Deutsches Institut für Bautechnik

Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

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European Technical Assessment

ETA-14/0027 of 3 April 2014

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	Vorpa Concrete Screw CSB CE
Product family to which the construction product belongs	Concrete screw for use in concrete
Manufacturer	VORPA srl Via S. Leo 5 47838 Riccione (RN) ITALIEN
Manufacturing plant	Italy-Plant 1
This European Technical Assessment contains	14 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	Guideline for European technical approval of "Metal anchors for use in concrete", ETAG 001 Part 3: "Undercut anchors", April 2013, used as European Assessment Document (EAD) according to Article 66 Paragraph 3 of Regulation (EU) No 305/2011.

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Specific Part

1 Technical description of the product

The Vorpa Concrete Screw CSB CE of sizes 8, 10, 12 and 16 is made of zinc plated steel. The anchor is screwed into a predrilled cylindrical drill hole. The special thread of the anchor cuts an internal thread into the member while setting. The anchorage is characterised by mechanical interlock in the special thread.

The Illustration and the description of the product are 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 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 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 for tension loads	See Annex C 1
Characteristic resistance for shear	See Annex C 2
Displacements under tension loads	See Annex C 1
Displacements under shear loads	See Annex C 2

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Characteristic values for tension loads under fire exposure	See Annex C 3
Characteristic values for shear loads under fire exposure	See Annex C 4

3.3 Hygiene, health and the environment (BWR 3)

Regarding dangerous substances there may be requirements (e.g. transposed European legislation and national laws, regulations and administrative provisions) applicable to the products falling within its scope of this European Technical Assessment. In order to meet the provisions of the EU-Construction Products Regulation, these requirements need also to be complied with, when and where they apply.

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3.4 Safety in use (BWR 4)

For Basic Works Requirement Safety in use the same criteria are valid as for Basic Works Requirement Mechanical resistance and stability.

3.5 Protection against noise (BWR 5)

Not applicable.

3.6 Energy economy and heat retention (BWR 6)

Not applicable.

3.7 Sustainable use of natural resources (BWR 7)

For the sustainable use of natural resources no performance was investigated for this product.

3.8 General aspects

The verification of durability is part of testing the essential characteristics. Durability is only ensured if the specifications of intended use according to Annex B are taken into account.

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

According to Decision of the Commission of 24 June 1996 (96/582/EC) (OJ L 254 of 08.10.96 p. 62-65), the system of assessment and verification of constancy of performance (see Annex V and Article 65 Paragraph 2 to Regulation (EU) No 305/2011) given in the following table applies.

Product	Intended use	Level or class	System
Metal anchors for use in concrete (heavy-duty type)	For fixing and/or supporting concrete structural elements or heavy units such as cladding and suspended ceilings	—	1

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

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

Issued in Berlin on 3 April 2014 by Deutsches Institut für Bautechnik

Gerhard Breitschaft
President

Beglaubigt:
Baderschneider

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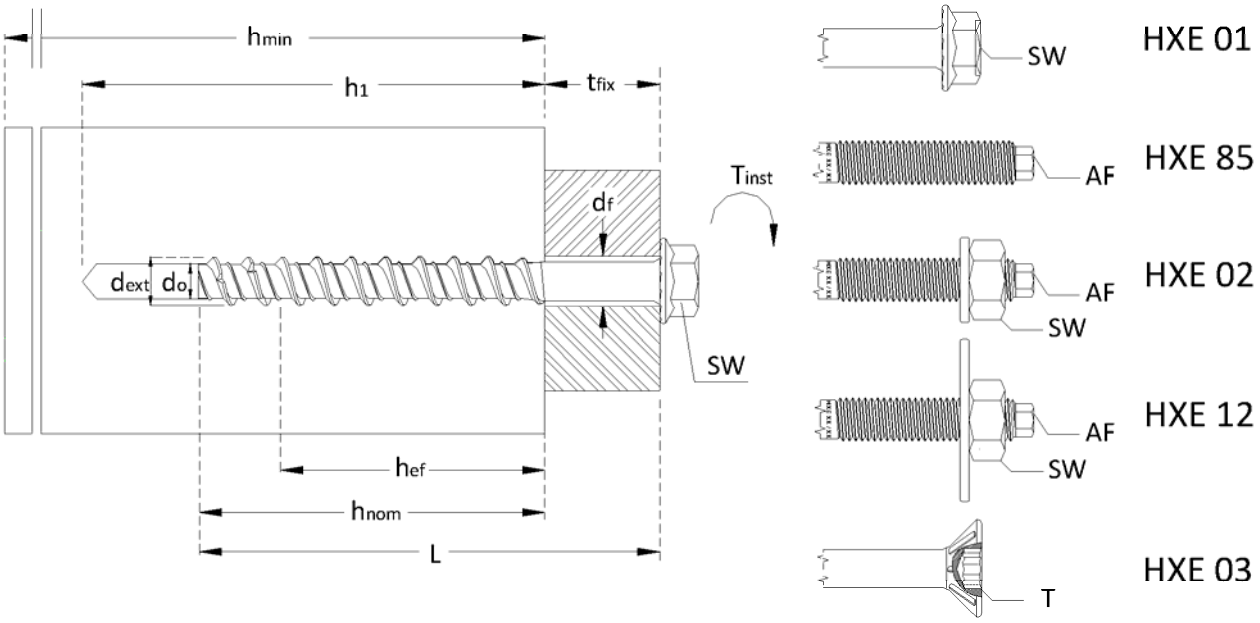
Installed condition anchor



d_0: Drill hole diameter
d_{ext}: Outside diameter of anchor
t_{fix}: Maximum thickness of fixture
d_f: Diameter of the clearance hole in the fixture
h_{min}: Minimum thickness of concrete member
h_1: Depth of the drill hole
h_{nom}: Minimum overall embedment depth
h_{ef}: Effective embedment depth
SW: Wrench size
AF: Hexagonal shank size
T: Hexalobular socket number
T_{INST}: Required torque moment

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Vorpa Concrete Screw CSB CE	Annex A 1
Product description Installed condition	

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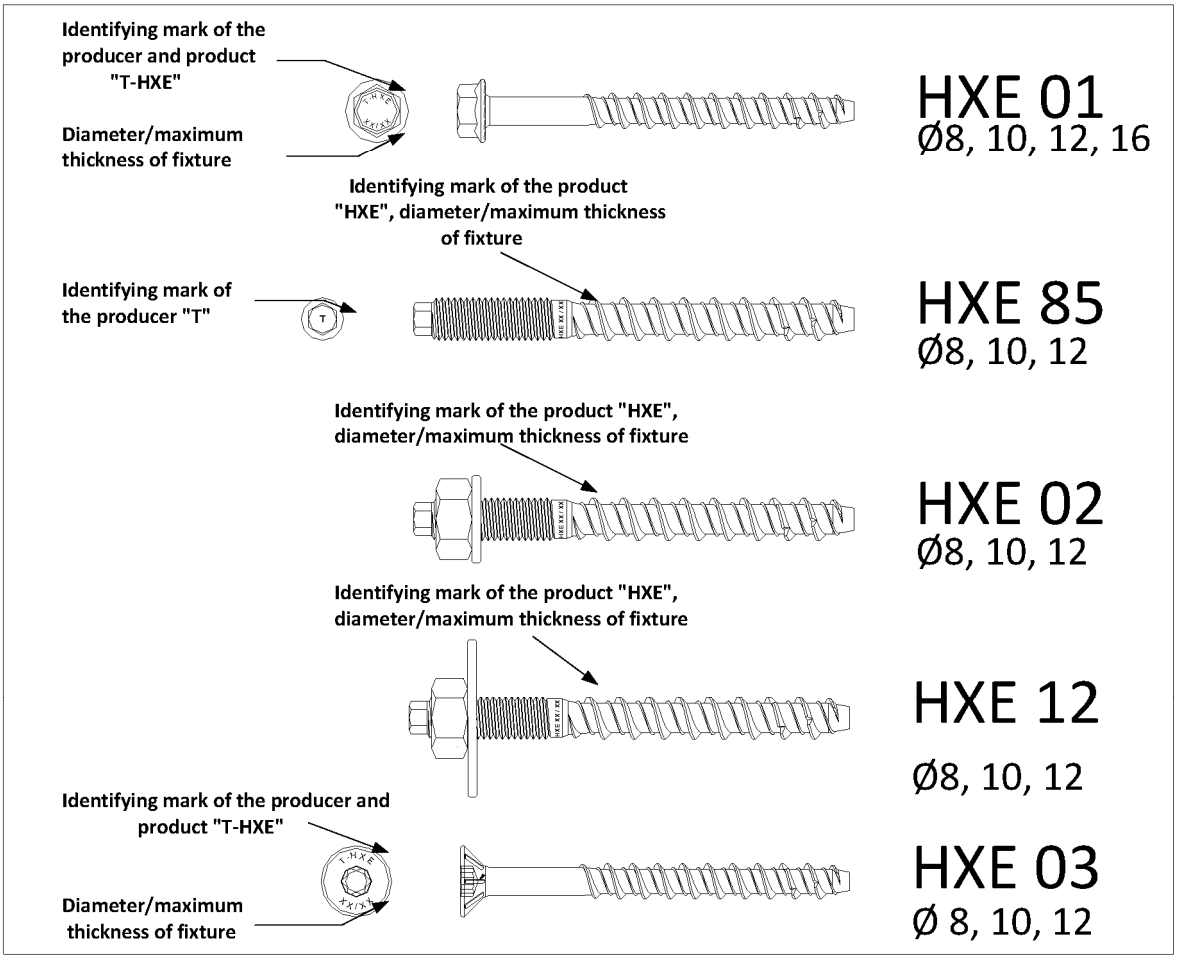
Designation of Screw anchors



The marking of embedment depth is given by the thread itself.

Table A1: Designation of screw anchor and materials

Type	Description	f_y [MPa]	f_u [MPa]	Finishing
HXE 01	Hexagonal flanged washer head screw	600	750	Materials galvanised ≥ 5µm according to ISO 4042:1999
HXE 85	Dual thread screw with hexagonal shank			
HXE 02	Dual thread screw with hexagonal shank, nut and washer according to ISO 7089:2000			
HXE 12	Dual thread screw with hexagonal shank, nut and washer according to ISO 7093:2000			
HXE 03	Flat countersunk head with ribs screw			

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Vorpa Concrete Screw CSB CE

Product description
Designation of screw anchor
Materials

Annex A 2

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Specifications of intended use

Anchorages subject to:

- Static and quasi-static loads: all sizes.
- Fire exposure: all sizes.

Base materials:

- Reinforced or unreinforced normal weight concrete according to EN 206-1:2000.
- Strength classes C20/25 to C50/60 according to EN 206-1:2000.
- Cracked or non-cracked concrete: all sizes.

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions.

Design:

- Anchorages 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 is indicated on the design drawings (e. g. position of the anchor relative to reinforcement or to supports, etc.).
- Anchorages are designed in accordance with ETAG 001, Annex C, design method A, Edition August 2010
- In case of requirements for resistance to fire exposure it must be ensured that local spalling of the concrete cover does not occur.

Installation:

- Hole drilling by hammer drilling only.
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- In case of aborted hole: new drilling at a minimum distance away of twice the depth of the aborted hole or smaller distance if the aborted hole is filled with high strength mortar and if under shear or oblique tension load it is not the direction of the load application.
- After installation further turning of the anchor is not possible. The head of the anchor is supported on the fixture and is not damaged.

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Vorpa Concrete Screw CSB CE	Annex B 1
Intended Use Specifications	

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Table B1: Installation parameters HXE 01

Denomination		HXE Ø8/6	HXE Ø10/8[1)]	HXE Ø12/10	HXE Ø16/14
Nominal drill hole diameter	d_o = [mm]	6	8	10	14
Cutting diameter of drill bit	$d_{cut} \leq$ [mm]	6.40	8.45	10.45	14.50
Effective anchorage depth	h_{ef} = [mm]	48	56	64	85
Depth of drill hole	h_1 = [mm]	75	85	100	140
Diameter of clearance in the fixture	d_f = [mm]	9	12	14	18
Overall anchor embedment depth in the concrete	h_{nom}=[mm]	60	70	80	110
Required torque moment	T_{inst} = [Nm]	20	50	80	160
Minimum thickness of concrete member	h_{min} = [mm]	100	110	130	170
Outside diameter of anchor	d_{ext} = [mm]	8	10	12	16
Wrench size HXE 01	SW = [mm]	10	13	15	21
Minimum thickness of fixture	t_{fix}=[mm]	≥5	≥5	≥5	≥5
Minimum length of the anchor HXE 01	L=[mm]	≥65	≥75	≥85	≥115
Minimum edge distance	c_{min} = [mm]	45	50	60	80
	for s ≥ [mm]	45	50	60	80
Minimum spacing	s_{min} = [mm]	45	50	60	80
	for c ≥ [mm]	45	50	60	80

[1]) e.g. Ø10/8 means the following : outside diameter of the screw anchor is 10 mm, diameter of drill bit is 8 mm

Table B2: Installation parameters HXE 85, HXE 02 and HXE 12

Denomination		HXE Ø8/6	HXE Ø10/8[1)]	HXE Ø12/10
Nominal drill hole diameter	d_o = [mm]	6	8	10
Cutting diameter of drill bit	$d_{cut} \leq$ [mm]	6.40	8.45	10.45
Effective anchorage depth	h_{ef} = [mm]	48	56	64
Depth of drill hole	h_1 = [mm]	75	90	100
Diameter of clearance in the fixture	d_f = [mm]	9	12	14
Overall anchor embedment depth in the concrete	h_{nom}=[mm]	60	70	80
Required torque moment	T_{inst} = [Nm]	20	50	80
Minimum thickness of concrete member	h_{min} = [mm]	100	110	130
Outside diameter of anchor	d_{ext}= [mm]	8	10	12
Wrench size HXE 02	SW = [mm]	13	17	19
Hexagonal shank size HXE 02[2)]	AF = [mm]	5	7	8
Minimum thickness of fixture	t_{fix}=[mm]	≥5	≥5	≥5
Minimum length of the anchor HXE 02	L=[mm]	≥85	≥100	≥113
Minimum edge distance	c_{min} = [mm]	45	50	60
	for s ≥ [mm]	45	50	60
Minimum spacing	s_{min} = [mm]	45	50	60
	for c ≥ [mm]	45	50	60

[1)] e.g. Ø10/8 means the following : outside diameter of the screw anchor is 10 mm, diameter of drill bit is 8 mm

[2)] setting requires an impact screwdriver 18V.(e.g. DeWalt DC820KB or Milwaukee HD18 HIW)

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Vorpa Concrete Screw CSB CE

Intended Use
Installation parameters of HXE 01, HXE 85, HXE 02 and HXE 12

Annex B 2

Deutsches Institut für Bautechnik DIBt

Table B3: Installation parameters HXE 03

Denomination		HXE Ø8/6	HXE Ø10/8[1)]	HXE Ø12/10
Nominal drill hole diameter	d_o = [mm]	6	8	10
Cutting diameter of drill bit	$d_{cut} \leq$ [mm]	6.40	8.45	10.45
Effective anchorage depth	h_{ef} = [mm]	48	56	64
Depth of drill hole	h_1 = [mm]	75	90	100
Diameter of clearance in the fixture	d_f = [mm]	9	12	14
Overall anchor embedment depth in the concrete	h_{nom}=[mm]	60	70	80
Required torque moment	T_{inst} = [Nm]	20	50	80
Minimum thickness of concrete member	h_{min} = [mm]	100	110	130
Outside diameter of anchor	d_{ext} = [mm]	8	10	12
Six lobe recess HXE 03	T	T30	T40	T50
Minimum thickness of fixture	t_{fix}=[mm]	≥5	≥5	≥5
Minimum length of the anchor HXE 03	L=[mm]	≥65	≥75	≥85
Minimum edge distance	c_{min} = [mm]	45	50	60
	for s ≥ [mm]	45	50	60
Minimum spacing	s_{min} = [mm]	45	50	60
	for c ≥ [mm]	45	50	60

1) e.g. Ø10/8 means the following: outside diameter of the screw anchor is 10 mm, diameter of drill bit is 8 mm

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Vorpa Concrete Screw CSB CE

Intended Use
Installation parameters of HXE 03

Annex B 3

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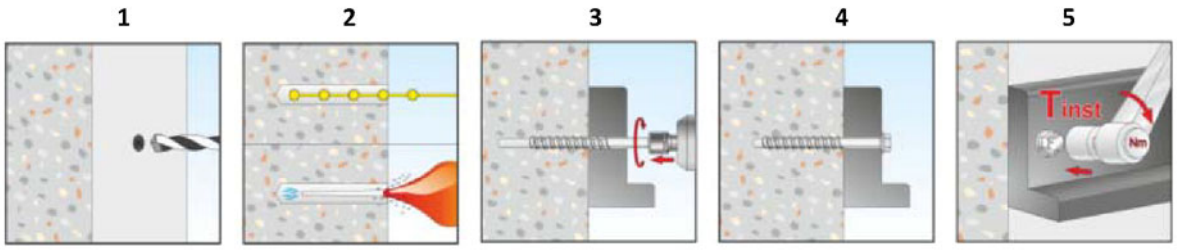
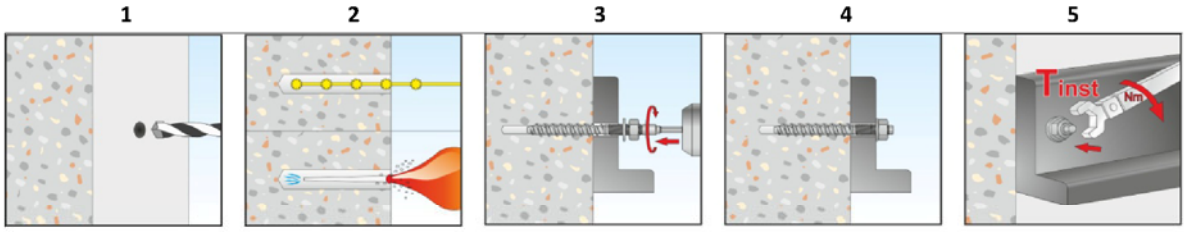
HXE 01 installation instructions



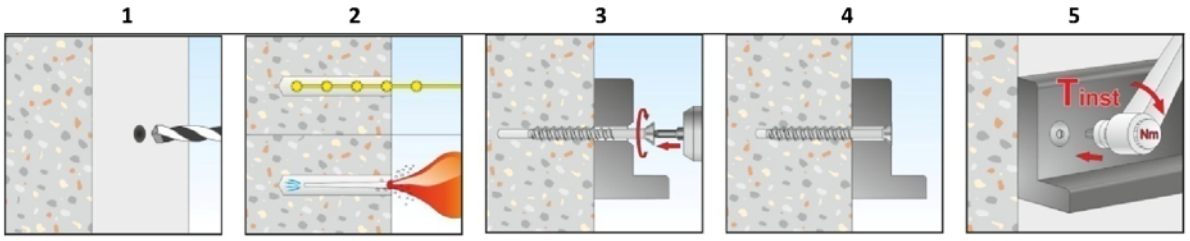
1 – Drill a hole in the base material
2 – Clean the drilled hole
3 – Set the screw in the concrete
4, 5 – Apply the required torque moment

HXE 85, HXE 02 and HXE 12 installation instructions



1 – Drill a hole in the base material
2 – Clean the drilled hole
3 – Set the screw in the concrete
4, 5 – Apply the required torque moment

HXE 03 installation instructions



1 – Drill a hole in the base material
2 – Clean the drilled hole
3 – Set the screw in the concrete
4, 5 – Apply the required torque moment

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Vorpa Concrete Screw CSB CE	Annex B 4
Intended Use Installation instructions	

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Table C1: Characteristic values of resistance under tension loads

Type of anchor / Size			HXE Ø8/6	HXE Ø10/8	HXE Ø12/10	HXE Ø16/14
Steel failure						
Characteristic Resistance	$N_{Rk,s}$	[kN]	20	35	50	95
Installation safety factor	γ_2		1.0			
Pull-out failure						
Effective embedment depth	h_{ef}	[mm]	48	56	64	85
Characteristic Resistance in uncracked concrete C20/25	$N_{Rk,p}$	[kN]	16	20	25	40
Characteristic Resistance in cracked concrete C20/25			4	7.5	9	16
Increasing factors for concrete	Ψ_c	C30/37	1.22			
		C40/50	1.41			
		C50/60	1.55			
Installation safety factor	γ_2		1.4	1.2	1.4	1.2
Concrete cone failure and splitting failure						
Effective embedment depth	h_{ef}	[mm]	48	56	64	85
Spacing	$s_{cr,N}$	[mm]	$3 \times h_{ef}$			
Edge distance	$c_{cr,N}$	[mm]	$1.5 \times h_{ef}$			
Spacing (splitting)	$s_{cr,sp}$	[mm]	160	175	195	255
Edge distance (splitting)	$c_{cr,sp}$	[mm]	80	85	95	130
Installation safety factor	γ_2	-	1.4	1.2	1.4	1.2

Table C2: Displacements under tension loads

Type of anchor / Size			HXE Ø8/6	HXE Ø10/8	HXE Ø12/10	HXE Ø16/14
Service tension load in uncracked concrete C20/25	N	[kN]	7.62	8.89	11.90	13.61
Displacements	δ_{N0}	[mm]	0.76	0.74	0.63	0.74
	$\delta_{N\infty}$	[mm]	0.29	0.34	0.23	0.41
Service tension load in cracked concrete C20/25	N	[kN]	1.90	4.17	4.29	5.44
Displacements	δ_{N0}	[mm]	0.27	0.39	0.45	0.79
	$\delta_{N\infty}$	[mm]	0.53	0.77	0.97	1.05

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Vorpa Concrete Screw CSB CE

Performances
Characteristic values of resistance under tension loads
Displacements under tension loads

Annex C 1

Deutsches Institut für Bautechnik DIBt

Table C3: Characteristic values of resistance under shear loads

Type of anchor / Size			**HXE Ø8/6**	**HXE Ø10/ 8**	**HXE Ø12/10**	**HXE Ø16/14**
Steel failure without level arm						
Characteristic Resistance	$V_{Rk,s}$	[kN]	9.4	20.1	32.4	56.9
Installation safety factor	γ_2		1.0			
Steel failure with level arm						
Characteristic bending moment	$M^0_{Rk,s}$	[Nm]	19	44	83	216
Installation safety factor	γ_2		1.0			
Concrete pry-out failure						
Effective embedment depth	h_{ef}	[mm]	48	56	64	85
Factor in equation (5.6) of the guideline Annex C, Section 5.2.3.3	k	-	1	1	2	2
Installation safety factor	γ_2		1.0			
Concrete edge failure						
Effective anchorage length	h_{ef}	[mm]	48	56	64	85
Effective diameter of the anchor	d	[mm]	6	8	10	14
Installation safety factor	γ_2	-	1.0			

Table C4: Displacements under shear loads

Type of anchor / Size			**HXE Ø8/6**	**HXE Ø10/8**	**HXE Ø12/10**	**HXE Ø16/14**
Service shear load in cracked and uncracked concrete C20/25	V	[kN]	4.50	9.60	15.40	27.10
Displacements	δ_{V0}	[mm]	0.94	1.47	1.87	3.00
	$\delta_{V\infty}$	[mm]	1.41	2.20	2.81	4.50

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Vorpa Concrete Screw CSB CE

Performances
Characteristic values of resistance under shear loads
Displacements under shear loads

Annex C 2

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Table C5: Characteristic values for tension loads under fire exposure

Duration of fire resistance = 30 min, screw anchor HXE			**Ø8/6**	**Ø10/8**	**Ø12/10**	**Ø16/14**
Steel Failure						
Characteristic Resistance	$N_{Rk,s,fi,30}$	[kN]	0.28	0.73	1.51	2.85
Pull-out failure						
Characteristic Resistance in concrete C20/25 to C50/60	$N_{Rk,p,fi,30}$	[kN]	1.00	1.87	2.25	4.0
Concrete cone failure						
Characteristic Resistance in concrete C20/25 to C50/60	$N_{Rk,c,fi,30}$	[kN]	2.87	4.23	5.90	12.0
Duration of fire resistance = 60 min, screw anchor HXE			**Ø8/6**	**Ø10/8**	**Ø12/10**	**Ø16/14**
Steel Failure						
Characteristic Resistance	$N_{Rk,s,fi,60}$	[kN]	0.25	0.64	1.13	2.14
Pull-out failure						
Characteristic Resistance in concrete C20/25 to C50/60	$N_{Rk,p,fi,60}$	[kN]	1.00	1.87	2.25	4.0
Concrete cone failure						
Characteristic Resistance in concrete C20/25 to C50/60	$N_{Rk,c,fi,60}$	[kN]	2.87	4.22	5.90	12.0
Duration of fire resistance = 90 min, screw anchor HXE			**Ø8/6**	**Ø10/8**	**Ø12/10**	**Ø16/14**
Steel Failure						
Characteristic Resistance	$N_{Rk,s,fi,90}$	[kN]	0.19	0.49	0.98	1.85
Pull-out failure						
Characteristic Resistance in concrete C20/25 to C50/60	$N_{Rk,p,fi,90}$	[kN]	1.00	1.87	2.25	4.0
Concrete cone failure						
Characteristic Resistance in concrete C20/25 to C50/60	$N_{Rk,c,fi,90}$	[kN]	2.87	4.22	5.90	12.0
Duration of fire resistance = 120 min, screw anchor HXE			**Ø8/6**	**Ø10/8**	**Ø12/10**	**Ø16/14**
Steel Failure						
Characteristic Resistance	$N_{Rk,s,fi,120}$	[kN]	0.14	0.39	0.75	1.43
Pull-out failure						
Characteristic Resistance in concrete C20/25 to C50/60	$N_{Rk,p,fi,120}$	[kN]	0.8	1.5	1.8	3.20
Concrete cone failure						
Characteristic Resistance in concrete C20/25 to C50/60	$N_{Rk,c,fi,120}$	[kN]	2.30	3.38	4.72	9.59
Spacing	$s_{cr,N}$	[mm]	**4 x h_{ef}**			
	s_{min}		45	50	60	80
Edge distance	$c_{cr,N}$		**2 x h_{ef}**			
	c_{min}		c_{min} = 2xh_{ef}; If fire attack comes from more than one side, the edge distance of the anchor has to be ≥ 300 mm or ≥ 2 x h_{ef}			

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Table C6: Characteristic values for shear loads under fire exposure

Duration of fire resistance = 30min, screw anchor HXE			**Ø8/6**	**Ø10/8**	**Ø12/10**	**Ø16/14**
Shear load without lever arm						
Characteristic resistance	$V_{Rk,s,fi,30}$	[kN]	0.28	0.73	1.51	2.85
Shear load with lever arm						
Characteristic bending resistance	$M_{Rk,s,fi,30}$	[Nm]	0.24	0.87	2.22	5.76
Duration of fire resistance = 60min, screw anchor HXE			**Ø8/6**	**Ø10/8**	**Ø12/10**	**Ø16/14**
Shear load without lever arm						
Characteristic resistance	$V_{Rk,s,fi,60}$	[kN]	0.25	0.64	1.13	2.14
Shear load with lever arm						
Characteristic bending resistance	$M_{Rk,s,fi,60}$	[Nm]	0.22	0.75	1.66	4.32
Duration of fire resistance = 90min, screw anchor HXE			**Ø8/6**	**Ø10/8**	**Ø12/10**	**Ø16/14**
Shear load without lever arm						
Characteristic resistance	$V_{Rk,s,fi,90}$	[kN]	0.19	0.49	0.98	1.85
Shear load with lever arm						
Characteristic bending resistance	$M_{Rk,s,fi,90}$	[Nm]	0.17	0.58	1.44	3.74
Duration of fire resistance = 120min, screw anchor HXE			**Ø8/6**	**Ø10/8**	**Ø12/10**	**Ø16/14**
Shear load without lever arm						
Characteristic resistance	$V_{Rk,s,fi,120}$	[kN]	0.14	0.39	0.75	1.43
Shear load with lever arm						
Characteristic bending resistance	$M_{Rk,s,fi,120}$	[Nm]	0.12	0.46	1.11	2.88
Concrete pry-out failure						
The characteristic resistance $V_{rk,cp,fi,Ri}$ in concrete C20/25 to C50/60 is determined by: $\mathbf{V_{Rk,c,fi(90)} = k \times N_{Rk,c,fi(90)}}$ (≤ R90) and $\mathbf{V_{Rk,c,fi(120)} = k \times N_{Rk,c,fi(120)}}$ (up to R120)						
Factor k	k	-	1	1	2	2
Concrete edge failure						
The characteristic resistance $V_{rk,cp,fi,Ri}$ in concrete C20/25 to C50/60 is determined by $\mathbf{V^0_{Rk,c,fi(90)} = 0.25 \times V^0_{Rk,c}}$ (R30, R60, R90) and $\mathbf{V^0_{Rk,c,fi(120)} = 0.20 \times V^0_{Rk,c}}$ (R120) with $V^0_{Rk,c}$ as an initial value of the characteristic resistance of a single anchor in cracked concrete C20/25						

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