Deutsches Institut für Bautechnik

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

European Technical Assessment Body for construction products

Member of EOTA
www.eota.eu

Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

European Technical Assessment ETA-20/1081 of 20 October 2025

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 serrated anchor channels HZA
Product family to which the construction product belongs	Anchor channels
Manufacturer	Leviat GmbH Liebigstraße 14 40764 Langenfeld DEUTSCHLAND
Manufacturing plant	Leviat Manufacturing Plants
This European Technical Assessment contains	36 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 07/2024
This version replaces	ETA-20/1081 issued on 4 April 2023

The European Technical Assessment is issued by the Technical Assessment Body in its official language. Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and shall be identified as such.

Communication of this European Technical Assessment, including transmission by electronic means, shall be in full. However, partial reproduction may only be made with the written consent of the issuing Technical Assessment Body. Any partial reproduction shall be identified as such.

This European Technical Assessment may be withdrawn by the issuing Technical Assessment Body, in particular pursuant to information by the Commission in accordance with Article 25(3) of Regulation (EU) No 305/2011.

Specific Part

1 Technical description of the product

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

The anchor channel is embedded surface-flush in the concrete. HALFEN serrated 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 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 static and quasi-static tension 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 static and quasi-static shear loading	
- Resistance to steel failure of channel bolt under shear loading without lever arm	$V_{Rk,s}$ see Annex C8
- Resistance to steel failure by bending of the channel bolt under shear load with lever arm	$M^0_{Rk,s}$ see Annex C8
- 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 C5
- Resistance to steel failure of connection between channel lips and channel bolt (shear load in direction of longitudinal channel axis)	$V_{Rk,s,l,x}$ see Annex C6
- Factor for sensitivity to installation (longitudinal shear)	γ_{inst} see Annex C6
- 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 C7
- Resistance to concrete edge failure	$k_{cr,V}$; $k_{ucr,V}$ see Annex C7
Characteristic resistance under combined static and quasi-static tension and shear loading	
- Resistance to steel failure of the anchor channel	k_{13} ; k_{14} see Annex C8
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 C9
- 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 C10

Essential characteristic	Performance
Characteristic resistance under seismic loading (seismic performance category C1)	
- Resistance to steel failure under seismic tension loading (seismic performance category C1)	$N_{Rk,s,a.eq}$; $N_{Rk,s,c.eq}$; $N^0{}_{Rk,s,l.eq}$ $M_{Rk,s,flex.eq}$ see Annex C11 $N_{Rk,s.eq}$ see Annex C12
- Resistance to steel failure under seismic shear loading for shear load in transverse direction (seismic performance category C1)	$V_{Rk,s.eq}$; $V^0{}_{Rk,s,l,y.eq}$; $V_{Rk,s,c,y.eq}$; $V_{Rk,s,a,y.eq}$ see Annex C12
- Resistance to steel failure under seismic shear loading for shear load in longitudinal channel axis (seismic performance category C1)	$V_{Rk,s,l,x.eq}$; $V_{Rk,s,a,x.eq}$; $V_{Rk,s,c,x.eq}$ see Annex C12
Characteristic resistance under static and quasi-static tension and/or shear loading	
- Displacements	δ_{N0} ; $\delta_{N\infty}$ see Annex C4 $\delta_{V,y,0}$; $\delta_{V,y,\infty}$; $\delta_{V,x,0}$; $\delta_{V,x,\infty}$ see Annex C7

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	$N_{Rk,s,fi}$;$V_{Rk,s,y,fi}$ see Annex C13 and C14

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.

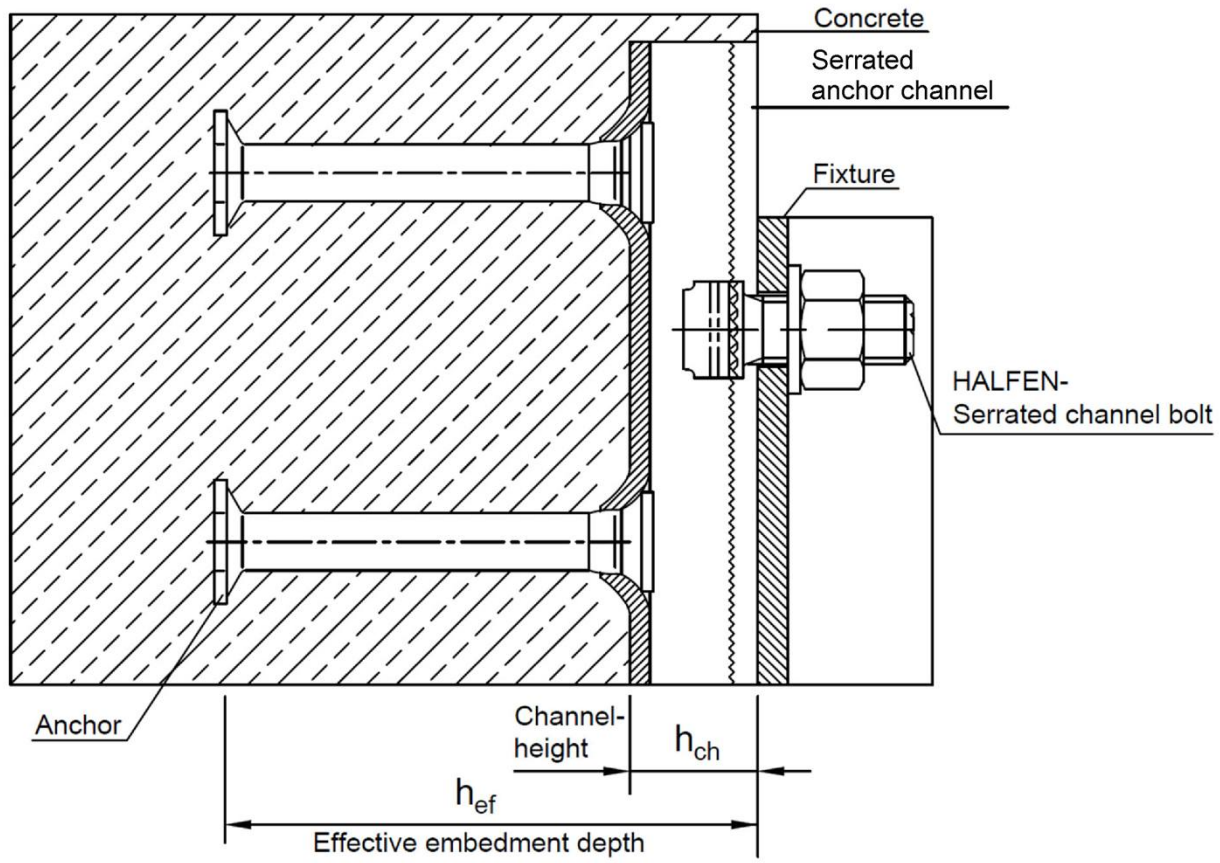
The following standards are referred to in this European Technical Assessment:

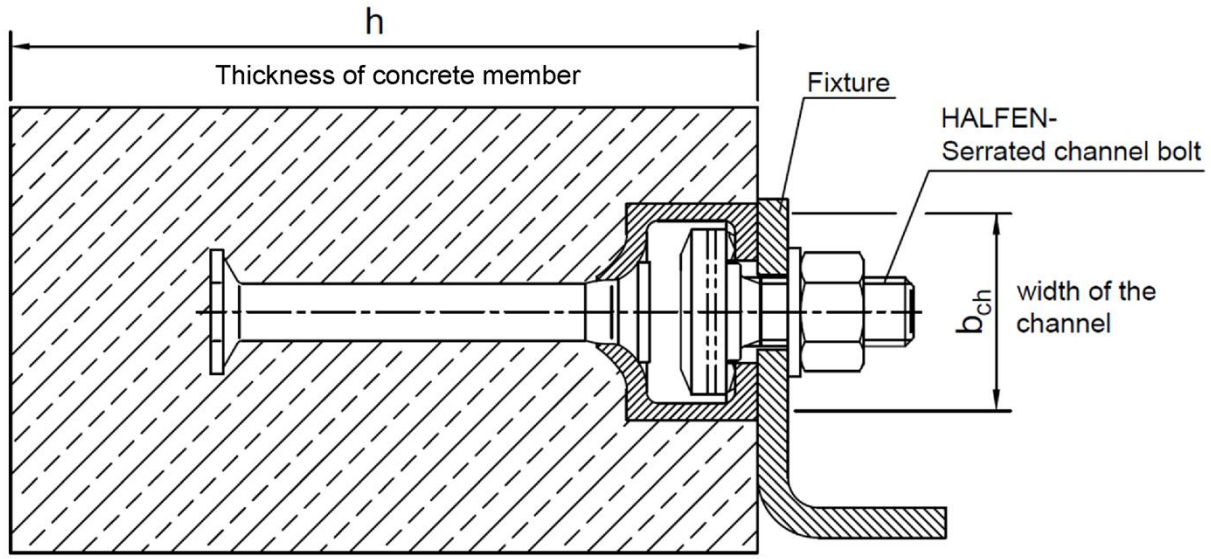
EN ISO 898-1:2013	Mechanical properties of fasteners made of carbon steel and alloy steel - Part 1: Bolts, screws and studs with specified property classes – Coarse thread and fine pitch thread (ISO 898-1:2013)

EN ISO 3506-1:2020	Fasteners - Mechanical properties of corrosion-resistant stainless steel fasteners - Part 1: Bolts, screws and studs with specified grades and property classes (ISO 3506-1:2020)
EN ISO 898-2:2022	Fasteners - Mechanical properties of fasteners made of carbon steel and alloy steel – Part 2: Nuts with specified property classes (ISO 898-2:2022)
EN ISO 3506-2:2020	Fasteners - Mechanical properties of corrosion-resistant stainless steel fasteners - Part 2: Nuts with specified grades and property classes (ISO 3506-2:2020)
EN ISO 1461:2022	Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods (ISO 1461:2022)
EN ISO 4042:2022	Fasteners - Electroplated coating systems (ISO 4042:2022)
EN ISO 10684:2004 + AC:2009	Fasteners - Hot dip galvanized coatings (ISO 10684:2004 + Cor. 1:2008)
EN ISO 7089:2000	Plain washers – Normal series, Product grade A (ISO 7089:2000)
EN ISO 7093-1:2000	Plain washers - Large series - Part 1: Product grade A (ISO 7093-1:2000)
EN ISO 4032:2023	Fasteners – Hexagon regular nuts (style 1) (ISO 4032:2023)
EN 10346:2015	Continuously hot-dip coated steel flat products for cold forming - Technical delivery conditions
EN 206:2013 + A2:2021	Concrete - Specification, performance, production and conformity
EN 1993-1-4:2006 + A1:2015 + A2:2020	Eurocode 3: Design of steel structures - Part 1-4: General rules - Supplementary rules for stainless steels
EN 1992-4:2018	Eurocode 2 - Design of concrete structures - Part 4: Design of fastenings for use in concrete
EOTA TR047:2021-05	Design of anchor channels in addition to EN 1992-4
EOTA TR050:2023-10	Calculation method for the performance of Anchor channels under Fatigue Cyclic Loading
EN 1992-1-1:2023	Eurocode 2: Design of concrete structures - Part 1-1: General rules - Rules for buildings, bridges and civil engineering structures

Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Tempel



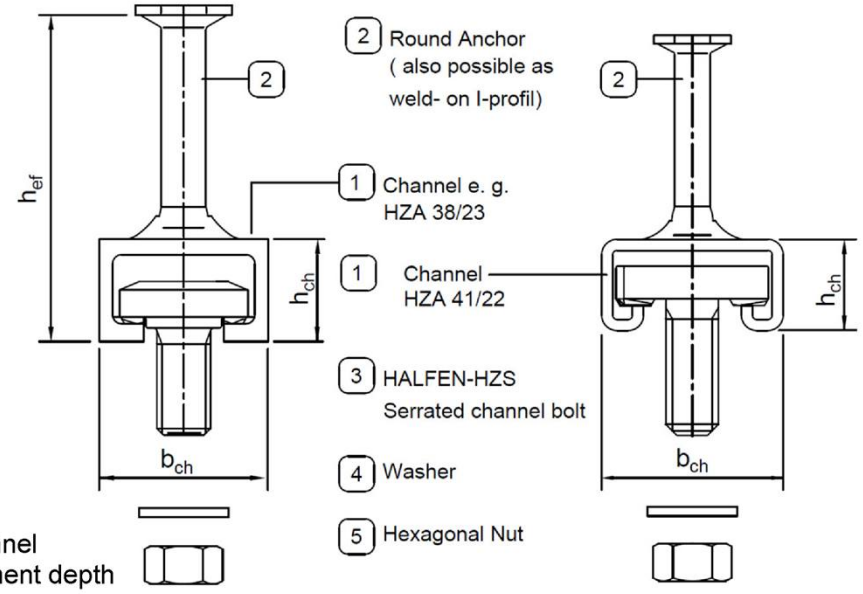


HALFEN Serrated Anchor Channels HZA	
Product description Installed condition	Annex A1

Deutsches Institut für Bautechnik DIBt

Anchor channel
HZA DYNAGRIP

Anchor channel
HZA



Legend
h_{ch} Channel height
b_{ch} Width of the channel
h_{ef} Effective embedment depth

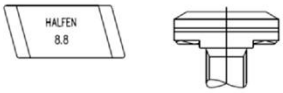
Marking of the HALFEN serrated anchor channel
e.g.: HZA 38/23 A4

a) Stamped on inner side of channel back	b) Printed on channel web
H or HALFEN	Identifying mark of producer
ZA	Type of anchor channel
38/23	Size
A4	Material
If $h_{ef} > h_{ef,min}$	Embedment depth in [mm]

Material of serrated channel:

Carbon 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

Marking of the HALFEN serrated channel bolts
e.g.: HALFEN 8.8



H or HALFEN	Identifying mark of producer
8.8	Strength grade

Material of serrated channel bolts:

Carbon 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 serrated channel bolts:

Carbon steel	
8.8	Strength grade 8.8
Stainless steel	
50, 70	Strength grade 50, 70

HALFEN Serrated Anchor Channels HZA

Product description
Product and marking

Annex A2

Deutsches Institut für Bautechnik DIBt

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 [5)]	
①	Channel profile	**Carbon steel** hot-dip galv. ≥ 55 µm acc. to (E) pre-galv. ≥ 15 µm, steel acc. to (K)	**Carbon steel** hot-dip galv. ≥ 55 µm acc. to (E) **Stainless steel** [2)] CRC II
②	Anchor	**Carbon steel** hot-dip galv. ≥ 55 µm acc. to (E)	**Carbon steel** hot-dip galv. ≥ 55 µm acc. to (E) **Stainless steel** [2)] CRC II
③	HALFEN serrated channel bolts	**Carbon steel** strength grade 8.8 (A) hot-dip galv. ≥ 50 µm acc. to (G) [1)]	**Carbon steel** strength grade 8.8 (A) hot-dip galv. ≥ 50 µm acc. to (G) [1)] **Stainless steel** [2)] strength grade 50,70 (B) CRC II
④	Washer [3)] (H) and (I) production class A, 200 HV	**Carbon steel** electroplated ≥ 5 µm acc. to (F)	**Carbon steel** hot-dip galv. ≥ 50 µm acc. to (G) [1)] **Stainless steel** [2)] CRC II
⑤	Hexagonal nuts (J)	**Carbon steel** strength grade 8 (C) electroplated ≥ 5 µm acc. to (F)	**Carbon steel** strength grade 8 (C) hot-dip galv. ≥ 50 µm acc. to (G) [1)] **Stainless steel** [2)] strength grade 70, 80 (D) CRC II

For footnotes see Annex A4

HALFEN Serrated Anchor Channels HZA	Annex A3
Product description Materials and intended use	

Deutsches Institut für Bautechnik DIBt

Table A1 (continued): Materials and intended use

Item no.	Specification	Intended use		
		3	4	5
		according EN 1993-1-4, Tab. A.2		
		For CRC III	For CRC IV	For CRC V
		Materials [6]		
①	Channel profile	**Stainless steel** CRC III	**Stainless steel** CRC IV	**Stainless steel** CRC V
②	Anchor	**Stainless steel** CRC III **Carbon steel** [4]	**Stainless steel** CRC IV	**Stainless steel** CRC V
③	HALFEN serrated channel bolts	**Stainless steel** strength grade 50,70 (B) CRC III	**Stainless steel** strength grade 50,70 (B) CRC IV	**Stainless steel** strength grade 50,70 (B) CRC V
④	Washer [3] (H) and (I) production class A, 200 HV	**Stainless steel** CRC III	**Stainless steel** CRC IV	**Stainless steel** CRC V
⑤	Hexagonal nuts (J)	**Stainless steel** strength grade 70, 80 (D) CRC III	**Stainless steel** strength grade 70, 80 (D) CRC IV	**Stainless steel** strength grade 70, 80 (D) CRC V

A - EN ISO 898-1
B - EN ISO 3506-1
C - EN ISO 898-2
D - EN ISO 3506-2
E - EN ISO 1461
F - EN ISO 4042
G - EN ISO 10684
H - EN ISO 7089
I - EN ISO 7093-1
J - EN ISO 4032
K - EN 10346

[1] or electroplated with special coating ≥ 12 µm

[2] stainless steel anchors only in combination with stainless steel channel profiles, channel bolts, washers and nuts

[3] not included in scope of delivery

[4] only for weld-on anchors with sufficient concrete cover acc. to EN 1992-1-1

[5] expected working life at least 50 years

[6] expected working life at least 100 years

Fig. 1

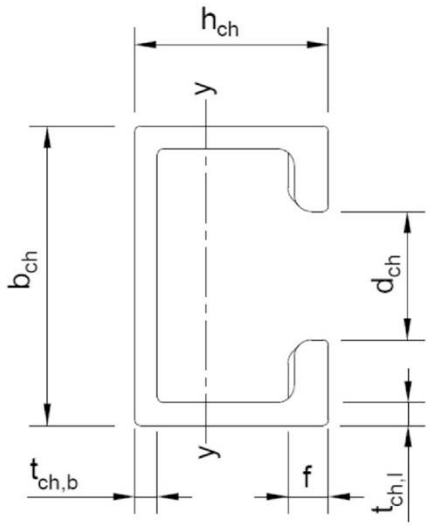


Fig. 2

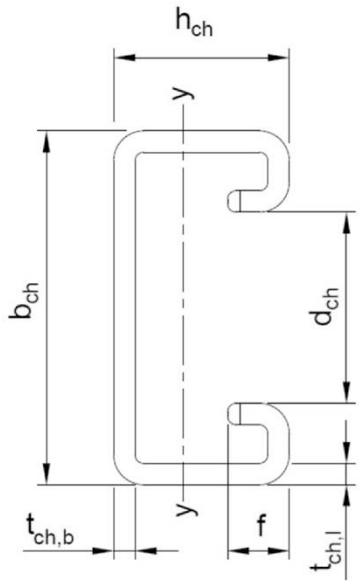


Table A2: Profile dimensions (steel and stainless steel)

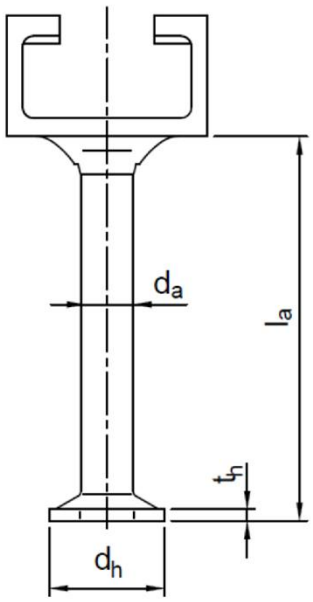
Anchor channel HZA	Material		Dimensions						
			b_{ch}	h_{ch}	$t_{ch,b}$	$t_{ch,l}$	d_{ch}	f	I_y
			[mm]						[mm^4]
29/20	Carbon steel	Fig. 1	29,0	20,0	2,5	2,5	14,0	5,0	10.200
38/23	Carbon steel & stainless steel		38,0	23,0	3,5	3,0	18,0	5,5	21.100
41/27	Carbon steel		40,0	27,0	4,2	4,0	18,0	7,0	39.000
53/34	Carbon steel & stainless steel		52,5	34,0	4,0	4,0	22,5	7,5	92.600
64/44	Carbon steel & stainless steel		64,0	44,0	4,5	5,0	26,0	10,0	240.300
41/22	Carbon steel & stainless steel	Fig. 2	41,3	20,7	2,5	2,5	22,3	7,2	12.600

HALFEN Serrated Anchor Channels HZA

Product description
Profile dimensions

Annex A5

Round Anchor



I-Anchor

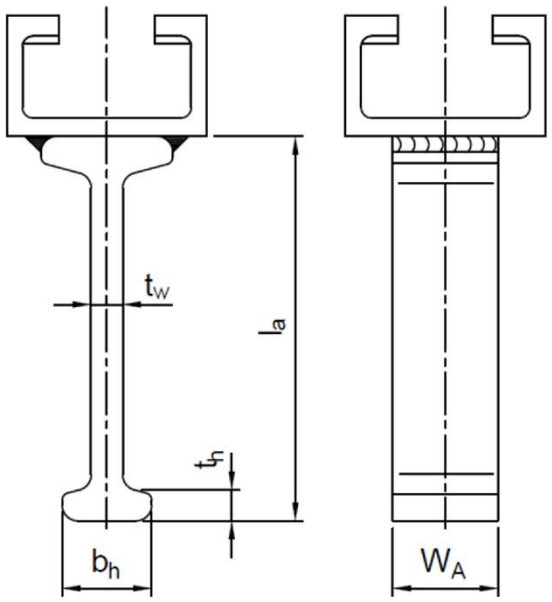


Table A3: Dimensions of anchors (Round Anchor and I-Anchor)

Anchor channel HZA	Round Anchor					I-Anchor					
	min l_a	d_a	d_h	t_h	A_h	min l_a	t_w	b_h	t_h	w_A	A_h
	[mm]				[mm²]	[mm]					[mm²]
29/20	64,0	8	16	1,9	151	69	5	18	3,5	12-20	156
38/23	73,0	10	20	2,2	236	128	6	17	5	20-30	220
41/27	124,0	12	25	2,7	378	128	6	17	5	25-35	275
53/34	123,7	12	25	2,7	378	128	6	17	5	30-40	330
64/44	–[1)]	–[1)]	–[1)]	–[1)]	–[1)]	140	7,1	20	6	41-50	529
41/22	63,3	8	16	1,9	151	69	5	18	3,5	12-20	156

[1)] Product not available

HALFEN Serrated Anchor Channels HZA

Product description
Dimensions of anchors

Annex A6

Figure 1
Round Anchor

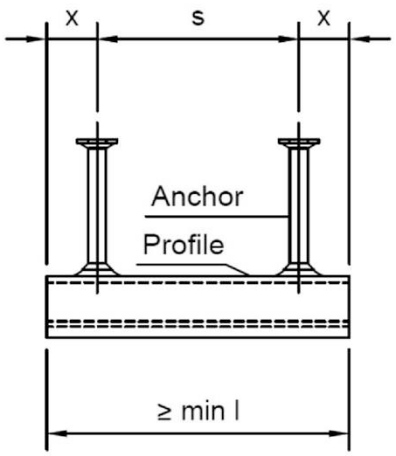


Figure 2
I-Anchor

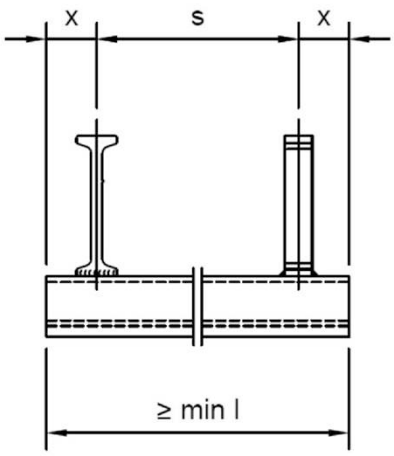


Table A4: Anchor positioning

Anchor channel HZA	Anchor spacing s		End spacing x		Min. Channel length l_{min}	
	s_{min}	s_{max}	Round Anchor Fig. 1	I-Anchor Fig. 2	Round Anchor Fig. 1	I-Anchor Fig. 2
	[mm]					
29/20	50	200	28[2)]	28[2)]	106	106
38/23	80	250	28[2)]	28[2)]	136	136
41/27	80	250	35	35	150	150
53/34	80	250	35	35	150	150
64/44	80	300[3)]	–[1)]	35	–[1)]	150
41/22	50	250	25[2)]	25[2)]	100	100

[1)] Product not available

[2)] The end spacing may be increased up to 35 mm

[3)] In case of fatigue cyclic tension load: s_{max} = 250 mm

HALFEN Serrated Anchor Channels HZA	Annex A7
Product description Anchor positioning, channel length	

HALFEN serrated channel bolts

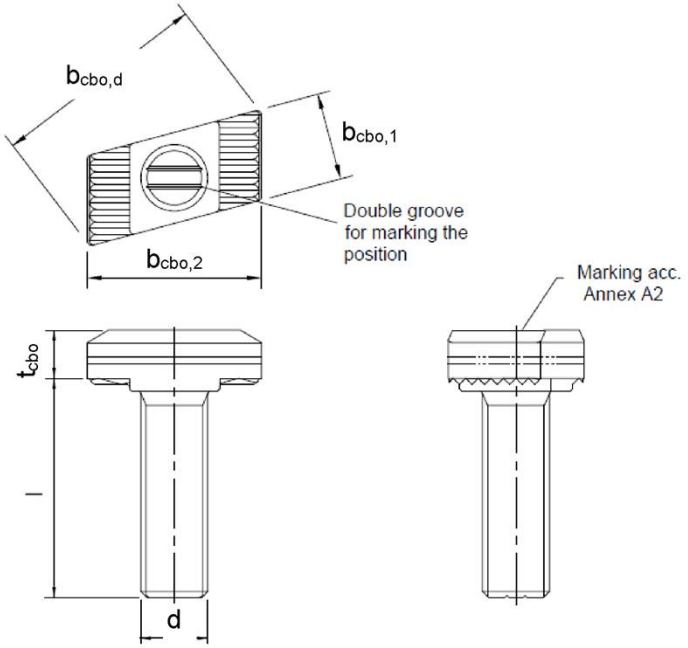


Table A5: Dimensions of HALFEN serrated channel bolts

Anchor channel HZA	Channel bolt HZS	Material	Thread diameter	Width $b_{cbo,1}$	Diagonal $b_{cbo,d}$	Length $b_{cbo,2}$	Thickness t_{cbo}
				[mm]			
29/20	HZS 29/20	8.8	M12	13,4	27,1	20,9	6,5
38/23 and 41/27	HZS 38/23	8.8 A4-70	M12	17,0	37,0	28,8	8,0
		8.8 A4-70	M16	17,0	37,0	28,8	8,0
53/34	HZS 53/34	8.8 A4-70	M16	21,0	51,6	41,6	11,5
		8.8 A4-70	M20	21,0	51,6	41,6	13,0
64/44	HZS 64/44	8.8 A4-70	M20	24,7	63,1	51,0	14,0
		8.8 A4-70	M24	24,7	63,1	51,0	16,0
41/22	HZS 41/22	8.8	M10	20,5	42,5	34,7	5,5
		8.8	M12	20,5	42,5	34,7	5,5
		A4-50	M12	20,5	42,5	34,7	7,5
		8.8 A4-50	M16	20,5	42,5	34,7	7,5

HALFEN Serrated Anchor Channels HZA

Product description
HALFEN serrated channel bolts, dimensions

Annex A8

Deutsches Institut für Bautechnik DIBt

Table A6: Strength grade

	Steel [1)]	Stainless steel [1)]	
Strength grade	8.8	50	70
f_{uk} [N/mm²]	800	500	700
f_{yk} [N/mm²]	640	210	450
Finish	Hot-dip galvanized	–	

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

HALFEN Serrated Anchor Channels HZA

Product description
HALFEN serrated channel bolts, strength grade

Annex A9

Deutsches Institut für Bautechnik DIBt

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 serrated channel bolts according to Annex A3-A4, Table A1, column 1-5)
- 100 years
  (anchor channels and serrated 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 and shear in the direction of the longitudinal axis of the channel
- Fatigue cyclic tension
  (anchor channel and serrated channel bolt according to Annex C9, Table C11)
- 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 serrated channel bolt according to Annex C11)
- Fire exposure for concrete class C20/25 to C50/60
  (anchor channels and serrated channel bolts according to Annex C13)

Base materials:

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

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions
  (anchor channels and serrated channel bolts acc. 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 serrated channel bolts acc. to Annex A3-A4, Table A1, column 2 - 5)
- According to EN 1993-1-4 relating to corrosion resistance class CRC III
  (anchor channels and serrated channel bolts acc. to Annex A4, Table A1, column 3 - 5)
- According to EN 1993-1-4 relating to corrosion resistance class CRC IV
  (anchor channels and serrated channel bolts acc. to Annex A4, Table A1, column 4 - 5)
- According to EN 1993-1-4 relating to corrosion resistance class CRC V
  (anchor channels and serrated channel bolts acc. to Annex A4, Table A1, column 5)

HALFEN Serrated Anchor Channels HZA	Annex B1
Intended use Specifications	

Design:

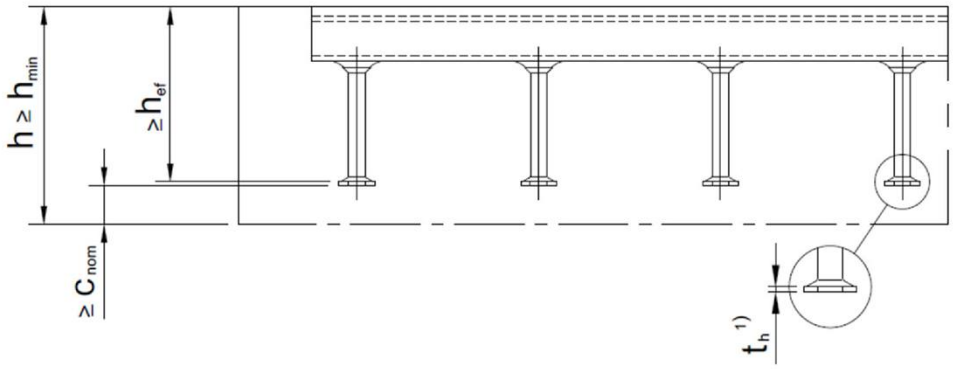
- Anchor channels are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the serrated anchor channel and serrated channel bolts are indicated 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 performance category C1) and fire exposure the anchor channels are designed in accordance with EN 1992-4 and EOTA TR 047.
- For fatigue loading the anchor channels are designed in accordance with EOTA TR 050.
- 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 (double groove 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 Serrated Anchor Channels HZA	Annex B2
Intended use Specifications	

Side view



Plan view

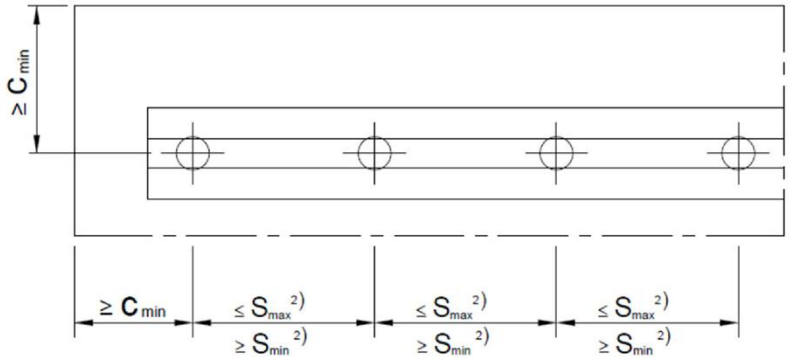


Table B1: Min. effective embedment depth, edge distance and thickness of concrete member

Serrated anchor channel HZA			29/20	38/23	41/27	53/34	64/44	41/22
Minimum effective embedment depth	[mm]	$h_{ef,min}$	82	94	148	155	178	82
Minimum edge distance		c_{min}	50	75	75	100	125	50
Minimum thickness of concrete member		h_{min}	$h_{ef} + t_h$ [1] + c_{nom} [3]					
			125	125	170	200	200	125

[1] t_h = Anchor head thickness
[2] s_{min}, s_{max} acc. to Annex A7, Tab. A4
[3] c_{nom} acc. to EN 1992-1-1

HALFEN Serrated Anchor Channels HZA

Intended use
Installation parameters of anchor channels

Annex B3

Deutsches Institut für Bautechnik DIBt

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

Anchor channel HZA	HALFEN serrated channel bolts d	Min. spacing of the serrated channel bolts $s_{min,cbo}$	Installation torque T_{inst} [4]					
			General [2] $T_{inst,g}$			Steel-to-steel contact [3] $T_{inst,s}$		
			Steel 8.8[1]	Stainless steel		Steel 8.8[1]	Stainless steel	
				50[1]	70[1]		50[1]	70[1]
	[mm]		[Nm]					
29/20	12	60	35	–[5]	–[5]	75	–[5]	–[5]
38/23	12	60	55	–[5]	50	75	–[5]	50
	16	80	75	–[5]	75	185	–[5]	130
41/27	12	60	75	–[5]	–[5]	75	–[5]	–[5]
	16	80	125	–[5]	–[5]	185	–[5]	–[5]
53/34	16	80	135	–[5]	130	185	–[5]	130
	20	100	165	–[5]	165	360	–[5]	250
64/44	20	100	315	–[5]	250	360	–[5]	250
	24	120	375	–[5]	335	625	–[5]	435
41/22	10	50	25	–[5]	–[5]	30	–[5]	–[5]
	12	60	30	20	–[5]	50	20	–[5]
	16	80	40	50	–[5]	140	50	–[5]

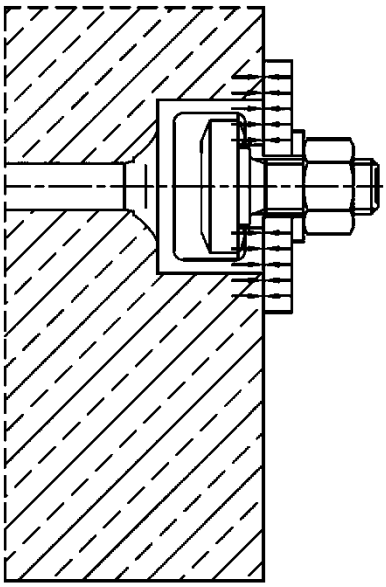
[1] Materials according to Annex A2 and Annex A3-A4, Tab. A1
[2] Acc. to Annex B5, Fig. 1
[3] Acc. to Annex B5, Fig. 2
[4] T_{inst} must not be exceeded
[5] Product not available

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.

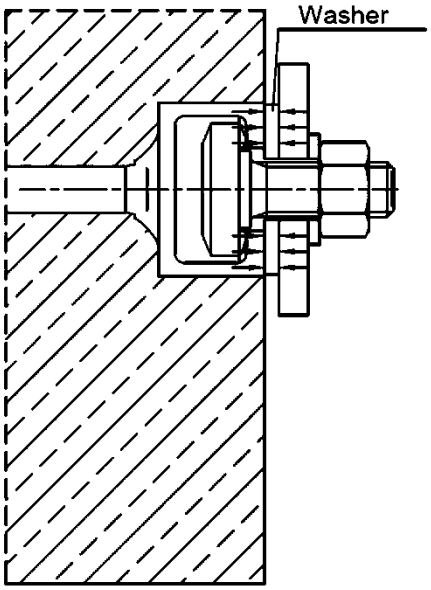
Fig. 1



Steel-to-steel contact

The fixture is not in contact with the concrete surface. 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.

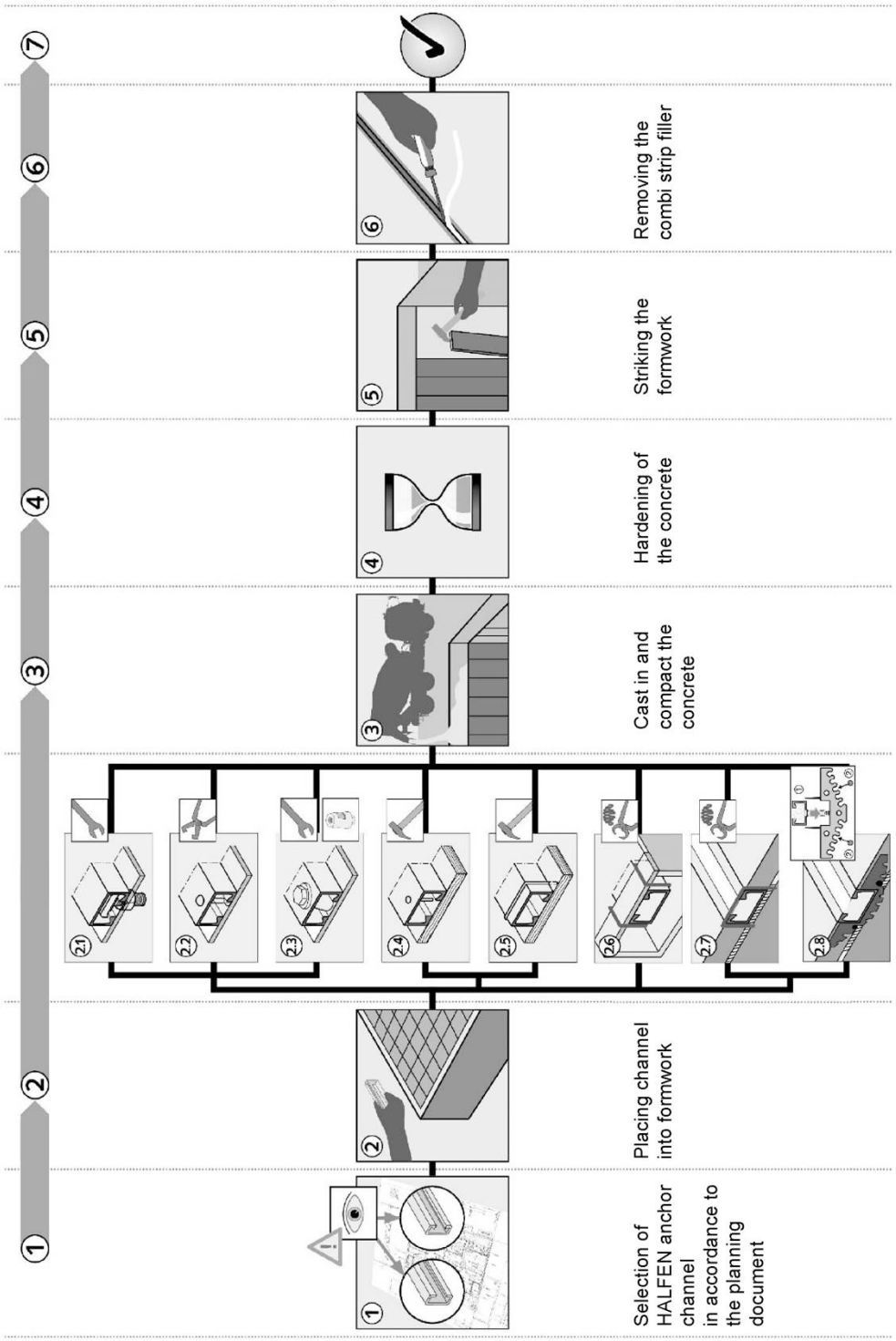
Fig. 2



HALFEN Serrated Anchor Channels HZA	Annex B5
Intended use Position of the fixture	

Deutsches Institut für Bautechnik DIBt

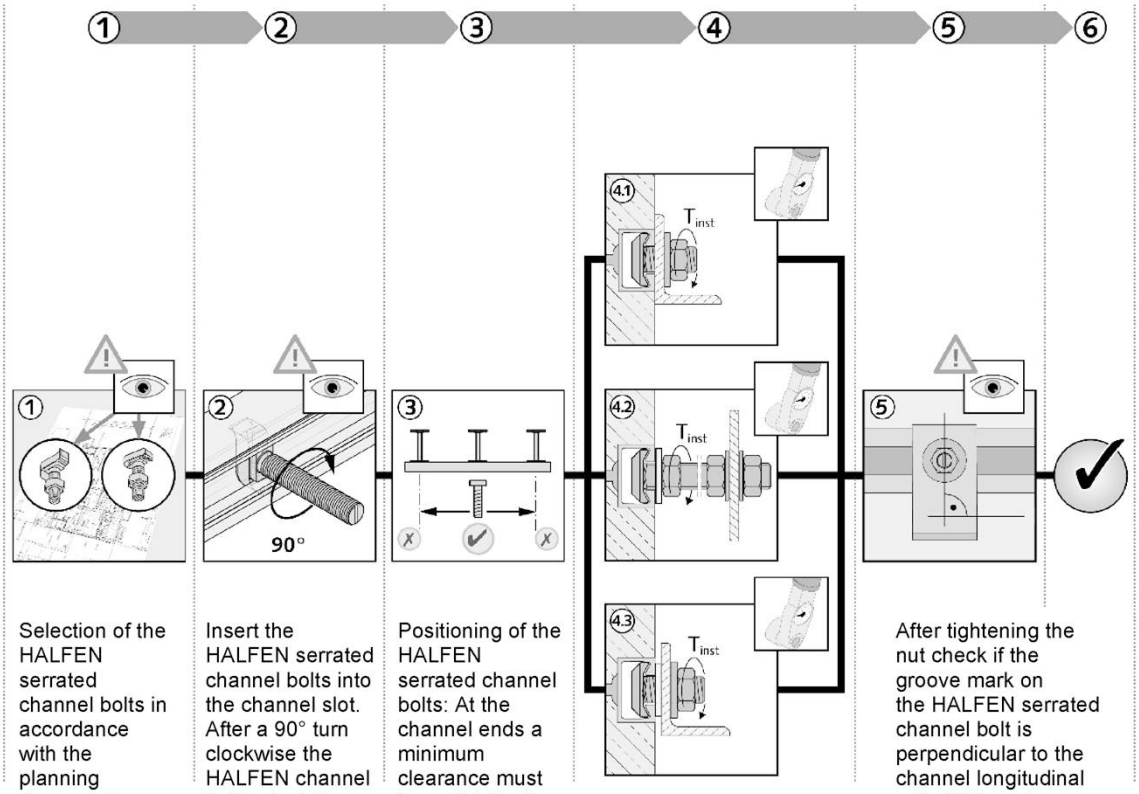
Installation of HALFEN serrated anchor channel



2.1 Steel formwork: Fixing with HALFEN serrated 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 Serrated Anchor Channels HZA	
Intended use Installation instruction of HALFEN serrated anchor channel	Annex B6

Installation of HALFEN serrated channel bolts



1. Selection of the HALFEN serrated channel bolts in accordance with the planning document.
2. Insert the HALFEN serrated channel bolts into the channel slot. After a 90° turn clockwise the HALFEN channel bolt locks into position (check whether the groove mark is perpendicular to the channel longitudinal axis).
3. Positioning of the HALFEN serrated 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.
4. 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.
5. After tightening the nut check if the groove mark on the HALFEN serrated channel bolt is perpendicular to the channel longitudinal axis. If it is not perpendicular the channel bolt must be completely loosened, re-inserted and tightened again.

Table B3: Installation torque

Pos. of fixture acc. Annex B5	Material strength grade		Anchor channel HZA	T_{inst} [Nm] [1]				
				M10	M12	M16	M20	M24
General	Steel 8.8 and (Stainless steel 50 / 70)		29/20	–[3]	35	–[3]	–[3]	–[3]
			38/23	–[3]	55 (50)	75 (75)	–[3]	–[3]
			41/27	–[3]	75	125	–[3]	–[3]
			53/34	–[3]	–[3]	135 (130)	165 (165)	–[3]
			64/44	–[3]	–[3]	–[3]	315 (250)	375 (335)
			41/22	25	30 (20)	40 (50)	–[3]	–[3]
Steel-to-steel contact	Steel	8.8	All profiles	30	75 / 50 [2]	185 / 140 [2]	360	625
	Stainless steel	50		–[3]	20	50	–[3]	–[3]
		70		–[3]	50	130	250	435

[1] T_{inst} must not be exceeded
[2] Only for HZS 41/22 M12 8.8 and for HZS 41/22 M16 8.8
[3] Product not available

HALFEN Serrated Anchor Channels HZA	Annex B7
Intended use Installation instruction of HALFEN serrated channel bolts	

Deutsches Institut für Bautechnik DIBt

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

Serrated anchor channel			**Steel**	**29/20**	**38/23**	**41/27**	**53/34**	**64/44**	**41/22**
Steel failure: Anchor									
Characteristic resistance	$N_{Rk,s,a}$	[kN]	carbon	20,1	31,4	54,0	56,5	100,0	20,1
			stainless	–[2]	35,3	–[2]	56,5	100,0	22,6
Partial factor	γ_{Ms} [1]		carbon	1,78	1,78	1,80	1,67	1,80	1,78
			stainless	–[2]	1,80	–[2]			1,80
Steel failure: Connection channel/anchor									
Characteristic resistance	$N_{Rk,s,c}$	[kN]	carbon	22,9	36,0	53,6	59,6	106,1	18,1
			stainless	–[2]	40,0	–[2]	55,0	94,4	26,1
Partial factor	$\gamma_{Ms,ca}$ [1]		1,8						
Steel failure: Local flexure of the channel lips									
Spacing of channel bolts for $N_{Rk,s,l}$	$s_{l,N}$	[mm]		58	76	80	105	128	83
Characteristic resistance	$N^0_{Rk,s,l}$	[kN]	carbon	22,9	39,3	53,6	82,5	119,5	20,1
			stainless	–[2]	40,0	–[2]	70,0	94,4	26,1
Partial factor	$\gamma_{Ms,l}$ [1]		1,8						

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

Table C2: Characteristic flexural resistance of channel

Serrated Anchor channel			**Steel**	**29/20**	**38/23**	**41/27**	**53/34**	**64/44**	**41/22**
Steel failure: Flexure of channel									
Characteristic flexural resistance of channel	$M_{Rk,s,flex}$	[Nm]	carbon	873	1497	2289	3452	6935	733
			stainless	–[2]	1670	–[2]	3608	7922	749
Partial factor	$\gamma_{Ms,flex}$ [1]		1,15						

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

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

HALFEN serrated channel bolt thread diameter					**M10**	**M12**	**M16**	**M20**	**M24**
Steel failure: Channel bolt									
Characteristic resistance	$N_{Rk,s}$	[kN]	Carbon steel	8.8	46,4	67,4 (48,5)[1]	125,6 (96,3)[2]	196,0	282,4
			Stainless steel	50[3]	–[5]	40,3	64,0	–[5]	–[5]
				70[3]	–[5]	59,0	109,9	171,5	247,1
Partial factor	γ_{Ms} [4]		Carbon steel	8.8	1,50				
			Stainless steel	50[3]	2,86				
				70[3]	1,87				

[1] For HZS 41/22 M12 8.8
[2] For HZS 41/22 M16 8.8
[3] Materials according Annex A2, A3 and A4
[4] In absence of other national regulations
[5] No performance assessed

Deutsches Institut für Bautechnik DIBt

Table C4: Characteristic resistances under tension load – concrete failure

Serrated anchor channel				**29/20**	**38/23**	**41/27**	**53/34**	**64/44**	**41/22**
Concrete failure: Pull-out									
Characteristic resistance in cracked concrete C12/15	Round anchors	$N_{Rk,p}$	[kN]	13,6	21,2	34,0	34,0	–[2)]	13,6
	I-anchors			14,0	19,8	24,8	29,7	47,6	14,0
Characteristic resistance in uncracked concrete C12/15	Round anchors	$N_{Rk,p}$	[kN]	19,0	29,7	47,6	47,6	–[2)]	19,0
	I-anchors			19,7	27,7	34,7	41,6	66,6	19,7
Increasing factor for $N_{Rk,p}$ = $N_{Rk,p}$ (C12/15) · Ψ_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		$k_{cr,N}$		7,9	8,1	8,6	8,7	8,9	7,9
		$k_{ucr,N}$		11,3	11,5	12,3	12,4	12,7	11,3
Partial factor		γ_{Mc} [1)]		1,5					
Concrete failure: Splitting									
Characteristic edge spacing		$c_{cr,sp}$	[mm]	246	281	445	465	534	246
Characteristic spacing		$s_{cr,sp}$		492	562	890	930	1068	492
Partial factor		γ_{Msp} [1)]		1,5					

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

HALFEN Serrated Anchor Channels HZA

Performances
Characteristic resistances under tension load – concrete failure

Annex C3

Deutsches Institut für Bautechnik DIBt

Table C5: Displacements under tension load

Serrated anchor channel			**Steel**	**29/20**	**38/23**	**41/27**	**53/34**	**64/44**	**41/22**
Tension load	N	[kN]	carbon	6,8	9,1	14,4	22,2	38,5	5,1
			stainless	–[1)]	10,9	–[1)]	21,8	37,4	8,5
Short-term displacement	δ_{N0}	[mm]	carbon	0,5	0,8	0,9	0,7	0,8	0,6
			stainless	–[1)]	0,9	–[1)]	0,7	0,7	1,0
Long-term displacement	$\delta_{N\infty}$	[mm]	carbon	0,9	1,7	1,8	1,4	1,7	1,3
			stainless	–[1)]	1,8	–[1)]	1,5	1,4	1,9

[1)] No performance assessed

Table C6: Characteristic resistances under shear load – steel failure anchor channel

Serrated anchor channel			**Steel**	**29/20**	**38/23**	**41/27**	**53/34**	**64/44**	**41/22**
Steel failure: Anchor									
Characteristic resistance	$V_{Rk,s,a,y}$	[kN]	carbon	20,1	43,9	53,6	101,1	156,3	29,7
			stainless	–[2]	39,0	–[2]	95,5	94,4	22,6
	$V_{Rk,s,a,x}$	[kN]	carbon	12,0	18,8	32,4	33,9	62,8	12,0
			stainless	–[2]	18,8	–[2]	33,9	62,8	13,5
Partial factor	$\gamma_{Ms,a}$ [1]		carbon	1,48	1,48	1,50	1,39	1,50	1,48
			stainless	–[2]	1,48	–[2]	1,39	1,50	1,50
Steel failure: Connection channel/anchor									
Characteristic resistance	$V_{Rk,s,c,y}$	[kN]	carbon	20,1	43,9	53,6	101,1	156,3	29,7
			stainless	–[2]	39,0	–[2]	95,5	94,4	22,6
	$V_{Rk,s,c,x}$	[kN]	carbon	13,7	21,6	32,2	35,8	63,7	10,9
			stainless	–[2]	24,0	–[2]	33,0	56,6	15,7
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]		58	76	80	105	128	83
Characteristic resistance	$V^0_{Rk,s,l,y}$	[kN]	carbon	20,1	43,9	53,6	101,1	156,3	29,7
			stainless	–[2]	39,0	–[2]	95,5	94,4	22,6
Partial factor	$\gamma_{Ms,l}$ [1]		1,8						

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

Table C6 (continued): Characteristic resistances under shear load – steel failure

Serrated anchor channel			**Steel**	**29/20**	**38/23**	**41/27**	**53/34**	**64/44**	**41/22**
Steel failure: Connection between channel lips and channel bolt in longitudinal channel axis									
Characteristic resistance	$V_{Rk,s,l,x}$ [kN]	M10	carbon	–[1]	–[1]	–[1]	–[1]	–[1]	13,6
		M12	carbon	12,6	23,6	23,6	–[1]	–[1]	14,4
			stainless	–[1]	20,1	–[1]	–[1]	–[1]	12,1
		M16	carbon	–[1]	23,6	32,0	39,5	–[1]	14,4
			stainless	–[1]	24,9	–[1]	51,7	–[1]	12,1
		M20	carbon	–[1]	–[1]	–[1]	39,5	85,8	–[1]
			stainless	–[1]	–[1]	–[1]	51,7	68,8	–[1]
		M24	carbon	–[1]	–[1]	–[1]	–[1]	85,8	–[1]
			stainless	–[1]	–[1]	–[1]	–[1]	68,8	–[1]
Installation factor	γ_{inst}		carbon	1,0	1,2	1,2	1,2	1,2	1,2
			stainless	–[1]	1,0 [2] 1,2	–[1]	1,4	1,0	1,2

[1] No performance assessed

[2] Valid for HZS 38/23 M12 A4-70

Deutsches Institut für Bautechnik DIBt

Table C7: Characteristic resistances under shear load – concrete failure

Serrated anchor channel			**29/20**	**38/23**	**41/27**	**53/34**	**64/44**	**41/22**
Concrete failure: Pry-out								
Product factor		k_8 [1]	2,0	2,0	2,0	2,0	2,0	2,0
Partial factor		γ_{Mc} [2]	1,5					
Concrete failure: Concrete edge								
Product factor k_{12}	cracked concrete	$k_{cr,V}$	6,1	7,5	7,5	7,5	7,5	6,5
	uncracked concrete	$k_{ucr,V}$	8,5	10,5	10,5	10,5	10,5	9,1
Partial factor		γ_{Mc} [2]	1,5					

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

Table C8: Displacements under shear load

Serrated anchor channel			**Steel**	**29/20**	**38/23**	**41/27**	**53/34**	**64/44**	**41/22**
Shear load in y-direction [1]	V_y	[kN]	carbon	8,0	17,4	21,3	40,1	62,0	11,8
			stainless	–[3]	15,5	–[3]	37,9	37,5	9,0
Short-term displacement in y-direction	$\delta_{V,y,0}$	[mm]	carbon	0,9	1,2	0,9	1,3	2,1	1,1
			stainless	–[3]	1,1	–[3]	2,1	2,1	0,9
Long-term displacement in y-direction	$\delta_{V,y,\infty}$	[mm]	carbon	1,4	1,8	1,4	2,0	3,2	1,7
			stainless	–[3]	1,7	–[3]	3,2	3,2	1,4
Shear load in x-direction [2]	V_x	[kN]	carbon	5,0	7,8	10,5	13,0	28,3	4,7
			stainless	–[3]	8,2	–[3]	14,6	27,3	4,0
Short-term displacement in x-direction	$\delta_{V,x,0}$	[mm]	carbon	0,4	0,2	0,2	0,3	0,9	0,1
			stainless	–[3]	0,6	–[3]	0,5	0,9	0,2
Long-term displacement in x-direction	$\delta_{V,x,\infty}$	[mm]	carbon	0,6	0,3	0,3	0,5	1,4	0,2
			stainless	–[3]	0,9	–[3]	0,8	1,4	0,3

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

HALFEN Serrated Anchor Channels HZA

Performances
Characteristic resistances under shear load – concrete failure, displacements

Annex C7

Deutsches Institut für Bautechnik DIBt

Table C9: Characteristic resistances under shear load – steel failure of HALFEN serrated channel bolt

HALFEN serrated channel bolt thread diameter					**M10**	**M12**	**M16**	**M20**	**M24**
Steel failure: Channel bolt									
Characteristic resistance	$V_{Rk,s}$	[kN]	steel	8.8	23,2	33,7	62,8	98,0	141,2
			Stainless steel	50[1)]	–[3)]	25,3	47,1	–[3)]	–[3)]
				70[1)]	–[3)]	35,4	65,9	102,9	148,3
Characteristic flexural resistance	$M^0_{Rk,s}$	[Nm]	steel	8.8	60	105	267	519	898
			Stainless steel	50[1)]	–[3)]	66	167	–[3)]	–[3)]
				70[1)]	–[3)]	92	233	454	786
Partial factor	γ_{Ms} [2)]		steel	8.8	1,25				
			Stainless steel	50[1)]	2,38				
				70[1)]	1,56				

[1)] Materials according Annex A2 and A3-A4
[2)] In absence of other national regulations
[3)] No performance assessed

Table C10: Characteristic resistance under combined tension and shear load

Serrated anchor channel		**29/20**	**38/23**	**41/27**	**53/34**	**64/44**	**41/22**
Steel failure: Local flexure of channel lips and failure by flexure of channel							
Product factor	k_{13}	Values according to EN 1992-4, Section 7.4.3.1					
Steel failure: Anchor and connection between anchor and channel							
Product factor	k_{14}	Values according to EN 1992-4, Section 7.4.3.1					

For Design Method I or II for assessment method C according to EOTA TR 050

Table C11: Combinations of anchor channels and channel bolts under fatigue tension load

Anchor channel		Channel bolts			
HZA	Anchor type	Channel bolt	Thread diameter [mm]	Grade	Material
38/23	round anchor	HZS 38/23	M16	8.8	steel electro-plated, hot-dip galv.; stainless steel
41/27					
53/34	round anchor + I-anchor	HZS 53/34	M20	8.8 / A4-70	
64/44	I-anchor	HZS 64/44	M24	8.8	

Table C12: Characteristic fatigue resistances $\Delta N_{Rk,s,lo,n}$ with lower load $N_{lok,s,n}$ – Steel failure

Anchor channel	HZA	38/23		41/27		53/34		64/44	
	Load cycles n	$\Delta N_{Rk,s,lo,n}$ [kN]	$N_{lok,s,n}$ [kN]	$\Delta N_{Rk,s,lo,n}$ [kN]	$N_{lok,s,n}$ [kN]	$\Delta N_{Rk,s,lo,n}$ [kN]	$N_{lok,s,n}$ [kN]	$\Delta N_{Rk,s,lo,n}$ [kN]	$N_{lok,s,n}$ [kN]
		carbon		carbon		carbon / stainless		carbon	
Characteristic resistances under fatigue tension load	$\leq 10^4$	16,0	0,0	16,0	0,0	30,0 / 30,0	0,0 / 0,0	55,0	0,0
	$2 \cdot 10^4$	16,0	0,0	16,0	0,0	29,0 / 27,4	0,0 / 0,0	45,2	0,0
	$5 \cdot 10^4$	13,3	2,5	13,3	2,5	22,5 / 19,7	3,0 / 6,5	34,6	9,4
	$1 \cdot 10^5$	10,9	4,9	10,9	4,9	18,5 / 15,3	6,7 / 10,8	28,3	16,9
	$2 \cdot 10^5$	8,9	6,9	8,9	6,9	15,2 / 11,9	9,7 / 14,2	23,1	23,0
	$5 \cdot 10^5$	6,9	9,0	6,9	9,0	11,8 / 8,6	12,9 / 17,5	17,7	29,4
	$1 \cdot 10^6$	5,6	10,2	5,6	10,2	9,7 / 6,7	14,9 / 19,4	14,5	33,2
	$2 \cdot 10^6$	4,6	11,2	4,6	11,2	8,0 / 5,2	16,5 / 20,9	11,8	36,4
	$5 \cdot 10^6$	3,5	12,3	3,5	12,3	6,2 / 3,7	18,1 / 22,3	9,1	39,6
	$7 \cdot 10^6$	3,5	12,3	3,5	12,3	6,2 / 3,3	18,1 / 22,8	8,2	40,6
	$1 \cdot 10^7$	3,5	12,3	3,5	12,3	6,2 / 3,3	18,1 / 22,8	7,4	41,6
	$5 \cdot 10^7$	3,5	12,3	3,5	12,3	6,2 / 3,3	18,1 / 22,8	4,6	44,9
	$\geq 10^8$	3,5	12,3	3,5	12,3	6,2 / 3,3	18,1 / 22,8	3,8	45,9

Table C13: Characteristic resistances under fatigue tension load after n load cycles with static preload N_{Elok} – Concrete failure

Pull-out and concrete cone failure:
Reduction factor for pull-out and concrete cone 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
	$1 \cdot 10^8$	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
[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 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 C14: Combinations of anchor channels and channel bolts under seismic load

Anchor channel		**Channel bolt**			
Profile	Material	Type	Thread Ø	Strength grade	Material
38/23	hot-dip galvanized	HZS 38/23	12 16	8.8	Steel hot-dip galvanized
41/27	hot-dip galvanized	HZS 38/23	12 16	8.8	Steel hot-dip galvanized
53/34	hot-dip galvanized	HZS 53/34	16 20	8.8	Steel electro-plated, hot-dip galvanized
41/22	hot-dip galvanized	HZS 41/22	12 16	8.8	Steel electro-plated, hot-dip galvanized

Table C15: Characteristic resistances under seismic tension load – steel failure

Anchor channel			**steel**	**38/23**	**41/27**	**53/34**	**41/22**
Steel failure: Anchor							
Characteristic resistance	$N_{Rk,s,a,eq}$	[kN]	carbon	31,4	54,0	56,5	20,1
Partial factor	$\gamma_{Ms,a}$ [1)]			1,78	1,80	1,67	1,78
Steel failure: Connection channel/anchor							
Characteristic resistance	$N_{Rk,s,c,eq}$	[kN]	carbon	36,0	53,6	59,6	18,1
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	76	80	105	83
Characteristic resistance	$N^0_{Rk,s,l,eq}$	[kN]	carbon	39,3	53,6	82,5	20,1
Partial factor	$\gamma_{Ms,l}$ [1)]			1,8			

[1)] In absence of other national regulations

Table C16: Characteristic flexural resistances under seismic tension load

Anchor channel			**steel**	**38/23**	**41/27**	**53/34**	**41/22**
Steel failure: Flexure of channel							
Characteristic resistance	$M_{Rk,s,flex,eq}$	[Nm]	carbon	1497	2289	3452	733
Partial factor	$\gamma_{Ms,flex}$ [1)]			1,15			

[1)] In absence of other national regulations

HALFEN Serrated Anchor Channels HZA

Performances
Char. resistances under seismic tension load (seismic performance category C1)

Annex C11

Deutsches Institut für Bautechnik DIBt

Table C17: Characteristic resistances under seismic tension load – steel failure of HALFEN serrated channel bolt HZS

HALFEN serrated channel bolt			**M12**	**M16**	**M20**
Steel failure					
Characteristic resistance	$N_{Rk,s,eq}$	[kN]	67,4 (48,5) [2]	125,6 (96,3) [3]	196,0
Partial factor	γ_{Ms} [1]		1,5		

[1] In absence of other national regulations
[2] For HZS 41/22 M12 8.8
[3] For HZS 41/22 M16 8.8

Table C18: Characteristic resistances under seismic shear load – steel failure

Anchor channel			**steel**	**38/23**	**41/27**	**53/34**	**41/22**
Steel failure: Anchor							
Characteristic resistance	$V_{Rk,s,a,y,eq}$	[kN]	carbon	43,9	53,6	101,1	29,7
Characteristic resistance	$V_{Rk,s,a,x,eq}$	[kN]	carbon	18,8	32,4	33,9	12,0
Partial factor	$\gamma_{Ms,a}$ [1]			1,48	1,50	1,39	1,48
Steel failure: Connection channel/anchor							
Characteristic resistance	$V_{Rk,s,c,y,eq}$	[kN]	carbon	43,9	53,6	101,1	29,7
Characteristic resistance	$V_{Rk,s,c,x,eq}$	[kN]	carbon	21,6	32,2	35,8	10,9
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	76	80	105	83
Characteristic resistance	$V^0_{Rk,s,l,y,eq}$	[kN]	carbon	43,9	53,6	101,1	29,7
Partial factor	$\gamma_{Ms,l,x}$ [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	23,6	23,6	39,5	14,4
Installation factor	γ_{inst}			1,2			

[1] In absence of other national regulations

Table C19: Characteristic resistance under seismic shear load – steel failure of HALFEN serrated channel bolt HZS

HALFEN serrated channel bolt			**M12**	**M16**	**M20**
Steel failure					
Characterist. resistance	$V_{Rk,s,eq}$	[kN]	33,7	62,8	98,0
Partial factor	γ_{Ms} [1]		1,25		

[1] In absence of other national regulations

HALFEN Serrated Anchor Channels HZA

Performances
Char. resistances under seismic tension/shear load (seismic performance category C1)

Annex C12

Table C20: Characteristic resistances under tension and shear load under fire exposure – steel failure

Serrated anchor channel					**29/20**	**38/23**	**41/27**	**53/34**	**64/44**	**41/22**
Steel failure: Anchor, Connection channel / anchor, Local flexure of channel lips, channel bolts										
Characteristic resistances	R30	M12	$N_{Rk,s,fi}$ = $V_{Rk,s,y,fi}$	[kN]	2,7	3,5	3,5	–[1]	–[1]	2,4
		M16			–[1]	4,5	4,5	4,5	–[1]	2,3
		M20			–[1]	–[1]	–[1]	10,3	10,3	–[1]
		M24			–[1]	–[1]	–[1]	–[1]	17,0	–[1]
	R60	M12			2,1	2,7	2,7	–[1]	–[1]	1,7
		M16			–[1]	3,3	3,3	3,3	–[1]	1,8
		M20			–[1]	–[1]	–[1]	7,8	7,8	–[1]
		M24			–[1]	–[1]	–[1]	–[1]	14,8	–[1]
	R90	M12			1,5	1,9	1,9	–[1]	–[1]	1,1
		M16			–[1]	2,1	2,1	2,1	–[1]	1,2
		M20			–[1]	–[1]	–[1]	5,3	5,3	–[1]
		M24			–[1]	–[1]	–[1]	–[1]	9,9	–[1]
	R120	M12			1,3	1,5	1,5	–[1]	–[1]	0,7
		M16			–[1]	1,5	1,5	1,5	–[1]	1,0
		M20			–[1]	–[1]	–[1]	4,0	4,0	–[1]
		M24			–[1]	–[1]	–[1]	–[1]	7,4	–[1]
Partial factor			$\gamma_{Ms,fi}$ [1]	[-]	1,0					

[1] No performance assessed

Table C21: Characteristic resistances under tension and shear load under fire exposure – min. axis distance of reinforcement

Serrated anchor channel				**29/20**	**38/23**	**41/27**	**53/34**	**64/44**	**41/22**
Min. axis distance of reinforcement [1]									
Min. axis distance	R30	a	[mm]	25	30	35	40	50	25
	R60	a		25	30	35	40	50	25
	R90	a		35	35	35	40	50	35
	R120	a		50	50	50	50	50	50

[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

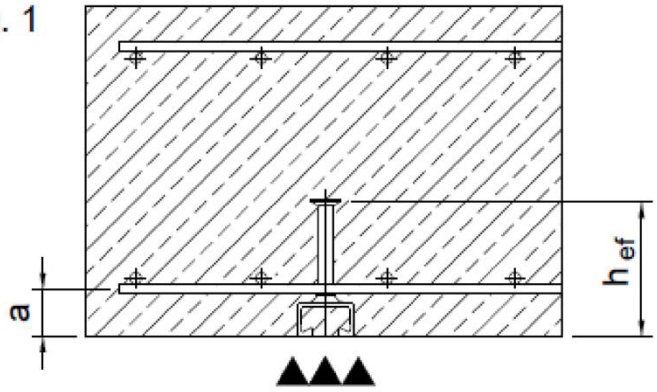
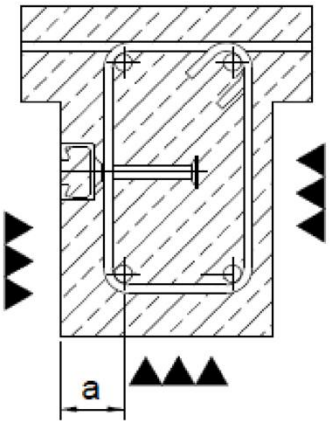


Fig. 2



HALFEN Serrated Anchor Channels HZA

Performances
Characteristic resistances under fire exposure – minimum axis distance

Annex C14