-22-100-30-06	220	0.109
HIT-SP ZV-0202-24-100-30-08	240	0.109
HIT-SP ZV-0302-24-100-30-06	240	0.108
HIT-SP ZV-0302-24-100-30-08	240	0.11
HIT-SP ZV-0502-24-100-30-06	240	0.109
HIT-SP ZV-0404-24-100-30-06	240	0.14
HIT-SP ZV-0804-24-100-30-08	240	0.16

Low Energy Component / HIT-HP MV

Insulation thickness 80 mm for cantilevered balcony slabs	Slab thickness [mm]	Thermal transmission coefficient ψ [W/(m K)]
HIT-HP MV- 0404-18-100-35	180	0.20
HIT-HP MV- 0504-18-100-35	180	0.21
HIT-HP MV- 0506-18-100-35	180	0.25
HIT-HP MV- 0804-18-100-35	180	0.23
HIT-HP MV- 0404-24-100-35	240	0.22
HIT-HP MV- 0504-24-100-35	240	0.23

Low Energy Component / HIT-SP MV

Insulation thickness 120 mm for cantilevered balcony slabs	Slab thickness [mm]	Thermal transmission coefficient ψ [W/(m K)]
HIT-SP MV- 0504-18-100-35	180	0.16
HIT-SP MV- 0705-18-100-35	180	0.19
HIT-SP MV- 0804-18-100-35	180	0.17
HIT-SP MV- 0907-18-100-35	180	0.22
HIT-SP MV- 1006-18-100-35	180	0.21
HIT-SP MV- 1008-18-100-35	180	0.24
HIT-SP MV- 1107-18-100-35	180	0.24
HIT-SP MV- 1208-18-100-35	180	0.25
HIT-SP MV- 0504-22-100-35	220	0.17
HIT-SP MV- 0705-22-100-35	220	0.20
HIT-SP MV- 0804-22-100-35	220	0.18
HIT-SP MV- 0504-24-100-35	240	0.17
HIT-SP MV- 0705-24-100-35	240	0.20
HIT-SP MV- 0804-24-100-35	240	0.18
HIT-SP MV- 0907-24-100-35	240	0.24
HIT-SP MV- 1006-24-100-35	240	0.23
HIT-SP MV- 1008-24-100-35	240	0.25
HIT-SP MV- 1107-24-100-35	240	0.25

Certificates by the Passive House Institute

In the higher category "Certified Passive House Component" which applies for cool, temperate climate HALFEN Balcony connections are certified for slab thicknesses from 160 mm to 240 mm.

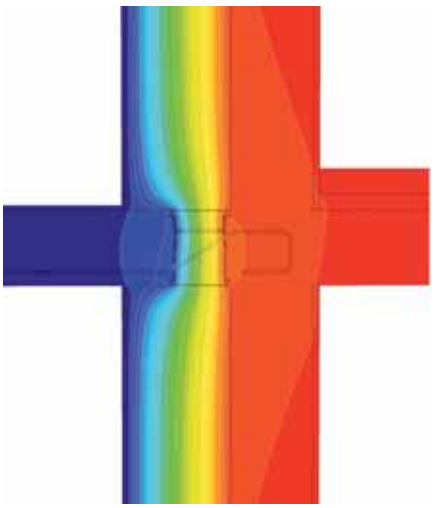


Figure: Isothermal diagram of the HIT-SP ZV-0202-16-100-30-06

The following criteria were used in awarding this certificate

- **Efficiency Criterion**
  In two typical applications (a terrace-house and an apartment) the construction fulfills the requirement of

$$\Delta U_{WB} < 0.01 \text{ W/(m}^2\text{K)}$$

- **Comfort Criterion**
  The inner surface must be warm enough to prevent mould and uncomfortable down-draught and radiation losses.

$$\theta_{i,min} > 17.00 \text{ °C}$$

Certified Passive House Component / HIT-SP ZV		
Insulation thickness 120 mm for simply-supported balcony slabs on columns	Slab thickness [mm]	Thermal transmission coefficient ψ [W/(m K)]
HIT-SP ZV-0202-16-100-30-06	160	0.096
HIT-SP ZV-0202-16-100-30-08	160	0.099
HIT-SP ZV-0302-16-100-30-06	160	0.098
HIT-SP ZV-0502-16-100-30-06	160	0.102
HIT-SP ZV-0202-18-100-30-06	180	0.096
HIT-SP ZV-0202-18-100-30-08	180	0.101
HIT-SP ZV-0302-18-100-30-06	180	0.102
HIT-SP ZV-0502-18-100-30-06	180	0.107
HIT-SP ZV-0202-22-100-30-06	220	0.104
HIT-SP ZV-0202-22-100-30-08	220	0.105
HIT-SP ZV-0302-22-100-30-06	220	0.106
HIT-SP ZV-0202-24-100-30-06	240	0.104

Certificates by the Passive House Institute for HALFEN HIT

Soundproofing according to DIN 4109

Soundproofing Requirements

With balconies and access balconies, vibration is transferred into the main structure of the building and distributed into adjacent rooms as airborne sound. DIN 4109 specifies the maximum level of the airborne sound pressure level $L'_{n,W}$ which penetrates the adjacent units of the building and which is measured with a standardised tapping machine. For access balconies in multi-storey buildings with residential and business units, the current version of DIN 4109 published in 1989 specifies as follows:

req. $L'_{n,W}$ = 53 dB (req. TSM = 10 dB)

The impact sound transmission from the balcony into the adjacent units can be significantly reduced by using thermally separated balcony connections.

In DIN 4109 there is no requirement defining the necessary sound-proofing insulation for balconies.
This more than 20-year-old norm is out of date and does not represent current technology.

Under special boundary conditions the standard versions of HALFEN HIT Insulated connections can fulfil the sound insulation requirements for access balconies.
The sound insulation properties of different elements were examined in independent on-site measurement and in measurements done in the MFPA Braunschweig laboratory.

Standardised tapping machine according to EN ISO 10140

Test setup according to EN ISO 10140 with built-in element

Laboratory measurements of impact sound

In laboratory measurements, the difference in the impact sound pressure level Δ L was examined on a balcony slab made with HIT elements in comparison to a continuous floor slab. The table shows the detected values for different load ranges.

For the first time, the difference in sound impact levels in slab connections are included in a building authority approval; they are included in the European Technical Approval, number ETA-13/0546.
The HALFEN Insulated connections HIT-HP and HIT-SP have the advantage that with the required, mandatory fire protection the necessary sound insulation is also ensured.

Differences in impact sound pressure level Δ L in dB resulting from laboratory measurements

HIT element ...MV	Difference in impact sound pressure level
HIT-HP MV-0504-18-100-35	12 dB
HIT-HP MV-0705-18-100-35	11 dB
HIT-HP MV-1207-18-100-35	11 dB
HIT-SP MV-0504-18-100-35	14 dB
HIT-SP MV-0705-18-100-35	15 dB
HIT-SP MV-1208-18-100-35	10 dB
HIT element ...ZV*	**Difference in impact sound pressure level**
HIT-HP ZV-0504-18-100-30-12	12 dB
HIT-HP ZV-0705-18-100-30-12	11 dB
HIT-HP ZV-1207-18-100-30-12	11 dB
HIT-SP ZV-0504-18-100-30-12	14 dB
HIT-SP ZV-0705-18-100-30-12	15 dB
HIT-SP ZV-1208-18-100-30-12	10 dB

*) Values from HIT MV are transferred for HIT ZV.
This is a very conservative assumption.

Fire protection according to EN 13501 and DIN 4102

All significant requirements concerning fire protection are laid down in the respective Building Regulations of the Federal States or in the relevant Master Building Regulations.

The components in close contact to the HALFEN Insulated connections HIT-HP or HIT-SP must also meet the requirements of the respective fire resistance class according to EN 13501-02 or DIN 4102-2 including DIN 4102-22 in order to fully exploit the fire protection classification of the connection.

The standard versions of the connecting units HIT-HP and HIT-SP are classified in class REI 120 according to EN 13501-02 as well as in class F 120-AB according to DIN 4102 in compliance with the European Technichal Approval ETA-13/0546 and the National Technical Approvals Z-15.7-293, Z-15.7-309 and Z-15.7-312.

This is possible due to the special shape of the insulating body in combination with the use of high-quality non-flammable mineral wool, Building Material Class A1 and Euro Class A1, respectively.

The structure prevents flashover on the element sides as the insulating wool encloses the load bearing elements (CSB, shear bars and tension bars) from all sides.

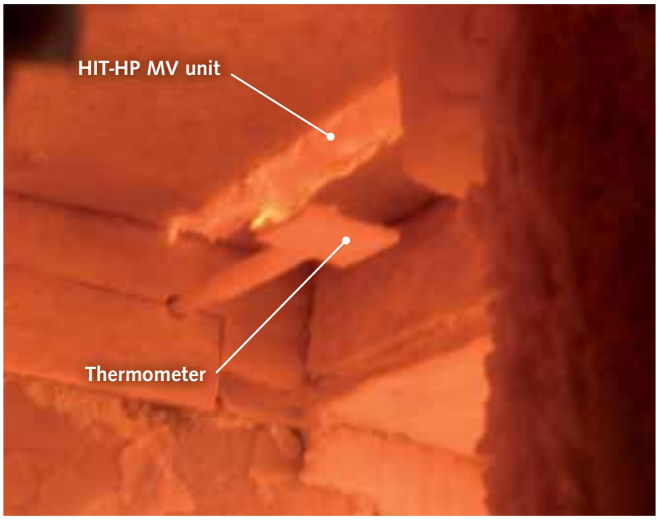
Meaning of the abbreviation REI:

R The structural safety of the connection is ensured for the specified duration.

E The propective effect of the connection is ensured for the specified duration.

I The thermal insulating property of the connection is ensured for the specified duration.

120 The functions above mentioned are ensured for 120 minutes of fire exposure in compliance with the standard time/temperature curve.



View into the fire test chamber during the HIT-HP MV fire-test after 120 minutes of exposure

The compliance with requirements concerning fire protection of any adjoining structural elements must be verified by the engineer.

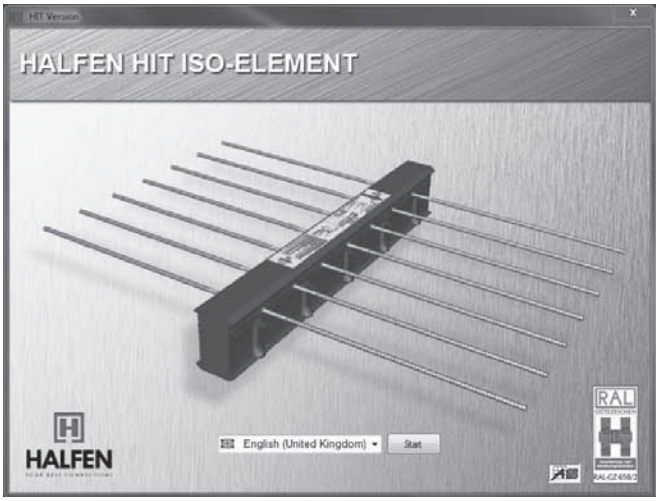
Advantages

The advantages of the new connection element in comparison to the elements used in conventional construction methods with polystyrene and fire boards are obvious:

- no confusion of the standard and F 90 versions
- selecting a fire-resistant element doesn't compromise heat insulation efficiency.
- no damage to the load bearing elements caused by flashover on the sides as the fire-resistant insulating wool encloses the load bearing elements from all sides
- protection against weathering

Innovations and advantages

The current version of the HIT balcony connections dimensioning software is based on the well proven previous versions; it has been improved and enhanced with significant additional functions.

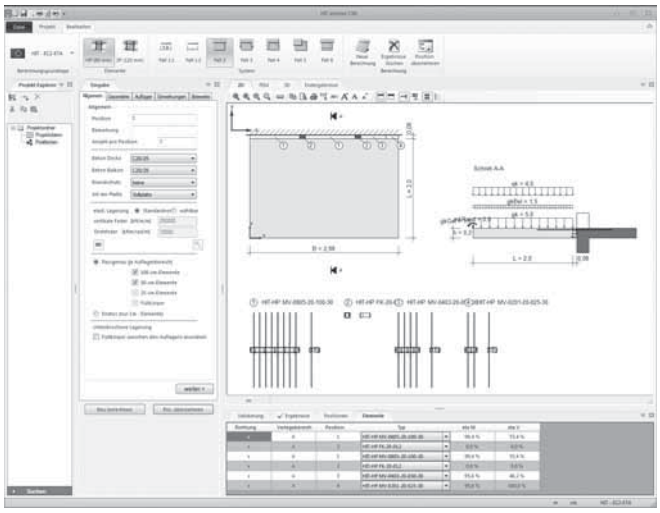


The HIT software provides verifiable calculations for your balconies and offers these 6 key advantages:

- free download available
- simple, intuitive user interface
- increased load and support options
- provides verifiable structural calculations
- generates DXF drawings to import into your construction drawings
- generates parts lists for easy ordering

Only 3 steps required to complete a parts list for enquiries and orders

Step 1: Simple and inituative data input



HALFEN features a large selection of balcony types:

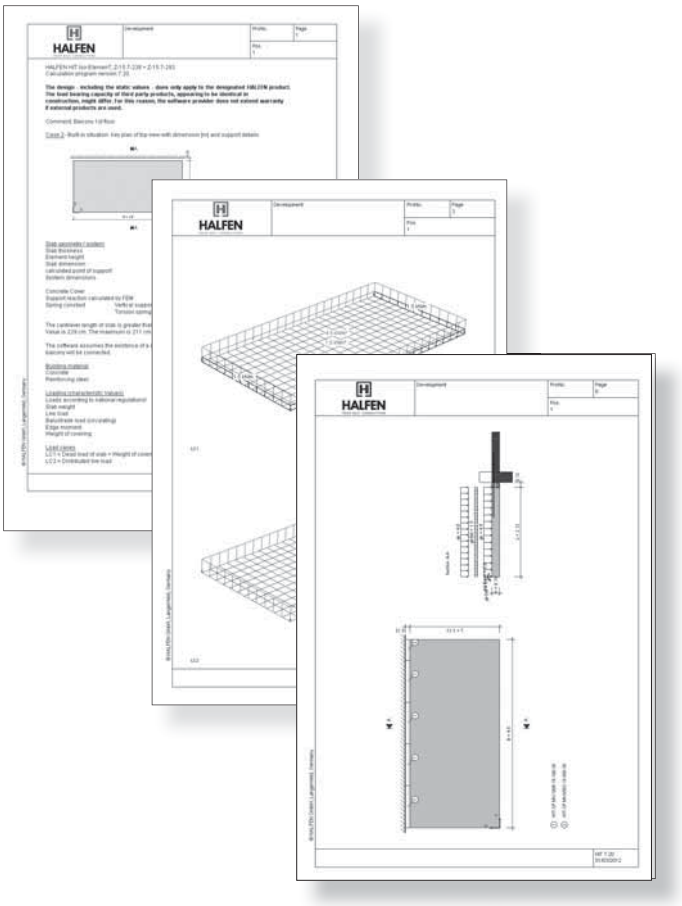
- cantilevered balcony
- cantilevered balcony with column
- recessed balcony
- external corner balcony
- external corner balcony with column
- corner, recessed balcony
- corner, recessed balcony with column

Step 2: Generation of verifiable structural calculations

The HIT design program uses the geometry of the balcony and the constraints regarding concrete cover and concrete strength to select the appropriate HIT elements.

If desired, the results can be printed as a verifiable structural calculation. Printouts can be generated in compact version or in greater detail including all investigated load cases and combinations, the distortion results, as well as graphical illustrations.

The graphical output capabilities of the significantly improved new HIT software can produce not only the basic geometry of the balcony but also a detailed top view and diagram illustrating the HALFEN HIT Insulated connections, the loads and the necessary connecting reinforcement.



Step 3: Parts lists printout

To simplify enquiry and the order process the HIT software can generate the following parts lists:

- parts list showing all individual balcony units (example on the right)
- parts listed as HIT types

HALFEN HIT Insulated connection Parts List
HIT Design Software
Project: Multifamily Building, Central Street
Created by: Mr. Builder
Company: ABC

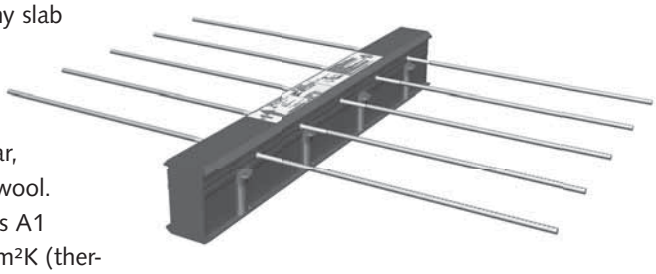
Position	Article number	Catalogue No.	Number of balconies	per item
1	HIT-SP MV-0704-22-100-30		4	4
1	HIT-SP MV-0402-22-050-30		4	1
2	HIT-SP MV-0604-22-100-30		2	6

Conclusion

The user-friendly, tried and tested HALFEN software is now available in a new design. The program allows intuitive operation and simple entry of numerous balcony support situations. HALFEN offers the planner a software for absolute reliability when planning and dimensioning balcony connections.

The software calculates HIT elements which have been building authority approved. Furthermore, all verifications required in accordance with approvals ETA-13/0546, Z-15.7-293, Z-15.7-309 or Z-15.7-312 can be provided.
This is an integral part of HALFENs integrated safety concept that no further approvals need to be separately acquired by planners when using HALFEN HIT Insulated connections.

Example 1: HALFEN HIT Insulated connection High Performance type HIT-HP MV-0504-hh-100-cc



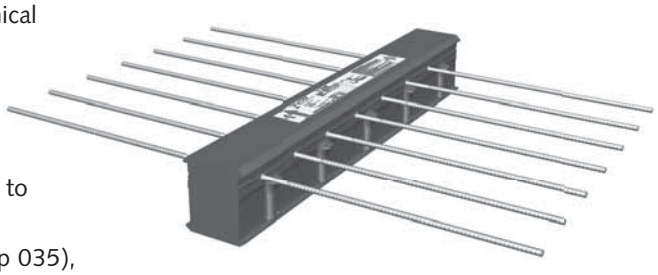
HALFEN HIT Insulated connection High Performance type HIT-HP MV for thermal separation of a free cantilevered, steel reinforced balcony slab from a steel reinforced main slab, according to European Technical Approval ETA-13/0546, with RAL Anchoring- and Reinforcement technology Quality Mark GZ 658/2, including compression shear bearings CSB made of ultra-high performance fibre-reinforced mortar, with an insulation joint (width 8 cm) made of fire-resistant mineral wool. Building Material Class A1 according to DIN 4102-1 or to Euro Class A1 according to EN 13501-1 with a thermal conductivity of 0.035 W/m²K (thermal conductivity 035), fire-resistant class REI 120 according to EN 13501-2 or F 120-AB according to DIN 4102-2 AB.

Type HIT-HP MV-0504-hh-100-cc with

HP = designation, thermal insulation thickness; 80 mm
0504 = load range with 5 tension bars and 4 compression shear bearings CSB
hh = balcony slab thickness (16 – 25) [cm]
100 = element width b [cm]
cc = upper concrete cover (30/35/50) [mm]
up to height h = 24 cm certificated by the Passive House Institute

or equivalent and install according to the manufacturer's installation instructions.

Example 2: HALFEN HIT Insulated connection Superior Performance type HIT-SP MV-0705-hh-100-cc



HALFEN HIT Insulated connection Superior Performance type HIT-SP MV for thermal separation of a free cantilevered, steel reinforced balcony slab from a steel reinforced main slab, according to the National Technical Approval Z-15.7-293, with the RAL Quality Mark Anchoring- and Reinforcement technology RAL-GZ 658/2, including compression shear bearings CSB made of ultra-high performance fibre-reinforced mortar, with a insulating joint (width 12 cm) made of fire-resistant mineral wool of Building Material Class A1 according to DIN 4102-1 or to Euro Class A1 according to EN 13501-1 with a thermal conductivity of 0.035 W/m²K (thermal conductivity group 035), fire-resistance class REI 120 according to EN 13501-2 or F 120-AB according to DIN 4102-2 AB.

Type HIT-SP MV-0705-hh-100-cc with

SP = designation, thermal insulation thickness; 120 mm
0705 = load range with 7 tension bars and 5 compression shear bearings CSB
hh = balcony slab thickness (16 – 25) [cm]
100 = element width b [cm]
cc = upper concrete cover (30/35/50) [mm]
up to height h = 24 cm certificated by the Passive House Institute

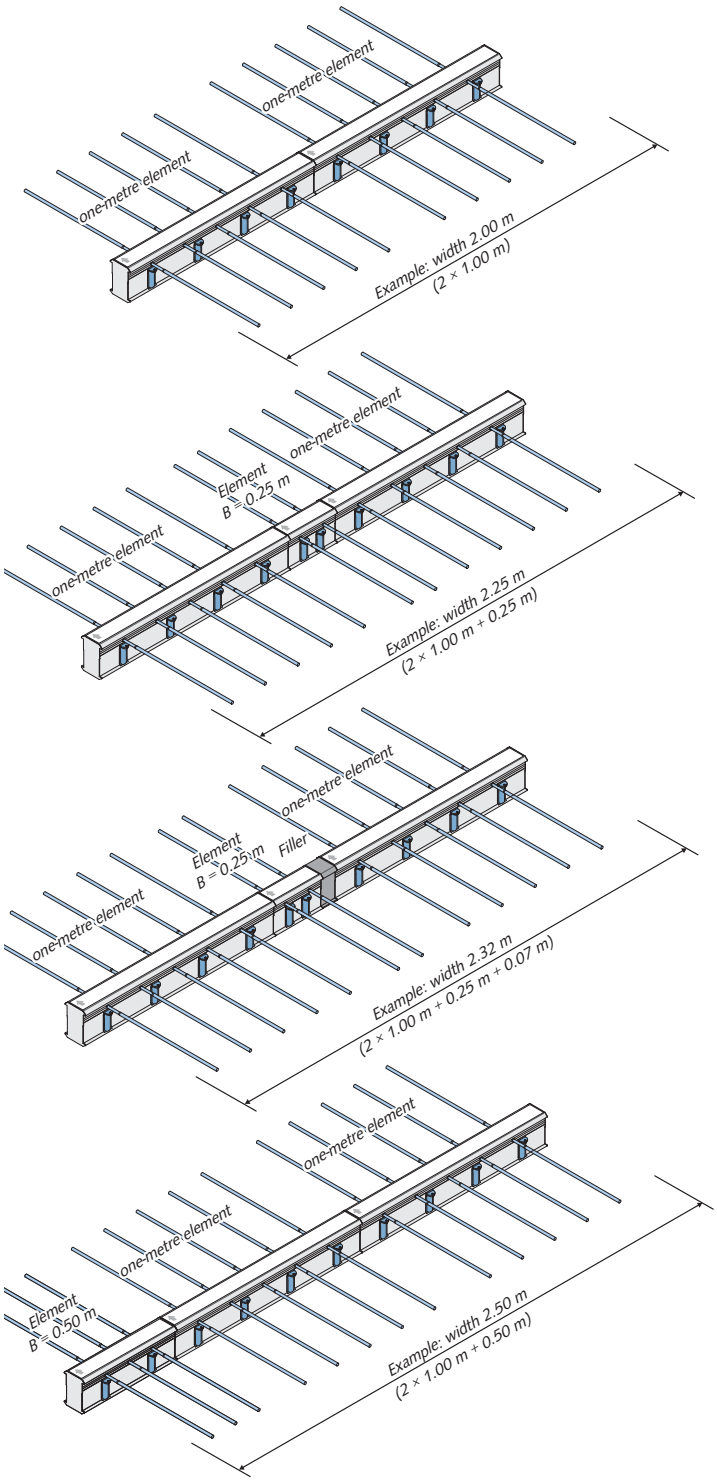
or equivalent and install according to the manufacturer's installation instructions.

Further tender specifications are available at www.halfen.com

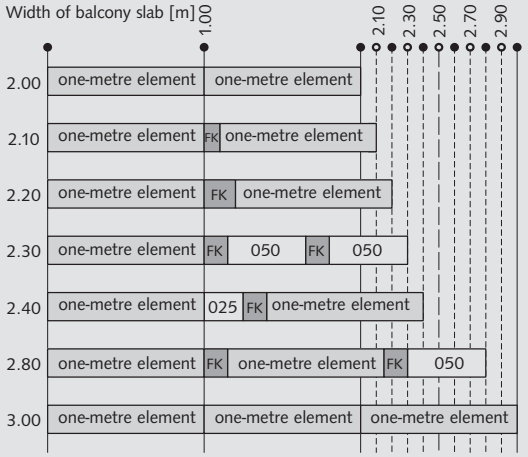
Optimized Combination

Optimized combination of HIT elements to reduce material waste; HALFEN HIT-HP, HIT-SP

Combinable: HIT elements with widths of 0.25 m, 0.50 m or 1.00 m can be combined to fit any width. Fillers can be used to ensure a precise fit.



Combination of HIT-HP / HIT-SP elements (B = 0.25/0.50/1.00 m) and fillers (examples)



The increase of the loaded areas when HIT fillers are used is compensated by the HIT design program with the respective additions.

FK = Filler HIT-HP FK (see below)

025 = Element with B = 0.25 m

050 = Element with B = 0.50 m

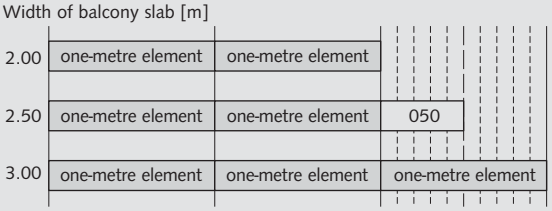
HIT fillers ease the installation of HIT elements as planned spacings can be filled with HIT-FK. No need to cut insulation to size on site.

The HIT-HP FK and HIT-SP FK fillers are available in the following sizes:

- width b = 6 – 100 cm
- height h = 16 – 30 cm
- thickness HIT-HP FK-SK = 8 cm
  HIT-SP FK-SK = 12 cm

Ordering examples:	Type	Dimensions in [cm]
HIT-HP FK-20-006	High Performance	b = 6, h = 20
HIT-SP FK-16-020	Superior Performance	b = 20, h = 16

Use of one-metre elements and short units



CONTACT HALFEN WORLDWIDE

HALFEN is represented by subsidiaries in the following 14 countries, please contact us:

Austria	HALFEN Gesellschaft m.b.H. Leonard-Bernstein-Str. 10 1220 Wien	Phone: +43-1-259 6770 E-Mail: office@halfen.at Internet: www.halfen.at	Fax: +43-1-259-677099
Belgium / Luxembourg	HALFEN N.V. Borkelstraat 131 2900 Schoten	Phone: +32-3-658 07 20 E-Mail: info@halfen.be Internet: www.halfen.be	Fax: +32-3-658 15 33
China	HALFEN Construction Accessories Distribution Co.Ltd. Room 601 Tower D, Vantone Centre No. A6 Chao Yang Men Wai Street Chaoyang District Beijing · P.R. China 100020	Phone: +86-10 5907 3200 E-Mail: info@halfen.cn Internet: www.halfen.cn	Fax: +86-10 5907 3218
Czech Republic	HALFEN s.r.o. Business Center Šafránkova Šafránkova 1238/1 155 00 Praha 5	Phone: +420 -311-690 060 E-Mail: info@halfen-deha.cz Internet: www.halfen-deha.cz	Fax: +420-235-314 308
France	HALFEN S.A.S. 18, rue Goubet 75019 Paris	Phone: +33-1- 445231 00 E-Mail: halfen@halfen.fr Internet: www.halfen.fr	Fax: +33-1-44523152
Germany	HALFEN Vertriebsgesellschaft mbH Liebigstr. 14 40764 Langenfeld	Phone: +49-2173-970-0 E-Mail: info@halfen.de Internet: www.halfen.de	Fax: +49-2173-970225
Italy	HALFEN S.r.l. Soc. Unipersonale Via F.lli Bronzetti N° 28 24124 Bergamo	Phone: +39-035-0760711 E-Mail: info@halfen.it Internet: www.halfen.it	Fax: +39-035-0760799
Netherlands	HALFEN b.v. Oostermaat 3 7623 CS Borne	Phone: +31-74-267 14 49 E-Mail: info@halfen.nl Internet: www.halfen.nl	Fax: +31-74-267 26 59
Norway	HALFEN AS Postboks 2080 4095 Stavanger	Phone: +47-51 82 34 00 E-Mail: post@halfen.no Internet: www.halfen.no	Fax: +47-51 82 34 01
Poland	HALFEN Sp. z o.o. Ul. Obornicka 287 60-691 Poznan	Phone: +48-61-622 14 14 E-Mail: info@halfen.pl Internet: www.halfen.pl	Fax: +48-61-622 14 15
Sweden	Halfen AB Vädursgatan 5 412 50 Göteborg	Phone: +46-31-98 58 00 E-Mail: info@halfen.se Internet: www.halfen.se	Fax: +46-31-98 58 01
Switzerland	HALFEN Swiss AG Hertistrasse 25 8304 Wallisellen	Phone: +41-44-849 78 78 E-Mail: mail@halfen.ch Internet: www.halfen.ch	Fax: +41-44-849 78 79
United Kingdom / Ireland	HALFEN Ltd. A1/A2 Portland Close Houghton Regis LU5 5AW	Phone: +44 -1582- 47 03 00 E-Mail: info@halfen.co.uk Internet: www.halfen.co.uk	Fax: +44-1582-47 03 04
United States of America	HALFEN USA Inc. 8521 FM 1976 P.O. Box 547 Converse, TX 78109	Phone: +1 800.423.91 40 E-Mail: info@halfenusa.com Internet: www.halfenusa.com	Fax: +1 877.683.4910

For countries not listed **HALFEN International**	HALFEN International GmbH Liebigstr. 14 40764 Langenfeld / Germany	Phone: +49 -2173-970-0 E-Mail: info@halfen.com Internet: www.halfen.com	Fax: +49-2173-970-849

Furthermore HALFEN is represented with sales offices and distributors worldwide. Please contact us: www.halfen.com

NOTES REGARDING THIS CATALOGUE

Technical and design changes reserved. The information in this publication is based on state-of-the-art technology at the time of publication. We reserve the right to make technical and design changes at any time. HALFEN GmbH shall not accept liability for the accuracy of the information in this publication or for any printing errors.

The Quality Management System of Halfen GmbH is certified for the locations in Germany, France, the Netherlands, Austria, Poland, Switzerland and the Czech Republic according to **DIN EN ISO 9001:2008**, Certificate No. QS-281 HH.

For further information please contact: **www.halfen.com**

R - 093 - E - 04/15 2.000 04/15