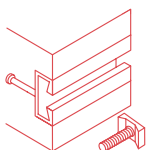
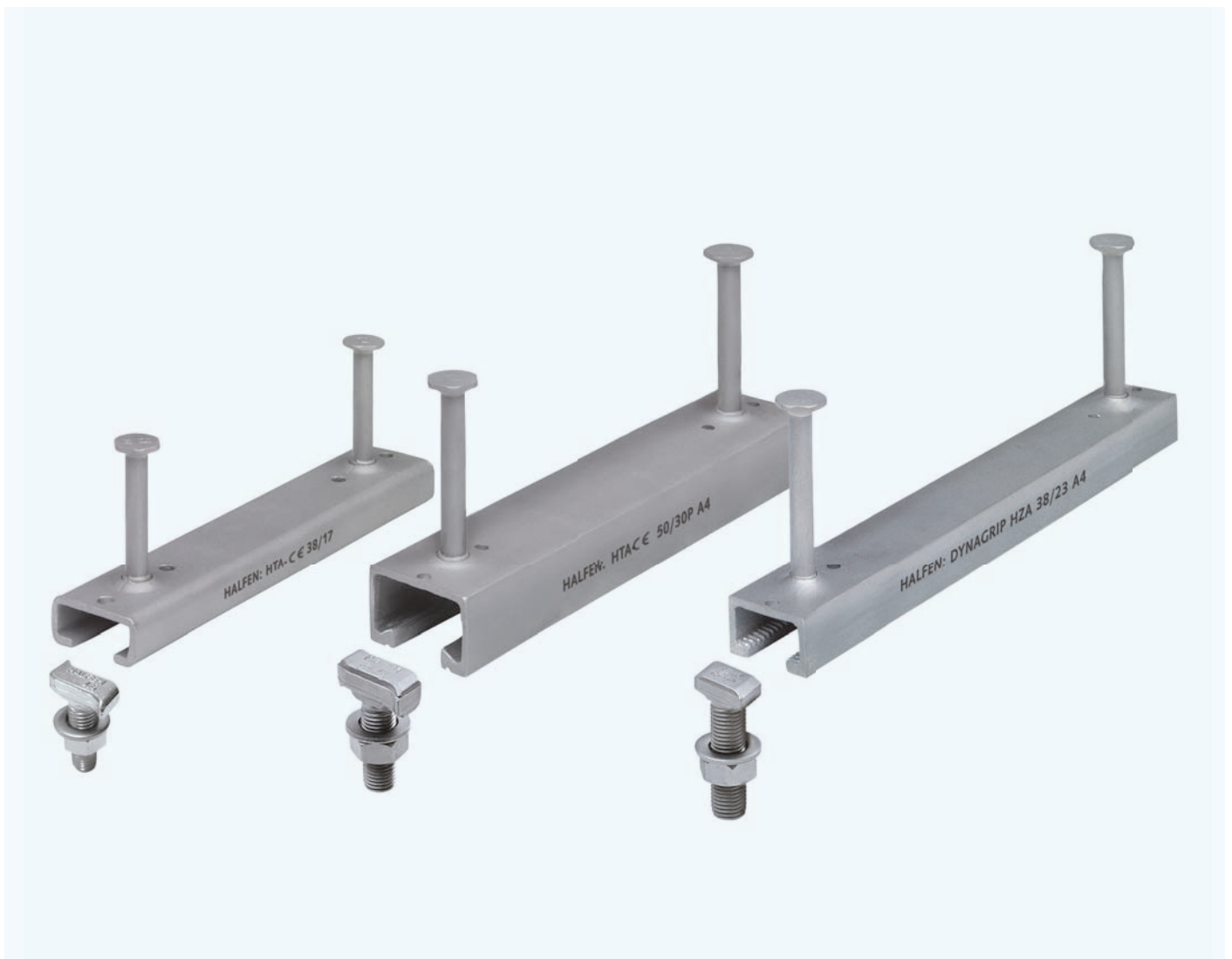




HALFEN

Halfen Cast-In Channels

Technical Product Information



Anchoring & Fixing
Cast-In Channels, T-Bolts & Accessories

English



We imagine, model and make engineered products and innovative construction solutions that help turn architectural visions into reality and enable our construction partners to build better, safer, stronger and faster.

Leviat is a world leader in connecting, fixing, lifting and anchoring technology.

From the build of new schools, hospitals, homes and infrastructure, to the repair and maintenance of heritage structures, our engineering skills are making a difference around the world.

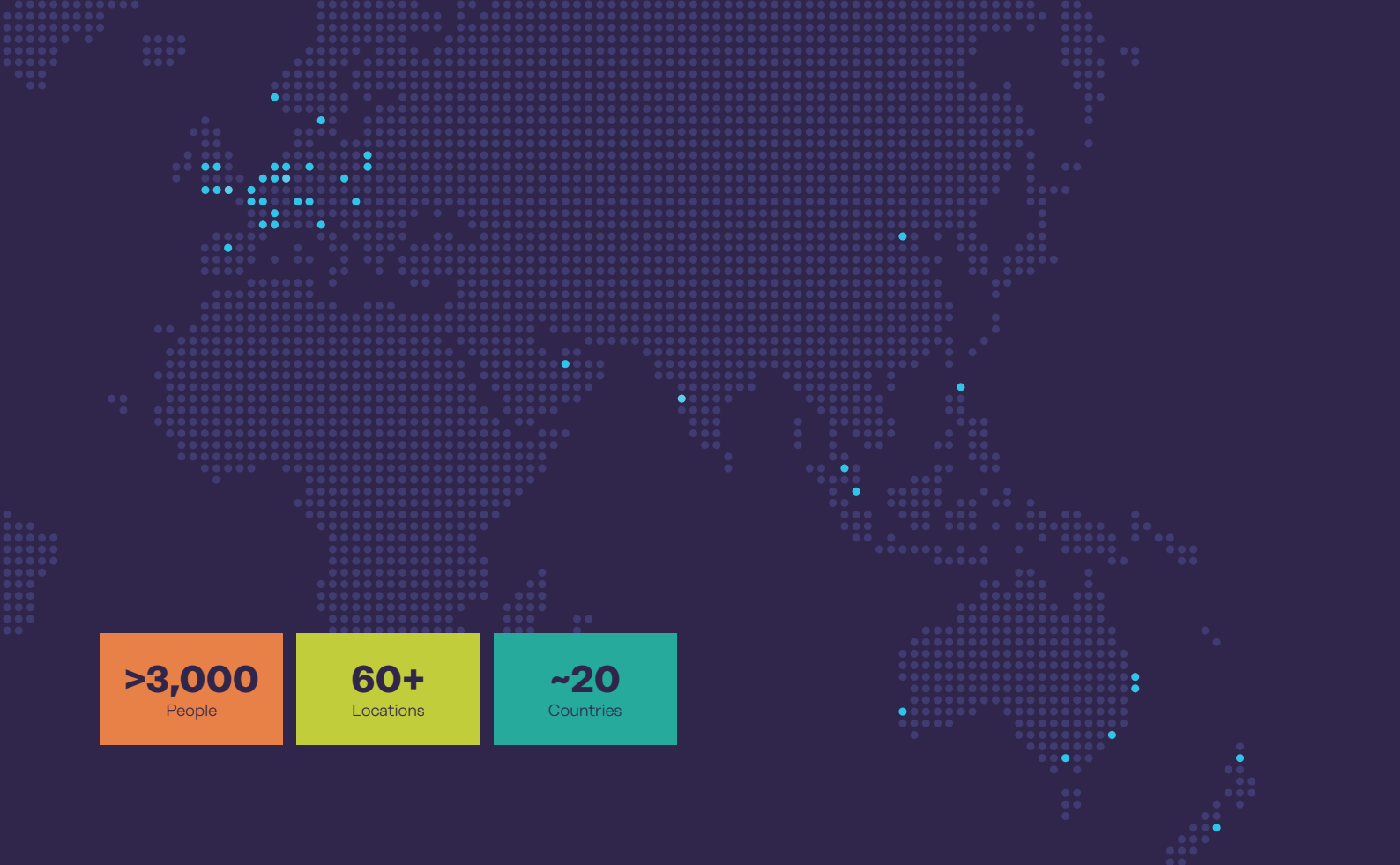
We provide technical design assistance at every stage of a project, from initial planning to installation and beyond.

Our technical support services range from simple product selection through to the development of a fully customised project-specific design solution.

Every promise we make locally, has the commitment and dedication of our global team behind it. We employ almost 3,000 people at 60 locations across North America, Europe and Asia-Pacific, providing an agile and responsive service worldwide.

Leviat, a CRH company, is part of the world's leading building materials business.

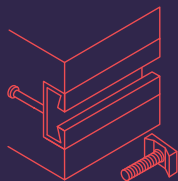




>3,000
People

60+
Locations

~20
Countries



Anchoring & Fixing

Systems for fixing secondary fixtures to concrete, including anchor channels, bolts and inserts; also tension rod systems for roofs and canopies.

- Cast-in Channels, T-Bolts & Accessories
- Threaded Inserts
- Rod Systems
- Attachment Points
- Post Installed Anchor Systems

Other areas of expertise:



Structural Connections

Systems to form robust, efficient connections, and continuity of concrete reinforcement as necessary, between walls, slabs, columns, beams and balconies, providing structural integrity as well as enhanced thermal and acoustic performance.



Lifting & Bracing

Systems for the safe and efficient transportation, lifting and temporary bracing of cast concrete elements and tilt-up panels before permanent structural connections are made.



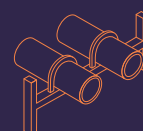
Façade Support & Restraint

Systems for the safe and thermally-efficient fixing of the external building envelope, including brick and natural stone, insulated sandwich panels, curtain walling and suspended concrete façades, and also the repair and strengthening of existing masonry installations.



Formwork & Site Accessories

Non-structural accessories that complement our engineered solutions and help keep your construction environment operating safely and efficiently, including moulds for casting standard and special concrete elements and construction essentials such as reinforcing bar spacers.



Industrial Technology

Mounting channels, pipe clamps and other versatile framing systems that provide safe fixing in a wide range of industrial applications.

Leviat product ranges:

Ancon | Aschwanden | Connolly | Halfen | Helifix | Isedio | Meadow Burke | Modersohn | Moment | Plaka | Scaldex | Thermomass

Halfen Cast-in Channels

Contents

General Information	6–13	
Integrated Quality – from start to finish	6	
Sustainability, Identification, BIM	7	
Product families in overview	8	
Product range - for preliminary computation	9	
Application segments and application examples	10–11	
Materials/ Corrosion protection	12–13	
Dimensioning	14–15	
Verification method	14	
Calculation basics, Verification flow chart	15	
Halfen HTA-CE Anchor channels	16–27	
The benefits at a glance	16	
Application examples	17	
Halfen HTA-CE, product range – overview channels and T-bolts	18–19	
Halfen Bolts type HS – overview	20–21	
Halfen Bolts type HS identification, bolt length, design resistance, torque values	22–23	
Halfen HSR Bolts	24	
Fatigue loads, edge and T-bolt spacing	25	
Fire resistance	26	
HTA-CE standard lengths, HTA-CS Channels “curved solution”	27	
Halfen HZA Anchor channels, serrated – DYNAGRIP®	28–36	
The benefits at a glance	28	
Application examples	29	
Halfen HZA Product range – Overview channels and bolts	30	
Halfen HZA standard lengths, HZA-CS Channels “curved solution”	31	
Halfen HZS Bolts	32–33	
Edge and T-bolt spacings/bolt lengths	34	
Fire resistance	35	
Fatigue loads, Tender text example HZA	36	
HTA-CE/HZA Installation	37–40	
Installation aids, further channel parts	37	
Channel installation to formwork or concrete	38	
Installing Halfen Bolts and attached structures	39	
Installation in pre-stressed concrete – channels with stainless steel anchors	40	

Halfen Cast-in Channels

Contents

Calculation software for HTA-CE and HZA Anchor channels 41

Halfen Curtain Wall System 42–53

The benefits at a glance	42
Application examples	43
Product range	44–45
Design principles	46
Halfen Channel HCW 52/34	45, 47–48
Edge of slab brackets HCW-ED	49
Dimensioning, interaction diagrams	50
Design Loads HCW-EW, HCW-ED	51
Top of slab brackets HCW-B1 and HCW-B2	52–53

Halfen HGB Handrail Connections 54–67

The benefits at a glance – Application examples	54–55
General, regulatory requirements	56
Materials/Corrosion protection	57
Product range	58
Installation	59
Dimensioning/Calculating example	50–67

Halfen HTU Channels for fixing Profiled Sheet Metal

Halfen HTU-S Channel, self anchoring	68–70
Halfen HTU Channels with welded anchors	71–74

Halfen Framing channels – Product range extract

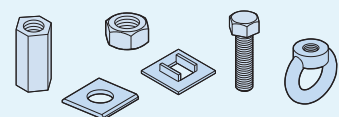
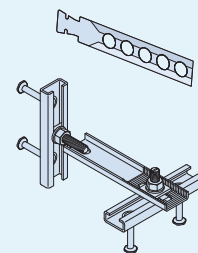
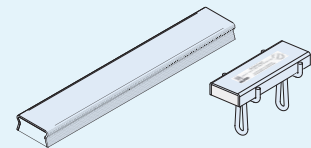
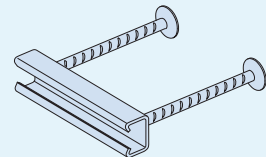
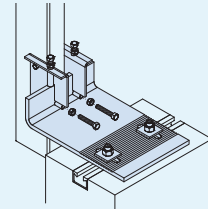
Benefits/Application examples/type overview	75–77
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Roof and Wall

The advantages at a glance – Application examples	78
Halfen HNA Timber fixing strap	80
Halfen Brick tie anchor system ML+BL	81–84
Halfen Restraint with turnbuckle SPV	85
Halfen Restraint tie HKZ; HKZ-GU/GF	86
Halfen HVL Precast connection	88
Halfen HKW Corner Guard	89

Accessories/Appendix

Nuts and washers	91
Threaded rods, hexagonal head bolts, coupler sleeves, ring nuts	92
Rail clips	93
Index	94
Contact, technical support	95



Halfen Cast-in Channels

Integrated Quality – from Start to Finish

Quality and safety are the ultimate targets in the production of the original Halfen Anchor Channel system. Therefore all our production locations are ISO 9001 certified to provide products that meet strict quality management standards. On the one hand this involves continual inspections, machine maintenance and quality testing during the manufacturing process and on the other hand it involves stringent quality control procedures of incoming raw materials right through to dispatch of the finished product.

Quality always comes first for our products and is guaranteed during each step of production! The extent, type and frequency of production checks carried out by us is determined by standards set and recorded.

Halfen Anchor Channels and Halfen Bolts, originating from our certified manufacturing plants, are produced of strictly regulated raw material. The complete raw material or semi-finished goods are procured solely from resources that meet our stringent in-house material specifications. Our suppliers must be ISO 9001 certified and must provide complete documentation on the required performance and quality. Therefore, our suppliers have to prove compliance with our material specifications with a 3.1 inspection certificate in accordance to DIN EN 10204.

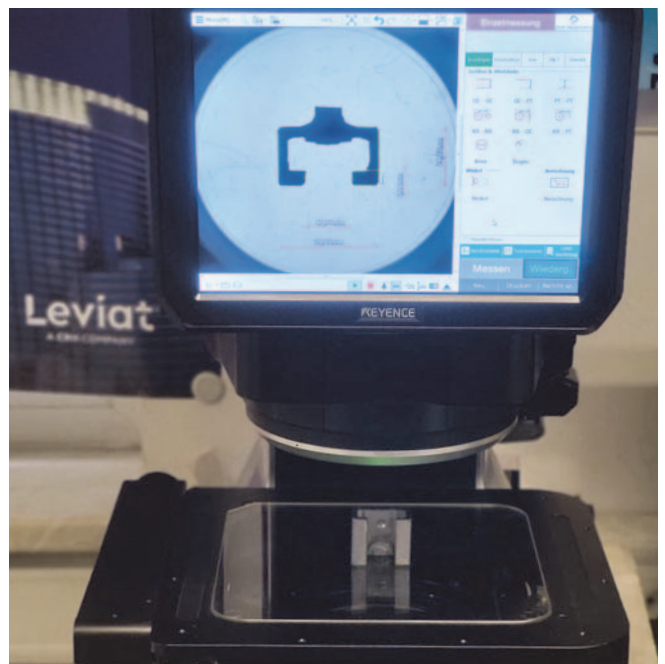
The inspection of incoming material is not limited to visual examination and dimensional checks. Every consignment is also analysed via spectral analysis. Moreover, the required tensile strength values, yield stress and rupture points are tested. Raw material is released for production only if all tests results are satisfying and comply with the provided 3.1 certification. The Halfen Anchor Channels and Halfen Bolts are continually checked during production for dimensional precision. The required frequency for quality checks is set in our quality control procedures.

At the end of the production process, before dispatch or storage, our (quality management system QMS) regulations require visual checks, dimensional control and tensile tests on a predetermined percentage of finished products. All tested anchor channels must prove a minimum safety factor against steel failure.

Our stringent Quality Assurance and Quality Control processes, part of the implemented QMS at our factories, ensure strict compliance to required quality standards and warrant the complete process chain, from the receipt of the raw material until final delivery of the finished products, are controllable and traceable. Therefore, complete traceability and a guarantee of the required performance and quality can be provided for all our products. Our focused approach on high quality and continuous improvement has been one of the reasons that our stakeholders have trusted us for the last almost 100 years! We are fully aware of our responsibility and will continue to maintain our excellent reputation with high quality products!



www.certainable.com



References

Tunnels



Lötschberg-Base tunnel, Switzerland

Bridges



Passerelle Simone de Beauvoir, Paris/France

Halfen Cast-in Channels

General

Sustainability

An EPD® (Environmental Product Declaration) provides transparent and comparable ecological data which helps to evaluate the sustainability of a building.

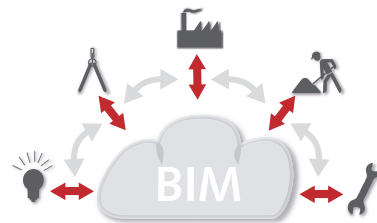
Already during the planning phase the data provided here is of great significance for architects and planners. The data provided also helps to ensure the high demands on the environmental performance of the building are met. Health Product Declarations (abbrev. HPD) complement our information on sustainability. The HPDs include a list of all components and information on the health effects of these components. The HPD for hot-dip galvanized Halfen Cast-in Channels helps to achieve additional points in the Leed system.

www.halfen.com / Downloads / Brochures / Environmental/ Health declarations



BIM

Having completed various projects using BIM methodology, we have considerable experience as a BIM partner. All Leviat engineers are trained to supervise this process in precise detail. Our combination of extensive experience and highly-trained engineers means we are perfectly placed to meet the increasing demand for BIM projects. Examples of our previous projects developed using BIM can be found at www.halfen.com / Service / BIM / BIM references.

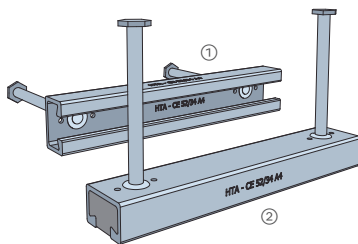


Fire-resistance / Material fatigue

A wide variety of Halfen Cast-in Channels are tested under fire exposure (according to TR 020 "Evaluation of anchorages in concrete with regard to fire resistance") as well as under cyclic loading. More details, characteristic resistances under fire exposure and fatigue resistances, are provided in the respective European Technical Assessments.

Type identification

- ① Inside on the bottom of the channel.
- ② Additionally on the channel side



Type identification

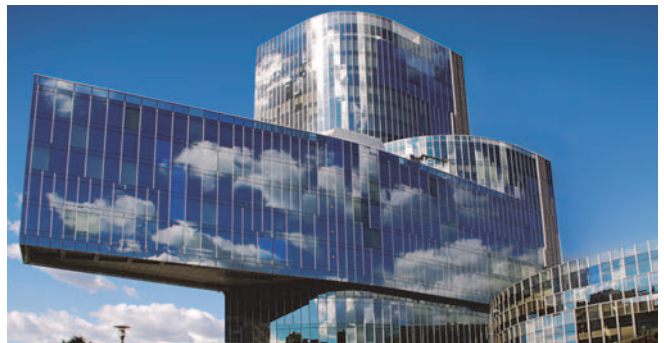
Material	Example
1.0038 / 1.0044	HTA-CE 38/17 HZA 53/34
A4: 1.4404 / 1.4571	HTA-CE 54/33 - A4 HZA 53/34 - A4
D4: 1.4062 / 1.4162	HTA-CE 38/17 - D4
HCR: 1.4529 / 1.4547	HTA-CE 38/17 - HCR

Sports



Rheinenergiestadion, Cologne/Germany

Curtain wall



Edificio Gas Natural, Barcelona/Spain

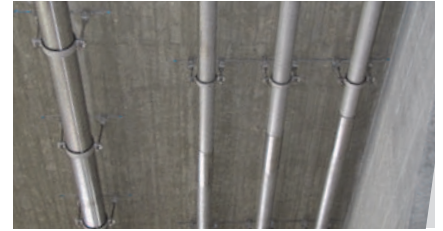
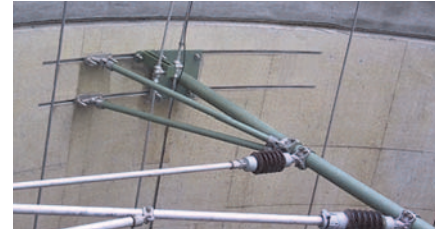
Halfen Cast-in Channels

Application Segments and Application Examples

Traffic infrastructure:

Tunnels, bridges, roads, airports and railway stations

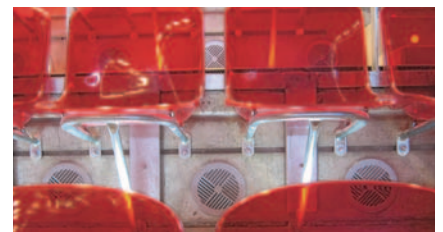
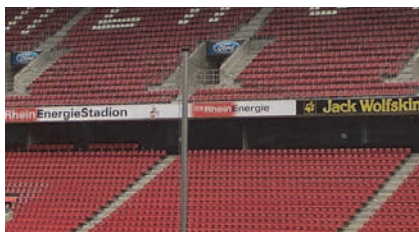
- OCS support
- drainage pipe installation
- fixing of signage or traffic lights
- fixing of rescue gates, stairways, emergency or maintenance ways
- various adjustable fixings to concrete whether with a straight or rounded shape



Public and residential buildings:

Stadiums, sports and leisure, trade and utility buildings, office and residential towers or detached houses

- adjustable fixing of all kind of elements — concrete, masonry, steel, wood or synthetics to concrete
- curtain wall façades
- stadium seatings
- fixings in elevator/lift construction
- brickwork, concrete, or natural stone facade claddings
- rail and banister fixings



Halfen Cast-in Channels

Application Segments and Application Examples

General infrastructure:

Power plants, energy & infrastructure, energy storage or transport, water and sewage projects

- cable tray support
- pipe support
- ventilation duct support
- fixing of stairs, ladders, signage, switch cabinets etc.
- application in critical buildings with high seismic risk or where protection against high impact loads is required



Industry:

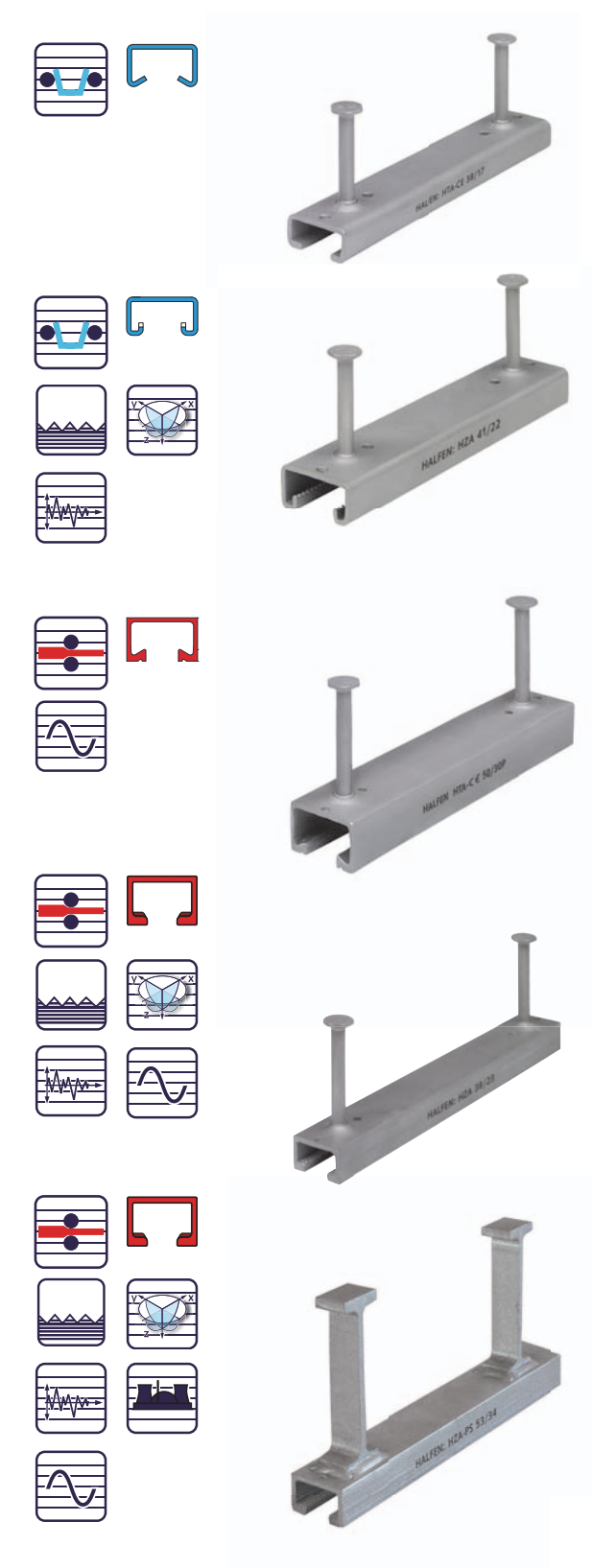
All kind of plants, e.g. production, automotive, agriculture, building industry

- machinery fixing
- fixing of general infrastructure
- fixing of stairs, ladders, maintenance levels etc.
- fixings in highly stressed areas, when exposed to pressure, dust, high temperature or corrosive gases from chemical processes
- fixing of elements exposed to fatigue loads



Halfen Anchor channels

Product Families in Overview



STANDARD

HTA-CE cold-formed

- medium performance - from lowest to medium load range
- as with all Halfen Anchor channels, perfect for adjustable, surface-flush fixings
- economic solution
- European Technical Assessment ETA - 09/0339 by DIBt*

HZA cold-formed, serrated

- suitable for 3-D loads
- medium load capacities in longitudinal direction
- European Technical Assessment ETA - 20/1081 by DIBt*

PREMIUM

HTA-CE hot-rolled

- medium to high load capacity
- low stress profile with high resistance to dynamic and impact loads, unmatched by cold-formed alternatives
- high resistance against local flexure due to optimized channel lip geometry
- In combination with Halfen HSR Bolts, *medium load bearing in longitudinal channel direction is possible. (*proportionally to the channel cross-section area, load bearing is lower than in application of serrated channels)
- European Technical Assessment ETA - 09/0339 by DIBt*

PERFORMANCE

HZA DYNAGRIP® hot-rolled, serrated

- superior performance
- High load capacities in longitudinal direction due mechanical interlock between serrated channel lips and T-bolt heads
- best suitable in seismic regions
- European Technical Assessment ETA - 20/1081 by DIBt*

ULTIMATE

HZA-Power Solution hot-rolled, serrated

- highest performance level
- developed for applications in safety relevant structures with highest requirements
- suitable for crack width up to 1.5 mm
- tested for extra-ordinary impact loads
- European Technical Assessment ETA - 17/0728 by DIBt*

*DIBt Deutsches Institut für Bautechnik = German Institute of Construction Engineering


cold formed
channel profile


hot-rolled
channel profile


serrated


3D - Loads

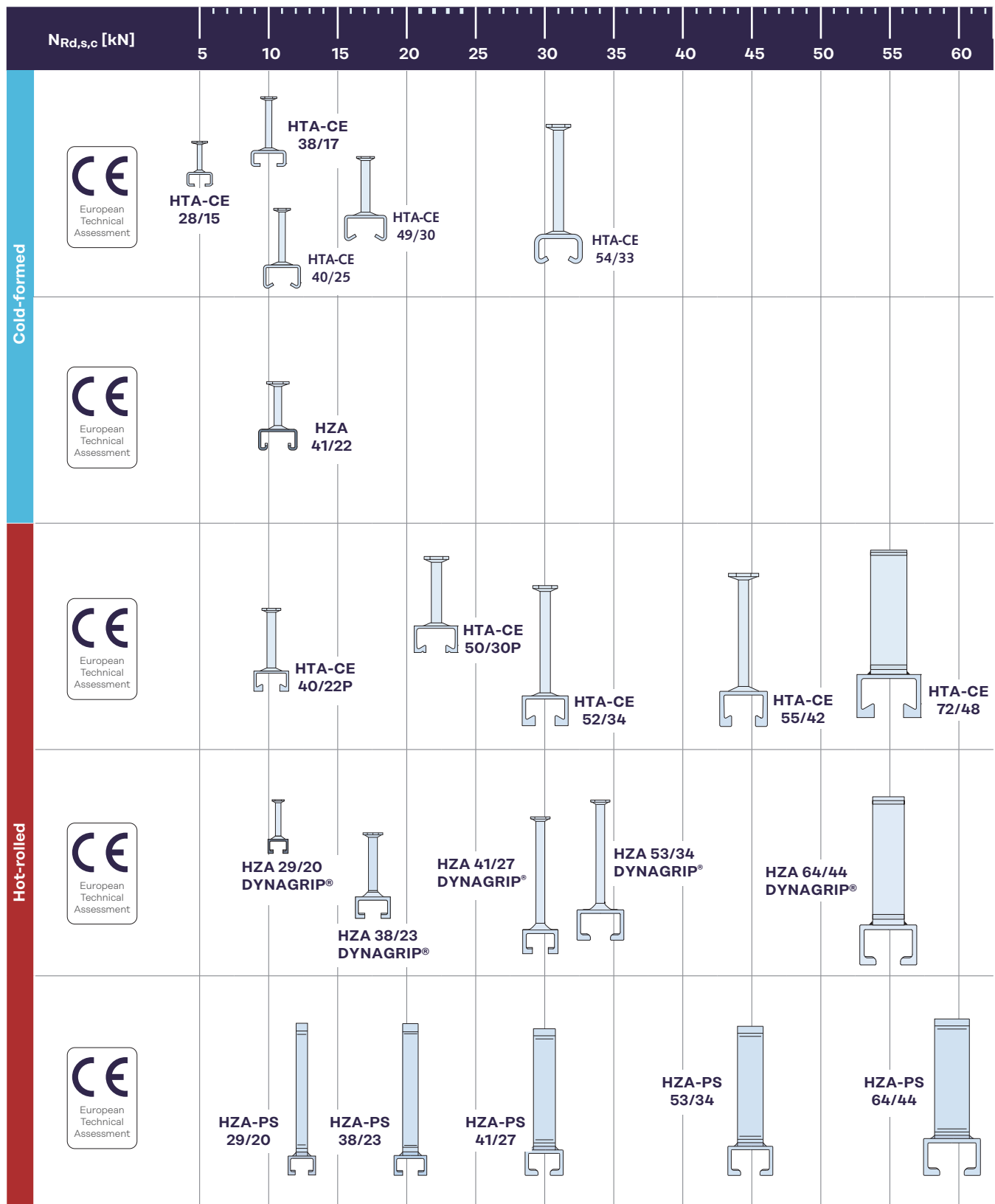

suitable for
fatigue loads


suitable for
seismic loading


suitable for applications
in safety relevant areas
in nuclear facilities

Halfen Anchor channels

Product Range – for Preliminary Computation



This overview shows the performance of the Halfen Cast-in Channels by comparing their design values of the load-bearing capacity of the concrete. Other types of failure as shown on page 14 may also be decisive for the evidence.

Halfen Anchor channels

General – all Channels

Hot-dip galvanized HDG:

Dipped in galvanizing bath, with a temperature of app. 460°C; this method is used for the Halfen Anchor Channels and a range of Halfen Bolts.



Zinc galvanized EPS:

Halfen Bolts are hot-dip galvanized or electrogalvanized. We always guarantee the best possible corrosion protection. Passivation layers are Cr(VI)-free.

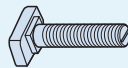


Halfen Anchor channels, steel, hot-dip galvanized

	  		Steel			
			Material		Standard	Zinc coat
		Channel profile	1.0038		EN 10 025-2 ①	HDG: ≥ 55µm
			1.0044		EN 10 025-2 ①	HDG: ≥ 55µm
		Bolt anchor B6	Steel		EN 10263 or EN 10269	HDG: ≥ 55µm
Weld-on anchor	Steel		EN 10 025-2	HDG: ≥ 55µm		

① Steel according to EN 10 025-2 and Leviat specification

Halfen Bolts, galvanized steel

		Steel				
		Material		Standard	Zinc coat	
		T-bolt	Steel (Sc) 4.6 or (Sc) 8.8	 	EN ISO 898-1	HDG: ≥ 50 μm EPS: ≥ 12 μm
		Hexagonal nut	Steel (Sc) 5 or (Sc) 8	 	EN 898-2	HDG: ≥ 50 μm EPS: ≥ 12 μm
		Washer	Steel	 	EN ISO 7089, EN ISO 7093	HDG: ≥ 50 μm EPS: ≥ 12 μm

Standard scope of delivery is bolt incl. nut. The washers must be ordered separately.

Stainless steel (SST):

Chromium is the most important alloy element in stainless steel. A specific chromium concentration ensures the generation of a passive layer on the surface of the steel that protects the base material against corrosion. This explains the high corrosion resistance of stainless steel.

SST = combined for all stainless steels



Materials:

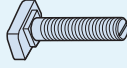
- ☐ MF = Mill finished
- ☒ HDG = Steel, hot-dip galvanized
- ☒ EPS = Steel, zinc plated (special coating)
- ☒ A4 = Stainless steel 1.4571/1.4404/1.4578
- ☒ FA = Standard Duplex (stainless bolts) 1.4462
- ☒ D4 = Lean Duplex (stainless channels) 1.4062/1.4162
- ☒ HCR = Stainless steel 1.4547/1.4529

(Sc) = Strength class

Halfen Anchor channels, stainless steel

		Stainless steel		
		Material	Standard	Corrosion resistance class ②
		Channel profile	1.4404 or 1.4571	III
			1.4062 or 1.4162	III
			1.4529 or 1.4547	V
		Bolt anchor B6	1.4404, 1.4571 or 1.4578	III
			1.4529 or 1.4547	V
		Weld-on anchor	1.4404 or 1.4571	III
			Steel ③	III

Halfen Bolts, stainless steel

		Stainless steel		
		Material	Standard	Corrosion resistance class ②
		T-bolt	1.4404, 1.4571, 1.4578 (A4-50 or A4-70 ④)	III
			1.4462 (FA-70 ④)	III
			1.4529, (HCR-50)	V
		Hexagonal nut	1.4404, 1.4571, 1.4578 (A4-50, A4-70)	III
			1.4529, (HCR-50)	V
		Washer	1.4404, 1.4571	III
			1.4529 or 1.4547	V

② See EN 1993-1-4, table A.3;

③ Corrosion protection of mill finished anchor, see page 13

④ Stainless steel, strength class 70 bolts are delivered subject to availability from stock in A4-70 grade material or in a higher FA-70 (1.4462) grade material. This applies to all Halfen Bolts listed as A4-70 material in this catalogue

Halfen Anchor channels

General – all Channels

Corrosion protection requirements – Material and applications				
Description	1	2	3	4
	Dry interior rooms	Damp interior rooms	Medium corrosion level	High level of corrosion
Definition of application areas	Anchor channels may only be used in components in indoor environments. For example: living and office spaces, schools, hospitals, commercial shops with the exception of wet rooms as in column 2.	Anchor channels may also be used in components in areas with normal humidity. For example: kitchens, bathrooms and laundry-rooms in residential buildings. Exceptions; where permanent steam is present, and under water.	Anchor channels may also be used in outdoor environments (including industrial environments and coastal regions) or in wet rooms, if conditions are not especially aggressive (for example: continual immersion in sea water etc. as in column 4).	Anchor channels may also be used in exceptionally aggressive environments (for example: continual immersion in sea water) or in seawater spray zones, chloride environments in swimming pools or in environments with an extremely aggressive chemical atmosphere (for example: flue gas desulphurization plants or road tunnels where de-icer systems are in use).
Channel profile 	Steel 1.0038, 1.0044; EN 10025 Hot-dip galvanized $\geq 55 \mu\text{m}$ ⑥	Steel 1.0038, 1.0044; EN 10025 Hot-dip galvanized $\geq 55 \mu\text{m}$ ⑥ Stainless steel 1.4307, 1.4567, 1.4541; EN 10088	Stainless steel 1.4404, 1.4571, 1.4062, 1.4162, 1.4362 EN 10088	Stainless steel 1.4462 ②, 1.4529, 1.4547 EN 10088
Anchor 	Steel 1.0038, 1.0214, 1.1132, 1.5525; EN 10263, EN 10269 Hot-dip galvanized $55 \mu\text{m}$ ⑥	Steel 1.0038, 1.0214, 1.1132, 1.5525; EN 10263, EN 10269 Hot-dip galvanized $\geq 55 \mu\text{m}$ ⑥; Stainless steel 1.4307, 1.4567, 1.4541; EN 10088	Stainless steel 1.4404, 1.4571, 1.4362, 1.4578 EN 10088 Mill finish, 1.0038 ③	
Special Halfen Bolts with shaft and bolts in accordance with EN ISO 4018 	Steel strength class 4.6/8.8 EN ISO 898-1 Zinc galvanized $\geq 5 \mu\text{m}$ ④	Steel strength class 4.6 / 8.8; EN ISO 898-1, Hot-dip galvanized $\geq 50 \mu\text{m}$ ① ⑥ Stainless steel, strength class 50, 70; 1.4307, 1.4567, 1.4541; EN ISO 3506-1	Stainless steel Strength class 50, 70 1.4404, 1.4571, 1.4362, 1.4578 EN ISO 3506-1	Stainless steel Strength class 50, 70 1.4462 ②, 1.4529, 1.4547 EN ISO 3506-1
Washers * EN ISO 7089 and EN ISO 7093-1 Product classification A, 200 HV 	Steel EN 10025 Zinc galvanized $\geq 5 \mu\text{m}$ ④	Steel EN 10025 Hot-dip galvanized $\geq 50 \mu\text{m}$ ① ⑥ Stainless steel, Steel grade A2, A3; EN ISO 3506-1	Stainless steel Steel grade A4, A5 EN ISO 3506-1	Stainless steel 1.4462 ②, 1.4529, 1.4547 EN ISO 3506-1
Hexagonal nut EN ISO 4032 	Steel strength class 5/8 EN ISO 898-2 Zinc galvanized $\geq 5 \mu\text{m}$ ④	Steel strength class 5/8 EN ISO 898-2 Hot-dip galvanized $\geq 50 \mu\text{m}$ ① ⑥ Stainless steel, strength class 70, 80; Steel grade A2, A3 EN ISO 3506-2	Stainless steel Strength class 70, 80 Steel grade A4, A5 EN ISO 3506-2	Stainless steel Strength class 70, 80 1.4462 ②, 1.4529, 1.4547 EN ISO 3506-2

* All washers must be ordered separately

① or zinc galvanized with special coating $\geq 12 \mu\text{m}$

② 1.4462 not suitable for swimming baths

③ Steel in accordance with EN 10025, 1.0038 not for anchor channels 28/15 and 38/17

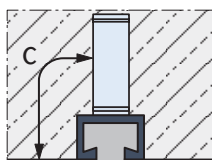
④ Zinc galvanized in accordance with EN ISO 4042

⑤ Hot-dip galvanized in accordance with EN ISO 10684

⑥ Hot-dip galvanized in accordance with EN ISO 1461

Halfen Channels (SST) mill finish welded-on anchors

Corrosion protection of the mill finished weld-on anchor is based on the following concrete cover c:



Concrete cover c

Concrete cover c [mm]					
	30	35	40	50	60
Profile HTA-CE	-	40/22P	52/34	-	72/48
	-	-	54/33	-	-
	-	-	50/30P	-	-
	-	-	49/30	-	-
Profile HZA	38/23	41/22	53/34	64/44	-

Halfen Channels (SST) made completely in stainless steel

The Halfen Anchor channels "entirely of stainless steel" are not restricted to any minimum concrete cover as no relevant corrosion occurs.

Areas of application

- bridge and tunnel construction (fastening of pipes, etc.)
- construction of sewage treatment plants (fixing of spillovers)
- chemical industry (installations exposed to aggressive substances)
- ventilated façades, e.g. masonry renders
- also for all structural reinforced concrete elements with higher demands on the concrete cover

Halfen Channels made in stainless steel – HCR

The high corrosion resistance (HCR) Halfen Anchor channels are mandatory when high concentrations of chlorides, sulphur and nitrogen oxides are present.

Areas of application

- road tunnels
- structures in salt water
- indoor swimming pools
- areas not routinely cleaned
- poorly ventilated parking garages
- in narrow, major city streets

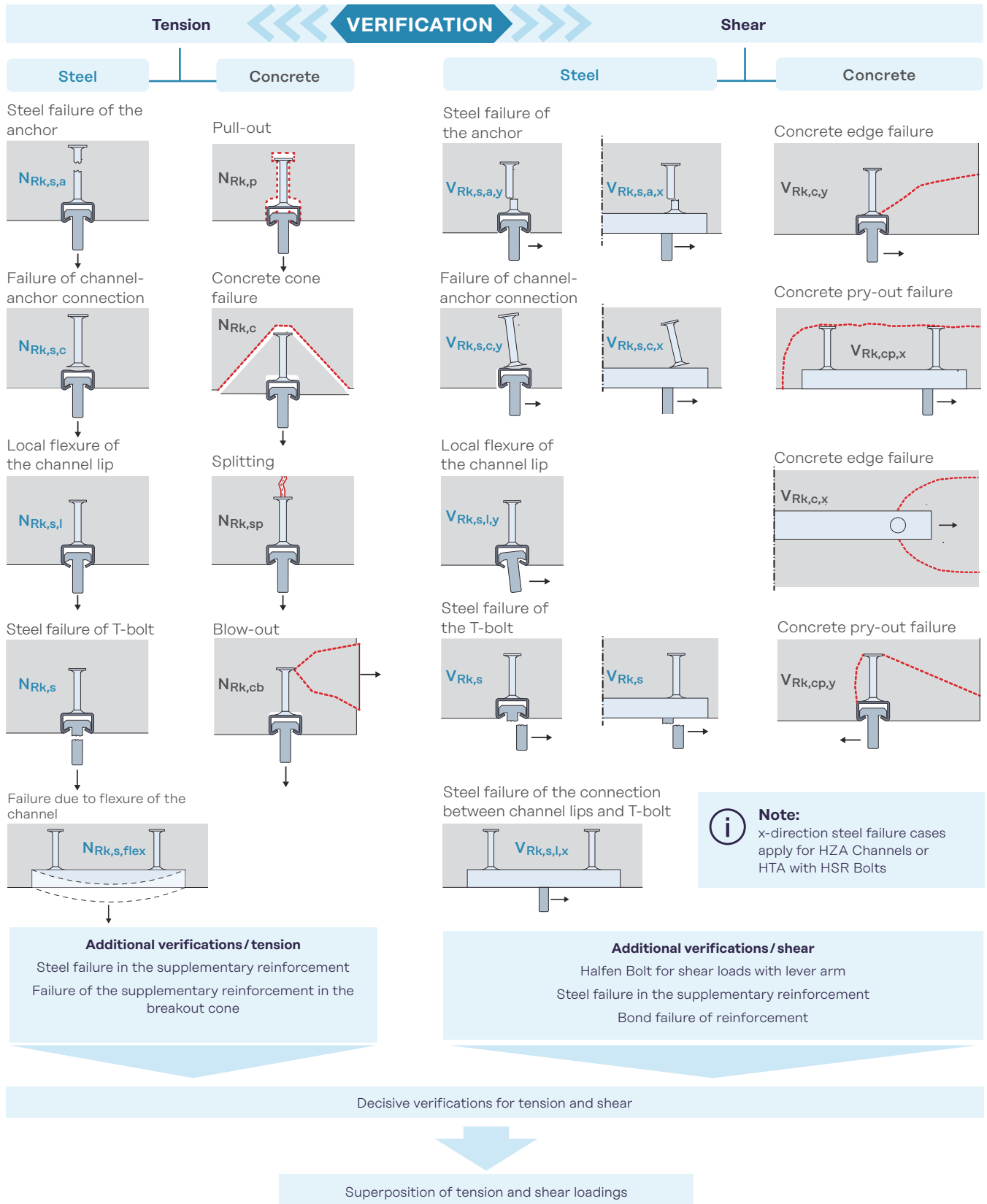
SST = combined for all stainless steels

Halfen Anchor channels

Dimensioning HTA-CE and HZA Anchor channels

Verification methods

in accordance with EN 1992-4, EOTA TR 047



Halfen Anchor channels

Dimensioning HTA-CE and HZA Anchor channels

Calculation basics

The following information is necessary to verify an anchor channel:

- type of Halfen Anchor channel and material
- length of the Halfen Anchor channel with number of anchors and spacing
- position of the Halfen Anchor channel in the concrete, defined by its distance from the lower, upper, left and right edges of the component
- thickness of the concrete elements
- concrete strength class
- condition of the concrete; cracked or verified as non-cracked
- dense reinforcement in the vicinity of the anchor channel
- Halfen Bolt thread size
- T-bolt positions
- tensile load and shear load applied to each T-bolt

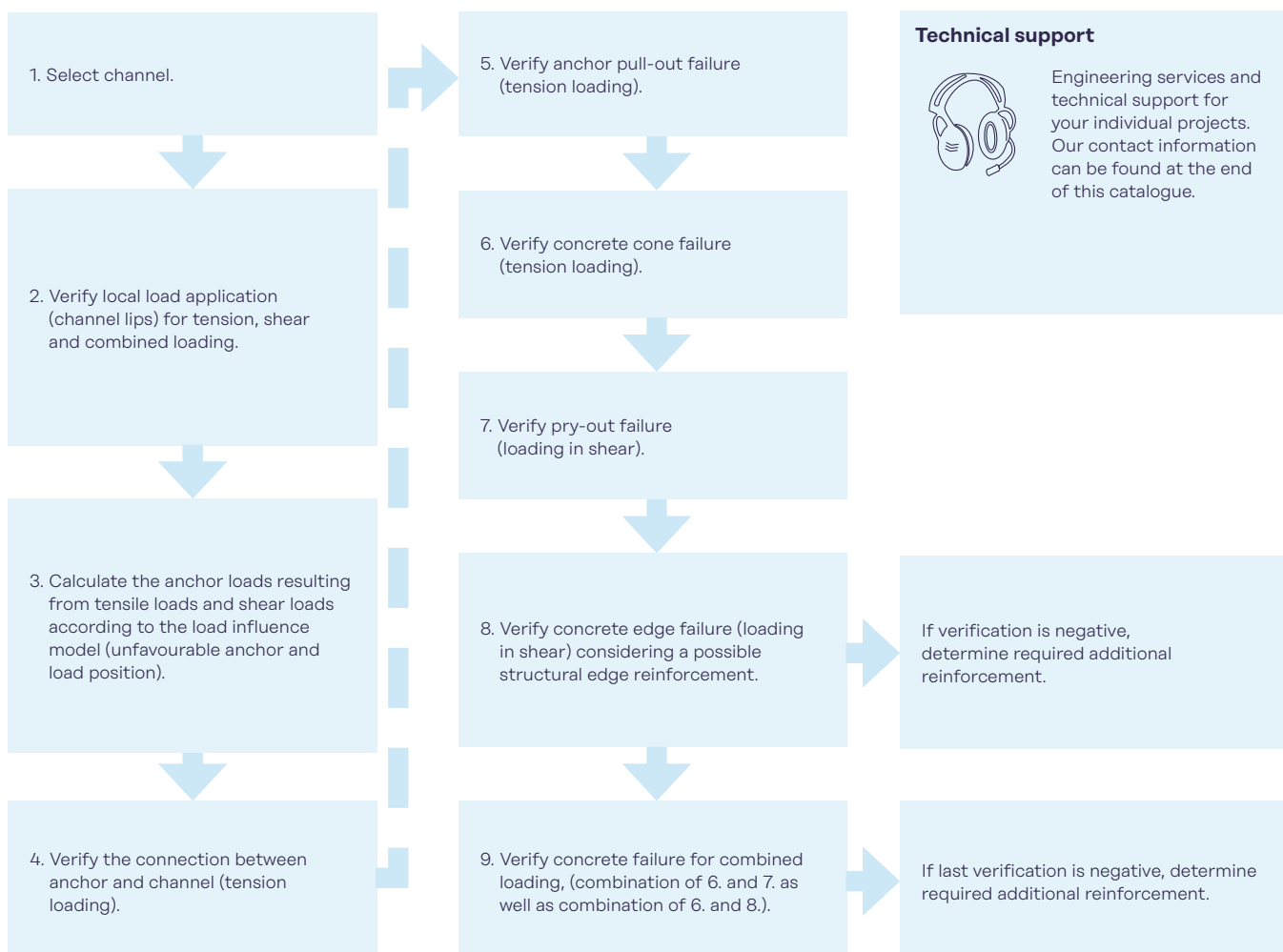


- Halfen Cast-in Channels
HTA/HTA-CE ETA-09/0339
- Halfen serrated Cast-in Channels
HZA, HZA Dynagrip ETA-20/1081
- Halfen HZA-PS Power Solution
ETA-17/0728

We provide a free and easy to use calculation software for the design of all HTA-CE and HZA Cast-in Channels.

Download at: www.halfen.com/en_DE/downloads/software-cad-bim/dimensioning-software

Verification method



HTA-CE Anchor channels

The benefits at a glance

Benefits

In addition to their excellent adjustability, Halfen Anchor channels save considerable installation time.

The result — faster construction and therefore increased cost savings.

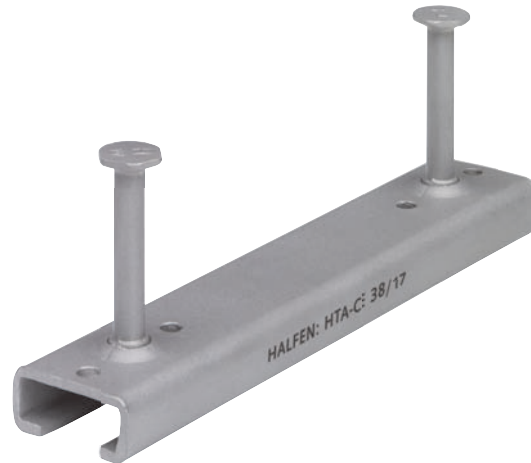
Safe and reliable

- no damage to the reinforcement
- approved for fire-resistant structural elements
- suitable for use in concrete pressure and tensile stress zones
- high corrosion resistance steels available
- hot-rolled profiles suitable for fatigue loads
- free and easy to use calculation programme
- European Technical Assessment (ETA)

Quick and economical

- adjustable anchoring
- bolts instead of welding
- maximum efficiency when installing matrices and rows
- cost effective installation using standard tools
- optimised pre-planning reduces construction time
- large range of types available for various requirements
- no noise, no dust and no vibration during installation

Halfen HTA-CE Anchor channels, cold-formed



Halfen HTA-CE Anchor channels, hot-rolled



suitable for
fatigue loads



HTA-CE Anchor channels

Application Examples

Curtain wall



Fixing of curtain wall elements – Crown Sydney/Australia

Noise barriers



Fixings of noise barriers to concrete posts

Utility tunnels



Utility fixings in TBM tunnels with curved anchor channels

Sports



Seat fixing in stadiums

Lifts/Elevator fixings



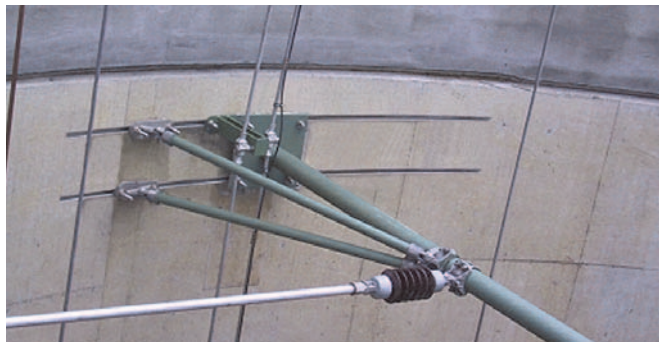
Fixing guide-rails with Halfen Anchor Channels

Bridges



Fixings for drainage systems

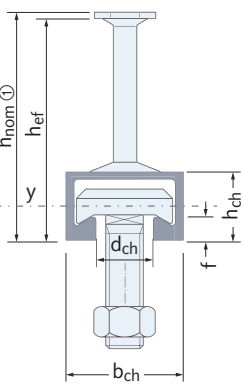
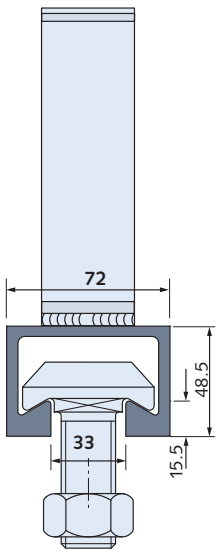
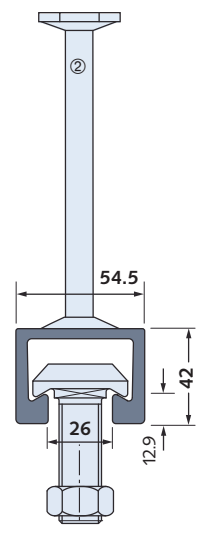
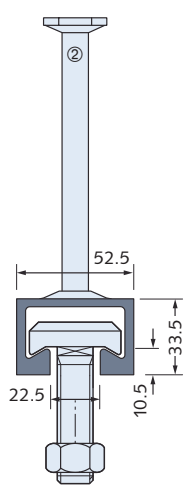
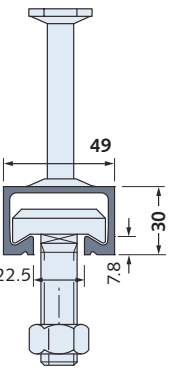
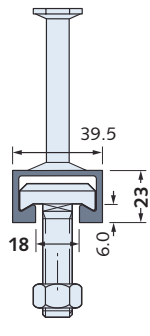
Tunnels



Fixing of overhead cables in railway tunnels

Halfen HTA-CE Anchor channels

Product Range – Overview: Channel and T-bolts

Dimensions and properties Halfen HTA-CE Anchor channel						
Profile		HTA-CE 72/48	HTA-CE 55/42	HTA-CE 52/34	HTA-CE 50/30P	HTA-CE 40/22P
Type		hot-rolled	hot-rolled	hot-rolled	hot-rolled	hot-rolled
Geometry Halfen HTA-CE Channels i Note: observe the installation height h_{nom} 						
Material description: see page 12	HDG					
	A4		-			
T-bolts		HS 72/48	HS 50/30	HS 50/30	HS 50/30	HS 40/22
Threads		M20-M30	M10-M20	M10-M20	M10-M20	M10-M16
s _{i,N} [mm]		144	109	105	98	79
Profile load capacity*						
N ⁰ _{Rd,s,l} [kN]		66.7	61.1	40.0	23.9	21.1
V ⁰ _{Rd,s,l} [kN]		81.1	61.1	43.5	32.8	19.4
M _{Rd,s,flex} [Nm]		7472	5606	2933	2437	1208
Geometry						
h _{nom} [mm] ① ②		(191)	182 (185)	162 (164)	112	97
b _{ch} [mm]		72	54.5	52.5	49	39.5
h _{ch} [mm]		48.5	42	33.5	30	23
I _y [mm ⁴]		349721	187464	93262	52896	20029
h _{ef} [mm]		179	175	155	106	91
c _{min} [mm]		150	100	75	75	50
c _{min} = minimal spacing channel/concrete edge s _{i,N} = axial spacing for T-bolts for N ⁰ _{Rd,s,l}			N ⁰ _{Rd,s,l} = channel lip load capacity (tension) V ⁰ _{Rd,s,l} = channel lip load capacity (shear)		① Nominal size and tolerance ② weld-on I- or T-anchors subject to available stock; for these (h _{nom}) values are in brackets.	

* Other failure modes might be decisive and have to be verified for each individual case (taking the geometric boundary conditions into account)
 We recommend to use the Halfen design software for verification

Halfen HTA-CE Anchor channels

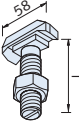
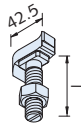
Product Range – Overview: Channel and T-bolts

Dimensions and properties Halfen HTA-CE Anchor channel												
Profile		HTA-CE 54/33		HTA-CE 49/30		HTA-CE 40/25		HTA-CE 38/17		HTA-CE 28/15		
Type		cold-formed		cold-formed		cold-formed		cold-formed		cold-formed		
Geometry Halfen HTA-CE Channels i Note: observe the installation height h_{nom}												

* Other failure modes might be decisive and have to be verified for each individual case (taking the geometric boundary conditions into account)
We recommend to use the Halfen design software for verification

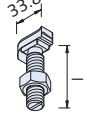
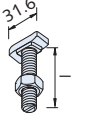
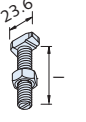
Halfen HTA-CE Anchor channels

Halfen HS Bolts

Halfen HS Bolts	Halfen Bolt	HS 72/48				HS 50/30			
	Suitable for profile	HTA-CE 72/48				HTA-CE 55/42, 52/34, 54/33, 50/30P, 49/30			
	Halfen Bolt dimensions								
Halfen Bolts type HS (no nib or serration) for profile types HTA  Other Halfen bolt lengths and materials are available on request! HDG = Steel, hot-dip galvanized EPS = Steel, zinc-plated A4 = Stainless steel FA = Duplex steel HCR = Stainless steel Material details and corrosion protection: see page 12–13 *on request	l [mm]	M20	M24	M27	M30	M10	M12	M16	M20
	30	-	-	-	-	-	HDG 4.6	-	-
		-	-	-	-	HDG 8.8	-	-	-
		-	-	-	-	-	A4-70	-	-
	40	-	-	-	-	-	HDG 4.6	HDG 4.6	-
		-	-	-	-	HDG 8.8	HDG 8.8	HDG 8.8	-
		-	-	-	-	-	A4-70	A4-70	-
	45	-	-	-	-	-	-	-	HDG 4.6
		-	-	-	-	-	HDG 8.8	-	HDG 8.8
	50	HDG 4.6	HDG 4.6	-	-	-	HDG 4.6	HDG 4.6	-
		-	-	-	-	HDG 8.8	HDG 8.8	-	-
		-	A4-50	-	-	-	-	-	-
		-	-	-	-	-	A4-70	A4-70	-
	55	-	-	-	-	-	-	-	HDG 4.6
		-	-	-	-	-	-	-	FA-70
	60	-	-	-	-	-	HDG 4.6	HDG 4.6	-
		HDG 8.8	-	-	-	-	HDG 8.8	HDG 8.8	HDG 8.8
		-	-	-	-	-	-	A4-70	-
	65	-	-	-	-	-	-	-	HDG 4.6
		-	-	-	-	-	-	-	HDG 8.8
	70	-	-	-	-	-	HDG 8.8	-	-
	75	HDG 4.6	HDG 4.6	HDG 4.6	HDG 4.6	-	-	-	HDG 4.6
		-	HDG 8.8	-	-	-	-	-	-
		EPS 8.8	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	FA-70
	80	-	-	-	-	-	HDG 4.6	HDG 4.6	HDG 4.6
		-	-	-	-	-	HDG 8.8	HDG 8.8	HDG 8.8
		-	-	-	-	-	-	A4-70	-
		-	-	-	-	-	-	-	FA-70
	100	HDG 4.6	HDG 4.6	-	HDG 4.6	-	HDG 4.6	HDG 4.6	HDG 4.6
		HDG 8.8*	-	HDG 8.8	-	-	HDG 8.8	HDG 8.8	HDG 8.8
		EPS 8.8	EPS 8.8	-	-	-	-	-	-
		-	A4-50	-	-	-	-	-	-
		-	-	-	-	-	FA-70	-	FA-70
		-	-	-	-	-	-	HCR-50*	-
	125	-	-	-	-	-	HDG 4.6	-	HDG 4.6
		-	-	-	-	-	HDG 8.8	-	HDG 8.8
	150	HDG 4.6	HDG 4.6	-	HDG 4.6	-	-	HDG 4.6	-
		-	-	-	-	-	EPS 4.6	-	HDG 8.8
		-	EPS 8.8	-	-	-	-	-	-
		-	-	-	-	-	-	FA-70	FA-70
	175	-	-	-	-	-	-	HDG 8.8	-
	200	HDG 4.6	HDG 4.6*	-	HDG 4.6	-	-	-	-
		-	-	-	-	-	EPS 4.6	EPS 4.6	EPS 4.6
	300	-	-	-	-	-	-	EPS 4.6*	-

Halfen HTA-CE Anchor channels

Halfen HS Bolts

Halfen Bolt	HS 40/22			HS 38/17			HS 28/15			
Suitable for profile	HTA-CE 40/22P, 40/25			HTA-CE 38/17			HTA-CE 28/15			
Halfen Bolt dimensions										
l [mm]	M10	M12	M16	M10	M12	M16	M6	M8	M10	M12
20	HDG 4.6	-	-	EPS 4.6	EPS 4.6	-	EPS 4.6	EPS 4.6	EPS 4.6	-
	-	-	-	-	-	-	-	EPS 8.8	-	-
	-	-	-	-	-	-	-	A4-70	A4-70*	-
30	HDG 4.6	HDG 4.6	-	HDG 4.6	HDG 4.6	-	-	-	HDG 4.6	-
	HDG 8.8	HDG 8.8	-	EPS 4.6	EPS 4.6	EPS 4.6	EPS 4.6	EPS 4.6	EPS 4.6	EPS 4.6
	-	-	-	-	-	A4-50*	-	-	-	-
	A4-70	A4-70	-	A4-70	A4-70	-	-	A4-70	A4-70	-
40	HDG 4.6	HDG 4.6	HDG 4.6	-	HDG 4.6	HDG 4.6	-	-	-	-
	HDG 8.8	HDG 8.8	HDG 8.8	-	-	-	-	-	HDG 8.8	-
	-	-	-	EPS 4.6	EPS 4.6	EPS 4.6	EPS 4.6	EPS 4.6	EPS 4.6	-
	-	-	-	-	-	A4-50	-	-	-	-
	A4-70	A4-70	A4-70	A4-70*	A4-70	-	-	-	A4-70	-
45	-	HDG 8.8	-	-	-	-	-	-	-	-
50	HDG 4.6	HDG 4.6	HDG 4.6	HDG 4.6	HDG 4.6	HDG 4.6	-	-	HDG 4.6	-
	-	HDG 8.8	HDG 8.8	EPS 4.6	EPS 4.6	EPS 4.6	-	EPS 4.6	EPS 4.6	EPS 4.6
	-	-	-	-	-	A4-50	-	-	-	-
	A4-70	A4-70	A4-70	A4-70	A4-70	A4-70	-	-	A4-70	-
	-	-	-	HCR-50	-	HCR-50	-	-	HCR-50	-
60	HDG 4.6	HDG 4.6	HDG 4.6	-	-	-	-	-	-	-
	HDG 8.8	HDG 8.8	HDG 8.8	-	-	HDG 8.8	-	-	-	-
	-	-	-	EPS 4.6	EPS 4.6	EPS 4.6	-	EPS 4.6	EPS 4.6	-
	-	-	-	-	EPS 8.8	-	-	-	-	-
	-	A4-70	A4-70	-	A4-70	-	-	-	-	-
70	-	-	-	-	HDG 8.8	-	-	-	-	-
80	HDG 4.6	HDG 4.6	HDG 4.6	-	-	HDG 4.6	-	-	-	-
	-	HDG 8.8	HDG 8.8	-	-	-	-	-	-	-
	-	-	-	EPS 4.6	EPS 4.6	EPS 4.6	-	EPS 4.6	EPS 4.6	EPS 4.6
	-	-	-	-	-	A4-50	-	-	-	-
	-	A4-70	A4-70	-	A4-70	-	-	-	A4-70	-
100	HDG 4.6	HDG 4.6	HDG 4.6	-	-	HDG 4.6	-	-	-	-
	-	HDG 8.8	HDG 8.8	-	-	-	-	-	-	-
	-	-	-	EPS 4.6	EPS 4.6	EPS 4.6	-	EPS 4.6	EPS 4.6	-
	-	-	-	-	A4-50	A4-50	-	-	A4-50*	-
	-	A4-70	A4-70	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
125	HDG 4.6	HDG 4.6	HDG 4.6	-	-	-	-	-	-	-
	-	HDG 8.8	-	-	EPS 4.6	EPS 4.6	-	-	EPS 4.6	-
	-	-	-	-	-	-	-	-	A4-50	-
150	-	-	HDG 4.6	-	-	-	-	-	-	-
	-	EPS 4.6	-	EPS 4.6	EPS 4.6	EPS 4.6	-	-	EPS 4.6	-
	-	-	-	-	-	A4-50	-	-	A4-50*	-
200	-	EPS 4.6	EPS 4.6	-	EPS 4.6	EPS 4.6	-	-	EPS 4.6	-
	-	-	-	-	-	-	-	-	A4-50*	-
250	-	-	EPS 4.6	-	-	-	-	-	-	-
300	-	-	EPS 4.6	-	-	-	-	-	-	-

Halfen HTA-CE Anchor channels

Halfen HS Bolts

Halfen Bolts — Type HS

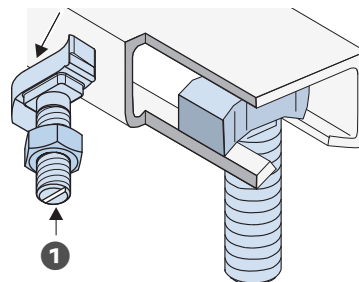


**Standard Halfen Bolts
(no nib or serration)
for all profile types HTA**

Two direction load capacity
identified on ① T-bolt tip with 1 notch

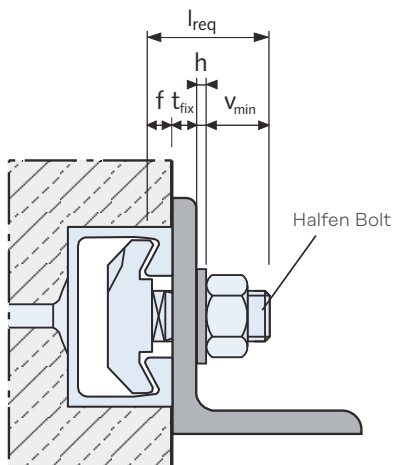
HALFEN 4.6 → Manufacturer
(for individual dimensions)
H 4.6 → Strength class resp.
property class

- HALFEN 4.6 → Strength class 4.6/8.8
galvanized (EPS) or
hot-dip galvanized (HDG)
- HALFEN A4-70 → Material grade
A4-50 / A4-70/FA-70
Stainless steel
- HALFEN HCR50 → Strength class 50
Stainless steel (1.4529/1.4547)



Calculating the bolt length l_{req} for Halfen Bolts

$$l_{req} = t_{fix} + f + h + v_{min}$$



Dimensions v_{min}	
T-bolt diameter	v_{min} [mm]
M6	11.0
M8	12.5
M10	14.5
M12	17.0
M16	20.5
M20	26.0
M24	29.0
M27	31.5
M30	33.5

Lip dimensions f	
Channel profile	f [mm]
28/15	2.3
38/17	3.0
40/22P	6.0
40/25	5.6
49/30	7.4
50/30P	7.9
52/34	10.5
54/33	7.9
55/42	12.9
72/48	15.5

l_{req} = required t-bolt length
 t_{fix} = thickness of clamped component
 f = profile lip height
 h = washer thickness
 v_{min} = nut height EN ISO 4032 + overhang approximately 5 mm ($\geq$ M20: 7 mm)

Bolt design values

The table on the right lists the design resistance of Halfen Bolts with different thread diameters, materials and strength classes.

$N_{Rd,s}$ is the resistance against tension loads, $V_{Rd,s}$ is the resistance against shear loads and $M^0_{Rd,s}$ is the flexural resistance when subjected to transverse load induced with a lever arm.

Design resistance										
Material / Strength class		M6	M8	M10	M12	M16	M20	M24	M27	M30
4.6	$N_{Rd,s}$ [kN]	4.0	7.3	11.6	16.9	31.4	49.0	70.6	91.8	112.2
	$V_{Rd,s}$ [kN]	2.9	5.3	8.3	12.1	22.6	35.2	50.7	66.0	80.6
	$M^0_{Rd,s}$ [Nm]	3.8	9.0	17.9	31.4	79.8	155.4	268.9	398.7	538.7
8.8	$N_{Rd,s}$ [kN]	10.7	19.5	28.6	44.9	83.7	130.7	188.3	244.8	299.2
	$V_{Rd,s}$ [kN]	6.4	11.7	17.2	27.0	50.2	78.4	113.0	146.9	179.5
	$M^0_{Rd,s}$ [Nm]	9.8	24.0	42.5	83.8	213.1	415.4	718.4	1065.2	1439.4
A4-50	$N_{Rd,s}$ [kN]	3.5	6.4	10.1	14.8	27.4	42.8	61.7	80.2	98.1
	$V_{Rd,s}$ [kN]	2.5	4.6	7.3	10.6	19.8	30.9	44.5	57.9	70.7
	$M^0_{Rd,s}$ [Nm]	3.2	7.9	15.7	27.5	70.0	136.3	235.8	349.7	472.5
A4-70	$N_{Rd,s}$ [kN]	7.5	13.7	21.7	31.6	58.8	91.7	132.1	171.8	210.0
	$V_{Rd,s}$ [kN]	5.4	9.9	15.6	22.7	42.2	66.0	95.1	123.6	151.0
	$M^0_{Rd,s}$ [Nm]	6.9	16.8	33.5	58.8	149.4	291.3	503.7	746.9	1009.2

Halfen HTA-CE Anchor channels

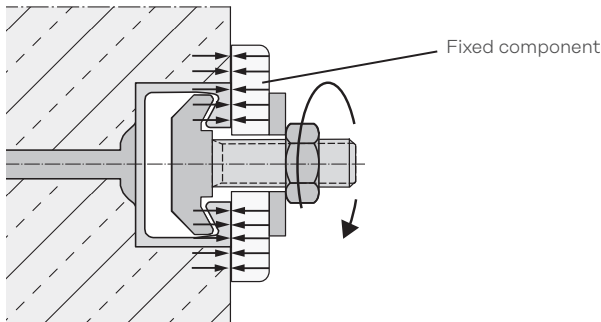
Halfen HS Bolts

Torque values HS

Standard

Components are braced against the concrete and anchor channel.

Torque is applied as in the following table and must not be exceeded.



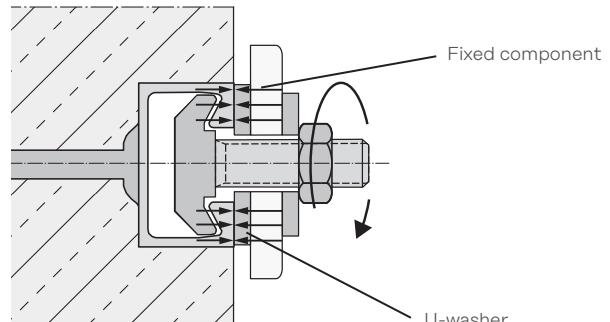
Standard torque values

Standard: Recommended torque values T_{inst}		
HTA-CE Profile	Halfen Bolt HS...M [mm]	Torque value T_{inst} [Nm]
		Steel 4.6; 8.8; Stainless steel; strength class 50; strength class 70
28/15	6	3
	8	7
	10	12
	12	15
38/17	10	14
	12	19
	16	40
40/22P 40/25	10	15
	12	25
	16	45
49/30 50/30P	10	15
	12	25
	16	60
	20	75
52/34 54/33	10	15
	12	25
	16	60
	20	120
55/42	10	15
	12	25
	16	60
	20	120
72/48	20	120
	24	200
	27	300
	30	380

Steel-Steel

Components are braced against the anchor channels using suitable washers.

Torque is applied as in the following table and must not be exceeded.



Torque values steel-steel

Steel-Steel: Recommended torque values T_{inst}					
HTA-CE Profile	Halfen Bolt HS...M [mm]	Torque value T_{inst} [Nm]			
		Steel 4.6	Steel 8.8	Stainless steel Strength class 50	Stainless steel Strength class 70
28/15	6	3	—	3	—
	8	7	20	8	15
	10	13	40	15	30
	12	18	70	25	50
38/17	10	15	40	15	30
	12	23	65	25	40
	16	60	135	45	130
	10	15	40	15	30
40/22P 40/25	12	25	70	25	50
	16	65	180	60	130
	10	15	40	15	30
	12	25	70	25	50
49/30 50/30P	16	65	180	60	130
	20	130	360	120	250
	10	15	40	15	30
	12	25	70	25	50
52/34 54/33	16	65	180	60	130
	20	130	360	120	250
	10	15	40	15	30
	12	25	70	25	50
55/42	16	65	180	60	130
	20	130	360	120	250
	10	15	40	15	30
	12	25	70	25	50
72/48	16	65	180	60	130
	20	130	360	120	250
	20	130	360	120	250
	24	230	620	200	440
	27	340	900	300	650
	30	460	1200	400	850

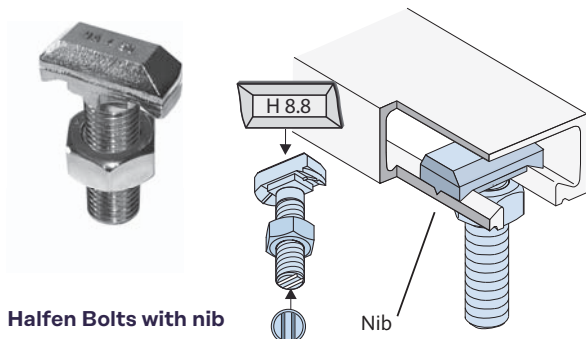


Tightening torques are also provided in the installation instructions, included with any box of bolts.
Torque values apply only to bolts in delivery condition (unlubricated).

Halfen HTA-CE Anchor channels

Halfen HSR Bolts with Nib

Halfen Bolts — Type HSR



Halfen Bolts with nib

Nib

- available for hot-rolled profiles: 40/22P, 50/30P, 52/34, 72/48
- only for carbon steel: FV
- load capacity in all directions
- load capacity in channel longitudinal direction according to expert report or ETA-09/0339*
- identification on T-bolt tip with 2 notches
- Tightening torques are provided also in the installation instructions, included with every box of bolts.

* for HSR 40/22 only

Bolt design values HSR

Available HSR				
Suitable for profile	72/48	52/34, 50/30P	40/22P	
Halfen Bolt	HSR 72/48	HSR 50/30	HSR 40/22	
Bolt dimensions				
l [mm]	M20	M16	M20	M16
40	-	HDG 8.8	-	EPS 8.8
45	-	-	EPS 8.8	-
60	-	EPS 8.8	EPS 8.8	EPS 8.8, HDG 8.8
75	HDG 8.8	-	EPS 8.8	-
80	-	HDG 8.8	-	-
100	-	EPS 8.8	-	-

HDG = Hot-dip galvanized

EPS = Zinc galvanized with special coating



If loads in the channel's longitudinal direction have to be verified, we recommend using serrated Halfen HZA Channels with serrated Halfen HZS Bolts. See pages 28–36.

Torque values HSR	
HSR 8.8	Indicative torque values ① [Nm]
M16	200 (150)②
M20	400

① For general installation (Steel - concrete contact)

Refer to installation instructions !

② For application within the ETA-09/0339, the torques in brackets are valid. This applies only for HSR 40/22 M16 Sc 8.8.

Load capacity HSR	
Halfen Bolt HSR	Grade 8.8 in channel longitudinal direction
	F _{Rd} [kN]
40/22 - M16	6.3
50/30 - M16	6.3
50/30 - M20	10.5
72/48 - M20	10.5

Halfen HTA-CE tender text example

Halfen HTA-CE Anchor channel 40/22P - HDG - 300 - KF

Halfen HTA-CE Anchor channel 40/22P with smooth channel lips for adjustable fixing of components,

in accordance with ETA-09/0339,

suitable for anchoring in cracked or uncracked normal-weight concrete with strength classes C12/15 to C90/105, under static, quasi-static, dynamic loading as well as fire exposure.

Type HTA-CE 40/22P - HDG - 300 - KF

with

N_{Rk,sc} = 29 kN = char. resistance, steel failure (tension), connection channel anchor

HDG = Corrosion protection, hot-dip galvanized

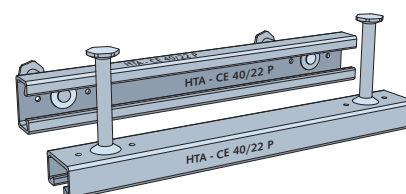
300 = Channel length [mm] with 2 anchors,

KF = Foam strip filler,

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



European
Technical
Assessment
ETA-09/0339



Halfen HTA-CE Anchor Channels

HTA-CE Fatigue Loads/Edge and Bolt Spacing

Design resistance for $n = 2 \times 10^6$ load cycles

Profile HTA-CE	Type	$\Delta N_{Rd,s,0,n}$	Allowable bolts	Material
40/22P	HDG/SST	2.94	M12 M16	8.8 / A4-70 4.6 / 8.8 / A4-70
50/30P	HDG	3.6	M16 M20	4.6 / 8.8 4.6 / 8.8
52/34	HDG/SST	4.9	M16 M20	8.8 / A4-70 8.8 / A4-70

SST: combined for all stainless steels

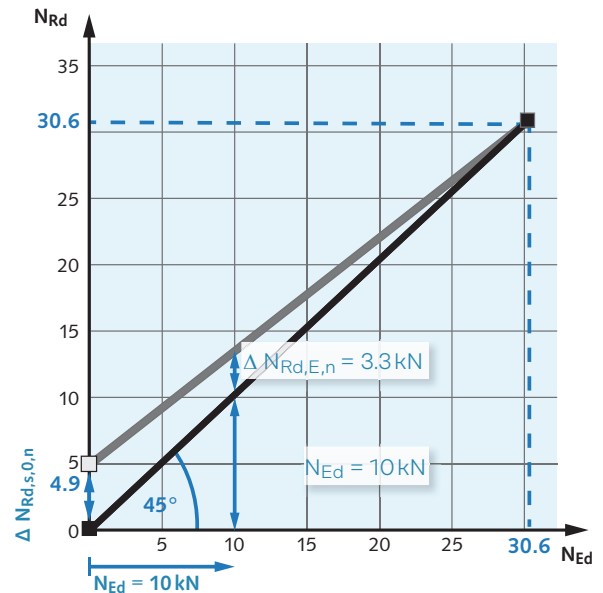
Example (also see diagram to the right):
Profile HTA-CE 52/34 - FV (standard, hot-dip galvanized),
for $n = 2 \times 10^6$ load cycles:

$N_{Rd} = 55 \div 1.8 = 30.6$ (taken from the ETA-09/0339)

N_{Ed} from permanent load = 10 kN (assumption)

$\Delta N_{Rd,E,n} = (30.6 - 10) \times 4.9/30.6 = 3.3$ kN

Diagram: HTA-CE 52/34 - FV
for $n = 2 \times 10^6$ load cycles



Minimum edge distances and minimum Halfen Bolt spacing

Anchors must be installed at a minimum distance from the component edges.

The distance depends on the selected channel profile.

According to the ETA, the spacing between bolts s_{cbo} must not be less than $s_{s,min} = 5 \times d_s$. Reduction of the load bearing capacity is required if $s_{cbo} < s_{sl,N}^*$.

The concrete load-bearing capacity must be verified for each individual case using the Halfen Anchor channel Software!

* $s_{sl,N}$ = centre distance of the bolts
subject to $N_{Rd,s,l}$
See tables pages 18–19

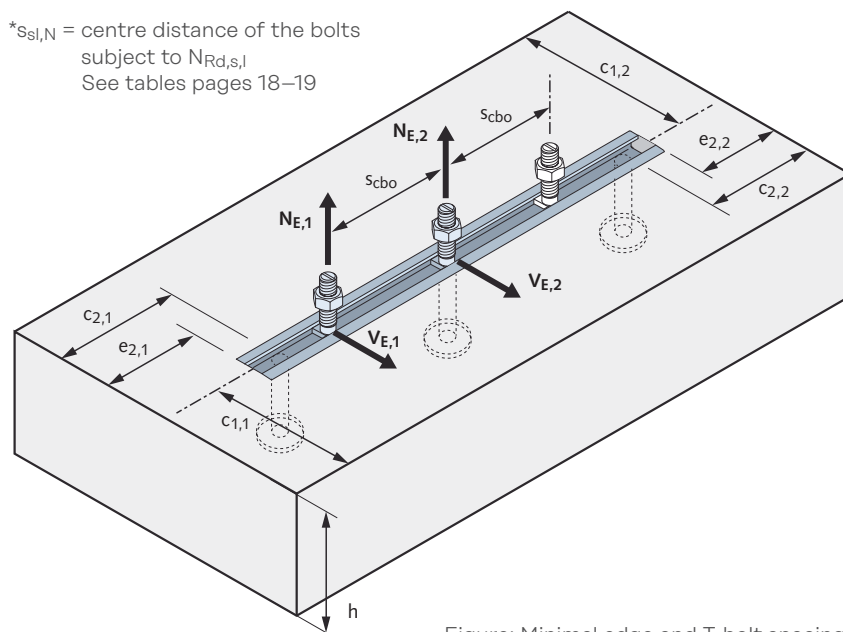


Figure: Minimal edge and T-bolt spacings

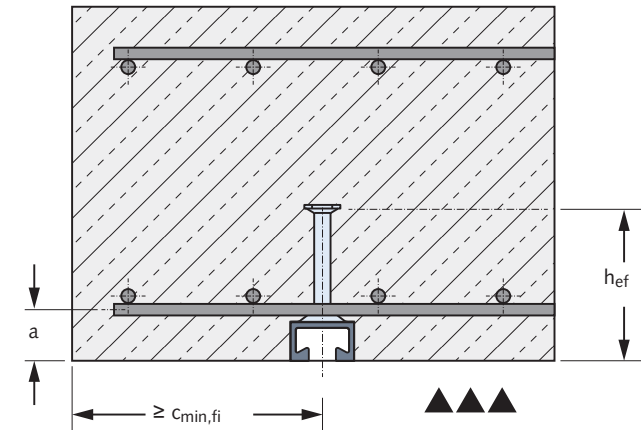
Edge and T-bolt spacing [mm]				
HTA-CE Profiles	M	$s_{s,min}$	c_{min}	e_{min}
28/15	6	30	40	15
	8	40	40	15
	10	50	40	15
	12	60	40	15
38/17	10	50	50	25
	12	60	50	25
	16	80	50	25
40/25 40/22P	10	50	50	25
	12	60	50	25
	16	80	50	25
49/30	10	50	75	50
	12	60	75	50
	16	80	75	50
	20	100	75	50
50/30P	10	50	75	40
	12	60	75	40
	16	80	75	40
	20	100	75	40
52/34 54/33	10	50	100	65
	12	60	100	65
	16	80	100	65
	20	100	100	65
55/42	10	50	100	65
	12	60	100	65
	16	80	100	65
	20	100	100	65
72/48	20	100	150	115
	24	120	150	115
	27	135	150	115
	30	150	150	115

Halfen HTA-CE Anchor channels

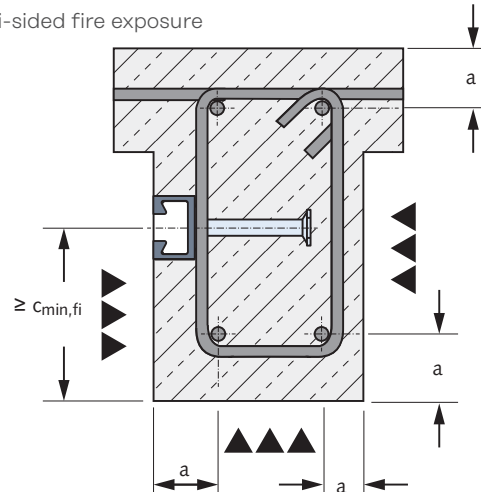
HTA-CE Fire Resistances

Halfen HTA-CE Anchor channels have been tested and classified for direct exposure to fire in accordance with EAD 330008 using the Standard ISO time-temperature curve (STC). The values shown in the table below are taken from ETA-09/0339.

Single-sided fire exposure



Multi-sided fire exposure



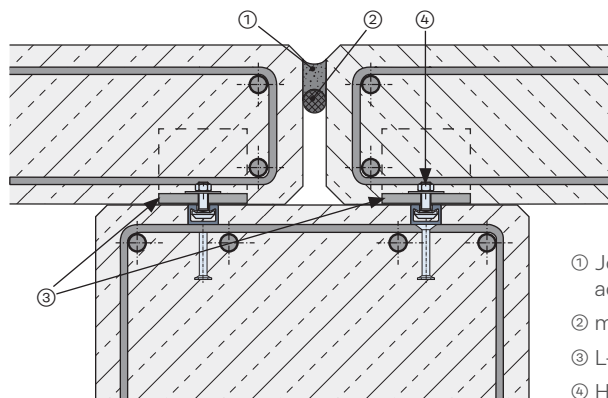
▲▲▲ fire exposure direction

Fire resistance capacities for HTA-CE Anchor channels — steel failure*											
Fire protection classes depending design resistances $N_{Rd,s.fi} = V_{Rd,s.fi}$ [kN]	HTA-CE	28/15	38/17	40/25	40/22P	49/30	50/30P	54/33	52/34	55/42	72/48
	Halfen Bolt	M12	M16	M16	M16	M16	M20	M20	M20	M20	M24
	R30	1.9	3.2	3.6	6.0	4.0	9.5	8.9	10.1	10.3	14.8
	R60	1.3	2.4	3.6	4.5	3.5	7.1	6.5	7.5	7.6	11.1
	R90	0.7	1.4	2.0	2.9	2.5	4.8	4.2	4.8	4.9	7.3
Minimum axial spacing a [mm]	R120	0.5	1.0	1.2	1.6	2.1	3.6	3.0	3.5	3.6	5.4
	R30	35						50			
	R60	35						50			
	R90	45						50			
Minimum edge spacing $c_{min,fi}$ [mm]	R120	60						65	70		
	fire exposure single-sided	90	152	158	182	188	212	310	310	350	358
	fire exposure multi-sided	300	300	300	300	300	300	310	310	350	358

Load capacities are valid for Halfen Anchor channels made of steel and stainless steel.

* Concrete load capacity under fire exposure has to be verified for each individual case in accordance with EN 1992-4 appendix D, for concrete strength classes C20/25 to C50/60.

Halfen Anchor channels are suitable for design connections of non-load bearing fire walls to concrete walls or columns.



Note: For fire wall connections of brickwork to concrete, see page 86 or technical product information Halfen FM Brickwork connections
www.halfen.com/downloads

- ① Joint sealing compound acc. to EN ISO 6927
- ② mineral fibre sealing rope
- ③ L-bracket $\geq 60 \times 5$ mm
- ④ Halfen Bolt diam. ≥ 10 mm

Halfen HTA-CE Anchor channels

HTA-CE Standard Lengths/HTA-CS – Curved Solution

HTA-CE Standard lengths

Our standard lengths are optimized lengths to reduce cut-offs.

We deliver Halfen HTA-CE Anchor channels in any length from 100 mm to 6070 mm. The number and spacing of the anchors can be freely defined. Please contact us at www.halfen.com or see the back inside cover of this catalogue for contact information.



We recommend the calculation program for Halfen Anchor channels in accordance with the ETA.

The tool is a powerful, user-friendly program for calculation of any channel length, anchor spacing and concrete cover.

Free download at www.halfen.com

HTA-CE standard lengths and number of anchors				
Length [mm] / Number of anchors				
HTA-CE 72/48	HTA-CE 55/42	HTA-CE 40/25, 50/30P, 49/30, 52/34, 54/33	HTA-CE 40/22P	HTA-CE 28/15, 38/17
150/2	150/2	150/2	150/2	100/2
200/2	200/2	200/2	200/2	150/2
250/2	250/2	250/2	250/2	200/2
300/2	300/2	300/2	300/2	250/2
350/3	350/3	350/3	350/3	300/3
400/3	400/3	400/3	400/3	350/3
550/3	550/3	550/3	550/3	450/3
1050/5	1050/5	800/4	800/4	550/4
6070/25	6070/25	1050/5	1050/5	850/5
-	-	3030/13 ①	3030/13 ②	1050/6
-	-	6070/25	6070/25	3030/16
-	-	-	-	6070/31
Anchor spacing ≤ 250 mm				Anchor spacing ≤ 200 mm

① Does not apply to HTA-CE 52/34, HTA-CE 54/33

② Does not apply to HTA-CE 40/22-P in SST (stainless)

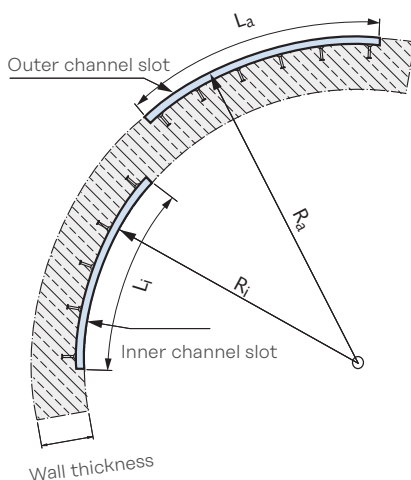
Halfen HTA-CS Anchor channels — Curved Solution

Areas of application:

- tunnel construction
- precast segments for utility tunnels
- curved walls
- sewage plants



Curved Halfen Cast-in Channels in tunnel segments



R_i = Radius of inner channel slot

R_a = Radius of outer channel slot

L = Length of channel after bending (maximum 5400 mm)

Ordering example:

Halfen Anchor channel, curved
HTA-CS 52/34-Q - A4, $R_i = 4000$ mm, $L = 1050$ mm

HTA-CS Smallest radius [m]*									
Profile	HTA-CS 72/48	HTA-CS 54/33	HTA-CS 52/34	HTA-CS 50/30P	HTA-CS 49/30	HTA-CS 40/22P	HTA-CS 40/25	HTA-CS 38/17	HTA-CS 28/15
Material									
Inner channel slot: min. R_i	HDG	on request	0.80 m	0.75 m	on request	0.80 m	on request	1.10 m	0.70 m
	SST	on request	0.80 m	0.80 m	on request	0.80 m	on request	0.90 m	0.70 m
Outer channel slot: min. R_a	HDG	on request	4.00 m	3.60 m	on request	3.00 m	on request	2.20 m	3.20 m
	SST	on request	4.00 m	3.60 m	on request	5.70 m	on request	1.70 m	5.40 m

HDG = hot-dip galvanized

SST = combined for all stainless steels

* please contact our technical support team for more detailed information

Halfen HZA Anchor channels, serrated

The benefits at a glance

In addition to their excellent adjustability, Halfen HZA Anchor channels save considerable installation time.

The result – faster construction and therefore increased cost savings.

Safe and reliable

- load bearing capacity in all directions
- European Technical Assessment ETA
- innovative serration on channel lips and T-bolt heads provides additional mechanical interlock connection
- approved for fire-resistant structural elements
- hot-rolled channels, suitable for fatigue loads
- suitable for use in earthquake safety design
- hot-rolled channels are free from inherent stress

Quick and economical

- adjustable anchorage
- bolts instead of welding
- maximum efficiency when installing in rows
- cost-effective installation using standard tools
- optimized pre-planning reduces construction time
- user-friendly installation; no noise, dust and vibration

HZA Anchor channels, cold-formed, serrated



European
Technical
Assessment



serrated



3D - Loads



approved for
seismic loading



HZA DYNAGRIP® Anchor channels, serrated



European
Technical
Assessment



serrated



3D - loads



suitable for
fatigue loads



suitable for
seismic loading



HZA-PS Anchor Channels, hot-rolled, serrated



European
Technical
Assessment



serrated



3D - loads



suitable for
fatigue loads



suitable for
seismic loading



suitable for applications
in safety relevant areas
in nuclear facilities



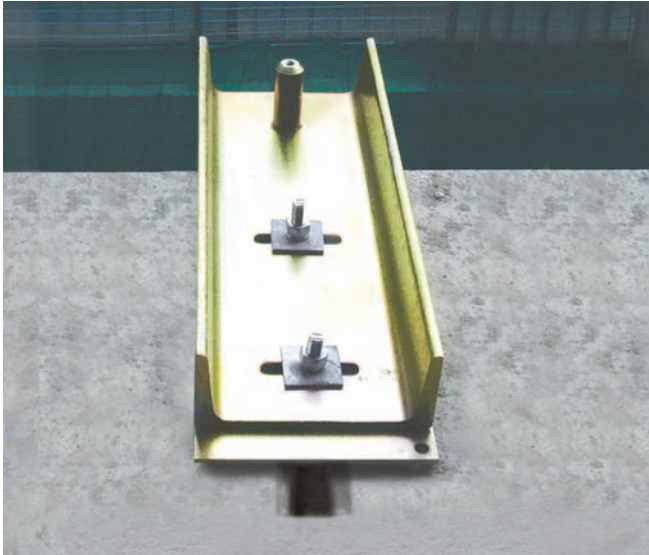
Halfen HZA-PS Anchor channels

More Information on the
HZA-PS is available at:
www.halfen.com

Halfen HZA Anchor channels, serrated

Application Examples: Installations with Halfen HZA Cast-In Channels

Curtain wall



Fixings of a Curtain wall façade, HZA near edge installation

Façade



Fixings for emergency access balconies
(Vertical installation of Halfen Channels)

Industrial plant installations



Pipe supports on vertical HZA Channels

Ski lift



Fixing of the drive unit for a ski lift

Lifts/Elevators



Fixing for guide-rails

Industrial building



Vertical channels in columns to attach further components

Halfen HZA Anchor channels, serrated

Product Range

Dimensions and properties Halfen HZA Anchor channels, serrated								
Profile		HZA 64/44 DYNAGRIP®	HZA 53/34 DYNAGRIP®	HZA 41/27 DYNAGRIP®	HZA 38/23 DYNAGRIP®	HZA 29/20 DYNAGRIP®	HZA 41/22	
Geometry Halfen HZA Channels		hot-rolled						cold- formed
Note: Observe the ① installation height h_{nom}								
		A4			-		-	
T-bolt		HZS 64/44	HZS 53/34	HZS 38/23	HZS 38/23	HZS 29/20	HZS 41/22	
Threads		M20 - M24	M16 - M20	M12 - M16	M12 - M16	M12	M12 - M16	
$s_{l,N} = s_{l,v}$ [mm]		128	105	80	76	58	83	
Profile load capacity*								
$N^0_{Rd,s,l}$ [kN]	HDG	58.9	45.8	29.8	21.8	12.7	11.2	
	SST	52.4	38.9		22.2	-	14.5	
$V^0_{Rd,s,l,y}$ [kN]	HDG	86.8	56.2	29.8	24.4	11.2	16.5	
	SST	52.4	53.1	-	21.7	-	12.6	
$V_{Rd,s,l,x}$ [kN]	HDG	39.7	18.3	10.9 (M12) 14.8 (M16)	10.9	7.0	6.7	
	SST	38.2	20.5	-	11.5	-	5.6	
$M_{Rd,s,flex}$ [Nm]	HDG	6030	3002	2289	1302	759	637	
	SST	6889	3137	-	1452	-	651	
Geometry								
h_{nom} [mm] ① ②		(187)	161 (165)	155	99	87	85	
b_{ch} [mm]		64.0	52.5	40.0	38.0	29.0	41.3	
h_{ch} [mm]		44.0	34.0	27.0	23.0	20.0	20.7	
I_y [mm ⁴]		240300	92600	39000	21100	10200	12600	
h_{ef} [mm]		178	155	148	94	82	82	
c_{min} [mm]		125	100	75	75	50	50	
c_{min} = minimal spacing channel/concrete edge $s_{l,N}$ = axial spacing for bolts for $N^0_{Rd,s,l}$ SST = combined for all stainless steel variants				$N^0_{Rd,s,l}$ = channel lip load capacity (tension) $V^0_{Rd,s,l}$ = channel lip load capacity (perpendicular shear) $V_{Rd,s,l,x}$ = channel lip load capacity (longitudinal shear)		① Nominal size and tolerance ② weld-on I- or T- anchors subject to available stock; for these (h_{nom}) values are in brackets.		

* Other failure modes might be decisive and have to be verified for each individual case (taking the geometric boundary conditions into account).



All hot-rolled profiles are suitable for fatigue loads. Additionally the channels HZA 53/34, HZA 38/23 and HZA 41/27 have an ETA approval for fatigue loading.

Halfen HZA Anchor channels

Standard Lengths/Halfen HZA Channels Curved Solution

Halfen HZA Channels — Standard lengths

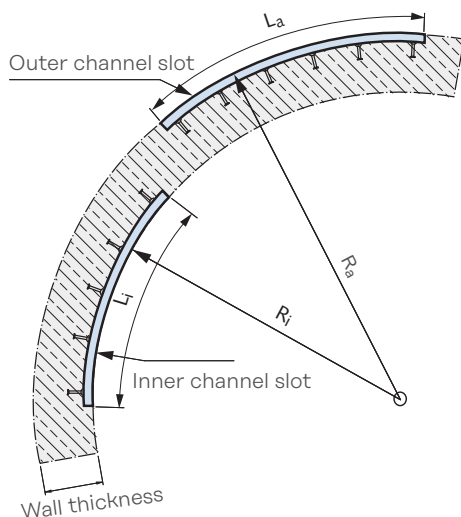
Standard lengths – Length [mm] / Number of anchors									
This table lists the standard lengths anchor channels in the Halfen HZA Product range. Standard lengths listed in the accompanying table are optimized lengths to reduce cut-offs. Please contact Leviat for pricing and product information for items stocked locally.	HZA 64/44; 53/34	HZA-PS 64/44; 53/34	HZA 41/27	HZA-PS 41/27	HZA 38/23	HZA-PS 38/23	HZA 29/20	HZA-PS 29/20	HZA 41/22
	-	-	-	-	-	-	-	-	100/2
	150/2	-	150/2	-	150/2	-	150/2	-	150/2
	200/2	200/2	200/2	200/2	200/2	200/2	200/2	200/2	200/2
	250/2	-	250/2	-	250/2	-	250/2	-	250/2
	300/2	-	300/2	-	300/2	-	300/3	-	300/2
	350/3	350/3	350/3	350/3	350/3	350/3	350/3	350/3	350/3
	400/3	-	400/3	-	400/3	-	400/3	-	400/3
	550/3	550/3	550/3	550/3	550/3	550/3	550/4	550/4	550/3
	-	800/4	-	800/4	800/4	800/4	-	800/5	-
	1050/5	1050/5	1050/5	1050/5	1050/5	1050/5	1050/6	1050/6	1050/5
	-	3030/13	-	3030/13	3030/13	3030/13	3030/16	3030/16	-
	6070/25	6070/25	6070/25	6070/25	6070/25	6070/25	6070/31	6070/31	6070/25

We deliver Halfen HZA Cast-in channels in any length from 100 mm to 6070 mm. The number and spacing of the anchors can be freely defined. Please contact us at www.halfen.com or see the back inside cover of this catalogue for contact information.



We recommend the Halfen Calculation program for Halfen Cast-in channels in accordance with the ETA. The tool is a powerful, user-friendly program for calculation of any channel length, anchor spacing and concrete cover. Free download at [www.halfen.com/downloads/software-cad/...](http://www.halfen.com/downloads/software-cad/)

Halfen HZA Channels curved solution



R_i = Radius of inner channel slot
 R_a = Radius of outer channel slot
 L = Length of channel after bending (maximum 5400 mm)

Areas of application:

- tunnel construction
- reinforced concrete tunnels for utilities
- curved walls
- sewage plants



Curved Halfen Anchor channels in tunnel segments

Ordering example:

Halfen Anchor channel, curved
HZA-CS 53/34-Q - A4, $R_i = 4000$ mm, $L = 1050$ mm

Smallest radius [m]*							
Profile		HZA-CS	HZA-CS	HZA-CS	HZA-CS	HZA-CS	HZA-CS
Material		64/44	53/34	41/27	38/23	29/20	41/22
Inner channel slot: min. R_i	■	on request	on request	on request	2.60m	0.85m	0.70m
	■	on request	on request	-	1.20m	-	0.70m
Outer channel slot: min. R_a	■	on request	on request	on request	1.40m	1.10m	2.20m
	■	on request	on request	-	3.50m	-	4.80m
■ hot-dip galvanized ■ A4 stainless steel						* please contact our technical support for more information	

Halfen HZA Anchor channels

Halfen HZS Bolts

Available Halfen HZS Bolts

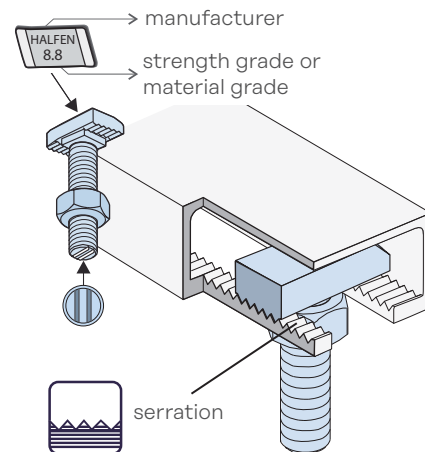


Halfen HZS Bolt,
serrated, incl. nut



Please order
washer separately

- The serration additionally ensures a positive load transmission in the longitudinal channel direction. The danger of T-bolt slippage is minimized.
- The Halfen Bolt is marked on the shaft end with 2 notches.
- Strength grade or material grade is marked on the T-bolt heads



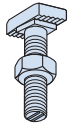
Halfen HZS Bolts										
Halfen Bolt	HZS 64/44		HZS 53/34		HZS 38/23		HZS 29/20	HZS 41/22		
Suitable for profile	64/44		53/34		41/27; 38/23		29/20	41/22		
Bolts dimensions										
Ø	M20	M24	M16	M20	M12	M16	M12	M12	M16	
l [mm]										
30	-	-	-	-	EPS 8.8	-	EPS 8.8	-	-	Other Halfen bolt lengths and materials are available on request! HDG = Steel, hot-dip galvanized EPS = Steel, zinc-plated A4 = Stainless steel FA = Duplex steel Material details and corrosion protection: see page 12–13 *on request
35	-	-	-	-	-	-	-	A4-50	-	
40	-	-	-	-	HDG 8.8 EPS 8.8	EPS 8.8	EPS 8.8	-	-	
50	-	-	-	-	HDG 8.8 EPS 8.8	EPS 8.8	HDG 8.8 EPS 8.8	A4-50	HDG 8.8 A4-50	
60	EPS 8.8	-	HDG 8.8 EPS 8.8 FA-70	-	EPS 8.8	HDG 8.8 EPS 8.8 A4-70	EPS 8.8	-	-	
65	-	-	-	HDG 8.8 EPS 8.8 FA-70	-	-	-	-	-	
80	HDG 8.8 EPS 8.8 FA-70	EPS 8.8* FA-70*	HDG 8.8	HDG 8.8	HDG 8.8 EPS 8.8	HDG 8.8 EPS 8.8 A4-70	EPS 8.8	A4-50	-	
100	-	-	HDG 8.8 EPS 8.8 FA-70	EPS 8.8 FA-70	EPS 8.8	EPS 8.8	EPS 8.8*	-	HDG 8.8	
125	EPS 8.8 FA-70	-	-	-	-	EPS 8.8*	EPS 8.8	-	-	
150	-	EPS 8.8 A4-70	-	-	-	EPS 8.8	EPS 8.8*	-	-	
200	-	-	-	-	-	EPS 8.8	-	-	-	
300	-	-	-	-	-	EPS 8.8	-	-	-	

Halfen HZA Anchor channels

Halfen Bolts: Dimensioning

Halfen HZS Bolts — Load capacity and bending moment

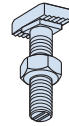
Design resistance HZS
with hot-rolled HZA DYNAGRIP® Anchor channels



DYNAGRIP®
HZA 64/44; HZA 53/34; HZA 41/27;
HZA 38/23; HZA 29/20

Material/ Strength class		M12	M16	M20	M24
8.8	$N_{Rd,s}$ [kN]	44.9	83.7	130.7	188.3
	$V_{Rd,s}$ [kN]	27.0	50.2	78.4	113.0
	$M^0_{Rd,s}$ [Nm]	84.0	212.8	415.2	718.4
A4-70	$N_{Rd,s}$ [kN]	31.6	58.8	91.7	132.1
	$V_{Rd,s}$ [kN]	22.7	42.2	66.0	95.1
	$M^0_{Rd,s}$ [Nm]	59.0	149.4	291.0	503.8

Design resistance HZS
with cold-formed HZA Anchor channels



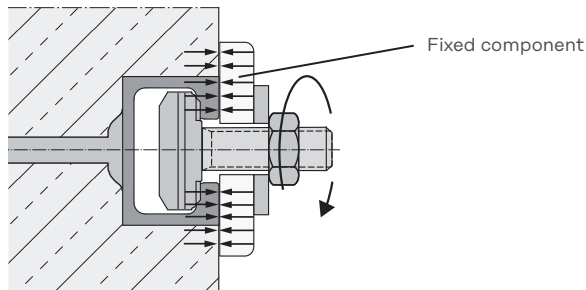
HZA 41/22

Material/ Strength class		M12	M16
8.8	$N_{Rd,s}$ [kN]	32.3	62.2
	$V_{Rd,s}$ [kN]	27.0	50.2
	$M^0_{Rd,s}$ [Nm]	84.0	208.8
A4-50	$N_{Rd,s}$ [kN]	14.1	22.4
	$V_{Rd,s}$ [kN]	10.6	19.8
	$M^0_{Rd,s}$ [Nm]	27.7	70.2

Torque values for Halfen HZS Bolts

Standard

Components are braced against the concrete and anchor channel. Torque is applied as in the following table and must not be exceeded.

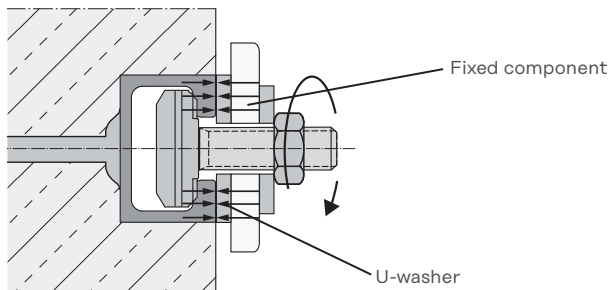


Standard torque values

Standard: Recommended torque values T_{inst}				
HZA Profile	Halfen Bolt HZS...M [mm]	Torque value T_{inst} [Nm]		
		Steel 8.8	Stainless steel Strength class 50	Stainless steel Strength class 70
41/22	12	30	20	-
	16	40	50	-
29/20	12	35	-	-
38/23	12	55	-	50
	16	75	-	75
41/27	12	75	-	-
	16	125	-	-
53/34	16	135	-	130
	20	165	-	165
64/44	20	315	-	250
	24	375	-	335

Steel-Steel

Components are braced against the anchor channels using suitable washers. Torque is applied as in the following table and must not be exceeded.



Torque values steel-steel

Steel-Steel: Recommended torque values T_{inst}				
HZA Profile	Halfen Bolt HZS...M [mm]	Torque value T_{inst} [Nm]		
		Steel 8.8	Stainless steel Strength class 50	Stainless steel Strength class 70
41/22	12	50	20	-
	16	140	50	-
29/20	12	75	-	-
38/23	12	75	-	50
	16	185	-	130
41/27	12	75	-	-
	16	185	-	-
53/34	16	185	-	130
	20	360	-	250
64/44	20	360	-	250
	24	625	-	435



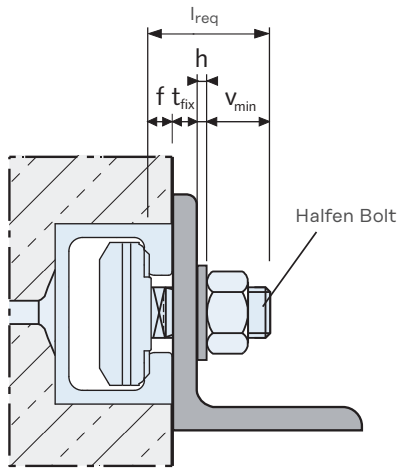
Torque values apply only to bolts in delivery condition (unlubricated). Tightening torques in [Nm] are also provided in the installation instructions of the bolts.

Halfen HZA Anchor channels

Minimum Edge Distances and Minimum Bolt Spacing/Bolt Length

Calculating the bolt length l_{req} for Halfen HZS Bolts

$$l_{req} = t_{fix} + f + h + v_{min}$$



Dimensions v_{min}	
T-bolt diameter	v_{min} [mm]
M12	17.0
M16	20.5
M20	26.0
M24	29.0

Lip dimensions f	
Channel profile	f [mm]
64/44	10.0
53/34	7.5
41/27	7.0
38/23	5.5
29/20	5.0
41/22	7.0

- l_{req} = required T-bolt length
 t_{fix} = thickness of clamped component
 f = profile lip height
 h = washer thickness
 v_{min} = nut height EN ISO 4032 + overhang approximately 5 mm ($\geq$ M20: 7 mm)

Minimum edge distances and minimum Halfen Bolt spacing

Anchors must be installed at a minimum distance from the component edges. The distance depends on the selected channel profile. According to the ETA, the spacing between bolts s_{cbo} must not be less than $s_{s,min} = 5 \times d_s$. Reduction of the load bearing capacity is required if $s_{cbo} < s_{sl,N}$ (see table on page 30).

The concrete load-bearing capacity must be verified for each individual case using the Halfen Anchor channel Software!

* $s_{sl,N}$ = centre distance of the bolts subject to $N_{Rd,s,l}$
See tables on page 30

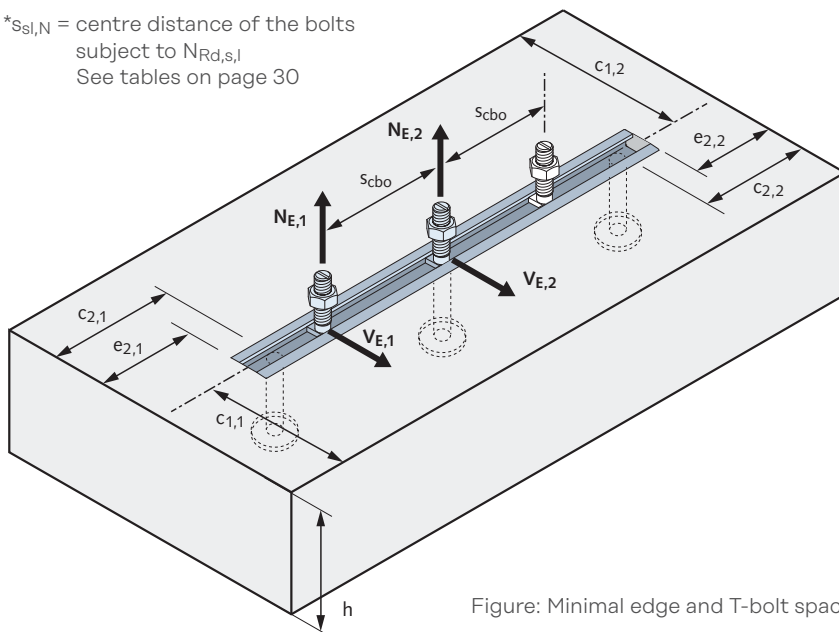


Figure: Minimal edge and T-bolt spacings

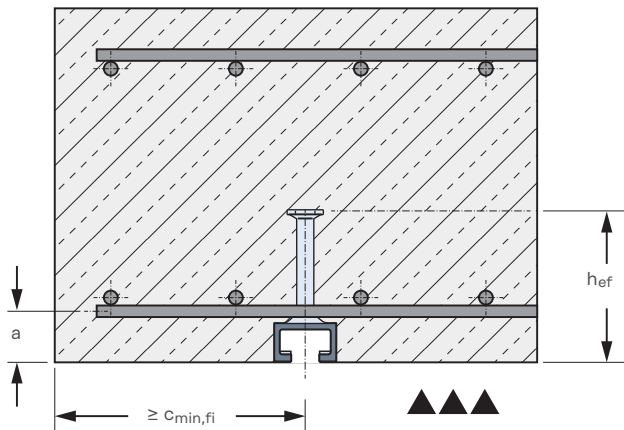
Edge and T-bolt spacing [mm]				
HZA Profiles	M	$s_{s,min}$	c_{min}	e_{min}
64/44	24	120	125	90
	20	100		
53/34	20	100	100	65
	16	80		
41/27	16	80	75	40
	12	60		
38/23	16	80	75	47
	12	60		
29/20	12	60	50	22
41/22	16	80	50	22
	12	60		

Halfen HZA Anchor channels

HZA Fire Resistances

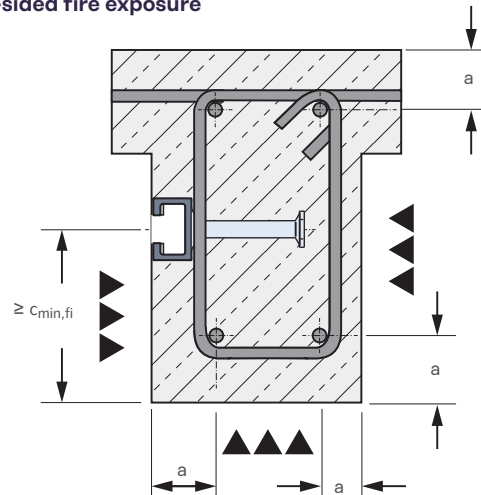
Halfen HZA Anchor channels have been tested and classified for direct exposure to fire in accordance with EAD 330008 using the Standard ISO time-temperature curve (STC). The values shown in the table below are taken from ETA-20/1081.

Single-sided fire exposure



▲▲▲ fire exposure direction

Multi-sided fire exposure



Fire resistance capacities for HZA Anchor channels, serrated — steel failure*												
Fire protection classes depending design resistances N _{Rd,s,fi} = V _{Rd,s,y,fi} [kN]	HZA	29/20	38/23		41/27		53/34		64/44		41/22	
	Halfen Bolt	M12	M12	M16	M12	M16	M16	M20	M20	M24	M12	M16
	R30	2.7	3.5	4.5	3.5	4.5	4.5	10.3	10.3	17.0	2.4	2.3
	R60	2.1	2.7	3.3	2.7	3.3	3.3	7.8	7.8	14.8	1.7	1.8
	R90	1.5	1.9	2.1	1.9	2.1	2.1	5.3	5.3	9.9	1.1	1.2
	R120	1.3	1.5	1.5	1.5	1.5	1.5	4.0	4.0	7.4	0.7	1.0
Minimum axial spacing a [mm]	R30	25	30		35		40		50		25	
	R60	25	30		35		40		50		25	
	R90	35	35		35		40		50		35	
	R120	50	50		50		50		50		50	
Minimum edge spacing c _{min,fi} [mm]	fire exposure single-sided	164	188		296		310		356		164	
	fire exposure multi-sided	300	300		300		310		356		300	

Load capacities are valid for serrated Halfen HZA Anchor channels made of steel and stainless steel.

* Concrete load capacity under fire exposure has to be verified for each individual case in accordance with EN 1992-4 appendix D, for concrete strength classes C20/25 to C50/60.

Halfen HZA Anchor channels

Fatigue Loads

HZA Anchor channels; design resistance for $n = 2 \times 10^6$ load cycles

Profile HZA	Type	$\Delta N_{Rd,s,0,n}$	$N_{lod,s,n}$	Allowable bolts	Material
38/23	HDG	3.4	6.2	M16	8.8
41/27		3.4	6.2	M16	
53/34		5.9	9.2	M20	
64/44		8.7	20.2	M24	

Example (also see diagram to the right):

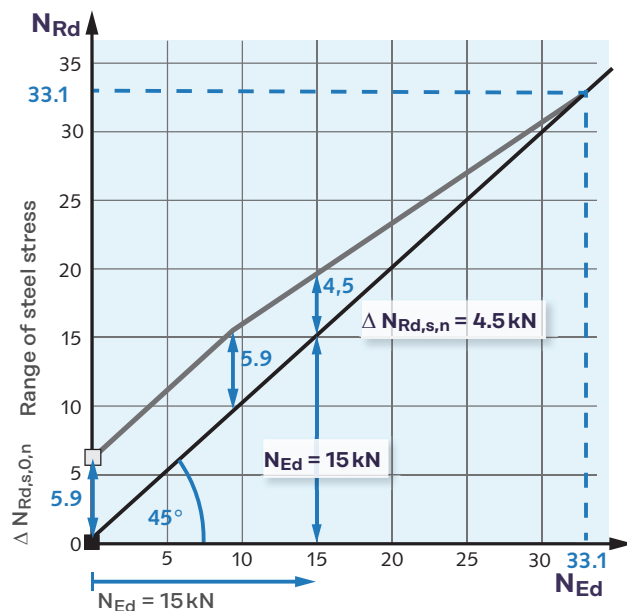
Profile HZA 53/34 - HDG (serrated, hot-dip galvanized),
for $n = 2 \times 10^6$ load cycles:

$N_{Rd} = 59.6 \div 1.8 = 33.1$ (taken from the ETA-20/1081)

N_{Ed} from permanent load = 15 kN (assumption)

$\Delta N_{Rd,E,n} = (33.1 - 15.0) \times 5.9 / (33.1 - 9.2) = 4.5$ kN

Diagram: HZA 53/34 - FV for $n = 2 \times 10^6$ load cycles



Tender text example

Halfen HZA type Channel 53/34 - HDG - 350 - KF

Halfen HZA Channel, serrated 53/34 DYNAGRIP® with serrated channel lips for adjustable fixing of components,

in accordance with European Technical Approval ETA-20/1081, suitable for anchoring in cracked or uncracked normal-weight concrete with strength class of C12/15 to C90/105, under static, quasi-static, dynamic loading as well as fire exposure.

Type HZA 53/34 - HDG - 350 - KF

with

$N_{Rk,s,c} = 59$ kN = char. resistance, steel failure (tension), connection channel anchor

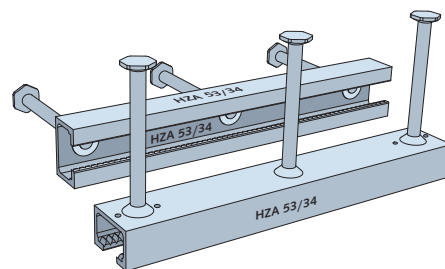
$\Delta N_{Rk,s,lo,n} = 8.0$ kN = char. fatigue resistance (2×10^6 load cycles), steel failure (tension),

HDG = Corrosion protection, hot-dip galvanized

350 = Channel length [mm] with 3 anchors,

KF = Foam strip filler,

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



Halfen HTA-CE/HZA Anchor channels

Installation Aids/Further Channel Parts

ANK-E end anchor; for on-site custom cut-length of Halfen Anchor Channels

Notes for assembling end anchor, type ANK-E

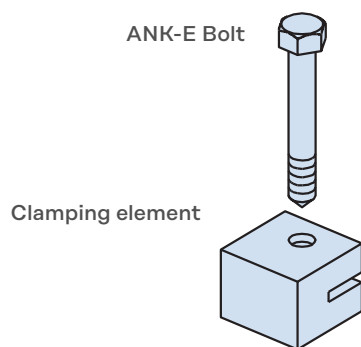
Cut the Halfen Anchor channel at the selected point. The cut face must be at a right angle to the longitudinal axis of the channel. The end projection "e" should not be less than 35 mm and not more than 175 (225) mm*.

Select the correct ANK-E End anchor for the Halfen Anchor channel profile; see table on the right. Slide the clamping element on to the back of the channel. If necessary, push in the foam filler at the end of the channel.

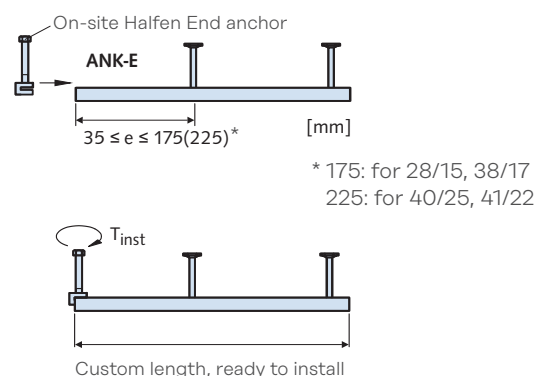
Tighten the bolt by applying the required torque. See table (right) for correct torque value.

End anchor selection			
for profile	End anchor	Thread	Torque T_{inst} [Nm]
28/15 - HDG	ANK-E1 - HDG	M8	10
28/15 - SST	ANK-E1 - A4	M8	10
38/17 - HDG	ANK-E2 - HDG	M10	20
40/25 - HDG			
41/22 - HDG ①			
38/17 - SST	ANK-E2 - A4	M10	20
41/22 - SST ①			

① Short HZA 41/22 sections may be used with one end anchor only. Not included in the approval.



Custom lengths



Halfen Channel pairs

Material/type:

Channel (Type straight or curved):

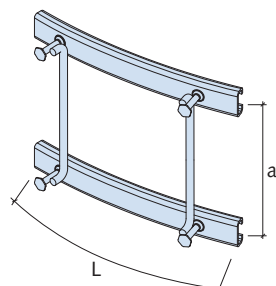
HDG = Hot-dip galvanized

SST = Stainless steel

Spacer:

Reinforcement steel B500B or B500B/A SST, $\varnothing$ 10-16 mm

Recommended for stainless steel type spacers in: B500B/A SST.



Ordering example:

Type: Halfen Channel pair HTA-CE 38/17

Dimensions: L = 350 mm, a = 200 mm

Material: hot-dip galvanized, with filler

Radius: $R_i = \dots$ (for curved type)

Halfen Corner channel

Material/type:

Channel and anchor:

HDG = Hot-dip galvanized

SST = Stainless steel

Standard type:

a/b = 125/250 mm

Other lengths for a and b

and other profiles are

available on request

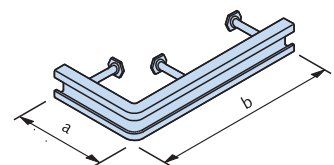


Figure: HTA-CE 38/17 – Corner piece

Area of application:

- fixing for Halfen Console anchors for supporting brickwork cladding
- other near edge fixings

Halfen HTA-CE/HZA Anchor channels

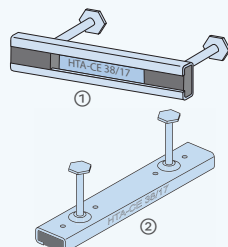
Installation/Assembly

1.1 Delivery and identification

We can supply ready to install short channels and standard lengths.

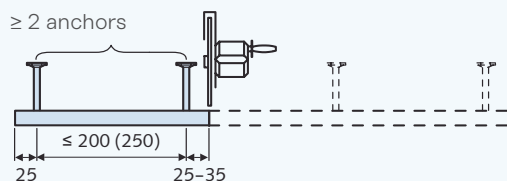
Product identification

- ① inside the channel
- ② also on the channel side



1.2 Installing to formwork

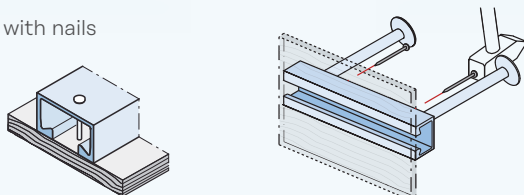
If required, Halfen Anchor channels can also be cut to size on site.



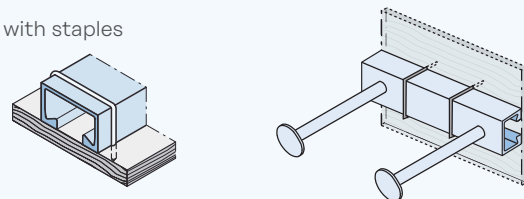
2.1 Fixing to the formwork

Timber formwork

2.1.1 with nails

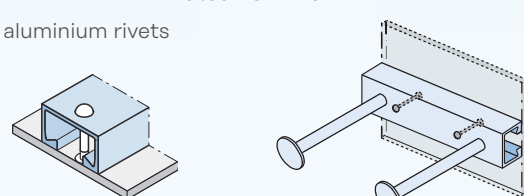


2.1.2 with staples

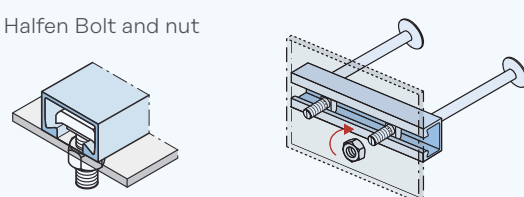


Steel formwork

2.1.3 aluminium rivets



2.1.4 Halfen Bolt and nut



2.1 Fixing to the formwork, continued

Steel formwork

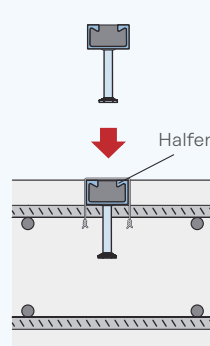
2.1.5 Halfen HFK Fixing cone



2.2 Top face installation

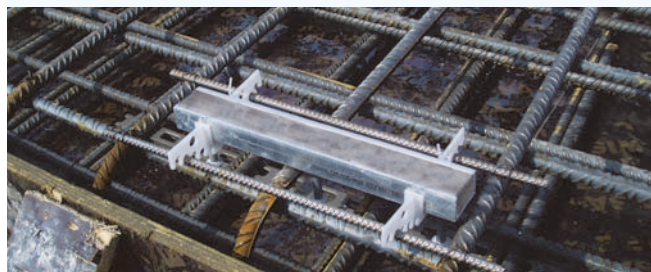
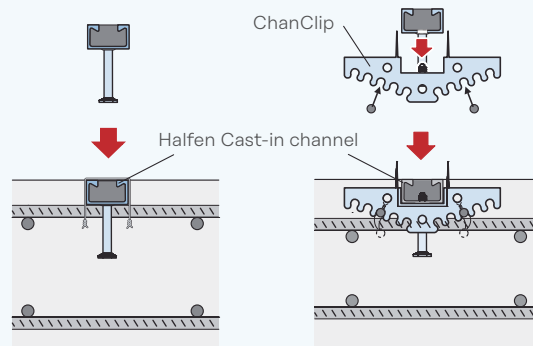
2.2.1

directly to reinforcement:
with tying wire

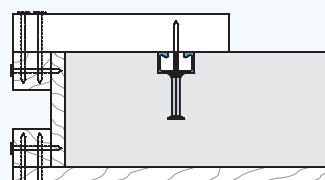


2.2.2

with Halfen HCP ChanClip



2.2.3 Installation using an auxiliary aid



Halfen HTA-CE/HZA Anchor channels

Installation/Assembly

3.1 Removing the filler

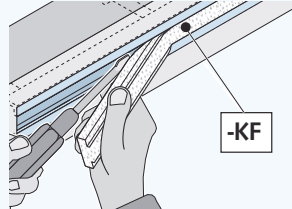
Strip filler, available in two versions:



KF – PE strip filler
with reinforcement layer



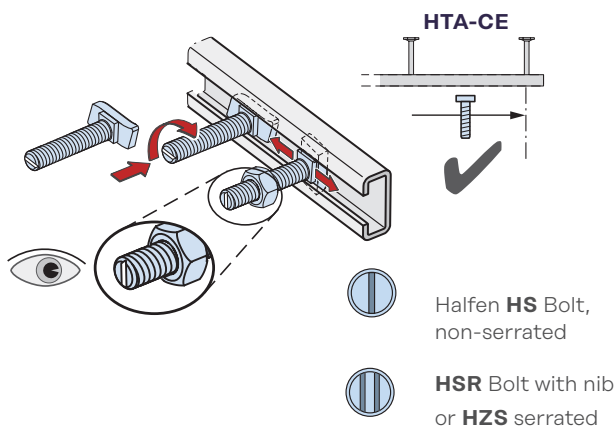
KF – PE strip filler



Removing the strip filler

Grip the strip filler at one end and pull out in one piece by hand; use a tool, e.g. a screwdriver.

4.1 Installing Halfen Bolts

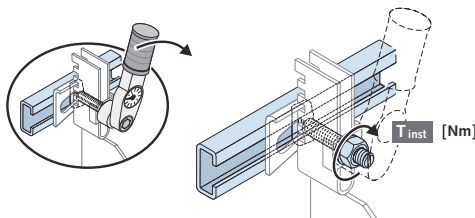


Safe assembly with Halfen Cast-in Channels

Halfen Bolts can be inserted anywhere in the channel slot, turned 90° and then locked in place by tightening the nut. Do not position bolts at channel ends past the last anchor. On channels with bolt anchors, the anchor locations are visible through the channel slot.

Check

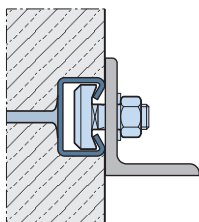
Bolts: After installation check that the bolts are properly aligned; the notch or notches in the tip of the shank must be at right angles to the longitudinal axis of the channel.



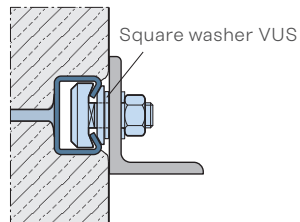
Fixings

The T-bolt heads must sit flush on both lips of the anchor channel and be secured by tightening the nut with a torque wrench with the required value. Observe the torque values in the tables on page 23-24 for HS/HSR or page 33 for HZS.

Direct attachment ①



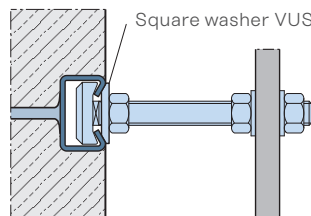
Surface-flush installation



Non-flush installation

- ① If the front surface of the channel is set back from the concrete surface, the attached structure must be shimmed with a washer (VUS). In case of shear stress, add bolt flexure to the tensile force.

Stand-off installation ②



- ② Always install a square washer for stand-off installations.

Example:

Halfen Channel: **HTA-CE 49/30**

Halfen Bolt: **HS 50/30 - M16**

Washer: **VUS 49/30 - M16**



Assembly instructions

Multi-language assembly instructions are delivered with the Halfen Cast-in Channels and with each Halfen Bolt card box. Additionally they can be found at www.halfen.com / Downloads / Brochures / Assembly Instructions.

Halfen HTA-CE/HZA Installation

Installation in Pre-stressed Concrete

Halfen Anchor Channels, hot-dip galvanized with stainless steel anchors

Requirements

according to EN 1992-1-1/NA (EC 2 with German National Annex, 2nd edition, 2016, chapter 8.10.1.1) "Ensure at least 20 mm concrete between pre-stressed tension strands and galvanized components." Otherwise there is a risk of hydrogen induced cracking.

Solution

If hot-dip galvanized channels are used together with stainless steel bolt anchors then the pre-stressed tension-strands are allowed to have contact with the stainless steel bolt anchor.

Types:

Lengths available:
up to 6.07 m

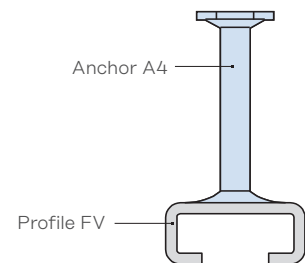
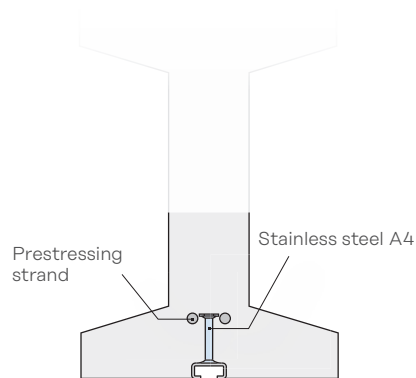
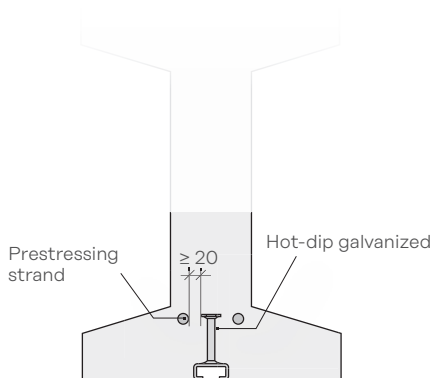
Available profiles:

50/30P

49/30

40/25

38/17



Halfen Cast-In Channels

Dimensioning HTA-CE and HZA Cast-in Channels

Halfen HTA-CE/HZA Software

The Halfen Calculation program for Halfen Cast-in Channels according to the ETA provides the user with a convenient and very powerful calculation tool.

Verifications

All necessary verifications are processed by the user-friendly dimensioning software. In just a few seconds the user is provided with a list of suitable Halfen Cast-in Channels for the relevant load situation.

Boundary conditions

The calculation takes into account all necessary boundary conditions, typical examples being:

- cracked or non-cracked concrete
- the geometry of the concrete components, in particular the distances from the channel to the component edge
- various reinforcement patterns
- consideration of several dimensioning or characteristic loads
- position of the loads with a definable adjustment range, and the option of shifting the defined T-bolt pattern along the complete channel length
- verification of the required Halfen Bolts and if required also for stand-off installations
- verification of longitudinal forces in Halfen HZA serrated cast-in channels

Input

The geometry and loads are entered interactively. Entries are displayed promptly in a 3D graphic. Entries can also be changed directly in the graphic. Click on the load, the measurement or the component line you want to change, to make the required modification.

Input loads

In addition to direct input of bolt loads, it is also possible to calculate the resulting loads by entering the actions/loads caused by secondary components (for example, curtain wall applications)

Results

After calculation, the software output provides either the results for a preselected profile, or in the case of automatic selection a list of all suitable profiles. Profiles and bolts with incomplete verifications are high-lighted in red.

Visual control

All verifications for the current channel profile are listed in a tree structure. Green check-marks indicate successful verifications. Red check-marks indicate unsatisfactory verifications.

For further visual control a progress bar on the right indicates the status of the verification process. Here too, red bars mean that a load has been exceeded, while green bars symbolize verifications that meet the criteria.

Detailed calculation information (with load positions, section sizes and utilization factors) can also be selected in a tree menu.

After selecting a Halfen Cast-in Channel and suitable T-bolts, the dimensioning results can be imported into the data list and saved.

Print-outs

Print-outs are possible in a brief and in a verifiable long version. The long version includes all decisive verifications, a diagram of necessary reinforcement and a 2D graphic of the geometry and load.

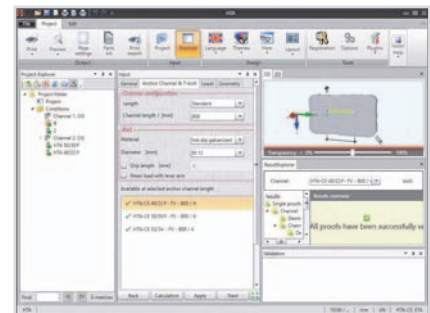
The latest version of the dimensioning program is available for download on the Internet at www.ancon.co.nz

System requirements:

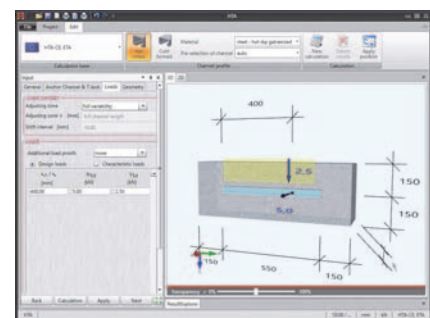
Windows 11, Windows 10, Windows 8,
Microsoft .NET Framework 4.7.2 or higher version

(.NET framework can be downloaded from our software portal)

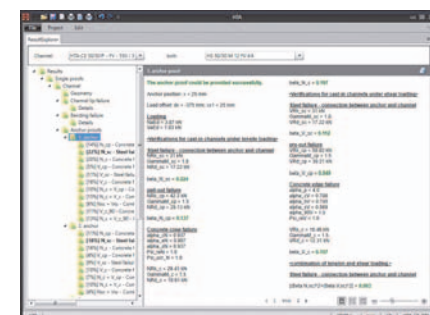
All software can be found under:
https://www.halfen.com/en_DE/downloads/software-cad-bim/dimensioning-software



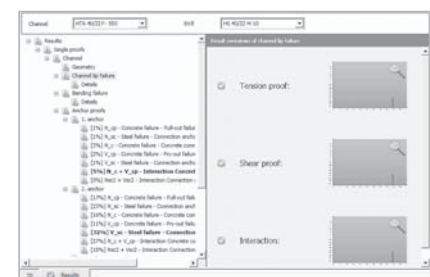
Input screen, Halfen Anchor Channel Software



Interactive 3D display



Results list



Overview of results



Print preview

Halfen Curtain Wall Support System

The benefits at a glance

Modern buildings require façades of the highest quality that can be installed quickly and safely.

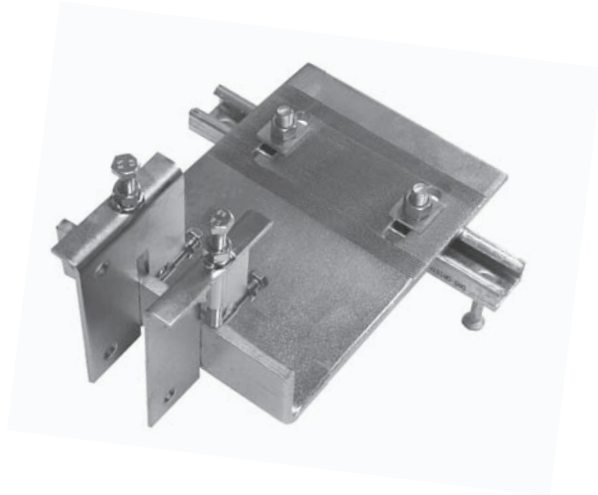
This is the reason the Halfen Curtain Wall System is chosen more and more frequently by architects and investors.

Fast and cost-effective

- 3-dimensional adjustable connection when used with cast-in channels
- uses bolts instead of welding
- fast assembly reduces installation time

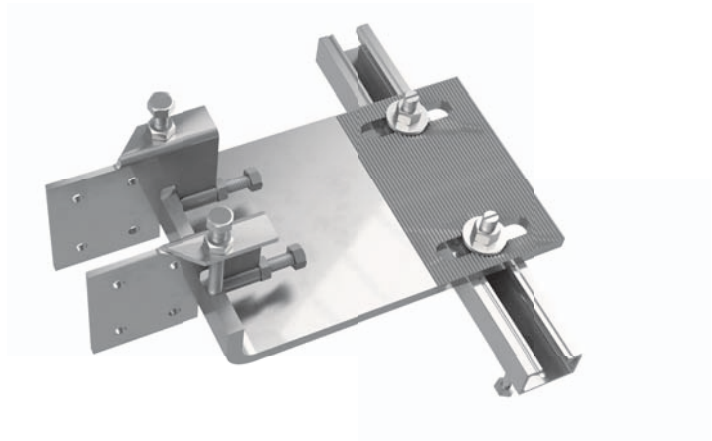
HCW-B2 Bracket

For modular façades. Anchored to the top surface of floor slabs.



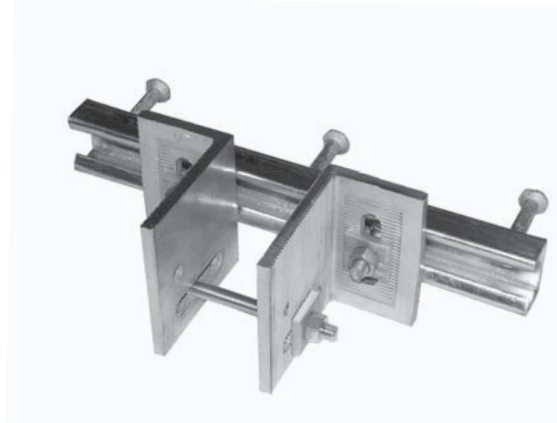
HCW-B1 Bracket

For post and beam façades. Anchored to the top surface of floor slabs.



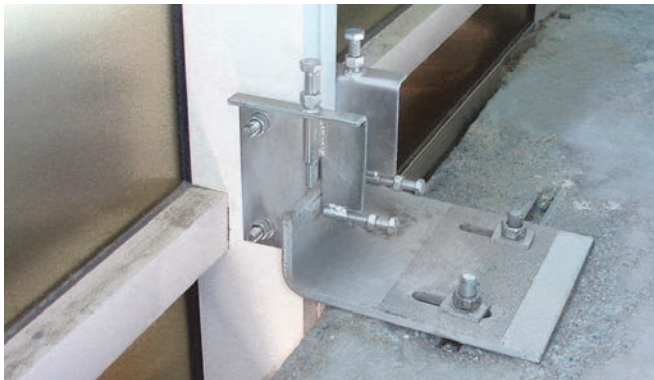
HCW-ED/-EW Brackets

For post and beam façades. Anchored to the edges of slabs.



Halfen Curtain Wall Support System

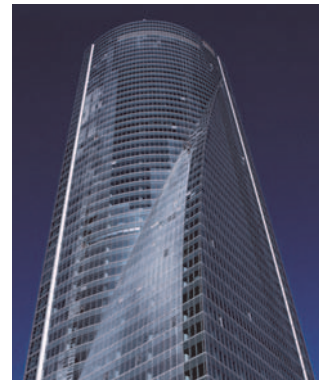
Application Examples



Fixing of a curtain wall system using HCW-B2 Brackets connected to HTA-CE Anchor Channels



Liberty Life, Johannesburg



Torre Espacio, Madrid



Fixing of a post and beam façade using HCW-ED Brackets on HTA-CE Anchor Channels



Post office Tower, Bonn



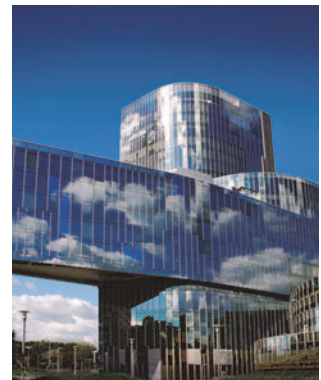
Sage Centre, Gateshead



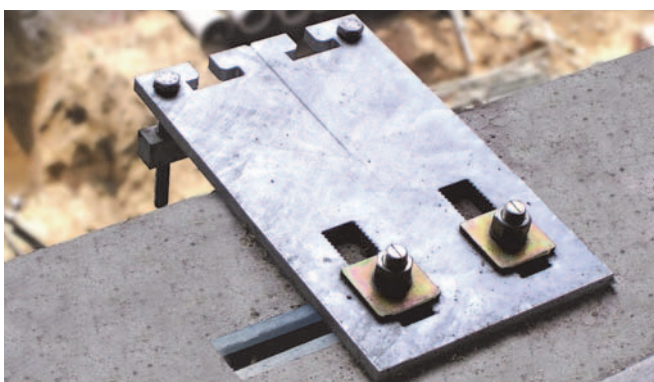
Fixing of a modular façade using HCW-ED Brackets on HTA-CE Anchor Channels



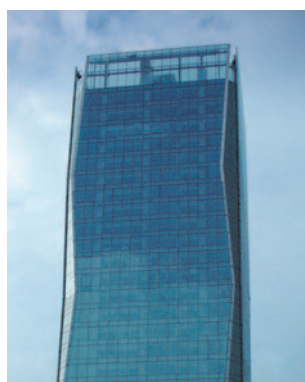
Burj Khalifa, Dubai



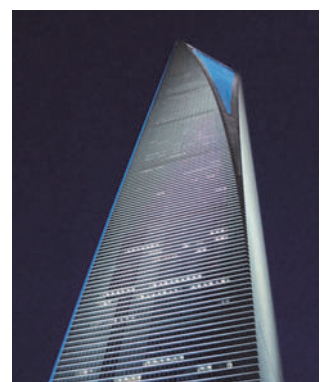
Edificio Gas Natural, Barcelona



Typical curtain wall fixing with HTA-CE Anchor Channels



Westin Libertador Hotel, Lima



World Financial Center, Shanghai

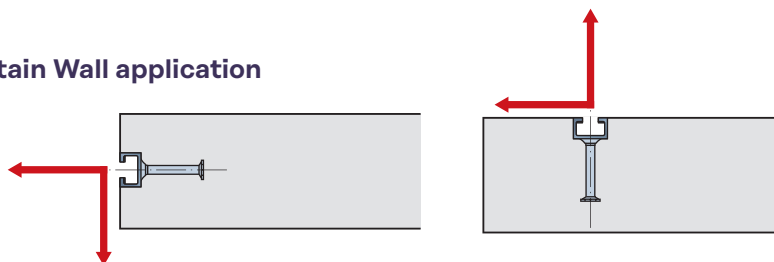
Halfen Curtain Wall Support Systems

Product Range

Halfen Cast-in Channels and bolts for Curtain Wall application

Load case: for standard slab thickness with standard tensile and transverse tensile loads

Halfen Anchor channels HTA/HZA with bolt anchors or weld-on I-anchors

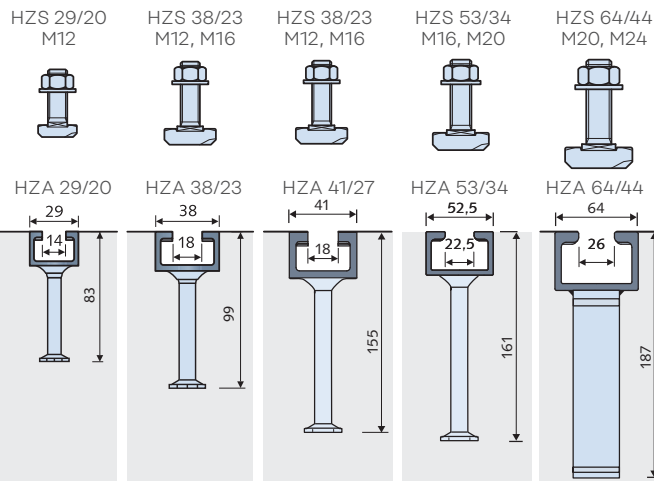


Hot-rolled serrated anchor channels and bolts



European
Technical
Assessment
ETA-20/1081

see pages 28–36
for channel details

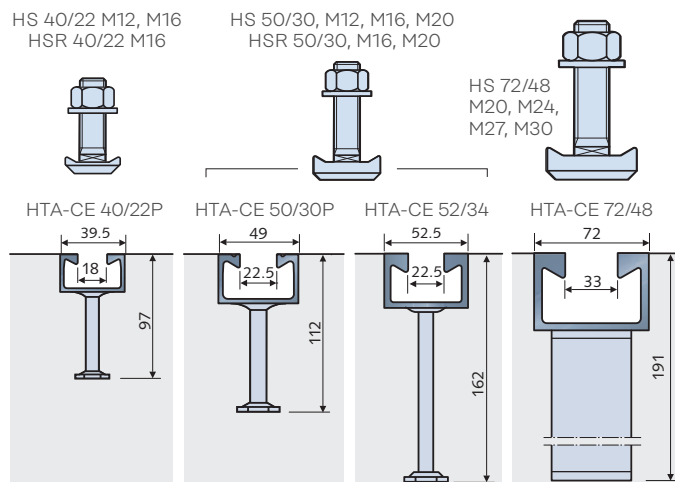


Hot-rolled (standard) anchor channels and bolts



European
Technical
Assessment
ETA-09/0339

see pages 16–27
for channel details



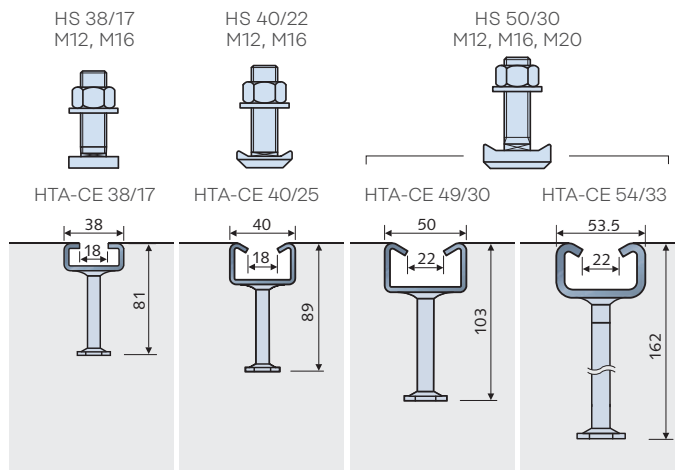
HSR T-bolt application is possible in accordance with an expert report or with ETA for load capacity in channel longitudinal direction. See page 24 also.

Cold-rolled (standard) anchor channels and bolts



European
Technical
Assessment
ETA-09/0339

see pages 16–27
for channel details



Halfen Curtain Wall Support Systems

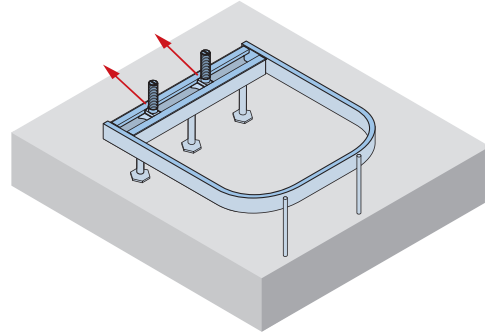
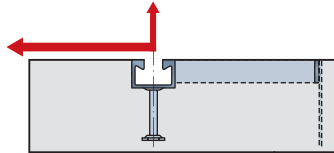
Product Range

Halfen HCW 52/34 Channels for Curtain Wall application

Load case: for thin slabs (thickness ≥ 12.5 cm) with high transverse tensile loads and small edge distance

Halfen Curtain wall channel HCW 52/34

(not included in the HTA-CE approvals)



HCW 52/34 with bracket and Halfen Bolt

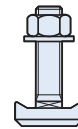
see pages 47–48



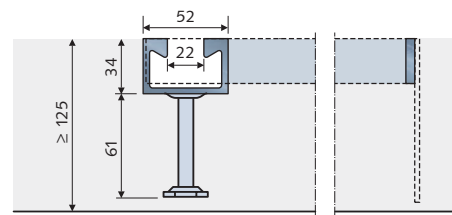
Fig. HCW 52/34 with bolts and bracket

HS 50/30 M16, M20

Grade 8.8

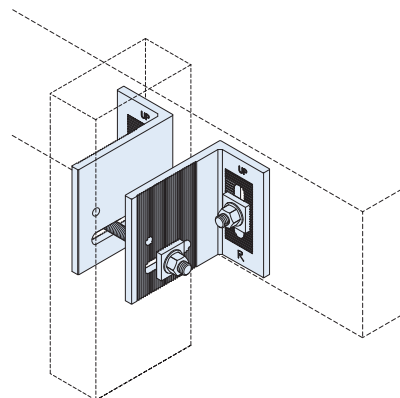
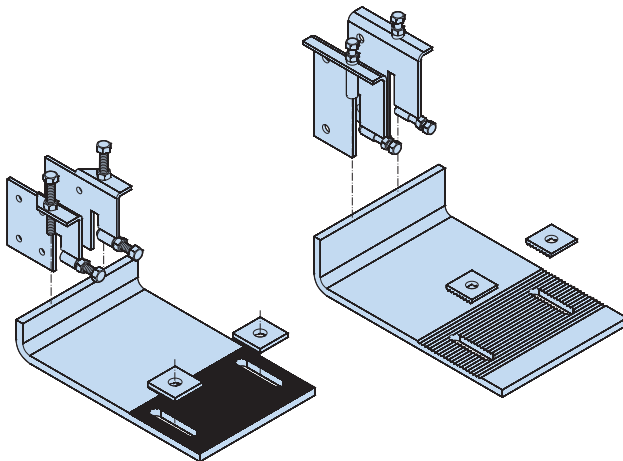


HCW 52/34



Halfen Curtain wall installation brackets

see pages 49–53



Halfen Curtain Wall Support Systems

Design principles

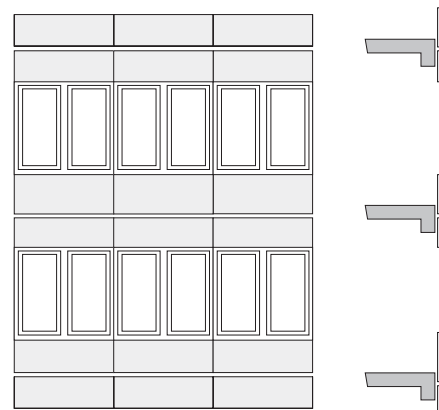
Curtain wall system

The curtain wall façade system gets its name from the fact that the construction hangs like a curtain in front of the floor slabs. (See figure 1 section)

The system is thin and lightweight, usually aluminum and glass. The façade is attached to the main structure of the building using only the required number of point-load connections. It is not structural, and by design, only able to carry its own weight, but it transfers load of wind and gravity to the structure of the building.

Specifically, this includes sufficient stability against wind loads, adequate ability to shrink and expand as well as insulation against frost in winter, heat in summer and against external noise.

In addition, various requirements must be met to protect against fire and other critical situations.



Curtain wall

Figure 1 partial (view) of a façade (section)

Post and beam façade and the modular façade

Basically, we distinguish between two methods of curtain wall façades:

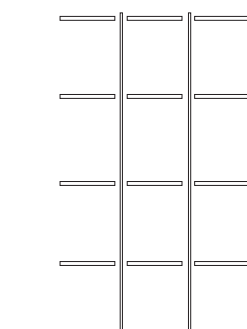
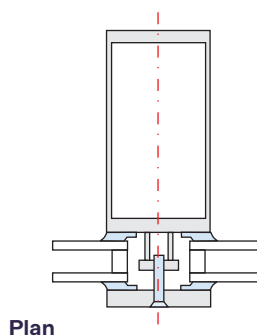
- the post and beam façade
- and the modular façade.

Post and beam façade

One basic distinctive difference is the way expansion in the façade is distributed (for example; thermal expansion). With the post and beam façade (see figure 2) the vertical and horizontal frame supports are installed in spacings corresponding to the façade elements. The supports are installed with an expansion gap between components allowing for sufficient expansion.

The respective longitudinal and transverse connections have an expandable joint. The filler elements (glass or panel) installed in a post and beam structure permit movement within the tolerance of the designed expansion joint. The glass and filler elements are delivered separately and are then installed on site, requiring on-site scaffolding.

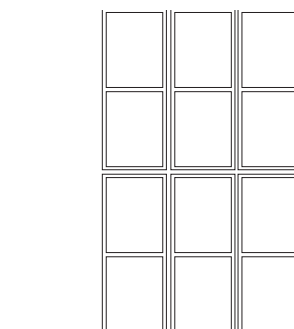
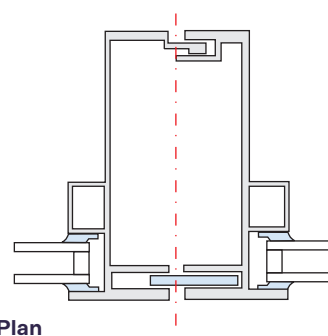
Post and beam façade



View

Figure 2

Modular façade



View

Figure 3

Modular façade

With the modular façade method (see figure 3), the façade is made of prefabricated elements, in which glass, natural stone or infills are pre-installed. The façade profiles are designed as a key and slot system to allow for expansion.

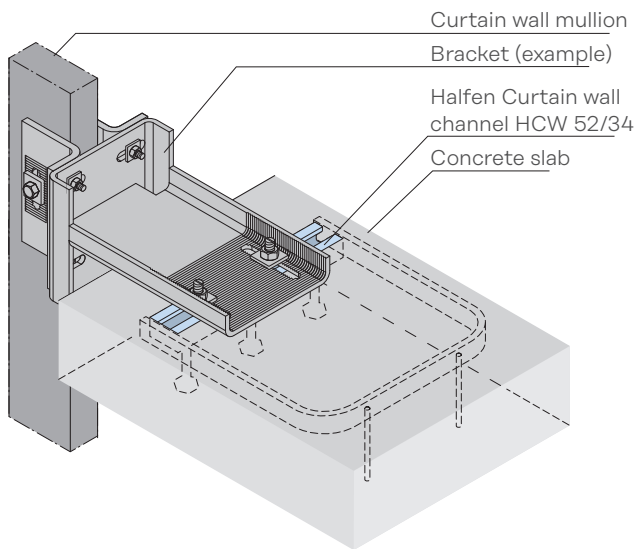
This method provides immediate weather protection and allows the building contractor to start interior work on the respective floor directly after the prefabricated modules have been installed.

Scaffolding is not required with this method of construction.

Halfen Curtain Wall Support Systems

Halfen Channel HCW 52/34

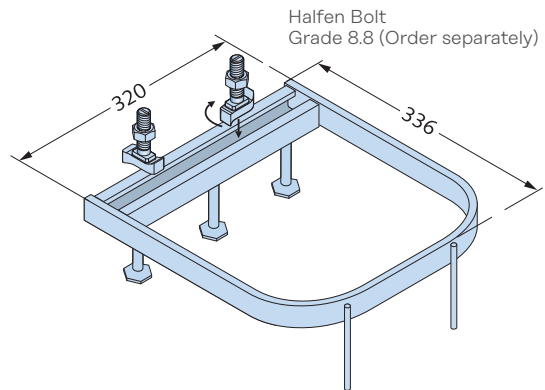
Typical installation



Product description

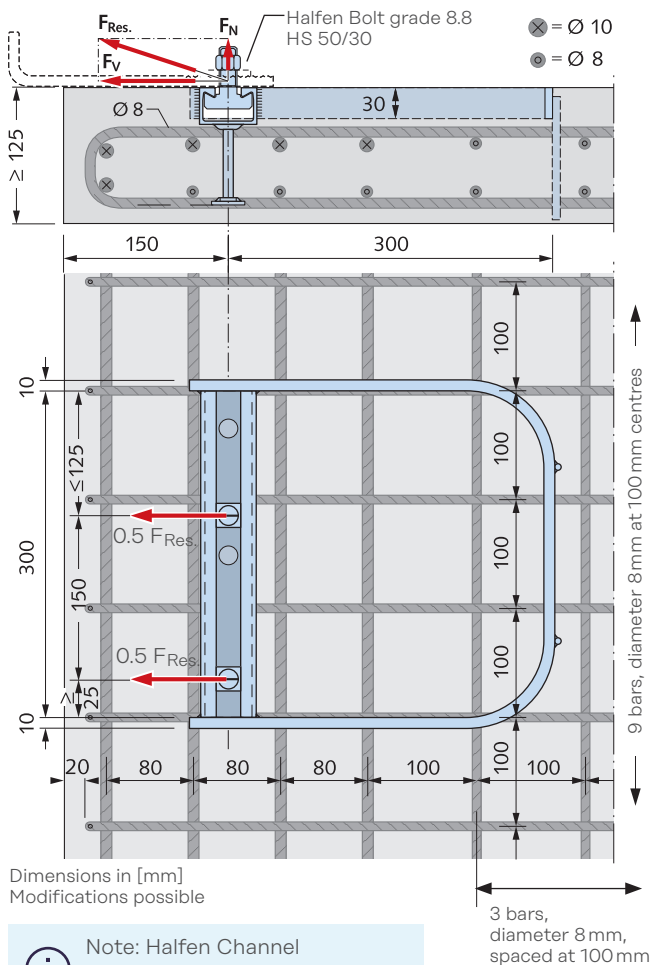
Identification: HCW 52/34

Material: hot-dip galvanized

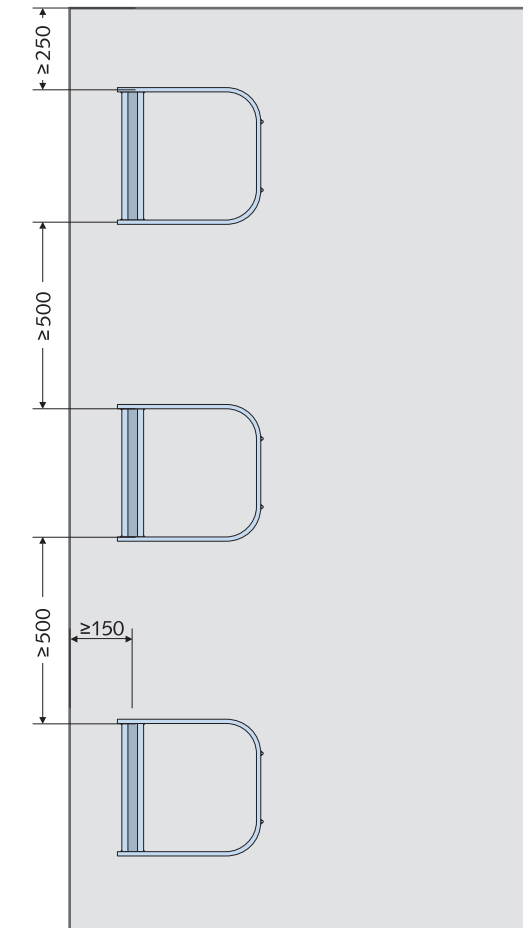


Dimensions in [mm]

Reinforcement requirements



Edge and element spacing



Halfen Curtain Wall Support System

Halfen Channel HCW 52/34

Channel load data

The following rupture loads were averaged from three tests:

$F_{V \text{ failure}}$	=	142.3 kN
$F_{N \text{ failure}}$	=	47.4 kN
$F_{\text{res, failure}} = \sqrt{F_{N^2} + F_{V^2}}$	=	150.0 kN

The load deformation diagram (see right) may be used to determine allowable loads based on acceptable displacement and the required safety factor according to local building codes. The diagram is based on the following:

- tensile and transverse loads were increased at a ratio of 1:3 up to breaking point
- concrete slab thickness ≥ 125 mm and reinforcement as shown on page 47
- concrete strength class $\geq C 20/25$ N/mm²
- load is transferred into the channel via two Halfen Bolts HS 50/30 M20 Grade 8.8. The T-bolt spacing is 150 mm.

A sample calculation is shown below. The safety factor is freely selected. However, it must be determined which factors are actually to be implemented, whether these are based on project specific boundary condition or on valid building regulations.

Calculation example: Assumed safety factor $\gamma = 3$
(failure test load / working load)

Average failure load from the tests:

Transverse tensile stress	$F_{V \text{ ultimate}}$	=	142.3 kN
Tensile stress	$F_{N \text{ ultimate}}$	=	47.4 kN
Res. diagonal tensile load	$F_{\text{res, ultimate}}$	=	150.0 kN

Actual working loads at bolts (specification by façade engineer):

Transverse tensile stress	$F_V = 35$ kN
Tensile stress	$F_N = 10$ kN

Allowable load with $\gamma = 3$ against average ultimate load from tests:

perm. F_V	=	$142.3/3$	=	47.4 kN
perm. F_N	=	$47.4/3$	=	15.8 kN
perm. F_{res}	=	$150/3$	=	50.0 kN

Control:

Working load $F_V = 35$ kN < 47.4 kN

Working load $F_N = 10$ kN < 15.8 kN

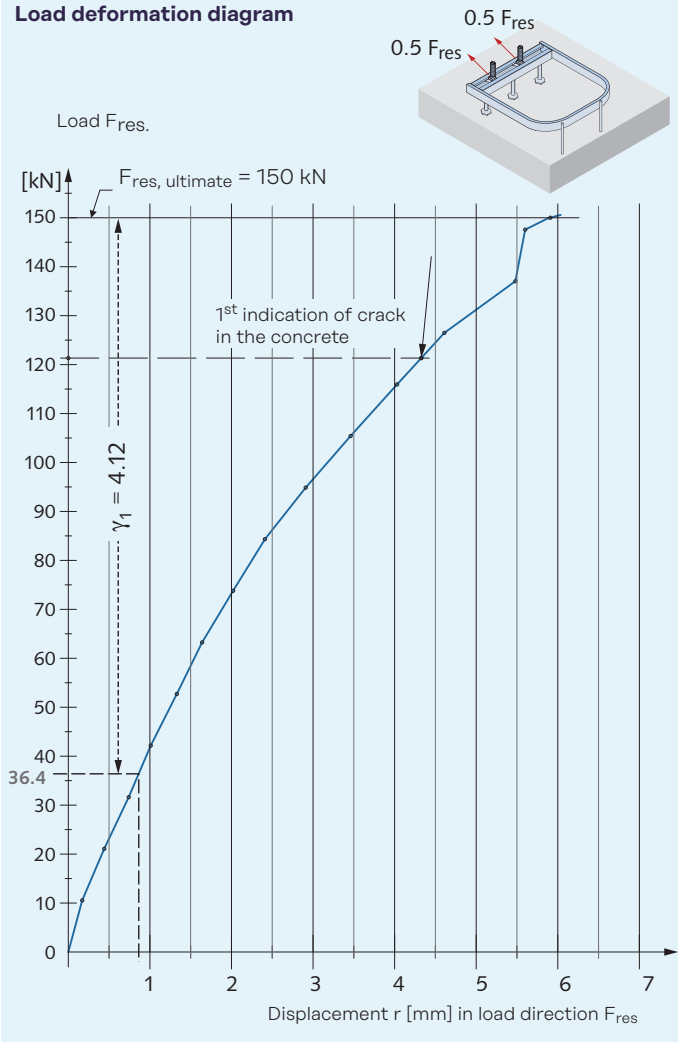
Working load $F_{\text{res}} = \sqrt{(10)^2 + (35)^2} = 36.4$ kN < 50 kN

Displacement at working load < 1 mm (see diagram).

Actual safety factor for average

ultimate load $\gamma_1 = (150/36.4) = 4.12$.

Load deformation diagram



Corresponding Halfen Bolts HS 50/30

Depending on the load size, we also recommend using Halfen Bolts HS 50/30 M16 or M20, grade 8.8 in combination with Halfen Channel HCW 52/34. The bolts stated below are hot-dip galvanized. Other bolt sizes and materials can be supplied. Please contact us for detailed information. Addresses can be found at the end of this catalogue.

Type selection Halfen Bolts HS 50/30 HDG Grade 8.8

Thread	Material grade	Available length L [mm]	Allowable resulting T-bolt load (all directions) perm. F_s [kN]	Allowable bending moment [Nm]	Recommended torque [Nm]
M 16	8.8	40, 60, 80, 100	36.1	111	60
M 20	8.8	45, 60, 80, 100	56.4	216	120



If the Halfen Bolt is stressed in the direction of a slot its load capacity must be verified taking bolt flexure into account.

Halfen Curtain Wall Support System

Edge of Slab Brackets HCW-ED Post and Beam Façades

Application example

Halfen Edge of slab brackets are connected in pairs, one each side of the mullion, and are available in two types:

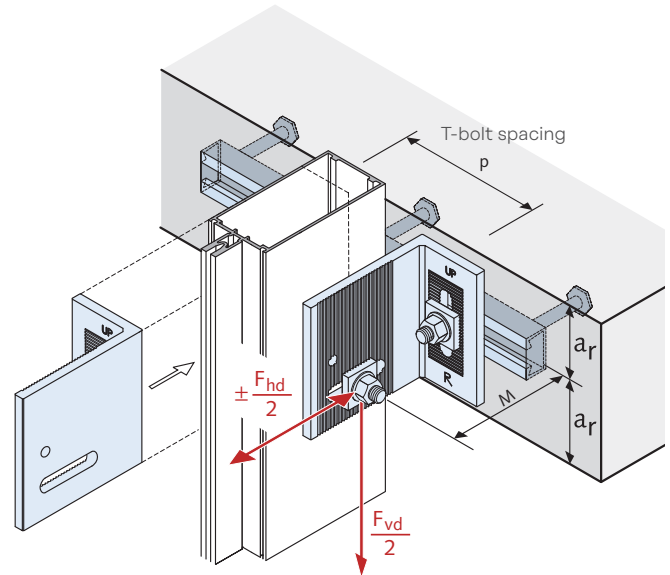
- Type HCW-ED Brackets are designed to support both vertical and horizontal loads.
- Type HCW-EW Brackets are designed to support only horizontal wind loads.
- The brackets guarantee a simple adjustable connection.

The Halfen Bolts (connection: bracket to Halfen Channel) and the standard hexagonal bolts M12 (connection: bracket to façade mullion) must be grade strength 8.8.

A round auxiliary hole in the long arm of the brackets can be used for temporary attachments. For example; temporary fixing of brackets to support the post with self-tapping screws until the final connection is made.

The brackets are made of high quality aluminium material. Special nylon discs are placed between the "Wind load" Bracket HCW-EW and support post.

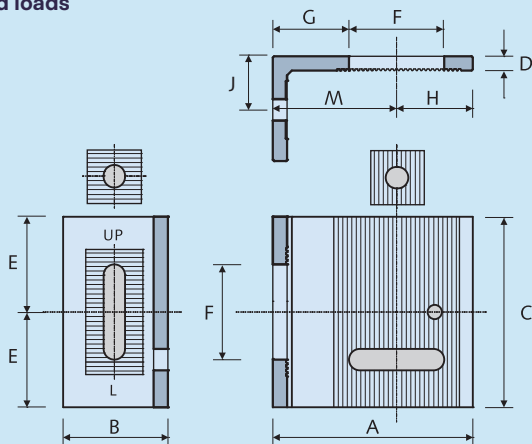
To guarantee correct installation, the HCW-ED brackets are marked 'R' for right, 'L' for left and 'UP' for top.



Bracket dimensions [mm]

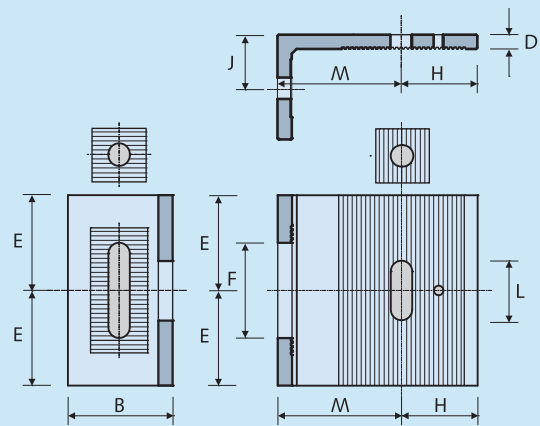
HCW-ED Brackets

for dead loads
and wind loads



HCW-EW Brackets

wind loads only



Serrated washers must be ordered separately

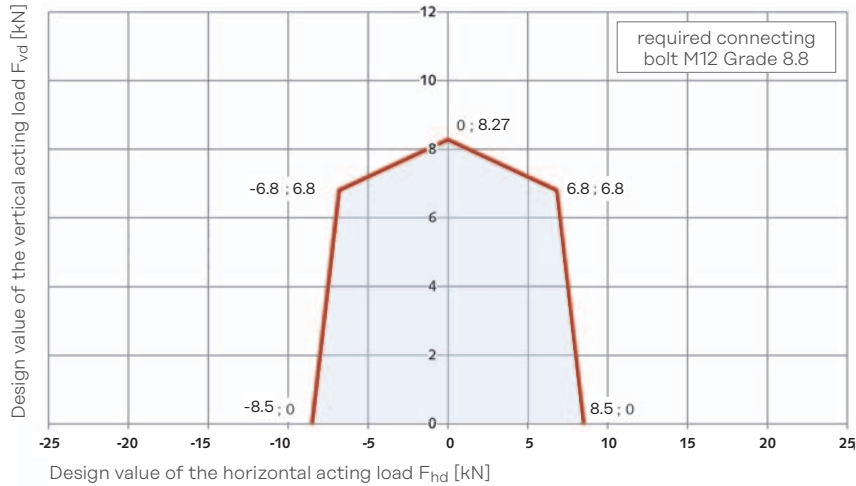
Serrated washers must be ordered separately

Size	Bracket code	A	B	C	D	E	F	G	H	J	L	M
Small	HCW-ED 1 HCW-EW 1	108	70	114	10	57	64	25	51	36	40	57
Medium	HCW-ED 2	133	70	127	10	64	64	51	51	36	40	82
Large	HCW-ED 3 HCW-EW 3	159	70	140	10	70	64	76	51	36	40	108

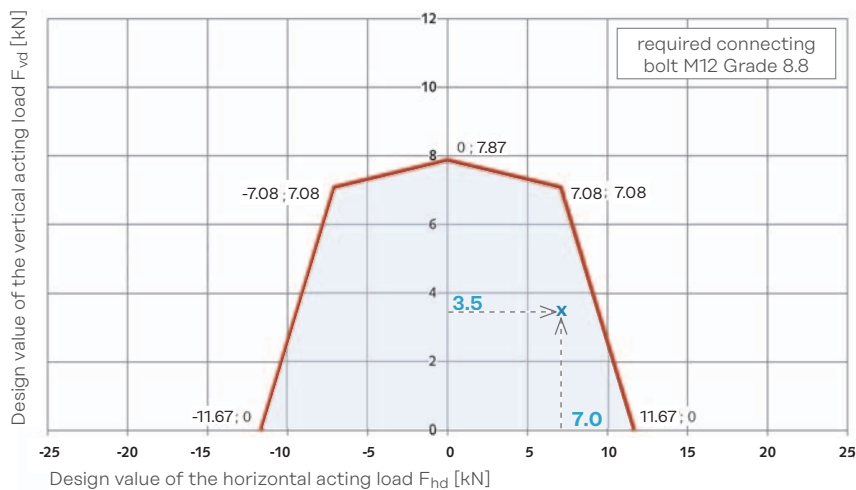
Halfen Curtain Wall Support Systems

Dimensioning

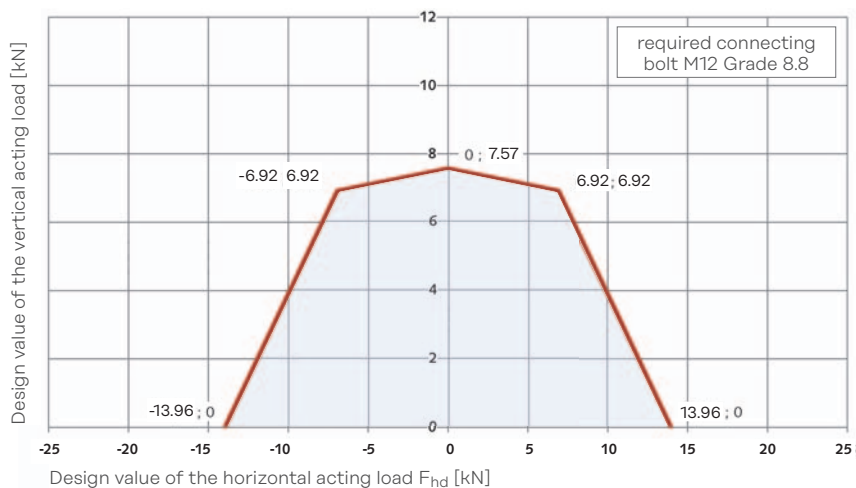
Interaction diagram for type HCW-ED1 (small)



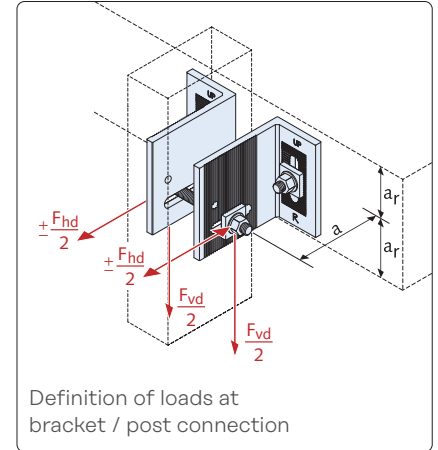
Interaction diagram for type HCW-ED2 (medium)



Interaction diagram for type HCW-ED3 (large)



Calculation basis



Permitted load interaction area



F_{Rd} values are in accordance with expert report. The report is available on request.

Halfen Curtain Wall Support Systems

Design loads HCW-EW; HCW-ED

Design loads using two HCW-EW Brackets, loads in the Halfen Bolts (HCW-ED)

Design wind loads for type HCW-EW

Max. applied design load F_{hd} [kN]			
Size	Bracket code	max. F_{vd} [kN]	max. F_{hd} [kN]
Small	HCW-EW 1	0	8.5*
Large	HCW-EW 3	0	13.96*

HCW-EW Brackets are only suitable for wind loads.

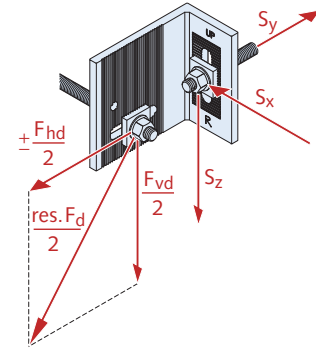
*Safety factors from EN 1992 included

Forces acting on the Halfen Bolts at the channel (HCW-ED)

The components of the design-reaction forces in the Halfen Bolts at the connection of the curtain wall bracket to a Halfen Cast-in channel, are calculated by multiplying the design loads F_{vd} and F_{hd} at connection curtain wall bracket and façade support post with the factors s_x , s_y and s_z . The factors are dependent on the bracket geometry, the load direction and the bolt position (see figure on the right). See table below for multiplication factors for determining the design reaction forces in the Halfen Bolts.

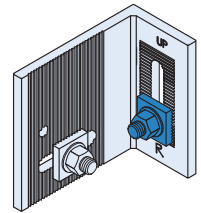
Calculation basis

Definition of the loads in the
- bracket/post connection
- bracket/channel connection

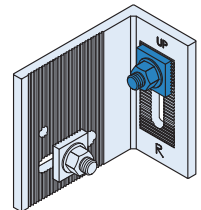


Lower installation position of Halfen Bolt (Position 3)									
Bracket	Dead load $S_i = (F_{vd} / 2) \times s_i$			Wind load $S_i = (F_{hd} / 2) \times s_i$			Resulting load 45° $S_i = (res. F_d / 2) \times s_i$		
	s_x	s_y	s_z	s_x	s_y	s_z	s_x	s_y	s_z
HCW-ED 1	0.5	3.2	-1.0	-1.0	1.0	0.0	-0.3	3.0	-0.7
HCW-ED 2	0.5	3.6	-1.0	-0.5	1.0	0.0	0.0	3.3	-0.7
HCW-ED 3	0.5	4.0	-1.0	-0.4	1.0	0.0	0.1	3.5	-0.7
Upper installation position of Halfen Bolt (Position 1)									
HCW-ED 1	0.6	1.3	-1.0	-1.0	3.6	0.0	-0.3	3.4	-0.7
HCW-ED 2	0.6	1.6	-1.0	-0.5	3.1	0.0	0.0	3.4	-0.7
HCW-ED 3	0.6	1.9	-1.0	-0.4	2.9	0.0	0.1	3.4	-0.7

① Lower installation position of Halfen Bolts (Position 3)



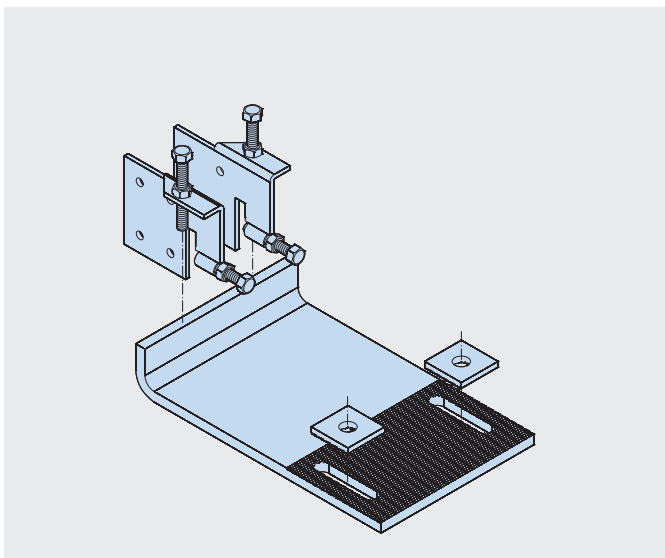
② Upper installation position of Halfen Bolts (Position 1)



Halfen Curtain Wall Support Systems

Top of Slab Brackets HCW-B1

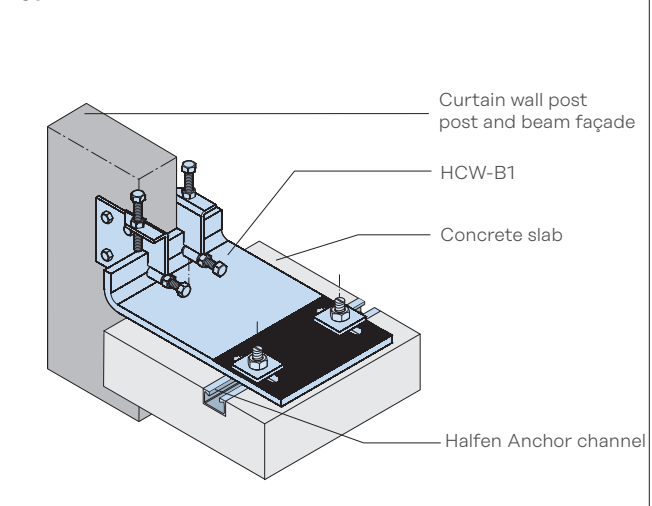
Support brackets for horizontal and vertical loads



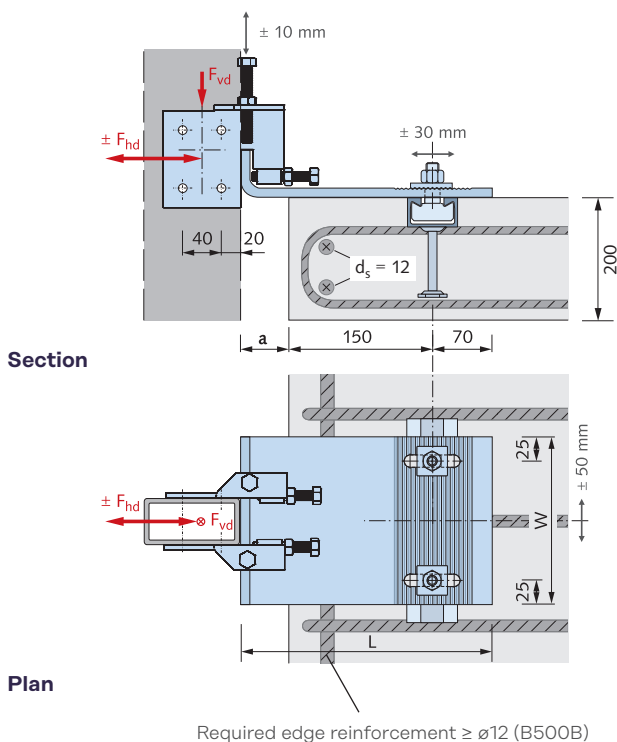
Halfen Brackets HCW-B1

Halfen Brackets HCW-B1 for installing to the top of concrete slabs, are available in two load ranges and three cantilever sizes. The brackets are made in grade S355 quality galvanized steel. Vertical adjustability is ± 10 mm. Three-dimensional adjustability is ensured when used in combination with Halfen Channels.

Typical installation



The lateral connecting plates are connected to the façade posts using M8 screws (not included). The façade planner is responsible for providing the static verification for the support posts. Use M16 Halfen Bolts, grade 8.8 (order separately), to connect the base bracket to the Halfen Channel. Depending on the façade type, the connection between the connecting plate and the base bracket can be designed either laterally adjustable or as a fixed point.



Dimensioning / Type selection

Design load ranges		
Load range [kN]	dead load F_{vd} [kN]	wind load F_{hd} [kN] (wind suction + compression)
4/12	4	± 12
7/20	7	± 20

F_{vd} , F_{hd} : allowable design loads with a partial safety factor $\gamma_F = 1.35$ for dead load and $\gamma_F = 1.5$ for wind load.

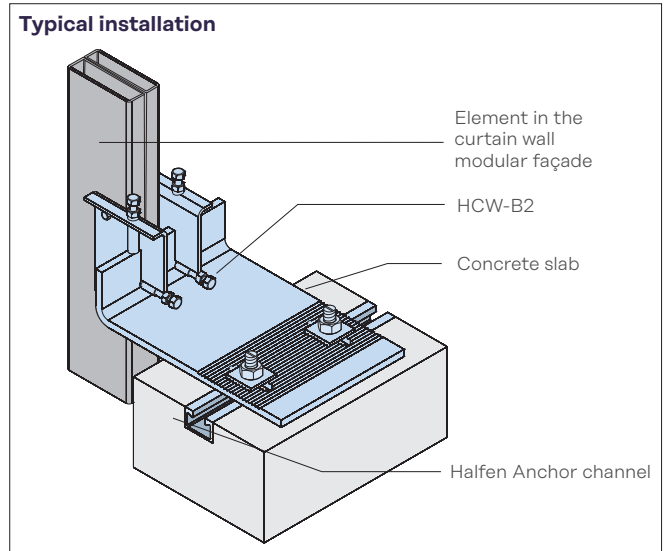
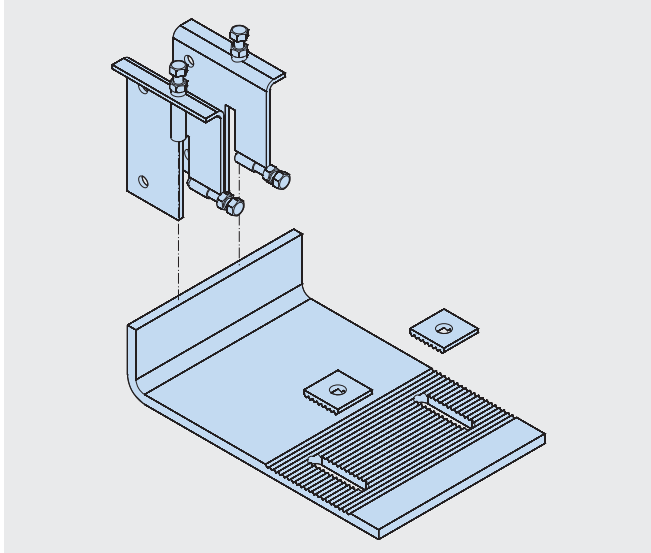
Type selection						
Load range [kN]	a [mm]	Item name HCW-B1-...	L [mm]	W [mm]	Halfen Channel ①	Recommended Halfen Bolt
4/12	50	...-4/12-50	270	150	HTA-CE 40/22P-250 2 Anchors	HS 40/22 M16×60 8.8
	75	...-4/12-75	295	150		
	100	...-4/12-100	320	150		
7/20	50	...-7/20-50	270	175	HTA-CE 50/30P-300 3 Anchors	HS 50/30 M16×60 8.8
	75	...-7/20-75	295	175		
	100	...-7/20-100	320	200		

① Recommended Halfen Anchor channel exploiting full load capacity of the bracket

Halfen Curtain Wall Support Systems

Top of Slab Brackets HCW-B2

Brackets for horizontal and vertical loads



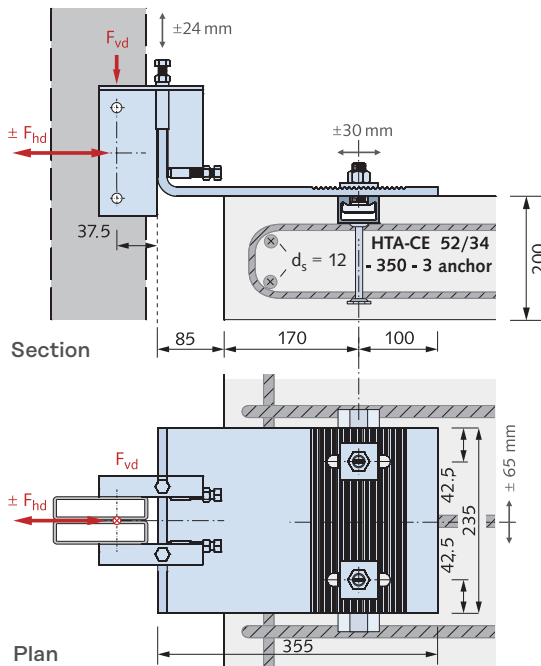
Halfen Brackets HCW-B2

Halfen Brackets HCW-B2 are made in grade S355 quality galvanized steel. The vertical adjustability is ± 24 mm. Three-dimensional adjustability is ensured when used in combination with Halfen Channels.

The lateral connecting plates are connected to the façade posts using M12 screws (not included in delivery).

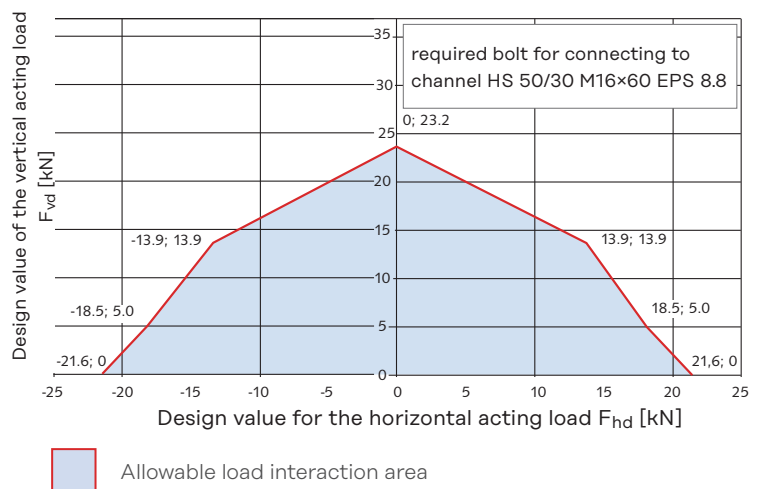
The façade planner is responsible for providing the static verification for the support posts.

Use M16 Halfen Bolts, grade 8.8 (order separately), to connect the base bracket to the Halfen Channel. Depending on the façade type, the connection between the connecting plate and the base bracket can be designed either laterally adjustable or as a fixed point.



Required edge reinforcement $\geq \phi 12$ (B500B)

Dimensioning



For any questions, please contact your local distributor. Addresses can be found at the end of this catalogue. www.halfen.com

HGB Handrail Connections

The benefits at a glance

Construction specialists consider the Halfen HGB Handrail connections to be particularly suited for fastening railings and banisters to the thin front faces of balcony slabs

Safe and reliable

- statically verified installation
- no damage to visible surfaces of concrete slabs
- also suitable to secure mandatory safety rails during construction (Refer to: EN 795 "Guard rails")
- use with Halfen high-strength bolts to ensure a reliable and statically sound connection of railing/banister components

Quick and economical

- adjustable anchorage
- can also be used in slabs as thin as $h \geq 100\text{mm}$
- installed with bolts instead of welding or drilling
- pre-planning reduces on-site construction time
- all attached components remain fully adjustable or are easily replaced as required

Halfen HGB Handrail connections profile HGB E-54/33-A4



Halfen HGB Handrail connections profile HGB E-49/30-D4



Halfen HGB Handrail connections profile HGB E-38/17-D4



Halfen HGB Handrail Connections

Application Examples

Safety barriers in stadiums



①-④: Safety barrier installation, multi purpose arena in Berlin



Fixing of safety rails, Rheinenergiestadion Cologne



Fixing of safety rails, Rheinenergiestadion Cologne

Railings



Used to secure safety rails during the construction phase



Cast-in HGB Channel, residential building

Halfen HGB Handrail Connection

General

Regulatory requirements

Balconies are part of the structural system. "They must be designed, constructed, maintained and modified in such a fashion that public order and safety, especially to health or life, is not endangered". Model building code and construction guidelines (Musterbauordnung MBO 2020 und Ausführungsvorschriften).

Technical guidelines issued by public notice as technical building regulations must be observed.* Technical rules provide information on load parameters, calculation, dimensioning of structural products, construction types, structural

layouts etc. A requirement of regional building codes refers to structural stability: "All structures must, as a whole and in their individual components, be structurally self-supporting". This stability must be statically verifiable based on current technical standards.

A further building regulation addresses traffic loads, for example: Balconies and loggias must be fitted with safety rails to prevent falls when they border on to an area with a drop of more than one metre. For a drop height up to 12m the minimum railing height is 0.90 m measured from the upper surface of

the finished floor surface or accessible ledge. For drop heights greater than 12m the banister height must be at least 1.10m. For exceptions see the German federal building regulations/ Deutsche LandesBauOrdnung.

Other regulations, not covered here, address the design, dimensioning, required spacings in the guard rail design, fire protection, thermal/sound insulation and rainwater drainage.

*issued by the highest construction supervision authorities of the German Federal States

Regulations, standards and directives (to be observed when designing safety rails)

Regional Building Codes



Individual regional states have their own building codes and regulations. All current technical regulations require proof of structural safety and integrity. A static calculation or a building authority certificate is required when designing and dimensioning the fixings for guard rails.

VOB — Part B, § 4, execution of construction:



§ 4.2 (1) It is the contractor's responsibility to provide the static documentation in accordance with the contract. He has to observe the recognized standards of practice as well as with the provisions of the law and regulatory directives. Tender and Contract Regulations for the German building industry (VOB Vergabe- und Vertragsordnung für Bauleistungen) Part B, §4.3, requires the contractor to report to the customer, in writing, any obvious design flaws, which he as the expert must be able to recognize. He alone is responsible for any resulting defect and consequential expenses. If he has satisfied his reporting obligation, the responsibility for the defect passes to the customer (defect example: banister attachment mounted in a concrete slab which is too thin).

BVM Directive

Directive on metal railings/banisters/balustrades, published by Federal Association of German Metalworkers (BVM Berufsverband Metall).

Other applicable regulations and standards (Extract):



- Accident Prevention Regulation "General Provisions" (DGUV Regulation 1)
- Industrial Safety Regulations
- ETB – Directive "Fall Prevention Installations", Publ. 1985
- Stainless Steels, EC3 part 1-4

EN 1992-1-1 (EC2): Design and construction of concrete support structures; with National Annex (NA)

EN 1991 (EC1): General effects on load structures; with National Annex (NA)

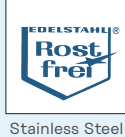
EN 1993 (EC3): design and construction of steel structures; with National Annex (NA)

Halfen HGB Handrail Connection

Materials/Corrosion Protection

Stainless Steel:

Chromium is the most important alloy element in stainless steel. A specific chromium concentration ensures the generation of a passive layer on the surface of the steel that protects the base material against corrosion. This explains the high corrosion resistance of stainless steel.



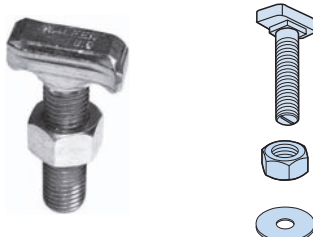
"Anchor channels in stainless steel may be used outdoors — also in an industrial and coastal environment, but may not be directly exposed to salt water".

See guidelines for "Metal railings, banisters and balustrades" issued by the German Association of Metalworkers (BVM Bundesverband der Metallverarbeiter).

Halfen HGB Channels, stainless steel

	Description	Stainless steel		
		Materials	Standard	Corrosion resistance class according to EN 1993-1-4, table A.3
	Channel profile	1.4404; 1.4571; 1.4062 or 1.4162	EN 10 088	III
	Ribbed-head anchor	Reinforcing steel B500B Reinforcing steel BSt 500 SST	DIN 488	

Halfen HGB Channels, stainless steel

	Description	Stainless steel		
		Materials	Standard	Corrosion resistance class according to EN 1993-1-4, table A.3
	Bolt	A4-70 1.4404, 1.4571	EN 3506-1 and EN 10 088	III
	Hexagonal nut	A4-70 1.4404 or 1.4571	EN 3506-1 and EN 10 088	III
	Washer	1.4404 or 1.4571	EN 10 088	III

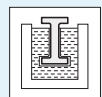
■ A4 = Stainless steel (see page 12 also)

Available on request:

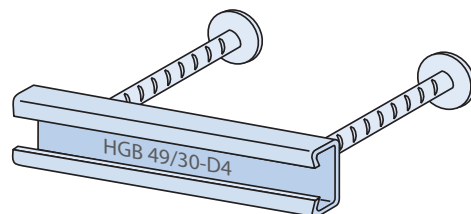
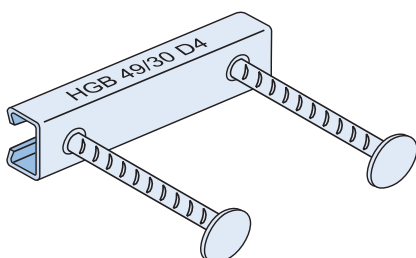
Galvanized material for interior, dry rooms, for instance when installing staircase railings and banisters in residential buildings, schools or commercial retail stores.

Hot-dip galvanized HDG:

Dipped in a galvanizing bath, with a temperature of approx. 460 °C; this method will primarily be used for your requested channels and bolts.



Identification of Halfen HGB channels

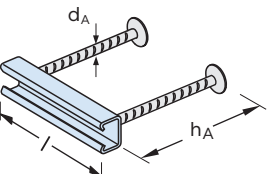
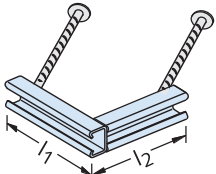
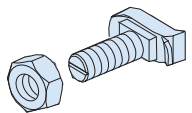
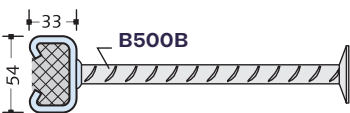
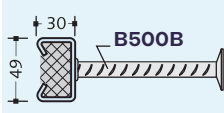


Product identification

- on channel side
- additionally inside the profile

Halfen HGB Handrail Connection

Product Range

Halfen HGB Channels and bolts										
Item description	Dimensions HGB E [mm]				Dimensions HGB EE [mm]				Halfen HS Bolts	
										
	l	dA	hA	Weight kg/each G	l1 / l2	dA	hA	Weight kg/each G	Type / FK	Dimensions
HGB E 54/33-A4  	100	14	200	1.071	170/170	14	250	2.262	HS 50/30 A4-70	M12x40 M16x40
	150			1.307						
	200			1.543						
HGB E 49/30-D4  	100	10	110	0.704	170/170	14	150	1.501	HS 50/30 A4-70	M12x40 M16x40
	150			0.855						
	200			1.007						
HGB E 38/17-D4  	100	10	201	0.824	170/170	12	201	1.214	HS 38/17 A4-70	M12x40 M16x40
	150			0.911						
	200			0.999						

 A4 = Stainless steel (channel) 1.4571/1.4404

 D4 = Stainless steel (channel duplex) 1.4062/1.4162

SST = combined for all stainless steels

Alternative galvanized channels for interior use (on request)

Ordering and materials

Ordering example HGB channel:

HGB E 38/17 - 200 - D4

①

②

③

- ① Description
- ② Length [mm]
- ③ Material

HGB E 49/30 - 200 - A4

①

②

③

- ① Description
- ② Length [mm]
- ③ Material

Ordering example Halfen Bolt:

HS 50/30 - M12x40 - A4-70

①

②

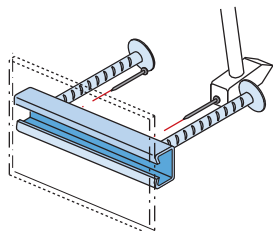
③

- ① Description
- ② Thread-Ø x Length [mm]
- ③ Material

HALFEN HGB Handrail Connection

Installation/Assembly

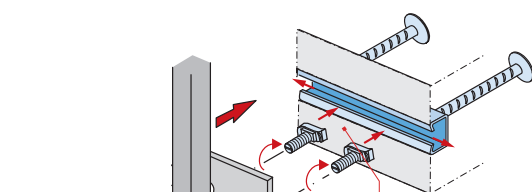
1 Nail the Halfen HGB channel to the formwork



Where possible, use stainless steel nails to avoid corrosion.

After striking the formwork remove the foam filler from the Halfen Cast-in channels.

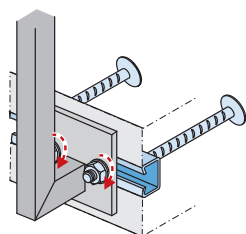
2 Installation and adjustment of balustrades



Insert the HS Bolts into the Halfen HGB channel (turn 90° until the bolt locks into place).

washers must be ordered separately

3 Tighten the bolts"



Tighten the nuts using a torque wrench. See table on the right for torque values



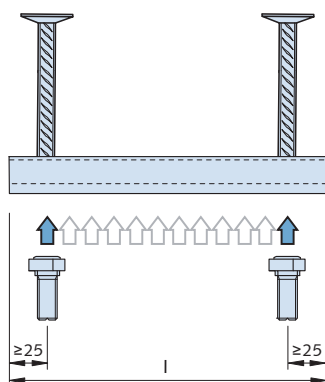
Nail the Halfen Cast-in channel to the formwork

Railing bolts

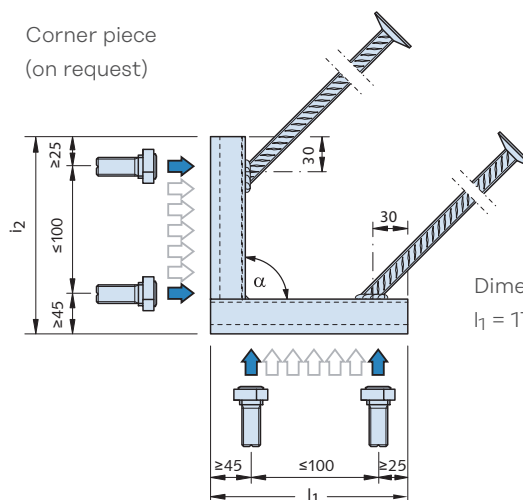
Stainless steel Material strength class Sc 70		Torque [Nm]	
HS 50/30 for profile 49/30 and 54/33		M16	60
		M12	25
HS 38/17 for profile 38/17		M16	40
		M12	25

Fixing position of the bolts

Short piece



Corner piece
(on request)



Dimensions [mm]:
 $l_1 = 170$, $l_2 = 170$, $\alpha = 90^\circ$

Halfen HGB Handrail Connection

Dimensioning Fundamentals

Railing height

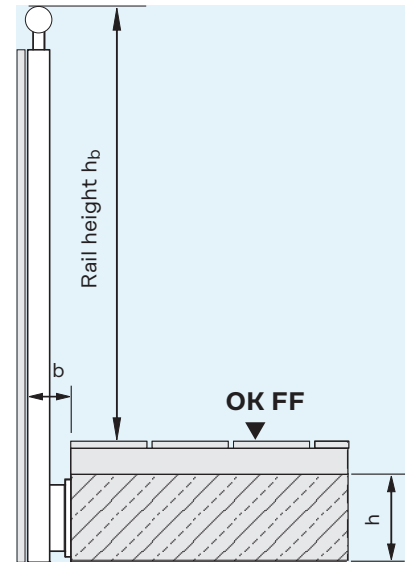
The minimum height h_b of a railing is 0.90m from the top surface of the finished floor or accessible ledge to the upper edge of the rail. For drop heights of more than 12.0m the railing must be at least 1.10m in height. (Exceptions; as specified in regional building codes)

It would be advisable to have one uniform minimum height of 1.00m as has already been mandated in the commercial sector and in a number of European countries.

Balcony slab

Anchor channels or dowel installations require concrete of at least C 20/25 grade. A case-by-case decision must be made if the concrete grade is less than C 20/25 grade or is unknown.

The thickness of the balcony slab must be at least $h = 100 - 150\text{mm}$ when the HGB is cast in the slab edge (depends on channel profile and according to the German HGB approval). Other types of installation and systems require a thicker slab. All weather-exposed concrete-embedded installations (e.g. for balconies) must be made of stainless steel.

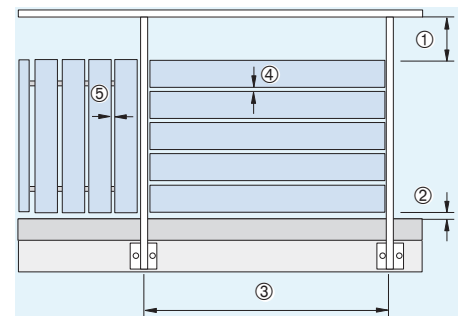


b = clear distance between the back of the balcony cladding and the front face of the balcony slab or gutter / kick plate

Spacings

Any structural design must take all basic requirements for railings and banisters into account. As a general rule, all railings and banisters must be designed so that personal injury is ruled out, for instance with correct spacing of rails, lattice bars or panels. They should also be designed so as not to entice but instead to discourage anyone from climbing over.

The specific requirements for guard rail design are determined by the intended use (residential, public, commercial) and the drop height involved. Also observe the building codes of each country or region, the ETB guidelines "Fall Protection Components" and DIN 18065 (Stairs in Buildings — definition, rules, key measurements) and guard rail regulation applicable at the construction site. In Germany these are the Guardrail regulations 2020 set by the German Association of Metalworkers, ("Geländer-Richtlinie 2020, BVM Berufsverband Metall").



- ① clear distance between bottom edge of hand rail and top edge of facing / lower structure
- ② clear distance between the top edge of the finished floor and the bottom edge of the facing lower structure
- ③ axis spacing between posts
- ④ clear distance between horizontal facings
- ⑤ clear distance between vertical facings

Halfen HGB Handrail Connection

Dimensioning

Dimensions

The forces acting on the railing must be transferred into the main building structure. It is necessary to verify that the forces

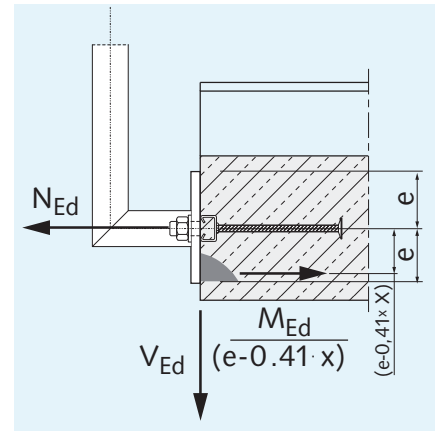
- a) are wholly supported by the railing and
- b) can be transferred via the connecting elements into the balcony slab.

$$N_{Ed} = \frac{M_{Ed}}{(e - 0.41 \cdot x)} + H_{Ed}$$

N_{Ed} = tensile force on the anchor

e = distance between channel axis and outer edge of the railing base plate

x = maximum concrete pressure zone level according to annex 8, table 8a and 8b



Railing heights

Drop height	Minimum height of rails (recommended)	Note
Less than 12m	90cm (100cm)	Relevant regional building regulations and if necessary other regulations e.g. for civil constructions must be observed.
Greater than 12m	110cm	

Calculation

1. Railing/banister load h according to EN 1991-1-1/NA Table 6.12 DE
"Calculation must assume 100% traffic load in drop direction and 50% of traffic load (but not less than 0.5kN/m) in the opposite direction."



for example: residential buildings and communal areas with low foot traffic	$q_k = 0.5 \text{ kN/m}$
for example: rooms for mass assembly, commercial sales spaces, corridors	$q_k = 1.0 \text{ kN/m}$
for example: areas for large gatherings of people, factories, workshops	$q_k = 2.0 \text{ kN/m}$

2. Vertical loads v according to BVM* guidelines
Load assumptions to calculate vertical loads are according to the BVM guidelines for guard rails/banisters.



from dead weight of structure including any renders	$v_1 = 0.40 \text{ kN/m}$
from window box	$v_2 = 0.35 \text{ kN/m}$
support capacity	$v_3 = 0.15 \text{ kN/m}$

3. Wind loads
 F_w according to EN 1991-1-4 and EN 1991-1-4/NA



Velocity force q in kN/m^2 and total wind pressure F_w are calculated according to EN 1991-1-4 with EN 1991-1-4/NA.
--

*German Association of Metalworkers
(BVM Bundesverband der Metallverarbeiter)

Halfen HGB Handrail Connection

Dimensioning

Extract from HGB approval Z-21.4-1912, page 6

3.2.2 Actions and required verifications

The actions H_{Ed} , V_{Ed} , M_{Ed} and N_{Ed} have to be determined according to the calculation basics as in annex 7.

The ratio in the design calculation between horizontal action and bending moment is limited to:

$$\frac{H_{Ed}}{M_{Ed}} \leq 1.5 \text{ [1/m]} \quad H_{Ed} \text{ [kN]}; M_{Ed} \text{ in [kNm]}$$

It has to be verified that the design action value E_d does not exceed the design resistance value R_d :

$E_d \leq R_d$ see table 3.1 and 3.2 below

E_d = Design action value (N_{Ed} , V_{Ed} , M_{Ed})

R_d = Design resistance value (N_{Rd} , V_{Rd} , M_{Rd})

For a standard case the following equation for the design action value applies (permanent load and variable load acting in the same direction):

$$E_d = \gamma_G \cdot G_k + \gamma_Q \cdot Q_k$$

G_k ; Q_k = characteristic value of permanent load or variable load according to recognized standards for load assumptions

γ_G ; γ_Q = partial safety factors for permanent and variable action

Extract from HGB approval no. Z-21.4-1912, page 7

Table 3.1 Required verifications for tensile loads

Steel failure	$N_{Ed} \leq N_{Rd,s}$ $\leq N_{Rd,s,s} \text{ (for single-bolt fixing)}$ $\leq 2 N_{Rd,s,s} \text{ (for two-bolt fixing)}$
Pull out failure	
Concrete failure with anchor reinforcement	
Spalling	

Table 3.2 Required verifications for shear loads

Steel failure	$V_{Ed} \leq V_{Rd,s}$ $\leq V_{Rd,s,s} \text{ (for single-bolt fixing)}$ $\leq 2 V_{Rd,s,s} \text{ (for two-bolt fixing)}$
Concrete failure with anchor reinforcement	
Concrete edge failure with anchor reinforcement	$V_{Ed} \leq V_{Rd,c}$
	$M_{Ed} \leq M_{Rd,c}$

With combined loads the following interactions must be verified:

$$1. \max. (N_{Ed} / N_{Rd,s})^2 + \max. (V_{Ed} / V_{Rd,s})^2 \leq 1.0$$

or

$$\max. (N_{Ed} / N_{Rd,s}) + \max. (V_{Ed} / V_{Rd,s}) \leq 1.2$$

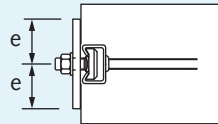
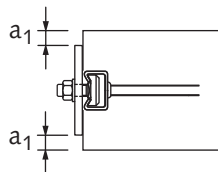
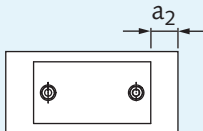
$$2. M_{Ed} / M_{Rd,c} + 1.5 V_{Ed} / V_{Rd,c} \leq 1.5$$

$$\text{for } 0.333 \leq V_{Ed} / V_{Rd,c} \leq 1.0$$

Halfen HGB Handrail Connection

Dimensioning

Extract from HGB-approval no. Z-21.4-1912, annex 6

Table 6: Installation and anchor parameters				
Description	Illustration	Anchor channels profiles		
		38/17	49/30	54/33
A) Profile shape and bolt positioning				
Minimum channel length required for a two-bolt fixing [mm]	annex 2	150	150	150
Minimum bolt distance p [mm]	see next page	80	80 (100) ①	80 (100) ①
B) Building element dimensions and anchor position in the element				
Minimum thickness of concrete element h [mm]	annex 8	100	140	150
Minimum edge distance c ₁ [mm] (channel axis to the upper and the lower edge of the concrete element)	annex 8	50	70	75
Minimum distance a _e [mm] to edge of concrete element (from end of channel)	see next page	40	50	50
C) Size and position of anchor plate				
Minimum distance e [mm] from the channel axis to the upper and the lower edge of the anchor plate		30	35	37.5
Minimum distance a ₁ [mm] from the upper and lower edge of the anchor plate to the upper and lower edge of the concrete element ②		10	10	10
Minimum distance a ₂ [mm] from the outer edge of the anchor plate to the edge of the concrete element		40	45	45

① The values in brackets apply when using M20 bolts

② In components with a weather groove, the bottom of the groove is regarded as the concrete element edge

Halfen HGB Handrail Connection

Dimensioning

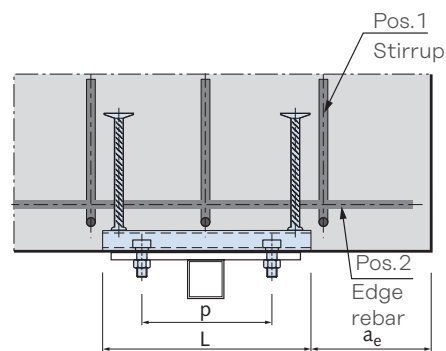
Extract; HGB approval no. Z-21.4-1912, annex 6

Table 7: Size and position of required minimum reinforcement

Description	Anchor channels		
	38/17	49/30	54/33
Stirrup / Quantity	3 Ø 8 $l_b = 200 \text{ mm}$	3 Ø 10 $l_b = 300 \text{ mm}$	3 Ø 12 $l_b = 400 \text{ mm}$
Edge rebar, top and bottom [mm]	Ø 8	Ø 10	Ø 12

Required minimum reinforcement:

One stirrup is placed centrally between the channel anchors and one stirrup directly next to each anchor at the channel ends (if positioned near to the edge, between the anchor and component edge).



Extract; HGB approval no. Z-21.4-1912, annex 8

Table 9: Design resistance for each bolt

Tensile				
Bolts Ø		M12	M16	M20
$N_{Rd,s}$ [kN]	4.6	16.9	31.4	49.0
	8.8	44.9	83.7	130.7
	A4-, HC-50	14.8	27.4	42.8
	A4-70*	31.6	58.8	91.7
Shear				
$V_{Rd,s}$ [kN]	4.6	12.1	22.6	35.2
	8.8	27.0	50.2	78.4
	A4-, HC-50	10.6	19.8	30.9
	A4-70*	22.7	42.2	66.0

* Values also apply for all stainless steels of strength class 70 (see also HGB approval, annex 4)

Design resistance of concrete pressure zone

$$M_{Rd,c} = 0.81 \cdot x \cdot b \cdot \frac{f_{ck}}{\gamma_{Mc}} \cdot (e - 0.41 \cdot x)$$

where:

x = maximum height; concrete pressure zone (see table 8a and 8b)

b = width of pressure zone = width of anchor plate b_p

f_{ck} = characteristic compression strength of concrete in accordance with EN 206-1:2001-07, for concrete strength $\geq C30/37$ only calculate using $f_{ck} = 30 \text{ N/mm}^2$

e = distance between anchor channel axis and outer edge of the anchor plate (see illustration on page 65, table 8)

$\gamma_{Mc} = 1.5$ (partial safety factor)

Halfen HGB Handrail Connection

Dimensioning

Extract, HGB-approval no. Z-21.4-1912, annex 8

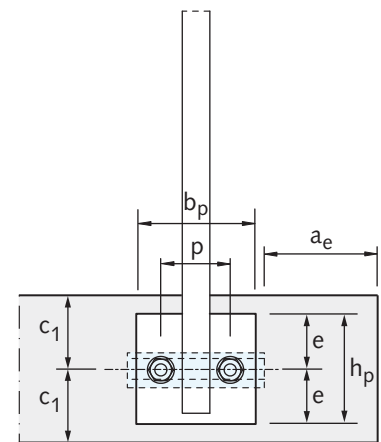
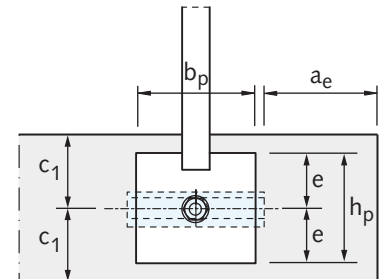
Table 8a: Design resistance of the channel using single-bolt fixing

Channel type		38/17	49/30	54/33
Minimum thickness of component h [mm]		100	140	150
Steel failure (single-bolt fixing)				
Tension	NR _{d,s} [kN]	10.0	17.2	30.6
Shear	V _{Rd,s} [kN]	10.0	17.2	30.6
Concrete failure (single-bolt fixing)				
V _{Rd,c} [kN]		6.7	11.7	12.7
Maximum height of concrete pressure zone x		0.25 · e ^①	0.30 · e ^①	0.40 · e ^①

Table 8b: Design resistance of the channel using a two-bolt fixing

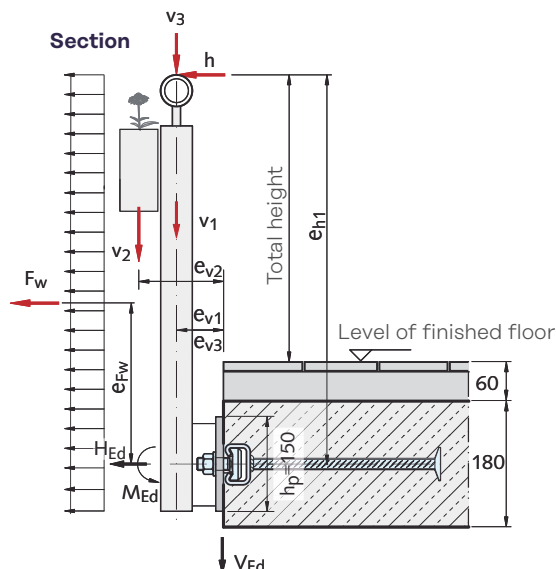
Profile		38/17	49/30	54/33
Minimum thickness of component h [mm]		100	140	150
Steel failure (two-bolt fixing)				
Tension	NR _{d,s} [kN]	15.0	25.8	45.8
Shear	V _{Rd,s} [kN]	15.0	25.8	45.8
Concrete failure (two-bolt fixing)				
V _{Rd,c} [kN]		6.7	11.7	12.7
Maximum height of concrete pressure zone x		0.25 · e ^①	0.30 · e ^①	0.40 · e ^①

① e = distance between the anchor channel axis and outer edges of the anchor plate.
For asymmetrical anchor plates the smallest distance to the outer edge of the anchor plate is used for calculation.

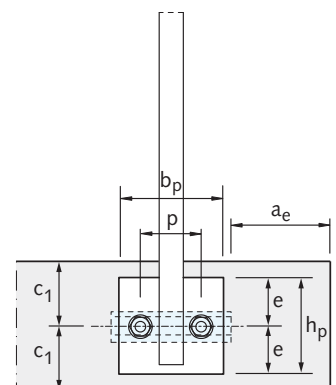


Dimensioning example Halfen HGB Guard rail fittings

M_{Ed} = used to calculate applicable moment relative to the channel axis
e_{v1}, e_{v2}, = distance of the vertical loads to
e_{v3} the front edge of the channel
e_{h1}, e_{Fw} = distance of the horizontal loads to the front edge of the channel
H_{Ed} = used to calculate the applicable horizontal effect
V_{Ed} = used to calculate the applicable vertical effect
h, F_w = horizontal load effects
v₁, v₂, v₃ = vertical load effects
b_p, h_p = anchor plate width and height



Elevation



Halfen HGB Handrail Connection

Calculation Example

Calculation example

Post spacing	1.5 m
Post height from FFL	1.0 m
Structure height	9.0 m < 25.0 m
Railing/banister load	0.5 kN/m (residential buildings)
Concrete slab thickness	180 mm
Distance of channel axis to component edge	$c_1 = 90 \text{ mm}$
Width of railing/banister anchor plate	$b_p = 150 \text{ mm}$
Height of railing/banister anchor plate	$h_p = 150 \text{ mm}$
Bolt spacing	$p = 80 \text{ mm}$
Concrete strength	C30/37

Load

Vertical loads:

Dead load, railing/banister including siding $v_1 = 0.40 \text{ kN/m}$

Dead load, flower box $v_2 = 0.35 \text{ kN/m}$

Vertical traffic load on the railing/banister $v_3 = 0.15 \text{ kN/m}$

Horizontal loads:

Railing/banister load $h = 0.50 \text{ kN/m}$

Wind force $q = 0.50 \text{ kN/m}^2$

(according to EN 1991-1-4 NA.B.3)

(assumption: building height $9.0 \text{ m} < 10.0 \text{ m}$, not prone to resonance frequency, inland wind zone 1)

Cantilevers:

$$e_{h1} = 1.0 + 0.06 + \frac{0.18}{2} = 1.15 \text{ m}$$

$$e_{Fw} = \frac{(1.15 + 0.075)}{2} - 0.075 = 0.53 \text{ m}$$

$$e_{v1} = 0.10 \text{ m}$$

$$e_{v2} = 0.20 \text{ m}$$

$$e_{v3} = 0.10 \text{ m}$$

Wind load bearing zone:

$$A = (1.00 + 0.06 + \frac{0.18}{2} + \frac{0.15}{2}) \cdot 1.5 = 1.84 \text{ m}^2$$

External pressure coefficient

(acc. to table 7.1 EN 1991-1-4):

$$h/d = 1, \text{ area B}$$

$$c_{pe,1} = -1.1 \text{ (wind-suction)}$$

$$c_{pe,10} = -0.8 \text{ (wind-suction)}$$

according to EN 1991-1-4 chapter 7.2.1 the following is valid:

$$1 \text{ m}^2 < A \leq 10 \text{ m}^2$$

$$c_{pe} = c_{pe,1} + (c_{pe,10} - c_{pe,1}) \cdot \lg A =$$

$$-1.1 + (-0.8 + 1.1) \cdot \lg 1.84 = -1.02$$

Wind suction:

$$F_w = c_{pe} \cdot q \cdot A = -1.02 \cdot 0.50 \cdot 1.84 = -0.94 \text{ kN}$$

Action per support:

Wind load $F_{w,Ed} = -0.94 \cdot 1.5 = -1.41 \text{ kN}$ (suction)
with $\gamma_F = 1.5$

Railing/banister $H_{Ed} = 0.5 \cdot 1.5 \cdot 1.5 = 1.13 \text{ kN}$
with $\gamma_F = 1.5$

Dead load railing/banister $V_{1Ed} = 0.40 \cdot 1.5 \cdot 1.35 = 0.81 \text{ kN}$
with $\gamma_F = 1.35$

Load from flower box $V_{2Ed} = 0.35 \cdot 1.5 \cdot 1.35 = 0.71 \text{ kN}$
with $\gamma_F = 1.35$

Vertical load on railing/banister $V_{3Ed} = 0.15 \cdot 1.5 \cdot 1.5 = 0.34 \text{ kN}$
with $\gamma_F = 1.5$

Determining bearing reactions H_{Ed} , V_{Ed} and M_{Ed}

Not classed as an utility (escape-route) balcony therefore combination with wind load is not required.

Load case 1: V + railing/banister load

$$M_{Ed} = 0.81 \cdot 0.10 + 0.71 \cdot 0.20 + 0.34 \cdot 0.10 + 1.13 \cdot 1.15 = 1.56 \text{ kNm}$$

$$V_{Ed} = 0.81 + 0.71 + 0.34 = 1.86 \text{ kN}$$

$$H_{Ed} = 1.13 \text{ kN}$$

Load case 2: V + wind

$$M_{Ed} = 0.81 \cdot 0.10 + 0.71 \cdot 0.20 + 1.41 \cdot 0.53 = 0.97 \text{ kNm}$$

$$V_{Ed} = 0.81 + 0.71 = 1.52 \text{ kN}$$

$$H_{Ed} = 1.41 \text{ kN}$$

Selected:

HGB-E 49/30, $l = 200 \text{ mm}$, D4 stainless steel

Bolt spacing $p = 80 \text{ mm}$

2 bolts HS 50/30 M12, A4-70,

Required minimum reinforcement:

Stirrups 3 $\emptyset 10$, $l_b = 300 \text{ mm}$

(see page 66 approval extract → annex 6, table 7),

Edge rebar 2 $\emptyset 10$

Splitting the moment into a load pair

$$N_{Ed} = \frac{M_{Ed}}{(e - 0.41 \cdot x)} + H_{Ed}$$

$$e = \frac{hp}{2} = 75 \text{ mm} \quad (\text{see approval no. Z-21.4.1912 annex 7})$$

$$x = 0.30 \cdot e = 0.30 \cdot 75 = 22.5 \text{ mm}$$

see page 67 (approval extract → annex 8 / table 8b)

$$e - 0.41 \cdot x = 75 - 0.41 \cdot 22.5 = 65.8 \text{ mm}$$

Halfen HGB Handrail Connection

Calculation example

Load case 1: V + railing/banister load

$$N_{Ed} = \frac{1.56 \text{ kNm}}{0.0658 \text{ m}} + 1.13 \text{ kN} = 24.84 \text{ kN} \rightarrow \text{decisive}$$

$$V_{Ed} = 1.86 \text{ kN} \rightarrow \text{decisive}$$

Load case 2: V + wind

$$N_{Ed} = \frac{0.98 \text{ kNm}}{0.0658 \text{ m}} + 1.41 \text{ kN} = 16.30 \text{ kN}$$

$$V_{Ed} = 1.52 \text{ kN}$$

Verifications

Geometrical boundry conditions according to approval Z-21.4-1912 annex 6, table 6 have been met.

Verification of steel capacity

Design resistance (steel) channel HGB 49/30 using 2 bolt fixing

$$N_{Rd,s} = 25.8 \text{ kN}$$

$$V_{Rd,s} = 25.8 \text{ kN} \quad \text{see page 67 (approval extract} \rightarrow \text{annex 8, table 8b)}$$

Channel, centric pull load

$$\frac{N_{Ed}}{N_{Rd,s}} = \frac{24.84}{25.8} = 0.96 < 1 \quad \checkmark$$

Channel, shear load

$$\frac{V_{Ed}}{V_{Rd,s}} = \frac{1.86}{25.8} = 0.07 < 1 \quad \checkmark$$

Channel, interaction

$$\left(\frac{N_{Ed}}{N_{Rd,s}} \right)^2 + \left(\frac{V_{Ed}}{V_{Rd,s}} \right)^2 = \left(\frac{24.84}{25.8} \right)^2 + \left(\frac{1.86}{25.8} \right)^2$$

$$= 0.93 + 0.01 = 0.94 < 1 \quad \checkmark$$

Design resistance (steel) bolt M12, A4-70

$$N_{Rd,s,s} = 31.6 \text{ kN}$$

$$V_{Rd,s,s} = 22.7 \text{ kN} \quad \text{see page 66 (approval extract} \rightarrow \text{annex 8, tab.9)}$$

Bolt, centric pull load

$$\frac{0.5 \cdot N_{Ed}}{N_{Rd,s,s}} = \frac{0.5 \cdot 24.84}{31.6} = 0.39 < 1 \quad \checkmark$$

Bolt, shear load

$$\frac{0.5 \cdot V_{Ed}}{V_{Rd,s,s}} = \frac{0.5 \cdot 1.86}{22.7} = 0.04 < 1 \quad \checkmark$$

Bolt, interaction

$$\left(\frac{0.5 \cdot N_{Ed}}{N_{Rd,s,s}} \right)^2 + \left(\frac{0.5 \cdot V_{Ed}}{V_{Rd,s,s}} \right)^2 = 0.392 + 0.042 = 0.15 < 1 \quad \checkmark$$

Verification of concrete capacity

Design resistance concrete

$$V_{Rd,c} = 11.7 \text{ kN} \quad \text{see page 67 (annex 8, table 8b)}$$

$$M_{Rd,c} = 0.81 \cdot x \cdot b \cdot \frac{f_{ck}}{\gamma_{Mc}} \cdot (e - 0.41 \cdot x)$$

$$M_{Rd,c} = 0.81 \cdot 22.5 \cdot 150 \cdot \frac{30}{1.5} \cdot 65.8 = 3597615 \text{ Nmm}$$

$$= 3.60 \text{ kNm}$$

Concrete edge failure

$$\frac{V_{Ed}}{V_{Rd,c}} = \frac{1.86}{11.7} = 0.16 < 1 \quad \checkmark$$

$$\frac{M_{Ed}}{M_{Rd,c}} = \frac{1.56}{3.60} = 0.43 < 1 \quad \checkmark$$

$$\frac{V_{Ed}}{V_{Rd,c}} = 0.16 < 0.333$$

→ According to the approval verification of interaction is not required, see page 64 (approval extract / page 7).

Verifying the ratio between horizontal action and bending moment

$$\frac{H_{Ed}}{M_{Ed}} = \frac{1.13 \text{ kN}}{1.56 \text{ kNm}} = 0.72 < 1.5$$

→ Design model is applicable

see page 64 (approval extract / page 6)

Halfen HTU-S Channel for fixing profiled Sheet Metal

The benefits at a glance

The Halfen HTU-S Channel is ideal for fixing all types of profiled sheets — easy and simple with self-drilling screws. Suitable for both shear loads and tension loads.

Thanks to the innovative channel design with its corrugated sides and filler, the new generation of Halfen HTU Channel is installed entirely in the required concrete cover. This avoids any problem with the required reinforcement.

Safe and reliable

- innovative geometry and corrugated edging ensure reliable anchorage
- polystyrene filler prevents the self-drilling screw from hitting concrete
- building authority approved
- the type stamp on the channel back ensures identification after installation

Efficient and economical

- simple installation in the required concrete cover
- one channel type irrespective of the reinforcement layout
- simple installation in the precast plant

Halfen HTU-S 60 Channel for fixing profiled sheet metal



Halfen HTU-S 100 Channel for fixing profiled sheet metal



Fixing of trapezoidal sheet metal roof element



Façade fixed using Halfen HTU Channels (Cologne Bonn Airport)

Halfen HTU-S Channel for fixing profiled Sheet Metal

General/Product Range

The Halfen Cast-in channel for fixing trapezoidal sheet metal has a U-shaped cross-section with the sides angled outwards. The corrugated sides of the channel provide a positive-lock with the concrete.

Both HTU-S Channel types (60 and 100mm) allow various bolt fixing and layout options. Halfen HTU-S Cast-in channels are building authority approved.
Approval: DIBt no. Z-21.4-2096



Fixing trapezoidal sheet metal using self-drilling screws

Area of application	Fixing of trapezoidal sheeting or wall-cladding elements using building authority or ETA approved self-drilling screws. Installed flush with the surface of precast concrete elements; concrete strength C25/30 up to C50/60, cracked or non-cracked.
Materials/corrosion protection	HTU Channel made of zinc-plated steel may be installed in environments of C1 to C3 corrosion category acc. to EN ISO 12944-2:2018-04.

Available lengths:

HTU-Channels are available in 3000 or 6000 mm lengths.

Order example HTU-S Channel, width 60 mm :

HTU 60/25/2,5-S 6000

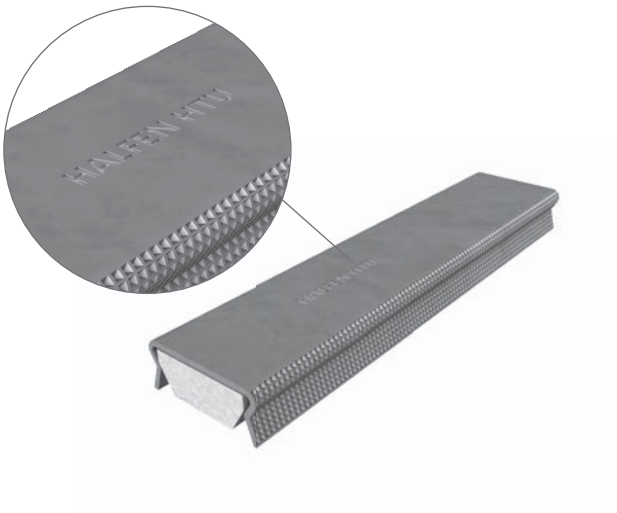
①

②

- ① Product name
- ② Length [mm]

Identification

Original Halfen self anchoring HTU-S Channels for fixing trapezoidal sheet metal can be identified by the stamp on the back of the channel displaying the brand name and the product description 'Halfen HTU'.



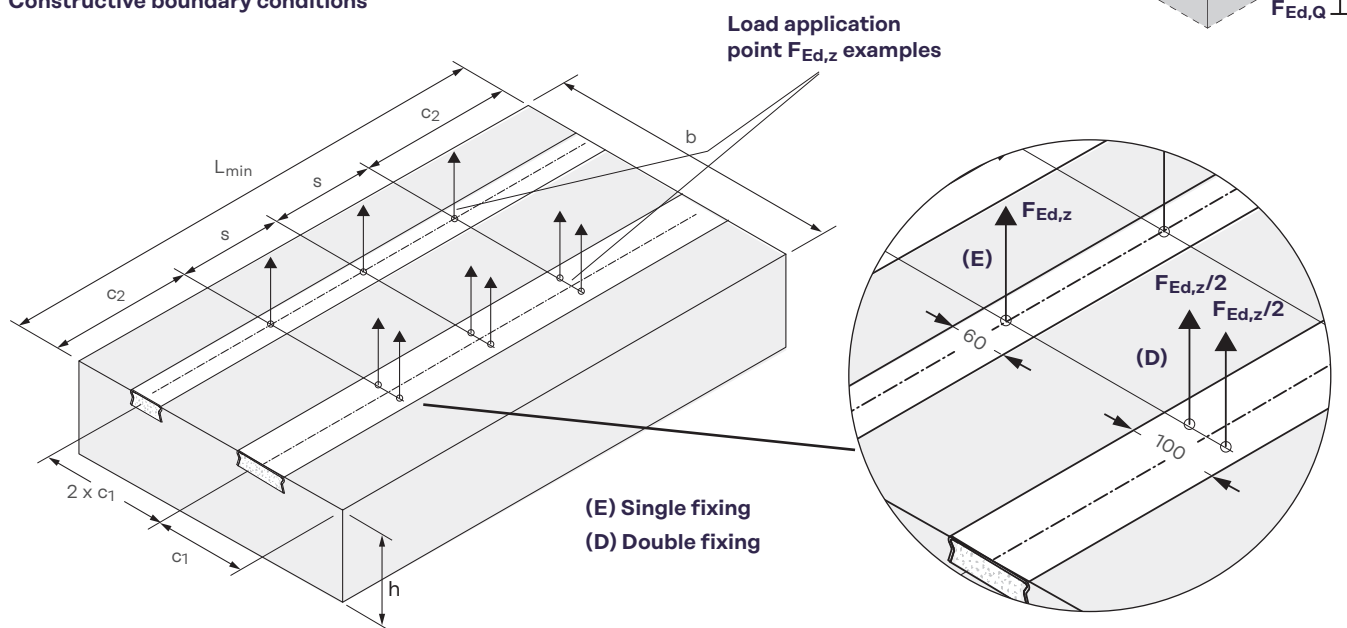
Detailed installation instructions for the self anchoring Halfen HTU-S Channel can be found at:
www.halfen.com ► Brochures ► Installation Instructions ► Fixing systems

Halfen HTU-S Channel for fixing profiled Sheet Metal

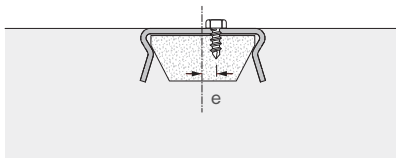
Dimensioning

Anchorage must be planned in accordance with engineering standards. Verification of direct local force transmission from the channel into the concrete has been provided if the approved values are complied with. Connecting accessories must be verified separately. Technical design must comply with building authority approval no. Z-21.4-2096.

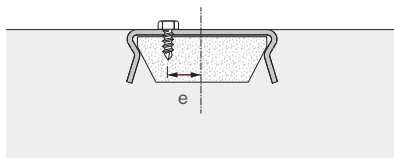
Constructive boundary conditions



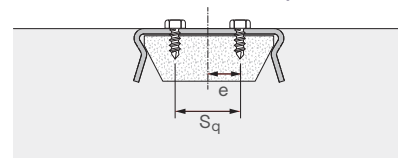
HTU-S 60 ($e_{\max} \leq b_{\text{HTU}}/6$)



HTU-S 100 (E) ($e_{\max} \leq b_{\text{HTU}}/6$)



HTU-S 100 (D) ($50 \text{ mm} \leq s_q \leq 70 \text{ mm}$)



Minimum element dimensions, bolt spacings and load resistances for concrete strength class C30/37 to C50/60 ①②③

Channel	$L_{\min}$ [mm]	(E) Single (D) Double fixing	$b_{\min}$ [mm]	$h_{\min}$ ④ [mm]	$C_{1,\min}$ ④ [mm]	$C_{2,\min}$ [mm]	$s_{\min}$ [mm]	F_{Rd} ①②③ [kN]
HTU 60/25/2,5-S	150	E	$2 \times c_1$	200	90	75	150	3.6
	250	E				125	250	4.9
	310	E				155	310	5.7
HTU 100/25/3-S	150	E D	$2 \times c_1$	200	120	75	150	2.4 4.2
	250	E D				125	250	3.5 6.0
	310	E D				155	310	4.2 7.1

① Resistance F_{Rd} applies for all load directions. The permanent load of $F_{Ed,z}$ must be limited to $0.15 \cdot F_{Rd}$.

② For concrete strength class C25/30 the resistances must be reduced with factor 0.91.

③ For concrete strength class > C30/37 the resistance F_{Rd} may be increased by ψ_c acc. to (annex 5, table 1 and annex 6, table 2)

④ For HTU 60/25/2,5-S lower values are allowed. See approval annex 5, table 1.

Halfen HTU-A_N Channel for fixing profiled Sheet Metal

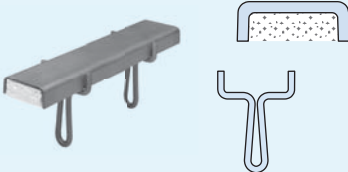
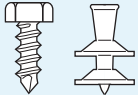
C-shaped Channels with Welded Anchors

The Halfen HTU Channels with welded anchors were developed in cooperation with the Association for the light-weight steel construction industry (IFBS Industrieverband für Bausysteme im Stahlleichtbau).

Made as a C-shaped channel in hot-dip galvanized steel with at least two welded anchors, and approved by the German Institute of Building Technology (DIBt Deutsches Institut für Bautechnik).

Approval: DIBt no. Z-21.4-84



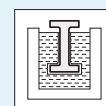
Halfen HTU Channels, steel hot-dip galvanized				
		Steel		
		Material	Standard	Zinc coating
	Channel profiles	■ 1.0038	EN 10 025-2	HDG: ≥ 50 μm
Anchor A _N				
	Fixing	Fixing of trapezoidal sheet metal or wall-cladding elements using building authority or ETA approved self-drilling screws. Installed flush with the surface of precast concrete elements.		



Vertical Halfen HTU Channels for fixing façade panels

Hot-dip galvanized HDG:

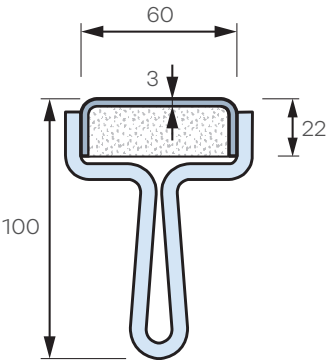
Dipped in a galvanizing bath at a temperature of approximately 460°C. This method is used primarily for open-profile channels.



Halfen HTU-A_N Channel for fixing profiled Sheet Metal

C-shaped Channels with Welded Anchors

Type HTU A_N 60/22/3



Ordering example:

HTU 60/22/3 - A_{N2} - HDG - 3000 - Sf

①

②

③

④

⑤

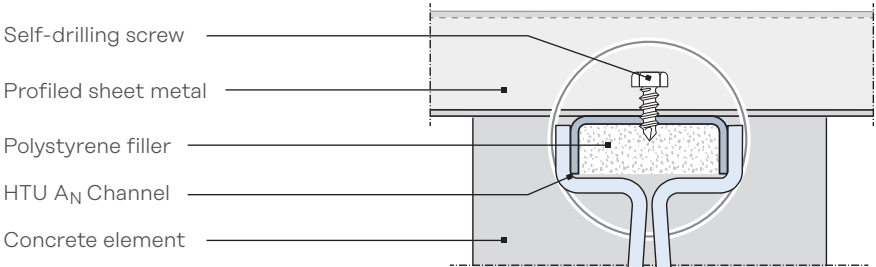
- ① Type / Profile
- ② Anchor configuration
- ③ Material / finish
- ④ Length [mm]
- ⑤ Polystyrene strip filler

Connecting element example HTU 3 mm material steel ETA 10/0200:

Self-drilling screws 6.3x19 e.g. JT2-6-6,3-19-xE16 with sealing disc.

Connecting element is exposed to weather:

JT3-6-6.3x25-E16 (Wall) or JZ3-6-6.3x25-E22 (Roof)

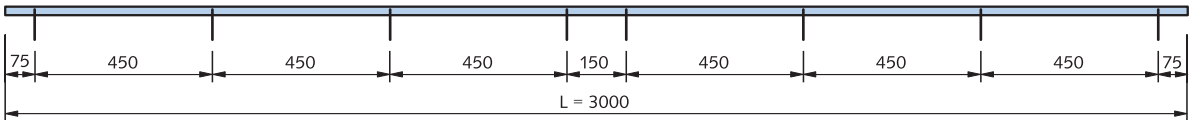


HTU 60/22/3 types	
HDG = Steel 1.0038, hot-dip galvanized	Number of anchors
HTU 60/22/3 - AN2- HDG - 3000 - Sf	8
HTU 60/22/3 - AN3- HDG - 3000 - Sf	20

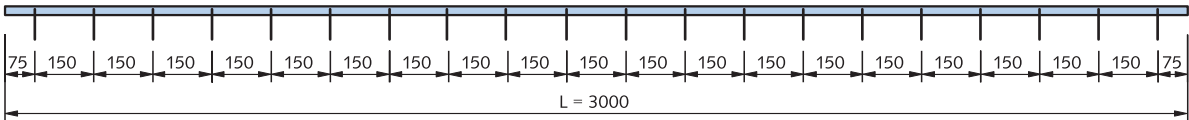
Profile cross-section A	2.81cm ²
Moment of inertia I _y / Moment of resistance w _y	1.13cm ⁴ / 0.71cm ³
Profile weight including anchors	2.49 kg/m

Anchor spacing:

Type A_{N2}



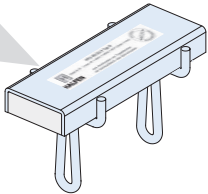
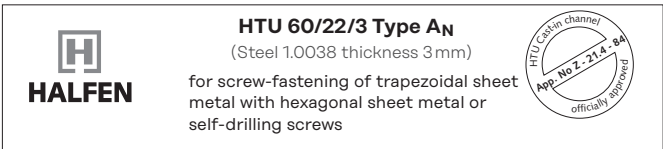
Type A_{N3}



Dimensions in [mm]

Identification Halfen HTU Channel

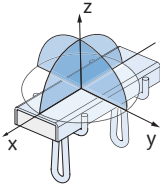
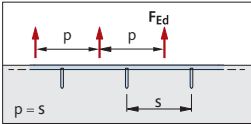
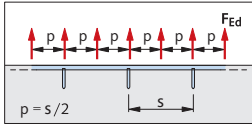
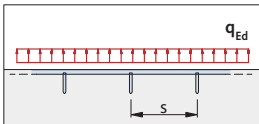
A identification label is fixed to the back of each channel.



Halfen HTU-A_N Channel for fixing profiled Sheet Metal

C-shaped Channels with Welded Anchors

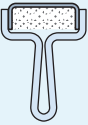
Table 1 Maximum design load-carrying capacity F_{Ed}

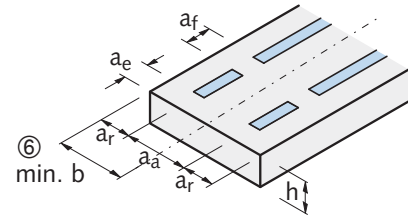
						
Profile HTU	Anchor spacing s [mm]	max. F_{Ed} [kN]		max. F_{Ed} [kN]		max. evenly distributed load q_{Ed} [kN/m]
60 / 22 / 3	450	p = s	4.6	p = s/2	3.5	15.5
	150		7.0		3.5	46.6

$$\sqrt{N_{Ed}^2 + V_{xEd}^2 + V_{yEd}^2} \leq \text{max. } F_{Ed}$$

Concrete $\geq$ C20/25

Table 2 Minimum distance when exploiting maximum load as in table 1

Profile	Minimum interaxial spacing and edge distance					
HTU 60/22/3	a _a ① [mm]	a _r ② [mm]	a _e ③ [mm]	a _f ④ [mm]	h ⑤ [mm]	b ⑥ [mm]
 Type A_N	200	100	20	20	100 + nom c	200



- ① If the HTU channels are placed so that the anchors of adjacent channels are offset by at least 200 mm, the axial spacing a_a may be reduced to 80 mm.
- ② If not exploiting the maximum load capacity F_{Ed} , see table above, the edge distance a_r may be reduced. This applies only for central tensile stress N_{Ed} .
- ③ With full exploitation of maximum load F_{Ed} as in the table above, the last anchor must be at least 100 mm from the component edge.
- ④ When fully exploiting maximum load capacity F_{Ed} , see table above, the "last anchors" of adjacent channels must be at least 150 mm apart.
- ⑤ Depends on the anchor's size and the required concrete cover.
- ⑥ Minimum width of building component for a one channel layout.

$$a_{r \text{ red.}} = \frac{\text{actual } N_{Ed}}{\text{max. } F_{Ed}} \times a_r \geq 50 \text{ mm}$$

actual N_{Ed} = design rating of actual load

max. F_{Ed} = maximum load as in the table above

The edge distances must not be reduced if transverse stress (V_{xEd} , V_{yEd}) is present.

Halfen HTU-S Channel for fixing profiled Sheet Metal

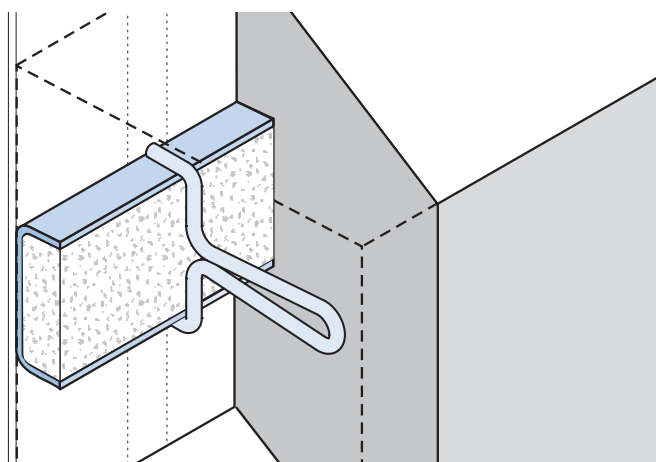
C-shaped Channels with Welded Anchors

Installation

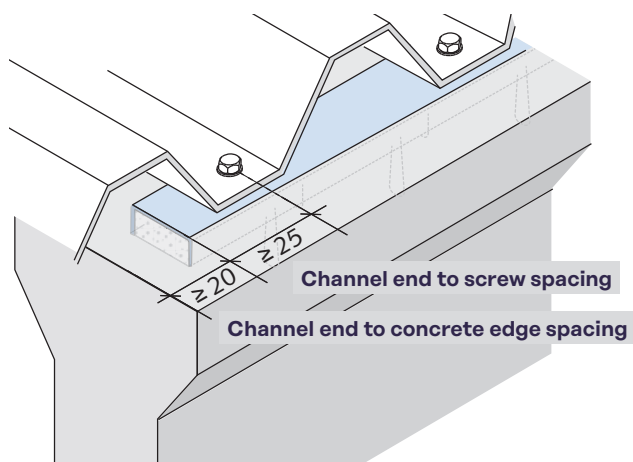
The ready-to-install HTU Channel is embedded flush with the final concrete surface. It is advisable to level the concrete surface and to apply a slight slope to the outer edge of the concrete. This is to ensure that the trapezoidal sheet metal rests only on the HTU Channel. According to German approval a heightened installation of up to 5 mm is also possible. Alternatively, if the trapezoidal sheet metal manufacturer

requires a minimal support width larger than 60 mm, this can be achieved through a flush channel installation and a flat concrete surface. Ensure that pre-stressed concrete trusses are properly aligned, centred and absolutely plane. Maintaining a 20 mm gap between individual channel ends is recommended.

Profiled sheet metal fixing in wall applications

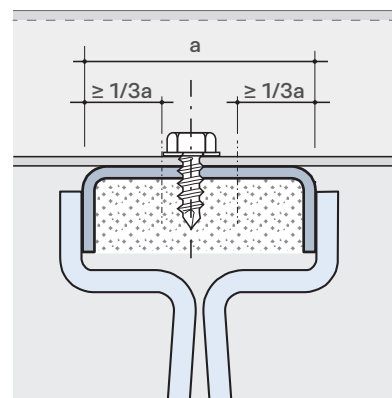


Profiled sheet metal fixing in roof applications

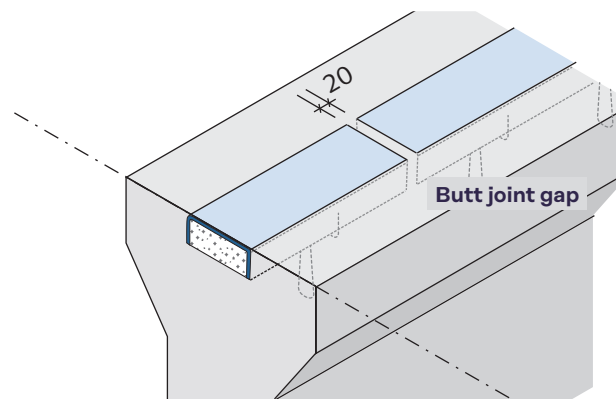


Dimensions in mm

Screw placement



Recommended butt joint gap between two channels



Assembly (with self-drilling screw)

- Use a power-driver to fix the self-drilling screw; a pilot hole is not required. Even 4-fold overlapping at joints is not a problem with self-drilling screws.
- The recommended engine speed and socket size must be observed; see product data sheet of the self-drilling screws.
- Suitable tools for various screws can be obtained from the screw supplier.
- The profiled sheet metal must be attached in the central third of the channel back. Screws must be positioned at a minimum distance of 25 mm from the channel ends.

Halfen Framing Channels

The benefits at a glance

To complement the product range we have a wide range of framing channels with accessories. We can supply everything you need for your project; everything from one source.

Quick and economical

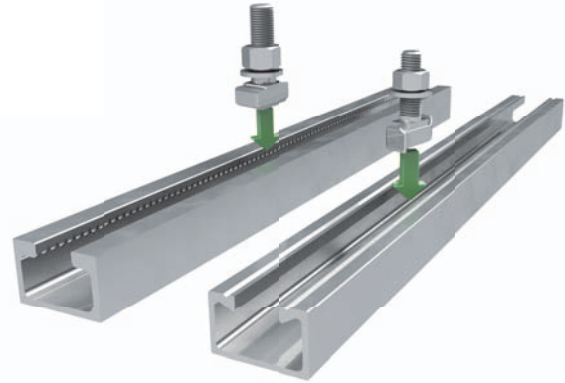
- full flexibility in positioning and dimensioning of the bolt connection
- quick installation and adjustability of plant equipment or building components
- dirt and noise free on-site modifications
- innovative modular assembly system; numerous complementary accessories available
- no more welding in hazardous environments
- bolted connections do not damage the corrosion protection of plant components



① The complete, available product range for industrial application can be found at www.halfen.com in the technical product information catalogues; Halfen MT-FBC (Versatile bolt systems); Halfen MT-FFC (Versatile framing connections) or Halfen Powerclick System. www.halfen.com / Downloads / Brochures /

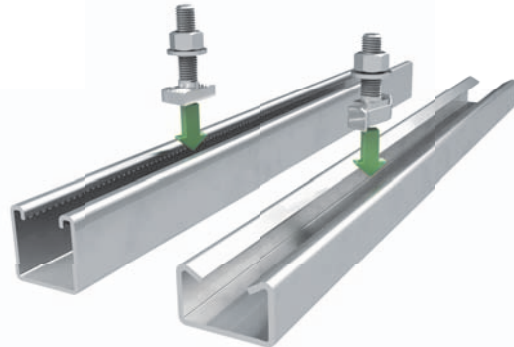
Halfen HM/HZM Framing channel, hot-rolled

The Halfen Framing channels range includes hot and cold-rolled channel profiles with standard or serrated channel lips.



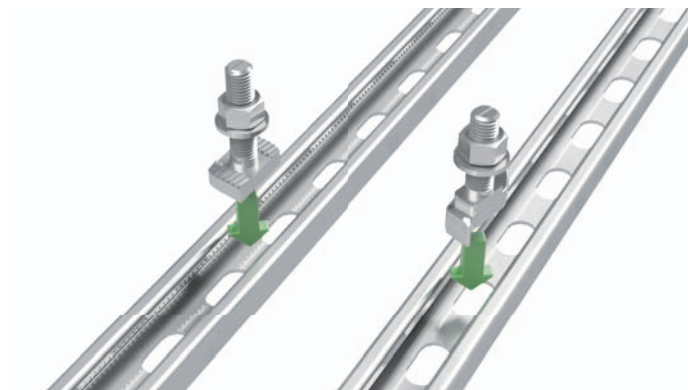
Halfen HM/HZM Framing channel, cold-rolled

Halfen Framing channels, used in combination with matching Halfen Bolts (or threaded plates ①) have all the benefits needed for versatile bolt and frame constructions.



Halfen HL/HZL Slotted channels

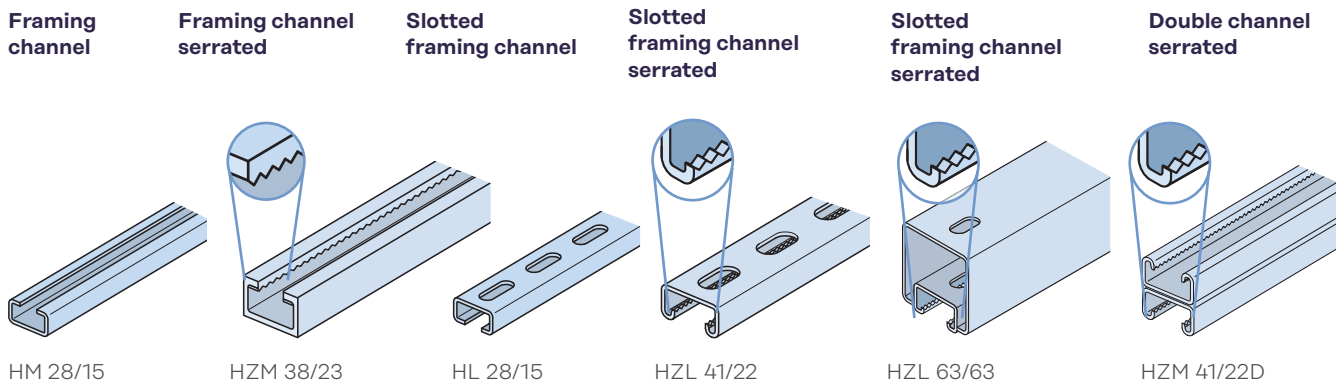
Halfen Framing channels are available, mill-finished, hot-dip galvanized or in stainless steel materials; slotted or non-slotted.



Halfen Framing Channels

Framing Channels HM/HZM/HL/HZL – Application Examples

Type Overview



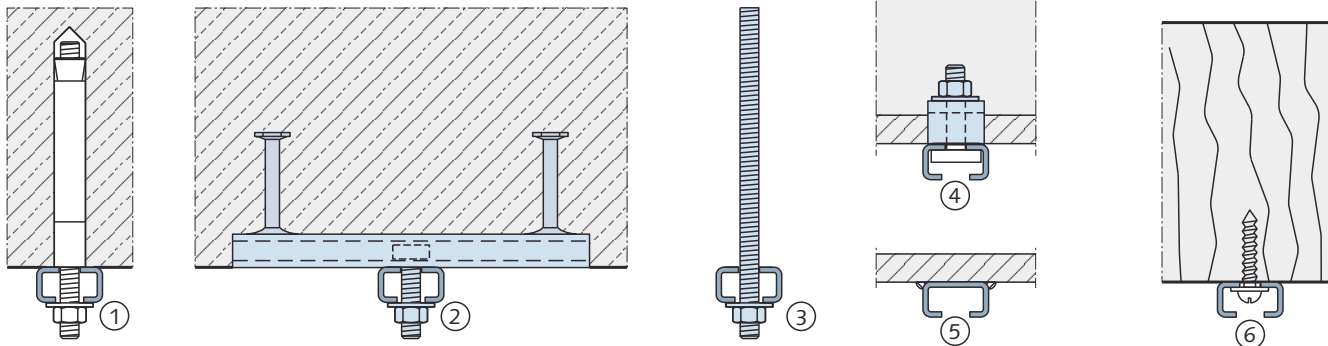
Application Examples

Halfen Framing channels HM/HZM and slotted Halfen Framing channels HL/HZL can be attached to a supporting structure using various methods:

- ① fastened to concrete or masonry with HB-VMU plus wedge anchors
- ② bolted to Halfen HTA-CE or HZA Anchor channels
- ③ connected to threaded rods
- ④ clamped to steel profile supports
- ⑤ welded to steel components
- ⑥ screwed or nailed to wood structures

Halfen Framing channels are a part of the Halfen Framing system:

- installations for plant engineering
- technical equipment in buildings
- heavy and light installations



Typical application of the Halfen Powerclick system

The Halfen Framing system product range can be found in the following catalogues:

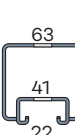
Halfen Versatile bolt connections,
Halfen Versatile framing connections
Halfen Powerclick System.



Framing Channels

Framing Channels HM/HZM/HL/HZL — Type Overview

Heavy Duty Framing System														
Hot-rolled				Cold-rolled			Hot-rolled	Cold-rolled		Hot-rolled, serrated				
HM 72/48 ■ ■	HM 55/42 ■	HM 52/34 ■ ■	HM 50/30 ■ ■	HM 49/30 ■ ■ ■	HM/HL 50/40 ■ ■ ■	HM 486 ■	HM 40/22 ■ ■	HM 40/25 ■ ■	HM 422 ■	HZM 64/44 ■ ■	HZM 53/34 ■ ■	HZM 41/27 ■	HZM 38/23 ■ ■	HZM 29/20 ■
														
														
HS / HSR 72/48, GWP 72/48	HS 50/30	HS / HSR 50/30, GWP 50/30		HS 50/30, GWP 50/30 or GWP 50/40			HS / HSR 40/22, GWP 40/22			HZS 64/44	HZS 53/34	HZS 38/23	HZS 38/23, HS 38/17	HZS 29/20, HS 28/15

Medium Duty Framing System							
Cold-rolled				Cold-rolled, serrated			
HM / HL 41/83 ■ ■	HM / HL 41/62 ■ ■	HM / HL 41/41 ■ ■ ■ ■	HM / HL 41/22 ■ ■	HZL 63/63 ■	HZM / HZL 41/41 ■ ■	HZM / HZL 41/22 ■ ■	
							
							
HZS/HS 41/41, HZS 41/22 GWP 41/41, GWP 41/22							

Light Duty Framing System					
Cold-rolled					Cold-rolled
HM 36/36, HL 36/36 ■ ■	HM 38/17 ■ ■ ■ ■	HM 28/28, HL 28/28 ■ ■ ■	HM 28/15, HL 28/15 ■ ■ ■ ■	HM 315 ■	HM 20/12, HL 20/12 ■ ■
					
					
HS 38/17, GWP 38/17		HS 28/15, GWP 28/15		GWP 28/15	HS 20/12, GWP 20/12

Materials/Finish:

- hot-dip galvanized HDG or mill finished WB
- sendzimir galvanized SV
- stainless steel A4 1.4571/1.4404
- stainless steel A2 1.4307 (on request)
- HCR high corrosion resistant steel 1.4547/1.4529 (on request)

More information about materials
→ see pages 12–13



HZM/HZL serrated channels

GWP locking plates are part of the Halfen MT-FBC Flexible Bolt connections product range.

Roof and Wall

The advantages at a glance

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 HNA Timber fixing strap

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

- reliable anchorage of versatile loads
- allows temperature related movements of the components
- improves constructive wood protection



Halfen ML and BL Brick tie anchor system

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

- simple installation
- reduction of movement cracks
- no need to drill when building brickwork cladding walls



Halfen HKZ or SPV Restraint ties

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

- simple installation in in-situ concrete or in the precast plant
- fast element installation on site



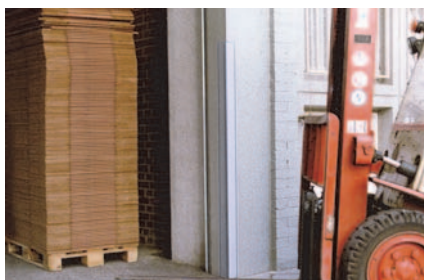
Halfen HVL-M Precast connection with Halfen HVL-E Cast-in channel

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

- easy installation
- efficient and economical
- time advantage due to high proportion of prefabrication



Halfen HKW Corner guard



- simple installation
- Maximum protection

Wall and column corner protector; application in industry and logistics buildings. Also highly recommended in multi-storey car parks.



Roof and Wall

Application Examples



Airbus paintshop building site. Example for Halfen HVL Restraint tie application



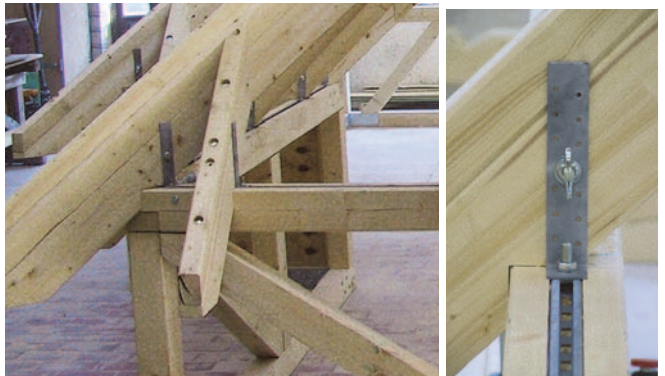
HVL-System application; precast components installed between the columns; Airbus paintshop building



Connecting construction timbers to concrete using Anchor channel and a Halfen HNA Timber fixing strap type WN 185



HVL-System in precast building components



Timber roof construction with Halfen HNA Fixing straps



Precast connection; Halfen HKZ Restraint tie with serrated washer



Halfen ML Brick-tie anchor system

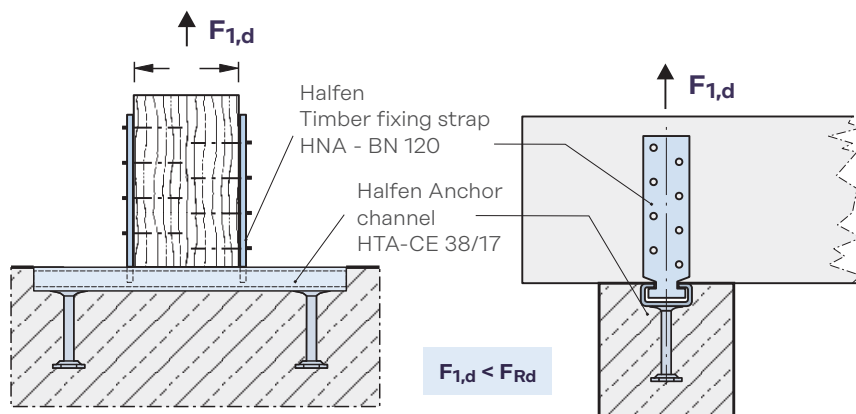
Roof and Wall

Halfen HNA Timber Fixing Strap

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

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).

Assembly example:



For calculation and design criteria see:

EN 1991-1-4 (EC1) and EN 1991-1-4/NA
EN 1995-1-1 (EC5)

Type selection:

Type N for HTA-CE 28/15
Type BN for HTA-CE 38/17

Dimensions in [mm]

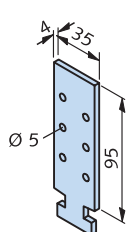
Ordering example HNA :

HNA - BN - 120 - HDG

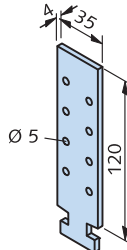
① ② ③

- ① Type
- ② Length [mm]
- ③ Finish

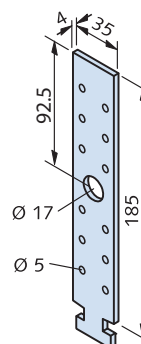
N 95
BN 95



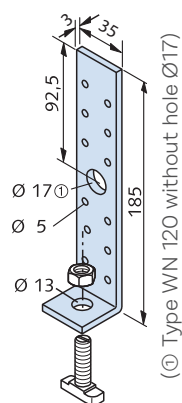
N 120
BN 120



BN 185



WN 120
WN 185



Halfen Bolt M10 with nut,
please order separately!

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

Roof and Wall

Brick Tie Anchor Systems ML + BL

Brick tie systems

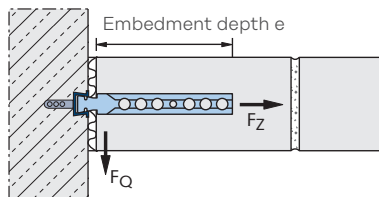
Halfen Brick tie systems are economic and proved fixing systems using Halfen ML Brick ties for fixing brickwork, in-fill panels, partition walls, cladding panels (with or without air gap or thermal insulation) to steel or timber structures or concrete walls and columns.

The brick ties are able to move vertically in the wall connector channels; this greatly reduces movement cracks in the brickwork.

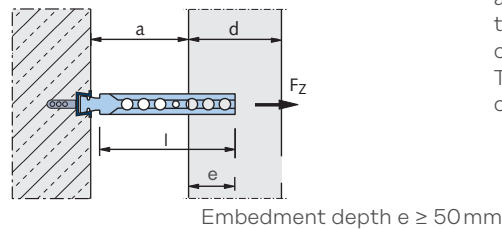
All HTA-CE and HMS profiles have a foam filling to prevent concrete ingress. The channels are attached to the formwork using standard nails.

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.

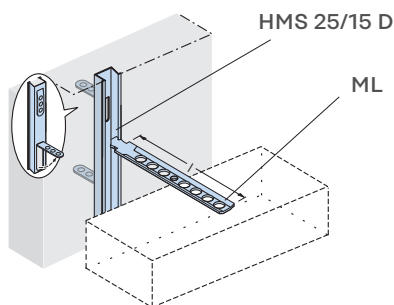
Wall connection



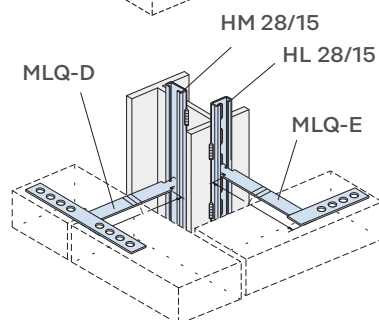
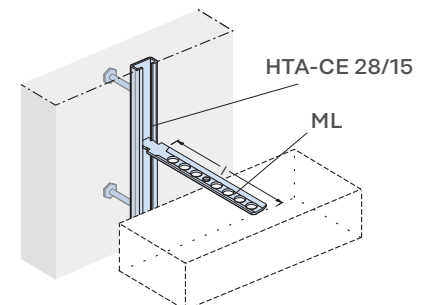
Facing brickwork connection



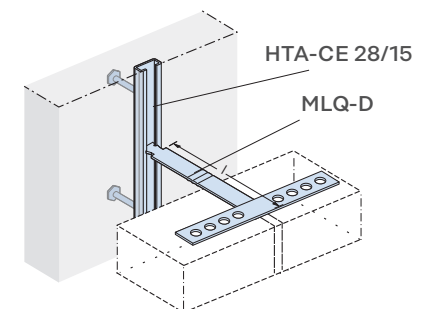
ML Brick ties in combination with Halfen Channels HMS, HTA-CE, HM and HL



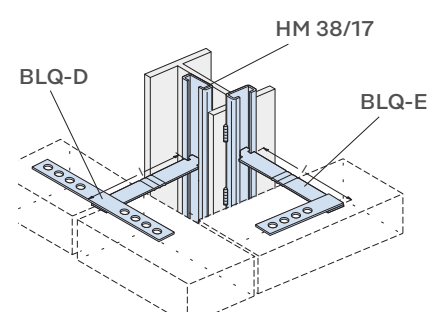
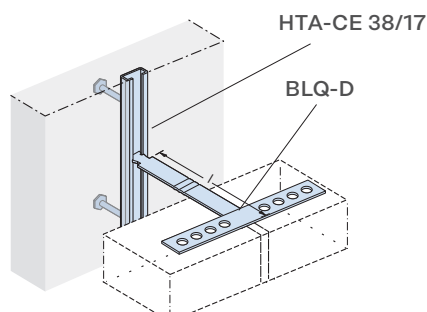
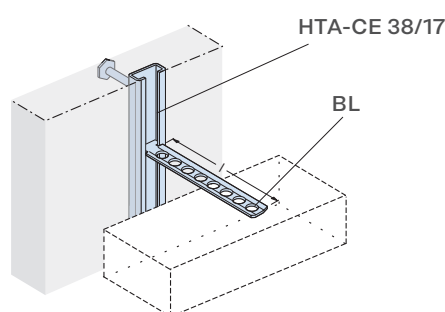
The pre-punched anchors in the HMS Channels are bent out by hand every 250 mm on-site to ensure safe anchorage in the concrete.



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-CE 38/17 and HM 38/17



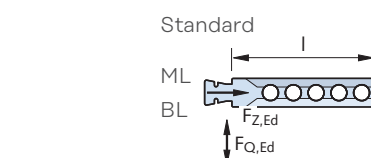
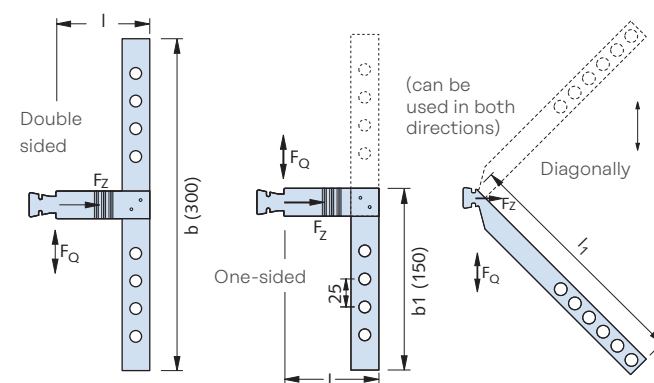
Roof and Wall

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	

Declared load capacity performance (EN 845-1)				
		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)	–

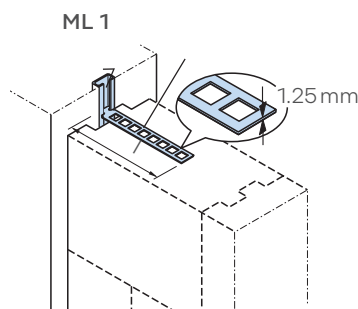
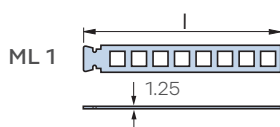
Halfen Brick ties are verified in accordance with EN 845-1 for various anchor channels with a minimum embedment depth of 50 mm.



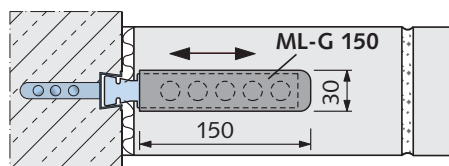
Brick ties ML 1 for connections with thin-joint mortar in interior applications

Material: Stainless steel A2

Type	Length l [mm]
ML1 -	125
	185
	245



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



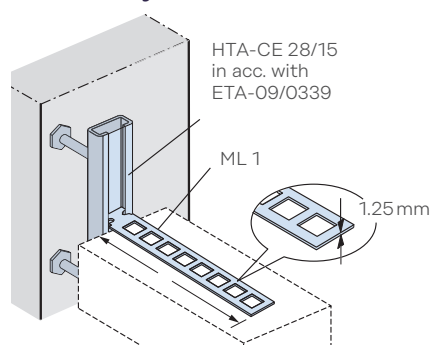
Allows movement in the anchor longitudinal direction; this helps to avoid cracking in long sections of brick wall or infill brickwork connected to concrete structures.

Material: Soft-PVC Article name: MLG- 150

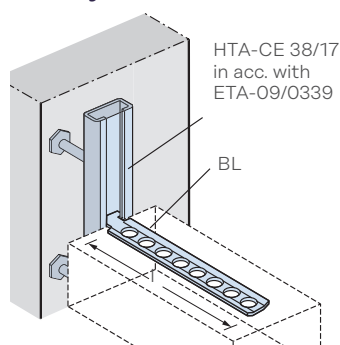
Channels load-bearing capacity with wall tie spacing of ≥ 25 cm

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 Wall

Brick Tie Anchor Systems ML + BL

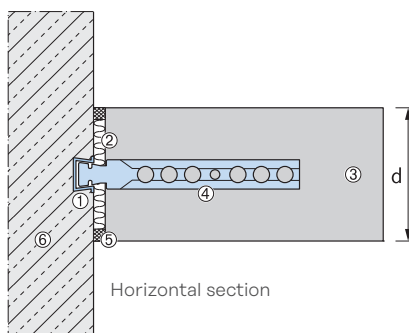
Brick-tie channel		Brick-tie anchor				
	HMS 25/15 D L = 2500 mm 	 ML Standard 26 × 2 [mm]	 ML1 25 × 1,25 [mm]	 MLQ - D Double-sided 25 × 3 [mm]	 MLQ - E One-sided 25 × 3 [mm]	 MLS Diagonal 22 × 3 [mm]
	HTA-CE 28/15 L = 1050 mm^① L = 6070 mm^① 	Type Length l [mm]	Type Length l [mm]	Type Length l [mm]	Type Length l [mm]	Type Length l₁ [mm]
	HL 28/15 L = 6070 mm^① 	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
	HTA-CE 38/17 L = 1050 mm^① L = 6070 mm^① 	 BL Standard 30 × 2 [mm]	 BLQ - D Double-sided 30 × 3 [mm]	 BLQ - E One-sided 30 × 3 [mm]	Material: HDG = Steel S235JR, hot-dip galvanized SV = Steel DX51D + Z275, Sendzimir galvanized D4 = D4 Lean duplex 1.4062, 1.4162 A4 = Stainless steel 1.4571/1.4404 A2 = Stainless steel 1.4301 ① Other lengths: Available on request	
Type Length l [mm]	Type Length l [mm]	Type Length l [mm]				
BL - 85	BLQ-D - 85	BLQ-E - 85				
BL - 120	BLQ-D - 120	BLQ-E - 120				
BL - 180	BLQ-D - 180	BLQ-E - 180				

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.

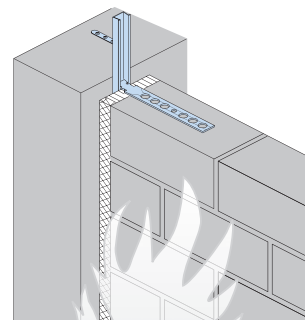
The anchorage to adjacent components (steel reinforced concrete supports or walls) meet the requirements for stability and fire resistance if the anchorage conforms to the standards set in DIN 4102-4 section 9.8.4 (figure 9.13, variant 2).



Anchor spacings

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

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)



Definition, DIN regulations

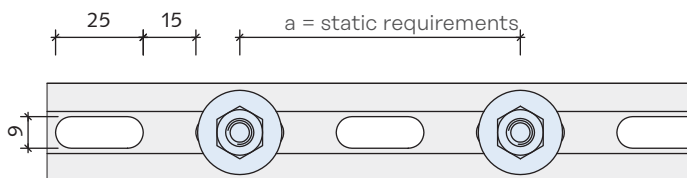
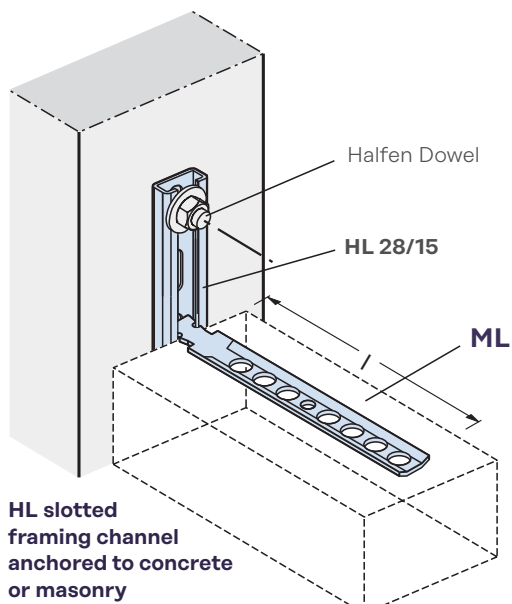
- ① Halfen Brick tie or Anchor Channel
- ② Insulation layer: According to DIN 4102-4 section 9.2.14 insulation layers in connecting joint gaps must, "[...] be made of non-flammable mineral fibre; have a melting point $\geq 1000^{\circ}\text{C}$ as stated in DIN 4102-17; and have a gross density of $\geq 30 \text{ kg/m}^3$ " 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 Channel Type ①	④ Brick tie anchor	
	for standard grout	for thin mortar
HMS 25/15 D	ML	ML 1
HTA-CE 28/15	ML	ML 1
HTA-CE 38/17	BL	—

Roof and Wall

Brick Tie Anchor Systems ML + BL

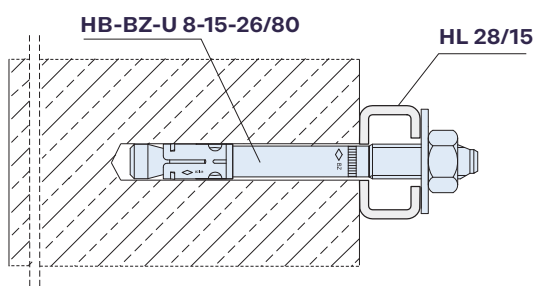
Bolt anchors/Anchor rods for installation of Halfen HL slotted framing channels



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

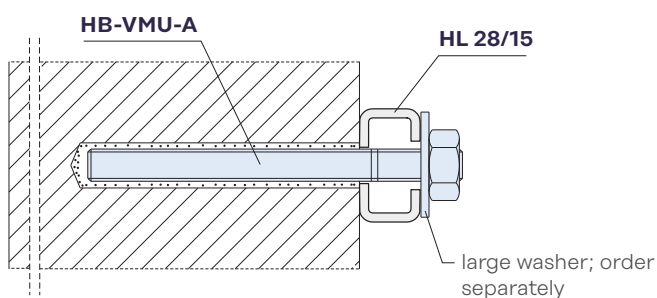


For more information on application and assembly see the Technical Product Information catalogue, Halfen HB Anchor bolt systems



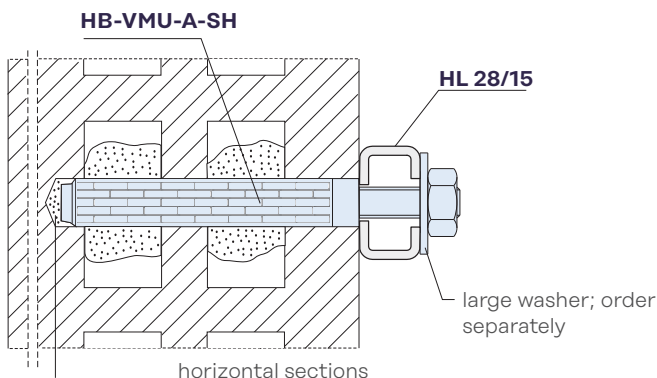
Bolt anchor HB-BZ-U 8-15-26/80

- 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)

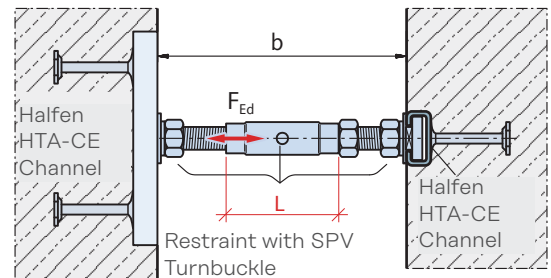
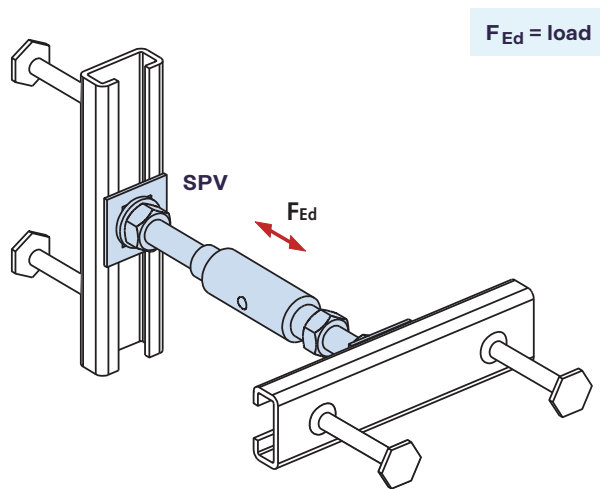


Anchor rod HB-VMU-A 8-20/110 with Perforated sleeve HB-VMU-SH 16x85

- 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 Wall

Restraint with Halfen Turnbuckle SPV



Ensure adequate screw depth:

M12 → ≥ 10 mm

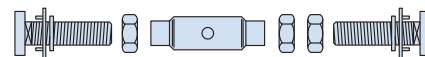
M16 → ≥ 13 mm

Product description

The restraint with turnbuckle SPV is suitable for compressive and tensile loads up to $F_{Ed} = 15.0 \text{ kN}$ 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 by using Halfen Anchor 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 SPV :

SPV - 7.0 - 100 - A4

① ② ③ ④

- ① Type
- ② Load group
- ③ Wall clearance b
- ④ Material / finish



Halfen Anchor 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	Halfen Bolt left-hand thread	Sleeve	Halfen Bolt right-hand thread	Halfen Bolt left-hand thread	Sleeve	Halfen Bolt right-hand thread	Halfen Bolt left-hand thread	Sleeve	Halfen Bolt right-hand thread
	b [mm]	M12 [mm]	L [mm]	M12 [mm]	M16 [mm]	L [mm]	M16 [mm]	M16 [mm]	L [mm]	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.

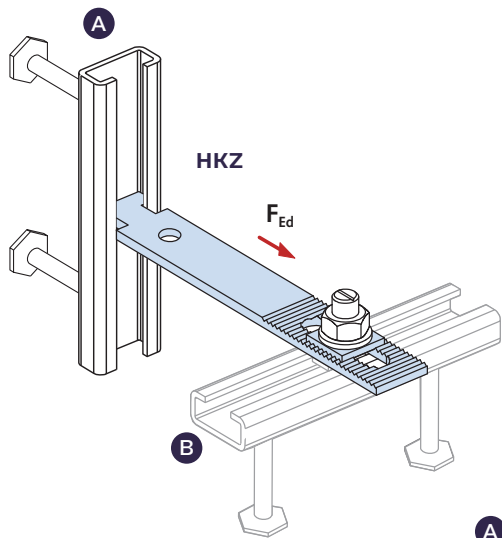
② Minimum tolerance is limited for load group 7.0



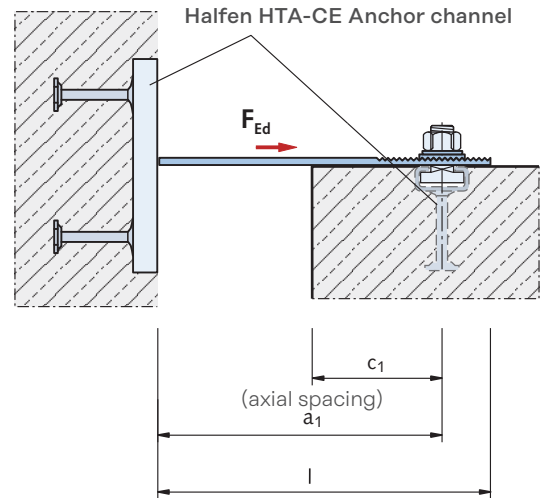
For further concrete façades accessories see catalogue Halfen Concrete façade anchor systems
www.halfen.com / Downloads / Brochures / ...

Roof and Wall

Halfen Restraint Tie HKZ



F_{Ed} = load



Product characteristics

The serrations in the bracket and in the washer ensure positive static load transmission. Two Halfen Anchor channels embedded at right angle in the concrete ensure three-dimensional adjustability.

- A** Halfen Channel suitable for HKZ-Restraint ties
- B** Halfen Channel or dowel according to approval

Ordering example HKZ :

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

- ① Type
- ② Wall clearance a_1
- ③ Material / finish



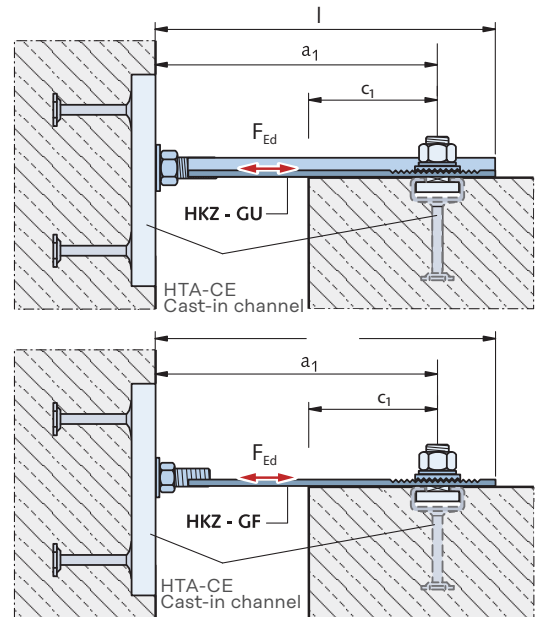
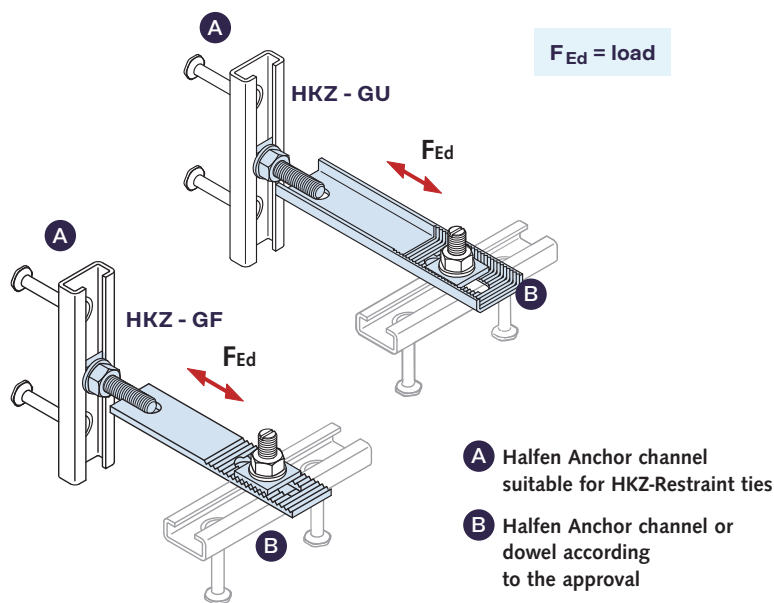
Please order Halfen Anchor channels, Halfen Bolts and washers separately

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

Roof and Wall

Halfen Restraint Tie HKZ - GF/GU



Product description

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

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 Anchor channels set in concrete; the connection is three-dimensionally adjustable.



Please order Halfen Anchor channels, Halfen Bolts and washers separately.

Ordering example SPV :

HKZ - GF 38/17 - 125 - EPS

① ② ③

- ① Type
- ② Wall clearance a_1
- ③ Material, EPS = zinc plated or A4 = Stainless steel

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

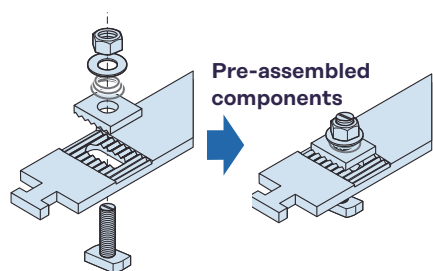
① The load capacities apply for the HKZ-restraint ties. The channel **A** and the fixing dowel/channel **B** must be verified, depending on the edge distance c_1 , the concrete grade and the reinforcement, for each application.

Roof and Wall

Halfen HVL Precast Connection

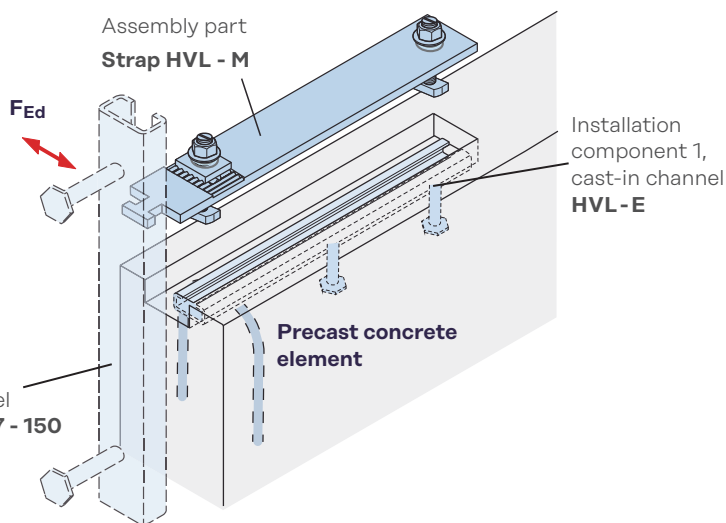
Assembly:

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



Pre-assembled components

Installation component 2, anchor channel HTA-CE 38/17 - 150



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.

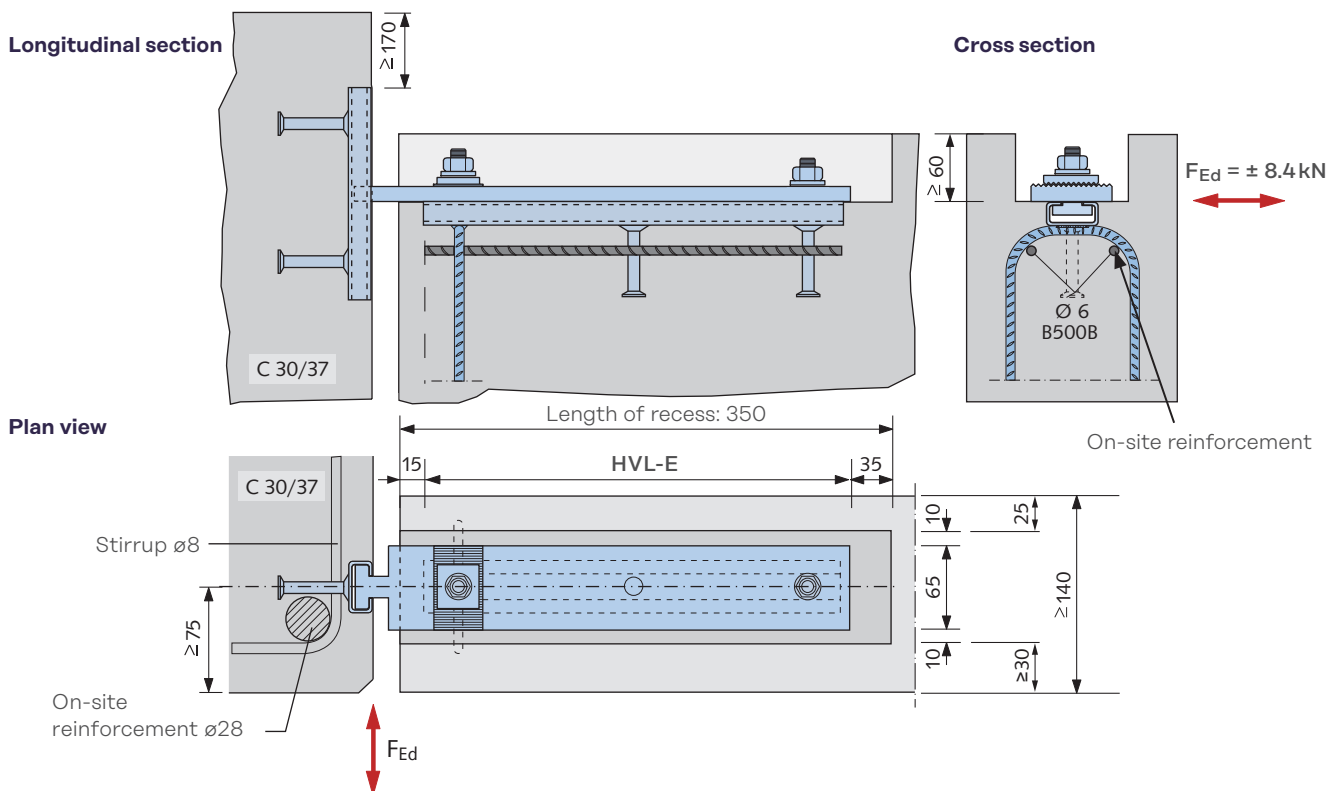
Installation component 2:

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

Corrosion protection

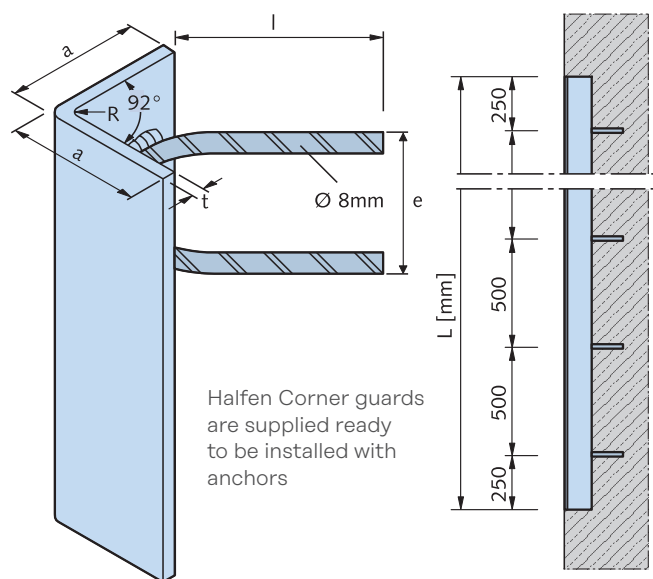
- hammer-head strap, Halfen Channel: hot-dip galvanized
- Halfen Bolts, nuts, washers and springs: galvanized

These parts are covered by mortar after installation.



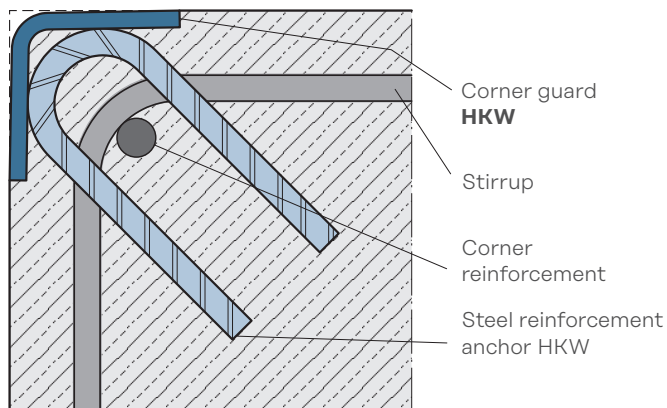
Roof and Wall

Halfen HKW Corner Guard



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

Column edge, typical cross-section



Material/Finish:

■ **HDG = Corner profile:** Steel (1.0038) hot-dip galvanized
Anchor: B500B

Ordering example SPV :

HKW 50/5 - HDG - 2000/4

① ② ③

- ① Type/Profile
- ② Material finish
- ③ Length /no. of anchors

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

Accessories

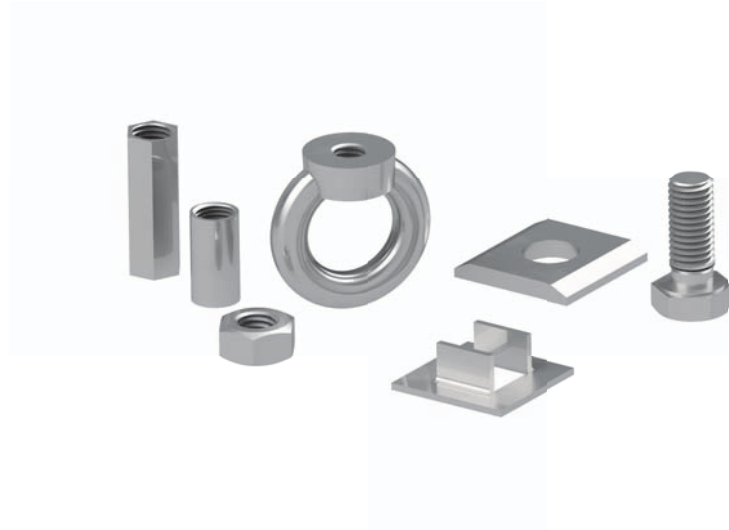
The benefits at a glance

You can design nearly all connections in buildings and industrial plants with Halfen Channels. With Anchor channels or framing channels, Halfen Bolts and with our wide range of accessories we provide fastenings for all purposes.

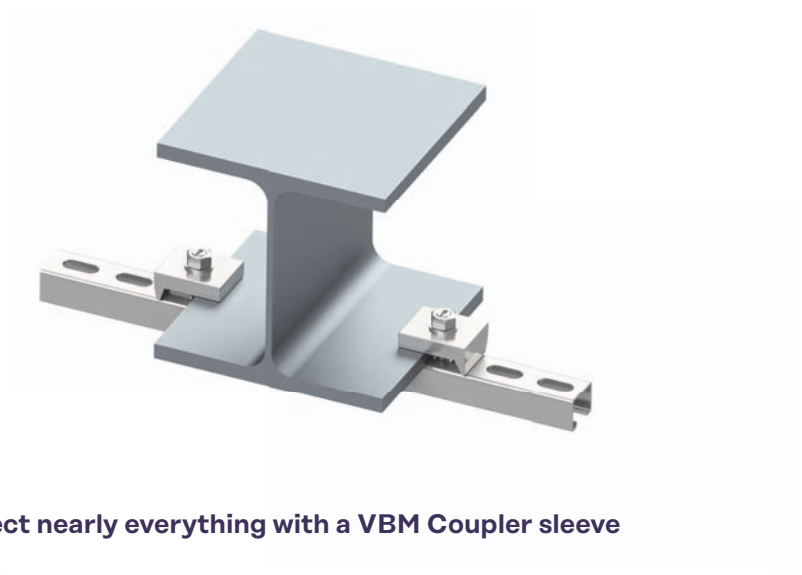
Fast and cost-effective

- 3-dimensional adjustable connection when used with cast-in channels
- uses bolts instead of welding
- simple assembly reduces installation time

Accessories for all Halfen Channels

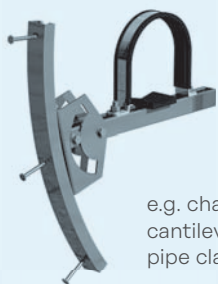


Application example with Halfen KLP Rail clips

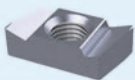


Further accessories for construction and industrial design

The Halfen Framing system (industrial) product range can be found in the following catalogues: "Halfen Flexible bolt connections", "Halfen Flexible framing connections" or "Halfen Powerclick System".



e.g. channel rings, cantilever arms, pipe clamps



e.g. threaded locking plates



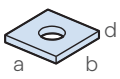
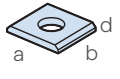
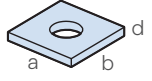
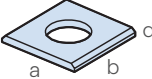
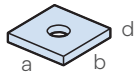
Connect nearly everything with a VBM Coupler sleeve



Accessories

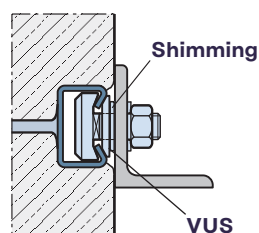
Nuts and Washers

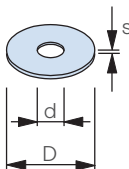
MU Hexagonal nuts EN ISO 4032/ DIN 934	EPS galvanized Sc 8 Bolt size	A4 stainless steel Bolt size	S/m DIN [mm]	S/m ISO [mm]
	M6	M6	10/5	10/5.2
	M8	M8	13/6.5	13/6.8
	M10	M10	17/8	16/ 8.4
	M12	M12	19/10	18/10.8
	M16	M16	24/13	24/14.8
	M24	-	36/19	36/21.5
	HDG hot-dip galvanized Bolt size	A2 stainless steel Bolt size	S/m DIN [mm]	S/m ISO [mm]
	M6	-	10/5	10/5.2
	M8	M8	13/6.5	13/6.8
	M10	M10	17/8	16/8.4
	M12	M12	19/10	18/10.8
	M16	M16	24/13	24/14.8

VUS Square washers	HDG Hot-dip galvanized Bolt size	A4 Stainless steel Bolt size	a × b × d [mm]
VUS 40/25 for profile 40/25; HZA 41/22			
	M10	M10	40 × 40 × 5
	M12	M12	40 × 40 × 5
	M16	M16	40 × 40 × 5
VUS 49/30 for profile 54/33, 49/30			
	M10	M10	37 × 37 × 5
	M12	M12	37 × 37 × 5
	M16	M16	37 × 37 × 5
	M20	M20	37 × 37 × 5
VUS 52/34 for profile 52/34, 50/30			
	M16	M16	50 × 50 × 6
	M20	M20	50 × 50 × 6
VUS 72/49 for profile 72/48			
	M20	M20	54 × 54 × 6
	M24	M24	54 × 54 × 6
	M27	M27	54 × 54 × 6
	M30	M30	54 × 54 × 6
VUS 41/41 for all 41/.. profiles			
	M6	M6	40 × 40 × 6
	M10	M10	40 × 40 × 6
	M12	M12	40 × 40 × 6

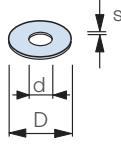
Ordering example: VUS 52/34 - HDG - M20

Application VUS:
for shimming non-flush
installation of Halfen
Anchor channels or for
stand-off installations
→ see page 39

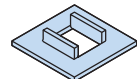


US Washers DIN EN ISO 7093/DIN 9021; DIN EN ISO 7094	EPS galvanized, bolt size	A4 stainless steel bolt size	D	d	s	
	bolt size	bolt size	[mm]			
	7094	M6	-	22	6.6	2
	9021	M8	M8	24	8.4	2
	9021	M10	M10	30	10.5	2.5
	7094	M12	-	45	13.5	4
	9021	M12	M12	37	13	3
	9021	M16	M16	50	17	3
	7094	M20	-	72	22	6
DIN/ ISO	HDG hot-dip galv. bolt size		D	d	s	
			[mm]			
9021	M10	-	30	10.5	2.5	
9021	M12	-	37	13	3	
9021	M16	-	50	17	3	

Ordering example: US - M12 - EPS - DIN 9021

US Washers DIN EN ISO 7089/ DIN 125	EPS galvanized bolt size	A4 Stainless steel bolt size	D [mm]	d [mm]	s [mm]
	M6	M6	12	6.4	1.6
	M8	M8	16	8.4	1.6
	M10	M10	21	10.5	2
	M12	M12	24	13	2.5
	M16	M16	30	17	3
	M20	M20	37	21	3
	M24	-	44	25	4
	HDG Hot-dip galvanized	A2 Stainless steel bolt size	D [mm]	d [mm]	s [mm]
	-	M8	17	8.4	1.6
	M10	M10	21	10.5	2
	M12	M12	24	13	2.5
	M16	M16	30	17	3
	M20	-	37	21	3
	M27	-	50	28	4

Ordering example: US - M12 - EPS - DIN 125

SIC Locking washer	EPS galvanized	A4 Stainless steel A4	Suitable for Halfen bolts	
			Type	Dimen- sions
	SIC-50/30-EPS	SIC-50/30-A4	50/30	M16, M20
	SIC-40/22-EPS	SIC-40/22-A4	38/17 40/22	M16
	SIC-38/23-EPS	-	38/23	M16
	SIC-29/20-EPS	-	29/20	M12
	SIC-38/17-EPS	SIC-38/17-A4	38/17 40/22	M12, M10
	SIC-28/15-EPS	SIC-28/15-A4	28/15	M8, M10
	SIC-20/12-EPS	SIC-20/12-A4	20/12	M8
	Application SIC: to secure and prevent Halfen Bolts back-turning during assembly.			

Ordering example: SIC - 38/17 - EPS

Accessories

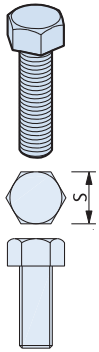
Threaded rods, Hexagonal head bolts, Coupler sleeves, Ring nuts

GWS Threaded rods DIN 976-1	EPS	A4	Length	F _{Rd}	allow. F
	Galvanized Sc 4.6 Thread	Stainless steel A4 Thread	[mm]	① [kN]	[kN]
	M6	M6	1000	3.1	2.2
	M8	M8	1000	5.6	4.0
	M10	M10	1000	9.0	6.4
	M12	M12	1000	13.0	9.3
	M16	M16	1000	24.2	17.3
	M20	M20	1000	37.8	27.0
	M24	-	1000	54.3	38.8



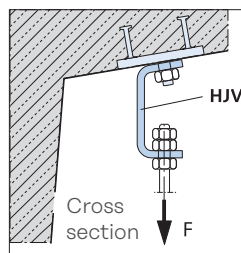
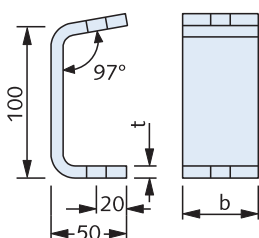
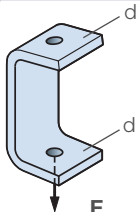
Ordering example: GWS - M12 x 1000 - EPS

HSK Hexagonal head bolts EN ISO 4017/ DIN 933 (without nut)	EPS 8.8	A4	S	S
	Galvanized Sc 8.8 Dimensions	Stainless steel Dimensions	DIN [mm]	EN ISO [mm]
	M 6 x 12	-	10	10
	M 6 x 25	-		
	M 8 x 25	M 8 x 25	13	13
	M 8 x 40	-		
	M 10 x 20	-	17	16
	M 10 x 30	M 10 x 30		
	M 10 x 45	M 10 x 45		
	M 10 x 60	-		
	M 10 x 70	-	19	18
	M 12 x 22	-		
	M 12 x 25	M 12 x 25		
	M 12 x 30	M 12 x 30		
	M 12 x 40	M 12 x 40	24	24
	M 12 x 50	-		
	M 12 x 60	M 12 x 60		
	M 12 x 80	M 12 x 80		
	M 12 x 90	-	24	24
	M 16 x 40	M 16 x 40		
	M 16 x 60	M 16 x 60		
	M 16 x 90	M 16 x 90		

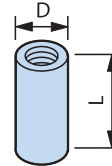


Hex bolts are used in combination with Halfen Locking plates

HJV Adjustment coupler	HDG	A4	t	b	d	max. F _{Ed}	allow. F
	Hot-dip galva- nized Type	Stain- less steel Type	[mm]	[mm]	[mm]	② [kN]	[kN]
	1	1	6	40	13	2.1	1.5
	2	2	8	50	17	4.6	3.3
	3	3	10	50	17	7.0	5

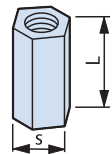


VBM Coupler sleeves, round	EPS	A4	D	L	F _{Rd}	allow. F
	Galvanized Thread	Stainless steel Thread	[mm]	[mm]	① [kN]	[kN]
	M6	M6	10/10	15	3.1	2.2
	M8	M8	12/14	20	5.6	4.0
	M10	M10	13/16	25	9.0	6.4
	M12	M12	16/20	30	13.0	9.3
	M16	M16	21/25	40	24.2	17.3
	M20	M20	26/32	50	37.8	27.0



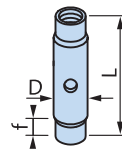
Ordering example: VBM - A4 - M16

SKM Hexagonal coupler sleeves	HDG	A4	S	L	F _{Rd}	allow. F
	Hot-dip galvanized Thread	Stainless steel Thread	[mm]	[mm]	① [kN]	[kN]
	M10	M10	17	40	9.0	6.4
	M12	M12	19	40	13.0	9.3
	M16	M16	24	50	24.2	17.3



Ordering example: SKM - HDG - M12

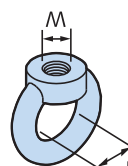
SPH Turnbuckles with right- and left-hand thread	A4 Stainless steel Thread M12 x Length L [mm]	A4 Stainless steel Thread M16 x Length L [mm]	D	D
			For M12 [mm]	For M16 [mm]
	M12 x 60	M16 x 60	16	22
	M12 x 75	M16 x 75	16	22
	M12 x 95	M16 x 95	16	22
	M12 x 115	M16 x 115	16	22
	M12 x 135	M16 x 135	16	22
	allow. F = 5 kN F _{Rd} = 7 kN	allow. F = 10 kN F _{Rd} = 14 kN		



f = min. screw depth
M12=10mm
M16=13 mm

Ordering example: SPH - A4 - M12 x 75

RM Ring nut DIN 582	EPS	d	F _{Rd}	allow. F
	C 15E, galvanized	[mm]	① [kN]	[kN]
	M8	20	2.0	1.4
	M10	25	3.2	2.3
	M12	30	4.8	3.4
	M16	35	9.8	7.0
	M20	40	16.8	12.0



Ordering example: RM - EPS - M12

- ① Recommended design value of the load capacity with a centric tensile stress
- ② Recommended design value of the load

Accessories

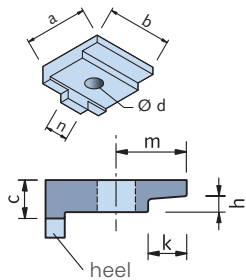
Rail Clips

KLP-S Rail clips, steel 1.0038 forged

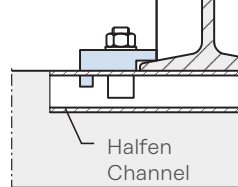
HDG hot-dip galvanized	Heel width n	for Halfen Bolts	Dimensions [mm]							Allowable load		Preferred for use with	
			a	b	c	Ø d	h	k	m	at σ allowable = 125 N/mm ²	Standard profile I	other beam, flange thickness channels	channels
Type	[mm]	Ø × l [mm]								F [kN]		t [mm]	
No. 10	16	M16 × 60	44.0	45	12	18	5	12.0	22.0	3.5	80–140	4–6	S24
No. 26	without heel	M16 × 60	62.5	64	21	18	9	16.5	34.5	3.5	160–240	7–9	S24, A45, A55
No. 20	20	M20 × 65	52.0	55	19	□ 21	8	15.0	24.0	10.0	160–240	7–9	S24–S49

Ordering example: KLP - S - Nr. 26 - HDG

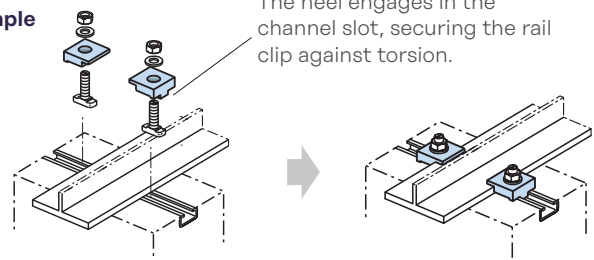
□ = square opening



Load diagram:
KLP-S



Assembly example
KLP-S



The heel engages in the channel slot, securing the rail clip against torsion.

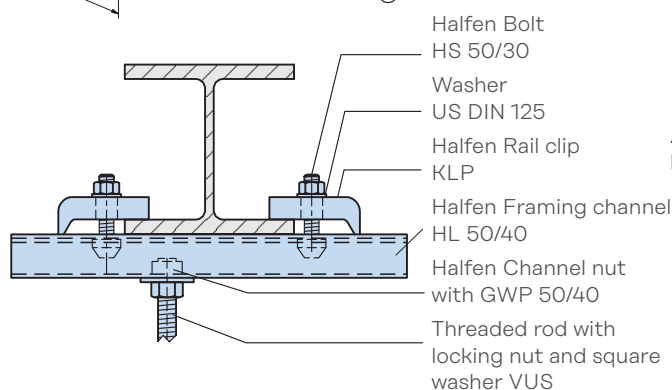
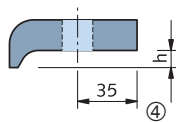
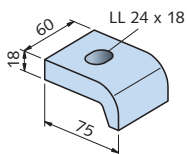
KLP - 60 Rail clips

HDG Hot-dip galvanized	Clamping height h [mm]	Allowable load ① [kN]	Preferred for use with		
			Standard profile I	Standard profile IPB	Crane and running tracks ③
60/10	10	F1 = 7.0 Halfen Bolt M16 × 60, Grade 4.6	120–160	100	A65, S33, S41
60/12	12		220–240	140	A100, S49, A75
60/14	14		240–280	160–180	A120, S54
60/16	16	F2 = 11.25 Halfen Bolt M16 × 60, Grade 8.8	300–340	200–220	S64
60/18	18 ②		360–380	240–260	-
60/20	20 ②		400–450	280–300	-

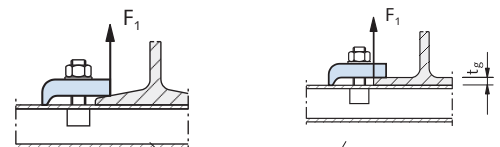
① Take the load capacity of Halfen Channels into account (Cantilever must be considered when selecting the Halfen Channels and bolts)

② Bolt M16 × 80 necessary ③ Check flange thickness of profile!

Order example: KLP - 60/10 - HDG

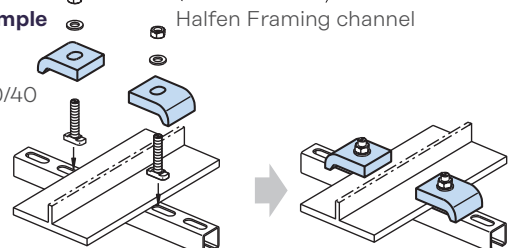


Load diagram
KLP - 60



Assembly example
KLP - 60

e.g. HL 50/40



Halfen Cast-in Channels

Index

Accessories	90	Pipe clamps	90
Adjustment coupler HJV	92	Power solution HZA-PS	28
Anchor channels performance overview	11	Precast connection HVL	88
Balcony railings	54–67	Product range Curtain wall channels	44–45
Banister/stair railings	54–67	Product range HGB Channel	58
Bolt anchors	84	Product range HTA-CE	18–19
Brick-tie channel HMS	81–82	Product range HTU Channel	71–72
Brick-ties ML/BL	81–84	Product range HTU-S Channel	68–70
Calculation software	41	Product range HZA	30
Cantilever arms	90	Profiled sheet metal fixing channel HTU	68–74
Corner guard HKW	89	Rail clips KLP/KLP-S	93
Corner pieces	37	Restraint tie HKZ	86–87
Corrosion protection HGB Channel	57	Restraint tie KZ	86–87
Corrosion protection HTU Channel	70	Restraint with turnbuckle SPV	85
Coupler sleeves VBM	92	Ring nut RM	92
Curtain Wall brackets B1/B2	52–53	Short lengths HTA-CE	27
Curtain Wall brackets HCW-ED/HCW-EW	49–51	Short lengths HZA	31
Curved channels HTA-CE	27	Slotted channels HL/HZL	75–77
Curved channels HZA-CS	31	Spacers	37
Dimensioning tool (Design Studio)	41	Square washers	91
Dowels	84	Stainless steel anchors	40
End-anchor	37	Standard delivery lengths HTA-CE	27
Fatigue loads HTA-CE	25	Standard delivery lengths HZA	31
Fatigue loads HZA	36	Tender text example HTA-CE	24
Fire resistance HTA-CE	26	Tender text example HZA	36
Fire resistance HZA	35	Threaded rods	92
Firewall connection	83	Tightening torques HS	23
Framing channels HM/HZM/HL/HZL	75–77	Tightening torques HSR	24
Handrail connection HGB	54–67	Tightening torques HZS	33
Hexagonal coupler sleeves SKM	92	Timber connections	80
Hexagonal head bolts HSK	92	Timber fixing strap HNA	80
Hexagonal nuts MU	91	Trapezoidal sheet fixings	68–74
Installation Anchor channels HTA-CE/HZA	38–39	Tunnel-segment channel	90
Installation HGB Handrail connection	59	Turnbuckles with right- and lefthand thread SPH	92
Installation of self-drilling screws	69–71	Verification methods HTA-CE/HZA	14–15
Load capacities HCW 52/34	48	Washers US	91
Load capacities HGB Channel	64–65		
Load capacities HTA-CE	18–19		
Load capacities HTU Channel	72–73		
Load capacities HTU-S Channel	70		
Load capacities HZA	30		
Locking washer	91		

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