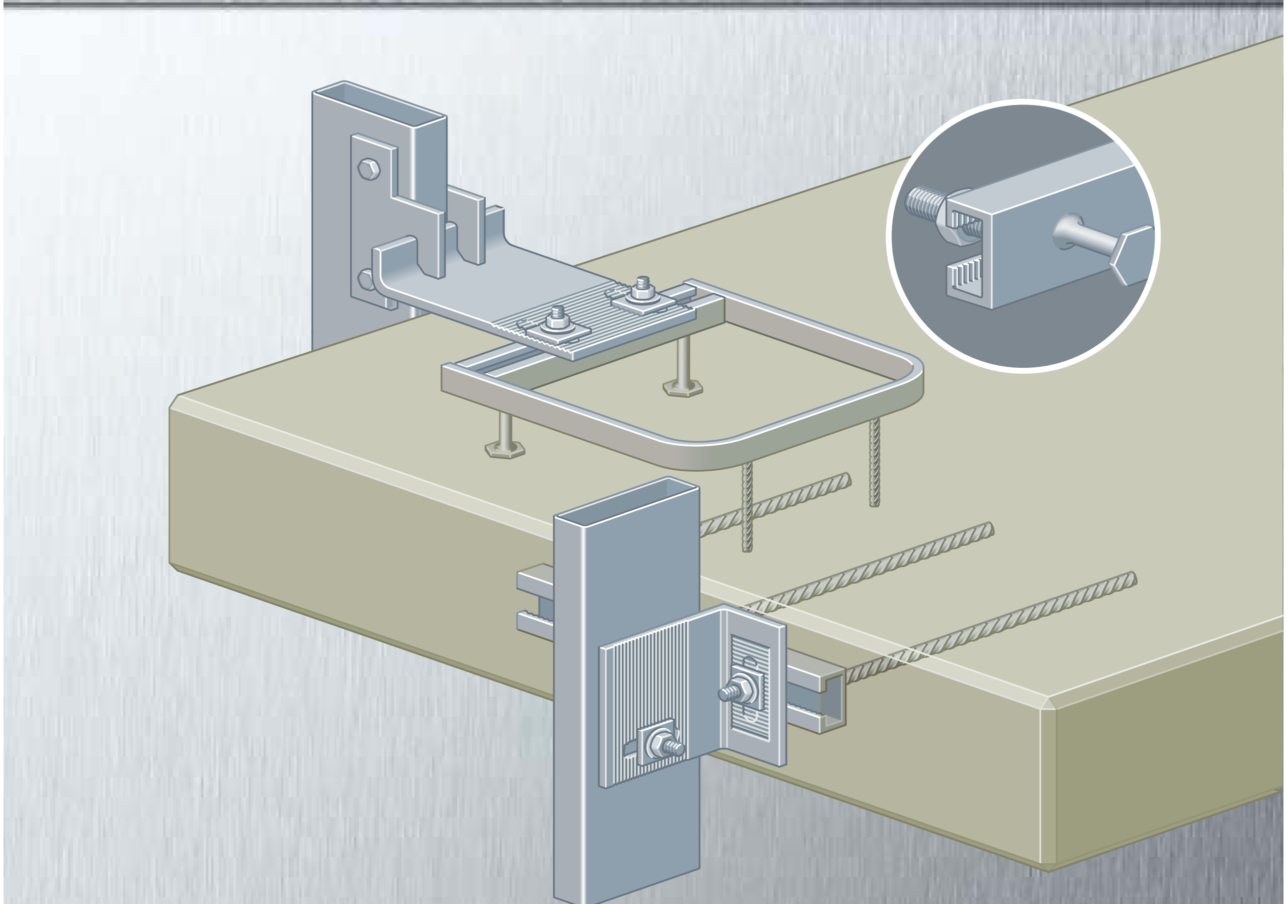
HALFEN CHANNELS FOR CURTAIN WALL
PRODUCT INFORMATION



HALFEN CURTAIN WALL SUPPORT SYSTEM

FACADE

HCW 05-CN-E

HALFEN·DEHA

YOUR BEST CONNECTIONS

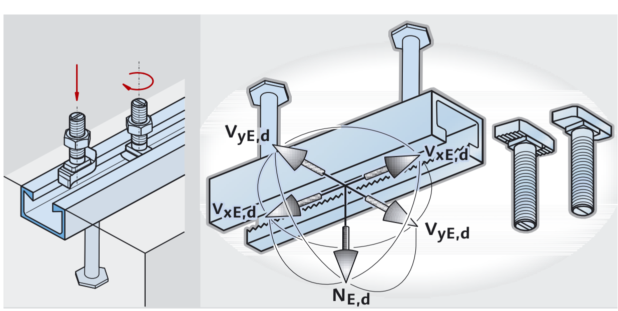
HALFEN-DEHA. WORLDWIDE LEADER IN CURTAIN WALL CONNECTIONS

CONTENTS PAGE

A Worldwide Reputation for Excellence

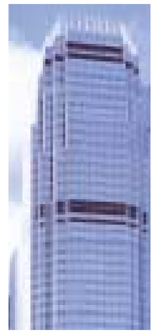
In 1929 HALFEN started to produce adjustable connection systems in Germany which soon became known as "Halfen channels". Now used worldwide, the amount of Halfen channels installed in the past 10 years alone would almost span the globe. The product allows adjustable connections to precast concrete as well as for concrete poured at the constructions site. Halfen channels are ideal, for framing applications, and for facade fixing solutions. A highly competent Research and Development team makes sure, that HALFEN-DEHA maintains its reputation as technology leader by offering the most innovative and the user-friendly fixing and anchoring systems.

The Halfen System

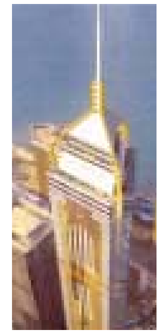


SHORT PROJECT LIST

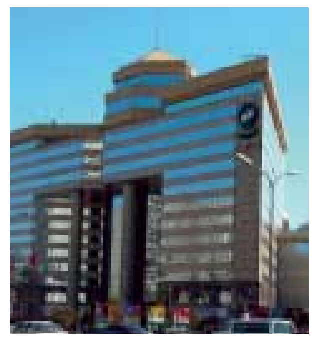

Jin-Mao, Shanghai

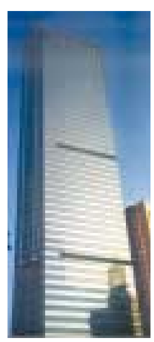

IFC One, Hong Kong


Henderson Centre, Beijing


Central Plaza, Hong Kong


Oriental Plaza, Beijing


COFCO Plaza, Beijing


Tianan Plaza, Tianan

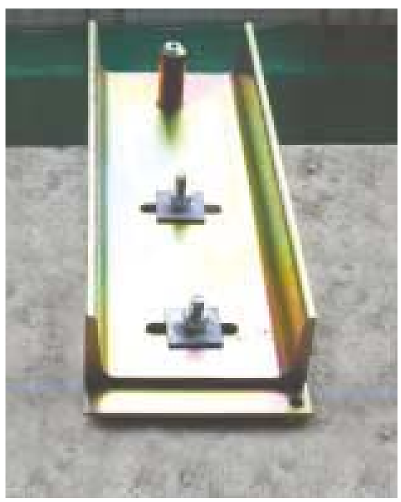

Hong Kong Chek Lap Kok Airport


New World Centre, Beijing

INSTALLATION EXAMPLES

Typical facade connection to the top of floor slab.

Typical facade connection to the edge of a floor slab.



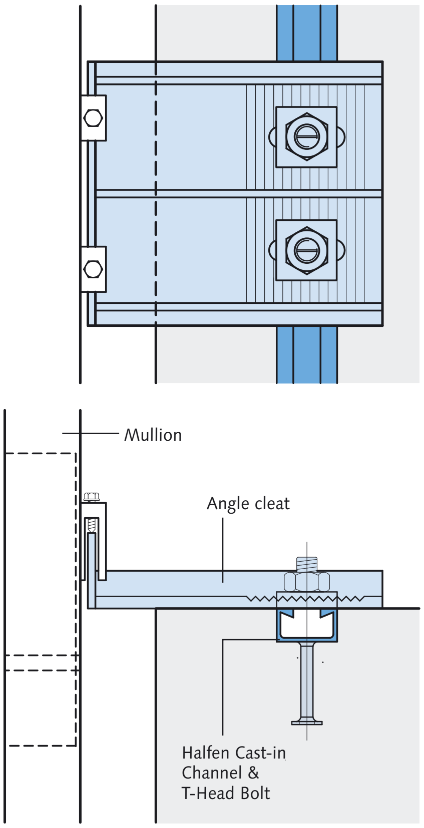
Facade connections using toothed HZA channels to provide adjustment in the direction of the wind load. One or two channels can be used per bracket.

Typical connection to the edge of a post tensioned floor slab.

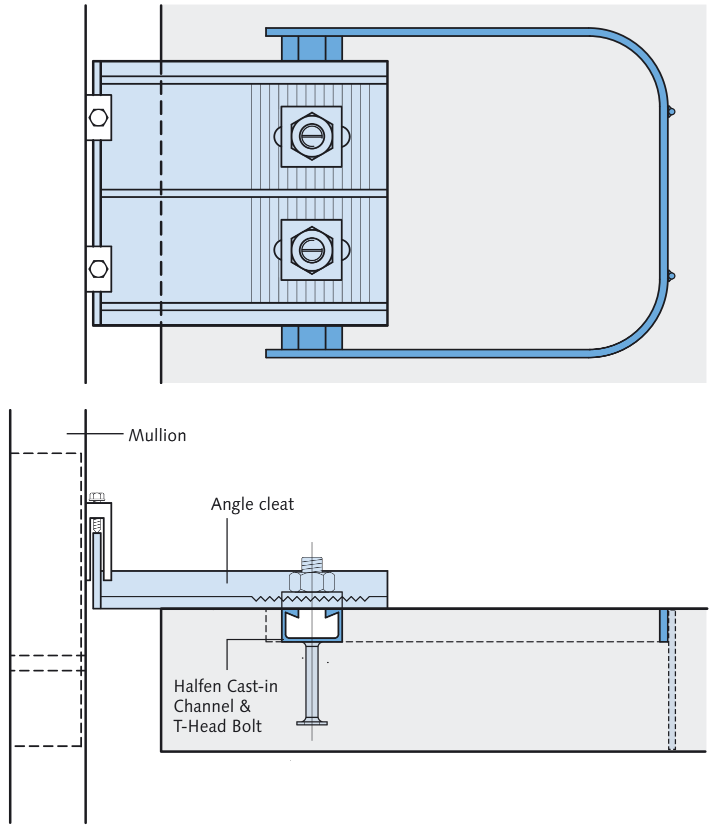
Sunscreen connections using channels to support vertical & horizontal loads.

Typical window connection to precast panel.

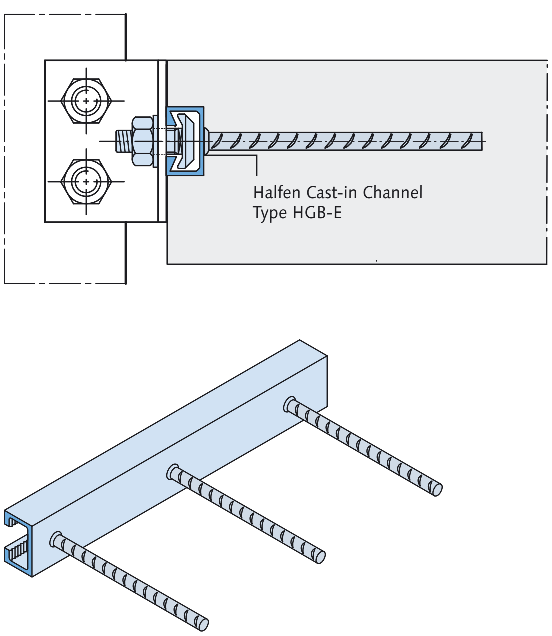
TYPICAL CURTAIN WALL CONNECTIONS



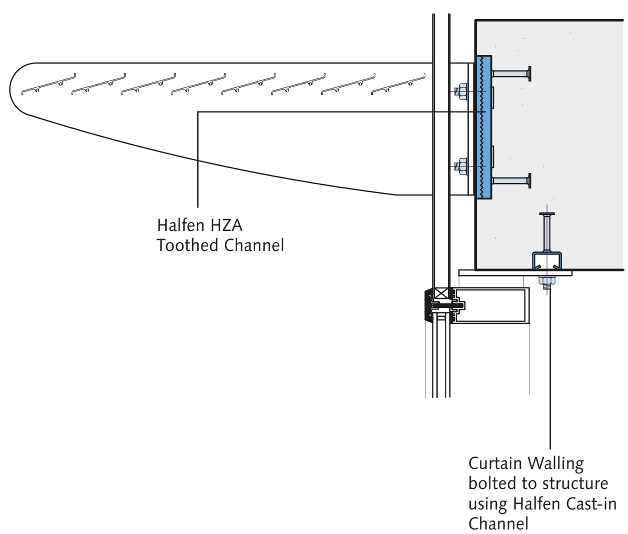
Typical anchorage detail to top of slab



High wind load connection using Halfen high load channel HCW S2/34

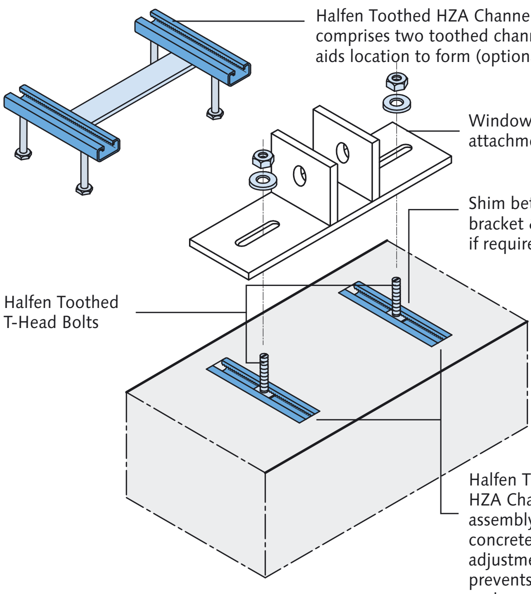


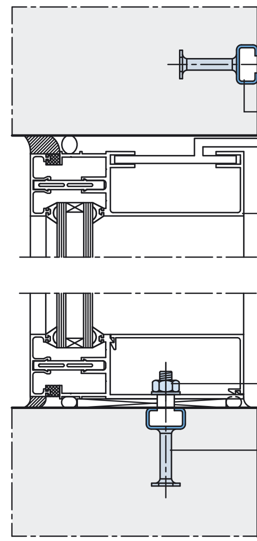
Typical anchorage detail to edge of thin slab



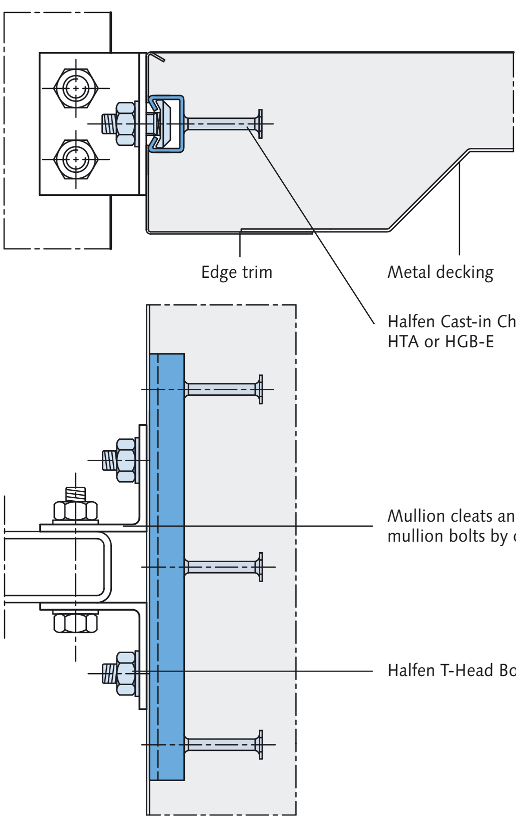
Typical sunscreen / glazing detail

TYPICAL CURTAIN WALL CONNECTIONS

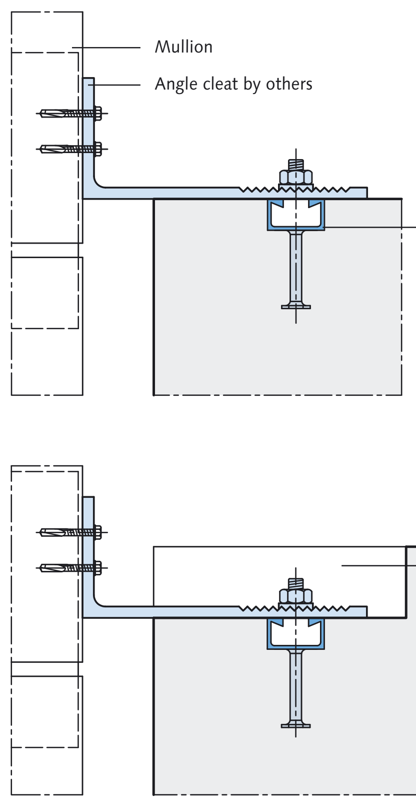




Typical anchorage details for individual or strip windows



Typical anchorage detail to metal deck floor slab



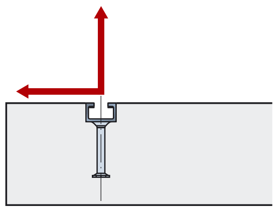
Typical anchorage detail to top of floor slabs.
Option of pocket at channel locations as illustrated.

HALFEN CAST-IN CHANNELS HTA, HZA, HCW AND HGB-E

SELECTING THE RIGHT HALFEN CHANNEL FOR EACH LOAD CONDITION

LOAD CONDITIONS AND REQUIRED HALFEN CHANNELS

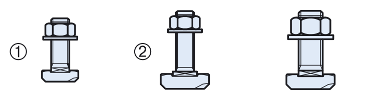
Normal slab conditions
→ page 10 - 13



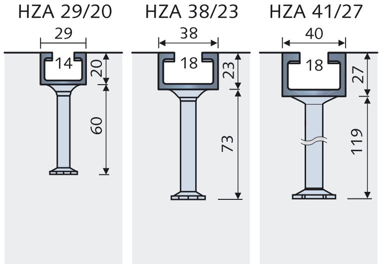
Standard Channels with Bolt Anchors

• Toothed channels + bolts

HZS/HS 29/20 M10 / M12	HZS/HS 38/23 M12 / M16	HZS/HS 38/23 M16

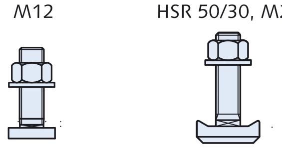


HZA 29/20	HZA 38/23	HZA 41/27

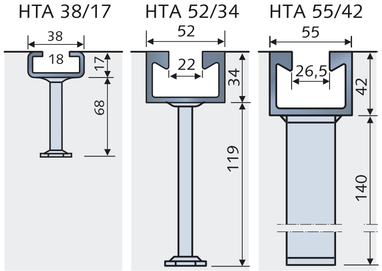


• Plain channels + bolts

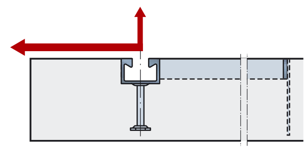
HS 38/17 M12	HS 50/30, M16 HSR 50/30, M20



HTA 38/17	HTA 52/34	HTA 55/42

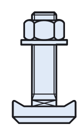


Thin slab conditions with small edge distances
High shear, medium tension
→ page 16 - 17

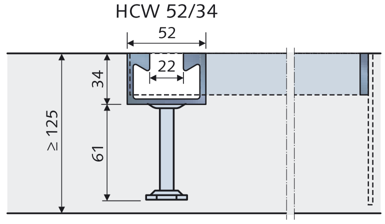


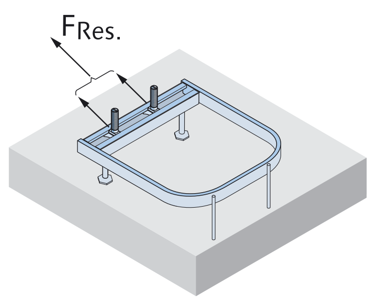
High Load Channel

HS 50/30, M16, M20
grade 8.8

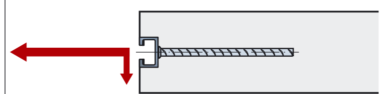


HCW 52/34





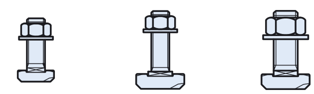
Thin slab conditions
High tension, small shear
→ page 14 - 15



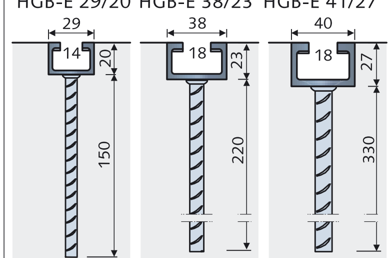
Standard Channels with Bar Anchors

• Toothed channels + bolts

HZS/HS 29/20 M10 / M12	HZS/HS 38/23 M12 / M16	HZS/HS 38/23 M16



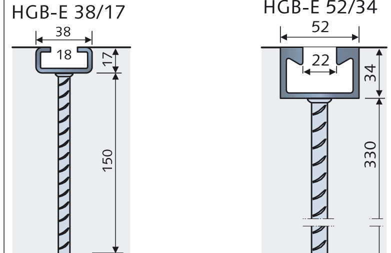
HGB-E 29/20	HGB-E 38/23	HGB-E 41/27



• Plain channels + bolts

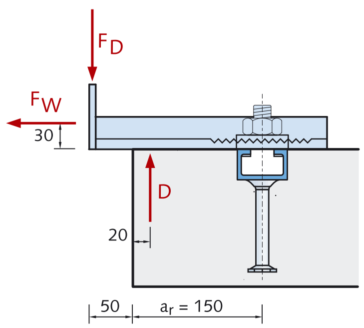
HS 38/17 M12, M16	HS 50/30 M12, M16

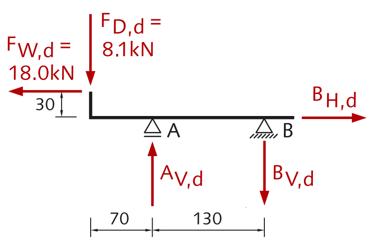
HGB-E 38/17	HGB-E 52/34

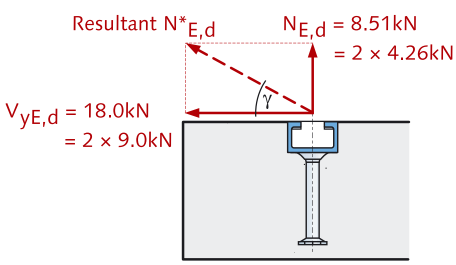


Notes:
① HZA 29/20 replaces and offers improved performance to HTA 40/22.
② HZA 38/23 replaces and offers improved performance to HTA 50/30.

EXAMPLE 1







Given:

working loads on the Curtain Wall bracket
- working deadload $F_D = 6.00$ kN
- working windload $F_W = 12.00$ kN

The calculation example uses load and resistance factor design, applying partial safety factors γ_F on the load side (action).

For deadloads: $\gamma_F = 1.35$ (acc. to German regulations ①)
For windloads: $\gamma_F = 1.50$ (acc. to German regulations ①)
⇒
- design deadload $F_{D,d} = \gamma_F \cdot F_D = 1.35 \cdot 6.0 \text{ kN} = 8.1 \text{ kN}$
- design windload $F_{W,d} = \gamma_F \cdot F_W = 1.5 \cdot 12.0 \text{ kN} = 18.00 \text{ kN}$

Design forces acting on the channel:

$B_{V,d} = (8.1 \cdot 70 + 18.0 \cdot 30) / 130 = 8.51 \mathrel{\hat{=}} N_{E,d}$
$B_{H,d} = F_{W,d} = 18.0 \text{ kN} \mathrel{\hat{=}} V_{yE,d}$

$$\gamma = \arctan\left(\frac{N_{E,d}}{V_{yE,d}}\right) = \arctan\left(\frac{8.51}{18.0}\right) = 25.3° > 15°$$

$$\Rightarrow N^*_{E,d} (\gamma > 15°) = \sqrt{(N_{E,d})^2 + (V_{yE,d})^2}$$

$$N^*_{E,d} = \sqrt{(8.51)^2 + (18.0)^2} = 19.91 \text{ kN} \mathrel{\hat{=}} 2 \times 9{,}96 \text{ kN}$$

SELECTED CHANNEL:

HZA 38/23 - 300 - 3 anchors with 2 bolts at 125mm centre (→ p. 12)

required a_r = 150 mm (→ p. 13) ✓ OK

$V_{yR,d}$ =	2 × 9.0	≥	$V_{yE,d}$ =	2 × 9.0	✓ OK
$N_{R,d}$ =	2 × 14.0	>	$N_{E,d}$ =	2 × 4.26	✓ OK
$N^*_{R,d}$ =	2 × 14.0	>	$N^*_{E,d}$ =	2 × 9.96	✓ OK

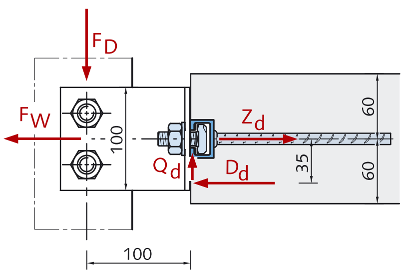
SELECTED BOLTS:

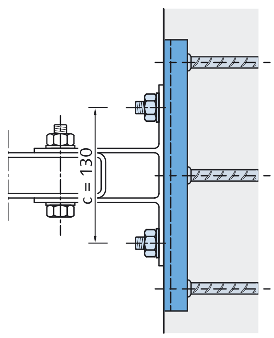
2 pieces HS 38/23 M12×60 gv 8.8 (→ p. 13)

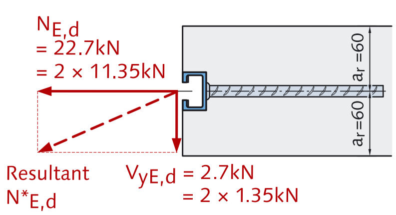
$V_{yR,d}$ =	27.0	>	$V_{yE,d}$ =	9.0	✓ OK
$N_{R,d}$ =	27.0	>	$N_{E,d}$ =	4.26	✓ OK
$F_{SR,d}$ =	27.0	>	$F_{SE,d}$ =	9.96	✓ OK

① Partial safety factors γ_F in China may be different from the German ones

EXAMPLE 2







Given:

working loads on the Curtain Wall bracket
- working deadload $F_D = 2.00$ kN
- working windload $F_W = 10.00$ kN

The calculation example uses load and resistance factor design, applying partial safety factors γ_F on the load side (action).

For deadloads: $\gamma_F = 1.35$ (acc. to German regulations ①)
For windloads: $\gamma_F = 1.50$ (acc. to German regulations ①)
⇒
- design deadload $F_{D,d} = \gamma_F \cdot F_D = 1.35 \cdot 2.0 \text{ kN} = 2.7 \text{ kN}$
- design windload $F_{W,d} = \gamma_F \cdot F_W = 1.5 \cdot 10.0 \text{ kN} = 15.0 \text{ kN}$

Design forces acting on the channel:

$Q_{,d} = F_{D,d} = 2.7 \text{ kN} \mathrel{\hat{=}} V_{yE,d}$

$Z_{,d} = F_{W,d} + F_{D,d} \times (100 / 35) = 15.0 + 2.7 \times (100 / 35)$
$= 22.7 \text{ kN} \mathrel{\hat{=}} N_{E,d}$

$N^*_{E,d} = \sqrt{(N_{E,d})^2 + (V_{yE,d})^2}$

$N^*_{E,d} = \sqrt{(22.7)^2 + (2.7)^2} = 22.86 \text{ kN}$
$= 2 \times 11.43 \text{ kN}$

SELECTED CHANNEL:

HGB-E 38/23 - 300 - 3 anchors with 2 bolts at 130mm centre (→ p. 14)

actual $a_r = 60$ mm (→ p. 14)

⇒ $V_{yR,d} = 2 \times 3.7 > V_{yE,d} = 2 \times 1.35$ ✓ OK
$N_{R,d} = 2 \times 14.0 > N_{E,d} = 2 \times 11.35$ ✓ OK
$N^*_{R,d} = 2 \times 14.0 > N^*_{E,d} = 2 \times 11.43$ ✓ OK

SELECTED BOLTS:

2 pieces HS 38/23 M12×60 gv 8.8 (→ p. 15)

actual c = 130 > required c ≥ 125 (→ p. 14) ✓ OK
$V_{yR,d} = 27.0 > V_{yE,d} = 1.35$ ✓ OK
$N_{R,d} = 27.0 > N_{E,d} = 11.35$ ✓ OK
$F_{SR,d} = 27.0 > F_{SE,d} = 11.43$ ✓ OK

① Partial safety factors γ_F in China may be different from the German ones

INSTALLATION

Nail channel to formwork

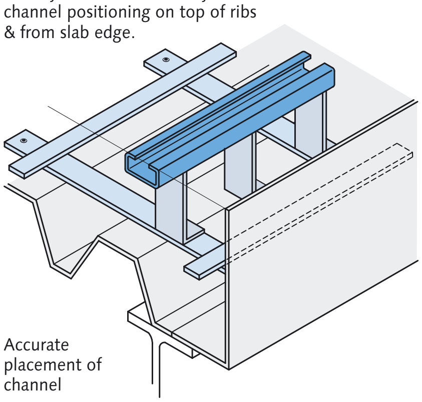
When concrete is set, remove the formwork, then remove the filler material from the channel.

Insert T-bolt into channel and rotate ninety degrees.

Attach component and tighten nut.

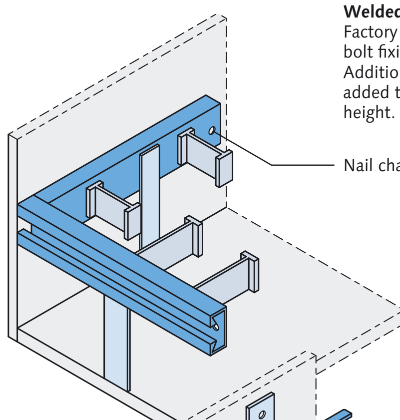
SPECIAL INSTALLATION ASSEMBLIES

Fabricated Ski Assembly
Factory fabricated assembly assures channel positioning on top of ribs & from slab edge.

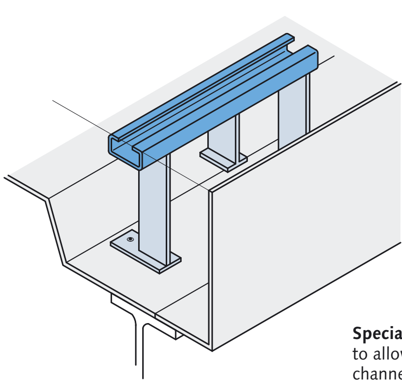


Accurate placement of channel

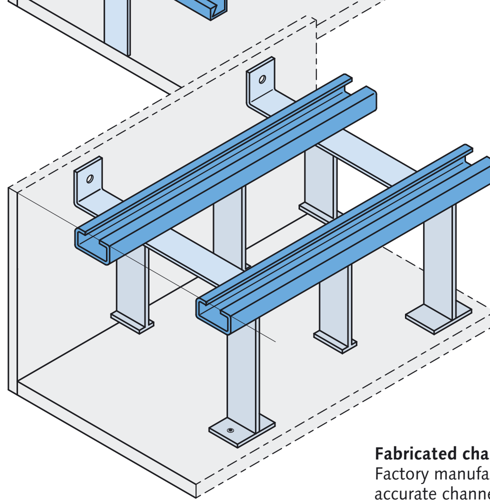
Welded Corner Assembly
Factory fabricated assembly allows bolt fixings close to corner edge. Additional spacer straps may be added to ensure correct channel height.



Nail channel securely to formwork

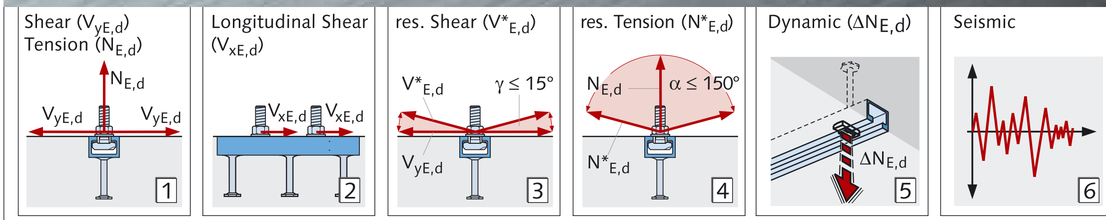


Special Anchor Fabrications
to allow positioning and fixing of channel to troughs in metal deck.



Fabricated channel pair
Factory manufactured to provide accurate channel spacing.

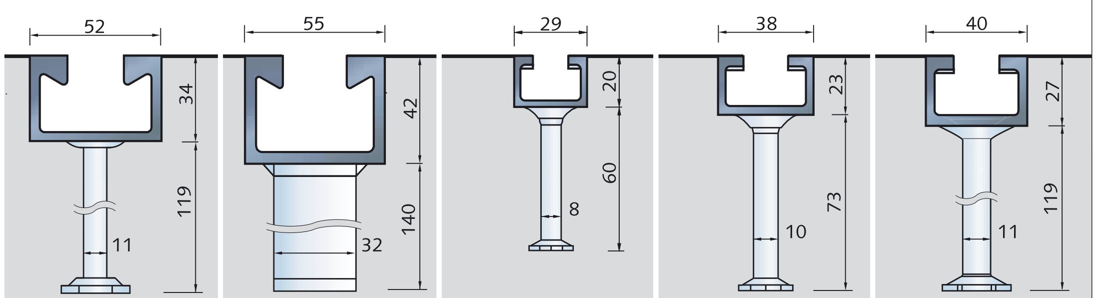
FACTORED DESIGN LOAD CONDITIONS



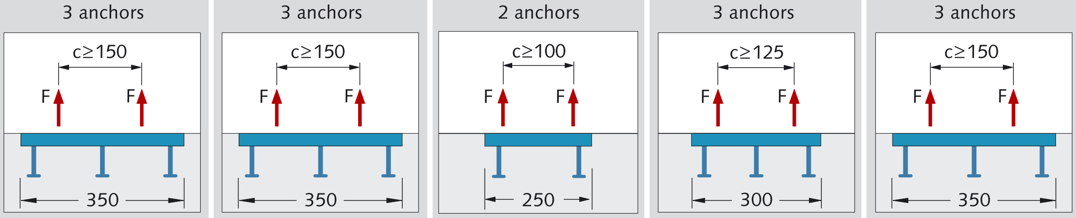
Structural analysis	$F_{R,d}$ Material resistance		$F_{E,d}$ Factored design load	
1 Shear Material Resistance	$V_{yR,d}$	≥	$V_{yE,d}$	
1 Tension Material Resistance	$N_{R,d}$	≥	$N_{E,d}$	
2 Longitudinal Shear Material Resistance	$V_{xR,d}$	≥	$V_{xE,d}$	
3 Resultant Shear Material Resistance	$V^*_{R,d}$	≥	res. $V_{E,d}$	$= \sqrt{(V_{xE,d})^2 + (V_{yE,d})^2}$
	$V^*_{R,d}$	≥	$V^*_{E,d}$ ($\gamma \leq 15°$ ①)	$= \sqrt{(N_{E,d})^2 + (\text{res. } V_{E,d})^2}$
4 Resultant Tension Material Resistance	$N^*_{R,d}$	≥	$N^*_{E,d}$ ($\gamma \geq 15°$, $\alpha \leq 150°$ ①)	$= \sqrt{(N_{E,d})^2 + (\text{res. } V_{E,d})^2}$
5 Dynamic Material Resistance	$\Delta N_{R,d}$	≥	$\Delta N_{E,d}$	

① $\gamma = \arctan\left(\frac{N_{E,d}}{\text{res. } V_{E,d}}\right)$

HALFEN CAST-IN CHANNELS HTA AND HZA – MATERIAL DESIGN RESISTANCE VALUES



Concrete compression strength ≥ C20/25
$f_{CK, cyl.} = 20$ N/mm²
$f_{CK, cube} = 25$ N/mm²



Channel Type:	HTA 52/34 350 mm 3 anchors	HTA 55/42 350 mm 3 anchors	HZA 29/20 250 mm 2 anchors	HZA 38/23 300 mm 3 anchors	HZA 41/27 350 mm 3 anchors
$N_{R,d}$ [kN]	2 × 30	2 × 37	2 × 8,5	2 × 14	2 × 28
$V_{yR,d}$ [kN]	2 × 15	2 × 18	2 × 8,5	2 × 9	2 × 15
$V_{xR,d}$ [kN]	2 × 10 ②	2 × 10 ②	2 × 7,5	2 × 11	2 × 12
$N^*_{R,d}$ [kN]	2 × 30	2 × 37	2 × 8,5	2 × 14	2 × 28
$V^*_{R,d}$ [kN]	2 × 15	2 × 18	2 × 8,5	2 × 9	2 × 15
$\Delta N_{R,d}$ [kN]	2 × 9 ③	2 × 10 ③	2 × 2,5	2 × 4	2 × 4
Material: hot-dip galvanised	channel: W1.0038 anchor: W1.5523 or W1.5535	channel: W1.0044 anchor: W1.0038	channel: W1.0044 anchor: W1.0205	channel: W1.0044 anchor: W1.0205	channel: W1.0044 anchor: W1.5523 or W1.5535

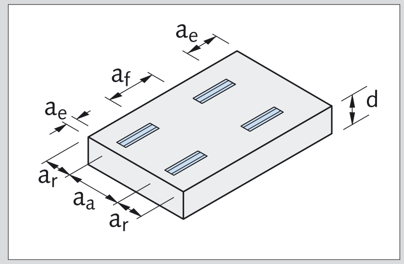
Notes: ② only with HSR M20 ③ only with welded I-anchor Q

HALFEN CAST-IN CHANNELS HTA/HZA – MINIMUM SPACING a_r, a_a, a_e, a_f AND d

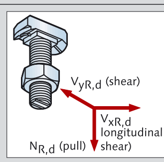
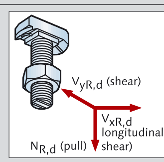
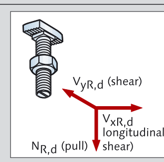
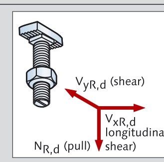
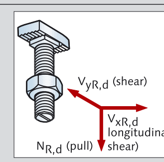
Minimum spacings and edge distances [mm] ④

For all concrete grades ≥ C20/25

Halfen Channel Type	a_r	a_a	a_e	a_f	d ⑤
HTA 52/34	200	400	175	350	160 + nom.c
HTA 55/42	250	500	225	450	185 + nom.c
HZA 29/20	100	200	80	200	80 + nom.c
HZA 38/23	150	300	130	250	96 + nom.c
HZA 41/27	200	400	175	350	146 + nom.c

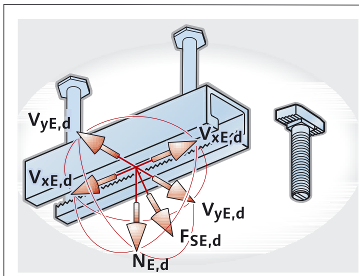


HALFEN T-HEAD BOLTS HSR, HZS – MATERIAL DESIGN RESISTANCE PER BOLT ⑥

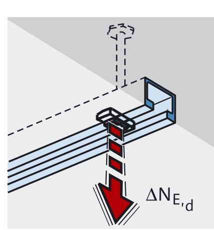
Halfen Channel Type	HTA 52/34 350 mm 3 anchors	HTA 55/42 350 mm 3 anchors	HZA 29/20 250 mm 2 anchors	HZA 38/23 300 mm 3 anchors	HZA 41/27 350 mm 3 anchors
Halfen T-head bolt Type	HSR 50/30 M20×60 gv 8.8	HSR 50/30 M20×60 gv 8.8	HZS 29/20 M12×60 gv 8.8	HZS 38/23 M12×60 gv 8.8 (HZS 38/23 M16×60 gv 8.8)	HZS 38/23 M16×60 gv 8.8
					
$N_{R,d} = V_{yR,d} = F_{SR,d}$ [kN]	78	78	27	27 (50)	50
$V_{xR,d}$ [kN]	10	10	27	27 (50)	50
$\Delta N_{R,d}$ [kN]	10	10	2	2 (4)	4
Required tightening torque [Nm]	400	400	80	80 (120)	120

Structural analysis

	$F_{R,d}$ Material resistance		$F_{E,d}$ Factored design load	
Shear Material Resistance	$V_{yR,d}$	≥	$V_{yE,d}$	
Tension Material Resistance	$N_{R,d}$	≥	$N_{E,d}$	
Longitudinal Shear Material Resistance	$V_{xR,d}$	≥	$V_{xE,d}$	
Resultant Material Resistance	$F_{SR,d}$	≥	$F_{SE,d}$	$= \sqrt{(N_{E,d})^2 + (V_{xE,d})^2 + (V_{yE,d})^2}$
Dynamic Material Resistance	$\Delta N_{R,d}$	≥	$\Delta N_{E,d}$	



Dynamic Load



Notes:

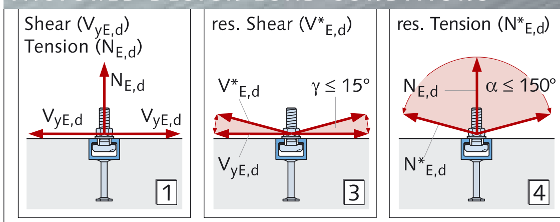
④ The minimum dimensions given in the table apply to reinforced concrete. For unreinforced concrete increase dimensions by 30%.

⑤ Derived from channel plus anchor plus the required concrete cover (e.g. to DIN 1045).

⑥ Channel load capacity must not be exceeded!

gv 4.6 = zinc plated, strength grade 4.6
gv 8.8 = zinc plated, strength grade 8.8

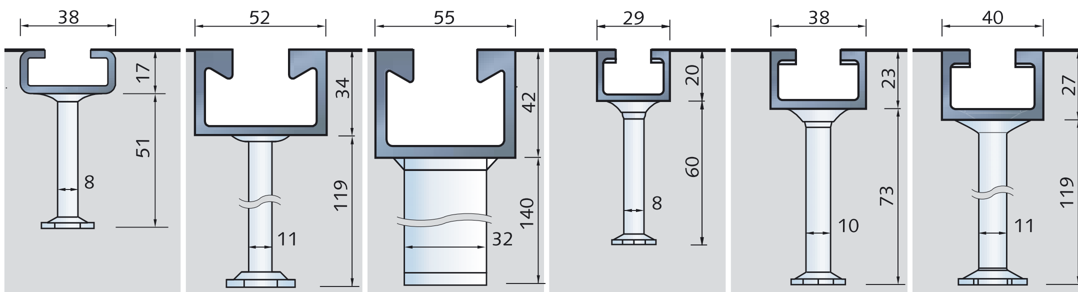
FACTORED DESIGN LOAD CONDITIONS



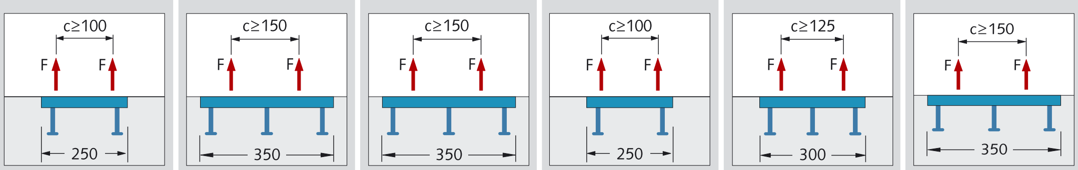
Structural analysis	$F_{R,d}$ Material resistance		$F_{E,d}$ Factored design load	
1 Shear Material Resistance	$V_{yR,d}$	≥	$V_{yE,d}$	
1 Tension Material Resistance	$N_{R,d}$	≥	$N_{E,d}$	
3 Resultant Shear Material Resistance	$V^*_{R,d}$	≥	$V^*_{E,d}$ ($\gamma \leq 15°$ ①)	$= \sqrt{(N_{E,d})^2 + (V_{yE,d})^2}$
4 Resultant Tension Material Resistance	$N^*_{R,d}$	≥	$N^*_{E,d}$ ($\gamma \geq 15°$, $\alpha \leq 150°$ ①)	$= \sqrt{(N_{E,d})^2 + (V_{yE,d})^2}$

① $\gamma = \arctan\left(\frac{N_{E,d}}{V_{yE,d}}\right)$

HALFEN CAST-IN CHANNELS HTA AND HZA – MATERIAL DESIGN RESISTANCE VALUES



Channel Type:	HTA 38/17	HTA 52/34	HTA 55/42	HZA 29/20	HZA 38/23	HZA 41/27
	250 mm 2 anchors	350 mm 3 anchors	350 mm 3 anchors	250 mm 2 anchors	300 mm 3 anchors	350 mm 3 anchors
Concrete compression strength ≥ C20/25 $f_{CK, cyl.} = 20$ N/mm² $f_{CK, cube} = 25$ N/mm²	c≥100	c≥150	c≥150	c≥100	c≥125	c≥150
$N_{R,d}$ [kN]	2 × 6	2 × 30	2 × 37	2 × 8,5	2 × 14	2 × 28
$V_{yR,d}$ [kN]	2 × 6	2 × 15	2 × 18	2 × 8,5	2 × 9	2 × 15
$N^*_{R,d}$ [kN]	2 × 6	2 × 30	2 × 37	2 × 8,5	2 × 14	2 × 28
$V^*_{R,d}$ [kN]	2 × 6	2 × 15	2 × 18	2 × 8,5	2 × 9	2 × 15
Material: hot-dip galvanised	channel: W1.0037 anchor: W1.0205	channel: W1.0038 anchor: W1.5523 or W1.5535	channel: W1.0044 anchor: W1.0038	channel: W1.0044 anchor: W1.0205	channel: W1.0044 anchor: W1.0205	channel: W1.0044 anchor: W1.5523 or W1.5535



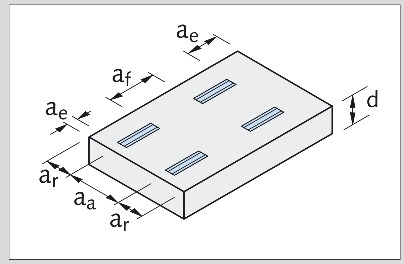
HALFEN CAST-IN CHANNELS AND T-HEAD BOLTS

FOR STANDARD APPLICATIONS

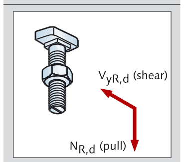
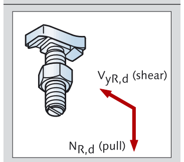
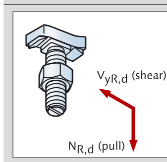
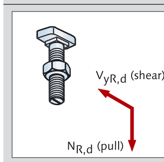
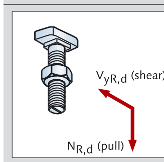
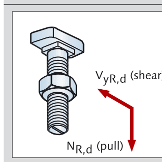
HALFEN CAST-IN CHANNELS HTA/HZA – MINIMUM SPACING a_r, a_a, a_e, a_f AND d

Minimum spacings and edge distances [mm] ②
For all concrete grades ≥ C20/25

Halfen Channel Type	a_r	a_a	a_e	a_f	d ③
HTA 38/17	75	150	50	100	70 + nom.c
HTA 52/34	200	400	175	350	160 + nom.c
HTA 55/42	250	500	225	450	185 + nom.c
HZA 29/20	100	200	80	200	80 + nom.c
HZA 38/23	150	300	130	250	96 + nom.c
HZA 41/27	200	400	175	350	146 + nom.c

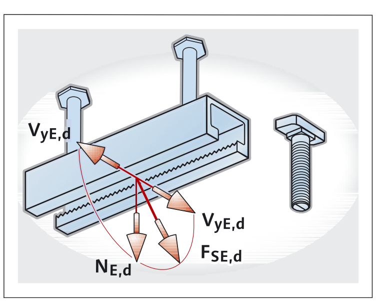


HALFEN T-HEAD BOLTS HS – MATERIAL DESIGN RESISTANCE PER BOLT ④

Halfen Channel Type	HTA 38/17 250 mm 2 anchors	HTA 52/34 350 mm 3 anchors	HTA 55/42 350 mm 3 anchors	HZA 29/20 250 mm 2 anchors	HZA 38/23 300 mm 3 anchors	HZA 41/27 350 mm 3 anchors
Halfen T-head bolt Type	HS 38/17 M12×60 gv 4.6	HS 50/30 M16×60 gv 8.8	HS 50/30 M16×60 gv 8.8	HS 29/20 M10×60 gv 8.8	HS 38/23 M12×60 gv 8.8 (HS 38/23 M16×60 gv 4.6)	HS 38/23 M16×60 gv 8.8
						
$N_{R,d} = V_{yR,d} = F_{SR,d}$ [kN]	13	50	50	18	27 (24)	50
Required tightening torque [Nm]	25	200	200	48	70 (60)	200

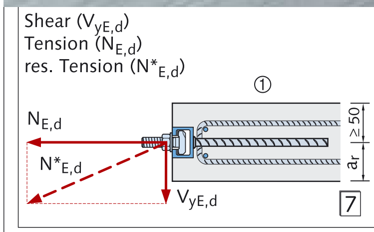
Structural analysis

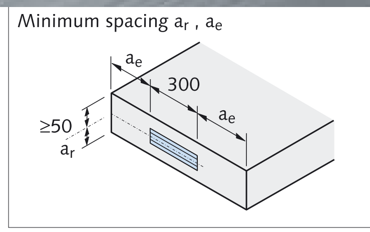
	$F_{R,d}$ Material resistance		$F_{E,d}$ Factored design load	
Shear Material Resistance	$V_{yR,d}$	≥	$V_{yE,d}$	
Tension Material Resistance	$N_{R,d}$	≥	$N_{E,d}$	
Resultant Material Resistance	$F_{SR,d}$	≥	$F_{SE,d}$	$= \sqrt{(N_{E,d})^2 + (V_{yE,d})^2}$



Notes:
② The minimum dimensions given in the table apply to reinforced concrete. For unreinforced concrete increase dimensions by 30%.
③ Derived from channel plus anchor plus the required concrete cover (e.g. to DIN 1045).
④ Channel load capacity must not be exceeded!
gv 4.6 = zinc plated, strength grade 4.6
gv 8.8 = zinc plated, strength grade 8.8

FACTORED DESIGN LOAD CONDITIONS



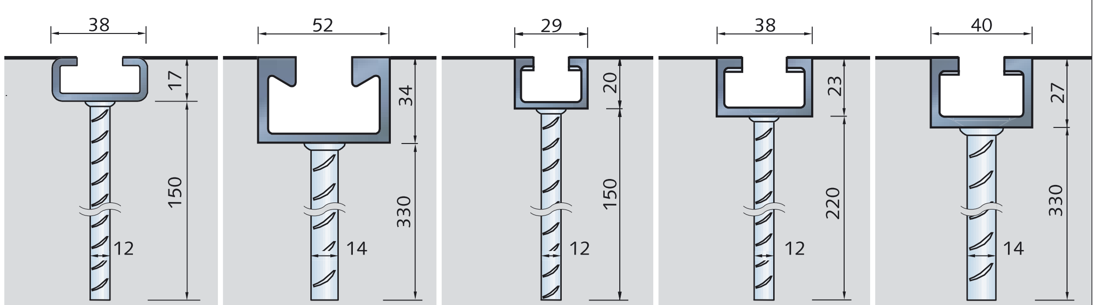


Structural analysis

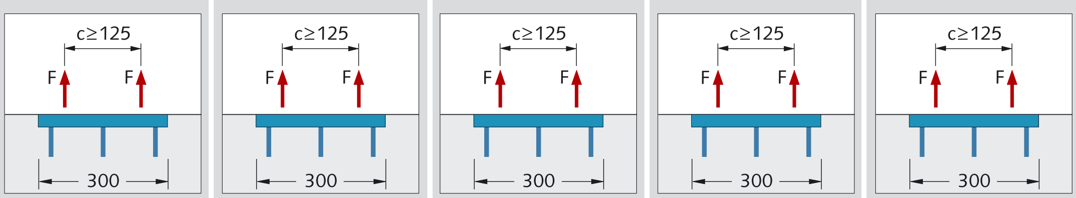
		$F_{R,d}$ Material resistance		$F_{E,d}$ Factored design load	
7	Shear Material Resistance	$V_{yR,d}$	≥	$V_{yE,d}$	
7	Tension Material Resistance	$N_{R,d}$	≥	$N_{E,d}$	
7	Resultant Tension Material Resistance	$N^*_{R,d}$	≥	$N^*_{E,d}$	$= \sqrt{(N_{E,d})^2 + (V_{yE,d})^2}$

Notes:
① The minimum dimensions given in the table apply to reinforced concrete.

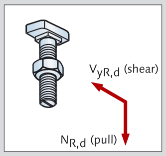
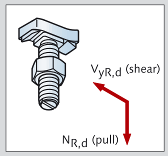
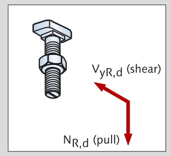
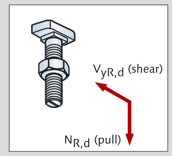
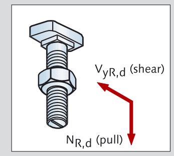
HALFEN CAST-IN CHANNELS HTA AND HZA – MATERIAL DESIGN RESISTANCE VALUES



Channel Type:		HGB-E 38/17 300 mm 3 anchors	HGB-E 52/34 300 mm 3 anchors	HGB-E 29/20 300 mm 3 anchors	HGB-E 38/23 300 mm 3 anchors	HGB-E 41/27 300 mm 3 anchors
Concrete compression strength ≥ C20/25 $f_{CK, cyl.}$ = 20 N/mm² $f_{CK, cube}$ = 25 N/mm²						
$N_{R,d} = N^*_{R,d}$ [kN]		2 × 7	2 × 24	2 × 9	2 × 14	2 × 22
a_r [mm]	a_e [mm]	$V_{yR,d}$ [kN]				
≥ 50	≥ 40	2 × 2.4				
≥ 60	≥ 45	2 × 3.7				
≥ 70	≥ 50	2 × 4.9				
≥ 75	≥ 50	2 × 5.6				
Material: hot-dip galvanised		channel: W1.0037 anchor: BSt 500S	channel: W1.0038 anchor: BSt 500S	channel: W1.0044 anchor: BSt 500S	channel: W1.0044 anchor: BSt 500S	channel: W1.0044 anchor: BSt 500S

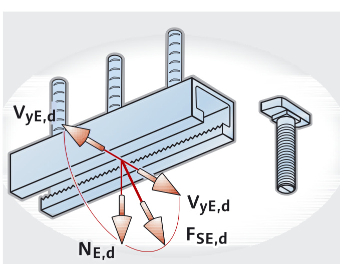


HALFEN T-HEAD BOLTS HS – MATERIAL DESIGN RESISTANCE PER BOLT ②

Halfen Channel Type	HGB-E 38/17 300 mm 3 anchors	HGB-E 52/34 300 mm 3 anchors	HGB-E 29/20 300 mm 3 anchors	HGB-E 38/23 300 mm 3 anchors	HGB-E 41/27 300 mm 3 anchors
Halfen T-head bolt Type	HS 38/17 M12×60 gv 4.6	HS 50/30 M16×60 gv 8.8	HS 29/20 M10×60 gv 8.8	HS 38/23 M12×60 gv 8.8 (HS 38/23 M16×60 gv 4.6)	HS 38/23 M16×60 gv 8.8
					
$N_{R,d} = V_{yR,d} = F_{SR,d}$ [kN]	13	50	18	27 (24)	50
Required tightening torque [Nm]	25	60	40	40 (60)	60

Structural analysis

	$F_{R,d}$ Material resistance		$F_{E,d}$ Factored design load	
Shear Material Resistance	$V_{yR,d}$	≥	$V_{yE,d}$	
Tension Material Resistance	$N_{R,d}$	≥	$N_{E,d}$	
Resultant Material Resistance	$F_{SR,d}$	≥	$F_{SE,d}$	$= \sqrt{(N_{E,d})^2 + (V_{yE,d})^2}$

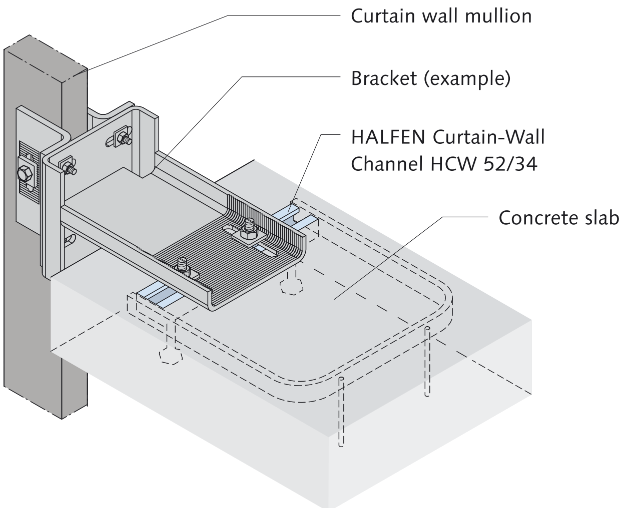


Notes:
② Channel load capacity must not be exceeded!
gv 4.6 = zinc plated, strength grade 4.6
gv 8.8 = zinc plated, strength grade 8.8

HALFEN HIGH LOAD CHANNEL HCW 52/34

FOR CURTAIN WALL CONNECTIONS

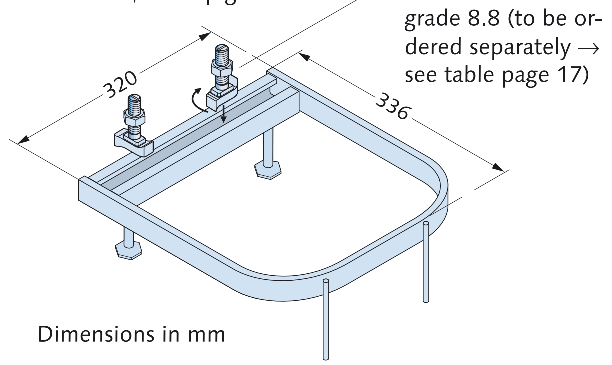
TYPICAL INSTALLATION



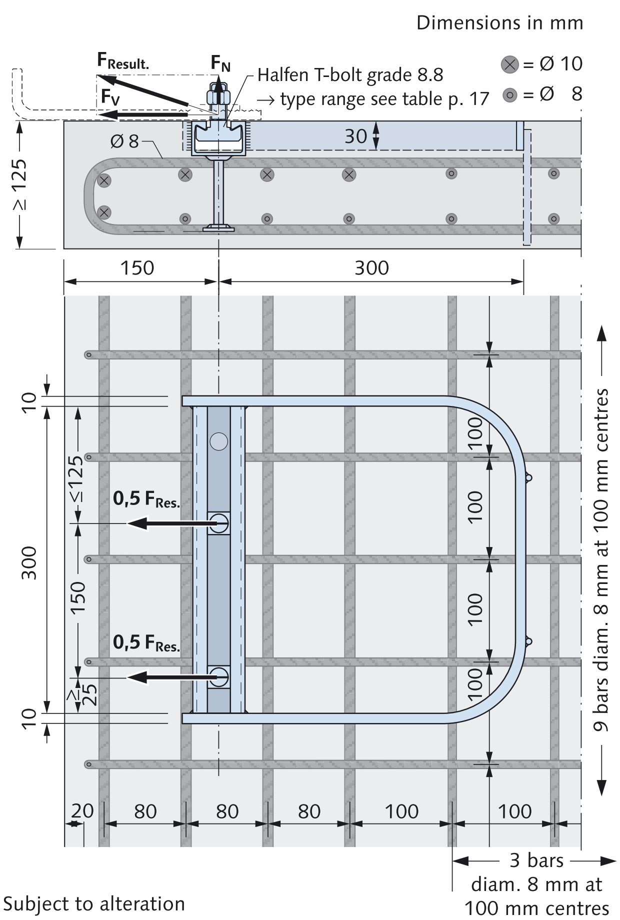
PRODUCT DESCRIPTION

Product Code:
HCW 52/34

Material:
Carbon steel, hot dip galvanised



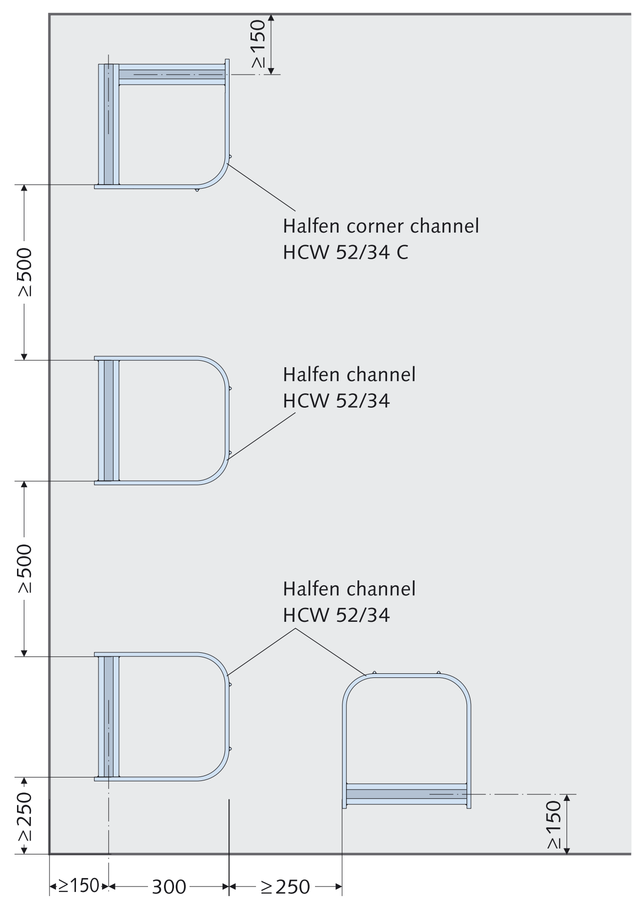
REINFORCEMENT REQUIREMENTS



Subject to alteration

CHANNEL DIMENSIONS AND POSITIONING

Halfen channel HCW 52/34 should be placed in the concrete according to the minimum edge distances and spacing dimensions shown in the drawing below. Corner conditions using Halfen channel HCW 52/34 C will require special design, please contact us for assistance.



HALFEN HIGH LOAD CHANNEL HCW 52/34

FOR CURTAIN WALL CONNECTIONS

CHANNEL LOAD DATA

A series of 3 tests produced the following average ultimate loads:

$F_{V\ ultimate}$	= 142.3 kN
$F_{N\ ultimate}$	= 47.4 kN
$F_{Result.\ ultimate} = \sqrt{F_N^2 + F_V^2}$	= 150.0 kN

The adjacent load deformation diagram 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:

The concrete slab is ≥ 125 mm thick and reinforced according to the diagram on the previous page.

Concrete compression strength ≥ C 20/25 N/mm² (cylinder/cube) with normal weight aggregate.

Load is equally distributed to the channel by two Halfen T-bolts (ordered separately) spaced at ≥ 150 mm centers. See below for sizes and load capacities.

An example of a typical calculation method is shown below. The factors used in the calculation example are for illustration only. Actual factors used on a project basis must be checked according to local or national building regulations. Also the calculations make no allowance for load magnification due to load eccentricities. These must be included according to the project design of the connection. Contact us for guidance if required.

Calculation Example: Assumed safety factor 3 applied to the ultimate test load.

Ultimate test load: $F_{Result.\ ultimate} = 150.0$ kN

⇒ $F_{V\ ultimate} = 142.3$ kN

⇒ $F_{N\ ultimate} = 47.4$ kN

Required working loads: $F_{V\ work.} = 35$ kN, $F_{N\ work.} = 10$ kN

Allowable load at 3:1 safety factor:

$F_{Result.\ allow.} = 50.0$ kN

⇒ $F_{V\ allow.} = 47.4$ kN

⇒ $F_{N\ allow.} = 15.8$ kN

Checking $F_{V\ work.} = 35\ kN < 47.4\ kN$ → so OK

Checking $F_{N\ work.} = 10\ kN < 15.8\ kN$ → so OK

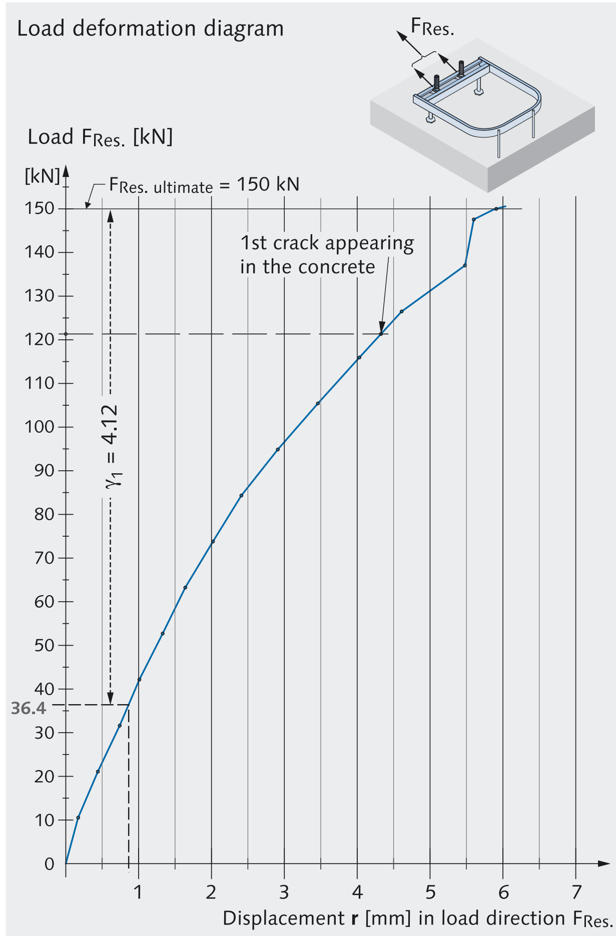
Checking $F_{Result.\ work.} = \sqrt{10^2 + 35^2} = \mathbf{36.4\ kN} < 50\ kN$ → so OK

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

Actual safety factor to ultimate test load: $\gamma_1 = \frac{150}{36.4} = 4.12$

The load deformation diagram may also be used as a basis for calculations according to load resistance design methods.

Partial safety factors should be incorporated according to local or national design norms.



FASTENER INFORMATION

Halfen 8.8 grade T-bolts type HS 50/30, M16 and M20 are recommended for use with Halfen channel type HCW 52/34 according to the load performance required.

The loads $F_{S\ Allow.}$ shown in the table below are per bolt and based on applied safety factors of approximately 2.5:1, other factors may be applied according to appropriate regulations and project requirements.

Please note, that fastener performance may be limited by channel capacity. The sizes shown are produced with a special coating equivalent to hot dip galvanising in salt spray tests. T-bolts in other sizes and materials are available if required, please contact us for details.

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

Thread Size	Material Grade DIN	L Available Lengths [mm]	$F_{S\ Allow.}$ bolt load (pull, angled pull and shear) [kN]	Allowable Bending Moment [Nm]	Recommended initial torque [Nm]
M 16	8.8	40, 60, 80, 100	36.1	111	200
M 20	8.8	45, 60, 80, 100	56.4	216	400

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

CURTAIN WALL FIXING *WITHOUT* HALFEN CHANNELS: THE DISADVANTAGES

Welding is slow, is a fire risk, and needs to be closely checked for quality.

Weld and paint splatter can cause expensive damage to the facade.

WELDING

- Risk of sparks starting fires and damaging glass & aluminium facade = high risk & high cost.
- Quality welding difficult to achieve and check on site = high risk.
- Welding needs a lot of time and should be tested to verify quality = slow installation & high risk.
- Painting required after welding to provide any corrosion protection = poor corrosion protection, more time, another operation to check, dripping paint damages facade and creates health hazard.
- Heavy electrical equipment, trailing wires, and electricity = safety hazards.
- Welds must be broken and re-welded if adjustment needed after initial installation = slow installation.
- Embedded plates are designed per project and need testing to verify performance.

Welded connections require painting to give minimal corrosion protection.

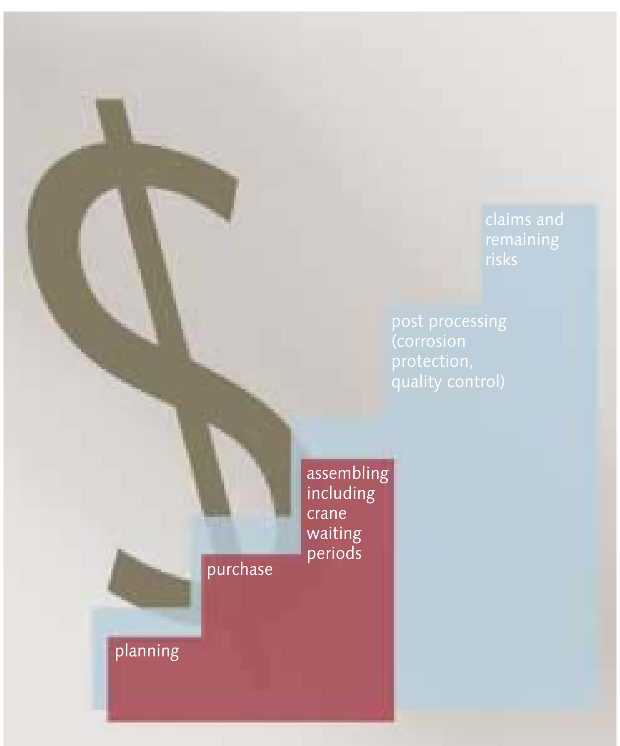
Welding requires difficult repositioning of heavy equipment and a costly energy supply.

CURTAIN WALL FIXING *WITH* HALFEN CHANNELS: THE ADVANTAGES

HALFEN CHANNEL

- Only simple tools needed for installation.
- Easy and fast to install without special training.
- Components protected from corrosion by quality galvanising and plating.
- Can be installed without power supply.
- Easily adjustable connections.
- Fully tested components with verified load capacities.

TOTAL COST COUNTS



Cast-In Channels   Welding Plates

The only tool required.