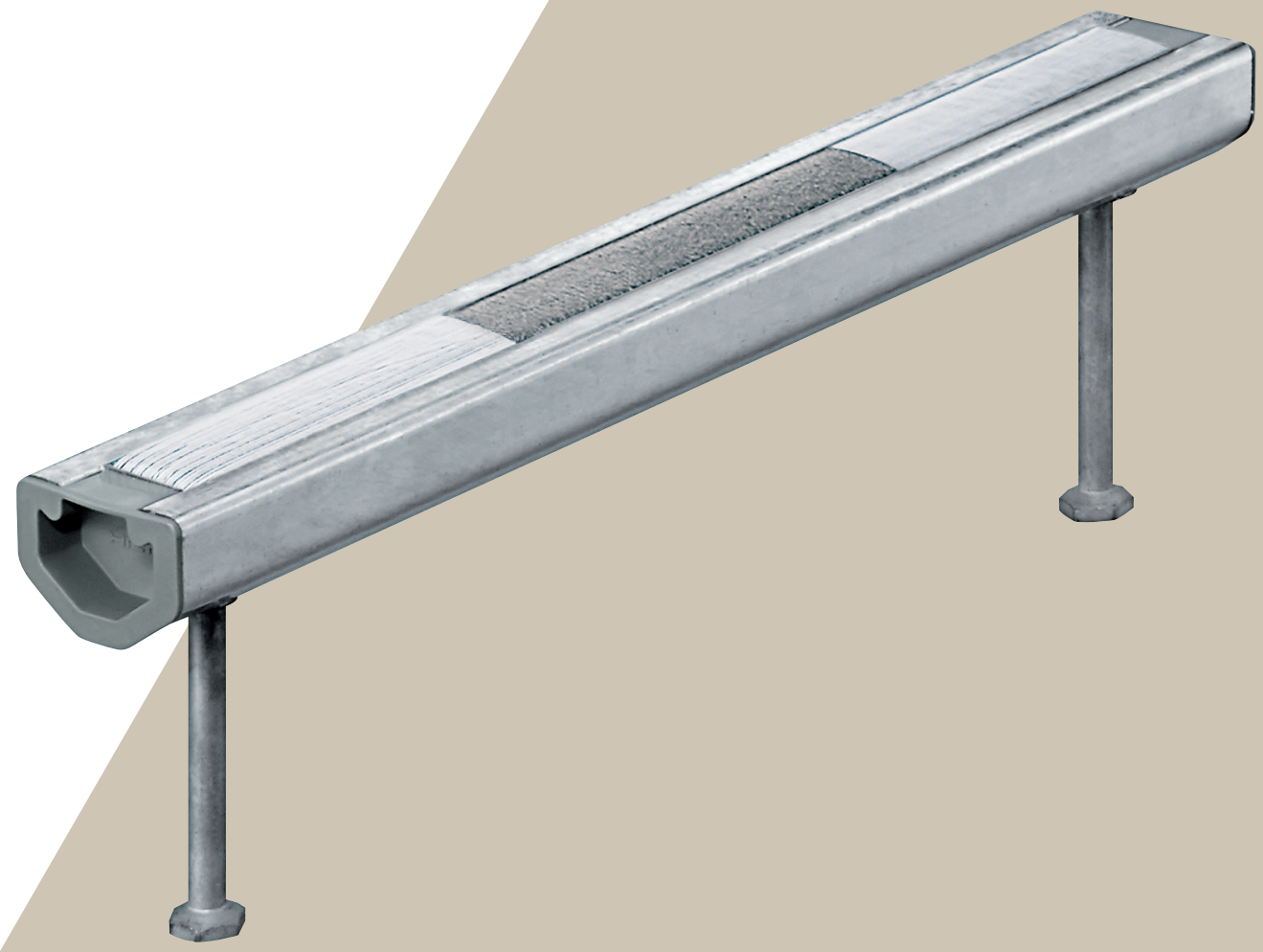
HAC TCRS
ANCHOR CHANNELS

Technical Datasheet
October 2019, Version 1.0



SELECTOR FOR STANDARD PRODUCTS

HAC TCRS anchor channels

Type		HAC plain anchor channels				HAC serrated anchor channels		
		HAC-40	HAC-50	HAC-60	HAC-70	HAC-30	HAC-T50	HAC-T70
								
Channel bolt type & bolt size	HBC-C	M10-M20				HBC-B	HBC-T	
	HBC-C-N	M12-M16	M12-M20			M10-M12	M12-M20	
	HBC-T						M12-M20	
	HBC-B					M10-M12		
Base material	Cracked concrete	■	■	■	■	■	■	■
	Uncracked concrete	■	■	■	■	■	■	■
	NWC concrete	■	■	■	■	■	■	■
	LWC concrete	◪ □	◪ □	◪ □	◪ □	◪ □	◪ □	◪ □
	Reinf./unreinforced	■	■	■	■	■	■	■
Technical data	European Technical Assessment (ETA)	■	■	■	■	■	■	■
	Static 2D	■	■	■	■	■	■	■
	Static 3D	■	■	■	■	■	■	■
	Seismic	□	□	□	□	□	□	□
	Fatigue	■	■	■	■	■		
	Fire	■	■	■	■	■		
Specification	Hot-dip galvanized (HDG)	■	■	■	■	■	■	■
	Stainless steel A4							
	Tear-out band	■	■	■	■	■	■	■
	End caps	■	■	■	■	■	■	■
PROFIS Anchor Channel software		✔						

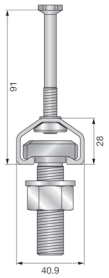
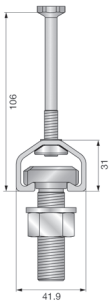
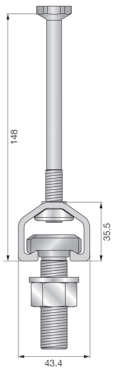
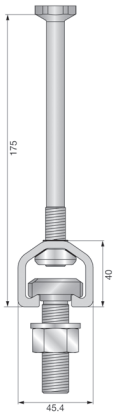
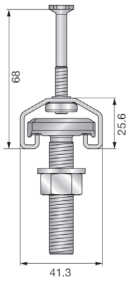
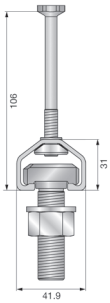
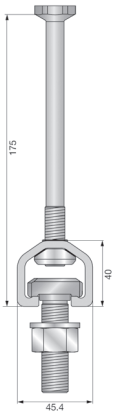
■ ETA approved ◪ Internal tests □ ICC ESR-3520 approved

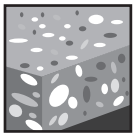
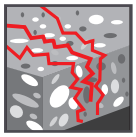
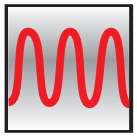
PRODUCT OVERVIEW

HAC anchor channels

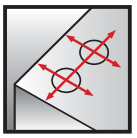
Plain anchor channels

Serrated anchor channels

HAC-40	HAC-50	HAC-60	HAC-70	HAC-30	HAC-T50	HAC-T70
						
HBC-C and HBC-C-N (standard and locking bolt)				HBC-B	HBC-T	

Base material		Load conditions				
						
Concrete (uncracked)	Concrete (cracked)	Static/ quasi-static	Static 3D loading	Fire resistance	Fatigue	Seismic 3D[1] loading

[1] Approved for seismic under ICC-ESR 3520 for seismic category A-D

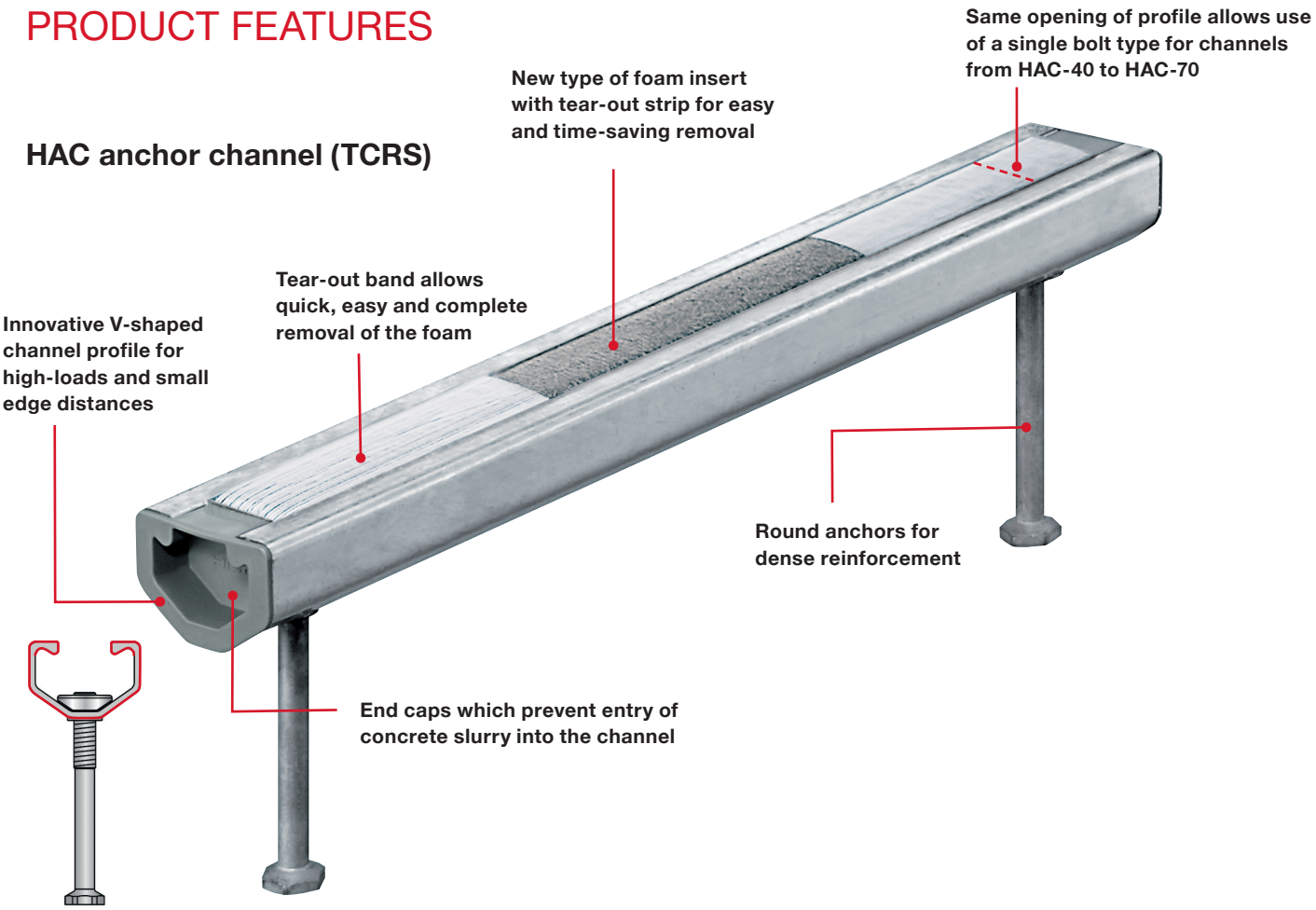
Other Information			
			
European Technical Assessment (ETA)	CE conformity	PROFIS Anchor Channel software	Small edge distance

Current approvals

Anchor channel	Description	Issuing Authority	No. / Date of issue
HAC (TCRS) Europe	European Technical Assessment (ETA) covering 3D static, fatigue tension and fire loads	DIBt Berlin	ETA-11/0006 18.07.2018
HAC (TCRS) USA	ICC approval (ESR) covering 3D static and seismic loads	ICC-ES	ESR-3520 04.2019

PRODUCT FEATURES

HAC anchor channel (TCRS)

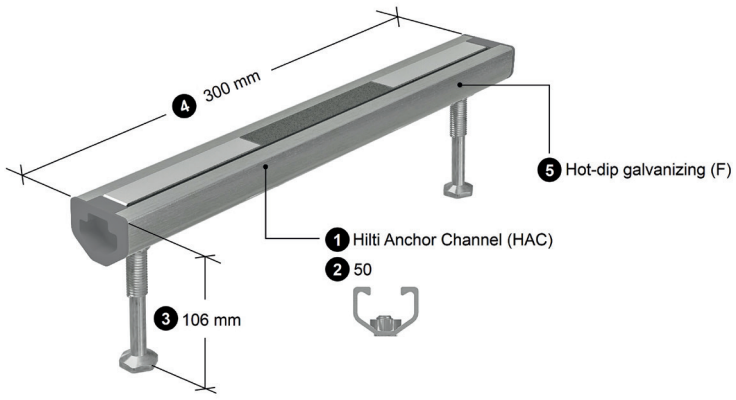


Nomenclature of HAC and HAC-T

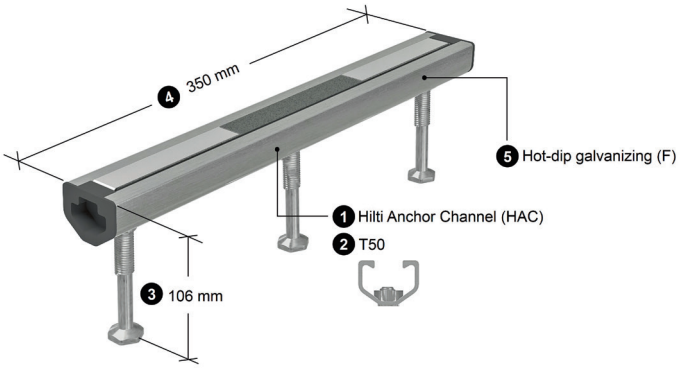
❶ Channel Type	❷ Profile type and size	❸ Effective embedment depth h_{ef} [mm]	❹ Anchor channel length [mm]	❺ Material finish
HAC	50	106	300	F (HDG)
HAC	T50	106	350	F (HDG)

Examples: ❶ Channel type ❷ Profile type/size ❸ h_{ef} ❹ Length ❺ Material finish

HAC-50 106/300 F

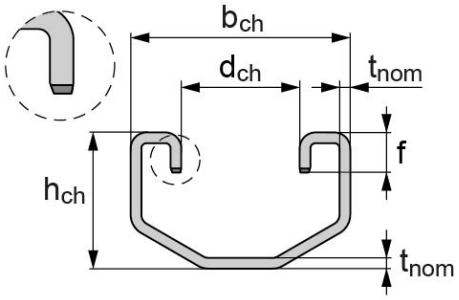


HAC-T50 106/350 F

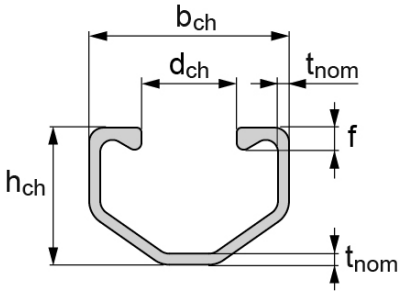


Dimensions of channel profile

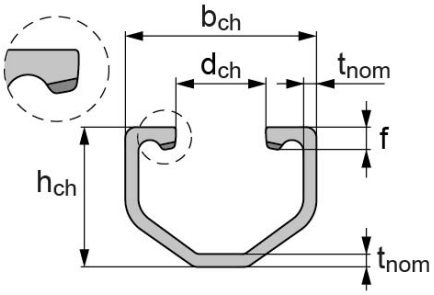
Description	Symbol	Units	Anchor Channels						
			HAC-30	HAC-40	HAC-50	HAC-T50	HAC-60	HAC-70	HAC-T70
Channel width	b_{ch}	[mm]	41.3	40.9	41.9	41.9	43.4	45.4	45.4
Channel height	h_{ch}	[mm]	25.6	28,0	31.0	31.0	35.5	40.0	40.0
Channel thickness	t_{nom}	[mm]	2.00	2.25	2.75	2.75	3.50	4.50	4.50
Channel profile opening	d_{ch}	[mm]	22.3	19.5	19.5	19.5	19.5	19.5	19.5
Channel lip height	f	[mm]	7.5	4.5	5.3	5.2	6.3	7.4	7.1
Profile moment of inertia	I_y	[mm^4]	15349	21463	33125	32049	57930	95457	92192



HAC-30



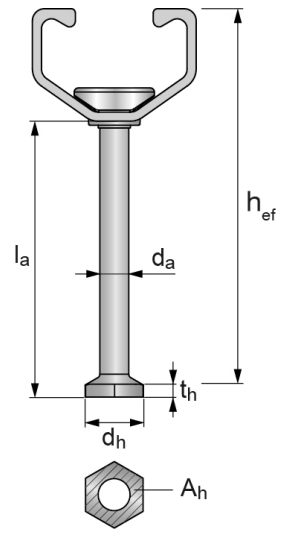
HAC-40, HAC-50, HAC-60, HAC-70



HAC-T50, HAC-T70

Dimensions of anchor

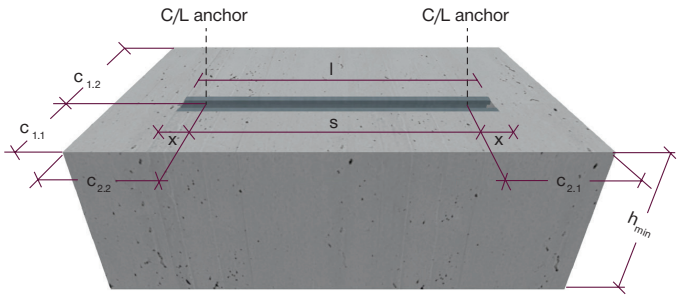
Description	Symbol	Units	Anchor Channels						
			HAC-30	HAC-40	HAC-50	HAC-T50	HAC-60	HAC-70	HAC-T70
Anchor shaft diameter	d_a	[mm]	5.4	7.2	9.0	9.0	9.0	10.9	10.9
Anchor head diameter	d_h	[mm]	11.5	17.5	19.5	19.5	19.5	23.0	23.0
Anchor length	l_A	[mm]	44.4	66.0	78.5	78.5	117.0	140.0	140.0
Head area	A_h	[mm^2]	89.0	209.0	258.0	258.0	258.0	356.0	356.0
Anchor head thickness	t_h	[mm]	2.0	3.0	3.5	3.5	4.5	5.0	5.0



Installation parameters for anchor channel

Description	Symbol	Units	Anchor Channels						
			HAC-30	HAC-40	HAC-50	HAC-T50	HAC-60	HAC-70	HAC-T70
Min. effective embedment depth	$h_{ef,min}$	[mm]	68	91	106	106	148	175	175
Min. anchor spacing	s_{min}	[mm]	50	100					
Max. anchor spacing	s_{max}	[mm]	250						
Min. end spacing	x	[mm]	25						
Minimum channel length	l_{min}	[mm]	100	150					
Min. edge distance (c_{11}, c_{12} & c_{21}, c_{22})	c_{min}	[mm]	50				75		
Min. thickness of concrete member	h_{min}	[mm]	80	105	125	125	168	196	196
			$h_{ef} + t_h + c_{nom}$ [1]						

1) c_{min} according to EN 1992-1-1:2004 + AC2010

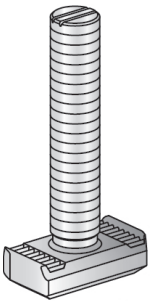
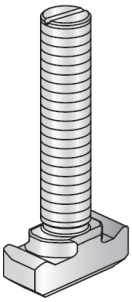
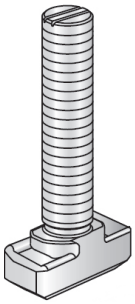
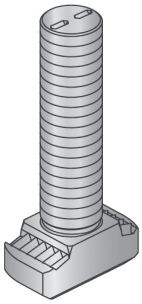
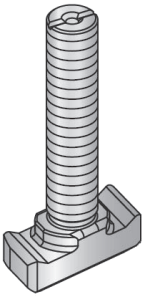


Materials of anchor channels and channel bolts

Component	Carbon steel			Stainless steel
	Material properties	Coating		Material properties
Channel Profile	Carbon steel according to EN 10025: 2004	Hot-dip galvanized ≥ 55 µm [1] Hot-dip galvanized ≥ 70 µm [2] according to EN ISO 1461: 2009		-
Rivet	Carbon steel	Hot-dip galvanized ≥ 45 µm [5] according to EN ISO 1461: 2009		-
Anchor	Carbon steel	Hot-dip galvanized ≥ 45 µm [5] according to EN ISO 1461: 2009		-
Channel bolt	Steel grade 4.6 and 8.8 according to EN ISO 898-1: 2013	Electroplated ≥ 8 µm according to DIN EN ISO 4042: 1999	Hot-dip galvanized ≥ 45 µm [5]	Steel grade 50 according to EN ISO 3506-1: 1.4401 / 1.4404 / 1.4571 / 1.4362 / 1.4578 / 1.4439
Plain washer [3] according to EN ISO 7089: 2000 and EN ISO 7093-1: 2000	Hardness class A ≥ 200 HV	Electroplated ≥ 8 µm	Hot-dip galvanized ≥ 45 µm [5]	Hardness class A ≥ 200 HV 1.4401 / 1.4404 / 1.4571 / 1.4362 / 1.4578 / 1.4439
Hexagonal nut according to EN ISO 4032: 2012 or DIN 934: 1987-10 [4]	Property class 8 according to EN ISO 898-2: 2012	Electroplated ≥ 8 µm	Hot-dip galvanized ≥ 45 µm [5]	Property class 70 according to EN ISO 3506-2: 2009 1.4401 / 1.4404 / 1.4571 / 1.4362 / 1.4578 / 1.4439

[1] For HAC-30F, HAC-40F and HAC-(T)50F.
[2] For HAC-60F and HAC-(T)70F.
[3] In scope of delivery only for HBC-C-N
[4] Hexagonal nuts according to DIN 934: 1987-10 for channel bolts made from carbon steel (4.6) and stainless steel.
[5] Hot-dip galvanized according to EN ISO 1461: 2009.

HBC channel bolts

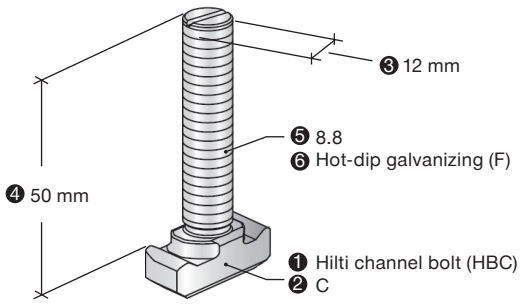
HBC-B	HBC-C	HBC-C-N	HBC-T	HBC-C-E
				
T-Head bolt compatible with serrated anchor channels HAC-30	T-Head bolt for anchor channels HAC-40 to HAC-70	Notching T-Head bolt for anchor channels HAC-40 to HAC-70	T-Head bolt for serrated anchor channels HAC-T50 and HAC-T70	T-Head bolt for anchor channels HAC-40 and HAC-50

Nomenclature of Hilti HBC channel bolts

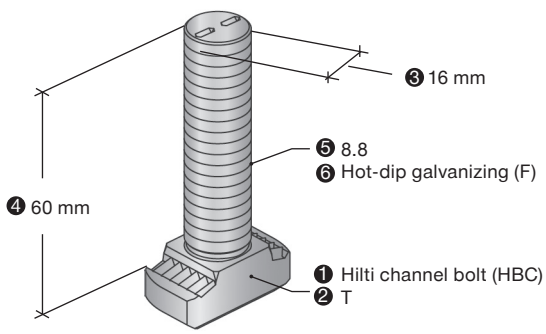
❶ Hilti Channel Bolt	❷ Bolt type	❸ Diameter	❹ Bolt length [mm]	❺ Steel grade	❻ Finish or material
HBC	C	M12	50	4.6, 8.8 & A4-50	F (HDG) or R (stainless steel)
HBC	E	M16	60	8.8	G (electroplated)
HBC	C-N	M16	80	8.8	F (HDG)
HBC	B	M10	40	4.6	F (HDG) or G (electroplated)
HBC	T	M16	60	8.8	F (HDG)

Examples: ❶ Channel bolt ❷ Bolt type ❸ Diameter ❹ Bolt length ❺ Steel grade ❻ Finish or material

HBC-C M12 x 50 8.8 F

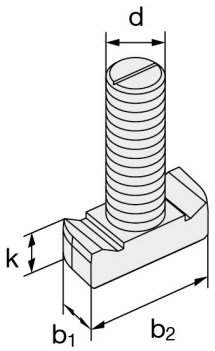


HBC-T M16 x 60 8.8 F



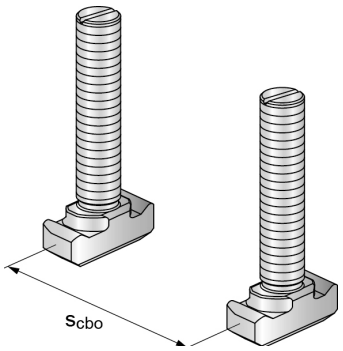
Dimension of channel bolts

Anchor channel	Channel bolt type	Dimensions			
		b_1	b_2	k	d
		(mm)			
HAC-30	HBC-B	19.0	34.0	9.2	10
					12
HAC-40 HAC-50	HBC-C-E	14.0	33.0	10.4	12
		17.0		13.4	16
HAC-40 HAC-50 HAC-60 HAC-70	HBC-C	14.0	33.0	10.4	10
					12
		18.5		11.4	16
				13.9	20
	HBC-C-N	18.5	33.0	11.4	12
					16
				13.9	20
HAC-T50 HAC-T70	HBC-T	18.5	35.4	12.0	12
					16
					20



Minimum spacing for channel bolts

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



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

Steel grade of bolts and corrosion protection

Channel Bolt	Carbon steel [1]		Stainless steel [1]
Steel grade	4.6	8.8	A4-50
f_{uk} [N/mm²]	400	800 / 830 [2]	500
f_{yk} [N/mm²]	240	640 / 660 [2]	210
Corrosion protection	G [3] F [4]		R

[1] Material properties according to table page 6
[2] Material properties according to EN ISO 898-1
[3] Electroplated
[4] Hot-dip galvanized

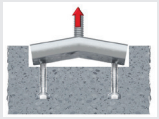
STEEL FAILURE MODES – STATIC RESISTANCE UNDER TENSION, PERPENDICULAR SHEAR AND LONGITUDINAL SHEAR

Static/
quasi-static

Resistance values under tension load - steel failure

Anchor channel			HAC-30	HAC-40	HAC-50	HAC-T50	HAC-60	HAC-70	HAC-T70
Steel failure: Anchor:									
	Characteristic resistance	$N_{Rk,s,a}$ [kN]	18.2	33.1	52.5	52.5	52.5	76.3	76.3
	Design resistance	$N_{Rd,s,a}$ [kN]	10.1	18.4	29.2	29.2	29.2	42.4	42.4
Steel failure: Connection between anchor and channel									
	Characteristic resistance	$N_{Rk,s,c}$ [kN]	18.2	25.0	35.0	35.0	50.1	71.0	71.0
	Design resistance	$N_{Rd,s,c}$ [kN]	10.1	13.9	19.4	19.4	27.8	39.4	39.4
Steel failure: Local flexure of channel lips									
	Characteristic or design spacing of channel bolts	$s_{l,N}$ [mm]	83	82	84	84	87	91	91
	Characteristic resistance	$N^0_{Rk,s,l}$ [kN]	19.9	25.0	35.0	35.0	50.1	71.0	71.0
	Design resistance	$N^0_{Rd,s,l}$ [kN]	11.1	13.9	19.4	19.4	27.8	39.4	39.4

Resistance values under tension load – steel failure

Anchor channel				HAC-30	HAC-40	HAC-50	HAC-T50	HAC-60	HAC-70	HAC-T70
Steel failure: Flexure of channel										
	Characteristic flexural resistance of channel	$M_{Rk,s,flex}$ [Nm]	HBC-B	755	-	-	-	-	-	-
			HBC-C	-	1136	1596	-	2187	3160	-
			HBC-C-E	-	1136	1596	-	-	-	-
			HBC-C-N	-	980	1345	-	2156	3005	-
			HBC-T	-	-	-	1596	-	-	2975
	Design flexural resistance of channel	$M_{Rd,s,flex}$ [Nm]	HBC-B	657	-	-	-	-	-	-
			HBC-C	-	988	1388	-	1902	2748	-
			HBC-C-E	-	988	1388	-	-	-	-
			HBC-C-N	-	852	1170	-	1875	2613	-
			HBC-T	-	-	-	1388	-	-	2587

Displacements under tension load

Anchor channel		HAC-30	HAC-40	HAC-50	HAC-T50	HAC-60	HAC-70	HAC-T70
Tension load	N [kN]	6.6	11.3	14.3	14.7	18.8	26.6	25.2
Short time displacement [1]	δ_{N0} [mm]	1.6	1.7	1.1	1.7	1.1	1.0	1.5
Long time displacement [1]	$\delta_{N\infty}$ [mm]	3.2	3.4	2.2	3.4	2.2	2.0	3.0

[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.

Static/
quasi-static

Resistance values under perpendicular and longitudinal shear load - steel failure

Anchor channel			HAC-30	HAC-40	HAC-50	HAC-T50	HAC-60	HAC-70	HAC-T70
Steel failure: Anchor									
	Characteristic resistance	$V_{Rk,s,a,y}$ [kN]	23.7	39.6	53.6	53.6	77.3	114.8	114.8
		$V_{Rk,s,a,x}$ [kN]	10.2	18.4	29.0	29.0	29.0	41.9	41.9
	Design resistance	$V_{Rd,s,a,y}$ [kN]	15.8	26.4	35.7	35.7	51.5	76.5	76.5
		$V_{Rd,s,a,x}$ [kN]	6.8	12.3	19.3	19.3	19.3	27.9	27.9
Steel failure: Connection between anchor and channel									
	Characteristic resistance	$V_{Rk,s,c,y}$ [kN]	23.7	39.6	53.6	53.6	77.3	114.8	114.8
		$V_{Rk,s,c,x}$ [kN]	9.1	12.5	17.5	17.5	25.1	35.5	35.5
	Design resistance	$V_{Rd,s,c,y}$ [kN]	13.2	22.0	29.8	29.8	42.9	63.8	63.8
		$V_{Rd,s,c,x}$ [kN]	5.1	6.9	9.7	9.7	13.9	19.7	19.7
Steel failure: Local flexure of channel lips under perpendicular shear									
	Characteristic or design spacing of channel bolts	$s_{l,v}$ [mm]	83	82	84	84	87	91	91
	Characteristic resistance	$V^0_{Rk,s,l,y}$ [kN]	23.7	34.9	47.5	47.5	72.2	95.8	95.8
	Design resistance	$V^0_{Rd,s,l,y}$ [kN]	13.2	19.4	26.4	26.4	40.1	53.2	53.2

Static/
quasi-static

Resistance values under longitudinal shear - steel failure

Anchor channel				HAC-30	HAC-40	HAC-50	HAC-T50	HAC-60	HAC-70	HAC-T70
Steel failure: Connection between channel lips and channel bolt										
	Characteristic resistance	$V_{Rk,s,l,x}$ [kN]	HBC-B M12 4.6	3.5	-		-	-		-
			HBC-C-N M12 8.8	-	8.5	8.5		8.5	8.5	
			HBC-C-N M16 8.8		19.7	19.7		19.7	19.7	
			HBC-C-N M20 8.8		-	24.1		24.1	24.1	
			HBC-T M12 8.8		-	-	15.1	-	-	15.1
			HBC-T M16 8.8				20.1			20.1
			HBC-T M20 8.8				20.1			20.1
	Design resistance	$V_{Rd,s,l,x}$ [kN]	HBC-B M12 4.6	1.4	-		-	-		-
			HBC-C-N M12 8.8	-	3.4	3.4		3.4	3.4	
			HBC-C-N M16 8.8		7.8	7.8		7.8	7.8	
			HBC-C-N M20 8.8		-	9.6		9.6	9.6	
			HBC-T M12 8.8		-	-	7.0	-	-	7.0
			HBC-T M16 8.8				9.3			9.3
			HBC-T M20 8.8				9.3			9.3

Displacements under perpendicular shear

Anchor channel		HAC-30	HAC-40	HAC-50	HAC-T50	HAC-60	HAC-70	HAC-T70
Shear load	V_y [kN]	8.0	13.9	18.9	21.0	29.0	38.0	45.6
Short time displacement [1]	$\delta_{v,y,0}$ [mm]	1.0	1.0	1.5	2.7	1.5	1.5	2.4
Long time displacement [1]	$\delta_{V,y,\infty}$ [mm]	1.5	1.5	2.3	4.1	2.3	2.3	3.6

1) Displacements in midspan of the anchor channel, including slip of channel bolt, deformation of channel lip and slip of the anchor channel in concrete.

Static/
quasi-static

Displacements under longitudinal shear

Anchor channel			HAC-30	HAC-40	HAC-50	HAC-T50	HAC-60	HAC-70	HAC-T70
Channel bolt			**HBC-B**	**HBC-C-N**		**HBC-T**	**HBC-C-N**		**HBC-T**
Shear load	V_x [kN]	M12	1.4	3.4		6.7	3.4		6.7
		M16	-	7.8		8.9	7.8		8.9
		M20		-	9.6	8.9	9.6		8.9
Short time displacement [1]	$\delta_{v,x,0}$ [mm]	M12	0.1	0.05		1.4	0.05		1.4
		M16	-	0.4		1.7	0.4		1.7
		M20		-	0.1	1.7	0.1		1.7
Long time displacement [1]	$\delta_{V,x,\infty}$ [mm]	M12	0.2	0.1		2.1	0.1		2.1
		M16	-	0,6		2,5	0.6		2.5
		M20		-	0.2	2.5	0.2		2.5

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

Resistance values under tension load – steel failure of channel bolts

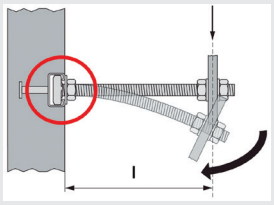
Channel bolt diameter					M10	M12	M16	M20
Steel failure								
	Characteristic resistance	$N_{Rk,s}$ [kN]	HBC-B	4.6	23.2	33.7	-	-
				A4-50	29.0	42.2	-	-
			HBC-C HBC-C-E	4.6	23.2	33.7	62.8	98.0
				8.8	46.4	67.4	125.6	174.3
				A4-50	29.0	42.2	78.5	122.5
			HBC-C-N	8.8	-	67.4	125.6	174.3
			HBC-T	8.8	-	67.4	125.6	177.4
	Design resistance	$N_{Rd,s}$ [kN]	HBC-B	4.6	11.6	16.8	-	-
				A4-50	10.1	14.7	-	-
			HBC-C HBC-C-E	4.6	11.6	16.8	31.4	49.0
				8.8	30.9	44.9	83.7	116.2
				A4-50	10.1	14.8	52.3	42.8
			HBC-C-N	8.8	-	44.9	83.7	116.2
			HBC-T	8.8	-	44.9	83.7	116.2

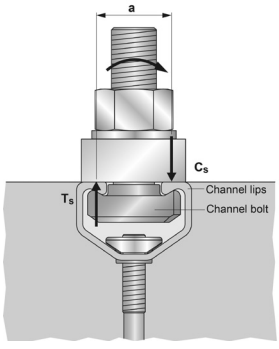
Static/
quasi-static

Resistance values under shear load – steel failure of channel bolts

Channel bolt diameter					M10	M12	M16	M20
Steel failure								
	Characteristic resistance	$V_{Rk,s}$ [kN]	HBC-B	4.6	13.9	20.2	-	-
				A4-50	17.4	25.3	-	-
			HBC-C HBC-C-E	4.6	13.9	20.2	37.7	58.8
				8.8	23.2	33.7	62.8	101.7
				A4-50	17.4	25.3	47.1	73.5
			HBC-C-N	8.8	-	33.7	62.8	101.7
			HBC-T	8.8	-	33.7	62.8	101.7
	Design resistance	$V_{Rd,s}$ [kN]	HBC-B	4.6	8.3	12.1	-	-
				A4-50	7.3	10.6	-	-
			HBC-C HBC-C-E	4.6	8.3	12.1	22.6	35.2
				8.8	18.6	27.0	50.2	60.9
				A4-50	7.3	10.6	19.8	30.9
			HBC-C-N	8.8	-	26.9	50.2	81.3
			HBC-T	8.8	-	26.9	50.2	81.3

Resistance values under shear load with lever arm – steel failure of channel bolt

Channel bolt diameter					M10	M12	M16	M20
Flexure resistance-steel								
	Characteristic flexure resistance	$M^0_{Rk,s}$ [Nm]	HBC-B	4.6	29.9	52.4	-	-
				A4-50	37.4	65.5	-	-
			HBC-C HBC-C-E	4.6	29.9	52.4	133.2	259.6
				8.8	59.8	104.8	266.4	538.7
				A4-50	37.4	65.5	166.5	324.5
			HBC-C-N	8.8	-	104.8	266.4	538.7
			HBC-T	8.8	-	104.8	266.4	538.7
	Design flexure resistance	$M^0_{Rd,s}$ [Nm]	HBC-B	4.6	17.9	31.3	-	-
				A4-50	15.7	27.5	-	-
			HBC-C HBC-C-E	4.6	17.9	31.3	79.8	155.5
				8.8	47.8	83.8	213.1	430.9
				A4-50	15.7	27.5	70.0	136.3
			HBC-C-N	8.8	-	83.8	213.1	430.9
			HBC-T	8.8	-	83.8	213.1	430.9
	Internal lever arm	a [mm]	HBC-B	4.6, A4-50	25.0	27.0	-	-
			HBC-C HBC-C-E	4.6, 8.8, A4-50	24.0	26.0	28.0	30.0
			HBC-C-N	8.8	-	26.0	28.0	30.0
			HBC-T	8.8	-	26.0	28.0	30.0

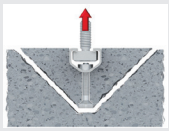


T_s = tension force acting on the channel lips
C_s = compression force acting on the channel lips
$M^0_{Rk,s} \leq 0.5 . N_{Rk,s,l} . a$
$M^0_{Rk,s} \leq 0.5 . N_{Rk,s,} . a$
a= internal lever arm

CONCRETE FAILURE MODES – STATIC RESISTANCE UNDER TENSION AND PERPENDICULAR SHEAR

Static/
quasi-static

Resistance values under tension load – concrete failure

Anchor channel				HAC-30	HAC-40	HAC-50	HAC-T50	HAC-60	HAC-70	HAC-T70
Pullout failure										
	Characteristic resistance in cracked concrete C12/15		$N_{Rk,p}$ [kN]	8.0	18.8	23.2	23.2	23.2	32.0	32.0
	Design resistance in cracked concrete C12/15		$N_{Rd,p}$ [kN]	5.3	12.5	15.4	15.4	15.4	21.3	21.3
	Amplification factor for other concrete grades		Ψ_c	$\Psi_c = \frac{f_{c,specified}}{12MPa}$						
Concrete cone failure										
	Product factor k_1 for characteristic resistance	cracked	$k_{cr,N}$	7.7	8.0	8.2	8.2	8.6	8.9	8.9
		un-cracked	$k_{ucr,N}$	11.0	11.5	11.7	11.7	12.3	12.7	12.7
	Product factor k_1 for design resistance	cracked	$k_{cr,N}$	5.1	5.3	5.5	5.5	5.7	5.9	5.9
		un-cracked	$k_{ucr,N}$	7.3	7.7	7.8	7.8	8.2	8.5	8.5
Splitting										
	Characteristic edge distance		$c_{cr,sp}$ [mm]	204	273	318	318	444	525	525
	Characteristic spacing		$s_{cr,sp}$ [mm]	$2.0 \cdot c_{cr,sp}$						

Resistance values under perpendicular shear load – concrete failure

Anchor channel				HAC-30	HAC-40	HAC-50	HAC-T50	HAC-60	HAC-70	HAC-T70
Pry out failure										
	Product factor		k_8	2.0						
Concrete edge failure										
	Product factor k_{12} for characteristic resistance	cracked concrete	$k_{cr,V}$	7.5	7.5	7.5	7.5	7.5	7.5	7.5
		un-cracked concrete	$k_{ucr,V}$	10.5	10.5	10.5	10.5	10.5	10.5	10.5
	Product factor k_{12} for design resistance	cracked concrete	$k_{cr,V}$	5.0	5.0	5.0	5.0	5.0	5.0	5.0
		un-cracked concrete	$k_{ucr,V}$	7.0	7.0	7.0	7.0	7.0	7.0	7.0

STEEL FAILURE MODES – COMBINED LOADING

Static/
quasi-static

Resistance under combined tension and shear loads

Anchor channel		HAC-30	HAC-40	HAC-50	HAC-T50	HAC-60	HAC-70	HAC-T70
Steel failure: Local flexure of channel lips and flexure of channel								
Product factor	k_{13}	1.0 [1]						
Steel failure: Anchor and connection between anchor and channel								
Product factor	k_{14}	1.0 [2]						

[1] k_{13} can be taken as 2,0 if $V_{Rd,s,l}$ is limited to $N_{Rd,s,l}$.
[2] k_{14} can be taken as 2,0 if max($V_{Rd,s,a}$; $V_{Rd,s,c}$) is limited to min($N_{Rd,s,a}$; $N_{Rd,s,c}$).

FIRE RESISTANCE

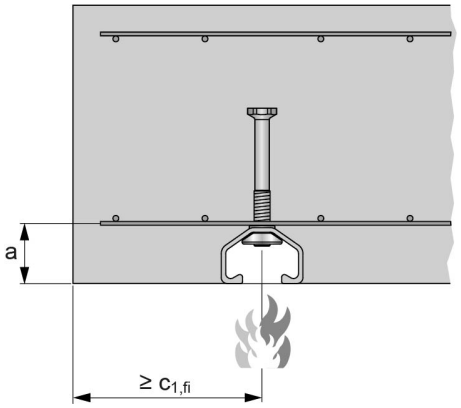
Fire
resistance

Resistance values under tension and shear load under fire exposure

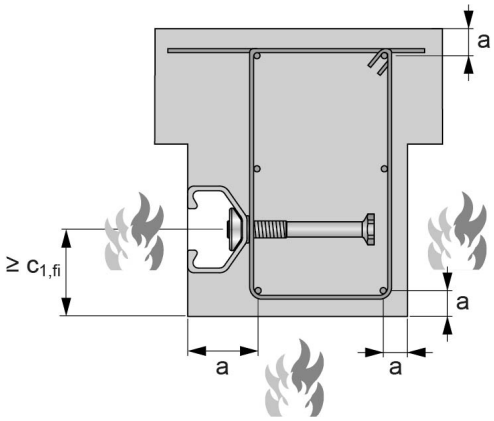
Anchor channel				HAC-30	HAC-40	HAC-50	HAC-60	HAC-70
Steel failure of anchor, connection between anchor and channel, local flexure of channel lip								
Characteristic and design resistance in cracked concrete C20/25	R30	$N_{Rk,s,fi}$ = $V_{Rk,s,fi}$ or $N_{Rd,s,fi}$ = $V_{Rd,s,fi}$	[kN]	2.5	2.8	5.7		
	R60			1.8	2.3	4.0		
	R90			1.1	1.7	2.3		
Axial spacing	R30	u	[mm]	35		50		
	R60			35		50		
	R90			45		50		

Resistance under tension and shear load of channel bolt under fire exposure

Channel bolt diameter					M8	M10	M12	M16	M20
Steel failure without lever arm									
Characteristic and design resistance	HBC-B	R30	$N_{Rk,s,fi}$ = $V_{Rk,s,fi}$ or $N_{Rd,s,fi}$ = $V_{Rd,s,fi}$	[kN]	1.0	1.7	2.5	-	
		R60			0.8	1.3	1.8		
		R90			0.6	0.9	1.1		
	HBC-C	R30			-	2.5	3.1	5.7	
		R60			-	1.9	2.5	4.0	
		R90			-	1.3	1.9	2.3	

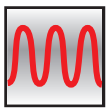


Fire exposure from one side only



Fire exposure from more than one side

FATIGUE LOADING



Fatigue

Possible channel / channel bolt combination under fatigue load

Anchor channel	Special screw type	Diameter	Steel grade	Corrosion class
HAC-30	HBC-B	M10	4.6	G [1] F [2]
		M12		
HAC-40	HBC-C	M12	4.6 8.8	
		M16		
		M20		
HAC-50		M16	4.6 8.8	
		M20		
HAC-60		M16	4.6 8.8	
		M20		
HAC-70		M20	4.6 8.8	

[1] Electroplated
[2] Hot-dip galvanized

Characteristic resistances under fatigue tension load - steel failure with n load cycles without static preload (N_{Ed} = 0) [1]

Anchor channel		HAC-30	HAC-40	HAC-50	HAC-60	HAC-70
Steel failure	**n**	$\Delta N_{Rk,s,0,n}$ [kN]				
Characteristic resistances under fatigue tension load without static preload	$\leq 10^6$	1.76	1.57	2.66	3.54	6.44
	$\leq 3 \cdot 10^6$	1.60	1.50	2.60	3.50	6.40
	$\leq 10^7$					
	$\leq 3 \cdot 10^7$					
	$> 6 \cdot 10^7$					

[1] Design method I according to EOTA TR 050

Reduction factor $\eta_{c,fat}$ with n load cycles without static preload (N_{Ed} = 0) [1]

Anchor channel		HAC-30	HAC-40	HAC-50	HAC-60	HAC-70
Concrete cone & pullout failure	n	$\eta_{c,fat}$ [-]				
Reduction factor for $\Delta N_{Rk,p;0;n} = \eta_{c,fat}$, $N_{Rk,p}$ $\Delta N_{Rk,c;0;n} = \eta_{c,fat}$, $N_{Rk,c}$ with $N_{Rk,p}$ at page 14 - 1st table $N_{Rk,c}$ calculated according to EOTA TR 047	$\leq 10^6$	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] Design method I according to EOTA TR 050

Characteristic resistances under fatigue tension load with n →∞ load cycles without static preload (N_{Ed} = 0) [1]

Anchor channel		HAC-30	HAC-40	HAC-50	HAC-60	HAC-70
Steel failure						
$\Delta N_{Rk,s;0;\infty}$	[kN]	1.6	1.5	2.6	3.5	6.4
Concrete cone and pullout failure						
$\eta_{c,fat}$	[-]	0.5				

[1] Design method II according to EOTA TR 050

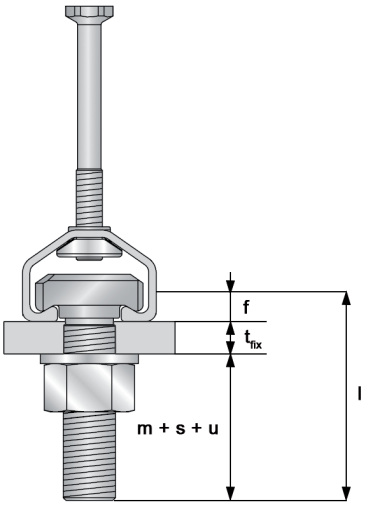
For the reduction of the characteristic resistances given in resistance tables on the left side in the transition zone from the static resistance to the fatigue limit resistance the partial safety factors are calculated as follows:

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

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: γ_M **= 1,8 and** $\gamma_{M,fat}$ **= 1,35**

In absence of other national regulations the following safety factor $\gamma_{M,fat}$ is recommended for design method II according to EOTA TR 050: $\gamma_{M,fat}$ **= 1,35**

Determination of required T-Bolt length



Required T-Bolt length $l = t_{fix} + f + (m+s+u)$

Profile	Production	Height of channel lip (f)	T-Bolt Type	m+s+u (mm)			
		[mm]		M10	M12	M16	M20
HAC-30	TCRS	7.5	HBC-B	13.9	17.3	-	-
HAC-40	TCRS	4.5	HBC-C	13.9	17.3	21.8	-
HAC-50	TCRS	5.3	HBC-C	13.9	17.3	21.8	27.0
HAC-60	TCRS	6.3	HBC-C	13.9	17.3	21.8	27.0
HAC-70	TCRS	7.4	HBC-C	13.9	17.3	21.8	27.0

l = nominal length of channel bolt
t_{fix} = fastenable thickness (Thickness of the attached part)
f = height of channel lip
m = thickness of the nut (ISO 4032)
s = thickness of the washer
u = channel bolt projection

Installation instructions for anchor channels HAC and HAC-T

1) Correct selection of anchor channel in accordance with the design specification.

2) If cutting of the anchor channel is necessary, cut the channel with an end spacing

x = 25mm or 0.98 inch

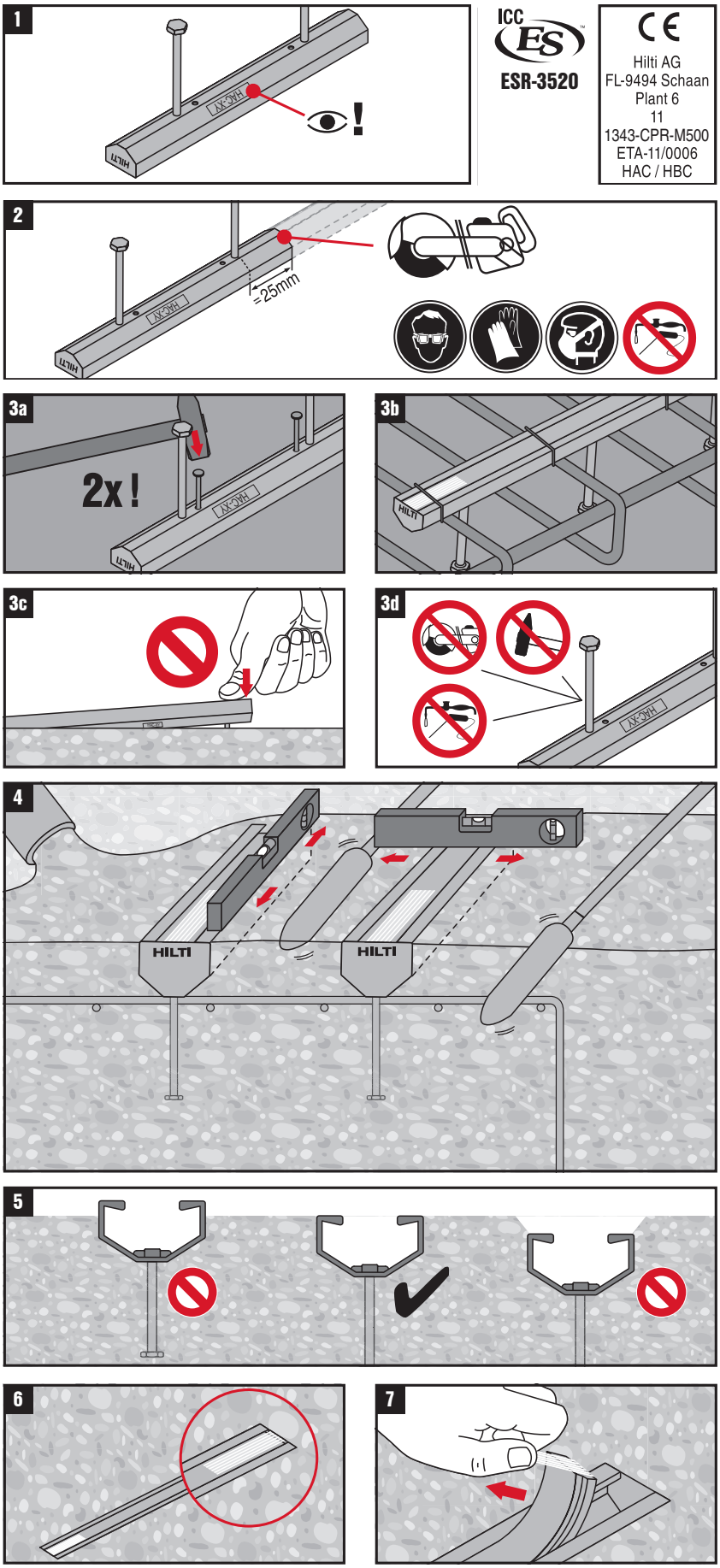
3) Position the anchor channel such that the channel lips will be flush with the surface of the concrete. Secure anchor channels to formwork (3a) or adjoining reinforcing steel (3b) with nails, staples, rivets, or wire ties as appropriate. Supports and attachments shall be adequate to ensure that anchor channels remain in position during concrete placement. Anchor channels shall not be pushed into fresh concrete (3c). Anchors shall not be bent, cut or otherwise modified (3d).

4) Anchor channels shall be protected from intrusion of concrete and slurry into the channel during concrete placement. Place and consolidate concrete around anchor channels to mitigate voids.

Make sure that channels are leveled.

5) Installed anchor channels must be flush with the concrete surface.

6 and 7) Remove the foam filler after hardening of concrete and striking the formwork.



Installation instructions for HBC-B channel bolts

1) Select Hilti channel bolt type HBC-B in accordance with the design specification.

2) Place the channel bolt in the channel and lock the channel bolt in the channel by turning it 90 degrees.

3) Verify alignment of the bolt with the groove. Groove of bolt must be perpendicular to the longitudinal axis of the channel.

4) Verify that the channel bolt is not located outside of that portion of the channel bounded by the outermost anchors.

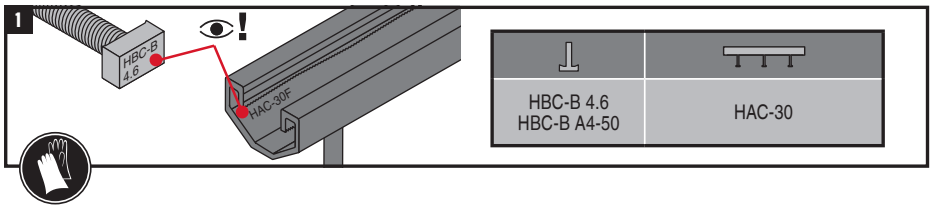
5) Do not cut channel bolts.

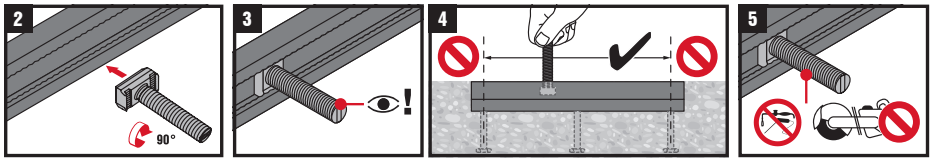
6) Install the fixture distinguishing between installation type A and installation type B.

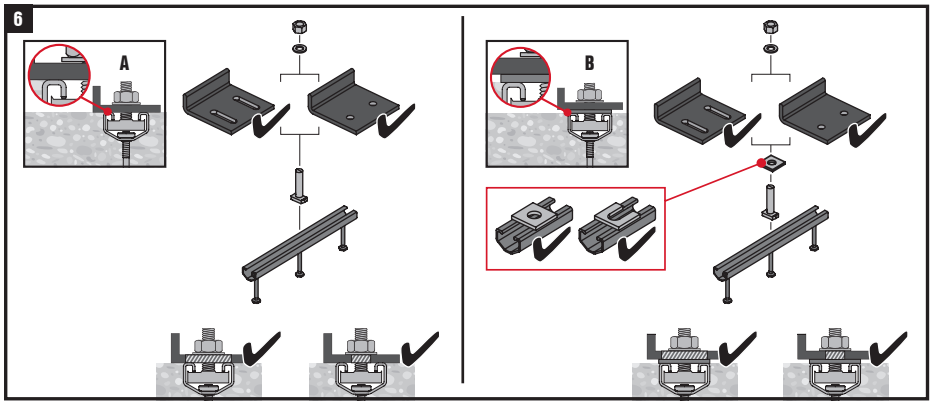
- For installation type A the fixture is in contact with the concrete surface and the channel profile.
- For installation type B suitable steel element e.g. square plate washer is used to avoid introducing forces into the concrete during application of the installation torque T_{inst}. The steel element shall have sufficient stiffness to avoid deformation of the channel lips.

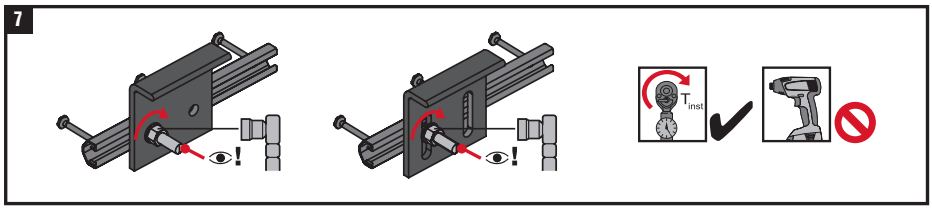
7) Apply the installation torque T_{inst} to the channel bolt with a calibrated torque wrench. Do not exceed the value T_{inst} distinguishing between installation type A and installation type B.

Select the correct installation torque T_{inst} according to material, channel type, channel bolt diameter, and installation type A or B.









		Tinst	
		A	B
		HAC-30	HAC-30
M10	4.6, A4-50	15 Nm / 11 ft-lb	15 Nm / 11 ft-lb
M12	4.6, A4-50	25 Nm / 19 ft-lb	25 Nm / 19 ft-lb

Hilti Instructions for Use (IFU) for Hilti HBC-B channel bolts

Installation instructions for HBC-C channel bolts

1) Select Hilti channel bolt type HBC-C in accordance with the design specification.

2) Place the channel bolt in the channel and lock the channel bolt in the channel by turning it 90 degrees.

3) Verify alignment of the bolt with the groove. Groove of bolt must be perpendicular to the longitudinal axis of the channel.

4) Verify that the channel bolt is not located outside of that portion of the channel bounded by the outermost anchors.

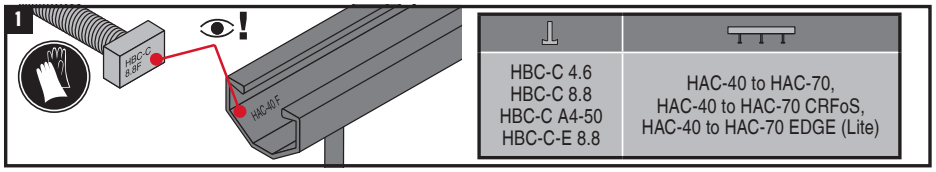
5) Do not cut channel bolts.

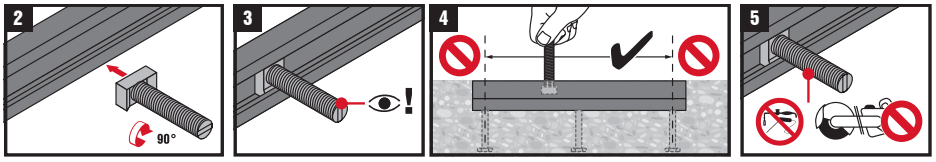
6) Install the fixture distinguishing between installation type A and installation type B.

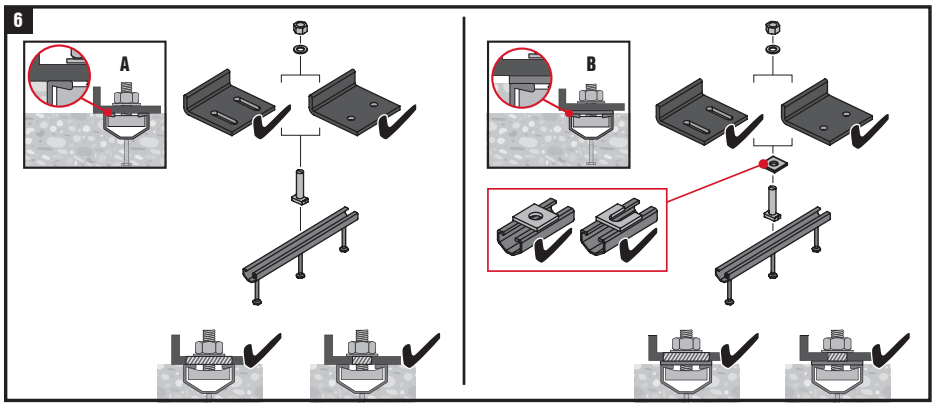
- For installation type A the fixture is in contact with the concrete surface and the channel profile.
- For installation type B suitable steel element e.g. square plate washer is used to avoid introducing forces into the concrete during application of the installation torque T_{inst}. The steel element shall have sufficient stiffness to avoid deformation of the channel lips.

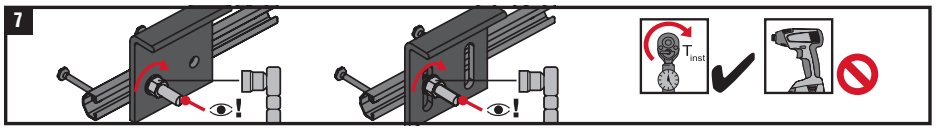
7) Apply the installation torque T_{inst} to the channel bolt with a calibrated torque wrench. Do not exceed the value T_{inst} distinguishing between installation type A and installation type B.

Select the correct installation torque T_{inst} according to material, channel type, channel bolt diameter, and installation type A or B.









		Tinst							
		A				B			
		HAC-40	HAC-50	HAC-60	HAC-70	HAC-40	HAC-50	HAC-60	HAC-70
M10	4.6, A4-50	15 Nm / 11 ft-lb				15 Nm / 11 ft-lb			
	8.8	15 Nm / 11 ft-lb				48 Nm / 35 ft-lb			
M12	4.6, A4-50	25 Nm / 19 ft-lb				25 Nm / 19 ft-lb			
	8.8	25 Nm / 19 ft-lb				75 Nm / 55 ft-lb			
M16	4.6, A4-50	60 Nm / 44 ft-lb				60 Nm / 44 ft-lb			
	8.8	60 Nm / 44 ft-lb				185 Nm / 136 ft-lb			
M20	4.6, A4-50	70 Nm / 52 ft-lb	105 Nm / 78 ft-lb	120 Nm / 89 ft-lb		120 Nm / 89 ft-lb			
	8.8	70 Nm / 52 ft-lb	105 Nm / 78 ft-lb	120 Nm / 89 ft-lb		320 Nm / 236 ft-lb			

Hilti Instructions for Use (IFU) for Hilti HBC-C channel bolts

Installation instructions for HBC-T channel bolts

1) Select Hilti serrated channel bolt in accordance with the design specification.

2) Place the channel bolt in the channel and lock the channel bolt in the channel by turning it 90 degrees.

3) Verify alignment of the bolt with the groove. Groove of bolt must be perpendicular to the longitudinal axis of the channel.

4) Verify that the channel bolt is not located outside of that portion of the channel bounded by the outermost anchors.

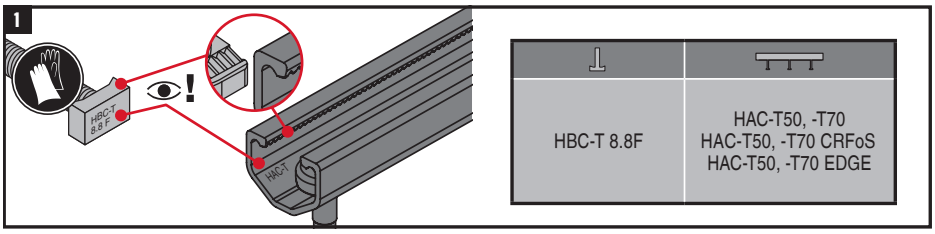
5) Do not cut channel bolts.

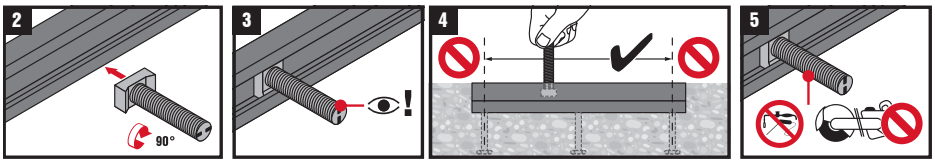
6) Install the fixture distinguishing between installation type A and installation type B.

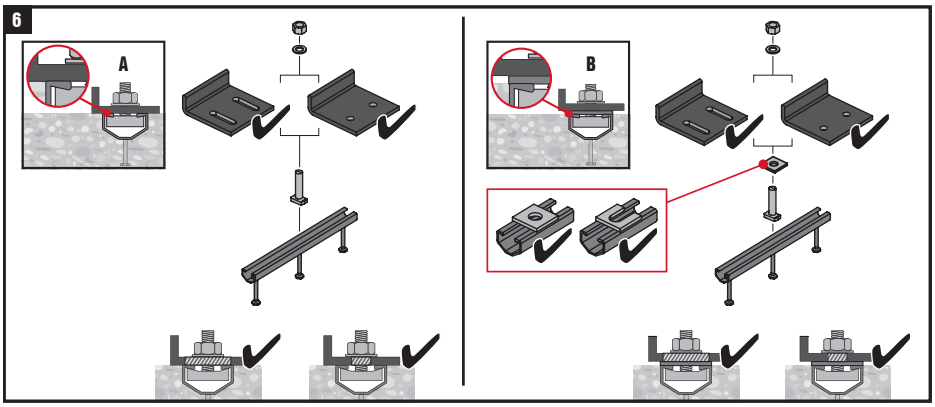
- For installation type A the fixture is in contact with the concrete surface and the channel profile.
- For installation type B suitable steel element e.g. square plate washer is used to avoid introducing forces into the concrete during application of the installation torque T_{inst}. The steel element shall have sufficient stiffness to avoid deformation of the channel lips.

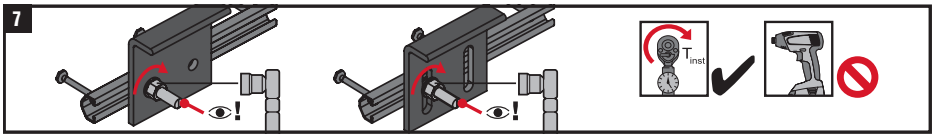
7) Apply the installation torque T_{inst} to the channel bolt with a calibrated torque wrench. Do not exceed the value T_{inst} distinguishing between installation type A and installation type B. Complete removal and reinstallation of the channel bolt HBC-T is not allowed.

Select the correct installation torque T_{inst} according to material, channel type, channel bolt diameter, and installation type A or B.









		T_{inst}			
		A		B	
		HAC-T50	HAC-T70	HAC-T50	HAC-T70
M12	8.8	75 Nm / 55 ft-lb		75 Nm / 55 ft-lb	
M16	8.8	100 Nm / 74 ft-lb		185 Nm / 136 ft-lb	
M20	8.8	120 Nm / 89 ft-lb		320 Nm / 236 ft-lb	

Installation instructions for HBC-C-N channel bolts

1) Select Hilti channel bolt in accordance with the design specification.

2) Place the channel bolt in the channel and lock the channel bolt in the channel by turning it 90 degrees.

3) Verify alignment of the bolt with the groove. Groove of bolt must be perpendicular to the longitudinal axis of the channel.

4) Verify that the channel bolt is not located outside of that portion of the channel bounded by the outermost anchors.

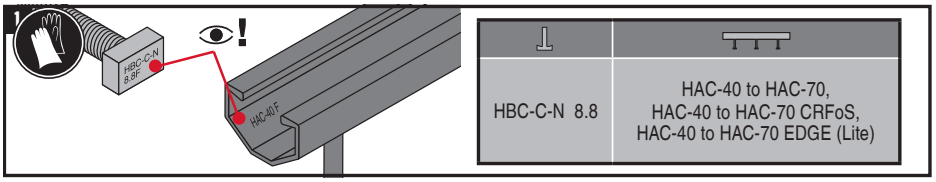
5) Do not cut channel bolts.

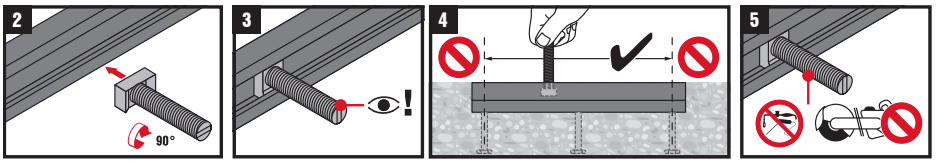
6) Install the fixture distinguishing between installation type A and installation type B.

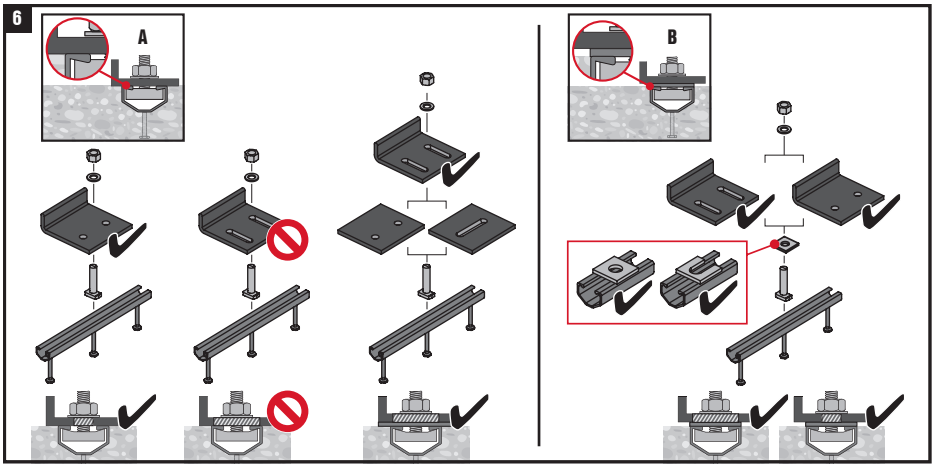
- For installation type A the fixture is in contact with the concrete surface and the channel profile.
- For installation type B suitable steel element e.g. square plate washer is used to avoid introducing forces into the concrete during application of the installation torque T_{inst}. The steel element shall have sufficient stiffness to avoid deformation of the channel lips.

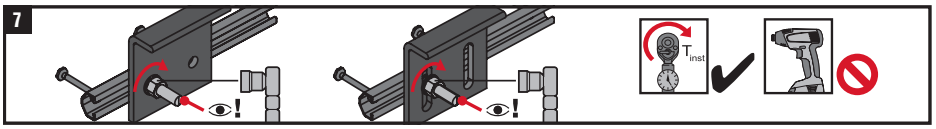
7) Apply the installation torque T_{inst} to the channel bolt with a calibrated torque wrench. Do not exceed the value T_{inst} distinguishing between installation type A and installation type B. Complete removal and reinstallation of the channel bolt HBC-C-N is not allowed.

Select the correct installation torque T_{inst} according to material, channel type, channel bolt diameter, and installation type A or B.









		Tinst							
		A				B			
		HAC-40	HAC-50	HAC-60	HAC-70	HAC-40	HAC-50	HAC-60	HAC-70
M12	8.8	75 Nm / 55 ft-lb				75 Nm / 55 ft-lb			
M16	8.8	185 Nm / 136 ft-lb				185 Nm / 136 ft-lb			
M20	8.8	–	320 Nm / 236 ft-lb			–	320 Nm / 236 ft-lb		

Hilti Aktiengesellschaft
9494 Schaan, Liechtenstein
P +423-234-2111

October, 1th 2019