HALFEN HIT INSULATED CONNECTION

TECHNICAL PRODUCT INFORMATION

HALFEN HIT INSULATED CONNECTION

CONCRETE

HIT 19-E

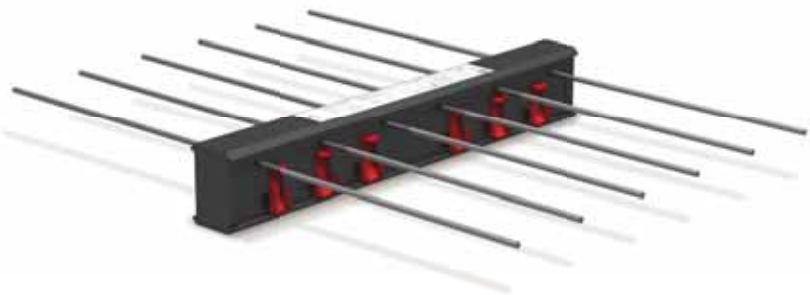
- the complete product range for balcony solutions
- with European Technical Assessment ETA
- symmetrical HIT Units with optimized CSB as standard

HALFEN
A CRH COMPANY

HALFEN
A CRH COMPANY

VERSATILE ADJUSTABILITY

The chameleon flexibly adapts to its surroundings – his colour change is mostly used for camouflage. The HALFEN HIT Insulated connections are just as versatile for application in a wide range of construction situations. But in contrast to the chameleon the HIT Balcony connections end up 100 % invisible – completely hidden in the concrete.



System solutions for every building situation:
The HALFEN Balcony connection.

Whether the height is offset, construction is straight or bends around a corner – with the HIT Insulated connections with 80 or 120 mm insulation thickness you can realize totally different balconies and cantilever elements. Thanks to the versatile system, a combination of various HIT elements is possible, all of which take into account the assumed horizontal forces, including all transverse forces or moments, and transfer them reliably to the main slab.

Find out more about our HIT Insulated connections at **www.halfen.com!**

HALFEN HIT INSULATED CONNECTION

Contents

Your benefits **4–5**

Type overview **6–9**

Product description **10**

Chapter 1 – HIT-HP MVX, HIT-SP MVX 11
– HIT-HP COR, HIT-SP COR 31
Chapter 2 – HIT-HP MVX-OU/OD, HIT-SP MVX-OU/OD 44
Chapter 3 – HIT-HP ZVX, HIT-SP ZVX 58
– HIT-HP ZDX, HIT-SP ZDX 59
Chapter 4 – HIT-HP DD, HIT-SP DD 87
– HIT-HP DVL, HIT-HP DDL 94
Chapter 5 – HIT-HP HT1–5, HIT-SP HT1–5 102
Chapter 6 – HIT-HP AT, HIT-SP AT 111
– HIT-HP FT, HIT-SP FT 119
– HIT-HP OTX, HIT-SP OTX 126
– HIT-HP FK, HIT-SP FK, width adjustment 134

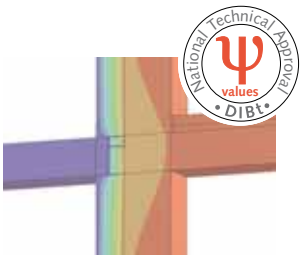
HIT-HP MVX
HIT-SP MVX

HIT-HP DVL

HIT-HP DDL

Building physics **136**

Chapter 7 – Basics of thermal insulation 137
– HALFEN ψ calculator 140
– Building authority approved thermal values 141
– Passive House Institute certification 149
– Noise protection according to DIN 4109 151
– Fire protection according to DIN EN 13501 152



HIT software **153**

Contact / Technical Support **155**

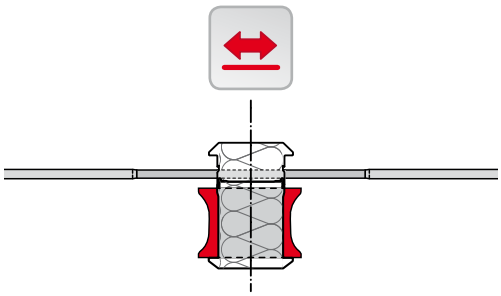
HALFEN HIT Insulated connection – the innovative balcony connection

Our main focus is the development and improvement of our products. Thanks to the innovative, double-symmetrical compression shear bearings CSB, HALFEN can now provide even greater reliability in planning and application as well as an improved installation procedure – both on-site or in the precast plant. The complete product range includes the HIT-HP with an insulation thickness of 80 mm and the HIT-SP option with 120 mm insulation thickness.

Reliable installation

The distinct shape of the CSB-bearing means the HIT Insulated connections for balconies (HIT-HP/SP MVX, ZDX, DD, HT) are symmetrical. Installation is therefore independent of the main slab or balcony direction.

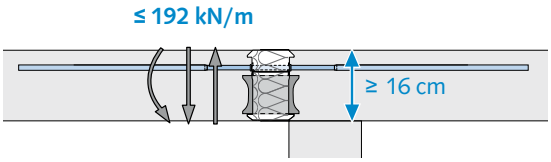
- no confusion of installation direction



Reliable planning

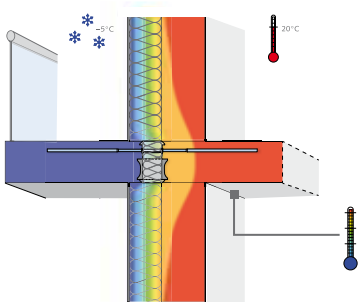
HALFEN's integrated safety concept:
The values provided in the tables are actual design values; therefore all necessary proofs for the slab connection are provided.

- possible shear loads up to 192 kN/m for slab thickness from 16 cm
- easy load range allocation even with the individual elements in our modular system



Up to 30 % improvement on building physics key-values

A significant reduction in the number of support elements is achieved due to the further optimization of the CSB-bearings.



Approved Environmental Performance

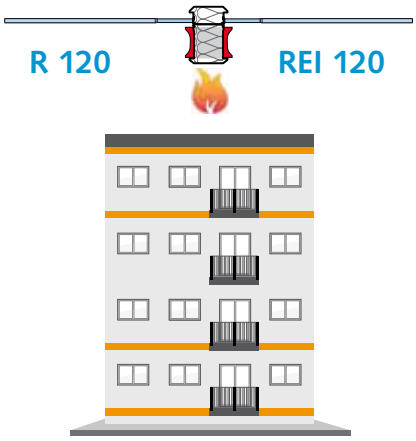
The Environmental Product Declaration EPD provides transparent and comparable ecological data for the ecological building assessment according to DIN EN 15978. It ensures that the high demands on the ecological performance of the building are also met. With obtaining the EPD for HALFEN HIT Insulated connection the necessary data for sustainability certification of the building are available.

Further benefits

Fire protection

The standard HIT Elements fulfil the requirements for the highest fire protection classification REI 120

- fire resistant thermal heat insulation material; A1 building material classification – non-flammable insulation
- suitable for use as a fire-break in ETICS façades (Expanded polystyrene)
- no mix-ups of elements with or without demands on fire protection
- additional fire protection is not required due to integrated all-sided fire protection



EnEV conformity

with building authority approved Ψ-Values

DIBt approved Ψ-values are available to calculate the total energy balance.

- HIT Calculator available on the HALFEN website: available for all platforms – no installation required!

Passive House Institute certified

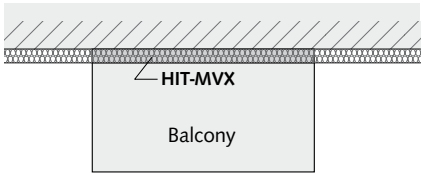
- highest category certified "Certified Passive house component" for the HIT-SP ZVX Element with up to 24 cm slab thickness
- certified as energy saving components starting with an insulation thickness of 80 mm for application in cantilevered and simply supported balcony slabs

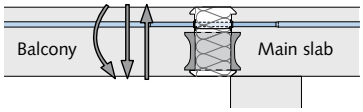
Certification and software

- CE marking with ETA European Technical Assessment
- approved by the German Centre of Competence for Construction (DIBt *Deutsches Institut für Bautechnik)*
- user-friendly software with integrated offcut-optimization to reduce waste

1 Cantilevered balcony slabs

Application for cantilevered balcony slabs

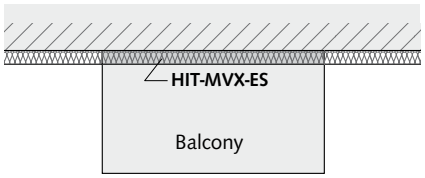


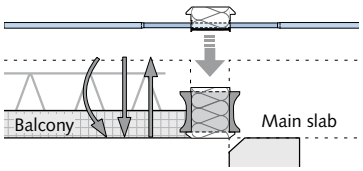


HIT-HP MVX / HIT-SP MVX
Transfers bending moments and positive and negative shear forces.
- insulation thickness 80 mm / 120 mm

→ **page 11**

Multi-part application for element slabs

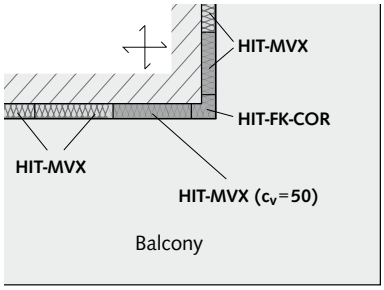


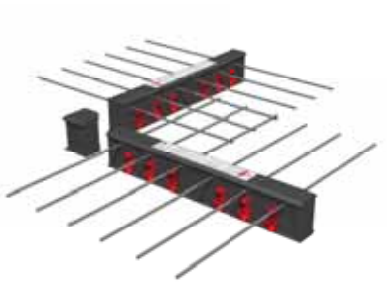


HIT-HP MVX-ES / HIT-SP MVX-ES
Product type for element slabs. Transfers bending moments and positive and negative shear forces.
- insulation thickness 80 mm / 120 mm

→ **page 11**

Application for cantilevered corner balcony slabs



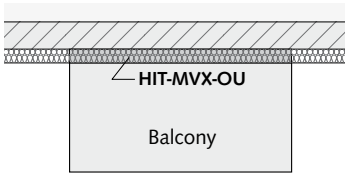


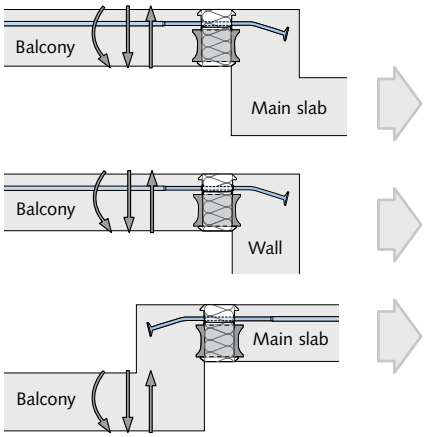
HIT-HP COR / HIT-SP COR
For cantilevered outside corner balconies, designed with standard elements with the same load bearing capacity and a corner filler.
- available as product type for element slabs (-ES)
- insulation thickness 80 mm / 120 mm

→ **page 31**

2 Cantilevered balcony slabs with height offset or wall connections

Application for upward height offset



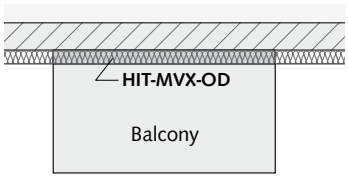


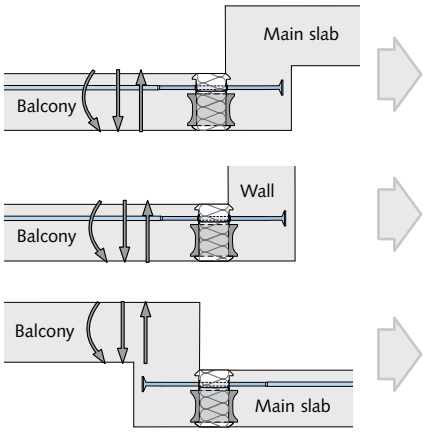
HIT-HP MVX-OU / HIT-SP MVX-OU
Height offset, balcony higher than main slab, upward wall connection. Transfers bending moments and positive and negative shear forces.

- available as product type for element slabs (-ES)
- available as custom design also for balcony side
- insulation thickness 80 mm / 120 mm

→ **page 44**

Application for downward height offset



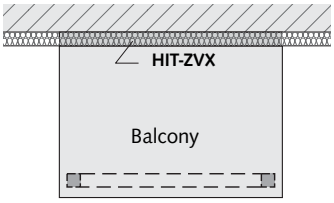


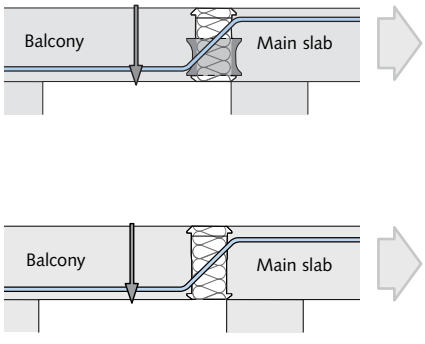
HIT-HP MVX-OD / HIT-SP MVX-OD
Height offset, balcony lower than main slab; downward wall connection. Transfers bending moments and positive and negative shear forces.

- available as product type for element slabs (-ES)
- available as custom design also for balcony side
- insulation thickness 80 mm / 120 mm

→ **page 44**

3 Simply-supported balcony slabs on columns





HIT-HP ZVX / HIT-SP ZVX
Transfers shear forces only

- insulation thickness 80 mm / 120 mm

→ **page 58**

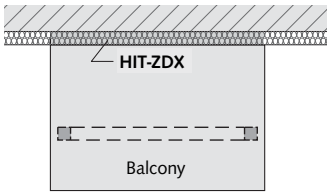
HIT-HP ZVX / HIT-SP ZVX without CSB
Transfers shear forces only for unrestrained simply supported connections, e.g. for loggias.

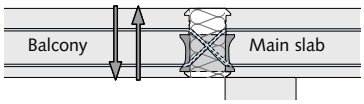
- insulation thickness 80 mm / 120 mm

→ **page 58**

► further types → see following pages

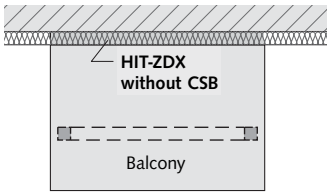
3 Simply-supported balcony slabs on columns

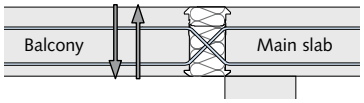




HIT-HP ZDX / HIT-SP ZDX
Transfers positive and negative shear forces
- insulation thickness 80 mm / 120 mm

→ **page 59**

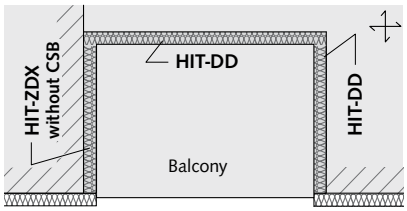


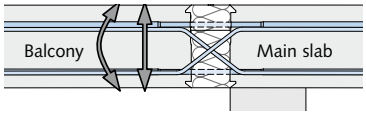


HIT-HP ZDX / HIT-SP ZDX without CSB
Transfers shear forces only for unrestrained simply supported connections
- insulation thickness 80 mm / 120 mm

→ **page 59**

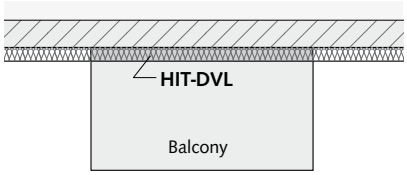
4 Continuous slabs

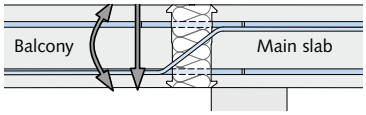




HIT-HP DD / HIT-SP DD
Transfers positive and negative bending moments and shear forces
- insulation thickness 80 mm / 120 mm

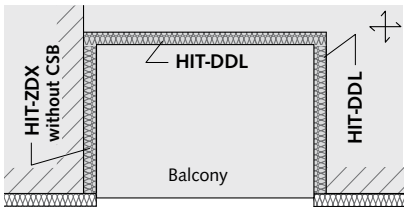
→ **page 87**

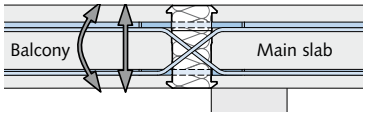




HIT-HP DVL NEW!
Transfers high shear forces and bi-directional moments.
- insulation thickness 80 mm

→ **page 94**

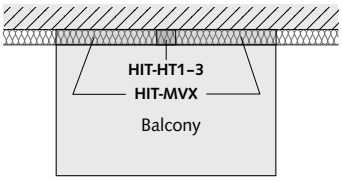


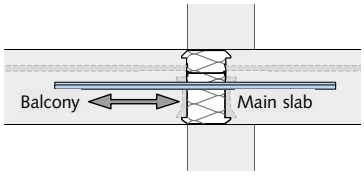


HIT-HP DDL NEW!
Transfers high bi-directional shear forces and moments.
- insulation thickness 80 mm

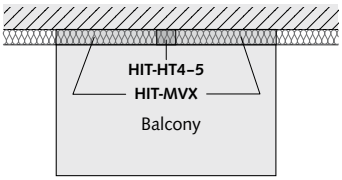
→ **page 95**

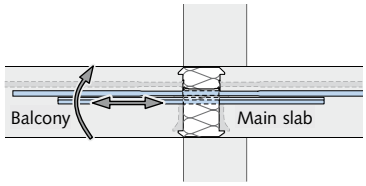
5 Absorption of horizontal forces





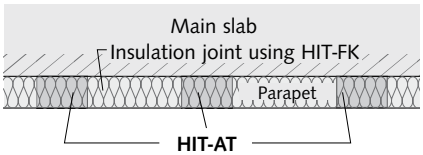
HIT-HP HT1–3 / HIT-SP HT1–3
For transfer of planned horizontal loads and lifting moments perpendicular to the insulation line
• insulation thickness 80 mm / 120 mm
→ **page 102**

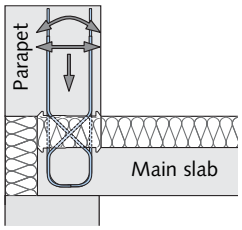




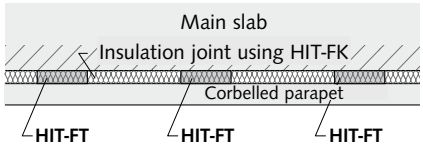
HIT-HP HT4–5 / HIT-SP HT4–5
For transfer of planned horizontal loads and lifting moments perpendicular to the insulation line, and lifting moments if applicable
• insulation thickness 80 mm / 120 mm
→ **page 102**

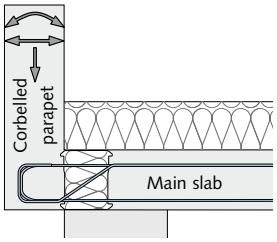
6 Parapets and corbels



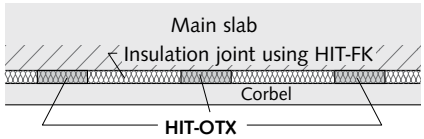


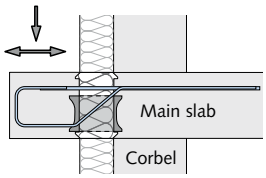
HIT-HP AT / HIT-SP AT
Forms a thermal barrier between parapet and main slab for selective use. Unit spacing based on structural requirements.
• insulation thickness 80 mm / 120 mm
→ **page 111**





HIT-HP FT / HIT-SP FT
Forms a thermal barrier between corbelled parapet and main slab for selective use.
Unit spacing based on structural requirements.
• insulation thickness 80 mm / 120 mm
→ **page 119**





HIT-HP OTX / HIT-SP OTX
Forms a thermal barrier between corbel and main slab for selective use. Unit spacing based on structural requirements.
• insulation thickness 80 mm / 120 mm
→ **page 126**

HIT-HP FK / HIT-SP FK: Fillers for insulation of the joint between balcony and main slab. Insulation thickness 80 mm / 120 mm → **page 134**

7 Building physics, technical information

Information on: thermal insulation, fire protection and noise reduction / planning aid / HALFEN design software → **page 136**

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 steel bar of strength class S 690 i.e. stainless steel B500NR
Shear bars	Stainless bar steel of strength B500NR or flash butt welded bar connection, consisting of a combination of stainless steel bar B500NR and reinforcing steel bars B500B
Compression shear bearings	High-performance mortar with increased compressive and tensile strength as well as optimized thermal conductivity
Casings	Plastic according to EN ISO 1163
Insulating material	Mineral wool (WLG 035) of Building Material Class A1, non-flammable insulation according to DIN 4102-14 or Euro Class A1 according to EN 13501-1

Connecting components	
Concrete	Suitable for concrete strengths ≥ C20/25
On-site reinforcement	Reinforcing steel B500

Test certificates

Technical Approvals	
HIT-HP/SP MVX **HIT-HP/SP ZVX and ZDX** **HIT-HP/SP DD, DVL and DDL** **HIT-HP/SP AT, FT, OTX**	EOTA: ETA-18/0189 including fire protection, thermal values and noise reduction DoP no. H10-18/0189
HIT-HP/SP MVX **HIT-HP/SP ZVX and ZDX**	DIBT Berlin: Approval no. Z-15.7-293 DIBT Berlin: Approval no. Z-15.7-312

Type Test	
Type tested by the LGA Landesgewerbeanstalt Bayern	Test no. S-WUE/100358 (German certification institute)

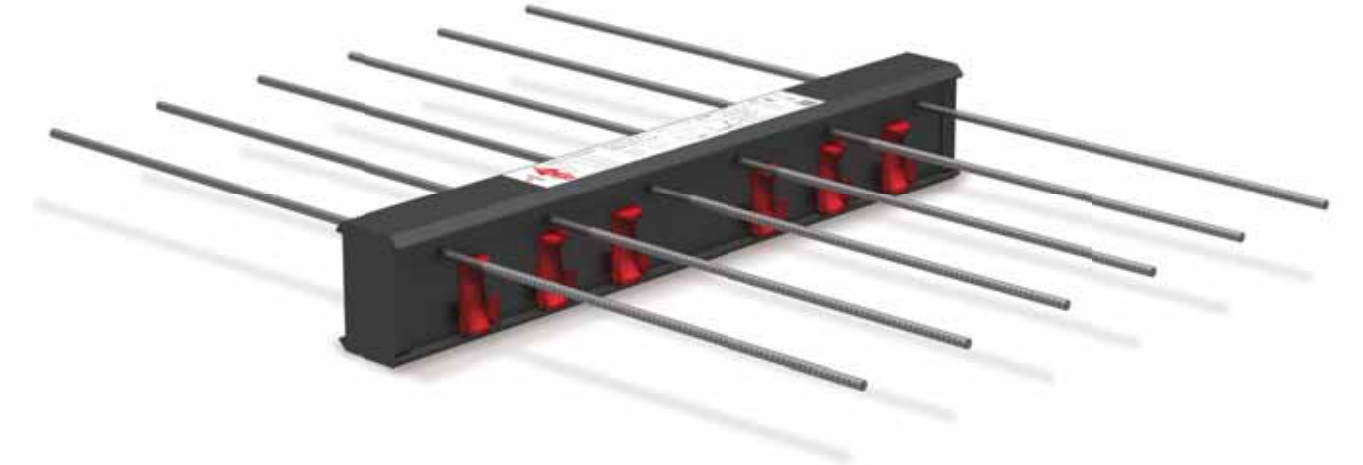
Certification	
Passive House Institute	Certification valid for slab thickness from 160 mm to 240 mm
Environmental Product Declaration EPD	comparable ecological data for the ecological building assessment according to DIN EN 15978

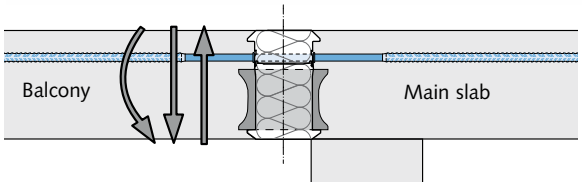
Approvals and type tests on the internet
The approvals and type tests can be found at **www.halfen.com/downloads/brochures**.
Or simply scan the code and then select the document to download a PDF file.

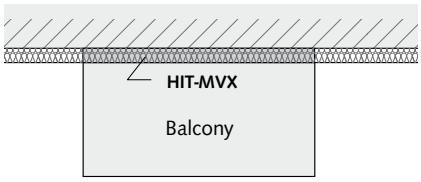
1

- Symmetrical balcony connection for cantilevered balcony slabs
- Transfers bending moments and positive and negative shear forces

type tested







Application: Cantilevered balcony

HIT-HP MVX – **High Performance** with 80 mm insulation thickness
HIT-SP MVX – **Superior Performance** with 120 mm insulation thickness
Both types are also available as multi-part design (-ES) for element slabs.

Content	Type	Page
The basics of load bearing capacity	HIT-HP MVX, HIT-SP MVX	12
Product types / Load range	HIT-HP MVX, HIT-SP MVX	13
Load bearing capacity values	HIT-HP MVX, HIT-SP MVX	14
Product type for element slabs	HIT-HP MVX-ES, HIT-SP MVX-ES	29
Elements for cantilevered corner balconies	HIT-HP COR, HIT-SP COR	31
On-site connecting reinforcement, installation diagram		34
HIT-MVX with prestressed concrete prefabricated slabs		36
Camber		41

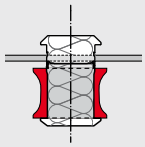
Load bearing behaviour of the HIT-MVX

Our latest development: Symmetrical HIT Elements

The static system of the HIT-MVX Elements is made of standard tension rods in reinforcement steel and stainless steel and the innovative CSB-bearing with high density fibre-reinforced high performance mortar.
CSB is an abbreviation of Compression-Shear-Bearing and describes its unique function; the simultaneous transmission of shear and compression loads.

Our latest innovation is the double-symmetrical CSB for transmitting shear loads in both directions. In combination with the tension rods these make up the symmetrical HIT-HP MVX which has 80 mm insulation thickness and the HIT-SP MVX with 120 mm insulation thickness.
These elements are suitable for moments as well as positive and negative shear loads.

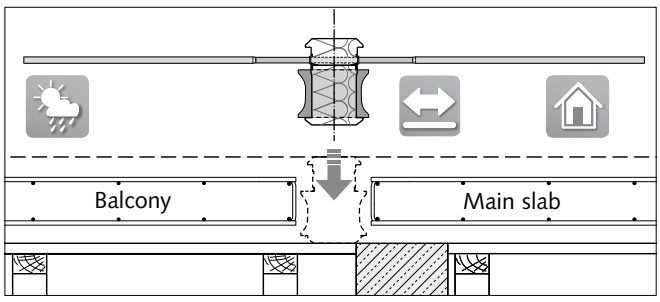
With the double-symmetrical CSB the HIT-MVX Insulated connections are symmetrical and can be installed independently of the main slab or the balcony direction.



Reliable installation with symmetrical HIT-MVX Elements

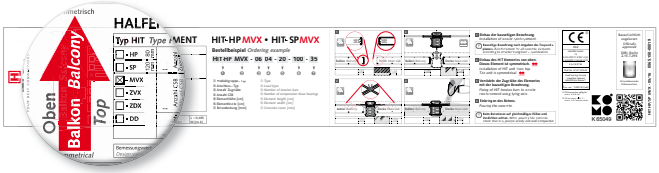
The HIT Balcony connection is designed for practical building requirements. All support elements are sufficiently secured in the sturdy plastic housing to ensure safe delivery, transport and easy on-site handling. In addition, the thermal insulation is optimally protected against mechanical damage and water.

The symmetrical HIT-MVX element is easily installed from above in the prepared formwork.



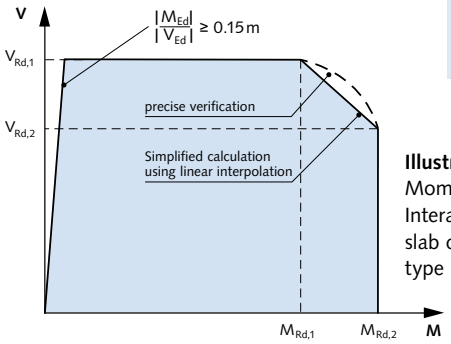
Reliable installation with symmetrical HIT-MVX Elements

The arrow marking defining the installation direction will continue to be displayed on all HIT Elements; including the double-symmetrical HIT-MVX-Type. This is to continue to ensure an efficient installation. If when inspected, it is found that the installation direction shown on the element has been overlooked, the new symmetrical design of the HIT Elements has a distinct advantage: The HIT Element is designed for the same loads and moments in both directions – therefore the HIT Elements can stay in-situ for further installation.



Load characteristics of the HIT Elements

The load capacity of a HIT-MVX follows the diagram below. If it is not planned to fully exploit the maximum shear capacity $V_{Rd,1}$, the CSB technology allows the option of increasing the moment load capacity using $M_{Rd,1}$.
$M_{Rd,2}$ is the maximum moment load capacity with the respective shear resistance $V_{Rd,2}$. The force couple must lie within the load-bearing capacity curve. This structural behaviour is taken into account in our HALFEN HIT-calculation software. The software selects the optimum load range for the HIT Elements for each current load-combination. The software is available in the download section on the HALFEN web page. The CSB technology allows safe and approval conform transfer of shear loads up to 192 kN per metre in main slab thicknesses from 160 mm and larger. To ensure this high shear capacity in the planned application as a cantilevered slab connection, the following **load/moment ratio** must be observed:



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

Illustration:
Moment-shear load-Interaction in cantileved slab connections, type HIT-MVX

Product types – 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 available as standard.

Possible combinations of upper and lower parts (TB- and CSB Boxes)

Element width B = 25 cm		No. of tension bars n_{TB}			
		1	2	3	4
Number of compression shear bearings n_{CSB}	1	●	●		
	2	●	●	●	●

Element width B = 50 cm		No. of tension bars n_{TB}								
		1	2	3	4	5	6	7	8	9
Number of compression shear bearings n_{CSB}	1	●	●							
	2	●	●	●	●					
	3		●	●	●	●	●			
	4		●	●	●	●	●	●	●	●
	5			●	●	●	●	●	●	●

Element width B = 100 cm		No. of tension bars n_{TB}															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	16	18
Number of compression shear bearings n_{CSB}	2		●	●	●	●											
	3		●	●	●	●	●	●									
	4		●	●	●	●	●	●	●	●							
	5				●	●	●	●	●	●	●	●					
	6				●	●	●	●	●	●	●	●	●	●			
	7				●	●	●	●	●	●	●	●	●	●	●	●	
	8				●	●	●	●	●	●	●	●	●	●	●	●	●
	9					●	●	●	●	●	●	●	●	●	●	●	●
	10						●	●	●	●	●	●	●	●	●	●	●
	11								●	●	●	●	●	●	●	●	●
	12										●	●	●	●	●	●	●

Values for load bearing capacities for selected elements → see pages 14 – 27. ● = HP and SP

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

Verifications
All necessary verifications have already been considered. Connecting elements must be verified by the planner.

Ordering example

HIT-HP	**MVX**	**-**	**08 08**	**-**	**20**	**-**	**100**	**-**	**35**	
HIT-HP	**MVX**	**-**	**04 04**	**-**	**18**	**-**	**050**	**-**	**50**	
HIT-SP	**MVX**	**-**	**02 02**	**-**	**18**	**-**	**025**	**-**	**30**	**- ES**
			❶ ❷		❸		❹ ❺	❻	❼	❽ ❾

HIT Custom solutions
Our technical support team is available to provide support for your project with custom solutions using HALFEN HIT Insulated connections.
Contact: → see inside back cover

Type designation

① Product group
② Joint spacing 80 mm (HP) or 120 mm (SP)
③ Connection type
④ Number of tension bars
⑤ Number of CSB compression shear units
⑥ Element height [cm]
⑦ Element width [cm]
⑧ Concrete cover (top) [mm]
⑨ For element slab design only

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

Load bearing capacity values $v_{Rd,1}$ / $m_{Rd,1}$ according to EN 1992-1-1 (EC2)

Shear capacity $\pm v_{Rd}$

Concrete strength: *C20/25* ≥C25/30

Type / Element width		HP MVX-0202	HP MVX-0302	HP MVX-0203	HP MVX-0403	HP MVX-0603
	B = 1.00 m					
	B = 0.50 m	HP MVX-0101	–	–	–	–
	B = 0.25 m	–	–	–	–	–
Design values	v_{Rd} [kN/m]	*32.0* **32.0**	*32.0* **32.0**	*48.0* **48.0**	*48.0* **48.0**	*48.0* **48.0**

Moment bearing capacity m_{Rd}

Type / Element width		HP MVX-0202	HP MVX-0302	HP MVX-0203	HP MVX-0403	HP MVX-0603
	B = 1.00 m					
	B = 0.50 m	HP MVX-0101	–	–	–	–
	B = 0.25 m	–	–	–	–	–

Concrete cover [mm]	30	35	50										
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*8.5*	8.7	*11.3*	11.9	*9.0*	9.2	*15.7*	16.4	*18.5*	21.5
	160		180	*8.9*	9.2	*12.1*	12.7	*9.5*	9.7	*16.7*	17.4	*19.8*	23.0
		170		*9.4*	9.7	*12.8*	13.4	*10.0*	10.2	*17.7*	18.4	*21.0*	24.4
	170		190	*9.9*	10.2	*13.6*	14.1	*10.5*	10.7	*18.7*	19.4	*22.3*	25.9
		180		***10.4***	**10.7**	***14.3***	**14.9**	***11.0***	**11.2**	***19.6***	**20.3**	***23.6***	**27.4**
	180		200	*10.9*	11.2	*15.0*	15.6	*11.5*	11.7	*20.6*	21.3	*24.8*	28.8
		190		*11.4*	11.7	*15.8*	16.4	*12.0*	12.2	*21.6*	22.3	*26.1*	30.3
	190		210	*11.9*	12.2	*16.5*	17.1	*12.5*	12.7	*22.6*	23.3	*27.4*	31.8
		200		***12.4***	**12.6**	***17.2***	**17.8**	***13.0***	**13.2**	***23.6***	**24.3**	***28.6***	**33.2**
	200		220	*12.9*	13.1	*18.0*	18.6	*13.5*	13.6	*24.6*	25.3	*29.9*	34.7
		210		*13.4*	13.6	*18.7*	19.3	*14.0*	14.1	*25.5*	26.2	*31.2*	36.2
	210		230	*13.9*	14.1	*19.5*	20.0	*14.5*	14.6	*26.5*	27.2	*32.5*	37.6
		220		***14.4***	**14.6**	***20.2***	**20.8**	***14.9***	**15.1**	***27.5***	**28.2**	***33.7***	**39.1**
	220		240	*14.8*	15.1	*20.9*	21.5	*15.4*	15.6	*28.5*	29.2	*35.0*	40.6
		230		*15.3*	15.6	*21.7*	22.3	*15.9*	16.1	*29.5*	30.2	*36.3*	42.0
	230		250	*15.8*	16.1	*22.4*	23.0	*16.4*	16.6	*30.5*	31.2	*37.5*	43.5
		240		***16.3***	**16.6**	***23.1***	**23.7**	***16.9***	**17.1**	***31.5***	**32.1**	***38.8***	**45.0**
	240		260	*16.8*	17.1	*23.9*	24.5	*17.4*	17.6	*32.4*	33.1	*40.1*	46.4
		250		*17.3*	17.6	*24.6*	25.2	*17.9*	18.1	*33.4*	34.1	*41.3*	47.9
	250		270	*17.8*	18.1	*25.4*	25.9	*18.4*	18.6	*34.4*	35.1	*42.6*	49.4
	> 250			Load bearing capacity values for further types (e.g. for h > 250 mm, C30/37, $v_{Rd,2}$ and $m_{Rd,2}$) can be found in the type tests at **www.halfen.com** or on request. See inside back cover for contact information.										

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

V_{Ed} ↓	ø6 / 25 cm			
V_{Ed} ↑	ø6 / 25 cm	ø6 / 19.5 cm	ø6 / 17.5 cm	ø6 / 17 cm

On-site stirrup reinforcement $A_{s,req}$ on main slab side (→ page 35)

V_{Ed} ↓	direct support	ø6 / 25 cm			
	indirect support	ø6 / 25 cm	ø6 / 19.5 cm	ø6 / 17.5 cm	ø6 / 17 cm
V_{Ed} ↑	direct / indirect support	ø6 / 25 cm			

Load bearing capacity values $v_{Rd,1}$ / $m_{Rd,1}$ according to EN 1992-1-1 (EC2)

Shear capacity $\pm v_{Rd}$

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

Type / Element width		HP MVX-0204	HP MVX-0404	HP MVX-0504	HP MVX-0604	HP MVX-0704
	B = 1.00 m					
	B = 0.50 m	HP MVX-0102	HP MVX-0202	–	HP MVX-0302	–
	B = 0.25 m	–	HP MVX-0101	–	–	–
Design values	v_{Rd} [kN/m]	*58.0* **60.4**		*64.0* **64.0**		

Moment bearing capacity m_{Rd}

Type / Element width				HP MVX-0204		HP MVX-0404		HP MVX-0504		HP MVX-0604		HP MVX-0704	
	B = 1.00 m												
	B = 0.50 m			HP MVX-0102		HP MVX-0202		–		HP MVX-0302		–	
	B = 0.25 m			–		HP MVX-0101		–		–		–	
Concrete cover [mm]	30	35	50										
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*9.3*	9.5	*16.9*	17.4	*20.0*	20.8	*22.7*	23.9	*24.7*	26.5
	160		180	*9.8*	10.0	*17.9*	18.4	*21.2*	22.1	*24.2*	25.3	*26.3*	28.2
		170		*10.3*	10.5	*18.9*	19.4	*22.5*	23.3	*25.6*	26.8	*28.0*	29.9
	170		190	*10.8*	10.9	*19.9*	20.4	*23.7*	24.5	*27.1*	28.3	*29.7*	31.7
		180		***11.3***	**11.4**	***20.8***	**21.4**	***24.9***	**25.7**	***28.6***	**29.8**	***31.4***	**33.4**
	180		200	*11.8*	11.9	*21.8*	22.3	*26.2*	27.0	*30.1*	31.2	*33.1*	35.1
		190		*12.3*	12.4	*22.8*	23.3	*27.4*	28.2	*31.5*	32.7	*34.8*	36.8
	190		210	*12.8*	12.9	*23.8*	24.3	*28.6*	29.4	*33.0*	34.2	*36.5*	38.6
		200		***13.3***	**13.4**	***24.8***	**25.3**	***29.8***	**30.7**	***34.5***	**35.7**	***38.2***	**40.3**
	200		220	*13.8*	13.9	*25.8*	26.3	*31.1*	31.9	*36.0*	37.1	*39.9*	42.0
		210		*14.3*	14.4	*26.7*	27.3	*32.3*	33.1	*37.4*	38.6	*41.6*	43.7
	210		230	*14.7*	14.9	*27.7*	28.2	*33.5*	34.4	*38.9*	40.1	*43.3*	45.4
		220		***15.2***	**15.4**	***28.7***	**29.2**	***34.8***	**35.6**	***40.4***	**41.6**	***44.9***	**47.2**
	220		240	*15.7*	15.9	*29.7*	30.2	*36.0*	36.8	*41.9*	43.0	*46.6*	48.9
		230		*16.2*	16.4	*30.7*	31.2	*37.2*	38.0	*43.3*	44.5	*48.3*	50.6
	230		250	*16.7*	16.8	*31.7*	32.2	*38.5*	39.3	*44.8*	46.0	*50.0*	52.3
		240		***17.2***	**17.3**	***32.6***	**33.2**	***39.7***	**40.5**	***46.3***	**47.5**	***51.7***	**54.0**
	240		260	*17.7*	17.8	*33.6*	34.1	*40.9*	41.7	*47.8*	48.9	*53.4*	55.8
		250		*18.2*	18.3	*34.6*	35.1	*42.1*	43.0	*49.2*	50.4	*55.1*	57.5
	250		270	*18.7*	18.8	*35.6*	36.1	*43.4*	44.2	*50.7*	51.9	*56.8*	59.2
	> 250			Load bearing capacity values for further types (e.g. for h > 250 mm, C30/37, $v_{Rd,2}$ and $m_{Rd,2}$) can be found in the type tests at **www.halfen.com** or on request. See inside back cover for contact information.										

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

V_{Ed} ↓	ø6 / 25 cm			
V_{Ed} ↑	ø6 / 14 cm	ø6 / 13.5 cm	ø6 / 13 cm	ø6 / 12.5 cm

On-site stirrup reinforcement $A_{s,req}$ on main slab side (→ page 35)

V_{Ed} ↓	direct support	ø6 / 25 cm			
	indirect support	ø6 / 14 cm	ø6 / 13.5 cm	ø6 / 13 cm	ø6 / 12.5 cm
V_{Ed} ↑	direct / indirect support	ø6 / 25 cm			

Load bearing capacity values $v_{Rd,1}$ / $m_{Rd,1}$ according to EN 1992-1-1 (EC2)

Shear capacity $\pm v_{Rd}$

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

Type / Element width		HP MVX-0804	HP MVX-0505	HP MVX-0605	HP MVX-0705	HP MVX-0805
	B = 1.00 m					
	B = 0.50 m	HP MVX-0402	–	–	–	–
	B = 0.25 m	HP MVX-0201	–	–	–	–
Design values	v_{Rd} [kN/m]	*64.0* **64.0**		*80.0* **80.0**		

Moment bearing capacity m_{Rd}

Type / Element width				HP MVX-0804		HP MVX-0505		HP MVX-0605		HP MVX-0705		HP MVX-0805	
	B = 1.00 m												
	B = 0.50 m			HP MVX-0402		–		–		–		–	
	B = 0.25 m			HP MVX-0201		–		–		–		–	
Concrete cover [mm]	30	35	50										
		160		*24.7*	28.7	*21.1*	21.8	*24.3*	25.2	*27.1*	28.4	*29.5*	31.2
	160		180	*26.4*	30.6	*22.4*	23.0	*25.8*	26.7	*28.8*	30.1	*31.5*	33.2
		170		*28.0*	32.6	*23.6*	24.2	*27.2*	28.2	*30.5*	31.8	*33.5*	35.1
	170		190	*29.7*	34.5	*24.8*	25.5	*28.7*	29.6	*32.2*	33.5	*35.4*	37.1
		180		***31.4***	**36.5**	***26.0***	**26.7**	***30.2***	**31.1**	***34.0***	**35.2**	***37.4***	**39.1**
	180		200	*33.1*	38.4	*27.3*	27.9	*31.7*	32.6	*35.7*	37.0	*39.4*	41.0
		190		*34.8*	40.4	*28.5*	29.2	*33.1*	34.1	*37.4*	38.7	*41.3*	43.0
	190		210	*36.5*	42.4	*29.7*	30.4	*34.6*	35.5	*39.1*	40.4	*43.3*	45.0
		200		***38.2***	**44.3**	***31.0***	**31.6**	***36.1***	**37.0**	***40.9***	**42.1**	***45.3***	**46.9**
	200		220	*39.9*	46.3	*32.2*	32.8	*37.6*	38.5	*42.6*	43.9	*47.2*	48.9
		210		*41.6*	48.2	*33.4*	34.1	*39.0*	40.0	*44.3*	45.6	*49.2*	50.9
	210		230	*43.3*	50.2	*34.6*	35.3	*40.5*	41.4	*46.0*	47.3	*51.2*	52.8
		220		***45.0***	**52.1**	***35.9***	**36.5**	***42.0***	**42.9**	***47.7***	**49.0**	***53.1***	**54.8**
	220		240	*46.7*	54.1	*37.1*	37.8	*43.5*	44.4	*49.5*	50.7	*55.1*	56.8
		230		*48.3*	56.0	*38.3*	39.0	*44.9*	45.9	*51.2*	52.5	*57.1*	58.7
	230		250	*50.0*	58.0	*39.6*	40.2	*46.4*	47.4	*52.9*	54.2	*59.0*	60.7
		240		***51.7***	**60.0**	***40.8***	**41.4**	***47.9***	**48.8**	***54.6***	**55.9**	***61.0***	**62.7**
	240		260	*53.4*	61.9	*42.0*	42.7	*49.4*	50.3	*56.3*	57.6	*63.0*	64.6
		250		*55.1*	63.9	*43.3*	43.9	*50.8*	51.8	*58.1*	59.3	*64.9*	66.6
	250		270	*56.8*	65.8	*44.5*	45.1	*52.3*	53.3	*59.8*	61.1	*66.9*	68.6
Design values m_{Rd} [kNm/m] for slab thickness [mm]	> 250			Load bearing capacity values for further types (e. g. for h > 250 mm, C30/37, $v_{Rd,2}$ and $m_{Rd,2}$) can be found in the type tests at **www.halfen.com** or on request. See inside back cover for contact information.										

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

V_{Ed} ↓	ø6 / 25 cm			
V_{Ed} ↑	ø6 / 12.5 cm	ø8 / 19.5 cm	ø8 / 19 cm	ø8 / 18.5 cm

On-site stirrup reinforcement $A_{s,req}$ on main slab side (→ page 35)

V_{Ed} ↓	direct support	ø6 / 25 cm			
	indirect support	ø6 / 12.5 cm	ø8 / 19.5 cm	ø8 / 19 cm	ø8 / 18.5 cm
V_{Ed} ↑	direct / indirect support	ø6 / 25 cm			

Load bearing capacity values $v_{Rd,1}$ / $m_{Rd,1}$ according to EN 1992-1-1 (EC2)

Shear capacity $\pm v_{Rd}$

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

Type / Element width		HP MVX-0506	HP MVX-0606	HP MVX-0706	HP MVX-0806	HP MVX-0906
	B = 1.00 m					
	B = 0.50 m	–	HP MVX-0303	–	HP MVX-0403	–
	B = 0.25 m	–	–	–	–	–
Design values	v_{Rd} [kN/m]			***96.0*** **96.0**		

Moment bearing capacity m_{Rd}

Type / Element width		HP MVX-0506	HP MVX-0606	HP MVX-0706	HP MVX-0806	HP MVX-0906
	B = 1.00 m					
	B = 0.50 m	–	HP MVX-0303	–	HP MVX-0403	–
	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	*28.5*	29.6	*31.4*	32.8	*34.0*	35.8
	160		180	*23.1*	23.6	*26.8*	27.6	*30.3*	31.3	*33.4*	34.8	*36.2*	38.0
		170		*24.3*	24.9	*28.3*	29.1	*32.0*	33.0	*35.4*	36.8	*38.5*	40.2
	170		190	*25.6*	26.1	*29.8*	30.6	*33.7*	34.8	*37.3*	38.7	*40.7*	42.4
		180		***26.8***	**27.3**	***31.3***	**32.0**	***35.4***	**36.5**	***39.3***	**40.7**	***42.9***	**44.6**
	180		200	*28.0*	28.6	*32.7*	33.5	*37.1*	38.2	*41.3*	42.7	*45.1*	46.9
		190		*29.2*	29.8	*34.2*	35.0	*38.9*	39.9	*43.2*	44.6	*47.3*	49.1
	190		210	*30.5*	31.0	*35.7*	36.5	*40.6*	41.7	*45.2*	46.6	*49.5*	51.3
		200		***31.7***	**32.2**	***37.2***	**37.9**	***42.3***	**43.4**	***47.2***	**48.6**	***51.7***	**53.5**
	200		220	*32.9*	33.5	*38.6*	39.4	*44.0*	45.1	*49.1*	50.5	*53.9*	55.7
		210		*34.2*	34.7	*40.1*	40.9	*45.7*	46.8	*51.1*	52.5	*56.2*	57.9
	210		230	*35.4*	35.9	*41.6*	42.4	*47.5*	48.5	*53.1*	54.5	*58.4*	60.1
		220		***36.6***	**37.2**	***43.1***	**43.8**	***49.2***	**50.3**	***55.0***	**56.4**	***60.6***	**62.3**
	220		240	*37.8*	38.4	*44.5*	45.3	*50.9*	52.0	*57.0*	58.4	*62.8*	64.6
		230		*39.1*	39.6	*46.0*	46.8	*52.6*	53.7	*59.0*	60.4	*65.0*	66.8
	230		250	*40.3*	40.8	*47.5*	48.3	*54.4*	55.4	*60.9*	62.3	*67.2*	69.0
		240		***41.5***	**42.1**	***49.0***	**49.7**	***56.1***	**57.1**	***62.9***	**64.3**	***69.4***	**71.2**
	240		260	*42.8*	43.3	*50.4*	51.2	*57.8*	58.9	*64.9*	66.3	*71.6*	73.4
		250		*44.0*	44.5	*51.9*	52.7	*59.5*	60.6	*66.8*	68.2	*73.9*	75.6
	250		270	*45.2*	45.8	*53.4*	54.2	*61.2*	62.3	*68.8*	70.2	*76.0*	77.8
	> 250			Load bearing capacity values for further types (e. g. for h > 250 mm, C30/37, $v_{Rd,2}$ and $m_{Rd,2}$) can be found in the type tests at **www.halfen.com** or on request. See inside back cover for contact information.										

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

V_{Ed} ↓	ø6 / 25 cm		
V_{Ed} ↑	ø8 / 16.5 cm	ø8 / 16 cm	ø8 / 15.5 cm

On-site stirrup reinforcement $A_{s,req}$ on main slab side (→ page 35)

V_{Ed} ↓	direct support	ø6 / 25 cm		
	indirect support	ø8 / 16.5 cm	ø8 / 16 cm	ø8 / 15.5 cm
V_{Ed} ↑	direct / indirect support	ø6 / 25 cm		

Load bearing capacity values $v_{Rd,1}$ / $m_{Rd,1}$ according to EN 1992-1-1 (EC2)

Shear capacity $\pm v_{Rd}$

Concrete strength: *C20/25* ≥C25/30

Type / Element width		HP MVX-1006	HP MVX-1106	HP MVX-0507	HP MVX-0607	HP MVX-0707
	B = 1.00 m					
	B = 0.50 m	HP MVX-0503	–	–	–	–
	B = 0.25 m	–	–	–	–	–
Design values	v_{Rd} [kN/m]	*96.0* **96.0**			*112.0* **112.0**	

Moment bearing capacity m_{Rd}

Type / Element width				HP MVX-1006		HP MVX-1106		HP MVX-0507		HP MVX-0607		HP MVX-0707	
	B = 1.00 m												
	B = 0.50 m			HP MVX-0503		–		–		–		–	
	B = 0.25 m			–		–		–		–		–	
Concrete cover [mm]	30	35	50										
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*36.3*	38.5	*37.0*	41.0	*22.4*	22.9	*26.1*	26.8	*29.6*	30.5
	160		180	*38.8*	41.0	*39.5*	43.7	*23.6*	24.1	*27.6*	28.3	*31.3*	32.2
		170		*41.2*	43.4	*42.1*	46.4	*24.9*	25.3	*29.1*	29.7	*33.0*	33.9
	170		190	*43.7*	45.9	*44.6*	49.1	*26.1*	26.5	*30.5*	31.2	*34.7*	35.7
		180		***46.2***	**48.3**	***47.1***	**51.8**	***27.3***	**27.8**	***32.0***	**32.7**	***36.5***	**37.4**
	180		200	*48.6*	50.8	*49.7*	54.5	*28.5*	29.0	*33.5*	34.2	*38.2*	39.1
		190		*51.1*	53.3	*52.2*	57.2	*29.8*	30.2	*35.0*	35.6	*39.9*	40.8
	190		210	*53.5*	55.7	*54.8*	59.9	*31.0*	31.5	*36.4*	37.1	*41.6*	42.5
		200		***56.0***	**58.2**	***57.3***	**62.6**	***32.2***	**32.7**	***37.9***	**38.6**	***43.3***	**44.3**
	200		220	*58.5*	60.6	*59.8*	65.3	*33.5*	33.9	*39.4*	40.1	*45.1*	46.0
		210		*60.9*	63.1	*62.4*	68.0	*34.7*	35.2	*40.9*	41.5	*46.8*	47.7
	210		230	*63.4*	65.5	*64.9*	70.7	*35.9*	36.4	*42.3*	43.0	*48.5*	49.4
		220		***65.8***	**68.0**	***67.4***	**73.4**	***37.1***	**37.6**	***43.8***	**44.5**	***50.2***	**51.1**
	220		240	*68.3*	70.5	*70.0*	76.1	*38.4*	38.8	*45.3*	46.0	*51.9*	52.9
		230		*70.7*	72.9	*72.5*	78.8	*39.6*	40.1	*46.8*	47.4	*53.7*	54.6
	230		250	*73.2*	75.4	*75.1*	81.5	*40.8*	41.3	*48.2*	48.9	*55.4*	56.3
		240		***75.7***	**77.8**	***77.6***	**84.2**	***42.1***	**42.5**	***49.7***	**50.4**	***57.1***	**58.0**
	240		260	*78.1*	80.3	*80.1*	86.9	*43.3*	43.8	*51.2*	51.9	*58.8*	59.7
		250		*80.6*	82.8	*82.7*	89.6	*44.5*	45.0	*52.7*	53.3	*60.6*	61.5
	250		270	*83.0*	85.2	*85.2*	92.3	*45.8*	46.2	*54.1*	54.8	*62.3*	63.2
	> 250			Load bearing capacity values for further types (e.g. for h > 250 mm, C30/37, $v_{Rd,2}$ and $m_{Rd,2}$) can be found in the type tests at **www.halfen.com** or on request. See inside back cover for contact information.										

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

V_{Ed} ↓	ø6 / 25 cm		
V_{Ed} ↑	ø8 / 15 cm	ø8 / 14.5 cm	ø8 / 14 cm

On-site stirrup reinforcement $A_{s,req}$ on main slab side (→ page 35)

V_{Ed} ↓	direct support	ø6 / 25 cm		
	indirect support	ø8 / 15 cm	ø8 / 14.5 cm	ø8 / 14 cm
V_{Ed} ↑	direct / indirect support	ø6 / 25 cm		

Load bearing capacity values $v_{Rd,1}$ / $m_{Rd,1}$ according to EN 1992-1-1 (EC2)

Shear capacity $\pm v_{Rd}$

Concrete strength: *C20/25* ≥C25/30

Type / Element width		HP MVX-0807	HP MVX-0907	HP MVX-1007	HP MVX-1107	HP MVX-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 m_{Rd}

Type / Element width		B = 1.00 m	HP MVX-0807		HP MVX-0907		HP MVX-1007		HP MVX-1107		HP MVX-1407	
		B = 0.50 m	–		–		–		–		–	
		B = 0.25 m	–		–		–		–		–	
Concrete cover [mm]	30	35	50									
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*32.8*	34.0	*35.7*	37.2	*38.4*	40.3	*40.9*	43.1	*43.2*	50.2
	160		180	*34.8*	35.9	*38.0*	39.5	*40.9*	42.8	*43.6*	45.8	*46.1*	53.6
		170		*36.7*	37.9	*40.2*	41.7	*43.4*	45.2	*46.3*	48.6	*49.1*	57.0
	170		190	*38.7*	39.9	*42.4*	43.9	*45.8*	47.7	*49.0*	51.3	*52.0*	60.4
		180		***40.7***	**41.8**	***44.6***	**46.1**	***48.3***	**50.1**	***51.7***	**54.0**	***55.0***	**63.9**
	180		200	*42.6*	43.8	*46.8*	48.3	*50.7*	52.6	*54.4*	56.7	*58.0*	67.3
		190		*44.6*	45.8	*49.0*	50.5	*53.2*	55.1	*57.1*	59.4	*60.9*	70.7
	190		210	*46.6*	47.7	*51.2*	52.7	*55.7*	57.5	*59.8*	62.1	*63.9*	74.1
		200		***48.5***	**49.7**	***53.4***	**55.0**	***58.1***	**60.0**	***62.5***	**64.8**	***66.8***	**77.6**
	200		220	*50.5*	51.7	*55.7*	57.2	*60.6*	62.4	*65.2*	67.5	*69.8*	81.0
		210		*52.5*	53.6	*57.9*	59.4	*63.0*	64.9	*67.9*	70.2	*72.8*	84.4
	210		230	*54.4*	55.6	*60.1*	61.6	*65.5*	67.3	*70.6*	72.9	*75.7*	87.8
		220		***56.4***	**57.6**	***62.3***	**63.8**	***67.9***	**69.8**	***73.3***	**75.6**	***78.7***	**91.2**
	220		240	*58.4*	59.5	*64.4*	66.0	*70.4*	72.3	*76.0*	78.3	*81.6*	94.7
		230		*60.3*	61.5	*66.4*	68.2	*72.9*	74.7	*78.8*	81.0	*84.6*	98.1
	230		250	*62.3*	63.5	*68.3*	70.4	*75.1*	77.2	*81.5*	83.7	*87.6*	101.5
		240		***64.3***	**65.4**	***70.2***	**72.7**	***77.2***	**79.6**	***84.1***	**86.4**	***90.5***	**104.9**
	240		260	*66.2*	67.4	*72.2*	74.9	*79.4*	82.1	*86.4*	89.1	*93.5*	108.3
		250		*68.2*	69.4	*74.1*	77.1	*81.5*	84.6	*88.8*	91.8	*96.4*	111.8
	250		270	*70.2*	71.3	*76.0*	79.3	*83.7*	87.0	*91.1*	94.5	*99.4*	115.2
	> 250			Load bearing capacity values for further types (e. g. for h > 250 mm, C30/37, $v_{Rd,2}$ and $m_{Rd,2}$) can be found in the type tests at **www.halfen.com** or on request. See inside back cover for contact information.									

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

V_{Ed} ↓	ø6 / 25 cm	ø6 / 24.5 cm	ø6 / 23.5 cm	ø6 / 21.5 cm
V_{Ed} ↑	ø8 / 13.5 cm		ø8 / 13 cm	ø8 / 12.5 cm

On-site stirrup reinforcement $A_{s,req}$ on main slab side (→ page 35)

V_{Ed} ↓	direct support	ø6 / 25 cm	ø6 / 24.5 cm	ø6 / 23.5 cm	ø6 / 21.5 cm
	indirect support	ø8 / 13.5 cm		ø8 / 13 cm	ø8 / 12.5 cm
V_{Ed} ↑	direct / indirect support	ø6 / 25 cm	ø6 / 24.5 cm	ø6 / 23.5 cm	ø6 / 21.5 cm

Load bearing capacity values $v_{Rd,1}$ / $m_{Rd,1}$ according to EN 1992-1-1 (EC2)

Shear capacity $\pm v_{Rd}$

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

Type / Element width		HP MVX-0508	HP MVX-0608	HP MVX-0708	HP MVX-0808	HP MVX-0908
	B = 1.00 m					
	B = 0.50 m	–	HP MVX-0304	–	HP MVX-0404	–
	B = 0.25 m	–	–	–	HP MVX-0202	–
Design values	v_{Rd} [kN/m]			*128.0* **128.0**		

Moment bearing capacity m_{Rd}

Type / Element width		HP MVX-0508	HP MVX-0608	HP MVX-0708	HP MVX-0808	HP MVX-0908
	B = 1.00 m					
	B = 0.50 m	–	HP MVX-0304	–	HP MVX-0404	–
	B = 0.25 m	–	–	–	HP MVX-0202	–

Concrete cover [mm]	30	35	50	HP MVX-0508		HP MVX-0608		HP MVX-0708		HP MVX-0808		HP MVX-0908	
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*22.8*	23.2	*26.7*	27.3	*30.4*	31.2	*33.8*	34.8	*37.0*	38.3
	160		180	*24.0*	24.4	*28.2*	28.7	*32.1*	32.9	*35.8*	36.8	*39.2*	40.6
		170		*25.3*	25.7	*29.6*	30.2	*33.8*	34.6	*37.7*	38.8	*41.5*	42.8
	170		190	*26.5*	26.9	*31.1*	31.7	*35.5*	36.3	*39.7*	40.7	*43.7*	45.0
		180		***27.7***	**28.1**	***32.6***	**33.2**	***37.2***	**38.0**	***41.7***	**42.7**	***45.9***	**47.2**
	180		200	*28.9*	29.3	*34.1*	34.6	*39.0*	39.8	*43.6*	44.7	*48.1*	49.4
		190		*30.2*	30.6	*35.5*	36.1	*40.7*	41.5	*45.6*	46.6	*50.3*	51.6
	190		210	*31.4*	31.8	*37.0*	37.6	*42.4*	43.2	*47.6*	48.6	*52.5*	53.8
		200		***32.6***	**33.0**	***38.5***	**39.1**	***44.1***	**44.9**	***49.5***	**50.6**	***54.7***	**56.0**
	200		220	*33.9*	34.3	*40.0*	40.5	*45.8*	46.6	*51.5*	52.5	*56.7*	58.3
		210		*35.1*	35.5	*41.4*	42.0	*47.6*	48.4	*53.5*	54.5	*58.7*	60.5
	210		230	*36.3*	36.7	*42.9*	43.5	*49.3*	50.1	*55.4*	56.5	*60.6*	62.7
		220		***37.5***	**38.0**	***44.4***	**45.0**	***51.0***	**51.8**	***57.4***	**58.4**	***62.5***	**64.9**
	220		240	*38.8*	39.2	*45.9*	46.4	*52.7*	53.5	*59.4*	60.4	*64.4*	67.1
		230		*40.0*	40.4	*47.3*	47.9	*54.4*	55.2	*61.3*	62.4	*66.4*	69.3
	230		250	*41.2*	41.6	*48.8*	49.4	*56.2*	57.0	*63.3*	64.3	*68.3*	71.5
		240		***42.5***	**42.9**	***50.3***	**50.9**	***57.9***	**58.7**	***65.3***	**66.3**	***70.2***	**73.8**
	240		260	*43.7*	44.1	*51.8*	52.3	*59.6*	60.4	*67.2*	68.3	*72.2*	76.0
		250		*44.9*	45.3	*53.2*	53.8	*61.3*	62.1	*69.2*	70.2	*74.1*	78.2
	250		270	*46.1*	46.6	*54.7*	55.3	*63.1*	63.9	*71.2*	72.2	*76.0*	80.4
	> 250			Load bearing capacity values for further types (e. g. for h > 250 mm, C30/37, $v_{Rd,2}$ and $m_{Rd,2}$) can be found in the type tests at **www.halfen.com** or on request. See inside back cover for contact information.										

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

V_{Ed} ↓	ø6 / 25 cm			ø6 / 23.5 cm
V_{Ed} ↑	ø8 / 13 cm	ø8 / 12.5 cm	ø8 / 12 cm	

On-site stirrup reinforcement $A_{s,req}$ on main slab side (→ page 35)

V_{Ed} ↓	direct support	ø6 / 25 cm			ø6 / 23.5 cm
	indirect support	ø8 / 13 cm	ø8 / 12.5 cm	ø8 / 12 cm	
V_{Ed} ↑	direct / indirect support	ø6 / 25 cm			ø6 / 23.5 cm

Load bearing capacity values $v_{Rd,1}$ / $m_{Rd,1}$ according to EN 1992-1-1 (EC2)

Shear capacity $\pm v_{Rd}$

Concrete strength: *C20/25* ≥C25/30

Type / Element width		HP MVX-1008	HP MVX-1108	HP MVX-1208	HP MVX-1308	HP MVX-1209
	B = 1.00 m					
	B = 0.50 m	HP MVX-0504	–	HP MVX-0604	–	–
	B = 0.25 m	–	–	HP MVX-0302	–	–
Design values	v_{Rd} [kN/m]		*128.0* **128.0**			*144.0* **144.0**

Moment bearing capacity m_{Rd}

Type / Element width				B = 1.00 m		HP MVX-1008		HP MVX-1108		HP MVX-1208		HP MVX-1308		HP MVX-1209	
				B = 0.50 m		HP MVX-0504		–		HP MVX-0604		–		–	
				B = 0.25 m		–		–		HP MVX-0302		–		–	
Concrete cover [mm]	30	35	50												
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*40.0*	41.7	*42.8*	44.8	*45.4*	47.7	*46.1*	50.5	*44.3*	49.2
	160		180	*42.5*	44.1	*45.5*	47.5	*48.3*	50.7	*49.1*	53.7	*47.0*	52.2
		170		*44.9*	46.6	*48.2*	50.2	*51.3*	53.6	*52.1*	56.9	*49.7*	55.1
	170		190	*47.4*	49.0	*50.9*	52.9	*54.2*	56.6	*55.1*	60.0	*52.4*	58.1
		180		***49.9***	**51.5**	***53.6***	**55.6**	***57.2***	**59.5**	***58.2***	**63.2**	***55.1***	**61.0**
	180		200	*52.3*	54.0	*56.3*	58.3	*60.1*	62.5	*61.2*	66.4	*57.8*	64.0
		190		*54.8*	56.4	*59.0*	61.0	*63.1*	65.4	*64.2*	69.6	*60.5*	66.9
	190		210	*57.2*	58.9	*61.7*	63.7	*66.0*	68.4	*67.2*	72.8	*63.2*	69.9
		200		***59.7***	**61.3**	***64.4***	**66.4**	***69.0***	**71.3**	***70.3***	**76.0**	***65.9***	**72.8**
	200		220	*62.2*	63.8	*67.1*	69.1	*71.9*	74.3	*73.3*	79.2	*68.6*	75.8
		210		*64.4*	66.2	*69.9*	71.8	*74.9*	77.2	*76.3*	82.4	*71.3*	78.7
	210		230	*66.5*	68.7	*72.3*	74.5	*77.8*	80.2	*79.3*	85.6	*74.0*	81.7
		220		***68.7***	**71.2**	***74.6***	**77.2**	***80.4***	**83.1**	***82.4***	**88.8**	***76.7***	**84.6**
	220		240	*70.8*	73.6	*77.0*	79.9	*83.0*	86.1	*85.4*	92.0	*79.4*	87.6
		230		*72.9*	76.1	*79.3*	82.6	*85.6*	89.0	*88.4*	95.2	*82.1*	90.5
	230		250	*75.1*	78.5	*81.7*	85.3	*88.2*	92.0	*91.4*	98.4	*84.8*	93.5
		240		***77.2***	**81.0**	***84.1***	**88.1**	***90.7***	**94.9**	***94.4***	**101.6**	***87.5***	**96.4**
	240		260	*79.4*	83.5	*86.4*	90.8	*93.3*	97.9	*97.5*	104.8	*90.2*	99.4
		250		*81.5*	85.9	*88.8*	93.5	*95.9*	100.8	*100.5*	108.0	*92.9*	102.3
	250		270	*83.7*	88.4	*91.1*	96.2	*98.4*	103.8	*103.5*	111.2	*95.6*	105.3
	> 250			Load bearing capacity values for further types (e. g. for h > 250 mm, C30/37, $v_{Rd,2}$ and $m_{Rd,2}$) can be found in the type tests at **www.halfen.com** or on request. See inside back cover for contact information.										

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

	HP MVX-1008	HP MVX-1108	HP MVX-1208	HP MVX-1308	HP MVX-1209
V_{Ed} ↓	ø6 / 22.5 cm	ø6 / 21.5 cm	ø6 / 21 cm	ø6 / 20.5 cm	ø6 / 19.5 cm
V_{Ed} ↑	ø8 / 12 cm		ø8 / 11.5 cm		ø8 / 10.5 cm

On-site stirrup reinforcement $A_{s,req}$ on main slab side (→ page 35)

		HP MVX-1008	HP MVX-1108	HP MVX-1208	HP MVX-1308	HP MVX-1209
V_{Ed} ↓	direct support	ø6 / 22.5 cm	ø6 / 21.5 cm	ø6 / 21 cm	ø6 / 20.5 cm	ø6 / 19.5 cm
	indirect support	ø8 / 12 cm		ø8 / 11.5 cm		ø8 / 10.5 cm
V_{Ed} ↑	direct / indirect support	ø6 / 22.5 cm	ø6 / 21.5 cm	ø6 / 21 cm	ø6 / 20.5 cm	ø6 / 19.5 cm

Load bearing capacity values $v_{Rd,1}$ / $m_{Rd,1}$ according to EN 1992-1-1 (EC2)

Shear capacity $\pm v_{Rd}$

Concrete strength: *C20/25* ≥C25/30

Type / Element width		HP MVX-1409	HP MVX-1210	HP MVX-1810*	HP MVX-1011	HP MVX-1211*
	B = 1.00 m					
	B = 0.50 m	–	HP MVX-0605	HP MVX-0905*	–	–
	B = 0.25 m	–	–	–	–	–
Design values	v_{Rd} [kN/m]	*144.0* **144.0**	*160.0* **160.0**	*57.9* **73.9**	*176.0* **176.0**	*132.3* **147.6**

Moment bearing capacity m_{Rd}

Type / Element width				HP MVX-1409		HP MVX-1210		HP MVX-1810*		HP MVX-1011		HP MVX-1211*	
			B = 1.00 m										
			B = 0.50 m	–		HP MVX-0605		HP MVX-0905*		–		–	
			B = 0.25 m	–		–		–		–		–	
Concrete cover [mm]	30	35	50										
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*44.3*	50.1	*41.2*	*47.1*	*63.2*	67.5	*37.2*	43.1	*49.6*	51.4
	160		180	*47.0*	53.2	*43.6*	*49.8*	*67.7*	71.9	*39.3*	45.5	*52.1*	54.4
		170		*49.7*	56.2	*46.0*	*52.5*	*72.1*	76.3	*41.3*	47.9	*54.7*	57.3
	170		190	*52.4*	59.2	*48.4*	*55.2*	*76.5*	80.8	*43.4*	50.2	*57.3*	60.3
		180		***55.1***	**62.2**	*50.7*	***57.9***	***81.0***	**85.2**	***45.5***	**52.6**	***59.8***	**63.2**
	180		200	*57.8*	65.3	*53.1*	*60.6*	*84.9*	89.6	*47.5*	55.0	*62.4*	66.2
		190		*60.5*	68.3	*55.5*	*63.3*	*88.7*	94.0	*49.6*	57.4	*65.0*	69.1
	190		210	*63.2*	71.3	*57.9*	*66.0*	*92.6*	98.5	*51.7*	59.8	*67.6*	72.1
		200		***65.9***	**74.3**	*60.3*	***68.7***	***96.5***	**102.9**	***53.7***	**62.2**	***70.1***	**75.0**
	200		220	*68.6*	77.3	*62.7*	*71.4*	*100.3*	107.3	*55.8*	64.5	*72.7*	78.0
		210		*71.3*	80.4	*65.0*	*74.1*	*104.2*	111.7	*57.8*	66.9	*75.3*	80.9
	210		230	*74.0*	83.4	*67.4*	*76.8*	*108.0*	116.2	*59.9*	69.3	*77.9*	83.9
		220		***76.7***	**86.4**	*69.8*	***79.5***	***111.9***	**120.6**	***62.0***	**71.7**	***80.4***	**86.8**
	220		240	*79.4*	89.4	*72.2*	*82.2*	*115.7*	125.0	*64.0*	74.1	*83.0*	89.8
		230		*82.1*	92.5	*74.6*	*84.9*	*119.6*	129.4	*66.1*	76.5	*85.6*	92.7
	230		250	*84.8*	95.5	*77.0*	*87.6*	*123.5*	133.9	*68.2*	78.8	*88.2*	95.7
		240		***87.5***	**98.5**	*79.3*	***90.3***	***127.3***	**138.3**	***70.2***	**81.2**	***90.7***	**98.6**
	240		260	*90.2*	101.5	*81.7*	*93.0*	*131.2*	142.7	*72.3*	83.6	*93.3*	101.6
		250		*92.9*	104.6	*84.1*	*95.7*	*135.0*	147.1	*74.4*	86.0	*95.9*	104.5
	250		270	*95.6*	107.6	*86.5*	*98.4*	*138.9*	151.6	*76.4*	88.4	*98.4*	107.5
	> 250			Load bearing capacity values for further types (e. g. for h > 250 mm, C30/37, $v_{Rd,2}$ and $m_{Rd,2}$) can be found in the type tests at **www.halfen.com** or on request. See inside back cover for contact information.										

* Load bearing capacities for $v_{Rd,2}$ and $m_{Rd,2}$

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

	HP MVX-1409	HP MVX-1210	HP MVX-1810*	HP MVX-1011	HP MVX-1211*
V_{Ed} ↓	ø6 / 18.5 cm	ø6 / 19 cm	ø6 / 15.5 cm	ø6 / 19 cm	ø6 / 17.5 cm
V_{Ed} ↑	ø8 / 10.5 cm	ø8 / 9 cm	ø8 / 9.5 cm	ø8 / 9 cm	

On-site stirrup reinforcement $A_{s,req}$ on main slab side (→ page 35)

		HP MVX-1409	HP MVX-1210	HP MVX-1810*	HP MVX-1011	HP MVX-1211*
V_{Ed} ↓	direct support	ø6 / 18.5 cm	ø6 / 19 cm	ø6 / 15.5 cm	ø6 / 19 cm	ø6 / 17.5 cm
	indirect support	ø8 / 10.5 cm	ø8 / 9 cm	ø8 / 9.5 cm	ø8 / 9 cm	
V_{Ed} ↑	direct / indirect support	ø6 / 18.5 cm	ø6 / 19 cm	ø6 / 15.5 cm	ø6 / 19 cm	ø6 / 17.5 cm

Load bearing capacity values $v_{Rd,2}$ / $m_{Rd,2}$ according to EN 1992-1-1 (EC2)

Shear capacity $\pm v_{Rd}$

Concrete strength: *C20/25* ≥C25/30

Type / Element width		HP MVX-1311	HP MVX-1811	HP MVX-1212	HP MVX-1312	HP MVX-1812
	B = 1.00 m					
	B = 0.50 m	–	–	–	–	–
	B = 0.25 m	–	–	–	–	–
Design values	v_{Rd} [kN/m]	*120.1* 135.3	*59.5* 73.9	*135.8* 147.6	*124.4* 135.3	*70.0* 73.9

Moment bearing capacity m_{Rd}

Type / Element width		HP MVX-1311	HP MVX-1811	HP MVX-1212	HP MVX-1312	HP MVX-1812
	B = 1.00 m					
	B = 0.50 m	–	–	–	–	–
	B = 0.25 m	–	–	–	–	–

Concrete cover [mm]												
	30	35	50									
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*52.6*	54.8	*65.6*	69.7	*49.6*	52.3	*52.6*	55.8	*65.6*	71.6
	160		180	*55.4*	58.0	*69.4*	74.1	*52.1*	55.2	*55.4*	59.0	*69.4*	76.0
		170		*58.2*	61.2	*73.3*	78.6	*54.7*	58.2	*58.2*	62.2	*73.3*	80.4
	170		190	*61.0*	64.4	*77.2*	83.0	*57.3*	61.1	*61.0*	65.4	*77.2*	84.8
		180		***63.8***	**67.6**	***81.0***	**87.4**	***59.8***	**64.1**	***63.8***	**68.6**	***81.0***	**89.3**
	180		200	*66.6*	70.8	*84.9*	91.8	*62.4*	67.0	*66.6*	71.8	*84.9*	93.7
		190		*69.4*	74.0	*88.7*	96.3	*65.0*	70.0	*69.4*	75.0	*88.7*	98.1
	190		210	*72.1*	77.2	*92.6*	100.7	*67.6*	72.9	*72.1*	78.2	*92.6*	102.6
		200		***74.9***	**80.4**	***96.5***	**105.1**	***70.1***	**75.9**	***74.9***	**81.4**	***96.5***	**107.0**
	200		220	*77.7*	83.6	*100.3*	109.5	*72.7*	78.8	*77.7*	84.6	*100.3*	111.4
		210		*80.5*	86.8	*104.2*	114.0	*75.3*	81.8	*80.5*	87.8	*104.2*	115.8
	210		230	*83.3*	90.0	*108.0*	118.4	*77.9*	84.7	*83.3*	91.0	*108.0*	120.3
		220		***86.1***	**93.2**	***111.9***	**122.8**	***80.4***	**87.7**	***86.1***	**94.2**	***111.9***	**124.7**
	220		240	*88.9*	96.4	*115.7*	127.2	*83.0*	90.6	*88.9*	97.4	*115.7*	129.1
		230		*91.7*	99.6	*119.6*	131.7	*85.6*	93.6	*91.7*	100.5	*119.6*	133.5
	230		250	*94.4*	102.8	*123.5*	136.1	*88.2*	96.5	*94.4*	103.7	*123.5*	138.0
		240		***97.2***	106.0	***127.3***	**140.5**	***90.7***	**99.5**	***97.2***	**106.9**	***127.3***	**142.4**
	240		260	*100.0*	109.2	*131.2*	144.9	*93.3*	102.4	*100.0*	110.1	*131.2*	146.8
		250		*102.8*	112.4	*135.0*	149.4	*95.9*	105.4	*102.8*	113.3	*135.0*	151.2
	250		270	*105.6*	115.6	*138.9*	153.8	*98.4*	108.3	*105.6*	116.5	*138.9*	155.7
	> 250			Load bearing capacity values for further types (e. g. for h > 250 mm, C30/37, $v_{Rd,1}$ and $m_{Rd,1}$) can be found in the type tests at **www.halfen.com** or on request. See inside back cover for contact information.									

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

V_{Ed} ↓	ø6 / 17 cm	ø6 / 14.5 cm	ø6 / 16.5 cm	ø6 / 16 cm	ø6 / 14 cm
V_{Ed} ↑	ø8 / 9 cm		ø8 / 8.5 cm		

On-site stirrup reinforcement $A_{s,req}$ on main slab side (→ page 35)

V_{Ed} ↓	direct support	ø6 / 17 cm	ø6 / 14.5 cm	ø6 / 16.5 cm	ø6 / 16 cm	ø6 / 14 cm
	indirect support	ø8 / 9 cm		ø8 / 8.5 cm		
V_{Ed} ↑	direct / indirect support	ø6 / 17 cm	ø6 / 14.5 cm	ø6 / 16.5 cm	ø6 / 16 cm	ø6 / 14 cm

Load bearing capacity values $v_{Rd,1}$ / $m_{Rd,1}$ according to EN 1992-1-1 (EC2)

Shear capacity $\pm v_{Rd}$

Concrete strength: *C20/25* ≥C25/30

120

Type / Element width		SP MVX-0202	SP MVX-0302	SP MVX-0403	SP MVX-0603	SP MVX-0304
	B = 1.00 m					
	B = 0.50 m	SP MVX-0101	–	–	–	–
	B = 0.25 m	–	–	–	–	–
Design values	v_{Rd} [kN/m]	*30.7* **32.0**	*28.3* **32.0**	*46.8* **48.0**	*46.8* **48.0**	*55.0* **58.7**

Moment bearing capacity m_{Rd}

Type / Element width				SP MVX-0202	SP MVX-0302	SP MVX-0403	SP MVX-0603	SP MVX-0304
	B = 1.00 m							
	B = 0.50 m			SP MVX-0101	–	–	–	–
	B = 0.25 m			–	–	–	–	–
Concrete cover [mm]	30	35	50					
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*8.5* 8.7	*11.3* 11.9	*14.0* *16.4*	*14.3* 19.4	*13.3* 13.6
	160		180	*8.9* 9.2	*12.1* 12.7	*14.8* *17.4*	*15.2* 20.7	*14.1* 14.4
		170		*9.4* 9.7	*12.8* 13.4	*15.7* *18.4*	*16.1* 21.9	*14.8* 15.1
	170		190	*9.9* 10.2	*13.6* 14.1	*16.5* *19.4*	*16.9* 23.2	*15.6* 15.8
		180		***10.4*** **10.7**	***14.3*** **14.9**	**17.3** ***20.3***	**17.8** **24.4**	**16.3** **16.6**
	180		200	*10.9* 11.2	*15.0* 15.6	18.2 *21.3*	18.7 25.6	17.0 17.3
		190		*11.4* 11.7	*15.8* 16.4	19.0 *22.3*	19.5 26.9	17.8 18.1
	190		210	*11.9* 12.2	*16.5* 17.1	19.9 *23.3*	20.4 28.1	18.5 18.8
		200		***12.4*** **12.6**	***17.2*** **17.8**	**20.7** ***24.3***	**21.2** **29.4**	**19.2** **19.5**
	200		220	*12.9* 13.1	*18.0* 18.6	21.5 *25.3*	22.1 30.6	20.0 20.3
		210		*13.4* 13.6	*18.7* 19.3	22.4 *26.2*	23.0 31.9	20.7 21.0
	210		230	*13.9* 14.1	*19.5* 20.0	23.2 *27.2*	23.8 33.1	21.5 21.7
		220		***14.4*** **14.6**	***20.2*** **20.8**	**24.0** ***28.2***	**24.7** **34.4**	**22.2** **22.5**
	220		240	*14.8* 15.1	*20.9* 21.5	24.9 *29.2*	25.6 35.6	22.9 23.2
		230		*15.3* 15.6	*21.7* 22.3	25.7 *30.2*	26.4 36.9	23.7 24.0
	230		250	*15.8* 16.1	*22.4* 23.0	26.6 *31.2*	27.3 38.1	24.4 24.7
		240		***16.3*** **16.6**	***23.1*** **23.7**	**27.4** ***32.1***	**28.2** **39.4**	**25.1** **25.4**
	240		260	*16.8* 17.1	*23.9* 24.5	28.2 *33.1*	29.0 40.6	25.9 26.2
		250		*17.3* 17.6	*24.6* 25.2	29.1 *34.1*	29.9 41.8	26.6 26.9
	250		270	*17.8* 18.1	*25.4* 25.9	29.9 *35.1*	30.8 43.1	27.4 27.6
	> 250			Load bearing capacity values for further types (e. g. for h > 250 mm, C30/37, $v_{Rd,2}$ and $m_{Rd,2}$) can be found in the type tests at **www.halfen.com** or on request. See inside back cover for contact information.				

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

V_{Ed} ↓	ø6 / 25 cm			
V_{Ed} ↑	ø6 / 25 cm	ø6 / 17.5 cm	ø6 / 17 cm	ø6 / 15 cm

On-site stirrup reinforcement $A_{s,req}$ on main slab side (→ page 35)

V_{Ed} ↓	direct support	ø6 / 25 cm			
	indirect support	ø6 / 25 cm	ø6 / 17.5 cm	ø6 / 17 cm	ø6 / 15 cm
V_{Ed} ↑	direct / indirect support	ø6 / 25 cm			

Load bearing capacity values $v_{Rd,1}$ / $m_{Rd,1}$ according to EN 1992-1-1 (EC2)

Shear capacity $\pm v_{Rd}$

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

Type / Element width		SP MVX-0404	SP MVX-0504	SP MVX-0604	SP MVX-0704	SP MVX-0705
	B = 1.00 m					
	B = 0.50 m	SP MVX-0202	–	SP MVX-0302	–	–
	B = 0.25 m	SP MVX-0101	–	–	–	–
Design values	v_{Rd} [kN/m]	*61.4* **64.0**		*62.4* **64.0**		*78.0* **80.0**

Moment bearing capacity m_{Rd}

Type / Element width				SP MVX-0404		SP MVX-0504		SP MVX-0604		SP MVX-0704		SP MVX-0705	
	B = 1.00 m												
	B = 0.50 m			SP MVX-0202		–		SP MVX-0302		–		–	
	B = 0.25 m			SP MVX-0101		–		–		–		–	
Concrete cover [mm]	30	35	50										
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*16.9*	17.4	*19.0*	20.8	*19.1*	23.9	*19.1*	25.9	*23.9*	28.4
	160		180	*17.9*	18.4	*20.2*	22.1	*20.3*	25.3	*20.3*	27.6	*25.3*	30.1
		170		*18.9*	19.4	*21.3*	23.3	*21.4*	26.8	*21.4*	29.2	*26.7*	31.8
	170		190	*19.9*	20.4	*22.5*	24.5	*22.6*	28.3	*22.6*	30.9	*28.2*	33.5
		180		***20.8***	**21.4**	***23.6***	**25.7**	***23.7***	**29.8**	***23.7***	**32.5**	***29.6***	**35.2**
	180		200	*21.8*	22.3	*24.8*	27.0	*24.9*	31.2	*24.9*	34.2	*31.1*	37.0
		190		*22.8*	23.3	*25.9*	28.2	*26.0*	32.7	*26.0*	35.9	*32.5*	38.7
	190		210	*23.8*	24.3	*27.1*	29.4	*27.2*	34.2	*27.2*	37.5	*34.0*	40.4
		200		***24.8***	**25.3**	***28.2***	**30.7**	***28.3***	**35.7**	***28.3***	**39.2**	***35.4***	**42.1**
	200		220	*25.8*	26.3	*29.4*	31.9	*29.5*	37.1	*29.5*	40.8	*36.8*	43.9
		210		*26.7*	27.3	*30.5*	33.1	*30.6*	38.6	*30.6*	42.5	*38.3*	45.6
	210		230	*27.7*	28.2	*31.7*	34.4	*31.8*	40.1	*31.8*	44.2	*39.7*	47.3
		220		***28.7***	**29.2**	***32.8***	**35.6**	***32.9***	**41.6**	***32.9***	**45.8**	***41.2***	**49.0**
	220		240	*29.7*	30.2	*34.0*	36.8	*34.1*	43.0	*34.1*	47.5	*42.6*	50.7
		230		*30.7*	31.2	*35.1*	38.0	*35.3*	44.5	*35.3*	49.1	*44.0*	52.5
	230		250	*31.7*	32.2	*36.3*	39.3	*36.4*	46.0	*36.4*	50.8	*45.5*	54.2
		240		***32.6***	**33.2**	***37.4***	**40.5**	***37.6***	**47.5**	***37.6***	**52.5**	***46.9***	**55.9**
	240		260	*33.6*	34.1	*38.6*	41.7	*38.7*	48.9	*38.7*	54.1	*48.4*	57.6
		250		*34.6*	35.1	*39.7*	43.0	*39.9*	50.4	*39.9*	55.8	*49.8*	59.3
	250		270	*35.6*	36.1	*40.9*	44.2	*41.0*	51.9	*41.0*	57.5	*51.2*	61.1
	> 250			Load bearing capacity values for further types (e. g. for h > 250 mm, C30/37, $v_{Rd,2}$ and $m_{Rd,2}$) can be found in the type tests at **www.halfen.com** or on request. See inside back cover for contact information.										

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

V_{Ed} ↓	ø6 / 25 cm		
V_{Ed} ↑	ø6 / 13.5 cm	ø6 / 13 cm	ø8 / 18.5 cm

On-site stirrup reinforcement $A_{s,req}$ on main slab side (→ page 35)

V_{Ed} ↓	direct support	ø6 / 25 cm		
	indirect support	ø6 / 13.5 cm	ø6 / 13 cm	ø8 / 18.5 cm
V_{Ed} ↑	direct / indirect support	ø6 / 25 cm		

Load bearing capacity values $v_{Rd,1}$ / $m_{Rd,1}$ according to EN 1992-1-1 (EC2)

Shear capacity $\pm v_{Rd}$

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

Type / Element width		SP MVX-0805	SP MVX-0906	SP MVX-1006	SP MVX-0907	SP MVX-1007
B = 1.00 m		–	–	–	–	–
B = 0.50 m		–	–	SP MVX-0503	–	–
B = 0.25 m		–	–	–	–	–
Design values	v_{Rd} [kN/m]	*78.0* **80.0**	*93.7* **96.0**	*93.7* **96.0**	*109.3* **112.0**	*109.3* **112.0**

Moment bearing capacity m_{Rd}

Type / Element width		SP MVX-0805	SP MVX-0906	SP MVX-1006	SP MVX-0907	SP MVX-1007
B = 1.00 m		–	–	–	–	–
B = 0.50 m		–	–	SP MVX-0503	–	–
B = 0.25 m		–	–	–	–	–

Concrete cover [mm]	30	35	50										
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*23.9*	31.2	*28.6*	35.8	*28.6*	38.5	*33.4*	37.2	*33.4*	40.3
	160		180	*25.3*	33.2	*30.4*	38.0	*30.4*	41.0	*35.4*	39.5	*35.4*	42.8
		170		*26.7*	35.1	*32.1*	40.2	*32.1*	43.4	*37.4*	41.7	*37.4*	45.2
	170		190	*28.2*	37.1	*33.8*	42.4	*33.8*	45.9	*39.4*	43.9	*39.4*	47.7
		180		***29.6***	**39.1**	***35.5***	**44.6**	***35.5***	**48.3**	***41.4***	**46.1**	***41.4***	**50.1**
	180		200	*31.1*	41.0	*37.3*	46.9	*37.3*	50.8	*43.4*	48.3	*43.4*	52.6
		190		*32.5*	43.0	*39.0*	49.1	*39.0*	53.3	*45.5*	50.5	*45.5*	55.1
	190		210	*34.0*	45.0	*40.7*	51.3	*40.7*	55.7	*47.5*	52.7	*47.5*	57.5
		200		***35.4***	**46.9**	***42.5***	**53.5**	***42.5***	**58.2**	***49.5***	**55.0**	***49.5***	**60.0**
	200		220	*36.8*	48.9	*44.2*	55.7	*44.2*	60.6	*51.5*	57.2	*51.5*	62.4
		210		*38.3*	50.9	*45.9*	57.9	*45.9*	63.1	*53.5*	59.4	*53.5*	64.9
	210		230	*39.7*	52.8	*47.6*	60.1	*47.6*	65.5	*55.5*	61.6	*55.5*	67.3
		220		***41.2***	**54.8**	***49.4***	**62.3**	***49.4***	**68.0**	***57.5***	**63.8**	***57.5***	**69.8**
	220		240	*42.6*	56.8	*51.1*	64.6	*51.1*	70.5	*59.6*	66.0	*59.6*	72.3
		230		*44.0*	58.7	*52.8*	66.8	*52.8*	72.9	*61.6*	68.2	*61.6*	74.7
	230		250	*45.5*	60.7	*54.6*	69.0	*54.6*	75.4	*63.6*	70.4	*63.6*	77.2
		240		***46.9***	**62.7**	***56.3***	**71.2**	***56.3***	**77.8**	***65.6***	**72.7**	***65.6***	**79.6**
	240		260	*48.4*	64.6	*58.0*	73.4	*58.0*	80.3	*67.6*	74.9	*67.6*	82.1
		250		*49.8*	66.6	*59.7*	75.6	*59.7*	82.8	*69.6*	77.1	*69.6*	84.6
	250		270	*51.2*	68.6	*61.5*	77.8	*61.5*	85.2	*71.6*	79.3	*71.6*	87.0
	> 250			Load bearing capacity values for further types (e. g. for h > 250 mm, C30/37, $v_{Rd,2}$ and $m_{Rd,2}$) can be found in the type tests at **www.halfen.com** or on request. See inside back cover for contact information.										

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

V_{Ed} ↓	ø6 / 25 cm				ø6 / 24.5 cm
V_{Ed} ↑	ø8 / 18.5 cm	ø8 / 15.5 cm	ø8 / 15 cm	ø8 / 13.5 cm	ø8 / 13.5 cm

On-site stirrup reinforcement $A_{s,req}$ on main slab side (→ page 35)

V_{Ed} ↓	direct support	ø6 / 25 cm				ø6 / 24.5 cm
	indirect support	ø8 / 18.5 cm	ø8 / 15.5 cm	ø8 / 15 cm	ø8 / 13.5 cm	ø8 / 13.5 cm
V_{Ed} ↑	direct / indirect support	ø6 / 25 cm				ø6 / 24.5 cm

Load bearing capacity values $v_{Rd,1}$ / $m_{Rd,1}$ according to EN 1992-1-1 (EC2)

Shear capacity $\pm v_{Rd}$

Concrete strength: *C20/25* ≥C25/30

120

Type / Element width		SP MVX-1107	SP MVX-1208	SP MVX-1209	SP MVX-1110	SP MVX-1112
	B = 1.00 m					
	B = 0.50 m	–	SP MVX-0604	–	–	–
	B = 0.25 m	–	SP MVX-0302	–	–	–
Design values	v_{Rd} [kN/m]	*109.3* 112.0	*124.9* 128.0	*139.2* 144.0	*147.0* 160.0	*154.9* 166.8

Moment bearing capacity m_{Rd}

Type / Element width				SP MVX-1107		SP MVX-1208		SP MVX-1209		SP MVX-1110		SP MVX-1112	
	B = 1.00 m												
	B = 0.50 m			–		SP MVX-0604		–		–		–	
	B = 0.25 m			–		SP MVX-0302		–		–		–	
Concrete cover [mm]	30	35	50										
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*33.4*	43.1	*38.2*	46.0	*39.1*	43.1	*37.7*	39.2	*36.3*	37.9
	160		180	*35.4*	45.8	*40.5*	48.8	*41.4*	45.6	*39.9*	41.3	*38.3*	40.0
		170		*37.4*	48.6	*42.8*	51.6	*43.7*	48.1	*42.0*	43.5	*40.3*	42.0
	170		190	*39.4*	51.3	*45.1*	54.4	*45.9*	50.6	*44.2*	45.7	*42.3*	44.0
		180		***41.4***	**54.0**	***47.4***	**57.2**	***48.2***	**53.0**	***46.3***	**47.8**	***44.2***	**46.0**
	180		200	*43.4*	56.7	*49.8*	60.1	*50.5*	55.5	*48.4*	50.0	*46.2*	48.1
		190		*45.5*	59.4	*52.1*	62.9	*52.8*	58.0	*50.6*	52.2	*48.2*	50.1
	190		210	*47.5*	62.1	*54.4*	65.7	*55.1*	60.5	*52.7*	54.3	*50.2*	52.1
		200		***49.5***	**64.8**	***56.7***	**68.5**	***57.4***	**63.0**	***54.8***	**56.5**	***52.1***	**54.2**
	200		220	*51.5*	67.5	*59.0*	71.3	*59.7*	65.5	*57.0*	58.7	*54.1*	56.2
		210		*53.5*	70.2	*61.3*	74.1	*62.0*	68.0	*59.1*	60.8	*56.1*	58.2
	210		230	*55.5*	72.9	*63.6*	76.9	*64.3*	70.5	*61.3*	63.0	*58.1*	60.3
		220		***57.5***	**75.6**	***65.9***	**79.7**	***66.6***	**72.9**	***63.4***	**65.2**	***60.1***	**62.3**
	220		240	*59.6*	78.3	*68.2*	82.5	*68.9*	75.4	*65.5*	67.3	*62.0*	64.3
		230		*61.6*	81.0	*70.5*	85.3	*71.1*	77.9	*67.7*	69.5	*64.0*	66.3
	230		250	*63.6*	83.7	*72.8*	88.1	*73.4*	80.4	*69.8*	71.7	*66.0*	68.4
		240		***65.6***	**86.4**	***75.1***	**90.9**	***75.7***	**82.9**	***71.9***	**73.8**	***68.0***	**70.4**
	240		260	*67.6*	89.1	*77.4*	93.7	*78.0*	85.4	*74.1*	76.0	*69.9*	72.4
		250		*69.6*	91.8	*79.8*	96.5	*80.3*	87.9	*76.2*	78.2	*71.9*	74.5
	250		270	*71.6*	94.5	*82.1*	99.3	*82.6*	90.3	*78.4*	80.3	*73.9*	76.5
	> 250			Load bearing capacity values for further types (e. g. for h > 250 mm, C30/37, $v_{Rd,2}$ and $m_{Rd,2}$) can be found in the type tests at **www.halfen.com** or on request. See inside back cover for contact information.										

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

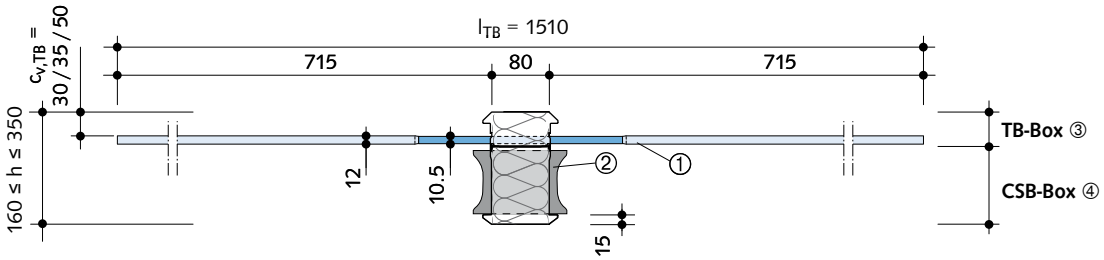
	SP MVX-1107	SP MVX-1208	SP MVX-1209	SP MVX-1110	SP MVX-1112
V_{Ed} ↓	ø6 / 23.5 cm	ø6 / 21 cm	ø6 / 19.5 cm	ø6 / 19 cm	ø6 / 17.5 cm
V_{Ed} ↑	ø8 / 13 cm	ø8 / 11.5 cm	ø8 / 10.5 cm	ø8 / 10 cm	ø8 / 9.5 cm

On-site stirrup reinforcement $A_{s,req}$ on main slab side (→ page 35)

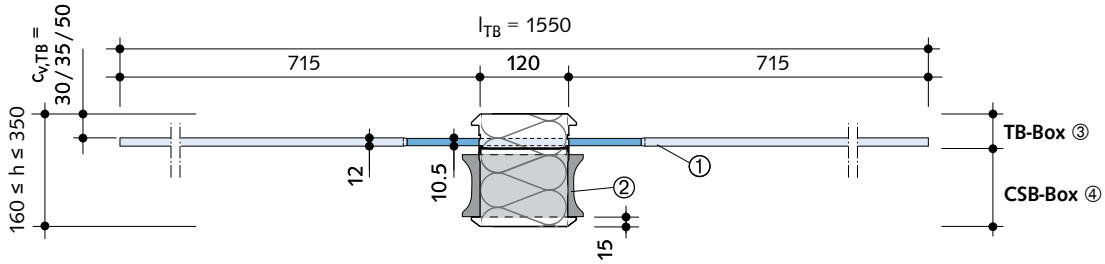
		SP MVX-1107	SP MVX-1208	SP MVX-1209	SP MVX-1110	SP MVX-1112
V_{Ed} ↓	direct support	ø6 / 23.5 cm	ø6 / 21 cm	ø6 / 19.5 cm	ø6 / 19 cm	ø6 / 17.5 cm
	indirect support	ø8 / 13 cm	ø8 / 11.5 cm	ø8 / 10.5 cm	ø8 / 10 cm	ø8 / 9.5 cm
V_{Ed} ↑	direct / indirect support	ø6 / 23.5 cm	ø6 / 21 cm	ø6 / 19.5 cm	ø6 / 19 cm	ø6 / 17.5 cm

Product description – Cross sections

HIT-HP MVX — High Performance



HIT-SP MVX — Superior Performance



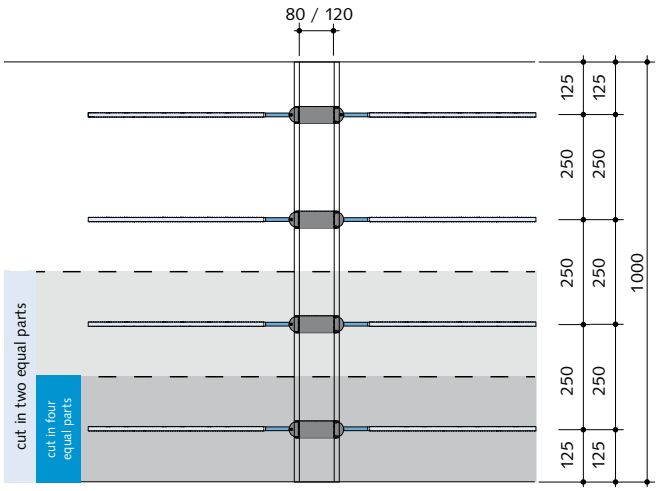
Dimensions in [mm]

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

Product description – Top view (examples)

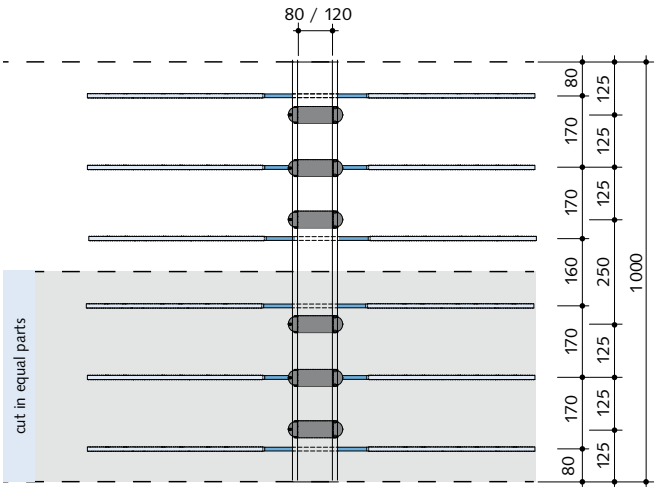
The layout of the tension rods and the double-symmetrical CSB-bearing has been optimized for cutting the elements. With an even number of support elements these are grouped in sections; this simplifies cutting the elements.

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



For a top view of other units with dimensions please refer to the relevant type test.

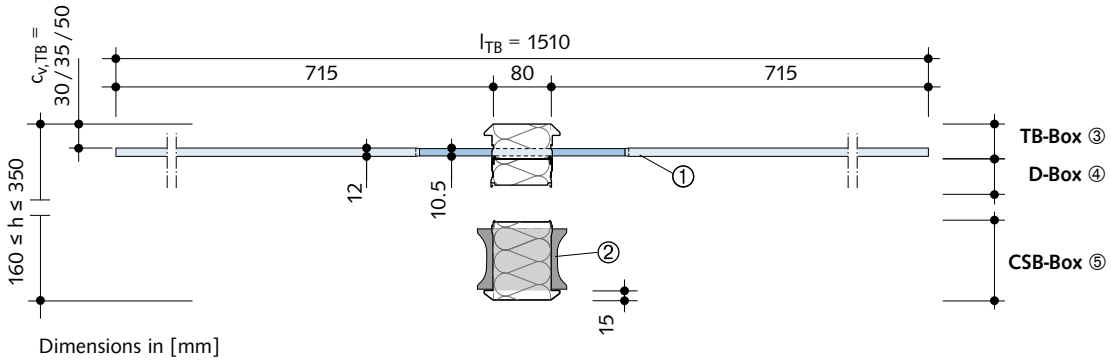
HIT-HP/SP - MVX 0606 - ... - 100
HIT-HP/SP - MVX 0303 - ... - 050



Application for element slabs – Cross sections

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

See pages from 14 for load bearing capacity tables

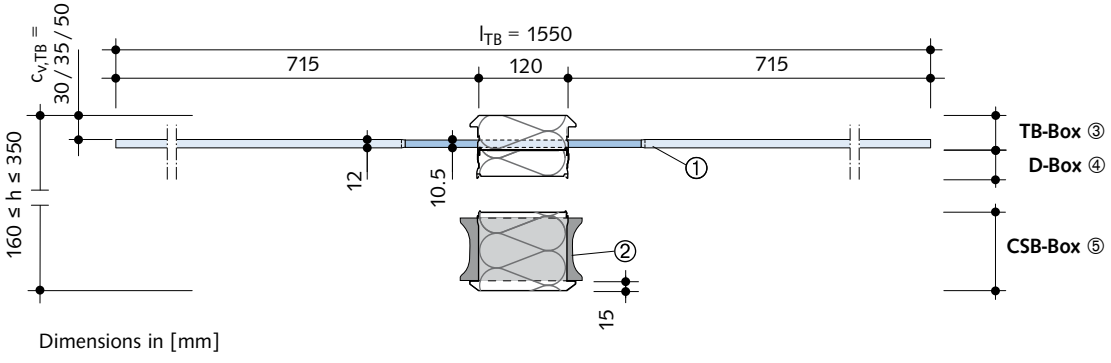


Dimensions in [mm]

① Tension bars ø12 mm / 10.5 mm in the joint
② Double-symmetrical compression shear bearings CSB
③ Tension bar box
h = 50 mm with $c_{v,TB}$ 30/35 mm
h = 70 mm with $c_{v,TB}$ 50 mm
④ Distance box as height compensation
h = 20 mm and higher (→ see page 30)
⑤ Compression shear bearing box
h = 110 mm

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

See pages from 24 for load bearing capacities tables



Dimensions in [mm]

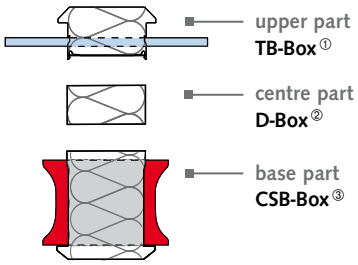
① Tension bars ø12 mm / 10.5 mm in the joint
② Double-symmetrical compression shear bearings CSB
③ Tension bar box
h = 50 mm with $c_{v,TB}$ 30/35 mm
h = 70 mm with $c_{v,TB}$ 50 mm
④ Distance box as height compensation
h = 20 mm and higher (→ see page 30)
⑤ Compression shear bearing box
h = 110 mm

HALFEN HIT INSULATED CONNECTION HIGH & SUPERIOR PERFORMANCE

HIT-HP MVX-ES, HIT-SP MVX-ES

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	_ VX	-	__ 05	-	11	-	100	-		-	CSB
Σ												
(HIT-HP MVX-ES)	HIT- HP	MVX	-	08 05	-	20	-	100	-	35	-	ES
				❶ ❷		❸		❹ ❺		❻		❼		❽		❾



① Tension bar box
② Distance box
③ Compression shear bearing box

Type designation

① Product group
② Joint spacing 80 mm (HP) or 120 mm (SP)
③ Connection type
④ Number of tension bars
⑤ Number of compression shear units CSB
⑥ Element height [cm]
⑦ Element width [cm]
⑧ Concrete cover (top) [mm]
⑨ For element slab design only

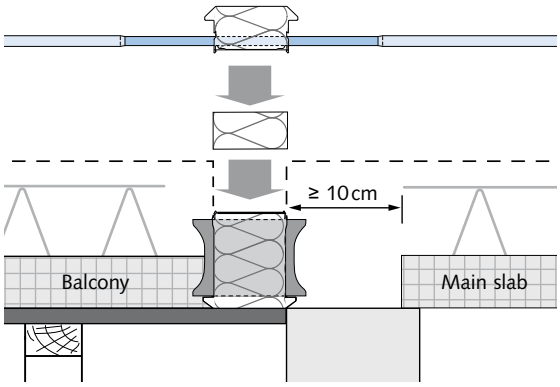
Height TB-Box [mm]	
c_v = 30/35	50
c_v = 50	70

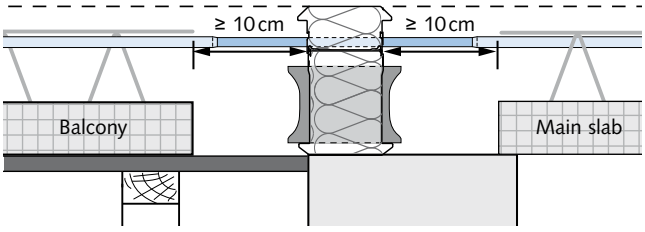
Height D-Box [mm]										
Slab height	160	170	180	190	200	210	220	230	240	250
c_v = 30/35	–	–	20	30	40	50	60	70	80	90
c_v = 50	–	–	–	–	20	30	40	50	60	70

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 MVX with element slabs with a structural cast-in-place concrete layer



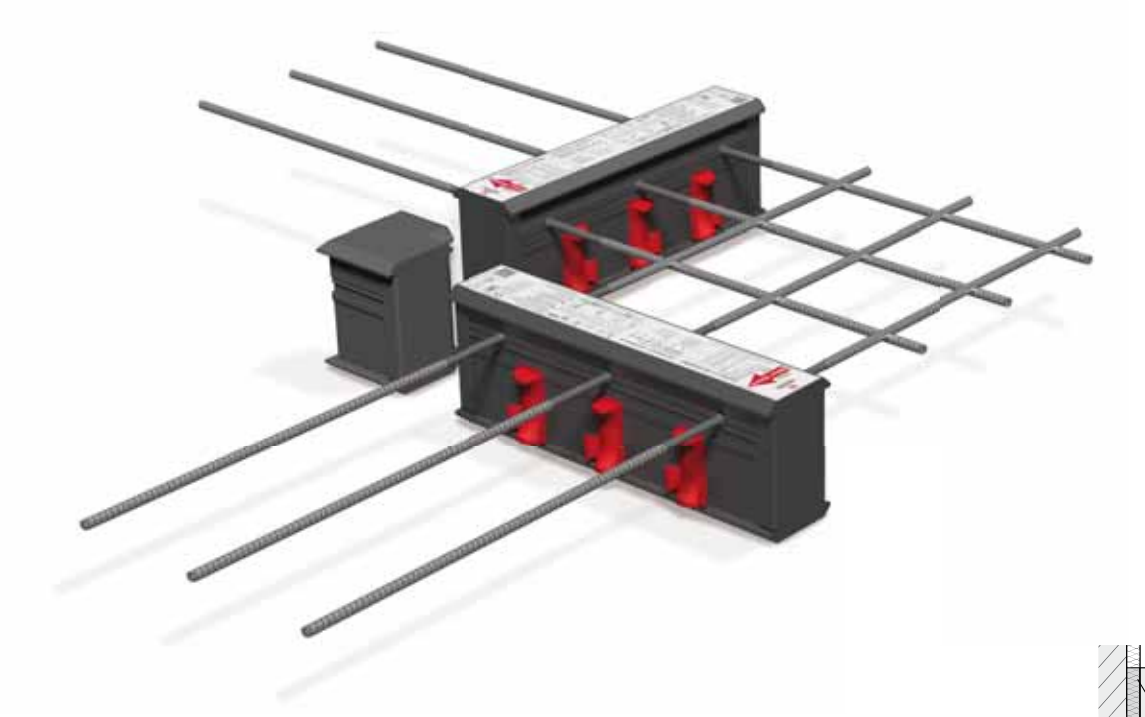


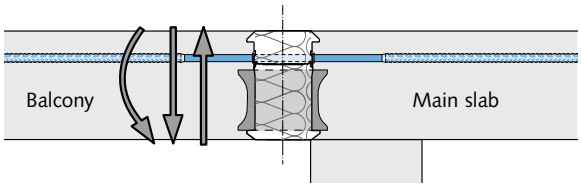
To create a positive connection a total distance of at least 10 cm between insulation element and precast unit has to be maintained. Detailed information for reinforcement layout can be found in the documents ETA-18/0189 and Z-15.7-293. The documents are available for download at **www.halfen.com**.

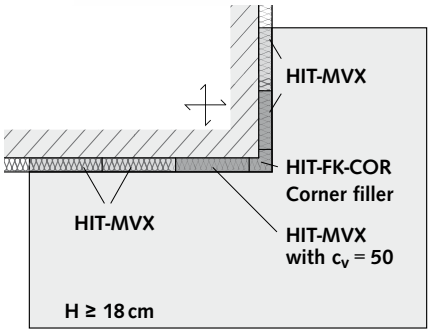
HIT-HP MVX-COR, HIT-SP MVX-COR

- Symmetrical connection for cantilevered corner balcony slabs
- Transfer of bending moments as well as positive and negative shear forces

type tested







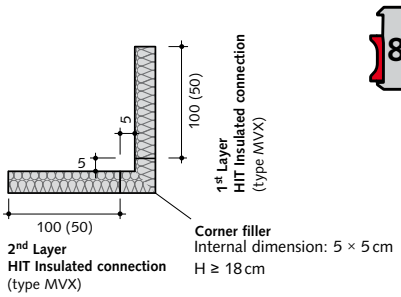
Application example: outer corner

HIT-HP MVX – **High Performance** with insulation thickness 80 mm
HIT-SP MVX – **Superior Performance** with insulation thickness 120 mm
Both types are also available as multi-part design (-ES) for element slabs.

Contents	Type	Page
Solutions for corner balconies	HIT-HP COR, HIT-SP COR	32
Span-to-depth ratio	HIT HP MVX, HIT SP MVX	33
On-site connecting reinforcement	HIT HP MVX, HIT SP MVX	33
Installation diagram	HIT HP MVX, HIT SP MVX	37
Joint and installation spacings	HIT HP MVX, HIT SP MVX	40
Camber	HIT HP MVX, HIT SP MVX	41

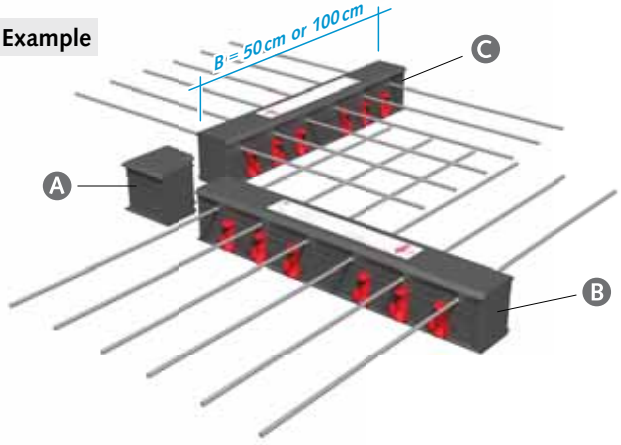
Elements for corner balconies

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



80 120

Example



Ⓐ Corner filler

Ⓑ HIT-MVX Standard element, 1st layer reinforcement (c_v = 30 mm – 35 mm)

Ⓒ HIT-MVX Standard element, 2nd layer reinforcement (c_v = 50 mm)

Ⓐ	HIT-HP	FK	-			20	-			COR - ES
Ⓑ	HIT-HP	MVX	-	05	04	- 20	-	100	- 35	
Ⓒ	HIT-HP	MVX	-	05	04	- 20	-	100	- 50	
	①	②	③	④	⑤	⑥		⑦	⑧	⑨ ⑩

Type designation

① Product group
② Joint spacing 80 mm (HP) or 120 mm (SP)
③ Connection type
④ Number of tension bars
⑤ Number of double-symmetrical CSB
⑥ Element height [cm]
⑦ Element width [cm]
⑧ Concrete cover (top) [mm]
⑨ For corner application only
⑩ For element slab design only

Exemplary load bearing capacity values HIT-HP MVX COR

Shear capacity ±v_{Rd}

Concrete strength: *C20/25* ≥C25/30

80

Type / Element width	B = 1.00 m	HP MVX-0506	HP MVX-0606	HP MVX-0706	HP MVX-0806	HP MVX-0906
	B = 0.50 m	–	HP MVX-0303	–	HP MVX-0403	–
	B = 0.25 m	–	–	–	–	–
Design values	v_{Rd} [kN/m]			*96.0* 96.0		

Moment bearing capacity m_{Rd}

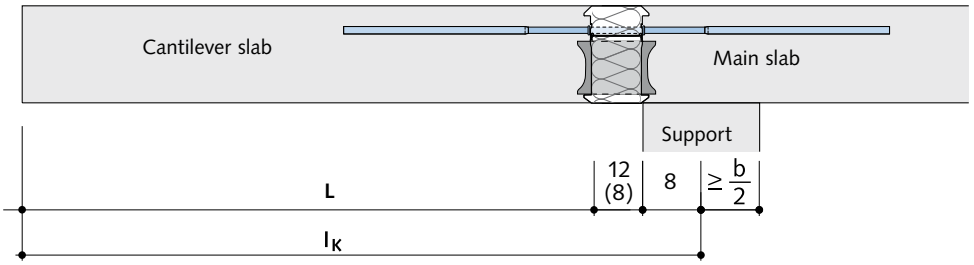
Type / Element width		B = 1.00 m		HP MVX-0506		HP MVX-0606		HP MVX-0706		HP MVX-0806		HP MVX-0906	
		B = 0.50 m		–		HP MVX-0303		–		HP MVX-0403		–	
		B = 0.25 m		–		–		–		–		–	
Concrete cover [mm]	30	35	50										
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*21.9*	22.4	*25.4*	26.1	*28.5*	29.6	*31.4*	32.8	*34.0*	35.8
	160		180	*23.1*	23.6	*26.8*	27.6	*30.3*	31.3	*33.4*	34.8	*36.2*	38.0
		170		*24.3*	24.9	*28.3*	29.1	*32.0*	33.0	*35.4*	36.8	*38.5*	40.2

All load bearing capacity values and connecting reinforcement → pages 14–27 (value c_v = 50 mm is decisive)

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).
The cantilever length l_k should be calculated as shown in the diagram below. Interim values have to be interpolated.

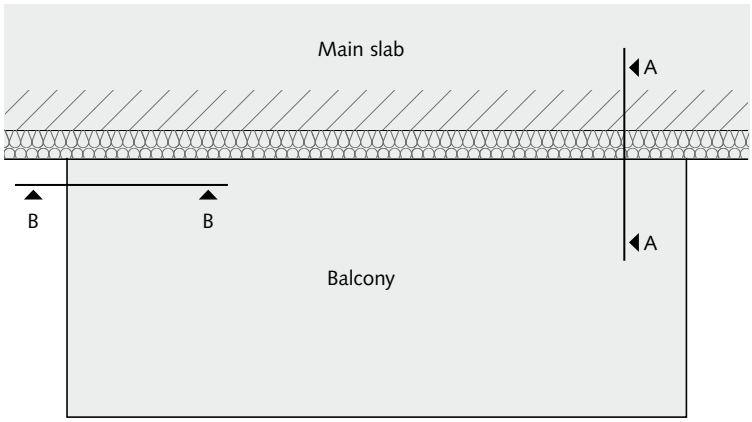
Maximum cantilever length l_k [m]		Slab thickness h [cm] of concrete slab									
		16	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Concrete cover [cm]	c_v = 3.0	1.74	1.88	2.02	2.16	2.30	2.44	2.58	2.72	2.86	3.00
	c_v = 3.5	1.67	1.81	1.95	2.09	2.23	2.37	2.51	2.65	2.79	2.93
	c_v = 5.0	–	1.60	1.74	1.88	2.02	2.16	2.30	2.44	2.58	2.72



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

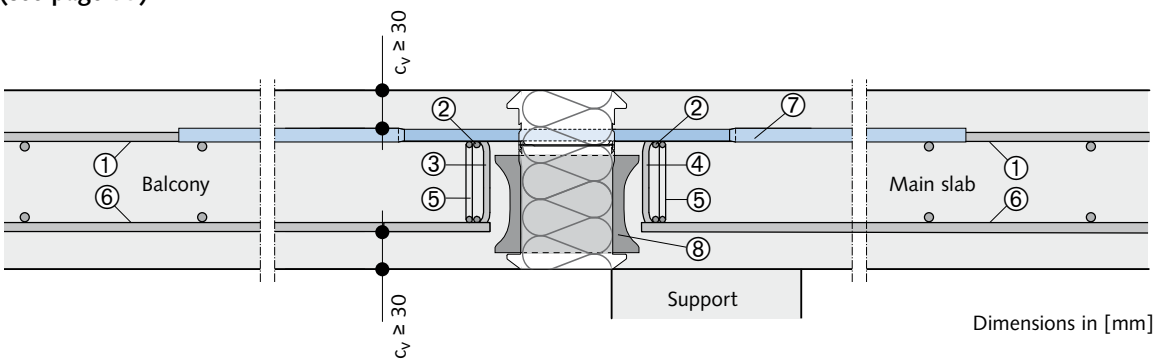
On-site reinforcement for direct and indirect support

Section A-A
Section B-B

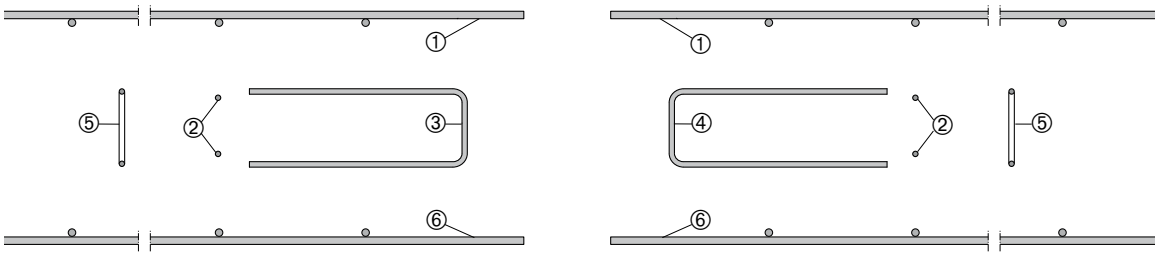


On-site reinforcement for direct and indirect support

Section A-A (see page 33)



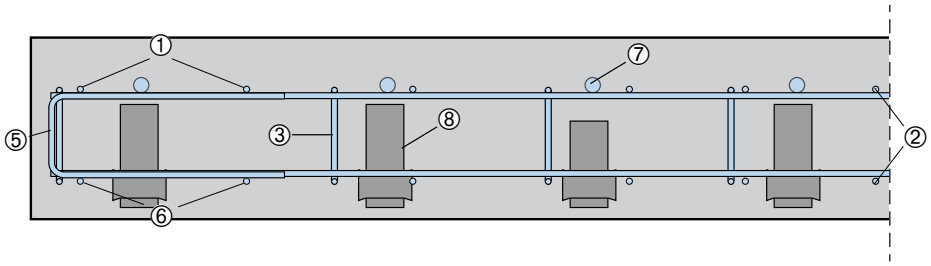
Reinforcement detail



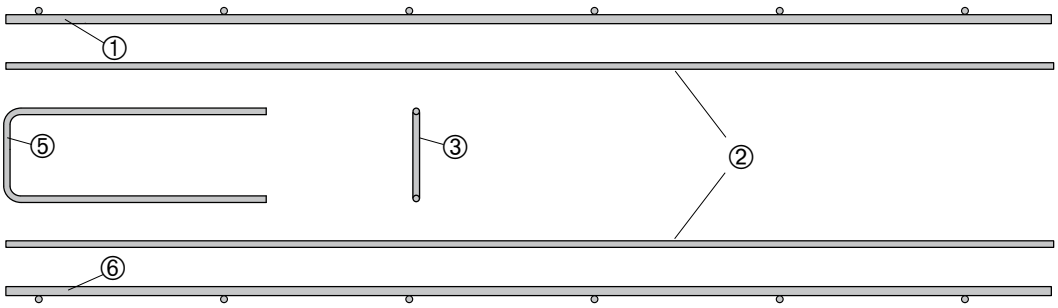
Legend: see next page

On-site reinforcement for direct and indirect support

Section B-B (see page 33)



Reinforcement detail



Legend: see next page

Connecting reinforcement

Recommendation for on-site reinforcement (depending on construction):
aligned butted surfaces, $a_{s,TB} \leq a_{s,overlap}$ with a load of 100 % of the maximal moment M_{Rd}.

No. of tension bars n_{TB}/m	$a_{s,TB}$ [cm²]	Variation A: mesh	Variation B: steel bars	Variation C: combined mesh and steel bars
2	2.26	R257 A	ø 8 / 22 cm	–
3	3.39	R335 A	ø10 / 23 cm	R188 A + ø8 / 25 cm
4	4.52	R524 A	ø10 / 17 cm	R188 A + ø8 / 18 cm
5	5.65	Q636 A	ø10 / 13.5 cm	R188 A + ø8 / 13 cm
6	6.79	–	ø10 / 11.5 cm	R188 A + ø8 / 10 cm
7	7.92	–	ø10 / 9.5 cm	R188 A + ø10 / 12.5 cm
8	9.05	–	ø12 / 12.5 cm	R257 A + ø10 / 12 cm
9	10.18	–	ø12 / 11 cm	R257 A + ø10 / 10 cm
10	11.31	–	ø12 / 10 cm	R257 A + ø10 / 9 cm
11	12.44	–	ø12 / 9 cm	R335 A + ø12 / 12 cm
12	13.57	–	ø12 / 8 cm	R335 A + ø12 / 11 cm
13	14.70	–	ø12 / 7.5 cm	R335 A + ø12 / 10 cm
14	15.83	–	ø12 / 7 cm	R524 A + ø12 / 10 cm
16	18.10	–	ø12 / 6 cm	Q636 A + ø12 / 9.5 cm
18	20.36	–	ø12 / 5.5 cm	Q636 A + ø12 / 6.5 cm
Main slab thickness h 160 – 350 mm				

Legend for page 34: on-site reinforcement

Position ①: Recommendation for upper connecting reinforcement	→ see table above
Position ②: horiz. Edge reinforcement, longitudinal to the insulation joint	min. 2× ø8 mm
Position ③: On-site stirrup reinforcement $A_{s,req}$ balcony side	depending on the V_{Ed} load and support (direct or indirect). Exact specifications for the corresponding HIT Type see pages 14–27.
Position ④: On-site stirrup reinforcement $A_{s,req}$ slab side	
Position ⑤: Stirrups as end anchorage for position ②	one stirrup on each side with min. ø8 mm
for **Position** ⑤: additional U-bar to secure the free edge of the balcony slab	according to DIN EN 1992-1-1 and DIN EN 1992-1-1/NA
Position ⑥: Bottom slab reinforcement	

Position ⑦: Tension bar of HIT HP-MVX and HIT SP MVX with overlap length of l_o = 615 mm
Position ⑧: Double-symmetrical CSB with Type HIT HP-MVX and HIT SP-MVX

Alternative connecting reinforcement as well as a reduction in the required connecting reinforcement overlap length with m_{Ed}/m_{Rd} ist possible.

Using HALFEN HIT-Insulated connection with pre-stressed concrete slabs

HALFEN and DW SYSTEMBAU (manufacturer of pre-stressed concrete slabs) have jointly developed constructive solutions to thermally separate cantilevered balcony slabs in compliance with fire protection regulations for use with pre-stressed concrete slabs. Also known as prestressed concrete hollow core slabs.

All these newly developed connection variants have one thing in common: The balconies are anchored to the main slab, irrespective of the direction of tension in the slab, using thin semi-precast, pre-stressed concrete elements and a concrete topping of at least 8 cm thickness.

The balcony loads are transferred to the main slab by friction and connecting reinforcement. The bond between the concrete topping and the semi-precast, pre-stressed concrete elements must be at least category "rough" and must be verified separately taking all loads into account.

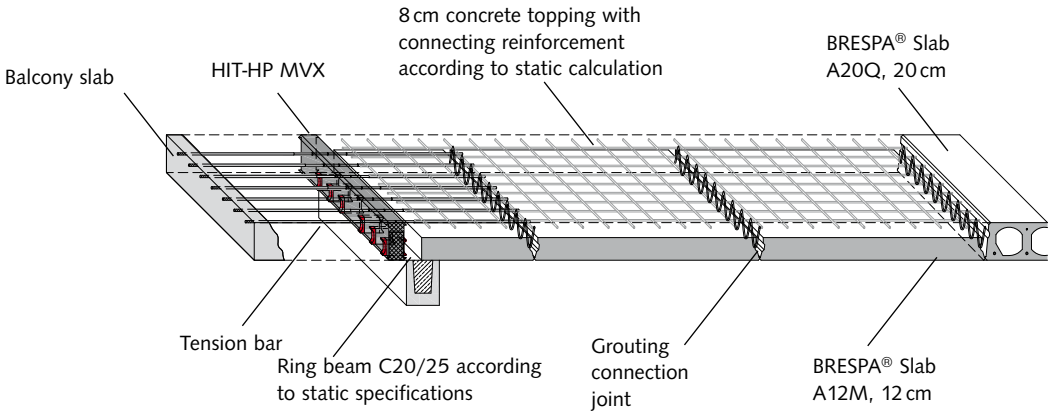


Fig: Balcony connection using HALFEN HIT-Insulated connection and concrete topping to BRESPA® solid slab element

Constructive boundary conditions

- the lateral edge of the slab is formed by a load-bearing beam or lintel
- the HALFEN HIT Elements are anchored using an on-site cast concrete layer
- for example, slab thicknesses of 20 cm are made with 12 cm BRESPA® solid slabs (A12M) and 8 cm concrete topping
- the surface of the semi-precast, pre-stressed concrete must be at least category "rough" and must be thoroughly cleaned and moistened before the on-situ concrete is poured
- structural shear reinforcement (i.e. small filigree lattice girder) is installed in the area of the element joints

Details of balcony connections length and crosswise to the slab tensioning direction can be found in the download area at **www.dw-systembau.de**.
The HIT design software at **www.halfen.com** provides the corresponding verifiable planning for the balconies.

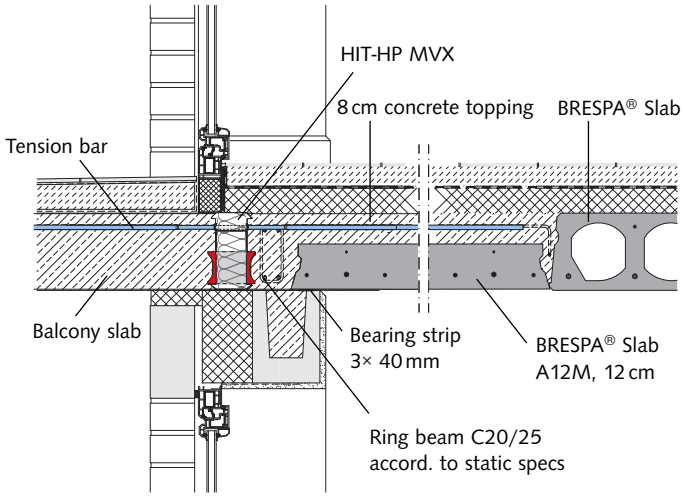
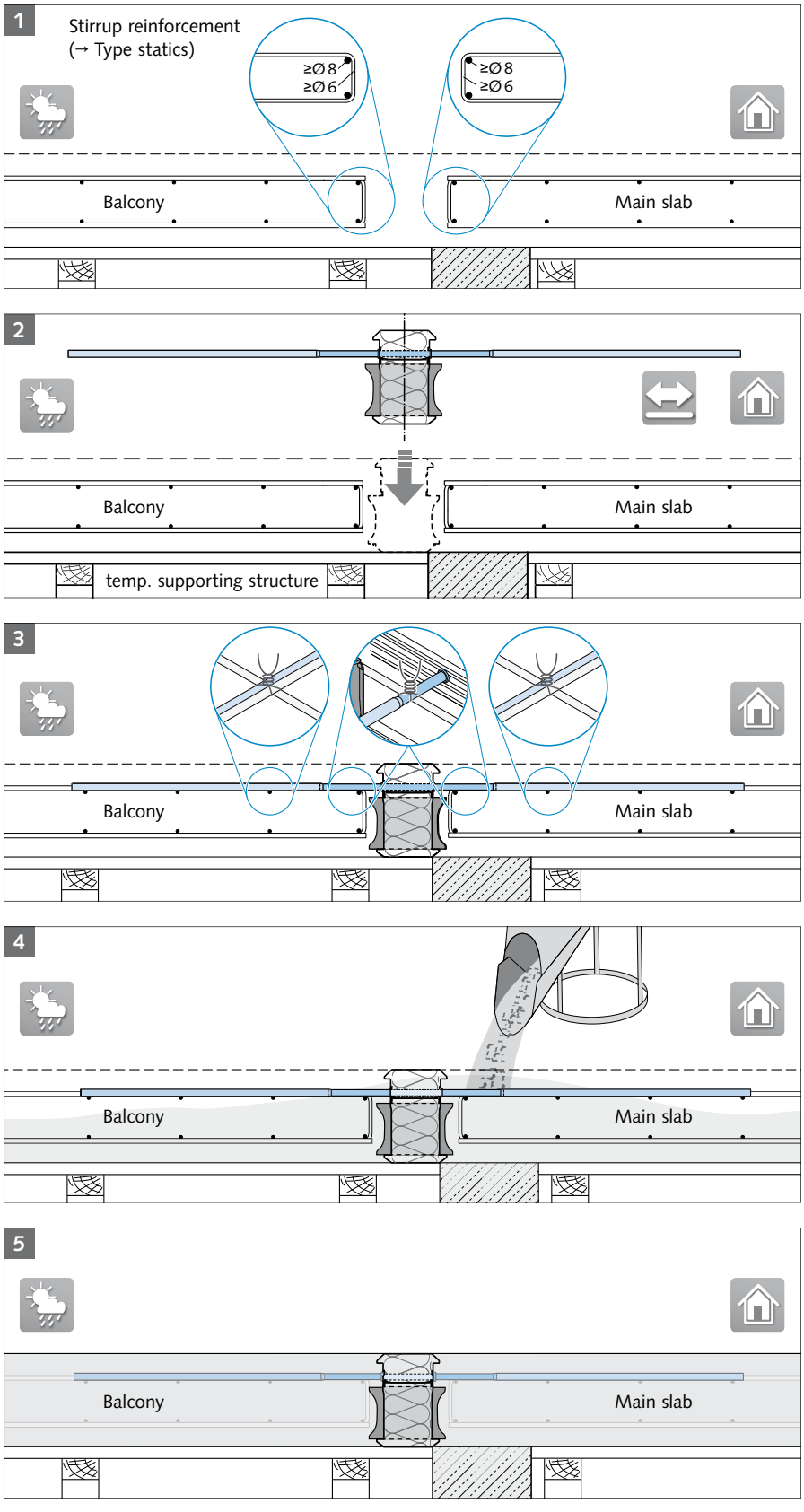


Fig: Balcony connection to BRESPA® solid slab element (example)

Installation diagram

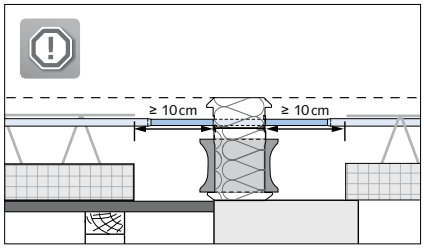


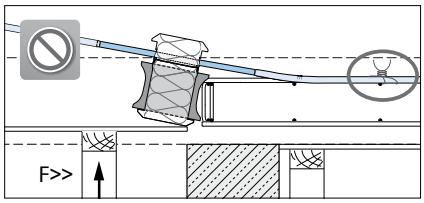
1 Installation of on-site reinforcement

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

2 Installation of the HIT Element from above

ⓘ The HIT-MVX Element is symmetrical; therefore, both installation directions are correct (custom solutions can vary).





⚠ Ensure that the formwork is at the correct height!

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

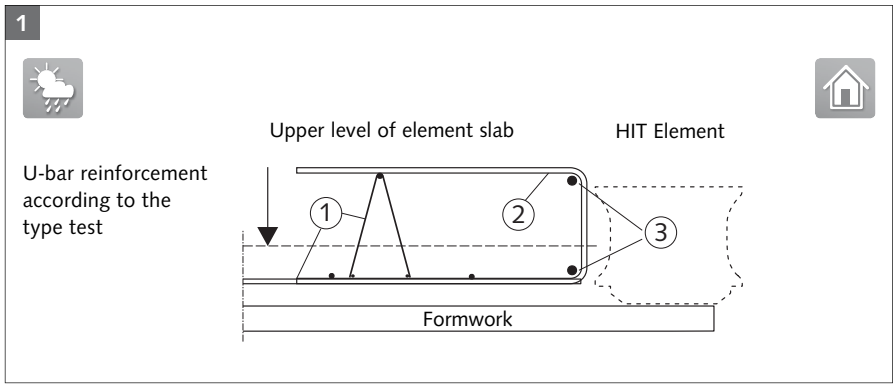
4 Pour the concrete

⚠ 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

ⓘ For further installation instructions please go to **www.halfen.com**.

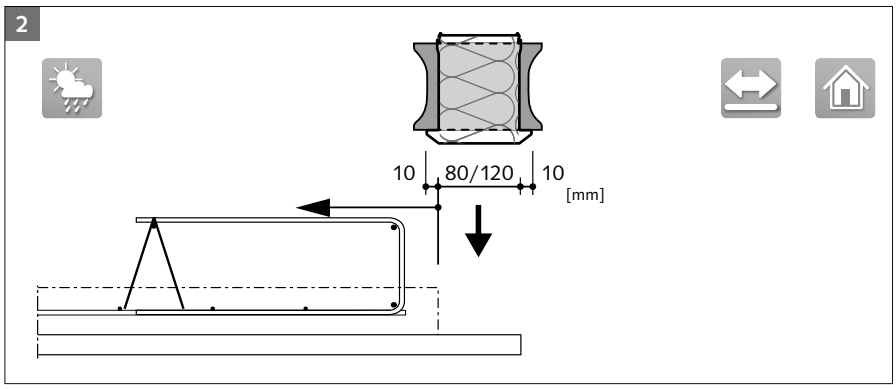
Installation diagram; precast plant



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 $A_{s,h}$ (min. ⌀8 mm), if required with end anchorage.

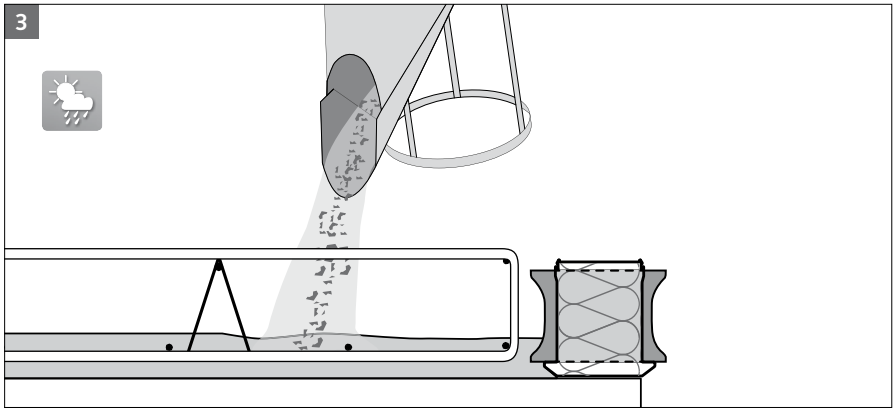
⚠ The on-site reinforcement must be placed as specified by the structural engineer.



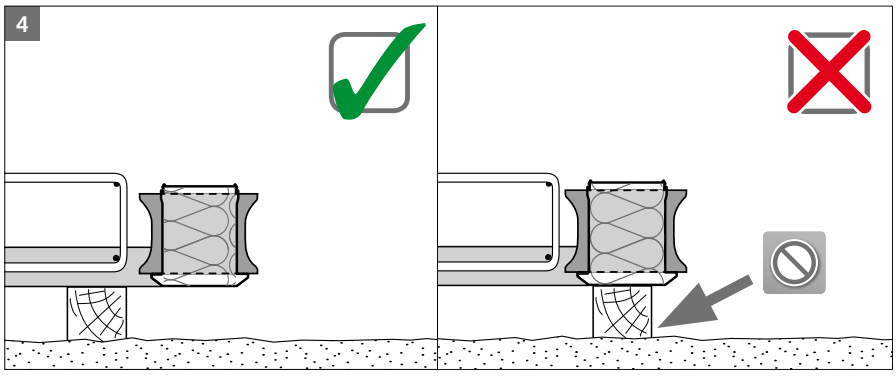
2 Installation of the CSB-Box

The HIT-MVX Element is symmetrical; therefore, both installation directions are correct (custom solutions can vary).

⚠ Ensure all HIT Elements are securely positioned.



3 Pour the concrete for the element slab

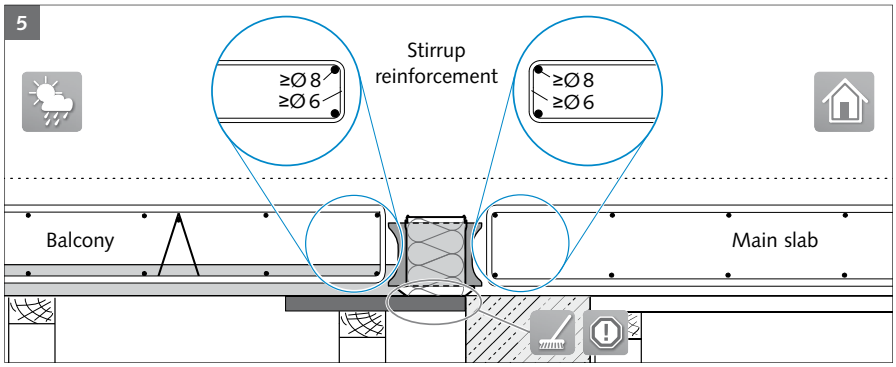


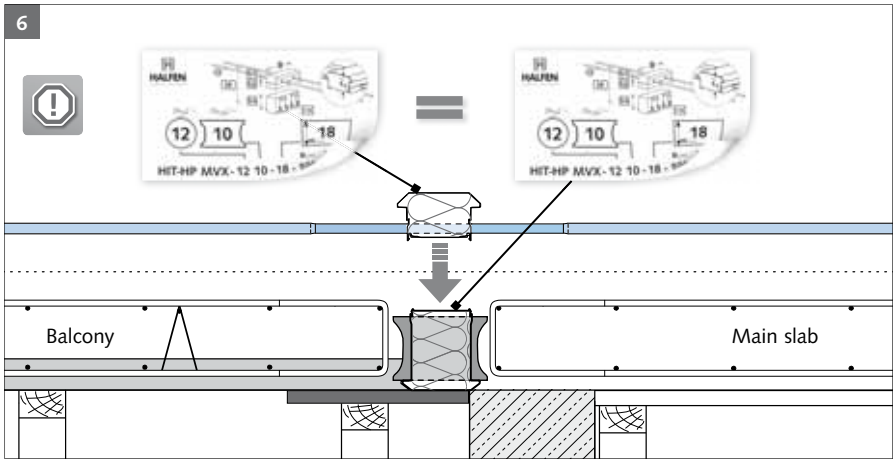
4 Transport to the construction site

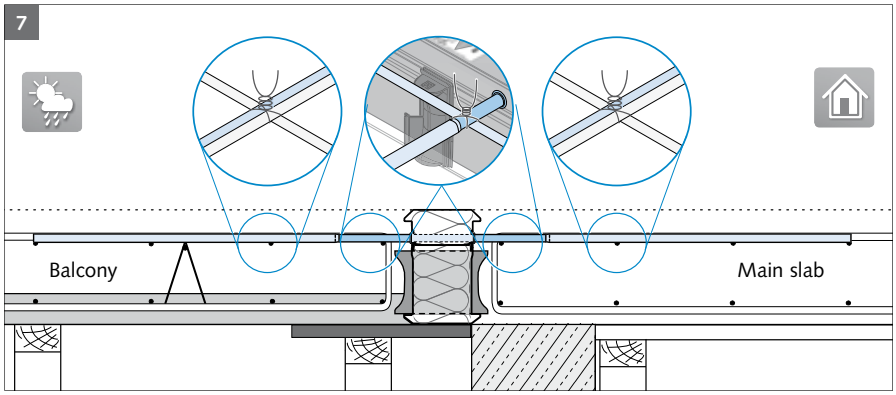
Ensure elements are properly secured during transport.
Do not rest concrete element slabs on other exposed HIT Elements.

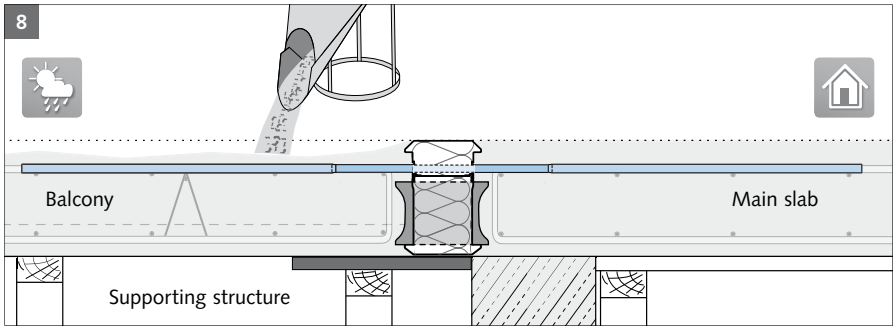
⚠ Never place temporary supports under the HIT Elements!

Installation diagram; construction site





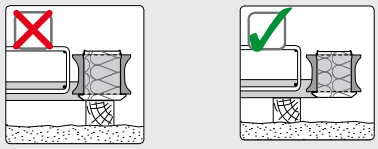




5 Install the on-site element slab reinforcement

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 temporary supports under the HIT Elements!

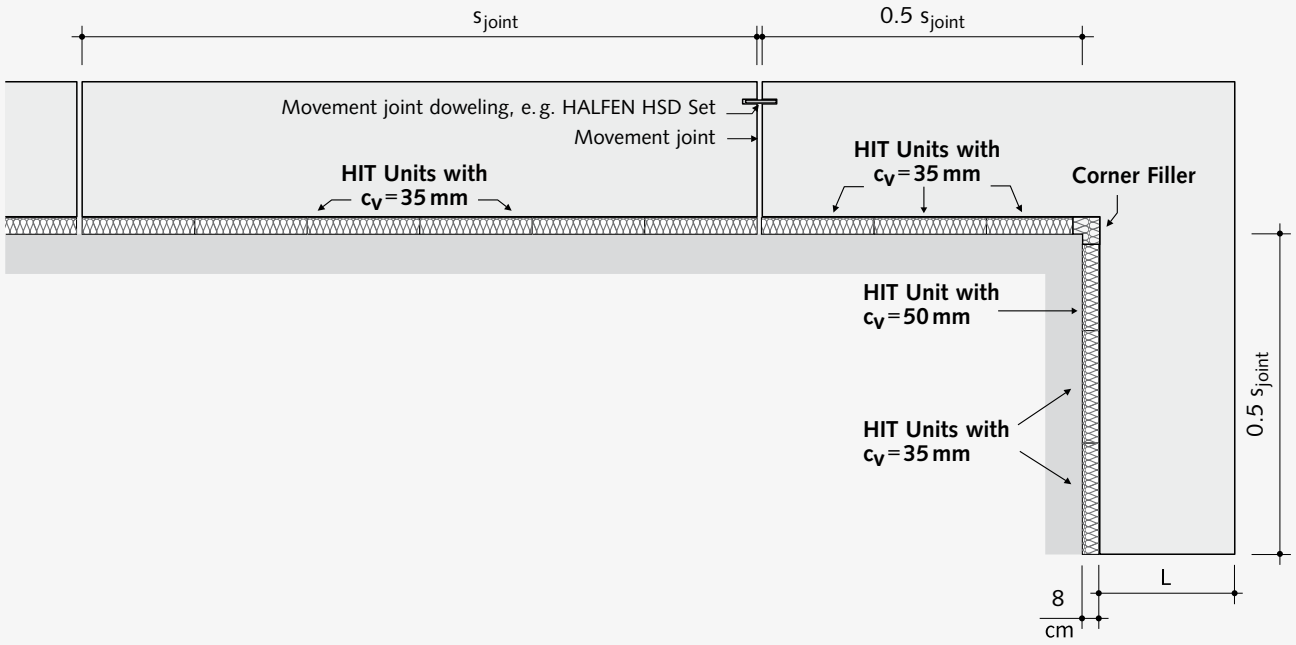
6 Install the tension bar box

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



Observe the expansion joints
According to the European Technical Assessment ETA, **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 s_{joint} according to the assessment. In balcony structures extending past an outer corner an expansion joint must be planned at least every 0.5 s_{joint}. For inside corners the limit is 0.5 s_{joint} for each length.

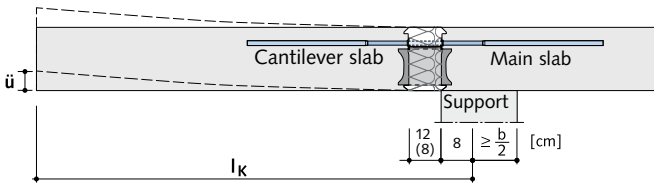
Application	HALFEN HIT Type	Decisive rebar diameter ∅	s_{joint} max. expansion joint spacing [m]	
			HP (80 mm)	SP (120 mm)
Cantilevered balconies	MVX	10.5 mm	13.5 m	23.0 m
	MVX-COR			
	DVL	14 mm	10.1 m	–
Offset cantilevered balconies	MVX-OD/OU	10.5 mm	13.5 m	23.0 m
Simply supported balconies	ZVX/ZDX-...-06	6 mm		
	ZVX/ZDX-...-08	8 mm		
	ZVX/ZDX-...-10	10 mm		
	ZVX/ZDX-...-12	12 mm	11.7 m	19.8 m
Loggias/ wall penetrating concrete slabs	DD-...-06/08/10	10.5 mm	13.5 m	23.0 m
	DD-...-12	12 mm	11.7 m	19.8 m
	DDL	14 mm	10.1 m	–
Roof parapets	AT	8 mm	13.5 m	23.0 m
Balcony parapets	FT			
Corbels	OTX			

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 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 42 refers **only to deformation** in HALFEN HIT Elements HIT-HP/SP MVX 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



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

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 40
- 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]

HALFEN HIT Insulated connection type
HIT-HP MVX-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 under quasi-permanent load combination

$$m_{Ed,perm} = (g_k + g_{k,Bel} + \Psi_2 \times q_k) \times l_K^2 / 2 + g_{k,Gel} \times l_K$$
$$= (4.5 + 1.5 + 0.3 \times 4.0) \times 1.9^2 / 2 + 1.5 \times 1.9$$
$$= 15.8\,kNm/m$$

Camber coefficient ü* = 0.82 %

read from table for: h = 180 and n_{TB} = 6

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 EN 1992-1-1 and EN 1992-1-1/NA
→ page 33, Span-to-depth ratio

HALFEN HIT INSULATED CONNECTION HIGH & SUPERIOR PERFORMANCE

HIT-HP MVX, HIT-SP MVX

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

Slab thickness h [mm]			Number of tension bars n_{TB} per metre of element			
			n_{TB} ≤ 8 tension bars per metre at concrete strength		n_{TB} > 8 tension bars per metre at concrete strength	
Concrete cover [mm]			C20/25	≥ C25/30	C20/25	≥ C25/30
30	**35**	**50**				
	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 coefficient ü* [%] at maximum element load bearing capacity (M_{Rd})

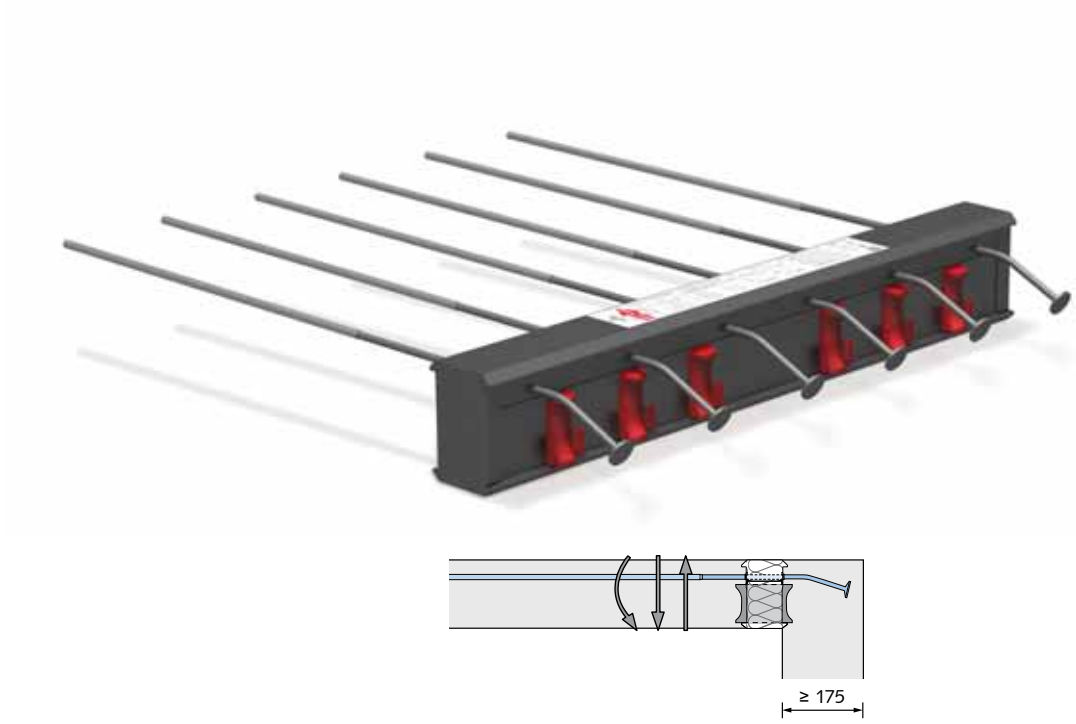
Slab thickness h [mm]			Number of tension bars n_{TB} per metre of element			
			n_{TB} ≤ 8 tension bars per metre at concrete strength		n_{TB} > 8 tension bars per metre at concrete strength	
Concrete cover [mm]			C20/25	≥ C25/30	C20/25	≥ C25/30
30	**35**	**50**				
	160		***1.04***	**1.11**	***0.89***	**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

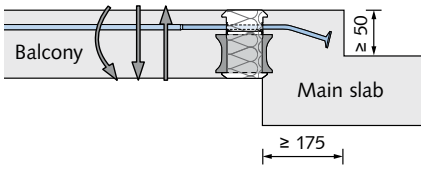
ⓘ The camber ü* is given for each slab thickness, for ≤ 8 tension bars per metre and > 8 per metre accordingly.

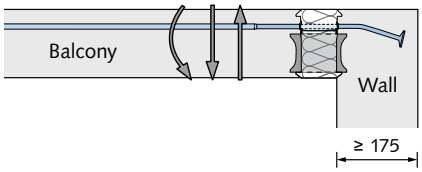
2

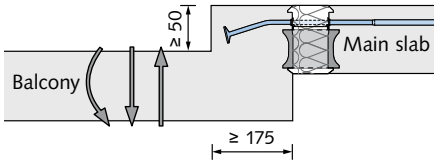
- For cantilevered balcony slabs with height offset (balcony higher than main slab) or upward wall connections
- Transfer of bending moments and bi-directional shear forces

type tested









Dimensions in [mm]

HIT-HP MVX-OU – **High Performance** 80 mm insulation thickness
HIT-SP MVX-OU – **Superior Performance** 120 mm insulation thickness
Both types are also available as multi-part design (-ES) for element slabs.

HIT-HP/SP MVX-OD as custom design
→ page 54

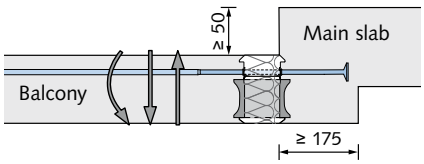
Content	Type	Page
Product types / Load range	HIT-HP/SP MVX-OU	45
Load bearing capacity values	HIT-HP/SP MVX-OU	46
Product description	HIT-HP/SP MVX-OU	54
On-site reinforcement	HIT-HP/SP MVX-OU	56
Installation diagram	HIT-HP/SP MVX-OU	57

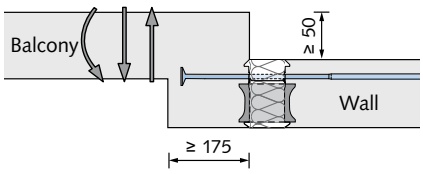
HALFEN HIT INSULATED CONNECTION HIGH & SUPERIOR PERFORMANCE

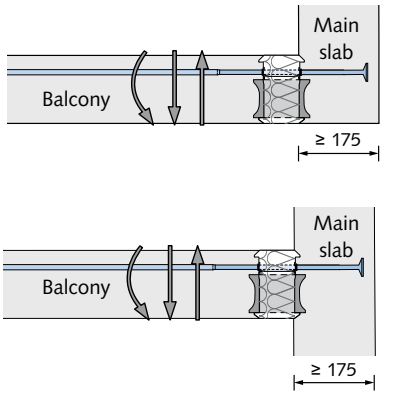
HIT-HP MVX-OD, HIT-SP MVX-OD

- For cantilevered balcony slabs with height offset (balcony lower than main slab) or downward wall connections
- Transfer of bending moments and bi-directional shear forces

CE CSB REI 120 type tested







Dimensions in [mm]

HIT-HP MVX-OD – **High Performance** 80 mm insulation thickness
HIT-SP MVX-OD – **Superior Performance** 120 mm insulation thickness

Both types are also available as a multi-part design (-ES) for element slabs.

HIT-HP/SP MVX-OD as custom design
→ see page 54

Content	Type	Page
Product types / Load range	HIT-HP/SP MVX-OD	44
Load bearing capacity values	HIT-HP/SP MVX-OD	50
Product description	HIT-HP/SP MVX-OD	54
On-site reinforcement	HIT-HP/SP MVX-OD	55
Installation diagram	HIT-HP/SP MVX-OD	57

Product types – 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 element (TB- and CSB-Boxes)

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

Element width B = 50 cm		Number of tension bars n_{TB}					
		1	2	3	4	5	6
Number of compression shear bearings n_{CSB}	1	●	●				
	2	●	●	●	●		
	3		●	●	●	●	●
	4		●	●	●	●	●
	5			●	●	●	●

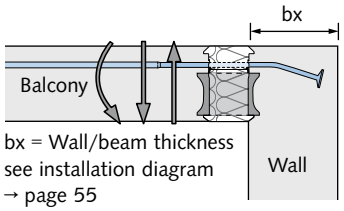
Element width B = 100 cm		Number of tension bars n_{TB}											
		1	2	3	4	5	6	7	8	9	10	11	12
Number of compression shear bearings n_{CSBw}	2		●	●	●	●							
	3		●	●	●	●	●	●					
	4		●	●	●	●	●	●	●	●			
	5				●	●	●	●	●	●	●	●	
	6				●	●	●	●	●	●	●	●	●
	7				●	●	●	●	●	●	●	●	●
	8				●	●	●	●	●	●	●	●	●
	9					●	●	●	●	●	●	●	●
	10						●	●	●	●	●	●	●
	11								●	●	●	●	●
	12										●	●	●

The load bearing capacity values for the selected elements can be found on pages 46 – 53 ● = HP and SP

Basic types – Ordering example

HIT-SP MVX - 07 05 - 20 - 100 - 35 - OU 175 - ES

❶ ❷ ❸ ❹ ❺ ❻ ❼ ❽ ❾ ❿ ⓫



bx = Wall/beam thickness
see installation diagram
→ page 55

Type designation

① Product group
② Insulation thickness 80 mm (HP) or 120 mm (SP)
③ Connection type
④ Number of tension rods
⑤ Number of CSB
⑥ Element height [cm]
⑦ Element width [cm]
⑧ Concrete cover (top) [mm]
⑨ Installation situation (Downward height offset)
⑩ Thickness of building element bx [mm]
⑪ Only for main element slab

bx for standard type:
175 mm < bx < 330 mm (HP)
175 mm < bx < 290 mm (SP)

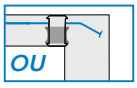
Larger widths are available as custom solutions designs.
Our technical support team is available to assist you in realizing your projects.
Contact: → see back of catalogue

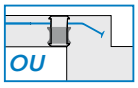
Possible slab thickness h

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

Load bearing capacity values $v_{Rd,1}$ / $m_{Rd,1}$ according to EN 1992-1-1 (EC2)

Shear load capacity ±v_{Rd} **Concrete strength:** *C20/25* ≥C25/30





Type / Element width	B = 1.00 m	HP MVX-0403-…-OU		HP MVX-0504-…-OU		HP MVX-0604-…-OU		HP MVX-0805-…-OU		HP MVX-0906-…-OU	
	B = 0.50 m	–		–		HP MVX-0302-…-OU		–		–	
	B = 0.25 m	–		–		–		–		–	
Design values	v_{Rd} [kN/m]	*48.0*	**48.0**	*64.0*	**64.0**	*64.0*	**64.0**	*80.0*	**80.0**	*96.0*	**96.0**

Moment bearing capacity m_{Rd}

Type / Element width	B = 1.00 m	HP MVX-0403-…-OU		HP MVX-0504-…-OU		HP MVX-0604-…-OU		HP MVX-0805-…-OU		HP MVX-0906-…-OU	
	B = 0.50 m	–		–		HP MVX-0302-…-OU		–		–	
	B = 0.25 m	–		–		–		–		–	
Concrete cover [mm]	30 / 35 / 50										
Design values m_{Rd} [kNm/m] for slab thickness [mm]											
	160			*15.7*	16.4	*20.0*	20.8	*22.7*	23.9	*29.5*	31.2	*34.0*	35.8
	160		180	*16.7*	17.4	*21.2*	22.1	*24.2*	25.3	*31.5*	33.2	*36.2*	38.0
		170		*17.7*	18.4	*22.5*	23.3	*25.6*	26.8	*33.5*	35.1	*38.5*	40.2
	170		190	*18.7*	19.4	*23.7*	24.5	*27.1*	28.3	*35.4*	37.1	*40.7*	42.4
		180		***19.6***	**20.3**	***24.9***	**25.7**	***28.6***	**29.8**	***37.4***	**39.1**	***42.9***	**44.6**
	180		200	*20.6*	21.3	*26.2*	27.0	*30.1*	31.2	*39.4*	41.0	*45.1*	46.9
		190		*21.6*	22.3	*27.4*	28.2	*31.5*	32.7	*41.3*	43.0	*47.3*	49.1
	190		210	*22.6*	23.3	*28.6*	29.4	*33.0*	34.2	*43.3*	45.0	*49.5*	51.3
		200		***23.6***	**24.3**	***29.8***	**30.7**	***34.5***	**35.7**	***45.3***	**46.9**	***51.7***	**53.5**
	200		220	*24.6*	25.3	*31.1*	31.9	*36.0*	37.1	*47.2*	48.9	*53.9*	55.7
		210		*25.5*	26.2	*32.3*	33.1	*37.4*	38.6	*49.2*	50.9	*56.2*	57.9
	210		230	*26.5*	27.2	*33.5*	34.4	*38.9*	40.1	*51.2*	52.8	*58.4*	60.1
		220		***27.5***	**28.2**	***34.8***	**35.6**	***40.4***	**41.6**	***53.1***	**54.8**	***60.6***	**62.3**
	220		240	*28.5*	29.2	*36.0*	36.8	*41.9*	43.0	*55.1*	56.8	*62.8*	64.6
		230		*29.5*	30.2	*37.2*	38.0	*43.3*	44.5	*57.1*	58.7	*65.0*	66.8
	230		250	*30.5*	31.2	*38.5*	39.3	*44.8*	46.0	*59.0*	60.7	*67.2*	69.0
		240		***31.5***	**32.1**	***39.7***	**40.5**	***46.3***	**47.5**	***61.0***	**62.7**	***69.4***	**71.2**
	240		260	*32.4*	33.1	*40.9*	41.7	*47.8*	48.9	*63.0*	64.6	*71.6*	73.4
		250		*33.4*	34.1	*42.1*	43.0	*49.2*	50.4	*64.9*	66.6	*73.9*	75.6
	250		270	*34.4*	35.1	*43.4*	44.2	*50.7*	51.9	*66.9*	68.6	*76.0*	77.8
	> 250			Load bearing capacity values for further elements (e.g. for h > 250 mm, C30/37, $v_{Rd,2}$ and $m_{Rd,2}$) are available in the type tests, at **www.halfen.com** and on request from our technical support team. See inside back cover for contact information.								

On-site stirrup reinforcement $A_{s,req}$ on balcony side (→ page 55)

V_{Ed} ↓	ø6 / 25 cm				
V_{Ed} ↑	ø6 / 17.5 cm	ø6 / 13.5 cm	ø6 / 13 cm	ø8 / 18.5 cm	ø8 / 15.5 cm

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

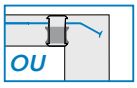
Number of stirrups per metre	5	6	7	9	10
Cross section A_{SW} [cm²/m] for each leg	5.7	6.8	7.9	10.2	11.3

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 have already been considered. Connecting elements must be verified by the planner.

Load bearing capacity values $v_{Rd,1}$ / $m_{Rd,1}$ according to EN 1992-1-1 (EC2)

Shear load capacity $\pm v_{Rd}$ **Concrete strength:** *C20/25* ≥C25/30



Type / Element width	B = 1.00 m	HP MVX-1006-...-OU		HP MVX-1008-...-OU		HP MVX-0610-...-OU		HP MVX-1010-...-OU		HP MVX-1012-...-OU	
	B = 0.50 m	HP MVX-0503-...-OU		HP MVX-0504-...-OU		HP MVX-0305-...-OU		HP MVX-0505-...-OU		–	
	B = 0.25 m	–		–		–		–		–	
Design values	v_{Rd} [kN/m]	*96.0*	**96.0**	*128.0*	**128.0**	*160.0*	**160.0**	*160.0*	**160.0**	*192.0*	**192.0**

Moment bearing capacity m_{Rd}

Type / Element width	B = 1.00 m			HP MVX-1006-...-OU		HP MVX-1008-...-OU		HP MVX-0610-...-OU		HP MVX-1010-...-OU		HP MVX-1012-...-OU	
	B = 0.50 m			HP MVX-0503-...-OU		HP MVX-0504-...-OU		HP MVX-0305-...-OU		HP MVX-0505-...-OU		–	
	B = 0.25 m			–		–		–		–		–	
Concrete cover [mm]	30	35	50										
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*36.3*	38.5	*40.0*	41.7	*27.5*	28.0	*41.2*	43.6	*32.5*	38.5
	160		180	*38.8*	41.0	*42.5*	44.1	*29.0*	29.4	*43.6*	46.0	*34.3*	40.5
		170		*41.2*	43.4	*44.9*	46.6	*30.4*	30.9	*46.0*	48.5	*36.0*	42.6
	170		190	*43.7*	45.9	*47.4*	49.0	*31.9*	32.4	*48.4*	50.9	*37.8*	44.7
		180		***46.2***	**48.3**	***49.9***	**51.5**	***33.4***	**33.9**	***50.7***	**53.4**	***39.5***	**46.7**
	180		200	*48.6*	50.8	*52.3*	54.0	*34.9*	35.3	*53.1*	55.8	*41.2*	48.8
		190		*51.1*	53.3	*54.8*	56.4	*36.3*	36.8	*55.5*	58.3	*43.0*	50.8
	190		210	*53.5*	55.7	*57.2*	58.9	*37.8*	38.3	*57.9*	60.8	*44.7*	52.9
		200		***56.0***	**58.2**	***59.7***	**61.3**	***39.3***	**39.8**	***60.1***	**63.2**	***46.5***	**55.0**
	200		220	*58.5*	60.6	*62.2*	63.8	*40.8*	41.2	*62.2*	65.7	*48.2*	57.0
		210		*60.9*	63.1	*64.4*	66.2	*42.2*	42.7	*64.4*	68.1	*50.0*	59.1
	210		230	*63.4*	65.5	*66.5*	68.7	*43.7*	44.2	*66.5*	70.6	*51.7*	61.2
		220		***65.8***	**68.0**	***68.7***	**71.2**	***45.2***	**45.7**	***68.7***	**73.1**	***53.4***	**63.2**
	220		240	*68.3*	70.5	*70.8*	73.6	*46.7*	47.1	*70.8*	75.5	*55.2*	65.3
		230		*70.7*	72.9	*72.9*	76.1	*48.1*	48.6	*72.9*	78.0	*56.9*	67.3
	230		250	*73.2*	75.4	*75.1*	78.5	*49.6*	50.1	*75.1*	80.4	*58.7*	69.4
		240		***75.7***	**77.8**	***77.2***	**81.0**	***51.1***	**51.6**	***77.2***	**82.9**	***60.4***	**71.5**
	240		260	*78.1*	80.3	*79.4*	83.5	*52.6*	53.0	*79.4*	85.4	*62.2*	73.5
		250		*80.6*	82.8	*81.5*	85.9	*54.0*	54.5	*81.5*	87.8	*63.9*	75.6
	250		270	*83.0*	85.2	*83.7*	88.4	*55.5*	56.0	*83.7*	90.3	*65.6*	77.7
	> 250			Load bearing capacity values for further elements (e.g. for h > 250 mm, C30/37, $v_{Rd,2}$ and $m_{Rd,2}$) are available in the type tests, at **www.halfen.com** and on request from our technical support team. See inside back cover for contact information.										

On-site stirrup reinforcement $A_{s,req}$ on balcony side (→ page 55)

V_{Ed} ↓	ø6/25 cm	ø6/22.5cm	ø6/25 cm	ø6/25 cm	ø6/16.5 cm
V_{Ed} ↑	ø8/15 cm	ø8/12 cm	ø8/9 cm	ø8/9 cm	ø8/8.5 cm

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

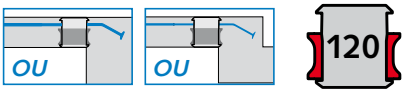
Number of stirrups per metre	11	11	7	11	11
Cross section A_{SW} [cm²/m] for each leg	12.4	12.4	7.9	12.4	12.4

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 have already been considered. Connecting elements must be verified by the planner.

Load bearing capacity values $v_{Rd,2}$ / $m_{Rd,2}$ according to EN 1992-1-1 (EC2)

Shear load capacity ±v_{Rd} **Concrete strength:** *C20/25* ≥C25/30



Type / Element width		SP MVX-0403-...-OU		SP MVX-0504-...-OU		SP MVX-0705-...-OU		SP MVX-0906-...-OU		SP MVX-1208-...-OU	
	B = 1.00 m										
	B = 0.50 m	–		–		–		–		SP MVX-0604-...-OU	
	B = 0.25 m	–		–		–		–		SP MVX-0302-...-OU	
Design values	v_{Rd} [kN/m]	*45.6*	**48.0**	*62.0*	**64.0**	*74.3*	**80.0**	*84.9*	**96.0**	*106.3*	**120.8**

Moment bearing capacity m_{Rd}

Type / Element width				SP MVX-0403-...-OU		SP MVX-0504-...-OU		SP MVX-0705-...-OU		SP MVX-0906-...-OU		SP MVX-1208-...-OU	
	B = 1.00 m												
	B = 0.50 m			–		–		–		–		SP MVX-0604-...-OU	
	B = 0.25 m			–		–		–		–		SP MVX-0302-...-OU	
Concrete cover [mm]	30	35	50										
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*15.7*	16.4	*20.0*	20.8	*27.1*	28.4	*34.0*	35.8	*45.4*	47.7
	160		180	*16.7*	17.4	*21.2*	22.1	*28.8*	30.1	*36.2*	38.0	*48.3*	50.7
		170		*17.7*	18.4	*22.5*	23.3	*30.5*	31.8	*38.5*	40.2	*51.3*	53.6
	170		190	*18.7*	19.4	*23.7*	24.5	*32.2*	33.5	*40.7*	42.4	*54.2*	56.6
		180		***19.6***	**20.3**	***24.9***	**25.7**	***34.0***	**35.2**	***42.9***	**44.6**	***57.2***	**59.5**
	180		200	*20.6*	21.3	*26.2*	27.0	*35.7*	37.0	*45.1*	46.9	*60.1*	62.5
		190		*21.6*	22.3	*27.4*	28.2	*37.4*	38.7	*47.3*	49.1	*63.1*	65.4
	190		210	*22.6*	23.3	*28.6*	29.4	*39.1*	40.4	*49.5*	51.3	*66.0*	68.4
		200		***23.6***	**24.3**	***29.8***	**30.7**	***40.9***	**42.1**	***51.7***	**53.5**	***69.0***	**71.3**
	200		220	*24.6*	25.3	*31.1*	31.9	*42.6*	43.9	*53.9*	55.7	*71.9*	74.3
		210		*25.5*	26.2	*32.3*	33.1	*44.3*	45.6	*56.2*	57.9	*74.9*	77.2
	210		230	*26.5*	27.2	*33.5*	34.4	*46.0*	47.3	*58.4*	60.1	*77.8*	80.2
		220		***27.5***	**28.2**	***34.8***	**35.6**	***47.7***	**49.0**	***60.6***	**62.3**	***80.4***	**83.1**
	220		240	*28.5*	29.2	*36.0*	36.8	*49.5*	50.7	*62.8*	64.6	*83.0*	86.1
		230		*29.5*	30.2	*37.2*	38.0	*51.2*	52.5	*65.0*	66.8	*85.6*	89.0
	230		250	*30.5*	31.2	*38.5*	39.3	*52.9*	54.2	*67.2*	69.0	*88.2*	92.0
		240		***31.5***	**32.1**	***39.7***	**40.5**	***54.6***	**55.9**	***69.4***	**71.2**	***90.7***	**94.9**
	240		260	*32.4*	33.1	*40.9*	41.7	*56.3*	57.6	*71.6*	73.4	*93.3*	97.9
		250		*33.4*	34.1	*42.1*	43.0	*58.1*	59.3	*73.9*	75.6	*95.9*	100.8
	250		270	*34.4*	35.1	*43.4*	44.2	*59.8*	61.1	*76.0*	77.8	*98.4*	103.8
	> 250			Load bearing capacity values for further elements (e.g. for h > 250 mm, C30/37, $v_{Rd,2}$ and $m_{Rd,2}$) are available in the type tests, at **www.halfen.com** and on request from our technical support team. See inside back cover for contact information.								

On-site stirrup reinforcement $A_{s,req}$ on balcony side (→ page 55)

V_{Ed} ↓	ø6/25 cm	ø6/25 cm	ø6/25 cm	ø6/25 cm	ø6/21 cm
V_{Ed} ↑	ø6/17.5 cm	ø6/13.5 cm	ø8/18.5 cm	ø8/15.5 cm	ø8/11.5 cm

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

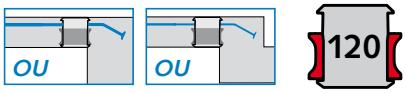
Number of stirrups per metre	5	6	8	10	13
Cross section A_{SW} [cm²/m] for each leg	5.7	6.8	9.0	11.3	14.7

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 have already been considered. Connecting elements must be verified by the planner.

Load bearing capacity values $v_{Rd,1}$ / $m_{Rd,1}$ according to EN 1992-1-1 (EC2)

Shear load capacity ±v_{Rd} **Concrete strength:** *C20/25* ≥C25/30



Type / Element width												
	B = 1.00 m	SP MVX-0202-...-OU		SP MVX-0406-...-OU		SP MVX-1006-...-OU		SP MVX-1008-...-OU		SP MVX-1012-...-OU	
	B = 0.50 m	SP MVX-0101-...-OU		SP MVX-0203-...-OU		SP MVX-0503-...-OU		SP MVX-0504-...-OU		–	
	B = 0.25 m	–		–		–		–		–	
Design values	v_{Rd} [kN/m]	*30.7*	**32.0**	*77.2*	**81.7**	*93.7*	**96.0**	*124.9*	**128.0**	*159.4*	**166.8**

Moment bearing capacity m_{Rd}

Type / Element width												
	B = 1.00 m	SP MVX-0202-...-OU		SP MVX-0406-...-OU		SP MVX-1006-...-OU		SP MVX-1008-...-OU		SP MVX-1012-...-OU	
	B = 0.50 m	SP MVX-0101-...-OU		SP MVX-0203-...-OU		SP MVX-0503-...-OU		SP MVX-0504-...-OU		–	
	B = 0.25 m	–		–		–		–		–	
Concrete cover [mm]	30 / 35 / 50										
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*8.5*	8.7	*18.1*	18.4	*28.6*	38.5	*38.2*	41.7	*36.3*	37.9
	160		180	*8.9*	9.2	*19.1*	19.4	*30.4*	41.0	*40.5*	44.1	*38.3*	40.0
		170		*9.4*	9.7	*20.1*	20.4	*32.1*	43.4	*42.8*	46.6	*40.3*	42.0
	170		190	*9.9*	10.2	*21.0*	21.4	*33.8*	45.9	*45.1*	49.0	*42.3*	44.0
		180		***10.4***	**10.7**	***22.0***	**22.4**	***35.5***	**48.3**	***47.4***	**51.5**	***44.2***	**46.0**
	180		200	*10.9*	11.2	*23.0*	23.4	*37.3*	50.8	*49.8*	54.0	*46.2*	48.1
		190		*11.4*	11.7	*24.0*	24.3	*39.0*	53.3	*52.1*	56.4	*48.2*	50.1
	190		210	*11.9*	12.2	*25.0*	25.3	*40.7*	55.7	*54.4*	58.9	*50.2*	52.1
		200		***12.4***	**12.6**	***26.0***	**26.3**	***42.5***	**58.2**	***56.7***	**61.3**	***52.1***	**54.2**
	200		220	*12.9*	13.1	*26.9*	27.3	*44.2*	60.6	*59.0*	63.8	*54.1*	56.2
		210		*13.4*	13.6	*27.9*	28.3	*45.9*	63.1	*61.3*	66.2	*56.1*	58.2
	210		230	*13.9*	14.1	*28.9*	29.3	*47.6*	65.5	*63.6*	68.7	*58.1*	60.3
		220		***14.4***	**14.6**	***29.9***	**30.2**	***49.4***	**68.0**	***65.9***	**71.2**	***60.1***	**62.3**
	220		240	*14.8*	15.1	*30.9*	31.2	*51.1*	70.5	*68.2*	73.6	*62.0*	64.3
		230		*15.3*	15.6	*31.9*	32.2	*52.8*	72.9	*70.5*	76.1	*64.0*	66.3
	230		250	*15.8*	16.1	*32.8*	33.2	*54.6*	75.4	*72.8*	78.5	*66.0*	68.4
		240		***16.3***	**16.6**	***33.8***	**34.2**	***56.3***	**77.8**	***75.1***	**81.0**	***68.0***	**70.4**
	240		260	*16.8*	17.1	*34.8*	35.2	*58.0*	80.3	*77.4*	83.5	*69.9*	72.4
		250		*17.3*	17.6	*35.8*	36.1	*59.7*	82.8	*79.8*	85.9	*71.9*	74.5
	250		270	*17.8*	18.1	*36.8*	37.1	*61.5*	85.2	*82.1*	88.4	*73.9*	76.5
	> 250			Load bearing capacity values for further elements (e.g. for h > 250 mm, C30/37, $v_{Rd,2}$ and $m_{Rd,2}$) are available in the type tests, at **www.halfen.com** and on request from our technical support team. See inside back cover for contact information.								

On-site stirrup reinforcement $A_{s,req}$ on balcony side (→ page 55)

V_{Ed} ↓	ø6/25 cm	ø6/22.5 cm	ø6/25 cm	ø6/22.5 cm	ø6/18.5 cm
V_{Ed} ↑	ø6/25 cm	ø8/16 cm	ø8/15 cm	ø8/11.5 cm	ø8/9.5 cm

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

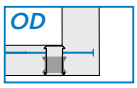
Number of stirrups per metre	3	5	11	11	11
Cross section A_{SW} [cm²/m] for each leg	3.4	5.7	12.4	12.4	12.4

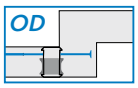
Minimum transverse reinforcement: At least one reinforcement bar ø 12 mm must be placed next to the anchor head on the side nearest to the element edge.

All necessary verifications have already been considered. Connecting elements must be verified by the planner.

Load bearing capacity values $v_{Rd,2}$ / $m_{Rd,2}$ according to EN 1992-1-1 (EC2)

Shear load capacity ±v_{Rd} **Concrete strength:** C20/25 ≥C25/30





Type / Element width	B = 1.00 m	HP MVX-0403-...-OD		HP MVX-0504-...-OD		HP MVX-0706-...-OD		HP MVX-0806-...-OD		HP MVX-1007-...-OD	
	B = 0.50 m	–		–		–		HP MVX-0403-...-OD		–	
	B = 0.25 m	–		–		–		–		–	
Design values	v_{Rd} [kN/m]	*31.1*	**35.7**	*45.6*	**51.8**	*74.6*	**83.8**	*62.3*	**71.5**	*64.5*	**75.2**

Moment bearing capacity m_{Rd}

Type / Element width	B = 1.00 m			HP MVX-0403-...-OD		HP MVX-0504-...-OD		HP MVX-0706-...-OD		HP MVX-0806-...-OD		HP MVX-1007-...-OD	
	B = 0.50 m			–		–		–		HP MVX-0403-...-OD		–	
	B = 0.25 m			–		–		–		–		–	
Concrete cover [mm]	30	35	50										
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*15.7*	16.4	*20.0*	20.8	*28.5*	29.6	*31.4*	32.8	*38.4*	40.3
	160		180	*16.7*	17.4	*21.2*	22.1	*30.3*	31.3	*33.4*	34.8	*40.9*	42.8
		170		*17.7*	18.4	*22.5*	23.3	*32.0*	33.0	*35.4*	36.8	*43.4*	45.2
	170		190	*18.7*	19.4	*23.7*	24.5	*33.7*	34.8	*37.3*	38.7	*45.8*	47.7
		180		***19.6***	**20.3**	***24.9***	**25.7**	***35.4***	**36.5**	***39.3***	**40.7**	***48.3***	**50.1**
	180		200	*20.6*	21.3	*26.2*	27.0	*37.1*	38.2	*41.3*	42.7	*50.7*	52.6
		190		*21.6*	22.3	*27.4*	28.2	*38.9*	39.9	*43.2*	44.6	*53.2*	55.1
	190		210	*22.6*	23.3	*28.6*	29.4	*40.6*	41.7	*45.2*	46.6	*55.7*	57.5
		200		***23.6***	**24.3**	***29.8***	**30.7**	***42.3***	**43.4**	***47.2***	**48.6**	***58.1***	**60.0**
	200		220	*24.6*	25.3	*31.1*	31.9	*44.0*	45.1	*49.1*	50.5	*60.6*	62.4
		210		*25.5*	26.2	*32.3*	33.1	*45.7*	46.8	*51.1*	52.5	*63.0*	64.9
	210		230	*26.5*	27.2	*33.5*	34.4	*47.5*	48.5	*53.1*	54.5	*65.5*	67.3
		220		***27.5***	**28.2**	***34.8***	**35.6**	***49.2***	**50.3**	***55.0***	**56.4**	***67.9***	**69.8**
	220		240	*28.5*	29.2	*36.0*	36.8	*50.9*	52.0	*57.0*	58.4	*70.4*	72.3
		230		*29.5*	30.2	*37.2*	38.0	*52.6*	53.7	*59.0*	60.4	*72.9*	74.7
	230		250	*30.5*	31.2	*38.5*	39.3	*54.4*	55.4	*60.9*	62.3	*75.1*	77.2
		240		***31.5***	**32.1**	***39.7***	**40.5**	***56.1***	**57.1**	***62.9***	**64.3**	***77.2***	**79.6**
	240		260	*32.4*	33.1	*40.9*	41.7	*57.8*	58.9	*64.9*	66.3	*79.4*	82.1
		250		*33.4*	34.1	*42.1*	43.0	*59.5*	60.6	*66.8*	68.2	*81.5*	84.6
	250		270	*34.4*	35.1	*43.4*	44.2	*61.2*	62.3	*68.8*	70.2	*83.7*	87.0
	> 250			Load bearing capacity values for further elements (e.g. for h > 250 mm, C30/37, $v_{Rd,2}$ and $m_{Rd,2)}$ are available in the type tests, at **www.halfen.com** and on request from our technical support team. See inside back cover for contact information.								

On-site stirrup reinforcement $A_{s,req}$ on balcony side (→ page 56)

V_{Ed} ↓	ø6/25 cm	ø6/25 cm	ø6/25 cm	ø6/25 cm	ø6/24.5 cm
V_{Ed} ↑	ø6/16.5 cm	ø6/12.5 cm	ø8/14 cm	ø8/14 cm	ø8/12.5 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	9	11
Cross section A_{SW} [cm²/m] for each leg	5.7	6.8	9.0	10.2	12.4

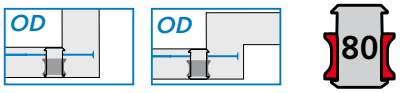
Minimum transverse reinforcement: At least one reinforcement bar ø 12 mm must be placed next to the anchor head on the side nearest to the element edge.

All necessary verifications have already been considered. Connecting elements must be verified by the planner.

Load bearing capacity values $v_{Rd,1}$ / $m_{Rd,1}$ according to EN 1992-1-1 (EC2)

Shear load capacity $\pm v_{Rd}$

Concrete strength: C20/25 ≥C25/30



Type / Element width	B = 1.00 m	HP MVX-0202-...-OD		HP MVX-0505-...-OD		HP MVX-0606-...-OD		HP MVX-0608-...-OD		HP MVX-0610-...-OD	
	B = 0.50 m	HP MVX-0101-...-OD		–		HP MVX-0303-...-OD		HP MVX-0304-...-OD		HP MVX-0305-...-OD	
	B = 0.25 m	–		–		–		–		–	
Design values	v_{Rd} [kN/m]	*32.0*	**32.0**	*80.0*	**80.0**	*96.0*	**96.0**	*128.0*	**128.0**	*137.0*	**147.1**

Moment bearing capacity m_{Rd}

Type / Element width	B = 1.00 m	HP MVX-0202-...-OD		HP MVX-0505-...-OD		HP MVX-0606-...-OD		HP MVX-0608-...-OD		HP MVX-0610-...-OD	
	B = 0.50 m	HP MVX-0101-...-OD		–		HP MVX-0303-...-OD		HP MVX-0304-...-OD		HP MVX-0305-...-OD	
	B = 0.25 m	–		–		–		–		–	
Concrete cover [mm]	30 / 35 / 50										
Design values m_{Rd} [kNm/m] for slab thickness [mm]											
	160			*7.6*	8.7	*19.0*	21.8	*22.8*	26.1	*24.7*	27.3	*22.3*	22.9
	160		180	*8.0*	9.2	*20.1*	23.0	*24.1*	27.6	*26.0*	28.7	*23.4*	24.1
		170		*8.5*	9.7	*21.1*	24.2	*25.4*	29.1	*27.4*	30.2	*24.6*	25.3
	170		190	*8.9*	10.2	*22.2*	25.5	*26.7*	30.6	*28.7*	31.7	*25.8*	26.5
		180		***9.3***	**10.7**	***23.3***	**26.7**	***28.0***	**32.0**	***30.1***	**33.2**	***26.9***	**27.7**
	180		200	*9.8*	11.2	*24.4*	27.9	*29.3*	33.5	*31.4*	34.6	*28.1*	28.9
		190		*10.2*	11.7	*25.5*	29.2	*30.5*	35.0	*32.8*	36.1	*29.3*	30.1
	190		210	*10.6*	12.2	*26.5*	30.4	*31.8*	36.5	*34.1*	37.6	*30.4*	31.3
		200		***11.0***	**12.6**	***27.6***	**31.6**	***33.1***	**37.9**	***35.5***	**39.1**	***31.6***	**32.5**
	200		220	*11.5*	13.1	*28.7*	32.8	*34.4*	39.4	*36.8*	40.5	*32.8*	33.6
		210		*11.9*	13.6	*29.8*	34.1	*35.7*	40.9	*38.2*	42.0	*34.0*	34.8
	210		230	*12.3*	14.1	*30.8*	35.3	*37.0*	42.4	*39.5*	43.5	*35.1*	36.0
		220		***12.8***	**14.6**	***31.9***	**36.5**	***38.3***	**43.8**	***40.9***	**45.0**	***36.3***	**37.2**
	220		240	*13.2*	15.1	*33.0*	37.8	*39.6*	45.3	*42.2*	46.4	*37.5*	38.4
		230		*13.6*	15.6	*34.1*	39.0	*40.9*	46.8	*43.6*	47.9	*38.6*	39.6
	230		250	*14.1*	16.1	*35.1*	40.2	*42.2*	48.3	*44.9*	49.4	*39.8*	40.8
		240		***14.5***	**16.6**	***36.2***	**41.4**	***43.5***	**49.7**	***46.3***	**50.9**	***41.0***	**42.0**
	240		260	*14.9*	17.1	*37.3*	42.7	*44.8*	51.2	*47.6*	52.3	*42.1*	43.1
		250		*15.4*	17.6	*38.4*	43.9	*46.1*	52.7	*49.0*	53.8	*43.3*	44.3
	250		270	*15.8*	18.1	*39.5*	45.1	*47.3*	54.2	*50.3*	55.3	*44.5*	45.5
	> 250			Load bearing capacity values for further elements (e.g. for h > 250 mm, C30/37, $v_{Rd,2}$ and $m_{Rd,2}$) are available in the type tests, at **www.halfen.com** and on request from our technical support team. See inside back cover for contact information.								

On-site stirrup reinforcement $A_{s,req}$ on balcony side (→ page 56)

V_{Ed} ↓	ø6/25 cm	ø6/25 cm	ø6/25 cm	ø6/25 cm	ø6/25 cm
V_{Ed} ↑	ø6/25 cm	ø8/16.5 cm	ø8/14 cm	ø8/12.5 cm	ø8/10.5 cm

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

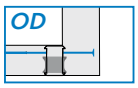
Number of stirrups per metre	3	6	7	7	7
Cross section A_{SW} [cm²/m] for each leg	3.4	6.8	7.9	7.9	7.9

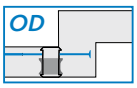
Minimum transverse reinforcement: At least one reinforcement bar ø 12 mm must be placed next to the anchor head on the side nearest to the element edge.

All necessary verifications have already been considered. Connecting elements must be verified by the planner.

Load bearing capacity values $v_{Rd,2}$ / $m_{Rd,2}$ according to EN 1992-1-1 (EC2)

Shear load capacity ±v_{Rd} **Concrete strength:** C20/25 ≥C25/30





Type / Element width	B = 1.00 m	SP MVX-0403-...-OD		SP MVX-0404-...-OD		SP MVX-0504-...-OD		SP MVX-0705-...-OD		SP MVX-0907-...-OD	
	B = 0.50 m	–		SP MVX-0202-...-OD		–		–		–	
	B = 0.25 m	–		SP MVX-0101-...-OD		–		–		–	
Design values	v_{Rd} [kN/m]	*23.8*	**28.0**	*48.2*	**53.8**	*35.9*	**41.5**	*35.6*	**42.6**	*59.7*	**69.5**

Moment bearing capacity m_{Rd}

Type / Element width	B = 1.00 m	SP MVX-0403-...-OD		SP MVX-0404-...-OD		SP MVX-0504-...-OD		SP MVX-0705-...-OD		SP MVX-0907-...-OD	
	B = 0.50 m	–		SP MVX-0202-...-OD		–		–		–	
	B = 0.25 m	–		SP MVX-0101-...-OD		–		–		–	

Concrete cover [mm]	30	35	50								
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		*15.7*	16.4	*16.9*	17.4	*20.0*	20.8	*27.1*	28.4	*35.7*	37.2
	160		180	*16.7*	17.4	*17.9*	18.4	*21.2*	22.1	*28.8*	30.1	*38.0*	39.5
		170		*17.7*	18.4	*18.9*	19.4	*22.5*	23.3	*30.5*	31.8	*40.2*	41.7
	170		190	*18.7*	19.4	*19.9*	20.4	*23.7*	24.5	*32.2*	33.5	*42.4*	43.9
		180		***19.6***	**20.3**	***20.8***	**21.4**	***24.9***	**25.7**	***34.0***	**35.2**	***44.6***	**46.1**
	180		200	*20.6*	21.3	*21.8*	22.3	*26.2*	27.0	*35.7*	37.0	*46.8*	48.3
		190		*21.6*	22.3	*22.8*	23.3	*27.4*	28.2	*37.4*	38.7	*49.0*	50.5
	190		210	*22.6*	23.3	*23.8*	24.3	*28.6*	29.4	*39.1*	40.4	*51.2*	52.7
		200		***23.6***	**24.3**	***24.8***	**25.3**	***29.8***	**30.7**	***40.9***	**42.1**	***53.4***	**55.0**
	200		220	*24.6*	25.3	*25.8*	26.3	*31.1*	31.9	*42.6*	43.9	*55.7*	57.2
		210		*25.5*	26.2	*26.7*	27.3	*32.3*	33.1	*44.3*	45.6	*57.9*	59.4
	210		230	*26.5*	27.2	*27.7*	28.2	*33.5*	34.4	*46.0*	47.3	*60.1*	61.6
		220		***27.5***	**28.2**	***28.7***	**29.2**	***34.8***	**35.6**	***47.7***	**49.0**	***62.3***	**63.8**
	220		240	*28.5*	29.2	*29.7*	30.2	*36.0*	36.8	*49.5*	50.7	*64.4*	66.0
		230		*29.5*	30.2	*30.7*	31.2	*37.2*	38.0	*51.2*	52.5	*66.4*	68.2
	230		250	*30.5*	31.2	*31.7*	32.2	*38.5*	39.3	*52.9*	54.2	*68.3*	70.4
		240		***31.5***	**32.1**	***32.6***	**33.2**	***39.7***	**40.5**	***54.6***	**55.9**	***70.2***	**72.7**
	240		260	*32.4*	33.1	*33.6*	34.1	*40.9*	41.7	*56.3*	57.6	*72.2*	74.9
		250		*33.4*	34.1	*34.6*	35.1	*42.1*	43.0	*58.1*	59.3	*74.1*	77.1
	250		270	*34.4*	35.1	*35.6*	36.1	*43.4*	44.2	*59.8*	61.1	*76.0*	79.3
	> 250			Load bearing capacity values for further elements (e.g. for h > 250 mm, C30/37, $v_{Rd,2}$ and $m_{Rd,2)}$ are available in the type tests, at **www.halfen.com** and on request from our technical support team. See inside back cover for contact information.								

On-site stirrup reinforcement $A_{s,req}$ on balcony side (→ page 56)

V_{Ed} ↓	ø6/25 cm	ø6/25 cm	ø6/25 cm	ø6/25 cm	ø6/25 cm
V_{Ed} ↑	ø6/16.5 cm	ø6/12.5 cm	ø6/12.5 cm	ø8/20 cm	ø8/14 cm

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

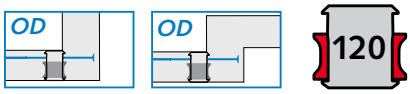
Number of stirrups per metre	5	5	6	8	10
Cross section A_{SW} [cm²/m] for each leg	5.7	5.7	6.8	9.0	11.3

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 have already been considered. Connecting elements must be verified by the planner.

Load bearing capacity values $v_{Rd,1}$ / $m_{Rd,1}$ according to EN 1992-1-1 (EC2)

Shear load capacity ±v_{Rd} **Concrete strength:** C20/25 ≥C25/30



Type / Element width	B = 1.00 m	SP MVX-0202-...-OD		SP MVX-0505-...-OD		SP MVX-0606-...-OD		SP MVX-0608-...-OD		SP MVX-0610-...-OD	
	B = 0.50 m	SP MVX-0101-...-OD		–		SP MVX-0303-...-OD		SP MVX-0304-...-OD		SP MVX-0305-...-OD	
	B = 0.25 m	–		–		–		–		–	
Design values	v_{Rd} [kN/m]	*28.6*	31.1	*71.5*	77.8	*85.8*	93.3	*107.3*	115.8	*111.5*	119.6

Moment bearing capacity m_{Rd}

Type / Element width	B = 1.00 m	SP MVX-0202-...-OD		SP MVX-0505-...-OD		SP MVX-0606-...-OD		SP MVX-0608-...-OD		SP MVX-0610-...-OD	
	B = 0.50 m	SP MVX-0101-...-OD		–		SP MVX-0303-...-OD		SP MVX-0304-...-OD		SP MVX-0305-...-OD	
	B = 0.25 m	–		–		–		–		–	
Concrete cover [mm]	30 / 35 / 50										
Design values m_{Rd} [kNm/m] for slab thickness [mm]	160	*7.2*	7.4	*17.9*	18.6	*21.5*	22.2	*25.7*	26.7	*24.8*	26.1
	160 / 180	*7.6*	7.8	*18.9*	19.6	*22.7*	23.4	*27.1*	28.2	*26.1*	27.4
	170	*8.0*	8.2	*19.9*	20.6	*23.9*	24.6	*28.5*	29.6	*27.4*	28.8
	170 / 190	*8.4*	8.6	*20.9*	21.6	*25.1*	25.8	*29.9*	31.0	*28.7*	30.1
	180	***8.8***	**9.1**	***21.9***	**22.6**	***26.3***	**27.0**	***31.3***	**32.5**	***30.0***	**31.5**
	180 / 200	*9.2*	9.5	*22.9*	23.7	*27.5*	28.3	*32.7*	33.9	*31.4*	32.9
	190	*9.6*	9.9	*23.9*	24.7	*28.7*	29.5	*34.1*	35.4	*32.7*	34.2
	190 / 210	*10.0*	10.3	*24.9*	25.7	*29.9*	30.7	*35.5*	36.8	*34.0*	35.6
	200	***10.4***	**10.7**	***25.9***	**26.7**	***31.1***	**31.9**	***36.9***	**38.2**	***35.3***	**37.0**
	200 / 220	*10.8*	11.1	*26.9*	27.7	*32.3*	33.1	*38.3*	39.7	*36.6*	38.3
	210	*11.2*	11.5	*27.9*	28.7	*33.5*	34.3	*39.7*	41.1	*37.9*	39.7
	210 / 230	*11.6*	11.9	*28.9*	29.8	*34.7*	35.6	*41.2*	42.6	*39.2*	41.1
	220	***12.0***	**12.3**	***29.9***	**30.8**	***35.9***	**36.8**	***42.6***	**44.0**	***40.6***	**42.4**
	220 / 240	*12.4*	12.7	*30.9*	31.8	*37.1*	38.0	*44.0*	45.5	*41.9*	43.8
	230	*12.8*	13.1	*31.9*	32.8	*38.3*	39.2	*45.4*	46.9	*43.2*	45.2
	230 / 250	*13.2*	13.5	*32.9*	33.8	*39.5*	40.4	*46.8*	48.3	*44.5*	46.5
	240	***13.6***	**13.9**	***33.9***	**34.9**	***40.7***	**41.6**	***48.2***	**49.8**	***45.8***	**47.9**
	240 / 260	*14.0*	14.3	*34.9*	35.9	*41.9*	42.9	*49.6*	51.2	*47.1*	49.3
	250	*14.4*	14.8	*35.9*	36.9	*43.1*	44.1	*51.0*	52.7	*48.4*	50.6
	250 / 270	*14.8*	15.2	*36.9*	37.9	*44.3*	45.3	*52.4*	54.1	*49.7*	52.0
	> 250	Load bearing capacity values for further elements (e.g. for h > 250 mm, C30/37, $v_{Rd,2}$ and $m_{Rd,2)}$ are available in the type tests, at **www.halfen.com** and on request from our technical support team. See inside back cover for contact information.									

On-site stirrup reinforcement $A_{s,req}$ on balcony side (→ page 56)

V_{Ed} ↓	ø6 / 25 cm	ø6 / 25 cm	ø6 / 25 cm	ø6 / 25 cm	ø6 / 20 cm
V_{Ed} ↑	ø6 / 25 cm	ø8 / 20 cm	ø8 / 16 cm	ø8 / 12.5 cm	ø8 / 12.5 cm

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

Number of stirrups per metre	3	6	7	7	7
Cross section A_{SW} [cm²/m] for each leg	3.4	6.8	7.9	7.9	7.9

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 have already been considered. Connecting elements must be verified by the planner.

Product description – cross sections

HIT-HP MVX-OU;
with bent anchor head

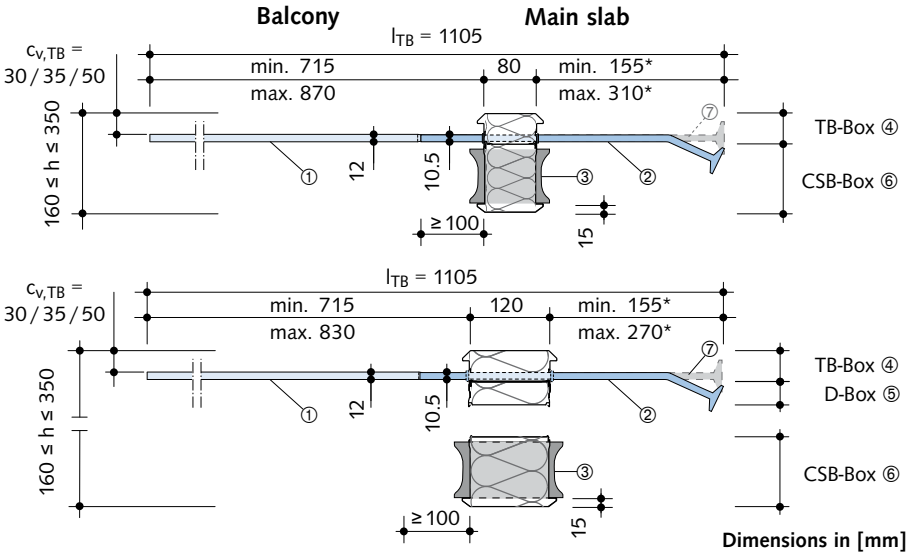
HIT-HP MVX-OD;
with straight anchor head
(dotted line)

Also available as multi part type for main slab element.

HIT-SP MVX-OU ES;
with bent anchor head

HIT-SP MVX-OD ES;
with straight anchor head
(dotted line)

① Tension section 1: ø12 mm
② Tension section 2: ø10.5 mm stainless steel
③ Double-symmetrical CSB
④ Tension bar box
⑤ Distance box as height offset h ≥ 18 mm or 20 mm (→ see page 30)
⑥ Compression shear bearing box
⑦ Tension bar with straight anchor head



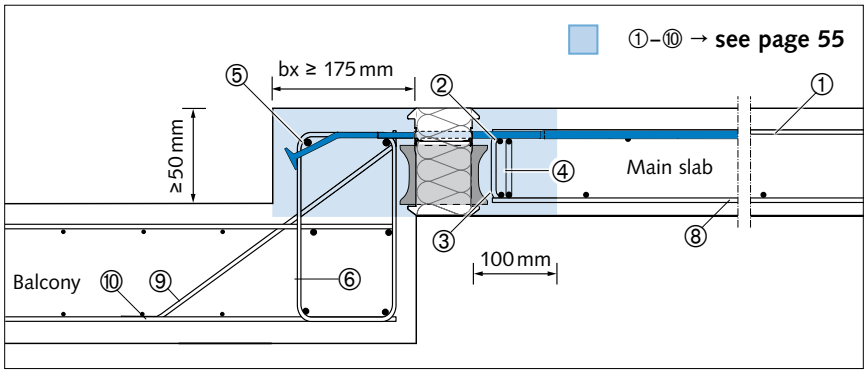
*The total length of the tension bar is pre-determined. The proportional section length for the main slab side depends on the actual geometry:
Building element thickness bx – 20 mm concrete cover.
155 mm ≤ bx – 20 mm ≤ 310 mm (HIT-HP)
≤ 270 mm (HIT-SP)
Further special lengths are available on request, See contact details at the back of the catalogue.

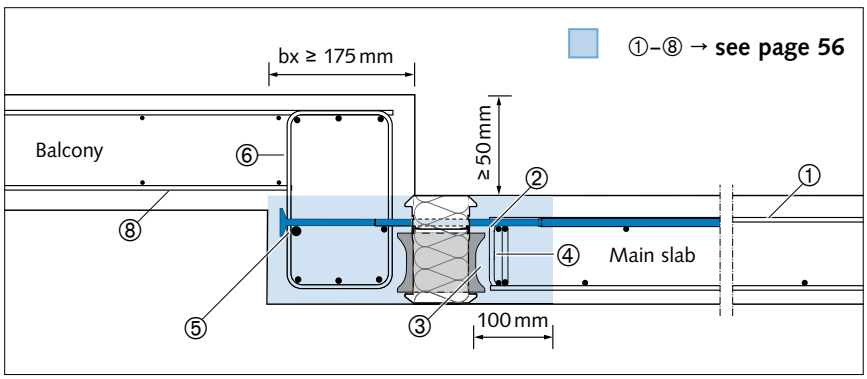
Example: For an element thickness of bx = 175 mm the tension bar length on the main slab side is 155 mm. This leaves a length of 870 mm for HIT-HP and 830 mm with HIT-SP Elements for the balcony side.

Balcony side anchor head as custom solutions

An anchor head application in a height offset balcony side is possible if the geometric requirements are observed (offset height x ≥ 50 mm, bx ≥ 175 mm).

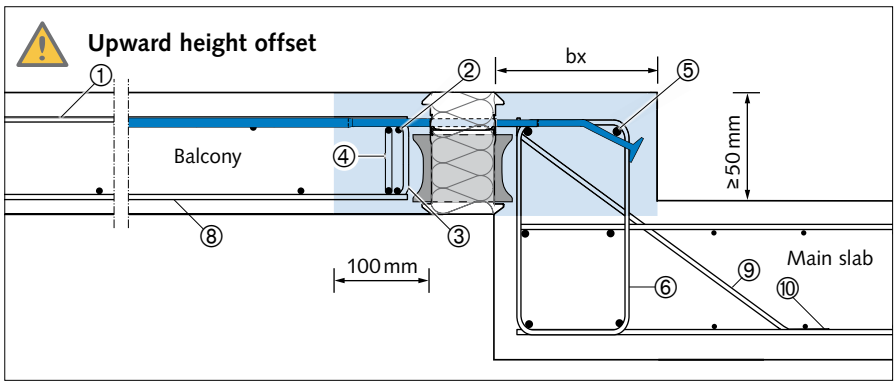
A beam reinforcement is required and the location of the shear reinforcement (min. ø12 mm, in close contact with the anchor heads) must be observed when designing the on-site connection reinforcement (balcony side).





HIT Custom solutions
Our technical support team is available to provide support in your project with custom solutions using HALFEN HIT Insulated connections
Contact: → see inside back cover

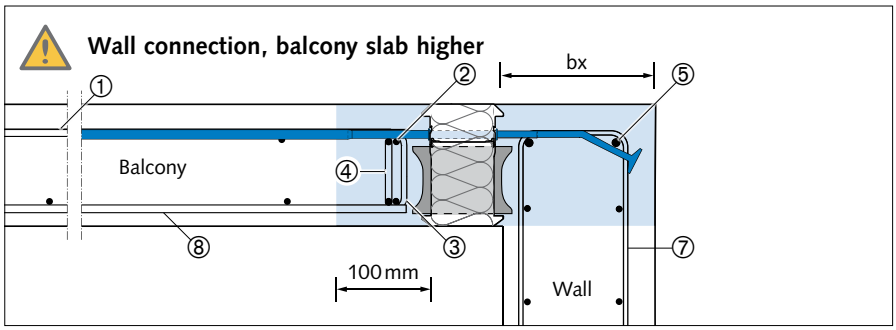
On-site reinforcement



No construction joints
permissable in this area:
Balcony side → vertical
Main slab → vertical and horizontal

bx = building element thickness

Design as frame corner!
Recommended:
bx ≥ height HIT Element

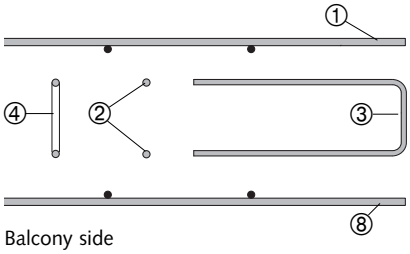


No construction joints
permissable in this area:
Balcony side → vertical
Wall side → vertical and horizontal

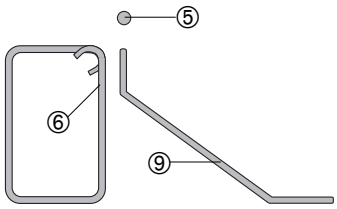
bx = building element thickness

Design as frame corner!
Recommended:
bx ≥ height HIT Element

On-site reinforcement HIT-…-OU (example)



Balcony side

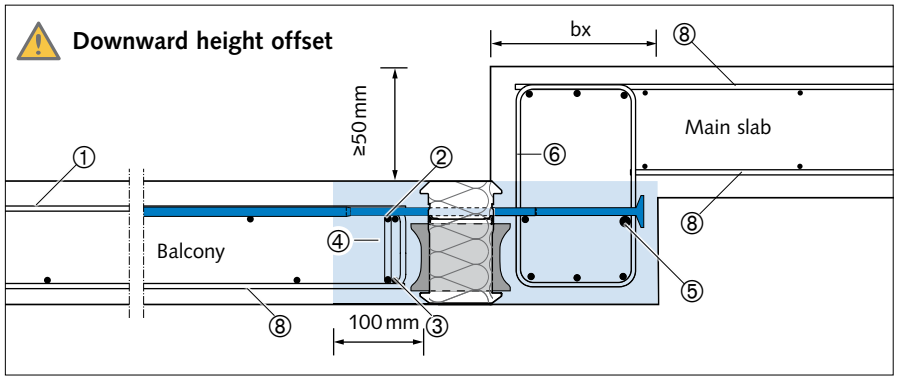


Main slab side height offset

Note
Ensure that the anchor bolts are placed behind the vertical structural reinforcement (e.g. stirrup).

Position	Reinforcement details
① Upper connecting reinforcement, on balcony side	→ see also table on page 35
② Horizontal tensile edge reinforcement, lengthwise to the insulation joint	min. 2× ø8 mm
③ Onsite stirrup reinforcement $A_{s,req}$ balcony side	depending on load V_{Ed} and support type (direct or indirect), each HIT-Type → see also pages 46–49
④ Stirrups as end anchorage of the position ②	one stirrup on each side with min. ø8 mm
④ Additional stirrups to secure the free edge of the balcony slab	acc. to DIN EN 1992-1-1 and DIN EN 1992-1-1/NA
⑤ Transverse reinforcement, close contact with the anchor heads	min. ø12
⑥ Required minimum stirrup reinforcement for load transfer from the HIT Insulated connection	→ see also pages 46–49
⑦ Required minimum reinforcement, stirrup or mesh reinforcement with statically required edge reinforcement for load transfer from the HIT Insulated connections	→ see also pages 46–49
⑧ Slab reinforcement; individual rebar or mesh reinforcement	must be specified by the structural engineer acc. to DIN EN 1992-1-1 and DIN EN 1992-1-1/NA
⑨ Constructive diagonal reinforcement	
⑩ Slab reinforcement as stirrup or mesh reinforcement with statically required edge reinforcement, upperside	

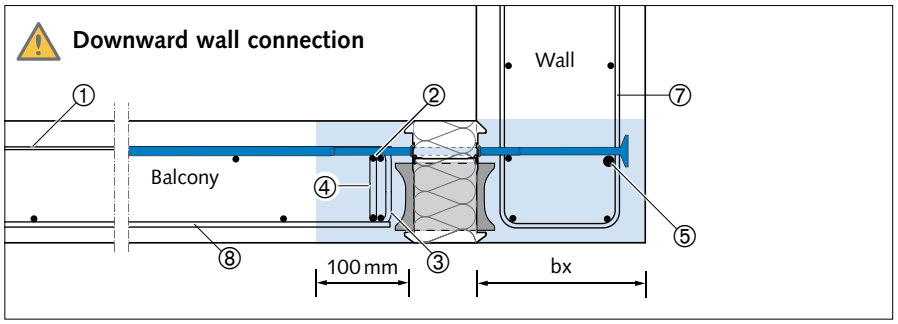
On-site reinforcement



No construction joints permissable in this area:
Balcony side → vertical
Main slab side → vert. and horizontal

bx = building element thickness

Design as frame corner!
Recommended:
bx ≥ HIT Element height

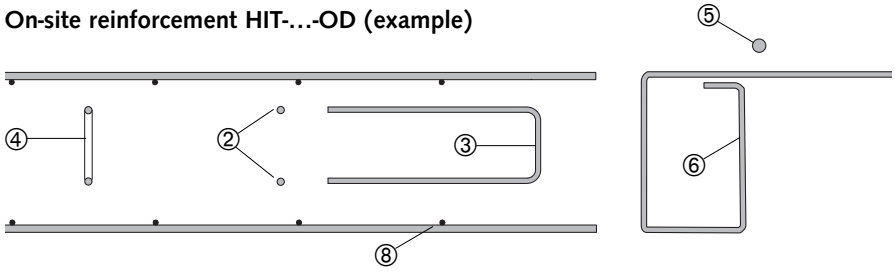


No construction joints permissable in this area:
Balcony side → vertical
Wall side → vertical and horizontal

bx = building element thickness

Design as frame corner!
Recommended:
bx ≥ HIT Element height

On-site reinforcement HIT-…-OD (example)



Balcony side

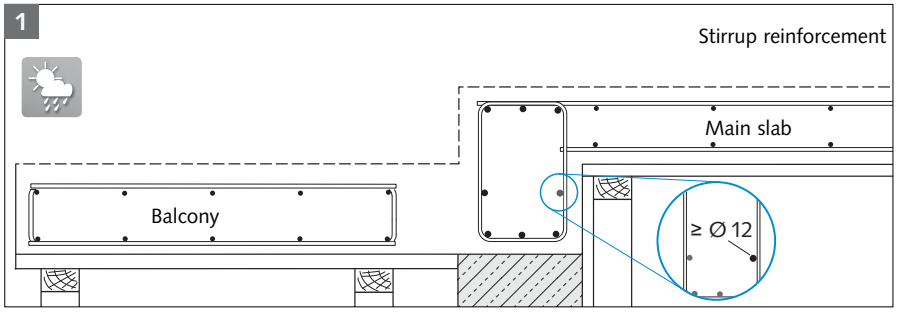
Main slab side height offset

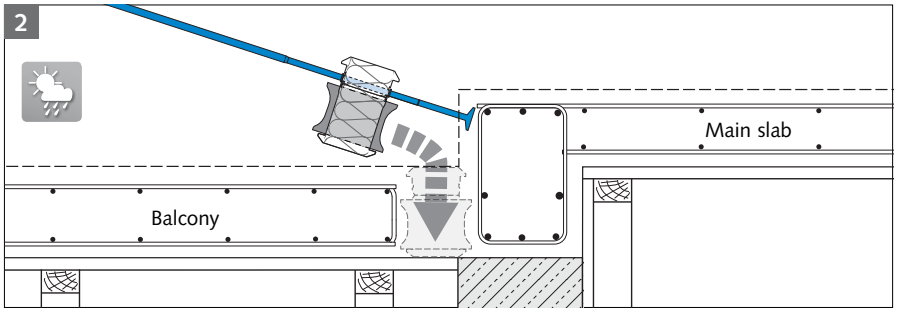
Further reinforcement required due to additional load factors (e.g. beam shear reinforcement or bending reinforcement) must be specified by the structural engineer!

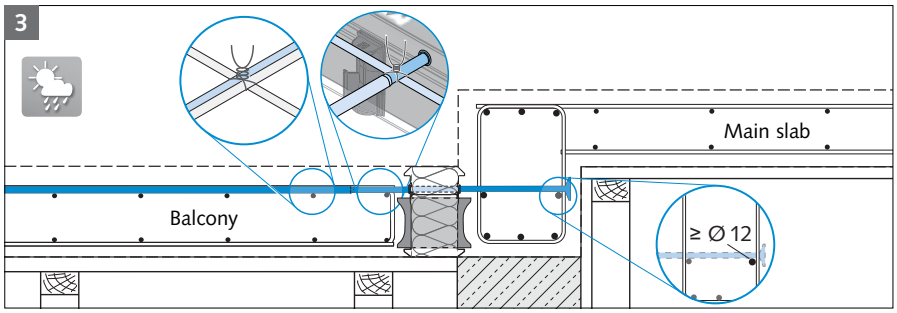
Ensure that the anchor bolts are placed behind the vertical structural reinforcement (e.g. stirrup).

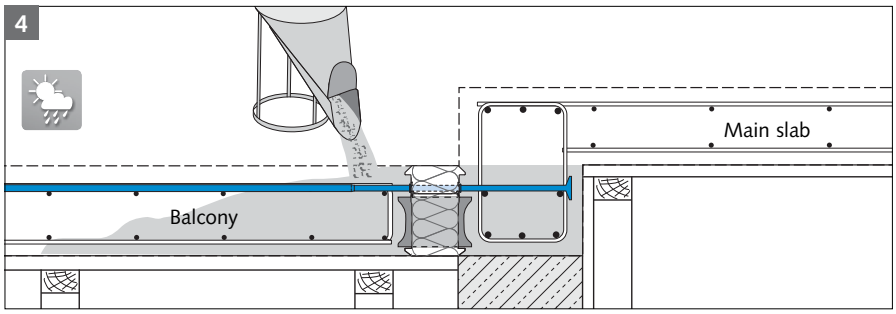
Position	Reinforcement details
① Recommendation for upper connecting reinforcement, on balcony side	→ see also table on page 35
② Horizontal tensile edge reinforcement, lengthwise to the insulation joint	min. 2× ø8 mm
③ Onsite stirrup reinforcement $A_{s,req}$ balcony side	depending on load V_{Ed} and support type (direct or indirect), each HIT-Type → see also pages 50–53
④ Stirrups as end anchorage of the position ③	one stirrup on each side with min. ø8 mm
④ Additional stirrups to secure the free edge of the balcony slab	acc. to DIN EN 1992-1-1 and DIN EN 1992-1-1/NA
⑤ Transverse reinforcement, close contact with the anchor heads	min. ø12
⑥ Required minimum stirrup reinforcement, for load transfer from the HIT Insulated connection	→ see also pages 50–53
⑦ Required minimum reinforcement- stirrup or mesh reinforcement with statically required edge reinforcement for load transfer from the HIT Insulated connections	→ see also pages 50–53
⑧ Slab reinforcement; individual rebar or mesh reinforcement	must be specified by the structural engineer acc. to DIN EN 1992-1-1 and DIN EN 1992-1-1/NA

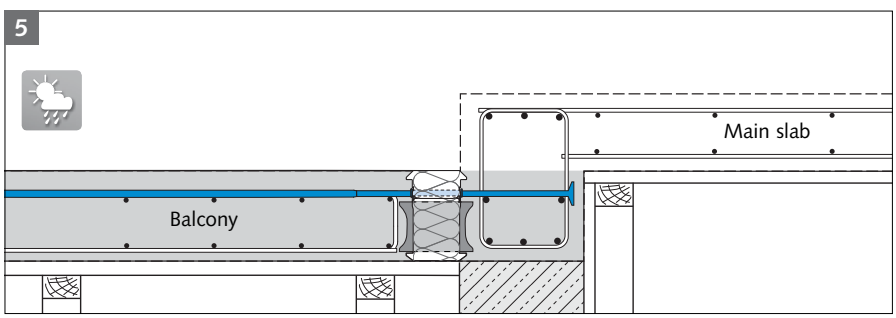
Installation diagram











1 Installation of on-site reinforcement

⚠ Ensure that the formwork is at the correct height!

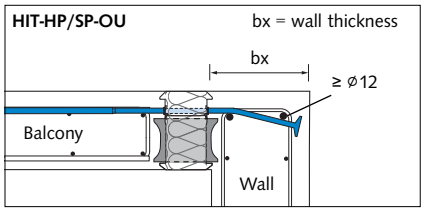
⚠ The on-site reinforcement must be placed as specified by the structural engineer.

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

Transverse reinforcement: min. ø12 mm, must to be placed with close contact to the anchor bolts.



4 Pouring the concrete

Observe required expansion joints
→ see illustrations on pages 55–56

⚠ 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 observe the notes on page 30.

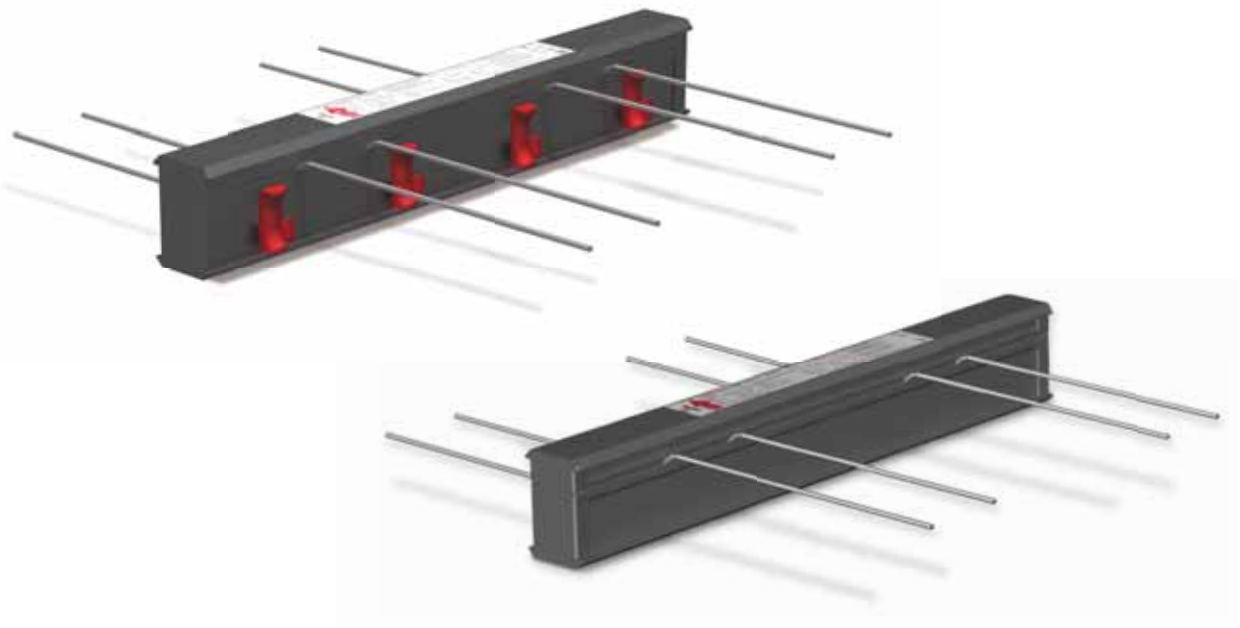
HALFEN HIT INSULATED CONNECTION HIGH & SUPERIOR PERFORMANCE

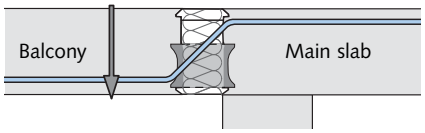
HIT-HP ZVX, HIT-SP ZVX

3

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

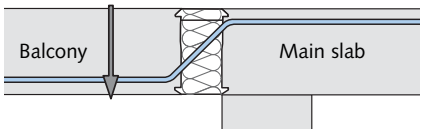
CE CSB REI 120 type tested





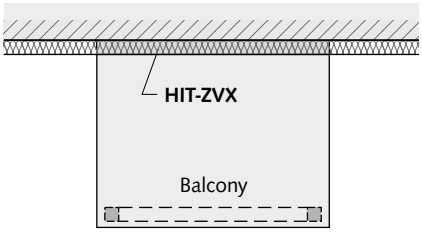
HIT-HP ZVX – High Performance
80 mm insulation thickness

HIT-SP ZVX – Superior Performance
120 mm insulation thickness



HIT-HP ZVX – High Performance
80 mm insulation thickness;
without CSB

HIT-SP ZVX – Superior Performance
120 mm insulation thickness;
without CSB



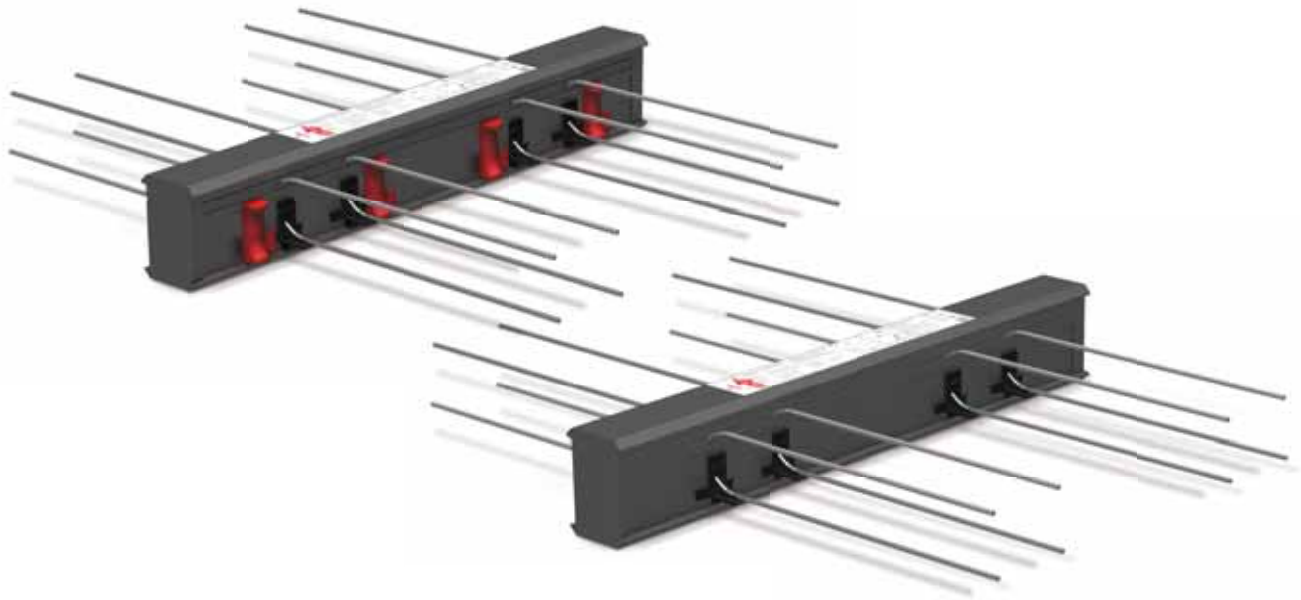
Application: Simply supported balcony on columns

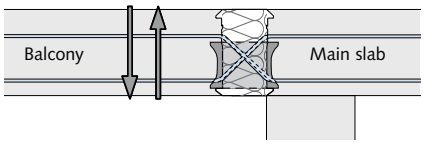
Content	Type	Page
Product types / Load range	HIT-HP ZVX, HIT-SP ZVX	60
Product description	HIT-HP ZVX, HIT-SP ZVX	61
Load bearing capacity values	HIT-HP ZVX, HIT-SP ZVX	62
Application examples and joint spacings	HIT-HP ZVX, HIT-SP ZVX	83
On-site reinforcement	HIT-HP ZVX, HIT-SP ZVX	85
Installation diagram	HIT-HP ZVX, HIT-SP ZVX	86

HIT-HP ZDX, HIT-SP ZDX

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

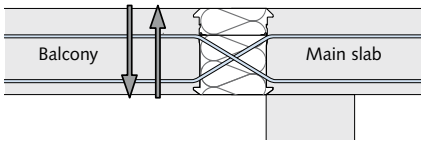
type tested





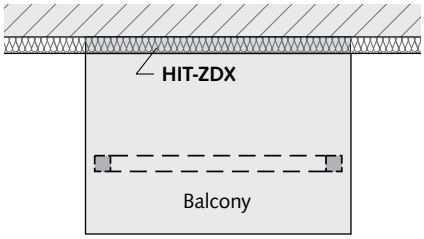
HIT-HP ZDX – High Performance
80 mm insulation thickness

HIT-SP ZDX – Superior Performance
120 mm insulation thickness



HIT-HP ZDX – High Performance
80 mm insulation thickness;
without CSB

HIT-SP ZDX – Superior Performance
120 mm insulation thickness;
without CSB



Application: Simply supported balcony on columns

Content	Type	Page
Product types / Load range	HIT-HP ZDX, HIT-SP ZDX	60
Product description	HIT-HP ZDX, HIT-SP ZDX	61
Load bearing capacity values	HIT-HP ZDX, HIT-SP ZDX	62
Application examples and joint spacings	HIT-HP ZDX, HIT-SP ZDX	83
On-site reinforcement	HIT-HP ZDX, HIT-SP ZDX	85
Installation diagram	HIT-HP ZDX, HIT-SP ZDX	86

HALFEN HIT INSULATED CONNECTION HIGH & SUPERIOR PERFORMANCE

HIT-HP ZVX, HIT-SP ZVX / HIT-HP ZDX, HIT-SP ZDX

Product types – Load range

The load range selection table illustrates the possible combinations of support elements (shear load bars and double-symmetrical CSB) depending on the element width. For HIT-ZDX Elements the number of shear load bars is given for each load direction (in the following identified as "side").

Possible combinations of SB (shear load bars) and CSB (Compression Shear Bearings)

Diameter of the shear load bars [mm]		ø 6								ø 8								ø 10								ø 12							
Element width B = 25 cm		Number of shear load bars n_{SB}																															
		1	2	3						1	2	3						2	3														
Number of compression shear bearings n_{CSB}	0	●	●	●						●	●	●						●	●														
	1	●	●							●	●							●															
Element width B = 33 cm		Number of shear load bars n_{SB}																															
										2	3	4	5					2	3	4	5					2	3	4	5				
Number of compression shear bearings n_{CSB}	0										●	●	●						●	●	●					●	●	●					
	2									●	●							●	●							●	●						
Element width B = 50 cm		Number of shear load 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 load bars n_{SB}																															
		2	3	4	5	6	7	8	9–12	2	3	4	5	6	7	8	9–12	4	5	6	7	8	9–12	4	5	6	7	8	9–12			
Number of compression shear bearings n_{CSB}	0			●	●	●	●	●	●			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			
	2	●	●	●	●	●	●	●		●	●	●	●	●				●	●					●								
	3	●	●	●	●	●	●	●		●	●	●	●	●				●	●						●								
	4			●		●		●				●		●		●		●		●		●		●		●		●					
	6																	●		●		●		●		●		●					

Load bearing capacity values for selected elements can be found on pages 62 – 82. ● = HP and SP

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

Basic types – Ordering example

HIT-HP ZVX - 08 04 - 18 - 100 - 30 - 08

❶ ❷ ❸ ❹ ❺ ❻ ❼ ❽ ❾

Type description

① Product group
② Insulation thickness 80 mm (HP) or 120 mm (SP)
③ Conection type
④ ZVX: No. of shear load bars
ZDX: No. of shear load bars on each side
⑤ Number of CSB
⑥ Element height [cm]
⑦ Element width [cm]
⑧ Lower concrete cover [mm]
⑨ Diameter shear load bars [mm]

HIT Custom solutions

Our technical support team is available to provide support for your project with custom solutions using HALFEN HIT Insulated connections

Contact: → see inside back cover

Possible main slab height h

Concrete cover [mm]		lower: 30	upper: ≥ 30	
Diameter of the shear load bars [mm]	06	08	10	12
Possible main slab height h [cm]	16 – 35	16 – 35	17 – 35	18 – 35

Product description – cross sections (typical applications)

Figure: Type HIT-SP ZVX-0404-...-06
Bent bar type; shear load bars ø6 mm
(also available for custom designs in ø8 mm)

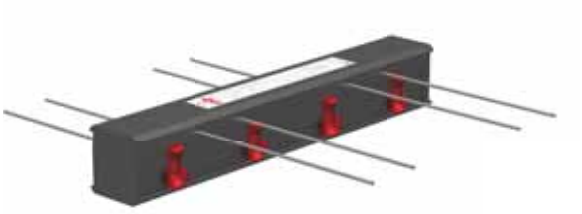
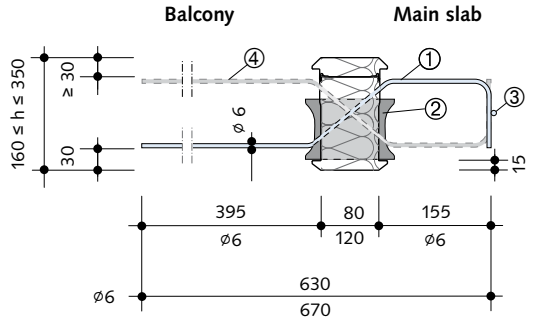
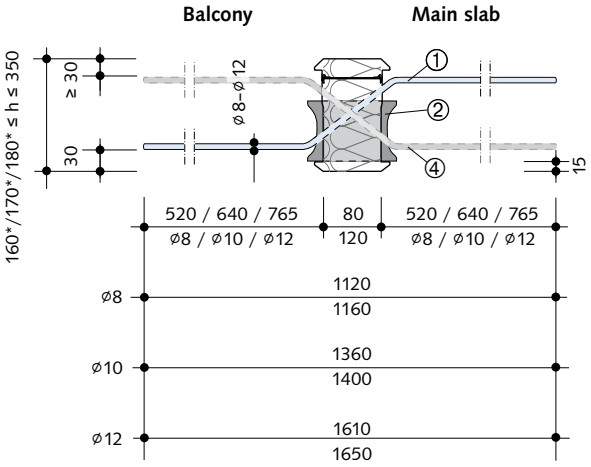


Figure: Type HIT-SP ZVX-0404-...-08
Straight bar type; shear load bars ø8, ø10, ø12 mm
(also available for custom designs in ø6 mm)

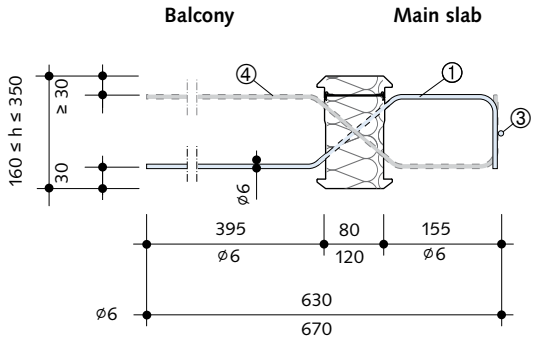


Dimensions in [mm]

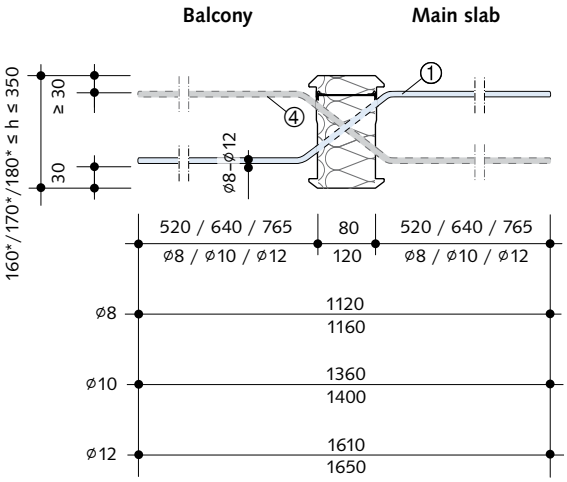


with no CSB for unrestraint connections, e.g. for loggias

Bent type; shear load bars ø6 mm



Straight type; shear load bars ø8, ø10, ø12 mm
(also available for custom designs in ø6 mm)



Dimensions in [mm]

① Shear load bars for HIT-ZVX Elements
② Double-symmetrical CSB
③ Load supporting shear bar for shear load bars ø6
④ Shear load bars for tranferring the shear loads upwards (in the opposite direction) for HIT-ZDX Elements

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

Load bearing capacity values according to DIN EN 1992-1-1 (EC2) — ø6 mm bar size

ZVX: Shear load capacity v_{Rd}
ZDX: Shear load capacity $\pm v_{Rd}$

Type / Element width	B = 1.00 m	0202-...-06		0302-...-06		0402-...-06		0502-...-06		0602-...-06	
	B = 0.50 m	–		–		0201-...-06		–		0301-...-06	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30									
Design values v_{Rd} [kN/m] for slab thickness [mm]	160 – 190	*29.0*	29.0	*42.8*	42.8	*55.9*	56.0	*68.4*	68.8	*79.4*	79.4
	200 – 210	*29.7*	29.7	*43.8*	43.8	*57.6*	57.6	*70.7*	70.9	*83.3*	83.3
	220 – 350	*30.2*	30.2	*44.9*	44.9	*59.3*	59.3	*73.5*	73.5	*87.3*	87.3

Type / Element width	B = 1.00 m	0403-...-06		0503-...-06		0603-...-06		0702-...-06		0703-...-06	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30									
Design values v_{Rd} [kN/m] for slab thickness [mm]	160 – 190	*57.4*	57.4	*70.9*	70.9	*83.8*	84.0	*87.3*	87.3	*96.4*	96.9
	200 – 210	*58.7*	58.7	*72.7*	72.7	*86.4*	86.4	*92.8*	92.8	*99.6*	99.8
	220 – 350	*60.1*	60.1	*74.6*	74.6	*89.0*	89.0	*100.7*	100.8	*103.2*	103.2

HIT-ZVX: On-site reinforcement $A_{s,req}$

Balcony		ø6 / 25 cm
Main slab	direct support	ø6 / 20 cm
	indirect support	0.26 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 20 cm

HIT-ZDX: On-site reinforcement $A_{s,req}$, on balcony side and main slab side

V_{Ed} ↑ ↓	direct / indirect support	0.26 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 20 cm

All required verifications for the insulation and for load transfer have already been considered. Connecting elements must be verified by the planner.

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

Load bearing capacity values according to DIN EN 1992-1-1 (EC2) ⌀8 mm bar size

HIT-ZVX: Shear load capacity v_{Rd}
HIT-ZDX: Shear load capacity $\pm v_{Rd}$

Type / Element width	B = 1.00 m	0202-...-08		0402-...-08		0502-...-08		0602-...-08		0804-...-08	
	B = 0.50 m	0101-...-08		0201-...-08		–		0301-...-08		0402-...-08	
	B = 0.25 m	–		–		–		–		0201-...-08	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30									
Design values v_{Rd} [kN/m] for slab thickness [mm]	160 – 190	*49.3*	49.4	*85.2*	85.2	*98.5*	98.5	*111.8*	111.8	*170.4*	170.4
	200 – 230	*51.5*	51.5	*93.8*	93.8	*109.3*	109.3	*124.7*	124.7	*187.6*	187.6
	240 – 350	*53.0*	53.0	*102.2*	102.3	*121.5*	121.5	*139.4*	139.4	*204.3*	204.7

HIT-ZVX: On-site reinforcement $A_{s,req}$

Balcony		⌀6 / 25 cm		
Main slab	direct support	⌀6 / 25 cm		
	indirect support	0.26 cm²/m + V_{Ed}/f_{yd} ≥ ⌀6 / 25 cm	0.29 cm²/m + V_{Ed}/f_{yd} ≥ ⌀6 / 25 cm	0.46 cm²/m + V_{Ed}/f_{yd} ≥ ⌀6 / 25 cm

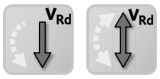
HIT-ZDX: On-site reinforcement $A_{s,req}$, on balcony side and main slab side

V_{Ed} ↑↓	direct / indirect support	0.26 cm²/m + V_{Ed}/f_{yd} ≥ ⌀6 / 25 cm	0.29 cm²/m + V_{Ed}/f_{yd} ≥ ⌀6 / 25 cm	0.46 cm²/m + V_{Ed}/f_{yd} ≥ ⌀6 / 25 cm

All required verifications for the insulation and for load transfer have already been considered. Connecting elements must be verified by the planner.

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

Load bearing capacity values according to DIN EN 1992-1-1 (EC2) — ø10 mm bar size



ZVX: Shear load capacity v_{Rd}
ZDX: Shear load capacity $\pm v_{Rd}$

Type / Element width	**B = 1.00 m**	**0402-...-10**		**0403-...-10**		**0404-...-10**		**0604-...-10**		**0804-...-10**	
	B = 0.50 m	0201-...-10		–		0202-...-10		0302-...-10		0402-...-10	
	B = 0.25 m	–		–		–		–		0201-...-10	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30									
Design values v_{Rd} [kN/m] for slab thickness [mm]	170 – 190	*115.2*	115.2	*131.2*	131.2	*146.9*	147.2	*188.7*	188.7	*230.3*	230.3
	200 – 240	*128.6*	128.6	*144.6*	144.6	*155.6*	156.3	*208.9*	208.9	*257.2*	257.2
	250 – 350	*143.9*	143.9	*159.1*	159.4	*162.4*	162.4	*231.8*	231.8	*287.8*	287.9

HIT-ZVX: On-site reinforcement $A_{s,req}$

Balcony		ø6 / 25 cm		
Main slab	direct support	ø6 / 25 cm		
	indirect support	0.35 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 25 cm	0.40 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 25 cm	0.58 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 25 cm

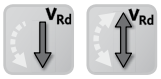
HIT-ZDX: On-site reinforcement $A_{s,req}$, on balcony side and main slab side

V_{Ed} ↑↓	direct / indirect support	0.35 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 25 cm	0.40 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 25 cm	0.58 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 25 cm

All required verifications for the insulation and for load transfer have already been considered. Connecting elements must be verified by the planner.

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

Load bearing capacity values according to DIN EN 1992-1-1 (EC2) — ø12 mm bar size



ZVX: Shear load capacity v_{Rd}
ZDX: Shear load capacity $\pm v_{Rd}$

Type / Element width		B = 1.00 m	0503-...-12		0604-...-12		0804-...-12		0606-...-12		0806-...-12	
		B = 0.50 m	–		0302-...-12		0402-...-12		0603-...-12		0403-...-12	
		B = 0.25 m	–		–		0201-...-12		–		–	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30										
Design values v_{Rd} [kN/m] for slab thickness [mm]	180–210	*188.6*	191.9		*243.6*	243.6	*251.5*	255.8	*275.6*	275.6	*335.5*	335.5
	220–350	*221.9*	221.9		*272.6*	272.6	*308.3*	314.1	*304.6*	304.6	*374.2*	374.2

HIT-ZVX: On-site reinforcement $A_{s,req}$

Balcony		ø6 / 25 cm		
Main slab	direct support	ø6 / 25 cm		
	indirect support	0.60 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 25 cm	0.74 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 25 cm	0.86 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 25 cm

HIT-ZDX: On-site reinforcement $A_{s,req}$, on balcony side and main slab side

V_{Ed} ↑↓	direct / indirect support	0.60 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 25 cm	0.74 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 25 cm	0,86 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 25 cm

All required verifications for the insulation and for load transfer have already been considered. Connecting elements must be verified by the planner.

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

HALFEN HIT INSULATED CONNECTION HIGH PERFORMANCE

HIT-HP ZVX, HIT-HP ZDX

Load bearing capacity values according to DIN EN 1992-1-1 (EC2) — ⌀8 mm and ⌀10 mm bar size

ZVX: Shear load capacity v_{Rd}
ZDX: Shear load capacity $\pm v_{Rd}$

Short unit

80

Type / Element width	B = 0.33 m	0202-…-08		0302-…-08		B = 0.33 m	0202-…-10		0302-…-10	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30				30	Concrete strength: *C20/25* ≥ C25/30			
Design values v_{Rd} [kN/m] for slab thickness [mm]	160–190	*148.1*	148.1	*212.9*	214.7	170–190	*220.5*	220.5	*283.4*	283.4
	200–230	*155.0*	155.0	*225.2*	225.2	200–240	*233.7*	233.7	*313.6*	313.6
	240–350	*159.8*	159.8	*234.9*	234.9	250–350	*244.0*	244.0	*348.1*	348.1

HIT-ZVX: 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	0.44 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm	0.60 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm		0.60 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm	0.71 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm

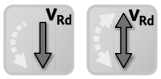
HIT-ZDX: On-site reinforcement $A_{s,req}$, on balcony side and main slab side

V_{Ed} ↑ ↓	direct / indirect support	0.44 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm	0.60 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm		0.60 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm	0.71 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm

All required verifications for the insulation and for load transfer have already been considered. Connecting elements must be verified by the planner.

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

Load bearing capacity values according to DIN EN 1992-1-1 (EC2) — ø12 mm bar size



ZVX: Shear load capacity v_{Rd}
ZDX: Shear load capacity $\pm v_{Rd}$

Type / Element width	B = 0.33 m	0202-...-12		0302-...-12	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30			
Design values v_{Rd} [kN/m] for slab thickness [mm]	180–210	*275.9*	275.9	*346.1*	365.8
	220–350	*304.9*	304.9	*386.6*	409.3

HIT-ZVX: On-site reinforcement $A_{s,req}$

Balcony		ø6 / 25 cm	
Main slab	direct support	ø6 / 25 cm	
	indirect support	0.74 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 25 cm	0.86 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 25 cm

HIT-ZDX: On-site reinforcement $A_{s,req}$, on balcony side and main slab side

V_{Ed} ↑ ↓	direct / indirect support	0.74 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 25 cm	0.86 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 25 cm

All required verifications for the insulation and for load transfer have already been considered. Connecting elements must be verified by the planner.

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

Load bearing capacity values according to DIN EN 1992-1-1 (EC2) — ø6 mm bar size

HIT-ZVX: Shear load capacity v_{Rd}
HIT-ZDX: Shear load capacity $\pm v_{Rd}$

Type / Element width	**B = 1.00 m**	**0400-...-06**		**0500-...-06**		**0600-...-06**		**0700-...-06**	
	B = 0.50 m	0200-...-06		–		0300-...-06		–	
	B = 0.25 m	0100-...-06		–		–		–	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30							
Design values v_{Rd} [kN/m] for slab thickness [mm]	160–190	*31.6*	31.6	*39.5*	39.5	*47.4*	47.4	*55.3*	55.3
	200–210	*34.8*	34.8	*43.5*	43.5	*52.2*	52.2	*60.8*	60.8
	220–350	*40.3*	40.3	*50.3*	50.3	*60.4*	60.4	*70.5*	70.5

Type / Element width	**B = 1.00 m**	**0800-...-06**		**0900-...-06**		**1000-...-06**		**1100-...-06**	
	B = 0.50 m	0400-...-06		–		0500-...-06		–	
	B = 0.25 m	0200-...-06		–		–		–	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30							
Design values v_{Rd} [kN/m] for slab thickness [mm]	160–190	*63.2*	63.2	*71.1*	71.1	*79.0*	79.0	*86.9*	86.9
	200–210	*69.5*	69.5	*78.2*	78.2	*86.9*	86.9	*95.6*	95.6
	220–350	*80.6*	80.6	*90.6*	90.6	*100.7*	100.7	*110.8*	110.8

HIT-ZVX: 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

HIT-ZDX: On-site reinforcement $A_{s,req}$, on balcony side and main slab side

V_{Ed} ↑↓	direct / indirect support	V_{Ed} / f_{yd} ≥ ø6 / 20 cm

All required verifications for the insulation and for load transfer have already been considered. Connecting elements must be verified by the planner.

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

Load bearing capacity values according to DIN EN 1992-1-1 (EC2) — ø8 mm bar size

HIT-ZVX: Shear load capacity v_{Rd}
HIT-ZDX: Shear load capacity $\pm v_{Rd}$

Type / Element width		B = 1.00 m		0700-...-08		0900-...-08		1000-...-08		1200-...-08	
		B = 0.50 m		–				0500-...-08		0600-...-08	
		B = 0.25 m		–						0300-...-08	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30									
Design values v_{Rd} [kN/m] for slab thickness [mm]	160–190	*93.1*	*93.1*	*119.7*	119.7	*133.0*	133.0	*159.7*	159.7		
	200–230	*108.2*	*108.2*	*139.1*	139.1	*154.5*	154.5	*185.4*	185.4		
	240–350	*125.3*	*125.3*	*161.1*	161.1	*179.0*	179.0	*214.8*	214.8		

HIT-ZVX: 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

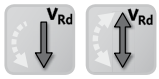
HIT-ZDX: On-site reinforcement $A_{s,req}$, on balcony side and main slab side

V_{Ed} ↑ ↓	direct / indirect support	V_{Ed} / f_{yd} ≥ ø6 / 25 cm

All required verifications for the insulation and for load transfer have already been considered. Connecting elements must be verified by the planner.

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

Load bearing capacity values according to DIN EN 1992-1-1 (EC2) — ø10 mm and ø12 mm bar size



HIT-ZVX: Shear load capacity v_{Rd}
HIT-ZDX: Shear load capacity $\pm v_{Rd}$

Type / Element width	B = 1.00 m	0600-...-10		0700-...-10		1000-...-10		1200-...-10	
	B = 0.50 m	0300-...-10		–		0500-...-10		0600-...-10	
	B = 0.25 m	–		–		–		0300-...-10	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30							
Design values v_{Rd} [kN/m] for slab thickness [mm]	170–190	*124.7*	124.7	*145.5*	145.5	*207.9*	207.9	*231.6*	249.5
	200–240	*144.9*	144.9	*169*	169	*241.5*	241.5	*269.1*	289.8
	250–350	*167.8*	167.8	*195.8*	195.8	*279.7*	279.7	*311.7*	335.7

Type / Element width	B = 1.00 m	0600-...-12		0700-...-12		0800-...-12		1200-...-12	
	B = 0.50 m	0300-...-12		–		0400-...-12		0600-...-12	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30							
Design values v_{Rd} [kN/m] for slab thickness [mm]	180–210	*179.6*	179.6	*209.5*	209.5	*239.5*	239.5	*333.6*	359.2
	220–350	*208.6*	208.6	*243.4*	243.4	*278.2*	278.2	*387.4*	417.2

HIT-ZVX: 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-ZDX: On-site reinforcement $A_{s,req}$, on balcony side and main slab side

V_{Ed} ↑↓	direct / indirect support	V_{Ed} / f_{yd} ≥ ø6 / 25 cm

All required verifications for the insulation and for load transfer have already been considered. Connecting elements must be verified by the planner.

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

Load bearing capacity values according to DIN EN 1992-1-1 (EC2) ⌀8 mm bar size

HIT-ZVX: Shear load capacity v_{Rd}
HIT-ZDX: Shear load capacity $\pm v_{Rd}$

Type / Element width	B = 0.33 m	0300-...-08		0400-...-08		0500-...-08	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30					
Design values v_{Rd} [kN/m] for slab thickness [mm]	160–190	*119.7*	119.7	*159.7*	159.7	*185.3*	199.6
	200–230	*139.1*	139.1	*185.4*	185.4	*215.2*	213.8
	240–350	*161.1*	161.1	*214.8*	214.8	*249.4*	268.5

HIT-ZVX: 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

HIT-ZDX: On-site reinforcement $A_{s,req}$, on balcony side and main slab side

V_{Ed} ↑↓	direct / indirect support	V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm

All required verifications for the insulation and for load transfer have already been considered. Connecting elements must be verified by the planner.

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

HALFEN HIT INSULATED CONNECTION HIGH PERFORMANCE

HIT-HP ZVX, HIT-HP ZDX

Load bearing capacity values according to DIN EN 1992-1-1 (EC2) — ø10 mm and ø12 mm bar size

HIT-ZVX: Shear load capacity v_{Rd}
HIT-ZDX: Shear load capacity $\pm v_{Rd}$

Type / Element width	B = 0.33 m	0300-…-10		0400-…-10		0500-…-10	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30					
Design values v_{Rd} [kN/m] for slab thickness [mm]	170–190	*187.1*	187.1	*231.6*	249.5	*289.5*	311.8
	200–240	*217.3*	217.3	*269.1*	289.8	*336.3*	362.2
	250–350	*251.7*	251.7	*311.7*	335.7	*389.6*	419.6

Type / Element width	B = 0.33 m	0200-…-12		0300-…-12		0400-…-12	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30					
Design values v_{Rd} [kN/m] for slab thickness [mm]	180–210	*179.6*	179.6	*250.2*	269.4	333.6	359.2
	220–350	*208.6*	208.6	*290.6*	312.9	*387.4*	417.2

HIT-ZVX: 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

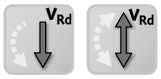
HIT-ZDX: On-site reinforcement $A_{s,req}$, on balcony side and main slab side

V_{Ed} ↑ ↓	direct / indirect support	V_{Ed} / f_{yd} ≥ ø6 / 25 cm

All required verifications for the insulation and for load transfer have already been considered. Connecting elements must be verified by the planner.

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

Load bearing capacity values according to DIN EN 1992-1-1 (EC2) — ø6 mm bar size



HIT-ZVX: Shear load capacity v_{Rd}
HIT-ZDX: Shear load capacity $\pm v_{Rd}$

Type / Element width	B = 1.00 m	0202-…-06		0302-…-06		0402-…-06		0502-…-06	
	B = 0.50 m	–		–		0201-…-06		–	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30							
Design values v_{Rd} [kN/m] for slab thickness [mm]	160–190	*23.6*	23.6	*34.6*	34.7	*45.0*	45.4	*55.0*	55.6
	200–210	*24.9*	24.9	*36.7*	36.8	*48.0*	48.2	*58.8*	59.3
	220–250	*26.3*	26.3	*39.0*	39.0	*51.2*	51.4	*63.1*	63.4

Type / Element width	B = 1.00 m	0503-…-06		0603-…-06		0702-…-06		0803-…-06	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30							
Design values v_{Rd} [kN/m] for slab thickness [mm]	160 – 190	*57.2*	57.5	*67.6*	68.1	*73.2*	74.7	*87.2*	88.3
	200–210	*60.7*	60.9	*71.9*	72.3	*79.0*	80.2	*93.4*	94.3
	220–350	*64.7*	64.7	*76.9*	77.0	*85.8*	86.6	*100.5*	101.0

HIT-ZVX: 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

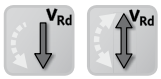
HIT-ZDX: On-site reinforcement $A_{s,req}$, on balcony side and main slab side

V_{Ed} ↑↓	direct / indirect support	0.28 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 20 cm

All required verifications for the insulation and for load transfer have already been considered. Connecting elements must be verified by the planner.

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

Load bearing capacity values according to DIN EN 1992-1-1 (EC2) ⌀8 mm bar size



ZVX: Shear load capacity v_{Rd}
ZDX: Shear load capacity $\pm v_{Rd}$

Type / Element width	B = 1.00 m	0502-…-08		0503-…-08		0602-…-08		0604-…-08		0804-…-08	
	B = 0.50 m	–		–		0301-…-08		0302-…-08		0402-…-08	
	B = 0.25 m	–		–		–		–		0201-…-08	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30									
Design values v_{Rd} [kN/m] for slab thickness [mm]	160 – 190	*85.4*	86.6	*92.7*	94.3	*97.1*	97.6	*113.0*	114.6	*143.6*	146.9
	200–230	*96.4*	98.5	*102.6*	103.8	*111.3*	111.8	*124.6*	125.8	*160.2*	162.7
	240–350	*105.8*	107.3	*110.7*	111.4	*123.4*	124.7	*134.0*	134.7	*174.1*	175.6

HIT-ZVX: On-site reinforcement $A_{s,req}$

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

HIT-ZDX: On-site reinforcement $A_{s,req}$, on balcony side and main slab side

V_{Ed} ↑ ↓	direct / indirect support	0.33 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm	0.49 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm

All required verifications for the insulation and for load transfer have already been considered. Connecting elements must be verified by the planner.

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

Load bearing capacity values according to DIN EN 1992-1-1 (EC2) ø10 mm bar size

ZVX: Shear load capacity v_{Rd}
ZDX: Shear load capacity $\pm v_{Rd}$

Type / Element width	B = 1.00 m	0402-...-10		0403-...-10		0604-...-10		0804-...-10		0806-...-10	
	B = 0.50 m	0201-...-10		–		0302-...-10		0402-...-10		0403-...-10	
	B = 0.25 m	–		–		–		0201-...-10		–	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30									
Design values v_{Rd} [kN/m] for slab thickness [mm]	170–190	*99.8*	100.3	*111.3*	114	*162.6*	166.4	*199.6*	200.6	*222.6*	227.9
	200–240	*114.8*	115.2	*124.4*	126.4	*183.0*	186.6	*229.5*	230.3	*248.8*	252.8
	250–350	*127.6*	128.6	*135.3*	136.7	*200.1*	202.6	*255.3*	257.2	*270.6*	273.4

HIT-ZVX: On-site reinforcement $A_{s,req}$

Balcony		ø6 / 25 cm		
Main slab	direct support	ø6 / 25 cm		
	indirect support	0.37 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 25 cm	0.61 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 25 cm	0.75 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 25 cm

HIT-ZDX: On-site reinforcement $A_{s,req}$, on balcony side and main slab side

V_{Ed} ↑↓	direct / indirect support	0.37 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 25 cm	0.61 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 25 cm	0.75 cm²/m + V_{Ed} / f_{yd} ≥ ø6 / 25 cm

Load bearing capacity values according to DIN EN 1992-1-1 (EC2) ø12 mm bar size

ZVX: Shear load capacity v_{Rd}
ZDX: Shear load capacity $\pm v_{Rd}$

Type / Element width	B = 1.00 m	0406-...-12		0804-...-12		0606-...-12		0806-...-12	
	B = 0.50 m	0203-...-12		0402-...-12		0303-...-12		0403-...-12	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30							
Design values v_{Rd} [kN/m] for slab thickness [mm]	180–210	*169.5*	171.9	*214.1*	225.5	*236.4*	242.8	*291.4*	292.7
	220–350	*186.9*	188.6	*264.6*	278.6	*265.3*	270.3	*333.8*	335.5

– for on-site reinforcement see following page –

1 MVX / -COR
2 MVX-OU/OD
3 ZVX / ZDX
4 DD / DDL / DVL
5 HT
6 AT / FT / OTX / FK
7 Building Physics, Planning

– continued from previous page –

On-site reinforcement ⌀12 mm bar size

Type / Element width					
	B = 1.00 m	0406-...-12	0804-...-12	0606-...-12	0806-...-12
	B = 0.50 m	0203-...-12	0402-...-12	0303-...-12	0403-...-12

HIT-ZVX: On-site reinforcement $A_{s,req}$

Balcony		⌀6 / 25 cm	
Main slab	direct support	⌀6 / 25 cm	
	indirect support	0.65 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm	0.90 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm

HIT-ZDX: On-site reinforcement $A_{s,req}$, on balcony side and main slab side

V_{Ed} ↑↓	direct / indirect support	0.65 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm	0.90 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm

Load bearing capacity values according to DIN EN 1992-1-1 (EC2) ⌀8 mm, ⌀10 mm bar size

ZVX: Shear load capacity v_{Rd}
ZDX: Shear load capacity $\pm v_{Rd}$

Short unit 120

Type / Element width	B = 0.33 m	0202-...-08		0302-...-08		B = 0.33 m	0202-...-10		0302-...-10	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30				30	Concrete strength: *C20/25* ≥ C25/30			
Design values v_{Rd} [kN/m] for slab thickness [mm]	160–190	*118.4*	119.2	*169.7*	172.1	170–190	*175.7*	178.4	*244.2*	249.9
	200–230	*129.1*	129.8	*187.1*	188.8	200–240	*194.0*	195.9	*274.7*	280.1
	240–350	*137.6*	137.8	*201.2*	202.2	250–350	*208.9*	210.1	*300.5*	304.3

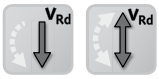
HIT-ZVX: On-site reinforcement $A_{s,req}$

Balcony		⌀6 / 25 cm			⌀6 / 25 cm	
Main slab	direct support	⌀6 / 25 cm			⌀6 / 25 cm	
	indirect support	0.47 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm	0.63 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm		0.63 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm	0.79 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm

HIT-ZDX: On-site reinforcement $A_{s,req}$, on balcony side and main slab side

V_{Ed} ↑↓	direct / indirect support	0.47 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm	0.63 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm		0.63 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm	0.79 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm

Load bearing capacity values according to DIN EN 1992-1-1 (EC2) ⌀12 mm bar size



ZVX: Shear load capacity v_{Rd}
ZDX: Shear load capacity $\pm v_{Rd}$

Type / Element width	B = 0.33 m	0202-...-12		0302-...-12	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30			
Design values v_{Rd} [kN/m] for slab thickness [mm]	180–210	*236.7*	243.0	*300.0*	317.6
	220–350	*265.6*	270.5	*345.0*	365.8

HIT-ZVX: On-site reinforcement $A_{s,req}$

Balcony		⌀6 / 25 cm	
Main slab	direct support	⌀6 / 25 cm	
	indirect support	0.78 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm	0.91 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm

HIT-ZDX: On-site reinforcement $A_{s,req}$, on balcony side and main slab side

V_{Ed} ↑ ↓	direct / indirect support	0.78 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm	0.91 cm²/m + V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm

All required verifications for the insulation and for load transfer have already been considered. Connecting elements must be verified by the planner.

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

Load bearing capacity values according to DIN EN 1992-1-1 (EC2) — ⌀6 mm bar size

ZVX: Shear load capacity v_{Rd}
ZDX: Shear load capacity $\pm v_{Rd}$

Concrete strength: *C20/25* ≥C25/30

120

Type / Element width	B = 1.00 m	0400-...-06		0500-...-06		0600-...-06		0700-...-06	
	B = 0.50 m	–		–		0300-...-06		–	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30							
Design values v_{Rd} [kN/m] for slab thickness [mm]	160–190	*26.1*	26.1	*32.6*	32.6	*39.1*	39.1	*45.6*	45.6
	200–210	*29.9*	29.9	*37.4*	37.4	*44.9*	44.9	*52.4*	52.4
	220–350	*34.8*	34.8	*43.5*	43.5	*52.2*	52.2	*60.8*	60.8

Type / Element width	B = 1.00 m	0800-...-06		0900-...-06		1100-...-06		1200-...-06	
	B = 0.50 m	0400-...-06		–		–		0600-...-06	
	B = 0.25 m	0200-...-06		–		–		0300-...-06	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30							
Design values v_{Rd} [kN/m] for slab thickness [mm]	160–190	*52.1*	52.1	*58.6*	58.6	*71.7*	71.7	*78.2*	78.2
	200–210	*59.9*	59.9	*67.4*	67.4	*82.3*	82.3	*89.8*	89.8
	220–350	*69.5*	69.5	*78.2*	78.2	*95.6*	95.6	*104.3*	104.3

HIT-ZVX: On-site reinforcement $A_{s,req}$

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

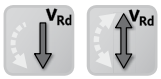
HIT-ZDX: On-site reinforcement $A_{s,req}$, on balcony side and main slab side

V_{Ed} ↑↓	direct / indirect support	V_{Ed} / f_{yd} ≥ ⌀6 / 20 cm

All required verifications for the insulation and for load transfer have already been considered. Connecting elements must be verified by the planner.

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

Load bearing capacity values according to DIN EN 1992-1-1 (EC2) ⌀8 mm bar size



ZVX: Shear load capacity v_{Rd}
ZDX: Shear load capacity $\pm v_{Rd}$

Concrete strength: *C20/25* ≥C25/30

120

Type / Element width		B = 1.00 m		0400-...-08		0600-...-08		0800-...-08		0900-...-08		1100-...-08	
		B = 0.50 m		0200-...-08		0300-...-08		0400-...-08		–		–	
		B = 0.25 m		0100-...-08		–		0200-...-08		–		–	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30											
Design values v_{Rd} [kN/m] for slab thickness [mm]	160–190	*43.7*	43.7	*65.6*	65.6	*87.4*	87.4	*98.3*	98.3	*120.2*	120.2		
	200–230	*53.2*	53.2	*79.8*	79.8	*106.4*	106.4	*119.7*	119.7	*146.3*	146.3		
	240–350	*61.8*	61.8	*92.7*	92.7	*123.6*	123.6	*139.1*	139.1	*170.0*	170.0		

HIT-ZVX: 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

HIT-ZDX: On-site reinforcement $A_{s,req}$, on balcony side and main slab side

V_{Ed} ↑↓	direct / indirect support	V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm

All required verifications for the insulation and for load transfer have already been considered. Connecting elements must be verified by the planner.

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

Load bearing capacity values according to DIN EN 1992-1-1 (EC2) — ⌀10 mm bar size

ZVX: Shear load capacity v_{Rd}
ZDX: Shear load capacity $\pm v_{Rd}$

Concrete strength: *C20/25* ≥C25/30

120

Type / Element width	B = 1.00 m	0600-...-10		0700-...-10		0800-...-10		1000-...-10		1200-...-10	
	B = 0.50 m	0300-...-10		–		0400-...-10		0500-...-10		0600-...-10	
	B = 0.25 m	–		–		0200-...-10		–		0300-...-10	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30									
Design values v_{Rd} [kN/m] for slab thickness [mm]	170–190	*102.4*	102.4	*119.5*	119.5	*136.6*	136.6	*170.7*	170.7	*190.3*	204.9
	200–240	*124.7*	124.7	*145.5*	145.5	*166.3*	166.3	*207.9*	207.9	*231.6*	249.5
	250– 350	*144.9*	144.9	*169.0*	169.0	*193.2*	193.2	*241.5*	241.5	*269.1*	289.8

HIT-ZVX: 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

HIT-ZDX: On-site reinforcement $A_{s,req}$, on balcony side and main slab side

V_{Ed} ↑ ↓	direct / indirect support	V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm

All required verifications for the insulation and for load transfer have already been considered. Connecting elements must be verified by the planner.

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

Load bearing capacity values according to DIN EN 1992-1-1 (EC2) ø12 mm bar size

ZVX: Shear load capacity v_{Rd}
ZDX: Shear load capacity $\pm v_{Rd}$

Concrete strength: *C20/25* ≥C25/30

Type / Element width		B = 1.00 m	0600-...-12		0800-...-12		1000-...-12		1200-...-12	
		B = 0.50 m	0300-...-12		0400-...-12		0500-...-12		0600-...-12	
Lower concrete cover [mm]	30		Concrete strength: *C20/25* ≥ C25/30							
Design values v_{Rd} [kN/m] for slab thickness [mm]	180–210		*147.5*	147.5	*196.7*	196.7	*228.3*	245.9	*274.0*	295.0
	220–350		*179.6*	179.6	*239.5*	230.5	*278.0*	299.3	*333.6*	359.2

HIT-ZVX: 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-ZDX: On-site reinforcement $A_{s,req}$, on balcony side and main slab side

V_{Ed} ↑ ↓	direct / indirect support	V_{Ed} / f_{yd} ≥ ø6 / 25 cm

All required verifications for the insulation and for load transfer have already been considered. Connecting elements must be verified by the planner.

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

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

ZVX: Shear load capacity v_{Rd}
ZDX: Shear load capacity $\pm v_{Rd}$

Type / Element width	B = 0.33 m	0300-….-08		0400-…-08		0500-…-08	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30					
Design values v_{Rd} [kN/m] for slab thickness [mm]	160–190	*98.3*	98.3	*131.1*	131.1	*152.2*	163.9
	200–230	*119.7*	119.7	*159.7*	159.7	*185.3*	199.6
	240–350	*139.1*	139.1	*185.4*	185.4	*215.2*	231.8

Type / Element width	B = 0.33 m	0300-…-10		0400-…-10		0500-…-10	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30					
Design values v_{Rd} [kN/m] for slab thickness [mm]	170–190	*153.7*	153.7	*190.3*	204.9	*237.8*	256.1
	200–240	*187.1*	187.1	*231.6*	249.5	*289.5*	311.8
	250–350	*217.3*	217.3	*269.1*	289.8	*336.3*	362.2

Type / Element width	B = 0.33 m	0200-…-12		0300-…-12		0400-…-12	
Lower concrete cover [mm]	30	Concrete strength: *C20/25* ≥ C25/30					
Design values v_{Rd} [kN/m] for slab thickness [mm]	180–210	*147.5*	147.5	*205.5*	221.3	*274.0*	295.0
	220–350	*179.6*	179.6	*250.2*	269.4	*333.6*	359.2

HIT-ZVX: 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

HIT-ZDX: On-site reinforcement $A_{s,req}$, on balcony side and main slab side

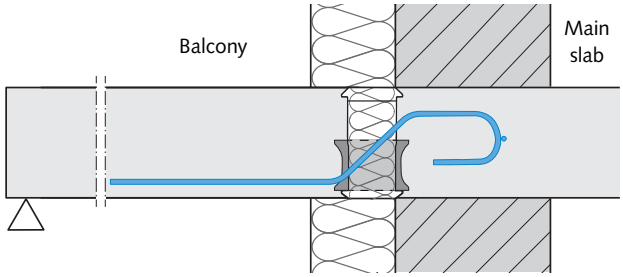
V_{Ed} ↑↓	direct / indirect support	V_{Ed} / f_{yd} ≥ ⌀6 / 25 cm

All required verifications for the insulation and for load transfer have already been considered. Connecting elements must be verified by the planner.

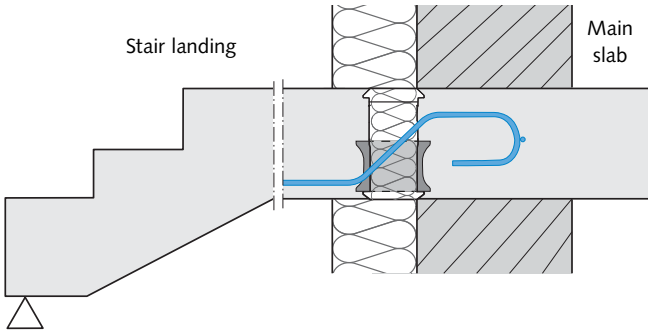
HALFEN HIT software is available at **www.halfen.com** to calculate connections for balcony projects.

Application examples in wall cross sections

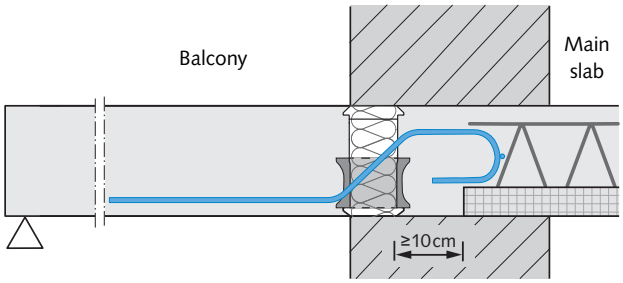
Installation diagram: Masonry cladded with ETICS (external thermal insulation composite system)



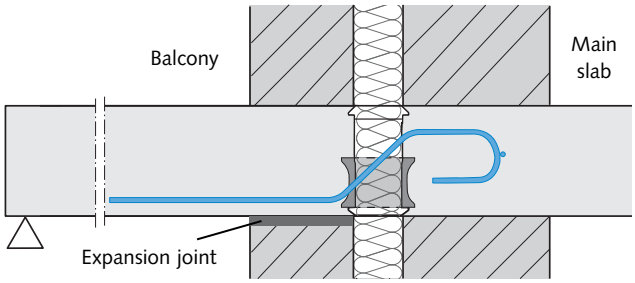
Installation diagram: Stair landing entrance to a building



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



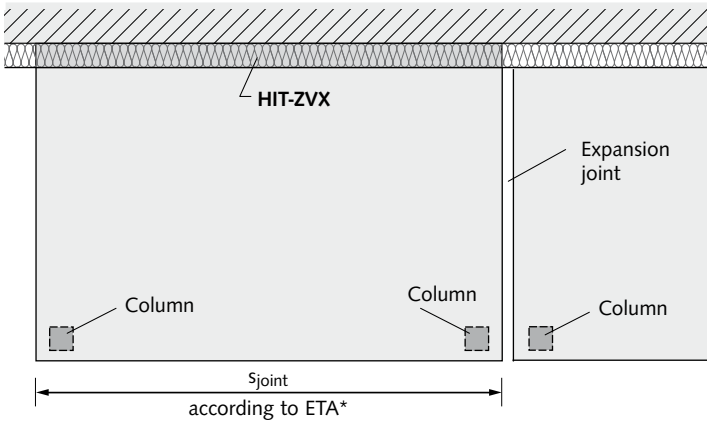
Installation diagram: Double-leaf masonry with balcony at main slab level



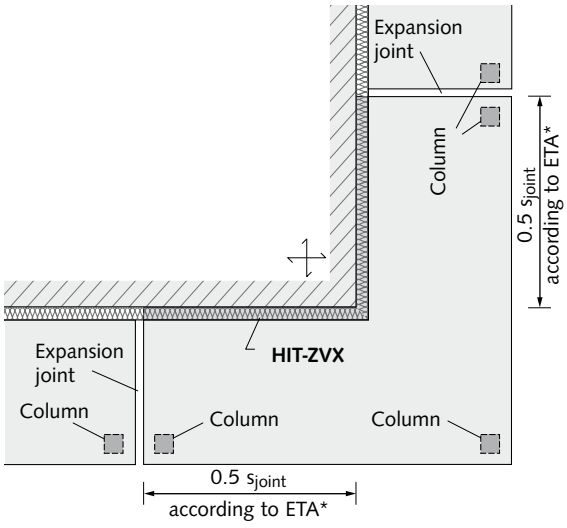
The dimension of the shear load bars has been optimized. During installation in main element slab the bars remain above the main element slab with all HIT heights.

Application examples / Expansion joint placement

Application 1: Expansion joint placement in linear balcony connections

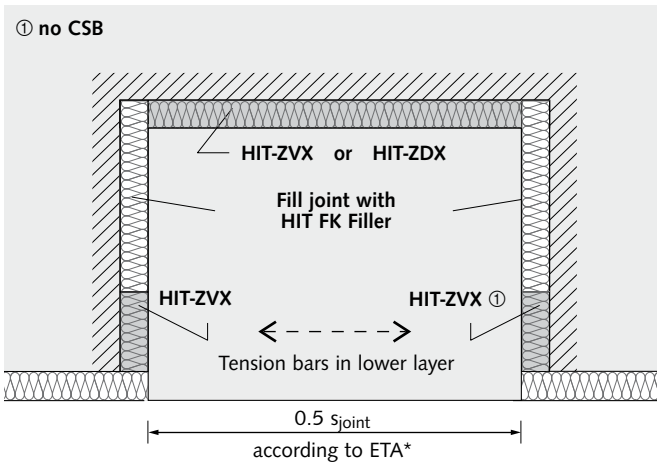


Application 2: Expansion joints in a corner balcony

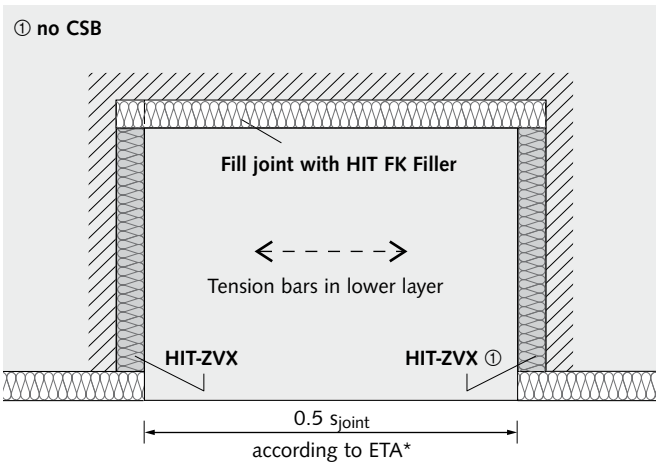


*see page 40

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

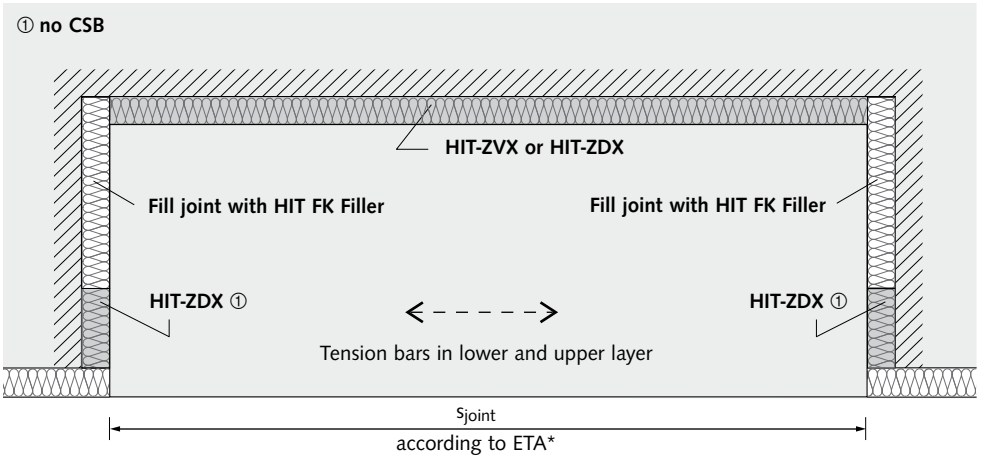


Application 4: Expansion joint location for two-side supported loggia (with CSB on the left or right)



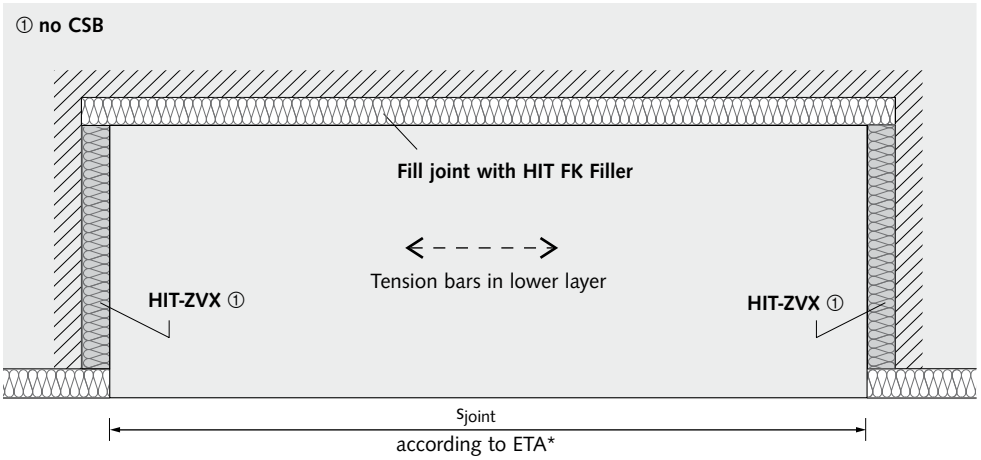
*see page 40

Application 5: Expansion joint for three-side supported loggia (left and right sides without CSB)



*see page 40

Application 6: Expansion joint for two-side supported loggia (left and right sides without CSB)

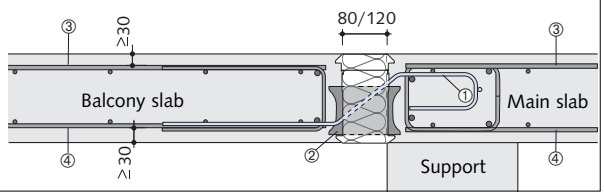


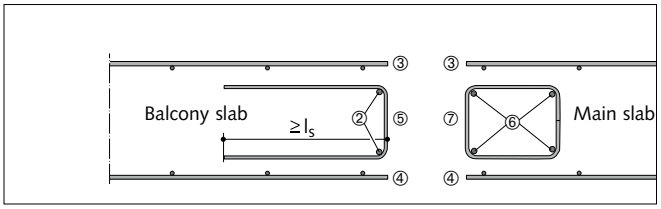
*see page 40

On-site reinforcement

with bent shear bars
- standard: ø = 6 mm

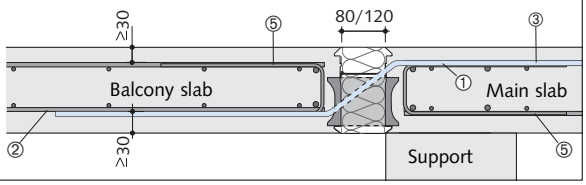
Longitudinal section

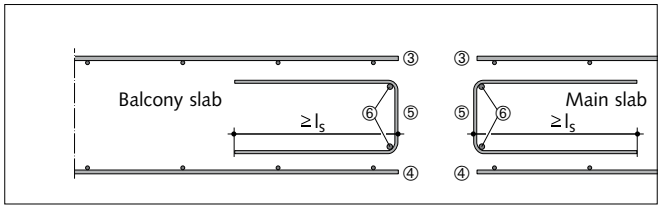




with straight shear bars
- standard: ø = 8 mm – 12 mm
  (also available as a non-standard ø6 mm version)

Longitudinal section





Dimensions in [mm]

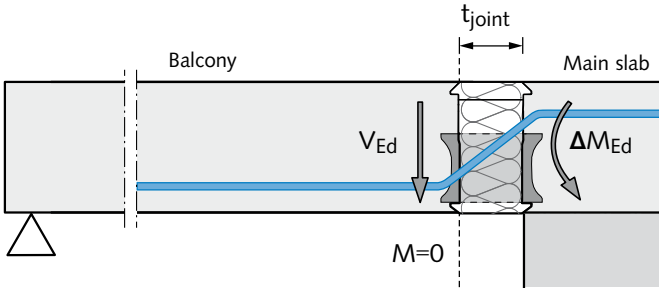
① HIT-Shear load bar (bei ø6 mm with load-bearing cross bar)
② Double-symmetrical CSB
③ Upper connecting reinforcement, steel bars or mesh
④ Lower connecting reinforcement, steel bars or mesh
⑤ U-bar → $A_{s,req}$, see pages 62 – 82
⑥ Transverse tensile reinforcement ø8
⑦ Edge reinforcement (min. ø6/20)

Moments from eccentric loads

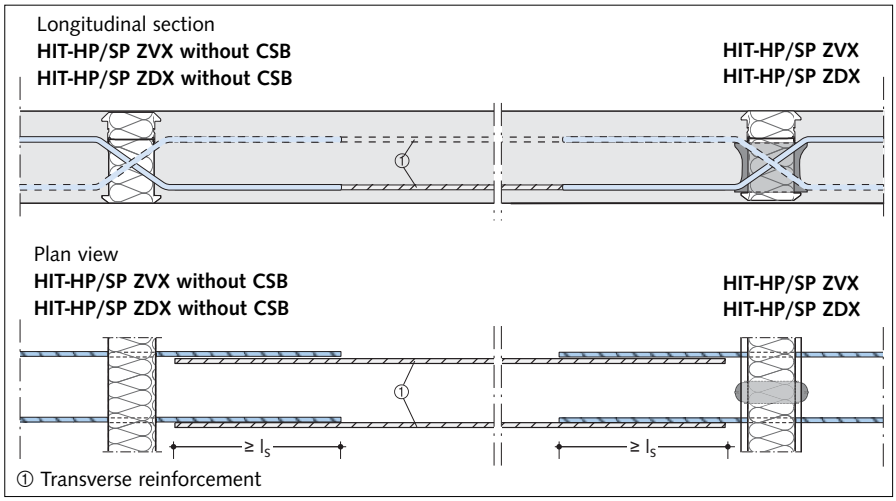
Moments resulting from an eccentric load must be considered when calculating for **HIT-HP/SP ZVX and ZDX with CSB**. The following applies:

$$\Delta M_{Ed} = V_{Ed} \cdot t_{joint}$$

with: t_{joint} = 0.08 m (HIT-HP ZVX/ZDX)
t_{joint} = 0.12 m (HIT-SP ZVX/ZDX)



On-site transverse reinforcement



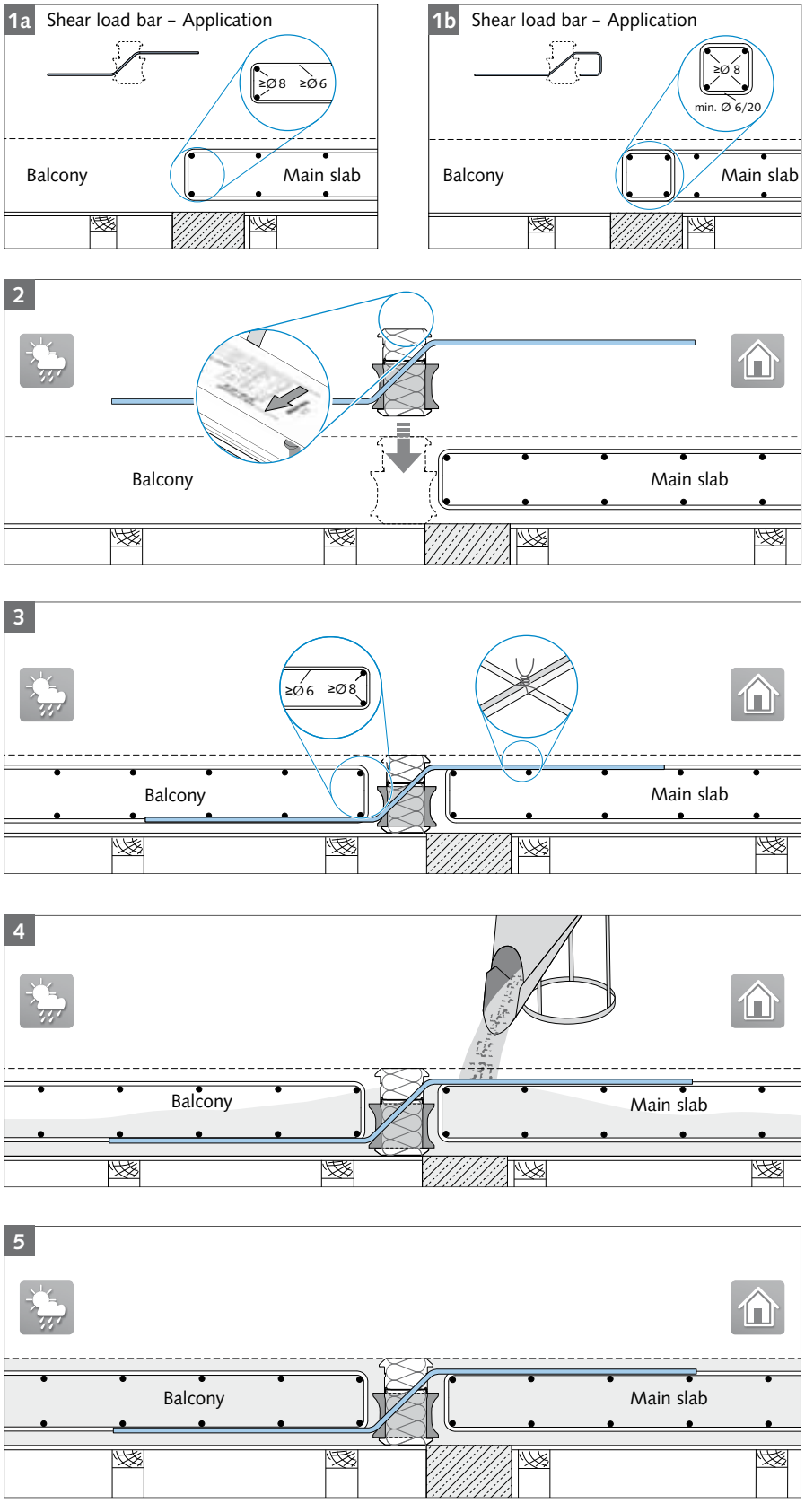
① Transverse reinforcement

Transverse reinforcement

When placing the transverse reinforcement in the balcony slab, each shear bar in the HIT Element (HP/SP ZVX or ZDX) 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

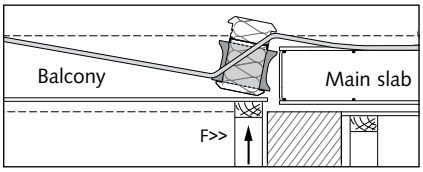


1 Installation of on-site reinforcement for the main slab

On-site reinforcement as specified by the structural engineer.

2 Installation of HIT Elements from above

HIT-ZDX Elements with bar diameters of ⌀8, 10 or 12 are symmetrical and do not have a dedicated installation direction.



Ensure that the formwork is at the correct height!

3 Installation of the on-site reinforcement, balcony side

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.

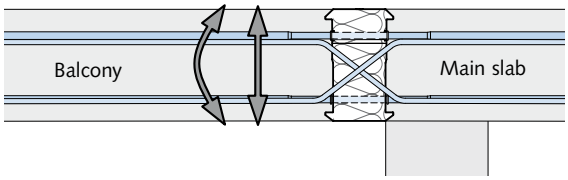
5 Freshly poured concrete balcony slab on support structure

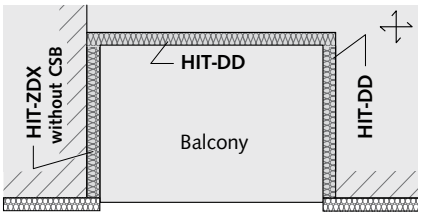
Further installation diagrams for the types HIT-HP/SP ZVX and HIT-HP/SP ZDX can be found in the installation instructions – available for download at our website www.halfen.com.

4

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

CE · REI 120 · type tested





Application: Continuous slab

HIT-HP DD – High Performance 80 mm insulation thickness
HIT-SP DD – Superior Performance 120 mm insulation thickness

Content	Type	Page
Product types / Load range	HIT-HP DD, HIT-SP DD	88
Load bearing capacity values	HIT-HP DD, HIT-SP DD	89
Product description	HIT-HP DD, HIT-SP DD	93
Elements with high load capacity	HIT-HP DVL/DDL	94
Installation diagram	HIT-HP DD, HIT-HP DVL/DDL	100
Camber	HIT-HP DD, HIT-SP DD, HIT-HP DVL/DDL	101

Load range

All types are available with shear load bar diameters 6 mm, 8 mm, 10 mm or 12 mm.

The following combinations of shear load bar SB (shear bars) and tension load bar TB are possible:

Possible combinations of support elements

Element width B = 25 cm		No. tension /compression bars n_{TB}	
		1	2
Number of shear load bars n_{SB}	1	●	●

Element width B = 50 cm		Number of tension /compression bars n_{TB}				
		2	3	4	5	6
Number of shear load 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 load bars n_{SB}	4	●		●		●			
	6	●	●	●	●	●	●	●	
	7		●		●		●	●	●

Load bearing capacity values for selected element can be found on pages 89–92 ● = 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
❶ ❷	❸		❹ ❺		❻		❼		❽		❾

Type description

① Product group
② Insulation thickness 80 mm (HP)
120 mm (SP)
③ Connection type
④ No. tension/compression bars
⑤ No. shear load bars on each side
⑥ Element height [cm]
⑦ Element width [cm]
⑧ Upper concrete cover [mm]
⑨ Diameter shear load bars [mm]

HIT Custom solutions

Our technical support team is available to provide support in your project with custom solutions using HALFEN HIT Insulated connections

Contact: → see inside back cover

Possible slab thickness h

Lower concrete cover: 30 mm / upper concrete cover: 30, 35 mm				
Diameter of the shear load bars [mm]	06	08	10	12
Possible main slab heights h [cm]	16–35	16–35	17–35	18–35
Lower concrete cover: 30 mm / upper concrete cover: 50 mm				
Diameter of the shear load bars [mm]	06	08	10	12
Possible main slab heights h [cm]	18–35	18–35	19–35	20–35

Decoding the type selection: 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

Specifications

Main slab thickness: 18 cm
Concrete strength: C20/25
Concrete cover: 35 mm

Bending moment: $m_{Rd} \geq 50.7$ kNm/m
Shear load*: $v_{Rd} \geq 55.3$ kN/m

Calculated number of tension/compression bars (xx): 10
Calculated number of shear load bars (yy)*: 07

Compiled type description: HIT-HP DD-1007*-18-100-35-06

*Determine the shear load bars for HIT-HP DD → see tables on page 90

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

Moment bearing capacity ±m_{Rd}

80

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			On request, please contact the HALFEN Technical Team; information can be found at the back of the catalogue.									

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

Shear load capacity ±v_{Rd}

Concrete strength: *C20/25* ≥C25/30

80

Number of shear bars yy				06		07		06		07	
Rebar 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
	240–350	240–350	260–350	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	
Rebar 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	170	190	124.8	124.8	145.6	145.6	–	–	–	–
	180	180	200	124.8	124.8	145.6	145.6	179.7	179.7	209.6	209.6
	190	190	210	124.8	124.8	145.6	145.6	179.7	179.7	209.6	209.6
	200	200	220	124.8	124.8	145.6	145.6	179.7	179.7	209.6	209.6
	210	210	230	144.9	144.9	169.1	169.1	179.7	179.7	209.6	209.6
	220	220	240	144.9	144.9	169.1	169.1	208.7	208.7	243.5	243.5
	230	230	250	144.9	144.9	169.1	169.1	208.7	208.7	243.5	243.5
	240	240	260	144.9	144.9	169.1	169.1	208.7	208.7	243.5	243.5
	250–350	250–350	270–350	167.9	167.9	195.9	195.9	208.7	208.7	243.5	243.5

All required verifications have already been considered. The adjacent connecting elements must be verified by the planner.

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

Decoding the type selection: 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

Specifications

Main slab thickness: 18 cm
Concrete strength: C25/30
Concrete cover: 35 mm

Bending moment: $m_{Rd} \geq 50.7$ kNm/m
Shear load*: $v_{Rd} \geq 45.6$ kNm/m

Calculated no. of tension/compression bars (xx): 10
Calculated no. of shear load bars (yy)*: 07

Compiled type description: HIT-SP DD-1007*-18-100-35-06

*Determine the shear load bars for HIT-SP DD → see tables on page 92

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

Moment bearing capacity ±m_{Rd}

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			On request, please contact our technical support team; contact information can be found at the back of the catalogue.									

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

Shear load capacity in both directions

Concrete strength: C20/25 ≥C25/30

120

Number of shear bars yy				06		07		06		07	
Rebar diameter dd				ø6 mm				ø8 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
	240–350	240–350	260–350	52.2	52.2	60.9	60.9	92.8	92.8	108.2	108.2

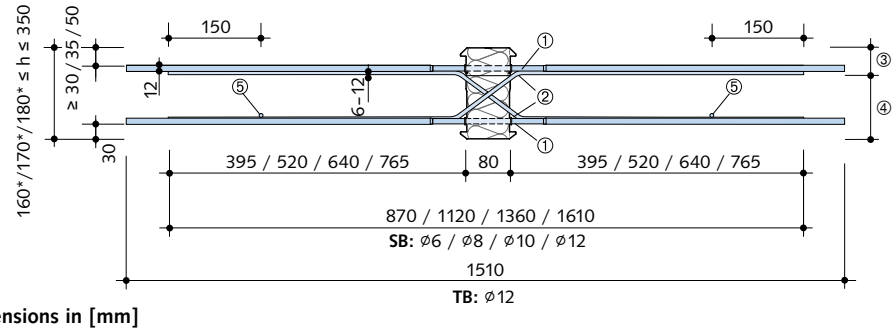
Number of shear bars yy				06		07		06		07	
Rebar diameter dd				ø10 mm				ø12 mm			
Concrete cover [mm]	30	35	50								
Design values v_{Rd} [kN/m] for slab thickness [mm]	160	160	180	–	–	–	–	–	–	–	–
	170	170	190	102.5	102.5	119.6	119.6	–	–	–	–
	180	180	200	102.5	102.5	119.6	119.6	147.6	147.6	172.2	172.2
	190	190	210	102.5	102.5	119.6	119.6	147.6	147.6	172.2	172.2
	200	200	220	102.5	102.5	119.6	119.6	147.6	147.6	172.2	172.2
	210	210	230	102.5	102.5	119.6	119.6	147.6	147.6	172.2	172.2
	220	220	240	124.8	124.8	145.6	145.6	179.7	179.7	209.6	209.6
	230	230	250	124.8	124.8	145.6	145.6	179.7	179.7	209.6	209.6
	240	240	260	124.8	124.8	145.6	145.6	179.7	179.7	209.6	209.6
	250–350	250–350	270–350	144.9	144.9	169.1	169.1	179.7	179.7	209.6	209.6

All required verifications have already been considered. The adjacent connecting elements must be verified by the planner.

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

Product description – cross sections (typical applications)

HIT-HP DD – High Performance

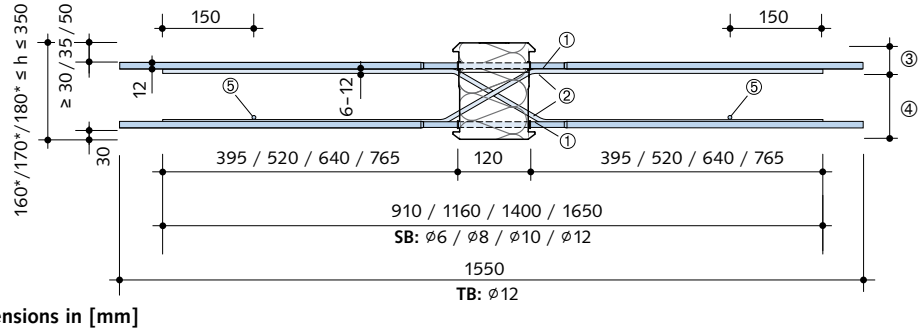


Dimensions in [mm]

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

* smallest available element height, depending on shear bar diameter: see table "Possible slab thickness h" (page 88)

HIT-SP DD – Superior Performance



Dimensions in [mm]

On-site reinforcement: Diameter and stirrup spacing is dependent on V_{Ed} [kN/m]

Stirrup spacing s / bar diameter [mm]	ø6	ø8	ø10
s ≤ 25 cm	49.2 kN/m	87.4 kN/m	136.6 kN/m
s ≤ 20 cm	61.5 kN/m	109.3 kN/m	170.7 kN/m
s ≤ 15 cm	82.0 kN/m	145.7 kN/m	227.7 kN/m
s ≤ 10 cm	122.9 kN/m	218.5 kN/m	341.5 kN/m

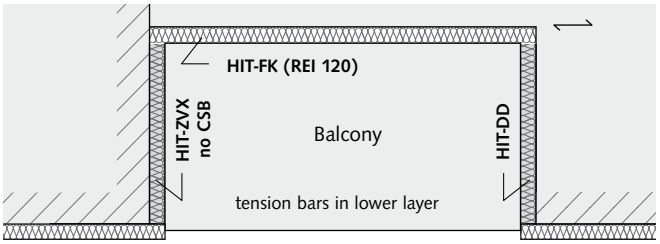
Vertical hanger reinforcement*:

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

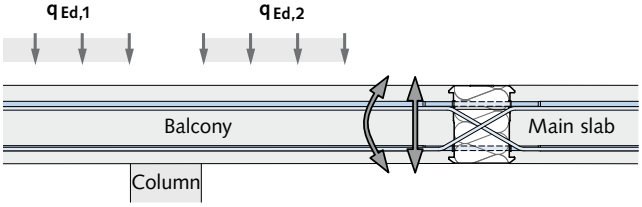
*in addition: horizontal transverse tensile reinforcement including end anchorage of at least 2 ø 8 mm

Application examples

- **Single axis tensioned main slab**
  For balcony slabs incorporated within a main slab, (continuous 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.



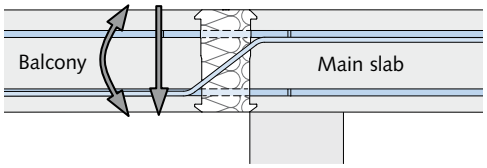
HALFEN HIT INSULATED CONNECTION HIGH PERFORMANCE

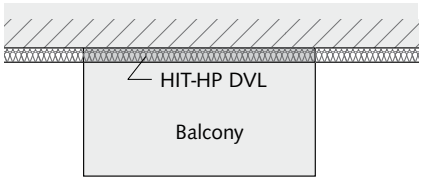
HIT-HP DVL

- Balcony connection with high load capacity values for cantilevered balcony slabs
- Transfers high shear forces and bi-directional moments

REI 120

NEW: Higher load bearing capacity values for **cantilevered** slabs.





HIT-HP DVL – High Performance 80 mm insulation thickness

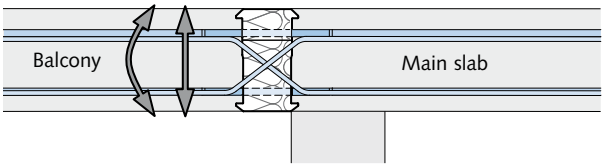
Application: Cantilevered balcony

Content	Type	Page
Product types / Load range	HIT-HP DVL	96
Load bearing capacity values	HIT-HP DVL	97
Product description	HIT-HP DVL	99

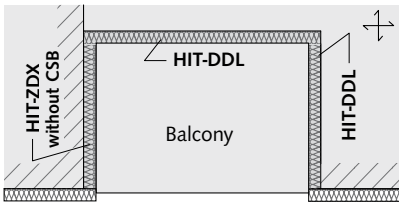
HIT-HP DDL

- Symmetrical connection with higher load capacity values for balcony slab incorporates in the main slab
- Transfers bi-directional shear forces and moments

NEW: Higher load bearing capacity values for **continuous** slabs.



HIT-HP DDL – High Performance 80 mm insulation thickness



Application: Continuous slab

Content	Type	Page
Product types / Load range	HIT-HP DDL	96
Load bearing capacity values	HIT-HP DDL	97
Product description	HIT-HP DDL	99

Load range

The following combinations of **shear load bar SB (⌀8 mm)** and **tension/compression bars TB (⌀14 mm)** are possible:

Possible combinations of support elements				
Element width B = 100 cm		**Number of tension /compression bars n_{TB} ⌀14 mm**		
		11	13	16
Number of shear load bars n_{SB} ⌀ 8 mm	6	●	●	●
	7	●	●	●
	8	●	●	●
	9	●	●	●

The following combinations of **shear load bar SB (⌀12 mm)** and **tension/compression bars TB (⌀14 mm)** are possible:

Possible combinations of support elements				
Element width B = 100 cm		**Number of tension /compression bars n_{TB} ⌀14 mm**		
		11	13	16
Number of shear load bars n_{SB} ⌀ 12 mm	5	●	●	●
	6	●	●	●
	7	●	●	●
	8	●	●	●
	9	●	●	●

Basic types – Ordering example

HIT-HP	DVL -	13 08	-	18	-	100	-	35	-	12
HIT-HP	DDL -	xx yy	-	hh	-	bbb	-	cc	-	dd
❶ ❷	❸	❹ ❺		❻		❼		❽		❾

Type description

① Product group
② Insulation thickness 80 mm (HP)
③ Connection type
④ No. tension/compression bars
⑤ DVL: No. shear load bars
DDL: No. shear load bars on each side
⑥ Element height [cm]
⑦ Element width [cm]
⑧ Upper concrete cover [mm]
⑨ Diameter shear load bars [mm]

Possible slab thickness h

Lower concrete cover: 30 mm / upper concrete cover: 30, 35 mm		
Diameter of the shear load bars [mm]	08	12
Possible main slab heights h [cm]	16 – 35	18 – 35
Lower concrete cover: 30 mm / upper concrete cover: 50 mm		
Diameter of the shear load bars [mm]	08	12
Possible main slab heights h [cm]	18 – 35	20 – 35

Decoding the type selection: HIT-HP DVL / HIT-HP DDL, tension/compression bars

Number of tension/compression bars xx				11		13		16	
Concrete cover [mm]	30	35	50	Concrete strength: C20/25 ≥ C25/30:					
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		52.0	59.6	61.4	70.5	75.6	86.7
	160		180	55.2	63.3	65.2	74.8	80.3	92.1
		170		58.4	67.0	69.0	79.2	84.9	97.5
	170		190	61.6	70.7	72.8	83.5	89.6	102.8
		180		64.8	74.4	76.6	87.9	94.3	108.2

Specifications

Main slab thickness: 18 cm
Concrete strength: C25/30
Concrete cover: 35 mm

Bending moment: m_{Rd} ≥ 94.3 kNm/m
Shear load*: v_{Rd} ≥ 239.5 kN/m

Calculated no. of tension/compression bars (xx): 16
Calculated no. of shear load bars (yy)*: 08

Compiled type description HIT-HP DVL-1608*-18-100-35-12

*Determine the shear load bars for HIT-HP DVL → see tables on page 98

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

Moment bearing capacity ±m_{Rd}

Number of tension/compression bars xx				11		13		16	
Concrete cover [mm]	30	35	50	Concrete strength: C20/25 ≥ C25/30:					
Design values m_{Rd} [kNm/m] for slab thickness [mm]		160		52.0	59.6	61.4	70.5	75.6	86.7
	160		180	55.2	63.3	65.2	74.8	80.3	92.1
		170		58.4	67.0	69.0	79.2	84.9	97.5
	170		190	61.6	70.7	72.8	83.5	89.6	102.8
		180		64.8	74.4	76.6	87.9	94.3	108.2
	180		200	68.0	78.0	80.4	92.2	98.9	113.5
		190		71.2	81.7	84.2	96.6	103.6	118.9
	190		210	74.4	85.4	88.0	100.9	108.3	124.2
		200		77.6	89.1	91.8	105.3	112.9	129.6
	200		220	80.9	92.8	95.6	109.6	117.6	134.9
		210		84.1	96.5	99.3	114.0	122.3	140.3
	210		230	87.3	100.1	103.1	118.3	126.9	145.6
		220		90.5	103.8	106.9	122.7	131.6	151.0
	220		240	93.7	107.5	110.7	127.0	136.3	156.3
		230		96.9	111.2	114.5	131.4	140.9	161.7
	230		250	100.1	114.9	118.3	135.7	145.6	167.1
		240		103.3	118.5	122.1	140.1	150.3	172.4
	240		260	106.5	122.2	125.9	144.4	154.9	177.8
		250		109.7	125.9	129.7	148.8	159.6	183.1
	250		270	112.9	129.6	133.5	153.1	164.3	188.5
	> 250			On request, please contact our technical support team; contact information can be found at the back of the catalogue.					

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

DVL: Shear load capacity v_{Rd}
DDL: Shear load capacity $\pm v_{Rd}$

Concrete strength: *C20/25* ≥C25/30

80

Number of shear bars yy				06		07		08		09	
Rebar diameter dd				⌀8 mm							
Concrete cover [mm]	30	35	50								
Design values v_{Rd} [kN/m] for slab thickness [mm]	160–190	160–190	180–210	79.8	79.8	93.1	93.1	106.4	106.4	119.7	119.7
	200–230	200–230	220–250	92.7	92.7	108.2	108.2	123.6	123.6	139.1	139.1
	240–250	240–250	–	107.4	107.4	125.3	125.3	143.2	143.2	161.1	161.1

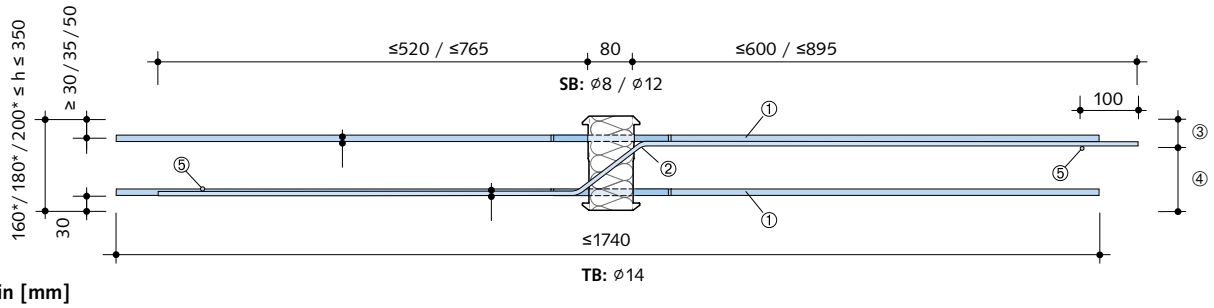
Number of shear bars yy				05		06		07		08		09	
Rebar diameter dd				⌀12 mm									
Concrete cover [mm]	30	35	50										
Design values v_{Rd} [kN/m] for slab thickness [mm]	180–210	180–210	200–230	149.7	149.7	179.6	179.6	209.5	209.5	239.5	239.5	269.4	269.4
	220–250	220–250	240–250	173.9	173.9	208.6	208.6	243.4	243.4	278.2	278.2	312.9	312.9

All required verifications have already been considered. The adjacent connecting elements must be verified by the planner.

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

Product description – cross sections HIT-HP DVL

HIT-HP DVL – High Performance



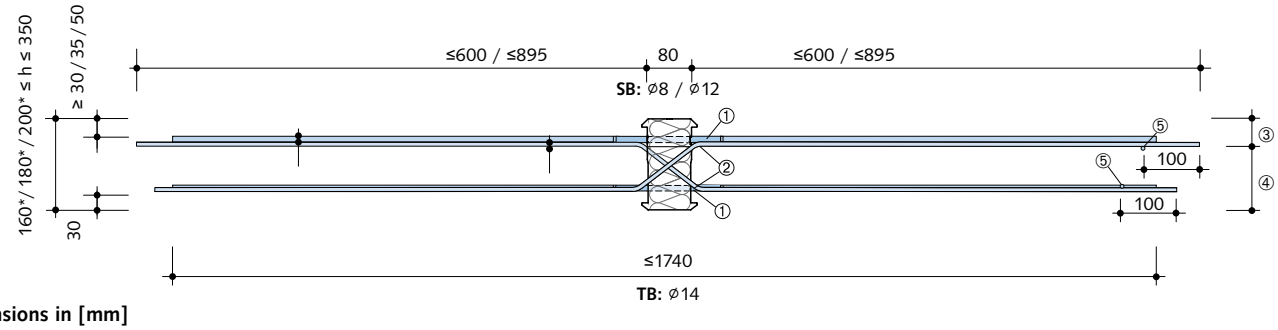
Dimensions in [mm]

① Tension/compression bars TB (ø 14 mm)
② Shear bars SB (ø 8 mm, ø 12 mm)
③ Tension bar box TB-Box
④ Shear bar box
⑤ Installation bar, structural (ø 6 mm)

* smallest available element height, depending on shear bar diameter: see table "Possible slab thickness h" (page 96)

Product description – cross sections HIT-HP DDL

HIT-HP DDL – High Performance



Dimensions in [mm]

① Tension/compression bars TB (ø 14 mm)
② Shear bars SB (ø 8 mm, ø 12 mm)
③ Tension bar box TB-Box
④ Shear bar box
⑤ Installation bar, structural (ø 6 mm)

* smallest available element height, depending on shear bar diameter: see table "Possible slab thickness h" (page 96)

On-site reinforcement, on balcony side and main slab side: Diameter and stirrup spacing is dependent on V_{Ed} [kN/m]

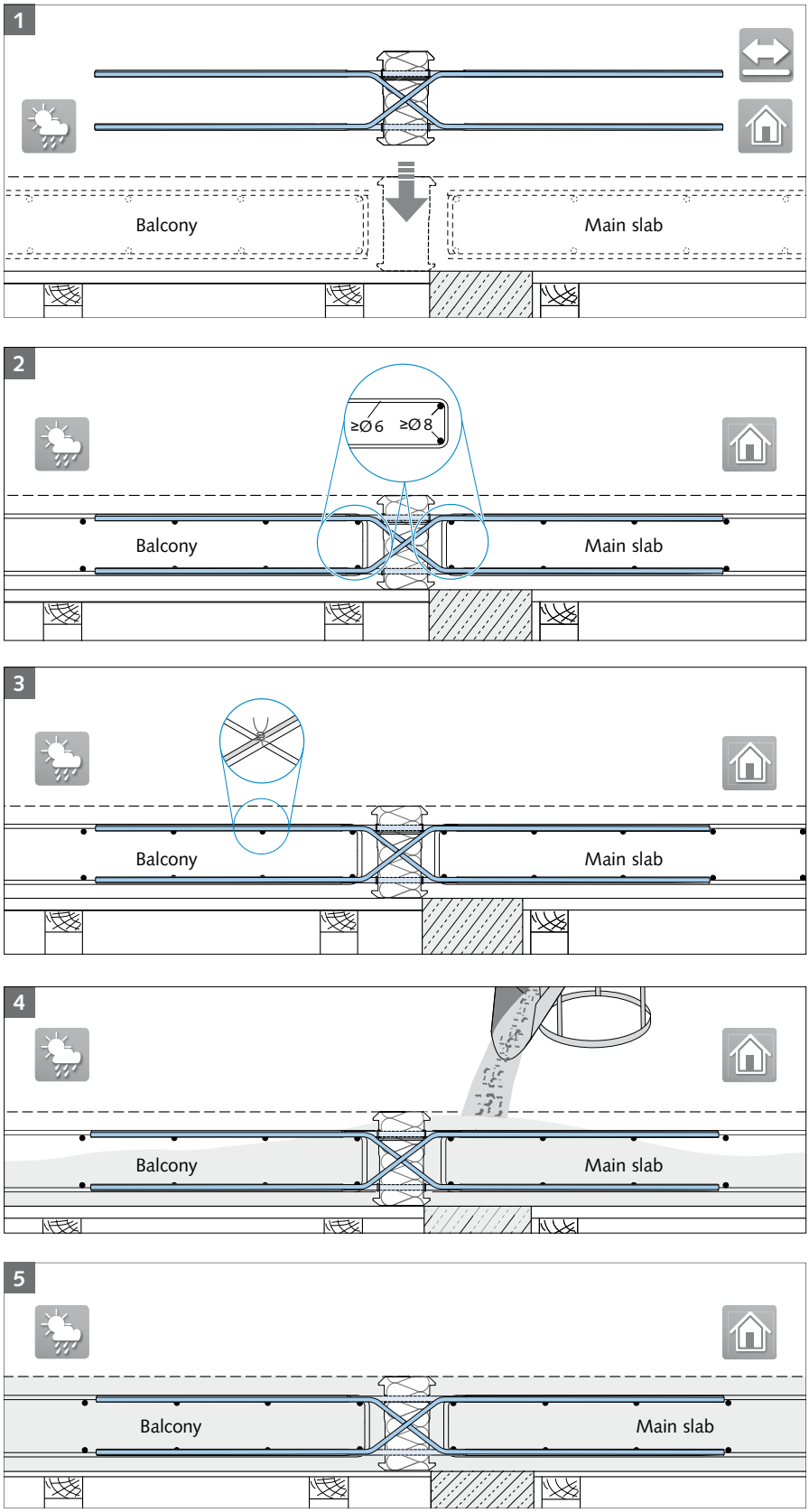
Stirrup spacing s / bar diameter [mm]	ø8	ø10
s ≤ 25 cm	87.4 kN/m	136.6 kN/m
s ≤ 20 cm	109.3 kN/m	170.7 kN/m
s ≤ 15 cm	145.7 kN/m	227.7 kN/m
s ≤ 10 cm	218.5 kN/m	341.5 kN/m

Vertical hanger reinforcement*:

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

*in addition: horizontal transverse tensile reinforcement including end anchorage of at least 2 ø 8 mm

Installation diagram HIT-DD, HIT-DVL and HIT-DDL



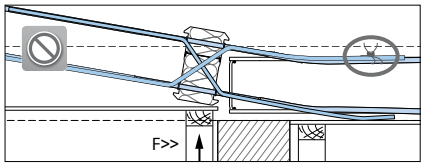
1 Positioning the HIT Element from above

Elements HIT-HP/SP DD and HIT-HP DDL are symmetrical; therefore both installation directions are correct.

2 Installing 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 at the correct height!

4 Pour the concrete

To ensure the HIT Elements are securly installed, pour and compact the concrete evenly. Ensure all HIT Elements are securely fixed.

5 Freshly concreted balcony slab on supporting structure

For further installation instructions please visit **www.halfen.com**.

Camber in the balcony slab

The deformation of the slab connection and the corresponding required camber in the formwork results from the component deformation according to DIN EN 1992-1-1 plus the elevation ü from the elastic deformation of the framework in the insulation joint and load induction zone.

The listed deformation and camber values result from the calculated torsions α_M of the HALFEN Elements HIT-HP DD and HIT-SP DD, as well as the HIT-HP DVL and HIT-HP DDL as a result of unit M_{Ed} = 1 kNm. These values refer exclusively to the deformation factor of the HIT Element.

$$ü = ü^*/n * l_k * M_{Ed(GZG)} \text{ [mm]}$$

with

n = $n_{TB/CB}$, Number of tension/compression bars per metre
l_k = Cantilever length [m]
$M_{Ed(GZG)}$ = acting moment in load case GZG [kNm/m]
ü* = Camber coefficient [‰/(kNm/m)]

HIT-DD/-DVL/-DDL: Camber u*

Slab thickness [mm] / Concrete cover [mm]			HIT-HP DD	HIT-SP DD	HIT-HP DVL HIT-HP DDL
30	35	50	ü*[‰/(kNm/m)]	ü*[‰/(kNm/m)]	ü*[‰/(kNm/m)]
	160		0.86	0.94	0.60
160		180	0.77	0.84	0.54
	170		0.69	0.75	0.48
170		190	0.62	0.67	0.43
	180		0.56	0.61	0.39
180		200	0.51	0.55	0.35
	190		0.46	0.51	0.32
190		210	0.43	0.46	0.29
	200		0.39	0.43	0.27
200		220	0.36	0.39	0.25
	210		0.34	0.37	0.23
210		230	0.31	0.34	0.21
	220		0.29	0.32	0.20
220		240	0.27	0.30	0.19
	230		0.25	0.28	0.17
230		250	0.24	0.26	0.16
	240		0.22	0.24	0.15
240		260	0.21	0.23	0.14
	250		0.20	0.22	0.14
250		270	0.19	0.20	0.13

5

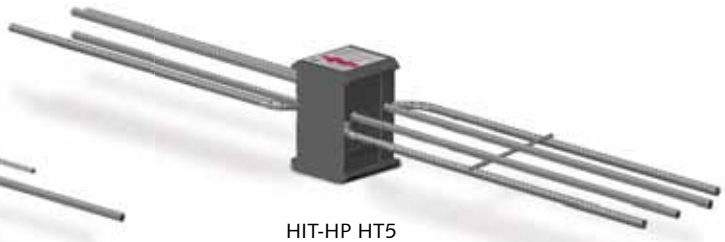
- Symmetrical additional elements with 80 mm and 120 mm insulation thickness
- Transfer of planned horizontal forces parallel and/or perpendicular to the insulation plane

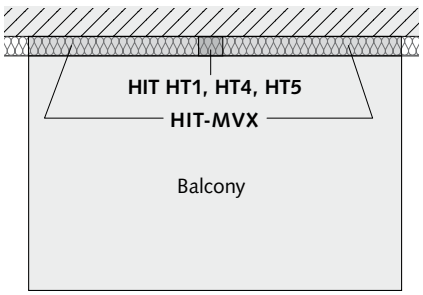

HIT-HP HT1


HIT-HP HT2

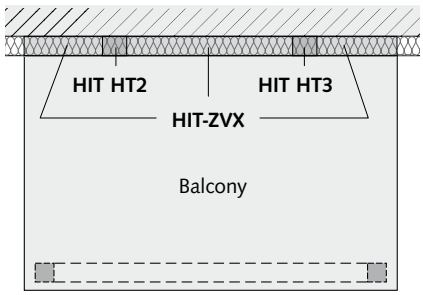

HIT-HP HT3


HIT-HP HT4

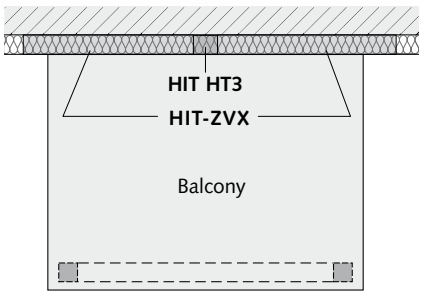

HIT-HP HT5



Application: Cantilevered balcony



Application: Simply supported balcony on columns



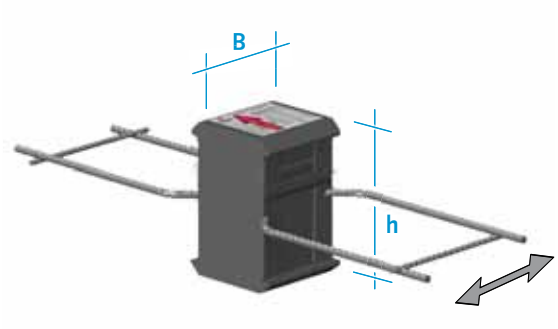
Application: Simply supported balcony on columns

HIT-HP HT1–5 – High Performance with 80 mm insulation thickness
HIT-SP HT1–5 – Superior Performance with 120 mm insulation thickness

Content	Type	Page
Product variations / load bearing capacities	HIT-HP HT1, HIT-SP HT1	103
Product variations / load bearing capacities	HIT-HP HT2, HIT-SP HT2	104
Product variations / load bearing capacities	HIT-HP HT3, HIT-SP HT3	105
Positioning / joint spacings	HIT-HP HT1–3, HIT-SP HT1–3	106
Product variations / load bearing capacities	HIT-HP HT4, HIT-SP HT4	107
Product variations / load bearing capacities	HIT-HP HT5, HIT-SP HT5	108
Positioning / joint spacings	HIT-HP HT4–5, HIT-SP HT4–5	110

Ordering example

HIT-HP	HT1	- hh	-	010
HIT-SP	HT1	- hh	-	015
❶ ❷	❸	❹		❺



Type designation

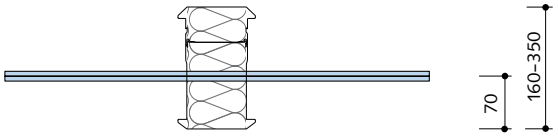
① Product group
② Joint spacing 80 mm (HP) or 120 mm (SP)
③ Connection type
④ Element height [cm]
⑤ Element width [cm]

Load bearing capacities and dimensions

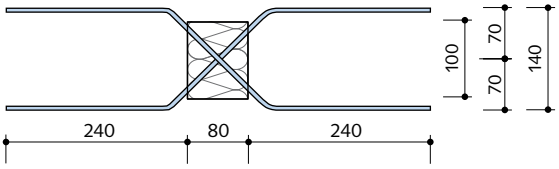
Horizontal forces parallel to the insulation plane

HIT-HP/SP HT1 Components			Design values			
Reinforcement		Element width B	*C20/25*		C25/30	
Shear bars	Tension/ compression bars	HIT-HP HIT-SP [mm]	*H_{Rd} ∥ [kN/ element]*	*H_{Rd} ⊥ [kN/ element]*	H_{Rd} ∥ [kN/ element]	H_{Rd} ⊥ [kN/ element]
2 × ø8	–	100 150	*±9.9*	*0*	±11.5	0

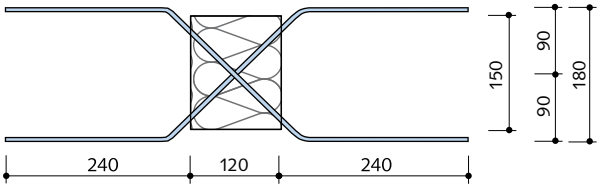
Vertical section HIT-HP/SP HT1



Top view HIT-HP HT1



Top view HIT-SP HT1



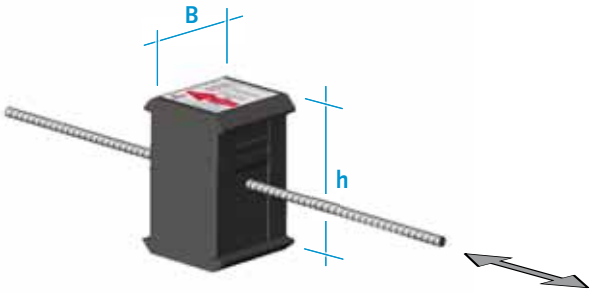
Dimensions in [mm]

HIT Type	HP	SP
Insulation thickness [mm]	80	120
Element width B [cm]	10	15
Possible HIT Element height h [cm]	16 – 35	

HIT-HP HT2, HIT-SP HT2

Ordering example

HIT-HP	**HT2**	-	**hh**	-	**010**
HIT-SP	**HT2**	-	**hh**	-	**015**
❶ ❷	❸		❹		❺



Type designation

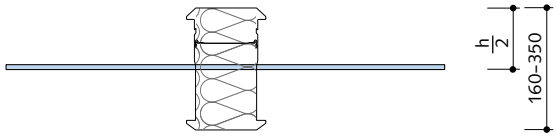
① Product group
② Joint spacing 80 mm (HP) or 120 mm (SP)
③ Connection type
④ Element height [cm]
⑤ Element width [cm]

Load bearing capacities and dimensions

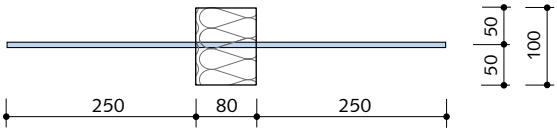
Horizontal forces perpendicular to the insulation plane

HIT-HP/SP HT2 Components			Design values			
Reinforcement		Element width B	*C20/25*		C25/30	
Shear bars	Tension/ compression bars	HIT-HP HIT-SP [mm]	*H_{Rd} ∥ [kN/ element]*	*H_{Rd} ⊥ [kN/ element]*	H_{Rd} ∥ [kN/ element]	H_{Rd} ⊥ [kN/ element]
–	1 × ø10	100 150	*0*	*±18.2*	0	±21.2

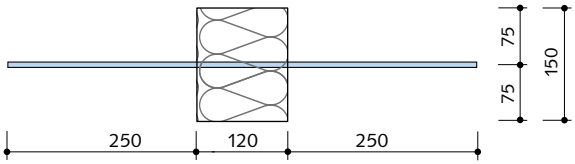
Vertical section HIT-HP/SP HT2



Top view HIT-HP HT2



Top view HIT-SP HT2

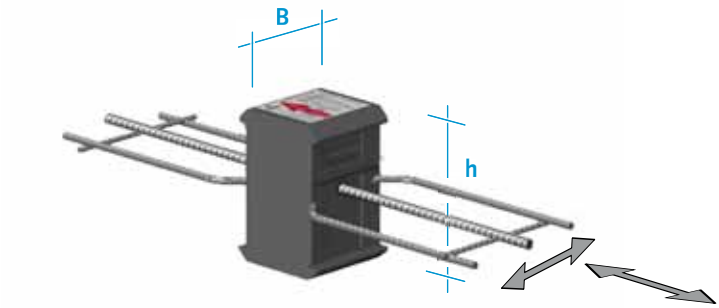


Dimensions in [mm]

HIT Type	HP	SP
Insulation thickness [mm]	80	120
Element width B [cm]	10	15
Possible slab thickness h [cm]	16 – 35	

Ordering example

HIT-HP	HT3	-	hh	-	010
HIT-SP	HT3	-	hh	-	015
❶ ❷	❸		❹		❺



Type designation

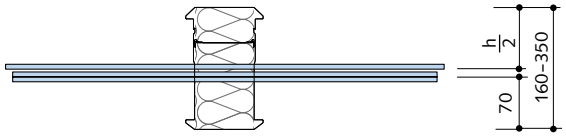
① Product group
② Joint spacing 80 mm (HP) or 120 mm (SP)
③ Connection type
④ Element height [cm]
⑤ Element width [cm]

Load bearing capacities and dimensions

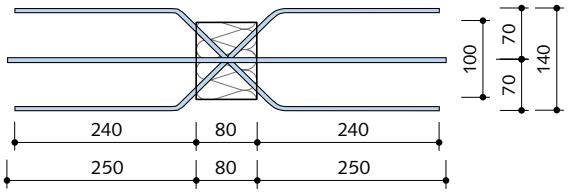
Horizontal forces parallel and perpendicular to the insulation plane

HIT-HP/SP HT3 Components			Design values			
Reinforcement		Element width B	*C20/25*		C25/30	
Shear bars	Tension/ compression bars	HIT-HP HIT-SP [mm]	*H_{Rd} ∥ [kN/ element]*	*H_{Rd} ⊥ [kN/ element]*	H_{Rd} ∥ [kN/ element]	H_{Rd} ⊥ [kN/ element]
2 × ø8	1 × ø10	100 150	*±9.9*	*±18.2*	±11.5	±21.2

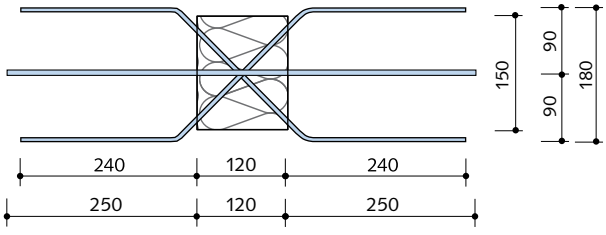
Vertical section HIT-HP/SP HT3



Top view HIT-HP HT3



Top view HIT-SP HT3



Dimensions in [mm]

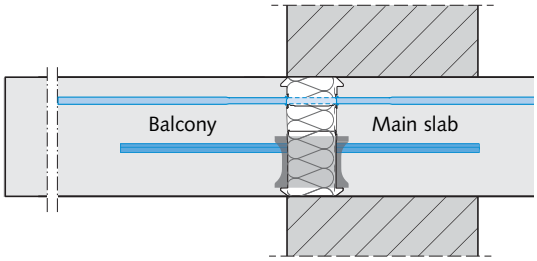
HIT Type	HP	SP
Insulation thickness [mm]	80	120
Element width B [cm]	10	15
Possible slab thickness h [cm]	16 – 35	

Position of the HIT-HT units in the cross section of a wall in combination with HIT Insulated connections

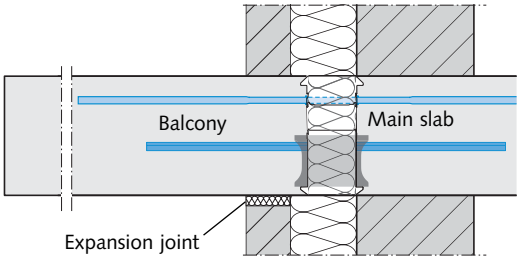
HALFEN HIT-HT Elements complement the HIT Product range and are used in combination with HIT Insulated connections.

HIT-HP/SP HT1
in combination with
HIT-HP/SP MVX

Single-leaf masonry with balcony at main slab level

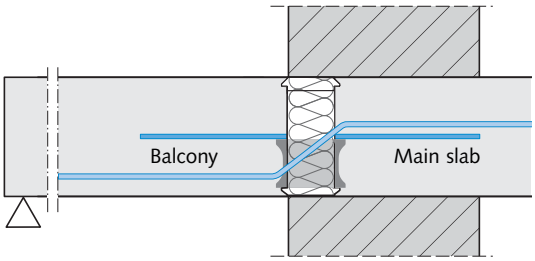


Double-leaf masonry with balcony at main slab level

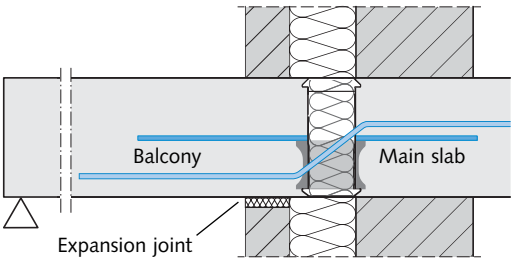


HIT-HP/SP HT2
in combination with
HIT-HP/SP ZVX or
HIT-HP/SP ZDX

Monolithic masonry with balcony at main slab level



Double-leaf masonry with balcony at main slab level



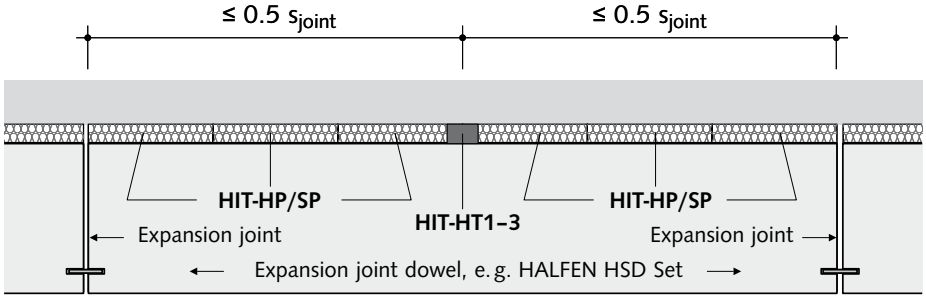
Refer to the installation instructions for installation diagrams, download at **www.halfen.com**.

Joint spacings

Expansion joints must be provided to limit the effect of temperature fluctuation in the external concrete components at a right angle to the insulation line of the HIT Elements.

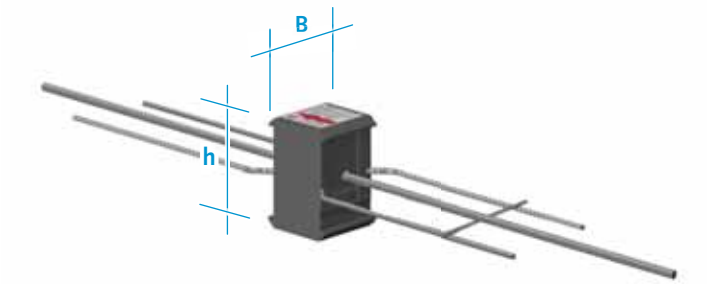
In straight, cantilevered balcony slabs the distance between joints must not exceed the maximum expansion joint spacing of s_{joint}.

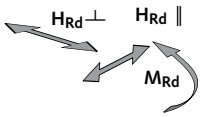
For balcony slabs using HIT-HP/HIT-SP HT1 and HT3 elements, the maximum edge distances of the HT Elements must be limited to 0.5 s_{joint} of the main HIT Element. → see page 40



Ordering example

HIT-HP	HT4	-	hh	-	010
HIT-SP	HT4	-	hh	-	015
❶ ❷	❸		❹		❺





Type designation

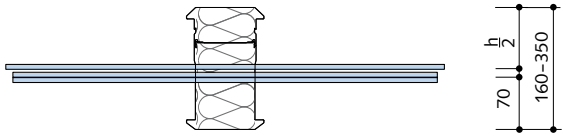
① Product group
② Joint spacing 80 mm (HP) or 120 mm (SP)
③ Connection type
④ Element height [cm]
⑤ Element width [cm]

Load bearing capacities and dimensions

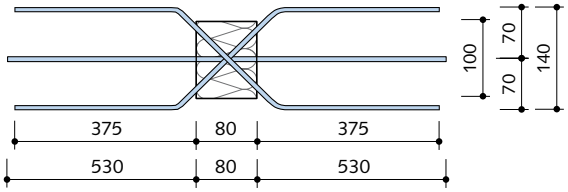
Horizontal forces parallel and perpendicular to the insulation plane

HIT-HP/SP HT4 Components			Design values			
Reinforcement		Element width B	*C20/25*		C25/30	
Shear bars	Tension / compression bars	HIT-HP HIT-SP [mm]	*H_{Rd} ∥ [kN/ element]*	*H_{Rd} ⊥ [kN/ element]*	H_{Rd} ∥ [kN/ element]	H_{Rd} ⊥ [kN/ element]
2 × ø8	1 × ø12	100 150	*±15.5*	*±43.7*	±15.5	±49.2

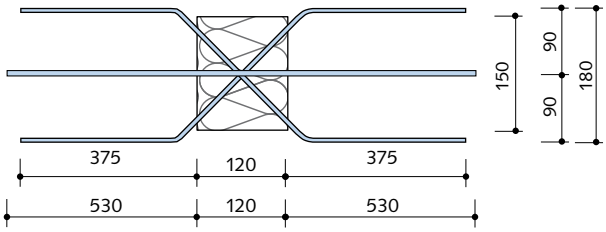
Vertical section HIT-HP/SP HT4



Top view HIT-HP HT4



Top view HIT-SP HT4



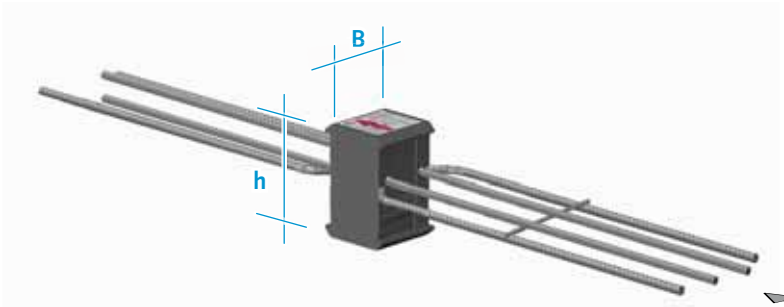
Dimensions in [mm]

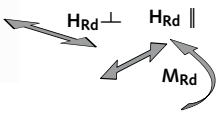
M_{Rd}
Load bearing capacity values for lifting moments are on page 109 of this catalogue.

HIT Type	HP	SP
Insulation thickness [mm]	80	120
Element width B [cm]	10	15
Possible slab thickness h [cm]	16 – 35	

Ordering example

HIT-HP	HT5	-	hh	-	010
HIT-SP	HT5	-	hh	-	015
❶ ❷	❸		❹		❺





Type designation

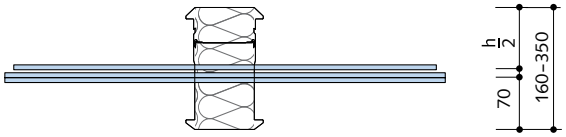
① Product group
② Joint spacing 80 mm (HP) or 120 mm (SP)
③ Connection type
④ Element height [cm]
⑤ Element width [cm]

Load bearing capacities and dimensions

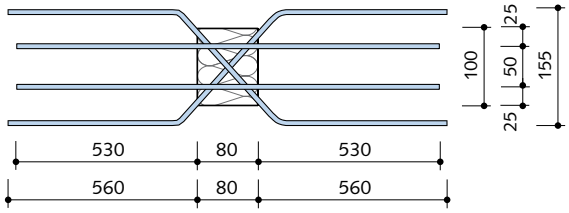
Horizontal forces parallel and perpendicular to the insulation plane

HIT-HP/SP HT5 Components			Design values			
Reinforcement		Element width B	C20/25		C25/30	
Shear bars	Tension/ compression bars	HIT-HP HIT-SP [mm]	H_{Rd} ∥ [kN/ element]	H_{Rd} ⊥ [kN/ element]	H_{Rd} ∥ [kN/ element]	H_{Rd} ⊥ [kN/ element]
2 × ø12	2 × ø12	100 150	±34.6	±87.5	±34.8	±98.4

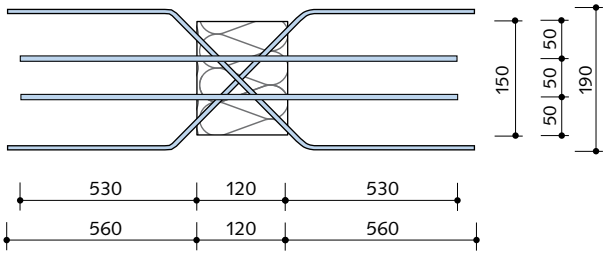
Vertical section HIT-HP/SP HT5



Top view HIT-HP HT5



Top view HIT-SP HT5



Dimensions in [mm]

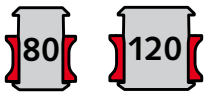
M_{Rd}
Load bearing capacity values for lifting moments are on page 109 of this catalogue.

HIT Type	HP	SP
Insulation thickness [mm]	80	120
Element width B [cm]	10	15
Possible slab thickness h [cm]	16 – 35	

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

Lifting moment

Concrete strength: *C20/25* ≥C25/30



Type	HIT-HP ... / HIT-SP ...			HT4		HT5	
Concrete cover [mm]	30	35	50				
Design values **M_{Rd} [kN/element]** for slab thickness [mm] and $H_{Rd} \perp \leq 0$			180	*1.4*	1.5	*2.7*	3.1
		160	190	*1.6*	1.8	*3.2*	3.5
	160	170	200	*1.8*	2.0	*3.6*	4.0
	170	180	210	*2.0*	2.3	*4.0*	4.5
	180	**190**	**220**	***2.2***	**2.5**	***4.5***	**5.0**
	190	200	230	*2.5*	2.8	*4.9*	5.5
	200	210	240	*2.7*	3.0	*5.3*	6.0
	210	220	250	*2.9*	3.2	*5.8*	6.5
	220	**230**	**260**	***3.1***	**3.5**	***6.2***	**7.0**
	230	240	270	*3.3*	3.7	*6.7*	7.5
	240	250	280	*3.5*	4.0	*7.1*	8.0
	250	260	290	*3.8*	4.2	*7.5*	8.5
	260	**270**	**300**	***4.0***	**4.5**	***8.0***	**9.0**
	270	280	310	*4.2*	4.7	*8.4*	9.4
	280	290	320	*4.4*	5.0	*8.8*	9.9
	290	300	330	*4.6*	5.2	*9.3*	10.4
	300	**310**	**340**	***4.9***	**5.5**	***9.7***	**10.9**
	310	320	350	*5.1*	5.7	*10.2*	11.4
	320	330		*5.3*	6.0	*10.6*	11.9
	330	340		*5.5*	6.2	*11.0*	12.4
	340	350		*5.7*	6.4	*11.5*	12.9
	350			*6.0*	6.7	*11.9*	13.4

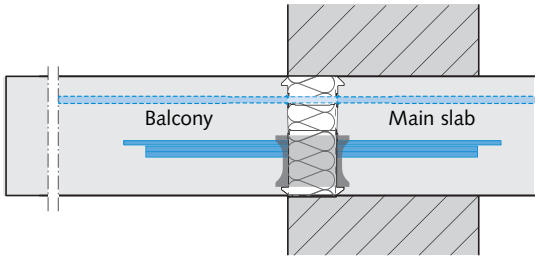
Lifting moment +M_{Rd} only in combination with HIT-MVX Elements

Position of the combined HIT-HT4/-HT5 Elements in the cross section of a wall

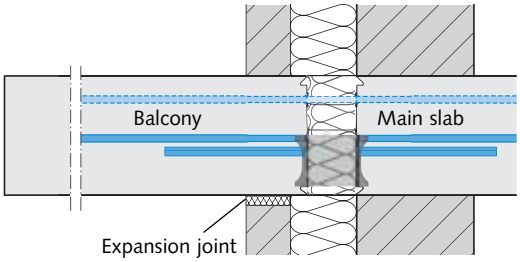
HALFEN HIT-HT4–5 Elements complement the HIT Product range and are only to be used in combination with HIT Balcony connection elements of types HIT-MVX.

HIT-HP/SP HT4 and HIT-HP/SP HT5 in combination with HIT-HP/SP MVX

Monolithic masonry with balcony at main slab level



Double-leaf masonry with balcony at main slab level

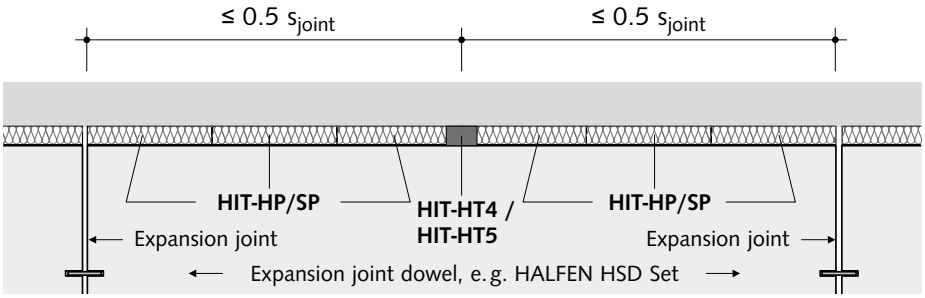


Joint spacings

Expansion joints must be provided to limit the effect of temperature fluctuation 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 the maximum expansion joint spacing of s_{joint}.

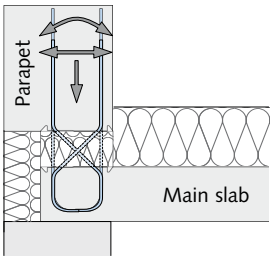
For balcony slabs using HIT-HP/HIT-SP HT4 and HT5 elements, the maximum edge distances of the HT Elements must be limited to 0.5 s_{joint} of the main HIT Element. → see page 40.



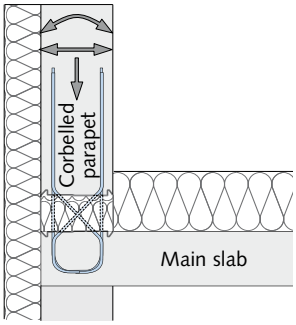
6

- Insulated connections to form a thermal barrier between the main slab and a parapet or a corbelled parapet
- Transfer of normal forces as well as positive and negative shear forces and bending moments

CE REI 120



Application: Floor slab with parapet



Application: Floor slab with high parapet or corbelled parapet

HIT-HP AT – **High Performance** with 80 mm insulation thickness
HIT-SP AT – **Superior Performance** with 120 mm insulation thickness

Content	Type	Page
Product variations / Load range	HIT-HP AT, HIT-SP AT	112
Product description	HIT-HP AT, HIT-SP AT	113
Calculation tables / Load bearing capacity values	HIT-HP AT, HIT-SP AT	115
Design example	HIT-HP AT, HIT-SP AT	117
On-site reinforcement	HIT-HP AT, HIT-SP AT	118

HIT-HP AT, HIT-SP AT

Product types – Load range

Possible combinations of shear bars and tension/compression loops are shown in the table below; includes using both HP and SP types of HIT Elements.

Possible combinations of structural elements

Element width B = 25 cm		Number of tension/compression loops ⌀8 mm	
		2	3
Number of shear bars ⌀6	1	●	●
in both directions	2	●	●
Type		AT1	AT2
Applicable parapet heights H (without joint)		≥ 22 cm	≥ 30 cm

● = HP and SP

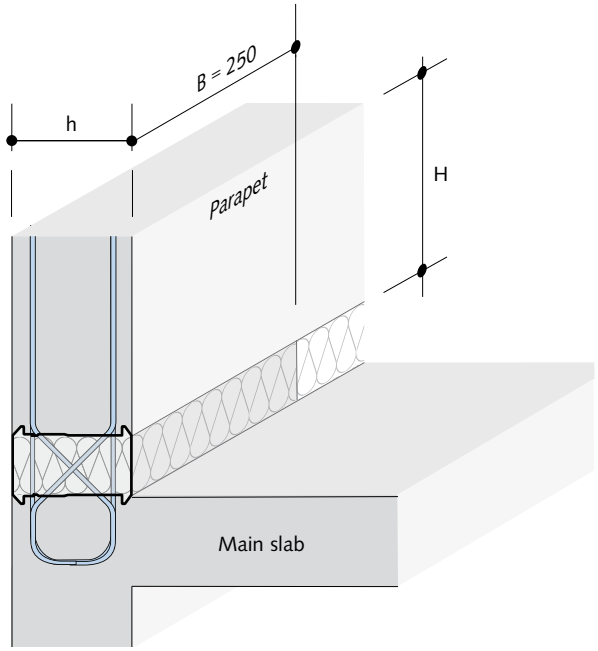
Ordering example

HIT-HP	AT 2	-	0302	-	16	- 025
HIT-SP	AT 1	-	0201	-	25	- 025
❶ ❷	❸		❹ ❺		❻	❼

Type designation

① Product group
② Joint spacing 80 mm (HP) or 120 mm (SP)
③ Connection type
④ Number of tension/compression loops
⑤ Number of shear bars per side
⑥ Element height h [cm]
⑦ Element width B [cm]

Possible parapet width



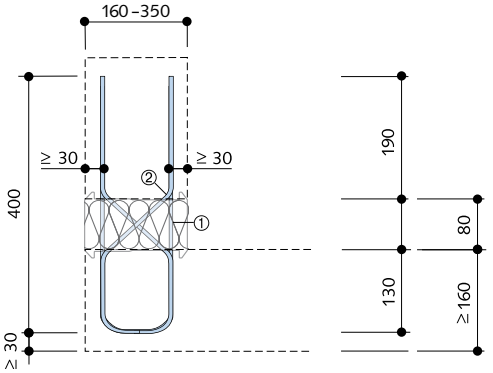
The illustration shows an application where the parapet width is identical to the height h of the HIT-AT Element.

Possible slab thickness h [cm]	16 – 35*
Slab height	≥160 mm

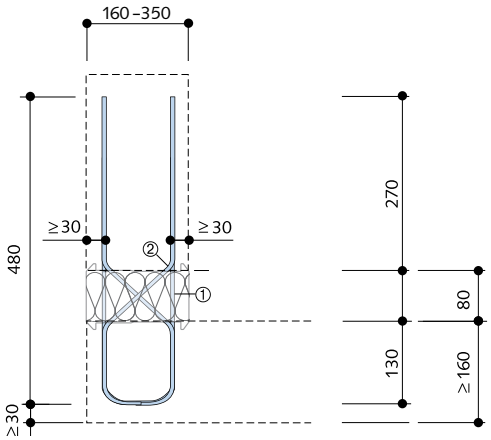
*Load bearing capacity values for slab heights >25 cm available on request

Product description – cross sections and top views

Cross section: HIT-HP AT1

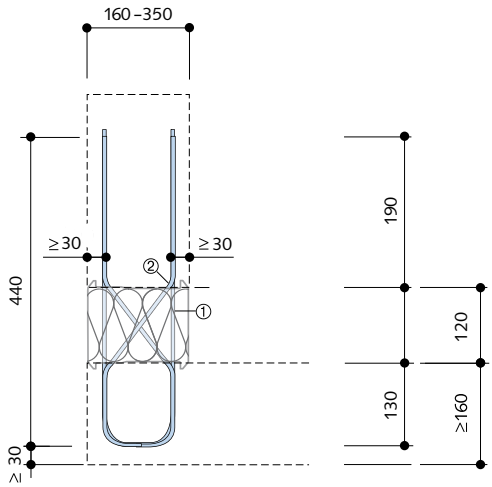


HIT-HP AT2

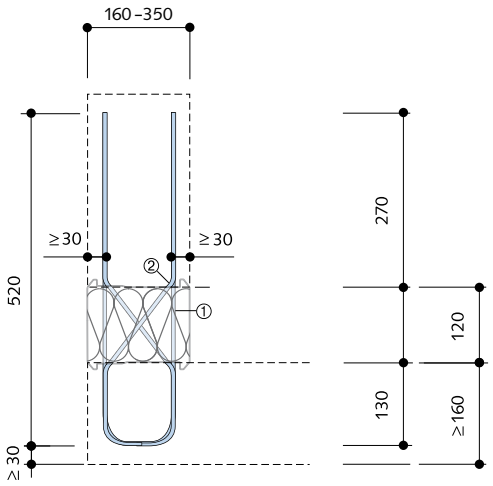


Dimensions in [mm]

Cross section: HIT-SP AT1

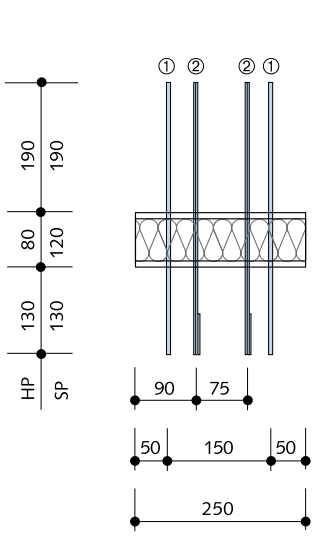


HIT-SP AT2



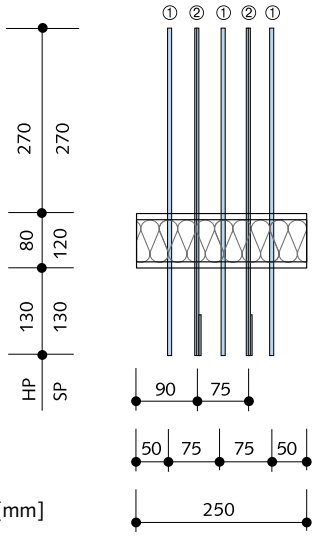
Dimensions in [mm]

Top view: HIT-HP/SP AT1 – bar spacings



① Tension/compression loops: ø8 mm, B500B NR
② Shear bars: ø6 mm, B500B NR

HIT-HP/SP AT2 – bar spacings

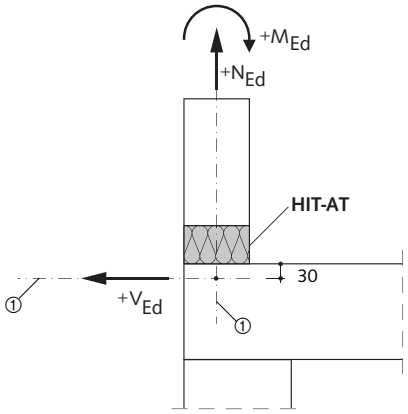


① Tension/compression loops: ø8 mm, B500B NR
② Shear bars: ø6 mm, B500B NR

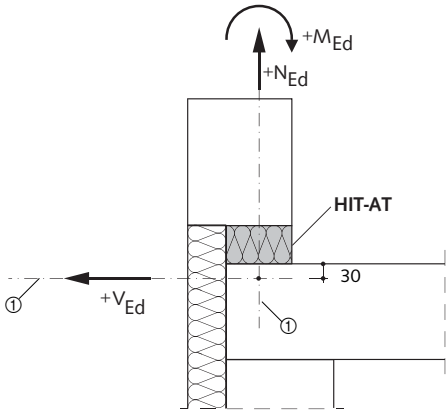
Dimensions in [mm]

Structural system

Sign convention for calculation



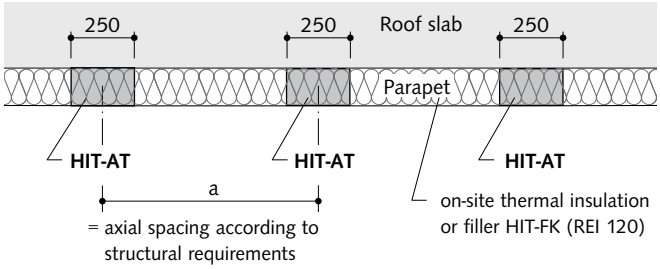
① Design section



① Design section

Dimensions in [mm]

Top view:
Roof slab with connected parapet



Determining the axial spacing a

Calculation of the maximum element spacing of the HIT-AT units is dependent on the effect of moment $\pm m_{Ed}$ [kNm/m], the normal force n_{Ed} [kN/m] and the shear load $\pm v_{Ed}$ [kN/m]

⇨ **see table (page 115f.)**

- **Step 1:** Determine the relationship (ratio) of the acting loads $|n_{Ed}/m_{Ed}|$ [1/m]
- **Step 2:** With $|n_{Ed}/m_{Ed}|$; select N_{Rd} from the **"Calculation tables"** depending on the element height h and the HIT-AT product type (AT1 or AT2). Intermediate values may be linearly interpolated.
- **Step 3:** Select the value for V_{Rd} in the table "**Load bearing capacity values**" for the respective HIT-AT variant depending on the element height h, of the selected product type, HIT-AT1 or HIT-AT2, and the shear load.
- **Step 4:** Calculate the element spacing a.
  $a_{max,1} = N_{Rd}/n_{Ed}$ [m]
  $a_{max,2} = V_{Rd}/v_{Ed}$ [m]
  $a = \min (a_{max,1} ; a_{max,2})$
- **Step 5: (optional)** **Check** the calculated load bearing capacities (per element).
  $n_{Ed} \cdot a = N_{Ed} \leq N_{Rd}$
  $m_{Ed} \cdot a = M_{Ed} \leq M_{Rd}$
  $v_{Ed} \cdot a = V_{Ed} \leq V_{Rd}$

Calculation tables

Calculation tables

Concrete strength: Parapet ≥C25/30
Main slab ≥C20/25

80

HIT-HP AT1	Element height h [mm]			
	160–170	180–190	200–210	220–250
$\lvert n_{Ed}/m_{Ed} \rvert$ [1/m]	N_{Rd} [kN/element]			
0	– 0.0	– 0.0	– 0.0	– 0.0
2	– 4.5	– 5.4	– 6.3	– 7.0
4	– 8.3	– 9.8	–11.1	–12.1
6	–11.4	–13.3	–15.0	–16.0
8	–14.2	–16.3	–18.2	–19.1
10	–16.5	–18.8	–20.9	–21.5
12	–18.5	–21.0	–23.2	–23.6
20	–24.7	–27.3	–29.5	–29.2
30	–29.5	–32.1	–34.3	–33.1
40	–32.8	–35.3	–37.2	–35.5
50	–35.1	–37.4	–39.3	–37.1
60	–36.8	–39.0	–40.8	–38.2

HIT-HP AT2	Element height h [mm]			
	160–170	180–190	200–210	220–250
$\lvert n_{Ed}/m_{Ed} \rvert$ [1/m]	N_{Rd} [kN/element]			
0	– 0.0	– 0.0	– 0.0	– 0.0
2	– 9.6	–11.5	–13.3	–14.8
4	–17.5	–20.7	–23.6	–25.6
6	–24.3	–28.2	–31.9	–33.8
8	–30.0	–34.5	–38.6	–40.4
10	–35.0	–39.9	–44.3	–45.7
12	–39.3	–44.5	–49.1	–50.0

Load bearing capacities for slab thicknesses > 25 cm are available on request.
See inside back cover for contact information.

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

V_{Rd} in both directions

Concrete strength: Parapet ≥C25/30
Main slab ≥C20/25

80

HIT-HP AT1	V_{Rd} [kN/element] for element height h [mm]			
	160–170	180–190	200–210	220–250
HIT-HP AT1-0201-hh-025	± 6.2		± 6.8	± 7.9
HIT-HP AT1-0202-hh-025	±12.4		±13.6	±15.8

HIT-HP AT2	V_{Rd} [kN/element] for element height h [mm]			
	160–170	180–190	200–210	220–250
HIT-HP AT2-0301-hh-025	± 7.9		± 8.7	±10.1
HIT-HP AT2-0302-hh-025	±15.8		±17.4	±20.1

M_{Rd} is dependent on N_{Rd}

HIT-HP AT1	M_{Rd} [kNm/element] for element height h [mm]			
N_{Rd} [kN/element]	160–170	180–190	200–210	220–250
0	±2.5	±3.0	±3.6	±4.1
– 5	±2.2	±2.7	±3.2	±3.7
–10	±2.0	±2.4	±2.9	±3.2
–15	±1.7	±2.1	±2.5	±2.8
–20	±1.5	±1.8	±2.2	±2.3
–25	±1.2	±1.5	±1.8	±1.8
–30	±1.0	±1.2	±1.4	±1.4

HIT-HP AT2	M_{Rd} [kNm/element] for element height h [mm]			
N_{Rd} [kN/element]	160–170	180–190	200–210	220–250
0	±5.3	±6.4	±7.6	±8.7
– 5	±5.0	±6.1	±7.2	±8.3
–10	±4.8	±5.8	±6.9	±7.8
–15	±4.5	±5.5	±6.5	±7.4
–20	±4.3	±5.2	±6.2	±6.9
–25	±4.0	±4.9	±5.8	±6.4
–30	±3.7	±4.6	±5.4	±6.0

Calculation tables

Calculation tables

Concrete strength: Parapet ≥C25/30
Main slab ≥C20/25

120

HIT-SP AT1	Element height h [mm]			
	160–170	180–190	200–210	220–250
$\lvert n_{Ed}/m_{Ed} \rvert$ [1/m]	N_{Rd} [kN/element]			
0	– 0.0	– 0.0	– 0.0	– 0.0
2	– 3.6	– 4.3	– 5.0	– 5.6
4	– 6.6	– 7.8	– 8.9	– 9.7
6	–9.2	–10.7	–12.0	–12.8
8	–11.3	–13.0	–14.6	–15.2
10	–13.2	–15.1	–16.7	–17.2
12	–14.8	–16.8	–18.5	–18.9
20	–19.7	–21.9	–23.6	–23.3
30	–23.6	–25.7	–27.4	–26.5
40	–26.2	–28.2	–29.8	–28.4
50	–28.1	–29.9	–31.4	–29.7
60	–29.4	–31.2	–32.6	–30.6

HIT-SP AT2	Element height h [mm]			
	160–170	180–190	200–210	220–250
$\lvert n_{Ed}/m_{Ed} \rvert$ [1/m]	N_{Rd} [kN/element]			
0	– 0.0	– 0.0	– 0.0	– 0.0
2	– 8.0	– 9.6	–11.1	–12.4
4	–14.7	–17.3	–19.8	–21.5
6	–20.3	–23.7	–26.7	–28.4
8	–25.2	–29.0	–32.4	–33.9
10	–29.3	–33.5	–37.1	–38.3
12	–33.0	–37.3	–41.2	–42.0

Load bearing capacities for slab thicknesses > 25 cm are available on request.
See inside back cover for contact information.

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

V_{Rd} in both directions

Concrete strength: Parapet ≥C25/30
Main slab ≥C20/25

120

HIT-SP AT1	V_{Rd} [kN/element] for element height h [mm]			
	160–170	180–190	200–210	220–250
HIT-SP AT1-0201-hh-025	± 5.1		± 5.9	± 6.8
HIT-SP AT1-0202-hh-025	±10.2		±11.7	±13.6

HIT-SP AT2	V_{Rd} [kN/element] for element height h [mm]			
	160–170	180–190	200–210	220–250
HIT-SP AT2-0301-hh-025	± 6.5		± 7.5	± 8.7
HIT-SP AT2-0302-hh-025	±13.0		±15.0	±17.4

M_{Rd} is dependent on N_{Rd}

HIT-SP AT1	M_{Rd} [kNm/element] for element height h [mm]			
N_{Rd} [kN/element]	160–170	180–190	200–210	220–250
0	±2.0	±2.4	±2.9	±3.3
– 5	±1.7	±2.1	±2.5	±2.8
–10	±1.5	±1.8	±2.1	±2.4
–15	±1.2	±1.5	±1.8	±1.9
–20	±1.0	±1.2	±1.4	±1.5
–25	±0.7	±0.9	±1.1	±1.0
–30	±0.5	±0.6	±0.7	±0.6

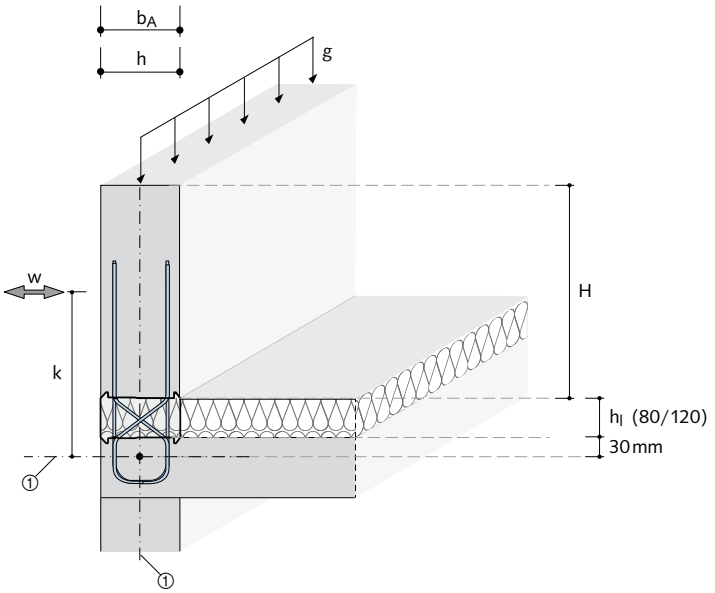
HIT-SP AT2	M_{Rd} [kNm/element] for element height h [mm]			
N_{Rd} [kN/element]	160–170	180–190	200–210	220–250
0	±4.4	±5.4	±6.4	±7.3
– 5	±4.2	±5.1	±6.0	±6.9
–10	±3.9	±4.8	±5.6	±6.4
–15	±3.7	±4.5	±5.3	±5.9
–20	±3.4	±4.2	±4.9	±5.5
–25	±3.2	±3.9	±4.6	±5.0
–30	±2.9	±3.6	±4.2	±4.6

Design example

Planned: Joint width 12 cm
HIT-SP AT2

Required: Axial spacing a [m]
of the elements (see page 97)

Assumed: H = 1.40 m
b_A = h = 0.20 m
h_l = 0.12 m



① Design section

Determining the loads

$g_d = H \cdot b_A \cdot \rho_{concrete} \cdot \gamma_G$

$g_d = 1.40\,m \cdot 0.20\,m \cdot 25\,kN/m^3 \cdot 1.35 = 9.45\,kN/m$

Assumption: w_k = wind pressure + wind suction = 2.6 kN/m²
(To simplify calculation the parapet height is assumed to be the same on both sides; wind load / left = wind load / right)

$w_d = w_k \cdot (H + h_l + 0.03) \cdot \gamma_Q$

$w_d = 2.6\,kN/m^2 \cdot 1.55\,m \cdot 1.5 = 6.05\,kN/m$

$k = (0.03\,m + h_l + H) \cdot 0.5$

$k = (0.03\,m + 0.12\,m + 1.40\,m) \cdot 0.5 = 0.78\,m$

Determining the axial spacing

$n_{Ed} = -9.45\,kN/m$

$m_{Ed} = 6.05\,kN/m \cdot 0.78\,m = 4.72\,kNm/m$

$v_{Ed} = -6.05\,kN/m$

Method / sign convention: see → page 114

Step 1: $|n_{Ed}/m_{Ed}| = |-9.45/4.72| = 2.00\ [1/m]$

Step 2: $N_{Rd} = -11.1\,kN/element$

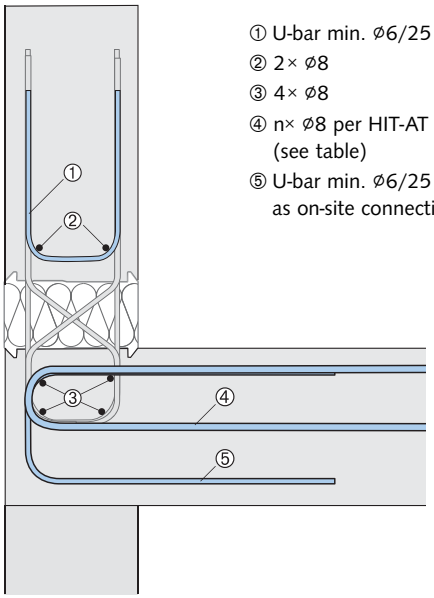
Step 3: $V_{Rd} = \pm 7.5\,kN/element$ (for HIT-SP AT2-0301-20-025)

Step 4: $a_{max1} = -11.1/-9.45 = 1.17\,m$
$a_{max2} = -7.5/-6.05 = 1.23\,m$
⇨ **a = 1.17 m**

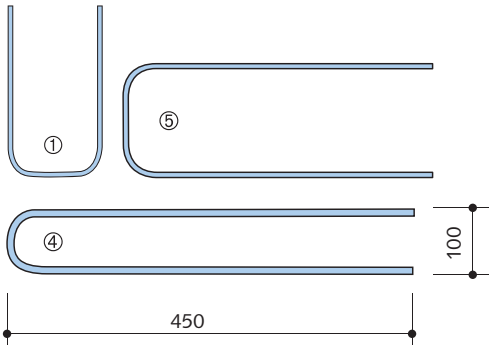
Step 5:
$N_{Ed} = -9.45 \cdot 1.17 = -11.06\,kN/element$
$M_{Ed} = 4.72 \cdot 1.17 = 5.52\,kNm/element < M_{Rd} = 5.54\,kNm/element$
$V_{Ed} = -6.05 \cdot 1.17 = -7.08\,kN/element < V_{Rd} = -7.5\,kN/element$

⇨ HIT-SP AT2-0301-20-025 with a maximum spacing of 1.17 m.

On-site reinforcement HIT-AT



① U-bar min. ø6/25 cm
② 2× ø8
③ 4× ø8
④ n× ø8 per HIT-AT Element (see table)
⑤ U-bar min. ø6/25 cm as on-site connecting reinforcement

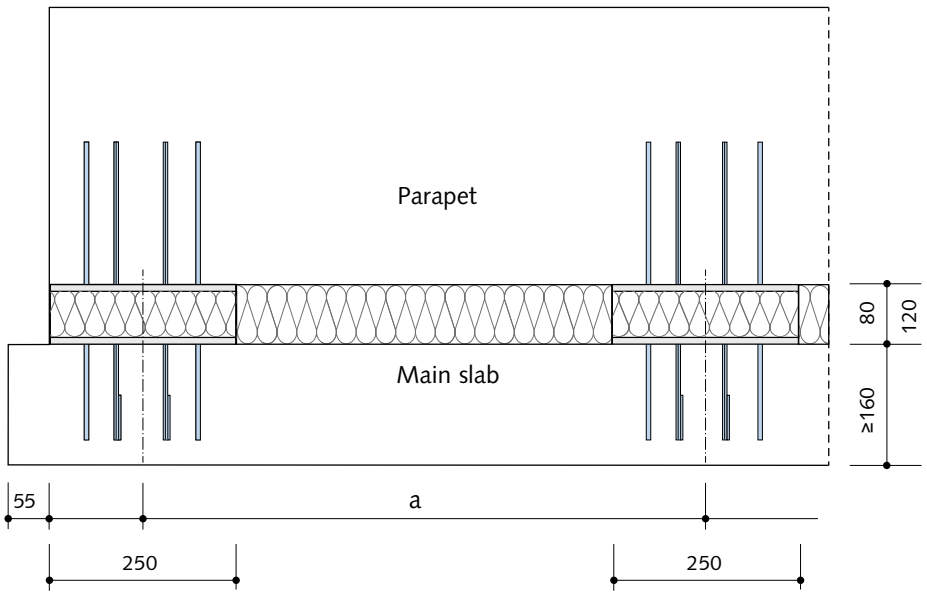


HIT-HP AT	Number **n** connecting bars ④
HIT-HP AT1	3
HIT-HP AT2	4
HIT-SP AT	**Number n connecting bars ④**
HIT-SP AT1	3
HIT-SP AT2	3

Edge distances

Edge distance

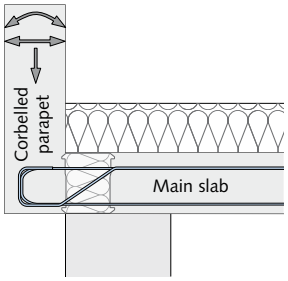
The HIT-AT Element can be installed flush with the concrete edge at the end of the parapet. The minimal distance from the side edge of the main concrete slab to the HIT-AT is 55 mm.



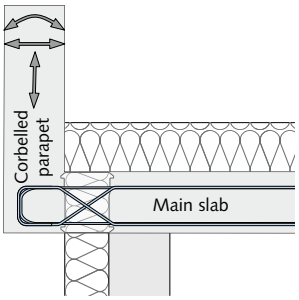
An installation diagram can be found on our website; **www.halfen.com**.

HIT-HP FT, HIT-SP FT

- Thermal insulated connections for application between the main slab and corbelled parapet
- Transfer of normal forces as well as shear forces and bending moments



Cross section:
Floor slab with corbelled parapet
and thermal insulating masonry



Cross section:
Floor slab with corbelled parapet
and external thermal insulation composite system

HIT-HP FT – **High Performance** with 80 mm insulation thickness
HIT-SP FT – **Superior Performance** with 120 mm insulation thickness

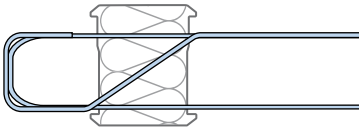
Content	Type	Page
Product variations / Load range	HIT-HP FT, HIT-SP FT	120
Product description	HIT-HP FT, HIT-SP FT	121
Calculation tables / Load bearing capacity values	HIT-HP FT, HIT-SP FT	123
On-site reinforcement	HIT-HP FT, HIT-SP FT	125

Product types – Load range

Listed in the table below are possible combinations of shear bars and tension/compression loops; this includes HIT Elements type HP and SP.

HIT-FT1: Possible combinations of structural elements

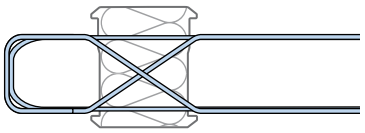
Element width B = 25 cm		**Number of tension/compression loops ⌀8**
		2
Number of shear bars ⌀6 **in one direction**	2	●
	3	●
● = HP and SP		



HIT-FT1

HIT-FT2: Possible combinations of structural elements

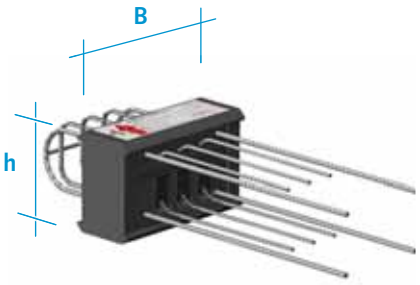
Element width B = 25 cm		**Number of tension/compression loops ⌀8**
		2
Number of shear bars ⌀6 **in both directions**	2	●
	3	●
● = HP and SP		



HIT-FT2

Ordering example

HIT-HP	**FT1**	**-**	**02 02**	**-**	**16**	**-**	**025**
HIT-SP	**FT2**	**-**	**02 03**	**-**	**25**	**-**	**025**
❶ ❷	❸		❹ ❺		❻		❼



Type designation

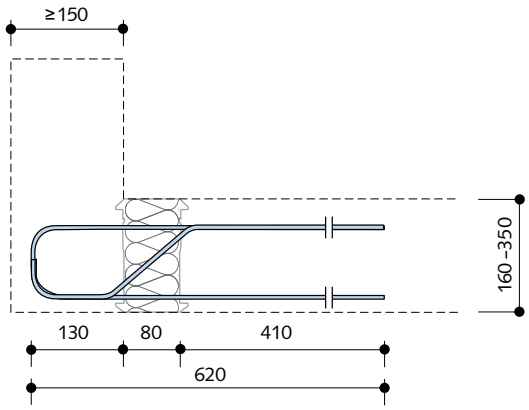
① Product group
② Joint spacing 80 mm (HP) or 120 mm (SP)
③ Connection type
④ Number of tension/compression loops
⑤ Number of shear bars per side
⑥ Element height h [cm]
⑦ Element width B [cm]

Corbelled parapets, available widths

Possible slab thickness h [cm]	16 – 35*
Corbelled parapets, width [cm]	≥ 15
*Load bearing capacities for slab thicknesses > 25 cm available on request	

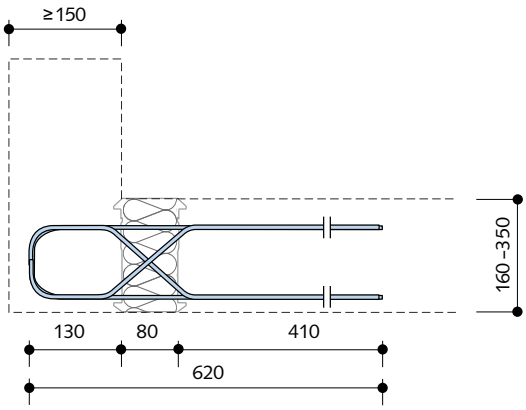
Product description – cross sections and top views

Cross section:
HIT-HP FT1

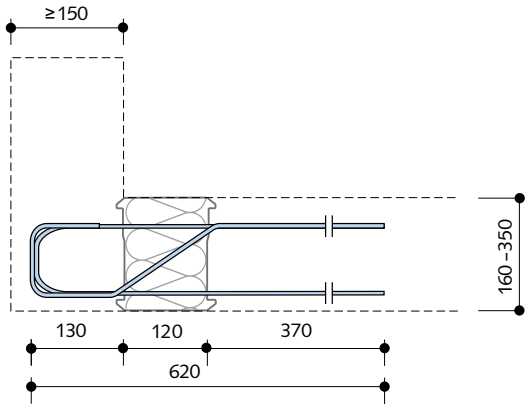


Dimensions in [mm]

HIT-HP FT2

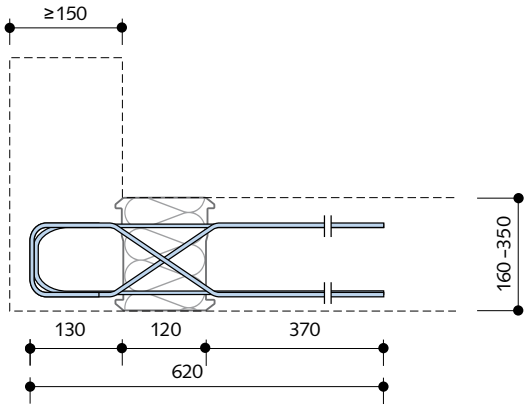


Cross section:
HIT-SP FT1



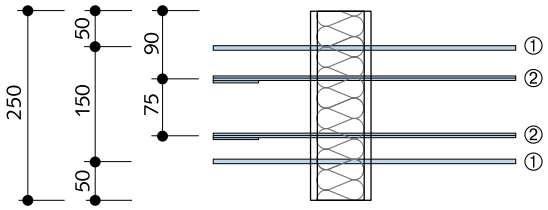
Dimensions in [mm]

HIT-SP FT2

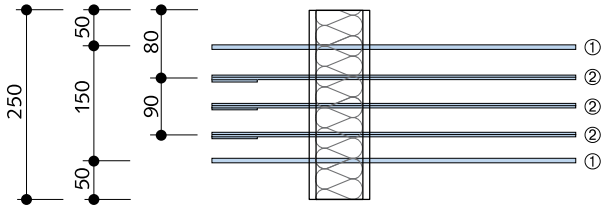


Top view:
HIT-HP/SP FT1 – Bar spacings
HIT-HP/SP FT2 – Bar spacings

- 2 Shear bars



- 3 Shear bars

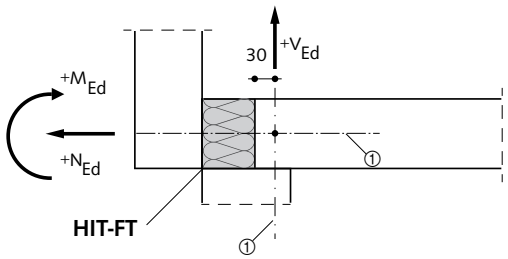


Dimensions in [mm]

① Tension/compression loops: ø8 mm, B500B NR
② Shear bars: ø6 mm, B500B NR,
with type HIT-FT1 only in one direction

Structural system

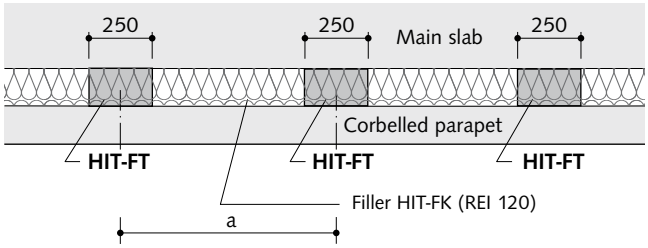
Sign convention for calculation



① Design section

Dimensions in [mm]

Top view:
Main slab with attached corbelled parapet



= axial spacing according to structural requirements

Determining of axial spacing a

Calculation of the maximum element spacing of the HIT-FT units is dependent on the effect of moment ±m_{Ed} [kNm/m], the normal force n_{Ed} [kN/m] and the shear load ±v_{Ed} [kN/m]

⇨ **see table (page 123 f.)**

- **Step 1:** Determine the relationship (ratio) of the acting loads $n_{Ed}/|m_{Ed}|$ [1/m]
- **Step 2:** With $n_{Ed}/|m_{Ed}|$ select N_{Rd} from the **"Calculation tables"**, depending on the element height h and the HIT-AT product type (HIT-FT1 or HIT-FT2). Intermediate values may be linearly interpolated.
- **Step 3:** Select the value for V_{Rd} in the table "**Load bearing capacity values**" for the respective HIT-AT variant depending on the element height h, the concrete strength class and the shear load in the main slab.
- **Step 4:** Calculate the element spacing a

  $a_{max,1} = N_{Rd}/n_{Ed}$ [m]
  $a_{max,2} = V_{Rd}/v_{Ed}$ [m]
  $a = \min(a_{max,1}; a_{max,2})$

- **Step 5: (optional)** **Check** the calculated load bearing capacities (per element).

  $n_{Ed} \cdot a = N_{Ed} \le N_{Rd}$
  $m_{Ed} \cdot a = M_{Ed} \le M_{Rd}$
  $v_{Ed} \cdot a = V_{Ed} \le V_{Rd}$

Calculation tables

Calculation tables

Concrete strength parapet: ≥C25/30
Concrete strength, main slab: ≥C20/25

80

HIT-HP FT1 HIT-HP FT2	+N_{Rd}* [kN/element]			
	Element height h [mm]			
n_{Ed} / |m_{Ed}| [1/m]	160–170	180–190	200–210	220–250
+50	56.6	60.4	63.4	59.9
+40	52.9	56.9	60.1	57.3
+30	47.7	51.9	55.3	53.4
+20	39.8	44.1	47.7	47.1
+12	29.9	33.9	37.4	38.1
+10	26.6	30.4	33.7	34.8
+ 8	22.8	26.3	29.4	30.8
+ 6	18.5	21.5	24.3	25.8
+ 4	13.4	15.7	18.0	19.5
+ 2	7.3	8.7	10.1	11.2
0	0.0	0.0	0.0	0.0

HIT-HP FT1 HIT-HP FT2	−N_{Rd}* [kN/element]			
	Element height h [mm]			
n_{Ed} / |m_{Ed}| [1/m]	160–170	180–190	200–210	220–250
− 2	−6.4	−7.6	−8.8	−9.8
− 4	−11.7	−13.8	−15.7	−17.1
− 6	−16.2	−18.8	−21.2	−22.6
− 8	−20.0	−23.0	−25.8	−26.9
−10	−23.3	−26.6	−29.5	−30.4
−12	−26.2	−29.7	−32.7	−33.4
−20	−34.8	−38.6	−41.7	−41.2
−30	−41.7	−45.4	−48.4	−46.8
−40	−46.3	−49.8	−52.6	−50.1
−50	−49.6	−52.9	−55.5	−52.4

Load bearing capacities for slab thicknesses > 25 cm are available on request.
See inside back cover for contact information.

* Sign convention → see page 122

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

V_{Rd} in one direction

HIT-HP FT1	V_{Rd} [kN/element] for element height h [mm]					
	160–190		200–210		220–250	
HIT-HP FT1-0202-hh-025	*−13.6*	−15.8	*−15.0*	−17.4	*−17.4*	−20.1
HIT-HP FT1-0203-hh-025	*−20.4*	−20.4	*−22.5*	−26.1	*−26.0*	−26.0

V_{Rd} in both directions

parapet: ≥C25/30
main slab: *C20/25* ≥C25/30

80

HIT-HP FT2	V_{Rd} [kN/element] for element height h [mm]					
	160–190		200–210		220–250	
HIT-HP FT2-0202-hh-025	*±13.6*	±15.8	*±15.0*	±17.4	*±17.4*	±20.1
HIT-HP FT2-0203-hh-025	*±20.4*	±20.4	*±22.5*	±26.1	*±26.0*	±26.0

M_{Rd} is dependent on N_{Rd}

Concrete strength parapet: ≥C25/30
Concrete strength, main slab: ≥C20/25

HIT-HP FT1 HIT-HP FT2	M_{Rd} [kNm/element] for element height h [mm]			
+N_{Rd}* [kN/element]	160–170	180–190	200–210	220–250
70	±0.5	±0.6	±0.8	±0.3
60	±1.0	±1.2	±1.5	±1.2
50	±1.5	±1.8	±2.2	±2.1
40	±2.0	±2.5	±2.9	±3.0
30	±2.5	±3.1	±3.6	±3.9
25	±2.7	±3.4	±4.0	±4.4
20	±3.0	±3.7	±4.3	±4.8
15	±3.3	±4.0	±4.7	±5.3
10	±3.5	±4.3	±5.1	±5.7
5	±3.7	±4.5	±5.4	±6.1

HIT-HP FT1 HIT-HP FT2	M_{Rd} [kNm/element] for element height h [mm]			
−N_{Rd}* [kN/element]	160–170	180–190	200–210	220–250
0	±3.5	±4.3	±5.0	±5.8
− 5	±3.3	±4.0	±4.7	±5.4
−10	±3.0	±3.7	±4.3	±4.9
−15	±2.8	±3.4	±4.0	±4.4
−20	±2.5	±3.1	±3.6	±4.0
−25	±2.2	±2.8	±3.3	±3.5
−30	±2.0	±2.5	±2.9	±3.1
−35	±1.7	±2.1	±2.6	±2.6
−40	±1.5	±1.8	±2.2	±2.2
−45	±1.2	±1.5	±1.9	±1.7
−50	±1.0	±1.2	±1.5	±1.3

Calculation tables

Calculation tables

Concrete strength parapet: ≥C25/30
Concrete strength, main slab: ≥C20/25

120

HIT-SP FT1 HIT-SP FT2	+N_{Rd}* [kN/element]			
	Element height h [mm]			
n_{Ed}/|m_{Ed}| [1/m]	160–170	180–190	200–210	220–250
+50	56.6	60.4	63.4	59.9
+40	52.9	56.9	60.1	57.3
+30	47.7	51.9	55.3	53.4
+20	39.8	44.1	47.7	47.1
+12	29.9	33.9	37.4	38.1
+10	26.6	30.4	33.7	34.8
+ 8	22.8	26.3	29.4	30.8
+ 6	18.5	21.5	24.3	25.8
+ 4	13.4	15.7	18.0	19.5
+ 2	6.4	8.0	9.6	11.1
0	0.0	0.0	0.0	0.0

HIT-SP FT1 HIT-SP FT2	−N_{Rd}* [kN/element]			
	Element height h [mm]			
n_{Ed}/|m_{Ed}| [1/m]	160–170	180–190	200–210	220–250
− 2	− 5.4	− 6.4	− 7.4	− 8.3
− 4	− 9.8	−11.6	−13.2	−14.3
− 6	−13.6	−15.8	−17.8	−18.9
− 8	−16.8	−19.3	−21.6	−22.6
−10	−19.5	−22.3	−24.8	−25.5
−12	−22.0	−24.9	−27.4	−28.0
−20	−29.2	−32.4	−35.0	−34.6
−30	−35.0	−38.1	−40.6	−39.2
−40	−38.8	−41.8	−44.1	−42.0
−50	−41.6	−44.4	−46.5	−43.9

Load bearing capacities for slab thicknesses > 25 cm are available on request.
See inside back cover for contact information.

* Sign convention → see page 122

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

V_{Rd} in one direction

HIT-SP FT1	V_{Rd} [kN/element] for element height h [mm]					
	160–190		200–210		220–250	
HIT-SP FT1-0202-hh-025	*−11.2*	−13.0	*−12.9*	−15.0	*−15.0*	−17.4
HIT-SP FT1-0203-hh-025	*−16.8*	−19.5	*−19.3*	−22.5	*−22.5*	−26.1

V_{Rd} in both directions

parapet: ≥C25/30
main slab: *C20/25* ≥C25/30

120

HIT-SP FT2	V_{Rd} [kN/element] for element height h [mm]					
	160–190		200–210		220–250	
HIT-SP FT2-0202-hh-025	*±11.2*	±13.0	*±12.9*	±15.0	*±15.0*	±17.4
HIT-SP FT2-0203-hh-025	*±16.8*	±19.5	*±19.3*	±22.5	*±22.5*	±26.1

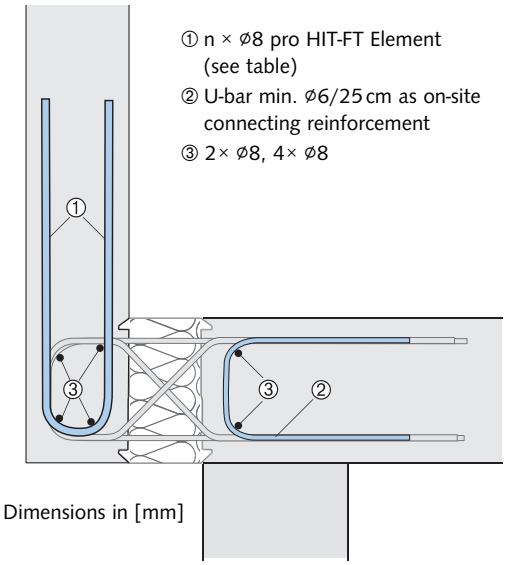
M_{Rd} is dependent on N_{Rd}

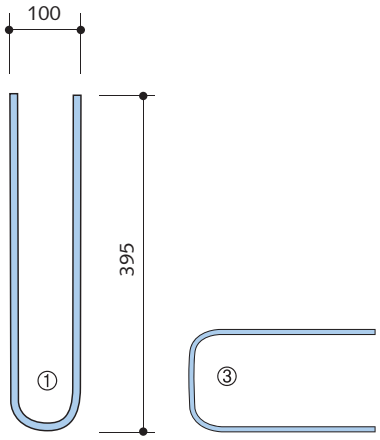
Concrete strength parapet: ≥C25/30
Concrete strength, main slab: ≥C20/25

HIT-SP FT1 HIT-SP FT2	M_{Rd} [kNm/element] for element height h [mm]			
+N_{Rd}* [kN/element]	160–170	180–190	200–210	220–250
70	±0.5	±0.6	±0.8	±0.3
60	±1.0	±1.2	±1.5	±1.2
50	±1.5	±1.8	±2.2	±2.1
40	±2.0	±2.5	±2.9	±3.0
30	±2.5	±3.1	±3.6	±3.9
25	±2.7	±3.4	±4.0	±4.4
20	±3.0	±3.7	±4.3	±4.8
15	±3.3	±4.0	±4.7	±5.3
10	±3.4	±4.1	±4.8	±5.5
5	±3.2	±3.8	±4.5	±5.2

HIT-SP FT1 HIT-SP FT2	M_{Rd} [kNm/element] for element height h [mm]			
−N_{Rd}* [kN/element]	160–170	180–190	200–210	220–250
0	±3.0	±3.6	±4.2	±4.9
− 5	±2.7	±3.3	±3.9	±4.4
−10	±2.4	±3.0	±3.5	±4.0
−15	±2.2	±2.7	±3.2	±3.5
−20	±1.9	±2.4	±2.8	±3.1
−25	±1.7	±2.1	±2.5	±2.6
−30	±1.4	±1.8	±2.1	±2.1
−35	±1.2	±1.5	±1.7	±1.7
−40	±0.9	±1.2	±1.4	±1.2
−45	±0.7	±0.8	±1.0	±0.8
−50	±0.4	±0.5	±0.7	±0.3

On-site reinforcement HIT-FT



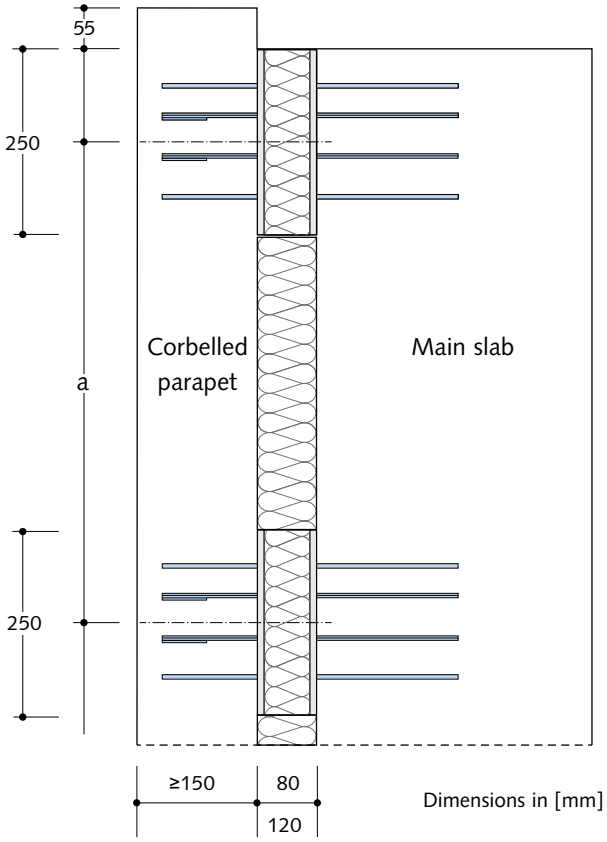


HIT Type	Number of shear bars	Number n connecting bars ①
HIT-HP FT1 HIT-HP FT2	2	3
	3	4
HIT-SP FT1 HIT-SP FT2	2	3
	3	4

Edge distances

Edge distances

The HIT-FT Element can be installed flush with the concrete edge at the end of the parapet. The minimal distance from the side edge of the main concrete slab to the HIT-FT is 55 mm.

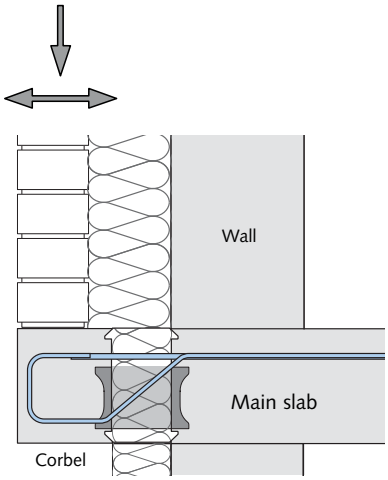


An installation diagram can be found on our website **www.halfen.com**.

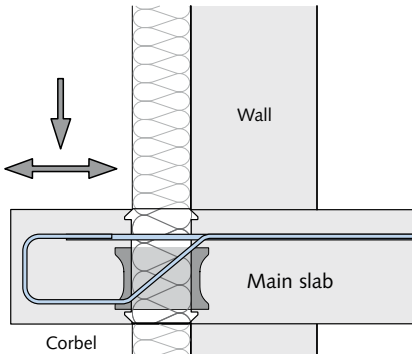
HALFEN HIT INSULATED CONNECTION HIGH & SUPERIOR PERFORMANCE

HIT-HP OTX, HIT-SP OTX

- Thermal insulated connections for application between the main slab and a corbel
- Transfer of normal forces and also of shear forces



Application: Floor slab supporting a brickwork façade



Application: Floor slab with a continuous fascia/corbel

HIT-HP OTX – **High Performance** with 80 mm insulation thickness
HIT-SP OTX – **Superior Performance** with 120 mm insulation thickness

Content	Type	Page
Product variations / Load range	HIT-HP OTX, HIT-SP OTX	127
Product description	HIT-HP OTX, HIT-SP OTX	128
Load bearing capacity values	HIT-HP OTX, HIT-SP OTX	129
On-site reinforcement	HIT-HP OTX, HIT-SP OTX	132
Determining axial spacing	HIT-HP OTX, HIT-SP OTX	133

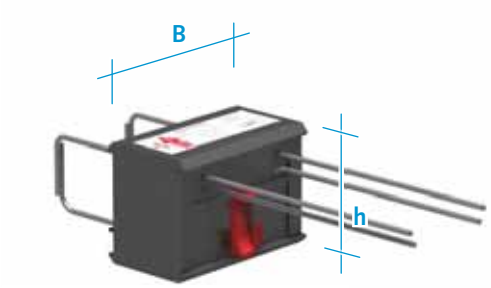
Product variations – Load range

The following table lists possible combinations of shear bars and tension bars.
All elements have a double-symmetric CSB.

Possible combinations of structural elements			
Element width B = 25 cm		**Number of tension bars ⌀8**	
		2	2
Number of shear bars ⌀6	2	●	●
Number of shear bars ⌀8	2	●	●
Type		**OTX1**	**OTX2**
● = HP and SP			

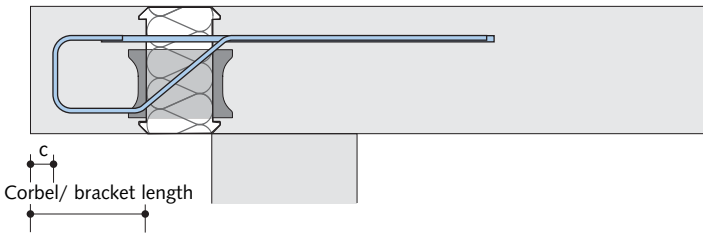
Ordering example

HIT-HP	**OTX 1**	-	**02**	**02**	- **18**	- **025**	- **06**
HIT-SP	**OTX 2**	-	**02**	**02**	- **25**	- **025**	- **08**
❶ ❷	❸		❹	❺	❻	❼	❽



Type designation
① Product group
② Joint spacing 80 mm (HP) or 120 mm (SP)
③ Connection type
④ Number of tension bars
⑤ Number of shear bars
⑥ Element height h [cm]
⑦ Element width B [cm]
⑧ Diameter shear bars [mm]

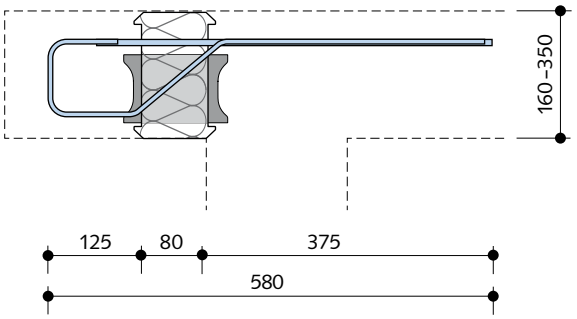
Possible slab thickness h



Concrete cover [mm] top and bottom	**30**
Possible slab thickness h [cm]	18 – 35*
Corbel/ bracket length [mm] HIT-OTX1	≥ 155 mm (c = 30 mm concrete cover at front edge)
Corbel/ bracket length [mm] HIT-OTX2	≥ 195 mm (c = 30 mm concrete cover at front edge)
* load bearing capacities for main slab heights > 25 cm available on request	

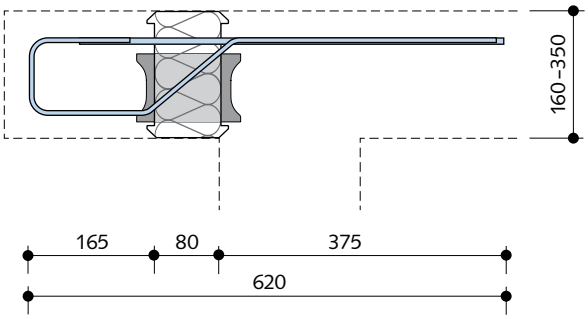
Product description – Sectional views

Cross section:
HIT-HP OTX1

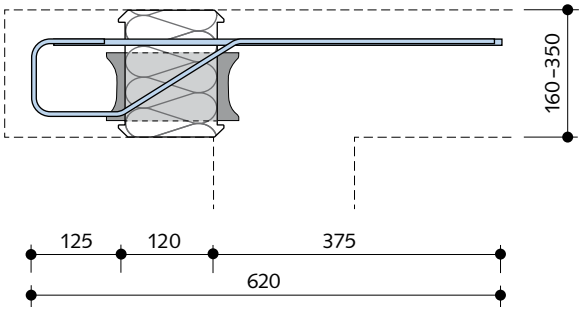


Dimensions in [mm]

HIT-HP OTX2

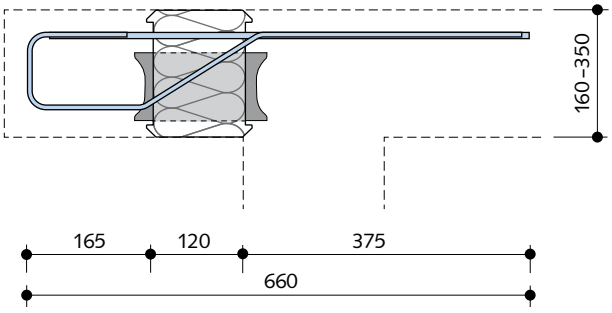


Cross section:
HIT-SP OTX1

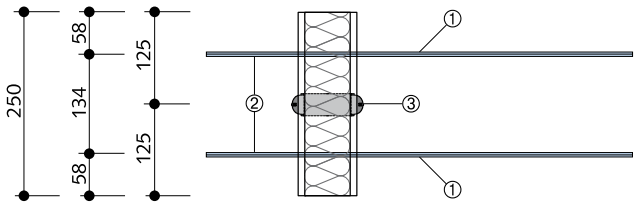


Dimensions in [mm]

HIT-SP OTX2

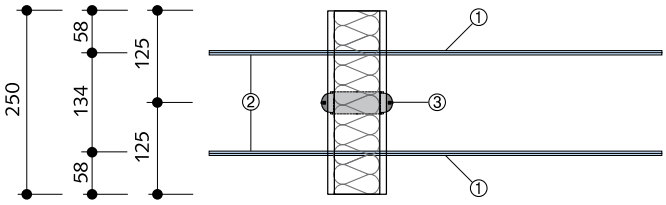


Top view:
HIT-HP/SP OTX1 – Bar spacings



Dimensions in [mm]

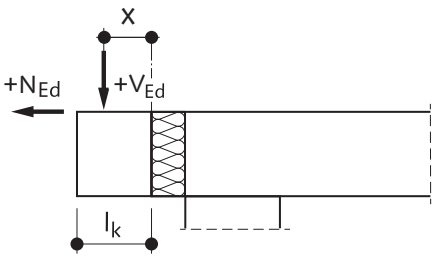
HIT-HP/SP OTX2 – Bar spacings



① Tension bars: ø8 mm, B500B NR
② Shear bars: ø6 mm or ø8 mm, B500B NR
③ double-symmetrical CSB

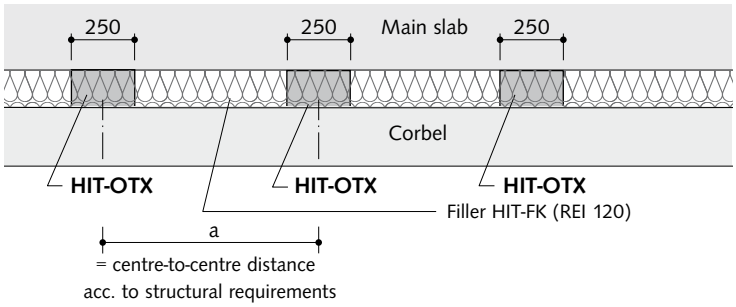
Structural system

Sign convention for calculation



l_k = cantilever length of the bracket
x = load distance

Top view: Main slab with corbel connected



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

V_{Rd} in one direction

Concrete strength, corbel: ≥C25/30
Concrete strength, main slab: *C20/25* ≥C25/30

80

HIT-HP OTX1	Element height [mm]	Shear bars ⌀6								Shear bars ⌀8							
		Load distance x [mm]								Load distance x [mm]							
		≤ 75		85		95		105		≤ 75		85		95		105	
Design values V_{Rd} [kN/element]	180	*27.3*	28.0	*25.9*	26.7	*24.6*	25.4	*23.5*	24.2	*27.8*	28.7	*26.4*	27.2	*25.0*	25.8	*23.8*	24.6
	190	*28.0*	28.0	*28.0*	28.0	*27.6*	28.0	*26.2*	27.0	*31.4*	32.4	*29.7*	30.6	*28.1*	29.0	*26.7*	27.5
	200	*28.8*	28.8	*28.8*	28.8	*28.8*	28.8	*28.1*	28.8	*32.8*	33.7	*31.1*	31.9	*29.5*	30.3	*28.1*	28.8
	210	*28.8*	28.8	*28.8*	28.8	*28.8*	28.8	*28.8*	28.8	*36.4*	37.3	*34.4*	35.2	*32.6*	33.4	*31.0*	31.7
	220	*28.8*	28.8	*28.8*	28.8	*28.8*	28.8	*28.8*	28.8	*40.2*	41.2	*37.9*	38.8	*35.9*	36.7	*34.0*	34.8
	230	*28.8*	28.8	*28.8*	28.8	*28.8*	28.8	*28.8*	28.8	*44.4*	46.4	*41.7*	42.7	*39.4*	40.2	*37.3*	38.1
	240	*29.7*	29.7	*29.7*	29.7	*29.7*	29.7	*29.7*	29.7	*42.8*	43.7	*40.5*	41.3	*38.5*	39.2	*36.6*	37.3
	250	*29.7*	29.7	*29.7*	29.7	*29.7*	29.7	*29.7*	29.7	*46.4*	47.2	*43.8*	44.6	*41.5*	42.3	*39.5*	40.2
	>250	Available on request. See inside back cover for contact information.															

$$N_{Rd} = \pm 0.1 \times V_{Rd}$$

All necessary verifications have been already considered. Connecting elements must be verified by the planner.

Load bearing capacity values of further types can be found on the following page.

HIT-HP OTX

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

V_{Rd} in one direction

Concrete strength, corbel: ≥C25/30
Concrete strength, main slab: *C20/25* ≥C25/30

HIT-HP OTX2	Element height [mm]	Shear bars ⌀6															
		Load distance x [mm]															
		≤ 75		85		95		105		115		125		135		145	
Design values V_{Rd} [kN/element]	180	*27.3*	28.0	*25.9*	26.7	*24.6*	25.4	*23.5*	24.2	*22.4*	23.1	*21.4*	22.1	*20.6*	21.2	*19.7*	20.3
	190	*28.0*	28.0	*28.0*	28.0	*27.6*	28.0	*26.2*	27.0	*25.0*	25.7	*23.9*	24.6	*22.9*	23.5	*22.0*	22.6
	200	*28.8*	28.8	*28.8*	28.8	*28.8*	28.8	*28.1*	28.8	*26.8*	27.5	*25.6*	26.3	*24.5*	25.2	*23.6*	24.1
	210	*28.8*	28.8	*28.8*	28.8	*28.8*	28.8	*28.8*	28.8	*28.8*	28.8	*28.2*	28.8	*27.0*	27.6	*25.9*	26.4
	220	*28.8*	28.8	*28.8*	28.8	*28.8*	28.8	*28.8*	28.8	*28.8*	28.8	*28.8*	28.8	*28.8*	28.8	*28.3*	28.8
	230	*28.8*	28.8	*28.8*	28.8	*28.8*	28.8	*28.8*	28.8	*28.8*	28.8	*28.8*	28.8	*28.8*	28.8	*28.8*	28.8
	240	*29.7*	29.7	*29.7*	29.7	*29.7*	29.7	*29.7*	29.7	*29.7*	29.7	*29.7*	29.7	*29.7*	29.7	*29.7*	29.7
	250	*29.7*	29.7	*29.7*	29.7	*29.7*	29.7	*29.7*	29.7	*29.7*	29.7	*29.7*	29.7	*29.7*	29.7	*29.7*	29.7
	>250	Available on request. See inside back cover for contact information.															

$$N_{Rd} = \pm 0.1 \times V_{Rd}$$

HIT-HP OTX2	Element height [mm]	Shear bars ⌀8															
		Load distance x [mm]															
		≤ 75		85		95		105		115		125		135		145	
Design values V_{Rd} [kN/element]	180	*27.8*	28.7	*26.4*	27.2	*25.0*	25.8	*23.8*	24.6	*22.7*	23.4	*21.8*	22.4	*20.8*	21.5	*20.0*	20.6
	190	*31.4*	32.4	*29.7*	30.6	*28.1*	29.0	*26.7*	27.5	*25.5*	26.2	*24.3*	25.0	*23.3*	23.9	*22.3*	22.9
	200	*32.8*	33.7	*31.1*	31.9	*29.5*	30.3	*28.1*	28.8	*26.8*	27.5	*25.6*	26.3	*24.5*	25.2	*23.6*	24.1
	210	*36.4*	37.3	*34.4*	35.2	*32.6*	33.4	*31.0*	31.7	*29.5*	30.2	*28.2*	28.8	*27.0*	27.6	*25.9*	26.4
	220	*40.2*	41.2	*37.9*	38.8	*35.9*	36.7	*34.0*	34.8	*32.4*	33.1	*30.9*	31.5	*29.5*	30.1	*28.3*	28.9
	230	*44.4*	46.4	*41.7*	42.7	*39.4*	40.2	*37.3*	38.1	*35.4*	36.1	*33.7*	34.4	*32.2*	32.8	*30.8*	31.4
	240	*42.8*	43.7	*40.5*	41.3	*38.5*	39.2	*36.6*	37.3	*34.9*	35.6	*33.4*	34.0	*32.0*	32.6	*30.7*	31.2
	250	*46.4*	47.2	*43.8*	44.6	*41.5*	42.3	*39.5*	40.2	*37.6*	38.3	*35.9*	36.6	*34.4*	35.0	*33.0*	33.5
	>250	Available on request. See inside back cover for contact information.															

$$N_{Rd} = \pm 0.1 \times V_{Rd}$$

All necessary verifications have been already considered. Connecting elements must be verified by the planner.

Load bearing capacity values of further types can be found on the following page.

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

V_{Rd} in one direction

Concrete strength, corbel: ≥C25/30
Concrete strength, main slab: *C20/25* ≥C25/30

HIT-SP OTX1	Element height [mm]	Shear bars ⌀6								Shear bars ⌀8							
		Load distance x [mm]								Load distance x [mm]							
		≤ 75		85		95		105		≤ 75		85		95		105	
Design values V_{Rd} [kN/element]	180	*22.5*	22.7	*22.5*	22.7	*22.5*	22.7	*21.7*	22.4	*25.5*	26.4	*24.2*	25.1	*23.1*	23.9	*22.1*	22.8
	190	*22.5*	22.7	*22.5*	22.7	*22.5*	22.7	*22.5*	22.7	*29.1*	30.2	*27.6*	28.6	*26.2*	27.1	*25.0*	25.8
	200	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1	*33.3*	34.4	*31.4*	32.5	*29.8*	30.7	*28.3*	29.1
	210	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1	*35.9*	36.7	*35.8*	36.7	*33.8*	34.8	*32.0*	32.8
	220	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1	*37.5*	38.6	*35.5*	36.4	*33.6*	34.5	*32.0*	32.7
	230	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1	*40.1*	40.7	*39.5*	40.5	*37.3*	38.3	*35.4*	36.2
	240	*25.6*	25.7	*25.6*	25.7	*25.6*	25.7	*25.6*	25.7	*40.9*	41.8	*38.7*	39.7	*36.8*	37.7	*35.1*	35.8
	250	*25.6*	25.7	*25.6*	25.7	*25.6*	25.7	*25.6*	25.7	*43.5*	43.9	*42.4*	43.3	*40.2*	41.1	*38.2*	38.9
	>250	Available on request. See inside back cover for contact information.															

$$N_{Rd} = \pm 0.1 \times V_{Rd}$$

HIT-SP OTX2	Element height [mm]	Shear bars ⌀6															
		Load distance x [mm]															
		≤ 75		85		95		105		115		125		135		145	
Design values V_{Rd} [kN/element]	180	*22.5*	22.7	*22.5*	22.7	*22.5*	22.7	*21.7*	22.4	*20.8*	21.5	*19.9*	20.6	*19.2*	19.8	*18.5*	19.1
	190	*22.5*	22.7	*22.5*	22.7	*22.5*	22.7	*22.5*	22.7	*22.5*	22.7	*22.4*	22.7	*21.5*	22.2	*20.7*	21.3
	200	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1	*23.8*	24.1	*22.9*	23.5	*22.0*	22.7
	210	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1
	220	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1
	230	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1	*24.0*	24.1
	240	*25.6*	25.7	*25.6*	25.7	*25.6*	25.7	*25.6*	25.7	*25.6*	25.7	*25.6*	25.7	*25.6*	25.7	*25.6*	25.7
	250	*25.6*	25.7	*25.6*	25.7	*25.6*	25.7	*25.6*	25.7	*25.6*	25.7	*25.6*	25.7	*25.6*	25.7	*25.6*	25.7
	>250	Available on request. See inside back cover for contact information.															

$$N_{Rd} = \pm 0.1 \times V_{Rd}$$

All necessary verifications have been already considered. Connecting elements must be verified by the planner.

Load bearing capacity values of further types can be found on the following page.

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

V_{Rd} in one direction

Concrete strength, corbel: ≥C25/30
Concrete strength, main slab: *C20/25* ≥C25/30

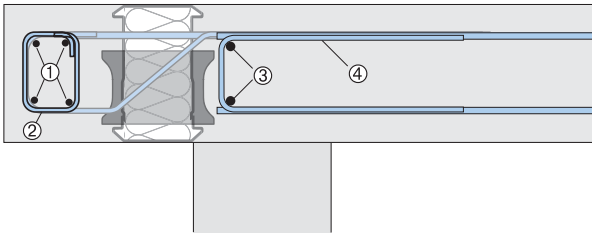
120

HIT-SP OTX2	Element height [mm]	Shear bars ⌀8													
		Load distance x [mm]													
		≤ 75		85		95		105		115		125		135		145	
Design values V_{Rd} [kN/element]	180	*25.4*	26.4	*24.2*	25.1	*23.0*	23.9	*22.0*	22.8	*21.1*	21.8	*20.2*	20.9	*19.4*	20.1	*18.7*	19.3
	190	*29.0*	30.1	*27.5*	28.5	*26.2*	27.1	*25.0*	25.8	*23.8*	24.6	*22.8*	23.6	*21.9*	22.6	*21.0*	21.7
	200	*33.2*	34.3	*31.3*	32.4	*29.7*	30.7	*28.2*	29.1	*26.9*	27.7	*25.7*	26.5	*24.6*	25.3	*23.6*	24.3
	210	*35.9*	36.7	*35.7*	36.7	*33.7*	34.7	*31.9*	32.8	*30.3*	31.2	*28.8*	29.7	*27.5*	28.3	*26.3*	27.1
	220	*37.4*	38.5	*35.4*	36.4	*33.6*	34.5	*31.9*	32.8	*30.5*	31.3	*29.1*	29.9	*27.9*	28.6	*26.8*	27.4
	230	*40.1*	40.7	*39.4*	40.4	*37.3*	38.2	*35.4*	36.2	*33.6*	34.5	*32.1*	32.9	*30.7*	31.4	*29.4*	30.1
	240	*40.5*	41.8	*38.7*	39.6	*36.8*	37.6	*35.0*	35.8	*33.5*	34.2	*32.0*	32.8	*30.7*	31.4	*29.5*	30.2
	250	*42.5*	43.9	*42.3*	43.2	*40.1*	41.0	*38.2*	39.0	*36.4*	37.2	*34.8*	35.5	*33.3*	34.0	*32.0*	32.6
	>250	Available on request. See inside back cover for contact information.													

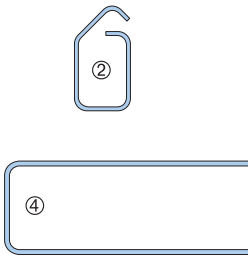
$$N_{Rd} = \pm 0.1 \times V_{Rd}$$

All necessary verifications have been already considered. Connecting elements must be verified by the planner.

On-site reinforcement HIT-OTX



① 4× ⌀8
② Stirrups 5× ⌀8 per HIT-OTX Element
③ 2× ⌀8
④ U-bar min. ⌀6 / 25 cm
as on-site connecting reinforcement



An installation diagram can be found at our website **www.halfen.com**.

Determining the axial spacing a

Calculation of the maximum element spacing of the HIT-OTX Elements is dependent on the acting shear forces $+v_{Ed}$ [kN/m] and the axial forces $\pm n_{Ed}$ [kN/m].

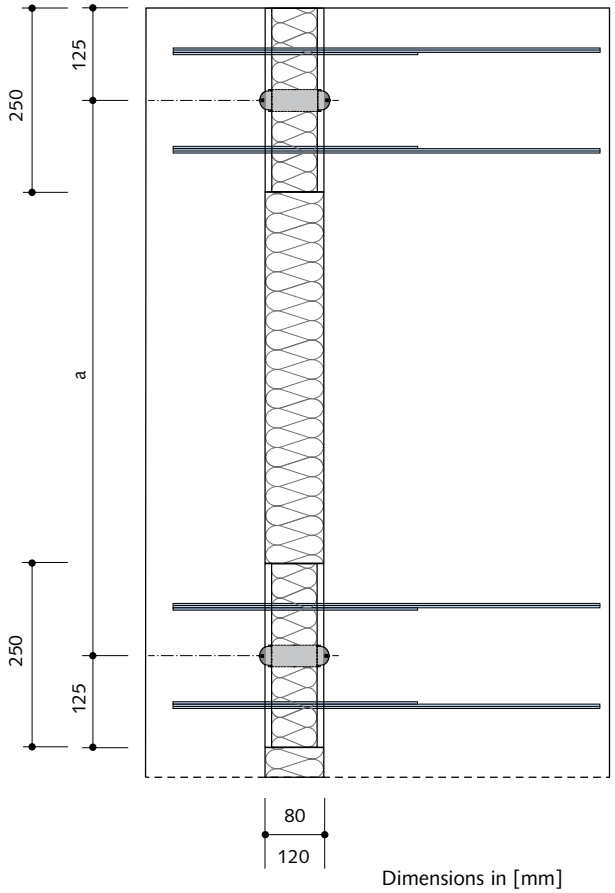
► **Step 1:** Find V_{Rd} (N_{Rd}) in the table **"Load bearing capacity values"** to select shear bars of either ø6 mm or ø8 mm this is dependent on the element height h, the concrete strength class and load distance x.

► **Step 2:** Calculate the element spacing a

$a_{max,1} = V_{Rd}/v_{Ed}$ [m]
$a_{max,2} = N_{Rd}/n_{Ed}$ [m]
$a = \min (a_{max,1} ; a_{max,2})$

► **Step 3: (optional)** Check the calculated load bearing capacities (per element)

$v_{Ed} \cdot a = V_{Ed} \leq V_{Rd}$
$n_{Ed} \cdot a = N_{Ed} \leq N_{Rd}$

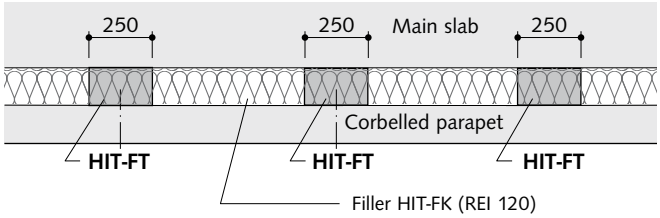


Dimensions in [mm]

HALFEN HIT INSULATED CONNECTION HIGH & SUPERIOR PERFORMANCE

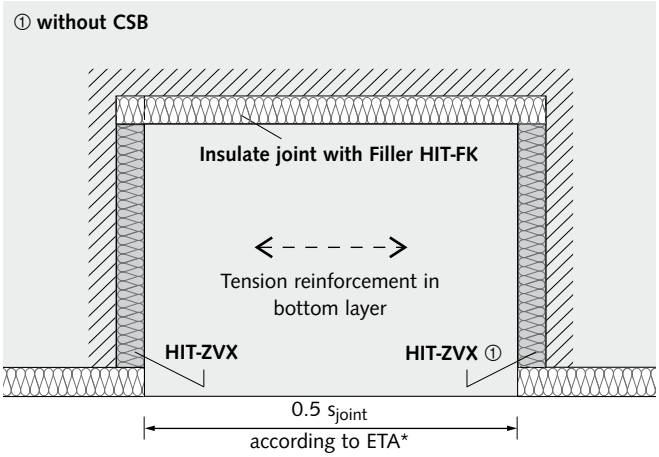
HIT-HP FK, HIT-SP FK

- Filler without support elements as a complementary element in all applications
- Mineral wool construction product class A1; used as an insulating material



Top view:
Main slab with attached corbelled parapet

HIT-HP FK – High Performance
with 80 mm insulation thickness
HIT-SP FK – Superior Performance
with 120 mm insulation thickness



*see page 40

Content	Type	Page
Practical width adjustment	HIT-HP FK, HIT-SP FK	135

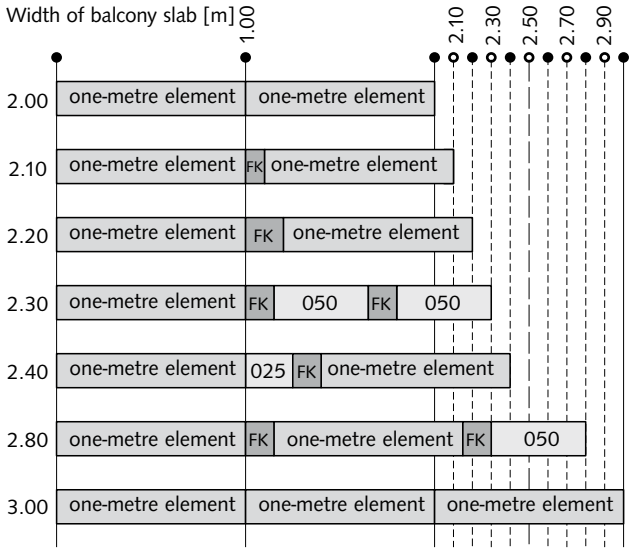
Optimized Combination

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 – 35 cm

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



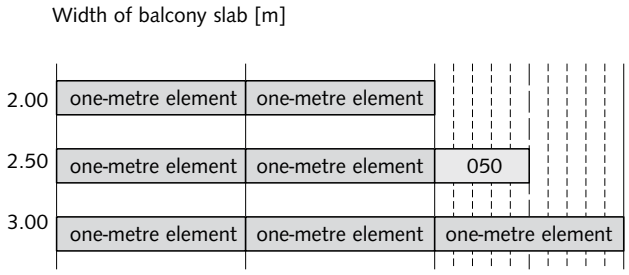
The increase of the loaded areas when HIT Fillers are used is compensated by the HIT Design program with the respective additions.

FK = Filler HIT-HP FK (see below)

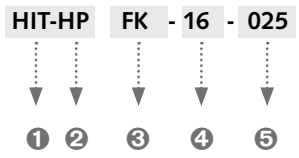
025 = Element with B = 0.25 m

050 = Element with B = 0.50 m

Use of one-metre elements and short units

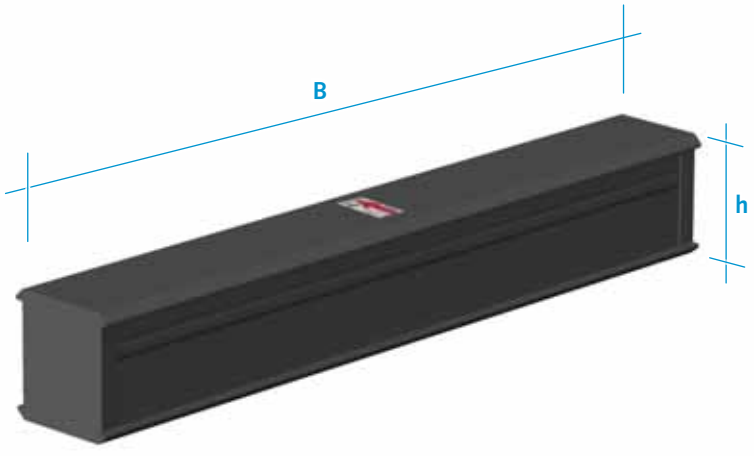


Ordering example for HIT Fillers



Type designation

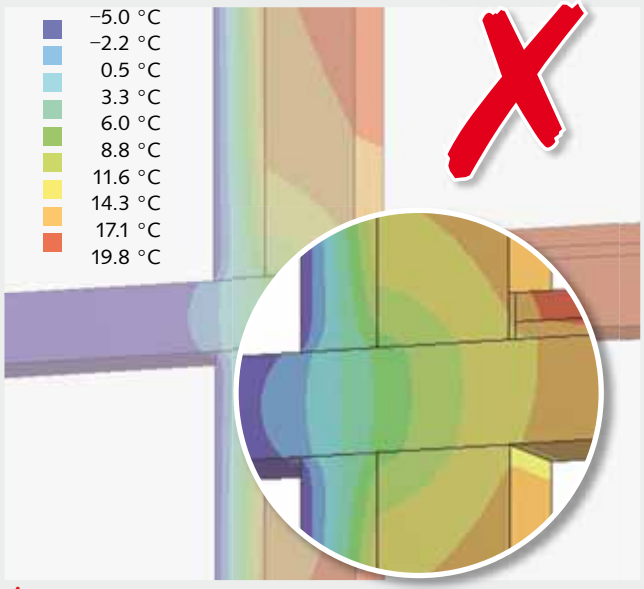
① Product group
② Joint spacing 80 mm (HP) or 120 mm (SP)
③ Connection type
④ Element height h [cm]
⑤ Element width B [cm]



7

- Building physics: Basics and specific values
- Software and tender specifications

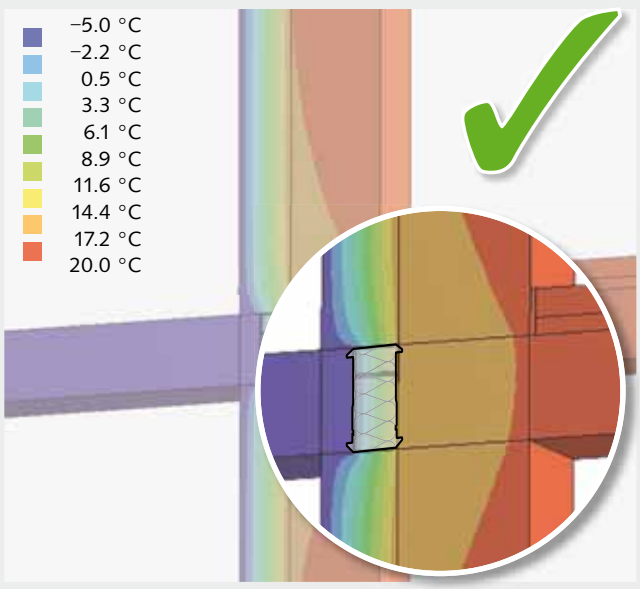
The temperature field in the cross section (shown as isotherms) illustrates the advantages of the HALFEN HIT Insulated connection for the required minimum thermal insulation: For instance no condensation and mould growth in critical areas.



Temperature below condensation point – negative effects

Balcony slab – installed without insulation:

- thermal bridge
- condensation
- moisture penetration
- mould formation on ceiling and wall
- cracks in the concrete slabs



Temperature OK – positive effects

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

- effective thermal insulation of the balcony slab
- temperature above the condensation point
- perfectly designed structural physics
- prevents cracks in the concrete resulting from extreme thermal expansion in the balcony connection

Contents **Page**

Thermal insulation basics 137
HALFEN Ψ Calculator 140
Building authority approved thermal values HIT-HP MVX, HIT-SP MVX 141
Building authority approved thermal values HIT-HP ZVX, HIT-SP ZVX 146
Passive House Institute certificates 149
Sound proofing according to DIN 4109 151
Fire protection according to EN 13501 152
HIT Software 153

Thermal insulation

Definition of thermal bridging

A thermal bridge is an area in buildings through which the transmission heat loss (heat loss) is increased.
Heat is conveyed to the outside of the building faster than through adjacent components. The following are types of thermal bridges are common to buildings:

- Material-related thermal bridges caused by materials or components with increased thermal conductivity, which are installed in specific areas,
  for example; steel support and beams.
- Geometric thermal bridges are created solely by geometric shapes, e.g. by an outer corner of a wall.
- Constructive thermal bridges such as non-insulated cantilever balcony slabs.

With regard to type, we need to distinguish between linear and point thermal bridges. In the case of a linear thermal bridge, the additional heat loss is determined by the linear heat transfer coefficient Ψ in W/(mK), for point type thermal bridge with the point thermal heat transfer coefficient χ in W/K.

Consequences of thermal bridges

Thermal bridges result in higher primary energy consumption, as the additional heat loss requires a higher heating output at low outside temperatures. The surface temperature in the area of thermal bridges can be significantly lower than in other areas. If the temperature falls below the critical limit, mould spores can form at humidity as low as 80%.
Behind cupboards and under carpets, mould usually remains undetected for a longer period of time and can cause health problems such as allergies.

If the surface temperature of a component falls below the condensation point, the water in the room air will condensate in these areas. This will moisten the structure of the building. This can impair the load-bearing capacity and serviceability of the building.

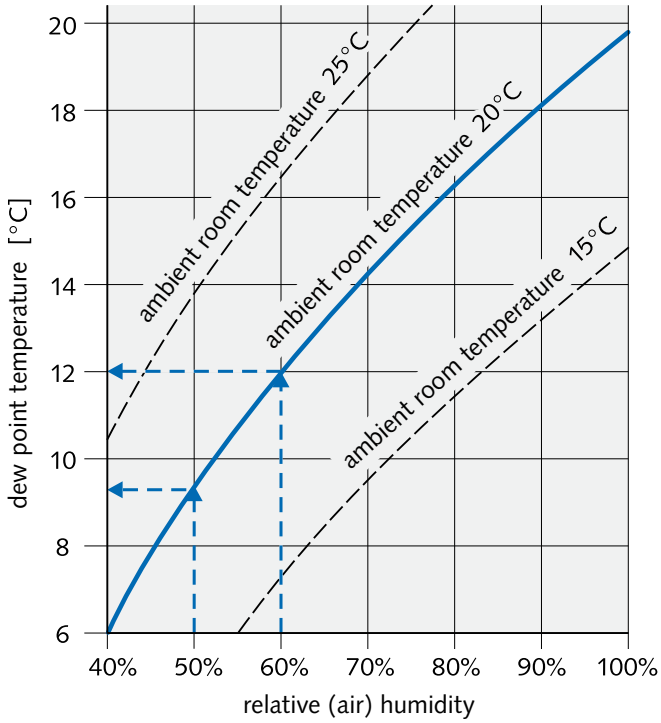


Fig.: Condensation diagram

Properties of air

Depending on the temperature, the air can retain different amounts of moisture. The capacity of the air to store water 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 condensation 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, condensation will form on this surface.

Amendments to DIN 4108-2

Temperature factor f_{Rsi}

The temperature factor f_{Rsi} is calculated using the minimum surface temperature Θ_{si}, of the interior air temperature Θ_i and the exterior air temperature Θ_e. According to the requirements in DIN 4108-2 concerning the minimum surface temperature and boundary conditions, the following criterion apply to prevent mould forming:

$$f_{Rsi} = \frac{\Theta_{si} - \Theta_e}{\Theta_i - \Theta_e} \geq 0.7$$

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

Linear thermal heat coefficient Ψ

Heat losses caused by a linear thermal bridge, for example a continuous balcony, are taken into account using the length-related heat transfer coefficient (unit W/(mK)). The length-related heat transfer coefficient is a parameter that describes the influence of this thermal bridge on the total heat flow and is characteristic for the relevant component.

The Ψ value depends on the insulation performance of the slab connection element (HIT element) and on the structural design of the wall. With increased insulation performance of the wall, the length-related heat transfer coefficient Ψ increases even if the HALFEN Insulated connection remains unchanged.

Equivalent thermal heat conductivity λ_{eq}

Complex building elements like the HALFEN Insulated connection consist of various base materials with different thermal conductivities. To consider this type of configuration in detail can be very complex. To simplify, a homogeneous, cube-shaped substitute with the same dimensions can be used in the insulation joint. An equivalent thermal conductivity λ_{eq} is assigned to the substitute body so that the total heat flow of both systems is identical. The determination of the λ_{eq} value is based on an detailed three-dimensional thermal bridge calculation.

The calculation of the equivalent thermal conductivity is defined in the European Assessment Document (EAD) for load-bearing thermal insulation elements and the European Technical Assessment (ETA) for HALFEN Insulated connections.

The λ_{eq} values cannot be used directly to calculate the primary energy demand of a building. With the help of a thermal bridge software, length-related heat transfer coefficients can be determined and the transmission losses calculated.
To achieve this, the thermal boundary conditions according to DIN EN ISO 6946 and DIN 4108 part 2 must be observed. Because of simplified modelling an exact calculation of the minimum surface temperature resp. the temperature factor is not possible. However, the results are sufficiently accurate and can be used to evaluate for mould formation.

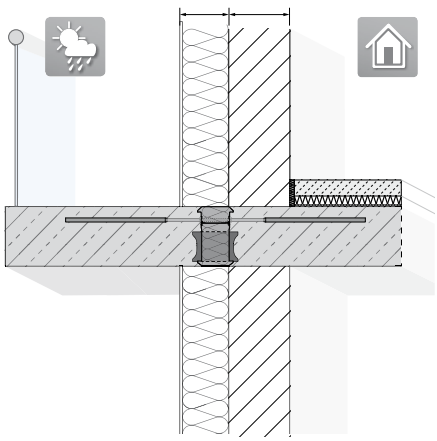


Fig. 1: Cross section through a balcony slab with a HALFEN HIT Insulated connection, connected to the main (inner) slab.

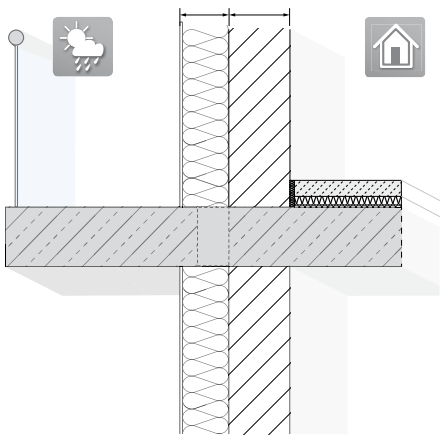


Fig. 2: Cross section through a balcony slab with homogeneous inset, connected to the main (inner) slab.

EnEV – The Energy Saving Directive

EnEV requirements

The European Buildings Directive of 2010 requires:

- that by 31st December 2020, all new buildings are low-energy buildings
- after 31st December all new buildings used by public authorities as owners are low-energy buildings

The amended EnEV 2014, which came into force on the 1st May 2014, implements this EU building directive.
The EnEV 2014 includes an improvement in the energy standard for new buildings, both residential and non-residential, from the 1st January 2016.
According to the 2016 EnEV, for new residential buildings the maximum value of the calculated annual primary energy demand is to be reduced by 25% compared to the 2009 EnEV, i.e. the result of the calculation of the annual primary energy demand of the reference house from 2009 EnEV is multiplied by the factor 0.75. In addition, the thermal insulation of the envelope in new buildings must exhibit an improvement of approx. 20%. The thermal heat loss (H'_T in (W/m²K)) of the building envelope must not exceed the corresponding maximum value of the reference house.

Calculation of thermal bridges

The energy related effect of thermal bridges is taken into account in the calculations for the EnEV verification. Thermal bridges can be calculated using three different methods:

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: With a detailed verification of the specific transmission loss of the thermal bridges according to DIN V 4108-6 or DIN V 18599 or by determination 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 methods 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, annex 2, according to National Technical Approvals Z-15.7-293 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.

The thermal values for HALFEN Insulated connection types HIT-HP MVX / HIT-SP MVX and HIT-HP ZVX / HIT-SP ZVX are included in the National Technical Approvals Z-15.7-293 and Z-15.7-312.

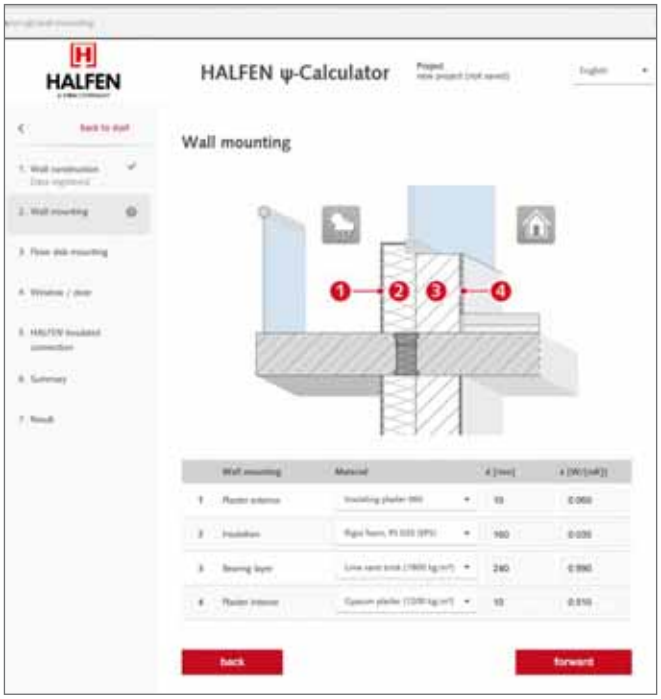
Calculation of thermal bridges in residential buildings

Description/ basics standard	**Method 1** without verifications	**Method 2** specification details or equivalent details	**Method 3** Exact calculation of thermal bridges with linear thermal transmission coefficients (= ψ-values)
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 slab connections, slab supports, thermally separated balcony slabs)

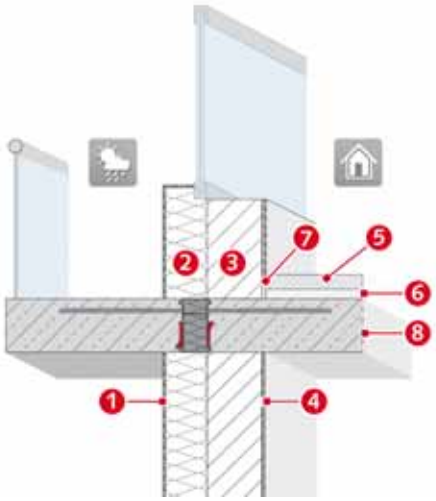
* ψ-values for various installation situations → see tables on page 142ff.

HALFEN ψ-Calculator – Thermal bridge tool for HALFEN Insulated connections

To obtain an Energy Performance Certification (EPC) according to the German Energy Saving Ordinance (EnEV Energie-einsparverordnung) verification of thermal bridges are required. To calculate the thermal bridges in balcony connections ψ-values are required to model the structure.
The essential key values for this are provided by HALFEN.



Screenshot HIT-Calculator Web App: Parameter input window



Component details

	Wall details
1	Exterior render
2	Insulation
3	load support layer
4	Interior plaster

	Slab details
5	Screed
6	Insulation
7	Edge insulation strips
8	load support layer

Illustration of an exterior wall: Here an example using an ETICS system with a window.

User-friendly selection of standard materials and their properties are available to ensure efficiency. This tool also provides the option of selecting windows and doors above a balcony.

The results of the ψ-value calculation can be output as a concise PDF file with all relevant parameters.
This can be printed and included in your planning and project documentation. Individual project details can also be included in the PDF output.
Using a link, previous defined installation situations can be reused; these can be edited or adapted with new specifications.

Five easy stages are required to enter the necessary parameters:

- selection of wall design
- selection of wall construction
- selection of slab details
- option to select windows/doors
- output of selected HALFEN HIT (type)

Select between an External Thermal Insulation Composite System (ETICS), a monolithic or double-leaf and a sandwich wall construction for calculation. All wall constructions consist of different layers, for example, an exterior render, insulation or the load-bearing layer. The thermal conductivity, materials and the dimensions of the various layers can be defined in further stages.

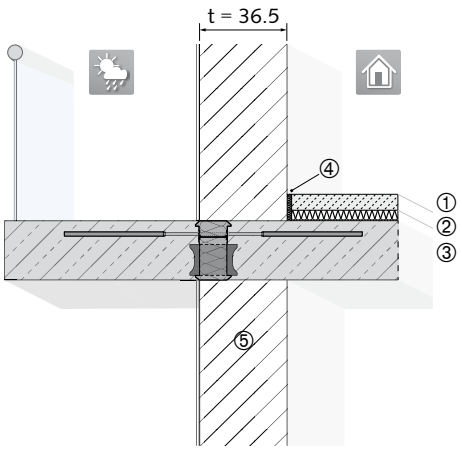
Thermal values according to Technical Approvals

The physical properties for HALFEN Insulated connections HIT-HP MVX / HIT-SP MVX and HIT-HP ZVX / HIT-SP ZVX 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 θ_{min} and temperature factor f_{Rsi}).

These values were officially integrated into the national technical approvals Z-15.7-293 and Z-15.7-312.

Compliance with the approved physical properties for HALFEN Insulated connections HIT-HP and HIT-SP is guaranteed by third party monitoring.

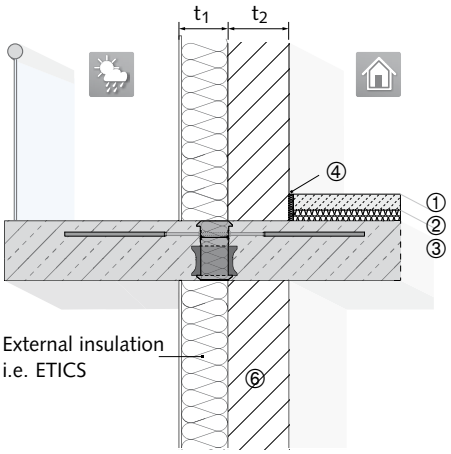
The approved physical property values for HALFEN Insulated connections HIT-HP MVX / HIT-SP MVX and HIT-HP ZVX / HIT-SP ZVX are listed in the tables on the following pages.



Installation diagram for 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 (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))
⑤ monolithic masonry

The thermal values only apply for the specified installation applications and boundary conditions.



Installation diagram for masonry with ETICS
Standard cross section
for thermal transmission coefficient "Exterior wall":
- thermally 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

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

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

Thermal conductivity λ 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 MVX- 0404-18-100-35	0.132	15.86	0.835	0.142	16.33	0.853	0.147	16.69	0.868
HIT-SP MVX- 0504-18-100-35	0.136	15.83	0.833	0.147	16.30	0.852	0.152	16.64	0.866
HIT-SP MVX- 0604-18-100-35	0.141	15.80	0.832	0.151	16.26	0.850	0.157	16.60	0.864
HIT-SP MVX- 0804-18-100-35	0.149	15.74	0.830	0.160	16.18	0.847	0.166	16.51	0.860
HIT-SP MVX- 0505-18-100-35	0.148	15.71	0.828	0.159	16.15	0.846	0.165	16.48	0.859
HIT-SP MVX- 0705-18-100-35	0.156	15.65	0.826	0.168	16.08	0.843	0.175	16.39	0.856
HIT-SP MVX- 0805-18-100-35	0.161	15.62	0.825	0.172	16.04	0.842	0.179	16.35	0.854
HIT-SP MVX- 0506-18-100-35	0.158	15.59	0.824	0.170	16.02	0.841	0.178	16.32	0.853
HIT-SP MVX- 0606-18-100-35	0.163	15.56	0.823	0.175	15.98	0.839	0.182	16.28	0.851
HIT-SP MVX- 0706-18-100-35	0.167	15.53	0.821	0.180	15.94	0.838	0.187	16.24	0.849
HIT-SP MVX- 0906-18-100-35	0.175	15.48	0.819	0.188	15.87	0.835	0.196	16.16	0.846
HIT-SP MVX- 1006-18-100-35	0.180	15.45	0.818	0.193	15.84	0.834	0.201	16.12	0.845
HIT-SP MVX- 1106-18-100-35	0.184	15.42	0.817	0.197	15.81	0.832	0.205	16.08	0.843
HIT-SP MVX- 0607-18-100-35	0.173	15.45	0.818	0.186	15.85	0.834	0.194	16.13	0.845
HIT-SP MVX- 0707-18-100-35	0.177	15.42	0.817	0.191	15.81	0.833	0.199	16.09	0.844
HIT-SP MVX- 0907-18-100-35	0.186	15.37	0.815	0.199	15.75	0.830	0.208	16.01	0.841
HIT-SP MVX- 1007-18-100-35	0.190	15.34	0.814	0.204	15.71	0.829	0.212	15.98	0.839
HIT-SP MVX- 1107-18-100-35	0.194	15.32	0.813	0.208	15.68	0.827	0.216	15.94	0.838
HIT-SP MVX- 1207-18-100-35	0.198	15.29	0.812	0.212	15.65	0.826	0.221	15.90	0.836
HIT-SP MVX- 1407-18-100-35	0.206	15.24	0.810	0.220	15.59	0.824	0.229	15.84	0.833
HIT-SP MVX- 0408-18-100-35	0.174	15.41	0.816	0.187	15.80	0.832	0.196	16.08	0.843
HIT-SP MVX- 0708-18-100-35	0.187	15.32	0.813	0.201	15.69	0.828	0.210	15.96	0.838
HIT-SP MVX- 0808-18-100-35	0.191	15.29	0.812	0.206	15.66	0.826	0.214	15.92	0.837
HIT-SP MVX- 1008-18-100-35	0.200	15.24	0.810	0.214	15.60	0.824	0.223	15.84	0.834
HIT-SP MVX- 1208-18-100-35	0.208	15.19	0.807	0.222	15.53	0.821	0.232	15.77	0.831
HIT-SP MVX- 1308-18-100-35	0.212	15.16	0.807	0.226	15.50	0.820	0.236	15.74	0.830
HIT-SP MVX- 1309-18-100-35	0.221	15.07	0.803	0.236	15.39	0.816	0.246	15.61	0.825
HIT-SP MVX- 0610-18-100-35	0.201	15.15	0.806	0.216	15.50	0.820	0.226	15.73	0.829
HIT-SP MVX- 0910-18-100-35	0.214	15.07	0.803	0.229	15.40	0.816	0.239	15.63	0.825
HIT-SP MVX- 1010-18-100-35	0.218	15.05	0.802	0.234	15.37	0.815	0.244	15.59	0.824
HIT-SP MVX- 1210-18-100-35	0.226	15.00	0.800	0.242	15.31	0.813	0.252	15.53	0.821
HIT-SP MVX- 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 MVX 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 MVX- 0404-18-100-35	0.168	17.80	0.912	0.187	18.08	0.923	0.194	18.25	0.930
HIT-HP MVX- 0504-18-100-35	0.175	17.76	0.910	0.193	18.05	0.922	0.200	18.21	0.929
HIT-HP MVX- 0604-18-100-35	0.181	17.73	0.909	0.199	18.02	0.921	0.206	18.18	0.927
HIT-HP MVX- 0804-18-100-35	0.194	17.66	0.906	0.211	17.95	0.918	0.217	18.12	0.925
HIT-HP MVX- 0505-18-100-35	0.194	17.64	0.906	0.211	17.94	0.918	0.216	18.11	0.924
HIT-HP MVX- 0705-18-100-35	0.207	17.57	0.903	0.223	17.87	0.915	0.228	18.05	0.922
HIT-HP MVX- 0805-18-100-35	0.213	17.54	0.902	0.229	17.84	0.914	0.233	18.02	0.921
HIT-HP MVX- 0506-18-100-35	0.212	17.53	0.901	0.228	17.83	0.913	0.231	18.02	0.921
HIT-HP MVX- 0606-18-100-35	0.219	17.49	0.900	0.234	17.80	0.912	0.237	17.99	0.919
HIT-HP MVX- 0706-18-100-35	0.225	17.46	0.898	0.240	17.77	0.911	0.243	17.96	0.918
HIT-HP MVX- 0906-18-100-35	0.238	17.39	0.896	0.251	17.71	0.908	0.253	17.90	0.916
HIT-HP MVX- 1006-18-100-35	0.244	17.36	0.894	0.257	17.68	0.907	0.258	17.87	0.915
HIT-HP MVX- 1106-18-100-35	0.249	17.33	0.893	0.262	17.65	0.906	0.263	17.85	0.914
HIT-HP MVX- 0607-18-100-35	0.236	17.38	0.895	0.249	17.70	0.908	0.251	17.90	0.916
HIT-HP MVX- 0707-18-100-35	0.243	17.35	0.894	0.255	17.67	0.907	0.257	17.87	0.915
HIT-HP MVX- 0907-18-100-35	0.255	17.29	0.891	0.267	17.61	0.904	0.267	17.81	0.912
HIT-HP MVX- 1007-18-100-35	0.261	17.26	0.890	0.272	17.58	0.903	0.272	17.79	0.911
HIT-HP MVX- 1107-18-100-35	0.267	17.23	0.889	0.278	17.56	0.902	0.277	17.76	0.910
HIT-HP MVX- 1207-18-100-35	0.272	17.20	0.888	0.283	17.53	0.901	0.282	17.73	0.909
HIT-HP MVX- 1407-18-100-35	0.283	17.14	0.886	0.293	17.48	0.899	0.292	17.68	0.907
HIT-HP MVX- 0408-18-100-35	0.239	17.35	0.894	0.252	17.68	0.907	0.253	17.87	0.915
HIT-HP MVX- 0708-18-100-35	0.259	17.25	0.890	0.270	17.58	0.903	0.270	17.79	0.911
HIT-HP MVX- 0808-18-100-35	0.265	17.22	0.889	0.276	17.55	0.902	0.275	17.76	0.910
HIT-HP MVX- 1008-18-100-35	0.277	17.16	0.886	0.287	17.49	0.900	0.285	17.70	0.908
HIT-HP MVX- 1208-18-100-35	0.289	17.10	0.884	0.297	17.44	0.898	0.295	17.65	0.906
HIT-HP MVX- 1308-18-100-35	0.294	17.07	0.883	0.302	17.41	0.897	0.300	17.63	0.905
HIT-HP MVX- 1309-18-100-35	0.309	16.98	0.879	0.316	17.33	0.893	0.312	17.55	0.902
HIT-HP MVX- 0610-18-100-35	0.283	17.09	0.884	0.292	17.44	0.898	0.289	17.66	0.906
HIT-HP MVX- 0910-18-100-35	0.301	17.00	0.880	0.308	17.35	0.894	0.304	17.58	0.903
HIT-HP MVX- 1010-18-100-35	0.307	16.97	0.879	0.314	17.33	0.893	0.309	17.56	0.902
HIT-HP MVX- 1210-18-100-35	0.318	16.92	0.877	0.324	17.28	0.891	0.319	17.51	0.900
HIT-HP MVX- 1412-18-100-35	0.356	16.70	0.868	0.357	17.08	0.883	0.349	17.33	0.893

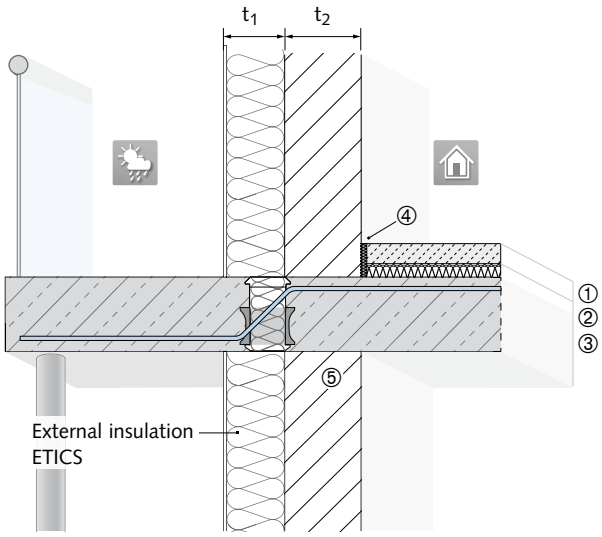
① ψ = Linear thermal transmission coefficient in W/(mK)
② $\theta_{si,min}$ = Minimum roomside surface temperature in °C
③ f_{Rsi} = Temperature factor in [-]

Thermal bridge characteristic values for HIT-SP MVX 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 MVX- 0404-18-100-35	0.115	18.12	0.925	0.134	18.40	0.936	0.145	18.54	0.942
HIT-SP MVX- 0504-18-100-35	0.121	18.09	0.924	0.140	18.37	0.935	0.150	18.51	0.941
HIT-SP MVX- 0604-18-100-35	0.126	18.06	0.922	0.145	18.34	0.934	0.155	18.48	0.939
HIT-SP MVX- 0804-18-100-35	0.137	18.00	0.920	0.156	18.28	0.931	0.165	18.43	0.937
HIT-SP MVX- 0505-18-100-35	0.137	17.99	0.919	0.155	18.27	0.931	0.164	18.42	0.937
HIT-SP MVX- 0705-18-100-35	0.148	17.92	0.917	0.166	18.21	0.929	0.175	18.37	0.935
HIT-SP MVX- 0805-18-100-35	0.154	17.89	0.916	0.171	18.19	0.927	0.179	18.34	0.934
HIT-SP MVX- 0506-18-100-35	0.153	17.89	0.916	0.170	18.18	0.927	0.178	18.34	0.933
HIT-SP MVX- 0606-18-100-35	0.158	17.86	0.914	0.176	18.15	0.926	0.183	18.31	0.932
HIT-SP MVX- 0706-18-100-35	0.164	17.83	0.913	0.181	18.12	0.925	0.188	18.28	0.931
HIT-SP MVX- 0906-18-100-35	0.175	17.77	0.911	0.191	18.07	0.923	0.198	18.23	0.929
HIT-SP MVX- 1006-18-100-35	0.180	17.74	0.910	0.196	18.04	0.922	0.203	18.20	0.928
HIT-SP MVX- 1106-18-100-35	0.186	17.71	0.908	0.201	18.01	0.921	0.207	18.18	0.927
HIT-SP MVX- 0607-18-100-35	0.174	17.76	0.910	0.190	18.06	0.922	0.196	18.23	0.929
HIT-SP MVX- 0707-18-100-35	0.179	17.73	0.909	0.195	18.03	0.921	0.201	18.20	0.928
HIT-SP MVX- 0907-18-100-35	0.190	17.67	0.907	0.205	17.98	0.919	0.211	18.15	0.926
HIT-SP MVX- 1007-18-100-35	0.196	17.65	0.906	0.210	17.95	0.918	0.215	18.12	0.925
HIT-SP MVX- 1107-18-100-35	0.201	17.62	0.905	0.215	17.93	0.917	0.220	18.10	0.924
HIT-SP MVX- 1207-18-100-35	0.206	17.59	0.904	0.220	17.90	0.916	0.225	18.08	0.923
HIT-SP MVX- 1407-18-100-35	0.216	17.54	0.902	0.229	17.85	0.914	0.233	18.03	0.921
HIT-SP MVX- 0408-18-100-35	0.177	17.73	0.909	0.192	18.04	0.921	0.198	18.21	0.928
HIT-SP MVX- 0708-18-100-35	0.194	17.64	0.906	0.208	17.95	0.918	0.213	18.12	0.925
HIT-SP MVX- 0808-18-100-35	0.199	17.61	0.905	0.214	17.92	0.917	0.218	18.10	0.924
HIT-SP MVX- 1008-18-100-35	0.210	17.56	0.902	0.224	17.87	0.915	0.228	18.05	0.922
HIT-SP MVX- 1208-18-100-35	0.220	17.50	0.900	0.233	17.82	0.913	0.237	18.00	0.920
HIT-SP MVX- 1308-18-100-35	0.226	17.48	0.899	0.238	17.79	0.912	0.241	17.98	0.919
HIT-SP MVX- 1309-18-100-35	0.239	17.39	0.896	0.251	17.72	0.909	0.253	17.90	0.916
HIT-SP MVX- 0610-18-100-35	0.216	17.50	0.900	0.229	17.82	0.913	0.232	18.00	0.920
HIT-SP MVX- 0910-18-100-35	0.232	17.42	0.897	0.244	17.74	0.910	0.246	17.93	0.917
HIT-SP MVX- 1010-18-100-35	0.237	17.39	0.896	0.249	17.71	0.909	0.250	17.91	0.916
HIT-SP MVX- 1210-18-100-35	0.248	17.34	0.893	0.258	17.67	0.907	0.259	17.86	0.914
HIT-SP MVX- 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 bridge characteristic values for HIT-HP ZVX for masonry with 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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-0803-16-100-30-06	0.133	18.00	0.920	0.152	18.28	0.931	0.160	18.44	0.937

– continue on 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 in [-]

Thermal bridge characteristic values for HIT-HP ZVX for masonry with 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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 in [-]

Thermal bridge characteristic values for HIT-SP ZVX for masonry with 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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-0804-16-100-30-08	0.115	18.11	0.924	0.141	18.35	0.934	0.162	18.43	0.937

– continue on 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 in [-]

Building Physics

Thermal bridge characteristic values for HIT-SP ZVX 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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 ZVX-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 in [-]

Certificates by the Passive House Institute – Low Energy Component

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.

Passive House Institute

PHI Low Energy Component

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:

$$\theta_{i,min} > 17.00 \text{ °C}$$

HALFEN HIT certificates on the Internet: If you are interested in HALFEN certificates, simply use the QR code or the hyperlink.

Low Energy Component HIT-HP MVX

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

Low Energy Component HIT-SP MVX

Insulation thickness 120 mm for cantilevered balcony slabs	Slab thickness [mm]	Thermal transmission coefficient ψ [W/(mK)]
HIT-SP MVX- 0202-18-100-35	180	0.109
HIT-SP MVX- 0404-18-100-35	180	0.167
HIT-SP MVX- 0504-18-100-35	180	0.16
HIT-SP MVX- 0705-18-100-35	180	0.19
HIT-SP MVX- 0804-18-100-35	180	0.17
HIT-SP MVX- 0907-18-100-35	180	0.22
HIT-SP MVX- 1006-18-100-35	180	0.21
HIT-SP MVX- 1008-18-100-35	180	0.24
HIT-SP MVX- 1107-18-100-35	180	0.24
HIT-SP MVX- 1208-18-100-35	180	0.25
HIT-SP MVX- 0202-22-100-35	220	0.113
HIT-SP MVX- 0404-22-100-35	220	0.173
HIT-SP MVX- 0504-22-100-35	220	0.17
HIT-SP MVX- 0705-22-100-35	220	0.20
HIT-SP MVX- 0804-22-100-35	220	0.18
HIT-SP MVX- 0202-24-100-35	240	0.115
HIT-SP MVX- 0404-24-100-35	240	0.175
HIT-SP MVX- 0504-24-100-35	240	0.17
HIT-SP MVX- 0705-24-100-35	240	0.20
HIT-SP MVX- 0804-24-100-35	240	0.18
HIT-SP MVX- 0907-24-100-35	240	0.24
HIT-SP MVX- 1006-24-100-35	240	0.23
HIT-SP MVX- 1008-24-100-35	240	0.25
HIT-SP MVX- 1107-24-100-35	240	0.25

Low Energy Component HIT-SP MVX-OD

Insulation thickness 120 mm for cantilevered balcony slabs with downward height offset	Slab thickness [mm]	Thermal transmission coefficient ψ [W/(mK)]
HIT-SP MVX-0504-18-100-35-OD	180	0.175
HIT-SP MVX-0504-22-100-35-OD	220	0.179
HIT-SP MVX-0504-24-100-35-OD	240	0.182

Low Energy Component HIT-SP MVX-OU

Insulation thickness 120 mm for cantilevered balcony slabs with upward height offset	Slab thickness [mm]	Thermal transmission coefficient ψ [W/(mK)]
HIT-SP MVX-0504-18-100-35-OU	180	0.170
HIT-SP MVX-0504-22-100-35-OU	220	0.178
HIT-SP MVX-0504-24-100-35-OU	240	0.180

Certificates by the Passive House Institute – Low Energy Component

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

PHI Low Energy Component

more information can be found at:
passivehouse.com ► certification

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

Certificates by the Passive House Institute – Certified Passive House Component

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.

CERTIFIED COMPONENT
passivehouse.com

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

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 distracting noise. The airborne sound pressure level $L'_{n,W}$ [dB] indicates the noise level between the adjacent units of the building.

DIN 4109 specifies the minimum requirements as follows:

req $L'_{n,w}$	DIN 4109-1; 1989-11	DIN 4109-1; 2016-07	DIN 4109-1; 2018-01
Floor slabs under terraces and loggias above lounges	≤ 53 dB	≤ 50 dB	≤ 50 dB
Floor slabs above access balconies	≤ 53 dB	≤ 53 dB	≤ 53 dB
Balconies	–	–	≤ 58 dB

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 (→ HALFEN HIT Insulated connections).

The sound insulation properties of different HIT 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 valued difference in the impact sound pressure level $\Delta L_{n,w}$ 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 Assessment, number ETA-18/0189.
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 $\Delta L_{n,w}$ in dB resulting from laboratory measurements	
HIT Element …MVX	**Difference in impact sound pressure level**
HIT-HP MVX-0504-18-100-35	12 dB
HIT-HP MVX-0705-18-100-35	11 dB
HIT-HP MVX-1207-18-100-35	11 dB
HIT-SP MVX-0504-18-100-35	14 dB
HIT-SP MVX-0705-18-100-35	15 dB
HIT-SP MVX-1208-18-100-35	10 dB
HIT Element …ZVX*	**Difference in impact sound pressure level**
HIT-HP ZVX-0504-18-100-30-12	12 dB
HIT-HP ZVX-0705-18-100-30-12	11 dB
HIT-HP ZVX-1207-18-100-30-12	11 dB
HIT-SP ZVX-0504-18-100-30-12	14 dB
HIT-SP ZVX-0705-18-100-30-12	15 dB
HIT-SP ZVX-1208-18-100-30-12	10 dB

* Values from HIT MVX are transferred for HIT ZVX. This is a very conservative assumption.

Fire protection according to EN 13501

Fire Protection Requirements
All significant requirements concerning fire protection are documented 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 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 in compliance with European Technical Assessment ETA-18/0189 and the National Technical Approvals Z-15.7-293 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.

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

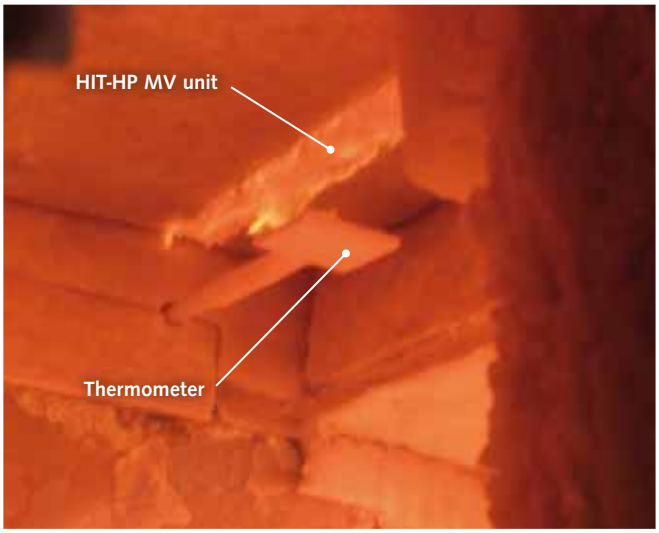
Meaning of the abbreviation REI:

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

E The room separation effect for the connection is ensured for the specified period.

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

Advantages
The advantages of the 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 R 120 versions
- selecting a fire-resistant element doesn't compromise heat insulation efficiency
- more robust construction as the easy damageable fire protection pads on the top and bottom of the connecting elements have been removed
- 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 up-dated version of the HIT-Software for calculation of HIT Insulated connections is a development of previous versions, which has been optimized and enhanced with essential functions.

The HIT design software allows you to plan verifiable balconies with these ten key advantages:

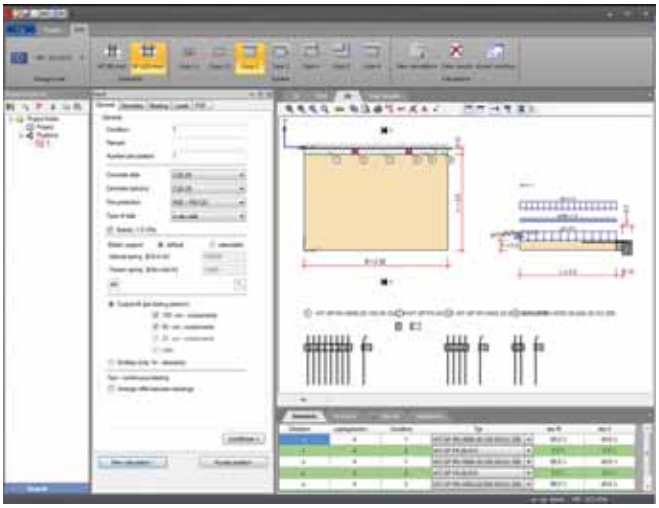
- free download available
- intuitive and easy to use
- enhanced load and support options
- verifiable static printouts
- generates .dxf-files output for input to construction plans, if required
- item-list compilation to facilitate ordering
- variable GUI using the current Windows design, fully customizable to your needs
- output of internal force progression for each load case
- option to select a variety of international standard
- numerous different language options available

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

Step 1: Easy and intuitive input of the initial parameters

HALFEN offers a wide selection of balcony types:

- cantilever balcony (see example on the right)
- cantilever balcony with column
- loggia
- outside corner balcony
- outside corner balcony with column
- inside corner balcony
- inside corner balcony with column
- height offset balcony

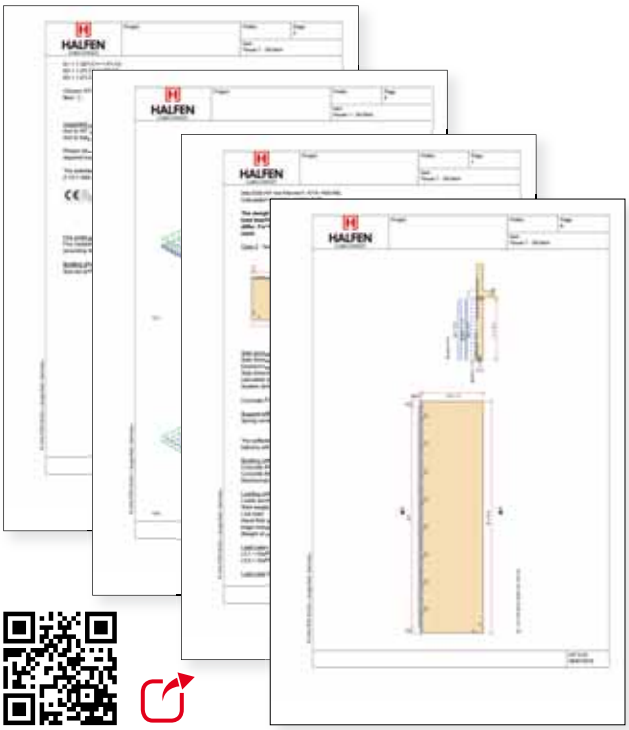


Step 2: Output of verifiable structural calculations

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

If required, the results can be printed out as a verifiable structural calculation. Printouts can be a compact version or in greater detail including all analysed load cases and combinations, the distortion results, as well as graphic illustrations.

The significantly improved graphic output capabilities of the new HIT software can include 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 MVX-0704-22-100-30		4	4
1	HIT-SP MVX-0402-22-050-30		4	1
2	HIT-SP MVX-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 easy input of parameter for numerous balcony support application. HALFEN provides the planner with a software with absolute reliability in designing and dimensioning balcony connections.

The software calculates building authority approved HIT Elements. All verifications required in accordance with the documents ETA-18/0189, Z-15.7-293 or Z-15.7-312 are also available — following HALFEN's integral safety concept that no further approvals need to be acquired by planners when using any HALFEN HIT Insulated connections.

BauStatik *(static calculation software)* ***from mb AEC Software***

- Integration of HIT elements into the powerful, document-based structural analysis software for structural engineers.

CONTACT HALFEN WORLDWIDE

HALFEN is represented by subsidiaries in the following 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	
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.cz Internet: www.halfen.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: +49-2173-970 225
Italy	HALFEN S.r.l. Soc. Unipersonale Via F.lli Bronzetti N° 28 24124 Bergamo	Phone: +39-035-0760711 E-Mail: tecnico@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	
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
Spain	HALFEN IBERICA, S.L. Polígono Industrial Santa Ana c/ Ignacio Zuloaga 20 28522 Rivas-Vaciamadrid	Phone: +34-91 632 18 40 E-Mail: info@halfen.es Internet: www.halfen.es	Fax: +34-91 633 42 57
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: info@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. PO Box 18687 San Antonio TX 78218	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

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 HALFEN GmbH subsidiaries in Germany, France, the Netherlands, Austria, Poland, Switzerland and the Czech Republic are Quality Management certified according to **ISO 9001:2015**, Certificate no. 202384-2016-AQ-GER-DAkkS.

QUALITY SYSTEM CERTIFICATION
DNV·GL
ISO 9001
www.dnvgl.com

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

R - 093 - E - 01/19 PDF 01/19