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

European Technical Assessment ETA-17/0336 of 18 July 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	Anchor channels (HAC-C) with channel bolts (HBC)
Product family to which the construction product belongs	Anchor channels
Manufacturer	Hilti AG Feldkircherstraße 100 9494 Schaan FÜRSTENTUM LIECHTENSTEIN
Manufacturing plant	Hilti Manufacturing Plants
This European Technical Assessment contains	41 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-17/0336 issued on 9 November 2020

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Specific Part

1 Technical description of the product

The anchor channels (HAC-C) with channel bolts (HBC) are a system consisting of C-shaped channel profile of carbon steel or stainless steel and at least two metal anchors non-detachably fixed to the channel back and channel bolts.

The anchor channel is embedded surface-flush in the concrete. Channel bolts (HBC) 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 tension load (static and quasi-static loading)	
- Resistance to steel failure of anchors	$N_{Rk,s,a}$ see Annex C1 and C2
- Resistance to steel failure of the connection between anchors and channel	$N_{Rk,s,c}$ see Annex C1 and C2
- 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 and C2
- Resistance to steel failure of channel bolt	$N_{Rk,s}$ see Annex C14
- Resistance to steel failure by exceeding the bending strength of the channel	s_{max} see Annex B3 and B4 $M_{Rk,s,flex}$ see Annex C3
- Maximum installation torque to avoid damage during installation	$T_{inst,g}$; $T_{inst,s}$ see Annex B5
- Resistance to pull-out failure of the anchor	$N_{Rk,p}$ see Annex C4 to C6
- Resistance to concrete cone failure	h_{ef} see Annex B3 and B4 $k_{cr,N}$; $k_{ucr,N}$ see Annex C4 to C6
- Minimum edge distances, spacing and member thickness to avoid concrete splitting during installation	s_{min} see Annex B3 and B4 c_{min} ; h_{min} see Annex B3 and B4
- Characteristic edge distance and spacing to avoid splitting of concrete under load	$s_{cr,sp}$; $c_{cr,sp}$ see Annex C4 to C6
- Resistance to blowout failure - bearing area of anchor head	A_h see Annex A4

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 C15
- Resistance to steel failure by bending of the channel bolt under shear load with lever arm	$M^0_{Rk,s}$ see Annex C16
- Resistance to steel failure of channel lips, steel failure of connection between anchor and channel or 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 C8 and C9
- Resistance to steel failure of connection between channel lips and channel bolt (longitudinal shear)	$V_{Rk,s,l,x}$ see Annex C10
- Factor for sensitivity to installation (longitudinal shear)	γ_{inst} see Annex C10
- Resistance to steel failure of the anchor (longitudinal shear)	$V_{Rk,s,a,x}$ see Annex C8 and C9
- Resistance to steel failure of connection between anchor and channel (longitudinal shear)	$V_{Rk,s,c,x}$ see Annex C8 and C9
- Resistance to concrete pry-out failure	k_8 see Annex C11
- Resistance to concrete edge failure	$k_{cr,V}$; $k_{ucr,V}$ see Annex C11
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 C13
Characteristic resistance under fatigue tension loading	
- Fatigue resistance to steel failure of the whole system (continuous or tri-linear function, assessment method A1, A2)	$\Delta N_{Rk,s,0,n}$ $(n = 1\ to\ n = \infty)$ see Annex C17
- Fatigue limit resistance to steel failure of the whole system (assessment method B)	$\Delta N_{Rk,s,0,\infty}$ see Annex C18
- Fatigue resistance to steel failure of the whole system (linearized function, assessment method C)	No performance assessed
- Fatigue resistance to concrete related failure (exponential function, assessment method A1, A2)	$\Delta N_{Rk,c,0,n}$ $\Delta N_{Rk,p,0,n}$$(n = 1\ to\ n = \infty)$ see Annex C18
- Fatigue limit resistance to concrete related failure (assessment method B)	$\Delta N_{Rk,c,0,\infty}$ $\Delta N_{Rk,p,0,\infty}$ see Annex C 18
- Fatigue resistance to concrete related failure (linearized function, assessment method C)	No performance assessed

Essential characteristic	Performance
Characteristic resistance under seismic loading (seismic performance category C1)	
- Resistance to steel failure under seismic tension loading (seismic performance category C1)	No performance assessed
- Resistance to steel failure under seismic shear loading for shear load in transverse direction (seismic performance category C1)	No performance assessed
- Resistance to steel failure under seismic shear loading for shear load in longitudinal channel axis (seismic performance category C1)	No performance assessed
Characteristic resistance under static and quasi-static tension and/or shear loading	
- Displacements	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 C12

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	See Annex C19 and C20

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 EAD

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

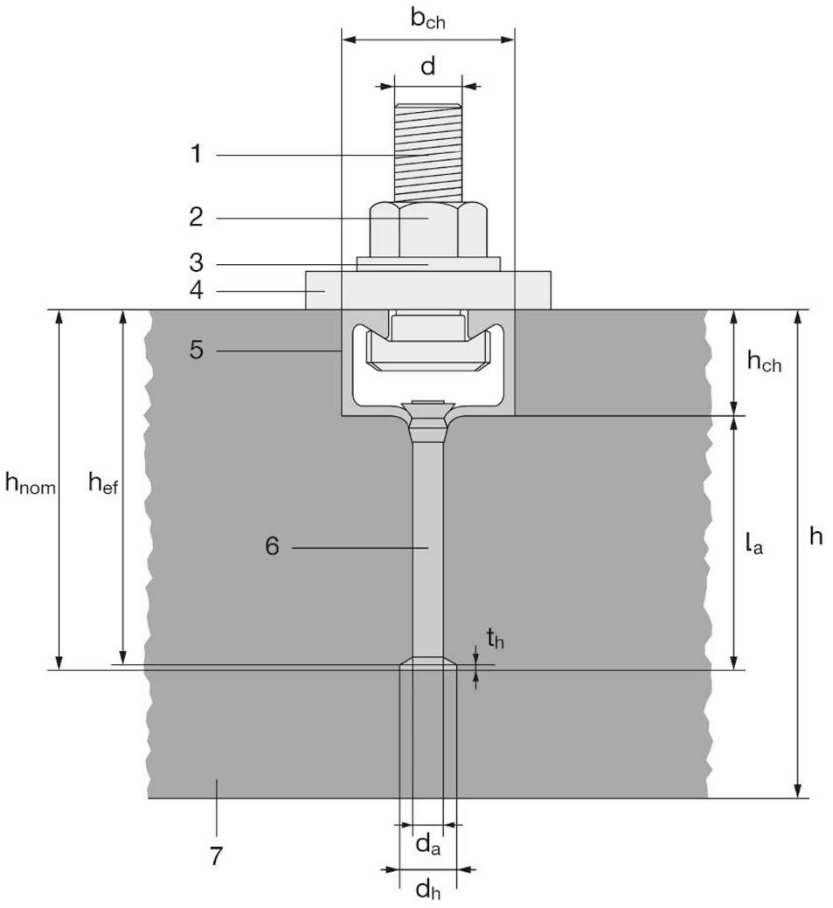
Issued in Berlin on 18 July 2024 by Deutsches Institut für Bautechnik.

LBD Dipl.-Ing. Andreas Kummerow
Head of Department

beglaubigt:
Müller

Deutsches Institut für Bautechnik DIBt

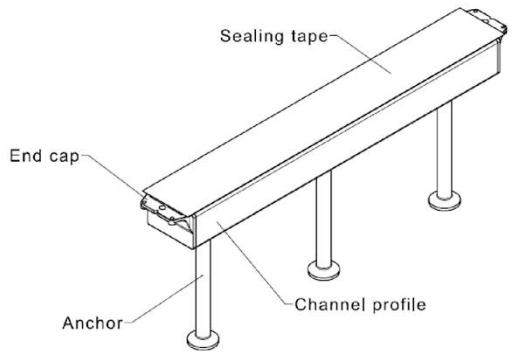
Product and installation condition



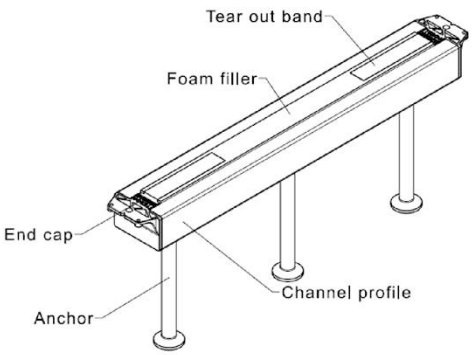
Key

1 channel bolt
2 hexagonal nut
3 washer
4 fixture
5 channel profile
6 anchor
7 concrete member

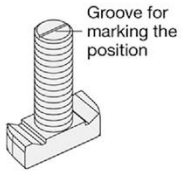
a)



b)



Hot-rolled anchor channel with (a) and without (b) sealing tape on top of the channel



Channel bolt

Hilti anchor channels (HAC-C) with channel bolts (HBC)

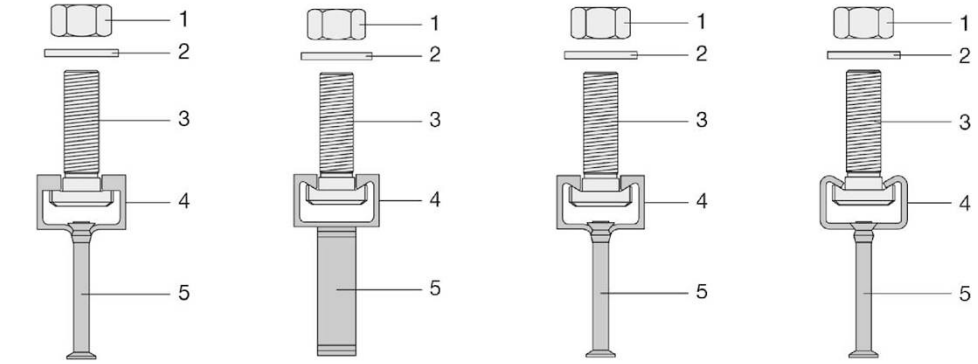
Product Description
Installed condition

Annex A1

Anchor channel types

Hot-rolled smooth and serrated (-T) channel profiles

Cold-formed smooth channel profiles

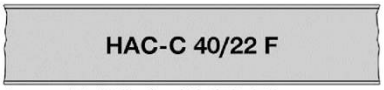


Key
1 hexagonal nut
2 washer
3 channel bolt
4 channel profile
5 anchor

Round anchor	I-anchor	Round anchor	Round anchor
HAC-C-T 53/34	HAC-C(-P) 40/22, HAC-C-P 40L, HAC-C(-P) 50/30, HAC-C-P 50L, HAC-C 52/34		HAC-C 28/15, HAC-C 38/17, HAC-C 40/25, HAC-C 49/30, HAC-C 54/33

Marking of the Hilti anchor channel:

HAC-C(-T)(-P)(-I) XZ Y/W



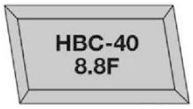
(e.g. HAC-C 40/22 F)

HAC	= Identifying mark of the manufacturer (**H**ilti **A**nchor **C**hannel)
T	= Additional marking for serrated channels
P	= Additional marking for premium line
I	= Additional marking for I-anchors (no marking in the case of round anchors)
X	= Size of the channel
Z	= Corrosion protection/ material
Y	= Minimum effective embedment depth
W	= Channel length

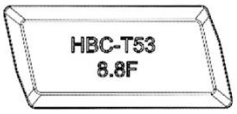
40/22	= Anchor channel size 40/22
F	= Hot dip galvanized
A	= stainless steel
79	h_{ef} = 79 mm minimum effective embedment depth
300	l_{ch} = 300 mm channel length

Marking of the Hilti channel bolt:

HBC-X-(N) YZ



(e.g. HBC-40 8.8F)



(e.g. HBC-T53 8.8F)

HBC	= Identifying mark of the manufacturer (**H**ilti **B**olt **C**hannel)
X	= Type of channel bolt
N	= Additional marking for notching bolt
Y	= Steel grade
Z	= Corrosion protection/ material

Hilti anchor channels (HAC-C) with channel bolts (HBC)

Product Description
Anchor channels

Annex A2

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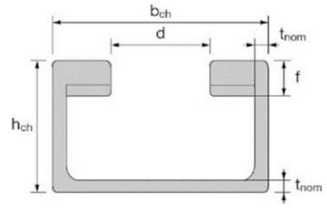
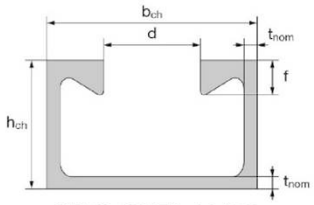
Channel profiles

Hot-rolled serrated channel profiles



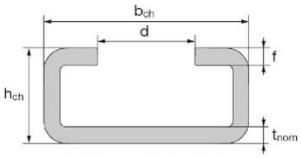
HAC-C-T 53/34

Hot-rolled smooth channel profiles

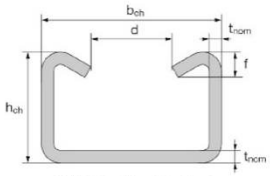


HAC-C(-P) 40/22,
HAC-C-P 40L,
HAC-C(-P) 50/30,
HAC-C-P 50L,
HAC-C 52/34

Cold-formed smooth channel profiles



HAC-C 28/15,
HAC-C 38/17



HAC-C 40/25,
HAC-C 49/30,
HAC-C 54/33

Table 1: Dimensions of channel profile

Anchor channel	b_{ch}	h_{ch}	t_{ch}	d_{ch}	f [1]	I_y
	[mm]					[mm^4]
HAC-C-T (hot-rolled serrated) channel profiles						
HAC-C-T 53/34	53,5	34,0	4,5	22,5	8,50	100900
HAC-C(-P) (hot-rolled) channel profiles						
HAC-C(-P) 40/22 HAC-C-P 40L	40,1	23,0	2,7	18,0	6,0	21504
HAC-C(-P) 50/30 HAC-C-P 50L	49,6	30,0	3,2	22,5	8,1	57781
HAC-C 52/34	52,5	34,0	4,0	22,5	11,5	97606
HAC-C (cold-formed) channel profiles						
HAC-C 28/15	28,0	15,5	2,3	12,0	2,3	4277
HAC-C 38/17	38,0	17,25	3,0	18,0	3,0	8224
HAC-C 40/25	40,0	25,0	2,75	18,0	5,6	20122
HAC-C 49/30	50,0	30,0	3,25	22,0	7,4	43105
HAC-C 54/33	53,5	33,0	5,0	21,5	8,0	74706

1) For hot-rolled serrated channels (HAC-C-T) height of channel lips is including height of the teeth.

Hilti anchor channels (HAC-C) with channel bolts (HBC)

Product Description
Anchor channels

Annex A3

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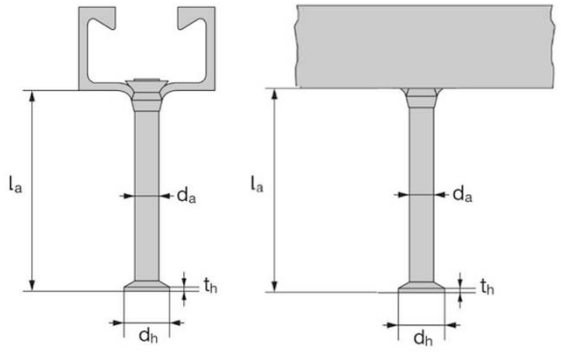
Anchors

Round anchor



Welded I-anchor

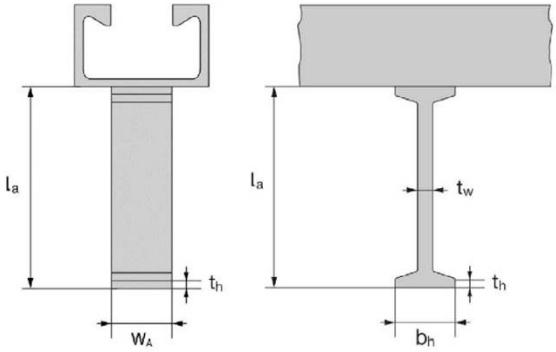


Table 2: Dimensions of anchor (welded I-anchor or round anchor)

Anchor channel	Round anchor					Welded 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]
HAC-C (hot-rolled serrated)											
HAC-C 53/34	119,5	12,0	26,0	2,5	417,8	1)					
HAC-C(-P) (hot-rolled)											
HAC-C 40/22	58,0	8,0	16,0	2,0	151	62,0	5,0	20,0	5,0	20,0	300
HAC-C-P 40/22	70,0	10,0	21,5	2,2	285	125,0	6,0	25,0	5,0	20,0	380
HAC-C-P 40L	83,2	10,0	21,5	2,2	285						
HAC-C 50/30	66,0	10,0	20,0	2,2	236	69,0	5,0	20,0	5,0	25,0	375
HAC-C-P 50/30	78,0	11,0	26,0	2,5	436	125,0	6,0	25,0	5,0	25,0	475
HAC-C-P 50L	118,3	11,0	26,0	2,5	436						
HAC-C 52/34	123,5	11,0	24,3	2,5	369	125,0	6,0	25,0	5,0	40,0	760
HAC-C (cold-formed)											
HAC-C 28/15	31,0	6,0	12,0	1,3	85	-1)					
HAC-C 38/17	60,8	8,0	16,0	2,0	151	-1)					
HAC-C 40/25	56,0	8,0	16,0	2,0	151	-1)					
HAC-C 49/30	66,0	10,0	20,0	2,2	236	-1)					
HAC-C 54/33	124,5	11,0	24,3	2,5	369	-1)					

1) Product not available

Hilti anchor channels (HAC-C) with channel bolts (HBC)

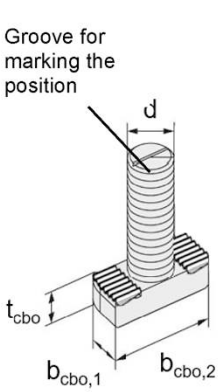
Product Description
Anchors

Annex A4

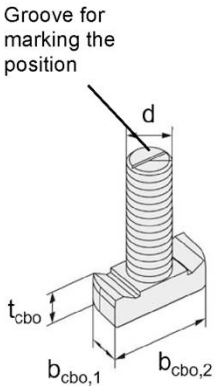
Channel bolts

Table 3: Dimensions of channel bolt

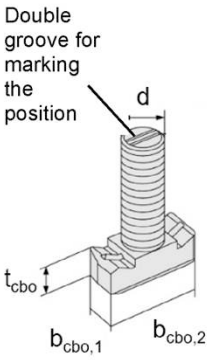
Anchor channel	Channel bolt	Steel grade	Dimensions			
			d	$b_{cbo,1}$	$b_{cbo,2}$	t_{cbo}
			[mm]			
HAC-C-T 53/34	HBC-T 53/34	8.8, A4-70	16	21,0	42,0	13,8
			20	21,0	42,0	13,8
HAC-C 49/30 HAC-C(-P) 50/30 HAC-C-P 50L HAC-C 52/34 HAC-C 54/33	HBC-50/30	8.8, A4-70	12	17,0	42,0	14,5
			16	17,0	42,0	15,5
			20	21,0	42,0	15,5
HAC-C-P 50/30 HAC-C-P 50L HAC-C 52/34	HBC-50/30-N	8.8, A4-70	16	21,0	42,0	15,5
			20	21,0	42,0	15,5
HAC-C(-P) 40/22 HAC-C-P 40L HAC-C 40/25	HBC-40/22	8.8, A4-70	10	14,0	33,0	10,5
			12	14,0	33,0	11,5
			16	17,0	33,0	11,5
HAC-C-P 40/22 HAC-C-P 40L	HBC-40/22-N	8.8, A4-70	16	17,0	33,0	11,5
HAC-C 38/17	HBC-38/17	8.8, A4-70	10	13,0	30,5	6,0
			12	13,0	30,5	7,0
			16	16,0	30,5	7,0
HAC-C 28/15	HBC-28/15	8.8, A4-70	8	10,1	22,2	5,0
			10	10,1	22,2	5,0
			12	11,0	22,2	6,0



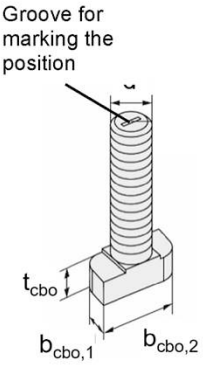
HBC-T 53/34



HBC-40/22;
HBC-50/30



HBC-40/22-N,
HBC-50/30-N



HBC-28/15;
HBC-38/17

[1] Material properties according to Annex A6

Table 4: Steel grade and corrosion protection

Channel Bolt	Carbon steel [1]	Stainless steel [2]
Steel grade	8.8	A4-70
f_{uk} [N/mm²]	800 / 830 [2]	700
f_{yk} [N/mm²]	640 / 660 [2]	450
Corrosion protection	G [3] F [4]	R

[1] Material properties according to Annex A6
[2] Material properties according to EN ISO 898-1:2013
[3] Electroplated
[4] Hot dip galvanized

Hilti anchor channels (HAC-C) with channel bolts (HBC)

Product Description
Channel bolts (HBC)

Annex A5

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Table 5: Materials

Component	Carbon steel			Stainless steel
	Material properties	Coating		Material properties
1	2a	2b	2c	3
Channel Profile	1.0038, 1.0044, 1.0045 according to EN 10025-1: 2004 1.0976, 1.0979 according to EN 10149-1: 2013	Hot dip-galvanized according to EN ISO 1461:2022		1.4362, 1.4401 1.4404, 1.4571, 1.4578 according to EN 10088-1:2023 [2]
Anchor	1.0038, 1.0213, 1.0214 according to EN 10025-1: 2004 1.5523, 1.5535 according to EN 10263-1:2017			
Channel bolt	Steel grade 8.8 according to EN ISO 898-1: 2013 AC: 2013	Electroplated according to EN ISO 4042: 1999	Hot dip galvanized ≥ 50 µm according to EN ISO 10684: 2004+ AC: 2009	Grade 70 according to EN ISO 3506-1:2020
Plain washer [1] according to EN ISO 7089: 2000 and EN ISO 7093-1: 2000	Hardness class A ≥ 200 HV	Electroplated according to EN ISO 4042: 1999	Hot dip galvanized ≥ 50 µm according to EN ISO 10684: 2004+ AC: 2009	1.4401, 1.4404 1.4571, 1.4578 according to EN 10088-1:2023
Hexagonal nut according to EN ISO 4032: 2012 or DIN 934: 1987-10	Property class 8 according to EN ISO 898-2:2022	Electroplated according to EN ISO 4042: 1999	Hot dip galvanized ≥ 50 µm according to EN ISO 10684: 2004+ AC: 2009	Property class 50, 70 or 80 according to EN ISO 3506-1:2020

[1] In scope of delivery only for notching channel bolts
[2] Anchors made of carbon steel according column 2a may also be used if they are welded and their concrete cover is more than 50mm and tempering colors are removed

Hilti anchor channels (HAC-C) with channel bolts (HBC)

Product Description
Materials

Annex A6

Deutsches Institut für Bautechnik DIBt

Specifications of intended use

Anchor channels and channel bolts subject to:

- Static and quasi-static tension and, shear perpendicular to the longitudinal axis of the channel
- Static and quasi-static shear perpendicular to the longitudinal axis
  (anchor channels HAC-C-P 40/22 and HAC-C-P 40L with notching channel bolts HBC-40/22-N and anchor channels HAC-C-P 50/30, HAC-C-P 50L, HAC-C 52/34 with notching channel bolts HBC-50/30-N and serrated anchor channels HAC-C-T 53/34 with serrated channel bolts HBC-T 53/34)
- Fatigue cyclic tension loads
  (anchor channels and channel bolts according to Annex C17)
- Fire exposure: for concrete class C20/25 to C50/60
  (anchor channels and channel bolts according to Annex C19)

Base materials:

- Reinforced or unreinforced compacted normal weight concrete without fibers 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 A6, Table 5, column 2 and 3).
- 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 A6, Table 5, column 2c and 3).
- According to EN 1993-1-4:2006+A2:2015 relating to corrosion resistance class CRC III
  (channel bolts, washers and nuts made of stainless-steel number 1.4401, 1.4404, 1.4571, 1.4362 und 1.4578 according to Annex A6, Table 5, column 3).

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 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.
- For fatigue loading the anchor channels are designed in accordance with 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.

Hilti anchor channels (HAC-C) with channel bolts (HBC)	Annex B1
Intended Use Specifications	

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 B3, Table 6 and 7 as well as Annex B4, Table 8 are generated including end-spacing and minimum channel length and only to be used in dry internal conditions.
- Installation in accordance with the installation instructions given in Annexes B6, B7, B8, B9 and B10.
- The anchor channels are fixed on the formwork, reinforcement or auxiliary construction such that no movement of the 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 channels are protected from penetration of concrete into the internal space of the channels.
- Washer may be chosen according to Annex A6 and provided separately by the user.
- Orientating the channel bolt (groove according to Annex B8, B9 and B10) rectangular to the channel axis.
- The required installation torques given in Annex B5 must be applied and must not be exceeded.

Hilti anchor channels (HAC-C) with channel bolts (HBC)	Annex B2
Intended Use Specifications	

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Table 6: Installation parameters for HAC-C-T (serrated hot-rolled) anchor channels

Anchor channel			**HAC-C-T 53/34**
Minimum effective embedment depth	$h_{ef,min}$	[mm]	155
Minimum spacing	s_{min}		80
Maximum spacing	s_{max}		250
End spacing	x		35
Minimum channel length	l_{min}		150
Minimum edge distance	c_{min}		75
Minimum thickness of concrete member	h_{min}		178
			$h_{ef} + t_h + c_{nom}$ [1)]

[1)] c_{nom} according to EN 1992-1-1:2004 + AC: 2010

Table 7: Installation parameters for HAC-C(-P) (hot-rolled) anchor channels

Anchor channel			**HAC-C 40/22**	**HAC-C-P 40/22**	**HAC-C-P 40L**	**HAC-C 50/30**	**HAC-C-P 50/30**	**HAC-C-P 50L**	**HAC-C 52/34**
Minimum effective embedment depth	$h_{ef,min}$	[mm]	79	91	106	94	106	148	155
Minimum spacing	s_{min}		100	50	50	100	50 [2)]	50	100
Maximum spacing	s_{max}		250						
End spacing	x		25 [3)]						35 [4)]
Minimum channel length	l_{min}		150	100	100	150	100	100	170 [5)]
Minimum edge distance	c_{min}		50			75			75
Minimum thickness of concrete member	h_{min}		100	100	120	105	120	162	165
			$h_{ef} + t_h + c_{nom}$ [1)]						

[1)] c_{nom} according to EN 1992-1-1:2004 + AC: 2010
[2)] s_{min} = 100 mm when used in combination with notched bolts
[3)] the end spacing may be increased from 25 mm to 35 mm
[4)] x = 25 mm for welded l-anchors
[5)] l_{min} = 150 mm for welded l-anchors

Hilti anchor channels (HAC-C) with channel bolts (HBC)

Intended Use
Installation parameters for anchor channels (HAC-C) and channel bolts (HBC)

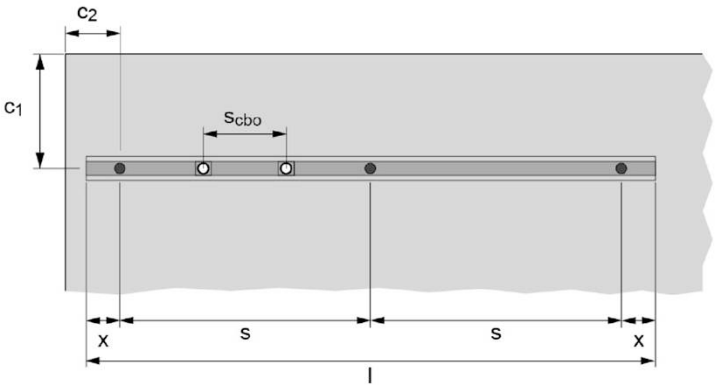
Annex B3

Deutsches Institut für Bautechnik DIBt

Table 8: Installation parameters for HAC-C (cold-formed) anchor channels

Anchor channel			HAC-C 28/15	HAC-C 38/17	HAC-C 40/25	HAC-C 49/30	HAC-C 54/33
Minimum effective embedment depth	$h_{ef,min}$	[mm]	45	76	79	94	155
Minimum spacing	s_{min}		50	100			
Maximum spacing	s_{max}		200		250		
End spacing	x		25 [2]				
Minimum channel length	l_{min}		100	150			
Minimum edge distance	c_{min}		40	50		75	100
Minimum thickness of concrete member	h_{min}		70	100		120	180
			$h_{ef} + t_h + c_{nom}$ [1]				

[1] c_{nom} according to EN 1992-1-1:2004 + AC: 2010
[2] the end spacing may be increased from 25 mm to 35 mm



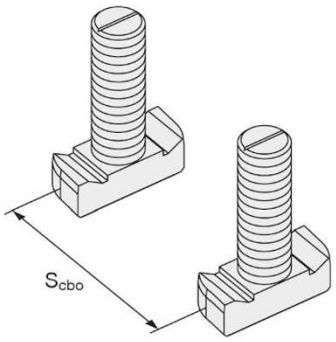


Table 9: Minimum spacing for channel bolts

Channel bolt			M8	M10	M12	M16	M20
Minimum spacing between channel bolts	$s_{cbo,min}$	[mm]	40	50	60	80	100

s_{cbo} = center to center spacing between channel bolts ($s_{cbo,min}$ = 5d)

Hilti anchor channels (HAC-C) with channel bolts (HBC)

Intended Use
Installation parameters for anchor channels (HAC-C) and channel bolts (HBC)

Annex B4

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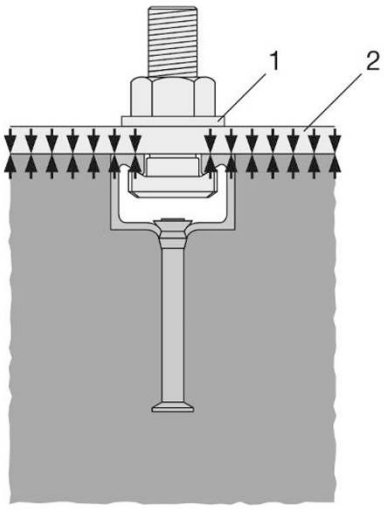
Table 10: Required installation torque T_{inst}

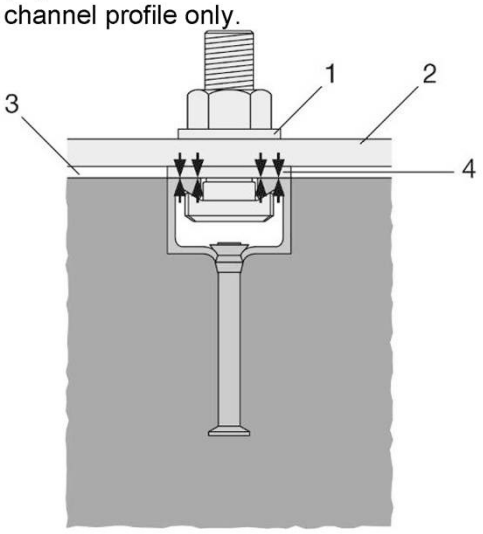
Channel bolt		Installation torque T_{inst} [Nm] 1)		
		General $T_{inst,g}$ [Nm]	Steel - steel contact $T_{inst,s}$ [Nm]	
		8.8, A4-70	8.8	A4-70
HBC-T 53/34	M16	100	100	100
	M20	120	120	120
HBC 50/30	M12	25	45	50
	M16	60	100	130
	M20	75	360	250
HBC 50/30-N	M16	60	185	-2)
	M20	75	320	-2)
HBC 40/22	M10	15	-2)	22
	M12	25	45	50
	M16	30	100	90
HBC 40/22-N	M16	30	185	-2)
HBC 38/17	M10	15	-2)	22
	M12	25	45	50
	M16	40	100	90
HBC 28/15	M8	7	20	15
	M10	10	40	30
	M12	13	60	50

1) T_{inst} must not be exceeded
2) Product not available

General: The fixture is in contact with the channel profile and the concrete surface



Steel-steel contact: The fixture is fastened to the anchor channel by suitable steel part (e.g. washer). Fixture is in contact with the channel profile only.



Key

1 washer

2 fixture

3 gap

4 suitable steel part

Anchor channels (HAC-C) with channel bolts (HBC)

Intended Use
Installation parameters for channel bolts (HBC)

Annex B5

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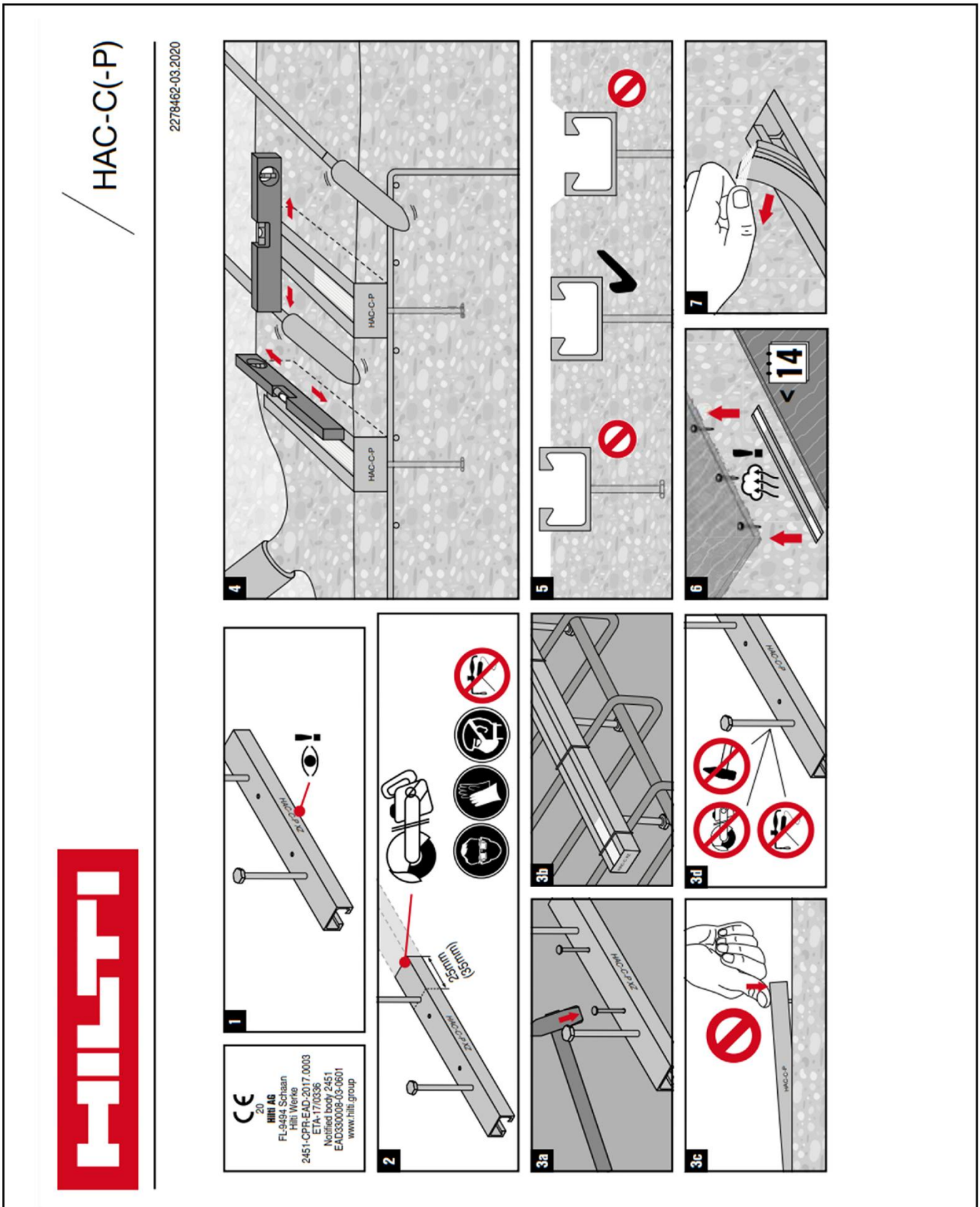

Hilti anchor channels (HAC-C) with channel bolts (HBC)

Intended Use
Installation instructions for anchor channels (HAC-C)

Annex B6

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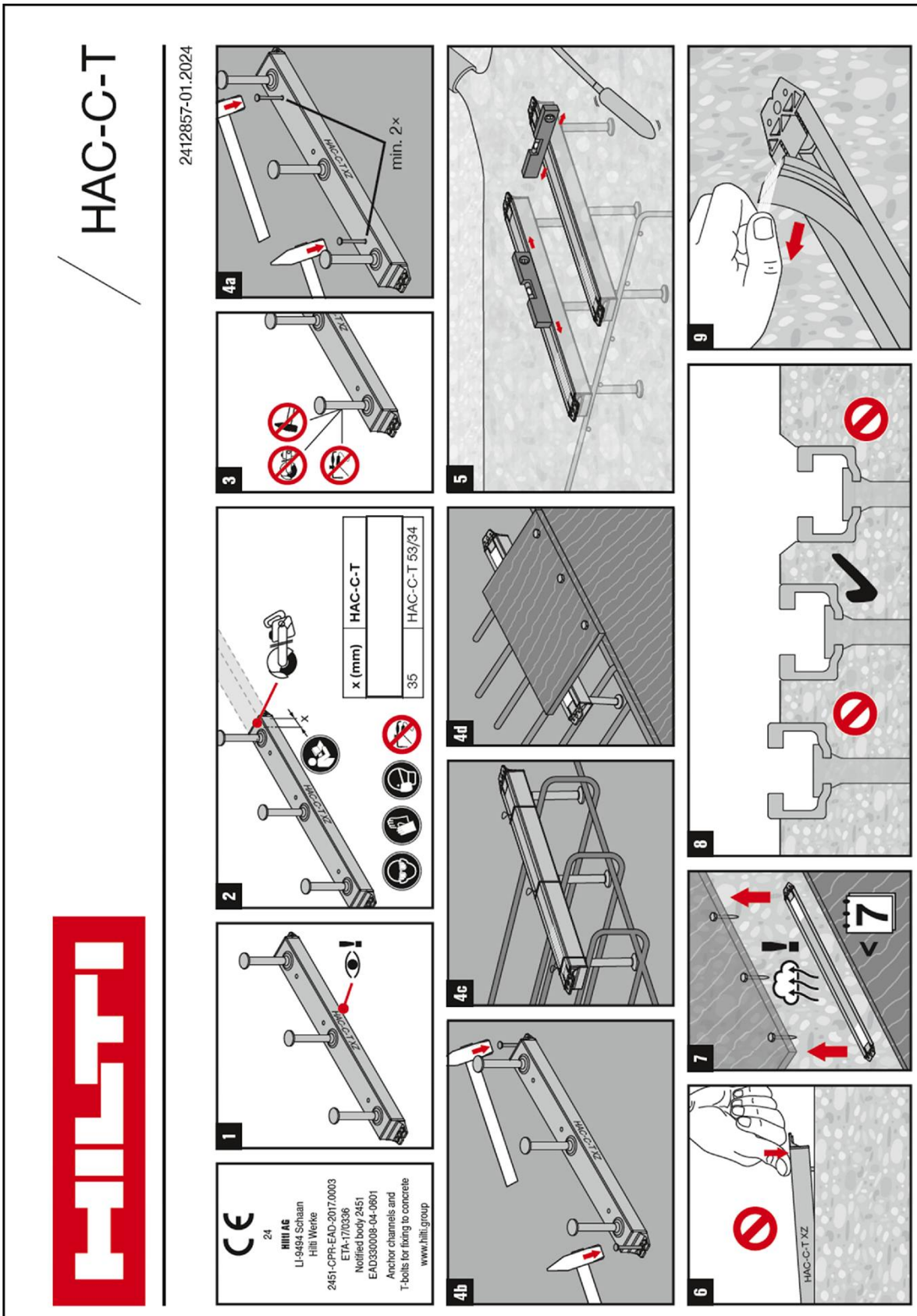

Hilti anchor channels (HAC-C) with channel bolts (HBC)

Intended Use
Installation instructions for anchor channels (HAC-C-T)

Annex B7

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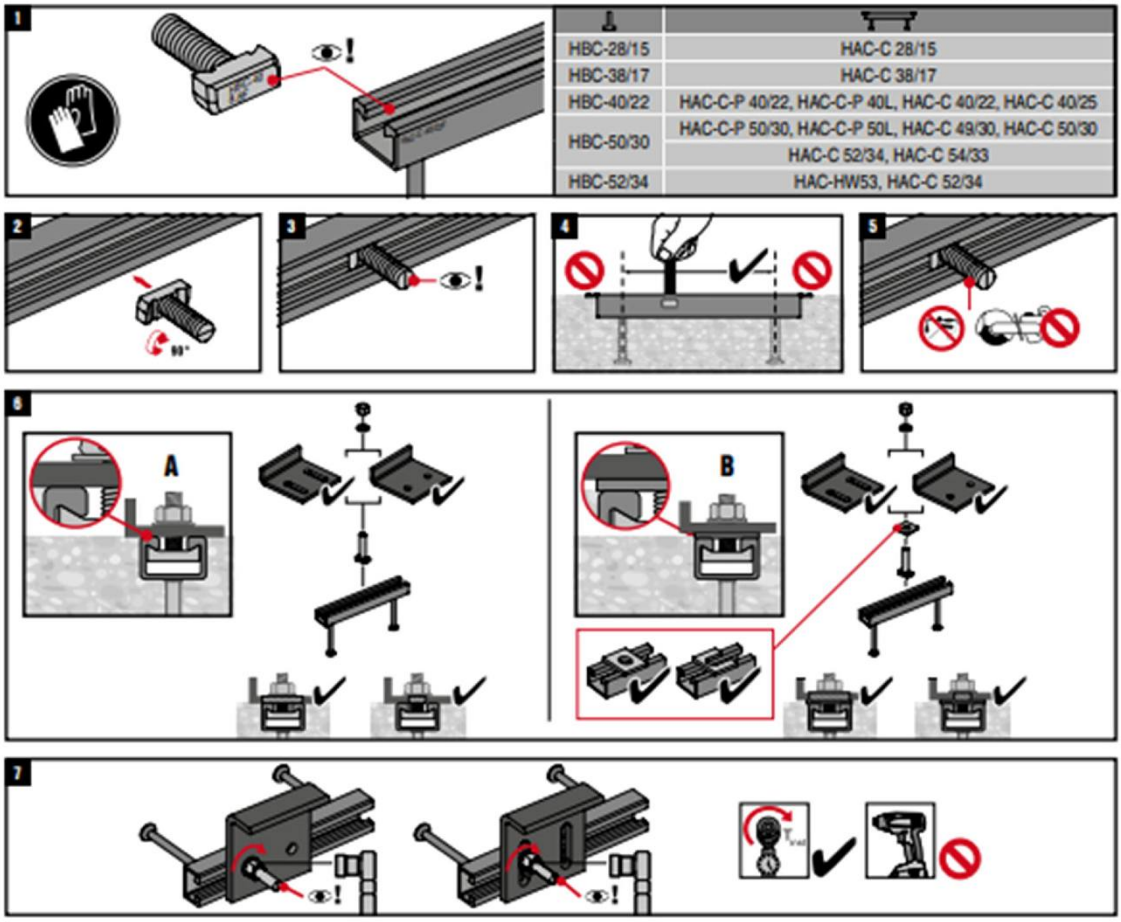
HILTI

HBC

2194125 A3-08.2020



HBC-28/15	HAC-C 28/15
HBC-38/17	HAC-C 38/17
HBC-40/22	HAC-C-P 40/22, HAC-C-P 40L, HAC-C 40/22, HAC-C 40/25
HBC-50/30	HAC-C-P 50/30, HAC-C-P 50L, HAC-C 49/30, HAC-C 50/30 HAC-C 52/34, HAC-C 54/33
HBC-52/34	HAC-HW53, HAC-C 52/34

Channel bolt		T_{inst} [Nm]				
		A	B			
		4.6, 8.8, A4-50, A4-70	4.6	8.8	A4-50	A4-70
HBC-28/15	M8	7	–	20	7	15
	M10	10		40	–	30
	M12	13		60		50
HBC-38/17	M10	15	13	15		22
	M12	25	–	45		50
	M16	40		100		90
HBC-40/22	M10	15	13	15		22
	M12	25	–	45		50
	M16	30		100		90
HBC-50/30	M12	25		45		50
	M16	55		100		130
	M20	55		360		250
HBC-52/34	M20	55		360		–

T_{inst} is the installation torque that shall be applied with a torque wrench and must not be exceeded.

Hilti anchor channels (HAC-C) with channel bolts (HBC)

Intended Use
Installation parameters for channel bolts (HBC)

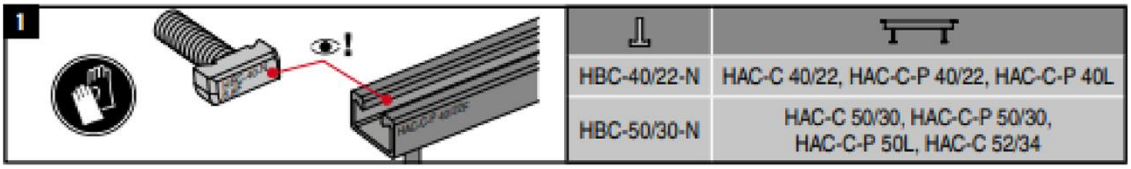
Annex B8

Deutsches Institut für Bautechnik DIBt

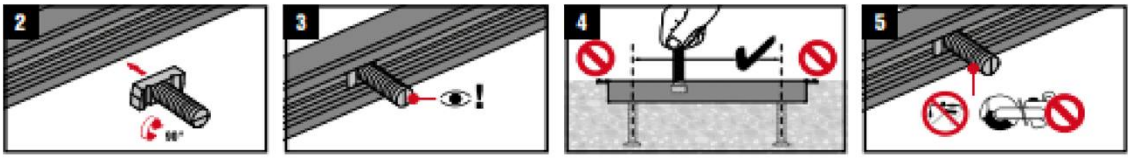
HILTI

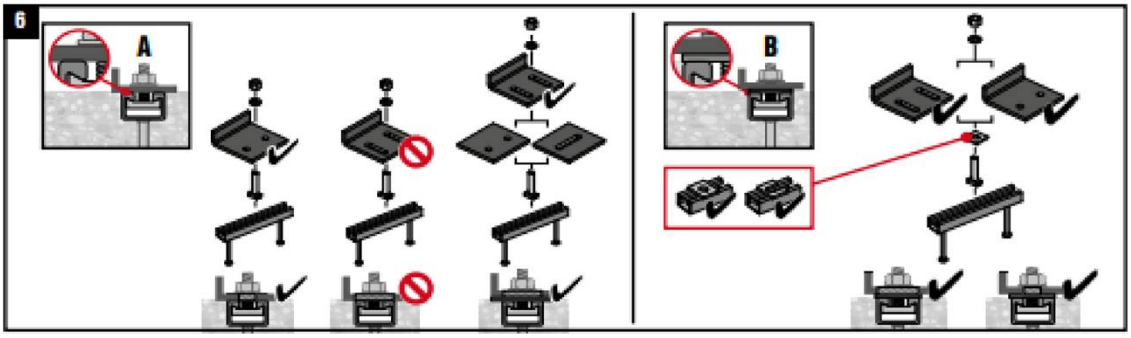
HBC-N

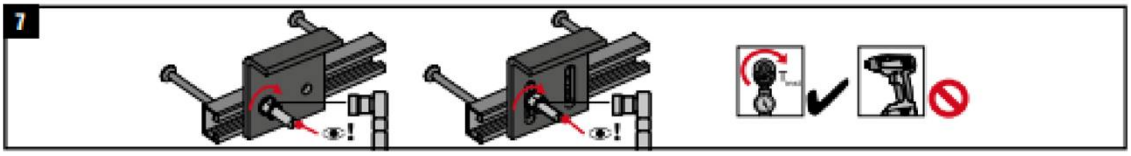
2257118 A1-08.2020



HBC-40/22-N	HAC-C 40/22, HAC-C-P 40/22, HAC-C-P 40L
HBC-50/30-N	HAC-C 50/30, HAC-C-P 50/30, HAC-C-P 50L, HAC-C 52/34







Anchor Channel	Channel Bolt	T_{inst} [Nm] A	T_{inst} [Nm] B
		8.8	8.8
HAC-C-P 40/22	HBC-40/22-N M16	160	160
HAC-C-P 40L			
HAC-C 40/22		60	160
HAC-C-P 50/30	HBC-50/30-N M16	185	185
HAC-C-P 50L			
HAC-C 50/30			
HAC-C 52/34			
HAC-C-P 50/30	HBC-50/30-N M20	320	320
HAC-C-P 50L			
HAC-C 50/30			
HAC-C 52/34			

T_{inst} is the installation torque that shall be applied with a torque wrench and must not be exceeded.

Hilti anchor channels (HAC-C) with channel bolts (HBC)

Intended Use
Installation parameters for channel bolts (HBC-N)

Annex B9

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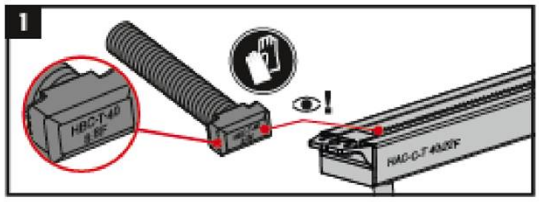
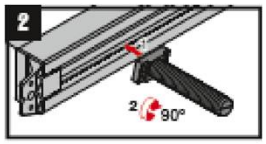
HILTI

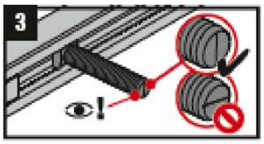
HBC-T

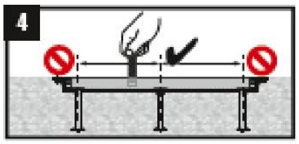
2412973-12.2023

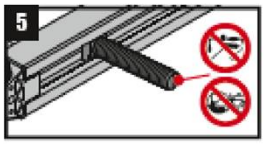


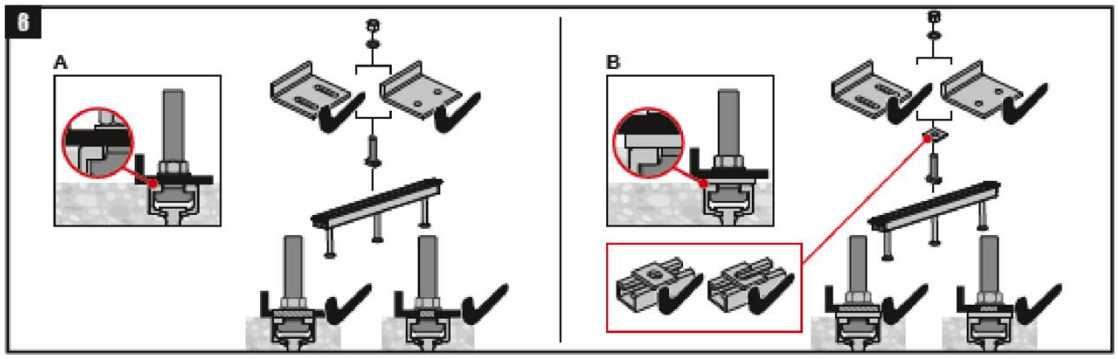
T-bolt	Channel
HBC-T-53/34	HAC-C-T 53/34

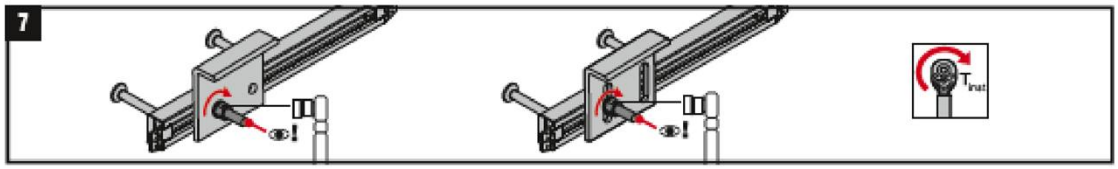












		A & B
		T_{inst} [Nm]
Channel bolt	Diam	8.8 / A4-70
HBC-53/34	M16	100
	M20	120

Hilti anchor channels (HAC-C) with channel bolts (HBC)

Intended Use
Installation parameters for channel bolts (HBC-T)

Annex B10

Table 11: Characteristic resistances under tension load – steel failure of HAC-C-T (serrated hot-rolled) anchor channels

Anchor channel					**HAC-C-T 53/34**
Steel failure: Anchor					
Characteristic resistance	Carbon steel	$N_{Rk,s,a}$	[kN]	73,5
	Stainless steel			
Partial factor	Carbon steel	γ_{Ms} [1)]	[-]	1,8
	Stainless steel			
Steel failure: Connection between anchor and channel					
Characteristic resistance	Carbon steel	$N_{Rk,s,c}$	[kN]	73,5
	Stainless steel			
Partial factor		$\gamma_{Ms,ca}$ [1)]	[-]	1,8
Steel failure: Local flexure of channel lips					
Characteristic spacing of channel bolts for $N_{Rk,s,l}$		$s_{l,N}$	[mm]	107
Characteristic resistance	Carbon steel	$N^0_{Rk,s,l}$	[kN]	85,0
	Stainless steel			
Partial factor		$\gamma_{Ms,l}$ [1)]	[-]	1,8

[1)] In absence of other national regulations.

Table 12: Characteristic resistances under tension load – steel failure of HAC-C(-P) (hot-rolled) anchor channels

Anchor channel			**HAC-C 40/22**	**HAC-C-P 40/22**	**HAC-C-P 40L**	**HAC-C 50/30**	**HAC-C-P 50/30**	**HAC-C-P 50L**	**HAC-C 52/34**
Steel failure: Anchor									
Characteristic resistance	$N_{Rk,s,a}$	[kN]	20,0	40,0	40,0	31,0	57,0	57,0	55,0
Partial factor	γ_{Ms} [1)]	[-]	1,8						
Steel failure: Connection between anchor and channel									
Characteristic resistance	$N_{Rk,s,c}$	[kN]	20,0	39,6	39,6	31,0	50,6	50,6	55
Partial factor	$\gamma_{Ms,ca}$ [1)]	[-]	1,8						
Steel failure: Local flexure of channel lips									
Characteristic spacing of the channel bolts for $N_{Rk,s,l}$	$s_{l,N}$	[mm]	79	79	79	98	98	98	105
Characteristic resistance	$N^0_{Rk,s,l}$	[kN]	47,9	47,9	47,9	50,5	50,5	50,5	65,0
Partial factor	$\gamma_{Ms,l}$ [1)]	[-]	1,8						

[1)] In absence of other national regulations.

Hilti anchor channels (HAC-C) with channel bolts (HBC)

Performance
Characteristic resistances of anchor channels (HAC-C) under tension load – steel failure

Annex C1

Deutsches Institut für Bautechnik DIBt

Table 13: Characteristic resistances under tension load – steel failure of HAC-C (cold-formed) anchor channels

Anchor channel			**HAC-C 28/15**	**HAC-C 38/17**	**HAC-C 40/25**	**HAC-C 49/30**	**HAC-C 54/33**
Steel failure: Failure of anchor							
Characteristic resistance	$N_{Rk,s,a}$	[kN]	9	18	20	31	55
Partial safety factor	γ_{Ms} 1)	[-]	1,8				
Steel failure: Failure of connection between anchor and channel							
Characteristic resistance	$N_{Rk,s,c}$	[kN]	9	18	20	31	55
Partial safety factor	$\gamma_{Ms,ca}$ 1)	[-]	1,8				
Steel failure: Local failure by flexure of channel lips							
Characteristic spacing of the channel bolts for $N_{Rk,s,l}$	$s_{l,N}$	[mm]	56	76	80	100	107
Characteristic resistance	$N^0_{Rk,s,l}$	[kN]	9	18	20	31	55
Partial safety factor	$\gamma_{Ms,l}$ 1)	[-]	1,8				

1) In absence of other national regulations.

Hilti anchor channels (HAC-C) with channel bolts (HBC)

Performance
Characteristic resistances of anchor channels (HAC-C) under tension load – steel failure

Annex C2

Deutsches Institut für Bautechnik DIBt

Table 14: Characteristic flexural resistance of HAC-C-T (serrated hot-rolled) channels under tension load

Anchor channel				HAC-C-T 53/34
Steel failure: Flexure of channel				
Characteristic flexural resistance of channel	carbon steel	$M_{Rk,s,flex}$	[Nm]	4870,1
	stainless steel			4625,6
Partial factor		$\gamma_{Ms,flex}$ [1)]	[-]	1,15

[1)] In absence of other national regulations.

Table 15: Characteristic flexural resistance of HAC-C(-P) (hot-rolled) channels under tension load

Anchor channel				HAC-C 40/22	HAC-C-P 40/22	HAC-C-P 40L	HAC-C 50/30	HAC-C-P 50/30	HAC-C-P 50L	HAC-C 52/34
Steel failure: Failure by flexure of channel										
Characteristic flexural resistance of channel	carbon steel	$M_{Rk,s,flex}$	[Nm]	1013	1704	1704	2084	3448	3448	3435
	stainless steel									
Partial factor		$\gamma_{Ms,flex}$ [1)]	[-]	1,15						

[1)] In absence of other national regulations.

Table 16: Characteristic flexural resistance of HAC-C (cold-formed) channels under tension load

Anchor channel				HAC-C 28/15	HAC-C 38/17	HAC-C 40/25	HAC-C 49/30	HAC-C 54/33
Steel failure: Flexure of channel								
Characteristic flexural resistance of channel	carbon steel	$M_{Rk,s,flex}$	[Nm]	316	538	979	1669	2929
	stainless steel				527		1702	2832
Partial factor		$\gamma_{Ms,flex}$ [1)]	[-]	1,15				

[1)] In absence of other national regulations.

Hilti anchor channels (HAC-C) with channel bolts (HBC)

Performance
Characteristic resistances of anchor channels (HAC-C) under tension load – steel failure

Annex C3

Deutsches Institut für Bautechnik DIBt

Table 17: Characteristic resistances under tension load – concrete failure of HAC-C-T (serrated hot-rolled) anchor channels

Anchor channel				**HAC-C-T 53/34**
Type of anchor				**R**
Concrete failure: Pull-out				
Characteristic resistance in cracked concrete C12/15		$N_{Rk,p}$	[kN]	37,6
Characteristic resistance in uncracked concrete C12/15				52,6
Factor for $N_{Rk,p} = N_{Rk,p(C12/15)} \cdot \Psi_c$	C16/20	ψ_c	[-]	1,33
	C20/25			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	cracked concrete	$k_{cr,N}$	[-]	8,7
	uncracked concrete	$k_{ucr,N}$	[-]	12,4
Partial factor		γ_{Mc} [1)]	[-]	1,5
Concrete failure: Splitting				
Characteristic edge distance		$c_{cr,sp}$	[mm]	465
Characteristic spacing		$s_{cr,sp}$	[mm]	930
Partial factor		$\gamma_{Msp} = \gamma_{Mc}$ [1)]	[-]	1,5

[1)] In absence of other national regulations.

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Table 18: Characteristic resistances under tension load – concrete failure of HAC-C(-P) (hot-rolled) anchor channels

Anchor channel				HAC-C 40/22		HAC-C-P 40/22		HAC-C-P 40L		HAC-C 50/30		HAC-C-P 50/30		HAC-C-P 50L		HAC-C 52/34	
Type of anchor				I	R	I	R	I	R	I	R	I	R	I	R	I	R
Concrete failure: Pull-out																	
Characteristic resistance in cracked concrete C12/15		$N_{Rk,p}$	[kN]	27,0	13,6	34,2	25,6	-[1]	25,6	33,8	21,2	42,8	39,2	-[1]	39,2	68,4	33,2
Characteristic resistance in uncracked concrete C12/15				37,8	19,0	47,9	35,8	-[1]	35,8	47,3	29,7	59,9	54,9	-[1]	54,9	95,8	46,5
Factor for $N_{Rk,p} = N_{Rk,p(C12/15)} \cdot \Psi_c$	C16/20	ψ_c	[-]	1,33													
	C20/25			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		$\gamma_{Mp} = \gamma_{Mc}$ [2]	[-]	1,5													
Concrete failure: Concrete cone																	
Product factor k_1	cracked concrete	$k_{cr,N}$	[-]	7,9		8,0		8,2		8,1		8,2		8,6		8,7	
	uncracked concrete	$k_{ucr,N}$	[-]	11,2		11,5		11,7		11,6		11,7		12,3		12,4	
Partial factor		γ_{Mc} [2]	[-]	[-]													
Concrete failure: Splitting																	
Characteristic edge distance		$c_{cr,sp}$	[mm]	237		273		318		282		318		444		465	
Characteristic spacing		$s_{cr,sp}$	[mm]	474		546		636		564		636		888		930	
Partial factor		$\gamma_{Mp} = \gamma_{Mc}$ [2]	[-]	1,5													

[1] Product not available
[2] In absence of other national regulations

Hilti anchor channels (HAC-C) with channel bolts (HBC)

Performance
Characteristic resistances of anchor channels (HAC-C) under tension load – concrete failure

Annex C5

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Table 19: Characteristic resistances under tension load – concrete failure of HAC-C (cold-formed) anchor channels

Anchor channel				**HAC-C 28/15**	**HAC-C 38/17**	**HAC-C 40/25**	**HAC-C 49/30**	**HAC-C 54/33**
Type of anchor				**R**	**R**	**R**	**R**	**R**
Concrete failure: Pull-out								
Characteristic resistance in cracked concrete C12/15		$N_{Rk,p}$	[kN]	7,6	13,6	13,6	21,2	33,2
Characteristic resistance in uncracked concrete C12/15				10,7	19,0	19,0	29,7	46,5
Factor for $N_{Rk,p} = N_{Rk,p(C12/15)} \cdot \Psi_c$	C16/20	ψ_c	[-]	1,33				
	C20/25			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	cracked concrete	$k_{cr,N}$	[-]	7,2	7,8	7,9	8,1	8,7
	uncracked concrete	$k_{ucr,N}$	[-]	10,3	11,2	11,2	11,6	12,4
Partial factor		γ_{Mc} [1)]	[-]	[-]				
Concrete failure: Splitting								
Characteristic edge distance		$c_{cr,sp}$	[mm]	135	228	237	282	465
Characteristic spacing		$s_{cr,sp}$	[mm]	270	456	474	564	930
Partial factor		$\gamma_{Msp} = \gamma_{Mc}$ [1)]	[-]	1,5				

[1)] In absence of other national regulations.

Table 20: Displacements of HAC-C-T (serrated hot-rolled) anchor channels under tension load

Anchor channel				**HAC-C-T 53/34**
Tension load	Carbon steel	N	[kN]	36,0
	Stainless steel			29,3
Short-term displacement [1]	Carbon steel	δ_{N0}	[mm]	1,2
	Stainless steel			1,1
Long-term displacement [1]	Carbon steel	$\delta_{N\infty}$	[mm]	2,4
	Stainless steel			2,1

[1] Displacements in midspan of the anchor channel, including slip of channel bolt, deformation of channel lips, bending of the channel and slip of the anchor channel in concrete

Table 21: Displacements of HAC-C(-P) (hot-rolled) anchor channels under tension load

Anchor channel			**HAC-C 40/22**	**HAC-C-P 40/22**	**HAC-C-P 40L**	**HAC-C 50/30**	**HAC-C-P 50/30**	**HAC-C-P 50L**	**HAC-C 52/34**
Tension load	N	[kN]	13,9	15,3	15,3	14,3	25,8	25,8	25,8
Short-term displacement [1]	δ_{N0}	[mm]	2,3	1,1	1,1	2,2	1,4	1,4	1,4
Long-term displacement [1]	$\delta_{N\infty}$	[mm]	4,6	2,2	2,2	4,4	2,8	2,8	2,8

[1] Displacements in midspan of the anchor channel, including slip of channel bolt, deformation of channel lips, bending of the channel and slip of the anchor channel in concrete.

Table 22: Displacements of HAC-C (cold-formed) anchor channels under tension load

Anchor channel			**HAC-C 28/15**	**HAC-C 38/17**	**HAC-C 40/25**	**HAC-C 49/30**	**HAC-C 54/33**
Tension load	N	[kN]	3,6	7,1	7,9	12,3	21,8
Short-term displacement [1]	δ_{N0}	[mm]	0,6	1,3	1,4	1,4	1,6
Long-term displacement [1]	$\delta_{N\infty}$	[mm]	1,2	2,6	2,8	2,8	3,2

[1] Displacements in midspan of the anchor channel, including slip of channel bolt, deformation of channel lips, bending of the channel and slip of the anchor channel in concrete.

Table 23: Characteristic resistances under shear load – steel failure of HAC-C-T (serrated hot-rolled) anchor channels

Anchor channel				**HAC-C-T 53/34**
Steel failure: Anchor				
Characteristic resistance	Carbon steel	$V_{Rk,s,a,y}$	[kN]	120,0
	Stainless steel			
Characteristic resistance	Carbon steel	$V_{Rk,s,a,x}$	[kN]	44,1
	Stainless steel			
Partial factor	Carbon steel	γ_{Ms} [1)]	[-]	1,5
	Stainless steel			
Steel failure: Connection between anchor and channel				
Characteristic resistance	Carbon steel	$V_{Rk,s,c,y}$	[kN]	120,0
	Stainless steel			
Characteristic resistance	Carbon steel	$V_{Rk,s,c,x}$	[kN]	45,5
	Stainless steel			
Partial factor		γ_{Ms} [1)]	[-]	1,8
Steel failure: Local flexure of channel lips under shear load perpendicular to the longitudinal axis of the channel				
Characteristic spacing of channel bolts for $V_{Rk,s,l}$		$s_{l,V}$	[mm]	107,0
Characteristic resistance	Carbon steel	$V^0_{Rk,s,l,y}$	[kN]	120,0
	Stainless steel			
Partial factor		$\gamma_{Ms,l}$ [1)]	[-]	1,8

[1)] In absence of other national regulations

Hilti anchor channels (HAC-C) with channel bolts (HBC)	Annex C8
Performance Characteristic resistances of anchor channels (HAC-C-T) under shear load – steel failure	

Table 24: Characteristic resistances under shear load – steel failure of HAC-C(-P) (hot-rolled) anchor channels

Anchor channel			HAC-C 40/22	HAC-C-P 40/22	HAC-C-P 40L	HAC-C 50/30	HAC-C-P 50/30	HAC-C-P 50L	HAC-C 52/34
Steel failure: Anchor									
Characteristic resistance	$V_{Rk,s,a,y}$	[kN]	26,0	58,1	58,1	40,3	100,0	100,0	121,5
Characteristic resistance	$V_{Rk,s,a,x}$	[kN]	-[2)]	24,0	24,0	-[2)]	34,2	34,2	33,1
Partial factor	γ_{Ms} [1)]	[-]	1,5						
Steel failure: Connection between anchor and channel									
Characteristic resistance	$V_{Rk,s,c,y}$	[kN]	26,0	58,1	58,1	40,3	100,0	100,0	121,5
Characteristic resistance	$V_{Rk,s,c,x}$	[kN]	-[2)]	23,8	23,8	-[2)]	30,4	30,4	28,1
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									
Characteristic spacing of channel bolts for $V_{Rk,s,l}$	$s_{l,V}$	[mm]	80	80	80	99	99	99	105
Characteristic resistance	$V^0_{Rk,s,l,y}$	[kN]	55,0	55,0	55,0	91,7	91,7	91,7	71,5
Partial factor	$\gamma_{Ms,l}$ [1)]	[-]	1,8						

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

Table 25: Characteristic resistances under shear load – steel failure of HAC-C (cold-formed) anchor channels

Anchor channel			HAC-C 28/15	HAC-C 38/17	HAC-C 40/25	HAC-C 49/30	HAC-C 54/33
Steel failure: Anchor							
Characteristic resistance	$V_{Rk,s,a,y}$	[kN]	9,0	18,0	20,0	31,0	55,0
Partial factor	γ_{Ms} [1)]	[-]	1,5				
Steel failure: Connection between anchor and channel							
Characteristic resistance	$V_{Rk,s,c,y}$	[kN]	9,0	18,0	20,0	31,0	55,0
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							
Characteristic spacing of channel bolts for $V_{Rk,s,l}$	$s_{l,V}$	[mm]	56	76	80	100	107
Characteristic resistance	$V^0_{Rk,s,l,y}$	[kN]	9,0	18,0	20,0	31,0	55,0
Partial factor	$\gamma_{Ms,l}$ [1)]	[-]	1,8				

[1)] In absence of other national regulations.

Hilti anchor channels (HAC-C) with channel bolts (HBC)

Performance
Characteristic resistances of anchor channels (HAC-C) under shear load – steel failure

Annex C9

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Table 26: Characteristic resistances under shear load in direction of the longitudinal axis of the channel – steel failure of HAC-C-T (serrated hot-rolled) anchor channels

Anchor channel					**HAC-C-T 53/34**
Steel failure: Connection between channel lips and channel bolt					
Characteristic resistance	HBC-T 53/34 M16	Carbon steel	$V_{Rk,s,l,x}$	[kN]	53,0
		Stainless steel			51,0
	HBC-T 53/34 M20	Carbon steel			65,0
		Stainless steel			51,0
Installation factor		Carbon steel	γ_{inst}	[-]	1,4
		Stainless steel			1,0

[1] Product not available

Table 27: Characteristic resistances under shear load in direction of the longitudinal axis of the channel – steel failure HAC-C(-P) (hot-rolled) anchor channels

Anchor channel				**HAC-C 40/22**	**HAC-C-P 40/22**	**HAC-C-P 40L**	**HAC-C 50/30**	**HAC-C-P 50/30**	**HAC-C-P 50L**	**HAC-C 52/34**
Steel failure: Connection between channel lips and channel bolt										
Characteristic resistance	HBC-40/22-N M16 8.8F	$V_{Rk,sl,x}$	[kN]	- [2]	12,5	12,5	- [2]	- [1]		
	HBC-50/30-N M16 8.8F				- [2]			8,3	8,3	8,3
	HBC-50/30-N M20 8.8F							8,3	8,3	8,3
Installation factor		γ_{inst}	[-]		1,4			1,0		

[1] Product not available
[2] No performance assessed

Hilti anchor channels (HAC) with channel bolts (HBC)

Performance
Characteristic resistances of anchor channels (HAC-C) under shear load – steel failure

Annex C10

Table 28: Characteristic resistances under shear load – concrete failure of HAC-C-T (serrated hot-rolled) anchor channels

Anchor channel				HAC-C-T 53/34
Concrete failure: Pry out failure				
Product factor		k_8	[-]	2,0
Partial factor		γ_{Mc} [1)]	[-]	1,5
Concrete failure: Concrete edge failure				
Product factor k_{12}	cracked concrete	$k_{cr,V}$	[-]	7,5
	uncracked concrete	$k_{ucr,V}$	[-]	10,5
Partial factor		γ_{Mc} [1)]	[-]	1,5

[1)] In absence of other national regulations

Table 29: Characteristic resistances under shear load – concrete failure of HAC-C(-P) (hot-rolled) anchor channels

Anchor channel				HAC-C 40/22	HAC-C-P 40/22	HAC-C-P 40L	HAC-C 50/30	HAC-C-P 50/30	HAC-C-P 50L	HAC-C 52/34
Concrete failure: Pry out										
Product factor		k_8	[-]	2,0						
Partial factor		γ_{Mc} [1)]	[-]	1,5						
Concrete failure: Concrete edge										
Product factor k_{12}	cracked concrete	$k_{cr,V}$	[-]	7,5						
	uncracked concrete	$k_{ucr,V}$	[-]	10,5						
Partial factor		γ_{Mc} [1)]	[-]	1,5						

1) In absence of other national regulations

Table 30: Characteristic resistances under shear load – concrete failure of HAC-C (cold-formed) anchor channels

Anchor channel				HAC-C 28/15	HAC-C 38/17	HAC-C 40/25	HAC-C 49/30	HAC-C 54/33
Concrete failure: Pry out								
Product factor		k_8	[-]	1,0	2,0			
Partial factor		γ_{Mc} [1)]	[-]	1,5				
Concrete failure: Concrete edge								
Product factor k_{12}	cracked concrete	$k_{cr,V}$	[-]	6,9	6,9	7,5		
	uncracked concrete	$k_{ucr,V}$	[-]	9,6	9,6	10,5		
Partial factor		γ_{Mc} [1)]	[-]	1,5				

[1)] In absence of other national regulations

Hilti anchor channels (HAC) with channel bolts (HBC)

Performance
Characteristic resistances of anchor channels (HAC-C) under shear load – concrete failure

Annex C11

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Table 31: Displacements under shear load of HAC-C-T (serrated hot-rolled) anchor channels

Anchor channel			**HAC-C-T 53/34**	
Bolt diameter			**M16**	**M20**
Carbon steel				
Shear load	V_y	[kN]	69,0	
Short-term displacement [1]	$\delta_{V0,y}$	[mm]	2,8	
Long-term displacement [1]	$\delta_{V\infty,y}$	[mm]	4,2	
Shear load	V_x	[kN]	33,1	40,6
Short-term displacement [1]	$\delta_{V0,x}$	[mm]	1,4	1,5
Long-term displacement [1]	$\delta_{V\infty,x}$	[mm]	2,0	2,2
Stainless steel				
Shear load	V_y	[kN]	66,8	
Short-term displacement [1]	$\delta_{V0,y}$	[mm]	2,5	
Long-term displacement [1]	$\delta_{V\infty,y}$	[mm]	3,7	
Shear load	V_x	[kN]	38,4	
Short-term displacement [1]	$\delta_{V0,x}$	[mm]	1,3	
Long-term displacement [1]	$\delta_{V\infty,x}$	[mm]	2,0	

[1] Displacements in midspan of the anchor channel, including slip of channel bolt, deformation of channel lips and slip of the anchor channel in concrete

Table 32: Displacements under shear load of HAC-C(-P) (hot-rolled) anchor channels

Anchor channel			**HAC-C 40/22**	**HAC-C-P 40/22**	**HAC-C-P 40L**	**HAC-C 50/30**	**HAC-C-P 50/30**	**HAC-C-P 50L**	**HAC-C 52/34**
Shear load	V_y	[kN]	10,3	29,0	29,0	16,0	39,7	28,4	28,4
Short-term displacement [1]	$\delta_{V0,y}$	[mm]	2,1	2,0	2,0	2,6	2,7	3,7	3,7
Long-term displacement [1]	$\delta_{V\infty,y}$	[mm]	3,1	3,5	3,5	3,9	4,0	5,5	5,5
Shear load	V_x	[kN]	[2]	5,2	5,2	[2]	3,3	3,3	7,9
Short-term displacement [1]	$\delta_{V0,x}$	[mm]	[2]	0,1	0,1	[2]	0,1	0,1	1,4
Long-term displacement [1]	$\delta_{V\infty,x}$	[mm]	[2]	0,2	0,2	[2]	0,2	0,2	2,0

[1] Displacements in midspan of the anchor channel, including slip of channel bolt, deformation of channel lips and slip of the anchor channel in concrete

Hilti anchor channels (HAC) with channel bolts (HBC)

Performance
Displacements under shear load

Annex C12

Table 33: Displacements under shear load perpendicular to longitudinal axis of HAC-C (cold-formed) anchor channels

Anchor channel			HAC-C 28/15	HAC-C 38/17	HAC-C 40/25	HAC-C 49/30	HAC-C 54/33
Shear load	V_y	[kN]	3,6	7,1	7,9	12,3	21,8
Short-term displacement [1)]	$\delta_{V0,y}$	[mm]	0,6	1,3	1,4	1,4	1,6
Long-term displacement [1)]	$\delta_{V\infty,y}$	[mm]	0,9	2,0	2,1	2,1	2,4

[1)] Displacements in midspan of the anchor channel, including slip of channel bolt, deformation of channel lips and slip of the anchor channel in concrete

Table 34: Characteristic resistances under combined tension and shear load of HAC-C-T (serrated hot-rolled) anchor channels

Anchor channel			HAC-C-T 53/34
Steel failure: Local flexure of channel lips and flexure of channel			
Product factor	k_{13}	[-]	Values according to EN 1992-4:2018, Section 7.4.3.1
Steel failure: Anchor and connection between anchor and channel			
Product factor	k_{14}	[-]	Values according to EN 1992-4:2018, Section 7.4.3.1

Table 35: Characteristic resistances under combined tension and shear load of HAC-C(-P) (hot-rolled) anchor channels

Anchor channel			HAC-C 40/22	HAC-C-P 40/22	HAC-C-P 40L	HAC-C 50/30	HAC-C-P 50/30	HAC-C-P 50L	HAC-C 52/34
Steel failure: Local flexure of channel lips and flexure of channel									
Product factor	k_{13}	[-]	Values according to EN 1992-4:2018, Section 7.4.3.1						
Steel failure: Anchor and connection between anchor and channel									
Product factor	k_{14}	[-]	Values according to EN 1992-4:2018, Section 7.4.3.1						

Table 36: Characteristic resistances under combined tension and shear load of HAC-C (cold-formed) anchor channels

Anchor channel			HAC-C 28/15	HAC-C 38/17	HAC-C 40/25	HAC-C 49/30	HAC-C 54/33
Steel failure: Local flexure of channel lips and flexure of channel							
Product factor	k_{13}	[-]	Values according to EN 1992-4:2018, Section 7.4.3.1				
Steel failure: Anchor and connection between anchor and channel							
Product factor	k_{14}	[-]	Values according to EN 1992-4:2018, Section 7.4.3.1				

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Table 37: Characteristic resistances under tension load – steel failure of channel bolts (HBC)

Channel bolt					**M8**	**M10**	**M12**	**M16**	**M20**
Steel failure									
Characteristic resistance (tension load)	$N_{Rk,s}$ [1]	[kN]	HBC-T 53/34	8.8	- [3]			125,6	203,4
				A4-70 [1]	- [3]			109,9	171,5
			HBC-50/30	8.8	- [3]		67,4	125,6	147,1
				A4-70 [1]	- [3]		59,0	109,9	121,2
			HBC-50/30-N	8.8	- [3]			125,6	186,6
				A4-70 [1]	- [3]				
			HBC-40/22	8.8	- [3]		67,4	125,6	- [3]
				A4-70 [1]	- [3]	20,5	59,0	91,0	- [3]
			HBC-40/22-N	8.8	- [3]			125,6	- [3]
				A4-70	- [3]				
			HBC-38/17	8.8	- [3]	- [3]	35,4	55,8	- [3]
				A4-70 [1]	- [3]	20,5	47,2	53,0	- [3]
			HBC-28/15	8.8	22,4	35,4	44,3	- [3]	
				A4-70 [1]	25,6	38,9	51,3	- [3]	
Partial factor	γ_{Ms} [2]	[-]	HBC-T 53/34 HBC-50/30(-N) HBC-40/22(-N) HBC-38/17 HBC-28/15	8.8	1,50				1,50
									1,51 [4]
				A4-70 [1]	1,87				

[1] Materials according to Table 5, Annex A6
[2] In absence of other national regulations
[3] Product not available
[4] Partial factor γ_{Ms} = 1,51 only for bolts HBC-T 53/34 M20

Hilti anchor channels (HAC) with channel bolts (HBC)

Performance
Characteristic resistances of channel bolts under tension load

Annex C14

Table 38: Characteristic resistances under shear load – steel failure of channel bolts (HBC)

Channel bolt					**M8**	**M10**	**M12**	**M16**	**M20**
Steel failure									
Characteristic resistance (shear load)	$V_{Rk,s}$ [1]	[kN]	HBC-T 53/34	8.8	- [3]			62,8	101,7
				A4-70 [1]	- [3]			65,9	102,9
			HBC-50/30	8.8	- [3]		33,7	62,8	101,7
				A4-70 [1]	- [3]		35,4	65,9	102,9
			HBC-50/30-N	8.8	- [3]			62,8	101,7
				A4-70	- [3]				
			HBC-40/22	8.8	- [3]	23,2	33,7	62,8	- [3]
				A4-70 [1]	- [3]	24,4	35,4	65,9	- [3]
			HBC-40/22-N	8.8	- [3]			62,8	- [3]
				A4-70	- [3]				
			HBC-38/17	8.8	- [3]	- [3]	33,7	62,8	- [3]
				A4-70 [1]	- [3]	24,4	35,4	65,9	- [3]
			HBC-28/15	8.8	14,6	23,2	33,7	- [3]	
				A4-70	15,4	24,4	35,4	- [3]	
Partial factor	γ_{Ms} [2]	[-]	HBC-T 53/34 HBC-28/15 HBC-38/17 HBC-40/22(-N) HBC-50/30(-N)	8.8	1,25				1,25 1,26 [4]
				A4-70	1,56				

[1] Materials according to Table 5, Annex A6
[2] In absence of other national regulations
[3] Product not available
[4] Partial factor γ_{Ms} = 1,26 only for bolts HBC-T 53/34 M20

Hilti anchor channels (HAC) with channel bolts (HBC)

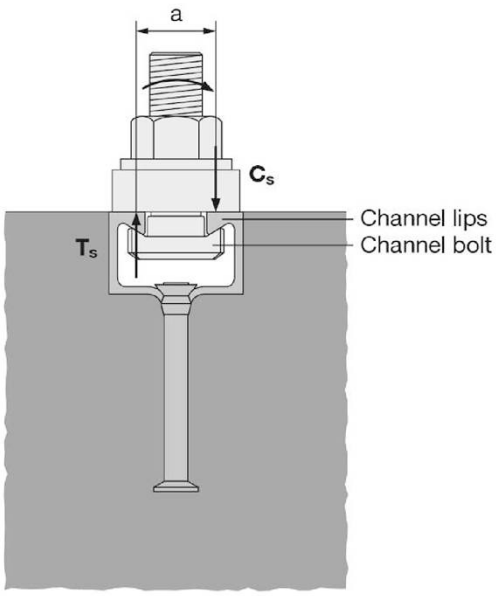
Performance
Characteristic resistances of channel bolts under shear load

Annex C15

Table 39: Characteristic resistances under shear load with lever arm – steel failure of channel bolts (HBC)

Channel bolt					**M8**	**M10**	**M12**	**M16**	**M20**
Steel failure									
Characteristic flexural resistance	$M^0_{Rk,s}$ [5]	[Nm]	HBC-T 53/34	8.8	- [4]			233,1	454,4
				A4-70 [2]	- [4]			233,1	454,4
			HBC-50/30(-N) HBC-40/22(-N) HBC-38/17 HBC-28/15	8.8	30,0	59,8	104,8	266,4	538,7
				A4-70 [2]	26,2	52,3	91,7	233,1	454,4
Partial factor	γ_{Ms} [1]	[-]	HBC-T 53/34 HBC-50/30(-N) HBC-40/22(-N) HBC-38/17 HBC-28/15	8.8	1,25				
				A4-70 [2]	1,56				
Internal lever arm	a	[mm]	HBC-T 53/34	53/34	- [4]			29,0	32,0
			HBC-50/30(-N)	50/30	- [4]		29,9	31,7	33,9
			HBC-40/22(-N)	40/22	- [4]	24,3	25,7	27,3	- [4]
			HBC-38/17	38/17	- [4]	23,0	24,3	26,3	- [4]
			HBC-28/15	28/15	17,3	18,7	20,0	- [4]	

[1] In absence of other national regulations
[2] Materials according to Table 5, Annex A6
[3] Not applicable for HBC-28/15 and HBC-50/30
[4] Product not available



[3] The characteristic flexure resistance according to Table 23 is limited as follows:

$M^0_{Rk,s} \le 0,5 \cdot N_{Rk,s,l} \cdot a$ ($N_{Rk,s,l}$ according to Table 15 and 17)

and

$M^0_{Rk,s} \le 0,5 \cdot N_{Rk,s} \cdot a$ ($N_{Rk,s}$ according to Table 29)

a = internal lever arm according Table 30

T_s = tension force acting on the channel lips

C_s = compression force acting on the channel lips

Hilti anchor channels (HAC) with channel bolts (HBC)

Performance
Characteristic resistances of channel bolts under shear load with lever arm

Annex C16

Table 40: Combination of anchor channels and channel bolts under fatigue tension load (Design method I or II for assessment method A1, A2 and B according to EOTA TR050, June 2022)

Anchor channel			Channel bolt			
Channel profile	**Anchor type**	**Corrosion protection**	**Channel bolt**	**Diameter**	**Steel grade**	**Corrosion protection**
HAC-C-P 40/22 HAC-C-P 40L	R	F	HBC-40/22	M12	8.8	G F
				M16		
HAC-C-P 50/30 HAC-C-P 50L			HBC-50/30	M16		
				M20		
HAC-C 52/34			HBC-50/30	M16		
				M20		

Table 41: Characteristic resistances under fatigue tension load - steel failure with n load cycles without static preload (N_{Ed} = 0) (Design method I according to EOTA TR050, June 2022)

Anchor channel		**HAC-C-P 40/22 HAC-C-P 40L**	**HAC-C-P 50/30 HAC-C-P 50L**	**HAC-C 52/34**
Steel failure	n	$\Delta N_{Rk,s,0,n}$ [kN]		
Characteristic resistance under fatigue tension load after n load cycles without static preload (N_{Ed} = 0)	$\leq 10^4$	16,4	20,9	24,3
	$\leq 10^5$	7,7	9,0	12,5
	$\leq 10^6$	3,2	4,2	7,1
	$\leq 2 \cdot 10^6$	2,6	3,7	6,4
	$\leq 5 \cdot 10^6$	2,2	3,4	5,9
	$\leq 10^8$	2,0	3,3	5,7
	$> 10^8$	1,8	3,2	5,5

Hilti anchor channels (HAC-C) with channel bolts (HBC)

Performance
Characteristic resistances under fatigue tension load according to assessment method A1, A2 and B

Annex C17

Table 42: Reduction factor $\eta_{c,fat}$ under fatigue tension load – concrete failure with n load cycles without static preload (N_{Ed} = 0)
(Design method I or II for assessment method A1, A2 and B according to EOTA TR050, June 2022)

Anchor channel		HAC-C-P 40/22 HAC-C-P 40L	HAC-C-P 50/30 HAC-C-P 50L	HAC-C 52/34
Pull-out failure **Concrete cone failure**	n	$\eta_{c,fat}$ [-]		
Reduction factor for $\Delta N_{Rk,p;0;n} = \eta_{c,fat} \cdot N_{Rk,p}$ $\Delta N_{Rk,c;0;n} = \eta_{c,fat} \cdot N_{Rk,c}$ with $N_{Rk,p}$ according to Annex C3 and C4 and $N_{Rk,c}$ calculated according to EOTA TR 047, March 2018 or EN 1992-4:2018	$\leq 10^6$	0,600		
	$\leq 3 \cdot 10^6$	0,571		
	$\leq 10^7$	0,542		
	$\leq 3 \cdot 10^7$	0,516		
	$\leq 6 \cdot 10^7$	0,500		
	$> 6 \cdot 10^7$ 1)	0,500		

1) for $\Delta N_{Rk,p;0;\infty}$, $\Delta N_{Rk,c;0;\infty}$

Table 43: Characteristic resistances under fatigue tension load – steel failure with n → ∞ load cycles without static preload (N_{Ed} = 0) (Design method II for assessment method B according to EOTA TR050, June 2022)

Anchor channel		HAC-C-P 40/22 HAC-C-P 40L	HAC-C-P 50/30 HAC-C-P 50L	HAC-C 52/34
Steel failure				
$\Delta N_{Rk,s;0;\infty}$	[kN]	1,8	3,2	5,5
Concrete cone and pull-out failure				
$\eta_{c,fat}$	[-]	0,5		

For the reduction of the characteristic resistances given in Tables 32 and 33 in the transition zone from the static resistance to the fatigue limit resistance the partial safety factors are calculated as follows:

$$\gamma_{M,fat,n} = \gamma_{M,fat} + (\gamma_M - \gamma_{M,fat}) \cdot (\Delta N_{Rk,n} - \Delta N_{Rk,\infty}) / (N_{Rk} - \Delta N_{Rk,\infty})$$

In absence of other national regulations, the following safety factors γ_M and $\gamma_{M,fat}$ are recommended for design method I according to EOTA TR 050, **June 2022**:

γ_M according Annex C1

$\gamma_{M,fat}$ = 1,35

In absence of other national regulations, the following safety factor $\gamma_{M,fat}$ is recommended for design method II (Table 34) according to EOTA TR 050, **June 2022**:

$\gamma_{M,fat}$ = 1,35

Table 44: Characteristic resistance under fire exposure – steel failure for HAC-C(-P) (hot-rolled) anchor channels

Channel bolt					**M10**	**M12**	**M16**	**M20**
Steel failure of anchor, connection between anchor and channel, local flexure of channel lip								
Characteristic resistance under fire exposure	HAC-C(-P) 40/22 HAC-C-P 40L	R60	$N_{Rk,s,fi}$ = $V_{Rk,s,y,fi}$	[kN]	- 3)	- 3)	3,5	- 2)
		R90					2,2	
		R120					1,5	
	HAC-C(-P) 50/30 HAC-C-P 50L HAC-C 52/34	R60			- 2)	3,8	3,9	
		R90				2,5	2,9	
		R120				1,9	2,4	
Partial safety factor			$\gamma_{Ms,fi}$ 1)	[-]	1,0			

1) In absence of other national regulations.
2) Product not available.
3) Performance not assessed.

Table 45: Characteristic resistance under fire exposure – steel failure for HAC-C (cold-formed) anchor channels

Channel bolt					**M10**	**M12**	**M16**	**M20**
Steel failure of anchor, connection between anchor and channel, local flexure of channel lip								
Characteristic resistance under fire exposure	HAC-C 28/15	R60	$N_{Rk,s,fi}$ = $V_{Rk,s,y,fi}$	[kN]	0,8		- 2)	- 2)
		R90			0,6			
		R120			0,5			
	HAC-C 38/17	R60			- 3)	- 3)	1,9	- 2
		R90					1,3	
		R120					1,0	
	HAC-C 40/25	R60			1,7	3,5		- 2)
		R90			1,2	2,2		
		R120			0,9	1,5		
	HAC-C 49/30	R60			- 2)	3,8	3,9	
		R90				2,5	2,9	
		R120				1,9	2,4	
Partial safety factor			$\gamma_{Ms,fi}$ 1)	[-]	1,0			

1) In absence of other national regulations.
2) Product not available.
3) Performance not assessed.

Hilti anchor channels (HAC-C) with channel bolts (HBC)

Performance
Characteristic resistances of anchor channels and channel bolts under fire exposure

Annex C19

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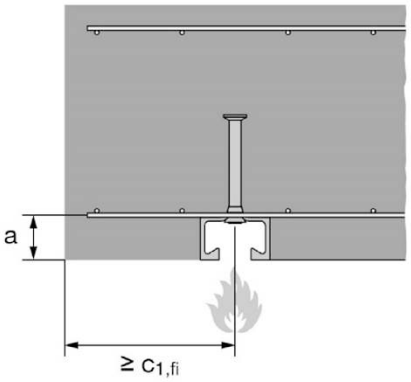
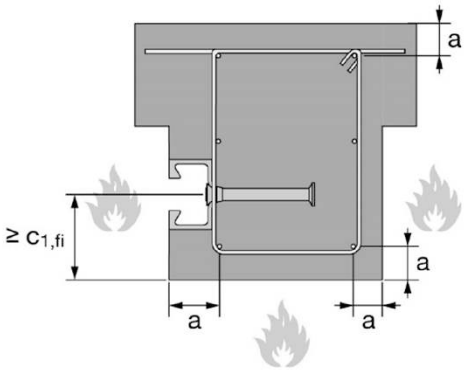
Table 46: Minimum axis distance of reinforcement

Anchor channel				**HAC-C 28/15; HAC-C 38/17; HAC-C 40/25; HAC-C(-P) 40/22; HAC-C-P 40L**	**HAC-C 49/30; HAC-C(-P) 50/30; HAC-C-P 50L; HAC-C 54/33; HAC-C 52/34**
Minimum axis distance	R60	a	[mm]	35	50
	R90			45	50
	R120			55	55

Fire exposure from one side only



Fire exposure from more than one side



Hilti anchor channels (HAC-C) with channel bolts (HBC)

Performance
Characteristic resistances of anchor channels and channel bolts under fire exposure

Annex C20