HALFEN HCW Curtain Wall

TECHNICAL PRODUCT INFORMATION

HALFEN HCW CURTAIN WALL

FAÇADE

HCW-14.1 US

HALFEN

YOUR BEST CONNECTIONS

Contents


Aria hotel, Las Vegas, NV

HALFEN Curtain Wall system

Curtain wall façades are increasingly becoming the number one choice for architects and their clients.

Modern buildings often demand high performance façades, which can be installed quickly to accommodate a tight construction schedule without compromising on safety and efficiency. HALFEN Curtain Wall Support Systems provide an ideal solution for installing façades.

HALFEN Curtain Wall Support Systems consist of a range of HALFEN Anchor Channels and matching HALFEN T-bolts. Special HALFEN Brackets are used to connect the curtain wall façade elements to the main structure of the building. HALFEN HCW Systems are galvanized to ensure corrosion protection. HALFEN Anchor Channels are designed for longitudinal, dynamic, and high wind loads. HALFEN Brackets are designed for horizontal and vertical loads and easy adjustability.

A torque wrench is the only required installation tool. Installing HALFEN Curtain Wall Support Systems eliminates any possibility of damage to the reinforcement. With HALFEN HCW Systems, you do not need to weld or use power-tools. HALFEN HCW Systems reduce on-site hazards, eliminate hand-tool vibrations, and minimize noise. HALFEN Curtain Wall Support Systems are engineered to perform.

HALFEN - World Leader in Curtain Wall Connections

Reference overview

Little Britain, London, UK

New York by Gehry, New York, NY

Mercedes Benz Centre, Munich, Germany

Hearst Tower, New York, NY

LA Live, Los Angeles, CA

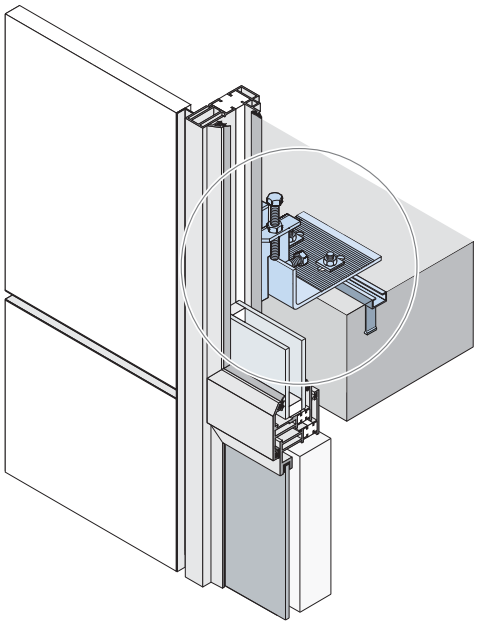
Encore Hotel, Las Vegas, NV

Vdara Hotel, Las Vegas, NV

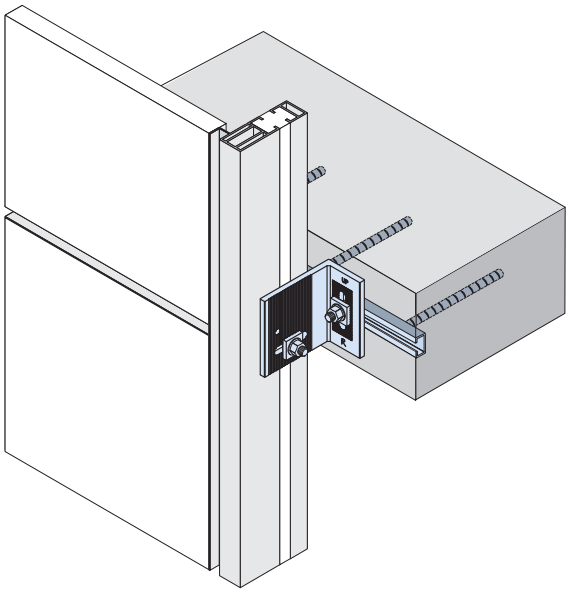
The HALFEN Anchor Channel System

Façade fixing with HALFEN Anchor channels

The HALFEN Anchor Channel range for curtain wall installation is designed for casting into the concrete members of the building structure. HALFEN T-bolts and special HALFEN Brackets are used to connect curtain wall façade elements to the channels. Engineered to the highest American and German standards the HALFEN Anchor Channel system is a proven, safe, efficient and cost-effective method for installing façade systems.



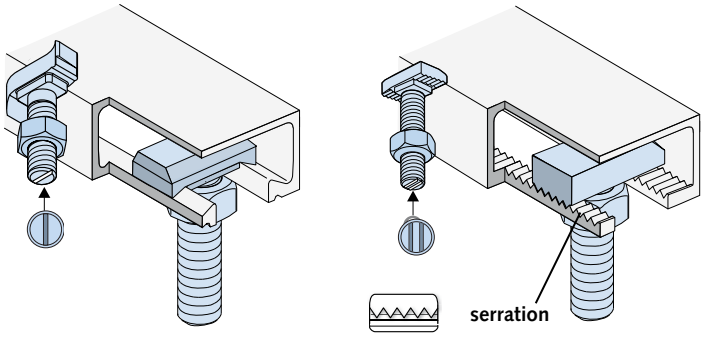
HALFEN Anchor Channels – top of slab application



HALFEN Anchor Channels – edge of slab application

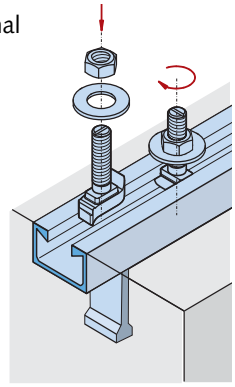
Main features

HALFEN Anchor Channels are available with plain lips (HALFEN HTA) used together with HALFEN HS T-Bolts or with toothed channel lips (HALFEN HZA) used with HALFEN HZS T-bolts. HALFEN Anchor Channels type HZA are used when loads act parallel to the channel axes. The interlock between the channel serration and the T-bolt head creates a positive connection between the channel and T-bolt to ensure safe load transfer.



Main features of HALFEN Anchor channels:

- optimal reliability
- wide range of channel profiles
- wide range of T-bolts
- high quality materials and finishes
- simple, quick installation and adjustment
- independently tested load capacities
- no power tools required, therefore no vibration, dust or excessive noise
- toothed profiles available for longitudinal loading



Installation Examples

Curtain wall connection installed to the top of a floor slab using a HALFEN HTA Anchor Channel

Edge of slab connections with HALFEN HTA Anchor Channels and HALFEN HCW Curtain Wall Brackets

HALFEN Curtain Wall Brackets fitted to the top of a floor slab using HALFEN HTA Anchor Channels

HALFEN Curtain Wall Brackets fitted to the edge of a thin post-tensioned slab using a HALFEN Anchor Channel

Window to sill-panel connection using a HALFEN Anchor Channel

Window to sill-panel connection using a HALFEN Anchor Channel

Advantages of the HALFEN Anchor Channel Systems

HALFEN Curtain Wall Support Systems

- extremely short installation time
- no welding damage to glass and framework
- easy adjustable connections
- allows for construction tolerances
- no specialized workers needed for installation
- single tool installation (torque wrench)
- no electrical power required during installation
- no on-site corrosion protection needed
- high quality materials and quality galvanization protect components from corrosion
- visual check is sufficient to confirm correct installation
- noise, vibration and dust free installation

Installation of glass façade elements

Glass façade to bracket connection

A torque wrench is the only tool required for installation.

Advantages of HALFEN Anchor Channels Compared to Drilled and Welded Connections

Mechanical or chemical post-installed anchors or steel plates with stud welded anchors are the traditional methods used to connect curtain wall façades to building slabs. If weld plates are used, additional brackets have to be welded on site during installation.

Compared with HALFEN Anchor Channels, post-installed anchors have the following disadvantages:

- power drilling can damage reinforcement
- power drills cause vibration, noise and dust
- vibration can be detrimental to the integrity of the concrete
- mechanical and chemical anchors are not adjustable
- chemical anchor installation involves multiple steps
- multiple steps often result in more errors
- quality is not controllable
- time consuming anchor installation
- additional safety hazards caused by heavy electrical equipment and cables
- increased cases of white finger syndrome caused by vibrating hand-tools

Vibrations can also cause permanent damage to health.

Compared with on-site welding, installing HALFEN Anchor Channels has the following advantages:

- quality controlled components
- requires only simple tools
- no time-consuming on-site welding
- no risk of spark-induced fires damaging installed elements
- no heavy or cumbersome equipment required
- fewer on-site hazards
- efficient, adjustable installation
- galvanized finish offers superior corrosion protection

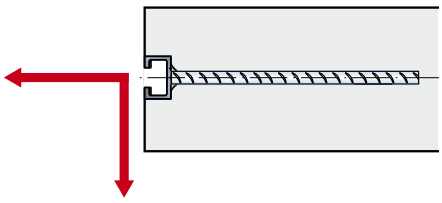
Welding requires moving heavy equipment and also requires a costly energy supply.

Welding can be a fire risk, is slow and also needs to be closely monitored to ensure quality.

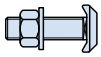
Range of HALFEN Anchor Channels for Curtain Wall Applications

Load application and required HALFEN Anchor Channels

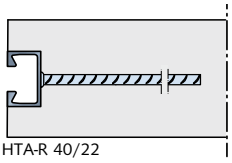
Edge of slab application
HALFEN Anchor Channels with rebar anchors
(See page 9 ff)



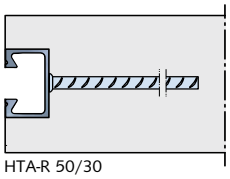
Smooth anchor channels and T-bolts



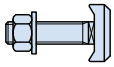
HS 40/22
M12, M16



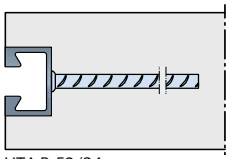
HTA-R 40/22



HTA-R 50/30



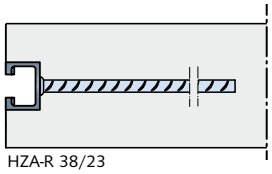
HS 50/30
M12, M16, M20



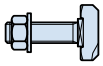
HTA-R 52/34

Toothed anchor channels and toothed T-bolts

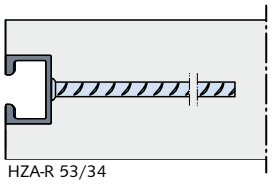
HZS 38/23
M16, M20



HZA-R 38/23

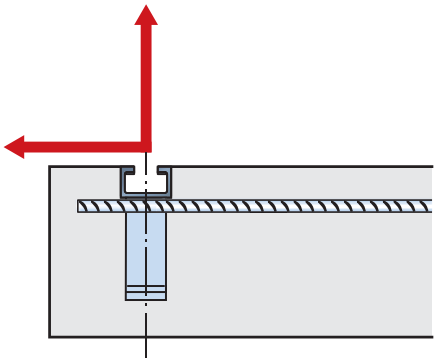


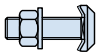
HZS 53/34
M16, M20



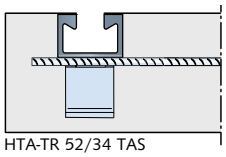
HZA-R 53/34

Top of slab application
HALFEN Anchor Channels with welded I-anchors and rebar anchors (See page 15 ff)

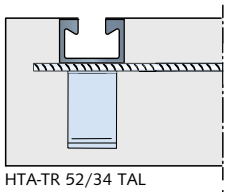




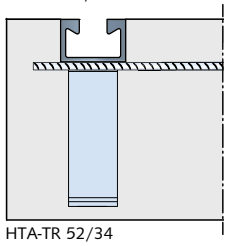
HS 50/30,
M12, M16, M20



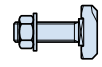
HTA-TR 52/34 TAS



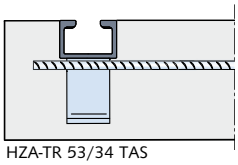
HTA-TR 52/34 TAL



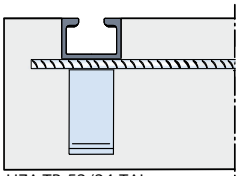
HTA-TR 52/34



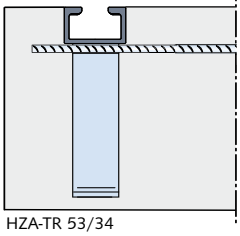
HZS 53/34
M16, M20



HZA-TR 53/34 TAS

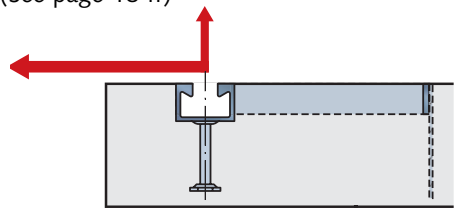


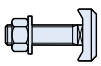
HZA-TR 53/34 TAL



HZA-TR 53/34

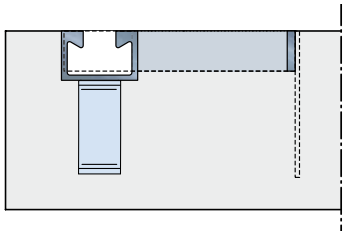
Thin slab conditions with high shear loads and minimal edge distances
HALFEN Anchor Channel (HCW 52/34)
(See page 18 ff)





HS 50/30 M16, M20
grade 8.8

High shear load HALFEN Anchor Channel and T-bolts

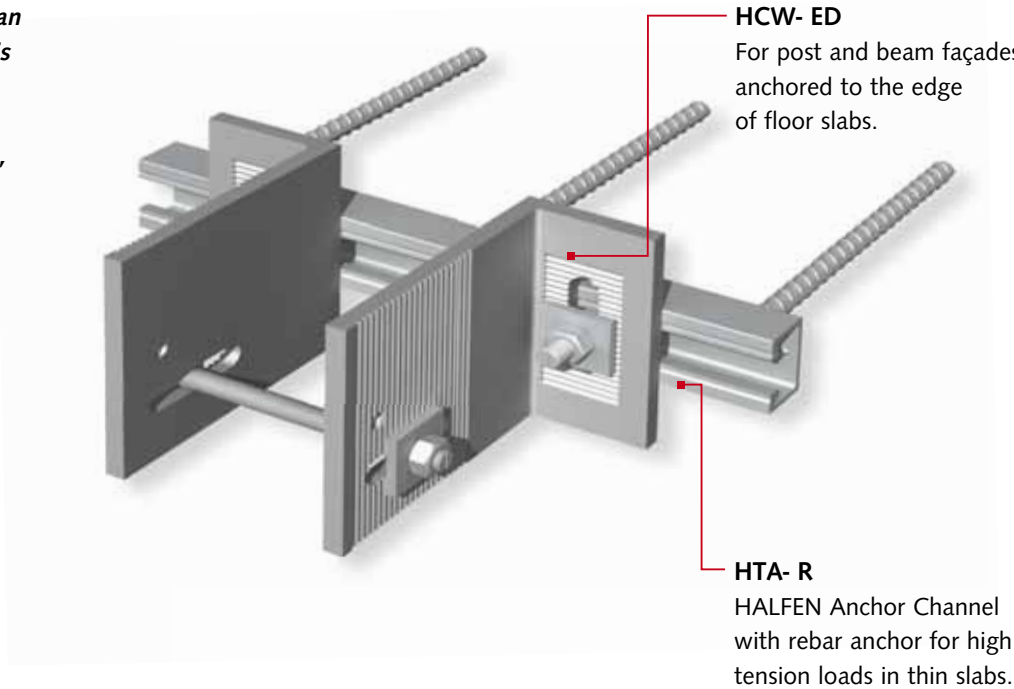


HCW 52/34

HALFEN Anchor Channels and HCW Brackets

Edge of slab connections

Modern buildings require façades of the highest quality that can be installed quickly and safely. This is why the HALFEN Curtain Wall System is chosen more and more frequently by architects, engineers, and investors.



HCW- ED
For post and beam façades. anchored to the edge of floor slabs.

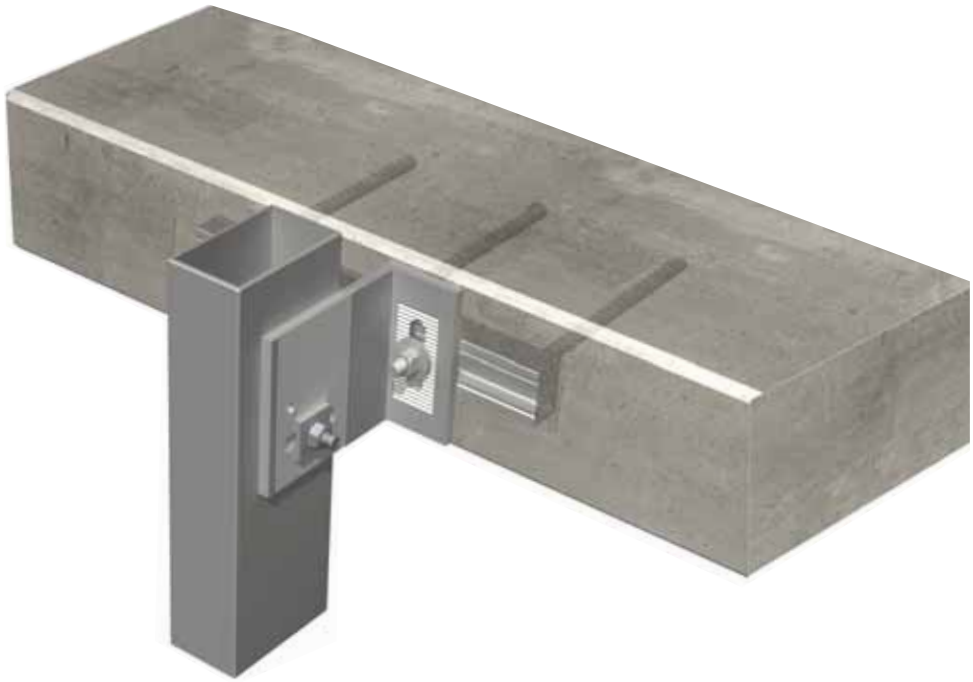
HTA- R
HALFEN Anchor Channel with rebar anchor for high tension loads in thin slabs.

Safe and reliable

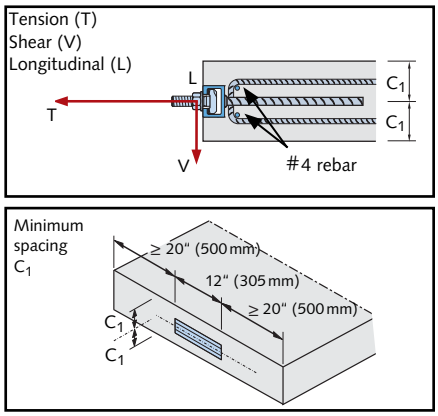
- no damage to the reinforcement
- suitable for use in concrete pressure and tensile stress zones
- suitable for dynamic loads

Quick and economical

- adjustable when used in combination with HALFEN Curtain Wall Brackets
- T-bolts instead of welding
- maximum efficiency when installing matrices and rows
- cost effective installation using standard tools
- optimized pre-planning reduces construction time
- wide range of channels and T-bolts available for various requirements
- no noise, no vibration during installation, therefore, no health hazards



HALFEN Anchor Channel type HTA-R and HZA-R



Concrete strength and safety factor
Allowable loads are valid with a 2.5:1 safety factor in reinforced concrete with a compression strength of 4,000 psi (27.5 N/mm²)

Note: The minimum dimensions in the table apply to reinforced concrete

Please contact our engineering team at engineering@halfenusa.com for corner solutions.

Design criteria	Allowable loads		Applied loads
Tension capacity	$T_{allow.}$	≥	T
Transverse shear capacity	$V_{allow.}$	≥	V
Longitudinal shear capacity	$L_{allow.}$	≥	L
	Allowable max. F	≥	$\sqrt{T^2+V^2+L^2}$

Two types of hot-rolled HALFEN Anchor Channel profiles are available;

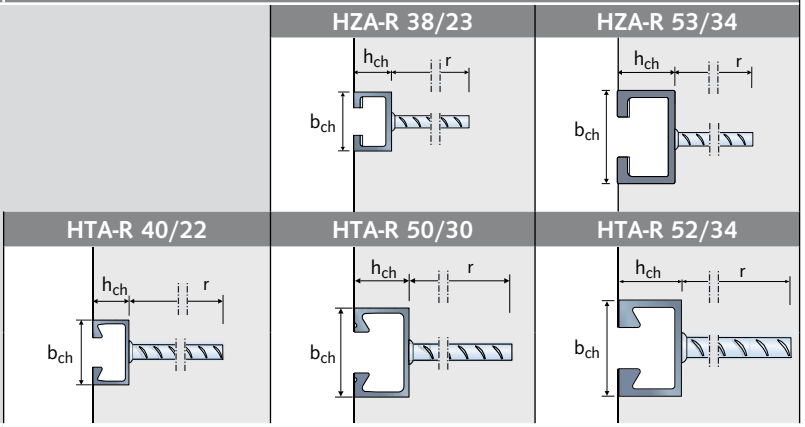
- HTA Anchor Channels with plain lips
- HZA Dynagrip® Anchor Channels with toothed lips

Both profiles are able to support tension (T) and transverse shear loads (V). The HZA toothed profile is also able to support significant longitudinal shear loads (L).

Channel dimensions

Channel type		b_{ch}	h_{ch}	r	bar #
*HTA-R 40/22	inch	1 9/16	7/8	14	#4 (12 mm)
	mm	40	22	356	
*HTA-R 50/30	inch	1 15/16	1 3/16	14	
	mm	50	30	356	
**HZA-R 38/23	inch	1 1/2	7/8	14	
	mm	38	23	356	
*HTA-R 52/34	inch	2 1/32	1 5/16	17	#5 (16 mm)
	mm	52	34	432	
**HZA-R 53/34	inch	2 1/16	1 5/16	17	
	mm	53	34	432	

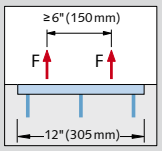
* HTA = standard profiles
** HZA = toothed profiles



Load data

C_1		Allowable max. F = max $T_{allow.}$		
≥ 2"	≥ 50 mm	2× 1,460 lbs (6.5 kN)	2× 2,250 lbs (10 kN)	2× 3,930 lbs (17.5 kN)
C_1		allowable max. transverse shear – max. V_{allow}		
≥ 2"	≥ 50 mm	2×385 lbs (1.7 kN)		
≥ 2 1/4"	≥ 60 mm	2×590 lbs (2.6 kN)		
≥ 2 3/4"	≥ 70 mm	2×780 lbs (3.5 kN)		
≥ 3"	≥ 75 mm	2×900 lbs (4.0 kN)		
C_1		**allowable max. longitudinal shear – max. L_{allow} **(only for HZA-R)**		
≥ 2"	≥ 50 mm	–	2×1,169 lbs (5.2 kN)	2× 1,394 lbs (6.2 kN)
≥ 3"	≥ 75 mm	–	2×2,158 lbs (9.6 kN)	2×2,563 lbs (11.4 kN)

12" (305 mm) 3 anchors



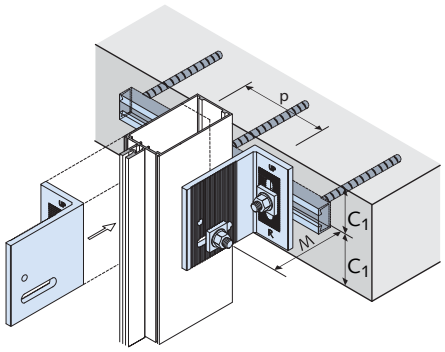
Notes: See pages 30 and 31 for T-bolt information and torque values.

HCW-ED Brackets for dead and wind loads

HALFEN HCW-ED Brackets are designed to support both vertical and horizontal loads.

The bracket connections are designed to be easily adjustable. T-bolts M12 (½") grade 8.8 connections are required for the mullion and anchor channel. Pilot holes are also provided in the bracket if it is preferred to temporarily position the bracket prior to drilling the mullion for the main connection.

The brackets are manufactured from high strength aluminum.
HCW-ED Brackets are marked 'R' (right) and 'L' (left) with 'UP' at the top.
Care should be taken to orientate the brackets correctly to avoid overloading the connections.



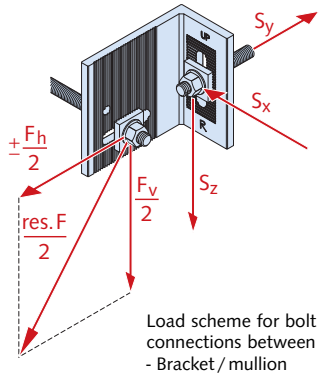
Curtain wall connection using HALFEN HCW-ED Brackets for dead loads and wind loads

Forces acting on the T-bolt at the channel (Bracket HCW-ED)

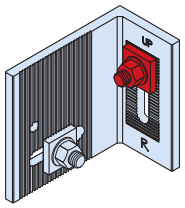
Bracket type	dead load $S_i = (F_v/2) \times s_i$			wind load $S_i = (F_h/2) \times s_i$			combined load 45° $S_i = (\text{res. } F/2) \times s_i$		
	s_x	s_y	s_z	s_x	s_y	s_z	s_x	s_y	s_z
② Top position fixing T-bolt (position 1)									
HCW-ED 1	0.6	1.3	-1.0	-1.0	3.6	0.0	-0.3	3.4	-0.7
HCW-ED 2	0.6	1.6	-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 Bottom position fixing T-bolt (position 3)									
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

① ② See page 12 for calculation example

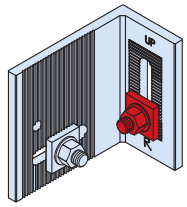
Calculation basis



Load scheme for bolt connections between
- Bracket / mullion
- Bracket / HALFEN Channel

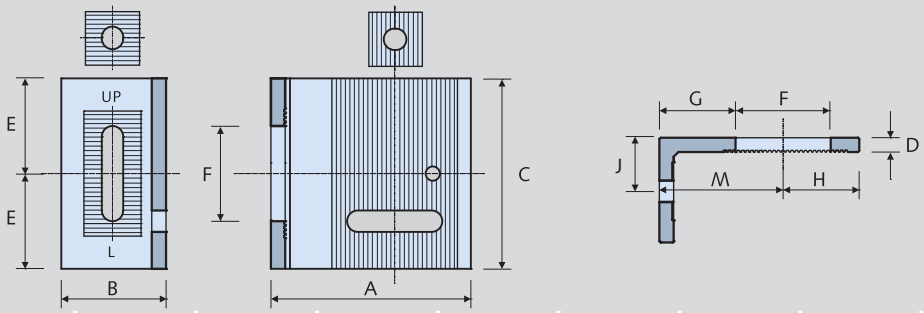


② Top position of fixing T-bolt (position 1)



① Bottom position of fixing T-bolt (position 3)

Dimensions — HCW-ED Brackets for wind and dead loads



serrated washers included

	A		B		C		D		E		F		G		H		J		M	
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
HCW-ED 1 small	4 ¼"	108	2 ¾"	70	4 ½"	114	⅜"	9.5	2 ¼"	57	2 ½"	64	1"	25	2"	51	1 13/32"	36	2 ¼"	57
HCW-ED 2 medium	5 ¼"	133	2 ¾"	70	5"	127	⅜"	9.5	2 ½"	64	2 ½"	64	2"	51	2"	51	1 13/32"	36	3 ¼"	82
HCW-ED 3 large	6 ¼"	159	2 ¾"	70	5 ½"	140	⅜"	9.5	2 ¾"	70	2 ½"	64	3"	76	2"	51	1 13/32"	36	4 ¼"	108

Calculation example

Given: slab thickness = 8" (200 mm); width of mullion = 3 ¼" (80 mm)
projection a = 3 ¼" (80 mm) – illustration below
working dead load F_v = +583 lbs (2.59 kN)
working wind load F_h = +1050 lbs (4.67 kN)

Selected: HALFEN Bracket type HCW-ED 2
possible projection M = 3 ¼" (82 mm) ± 1" (25 mm) ✓ OK
interaction diagram for HCW-ED 2 (see page 13) proves that the given load is within the permitted load interaction area ✓ OK

Calculation loads at each HALFEN T-bolt (see page 11)
① bottom position of T-bolt (position 3)

Sx = (583/2) × 0.5 + (1050/2) × (-0.5) = -116.8 lbs (-0.50 kN)
Sy = (583/2) × 3.6 + (1050/2) × 1.0 = +1574.4 lbs (7.0 kN)
Sz = (583/2) × (-1.0) + 0 = -291.5 lbs (-1.3 kN)

⇒ resultant load on each T-bolt

$$res.S = \sqrt{(-116.8)^2 + (1574.4)^2 + (-291.5)^2} = 1605 \text{ lbs } (7.2 \text{ kN})$$

② top position of T-bolt (position 1)

Sx = (583/2) × 0.6 + (1050/2) × (-0.5) = -87.6 lbs (-0.4 kN)
Sy = (583/2) × 1.6 + (1050/2) × 3.1 = +2094 lbs (+9.3 kN)
Sz = (583/2) × (-1.0) + 0 = -291.5 lbs (-1.3 kN)

resultant load on each T-bolt

$$res.S = \sqrt{(87.6)^2 + (2094)^2 + (291.5)^2} = 2216 \text{ lbs } (9.9 \text{ kN})$$

Selected channel:

HTA-R 50/30 - 305 - 3 anchors - (see page 10)

Channel $V_{allow.}$ ($C_1 \geq 75$ mm) = 2 × 900 lbs > 2 × Sz = 2 × 291.5 lbs ✓ OK
Channel $F_{allow.}$ = 2 × 2250 lbs > 2 × res. S = 2 × 2116 lbs ✓ OK

Selected T-bolt:

HS 50/30 - T-bolt M12 (1/2") grade 8.8 - (see page 30)

$T_{allow.}$ = 6070 lbs
$V_{allow.}$ = 3642 lbs

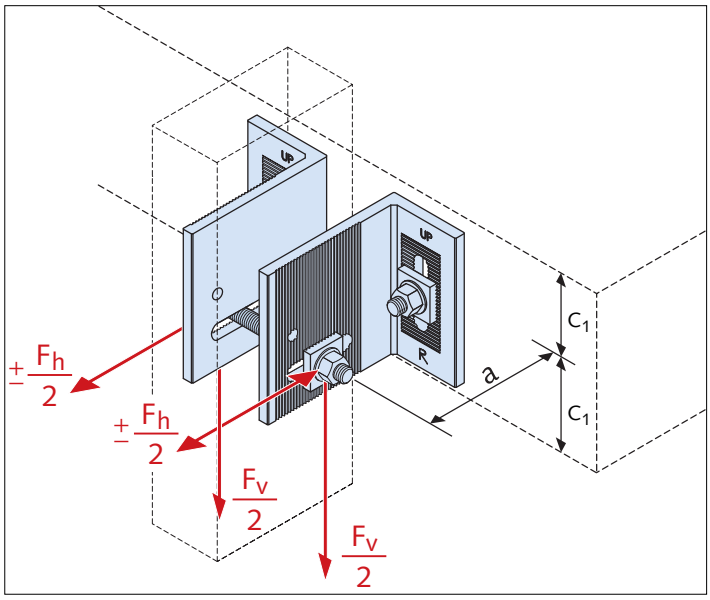
actual T = S_y = 2094 lbs
actual V = $\sqrt{Sx^2 + Sz^2} = \sqrt{(87.6)^2 + (291.5)^2}$ = 304 lbs

$(T/T_{allow.}) \leq 1$; (2094/6070) = 0.35 < 1 ✓ OK
$(V/V_{allow.}) \leq 1$; (304/3642) = 0.08 < 1 ✓ OK

$(T/T_{allow})^2 + (V/V_{allow.})^2 \leq 1$
$(0.35)^2 + (0.08)^2 = 0.13 < 1$ ✓ OK

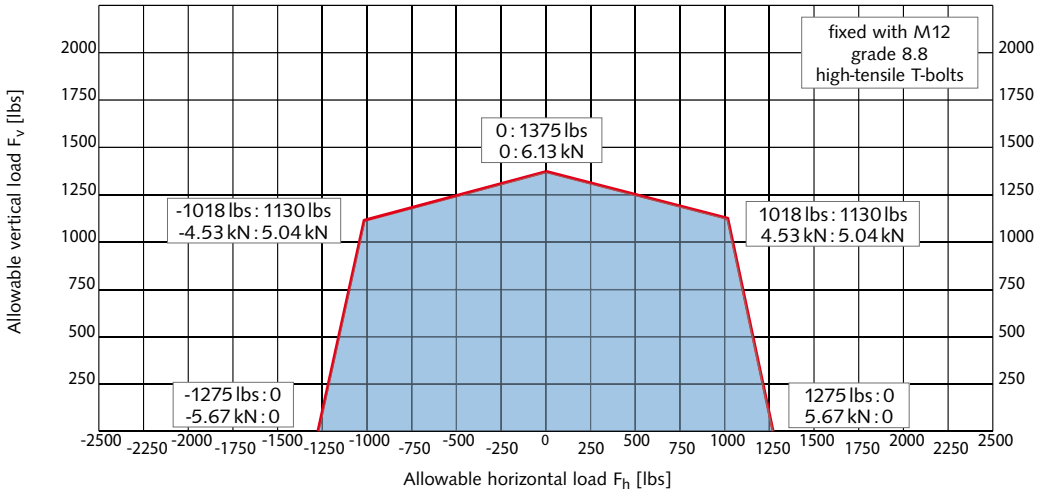
Check: T-bolt spacing
p = 80 + (2 × 36) = 152 mm > 150 mm ✓ OK

Calculation basis



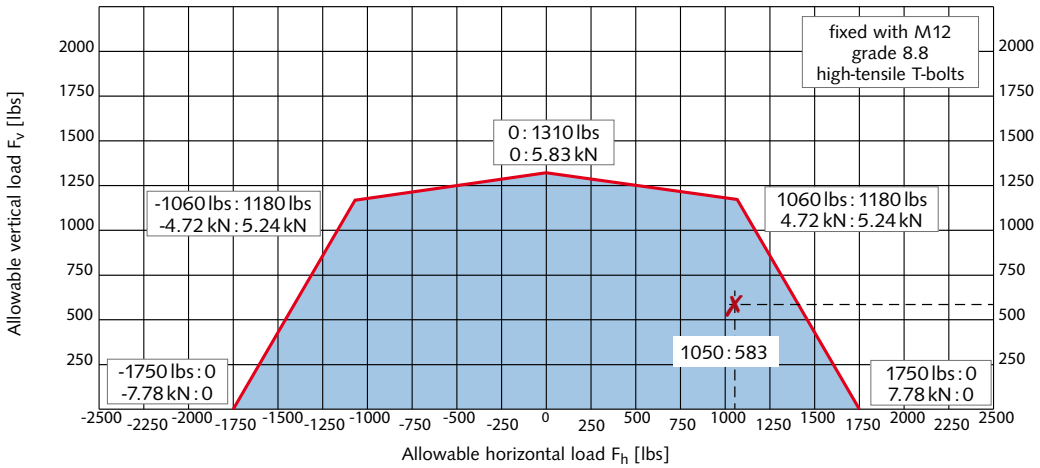
Edge of Slab Brackets HCW-ED

Interaction diagram type HCW-ED1 (small)

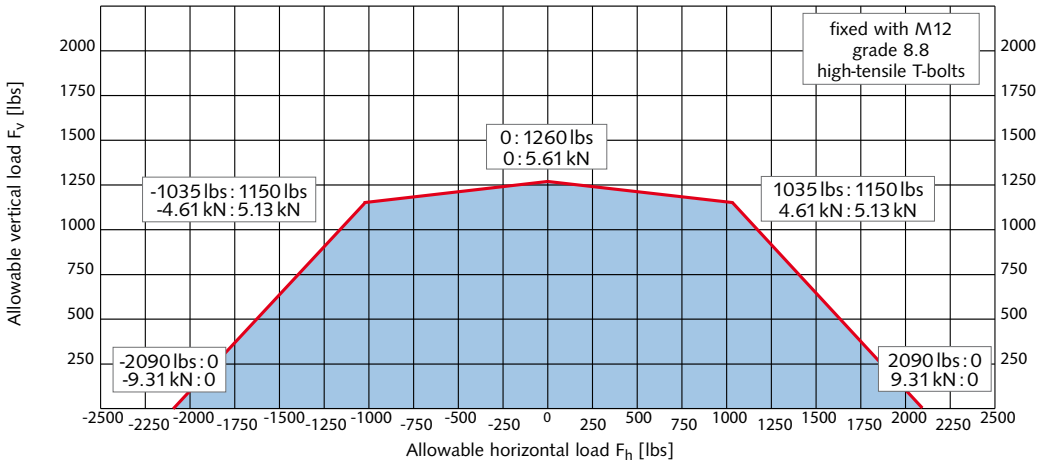


The blue areas show the allowable interaction of vertical and horizontal loads distributed equally between one pair of HCW-ED Brackets.
Each side of the bracket pair will support half of the load.

Interaction diagram type HCW-ED2 (medium)



Interaction diagram type HCW-ED3 (large)



HALFEN Bracket HCW-EW for wind loads

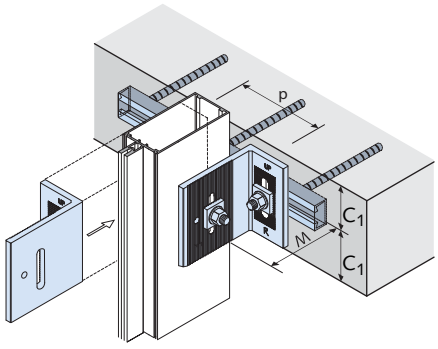
HCW-EW Brackets are designed to support only wind load.

Max. applied working load F_h				
Size	Bracket code	max. F_v*	max. F_h [lbs]	[kN]
small	**HCW-EW 1**	0	±1,274	± 5.67
medium	**HCW-EW 2**	0	±1,749	± 7.78
large	**HCW-EW 3**	0	±2,092	± 9.31
*Note: HCW-EW Brackets are for wind loads only				

To calculate the reaction force on the HALFEN T-bolt in the connection between the HALFEN HCW Curtain Wall Bracket and the HALFEN Anchor Channel, the working load F_h at the connection between the curtain wall bracket and façade mullion has to be multiplied with the factors s_x and s_y.

These factors depend on:
- the load direction
- the bracket geometry
- the T-bolt position
  (see illustrations on the right)

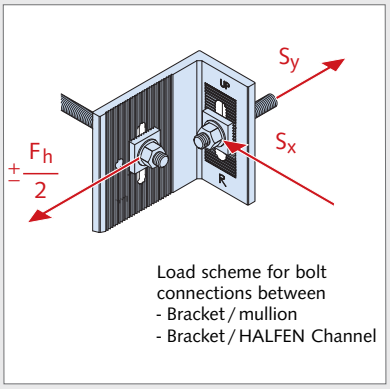
The multiplication factors to calculate the forces on the T-bolt can be found in the following table.



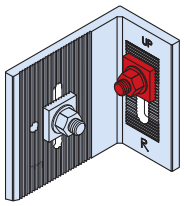
Low-friction Nylatron shims are available for wind load brackets

Position of fixing T-bolt		① Bottom position 3		② Top position 1	
Bracket type		wind load $S_i = (F_h/2) \times s_i$		wind load $S_i = (F_h/2) \times s_i$	
Size	Bracket code	s_x	s_y	s_x	s_y
small	HCW-EW 1	-1.0	1.0	-1.0	3.6
medium	HCW-EW 2	-0.5	1.0	-0.5	3.1
large	HCW-EW 3	-0.4	1.0	-0.4	2.9

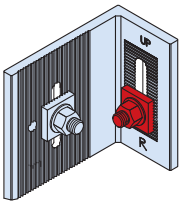
Calculation basis



Load scheme for bolt connections between
- Bracket / mullion
- Bracket / HALFEN Channel

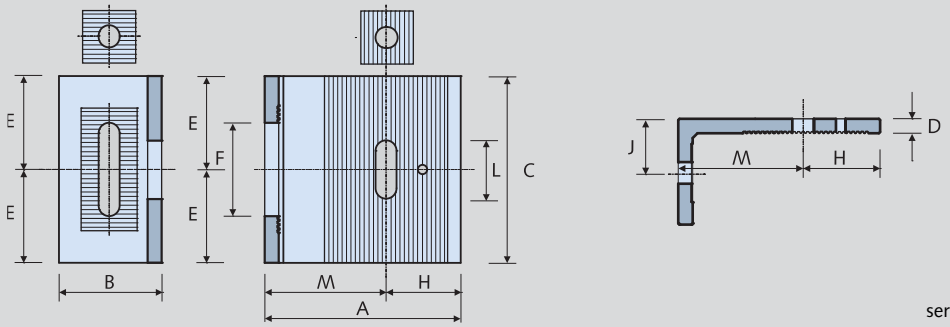


② Top position of fixing T-bolt (position 1)



① Bottom position of fixing T-bolt (position 3)

Dimensions — HCW-EW Brackets, only for wind loads



serrated washers included

	A		B		C		D		E		F		H		J		L		M	
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
HCW-EW 1 small	4 ¼"	108	2 ¾"	70	4 ½"	114	⅜"	9.5	2 ¼"	57	2 ½"	64	2"	51	1 13/32"	36	1 9/16"	40	2 ¼"	57
HCW-EW 2 medium	5 ¼"	133	2 ¾"	70	5"	127	⅜"	9.5	2 ½"	64	2 ½"	64	2"	51	1 13/32"	36	1 9/16"	40	3 ¼"	82
HCW-EW 3 large	6 ¼"	159	2 ¾"	70	5 ½"	140	⅜"	9.5	2 ¾"	70	2 ½"	64	2"	51	1 13/32"	36	1 9/16"	40	4 ¼"	108

HALFEN Anchor Channels and HCW Brackets

Top of slab connections

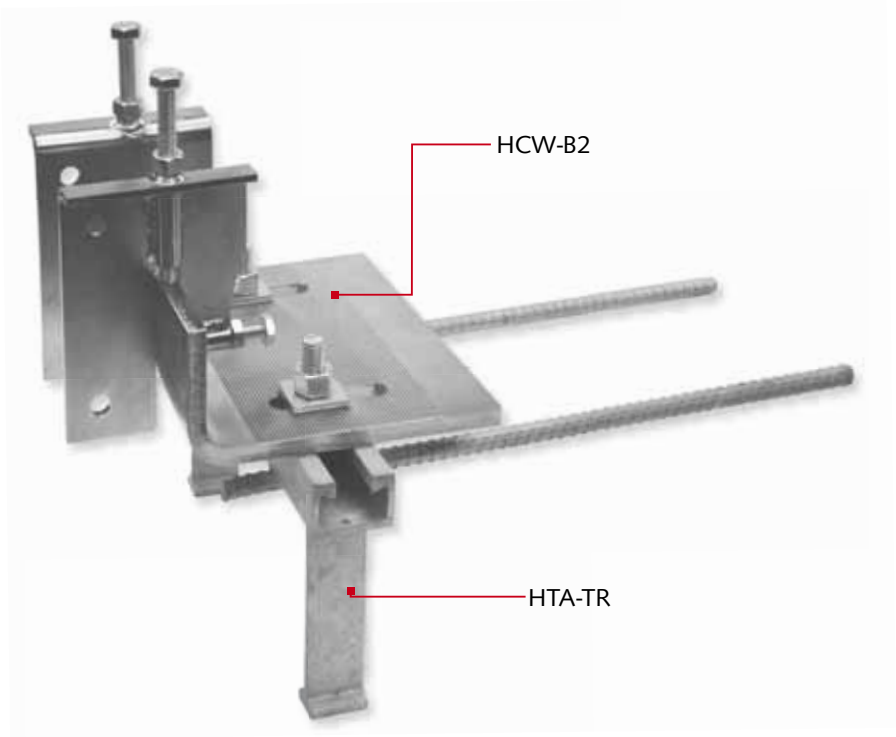
Modern buildings require façades of the highest quality that can be installed quickly and safely. This is why the HALFEN Curtain Wall System is chosen more and more frequently by architects, engineers, and investors.

Safe and reliable

- HTA-TR special embeds for the special requirements of top of slab connections (not suitable for longitudinal loads)
- HZA-TR special embeds are used if additional loads in longitudinal direction are present
- capacities based on independent testing

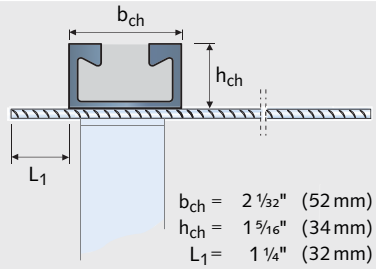
Quick and economical

- cost effective installation using standard tools
- adjustable in all three planes when used with HALFEN Curtain Wall Brackets
- T-bolts instead of welding
- no damage to the reinforcement
- no on-site welding required



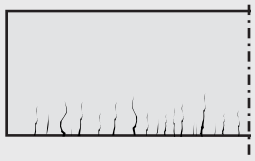
HALFEN HTA-TR Anchor Channels — dimensions and load data

Dimensions HTA-TR 52/34



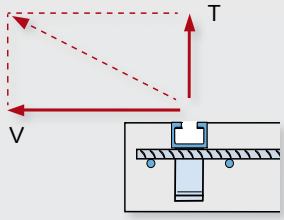
b_{ch} = 2 1/32" (52 mm)
h_{ch} = 1 5/16" (34 mm)
L_1 = 1 1/4" (32 mm)
rebar #4 (12 mm)
rebar length = (458)

Cracked concrete



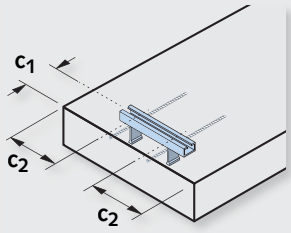
All load capacities assume cracked concrete, for uncracked concrete the capacities can be increased by the following factors:
Increasement factor shear: $\psi_{c,v}$ = 1.40
Increasement factors tension: $\psi_{c,t}$ = 1.25

Loads



$$\left[\frac{T}{T_{allow.}}\right]^{5/3} + \left[\frac{V}{V_{allow.}}\right]^{5/3} \le 1.0$$

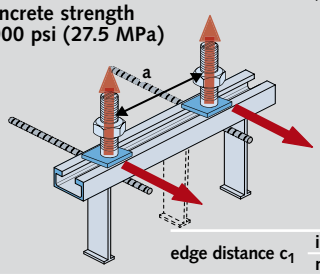
Edge distance

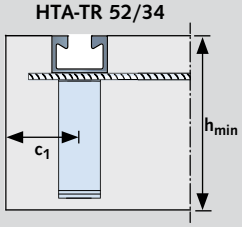


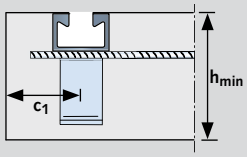
Edge distance first anchor
$c_2 \ge 10"$

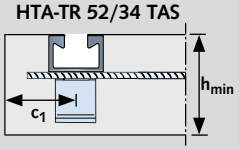
Concrete capacity

*Allowable loads for normal concrete, concrete strength 4000 psi (27.5 MPa)







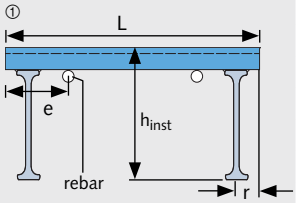


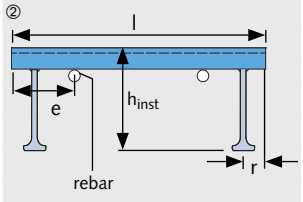
edge distance c_1		HTA-TR 52/34				HTA-TR 52/34 TAL				HTA-TR 52/34 TAS				Steel capacity
		h_{min} = 7 3/8" (187mm)				h_{min} = 6" (152mm)				h_{min} = 4 3/4" (121 mm)				
	inch	2 1/4"	3"	4"	6"	2 1/4"	3"	4"	6"	2 1/4"	3"	4"	6"	steel failure all types
	mm	58	75	100	150	58	75	100	150	58	75	100	150	
T-bolt distance a ≥ 4" (100 mm)														
*Allowable tension load $T_{allow.}$	lbs	2× 2,608	3,035	3,507	4,294	1,843	2,158	2,495	3,057	1,281	1,484	1,731	2,113	4,512
	kN	2× 11.6	13.5	15.6	19.1	8.2	9.6	11.1	13.6	5.7	6.6	7.7	9.4	20.0
*Allowable shear load $V_{allow.}$	lbs	2× 2,248	2,698	3,214	4,271	1,911	2,428	3,012	4,226	1,596	2,248	2,810	4,159	4,512
	kN	2× 10.0	12.0	14.3	19.0	8.5	10.8	13.4	18.8	7.1	10.0	12.5	18.5	20.0

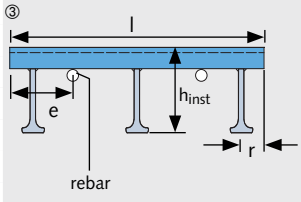
Anchor channel dimensions

	inch	mm
L	12"	305
r	1 1/4"	32
e	3"	76
rebar size	#4	12

overall anchor channel height $h_{inst.}$	inch	mm
①	6 3/8"	162
②	5"	127
③	3 3/4"	95







*concrete capacities can be adapted for different concrete strengths up to 5000 psi with a factor of $\sqrt{\frac{f_c}{4000}}$, allowable capacity may be limited by steel capacity.

For sand-lightweight concrete, capacities have to be reduced with factor λ = 0.85. $\left(0.85\sqrt{\frac{f_c}{4000}}\right)$. In all cases the values are limited by the steel capacity.

Calculation example

Given:

Slab Thickness:	6 1/2" (165 mm)
Concrete strength:	f_c = 3,500 psi
T-bolt spacing:	5" (127 mm)
Edge distance:	c_1 = 3" (76 mm)
Tension Load (from dead load):	2 × 1,250 lbs
Horizontal load (from wind):	2 × 1,550 lbs

Calculation:

Selected: **HALFEN HTA-TR 52/34 TAL** for slab thickness 6" ≤ h < 7 3/8".

$T_{allow,\,4000}$ = 2,158 lbs*

$T_{allow,\,3500}$ = 2,158 lbs × $\sqrt{\frac{3,500}{4,000}}$ = 2,019 lbs < 4,512 lbs

$V_{allow,\,4000}$ = 2,428 lbs*

$V_{allow,\,3500}$ = 2,428 lbs × $\sqrt{\frac{3,500}{4,000}}$ = 2,271 lbs < 4,512 lbs

Proof:

Tension: $\frac{T}{T_{allow.}} = \frac{1,250}{2,019} = 0.62 \le 1.0$

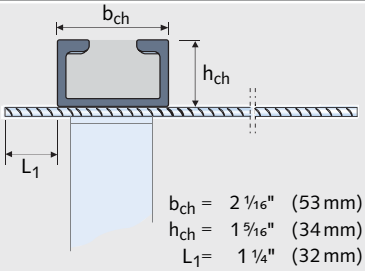
Shear: $\frac{V}{V_{allow.}} = \frac{1,550}{2,271} = 0.68 \le 1.0$

Interaction: $\left[\frac{1,250}{2,019}\right]^{5/3} + \left[\frac{1,550}{2,271}\right]^{5/3} = 0.98 \le 1.0$

* from table above for HTA-TR 52/34 TAL with c_1 = 3"

HALFEN HZA-TR Anchor Channels — dimensions and load data

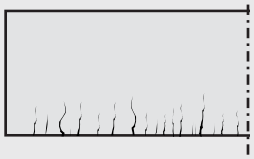
Dimensions HZA-TR 53/34



b_{ch} =	2 1/16"	(53 mm)
h_{ch} =	1 5/16"	(34 mm)
L_1 =	1 1/4"	(32 mm)
rebar	#4	(12 mm)

rebar length =(458)

Cracked concrete

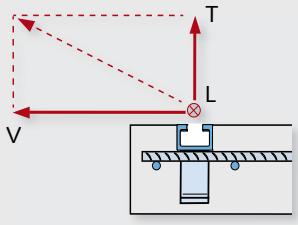


All load capacities assume cracked concrete, for uncracked concrete the capacities can be increased by the following factors:

Increasement factor shear: $\psi_{c,v} = 1.40$

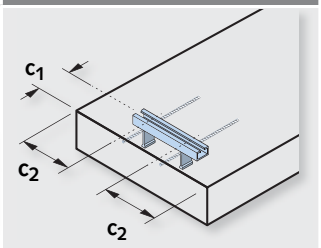
Increasement factors tension: $\psi_{c,t} = 1.25$

Loads



$$\left[\frac{T}{T_{allow.}}\right]^{5/3}+\left[\frac{V}{V_{allow.}}\right]^{5/3}+\left[\frac{L}{L_{allow.}}\right]^{5/3}\le 1.0$$

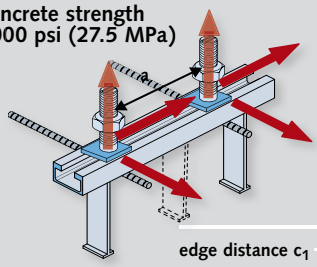
Edge distance

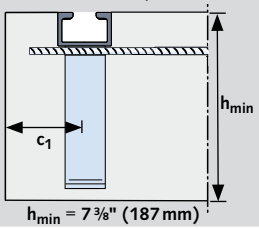


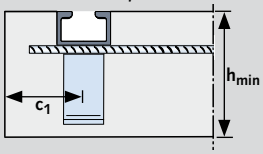
Edge distance first anchor $c_2 \ge 20"$

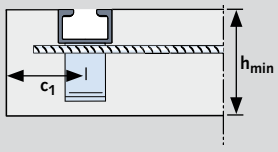
Concrete capacity

***Allowable loads for normal concrete, concrete strength 4000 psi (27.5 MPa)**







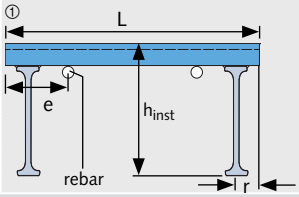


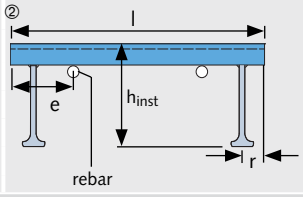
edge distance c_1		HZA-TR 53/34 h_{min} = 7 3/8" (187 mm)				HZA-TR 53/34 TAL h_{min} = 6" (152 mm)				HZA-TR 53/34 TAS h_{min} = 4 3/4" (121 mm)				Steel capacity
	inch	2 1/4"	3"	4"	6"	2 1/4"	3"	4"	6"	2 1/4"	3"	4"	6"	steel failure all types
	mm	58	75	100	150	58	75	100	150	58	75	100	150	
T-bolt distance a = 6" (150 mm)														
*Allowable tension load $T_{allow.}$	lbs	2,698	3,170	3,641	4,473	1,933	2,271	2,630	3,215	1,304	1,506	1,754	2,136	4,157
	kN	12.0	14.1	16.2	19.9	8.6	10.1	11.7	14.3	5.8	6.7	7.8	9.5	18.5
*Allowable shear load $V_{allow.}$	lbs	2,023	2,427	2,900	3,844	1,731	2,181	2,720	3,799	1,439	2,023	2,540	3,754	4,157
	kN	9.0	10.8	12.9	17.1	7.7	9.7	12.1	16.9	6.4	9.0	11.3	16.7	18.5
*Allowable longitudinal load $L_{allow.}$	lbs	1,664	2,630	3,641	5,395	1,574	2,495	3,462	4,586	1,484	2,360	2,923	3,754	4,157
	kN	7.4	11.7	16.2	24.0	7.0	11.1	15.4	20.4	6.6	10.5	13.0	16.7	18.5
T-bolt distance a = 5" (125 mm)														
*Allowable tension load $T_{allow.}$	lbs	2,653	3,102	3,574	4,384	1,911	2,226	2,562	3,124	1,281	1,506	1,754	2,113	3,988
	kN	11.8	13.8	15.9	19.5	8.5	9.9	11.4	13.9	5.7	6.7	7.8	9.4	17.7
*Allowable shear load $V_{allow.}$	lbs	2,023	2,427	2,900	3,844	1,731	2,181	2,720	3,799	1,439	2,023	2,540	3,754	3,988
	kN	9.0	10.8	12.9	17.1	7.7	9.7	12.1	16.9	6.4	9.0	11.3	16.7	17.7
*Allowable longitudinal load $L_{allow.}$	lbs	1,664	2,630	3,641	5,395	1,574	2,495	3,462	4,586	1,484	2,360	2,923	3,754	3,988
	kN	7.4	11.7	16.2	24.0	7.0	11.1	15.4	20.4	6.6	10.5	13.0	16.7	17.7
T-bolt distance a = 4" (100 mm)														
*Allowable tension load $T_{allow.}$	lbs	2,608	3,035	3,507	4,294	1,843	2,158	2,495	3,057	1,281	1,486	1,731	2,113	3,822
	kN	11.6	13.5	15.6	19.1	8.2	9.6	11.1	13.6	5.7	6.6	7.7	9.4	17.0
*Allowable shear load $V_{allow.}$	lbs	2,023	2,427	2,900	3,844	1,731	2,181	2,720	3,799	1,439	2,023	2,540	3,754	3,822
	kN	9.0	10.8	12.9	17.1	7.7	9.7	12.1	16.9	6.4	9.0	11.3	16.7	17.0
*Allowable longitudinal load $L_{allow.}$	lbs	1,664	2,630	3,641	5,395	1,574	2,495	3,462	4,586	1,484	2,360	2,923	3,754	3,822
	kN	7.4	11.7	16.2	24.0	7.0	11.1	15.4	20.4	6.6	10.5	13.0	16.7	17.0

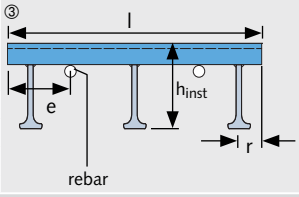
Anchor channel dimensions

	inch	mm
L	12"	305
r	1 1/4"	32
e	3"	76
rebar size	#4	12

overall anchor channel height $h_{inst.}$		
	inch	mm
①	6 3/8"	162
②	5"	127
③	3 3/4"	95



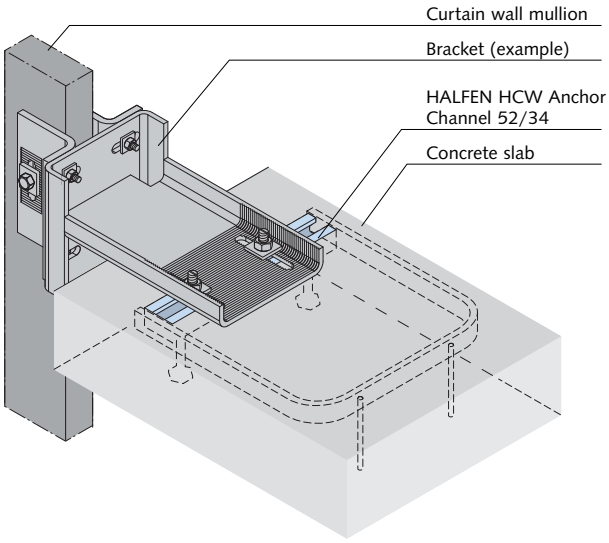




*concrete capacities can be adapted for different concrete strengths up to 5000 psi with a factor of $\sqrt{\frac{fc}{4000}}$, allowable capacity may be limited by steel capacity.

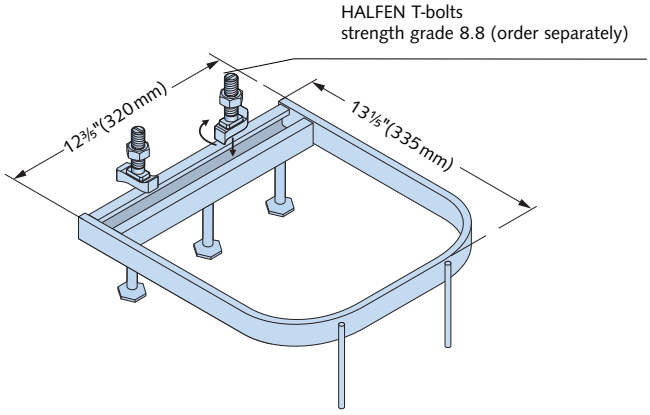
For sand-lightweight concrete, capacities have to be reduced with factor $\lambda = 0.85$. $\left(0.85\sqrt{\frac{fc}{4000}}\right)$. In all cases the values are limited by the steel capacity.

HALFEN Anchor Channel HCW 52/34

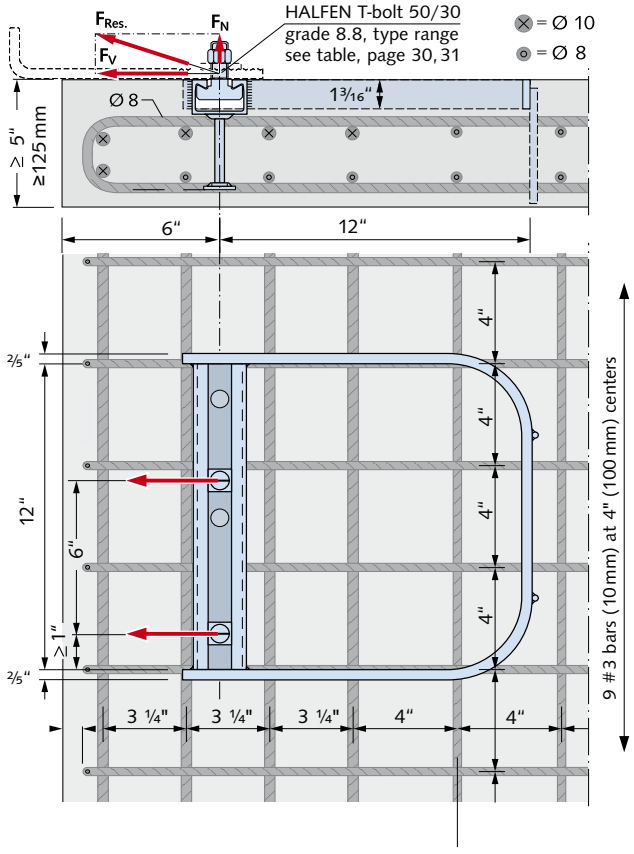


Product code: HCW 52/34

Material: W1.0038, hot-dip galvanized

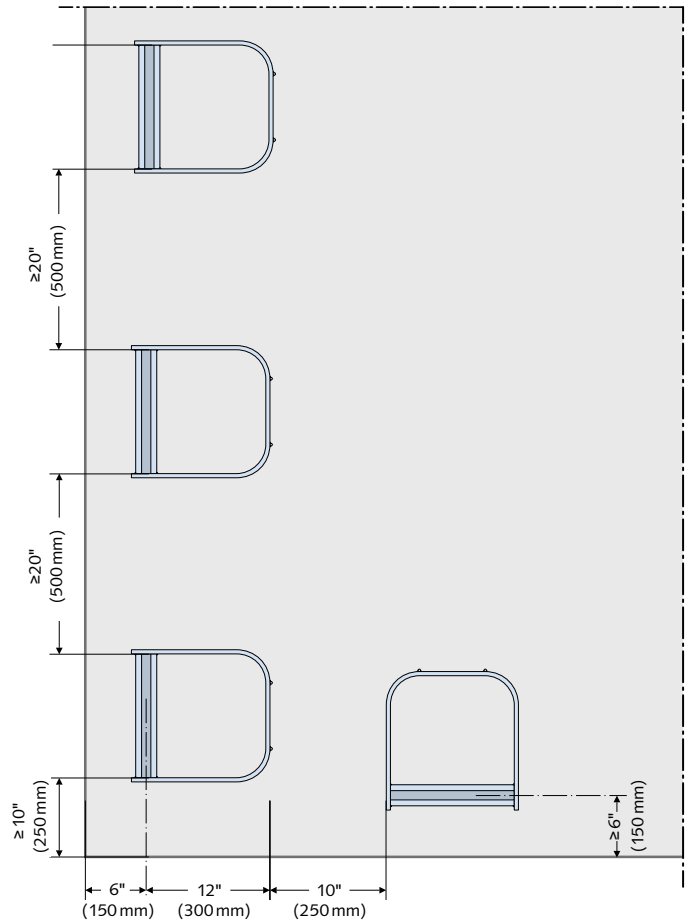


Reinforcement requirements



Loads should be evenly distributed into the channel using two T-bolts.

Channel dimensions and layout



HALFEN Anchor Channel HCW 52/34 – Load data

A series of three tests produced the following average ultimate loads:

$F_{V\ ultimate}$	= 31,990 lbs (142.3 kN)
$F_{N\ ultimate}$	= 10,665 lbs (47.4 kN)
$F_{result.\ ultimate} = \sqrt{F_N^2 + F_V^2}$	= 33,720 lbs (150.0 kN)

The adjacent load deformation diagram can 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.
- A concrete slab 5" (125 mm) thick and reinforced according to the diagram on the previous page.
- Concrete compression strength ≥ 2,900 psi (20/25 N/mm² (cylinder/cube) with normal weight aggregate.
- Load equally distributed to the channel via two HALFEN HS 50/30 T-bolts M20 grade 8.8 spaced at 6" (150 mm) centers.

A typical calculation method is shown below.
The factors used in the calculation example are only an example. Actual factors used on a project basis must be checked according to local or national building regulations. These calculations also make no allowance for load increase due to load eccentricities. These must be included according to the project design of the connection.
Contact us if further information and help is required here.
Calculation example: Assumed safety factor 3 applied to the ultimate test load.

Ultimate test load: $F_{Result.\ ultimate}$ = 33,720 lbs (150.0 kN)
⇒ $F_{V\ ultimate}$ = 31,990 lbs (142.3 kN)
⇒ $F_{N\ ultimate}$ = 10,665 lbs (47.4 kN)

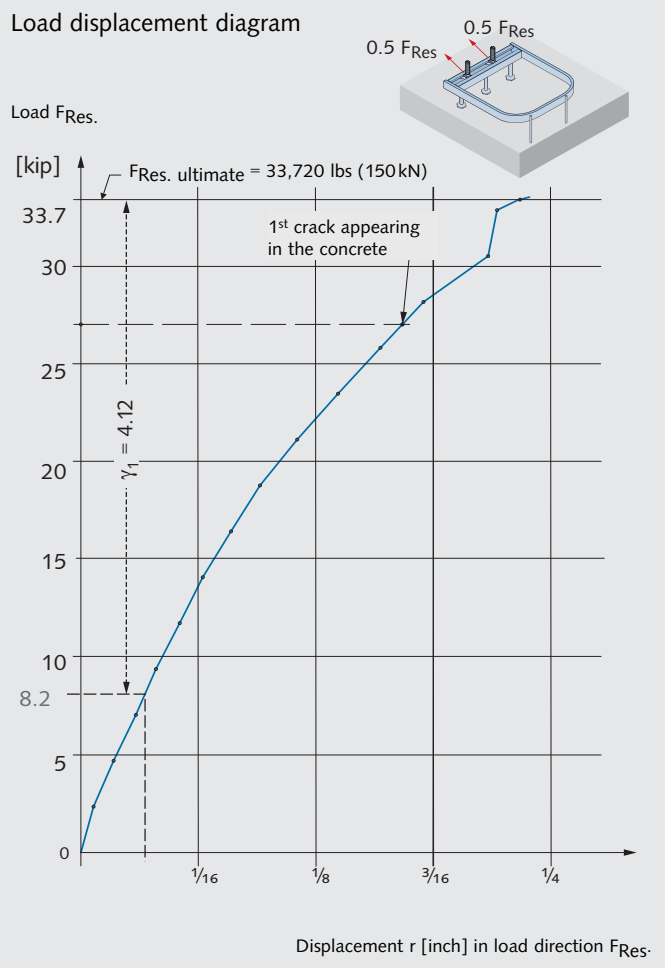
Required working loads: $F_{V\ work.}$ = 7,868 lbs (35 kN), $F_{N\ work.}$ = 2,248 lbs (10 kN)

Allowable load at 3:1 safety factor:
$F_{Result.\ allowable}$ = 11,240 lbs 50.0 kN
⇒ $F_{V\ allowable}$ = 10,663 lbs 47.4 kN
⇒ $F_{N\ allowable}$ = 3,555 lbs 15.8 kN

Checking $F_{V\ work.}$ = 7,868 lbs (35 kN) < 10,663 lbs (47.4 kN) ✓ OK
Checking $F_{N\ work.}$ = 2,248 lbs (10 kN) < 3,555 lbs (15.8 kN) ✓ OK
Checking $F_{Result.\ work.} = \sqrt{(7{,}868)^2 + (2{,}248)^2}$ = 8,182 lbs (36,4 kN)
< 11,240 lbs (50 kN) ✓ OK

Displacement at working load < 0.04" (< 1 mm) (see diagram).

Actual safety factor to ultimate test load: γ_1 = (33,720 / 8,182) = 4.12



Fastener information

Depending on the load size, we recommend the use of HALFEN T-bolts HS 50/30 M16 or M20, grade 8.8 in combination with HALFEN Anchor Channel HCW 52/34. The T-bolts listed below are zinc galvanized with a special coating.

For interior use this design is considered equivalent to a hot-dip galvanized design. Other T-bolt sizes and materials can be supplied. Please contact us for detailed information. HALFEN contact information can be found on page 36.

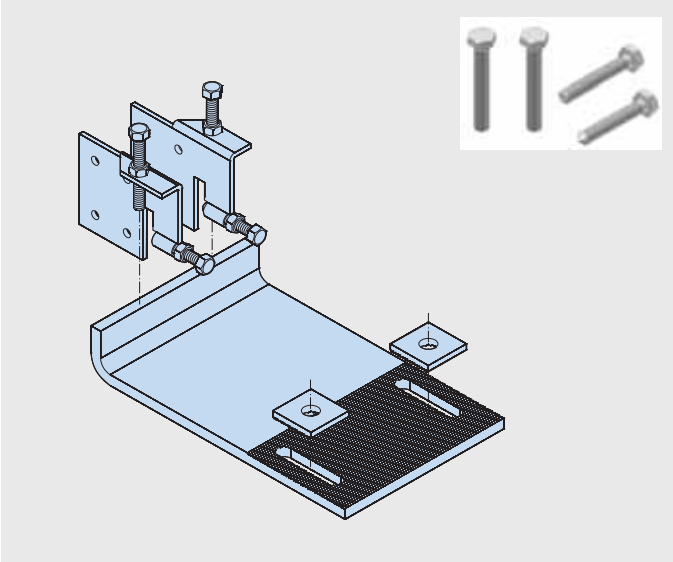
Type selection HALFEN T-bolts HS 50/30 grade 8.8

Thread size	Available lengths L		Bolt load allow. tension		Bolt load allow. shear		Allowable bending moment		Recommended initial torque	
	[inch]	[mm]	[lbs]	[kN]	[lbs]	[kN]	[ft.lbs]	[Nm]	[ft.lbs]	[Nm]
M 16 (⅝")	1 ½" 2 ⅜"	40 60	11,294	50.2	6,777	30.2	81.9	111	45	60
M 20 (¾")	3 ¼" 4"	80 100	17,625	78.4	10,575	47.0	159.3	216	90	120

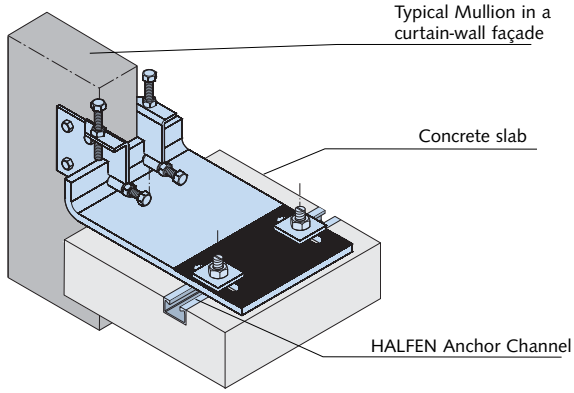
The capacity of the T-bolts should be checked for allowable bending moment if slotted holes are used in the bracket to achieve tolerance transverse to the channel.

Top of Slab Brackets Type HCW-B1

Support bracket for horizontal and vertical loads

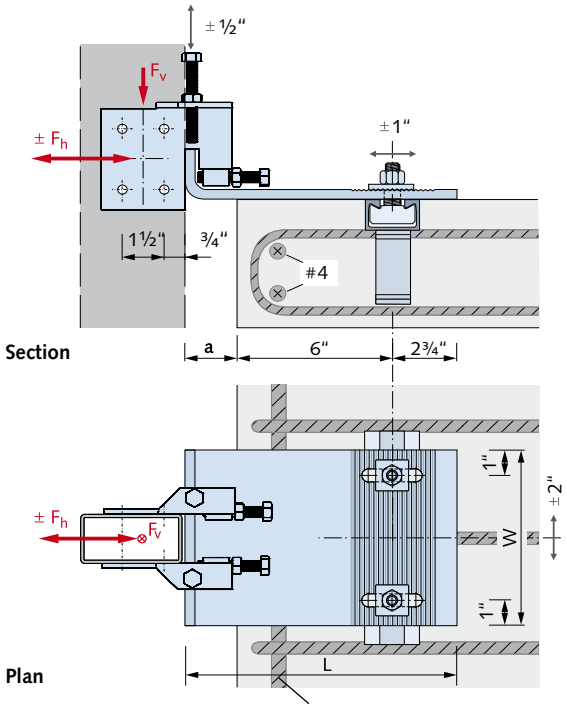


Typical assembly



HALFEN Brackets type HCW-B1 for top of slab installation are available in two load ranges and three sizes. The brackets are made of S355 grade quality galvanized steel. Three dimensional adjustability is ensured when used in combination with HALFEN HTA Anchor Channels. The lateral connecting plates are connected to the façade posts using M8 (5/16") screws (order separately).

Use HALFEN T-Bolts M16 (5/8") grade 8.8 (order separately) to connect the base bracket to the HALFEN Anchor Channel. Depending on the façade type, the connection between the connecting plate and the base bracket can be designed to allow lateral expansion or as a fixed point.



Required edge reinforcement ≥ #4 (ø12 mm)

Dimensioning / Type selection

Design load ranges

Load range		dead load		wind load	
		$F_{v\,allow.}$	$F_{v,d}$	$F_{h\,allow.}$	$F_{h,d}$
4/12	[lbs]	660	900	±1,800	±2,700
	[kN]	2.95	4.0	± 8.0	±12
7/20	[lbs]	1,160	1570	±2,990	±4,500
	[kN]	5.15	7.0	± 13.3	±20

$F_{v,d}$, $F_{h,d}$: design loads with a partial safety factor γ_F = 1.35 for dead loads and γ_F = 1.5 for wind loads.

$F_{v,d} = F_{v\,allow.} \times 1.35$

$F_{h,d} = F_{h\,allow.} \times 1.50$

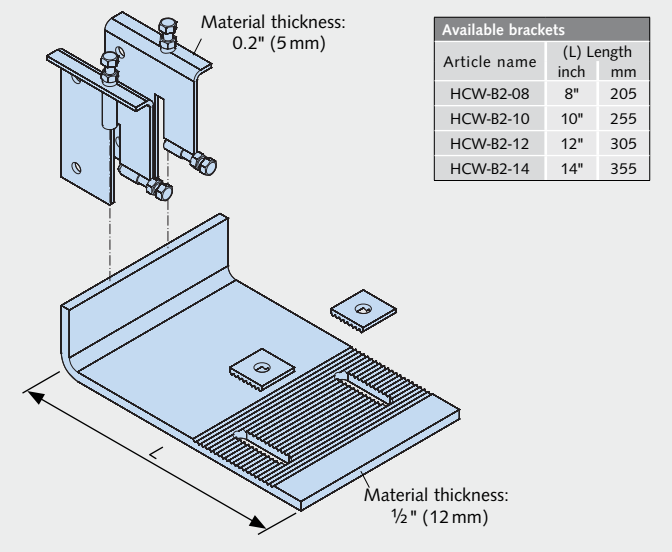
Type selection

Load range	a [inch]	Item name HCW-B1-...	L [inch]	W [inch]	HALFEN Anchor Channel ①	Recommended HALFEN T-bolt 8.8
4/12	2"	...-4/12-50	10 5/8"	6"	HTA 40/22 250 mm (10") 2 Anchors	HS 40/22 M16×60 (5/8"×2 3/8")
	3"	...-4/12-75	11 5/8"	6"		
	4"	...-4/12-100	12 5/8"	6"		
7/20	2"	...-7/20-50	10 5/8"	7"	HTA 50/30-300 mm (12") 3 Anchors	HS 50/30 M16×60 (5/8"×2 3/8")
	3"	...-7/20-75	11 5/8"	7"		
	4"	...-7/20-100	12 5/8"	8"		

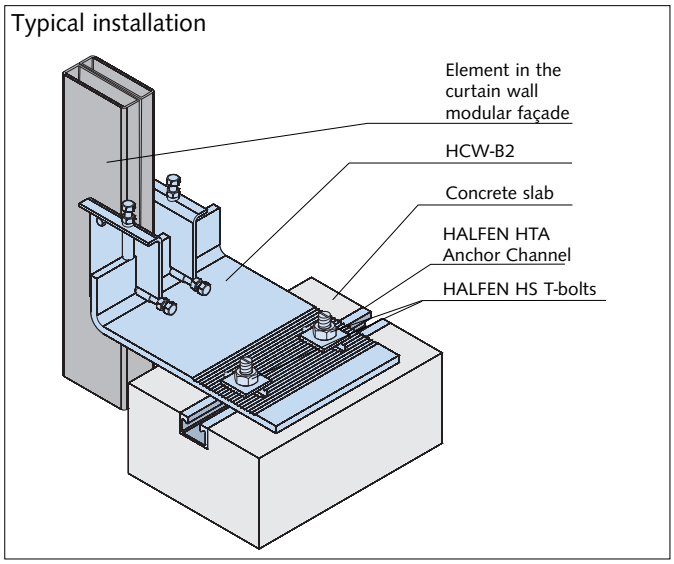
① Recommended HALFEN Anchor Channel exploiting the full load capacity of the bracket.

Top of Slab Brackets Type HCW-B2

Support bracket for horizontal and vertical loads



Available brackets		
Article name	(L) Length inch	mm
HCW-B2-08	8"	205
HCW-B2-10	10"	255
HCW-B2-12	12"	305
HCW-B2-14	14"	355

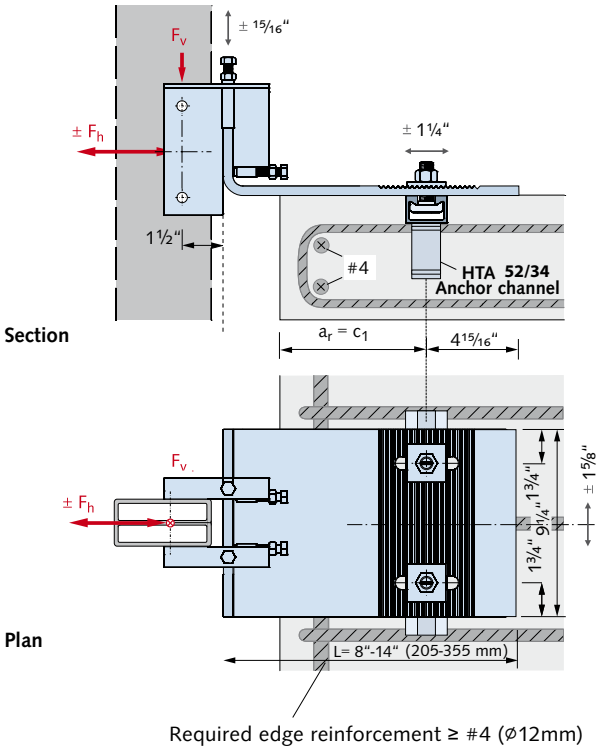


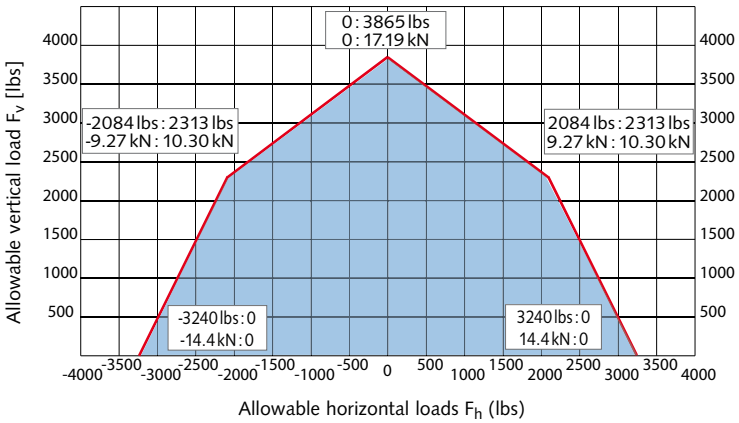
HALFEN Brackets HCW-B2 are made of S355 grade quality galvanized steel. The vertical adjustability is ± 15⁄16"(24 mm). Three dimensional adjustability is ensured when used in combination with HALFEN HTA Anchor Channels. The lateral connecting plates are connected to the façade posts using M12 (½") screws (order separately).

HALFEN HCW-B2 base Brackets are available in 4 different lengths for variable edge distances (c_1) of HALFEN Anchor Channels. Use HALFEN HS T-bolts M16 (⅝") 8.8 grade (order separately) to connect the base bracket to the HALFEN Anchor Channel. Depending on the façade type, the connection between the connecting plate and the base bracket can allow lateral expansion or can be designed as a fixed point.

The blue area in the diagram shows the allowable interaction area of horizontal and vertical loads on the HCW-B2 bracket. Each bracket half will support half the load.

The loading on the T-bolts and the channel depends on the selected L-shape base bracket. The structural design of the required channel has to be done separately.

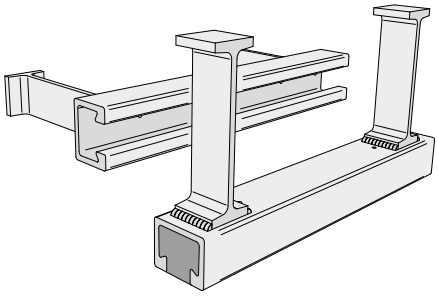




Required channel: HTA 52/34 - 350 mm (14") or HTA-TR 52/34 (see page 16)
Required T-bolts: 2 x HS 50/30 M16 x 60 (⅝" x 2 3⁄8") 8.8 grade

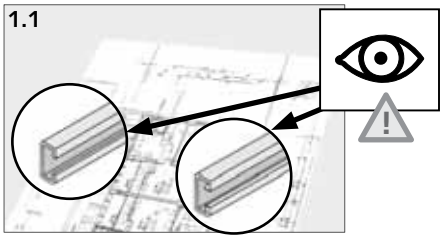
Installation of HALFEN Anchor Channels in concrete slabs

HALFEN Anchor Channels type HTA, ready for installation



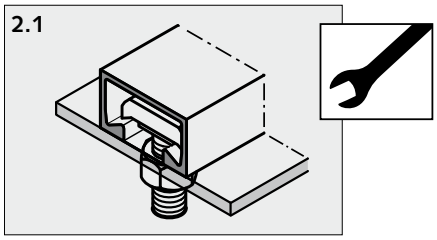
HALFEN Anchor Channels are supplied with pre-punched holes and strip filler. Any excess strip filler should be trimmed close to the channel ends.
Before fixing a HALFEN Anchor Channel to formwork, ensure that the profile, material, length and the selected position is as specified in the plans. Fix channels securely so that they remain flush with the surface of the formwork and will not be displaced when pouring the concrete. If the selected formwork is not suitable for nails, use an alternative method for fixing. For top-of-slab applications make sure the top of the channel is flush with the finished concrete surface.

⚠ Remove steel packing straps immediately after delivery of stainless steel HALFEN Anchor Channels to prevent rust stains forming. Store the channels separately, with sufficient distance from other metals. Avoid damage to surface and contamination caused by carbon steel. Store the channels in a dry, protected and well ventilated environment. Only use stainless steel fixing material.

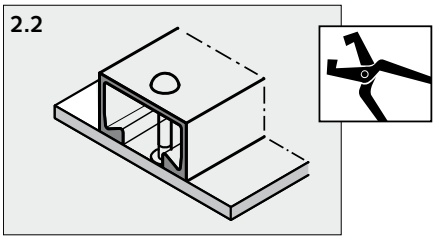


1.1 Select HALFEN Anchor Channel according to the design plans.

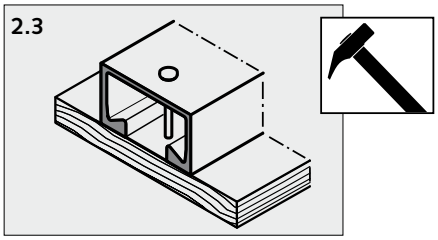
Steel formwork



2.1 Secure with HALFEN T-bolts through the formwork.

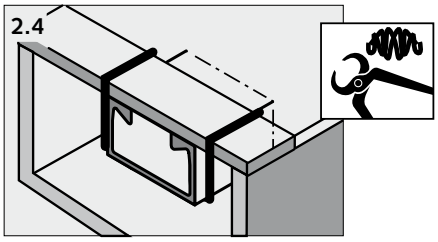


2.2 Using rivets or T-bolts (supplied by the contractor) through the pre-punched nail holes in the HALFEN Anchor Channel.

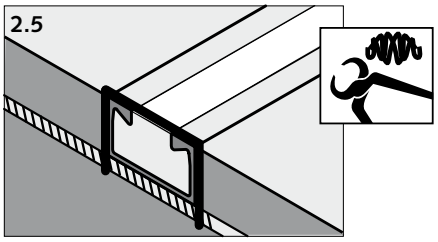


2.3: Fix to timber formwork with nails through the pre-punched holes in the back of the channel.

⚠ **Anchor channels must be securely fastened; the lips must be flush with the finished concrete surface. Incorrectly positioned channels will not have full load capacity!**

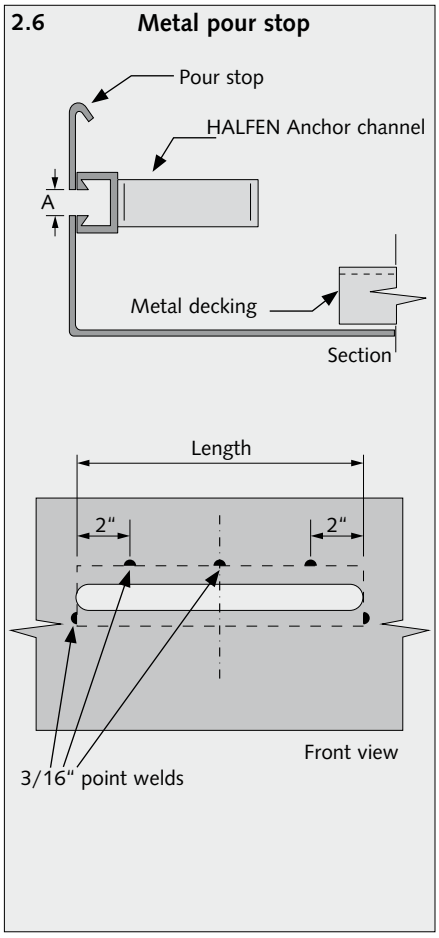


2.4 With a fixing bracket: Meticulous concrete compaction is essential to prevent air bubbles forming underneath the auxiliary work.



2.5 Fixing directly to the reinforcement: Secure the HALFEN Anchor Channel with tie wire.

Installation to the edge of metal decks



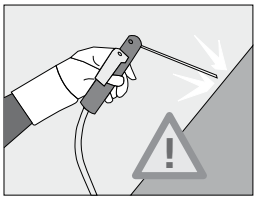
2.6 Securing HALFEN Anchor Channels to metal pour stops

1. Slotted pour stop: Pour stops at HALFEN Anchor Channel locations must be slotted. Slots should be pre-punched by the pour stop supplier. Cutting with a welding torch on site is not recommended. The slot width (dimension A) should be sized and cut to correspond with the space between the channel lips of the HALFEN Anchor Channel. Over sizing dimension A should be avoided.

2. Welding: Prior to welding, HALFEN Anchor Channels should be clamped securely in position over the slot in the pour stop (Figure 2.6). Care should be taken to ensure the channel is aligned properly with the slot.

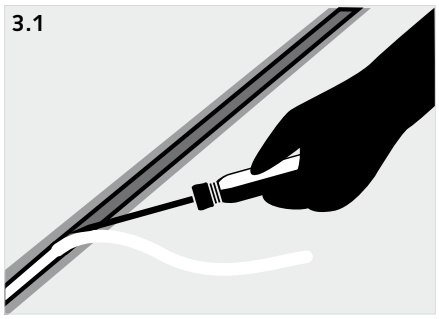
To connect an HALFEN Anchor Channel up to 24" long to the pour stop, three $^{3}/_{16}$" welds should be used along the top edge of the channel. A $^{3}/_{16}$" weld should be used at the bottom lip at each end of the channel (refer to Figure 2.6). American Welding Society Standard Specification ANSI/AWS provides for welding to 10-18 gauge galvanized steel (commonly used for pour stops)

After welding, the HALFEN Anchor Channel should be inspected to check it is firmly attached to the pour stop. Large welds or repeated welding should be avoided as this may damage the strip filler in the anchor channel. The pour stop should also be inspected after welding to ensure it has not been deformed.



Welding of galvanized steel components produces hazardous fumes. Appropriate precautions should be taken to ensure safe working conditions for those in the vicinity of the welding.

3. After concreting and striking the formwork

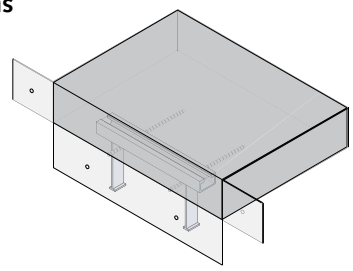


3.1 Remove filler using an appropriate tool, e.g. screwdriver.

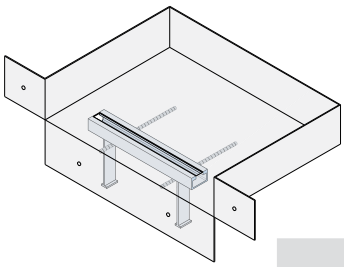
For correct use of HALFEN T-bolts see instructions for T-bolts.

Installation: Options

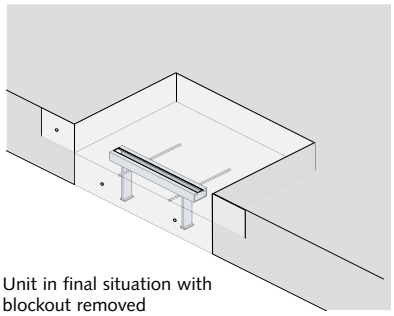
Blockout installations



Unit with blockout filler in place



Unit with blockout filler removed



Unit in final situation with blockout removed

For recessed and hidden façade brackets and connections HALFEN Anchor Channels are supplied pre-attached to block-out assemblies.

Key features:

- 16 gauge galvanized sheet metal
- pre-punched nail holes
- custom designed for customers projects
- easy to install
- pre-assembled delivery available on request

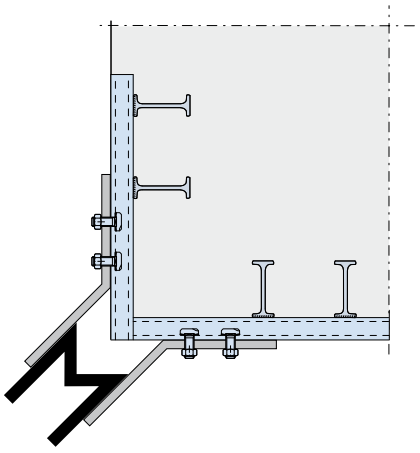
The block-out assemblies are secured with bolt connections (order seperately) to the pour-stop or to the formwork before pouring the concrete.

The foam fillers are removed after the concrete has hardened sufficiently to install the HALFEN Curtain Wall Brackets to the HALFEN Anchor Channel. The recess can be sealed to hide the connection; this ensures a smooth and unobstructed floor surface.

Block-out assemblies for individual projects can be designed by and ordered from HALFEN.

Please contact our engineering team at engineering@halfenusa.com if further information is required.

HALFEN Corner connections



Please contact our engineering team at engineering@halfenusa.com for corner solutions

The corners of curtain wall façades are usually the most heavily stressed part of the structure, this is due to wind action and the required geometry of façade bracket connections. Dedicated engineering is usually required to ensure adequate connection in these areas.

Common complicating factors affecting the design of these connections include;

- post-tension cones
- structural steel
- requirements for block-outs
- permanent metal deck formwork at corner locations

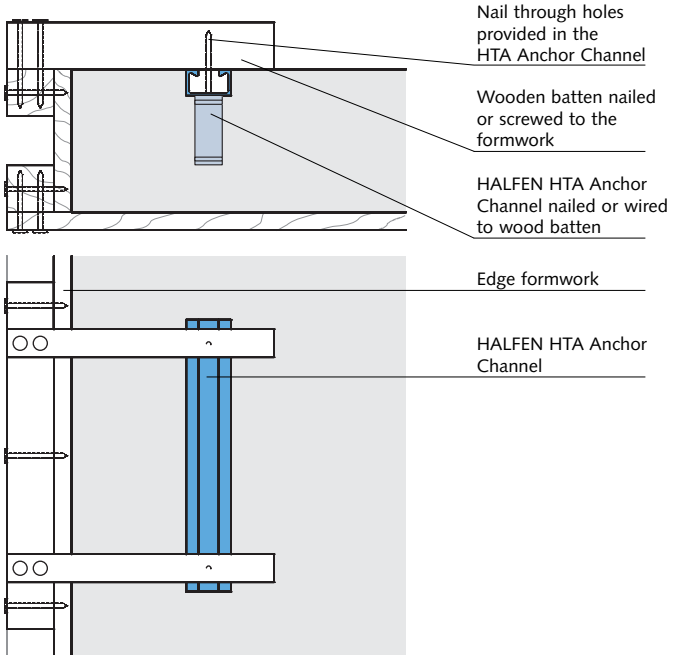
In these cases particularly, consultation with HALFEN is advised to ensure that the typical high loads at corners are adequately transferred to the structure. The illustration on the left shows one example of an anchoring concept. Projects normally require dedicated input and planning from HALFEN to achieve the most cost effective results.

Installation examples: HALFEN Anchor Channels

An auxiliary construction is required to secure the HALFEN Anchor Channel in position. Two possible methods for installation are illustrated below.

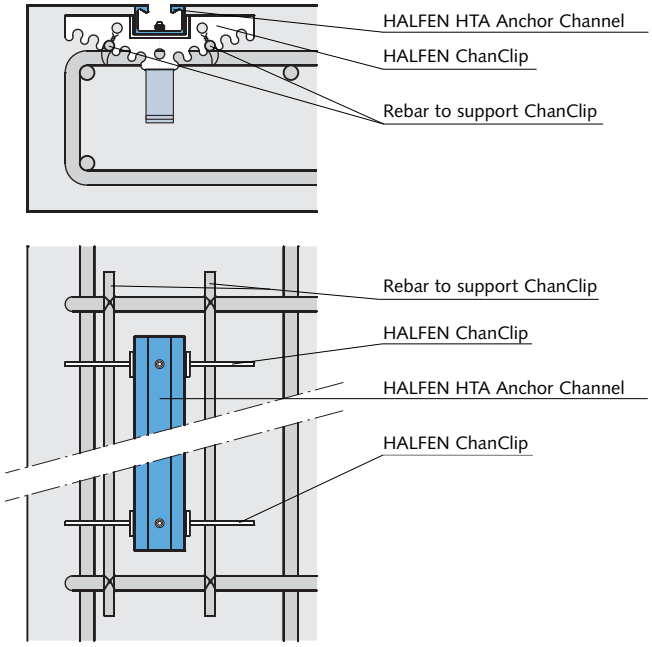
To avoid corrective measures being required when installing the façade elements make sure the channels are securely fixed and flush with the final concrete surface.

With timber formwork



HALFEN Anchor Channels for installation to the top of a slab secured to wood battens nailed to the timber formwork

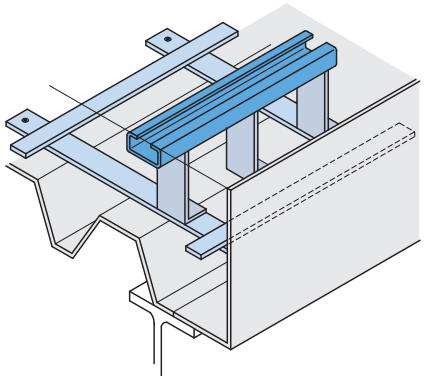
ChanClip



HALFEN Anchor Channels, for top of a slab installation secured to the top of the reinforcement using HALFEN ChanClips (patented)

Custom fixing methods

HALFEN Anchor Channels can be delivered pre-assembled for individual solutions.



Custom solution anchor channels

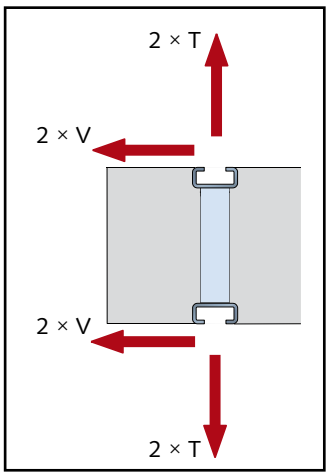
Custom solutions are available from HALFEN to ensure accurate installation of anchor channels. Channels are supplied with special anchors or spacing straps to secure the anchor channel to metal pour stops or decks. This ensures the channels remain in position at the correct height and at the correct edge distance; the channels cannot be dislodged when pouring the concrete.

HALFEN project based solutions are available for most types of construction.

Please contact our engineering team at engineering@halfenusa.com if further information is required.

Dual Connection to the Top/Bottom of Floor Slabs

HALFEN Window/wall connection



HALFEN Anchor Channel type HWW 38/17 for adjustable window to wall anchoring to the top and bottom of floor slabs.

Design criteria	Allowable loads		Applied loads
Tension capacity	$T_{allow.}$	≥	T
Transverse shear capacity	$V_{allow.}$	≥	V

Interaction $\left[\frac{T}{T_{allow.}}\right]^{1.5} + \left[\frac{V}{V_{allow.}}\right]^{1.5} \leq 1.0$

Concrete strength and safety factor

Allowable loads are valid with a 2.5:1 safety factor in reinforced concrete with a compression strength of 2.900 psi (20 Nmm²)

Dimensions and load data

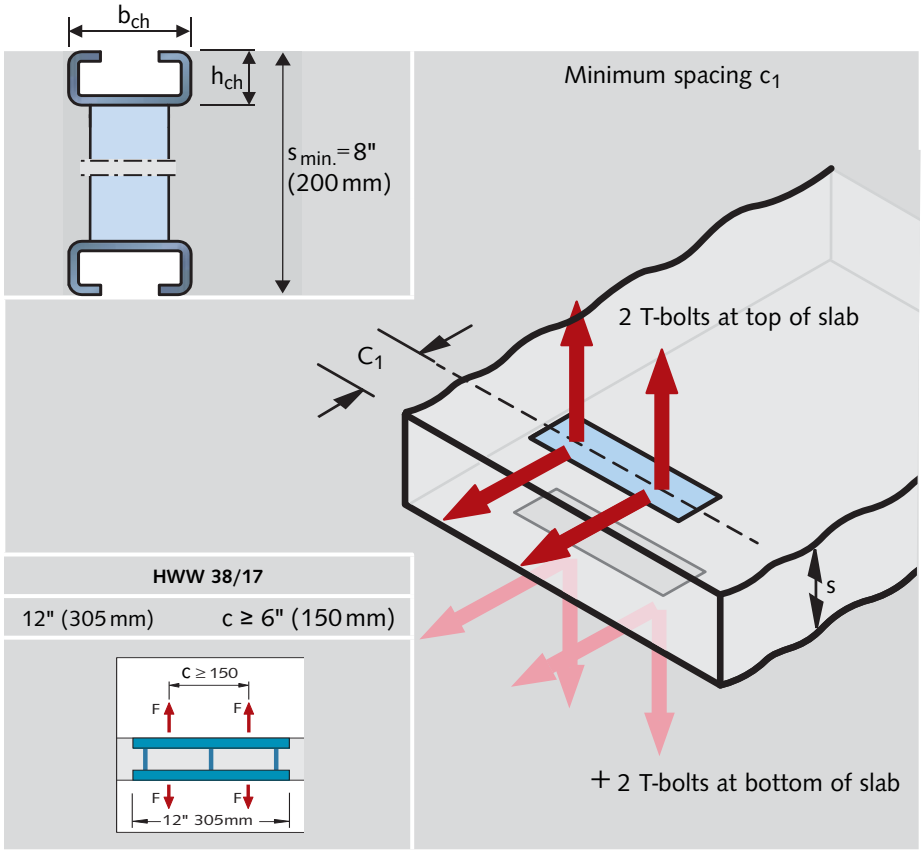
Channel dimensions

Type of channel		b_{ch}	h_{ch}	s
HWW 38/17	inch	1 ½"	⅝"	8"-24"
	mm	38	17	200-600

Allowable T-bolt loads

	4 × lbs	4 × kN	min. c_1
tension - $T_{allow.}$	1,000	4.46	3 inches (75 mm)
transverse shear- $V_{allow.}$	450	2.0	

Allowable loads assume equal load distribution with two T-bolts connections spaced a minimum of 6" apart in both the top and bottom channels (4 connections total per assembly). See page 30 and 31 for more T-bolt information.



HALFEN HTU Anchor Channels

The advantages at a glance

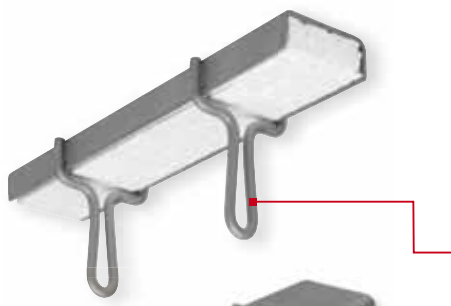
The technically perfect solution for efficient connections to concrete. HALFEN HTU Anchor Channels and Self-tapping Screws have become a standard everyday solution in the construction industry.

Safe and dependable

- optimal shape of the anchoring elements ensures safe and low-slip anchorage
- the Polystyrene-filler, prevents the drill or self-tapping-screws hitting concrete
- officially approved

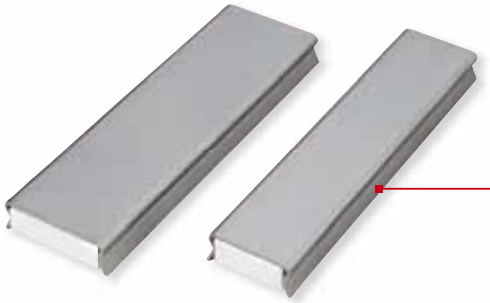
Quick and cost-effective

- simple installation
- also for quick and easy installation of trapezoidal sheeting
- two anchor designs, A_N and D for optimum adaptation to planned reinforcement



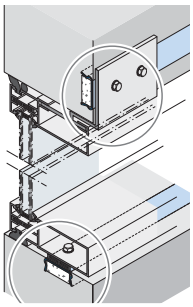
HALFEN HTU Anchor Channels
Anchor design A_N

HALFEN HTU Anchor Channels
Anchor design D

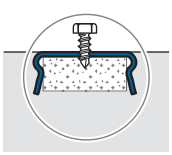


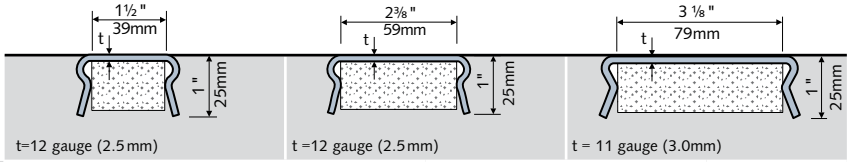
HALFEN HTU Anchor Channels
Self anchoring

HALFEN Anchor Channels HTU— self-anchoring

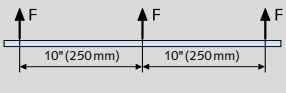


HALFEN HTU Self-anchoring Channels provide an ideal method for connecting window frames, door frames, trapezoidal steel sheets and metal cladding panels to concrete using self-tapping screws. They are easy to install and allow two dimensional adjustment of the connection. HTU Self-anchoring Channels are available pre-galvanized in lengths of 19´ 8" (six meters). See below for details of self-anchoring channels with welded anchors.

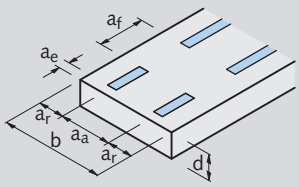




t=12 gauge (2.5 mm) | t =12 gauge (2.5 mm) | t = 11 gauge (3.0mm)

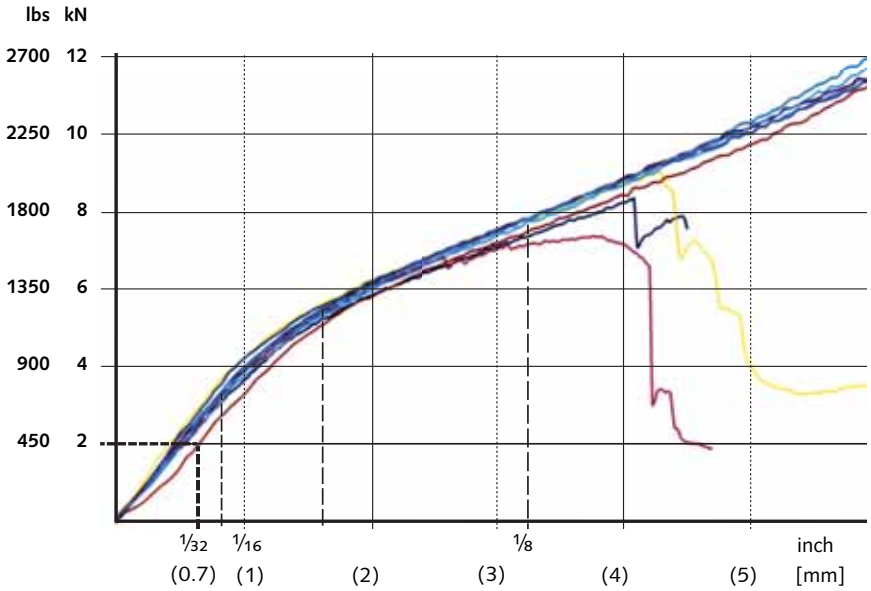


Channel type		**HTU 40/25/2.5 - sv (IT)**		**HTU 60/25/2.5 - sv (FR)**		**HTU 80/25/3.0 - sv (FR)**	
Allowable **F** ①		450 lbs/10"	2 kN / 250 mm	450 lbs/10"	2 kN / 250 mm	450 lbs/10"	2 kN / 250 mm
Minimum concrete dimensions [mm]	a_a	5 ½"	140 mm	6 ¼"	160 mm	7 ⅛"	180 mm
	a_r	2 ¾"	70 mm	3 ⅛"	80 mm	3 ½	90 mm
	a_e	¾"	20 mm	¾"	20 mm	¾"	20 mm
	a_f	¾"	20 mm	¾"	20 mm	¾"	20 mm
	d ②	1"	25 mm + cover	1"	25 mm + cover	1"	25 mm + cover



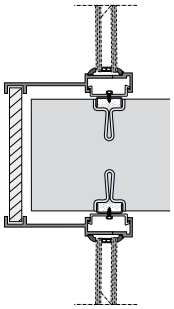
Notes: ① Suitable for pull-out, shear and resultant loads. Minimum required concrete strength 2900 psi (C20/25 N/mm²). Fixtures must be capable of supporting the loads and be installed according to manufacturer's recommendations.
② Concrete must be of sufficient depth to transfer loads from the channel and provide adequate cover.

HTU Self-anchoring Channels — load displacement curve

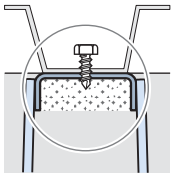


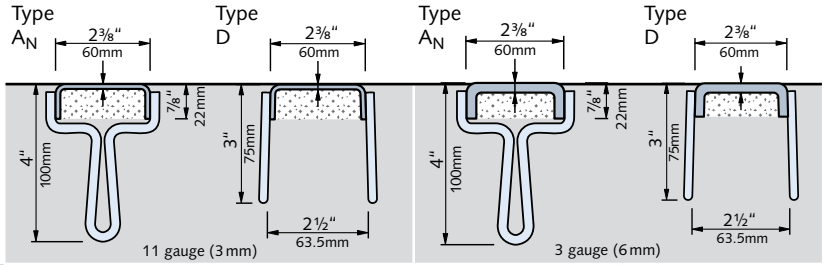
The allowable load F in the table is based on the load-displacement-curves shown below.
At the maximum load of 450 lbs (2.0 kN) with a spacing of 10" (250 mm) displacements up to 0.03" (0.7 mm) can occur

HALFEN Anchor channels HTU — welded anchors



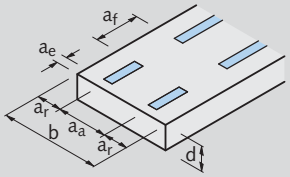
All HALFEN Anchor Channels HTU 60/22 are available hot-dip galvanized in 9´10" (3 m) lengths. HTU 60/22/3 is also available in A4 stainless steel. Anchors are spaced at 18" (450 mm) or 6" (150 mm).





According to approval no. Z-21.4-84, the allowable load on the channel must be statically verified for a point-load F_s at the bolts acting on a single- or multi-span system with free-pivot assumed support points. The resulting anchor load F_R must not exceed the allowable load F_R = 5 kN

Channel type			HTU 60/22/3		HTU 60/22/6	
Cross-section dimensions	A	cm²	2.81		4.94	
	J_x	cm⁴	1.13		1.84	
	W_{xo}	cm³	1.92		2.45	
	W_{xu}	cm³	0.71		1.27	
	W_{pl}	cm³	1.33		2.43	
Minimum concrete dimensions inch (mm)	a_a		8 inches (200 mm)			
	a_r		4 inches (100 mm)			
	a_e		¾ inches (20 mm)			
	a_f		¾ inches (20 mm)			
	d ②		4" (100 mm) + cover	3" (75 mm) + cover	4" (100 mm) + cover	3" (75 mm) + cover



Notes: The self-tapping fixtures and the structure must be capable of supporting the loads. Fixtures should be positioned in the central third of the channel width and no closer than 1" (25 mm) from the end of the channel. If the anchor is subjected to only tensile load at the anchor and the actual load F in the anchor is less than the allowable anchor load F_R then the edge distance a_r can be reduced according to the formula: reduced $a_r = \frac{\text{actual F}}{\text{allow. } F_R} \times a_r$. Further design information is available in the Technical Product Information catalog for HALFEN Anchor Channels.

Order example:

polystyrene strip filler
length (mm)
material/finish
anchor configuration
type/profile

HTU 60/22/3 - D2 - FV - 3000 -Sf

HTU 60/22/3 ■ = hot-dip galvanized	number of anchors
HTU 60/22/3 - A_N2 - FV - 3000 - Sf	8
HTU 60/22/3 - D2 - FV - 3000 - Sf	8
HTU 60/22/3 - A_N3 - FV - 3000 - Sf	20
HTU 60/22/3 - D3 - FV - 3000 - Sf	20

HTU 60/22/6 ■ = hot-dip galvanized	number of anchors
HTU 60/22/6 - A_N2 - FV - 3000 - Sf	8
HTU 60/22/6 - D2 - FV - 3000 - Sf	8
HTU 60/22/6 - A_N3 - FV - 3000 - Sf	20
HTU 60/22/6 - D3 - FV - 3000 - Sf	20

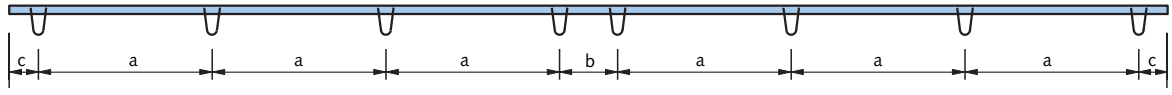
■ = Stainless steel A4	
HTU 60/22/3 - A_N2 - A4 - 3000 - Sf	8
HTU 60/22/3 - D2 - A4 - 3000 - Sf	8
HTU 60/22/3 - A_N3 - A4 - 3000 - Sf	20
HTU 60/22/3 - D3 - A4 - 3000 - Sf	20

■ **FV** = Steel S235JR, hot-dip galvanized
■ **A4** = Stainless steel 1.4571/1.4404 ①

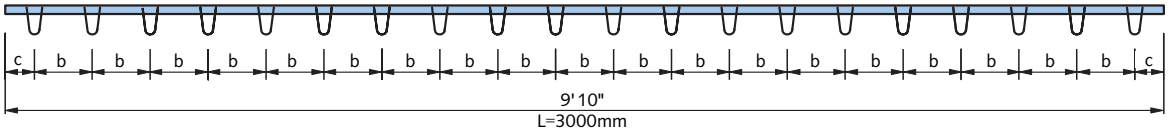
Anchor spacing:

a = 18" (450 mm)
b = 6" (150 mm)
c = 3" (75 mm)

Type **D2** or **A_N2**
■ ■ ①

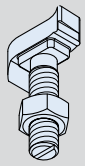
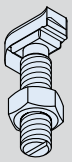
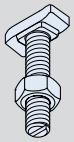


Type **D3** or **A_N3**
■ ■ ①



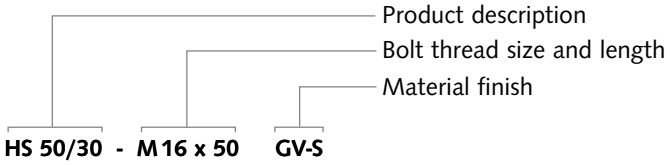
① Material A4 available only in ⅛" (3 mm) thickness

HS T-bolts for standard anchor channels — available T-bolts and engineering data

For channel types		HTA-R 52/34 HTA-R 50/30			HTA-TR 52/34 HCW 52/34			HTA-R 40/22				HWW 38/17	
HS T-bolts		 HS 50/30						 HS 40/22				 HS 38/17	
T-bolt grade		4.6			8.8			4.6		8.8		4.6	
T-bolt diameter	metric	M20	M16	M12	M20	M16	M12	M16	M12	M16	M12	M16	M12
	inch	¾"	⅝"	½"	¾"	⅝"	½"	⅝"	½"	⅝"	½"	⅝"	½"
Allowable tension	lbs	8,813	5,643	3,035	17,625	11,285	6,070	5,643	3,035	11,285	6,070	5,648	3,035
	kN	39.2	25.1	13.5	78.4	50.2	27.0	25.1	13.5	50.2	27.0	25.1	13.5
Allowable transverse shear	lbs	5,283	3,395	1,821	10,566	6,789	3,642	3,395	1,821	6,789	3,642	3,395	1,821
	kN	23.5	15.1	8.1	47.0	30.2	16.2	15.1	8.1	30.2	16.2	15.1	8.1
Recommended torque	ft lbs	90 (55) ①	45	20	90 (55) ①	45	20	35	20	35	20	30	20
	Nm	120 (75) ①	60	25	120 (75) ①	60	25	45	25	45	25	40	25
Allowable bending moment	ft lbs	63.8	32.7	12.9	159.3	81.8	32.2	32.7	12.9	81.8	32.2	32.7	12.9
	Nm	86.5	44.4	17.5	216.4	111	43.7	44.4	17.5	111	43.7	44.4	17.5
Standard range of T-bolts lengths													
40 mm (1 ½")						✔			✔				✔
45 mm (1 ¾")											✔		
50 mm (2")			✔*	✔*				✔*	✔*			✔*	✔*
55 mm (2 ¼")		✔											
60 mm (2 ⅜")			✔	✔	✔	✔*	✔	✔*	✔	✔*	✔	✔	✔
65 mm (2 ⅝")		✔*											
70 mm (2 ¾")										✔			
75 mm (3")		✔											
80 mm (3 ⅛")			✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔

Notes: The T-bolt load capacities may be limited by the channel capacity; check channel capacity according to the data in this catalog
✔ = Available in zinc plated finished with a special coating.
* = Hot-dip galvanized available on request.
Stainless steel T-bolts are available in a range of sizes on request.
① Value for 50/30 channels

Order example for a HS 50/30 T-bolt with a 16 mm thread in a zinc galvanized finish with a special coating



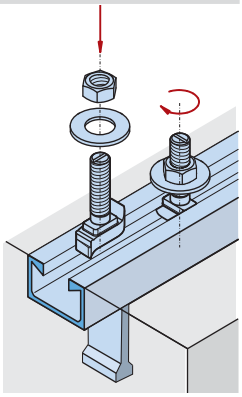
Installing the T-bolt:

Turn the T- bolt in a clock-wise direction.

Install the required components.

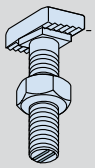
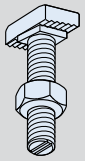
The notch in the shaft must be at right angles to the longitudinal direction of the channel.

Tighten the T-bolt to the correct torque as required for the application.



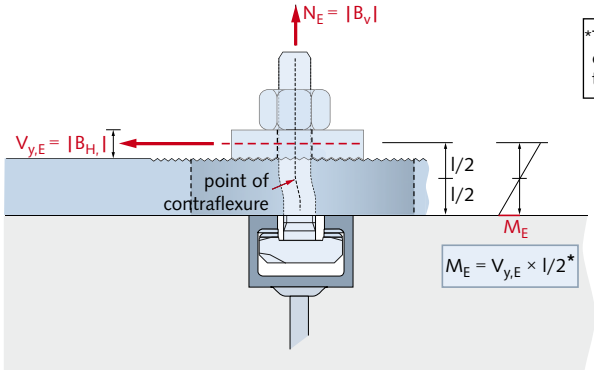
HALFEN T-bolts

HZS T-bolts for serrated anchor channels — available T-bolts and engineering data

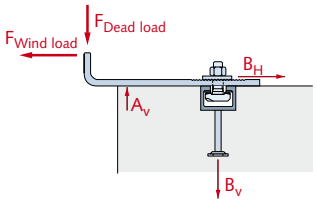
For channel types		HZA-R 53/34 HZA-TR 53/34		HZA-R 38/23	
HZS T-bolts		 HZS 53/34		 HZS 38/23	
T-bolt grade		8.8		8.8	
T-bolt diameter	metric	M20	M16	M16	M12
	inch	3/4"	5/8"	5/8"	1/2"
Allowable tension	lbs	17,625	11,285	11,285	6,070
	kN	78.4	50.2	50.2	27.0
Allowable transverse shear	lbs	10,566	6,789	6,789	3,642
	kN	47.0	30.2	30.2	16.2
Allowable longitudinal shear	lbs	4,950	4,950	2,700	2,700
	kN	22.0	22.0	12.0	12.0
Recommended torque	ft lbs	260	150	90	60
	Nm	350	200	120	80
Allowable bending moment	ft lbs	159.6	81.8	81.8	32.2
	Nm	216.4	111	111	43.7
Standard range of T-bolts lengths					
40 mm (1 1/2")					✔
50 mm (2")				✔	✔
60 mm (2 3/8")			✔	✔	✔
65 mm (2 5/8")		✔*			
80 mm (3 1/8")				✔	✔

Notes: Allowable longitudinal loads are based on the torque values above.
The T-bolt load capacities may be limited by the channel capacity; check channel capacity according to the data in this catalog
✔ = Available in zinc plated finished with a special coating.
* = Hot-dip galvanized available on request
Stainless steel T-bolts are available in a range of sizes on request.

Verification of HZS and HS T-bolts for bending



*The assumption is that the attachment cannot rotate and the moment M_E can be taken up and transfered by the attachment.



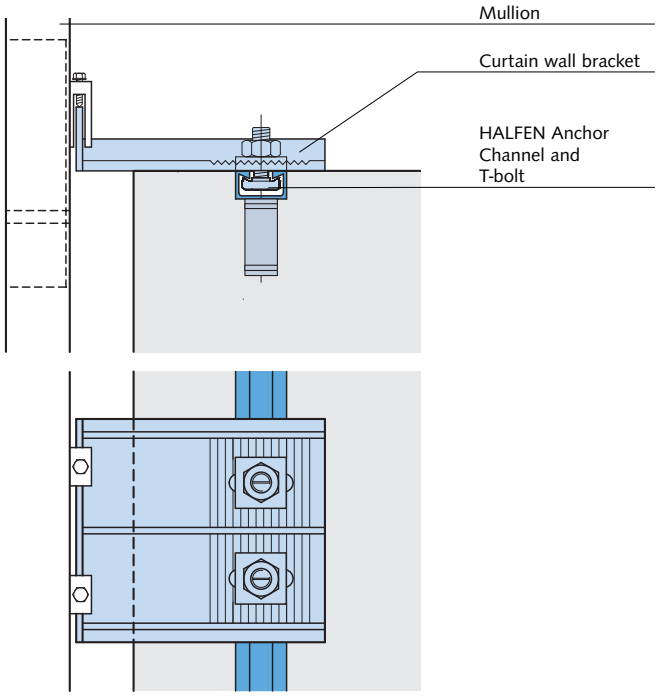
Required verification

$$N_E \leq F_{allow.} \times (1 - M_E / M_{allow.})$$

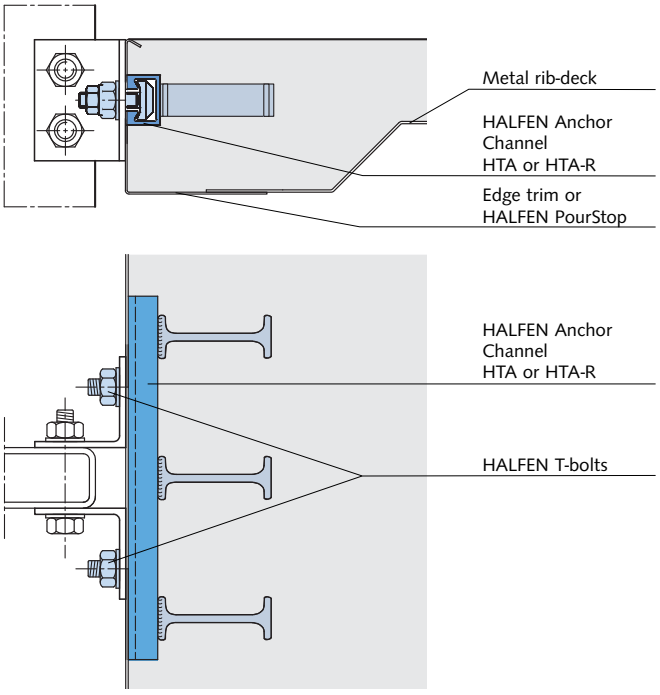
$F_{allow.}$ = $F_{allow.}$ for HZS/HS T-bolts
$M_{allow.}$ = allowable bending moment
N_E = value of the present tensile load component
M_E = value of the present bending moment

Application examples

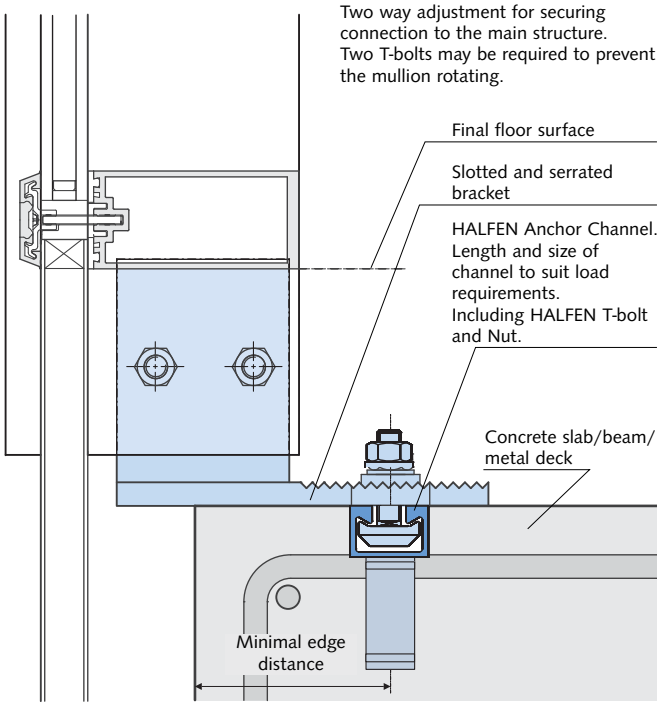
Façade connections vary according to their purpose and the type of structure. Four typical examples are shown below. Please contact your local HALFEN representative for specific assistance.



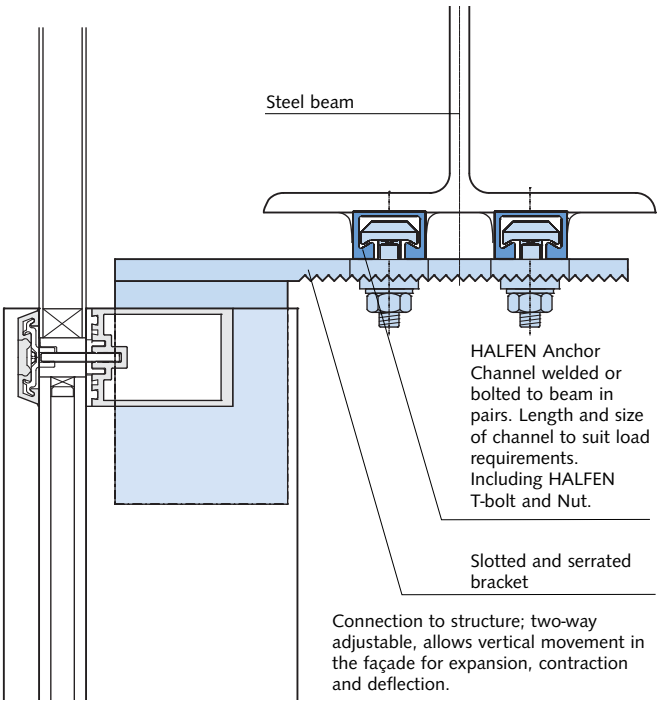
Typical detail; connection to top of slab



Typical detail; connection to metal rib-deck slab



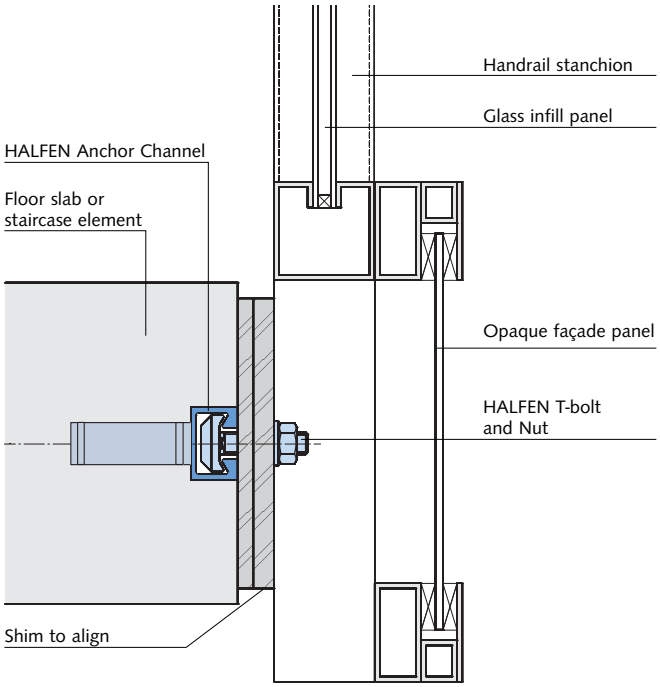
Base connection for curtain wall or shop front.

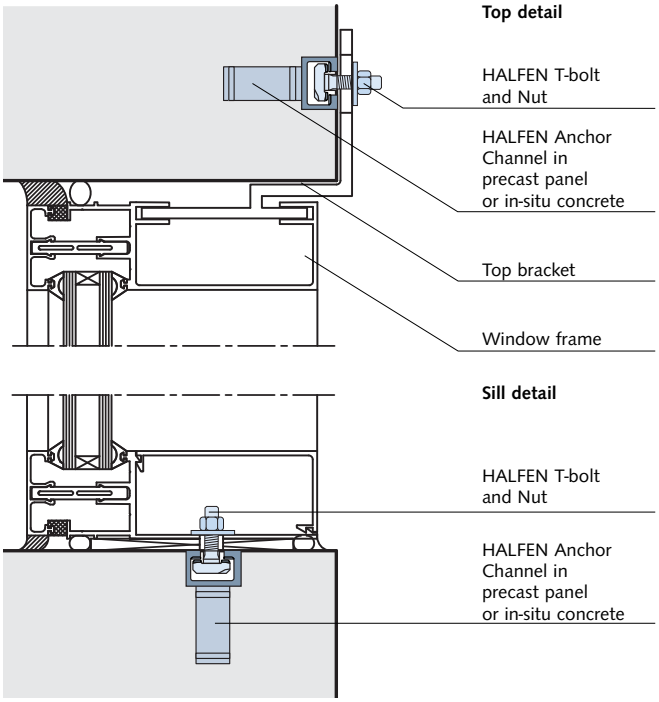


Sliding head connection for curtain wall.

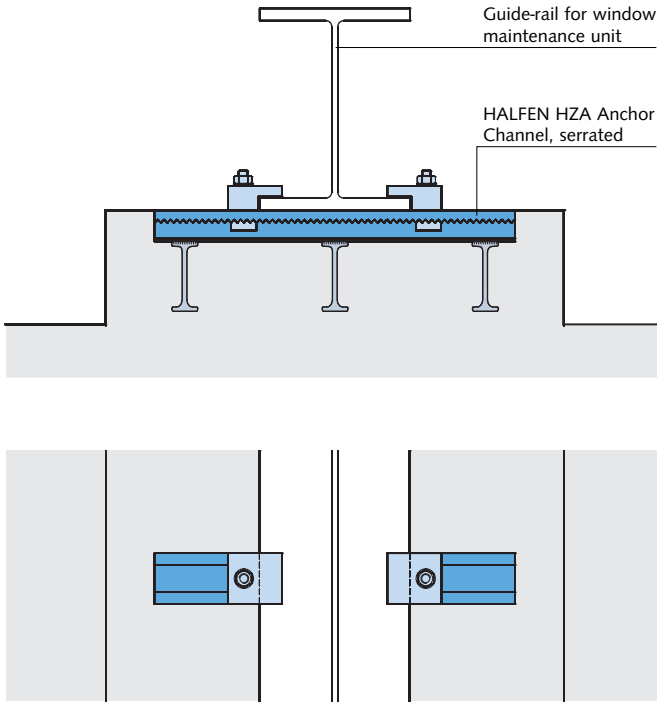
Application examples

Four typical examples illustrating types of connections used with curtain wall façades.
Please contact your local HALFEN representative for specific assistance.

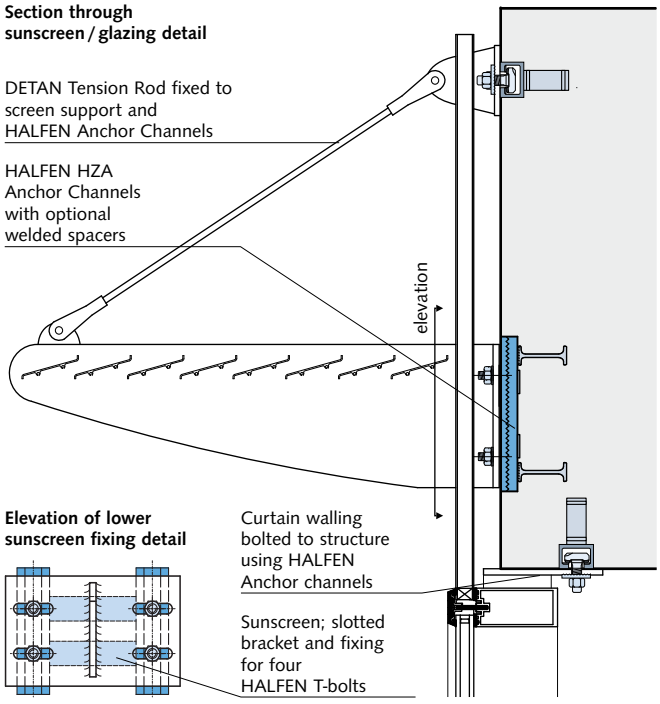




Typical detail; single or strip window-element anchorage



Steel beam to concrete connection using HALFEN HZA Anchor Channel and HALFEN Beam Clamps.



Typical detail; anchoring of sunscreen / glazing using HALFEN Anchor Channels and DETAN Tension Rod System.

Recommendations for using the load resistance design method for HALFEN Anchor Channels and T-bolts

While concrete design according to ACI 318 always needs to be done using the Load Resistance Factor Design Method (LRFD), steel structures like the façade of buildings can still be calculated using the allowable stress design method (ASD). In the LRFD method safety factors are applied to both sides of the equation (loads and resistances) while in the ASD method the safety is only applied to the resistance part and the loads are applied unfactored.

As most of the time the acting loads from the façade are calculated with the ASD method, all capacities in this brochure are meant to be used in combination with the ASD method using unfactored loads. The capacities of the products used in this brochure are based on calculations and testing using a safety factor of at least 2.5 to the characteristic failure value.

If the LRFD method shall be used, the capacities given in this document may be converted using the factor 1.4:

$$T_{LRFD} = 1.4 \times T_{allow.}$$

$$V_{LRFD} = 1.4 \times V_{allow.}$$

$$L_{LRFD} = 1.4 \times L_{allow.}$$

The LRFD calculation for the Anchor Channels and T-bolts may be done using all capacities given in this brochure multiplied with factor 1.4. These LRFD capacities need to be compared to the factored loads.

1450 Brickel, Miami, FL

HALFEN HZA DYNAGRIP® Anchor Channels

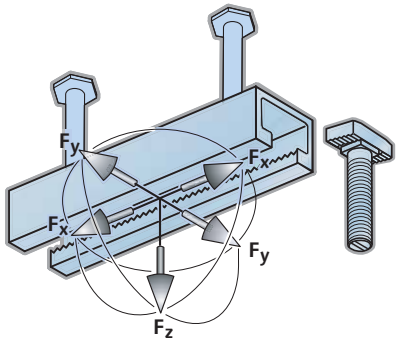
Permanent anchorage in concrete

HALFEN Anchor Channels are used by planners across North America. A new dimension in concrete embeds is now available for this widely-used and generally accepted anchoring method.

Reduced construction time
Connections with HALFEN Anchor Channels are installed quickly and efficiently using only a torque wrench. On-site welded and drilled connections are no longer needed; therefore no complex, time consuming installation-methods and verifications are required.

Resolves tolerance issues
Allows for large tolerances, which are common in connections to concrete constructions.

HALFEN HZA DYNAGRIP®
Toothed anchor channels and toothed HALFEN T-bolts provide safe three-dimensional load capacity and superior dynamic performance.



For further information, please refer to our HZA DYNAGRIP® Toothed Channels brochure.

Maximum safety and reliability
Installing to HALFEN HZA DYNAGRIP® Toothed Anchor Channels avoids damage to concrete and reinforcement. Anchor channels can be used safely in concrete tension zones, anchor channels will never loosen; they remain permanently fixed in position.

Suitable for all applications
Four channel profiles in carbon and stainless steel, available in lengths up to 20'; used in combination with a choice of four T-bolt diameters, in lengths of 1" to 12" – all the choice the engineer needs.

Reduced risk
Load tables available for standard applications – engineering support provided by HALFEN for custom situations.

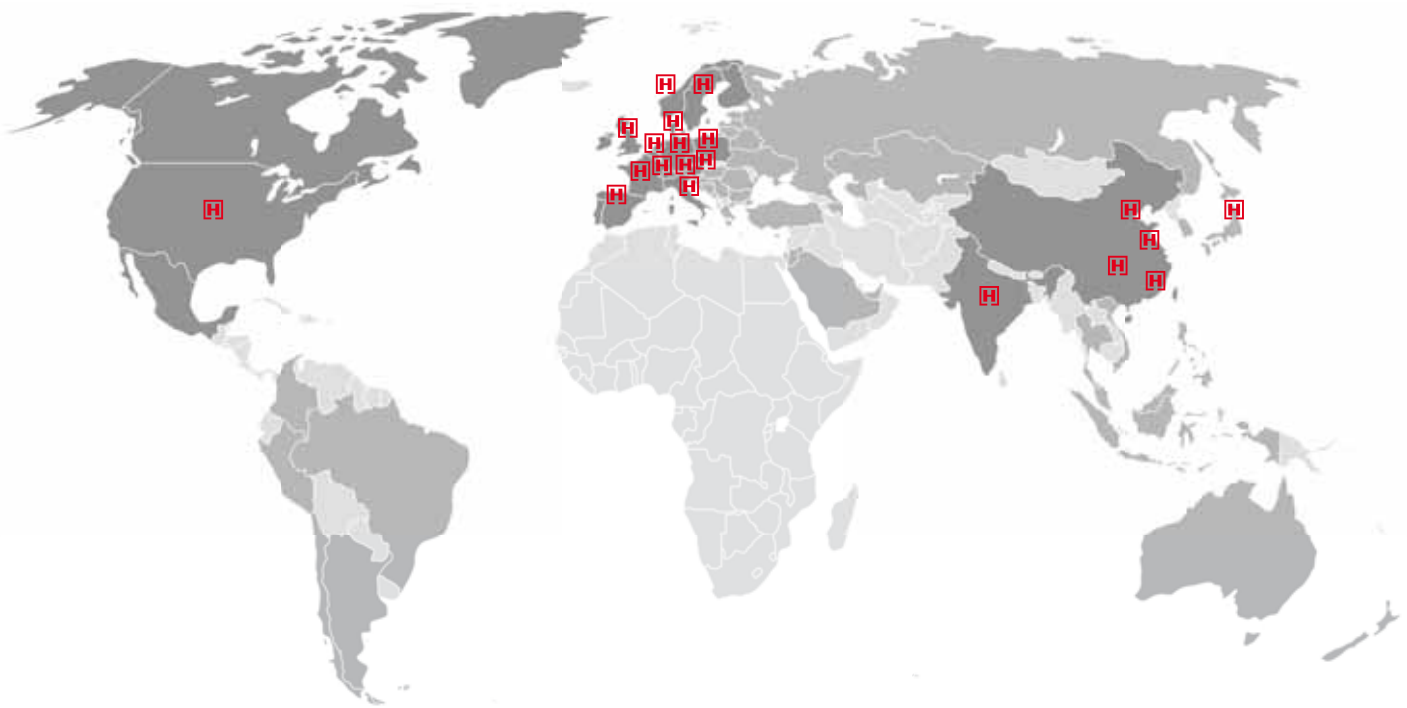
Mechanical load transmission
Interlocking serration in the channel and the T-bolt ensure positive transmission of loads in all directions.

HALFEN HZA DYNAGRIP® Anchor Channels are high performance, hot-rolled, toothed profiles. Used in combination with matching, serrated HALFEN T-bolts this system permits easy-adjustable installation of very high-capacity, longitudinal, load connections.

Numerous advantages, one result: HALFEN provides safety, reliability and efficiency for you and your customers.

CONTACT HALFEN WORLDWIDE

HALFEN has a global network of Subsidiary Companies to assist you. The main contact information for North America, Europe and Asia is provided below. For a full list of offices please visit www.halfen.com



USA & Mexico	HALFEN USA Inc. 8521 F.M. 1976 Converse, TX 78109	Phone: +1 800.423.9140 E-Mail: info@halfenusa.com Web: www.halfenusa.com	Fax: +1.877.683.4910
Canada	UCC Industries International [Distributor] Units 12 & 13 895 Sandy Beach Road Pickering, Ontario, L1W 3N7	Phone: +1 905.831.7724 E-Mail: bhughes@ucci.ca Web: www.ucci.ca	Fax: +1 905.831.5872
	Provinces of British Columbia and Alberta:	Please contact HALFEN USA Inc.	
Germany	HALFEN GmbH Liebigstrasse 14 40764 Langenfeld	Phone: +49 2173 970-0 E-Mail: info@halfen.de Web: www.halfen.de	Fax: +49 2173 970-123

HALFEN is also represented by distributors in Argentina, Australia, Azerbaijan, Belarus, Brazil, Bulgaria, Chile, China, Colombia, Croatia/Bosnia-Herzegovina/FYROM/Montenegro, Cyprus, Estonia, Greece, Hong Kong, Hungary, India, Indonesia, Ireland, Israel, Japan, Jordan, Kingdom of Saudi-Arabia, Latvia, Lebanon, Lithuania, Luxembourg, Malaysia, Malta, Mexico, New Zealand, Peru, Philippines, Republic of Kazakhstan, Romania, Russia, Serbia, Singapore, Slovenia, Spain, South Korea, Taiwan/ROC, Thailand, Turkey, Ukraine, United Arab Emirates, Uruguay, Vietnam

HALFEN GmbH shall not accept liability for the accuracy of the information in this publication or for any printing errors.

PRINT/PDF 10/14
FE 063-US - 10/14

HALFEN
YOUR BEST CONNECTIONS