Deutsches Institut für Bautechnik

Public-law institution jointly founded by the federal states and the Federation

European Technical Assessment Body for construction products

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European Technical Assessment ETA-09/0339 of 30 May 2024

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	Halfen anchor channel HTA
Product family to which the construction product belongs	Anchor channels
Manufacturer	Leviat GmbH Liebigstraße 14 40764 Langenfeld DEUTSCHLAND
Manufacturing plant	Leviat Werke
This European Technical Assessment contains	34 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330008-04-0601, Edition 03/2024
This version replaces	ETA-09/0339 issued on 7 December 2021

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Specific Part

1 Technical description of the product

The HALFEN Anchor Channels HTA is a system consisting of a C-shaped channel profile of steel and stainless steel and at least two metal anchors non-detachably fixed on the channel back and channel bolts.

The anchor channel is embedded surface-flush in the concrete. HALFEN channel bolts with appropriate hexagon nuts and washers are fixed to the channel.

The product description is given in Annex A.

2 Specification of the intended use in accordance with the applicable European Assessment Document

The performances given in Section 3 are only valid if the anchor channel is used in compliance with the specifications and conditions given in Annex B.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the anchor channel of at least 50 and/ or 100 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for its assessment

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance under tension load (static and quasi-static loading)	
- Resistance to steel failure of anchors	$N_{Rk,s,a}$ see Annex C1
- Resistance to steel failure of the connection between anchors and channel	$N_{Rk,s,c}$ see Annex C1
- Resistance to steel failure of channel lips and subsequently pull-out of channel bolt	$N^0_{Rk,s,l}$; $s_{l,N}$ see Annex C1
- Resistance to steel failure of channel bolt	$N_{Rk,s}$ see Annex C2
- Resistance to steel failure by exceeding the bending strength of the channel	s_{max} see Annex A7 $M_{Rk,s,flex}$ see Annex C1
- Maximum installation torque to avoid damage during installation	$T_{inst,g}$; $T_{inst,s}$ see Annex B4
- Resistance to pull-out failure of the anchor	$N_{Rk,p}$ see Annex C3
- Resistance to concrete cone failure	h_{ef} see Annex B3 $k_{cr,N}$; $k_{ucr,N}$ see Annex C3
- Minimum edge distances, spacing and member thickness to avoid concrete splitting during installation	s_{min} see Annex A7 c_{min} ; h_{min} see Annex B3
- Characteristic edge distance and spacing to avoid splitting of concrete under load	$s_{cr,sp}$; $c_{cr,sp}$ see Annex C3
- Resistance to blowout failure - bearing area of anchor head	A_h see Annex A6

Essential characteristic	**Performance**
Characteristic resistance under shear load (static and quasi-static loading)	
- Resistance to steel failure of channel bolt under shear loading without lever arm	$V_{Rk,s}$ see Annex C6
- Resistance to steel failure by bending of the channel bolt under shear load with lever arm	$M^0_{Rk,s}$ see Annex C6
- Resistance to steel failure of channel lips, steel failure of connection between anchor and channel and steel failure of anchor (shear load in transverse direction)	$V^0_{Rk,s,l,y}$; $s_{l,V}$; $V_{Rk,s,c,y}$; $V_{Rk,s,a,y}$ see Annex C4
- Resistance to steel failure of connection between channel lips and channel bolt (shear load in longitudinal channel axis)	$V_{Rk,s,l,x}$ see Annex C5
- Factor for sensitivity to installation (longitudinal shear)	γ_{inst} see Annex C5
- Resistance to steel failure of the anchor (longitudinal shear)	$V_{Rk,s,a,x}$ see Annex C5
- Resistance to steel failure of connection between anchor and channel (longitudinal shear)	$V_{Rk,s,c,x}$ see Annex C5
- Resistance to concrete pry-out failure	k_8 see Annex C4
- Resistance to concrete edge failure	$k_{cr,V}$; $k_{ucr,V}$ see Annex C4
Characteristic resistance under combined tension and shear load (static and quasi-static load)	
- Resistance to steel failure of the anchor channel	k_{13} ; k_{14} see Annex C7
Characteristic resistance under fatigue tension loading	
- Fatigue resistance to steel failure of the whole system (continuous or tri-linear function, assessment method A1, A2)	No Performance assessed
- Fatigue limit resistance to steel failure of the whole system (assessment method B)	No Performance assessed
- Fatigue resistance to steel failure of the whole system (linearized function, assessment method C)	$\Delta N_{Rk,s,lo,n}$; $N_{lok,s,n}$ (n = 10^4 to n = ∞) see Annex C8
- Fatigue resistance to concrete related failure (exponential function, assessment method A1, A2)	No Performance assessed
- Fatigue limit resistance to concrete related failure (assessment method B)	No Performance assessed
- Fatigue resistance to concrete related failure (linearized function, assessment method C)	$\Delta N_{Rk,c,E,n}$; $\Delta N_{Rk,p,E,n}$ (n = 10^4 to n = ∞) see Annex C9

Essential characteristic	Performance
Characteristic resistance under seismic loading (seismic performance category C1) - Resistance to steel failure under seismic tension loading (seismic performance category C1) - Resistance to steel failure under seismic shear loading for shear load in transverse direction (seismic performance category C1) - Resistance to steel failure under seismic shear loading for shear load in longitudinal channel axis (seismic performance category C1)	$N_{Rk,s,a,eq}$; $N_{Rk,s,c,eq}$; $N^0{}_{Rk,s,l,eq}$; $N_{Rk,s,eq}$; $M_{Rk,s,flex,eq}$ see Annex C10 $V_{Rk,s,eq}$; $V^0{}_{Rk,s,l,y,eq}$; $V_{Rk,s,c,y,eq}$; $V_{Rk,s,a,y,eq}$ see Annex C11 $V_{Rk,s,l,x,eq}$; $V_{Rk,s,a,x,eq}$; $V_{Rk,s,c,x,eq}$ see Annex C11
Characteristic resistance under static and quasi-static tension and/or shear loading - Displacements (static and quasi-static load)	δ_{N0} ; $\delta_{N\infty}$ see Annex C7 $\delta_{V,y,0}$; $\delta_{V,y,\infty}$; $\delta_{V,x,0}$; $\delta_{V,x,\infty}$ see Annex C7

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	See Annex C12 and C13

3.3 Aspects of durability linked with the Basic Works Requirements

Essential characteristic	Performance
Durability	See Annex B1

4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with EAD No. 330008-04-0601, the applicable European legal act is: [2000/273/EC].

The system to be applied is: 1

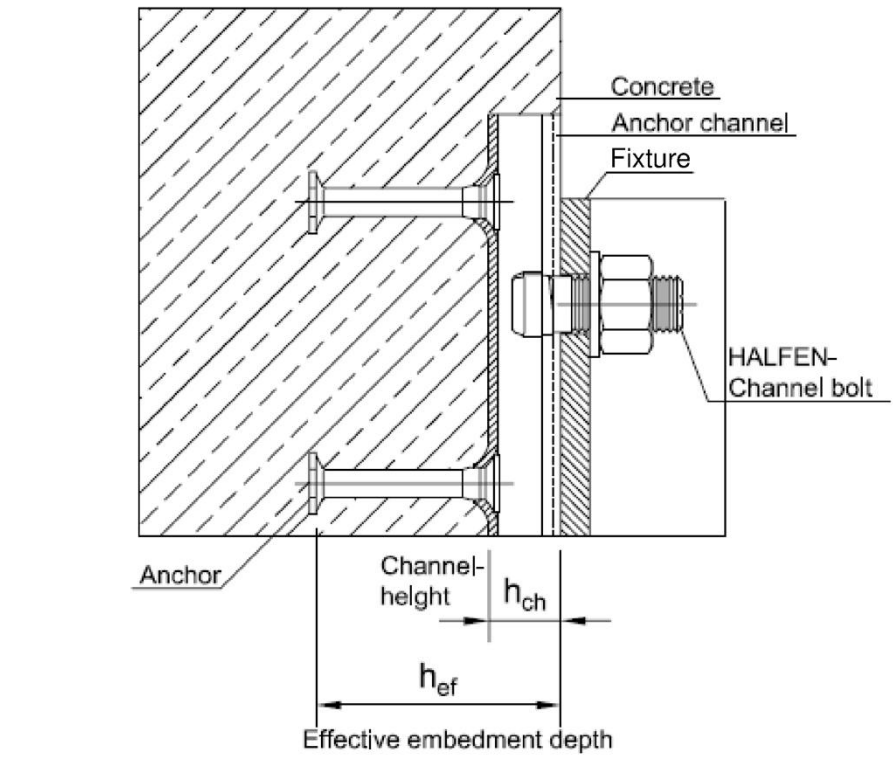
5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document

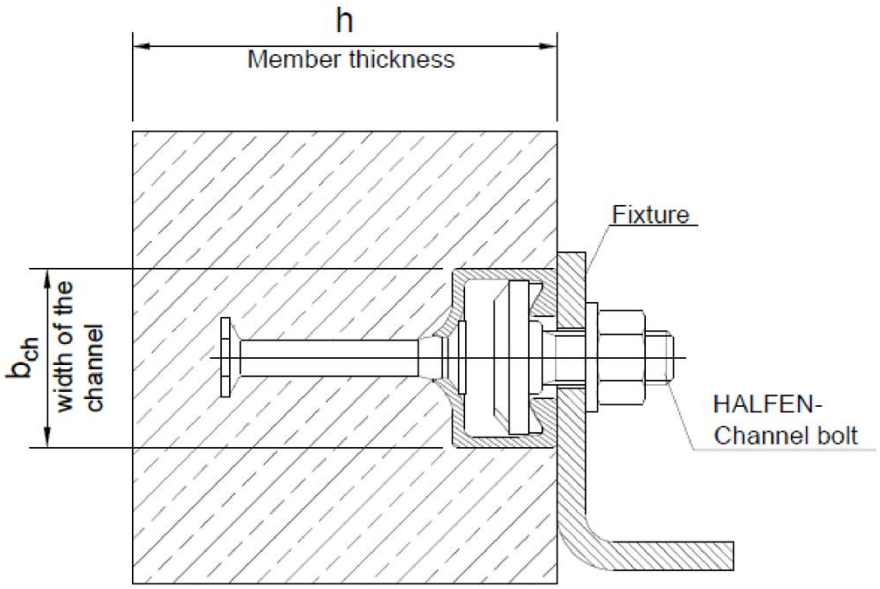
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 30 May 2024 by Deutsches Institut für Bautechnik

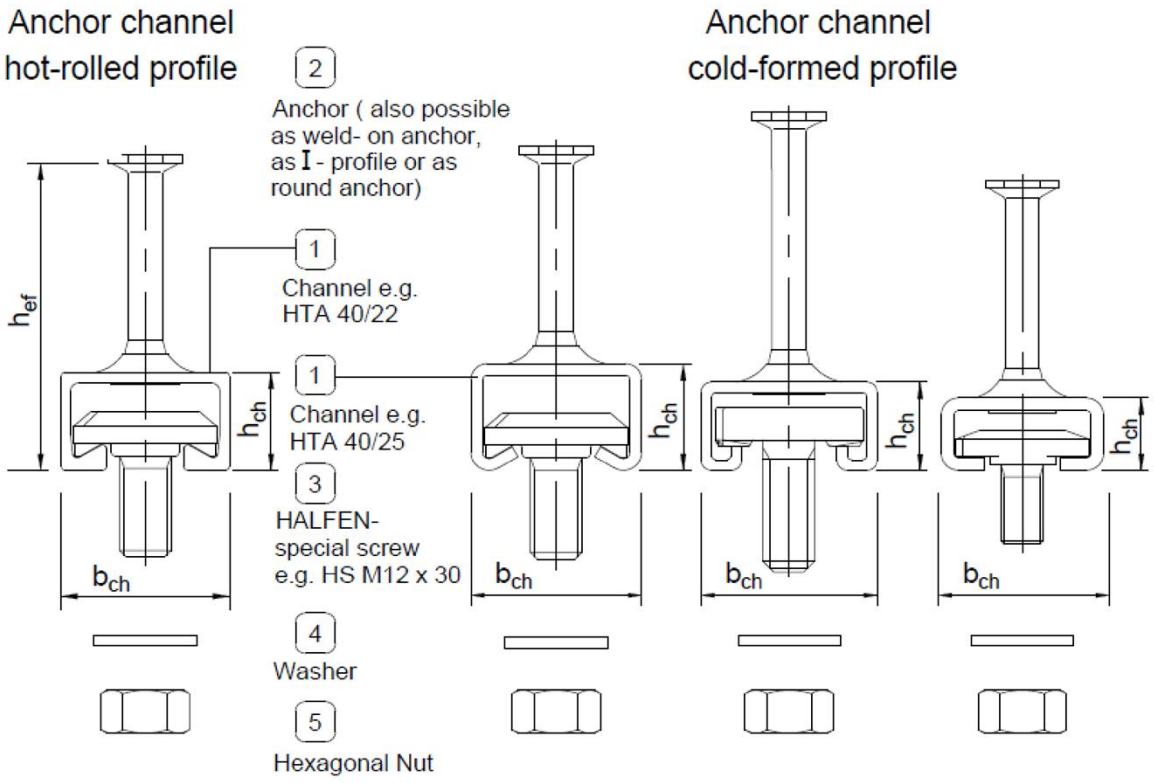
Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Müller





HALFEN Anchor Channels HTA	Annex A1
Product description Installed condition	



Marking of the HALFEN anchor channel
e.g.: HTA-CE 40/22 A4

a) Stamped on back of channel

b) Printed on channel web

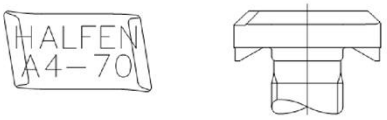
H or HALFEN	Identifying mark of producer
TA	Type of anchor channel
40/22	Size
A4	Material
If $h_{ef} > h_{ef,min}$	Emdbedment depth in [mm]

Material of channel:

Steel	
No marking for	hot-dip galvanized
SV	pre-galvanized
Stainless steel	corrosion resistance class
A2	CRC II
A4	CRC III
D4	CRC III
D6	CRC IV
HCR/A8	CRC V

Close to the anchor a nail hole is positioned.

Marking of the HALFEN channel bolts
e.g.: HALFEN A4-70



H, HALFEN	Identifying mark of the producer
A4	Material
70	Strength grade

Material of channel bolts:

Steel	
No marking	
Stainless steel	corrosion resistance class
A2	CRC II
A4	CRC III
D4	CRC III
FA/D6	CRC IV
HCR/A8	CRC V

Strength grade of the channel bolts:

Steel	
4.6, 8.8	Strength grade 4.6, 8.8
Stainless steel	
50, 70	Strength grade 50, 70

HALFEN Anchor Channels HTA

Product description
Marking and materials

Annex A2

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Table A1: Materials and intended use

Item no.	Specification	Intended use	
		1	2
		Dry internal conditions	**Internal conditions with usual humidity**
		Anchor channels may only be used in structures subject to dry internal conditions	Anchor channels may also be used in structures subject to internal conditions with usual humidity. For examples see use conditions in Annex B1
		Materials [6]	
①	Channel profile	**Carbon steel** 1.0038 (A), 1.0044 (A), 1.0045 (A) 1.0976 (D) hot-dip galv. ≥ 55 µm acc. to (N) 1.0242+Z (U), 1.0529+Z (U) hot-dip galv. ≥ 15 µm (pre-galvanized)	**Carbon steel** 1.0038 (A), 1.0044 (A), 1.0045(A) 1.0976 (D) hot-dip galv. ≥ 55 µm acc. to (N) **Stainless steel** [5] 1.4301 (G), 1.4307 (G), 1.4567 (G) 1.4541 (G)
②	Anchor	**Carbon steel** 1.0038 (A), 1.0214 (B), 1.0213 (B) 1.1132 (E), 1.1122 (E), 1.5525 (I) 1.5535 (I), 1.5523 (H), 1.0045 (A) hot-dip galv. ≥ 55 µm acc. to (N)	**Carbon steel** 1.0038 (A), 1.0214 (B), 1.0213 (B) 1.1132 (E), 1.1122 (E), 1.5525 (I) 1.5535 (I), 1.5523 (H), 1.0045 (A) hot-dip galv. ≥ 55 µm acc. to (N) **Stainless steel** [5] 1.4301 (G), 1.4307 (G) 1.4567 (G), 1.4541 (G)
③	HALFEN channel bolts	**Carbon steel** strength grade 4.6 / 8.8 (J) hot-dip galv. ≥ 50 µm acc. to (P) [1]	**Carbon steel** strength grade 4.6 / 8.8 (J) hot-dip galv. ≥ 50 µm acc. to (P) [1] **Stainless steel** [5] strength grade 50 / 70 (K) 1.4301 (G), 1.4307 (G) 1.4567 (G), 1.4541 (G)
④	Washer [3] (R) and (S) production class A, 200 HV	**Carbon steel** EN 10025-1:2017 electroplated ≥ 5 µm acc. to (O)	**Carbon steel** EN 10025-1:2017 hot-dip galv. ≥ 50 µm acc. to (P) [1] **Stainless steel** [5] steel grade A2, A3 (K)
⑤	Hexagonal nuts (T)	**Carbon steel** strength grade 5/8 (L) electroplated ≥ 5 µm acc. to (O)	**Carbon steel** strength grade 5/8 (L) hot-dip galv. ≥ 50 µm acc. to (P) [1] **Stainless steel** [5] strength grade 70 / 80 (M) steel grade A2, A3 (M)

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Table A1 (continued): Materials and intended use

Item no.	Specification	Intended use		
		3	4	5
		according EN 1993-1-4:2006+A1:2015, Tab. A.2		
		For CRC III	For CRC IV	For CRC V
		Materials [7]		
①	Channel profile	**Stainless steel** 1.4401 (G), 1.4404 (G) 1.4571 (G), **Stainless steel D4** 1.4062 (F), 1.4162 (F), 1.4362 (G)	**Stainless steel** 1.4462[2] (G)	**Stainless steel** 1.4529 (G), 1.4547 (G), 1.4410 (G)
②	Anchor	**Stainless steel** 1.4401 (G), 1.4404 (G) 1.4571 (G), 1.4362 (G) 1.4578 (G) **Carbon steel** [4] 1.0038 (A)	**Stainless steel** 1.4462[2] (G)	**Stainless steel** 1.4529 (G), 1.4547 (G), 1.4410 (G)
③	HALFEN channel bolts	**Stainless steel** strength grade 50 / 70 (K) 1.4401 (G), 1.4404 (G) 1.4571 (G), 1.4362 (G) 1.4578 (G)	**Stainless steel** strength grade 50 / 70 (K) 1.4462[2] (G)	**Stainless steel** strength grade 50 / 70 (K) 1.4529 (G), 1.4547 (G), 1.4410 (G)
④	Washer [3] (R) and (S) production class A, 200 HV	**Stainless steel** steel grade A4, A5 (K)	**Stainless steel** 1.4462[2] (G)	**Stainless steel** 1.4529 (G), 1.4547 (G), 1.4410 (G)
⑤	Hexagonal nuts (T)	**Stainless steel** strength grade 70 / 80 (M) steel grade A4, A5 (M)	**Stainless steel** strength grade 70 / 80 (M) 1.4462[2] (G)	**Stainless steel** strength grade 70 / 80 (M) 1.4529 (G), 1.4547 (G), 1.4410 (G)

A - EN 10025-2:2004
B - EN 10263-2:2017
D - EN 10149-2:2013
E - EN 10263-3:2017
F - EN 10088-2:2014
G - EN 10088-3:2014
H - EN 10269:2013
I - EN 10263-4:2017
J - EN ISO 898-1:2013+AC:2013
K - EN ISO 3506-1:2020
L - EN ISO 898-2:2022
M - EN ISO 3506-2:2020
N - EN ISO 1461:2022
O - EN ISO 4042:2022
P - EN ISO 10684:2004+AC:2009
R - EN ISO 7089:2000
S - EN ISO 7093-1:2000
T - EN ISO 4032:2023
U - EN 10346:2015

[1] or electroplated with special coating ≥ 12 µm
[2] 1.4462 not applicable for indoor swimming pools
[3] not included in scope of delivery
[4] only for weld-on anchors with sufficient concrete cover acc. to EN 1992-1-1:2004+AC:2010+A1:2014
[5] stainless steel anchors only in combination with stainless steel channel profiles, channel bolts, washers and nuts
[6] expected working life at least 50 years
[7] expected working life at least 100 years

HALFEN Anchor Channels HTA

Product description
Materials and intended use

Annex A4

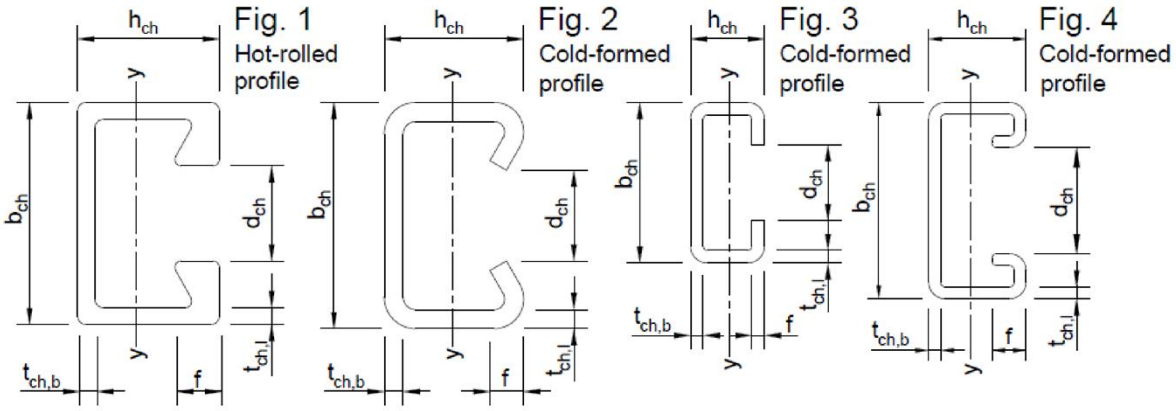

Table A2: Profile dimensions (steel and stainless steel)

Anchor channel	Figure	Dimensions						Material	I_y
		b_{ch}	h_{ch}	$t_{ch,b}$	$t_{ch,l}$	d_{ch}	f		
		[mm]							[mm⁴]
28/15	3	28,00	15,25	2,25	2,25	12,00	2,25	Steel	4.060
38/17	3	38,00	17,50	3,00	3,00	18,00	3,00		8.547
41/22	4	41,30	20,70	2,50	2,50	22,30	7,20		12.600
40/25	2	40,00	25,00	2,75	2,75	18,00	5,60		20.570
49/30	2	50,00	30,00	3,00	3,00	22,00	7,39		41.827
54/33	2	54,00	33,00	4,50	4,50	22,00	7,90		72.079
72/49	2	72,00	49,00	6,00	6,00	33,00	9,90		293.579
40/22 / 40/22P	1	39,50	23,00	2,60	2,40	18,00	6,00		20.029
50/30 / 50/30P	1	49,00	30,00	3,20	2,75	22,50	7,85		52.896
52/34	1	52,50	33,50	4,10	4,00	22,50	10,50		93.262
55/42	1	54,50	42,00	5,00	5,00	26,00	12,90		187.464
72/48	1	72,00	48,50	4,50	5,00	33,00	15,50		349.721
28/15	3	28,00	15,25	2,25	2,25	12,00	2,25	Stainless steel	4.060
38/17	3	38,00	17,50	3,00	3,00	18,00	3,00		8.547
41/22	4	41,30	20,70	2,50	2,50	22,30	7,20		12.600
40/25	2	39,50	25,00	2,50	2,50	18,00	5,40		19.097
49/30	2	50,00	30,00	3,00	3,00	22,00	7,39		41.827
54/33	2	54,00	33,00	4,50	4,50	22,00	7,90		72.079
72/49	2	72,00	49,00	6,00	6,00	33,00	9,90		293.579
40/22 / 40/22P	1	39,50	23,00	2,60	2,40	18,00	6,00		20.029
50/30 / 50/30P	1	49,00	30,00	3,20	2,75	22,50	7,85		52.896
52/34	1	52,50	33,50	4,10	4,00	22,50	10,50		93.262
55/42	1	54,50	42,00	5,00	5,00	26,00	12,90		187.464
72/48	1	72,00	48,50	4,50	5,00	33,00	15,50		349.721

HALFEN Anchor Channels HTA

Product description
Profile dimensions

Annex A5

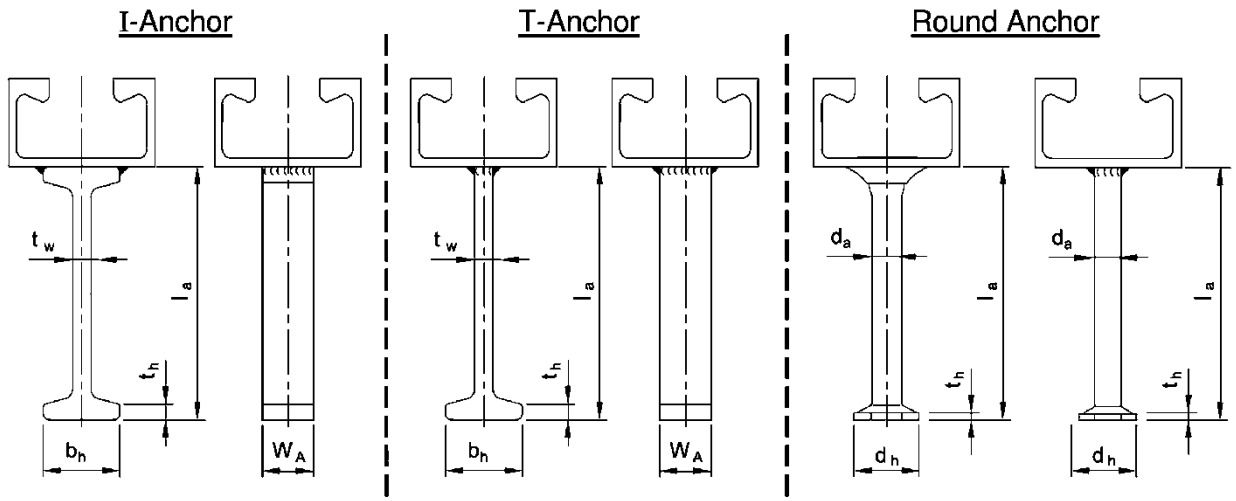

Table A3: Dimensions of anchors (I-Anchor, T-Anchor or Round Anchor)

Anchor channel l	I-Anchor und T-Anchor						Round Anchor				
	min l_a	t_w	b_h	t_h	w_A 4)	A_h 4)	min l_a	d_a	d_h	t_h	A_h
	[mm]					[mm²]	[mm]				[mm²]
28/15	62	5	18	3,3	10 - 20	130	32	6	12	1,3	85
38/17 3)	62	5	18	3,3	10 (14) - 20	130 (182)	60,4	8	16	1,9	151
41/22	69	5	18	3,5	10 (14) - 20	130 (182)	63,3	8	16	1,9	151
40/25	62	5	18	3,3	12 (14) - 24	156 (182)	60,9	8	16	1,9	151
40/22	62	5	18	3,3	12 - 24	156	60,9	8	16	1,9	151
40/22P	128	6	17	5	18 - 30	198	70,2	10	20	2,2	236
49/30	69	5	18	3,5	18 (20) - 30	234 (260)	69,2	10	20	2,2	236
50/30	69	5	18	3,5	18 - 30	234	69,2	10	20	2,2	236
50/30P	128	6	17	5	25 - 35	275	78,7	12	25	2,7	378
54/33	128	6	17	5	30 - 40	330	126	12	25	2,7	378
52/34	128	6	17	5	30 - 40	330	125,5	12	25	2,7	378
55/42 1)	140	7,1	20	6	35 - 45	452	136,2	14	28	3,2	462
72/49	140	7,1	20	6	40 - 50	516	- 2)				
72/48	140	7,1	20	6	40 - 50	516	- 2)				

1) HTA 55/42 in stainless steel only with weld-on anchors.
2) Product not available.
3) HTA 38/17 in stainless steel D4 only with round anchors.
4) values in brackets for anchor channels in stainless steel

HALFEN Anchor Channels HTA

Product description
Dimensions of anchors

Annex A6

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Figure 1

Round anchor
(B6-anchor)

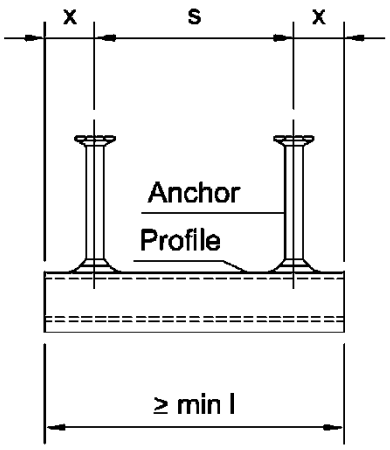

Figure 2

Weld- on anchor
(I-anchor and T-anchor)

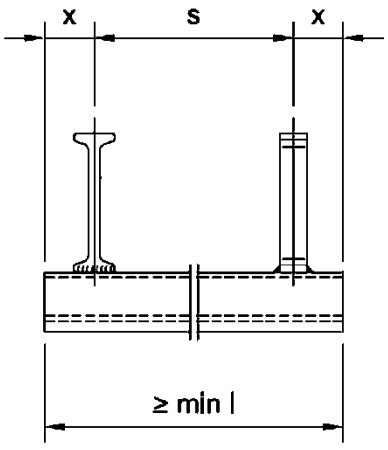

Figure 3

Weld- on anchor
round

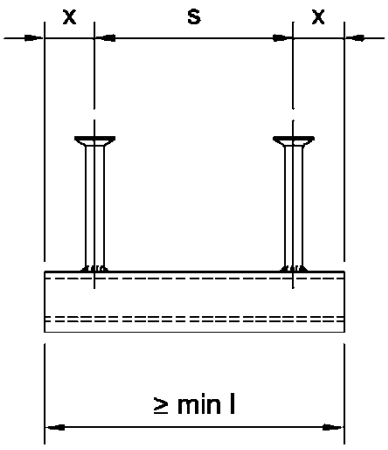

Table A4: Anchor positioning

Anchor channel	Anchor spacing s		End spacing x [1]		Min. Channel length l_{min}	
	s_{min}	s_{max}	Round anchor Fig. 1	Welded anchor Fig. 2 and 3	Round anchor Fig. 1	Welded anchor Fig. 2 and 3
	[mm]					
28/15 38/17	50	200	25	25	100	100
41/22 40/25 40/22 40/22P 49/30 50/30 50/30P	100 (50)	250	25 [2]	25 [2]	100	150
52/34 54/33	100 (80)	250	35	25 [2]	150	150
55/42	100 (80)	300	35	25 [2]	150	150
72/48 72/49	100 (80)	400	- [3]	25 [2]	- [3]	150

( ) valid for round anchor acc. Fig. 1.
[1] For channels with l = 6070 mm the end spacing x is always 35 mm.
[2] End spacing may be increased up to 35 mm.
[3] Product not available.

HALFEN Anchor Channels HTA	Annex A7
Product description Anchor positioning, channel length	

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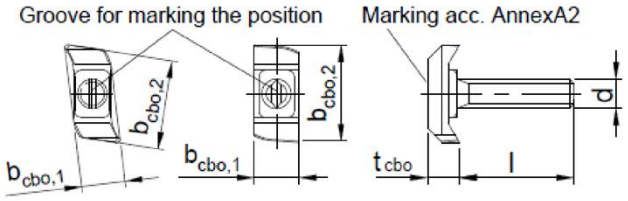
HALFEN channel bolts

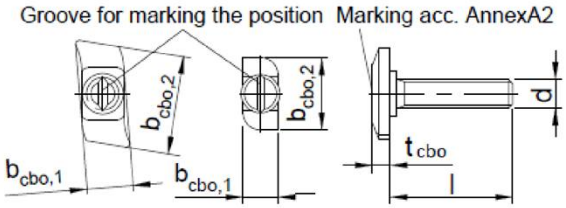
Hook-head geometry

HS: Type A Type B

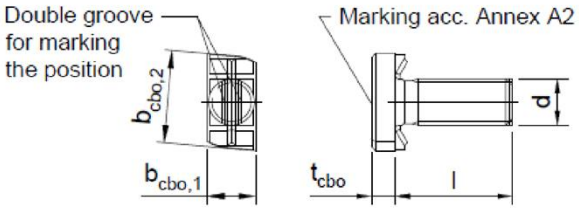


Hammer-head geometry

HS: Type A Type B



HSR: Notching channel bolt



HZS: Serrated channel bolt

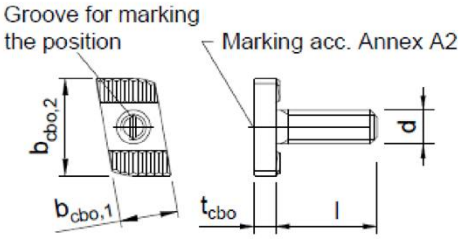


Table A5: Dimensions of HALFEN channel bolts

Head		Thread Ø	Channel bolts (Type A)			Altern. channel bolts (Type B)			Anchor channel
			Width	Length	Thickness	Width	Length	Thickness	
			$b_{cbo,1}$	$b_{cbo,2}$	t_{cbo}	$b_{cbo,1}$	$b_{cbo,2}$	t_{cbo}	
Hook-head	HS 40/22	M10	15,0	30,8	7,2	- [1]	- [1]	- [1]	40/22
		M12	15,0	30,8	7,2	- [1]	- [1]	- [1]	40/22P
		M16	17,4	30,8	8,2 (9,8)	- [1]	- [1]	- [1]	40/25
	HSR 40/22	M16 [2]	17,0	32,3	8,5	- [1]	- [1]	- [1]	40/22P
	HS 50/30	M10	16,3	40,2	10,0	15,0	41,5	10,0	49/30
		M12	16,3	40,2	10,0	15,0	41,5	10,0	50/30, 50/30P
		M16	19,4	40,2	11,0	20,0	41,5	11,0	52/34, 54/33
		M20	21,0	39,5	12,5	21,0	41,5	12,0	55/42
		M24	- [1]	- [1]	- [1]	24,5	41,0	18,0	55/42
	HS 72/48	M20	- [1]	- [1]	- [1]	23,0	58,0	14,0	72/48 72/49
		M24	- [1]	- [1]	- [1]	25,0	58,0	16,0	
		M27	- [1]	- [1]	- [1]	28,0	58,0	18,0	
		M30	- [1]	- [1]	- [1]	31,0	58,0	20,0	
Hammer-head	HS 28/15	M6	10,6	21,1	4,0	10,1	22,7 (22,2)	4,0	28/15
		M8	10,6	21,1 (20,7)	4,5	10,1	22,7 (22,2)	4,0	
		M10	10,9	20,2	5,0	10,1	22,7 (22,2)	5,0 (4,0)	
		M12	10,8	20,1	6,5	10,1	22,7 (22,2)	5,5	
	HS 30	M10	10,8	20,2	7,0	- [1]	- [1]	- [1]	
		M12	10,8	20,2	7,0	- [1]	- [1]	- [1]	
	HS 38/17	M10	13,6-14,1	29,0	6,0	13 (12)	30,5	6,0	38/17
		M12	13,6-14,1	29,0	6,0	13 (12)	30,5	7,0 (6,0)	
		M16	16,0	29,0	8,5	16,0	30,5	7,0	
	HZS 41/22	M12 [3]	20,5	34,7	7,5 (5,5)	- [1]	- [1]	- [1]	41/22
		M16 [3]	20,5	34,7	7,5	- [1]	- [1]	- [1]	

( ) Value applies for strength grade 8.8 [1] Product not available [2] strength grade 8.8 only [3] strength grade 8.8 and 50

HALFEN Anchor Channels HTA

Product description
HALFEN channel bolts, dimensions

Annex A8

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Table A6: Strength grade

	Steel [1]		Stainless steel [1]	
Strength grade	4.6	8.8	50	70
f_{uk} [N/mm²]	400	800	500	700
f_{yk} [N/mm²]	240	640	210	450
Finish	electroplated, hot-dip galv.		-	

[1] Materials according Annex A2 and Annex A3-A4, Tab. A1

HALFEN Anchor Channels HTA	Annex A9
Product description HALFEN channel bolts, strength grade	

Specifications for intended use

Working Life:

The verification and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the anchor channel of at least

- 50 years
  (anchor channels and channel bolts according to Annex A3-A4, Table A1, column 1-5)
- 100 years
  (anchor channels and channel bolts according to Annex A4, Table A1, column 3-5)

Anchor channels and channel bolts subject to:

- Static and quasi-static tension, shear perpendicular to the longitudinal axis of the channel
- Static and quasi-static shear in the direction of the longitudinal axis of the channel
  (anchor channel and channel bolt according to Annex C5)
- Fatigue cyclic tension loads
  (anchor channels and channel bolts according to Annex C8)
- Seismic tension, seismic shear perpendicular to the longitudinal axis of the channel and seismic shear in the direction of the longitudinal axis of the channel (seismic performance category C1)
  (anchor channel and channel bolt according to Annex C10)
- Fire exposure for concrete class C20/25 to C50/60
  (anchor channels and channel bolts according to Annex C12)

Base materials:

- Reinforced or unreinforced compacted normal weight concrete without fibres according to EN 206:2013 + A2:2021.
- Strength classes C12/15 to C90/105 according to EN 206:2013 + A2:2021.
- Cracked or uncracked concrete.

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions
  (anchor channels and channel bolts according to Annex A3-A4, Table A1, column 1 - 5)
- Structures subject to internal conditions with usual humidity (e.g. kitchen, bath and laundry in residential buildings, exceptional permanent damp conditions and application under water)
  (anchor channels and channel bolts according to Annex A3-A4, Table A1, column 2 - 5)
- According to EN 1993-1-4:2006 + A1:2015 + A2:2020 relating to corrosion resistance class CRC III
  (anchor channels and channel bolts according to Annex A4, Table A1, column 3 - 5)
- According to EN 1993-1-4:2006 + A1:2015 + A2:2020 relating to corrosion resistance class CRC IV
  (anchor channels and channel bolts according to Annex A4, Table A1, column 4 - 5)
- According to EN 1993-1-4:2006 + A1:2015 + A2:2020 relating to corrosion resistance class CRC V
  (anchor channels and channel bolts according to Annex A4, Table A1, column 5)

HALFEN Anchor Channels HTA	Annex B1
Intended use Specifications	

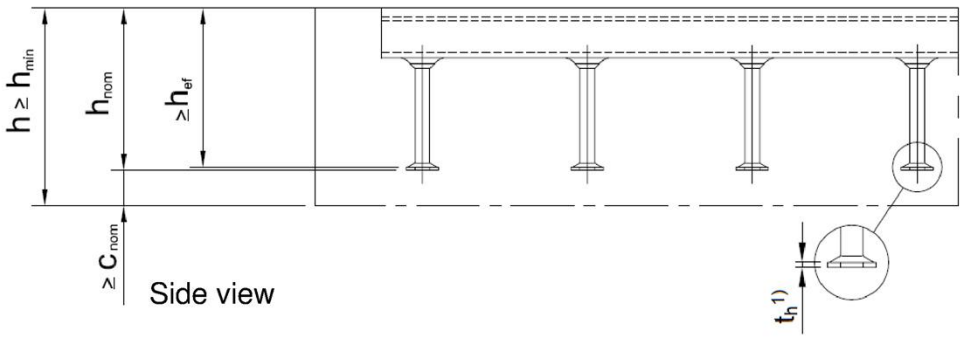
Design:

- Anchor channels are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the anchor channel and channel bolts are indicated on the design drawings (e.g. position of the anchor channel relative to the reinforcement or to supports).
- For static and quasi-static loading as well as seismic loading (seismic performanche category C1) and fire exposure the anchor channels are designed in accordance with EN 1992-4:2018 and EOTA TR 047 "Design of Anchor Channels", May 2021 or.
- For fatigue loading the anchor channels are designed in accordance with EOTA TR 050 "Calculation Method for the Performance of Anchor Channels under Fatigue Loading", June 2022.
- The characteristic resistances are calculated with the minimum effective embedment depth.

Installation:

- The installation of anchor channels is carried out by appropriately qualified personnel under the supervision of the person responsible for the technical matters on site.
- Use of the anchor channels only as supplied by the manufacturer – without any manipulations, repositioning or exchanging of channel components.
- Cutting of anchor channels is allowed only if pieces according to Annex A7, Table A4 are generated including end spacing and minimum channel length and only to be used in dry internal conditions (Annex A3, Table A1, column 1). For anchor channels made of stainless steel there are no restrictions regarding corrosion resistance when using cut channel pieces, if cutting is done professionally and contamination of cutting edges with corroding material is avoided.
- Installation in accordance with the installation instruction given in Annexes B6 and B7.
- The anchor channels are fixed on the formwork, reinforcement or auxiliary construction such that no movement of the anchor channels will occur during the time of laying the reinforcement and of placing and compacting the concrete.
- The concrete under the head of the anchors is properly compacted. The anchor channels are protected from penetration of concrete into the internal space of the channel profiles.
- Washer may be chosen according to Annex A3-A4 and provided separately by the user.
- Orientating the channel bolt (groove mark according to Annex B7) rectangular to the channel axis.
- The required installation torque given in Annex B4 must be applied and must not be exceeded.

HALFEN Anchor Channels HTA	Annex B2
Intended use Specifications	



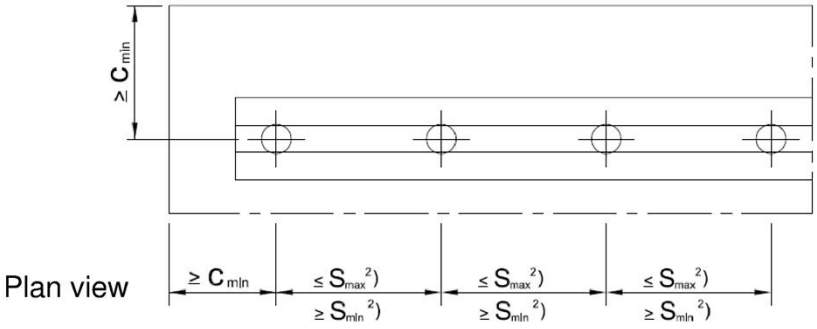


Table B1-1: Minimum effective anchorage depth, edge distance and member thickness

Anchor channel			**28/15**	**38/17**	**41/22**	**40/25**	**49/30**	**54/33**	**72/49**
Min. effective anchorage depth – round anchor	[mm]	$h_{ef,min}$	45	76	82	84	94	155	- [4]
Min. effective anchorage depth – I- & T-anchor	[mm]	$h_{ef,min}$	74	76	82	84	96	156	183
Min. edge distance	[mm]	c_{min}	40	50	50	50	75	100	150
Min. member thickness	[mm]	h_{min}		actual $h_{ef} + t_h + c_{nom}$ [3]					
			55	90	90	90	105	170	195

Table B1-2: Minimum effective anchorage depth, edge distance and member thickness

Anchor channel			**40/22**	**40/22P**	**50/30**	**50/30P**	**52/34**	**55/42**	**72/48**
Min. effective anchorage depth – round anchor	[mm]	$h_{ef,min}$	82	91	94	106	155	175	- [4]
Min. effective anchorage depth – I- & T-anchor	[mm]	$h_{ef,min}$	82	146	95	153	156	176	182
Min. edge distance	[mm]	c_{min}	50	50	75	75	100	100	150
Min. member thickness	[mm]	h_{min}	actual $h_{ef} + t_h + c_{nom}$ [3]						
			90	105	105	120	170	190	195

[1] t_h = Anchor head thickness
[2] s_{min}, s_{max} acc. Annex A7, Table A4
[3] c_{nom} acc. EN 1992-1-1:2004 + AC:2010
[4] Product not available

HALFEN Anchor Channels HTA	Annex B3
Intended use Installation parameters of anchor channels	

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Table B2: Minimum spacing and installation torque of HALFEN channel bolts

Anchor channel	**HALFEN Channel bolts Ø**	**Min. spacing $s_{min,cbo}$ of the channel bolts**	**Installation torque T_{inst} [4]**				
			General [2] $T_{inst,g}$	Steel – steel contact [3] $T_{inst,s}$			
			Steel 4.6; 8.8 Stainless steel 50; 70 [1]	Steel 4.6	Stainless steel 50 [1]	Steel 8.8	Stainless Steel 70 [1]
	[mm]	[mm]	[Nm]				
28/15	6	30	3	3	3	- [5]	- [5]
	8	40	8	8	8	20	15
	10	50	13	15	15	40	30
	12	60	15	25	25	70 [7]	50
38/17	10	50	15	15	15	40	30
	12	60	25	25	25	70	50
	16	80	40	65	60	180	130
41/22	12	60	20	- [5]	20	55	- [5]
	16	80	40	- [5]	50	140	- [5]
40/25 40/22 40/22P	10	50	15	15	15	40	30
	12	60	25	25	25	70	50
	16	80	45	65	60	180	130
40/22P	16 [6]	80	150	- [5]	- [5]	180	- [5]
49/30 50/30 50/30P	10	50	15	15	15	40	30
	12	60	25	25	25	70	50
	16	80	60	65	60	180	130
	20	100	75	130	120	360	250
52/34 54/33	10	50	15	15	15	40	30
	12	60	25	25	25	70	50
	16	80	60	65	60	180	130
	20	100	120	130	120	360	250
55/42	10	50	15	15	15	40	30
	12	60	25	25	25	70	50
	16	80	60	65	60	180	130
	20	100	120	130	120	360	250
	24	120	200	230	200	620	440
72/48 72/49	20	100	120	130	120	360	250
	24	120	200	230	200	620	440
	27	135	300	340	300	900	650
	30	150	380	460	400	1200	850

[1] Materials according to Annex A2 and Annex A3-A4, Tab. A1
[2] Acc. to Annex B5, Fig.1
[3] Acc. to Annex B5, Fig. 2
[4] T_{inst} must not be exceeded
[5] Product not available
[6] valid for channel bolt type HSR
[7] 55 Nm for HS 30

HALFEN Anchor Channels HTA

Intended use
Installation parameters

Annex B4

Deutsches Institut für Bautechnik DIBt

General

The fixture is in contact with the channel profile and the concrete surface.
The installation torque according to Annex B4, Table B2 shall be applied and must not be exceeded.

Steel to steel contact

The fixture is fastened to the anchor channel by suitable steel parts (e.g. washer). The installation torque according to Annex B4, Table B2 shall be applied and must not be exceeded.

Fig. 1

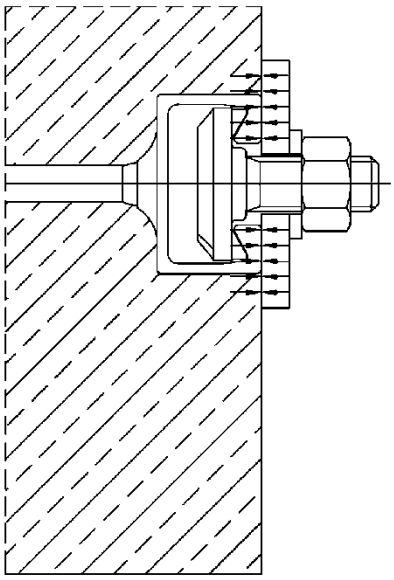
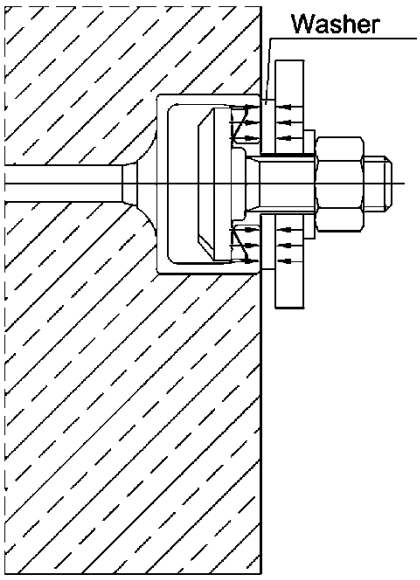


Fig. 2



HALFEN Anchor Channels HTA	Annex B5
Intended use Position of the fixture	

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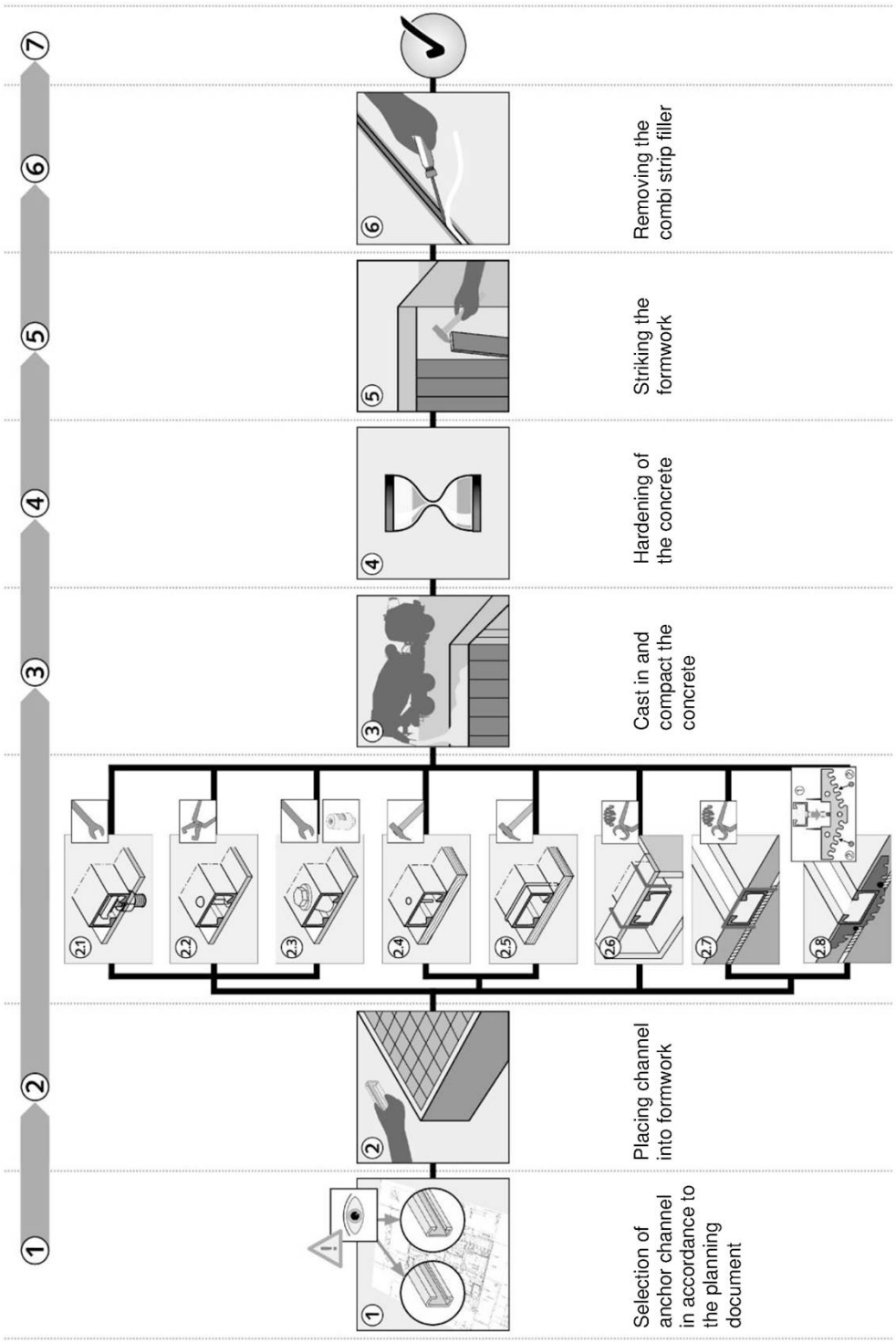
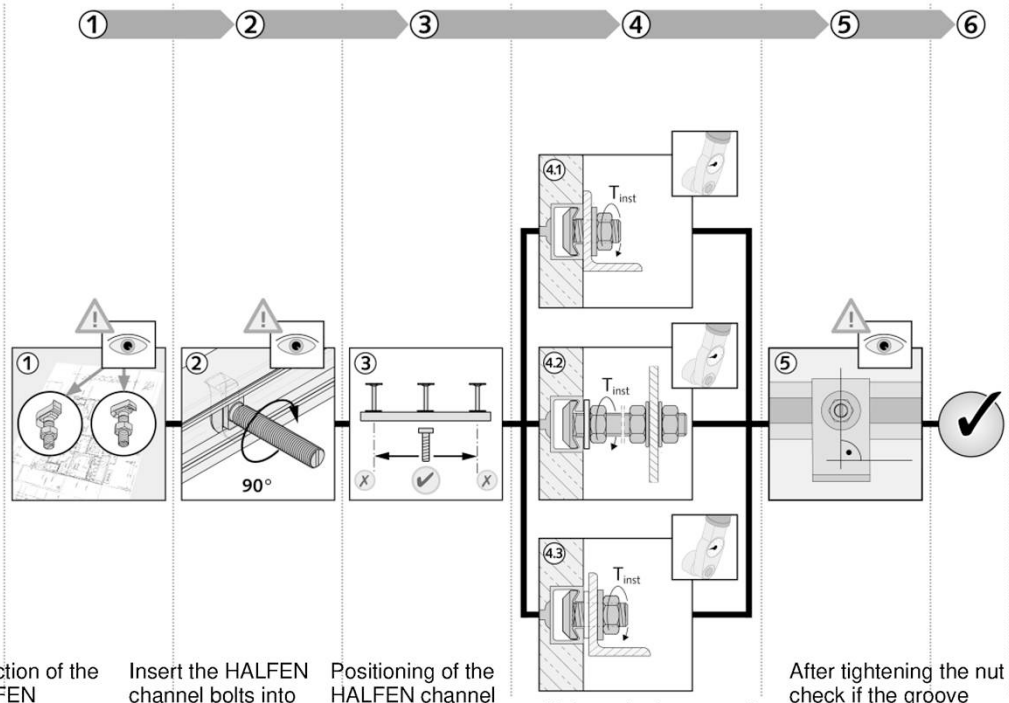
Installation of HALFEN anchor channel



2.1 Steel formwork: Fixing with HALFEN channel bolts through formwork penetration
2.2 Steel formwork: Fixing with rivets
2.3 Steel formwork: Fixing with HALFEN Fixing cone
2.4 Timber formwork: Fixing with nails
2.5 Timber formwork: Fixing with staples
2.6 Fixing in the top surface of concrete: Fixing by using auxiliary construction
2.7 Fixing in the top surface of concrete: Fixing from above directly to the reinforcement
2.8 Fixing in the top surface of concrete: Fixing from above to the reinforcement, using the HALFEN ChanClip

HALFEN Anchor Channels HTA	
Intended use Installation instruction – HALFEN Anchor channel	Annex B6

Installation of HALFEN channel bolts



Selection of the HALFEN channel bolts in accordance with the planning document.

Insert the HALFEN channel bolts into the channel slot. After a 90° turn clockwise the HALFEN screw locks into position (check whether the groove mark is perpendicular to the channel longitudinal axis).

Positioning of the HALFEN channel bolts: At the channel ends a minimum clearance must be maintained, which corresponds with the overhang beyond the last anchor acc. to Annex A7.

Tighten the hexagonal nut to the installation torque (T_{inst}) acc. table stated below. T_{inst} must not be exceeded. 4.1: general application, 4.2 and 4.3: steel to steel contact.

After tightening the nut check if the groove mark on the HALFEN channel bolt is perpendicular to the channel longitudinal axis. If it is not perpendicular the screw must be completely loosened, re-inserted and tightened again.

Table B3: Installation torque

Pos. of fixture acc. Annex B5	Material strength grade		Anchor channel	T_{inst} [Nm] 1)								
				M6	M8	M10	M12	M16	M20	M24	M27	M30
General	Steel 4.6 / 8.8 and Stainless steel 50 / 70		28/15	3	8	13	15	- 2)	- 2)	- 2)	- 2)	- 2)
			38/17	- 2)	- 2)	15	25	40	- 2)	- 2)	- 2)	- 2)
			41/22	- 2)	- 2)	- 2)	20	40	- 2)	- 2)	- 2)	- 2)
			40/22, 40/22P, 40/25	- 2)	- 2)	15	25	45	- 2)	- 2)	- 2)	- 2)
			40/22P + HSR	- 2)	- 2)	- 2)	- 2)	150	- 2)	- 2)	- 2)	- 2)
			49/30, 50/30, 50/30P	- 2)	- 2)	15	25	60	75	- 2)	- 2)	- 2)
			54/33, 53/34	- 2)	- 2)	15	25	60	120	- 2)	- 2)	- 2)
			55/42	- 2)	- 2)	15	25	60	120	200	- 2)	- 2)
			72/49, 72/48	- 2)	- 2)	- 2)	- 2)	- 2)	120	200	300	380
Steel to steel contact	Steel	4.6	All profiles	3	8	15	25	65	130	230	340	460
		8.8		- 2)	20	40	70 (55)	180 (140)	360	620	900	1200
	Stainl. Steel	50		3	8	15	25 (20)	60 (50)	120	200	300	400
		70		- 2)	15	30	50	130	250	440	650	850

1) T_{inst} must not be exceeded 2) Product not available 3) values in brackets for HZS 41/22

HALFEN Anchor Channels HTA

Intended use
Installation instruction – HALFEN channel bolts

Annex B7

Deutsches Institut für Bautechnik DIBt

Table C1: Characteristic Resistances under tension load – steel failure anchor channel

Anchor channel			steel	28/15	38/17	41/22 / 40/25	40/22 / 40/22P	49/30	50/30 / 50/30P	54/33	52/34	55/42	72/49 / 72/48
Steel failure: Anchor													
Characteristic resistance	$N_{Rk,s,a}$	[kN]	carbon	9	18	18 / 20	20 / 31	31	31 / 56	56	56	80	102
			stainless [3]	12,7	22,6	22,6	20 / 31	35,3	31 / 56	56,5	56	- [2]	102
			stainless D4	15,3	27,2	22,6	- [2]	35,3	- [2]	56,5	- [2]	- [2]	- [2]
Partial factor	γ_{Ms} [1]			1,8									
Steel failure: Connection channel/anchor													
Characteristic resistance	$N_{Rk,s,c}$	[kN]	carbon	9	18	18 / 20	20 / 29	31	31 / 39	55	55	80	100
			stainless [3]	12,7	22,6	22,6	20 / 29	35,3	31 / 39	56,5	55	- [2]	100
			stainless D4	15,3	27,2	22,6	- [2]	35,3	- [2]	56,5	- [2]	- [2]	- [2]
Partial factor	$\gamma_{Ms,ca}$ [1]			1,8									
Steel failure: Local flexure of the channel lips													
Spacing of channel bolts for $N^0_{Rk,s,l}$	$s_{l,N}$	[mm]	all materials	56	76	83 / 80	79	100	98	107	105	109	144
Characteristic resistance	$N^0_{Rk,s,l}$	[kN]	carbon	9	18	20	38	31	43	55	72	110	100 / 120
			stainless [3]	12,7	22,6	26 / 22,6	38	35,3	43	56,5	72	- [2]	100 / 120
			stainless D4	16,1	35,4	26 / 22,6	- [2]	35,3	- [2]	56,5	- [2]	- [2]	- [2]
Partial factor	$\gamma_{Ms,l}$ [1]			1,8									

[1] In absence of other national regulations

[2] No performance assessed

[3] Valid for all stainless steel materials except D4, see Annex A4

Table C2: Characteristic flexural resistance of channel

Anchor channel			steel	28/15	38/17	41/22 40/25	40/22 40/22P	49/30	50/30 50/30P	54/33	52/34	55/42	72/49	72/48
Char. flexure resistance of channel	$M_{Rk,s,flex}$	[Nm]	carbon, stainless [3]	317	580	733 / 1071	1389	1673	2803	2984	3373	6447	8617	8593
			stainless D4	432	836	749 / 1262	- [2]	2528	- [2]	2984	- [2]	- [2]	- [2]	- [2]
Partial factor	$\gamma_{Ms,flex}$ [1]			1,15										

[1] In absence of other national regulations [2] No performance assessed

[3] Valid for all stainless steel materials except D4, see Annex A4

HALFEN Anchor Channels HTA

Performances
Characteristic resistances under tension load – steel failure anchor channel

Annex C1

Table C3: Characteristic resistances under tension load – steel failure of HALFEN channel bolts

HALFEN Channel bolts ∅				M6	M8	M10	M12 [3]	M16 [3]	M20	M24	M27	M30
Steel failure												
Characteristic resistance	$N_{Rk,s}$	[kN]	4.6	8,0	14,6	23,2	33,7	62,8	98,0	141,2	183,6	224,4
			8.8	16,1	29,3	46,4	67,4 [4] (48,5)	125,6 (96,3)	196,0	282,4	367,2	448,8
			50 [1]	10,1	18,3	29,0	42,2 (40,3)	78,5 (64,0)	122,5	176,5	229,5	280,5
			70 [1]	14,1	25,6	40,6	59,0	109,9	171,5	247,1	321,3	392,7
Partial factor	γ_{Ms} [2]		4.6	2,00								
			8.8	1,50								
			50 [1]	2,86								
			70 [1]	1,87								

[1] Materials according Annex A2 and A3
[2] In absence of other national regulations
[3] values in brackets for HZS 41/22
[4] 50,7 kN for HS 30

HALFEN Anchor Channels HTA

Performances
Characteristic resistances under tension load – steel failure channel bolts

Annex C2

Deutsches Institut für Bautechnik DIBt

Table C4: Characteristic resistances under tension load – concrete failure

Anchor channel				**28/15**	**38/17**	**41/22 40/22 40/25**	**40/22P**	**49/30 50/30**	**50/30P**	**54/33 52/34**	**55/42**	**72/49 72/48**
Concrete failure: Pull-out												
Characteristic resistance in cracked concrete C12/15	Round anchors	$N_{Rk,p}$	[kN]	7,6	13,6	13,6	21,2	21,2	34,0	34,0	41,6	- [2]
	I-anchors [3]			11,7	11,7	14,0	17,8	21,0	24,7	29,7	40,6	46,4
Characteristic resistance in uncracked concrete C12/15	Round anchors	$N_{Rk,p}$	[kN]	10,6	19,0	19,0	29,7	29,7	47,6	47,6	58,2	- [2]
	I-anchors [3]			16,4	16,4	19,6	24,9	29,4	34,6	41,6	56,8	65,0
Increasing factor for $N_{Rk,p} = N_{Rk,p,(C12/15)} \cdot \Psi_c$	C20/25	Ψ_c	[-]	1,67								
	C25/30			2,08								
	C30/37			2,50								
	C35/45			2,92								
	C40/50			3,33								
	C45/55			3,75								
	C50/60			4,17								
	C55/67			4,58								
	≥C60/75			5,00								
Partial factor		$\gamma_{Mp}=\gamma_{Mc}$ [1]		1,5								
Concrete failure: Concrete cone												
Product factor k_1		$k_{cr,N}$		7,2	7,8	7,9	8,0	8,1	8,2	8,7	8,9	8,9
		$k_{ucr,N}$		10,3	11,2	11,2	11,5	11,5	11,7	12,4	12,6	12,7
Charact.edge spacing		$c_{cr,N}$	[mm]	111	171	176	195	199	216	260	269	270
Charact.spacing		$s_{cr,N}$		2,0 $c_{cr,N}$								
Partial factor		γ_{Mc} [1]		1,5								
Concrete failure: Splitting												
Charact.edge spacing		$c_{cr,sp}$	[mm]	135	228	246 / 252	273	282	318	465	525	546
Charact.spacing		$s_{cr,sp}$		2,0 $c_{cr,sp}$								
Partial factor		γ_{Msp} [1]		1,5								

[1] In absence of other national regulations [2] No performance assessed

[3] Value valid for minimum I-anchor size; for other sizes the characteristic resistance can be calculated using A_h from Annex A6, Table A3 or the actual dimension.

HALFEN Anchor Channels HTA

Performances
Characteristic resistances under tension load – concrete failure

Annex C3

Deutsches Institut für Bautechnik DIBt

Table C5: Characteristic resistances under shear load

Anchor channel			**steel**	**28/15**	**38/17**	**41/22 40/25**	**40/22 / 40/22P**	**49/30**	**50/30 / 50/30P**	**54/33**	**52/34**	**55/42**	**72/49 / 72/48**
Steel failure: Anchor													
Characteristic resistance	$V_{Rk,s,a,y}$	[kN]	carbon	9	18	29,7 / 20	35	31	52 / 59	55	78	110	100 / 146
			stainless [4]	12,7	22,6	22,6	35	35,3	52 / 59	56,5	78	- [3]	100 / 146
			stainless D4	18	30	22,6 / 30,8	- [3]	58,9	- [3]	56,5	- [3]	- [3]	- [3]
Partial factor	γ_{Ms} [1]			1,8									
Steel failure: Connection channel / anchor													
Characteristic resistance	$V_{Rk,s,c,y}$	[kN]	carbon	9	18	29,7 / 20	35	31	52 / 59	55	78	110	100 / 146
			stainless [4]	12,7	22,6	22,6	35	35,3	52 / 59	56,5	78	- [3]	100 / 146
			stainless D4	18	30	22,6 / 30,8	- [3]	58,9	- [3]	56,5	- [3]	- [3]	- [3]
Partial factor	$\gamma_{Ms,ca}$ [1]			1,8									
Steel failure: Local flexure of channel lips													
Spacing of channel bolts for $V_{Rk,s,l}$	$s_{l,V}$	[mm]	all materials	56	76	83 / 80	79	100	98	107	105	109	144
Characteristic resistance	$V^0_{Rk,s,l,y}$	[kN]	carbon	9	18	29,7 / 20	35	31	52 / 59	55	78	110	100 / 146
			stainless [4]	12,7	22,6	22,6	35	35,3	52 / 59	56,5	78	- [3]	100 / 146
			stainless D4	18	30	22,6 / 30,8	- [3]	58,9	- [3]	56,5	- [3]	- [3]	- [3]
Partial factor	$\gamma_{Ms,l}$ [1]			1,8									
Concrete failure: Pry-out													
Product factor		k_8 [2]	all materials	1,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0
Partial factor		γ_{Mc} [1]		1,5									
Concrete failure: Concrete edge													
Product-factor k_{12}	cracked concrete	$k_{cr,V}$	all materials	4,5	7,5	6,5 / 7,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5
	uncracked concrete	$k_{ucr,V}$		6,3	10,5	9,1 / 10,5	10,5	10,5	10,5	10,5	10,5	10,5	10,5
Partial factor		γ_{Mc} [1]		1,5									

[1] In absence of other national regulations

[2] Without supplementary reinforcement. In case of supplementary reinforcement the factor k_8 should be multiplied with 0,75.

[3] No performance assessed

[4] Valid for all stainless steel materials except D4, see Annex A4

Table C5 (continued): Characteristic resistances under shear load

Anchor channel			**steel**	**40/22P**
Steel failure: Anchor				
Characteristic resistance	$V_{Rk,s,a,x}$	[kN]	carbon	18,6
Partial factor	γ_{Ms} [1)]		1,8	
Steel failure: Connection channel / anchor				
Characteristic resistance	$V_{Rk,s,c,x}$	[kN]	carbon	17,4
Partial factor	$\gamma_{Ms,ca}$ [1)]		1,8	
Steel failure: Connection between channel lips and channel bolt				
Characteristic resistance	$V_{Rk,s,l,x}$	[kN]	carbon	13,5
Installation factor	γ_{inst} [1)]		1,2	

[1)] In absence of other national regulations

Table C6: Charact. resistances under shear load – steel failure of HALFEN channel bolts

HALFEN Channel bolts ∅				**M6**	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel failure												
Characteristic resistance	$V_{Rk,s}$	[kN]	4.6	4,8	8,8	13,9	20,2	37,7	58,8	84,7	110,2	134,6
			8.8	8,0	14,6	23,2	33,7	62,8	98,0	141,2	183,6	224,4
			50 1)	6,0	11,0	17,4	25,3	47,1	73,5	105,9	137,7	168,3
			70 1)	8,4	15,4	24,4	35,4	65,9	102,9	148,3	192,8	235,6
Characteristic flexure resistance	$M^0_{Rk,s}$	[Nm]	4.6	6,3	15,0	29,9	52,4	133,2	259,6	449,0	665,8	899,6
			8.8	12,2	30,0	59,8	104,8 3)	266,4 4)	519,3 5)	898,0	1331,5	1799,2
			50 1)	7,6	18,7	37,4	65,5	166,5	324,5	561,3	832,2	1124,5
			70 1)	10,7	26,2	52,3	91,7 3)	233,1 4)	454,4	785,8	1165,1	1574,3
Partial factor	γ_{Ms} 2)		4.6	1,67								
			8.8	1,25								
			50 1)	2,38								
			70 1)	1,56								

1) Materials according Annex A2 and A3
2) In absence of other national regulations
3) For HTA 28/15 $M^0_{Rk,s}$ is limited to 84 Nm.
4) For HTA 38/17 $M^0_{Rk,s}$ is limited to 231 Nm.
5) For HTA 49/30 $M^0_{Rk,s}$ is limited to 509 Nm.

HALFEN Anchor Channels HTA

Performances
Characteristic resistances under shear load – steel failure channel bolts

Annex C6

Deutsches Institut für Bautechnik DIBt

Table C7: Displacements under tension load

Anchor channel			**28/15**	**38/17 41/22**	**40/25 40/22**	**40/22P**	**49/30 50/30**	**50/30P**	**54/33 52/34**	**55/42**	**72/49 72/48**
Tension load	N_{Ek}	[kN]	3,6	7,1	7,9	11,5	12,3	15,5	21,8	31,7	39,7
Short-term displacement	δ_{N0}	[mm]	0,3	0,3 0,6	0,4	0,4	0,4	0,5	0,5	0,5	0,5
Long-term displacement	$\delta_{N\infty}$	[mm]	0,6	0,6 1,3	0,8	0,8	0,8	1,0	1,0	1,0	1,0

Table C8: Displacements under shear load

Anchor channel			**28/15**	**38/17 41/22**	**40/25 40/22**	**40/22P**	**49/30 50/30**	**50/30P**	**54/33 52/34**	**55/42**	**72/49 72/48**
Shear load in y-direction [1]	V_y	[kN]	3,6	7,1 11,8	7,9 13,9	13,9	12,3 20,6	23,4	21,8 31,0	43,7	39,7 57,9
Short-term displacements	$\delta_{V,y,0}$	[mm]	0,6	0,6 1,1	0,6	0,6	0,6	0,6	1,2	1,2	1,2
Long-term displacements	$\delta_{V,y,\infty}$	[mm]	0,9	0,9 1,7	0,9	0,9	0,9	0,9	1,8	1,8	1,8
Shear load in x-direction [2]	V_x	[kN]	- [3]	- [3]	- [3]	4,5	- [3]	- [3]	- [3]	- [3]	- [3]
Short-term displacements	$\delta_{V,x,0}$	[mm]	- [3]	- [3]	- [3]	0,2	- [3]	- [3]	- [3]	- [3]	- [3]
Long-term displacements	$\delta_{V,x,\infty}$	[mm]	- [3]	- [3]	- [3]	0,3	- [3]	- [3]	- [3]	- [3]	- [3]

[1] y-direction (perpendicular to longitudinal axis of channel)
[2] x-direction (in direction of the longitudinal channel axis)
[3] No performance assessed

Table C9: Characteristic resistances under combined tension and shear load

Anchor channel		**28/15**	**38/17 41/22**	**40/25 40/22**	**40/22P**	**49/30 50/30**	**50/30P**	**54/33 52/34**	**55/42**	**72/49 72/48**
Steel failure: Local failure by flexure of channel lips and failure by flexure of channel										
Product factor	k_{13}	Values according to EN 1992-4:2018, section 7.4.3.1								
Steel failure: Failure of anchor and connection between anchor and channel										
Product factor	k_{14}	Values according to EN 1992-4:2018, section 7.4.3.1								

HALFEN Anchor Channels HTA

Performances
Displacements and char. resistances under combined tension and shear load

Annex C7

For design method I or II for assessment method C acc. to EOTA TR 050, June 2022

Table C10: Combinations of anchor channels and channel bolts under fatigue tension load

Anchor channel				**Channel bolts**			
Profile	Anchor	d_1 [mm]	Material	Channel bolt	Thread Ø [mm]	Grade	Material
40/22	B6	8	Steel hot-dip galv.	HS 40/22	M12	8.8	Steel electro-plated, hot-dip galv.; stainless steel
					M16	4.6	
						8.8	
40/22P	B6	10	Steel hot-dip galv.; stainless steel	HS 40/22	M12	8.8 / A4-70	
					M16	4.6	
						8.8 / A4-70	
50/30	B6	10	Steel hot-dip galv.	HS 50/30	M16	4.6	
					M20	8.8	
50/30P	B6	12	Steel hot-dip galv.	HS 50/30	M16	4.6	
					M20	8.8	
52/34	B6	12	Steel hot-dip galv.; stainless steel	HS 50/30	M16	8.8 / A4-70	
					M20		

Design Method I acc. EOTA TR 050, June 2022

Table C11: Characteristic resistances under fatigue tension load after n load cycles without static preload ($N_{Ed} = 0$) – Steel failure

Anchor channel		**40/22**	**40/22P**		**50/30** **50/30P**	**52/34**	
	Load cycles n	$\Delta N_{Rk,s;lo;n}$ with $N_{lok,s,n} = 0$ [kN]					
		carbon	carbon	stainless	carbon	carbon	stainless
Characteristic resistances under fatigue tension load without static preload	$\leq 10^4$	11,7	12,8		16,5	22,2	
	$\leq 10^5$	6,7	7,7		9,8	13,2	
	$\leq 10^6$	3,8	4,7		5,8	7,9	
	$\leq 2 \cdot 10^6$	3,2	4,0		4,9	6,7	
	$\leq 5 \cdot 10^6$	2,6	3,3		4,0	5,5	
	$\leq 7 \cdot 10^6$	2,4	3,3	3,0		5,5	5,1
	$\leq 10^8$	1,2					
	$> 10^8$	-					

For design method I or II for assessment method C acc. to EOTA TR 050, June 2022

Table C12: Characteristic resistances under fatigue tension load after n load cycles with lower load share N_{Elok} – Concrete cone and pull-out failure

	Load cycles n	$\eta_{k,c,fat} = \eta_{k,p,fat}$ [-]								
		S_{lok} =								
		0,0	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8
Reduction factor for $\Delta N_{Rk,c,E,n} = \eta_{k,c,fat} \cdot N_{Rk,c}$ [1] $\Delta N_{Rk,p,E,n} = \eta_{k,p,fat} \cdot N_{Rk,p}$ [2] $S_{lok} = 2{,}25 \cdot N_{Elok}/N_{Rk,c(p)} \leq 0{,}8$ [3]	$\leq 10^4$	0,725	0,668	0,600	0,527	0,450	0,370	0,288	0,205	0,120
	$2 \cdot 10^4$	0,704	0,650	0,585	0,514	0,439	0,360	0,279	0,197	0,114
	$5 \cdot 10^4$	0,677	0,627	0,566	0,497	0,424	0,347	0,268	0,188	0,106
	$1 \cdot 10^5$	0,656	0,610	0,551	0,484	0,412	0,337	0,260	0,181	0,100
	$2 \cdot 10^5$	0,636	0,592	0,536	0,471	0,401	0,328	0,251	0,174	0,094
	$5 \cdot 10^5$	0,608	0,569	0,516	0,454	0,386	0,315	0,240	0,164	0,087
	$1 \cdot 10^6$	0,588	0,551	0,501	0,441	0,375	0,305	0,232	0,157	0,081
	$2 \cdot 10^6$	0,567	0,534	0,486	0,428	0,364	0,295	0,223	0,150	0,075
	$5 \cdot 10^6$	0,539	0,511	0,466	0,411	0,349	0,282	0,212	0,140	0,067
	$1 \cdot 10^7$	0,519	0,493	0,451	0,398	0,337	0,272	0,204	0,133	0,061
	$2 \cdot 10^7$	0,498	0,476	0,436	0,385	0,326	0,262	0,195	0,126	0,055
	$5 \cdot 10^7$	0,471	0,453	0,416	0,367	0,311	0,250	0,184	0,116	0,047
	10^8	0,450	0,435	0,401	0,354	0,300	0,240	0,176	0,109	0,041

[1] $N_{Rk,c}$ static resistance according to Annex C3 and EN 1992-4:2018 or EOTA TR 047, May 2021
[2] $N_{Rk,p}$ static resistance according to Annex C3
[3] N_{Elok} characteristic value of the static pre-load decisive for concrete cone or pull-out failure

In absence of other national regulations the following partial factors $\gamma_{M,fat}$ are recommended for design method I and II according to EOTA TR 050, June 2022 for assessment method C.

$\gamma_{Ms,fat}$ = 1,35 (steel)
$\gamma_{Mc,fat} = \gamma_{Mp,fat}$ = 1,5 (concrete)

For seismic performance category C1

Table C13: Combinations of anchor channels and channel bolts under seismic load

Anchor channel		Channel bolt			
Profile	Material	Channel bolt	Thread Ø	Grade	Material
40/22P	hot-dip galvanized	HSR 40/22	16	8.8	Steel electro-plated, hot-dip galvanized

Table C14: Characteristic resistances under seismic tension load – steel failure

Anchor channel			**steel**	**40/22P**
Steel failure: Anchor				
Characteristic resistance	$N_{Rk,s,a,eq}$	[kN]	carbon	31
Partial factor	$\gamma_{Ms,a}$ [1)]		1,8	
Steel failure: Connection channel/anchor				
Characteristic resistance	$N_{Rk,s,c,eq}$	[kN]	carbon	29
Partial factor	$\gamma_{Ms,ca}$ [1)]		1,8	
Steel failure: Local flexure of the channel lips				
Spacing of channel bolts for $N^0_{Rk,s,l,eq}$	$s_{l,N}$	[mm]	carbon	79
Characteristic resistance	$N^0_{Rk,s,l,eq}$	[kN]	carbon	38
Partial factor	$\gamma_{Ms,l}$ [1)]		1,8	

[1)] In absence of other national regulations

Table C15: Characteristic flexural resistances under seismic tension load

Anchor channel			**steel**	**40/22P**
Steel failure: Flexure of channel				
Characteristic flexural resistance of channel	$M_{Rk,s,flex,eq}$	[Nm]	carbon	1389
Partial factor	$\gamma_{Ms,flex}$ [1)]		1,15	

[1)] In absence of other national regulations

Table C16: Characteristic resistances under seismic tension load – steel failure of HALFEN HSR channel bolt

HALFEN HSR channel bolt			**M16**
Steel failure			
Characteristic resistance	$N_{Rk,s,eq}$	[Nm]	125,6
Partial factor	γ_{Ms} [1)]		1,5

[1)] In absence of other national regulations

Table C17: Characteristic resistances under seismic shear load – steel failure

Anchor channel			**steel**	**40/22P**
Steel failure: Anchor				
Characteristic resistance	$V_{Rk,s,a,y,eq}$	[kN]	carbon	35
Characteristic resistance	$V_{Rk,s,a,x,eq}$	[kN]	carbon	18,6
Partial factor	$\gamma_{Ms,a}$ [1]		1,8	
Steel failure: Connection channel/anchor				
Characteristic resistance	$V_{Rk,s,c,y,eq}$	[kN]	carbon	35
Characteristic resistance	$V_{Rk,s,c,x,eq}$	[kN]	carbon	17,4
Partial factor	$\gamma_{Ms,ca}$ [1]		1,8	
Steel failure: Local flexure of channel lips under shear load perpendicular to the longitudinal axis of the channel				
Spacing of channel bolts for $V_{Rk,s,l,eq}$	$s_{l,V}$	[mm]	carbon	79
Characteristic resistance	$V^0_{Rk,s,l,y,eq}$	[kN]	carbon	35
Partial factor	$\gamma_{Ms,l}$ [1]		1,8	
Steel failure: Connection between channel lips and channel bolt under shear in the direction of the longitudinal channel axis				
Characteristic resistance	$V_{Rk,s,l,x,eq}$	[kN]	carbon	13,5
Installation factor	γ_{inst} [1]		1,2	

[1] In absence of other national regulations

Table C18: Characteristic resistance unter seismic shear load – steel failure of HALFEN channel bolt HSR

HALFEN channel bolt HSR			**M16**
Steel failure			
Characterist. resistance	$V_{Rk,s,eq}$	[kN]	62,8
Partial factor	γ_{Ms} [1]		1,25

[1] In absence of other national regulations

Table C19: Characteristic resistances under tension and shear load under fire exposure – steel failure

Anchor channel					28/15	38/17	41/22	40/25	40/22 40/22P	49/30	50/30 50/30P	54/33 52/34	55/42	72/49 72/48
Steel failure: Anchor, Connection channel / anchor, Local flexure of channel lips, channel bolts														
Characteristic resistances	R30	M8	$N_{Rk,s,fi}$ = $V_{Rk,s,y,fi}$	[kN]	1,0	- 2)	- 2)	- 2)	- 2)	- 2)	- 2)	- 2)	- 2)	- 2)
		M10			1,0	1,7	- 2)	1,9	1,9	1,9	1,9	1,9	- 2)	- 2)
		M12			1,9	1,7	2,4	1,9	2,5	2,5	2,5	2,5	- 2)	- 2)
		M16			- 2)	3,2	2,3	3,6	6,0	4,0	6,0	6,0	6,3	6,3
		M20			- 2)	- 2)	- 2)	- 2)	- 2)	4,0	9,5	8,9 10,1	10,3	10,3
		M24			- 2)	- 2)	- 2)	- 2)	- 2)	- 2)	- 2)	- 2)	14,8	14,8
	R60	M8			0,8	- 2)	- 2)	- 2)	- 2)	- 2)	- 2)	- 2)	- 2)	- 2)
		M10			0,8	1,5	- 2)	1,5	1,5	1,5	1,5	1,5	- 2)	- 2)
		M12			1,3	1,5	1,7	1,5	2,5	2,5	2,5	2,5	- 2)	- 2)
		M16			- 2)	2,4	1,8	3,6	4,5	3,5	4,5	4,5	4,8	4,8
		M20			- 2)	- 2)	- 2)	- 2)	- 2)	3,5	7,1	6,5 7,5	7,6	7,6
		M24			- 2)	- 2)	- 2)	- 2)	- 2)	- 2)	- 2)	- 2)	11,1	11,1
	R90	M8			0,6	- 2)	- 2)	- 2)	- 2)	- 2)	- 2)	- 2)	- 2)	- 2)
		M10			0,6	1,0	- 2)	1,1	1,1	1,1	1,1	1,1	- 2)	- 2)
		M12			0,7	1,0	1,1	1,1	1,6	1,6	1,6	1,6	- 2)	- 2)
		M16			- 2)	1,4	1,2	2,0	2,9	2,5	3,0	3,0	3,3	3,3
		M20			- 2)	- 2)	- 2)	- 2)	- 2)	2,5	4,8	4,2 4,8	4,9	4,9
		M24			- 2)	- 2)	- 2)	- 2)	- 2)	- 2)	- 2)	- 2)	7,3	7,3
	R120	M8			0,5	- 2)	- 2)	- 2)	- 2)	- 2)	- 2)	- 2)	- 2)	- 2)
		M10			0,5	0,8	- 2)	0,8	0,8	0,8	0,8	0,8	- 2)	- 2)
		M12			0,5	0,8	0,7	0,8	1,1	1,2	1,2	1,2	- 2)	- 2)
		M16			- 2)	1,0	1,0	1,2	1,6	2,1	2,3	2,3	2,6	2,6
		M20			- 2)	- 2)	- 2)	- 2)	- 2)	2,1	3,6	3,0 3,5	3,6	3,6
		M24			- 2)	- 2)	- 2)	- 2)	- 2)	- 2)	- 2)	- 2)	5,4	5,4
Partial factor			$\gamma_{Ms,fi}$ 1)	[-]	1,0									

1) In absence of other national regulations 2) No performance assessed

HALFEN Anchor Channels HTA

Performances
Characteristic resistances under tension and shear load under fire exposure

Annex C12

Table C20: Characteristic resistances under tension and shear load under fire exposure – concrete cone failure and min. axis distance of reinforcement

Anchor channel				**28/15**	**38/17**	**41/22 40/25**	**40/22 40/22P**	**49/30**	**50/30 50/30P**	**54/33 52/34**	**55/42**	**72/49 72/48**
Min. axis distance of reinforcement [1]												
Min. axis distance	R30	a	[mm]	35	35	35	35	35	35	50	50	50
	R60	a		35	35	35	35	35	35	50	50	50
	R90	a		45	45	45	45	45	45	50	50	50
	R120	a		60	60	60	60	60	60	65	70	70

[1] The reinforced concrete has to be designed acc. to EN 1992. The fire resistance class of the concrete member is not part of this ETA.

Fig. 1

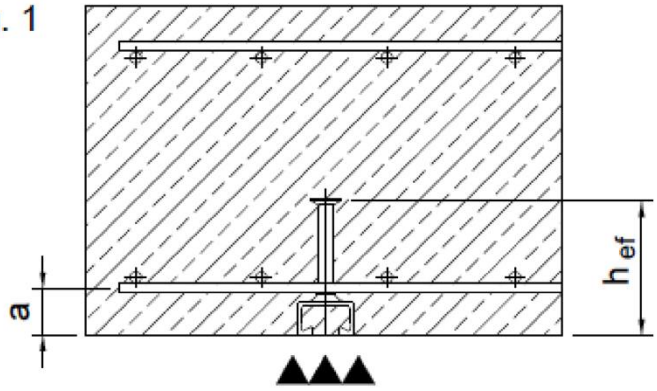
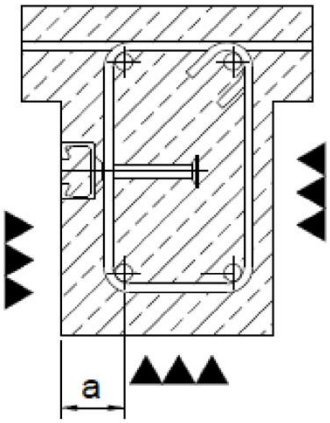


Fig. 2



HALFEN Anchor Channels HTA

Performances
Characteristic resistances under tension and shear load under fire exposure

Annex C13