ROOF AND WALLS

The right solution for each application

The efficient and established installation systems for timber roof structures, masonry restraints and connectors for concrete façades are proven practical solutions for the construction industry, greatly improving construction time with significant cost-saving.

Halfen HSF Rafter shoe

Suitable for horizontal forces acting on rafter and collar beam roofs.

Halfen HNA Timber fixing strap

Suitable for all acting loads e.g. wind loads in roof structures.

Halfen HKZ or SPV Restraint ties

For connection of tension and compression loads from concrete walls elements.

Halfen ML and BL Brick tie anchor system

For connection of brickwork to concrete walls and columns or steel elements.

Halfen HVL-M Precast connection with Halfen HVL-E Cast-in channel

Suitable for horizontal loads in concrete wall elements (loads perpendicular to the bracket).

Halfen HKW Corner guard

Wall and column corner protector; application in industry and multi-storey car parks.

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Halfen HSF Rafter shoe 6/12

Halfen HKZ Restraint tie with serrated washer

Airbus paintshop with Halfen HVL Restraint tie

HVL-System in precast building components

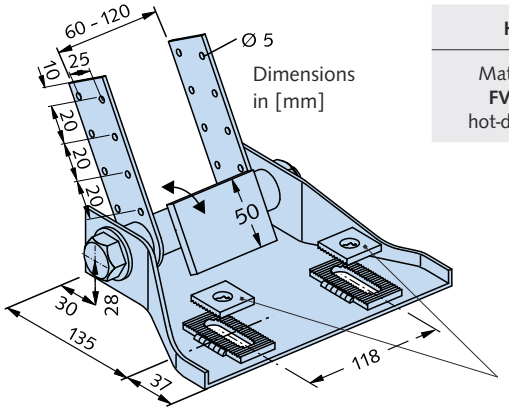
Connecting construction timbers to concrete using Halfen HNA

Timber roof construction with Halfen HNA Fixing straps

Corner guards in an industrial environment

Halfen ML Brick-tie anchor system

ROOF AND WALLS
Halfen HSF Rafter Shoe



HSF 6/12

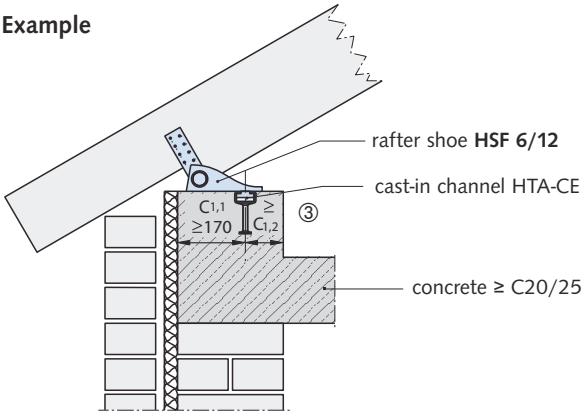
Material/Finish:
FV = 1.0038,
hot-dip galvanized

In modern wood constructions, HSF 6/12 rafter shoes are used to support the horizontal forces in rafter and collar tie roofs.

The advantages at a glance:

- minimal planning; simply specify the profile and position of the Halfen Cast-in channels in the concrete element
- clearly defined statics with flexible rafter shoes
- complex and therefore costly support structures are not necessary
- simple and straightforward roof construction:
  a) adjustable support plate
  b) adjustable nailing brackets for vertical anchorage for various rafter widths from 60 to 120 m
  c) adjustable in longitudinal rafter axis ± 15 mm
- freely adjustable rafter spacings in the longitudinal axis of the Halfen Channel without additional measures
- hot-dip galvanized for excellent corrosion protection

Example

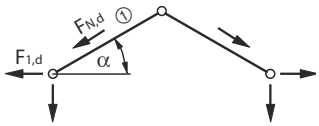


Definition $c_{1,1}$ and $c_{1,2}$ see page 27

The horizontal forces are transferred into the main concrete structure using (ETA) European Technical approved Halfen HTA-CE Cast-in channels.
During assembly ensure that the serration in the counter plates engages in the base plate. The marking on the counter plates must be at right angles to the slot in the base plate.

Rafter roof static system:

$F_{1,d} < F_{Rd}$



Design values F_{Rd}

Load F_{Rd} [kN/Rafter]	Required Halfen Cast-in channel Type	Min. edge distance ② $C_{1,2}$ [mm]	Required Halfen Bolt Type dimensions
12.6	HTA-CE 38/17	75	HS 38/17 - M16 × 40
16.8	HTA-CE 40/22 P HTA-CE 40/25	100	HS 40/22 - M16 × 50
19.6	HTA-CE 50/30 P HTA-CE 49/30	150	HS 50/30 - M16 × 50

① The maximum rafter strength is limited by the design load of each individual component in the rafter shoe. Load tests resulted in a mean breaking load of 50 kN. With normal loads larger than the recommended load capacity (= about ⅓ of the breaking load), the rafter spacing will need to be reduced.
② If lower loads are present, then the minimum edge distance $C_{1,2}$ for the Halfen Cast-in channels can be reduced. The distance to the concrete edge must be at least 170 mm.
③ Make sure that the Halfen Cast-in channels are installed flush with the concrete surface. Use spacers if necessary.

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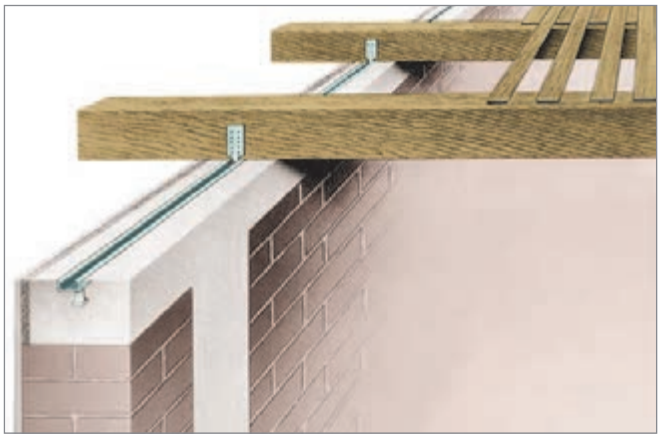
Halfen HNA Timber Fixing Strap



Typical installation of timber beams using HNA nailing straps with Halfen Cast-in channels embedded in concrete.

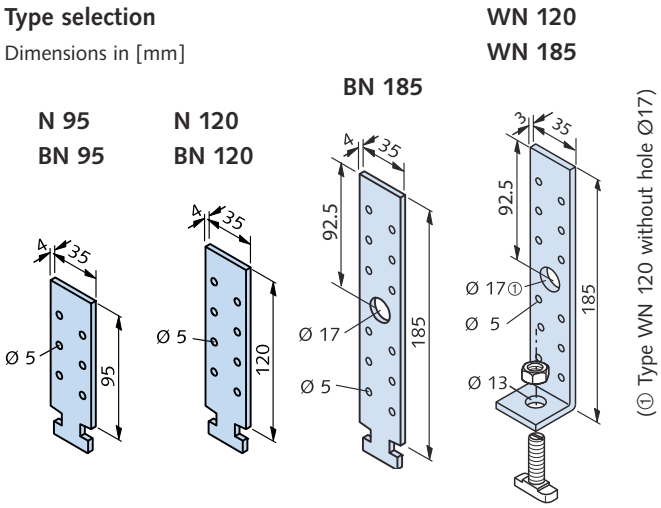
To provide an optimal base for roof framework, continuous Halfen HTA-CE Cast-in channels or Halfen HTA-CE Cast-in channel short elements are cast in the concrete; suitable for concrete ring beams or slabs. The type of Halfen HTA-CE Cast-in channels, nailing straps and nails depend on the assumed loads (ex. wind force).

For calculation and design criteria see:
- EN 1991-1-4 (EC1) and EN 1991-1-4/NA
- EN 1995-1-1 (EC5)

The timber fixing straps can be positioned on one or both sides of the timber beams or rafters. Refer to the following table for F_{Rd} load capacities. The beams / framework must be secured against twisting when straps are used only on one side of the beams, (example by nailing to the upper wood roof boarding).

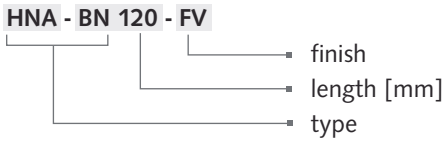
Type selection

Dimensions in [mm]

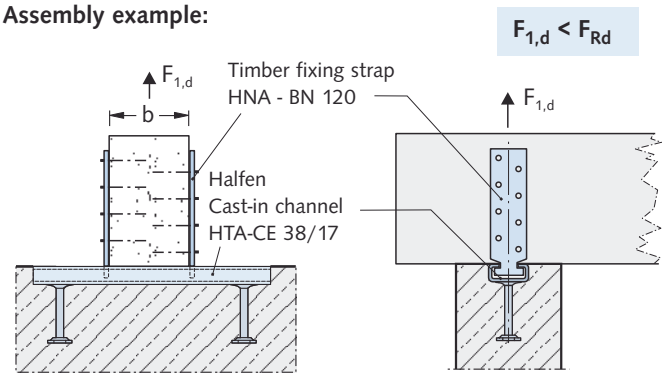


Halfen Bolt M10 with nut, **please order separately!**

Ordering example:



Assembly example:



Type selection, timber fixing straps

Suitable for Halfen Cast-in channel:	Material/Finish FV = 1.0038, hot-dip galvanized	Design value for load capacity F_{Rd} [kN] for each beam attachment			Attaching timber fixing straps to wooden beams/rafters	
	Item name: Length [mm]	Position of timber fixing straps			Wire nails	Anchor nails
		Single-sided	Double-sided			
			for b ≥ 60 mm	b ≥ 100 mm		
HTA-CE 28/15 hot-dip galvanized (FV)	**HNA - N 95 - FV**	4.2	4.9	5.6	according to EN 10230-1	according to the manufacturer's technical approval
	HNA - N 120 - FV					
	HNA - WN 120 - FV	1.4	2.8	2.8		
	HNA - WN 185 - FV					
HTA-CE 38/17 hot-dip galvanized (FV)	**HNA - BN 95 - FV**	6.3	7.5	8.4		
	HNA - BN 120 - FV					
	HNA - BN 185 - FV					
	HNA - WN 120 - FV	1.4	2.8	2.8		
	HNA - WN 185 - FV					

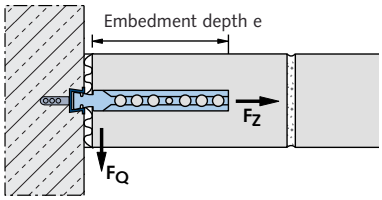
ROOF AND WALLS
Brick Tie Anchor Systems ML + BL

Halfen Brick tie systems are economic and proved fixing systems using Halfen ML Brick ties for fixing brickwork, in-fill panels, partition walls, cladding panels (with or without air gap or thermal insulation) to steel or timber structures or concrete walls and columns. **The brick ties are able to move vertically in the wall connector channels; this greatly reduces movement cracks in the brickwork.**

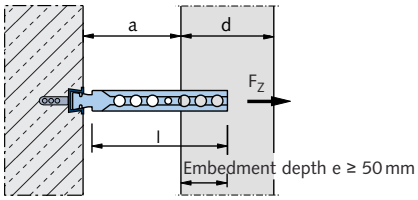
All HTA-CE and HMS profiles have a foam filling to prevent concrete ingress. The channels are attached to the formwork using standard nails.

The Halfen Brick tie anchors are inserted at the recommended intervals (static requirements) in the brick wall during construction. The anchors are inserted in the brick tie channels, turned 90°, laid flat between the rows of brick and pressed into the mortar. The perforations in the anchors optimise anchorage with the mortar.

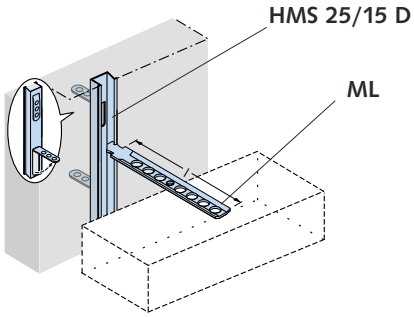
Wall connection



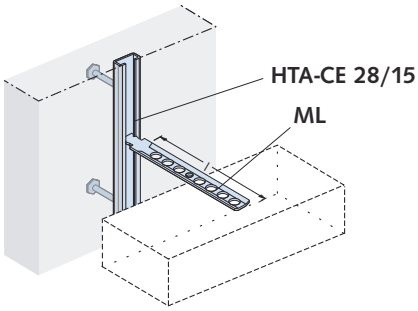
Facing brickwork connection

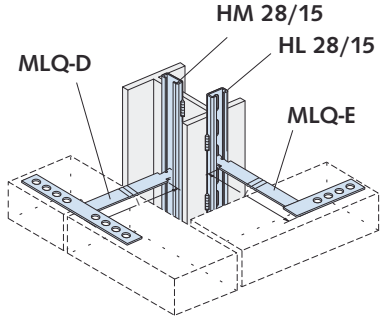


ML Brick ties in combination with Halfen Channels HMS, HTA, HM and HL

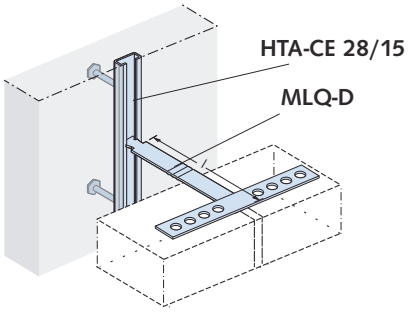


The pre-punched anchors in the HMS Channels are bent out by hand every 250 mm on-site to ensure safe anchorage in the concrete.

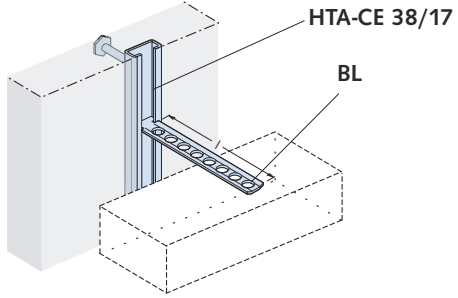


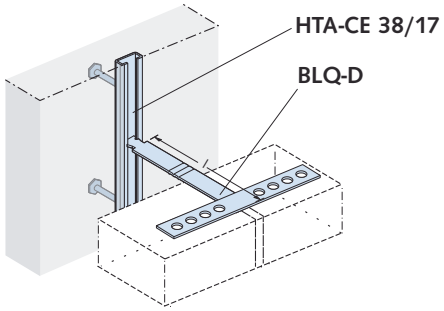


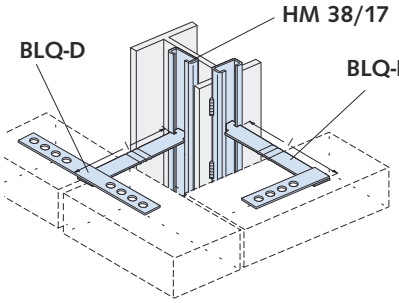
HM 28/15 welded to steel column. **HL 28/15** can be alternatively bolted with dowels to concrete.



BL Brick tie in combination with Halfen Channel type HTA 38/17 and HM 38/17







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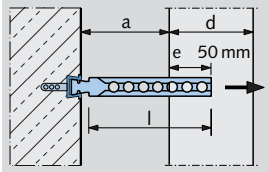
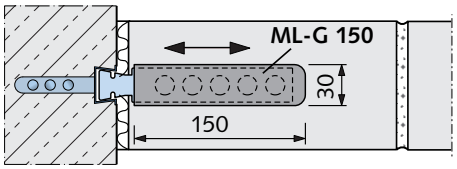
Brick Tie Anchor Systems ML + BL

Allowable wall spacing a			
Connection two-leaf masonry	Length **l** (l_1) [mm]	Spacing **a** [mm]	**d** [mm]
	85	20 - 45	115
	120	40 - 80	
	180	85 - 140	
	(300)	0 - 80	240
	(350)	20 - 95	
	(400)	35 - 115	

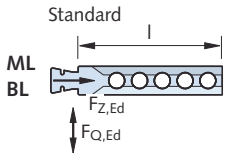
Halfen Brickwork anchors are verified in accordance with EN 845-1 for various anchor channels with a minimum embedment depth of 50mm:

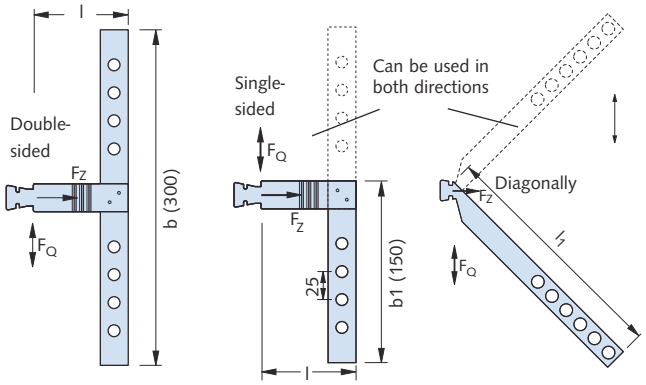
Characteristic load-bearing capacity (validated preformance)				
		BL	ML	ML1
F_Z [KN] Axial load	HTA-CE	3.2	2.7	2.5
	HMS	-	1.6	1.6
F_Q [KN] Shear load	HTA/HMS	2.7	1.5	1.4
F_D [KN] Compression load	HTA/HMS	1.0 (BL180)	1.0 (ML180)	-

Sliding sleeve ML-G 150 for ML-Anchor, for wall connections



Allows movement in the anchor longitudinal direction; this helps to avoid cracking in long sections of brick wall or infill brickwork connected to concrete structures.
Material: Soft-PVC Article name: MLG-150

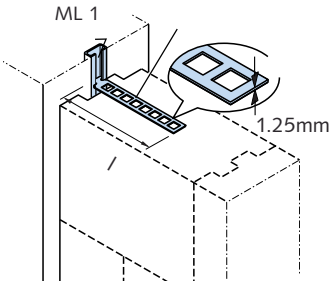


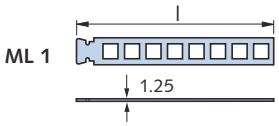


Brick ties ML 1 for connections with thin-joint mortar in interior applications

Material: Stainless steel W1.4301 A2

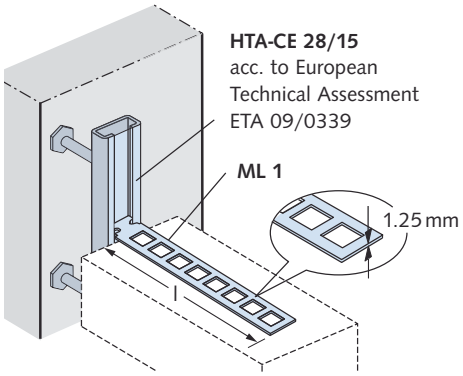
Brick ties stainless steel	
Article name	**Length l [mm]**
ML1-125-A2	125
ML1-125-A2	185
ML1-125-A2	245



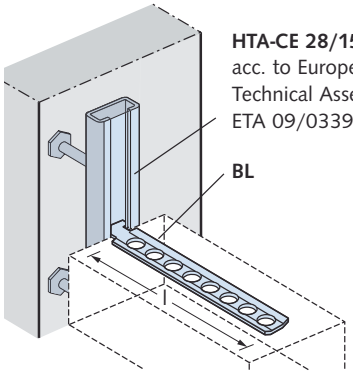


Channels load-bearing capacity with wall tie spacing of ≥ 25 cm			
Brick tie channel	**HMS 25/15 D**	**HTA-CE 28/15**	**HTA-CE 38/17**
Centric tension **F_Z** [kN] ($F_{Z,Rd}$)	1.2 (1.6)	3.0 (4.0)	4.5 (6.1)
Transverse stress **F_Q** [kN] ($F_{Q,Rd}$)	1.5 (2.0)	3.0 (4.0)	4.5 (6.1)

ML 1 Masonry connection

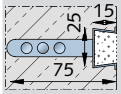
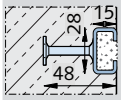
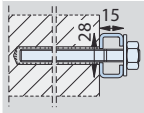
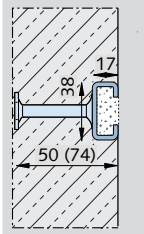


BL Masonry connection



ML/BL Masonry connection

ROOF AND WALLS
Brick Tie Anchor Systems ML + BL

Brick-tie channel		Brick-tie anchor				
		ML Standard 26 × 2 [mm]	ML 1 25 × 1.25 [mm]	MLQ - D Double-sided 25 × 3 [mm]	MLQ - E One-sided 25 × 3 [mm]	MLS Diagonal 22 × 3 [mm]
		Type / Length l [mm]	Type / Length l [mm]	Type / Length l [mm]	Type / Length l [mm]	Type / Length l_1 [mm]
	**HMS 25/15 D** L = 2500 mm					
	**HTA-CE 28/15** L = 1050 mm① L = 6070 mm①					
	**HL 28/15** L = 6070 mm①					
	**HTA-CE 38/17** L = 1050 mm① L = 6070 mm①	BL Standard 30 × 2 [mm] Type / Length l [mm]	BLQ - D Double-sided 30 × 3 [mm] Type / Length l [mm]	BLQ - E One-sided 30 × 3 [mm] Type / Length l [mm]		
		ML - 85	**ML 1 - 125**	**MLQ-D - 85**	**MLQ-E - 85**	**MLS - 300**
		ML - 120	**ML 1 - 185**	**MLQ-D - 120**	**MLQ-E - 120**	**MLS - 350**
		ML - 180	**ML 1 - 245**	**MLQ-D - 180**	**MLQ-E - 180**	**MLS - 400**
		BL - 85	**BLQ-D - 85**	**BLQ-E - 85**		
		BL - 120	**BLQ-D - 120**	**BLQ-E - 120**		
		BL - 180	**BLQ-D - 180**	**BLQ-E - 180**		

Material:
- **FV** = Steel S235JR, hot-dip galvanised
- **SV** = Steel DX51D + Z275, Sendzimir galvanised
- **A4** = Stainless steel 1.4571/1.4404
- **A2** = Stainless steel 1.4301

① Other lengths: **Available on request**

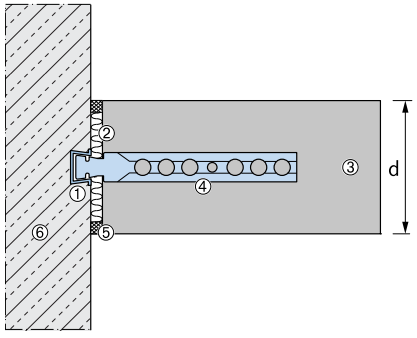
Firewall connection according to DIN 4102-4 : 2016-05

Solid masonry fire walls

Statically required connections of load bearing, room-enclosing, masonry walls can also be designed as fire walls in accordance DIN 4102-4 section 9.8.4 using Halfen Brick tie channels.
The anchorage to adjacent components (steel reinforced concrete supports or walls) meet the requirements for stability and fire resistance if the anchorage conforms to the standards set in DIN 4102-4 section 9.8.4 (figure 9.13, variant 2).

Anchor spacings

Halfen Brick tie anchors can be used at any position along the whole length of the brick tie channel. Generally the standard spacing between the anchors is 250 mm (4 anchors per metre).



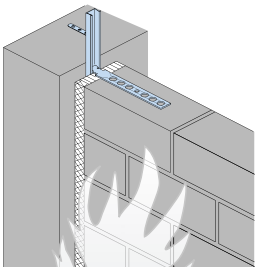
Definition, DIN regulations

① **Halfen Cast-in channel**
② **Insulation layer:**
According to DIN 4102-4 section 9.2.14 insulation layers in connecting joint gaps must, "[...] be made of non-flammable mineral fibre; have a melting point ≥ 1000°C as stated in DIN 4102-17; and have a gross density of ≥ 30 kg/m³" and must not smoulder.
③ **Masonry:**
Bricks (gross density class) and minimum wall thickness according to DIN EN 1996-1-2: 2011-04.
④ **Masonry connection** (vertically adjustable)
⑤ **Expansion joint**
⑥ **Concrete**

Product information

Halfen Cast-in channel Type ①	④ Brick tie anchor	
	for standard grout	for thin mortar
HMS 25/15 D	ML	ML 1
HTA 28/15	ML	ML 1
HTA 38/17	BL	–

Connection of a load bearing masonry wall as a firewall according to DIN 4102-4 section 9.8.4 (figure 9.13) or according to DIN EN 1996-1-2: 2011-04 (figure E.4B)



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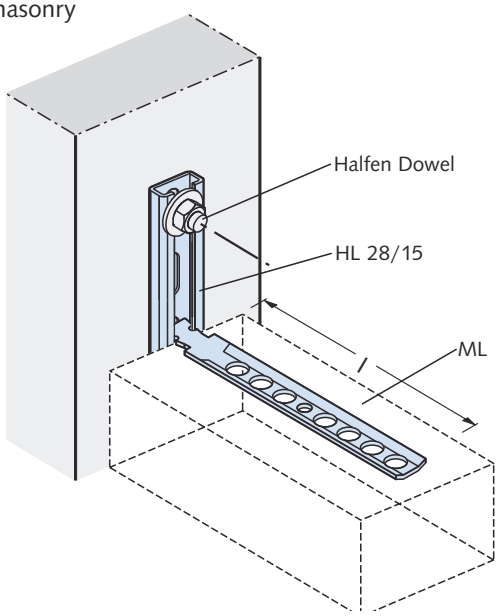
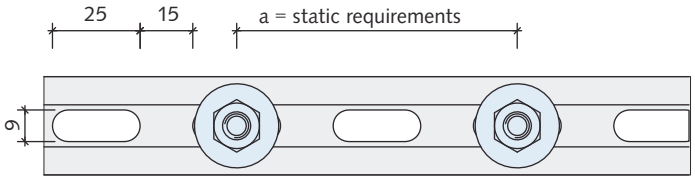
Halfen Anchor Bolt Systems

HL slotted framing channels anchored to concrete or masonry



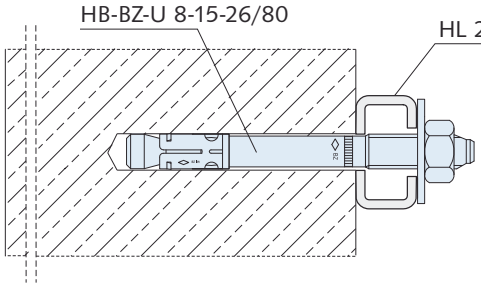
Top view



ETA-17/0196 ETA-16/0691

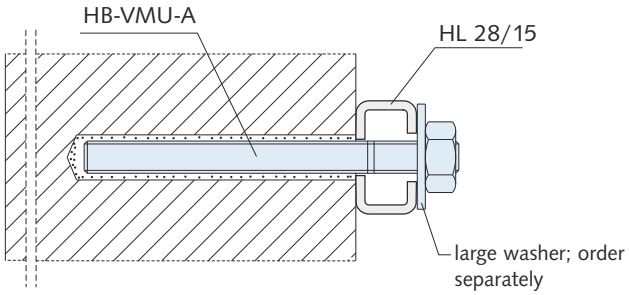
ETA 17/0196 (brickwork) and ETA 16/0691 (concrete)/ Injection system HB-VMU plus

For more information on application and assembly see the Technical Product Information catalogue, **Halfen HB Anchor bolt systems**



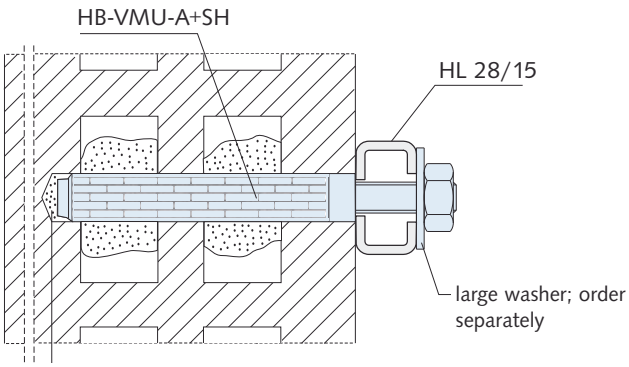
Bolt anchor HB-BZ-U 8-15-26/80

- galvanized or (A4) stainless steel
- approved for cracked and non-cracked concrete
- with large washer DIN 9021/EN ISO 7093



Anchor rod HB -VMU-A 8-20/110

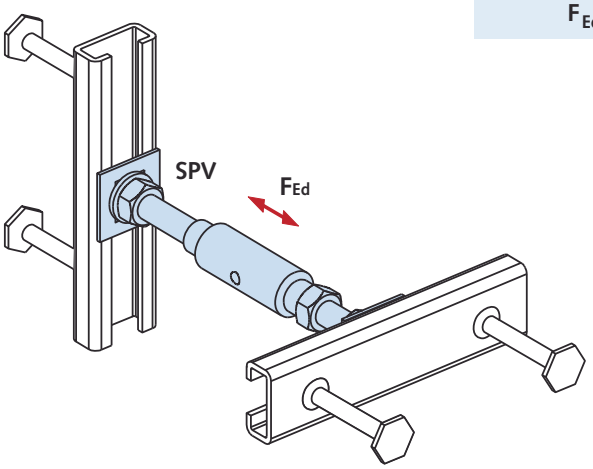
- galvanized or (A4) stainless steel
- approved for **monolithic masonry**
- with large washer DIN 9021/EN ISO 7093 (order separately)
- mortar cartridge HB-VMU plus 280 and static mixer (order separately)



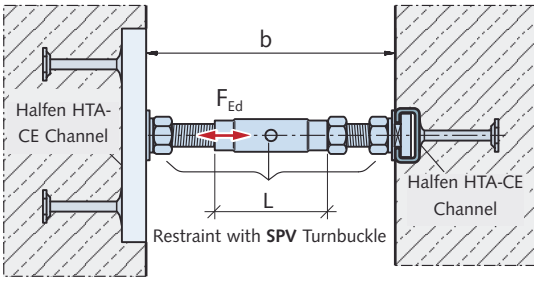
Anchor rod HB-VMU-A 8-20/110 with Perforated sleeve HB-VMU-SH 16×85

- galvanized or (A4) stainless steel
- approved for **perforated brick masonry**
- with large washer DIN 9021/EN ISO 7093 (order separately)
- mortar cartridge HB-VMU plus 280 and static mixer (order separately)

ROOF AND WALLS
Restraint with Turnbuckle SPV



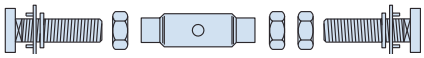
F_{Ed} = load



Ensure adequate screw depth:
M12 → ≥ 10 mm
M16 → ≥ 13 mm

Product description
The restraint with turnbuckle SPV is suitable for compressive and tensile loads up to F_{Ed} = 15.0 kN and for clearances up to 200 mm. By turning the clamping sleeve (sleeve has a right and left-hand thread), the clearance can be freely adjusted within the given range. Connected to the building structure using Halfen Cast-in channels (order separately).

Included in delivery



- Turnbuckle SPH
- 2 HALFEN Bolts
  (1 right-hand thread, 1 left-hand thread)
- 3 standard nuts
- 2 washers and 2 SIC locking washers

Ordering example:

Item name: **SPV - 7,0 - 100 - A4**

- SPV → type
- 7,0 → load group
- 100 → wall clearance b
- A4 → material / finish

Halfen Cast-in channels must be ordered separately

Halfen SPV Restraint with turnbuckle

Load group		5.0			7.0			10.0		
Load capacity F_{Rd} [kN]		±7.5			±10.0			±15.0		
Type	Stand-off distance b [mm]	Halfen Bolt left-hand thread M12 [mm]	Sleeve L [mm]	Halfen Bolt right-hand thread M12 [mm]	Halfen Bolt left-hand thread M16 [mm]	Sleeve L [mm]	Halfen Bolt right-hand thread M16 [mm]	Halfen Bolt left-hand thread M16 [mm]	Sleeve L [mm]	Halfen Bolt right-hand thread M16 [mm]
SPV	100 ±10 ②	50	60	40	50	60	40	-	-	-
	120 ±15	50	75	40	50	75	40	-	-	-
	140 ±15	50	75	60	50	75	60	80	60	50
	160 ±15	50	95	60	50	95	60	80	75	50
	180 ±15	50	115	60	50	115	60	80	95	50
	200 ±15	50	135	60	50	135	60	80	115	50
Recommended fixing		HTA-CE 38/17 ①			HTA-CE 38/17 ①			HTA-CE 49/30 ①		

① Short elements 150, 200 and 250. The respective boundary conditions must be taken into consideration when verifying the anchorage.
② Minimum tolerance is limited for load group 7.0

For further concrete façades accessories
see catalogue **Halfen Concrete façade anchor systems**
www.halfen.com ▻ Downloads ▻ Brochures ▻ ...

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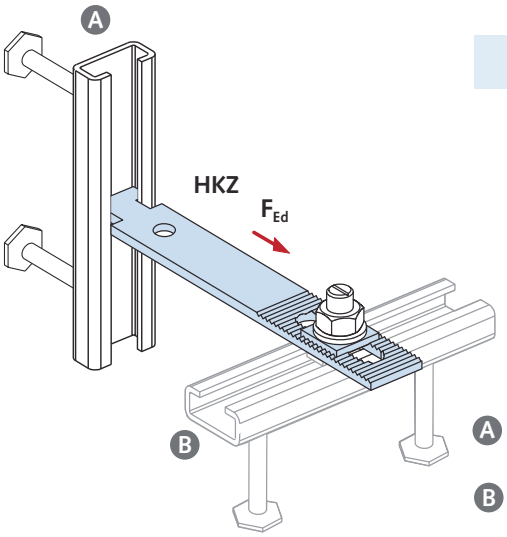
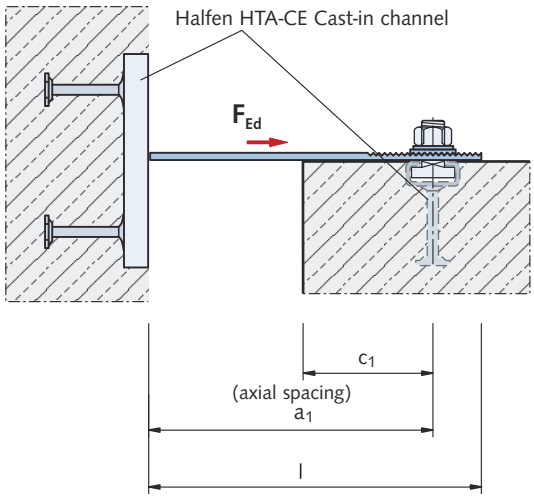
Restraint Tie HKZ



F_{Ed} = load



Ⓐ **Halfen Channel suitable for HKZ-Restraint ties**

Ⓑ **Halfen Channel or dowel according to approval**

Product characteristics

The serrations in the bracket and in the washer ensure positive static load transmission.

Two Halfen Cast-in channels embedded at right angle in the concrete ensure three-dimensional adjustability.

Please order HALFEN Cast-in channels and HALFEN Bolts and washers separately

Ordering example:

Item name: **HKZ-38/17 - 100 - A4**

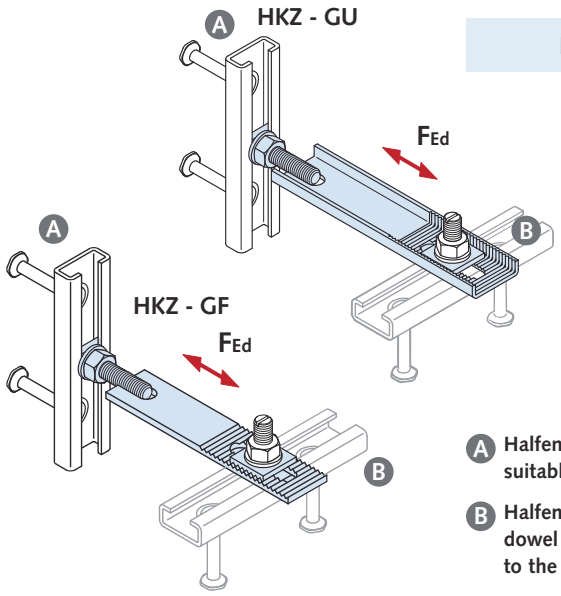
- type
- clearance a_1
- material / finish

Halfen HKZ Restraint tie

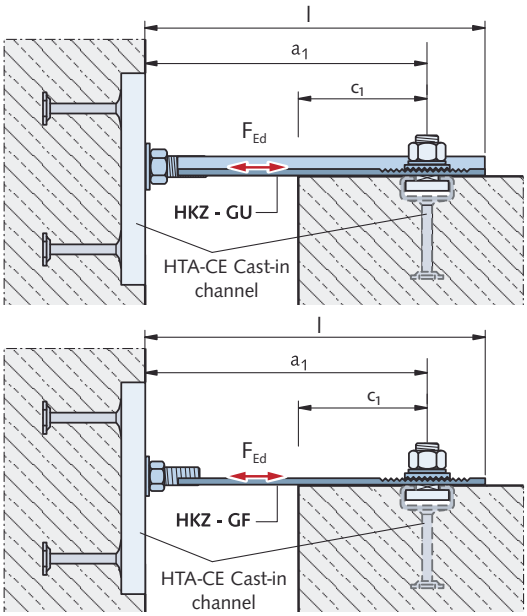
Characteristics: ① Load capacity F_{Rd} [kN]	Type selection: GV = galvanized. Not suitable for façades with ventilation gaps. Type	a_1 [mm]	Type selection: A4 = Stainless steel grade 1.4571/1.4404. Type	a_1 [mm]	Dimensions: Length l [mm]	Spacing a_1 [mm]	Tolerance [mm]	Holes [mm]
+4.9 (tension only)	HKZ 28/15 - 50 - GV		HKZ 28/15 - 50 - A4		90	50	a_1 ±20	LL 11 × 55
	HKZ 28/15 - 75 - GV		HKZ 28/15 - 75 - A4		115	75		
	HKZ 28/15 - 100 - GV		HKZ 28/15 - 100 - A4		140	100		LL 11 × 55 RL 11
	HKZ 28/15 - 125 - GV		HKZ 28/15 - 125 - A4		165	125		
	HKZ 28/15 - 150 - GV		HKZ 28/15 - 150 - A4		190	150		
	HKZ 28/15 - 175 - GV		HKZ 28/15 - 175 - A4		215	175		
	HKZ 28/15 - 200 - GV		HKZ 28/15 - 200 - A4		240	200		
	HKZ 28/15 - 225 - GV		HKZ 28/15 - 225 - A4		265	225		
	HKZ 28/15 - 250 - GV		HKZ 28/15 - 250 - A4		290	250		
+9.8 (tension only)	HKZ 38/17 - 75 - GV		HKZ 38/17 - 75 - A4		115	75	a_1 ±20	LL 13 × 55
	HKZ 38/17 - 100 - GV		HKZ 38/17 - 100 - A4		140	100		LL 13 × 55 RL 13
	HKZ 38/17 - 125 - GV		HKZ 38/17 - 125 - A4		165	125		
	HKZ 38/17 - 150 - GV		HKZ 38/17 - 150 - A4		190	150		
	HKZ 38/17 - 175 - GV		HKZ 38/17 - 175 - A4		215	175		
	HKZ 38/17 - 200 - GV		HKZ 38/17 - 200 - A4		240	200		
	HKZ 38/17 - 225 - GV		HKZ 38/17 - 225 - A4		265	225		
	HKZ 38/17 - 250 - GV		HKZ 38/17 - 250 - A4		290	250		
	HKZ 38/17 - 275 - GV		HKZ 38/17 - 275 - A4		315	275		
	HKZ 38/17 - 300 - GV		HKZ 38/17 - 300 - A4		340	300		

① The load capacities apply for the HKZ-restraint ties. The channel Ⓐ and the fixing dowel/channel Ⓑ must be verified, depending on the edge distance c_1, the concrete grade and the reinforcement, for each application.

ROOF AND WALLS
Restraint Tie HKZ - GF/GU



F_{Ed} = load



A Halfen Channel suitable for HKZ-Restraint ties

B Halfen Channel or dowel according to the approval

Product description

The serrations in the bracket and in the washer ensure positive static load transmission.

Please order Halfen Cast-in channels and Halfen Bolts and washers separately.

The double-sided attachment using a Halfen Bolt and a threaded plate ensures positive and slippage-free wind anchoring when used in combination with Halfen HTA-CE Cast-in channels set in concrete; the connection is three-dimensionally adjustable.

Ordering example:

Item name: **HKZ - GF 38/17 - 125 - GV**

- HKZ: type
- GF 38/17: axial spacing a_1
- 125: material
- GV/A4

Halfen Restraint ties, type HKZ-GF and type HKZ-GU

Characteristics: ① Load capacity F_{Rd} [kN]	Type selection: GV = galvanized not suitable for façades with ventilation gap Type	a_1 [mm]	Type selection: A4 = Stainless steel 1.4571/1.4404 Type	a_1 [mm]	Dimensions: Length l [mm]	Spacing a_1 [mm]	Tolerance [mm]	Slot [mm]
±4.9	HKZ - GF 28/15 - 75 - GV		HKZ - GF 28/15 - 75 - A4		115	75	a_1 ±20	11 × 55
	HKZ - GF 28/15 - 100 - GV		HKZ - GF 28/15 - 100 - A4		140	100		
	HKZ - GF 28/15 - 125 - GV		HKZ - GF 28/15 - 125 - A4		165	125		
	HKZ - GF 28/15 - 150 - GV		HKZ - GF 28/15 - 150 - A4		190	150		
	HKZ - GF 28/15 - 175 - GV		HKZ - GF 28/15 - 175 - A4		215	175		
±9.8	HKZ - GF 38/17 - 100 - GV		HKZ - GF 38/17 - 100 - A4		140	100	a_1 ±20	13 × 55
	HKZ - GF 38/17 - 125 - GV		HKZ - GF 38/17 - 125 - A4		165	125		
	HKZ - GF 38/17 - 150 - GV		HKZ - GF 38/17 - 150 - A4		190	150		
	HKZ - GF 38/17 - 175 - GV		HKZ - GF 38/17 - 175 - A4		215	175		
	HKZ - GU 38/17 - 200 - GV		HKZ - GU 38/17 - 200 - A4		240	200	a_1 ±20	13 × 55
	HKZ - GU 38/17 - 225 - GV		HKZ - GU 38/17 - 225 - A4		265	225		
	HKZ - GU 38/17 - 250 - GV		HKZ - GU 38/17 - 250 - A4		290	250		
±16.8	HKZ - GU 50/30 - 200 - GV		HKZ - GU 50/30 - 200 - A4		240	200	a_1 ±20	17 × 60
	HKZ - GU 50/30 - 225 - GV		HKZ - GU 50/30 - 225 - A4		265	225		
	HKZ - GU 50/30 - 250 - GV		HKZ - GU 50/30 - 250 - A4		290	250		
	HKZ - GU 50/30 - 275 - GV		HKZ - GU 50/30 - 275 - A4		315	275		
	HKZ - GU 50/30 - 300 - GV		HKZ - GU 50/30 - 300 - A4		340	300		

① The load capacities apply for the HKZ-restraint ties. The channel A and the fixing dowel/channel B must be verified, depending on the edge distance c_1, the concrete grade and the reinforcement, for each application.

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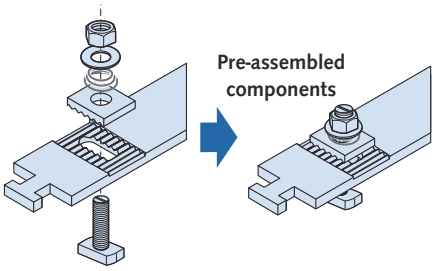
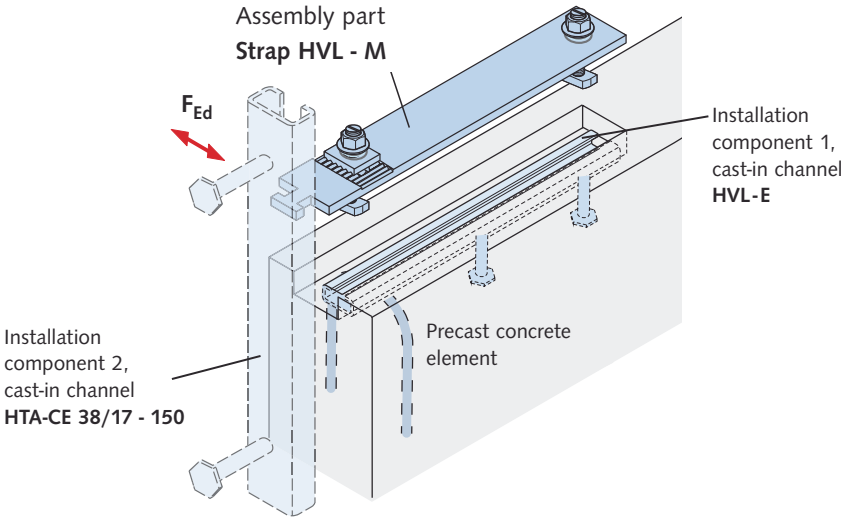
HVL Precast Connection

Assembly:
The connecting strap is delivered ready to be installed: The bolt fastening sets and the counter plate are pre-assembled for fast installation.





Assembly part HVL-M
Pre-assembled, consisting of:
- serrated hammer-head strap
- 1 serrated counter plate
- 2 bolt sets
  (Bolt HS 38/17 - M12 × 50
  + washer + tapered compressed spring)

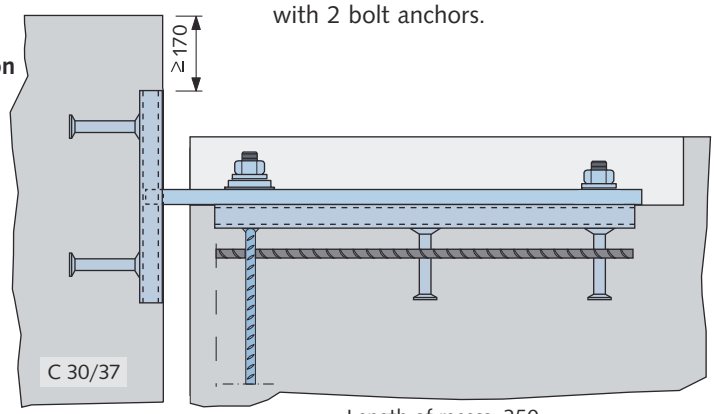
Installation component 1 HVL-E:
Halfen Cast-in channel
HTA 38/17-300-SK with 2 bolt anchors and one loop end anchor.

Installation component 2:
Halfen Cast-in channel
HTA-CE 38/17-150
with 2 bolt anchors.

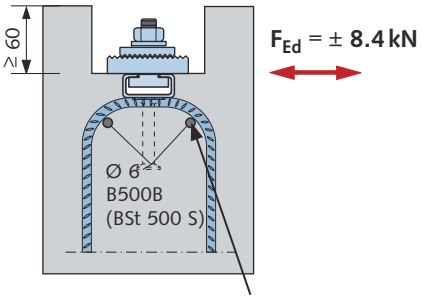
Corrosion protection
- hammer-head strap, cast-in channel: hot-dip galvanized
- Halfen Bolts, nuts, washers and springs: galvanized

These parts are covered by mortar after installation.

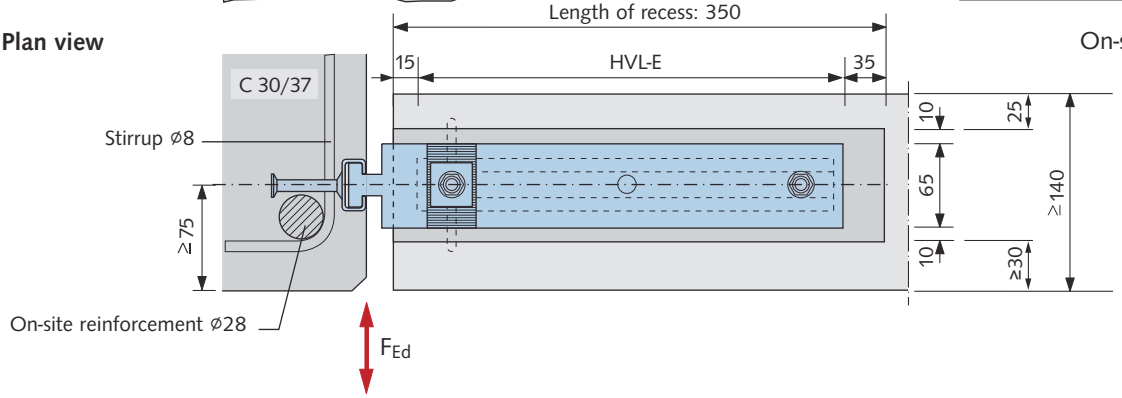
Longitudinal section



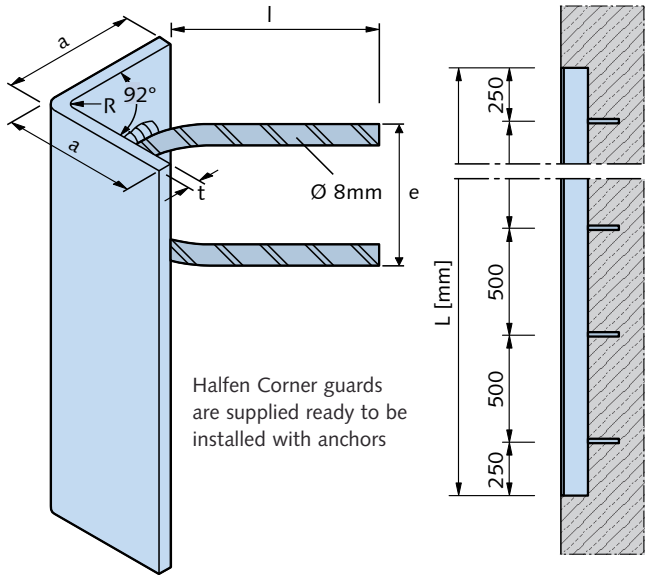
Cross section



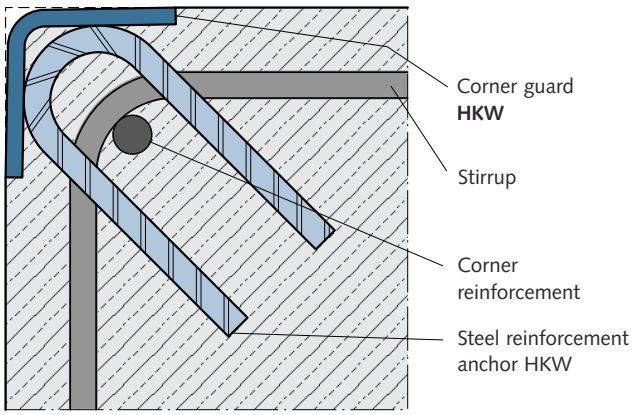
Plan view



ROOF AND WALLS
Halfen HKW Corner Guard



Column edge, typical cross-section



Corner guard HKW						
Type selection:				Material/Finish:		Anchor dimensions	Radius
Type	a/t [mm]	Length L [mm]	no. of anchors	**FV** = hot-dip galvanized	**A2** = Stainless steel	l × e [mm]	R [mm]
HKW	**50/5 -**	**500 / 2**		FV	A2	75 × 55	6
		750 / 2		FV	A2		
		1000 / 2		FV	A2		
		1500 / 3		FV	A2		
		2000 / 4		FV	A2		
HKW	**80/6 -**	**500 / 2**		FV	A2	100 × 85	8
		750 / 2		FV	A2		
		1000 / 2		FV	A2		
		1500 / 3		FV	A2		
		2000 / 4		FV	A2		
HKW	**100/8 -**	**500 / 2**		FV	A2	110 × 85	16
		750 / 2		FV	A2		
		1000 / 2		FV	A2		
		1500 / 3		FV	A2		
		2000 / 4		FV	A2		

Material/Finish:

- **FV** = **Corner profile:** Steel hot-dip galvanized 1.0038
  Anchor: B500B (BSt 500 S)
- **A2** = **Corner profile:** Stainless steel 1.4307
  Anchor: B500B/A NR

Advantages:

- 92° angle ensures a tight fit to the formwork. This prevents concrete seeping between the formwork and the corner profile, resulting in a smoother finish
- U-shaped concrete reinforced anchors do not restrict the corner reinforcement and allow easy installation of the reinforcement
- anchors are of reinforcement steel quality to guarantee optimal anchorage
- competitive pricing through serial production

Ordering example:

HKW 50/5 - A2 - 2000/4

- 2000/4 → length/no. of anchors
- A2 → material/finish
- HKW 50/5 → type/profile

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