



**INSTITUTO DE CIENCIAS  
DE LA CONSTRUCCIÓN  
EDUARDO TORROJA**

C/ Serrano Galvache n. 4 28033 Madrid (Spain)  
Tel.: (34) 91 302 04 40  
[direccion.ietcc@csic.es](mailto:direccion.ietcc@csic.es) <https://dit.ietcc.csic.es>

**European Technical  
Assessment**

**ETA 18/0020  
of 29/08/2023**

English translation prepared by IETcc. Original version in Spanish language

**General Part**

**Technical Assessment Body issuing the ETA designated according to Art. 29 of Regulation (EU) 305/2011:**

Instituto de Ciencias de la Construcción Eduardo Torroja (IETcc)

**Trade name of the construction product:**

**Vesta VTC-3 Seismic  
Vesta VTC-3 HDG Seismic  
Vesta VTC-3X Seismic  
Vesta VTC-3 A4**

**Product family to which the construction product belongs:**

Torque controlled expansion anchor made of galvanized steel, sherardized steel or stainless steel of sizes M8, M10, M12, M16, M20 and M24 for use in cracked or uncracked concrete.

**Manufacturer:**

**Fikstek Bağlantı Teknolojileri San. ve Tic. LTD. ŞTİ.**  
Dudullu OSB, DES Sanayi Sitesi 103  
58, 34776 Ümraniye, İstanbul, Turkey  
website: [www.vestafix.com](http://www.vestafix.com)

**Manufacturing plants:**

Vesta Factory No:7

**This European Technical Assessment contains:**

18 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 330232-01-0601 "Mechanical fasteners for use in concrete", ed. December 2019

**This version replaces**

ETA 18/0020 issued on 01/03/2018



*English translation prepared by IETcc*

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

This European Technical Assessment may be withdrawn by the issuing Technical Assessment Body, in particular pursuant to information by the Commission according to article 25 (3) of Regulation (EU) No 305/2011.

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## SPECIFIC PART

### 1. Technical description of the product

The Vesta VTC-3 Seismic wedge anchor in the range of M8, M10, M12, M16, M20 and M24 is an anchor made of galvanised steel. The Vesta VTC-3 HDG Seismic wedge anchor in the range of M8, M10, M12, M16 and M20 is an anchor made of sherardized steel. The Vesta VTC-3X Seismic wedge anchor in the range of M8, M10, M12, M16 and M20 is an anchor made of galvanized steel. The Vesta VTC-3 A4 wedge anchor in the range of M8, M10, M12, M16 and M20 is an anchor made of stainless steel. The anchor is installed into a predrilled cylindrical hole and anchored by torque-controlled expansion. The anchorage is characterized by friction between expansion clip and concrete.

Product and installation descriptions are given in annexes A1 and A2.

### 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 mean to 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 to tension load (static and quasi-static loading) Method A	See Annex C1, C3 and C4
Characteristic resistance to shear load (static and quasi-static loading).	See Annex C1 and C5
Displacements	See Annex C6
Characteristic resistance and displacements for seismic performance category C1 and C2	See Annex C7 and C8

#### 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 annexes C9 and C10



English translation prepared by IETcc

**4. Assessment and Verification of Constancy of Performances (hereinafter AVCP) system applied, with reference to its legal base**

The applicable European legal act for the system of Assessment and Verification of Constancy of Performances (see annex V to Regulation (EU) No 305/2011) is 96/582/EC.

The system to be applied is 1.

**5. Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document.**

The technical details necessary for the implementation of the AVCP system are laid down in the quality plan deposited at Instituto de Ciencias de la Construcción Eduardo Torroja.



Instituto de Ciencias de la Construcción Eduardo Torroja  
CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS

C/ Serrano Galvache n.º 4. 28033 Madrid.

Tel: (+34) 91 302 04 40

<https://dit.ietcc.csic.es>



On behalf of the Instituto de Ciencias de la Construcción Eduardo Torroja  
Madrid, 29<sup>th</sup> of August 2023

Mr. Ángel Castillo Talavera  
Director IETcc - CSIC



## Product and installed condition

VTC-3 Seismic, VTC-3 HDG Seismic, VTC-3X Seismic. VTC-3 A4 anchor



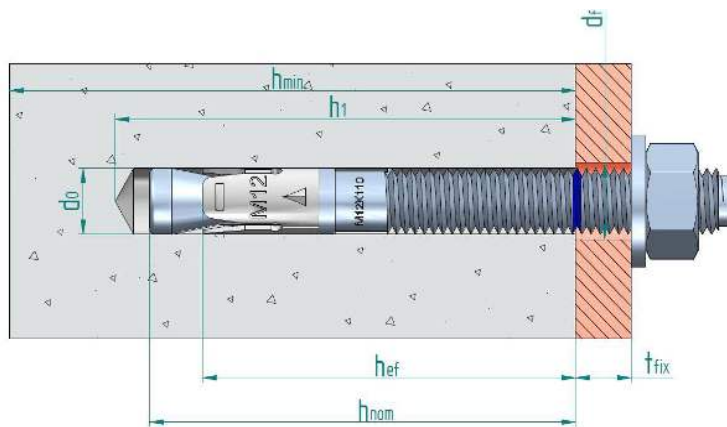
Identification on anchor:

- Expansion clip:
  - Anchor VTC-3 Seismic: Company logo + "VTC-3" + Metric.
  - Anchor VTC-3 HDG Seismic: Company logo + "VTC-3 HDG" + Metric.
  - Anchor VTC-3X Seismic: Company logo + "VTC-3X" + Metric
  - Anchor VTC-3 A4: Company logo + "VTC-3 A4" + Metric
- Anchor body: Metric x Length
- Blue ring mark to show embedment depth
- Length letter code on head:

Letter on head	Length [mm]
C	68 ÷ 75
D	76 ÷ 88
E	89 ÷ 101
F	102 ÷ 113
G	114 ÷ 126
H	127 ÷ 139

Letter on head	Length [mm]
I	140 ÷ 151
J	152 ÷ 164
K	165 ÷ 177
L	178 ÷ 190
M	191 ÷ 202
N	203 ÷ 215

Letter on head	Length [mm]
O	216 ÷ 228
P	229 ÷ 240
Q	241 ÷ 253
R	254 ÷ 266
S	267 ÷ 300



- $d_0$ : Nominal diameter of drill bit
- $d_r$ : Fixture clearance hole diameter
- $h_{ef}$ : Effective anchorage depth
- $h_1$ : Depth of drilled hole
- $h_{nom}$ : Overall anchor embedment depth in the concrete
- $h_{min}$ : Minimum thickness of concrete member
- $t_{fix}$ : Fixture thickness

### VTC-3 Seismic anchors

#### Product description

Installed condition

Annex A1



**Table A1: materials**

Item	Designation	Material for VTC-3 Seismic	Material for VTC-3 HDG Seismic
1	Anchor body	M8 to M20: carbon steel wire rod, galvanized $\geq 5 \mu\text{m}$ ISO 4042 Zn5/An/T0 with antifriction coating M24: machine carbon steel, galvanized $\geq 5 \mu\text{m}$ ISO 4042 Zn5/An/T0 with antifriction coating	Carbon steel wire rod, sherardized $\geq 40 \mu\text{m}$ EN 13811
2	Washer	DIN 125, DIN 9021, DIN 440 galvanized $\geq 5 \mu\text{m}$ ISO 4042 Zn5/An/T0	DIN 125, DIN 9021, DIN 440 sherardized $\geq 40 \mu\text{m}$ EN 13811
3	Nut	DIN 934 class 6, galvanized $\geq 5 \mu\text{m}$ ISO 4042 Zn5/An/T0	DIN 934 class 6, sherardized $\geq 40 \mu\text{m}$ EN 13811
4	Expansion clip	Stainless steel	Stainless steel

Item	Designation	Material for VTC-3X Seismic	Material for VTC-3 A4
1	Anchor body	Carbon steel wire rod, galvanized $\geq 5 \mu\text{m}$ ISO 4042 Zn5/An/T0 with antifriction coating	Stainless steel, grade A4
2	Washer	DIN 125, DIN 9021, DIN 440 galvanized $\geq 5 \mu\text{m}$ ISO 4042 Zn5/An/T0	DIN 125, DIN 9021, DIN 440 stainless steel, grade A4
3	Nut	DIN 934 class 6 galvanized $\geq 5 \mu\text{m}$ ISO 4042 Zn5/An/T0	Stainless steel, grade A4 with antifriction coating
4	Expansion clip	Carbon steel strip, sherardized $\geq 15 \mu\text{m}$ EN 13811	Stainless steel, grade A4, galvanized $\geq 5 \mu\text{m}$ ISO 4042 Zn5/An/T0

**VTC-3 Seismic anchors**

**Product description**

Materials

**Annex A2**



**Specifications of intended use**

Version	Intended use	M8	M10	M12	M16	M20	M24
VTC-3 Seismic	Static or quasi static loads	✓	✓	✓	✓	✓	✓
	Seismic loads category C1		✓	✓	✓		
	Seismic loads category C2			✓	✓		
	Resistance to fire exposure	✓	✓	✓	✓	✓	✓
VTC-3 HDG Seismic	Static or quasi static loads	✓	✓	✓	✓	✓	
	Seismic loads category C1	✓	✓	✓	✓	✓	
	Seismic loads category C2			✓	✓	✓	
	Resistance to fire exposure	✓	✓	✓	✓	✓	
VTC-3X Seismic	Static or quasi static loads	✓	✓	✓	✓	✓	
	Seismic loads category C1	✓	✓	✓	✓	✓	
	Seismic loads category C2		✓	✓		✓	
	Resistance to fire exposure	✓	✓	✓	✓	✓	

**Base materials:**

- Reinforced or unreinforced normal weight concrete without fibres according to EN 206:2013+A1:2016
- Strength classes C20/25 to C50/60 according to EN 206:2013+A1:2016
- Cracked or uncracked concrete

**Use conditions (environmental conditions):**

- VTC-3 Seismic, VTC-3X Seismic: anchorages subjected to dry internal conditions.
- VTC-3 HDG Seismic:
  - Anchorages in cracked concrete: dry internal conditions
  - Anchorages in uncracked concrete: durability depending on the following environmental corrosivity categories according to ISO 9223:2012:

Corrosivity category	Corrosivity	Durability [years]
C1	Very low	50 <sup>1)</sup>
C2	Low	50 <sup>1)</sup>
C3	Medium	19
C4	High	9.5
C5	Very high	4.7
CX	Extreme	--

1) Working life of fastener limited to 50 years according to EAD 330232-01-0601 section 1.2.2

- VTC-3 A4: anchorages subjected to dry internal conditions, to external atmospheric exposure (including industrial and marine environment) or to permanent internal damp conditions if no particular aggressive conditions exist. Such particular aggressive conditions are e.g., permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with extreme chemical pollution (e.g., in desulphurization plants or road tunnels where de-icing materials are used). Atmospheres under Corrosion Resistance Class CRC III according to EN 1993-1-4:2006+A1:2015 annex A.

<b>VTC-3 Seismic anchors</b>	<b>Annex B1</b>
<b>Intended use</b>	
Specifications	



Corrosivity category	Corrosivity	Typical environments – Examples	
		Indoor	Outdoor
C1	Very low	Heated spaces with low relative humidity and insignificant pollution; e.g., offices, schools, museums.	Dry or cold zone, atmospheric environment with very low pollution and time of wetness; e.g., certain desserts, Central Artic/Antarctic.
C2	Low	Unheated spaces with varying temperature and relative humidity. Low frequency of condensation and low pollution; e.g., storage, sport halls.	Temperate zone, atmospheric environment with low pollution ( $SO_2 < 5 \mu g/m^3$ ); e.g., rural areas, small towns. Dry or cold zone, atmospheric environment with short time or wetness, e.g., deserts, subarctic areas.
C3	Medium	Spaces with moderate frequency of condensation and moderate pollution from production process; e.g., food-processing plants, laundries, breweries, dairies.	Temperate zone, atmospheric environment with medium pollution ( $SO_2 5 \mu g/m^3$ to $30 \mu g/m^3$ ), or some effect of chlorides, e.g., urban areas, coastal areas with low deposition of chlorides. Subtropical and tropical zone, atmosphere with low pollution.
C4	High	Spaces with high frequency of condensation and high pollution from production process; e.g., industrial processing plants.	Temperate zone, atmospheric environment with high pollution ( $SO_2 30 \mu g/m^3$ to $90 \mu g/m^3$ ), or substantial effect of chlorides; e.g., polluted urban areas, industrial areas, coastal areas without spray of salt water or exposure to strong effect of de-icing salts. Subtropical and tropical zone, atmosphere with medium pollution.
C5	Very High	Spaces with very high frequency of condensation and/or high pollution from production process; e.g., mines, caverns for industrial purposes, unventilated sheds in subtropical and tropical zones	Temperate zone, atmospheric environment with very high pollution ( $SO_2 90 \mu g/m^3$ to $250 \mu g/m^3$ ), or significant effect of chlorides; e.g., industrial areas, coastal areas, sheltered positions on coastline. Subtropical and tropical zone, atmosphere with medium pollution.
CX	Extreme	Spaces with almost permanent condensation or extensive periods of exposure to extreme humidity effects and/or high pollution from production process; e.g., unventilated sheds in humid tropical zones with penetration of outdoor pollution including airborne chlorides and corrosion-stimulating particulate matter	Subtropical and tropical zone (very high time of wetness), atmospheric environment with very high $SO_2$ pollution (higher than $250 \mu g/m^3$ ) including accompanying and production factors and/or strong effect of chlorides; e.g., extreme industrial areas, coastal and offshore areas, occasional contact with salt spray.

**Design:**

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete.
- Verifiable calculation rules and drawings are prepared taking into 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 under static or quasi-static actions are designed for design method A in accordance with EN 1992-4:2018
- Anchorages under seismic actions are designed in accordance with EN 1992-4:2018. Anchorages shall be positioned outside of critical regions (e.g. plastic hinges) of the concrete structure. Fastening in stand-off installation or with grout layer are not allowed.
- Anchorages under fire exposure are designed in accordance with EN 1992-4:2018. It must be ensured that local spalling of the concrete cover does not occur.

**Installation:**

- Hole drilling by rotary plus hammer mode.
- Anchor installation carried out by appropriately qualified personal 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 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.

<b>VTC-3 Seismic anchors</b>	<b>Annex B2</b>
<b>Intended use</b>	
<b>Specifications</b>	





**Table C1: Installation parameters for VTC-3 Seismic, VTC-3 HDG Seismic, VTC-3X Seismic anchors**

Installation parameters			Performances					
			M8	M10	M12	M16	M20	M24
$d_0$	Nominal diameter of drill bit:	[mm]	8	10	12	16	20	24
$d_f$	Fixture clearance hole diameter:	[mm]	9	12	14	18	22	26
$T_{inst}$	Nominal installation torque:	[Nm]	20 / 15 <sup>1)</sup>	40	60	100	200	250
$L_{min}$	Minimum total length of the bolt:	[mm]	68	82	98	119	140	175
$h_{min}$	Minimum thickness of concrete member:	[mm]	100	120	140	170	200	250
$h_1$	Depth of drilled hole:	[mm]	60	75	85	105	125	155
$h_{nom}$	Overall anchor embedment depth in the concrete:	[mm]	55	68	80	97	114	143
$h_{ef}$	Effective anchorage depth:	[mm]	48	60	70	85	100	125
$t_{fix}$	Thickness of fixture for washer DIN 125 $\leq$ <sup>2)</sup>	[mm]	L - 66	L - 80	L - 96	L - 117	L - 138	L - 170
$t_{fix}$	Thickness of fixture for washers DIN 9021, DIN 440 $\leq$ <sup>2)</sup>	[mm]	L - 67	L - 81	L - 97	L - 118	L - 139	L - 171
$s_{min}$	Minimum allowable spacing:	[mm]	40	40	60	65	95	125
	for edge distance $c \geq$	[mm]	55	70	75	95	105	125
$c_{min}$	Minimum allowable distance:	[mm]	45	45	55	70	95	125
	for spacing $s \geq$	[mm]	55	90	110	115	105	125

<sup>1)</sup> Respective values for anchors VTC-3 Seismic / VTC-3 HDG Seismic, VTC-3X Seismic

<sup>2)</sup> L = total anchor length

**Table C2: Installation parameters for VTC-3 A4 anchor**

Installation parameters			Performances				
			M8	M10	M12	M16	M20
$d_0$	Nominal diameter of drill bit:	[mm]	8	10	12	16	20
$d_f$	Fixture clearance hole diameter:	[mm]	9	12	14	18	22
$T_{inst}$	Nominal installation torque:	[Nm]	15	30	60	100	200
$L_{min}$	Minimum total length of the bolt:	[mm]	68	82	98	119	140
$h_{min}$	Minimum thickness of concrete member:	[mm]	100	120	140	170	200
$h_1$	Depth of drilled hole:	[mm]	60	75	85	105	125
$h_{nom}$	Overall anchor embedment depth in the concrete:	[mm]	55	68	80	97	114
$h_{ef}$	Effective anchorage depth:	[mm]	48	60	70	85	100
$t_{fix}$	Thickness of fixture for washer DIN 125 $\leq$ <sup>1)</sup>	[mm]	L - 66	L - 80	L - 96	L - 117	L - 138
$t_{fix}$	Thickness of fixture for washers DIN 9021, DIN 440 $\leq$ <sup>1)</sup>	[mm]	L - 67	L - 81	L - 97	L - 118	L - 139
$s_{min}$	Minimum allowable spacing:	[mm]	42	47	57	75	100
$c_{min}$	Minimum allowable distance:	[mm]	47	52	62	75	90

<sup>1)</sup> L = total anchor length

VTC-3 Seismic anchors

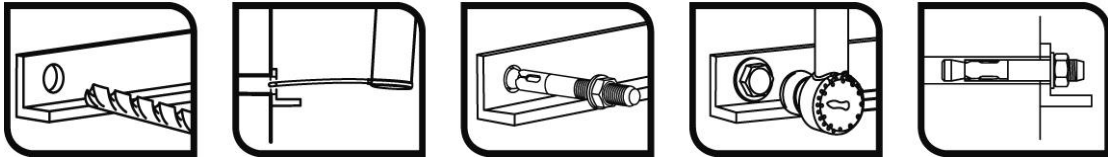
Performances

Installation parameters

Annex C1



### Installation process



**VTC-3 Seismic anchors**

**Performances**

Installation procedure

**Annex C2**



**Table C3: Essential characteristics under static or quasi-static tension loads according to design method A according to EN 1992-4 for VTC-3 Seismic, VTC-3 HDG Seismic, VTC-3X Seismic anchors**

Essential characteristics under static or quasi-static tension loads according to design method A		Performances					
		M8	M10	M12	M16	M20	M24
<b>Tension loads: steel failure</b>							
$N_{Rk,s}$	Characteristic resistance: [kN]	18.1	31.4	40.4	72.7	116.6	179.2
$\gamma_{Ms}$	Partial safety factor: <sup>1)</sup> [-]	1.5	1.5	1.5	1.5	1.5	1.5
<b>Tension loads: pull-out failure in concrete</b>							
<b>VTC-3 Seismic anchor</b>							
$N_{Rk,p,ucr}$	Characteristic resistance in C20/25 uncracked concrete: [kN]	9	18	20	36	48	55
$N_{Rk,p,cr}$	Characteristic resistance in C20/25 cracked concrete: [kN]	5	9.5	12	25	32	35
<b>VTC-3 HDG Seismic anchor</b>							
$N_{Rk,p,ucr}$	Characteristic resistance in C20/25 uncracked concrete: [kN]	10	18	-- <sup>1)</sup>	36	-- <sup>1)</sup>	--
$N_{Rk,p,cr}$	Characteristic resistance in C20/25 cracked concrete: [kN]	6	10	16	-- <sup>1)</sup>	30	--
<b>VTC-3X Seismic anchor</b>							
$N_{Rk,p,ucr}$	Characteristic resistance in C20/25 uncracked concrete: [kN]	10	18	28	34	-- <sup>1)</sup>	--
$N_{Rk,p,cr}$	Characteristic resistance in C20/25 cracked concrete: [kN]	7	11	15	-- <sup>1)</sup>	-- <sup>1)</sup>	--
$\gamma_{ins}$	Installation safety factor: [-]	1.2	1.0	1.0	1.0	1.0	1.2
$\psi_c$	Increasing factor for C30/37 [-]	1.22	1.17	1.22	1.22	1.17	1.22
	C40/50 [-]	1.41	1.31	1.41	1.41	1.31	1.41
	C50/60 [-]	1.58	1.43	1.58	1.58	1.43	1.58
<b>Tension loads: concrete cone and splitting failure</b>							
$h_{ef}$	Effective embedment depth: [mm]	48	60	70	85	100	125
$k_{ucr,N}$	Factor for uncracked concrete: [-]	11.0					
$k_{cr,N}$	Factor for cracked concrete: [-]	7.7					
$\gamma_{ins}$	Installation safety factor: [-]	1.2	1.0	1.0	1.0	1.0	1.2
$S_{cr,N}$	Concrete cone failure: [mm]	3 x $h_{ef}$					
$C_{cr,N}$	[mm]	1.5 x $h_{ef}$					
$S_{cr,sp}$	Splitting failure: [mm]	288	300	350	425/510 <sup>2)</sup>	500/600 <sup>2)</sup>	560
$C_{cr,sp}$	[mm]	144	150	175	213/255 <sup>2)</sup>	250/300 <sup>2)</sup>	280

1) Pull out failure is not decisive

2) Respective values for anchors VTC-3 Seismic / VTC-3 HDG Seismic, VTC-3X Seismic

VTC-3 Seismic anchors

Performances

Essential characteristics under static or quasi-static tension loads

Annex C3



**Table C4: Essential characteristics under static or quasi-static tension loads according to design method A according to EN 1992-4 for VTC-3 A4 anchor**

Essential characteristics under static or quasi-static tension loads according to design method A			Performances					
			M8	M10	M12	M16	M20	
<b>Tension loads: steel failure</b>								
$N_{Rk,s}$	Characteristic resistance:	[kN]	18.5	30.9	45.5	71.5	122.5	
$\gamma_{Ms}$	Partial safety factor:	[-]	1.4	1.4	1.4	1.4	1.4	
<b>Tension loads: pull-out failure in concrete</b>								
$N_{Rk,p,ucr}$	Characteristic resistance in C20/25 uncracked concrete:	[kN]	12	16	22	--1)	--1)	
$\psi_c$	Increasing factor for $N^0_{Rk,p}$ :	C30/37	[-]	1.22	1.22	1.22	1.22	1.09
		C40/50	[-]	1.41	1.41	1.41	1.41	1.16
		C50/60	[-]	1.58	1.58	1.58	1.58	1.22
$N_{Rk,p,cr}$	Characteristic resistance in C20/25 cracked concrete:	[kN]	8.5	14	19	--1)	--1)	
$\psi_c$	Increasing factor for $N^0_{Rk,p}$ :	C30/37	[-]	1.01	1.00	1.09	1.09	1.17
		C40/50	[-]	1.02	1.00	1.15	1.16	1.32
		C50/60	[-]	1.02	1.00	1.20	1.22	1.44
$\gamma_{ins}$	Installation safety factor:	[-]	1.0	1.0	1.2	1.2	1.2	
<b>Tension loads: concrete cone and splitting failure</b>								
$h_{ef}$	Effective embedment depth:	[mm]	48	60	70	85	100	
$k_{ucr,N}$	Factor for uncracked concrete:	[-]	11.0					
$k_{cr,N}$	Factor for cracked concrete:	[-]	7,7					
$\gamma_{ins}$	Installation safety factor:	[-]	1.0	1.0	1.2	1.2	1.2	
$S_{cr,N}$	Concrete cone failure:	[mm]	3 x $h_{ef}$					
$C_{cr,N}$		[mm]	1.5 x $h_{ef}$					
$S_{cr,sp}$	Splitting failure:	[mm]	164	204	238	290	380	
$C_{cr,sp}$		[mm]	82	102	119	145	190	

1) Pull out failure is not decisive

**VTC-3 Seismic anchors**

**Performances**

Essential characteristics under static or quasi-static tension loads

**Annex C4**



**Table C5: Essential characteristics under static or quasi-static shear loads of design method A according to EN 1992-4 for VTC-3 Seismic, VTC-3 HDG Seismic, VTC-3X Seismic anchors**

Essential characteristics under static or quasi-static shear loads according to design method A			Performances					
			M8	M10	M12	M16	M20	M24
<b>Shear loads: steel failure without lever arm</b>								
$V_{Rk,s}$	Characteristic resistance:	[kN]	11.0	17.4	25.3	47.1	73.1	84.7
$k_7$	Ductility factor:	[-]	1.00					
$\gamma_{Ms}$	Partial safety factor:	[-]	1.25	1.25	1.25	1.25	1.25	1.25
<b>Shear loads: steel failure with lever arm</b>								
$M^0_{Rk,s}$	Characteristic bending moment:	[Nm]	22.5	44.8	78.6	199.8	389.4	673.5
$\gamma_{Ms}$	Partial safety factor:	[-]	1.25	1.25	1.25	1.25	1.25	1.25
<b>Shear loads: concrete pryout failure</b>								
$k_8$	Pryout factor:	[-]	1	2	2	2	2	2
$\gamma_{ins}$	Installation safety factor:	[-]	1.00					
<b>Shear loads: concrete edge failure</b>								
$l_f$	Effective length of anchor under shear loads:	[mm]	48	60	70	85	100	125
$d_{nom}$	Outside anchor diameter:	[mm]	8	10	12	16	20	24
$\gamma_{ins}$	Installation safety factor:	[-]	1.00					

**Table C6 Essential characteristics under static or quasi-static shear loads of design method A according to EN 1992-4 for VTC-3 A4 anchor**

Essential characteristics under static or quasi-static shear loads according to design method A			Performances				
			M8	M10	M12	M16	M20
<b>Shear loads: steel failure without lever arm</b>							
$V_{Rk,s}$	Characteristic resistance:	[kN]	11.9	18.9	27.4	55.0	85.9
$k_7$	Ductility factor:	[-]	1.00				
$\gamma_{Ms}$	Partial safety factor:	[-]	1.25	1.25	1.25	1.25	1.25
<b>Shear loads: steel failure with lever arm</b>							
$M^0_{Rk,s}$	Characteristic bending moment:	[Nm]	26.2	52.3	91.7	233.1	454.3
$\gamma_{Ms}$	Partial safety factor:	[-]	1.25	1.25	1.25	1.25	1.25
<b>Shear loads: concrete pryout failure</b>							
$k_8$	Pryout factor:	[-]	1	2	2	2	2
$\gamma_{ins}$	Installation safety factor:	[-]	1.00				
<b>Shear loads: concrete edge failure</b>							
$l_f$	Effective length of anchor under shear loads:	[mm]	48	60	70	85	100
$d_{nom}$	Outside anchor diameter:	[mm]	8	10	12	16	20
$\gamma_{ins}$	Installation safety factor:	[-]	1.00				

VTC-3 Seismic anchors

Performances

Essential characteristics under static or quasi-static shear loads

Annex C5



**Table C7: Displacements under tension loads for VTC-3 Seismic, VTC-3 HDG Seismic, VTC-3X Seismic, VTC-3 A4 anchors**

Displacements under tension loads		Performances						
		M8	M10	M12	M16	M20	M24	
<b>VTC-3 Seismic anchor</b>								
N	Service tension load:	[kN]	2.5	4.3	6.3	10.4	13.9	18.0
$\delta_{N0}$	Short term displacement:	[mm]	1.1	0.7	1.0	0.4	1.6	0.4
$\delta_{N\infty}$	Long term displacement:	[mm]	1.9	1.9	1.9	1.9	1.9	2.0
<b>VTC-3 HDG Seismic anchor</b>								
N	Service tension load:	[kN]	2.5	4.3	6.3	10.4	13.9	--
$\delta_{N0}$	Short term displacement:	[mm]	1.0	1.1	0.9	1.5	1.2	--
$\delta_{N\infty}$	Long term displacement:	[mm]	1.9	1.9	1.9	1.9	1.9	--
<b>VTC-3X Seismic anchor</b>								
N	Service tension load:	[kN]	2.5	4.3	7.6	11.9	14.3	--
$\delta_{N0}$	Short term displacement:	[mm]	1.0	1.1	0.9	1.5	1.3	--
$\delta_{N\infty}$	Long term displacement:	[mm]	1.6	1.6	1.6	1.6	1.6	--
<b>VTC-3 A4 anchor</b>								
N	Service tension load in non cracked concrete:	[kN]	5.7	7.6	8.7	15.3	19.5	--
$\delta_{N0}$	Short term displacement:	[mm]	1.4	1.4	1.4	1.8	1.8	--
$\delta_{N\infty}$	Long term displacement:	[mm]	1.9	1.9	1.9	1.9	1.9	--
<b>VTC-3 A4 anchor</b>								
N	Service tension load in cracked concrete:	[kN]	4.0	6.7	7.5	10.7	13.7	--
$\delta_{N0}$	Short term displacement:	[mm]	1.2	1.3	1.3	1.3	1.3	--
$\delta_{N\infty}$	Long term displacement:	[mm]	1.7	1.7	1.7	1.7	1.7	--

**Table C8: Displacements under shear load for VTC-3 Seismic, VTC-3 HDG Seismic, VTC-3X Seismic, VTC-3 A4 anchors**

Displacements under shear loads		Performances						
		M8	M10	M12	M16	M20	M24	
<b>VTC-3 Seismic anchor</b>								
V	Service shear load:	[kN]	4.9	6.8	8.5	15.1	24.6	33.6
$\delta_{V0}$	Short term displacement:	[mm]	1.0	1.5	1.8	1.9	3.1	1.4
$\delta_{V\infty}$	Long term displacement:	[mm]	1.5	2.3	2.7	2.9	4.7	2.1
<b>VTC-3 HDG Seismic anchor</b>								
V	Service shear load:	[kN]	4.9	6.8	8.5	15.1	24.6	-
$\delta_{V0}$	Short term displacement:	[mm]	1.0	1.5	1.8	1.9	3.1	--
$\delta_{V\infty}$	Long term displacement:	[mm]	1.5	2.3	2.7	2.9	4.7	--
<b>VTC-3X Seismic anchor</b>								
V	Service shear load:	[kN]	4.9	6.8	8.5	15.1	24.6	--
$\delta_{V0}$	Short term displacement:	[mm]	1.0	1.5	1.8	1.9	3.1	--
$\delta_{V\infty}$	Long term displacement:	[mm]	1.5	2.3	2.7	2.9	4.7	--
<b>VTC-3 A4 anchor</b>								
V	Service shear load:	[kN]	6.8	10.8	15.7	31.4	46.9	--
$\delta_{V0}$	Short term displacement:	[mm]	1.9	1.6	1.6	2.2	2.2	--
$\delta_{V\infty}$	Long term displacement:	[mm]	2.4	2.4	2.4	3.3	3.3	--

**VTC-3 Seismic anchors**

**Performances**

Displacements under static or quasi-static tension and shear loads

**Annex C6**



**Table C9: Essential characteristics for seismic performance category C1 VTC-3 Seismic, VTC-3 HDG Seismic, VTC-3X Seismic anchors**

Essential characteristics for seismic performance category C1			Performances					
			M8	M10	M12	M16	M20	M24
<b>Steel tension failure</b>								
$N_{Rk,s,C1}$	Characteristic tension steel failure:	[kN]	18.1	31.4	40.4	72.7	116.6	--
$\gamma_{Ms,N}$	Partial safety factor:	[-]	1.5	1.5	1.5	1.5	1.5	--
<b>Steel shear failure</b>								
<b>VTC-3 Seismic anchor</b>								
$V_{Rk,s,C1}$	Characteristic shear steel failure:	[kN]	--	12.2	17.8	33.0	--	--
<b>VTC-3 HDG Seismic anchor</b>								
$V_{Rk,s,C1}$	Characteristic shear steel failure:	[kN]	6.6	12.5	18.9	35.4	54.8	--
<b>VTC-3X Seismic anchor</b>								
$V_{Rk,s,C1}$	Characteristic shear steel failure:	[kN]	7.7	12.2	17.8	33.0	58.5	--
$\alpha_{gap}$	Factor for annular gap:	[-]	0.5					--
$\gamma_{Ms,V}$	Partial safety factor:	[-]	1.25	1.25	1.25	1.25	1.25	--
<b>Pull out failure</b>								
<b>VTC-3 Seismic anchor</b>								
$N_{Rk,p,C1}$	Characteristic pull out failure:	[kN]	--	5.3	8.4	17.5	--	--
<b>VTC-3 HDG Seismic anchor</b>								
$N_{Rk,p,C1}$	Characteristic pull out failure:	[kN]	6.0	9.0	16.0	25.0	30.0	--
<b>VTC-3X Seismic anchor</b>								
$N_{Rk,p,C1}$	Characteristic pull out failure:	[kN]	5.9	8.9	16.0	25.0	30.0	--
$\gamma_{ins}$	Installation safety factor:	[-]	1.2	1.0	1.0	1.0	1.0	--
<b>Concrete cone failure</b>								
$h_{ef}$	Effective embedment depth:	[mm]	48	60	70	85	100	--
$s_{cr,N}$	Spacing:	[mm]	3 x $h_{ef}$					--
$c_{cr,N}$	Edge distance:	[mm]	1.5 x $h_{ef}$					--
$\gamma_{ins}$	Installation safety factor:	[-]	1.2	1.0	1.0	1.0	1.0	--
<b>Concrete pryout failure</b>								
$k_8$	Pryout factor:	[-]	1	2	2	2	2	--
<b>Concrete edge failure</b>								
$l_f$	Effective length of anchor:	[mm]	48	60	70	85	100	--
$d_{nom}$	Outside anchor diameter:	[-]	8	10	12	16	20	--

<b>VTC-3 Seismic anchors</b>	<b>Annex C7</b>
<b>Performances</b>	
Essential characteristics for seismic performance category C1	



**Table C10: Essential characteristics for seismic performance category C2 VTC-3 Seismic, VTC-3 HDG Seismic, VTC-3X Seismic anchors**

Essential characteristics for seismic performance category C2			Performances					
			M8	M10	M12	M16	M20	M24
<b>Steel tension and shear failure</b>								
$N_{Rk,s,C2}$	Characteristic tension steel failure:	[kN]	--	31.4	40.4	72.7	116.6	--
$\gamma_{Ms,N}$	Partial safety factor:	[-]	--	1.5	1.5	1.5	1.5	--
$V_{Rk,s,C2}$	Characteristic shear steel failure:	[kN]	--	12.2	17.8	33.0	58.5	--
$\alpha_{gap}$	Factor for annular gap	[-]	--	0.5	0.5	0.5	0.5	--
$\gamma_{Ms,V}$	Partial safety factor:	[-]	--	1.25	1.25	1.25	1.25	--
<b>Pull out failure</b>								
<b>VTC-3 Seismic anchor</b>								
$N_{Rk,p,C2}$	Characteristic pull out failure:	[kN]	--	--	5.2	8.9	--	--
<b>VTC-3 HDG Seismic anchor</b>								
$N_{Rk,p,C2}$	Characteristic pull out failure:	[kN]	--	--	5.9	16.3	17.2	--
<b>VTC-3X Seismic anchor</b>								
$N_{Rk,p,C2}$	Characteristic pull out failure:	[kN]	--	3.9	9.1	--	21.0	--
$\gamma_{ins}$	Installation safety factor:	[-]	--	1.0	1.0	1.0	1.0	--
<b>Concrete cone failure</b>								
$h_{ef}$	Effective embedment depth:	[mm]	--	60	70	85	100	--
$s_{cr,N}$	Spacing:	[mm]	--	3 x $h_{ef}$				--
$c_{cr,N}$	Edge distance:	[mm]	--	1.5 x $h_{ef}$				--
$\gamma_{ins}$	Installation safety factor:	[-]	--	1.0	1.0	1.0	1.0	--
<b>Concrete pryout failure</b>								
$k_8$	Pryout factor:	[-]	--	2	2	2	2	--
<b>Concrete edge failure</b>								
$l_f$	Effective length of anchor:	[mm]	--	60	70	85	100	--
$d_{nom}$	Outside anchor diameter:	[-]	--	10	12	16	20	--
<b>Displacements</b>								
<b>VTC-3 Seismic anchor</b>								
$\bar{\delta}_{N,C2}$ (DLS)	Displacement Damage	[mm]	--	--	2.34	3.99	--	--
$\bar{\delta}_{V,C2}$ (DLS)	Limitation State: <sup>1) 2)</sup>	[mm]	--	--	5.53	5.96	--	--
$\bar{\delta}_{N,C2}$ (ULS)	Displacement Ultimate Limit	[mm]	--	--	9.54	10.17	--	--
$\bar{\delta}_{V,C2}$ (ULS)	State: <sup>1)</sup>	[mm]	--	--	9.08	10.66	--	--
<b>VTC-3 HDG Seismic anchor</b>								
$\bar{\delta}_{N,C2}$ (DLS)	Displacement Damage	[mm]	--	--	6.79	5.21	5.72	--
$\bar{\delta}_{V,C2}$ (DLS)	Limitation State: <sup>1) 2)</sup>	[mm]	--	--	5.53	5.96	6.37	--
$\bar{\delta}_{N,C2}$ (ULS)	Displacement Ultimate Limit	[mm]	--	--	24.70	19.58	17.20	--
$\bar{\delta}_{V,C2}$ (ULS)	State: <sup>1)</sup>	[mm]	--	--	9.08	10.66	12.32	--
<b>VTC-3X Seismic anchor</b>								
$\bar{\delta}_{N,C2}$ (DLS)	Displacement Damage	[mm]	--	3.15	5.57	--	6.82	--
$\bar{\delta}_{V,C2}$ (DLS)	Limitation State: <sup>1) 2)</sup>	[mm]	--	5.61	5.53	--	6.37	--
$\bar{\delta}_{N,C2}$ (ULS)	Displacement Ultimate Limit	[mm]	--	14.77	20.31	--	29.12	--
$\bar{\delta}_{V,C2}$ (ULS)	State: <sup>1)</sup>	[mm]	--	8.68	9.08	--	12.32	--

<sup>1)</sup> The listed displacements represent mean values

<sup>2)</sup> A small displacement may be required in the design in the case of displacements sensitive fastening of "rigid" supports. The characteristics resistance associated with such small displacements may be determined by linear interpolation or proportional reduction.

**VTC-3 Seismic anchors**

**Performances**

Essential characteristics for seismic performance category C2

**Annex C8**





**Table C11: Essential characteristics under fire exposure VTC-3 Sesimic, VTC-3 HDG Seismic, VTC-3X Seismic anchors**

Essential characteristics under fire exposure			Performances					
			M8	M10	M12	M16	M20	M24
<b>Steel failure</b>								
N <sub>Rk,s,fi</sub>	Characteristic tension resistance:	R30 [kN]	0,4	0,9	1,7	3,1	4,9	7,1
		R60 [kN]	0,3	0,8	1,3	2,4	3,7	5,3
		R90 [kN]	0,3	0,6	1,1	2,0	3,2	4,6
		R120 [kN]	0,2	0,5	0,8	1,6	2,5	3,5
V <sub>Rk,s,fi</sub>	Characteristic shear resistance:	R30 [kN]	0,4	0,9	1,7	3,1	4,9	7,1
		R60 [kN]	0,3	0,8	1,3	2,4	3,7	5,3
		R90 [kN]	0,3	0,6	1,1	2,0	3,2	4,5
		R120 [kN]	0,2	0,5	0,8	1,6	2,5	3,5
M <sup>0</sup> <sub>Rk,s,fi</sub>	Characteristic bending resistance:	R30 [Nm]	0,4	1,1	2,6	6,7	13,0	22,5
		R60 [Nm]	0,3	1,0	2,0	5,0	9,7	16,8
		R90 [Nm]	0,3	0,7	1,7	4,3	8,4	14,6
		R120 [Nm]	0,2	0,6	1,3	3,3	6,5	11,2
<b>Pull out failure</b>								
N <sub>Rk,p,fi</sub>	Characteristic resistance:	R30 [kN]	1,3/1,5 <sup>3)</sup>	2,3	3,0/4,0 <sup>3)</sup>	6,3	7,5	7,5
		R60 [kN]						
		R90 [kN]						
		R120 [kN]	1,0/1,2 <sup>3)</sup>	1,8	2,4/3,2 <sup>3)</sup>	5,0	6,0	6,0
<b>Concrete cone failure <sup>2)</sup></b>								
N <sub>Rk,c,fi</sub>	Characteristic resistance:	R30 [kN]	2,9	5,0	7,4	12,0	18,0	31,4
		R60 [kN]						
		R90 [kN]						
		R120 [kN]	2,3	4,0	5,9	9,6	14,4	25,2
S <sub>cr,N,fi</sub>	Critical spacing:	R30 to R120 [mm]	4 x h <sub>ef</sub>					
S <sub>min,fi</sub>	Minimum spacing:	R30 to R120 [mm]	50	60	70	85/128 <sup>1)</sup>	100/150 <sup>1)</sup>	125
C <sub>cr,N,fi</sub>	Critical edge distance:	R30 to R120 [mm]	2 x h <sub>ef</sub>					
C <sub>min,fi</sub>	Minimum edge distance:	R30 to R120 [mm]	c <sub>min</sub> = 2 x h <sub>ef</sub> ; if fire attack comes from more than one side, the edge distance of the anchor has to be ≥ 300 mm and ≥ 2 x h <sub>ef</sub>					
<b>Concrete pry out failure</b>								
k <sub>s</sub>	Pryout factor:	R30 to R120 [-]	1	2	2	2	2	2

<sup>1)</sup> Respective values for anchors VTC-3 Seismic / VTC-3 HDG Seismic, VTC-3X SeismicC

<sup>2)</sup> As a rule, splitting failure can be neglected since cracked concrete and reinforcement is assumed.

In absence of other national regulations the partial safety factor for resistance under fire exposure  $\gamma_{m,fi} = 1,0$  is recommended

VTC-3 Seismic anchors	<b>Annex C9</b>
Performances	
Essential characteristics under fire exposure	



**Table C12: Essential characteristics under fire exposure VTC-3 A4 anchor**

Essential characteristics under fire exposure			Performances				
			M8	M10	M12	M16	M20
<b>Steel failure</b>							
$N_{Rk,s,fi}$	Characteristic tension resistance:	R30 [kN]	0,7	1,5	2,5	4,7	7,4
		R60 [kN]	0,6	1,2	2,1	3,9	6,1
		R90 [kN]	0,4	0,9	1,7	3,1	4,9
		R120 [kN]	0,4	0,8	1,3	2,5	3,9
$V_{Rk,s,fi}$	Characteristic shear resistance:	R30 [kN]	0,7	1,5	2,5	4,7	7,4
		R60 [kN]	0,6	1,2	2,1	3,9	6,1
		R90 [kN]	0,4	0,9	1,7	3,1	4,9
		R120 [kN]	0,4	0,8	1,3	2,5	3,9
$M^0_{Rk,s,fi}$	Characteristic bending resistance:	R30 [Nm]	0,7	1,9	3,9	10,0	19,5
		R60 [Nm]	0,6	1,5	3,3	8,3	16,2
		R90 [Nm]	0,4	1,2	2,6	6,7	13,0
		R120 [Nm]	0,4	1,0	2,1	5,3	10,4
<b>Pull out failure</b>							
$N_{Rk,p,fi}$	Characteristic resistance:	R30 [kN]	2,1	3,5	4,8	-- <sup>1)</sup>	-- <sup>1)</sup>
		R60 [kN]	2,1	3,5	4,8	-- <sup>1)</sup>	-- <sup>1)</sup>
		R90 [kN]	1,7	2,8	3,8	-- <sup>1)</sup>	-- <sup>1)</sup>
		R120 [kN]	1,7	2,8	3,8	-- <sup>1)</sup>	-- <sup>1)</sup>
<b>Concrete cone failure <sup>2)</sup></b>							
$N_{Rk,c,fi}$	Characteristic resistance:	R30 [kN]	2,7	4,8	7,1	11,5	17,2
		R60 [kN]	2,7	4,8	7,1	11,5	17,2
		R90 [kN]	2,2	43,8	5,6	9,2	13,8
		R120 [kN]	2,2	43,8	5,6	9,2	13,8
$s_{cr,N,fi}$	Critical spacing:	R30 to R120 [mm]	4 x $h_{ef}$				
$s_{min,fi}$	Minimum spacing:	R30 to R120 [mm]	42	47	57	75	100
$c_{cr,N,fi}$	Critical edge distance:	R30 to R120 [mm]	2 x $h_{ef}$				
$c_{min,fi}$	Minimum edge distance:	R30 to R120 [mm]	$c_{min} = 2 \times h_{ef}$ ; if fire attack comes from more than one side, the edge distance of the anchor has to be $\geq 300$ mm and $\geq 2 \times h_{ef}$				
<b>Concrete pry out failure</b>							
$k_8$	Pryout factor:	R30 to R120 [-]	1	2	2	2	2

<sup>1)</sup> Pull out failure is not decisive

<sup>2)</sup> As a rule, splitting failure can be neglected since cracked concrete and reinforcement is assumed.

In absence of other national regulations the partial safety factor for resistance under fire exposure  $\gamma_{m,fi} = 1,0$  is recommended

**VTC-3 Seismic anchors**

**Performances**

Essential characteristics under fire exposure

**Annex C10**

