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Authorised and notified according to Article 29 of the Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011

European Technical Assessment ETA-18/1009 of 2018/11/18

I General Part

Technical Assessment Body issuing the ETA and designated according to Article 29 of the Regulation (EU) No 305/2011: ETA-Danmark A/S	
Trade name of the construction product:	ARVEX CE Injection System
Product family to which the above construction product belongs:	Bonded injection type anchor for use in non-cracked concrete: sizes M8 to M24, rebar 8 to 25 mm
Manufacturer:	ARVEX GROBELNY Sp. z o.o. Ul. Makuszyńskiego 4 PL-30-969 Kraków Tel. +48 12 644 64 57 Internet www.arvex.pl
Manufacturing plant:	ARVEX GROBELNY Sp. z o.o. Manufacturing plant I
This European Technical Assessment contains:	20 pages including 14 annexes which form an integral part of the document
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of:	EOTA EAD 330499-00-0601, “Bonded fasteners for use in concrete”
This version replaces:	

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

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II SPECIFIC PART OF THE EUROPEAN TECHNICAL ASSESSMENT

1 Technical description of product and intended use

Technical description of the product
The Arvex CE is a bonded anchor (injection type) for concrete consisting of a cartridge with Arvex CE injection mortar and a steel element. The steel element consists of a commercial threaded rod with washer and hexagon nut in the range of M8 to M24 or a reinforcing bar in the range of diameter 8 to 25mm.

The product specification is given in annex A.

The steel element is placed into a drilled hole filled with injection mortar and is anchored via the bond between metal part, injection mortar and concrete.

The characteristic material values, dimensions and tolerances of the anchors not indicated in Annexes shall correspond to the respective values laid down in the technical documentation[1] of this European Technical Assessment.

2 Specification of the intended use in accordance with the applicable EAD

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 provisions made in this European Technical Assessment are based on an assumed intended working life of the anchor of 50 years.

The indications given on the working life cannot be interpreted as a guarantee given by the producer or Assessment Body, 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.

1 The technical documentation of this European Technical Assessment is deposited at ETA-Danmark and, as far as relevant for the tasks of the Notified bodies involved in the attestation of conformity procedure, is handed over to the notified bodies.

3 Performance of the product and references to the methods used for its assessment

3.1 Characteristics of product

Mechanical resistance and stability (BWR 1):
The essential characteristics are detailed in the Annex C.

Safety in case of fire (BWR 2):
The essential characteristics are detailed in the Annex C.

Hygiene, health and the environment (BWR3):
No performance assessed

Safety in use (BWR4):
For basic requirement Safety in use the same criteria are valid for Basic Requirement Mechanical resistance and stability (BWR1).

Sustainable use of natural resources (BWR7)
No performance determined

Other Basic Requirements are not relevant.

3.2 Methods of assessment

The assessment of fitness of the anchor for the intended use in relation to the requirements for mechanical resistance and stability and safety in use in the sense of the Basic Requirements 1 and 4 has been made in accordance with EOTA EAD 330499-00-0601, "Bonded fasteners for use in concrete" option 7.

4 Assessment and verification of constancy of performance (AVCP)

4.1 AVCP system

According to the decision 96/582/EC of the European Commission, the system(s) of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) is 1.

5 Technical details necessary for the implementation of the AVCP system, as foreseen in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at ETA-Danmark prior to CE marking.

Issued in Copenhagen on 2018-11-18 by

Thomas Bruun
Managing Director, ETA-Danmark

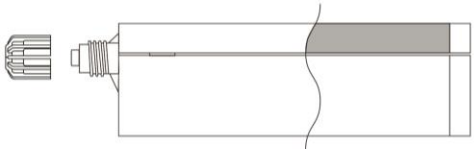
Cartridge: ARVEX CE

A) Foil Bag Cartridge 165ml, 300ml.
B) Coaxial Cartridge 380ml / 400 ml / 410 ml / 420ml
C) Side by Side Cartridge 345ml, 825ml

Cartridge Print: ARVEX CE
Including - Installation procedure, Production Batch code, Expiry Date, Storage conditions, Health & Safety warning, Gel & Cure time according to temperatures.

A)

B)

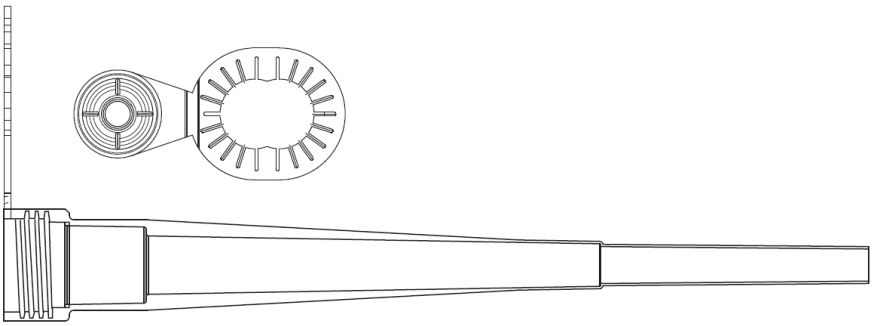


C)

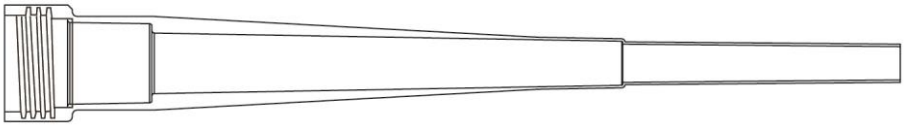
Marking:

ARVEX CE
Batch code, either expiry date or manufacturing date with shelf life

Mixer with hanger



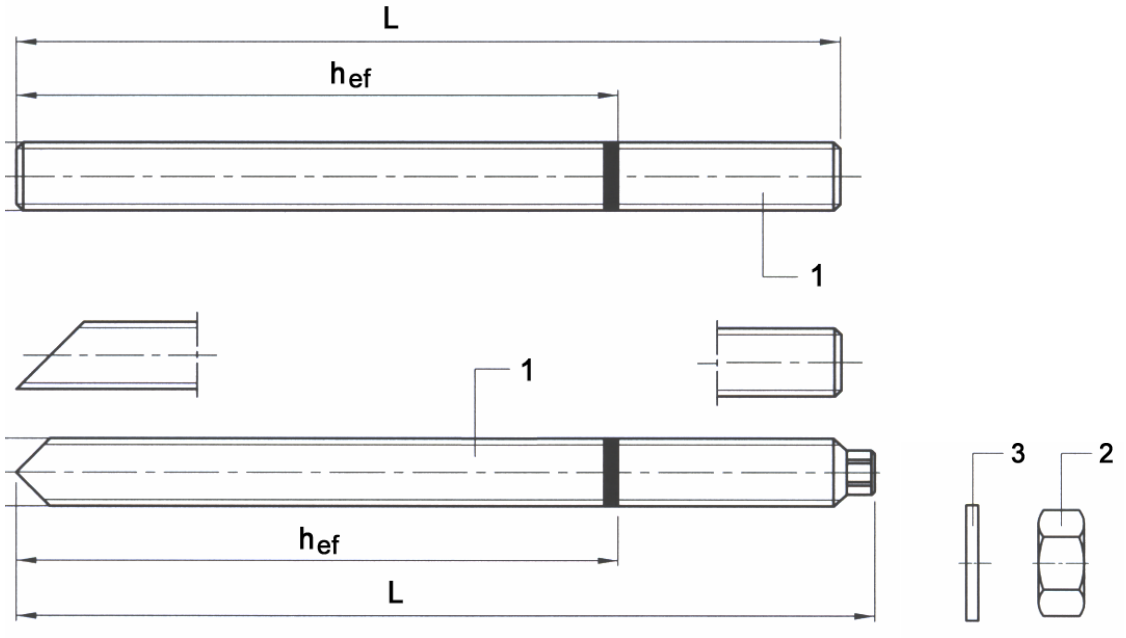
Mixer



ARVEX CE	Annex A1 of European Technical Assessment ETA-18/1009
Product and intended use	

Anchor rod and rebar

Threaded Steel Stud, Nut and Washer
Sizes M8, M10, M12, M16, M20, M24



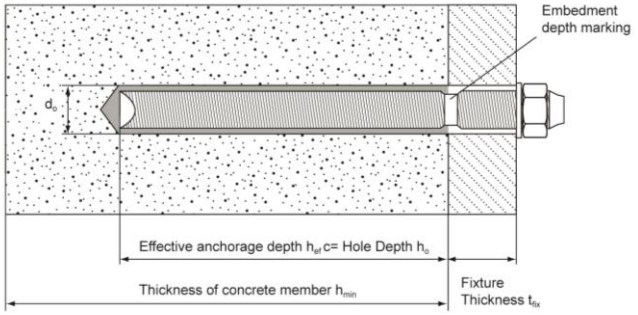
Rebar
Diameter Ø 8mm, Ø 10mm, Ø 12mm, Ø 14mm, Ø 16mm, Ø 20mm, Ø 25mm,

ARVEX CE	**Annex A2** of European Technical Assessment ETA-18/1009
Threaded rod types and rebar's dimensions	

Installed Anchor and Intended Use

Table A1: Installation details for anchor rods

Anchor size			M8	M10	M12	M16	M20	M24
Diameter of element	d	[mm]	8	10	12	16	20	24
Range of anchorage depth h_{ef}	min	[mm]	60	60	70	80	90	100
and bore hole depth h_o	max	[mm]	96	120	144	192	240	288
Effective anchorage depth	h_{ef}	[mm]	80	90	110	125	170	210
Nominal diameter of drill bit	D_o	[mm]	10	12	14	18	24	28
Diameter of clearance hole in the fixture	D_f	[mm]	9	12	14	18	22	26
Maximum torque moment	T_{max}	[Nm]	10	12	20	40	70	90
Minimum thickness of concrete member	h_{min}	[mm]	h_{ef} + 30mm ≥ 100mm			h_{ef} + 2d_o		
Minimum spacing	S_{min}	[mm]	40	50	60	80	100	120
Minimum edge distance	C_{min}	[mm]	40	50	60	80	100	120



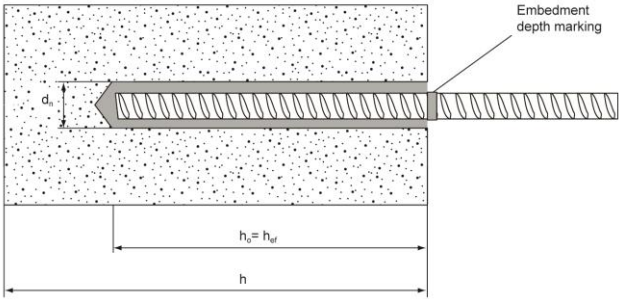


Table A2: Installation details for rebar

Rebar size (mm)			ϕ 8	ϕ 10	ϕ 12	ϕ 14	ϕ 16	ϕ 20	ϕ 25
Diameter of element	d	[mm]	8	10	12	14	16	20	25
Range of anchorage depth h_{ef}	min	[mm]	60	60	70	75	80	90	100
and bore hole depth h_o	max	[mm]	96	120	144	168	192	240	288
Nominal diameter of drill bit	D_o	[mm]	12	14	16	18	20	25	30
Minimum thickness of concrete member	h_{min}	[mm]	h_{ef} + 30mm ≥ 100mm			h_{ef} + 2d_o			
Minimum spacing	S_{min}	[mm]	40	50	60	70	80	100	120
Minimum edge distance	C_{min}	[mm]	40	50	60	70	80	100	120

Table A3: Threaded rod and rebar materials

Designation	Material
Threaded rods made of zinc coated steel	
Threaded rod M8 – M24	Strength class 4.6 to 12.9 EN ISO 898-1 Steel galvanized ≥ 5µm EN ISO 4042 Hot dipped galvanized ≥ 45µm EN ISO 10684
Washer ISO 7089	Steel galvanized EN ISO 4042; hot dipped galvanized EN ISO 10684
Nut EN ISO 4032	Strength class 8 EN ISO 898-2 Steel galvanized ≥ 5µm EN ISO 4042 Hot dipped galvanized ≥ 45µm EN ISO 10684
Threaded rods made of stainless steel	
Threaded rod M8 – M24	Strength class 50, 70 or 80 EN ISO 3506; Stainless steel 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 end 10088
Washer ISO 7089	Stainless steel 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 end 10088
Nut EN ISO 4032	Strength class 70 and 80 EN ISO 3506-1; Stainless steel 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 end 10088
Threaded rods made of high corrosion resistant steel	
Threaded rod M8 – M24	Strength class 70 or 80 R_m = 800 N/mm²; $R_{p0,2}$=640 N/mm² High corrosion resistant steel 1.4529, 1.4565 EN 10088
Washer ISO 7089	High corrosion resistant steel 1.4529, 1.4565 EN 10088
Nut EN ISO 4032	Strength class 70 EN ISO 3506-2; High corrosion resistant steel 1.4529, 1.4565 EN 10088
Rebars	
Rebars ϕ8 to ϕ25	class B and C of characteristic yield strength f_{yk} from 400 MPa to 600 MPa

Use:
The anchors are intended to be used for anchorages for which requirements for mechanical resistance and stability and safety in use in the sense of the Basic Requirements 1 and 4 of Regulation 305/2011 (EU) shall be fulfilled and failure of anchorages made with these products would compromise the stability of the works, cause risk to human life and/or lead to considerable economic consequences.

Anchors subject to:
- Static and quasi-static loads: M8 to M24, Rebar Ø8 to Ø25

Base materials:
- Reinforced or unreinforced normal weight concrete of strength class C20/25 at minimum to C50/60 at maximum according to EN 206-1.
- Non cracked concrete: sizes from M8 to M24 and rebar ϕ8mm to ϕ25mm

Temperature range:
The anchors may be used in the following temperature range:
a) T: - 40 °C to + 40°C (max short term temperature + 40 °C and max long term temperature + 24 °C).

Use conditions (Environmental conditions):
Elements made of galvanized steel and stainless steel may be used in structures subject to the following conditions:
- Structures subject to dry internal conditions
  (zinc coated steel, stainless steel A2 resp. A4 or high corrosion resistant steel).
- Structures subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal condition, if no particular aggressive conditions exist
  (stainless steel A4 or high corrosion resistant steel).
- Structures subject to external atmospheric exposure and to permanently damp internal condition, if other particular aggressive conditions exist
  (high corrosion resistant steel).
- Note: 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).

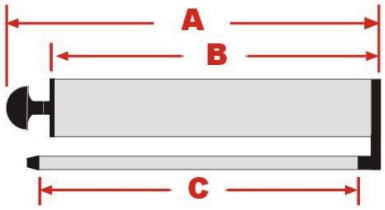
Installation:
The anchors may be installed in:
- Dry or wet concrete (use category 1)
- Flooded holes with the exception of seawater (use category 2)
- All the diameters may be used overhead
- The anchor is suitable for hammer drilled holes

Proposed design methods:
- Static and quasi-static load: FprEN 1992-4:2017 and EOTA Technical Report TR055

Table B1: Installation data

Threaded rod and rebar	Size	Nominal drill bit diameter d_o (mm)	Steel Brush	Cleaning methods	
				Manual cleaning (MAC)	Compressed air cleaning (CAC)
Studs 	M8	10	12 mm	Yes … $h_{ef} \leq 80$ mm	Yes
	M10	12	14 mm	Yes … $h_{ef} \leq 100$ mm	
	M12	14	16 mm	Yes … $h_{ef} \leq 120$ mm	
	M16	18	20 mm	Yes … $h_{ef} \leq 160$ mm	
	M 20	24	26 mm	Yes … $h_{ef} \leq 200$ mm	
	M 24	28	30 mm	Yes … $h_{ef} \leq 240$ mm	
Rebar 	ϕ 8 mm	12	14 mm	Yes … $h_{ef} \leq 80$ mm	Yes
	ϕ 10 mm	14	16 mm	Yes … $h_{ef} \leq 100$ mm	
	ϕ 12 mm	16	18 mm	Yes … $h_{ef} \leq 120$ mm	
	ϕ 14 mm	18	20 mm	Yes … $h_{ef} \leq 140$ mm	
	ϕ 16 mm	20	22 mm	Yes … $h_{ef} \leq 160$ mm	
	ϕ 20 mm	25	28 mm	Yes … $h_{ef} \leq 200$ mm	
	ϕ 25 mm	30	34 mm	Yes … $h_{ef} \leq 240$ mm	

Manual Cleaning (MAC):
Arvex hand pump recommended for
Blowing out bore holes with diameters
$d_o \leq 24$ mm and bore holes depth $h_o \leq 10d$



190mm (240x190x300mm)	280mm (330x280x300mm)	400mm (420x370x350mm)
-(A) : 240mm (overall) -(B) : 190mm (Body) -(C) : 300mm (Tube)	-(A) : 330mm (overall) -(B) : 280mm (Body) -(C) : 300mm (Tube)	-(A) : 420mm (overall) -(B) : 370mm (Body) -(C) : 350mm (Tube)

Compressed air cleaning (CAC):
Recommended air nozzle with an
Orifice opening of minimum
3,5mm in diameter.

Table B2: Minimum curing time

Minimum base material temperature C°	Gel time (working time) In dry/wet concrete	Curing time in dry concrete	Curing time in wet concrete
0°C ≤ $T_{base\ material}$ < 10°C	20 min	90 min	180 min
10°C ≤ $T_{base\ material}$ < 20°C	9 min	60 min	120 min
20°C ≤ $T_{base\ material}$ < 30°C	5 min	30 min	60 min
30°C ≤ $T_{base\ material}$ ≤ 40°C	3 min	20 min	40 min

The temperature of the bond material must be ≥ 20°C

Resin injection pump details		
Image	**Size Cartridge / Code**	**Type**
	**165 / 300ml** **165 / 300 ml 10:1**	**Manual**
	**345 / 380 / 400 / 410 / 420ml** **420 ml 10:1** **345 ml 10:1**	**Manual**
	**165 / 300 / 345 / 380 / 400 / 410 / 420ml** **165 / 300 ml** **345ml** **380 / 400 / 410 / 420 ml** **7.4v Tool**	**Battery**
	**380 / 400 / 410 / 420 / 825ml** **380 / 400 / 410 / 420 ml** **825ml**	**Pneumatic**

Table B3 - parameters: drilling, hole cleaning and installation

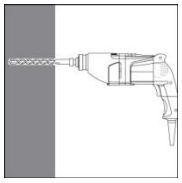
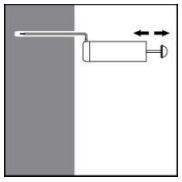
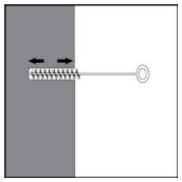
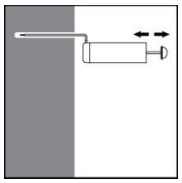
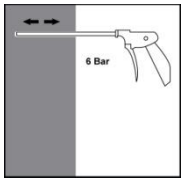
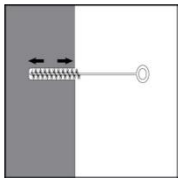
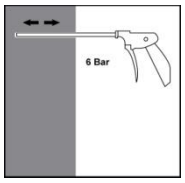
Bore hole drilling		
		Drill hole in the substrate to the required embedment depth using the appropriately sized carbide drill bit.
Bore hole cleaning Just before setting an anchor, the bore hole must be free of dust and debris.		
a) Manual air cleaning (MAC) for all bore hole diameters $d_o \leq$ 24mm and bore hole depth $h_o \leq 10d$		
	**X 4**	The manual pump shall be used for blowing out bore holes up to diameters $d_o \leq$ 24mm and embedment depths up to $h_{ef} \leq 10d$. Blow out at least 4 times from the back of the bore hole, using an extension if needed.
	**X 4**	Brush 4 times with the specified brush size (see Table B1) by inserting the steel brush to the back of the hole (if needed with an extension) in a twisting motion and removing it.
	**X 4**	Blow out again with manual pump at least 4 times.
b) Compressed air cleaning (CAC) for all bore hole diameters d_o and all bore hole depths		
	**X 2**	Blow 2 times from the back of the hole (if needed with a nozzle extension) over the whole length with oil-free compressed air (min. 6 bar at 6 m³/h).
	**X 2**	Brush 2 times with the specified brush size (see Table B1) by inserting the steel brush to the back of the hole (if needed with an extension) in a twisting motion and removing it.
	**X 2**	Blow out again with compressed air at least 2 times.

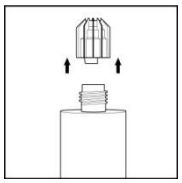
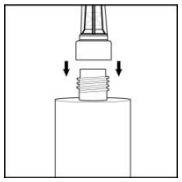
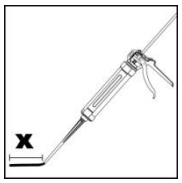
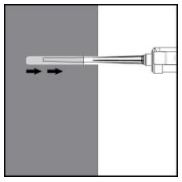
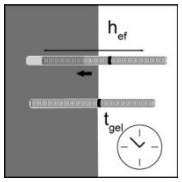
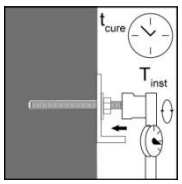
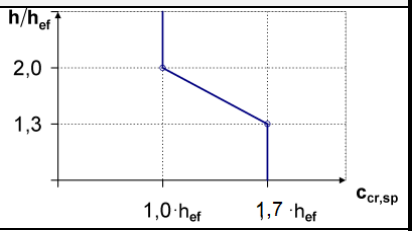
Table B4 - parameters: drilling, hole cleaning and installation	
	Remove the threaded cap from the cartridge. Cut open the foil bag if necessary.
	Tightly attach the mixing nozzle. Do not modify the mixer in any way. Made sure the mixing element is inside the mixer. Use only the supplied mixer.
	Insert the cartridge into the dispenser gun.
	Discard the initial trigger pulls of adhesive. Depending on the size of the cartridge, an initial amount of adhesive mix must be discarded. Discard quantities are 10 cm for all cartridges
	Inject the adhesive starting at the back of the hole, slowly withdrawing the mixer with each trigger pull. Fill holes approximately 2/3 full, to ensure that the annular gap between the anchor and the concrete is completely filled with adhesive along the embedment depth.
	Before use, verify that the threaded rod is dry and free of contaminants. Install the threaded rod to the required embedment depth during the open gel time t_{gel} has elapsed. The working time t_{gel} is given in Table B2.
	The anchor can be loaded after the required curing time t_{cure} (see Table B2). The applied torque shall not exceed the values T_{max} given in Table A1.

Table C1: Design method A, characteristic tension load values

ARVEX CE with threaded rods			M8	M10	M12	M16	M20	M24
Steel failure								
Characteristic resistance, class 4.6 and 4.8	$N_{Rk,s}$	[kN]	15	23	34	63	98	141
Characteristic resistance, class 5.6 and 5.8	$N_{Rk,s}$	[kN]	18	29	42	78	122	176
Characteristic resistance, class 8.8	$N_{Rk,s}$	[kN]	29	46	67	125	196	282
Characteristic resistance, class 10.9	$N_{Rk,s}$	[kN]	38	60	87	163	255	367
Characteristic resistance, class 12.9	$N_{Rk,s}$	[kN]	44	70	103	190	299	431
Characteristic resistance, A2, A4 and HCR, Property class 50	$N_{Rk,s}$	[kN]	18	29	42	78	122	176
Characteristic resistance, A2, A4 and HCR, Property class 70	$N_{Rk,s}$	[kN]	26	41	59	110	171	247
Characteristic resistance, A4 and HCR, Property class 80	$N_{Rk,s}$	[kN]	29	46	67	126	196	282
Partial safety factor 4.6 and 5.6	$\gamma_{Ms,N}$ [1]	[-]	2					
Partial safety factor 4.8, 5.8, 8.8, 10.9 and 12.9	$\gamma_{Ms,N}$ [1]	[-]	1,5					
Partial safety factor A2, A4 and HCR class 70	$\gamma_{Ms,N}$ [1]	[-]	1,87					
Partial safety factor A2, A4 and HCR class 80	$\gamma_{Ms,N}$ [1]	[-]	1,60					
Combined Pull-out and Concrete cone failure [2]								
Diameter of threaded rod	d	[mm]	8	10	12	16	20	24
Characteristic bond resistance in non-cracked concrete C20/25 – dry or wet concrete								
Temperature range a [3] : 40°C/24°C	$\tau_{Rk,ucr}$	[N/mm²]	7	7	6.5	6.5	6	5.5
Partial safety factor – dry or wet concrete	γ_{inst}	[-]	1,2			1,4		
Characteristic bond resistance in non-cracked concrete C20/25 – flooded holes								
Temperature range a [3] : 40°C/24°C	$\tau_{Rk,ucr}$	[N/mm²]	7	7	6.5	6	5	4.5
Partial safety factor – flooded holes	γ_{inst}	[-]	1,2		1,4			
Increasing factor for $\tau_{Rk,ucr}$ in non-cracked concrete	ψ_c	C30/37	1,0					
		C40/50	1,0					
		C50/60	1,0					
Factor for determination of the concrete cone failure	$k_{ucr,N}$	[-]	11,0 (based on concrete cylinder strength f_{ck}) 10,1 (based on concrete strength $f_{ck,cube}$)					
Splitting failure [2]								
Edge distance $c_{cr,sp}$ [mm] for	h / h_{ef} [4] ≥ 2,0		1,0 h_{ef}					
	2,0 > h / h_{ef} [4] > 1,3		3 h_{ef} - 1 h					
	h / h_{ef} [4] ≤ 1,3		1.7 h_{ef}					
Spacing	$s_{cr,sp}$	[mm]	2 $c_{cr,sp}$					



[1] In absence of national regulations
[2] Calculation of concrete and splitting, see annex B1
[3] Explanations, see annex B1
[4] h concrete member thickness, h_{ef} effective anchorage depth

ARVEX CE	Annex C1 of European Technical Assessment ETA-18/1009
Performance for static and quasi-static loads: Resistances	

Table C2: Displacements under tension load

ARVEX CE with threaded rods			M8	M10	M12	M16	M20	M24
Temperature range a [5] : 40°C / 24°C								
Displacement	δ_{N0}	[mm/(N/mm^2)]	0,03	0,04	0,04	0,04	0,09	0,30
Displacement	$\delta_{N\infty}$	[mm/(N/mm^2)]	-	-	0,15	-	-	-

[5] Explanation see annex B1

Table C3: Design method A, Characteristic shear load values

ARVEX CE with threaded rods			M8	M10	M12	M16	M20	M24
Steel failure without lever arm								
Characteristic resistance, class 4.6 and 4.8	$V_{Rk,s}$	[kN]	7	12	17	31	49	70
Characteristic resistance, class 5.6 and 5.8	$V_{Rk,s}$	[kN]	9	15	21	39	61	88
Characteristic resistance, class 8.8	$V_{Rk,s}$	[kN]	15	23	34	63	98	141
Characteristic resistance, class 10.9	$V_{Rk,s}$	[kN]	19	30	43	81	127	183
Characteristic resistance, class 12.9	$V_{Rk,s}$	[kN]	22	35	51	95	149	215
Characteristic resistance, A2, A4 and HCR, Property class 50	$V_{Rk,s}$	[kN]	9	15	21	39	61	88
Characteristic resistance, A2, A4 and HCR, Property class 70	$V_{Rk,s}$	[kN]	13	20	30	55	86	124
Characteristic resistance, A4 and HCR, Property class 80	$V_{Rk,s}$	[kN]	15	23	34	63	98	141
Steel failure with lever arm								
Characteristic resistance, class 4.6 and 4.8	$M^0_{Rk,s}$	[Nm]	15	30	52	133	260	449
Characteristic resistance, class 5.6 and 5.8	$M^0_{Rk,s}$	[Nm]	19	37	65	166	324	560
Characteristic resistance, class 8.8	$M^0_{Rk,s}$	[Nm]	30	60	105	266	519	896
Characteristic resistance, class 10.9	$M^0_{Rk,s}$	[Nm]	37	75	131	333	649	1123
Characteristic resistance, class 12.9	$M^0_{Rk,s}$	[Nm]	45	90	157	400	779	1347
Characteristic resistance, A2, A4, HCR -50	$M^0_{Rk,s}$	[Nm]	19	37	65	166	324	560
Characteristic resistance, A2, A4, HCR -70	$M^0_{Rk,s}$	[Nm]	26	52	95	232	454	784
Characteristic resistance, A4, HCR - 80	$M^0_{Rk,s}$	[Nm]	30	59	105	266	519	896
Partial safety factor steel failure								
Steel, Property class 4.6 or 5.6	$\gamma_{Ms,V}$ [1]	[-]	1,67					
Steel, Property class 4.8, 5.8 or 8.8	$\gamma_{Ms,V}$ [1]	[-]	1,25					
Steel, Property class 10.9 or 12.9	$\gamma_{Ms,V}$ [1]	[-]	1,50					
Stainless steel A2, A4 or HCR Property class 50	$\gamma_{Ms,V}$ [1]	[-]	2,38					
Stainless steel A2, A4 or HCR Property class 70	$\gamma_{Ms,V}$ [1]	[-]	1,56					
Stainless steel A4 or HCR Property class 80	$\gamma_{Ms,V}$ [1]	[-]	1,33					
Concrete pryout failure								
Factor in equation (27) of CEN/TS 1992-4-5, 6.3.3	k_3	[-]	1,0 for h_{ef} < 60mm 2,0 for h_{ef} ≥ 60mm					
Partial safety factor	γ_{Mc} [1]	[-]	1,5					
Concrete edge failure								
Partial safety factor	γ_{Mc} [1]	[-]	1,5					

1) In absence of national regulations

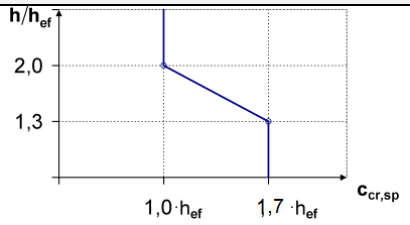
Table C4: Displacements under shear load

ARVEX CE with threaded rods			M8	M10	M12	M16	M20	M24
Displacement	δ_{V0}	[mm/kN]	0,06	0,06	0,05	0,04	0,04	0,03
Displacement	$\delta_{V\infty}$	[mm/kN]	0,09	0,08	0,08	0,06	0,06	0,05

ARVEX CE	**Annex C3** of European Technical Assessment ETA-18/1009
Performance for static, quasi-static and seismic loads: Displacements	

Table C5: Design method A, characteristic tension load values

ARVEX CE with rebar			ϕ 8	ϕ 10	ϕ 12	ϕ 16	ϕ 20	ϕ 25
Steel failure								
Characteristic tension resistance	$N_{Rk,s}$	[kN]	$A_s \cdot f_{uk}$ [1]					
Cross section area	A_s	[mm²]	50	79	113	201	314	491
Partial safety factor	$\gamma_{Ms,N}$ [2]	[-]	1,4					
Combined Pull-out and Concrete cone failure [3]								
Diameter of rebar	d	[mm]	8	10	12	16	20	25
Characteristic bond resistance in non-cracked concrete C20/25 – dry or wet concrete								
Temperature range a [4] : **40°C/24°C**	$\tau_{Rk,ucr}$	[N/mm²]	**5.5**	**5.5**	**5.5**	**5**	**5**	**5**
Partial safety factor – dry or wet concrete	γ_{inst} [2]	[-]	1,2			1,4		
Characteristic bond resistance in non-cracked concrete C20/25 – flooded holes								
Temperature range a [4] : **40°C/24°C**	$\tau_{Rk,ucr}$	[N/mm²]	**5.5**	**5.5**	**5.5**	**5**	**4.5**	**4**
Partial safety factor – flooded holes	γ_{inst}	[-]	1,2		1,4			
Increasing factor for $\tau_{Rk,ucr}$ in non-cracked concrete	ψ_c	C30/37	1,0		1,1			
		C40/50	1,0	1,1				1,2
		C50/60	1,0	1,1	1,2			1,3
Splitting failure [3]								
Edge distance $c_{cr,sp}$ [mm] for		h / h_{ef} [5] ≥ 2,0	1,0 h_{ef}					
		2,0 > h / h_{ef} [5] > 1,3	3 h_{ef} - 1 h					
		h / h_{ef} [5] ≤ 1,3	1.7 h_{ef}					
Spacing	$s_{cr,sp}$	[mm]	2 $c_{cr,sp}$					



[1] f_{uk} shall be taken from the specifications of reinforcing bars
[2] in absence of national regulation
[3] Calculation of concrete and splitting, see annex B1
[4] Explanations, see annex B1
[5] h concrete member thickness, h_{ef} effective anchorage depth

Table C6: Displacements under tension load

ARVEX CE with rebar			ϕ 8	ϕ 10	ϕ 12	ϕ 16	ϕ 20	ϕ 25
Temperature range a [4] : 40°C / 24°C								
Displacement	δ_{N0}	[mm/(N/mm²)]	0,03	0,03	0,04	0,07	0,07	0,10
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	-	-	0,15	-	-	-

Table C7: Design method A, Characteristic shear load values

ARVEX CE with rebar			**ϕ 8**	**ϕ 10**	**ϕ 12**	**ϕ 16**	**ϕ 20**	**ϕ 25**
Steel failure without lever arm								
Characteristic shear resistance	$V_{Rk,s}$	[kN]	$0{,}50 \cdot A_s \cdot f_{uk}$ [1)]					
Cross section area	A_s	[mm^2]	**50**	**79**	**113**	**201**	**314**	**491**
Partial safety factor	$\gamma_{Ms,N}$ [2)]	[-]	1,5					
Steel failure with lever arm								
Characteristic bending moment	$M^0_{Rk,s}$	[Nm]	$1.2 \cdot W_{el} \cdot f_{uk}$ [1)]					
Elastic section modulus	W_{el}	[Nm]	**50**	**98**	**170**	**402**	**785**	**1534**
Partial safety factor	$\gamma_{Ms,N}$ [2)]	[-]	1,5					
Concrete pryout failure								
Factor	k_8	[-]	1,0 for $h_{ef} < 60mm$ 2,0 for $h_{ef} \geq 60mm$					
Partial safety factor	γ_{Mc}	[-]	1,5					
Concrete edge failure								
Partial safety factor	γ_{Mc} [1)]	[-]	1,5					

[1)] f_{uk} shall be taken from the specifications of reinforcing bars
[2)] In absence of national regulations

Table C8: Displacements under shear load

ARVEX CE with rebar			**ϕ 8**	**ϕ 10**	**ϕ 12**	**ϕ 16**	**ϕ 20**	**ϕ 25**
Displacement	δ_{V0}	[mm/kN]	0,05	0,05	0,05	0,04	0,04	0,03
Displacement	$\delta_{V\infty}$	[mm/kN]	0,08	0,08	0,07	0,06	0,05	0,05

Table C9: Resistance to fire

ESSENTIAL CHARACTERISTICS	PERFORMANCE
Resistance to fire	NPA

Table C10: Reaction to fire

ESSENTIAL CHARACTERISTICS	PERFORMANCE
Reaction to fire	In the final application, the thickness of the mortar layer is about 1 to 2 mm and most of the mortar is material classified class A1 according to EC Decision 96/603/EC. Therefore, it may be assumed that the bonding material (synthetic mortar or a mixture of synthetic mortar and cementitious mortar) in connection with the metal anchor in the end use application do not contribute to fire growth or to the fully developed fire and they have no influence to the smoke hazard.