

Approval body for construction products  
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and  
Laender Governments



## European Technical Assessment

**ETA-17/0336**  
**of 11 July 2017**

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 Werke

This European Technical Assessment  
contains

23 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

European Assessment Document (EAD)  
330008-02-0601

**European Technical Assessment**

**ETA-17/0336**

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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 resistances under static and quasi-static loads and displacements	See Annex C1 to C6

**3.2 Safety in case of fire (BWR 2)**

Essential characteristic	Performance
Reaction to fire	Anchorage satisfy requirements for Class A1
Resistance to fire	See Annex C7

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

In accordance with EAD No. 330008-02-0601, 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**

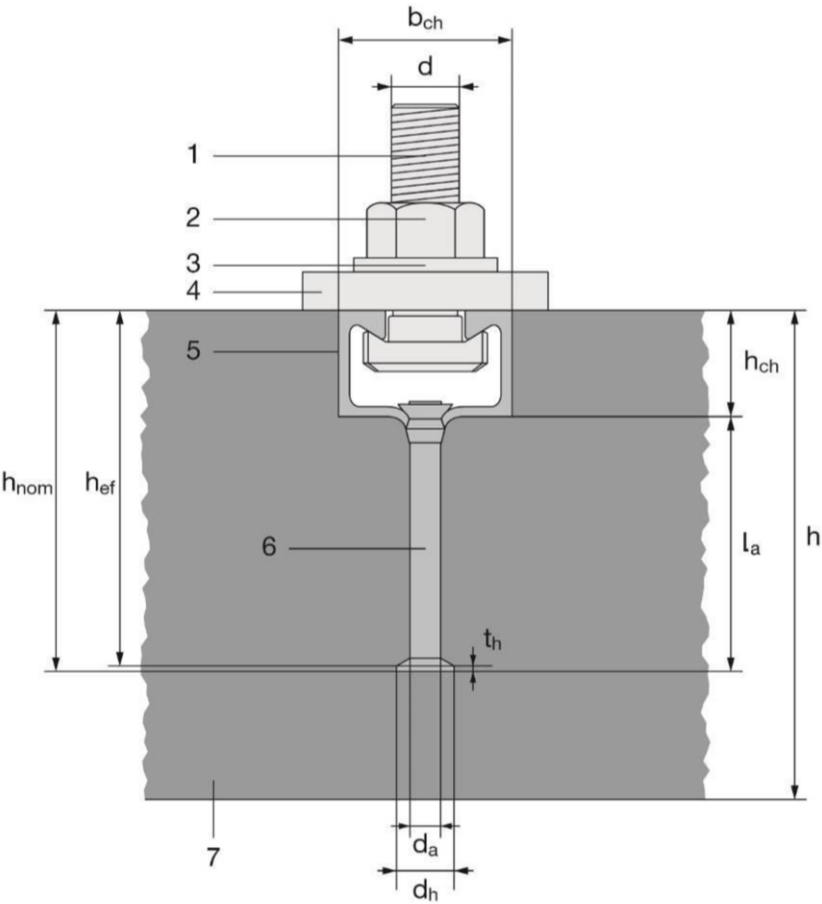
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 11 July 2017 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow  
Head of Department

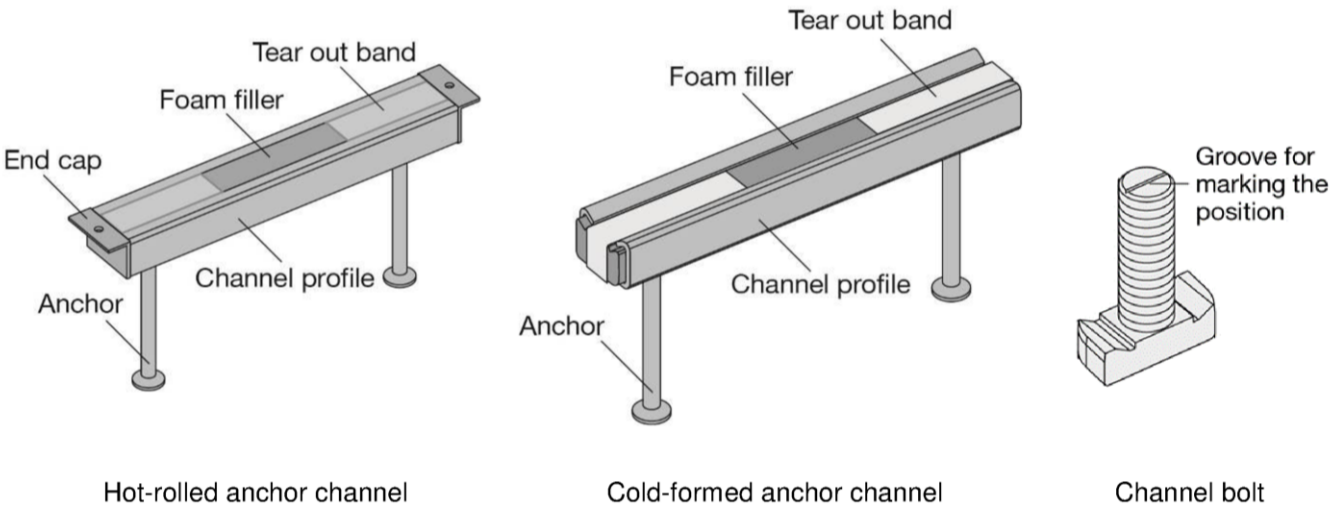
*beglaubigt:*  
Müller

Product and installation condition



Key

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



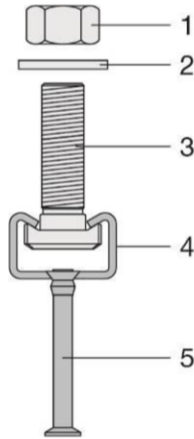
Anchor channels (HAC-C) with channel bolts (HBC)

Product Description  
Installed condition

Annex A1

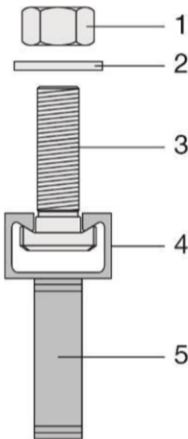
Anchor channel types

Cold-formed channel profiles

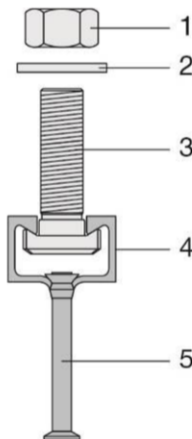


Round anchor

Hot-rolled channel profiles



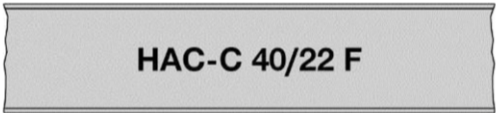
I-anchor



Round anchor

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

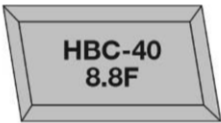
Marking of the anchor channels:  
HAC-C(-I) XZ



- HAC-C = Identifying mark of the manufacturer  
I = Additional marking for I-anchors (no marking in the case of round anchors)  
X = Size of the channel  
Z = Corrosion class / Material  
F = Hot-dip galvanized  
A4 = Stainless steel

- (e.g. HAC-C 40/22 F)
- 40/22 = Anchor channel size 40/22  
F = Hot-dip galvanized

Marking of the channel bolt:  
HBC-X YZ



- HBC = Identifying mark of the manufacturer  
X = Type of channel bolt  
Y = Steel grade (4.6, 8.8, 70)  
Z = Corrosion class / Material  
F = Hot-dip galvanized  
R = Stainless steel

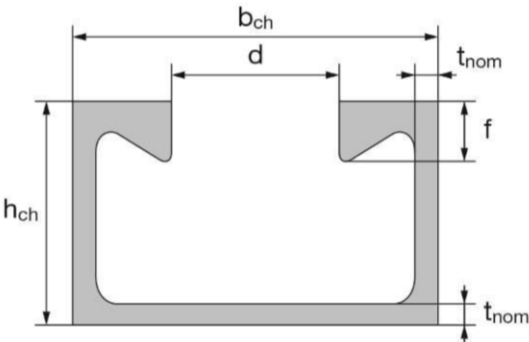
- (e.g. HBC-40/22 8.8F)
- 40 = Channel bolt type in combination with HAC-C 40/22F  
8.8 = Steel grade  
F = Hot-dip galvanized

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

**Product Description**  
Anchor channel types and marking

Annex A2

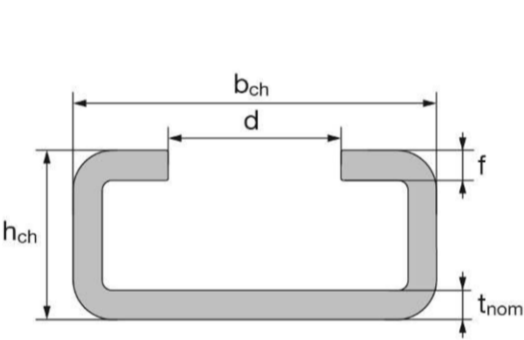
Channel profiles



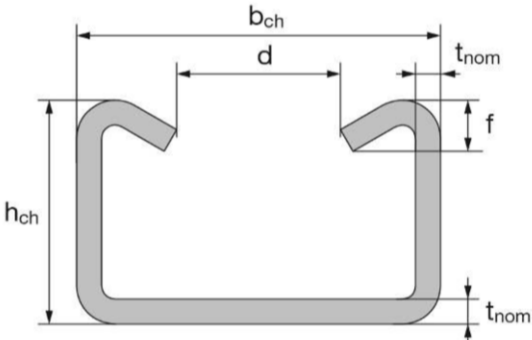
HAC-C 40/22, HAC-C 50/30, HAC-C 52/34

Table 1: Dimensions of hot-rolled channel profile

Anchor channel	b <sub>ch</sub>	h <sub>ch</sub>	t <sub>nom</sub>	d	f	I <sub>y</sub>
	[mm]					[mm <sup>4</sup> ]
40/22	39,5	23,0	2,4	18,0	6,0	20087
50/30	49,0	30,0	2,75	22,5	8,1	53652
52/34	52,5	34,0	4,0	22,5	11,5	97606



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



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

Table 2: Dimensions of cold-formed channel profile

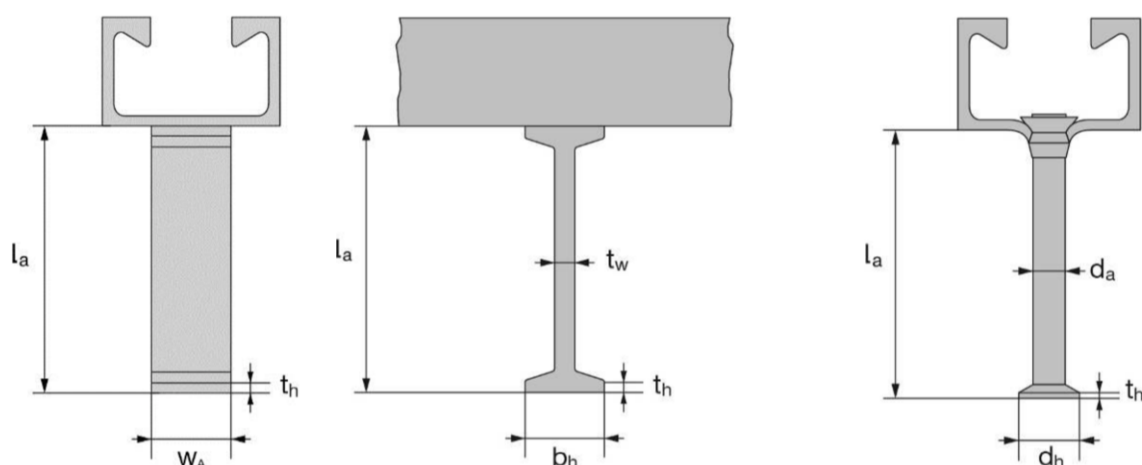
Anchor channel	b <sub>ch</sub>	h <sub>ch</sub>	t <sub>nom</sub>	d	f	I <sub>y</sub>
	[mm]					[mm <sup>4</sup> ]
28/15	28,0	15,5	2,3	12,0	2,3	4277
38/17	38,0	17,25	3,0	18,0	3,0	8224
40/25	40,0	25,0	2,75	18,0	5,6	20122
49/30	50,0	30,0	3,25	22,0	7,4	43105
54/33	53,5	33,0	5,0	21,5	8,0	74706

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

Product Description  
Channel profiles (HAC-C)

Annex A3

## Anchors



**Table 3: Dimensions of anchor  
(welded I-anchor or round anchor)**

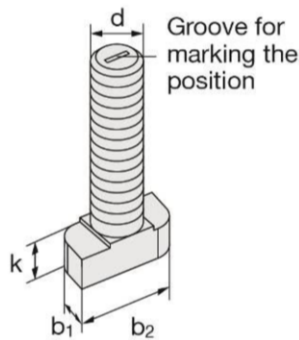
Anchor channel	I-anchor						Round anchor				
	min l <sub>a</sub>	t <sub>w</sub>	b <sub>h</sub>	t <sub>h</sub>	w <sub>A</sub>	A <sub>h</sub>	min l <sub>a</sub>	d <sub>a</sub>	d <sub>h</sub>	t <sub>h</sub>	A <sub>h</sub>
	[mm]					[mm²]	[mm]				[mm²]
28/15	-						31,0	6,0	12,0	1,3	85
38/17	-						60,8	8,0	16,0	2,0	151
40/25	-						56,0				
40/22	62,0	5,0	20,0	5,0	20,0	300	58,0				
49/30	-						66,0	10,0	20,0	2,2	236
50/30	69,0	5,0	20,0	5,0	25,0	375					
54/33	-						124,5	11,0	24,3	2,5	369
52/34	125,0	6,0	25,0	5,0	40,0	760	123,5				

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

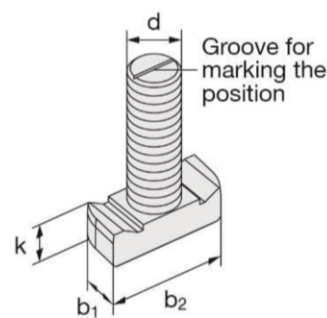
**Product Description**  
Anchors

Annex A4

### Channel bolts



HBC-28/15, HBC-38/17



HBC-40/22, HBC-50/30

Table 4: Dimensions of channel bolt

Anchor channel	Channel bolt type	Dimensions			
		b <sub>1</sub>	b <sub>2</sub>	k	d
		[mm]			
HAC-C 28/15	HBC-28/15	10,1	22,2	5,0	8
		11,0		6,0	10
HAC-C 38/17	HBC-38/17	13,0	30,5	6,0	10
		16,0		7,0	12
HAC-C 40/22 HAC-C 40/25	HBC-40/22	14,0	33,0	10,5	10
		17,0		11,5	12
HAC-C 49/30 HAC-C 50/30 HAC-C 52/34 HAC-C 54/33	HBC-50/30	17,0	42,0	14,5	12
		21,0		15,5	16
					20

Table 5: Steel grade and corrosion class

Channel Bolt	Carbon steel <sup>1)</sup>		Stainless steel <sup>1)</sup>	
Steel grade	4.6	8.8	A4-50	A4-70
f <sub>uk</sub> [N/mm <sup>2</sup> ]	400	800 / 830 <sup>2)</sup>	500	700
f <sub>yk</sub> [N/mm <sup>2</sup> ]	240	640 / 660 <sup>2)</sup>	210	450
Corrosion class	G <sup>3)</sup> F <sup>4)</sup>		R <sup>5)</sup>	

<sup>1)</sup> Material properties according to Annex A6

<sup>2)</sup> Material properties according to EN ISO 898-1

<sup>3)</sup> Electroplated

<sup>4)</sup> Hot-dip galvanized

<sup>5)</sup> Stainless steel

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

**Product Description**  
Channel bolts (HBC)

Annex A5

**Table 6: Materials**

Component	Carbon steel			Stainless steel
	Mechanical properties	Coating		Mechanical properties
1	2a	2b	2c	3
Channel Profile	1.0038, 1.0044, 1.0045 according to EN 10025: 2005 1.0976, 1.0979 according to EN 10149: 2013	Hot dip galvanized $\geq 50 \mu\text{m}$ according to EN ISO 10684: 2004/AC: 2009		1.4362, 1.4401 1.4404, 1.4571, 1.4578 according to EN 10088: 2005
Anchor	1.0038, 1.0213, 1.0214 according to EN 10025: 2005 1.5523, 1.5535 according to EN 10263: 2002-02			
Channel bolt	Steel grade 4.6 and 8.8 according to EN ISO 898-1: 2013	Electroplated according to EN ISO 4042: 1999	Hot dip galvanized $\geq 50 \mu\text{m}$ according to EN ISO 10684: 2004/ AC: 2009	Grade 50 or 70 according to EN ISO 3506: 2009
Plain washer <sup>1)</sup> according to ISO 7089: 2000 and ISO 7093-1: 2000	Hardness class A $\geq 200 \text{ HV}$	Electroplated according to EN ISO 4042: 1999	Hot dip galvanized $\geq 50 \mu\text{m}$ according to EN ISO 10684: 2004/ AC: 2009	1.4401, 1.4404 1.4571, 1.4578 according to EN 10088: 2005
Hexagonal nut according to ISO 4032: 2012 or DIN 934: 1987-10 <sup>2)</sup>	Property class 5 or 8 according to EN ISO 898-2: 2012	Electroplated according to EN ISO 4042: 1999	Hot dip galvanized $\geq 50 \mu\text{m}$ according to EN ISO 10684: 2004/ AC: 2009	Property class 50, 70 or 80 according to EN ISO 3506: 2009

<sup>1)</sup> Not in the scope of delivery

<sup>2)</sup> Hexagonal nuts according to DIN 934 for channel bolts made from carbon steel (4.6) and stainless steel

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

**Product Description**  
Materials

Annex A6

## Specifications of intended use

### Anchor channels and channel bolts subject to:

- Static and quasi-static loads in tension and shear perpendicular to the longitudinal axis of the channel.
- Fire exposure: only for concrete class C20/25 to C50/60.

### Base materials:

- Reinforced or unreinforced normal weight concrete according to EN 206: 2000.
- Strength classes C12/15 to C90/105 according to EN 206: 2000.
- Cracked or uncracked concrete.

### Use conditions (Environmental conditions):

- Structures subject to dry internal conditions (e.g. accommodations, bureaus, schools, hospitals, shops, exceptional internal conditions with usual humidity)  
(anchor channels and channel bolts according to Annex A6, Table 6, 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 6, column 2c and 3).
- The stainless steel anchor channels (HAC-C) and channel bolts (HBC), washers and nuts may be used in structures subject to external atmospheric conditions (including industrial and marine environment) or exposure in permanently damp internal conditions, if no particular aggressive conditions (e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with chemical pollution e.g. desulphurization plants or road tunnels where de-icing materials are used) exist  
(anchor channels and channel bolts according to Annex A6, Table 6, 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 as well as fire exposure the anchor channels are designed in accordance with EOTA TR 047 "Calculation Method for the Performance of Anchor Channels" or EN 1992-4: 2016.
- The characteristic resistances are calculated with the minimum effective embedment depth.

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

Intended Use  
Specifications

Annex B1

#### 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 7 are generated including end spacing and minimum channel length and in case of hot-dip galvanised anchor channels only to be used in dry internal conditions.
- Installation in accordance with the manufacturer's specifications given in Annexes B5 and B6
- 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 around the head of the anchors are 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 B6) rectangular to the channel axis.
- The required installation torques given in Annex B4 must be applied and must not be exceeded.

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

**Intended Use**  
Specifications

Annex B2

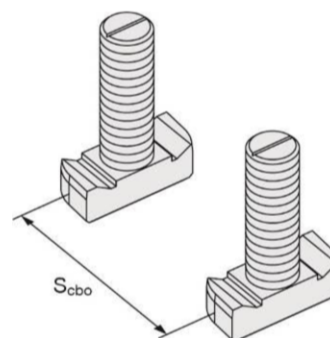
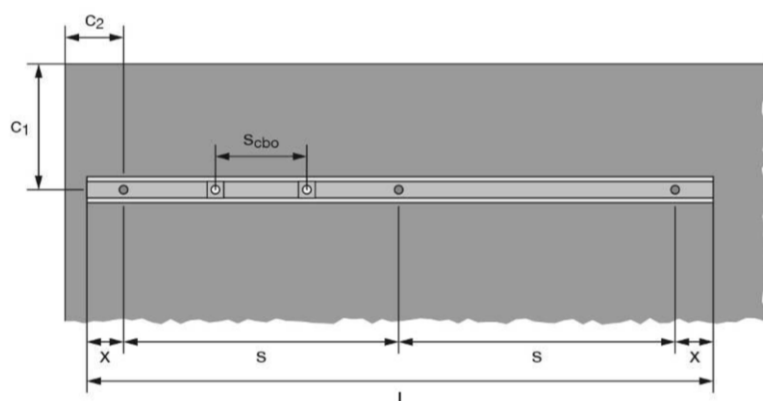
**Table 7: Installation parameters for anchor channel**

Anchor channel HAC-C			28/15	38/17	40/25	40/22	49/30	50/30	54/33	52/34	
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 <sup>1)</sup>								35 <sup>2)</sup>
Minimum channel length	$l_{min}$		100	150							170 <sup>3)</sup>
Minimum edge distance	$c_{min}$		40	50			75		100		
Minimum thickness of concrete member	$h_{min}$		70	100			120		180		

<sup>1)</sup> The end spacing may be increased from 25 mm to 35 mm

<sup>2)</sup>  $x = 25$  mm for welded I-anchors

<sup>3)</sup>  $l_{min} = 150$  mm for welded I-anchors



**Table 8: 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 ( $s_{cbo,min} = 5d$ )

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

#### Intended Use

Installation parameters for anchor channels (HAC-C)

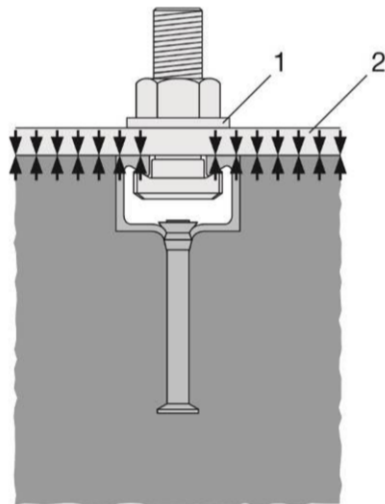
Annex B3

Table 9: Required installation torque  $T_{\text{inst}}$

Channel bolt		T <sub>inst</sub> <sup>1)</sup> [Nm]				
		General	Steel - steel contact			
		4.6, 8.8, A4-50, A4-70	4.6	8.8	A4-50	A4-70
28/15	M8	7	-	20	7	15
	M10	10		40		30
	M12	13		60		50
38/17	M10	15	13	-	-	22
	M12	25	-	45		50
	M16	40		100		90
40/22	M10	15	13	-	-	22
	M12	25	-	45		50
	M16	30		100		90
50/30	M12	25	-	45	-	50
	M16	60		100		130
	M20	75		360		250

<sup>1)</sup>  $T_{\text{inst}}$  must not be exceeded

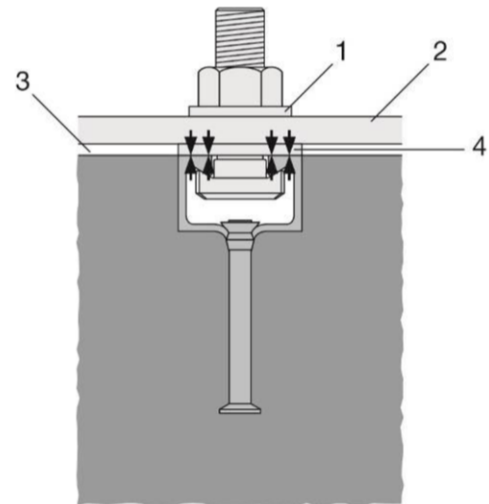
**General:** The fixture is in contact with the channel profile and the concrete surface.



**Key**

- 1 washer
- 2 fixture
- 3 gap
- 4 suitable steel part

**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.

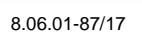


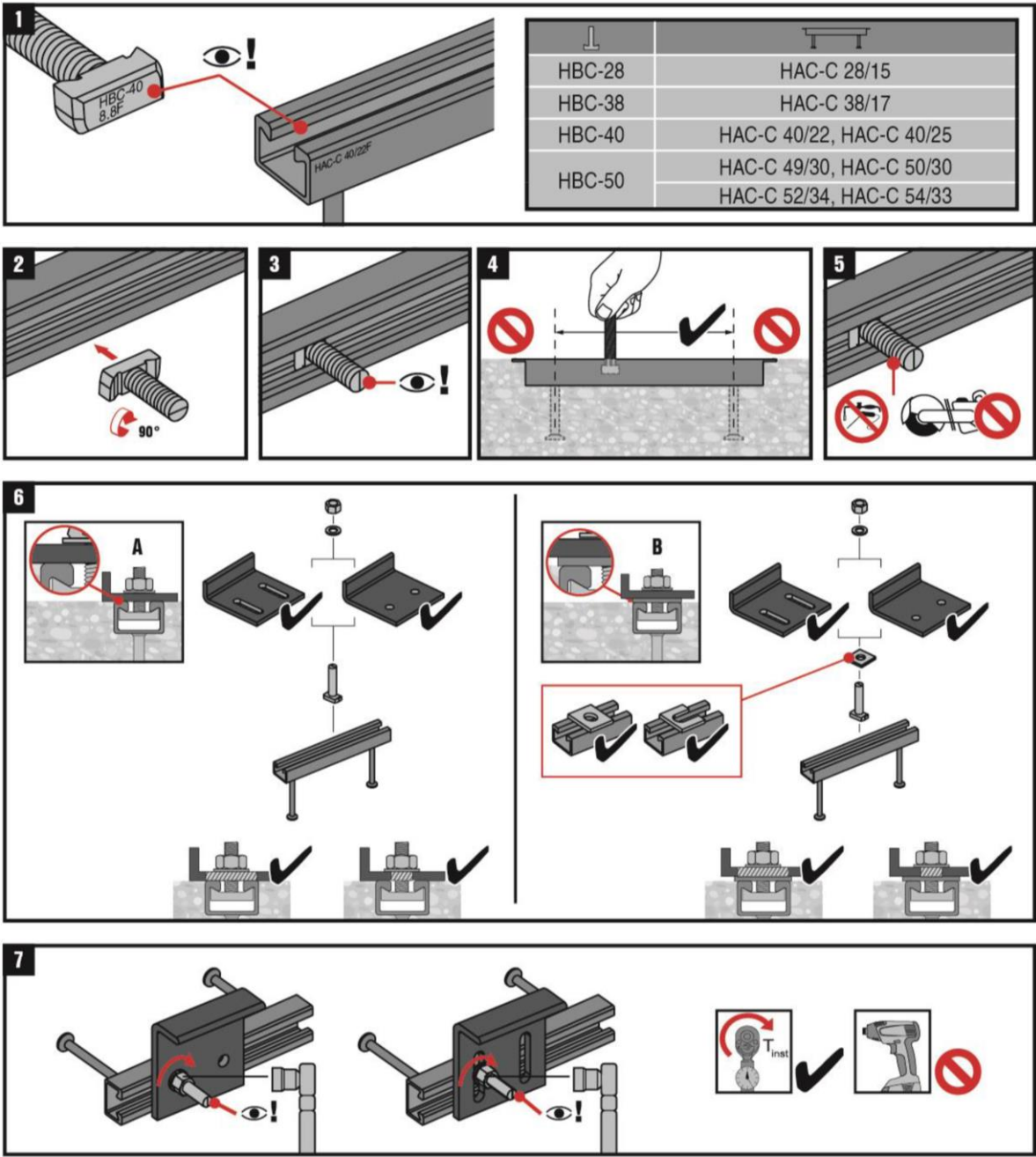
**Anchor channels (HAC-C) with channel bolts (HBC)**

**Intended Use**

Installation parameters for channel bolts (HBC)

Annex B4





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

Annex B6

**Table 10: Characteristic resistances under tension load – steel failure of anchor channel**

Anchor channel HAC-C			28/15	38/17	40/25	40/22	49/30	50/30	54/33	52/34
Steel failure: Failure of anchor										
Characteristic resistance	N <sub>Rk,s,a</sub>	[kN]	9	18	20		31		55	
Partial safety factor	γ <sub>Ms</sub> <sup>1)</sup>	[-]	1,8							
Steel failure: Failure of connection between anchor and channel										
Characteristic resistance	N <sub>Rk,s,c</sub>	[kN]	9	18	20		31		55	
Partial safety factor	γ <sub>Ms,ca</sub> <sup>1)</sup>	[-]	1,8							
Steel failure: Local failure by flexure of channel lips										
Characteristic spacing of the channel bolts for N <sub>Rk,s,l</sub>	s <sub>l,N</sub>	[mm]	56	76	80	79	100	98	107	105
Characteristic resistance	N <sup>0</sup> <sub>Rk,s,l</sub>	[kN]	9	18	20	35	31	36	55	65
Partial safety factor	γ <sub>Ms,l</sub> <sup>1)</sup>	[-]	1,8							

<sup>1)</sup> In absence of other national regulations

**Table 11: Characteristic flexural resistance of channel under tension load**

Anchor channel HAC-C				28/15	38/17	40/25	40/22	49/30	50/30	54/33	52/34
Steel failure: Failure by flexure of channel											
Characteristic flexural resistance of channel	carbon steel	M <sub>Rk,s,flex</sub>	[Nm]	316	538	979	1013	1669	2084	2929	3435
	stainless steel				527			1702		2832	
Partial safety factor		γ <sub>Ms,flex</sub> <sup>1)</sup>	[-]	1,15							

<sup>1)</sup> In absence of other national regulations

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

#### Performance Data

Characteristic resistances of anchor channels under tension load

Annex C1

**Table 12: Characteristic resistances under tension load – concrete failure**

Anchor channel HAC-C			28/15	38/17	40/25	40/22		49/30	50/30		54/33	52/34	
Type of anchor			R	R	R	I	R	R	I	R	R	I	R
Pullout failure													
Characteristic resistance in cracked concrete C12/15	N <sub>Rk,p</sub>	[kN]	7,6	13,6		27,0	13,6	21,2	33,8	21,2	33,2	68,4	33,2
Characteristic resistance in uncracked concrete C12/15			10,7	19,0		37,8	19,0	29,7	47,3	29,7	46,5	95,8	46,5
Amplification factor of N <sub>Rk,p</sub>	C16/20	ψ <sub>c</sub> [-]	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 safety factor	γ <sup>Mp</sup> = γ <sup>Mc</sup> <sup>1)</sup>	[-]	1,5										
Concrete cone failure													
Product factor k <sub>1</sub>	cracked concrete	k <sub>cr,N</sub>	[-]	7,2	7,8	7,9		8,1			8,7		
	uncracked concrete	k <sub>ucr,N</sub>	[-]	10,3	11,2	11,2		11,6			12,4		
Partial safety factor	γ <sup>Mc</sup> <sup>1)</sup>	[-]	1,5										
Splitting													
Characteristic edge distance	C <sub>cr,sp</sub>	[mm]	135	228	237			282			465		
Partial safety factor	γ <sup>Msp</sup> = γ <sup>Mc</sup> <sup>1)</sup>	[-]	1,5										

<sup>1)</sup> In absence of other national regulations

**Table 13: Displacements under tension load**

Anchor channel HAC-C			28/15	38/17	40/25	40/22	49/30	50/30	54/33	52/34
Tension load	N	[kN]	3,6	7,1	7,9	13,9	12,3	14,3	21,8	25,8
Short-term displacement <sup>1)</sup>	$\delta_{N0}$	[mm]	0,6	1,3	1,4	2,3	1,4	2,2	1,6	1,4
Long-term displacement <sup>1)</sup>	$\delta_{N\infty}$	[mm]	1,2	2,6	2,8	4,6	2,8	4,4	3,2	2,8

<sup>1)</sup> 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

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

##### Performance Data

Characteristic resistances of anchor channels and displacements under tension load

Annex C2

**Table 14: Characteristic resistances under shear load – steel failure of anchor channel**

Anchor channel HAC-C			28/15	38/17	40/25	40/22	49/30	50/30	54/33	52/34
Steel failure: Failure of anchor										
Characteristic resistance	V <sub>Rk,s,a</sub>	[kN]	9,0	18,0	20,0	26,0	31,0	40,3	55,0	71,5
Partial safety factor	γ <sub>Ms</sub> <sup>1)</sup>	[-]	1,5							
Steel failure: Failure of connection between anchor and channel										
Characteristic resistance	V <sub>Rk,s,c</sub>	[kN]	9,0	18,0	20,0	26,0	31,0	40,3	55,0	71,5
Partial safety factor	γ <sub>Ms,ca</sub> <sup>1)</sup>	[-]	1,8							
Steel failure: Local failure by flexure of channel lips										
Characteristic spacing of channel bolts for V <sub>Rk,s,l</sub>	s <sub>l,v</sub>	[mm]	56	76	80	79	100	98	107	105
Characteristic resistance	V <sup>0</sup> <sub>Rk,s,l</sub>	[kN]	9,0	18,0	20,0	26,0	31,0	40,3	55,0	71,5
Partial safety factor	γ <sub>Ms,l</sub> <sup>1)</sup>	[-]	1,8							

<sup>1)</sup> In absence of other national regulations

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

**Performance Data**

Characteristic resistances of anchor channels under shear load

Annex C3

**Table 15: Characteristic resistances under shear load – concrete failure**

Anchor channel HAC-C			28/15	38/17	40/25	40/22	49/30	50/30	54/33	52/34
Pry out failure										
Product factor	k <sub>8</sub>	[-]	1,0	2,0						
Partial safety factor	γ <sub>Mc</sub> <sup>1)</sup>	[-]	1,5							
Concrete edge failure										
Product factor k <sub>12</sub>	cracked concrete	k <sub>cr,V</sub>	[-]	6,9	7,5					
	uncracked concrete	k <sub>ucr,V</sub>	[-]	9,6	10,5					
Partial safety factor	γ <sub>Mc</sub> <sup>1)</sup>	[-]	1,5							

<sup>1)</sup> In absence of other national regulations

**Table 16: Displacements under shear load**

Anchor channel HAC-C			28/15	38/17	40/25	40/22	49/30	50/30	54/33	52/34
Shear load	V	[kN]	3,6	7,1	7,9	10,3	12,3	16,0	21,8	28,4
Short-term displacement <sup>1)</sup>	$\delta_{V0}$	[mm]	0,6	1,3	1,4	2,1	1,4	2,6	1,6	3,7
Long-term displacement <sup>1)</sup>	$\delta_{V\infty}$	[mm]	0,9	2,0	2,1	3,1	2,1	3,9	2,4	5,5

<sup>1)</sup> 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 17: Characteristic resistances under combined tension and shear load**

Anchor channel HAC-C			28/15	38/17	40/25	40/22	49/30	50/30	54/33	52/34
Steel failure: Local failure by flexure of channel lips and failure by flexure of channel										
Product factor	k <sub>13</sub>	[-]	1,0 <sup>1)</sup>							
Steel failure: Failure of anchor and connection between anchor and channel										
Product factor	k <sub>14</sub>	[-]	1,0 <sup>2)</sup>							

<sup>1)</sup>  $k_{13}$  can be taken as 2,0 if  $V_{Rd,s,l}$  is limited to  $N_{Rd,s,l}$

<sup>2)</sup>  $k_{14}$  can be taken as 2,0 if  $\max(V_{Rd,s,a}; V_{Rd,s,c})$  is limited to  $\min(N_{Rd,s,a}; N_{Rd,s,c})$

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

### Performance Data

Characteristic resistances of anchor channels and displacements under shear load  
Characteristic resistances under combined tension and shear load

Annex C4

**Table 18: Characteristic resistances under tension and shear load – steel failure of channel bolts**

Channel bolt					M8	M10	M12	M16	M20			
Steel failure												
Characteristic tension resistance	N <sub>Rk,s</sub> <sup>1)</sup>	[kN]	HBC-28/15	4.6	-							
				8.8	22,4	35,4	44,3	-				
				A4-50 <sup>2)</sup>	17,2	-						
				A4-70 <sup>2)</sup>	25,6	38,9	51,3	-				
			HBC-38/17	4.6	-	23,2	-					
				8.8		-	35,4	55,8	-			
				A4-70 <sup>2)</sup>		20,5	47,2	53,0				
			HBC-40/22	4.6		23,2	-					
				8.8		-	35,4	55,8	-			
				A4-70 <sup>2)</sup>		20,5	58,6	91,0				
			HBC-50/30	4.6		-						
				8.8		-	35,4	55,8	183,1			
				A4-70 <sup>2)</sup>			58,6	109,0	129,0			
			Partial safety factor	γ <sub>Ms</sub> <sup>3)</sup>	[-]	HBC-28/15	4.6	2,00				
						HBC-38/17	8.8	1,50				
HBC-40/22	A4-50 <sup>2)</sup>	2,86										
HBC-50/30	A4-70 <sup>2)</sup>	1,87										
Characteristic shear resistance	V <sub>Rk,s</sub> <sup>1)</sup>	[kN]	HBC-28/15	4.6	-							
				8.8	14,6	23,2	33,7	-				
				A4-50 <sup>2)</sup>	11,0	-						
				A4-70	15,4	24,4	35,4	-				
			HBC-38/17	4.6	-	13,9	-					
				8.8		-	33,7	62,8	-			
				A4-70 <sup>2)</sup>		24,4	35,4	65,9				
			HBC-40/22	4.6		13,9	-					
				8.8		-	33,7	62,8	-			
				A4-70 <sup>2)</sup>		24,4	35,4	65,9				
			HBC-50/30	4.6		-						
				8.8		-	33,7	62,8	98,0			
				A4-70 <sup>2)</sup>			35,4	65,9	102,9			
			Partial safety factor	γ <sub>Ms</sub> <sup>3)</sup>	[-]	HBC-28/15	4.6	1,67				
						HBC-38/17	8.8	1,25				
HBC-40/22	A4-50 <sup>2)</sup>	2,38										
HBC-50/30	A4-70	1,56										

<sup>1)</sup> In conformity to EN ISO 898-1:1999

<sup>2)</sup> Materials according to Table 6, Annex A6

<sup>3)</sup> In absence of other national regulations

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

#### Performance Data

Characteristic resistances of channel bolts under tension and shear load

Annex C5

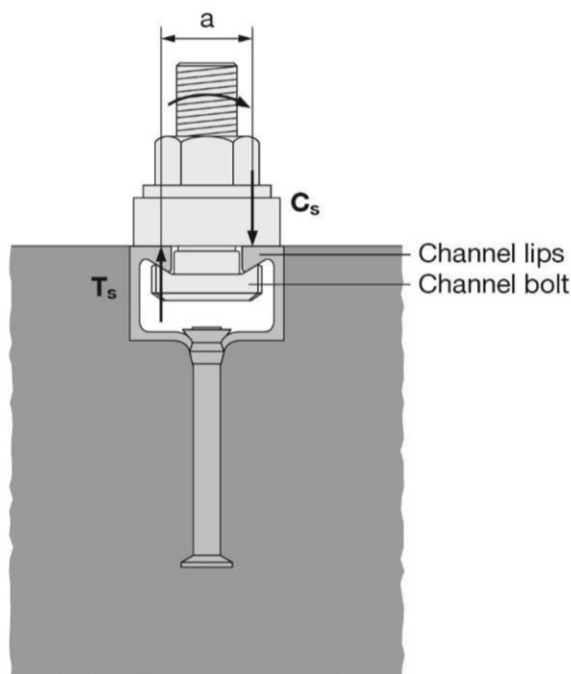
**Table 19: Characteristic resistances under shear load with lever arm – steel failure of channel bolts**

Channel bolt <sup>1)</sup>					M8	M10	M12	M16	M20
<b>Steel failure</b>									
Characteristic flexural resistance	$M^{0}_{Rk,s}$	[Nm]	HBC-28/15	4.6	-	29,9 <sup>3)</sup>	-		
			HBC-38/17	8.8	30,0	59,8	104,8	266,4	519,3
			HBC-40/22	A4-50 <sup>2)</sup>	18,7	-			
			HBC-50/30	A4-70 <sup>2)</sup>	26,2	52,3	91,7	233,1	454,4
Partial safety factor	$\gamma_{Ms}$ <sup>1)</sup>	[-]	HBC-28/15	4.6	1,67				
			HBC-38/17	8.8	1,25				
			HBC-40/22	A4-50 <sup>2)</sup>	2,38				
			HBC-50/30	A4-70 <sup>2)</sup>	1,56				
Internal lever arm	a	[mm]	HBC-28/15	28/15	17,3	18,7	20,0	-	
			HBC-38/17	38/17	-	23,0	24,3	26,3	-
			HBC-40/22	40/22		24,3	25,7	27,3	
			HBC-50/30	50/30		-	29,9	31,7	33,9

<sup>1)</sup> In absence of other national regulations

<sup>2)</sup> Materials according to Table 6, Annex A6

<sup>3)</sup> Not applicable for HBC-28/15 and HBC-50/30



<sup>3)</sup> The characteristic flexure resistance according to Table 19 is limited as follows:

$$M^{0}_{Rk,s} \leq 0,5 \cdot N_{Rk,s,l} \cdot a \quad (N_{Rk,s,l} \text{ according to Table 10})$$

$$M^{0}_{Rk,s} \leq 0,5 \cdot N_{Rk,s} \cdot a \quad (N_{Rk,s} \text{ according to Table 18})$$

a = internal lever arm according to Table 19

$T_s$  = tension force acting on the channel lips

$C_s$  = compression force acting on the channel lips

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

##### Performance Data

Characteristic flexural resistances of channel bolts under shear load

Annex C6

**Table 20: Characteristic resistance  $F_{Rd,s,fi}$  [kN] of anchor channels under fire exposure**

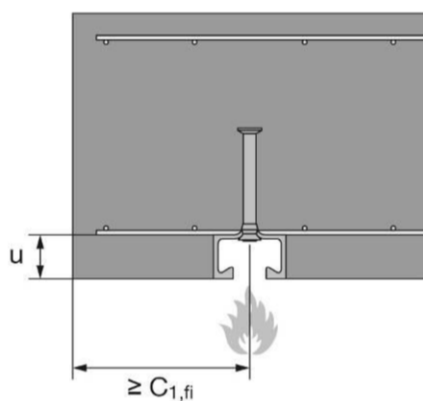
Channel bolt				M10	M12	≥ M16	
Steel failure of anchor, connection between anchor and channel, local flexure of channel lip							
Characteristic resistance in cracked concrete C20/25	HAC-C 28/15	R60	$N_{Rk,s,fi}$ = $V_{Rk,s,fi}$	[kN]	0,8		-
		R90			0,6		
		R120			0,5		
	HAC-C 38/17	R60			-	1,9	
		R90			-	1,3	
		R120			-	1,0	
	HAC-C 40/25 HAC-C 40/22	R60			1,7	3,5	
		R90			1,2	2,2	
		R120			0,9	1,5	
	HAC-C 49/30 HAC-C 50/30 HAC-C 52/34	R60			-	3,8	3,9
		R90				2,5	2,9
		R120				1,9	2,4
Partial safety factor			$\gamma_{Ms,fi}$ <sup>1)</sup>	[-]	1,0		

<sup>1)</sup> In absence of other national regulations

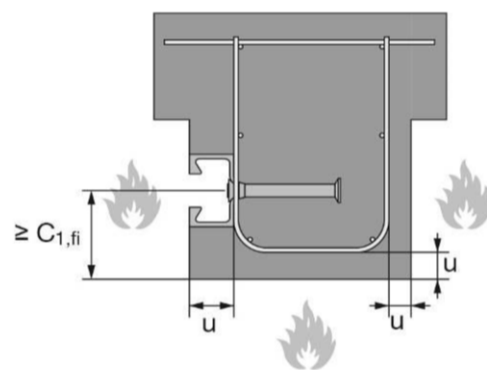
**Table 21: Minimum concrete cover**

Anchor channel HAC-C				28/15	38/17	40/25	40/22	49/30	50/30	54/33	52/34
Concrete cover	R60	u	[mm]	35				50	50	50	50
	R90			45							
	R120			55							

**Fire exposure from one side only**



**Fire exposure from more than one side**



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

**Performance Data**

Characteristic resistances of anchor channels and channel bolts under fire exposure

Annex C7