TELJESÍTMÉNY-NYILATKOZAT

DoP Nr. KEW - 1020-CPR-090-039708 **- hu**

1. A termék egyértelmű neve, kódja: Rögzítőhabarcs VM EP / EW / ES

2. Típus-, gyártási -, szériaszám, vagy más jelölés a termék egyértelmű azonosítására a 11. cikk 4. bekezdése szerint:
   ETA-09/0184 melléklet A2
   Gyártási szám: lásd csomagolás

3. Az építési termék gyártó által megadott felhasználása(i) a műszaki specifikáció alapján

Terméktípus	33. termékcsoport: vegyi rögzítés
A felhasználás helye	ETA-13/1002 melléklet B1
Felhasználási kategóriák	ETA-13/1002 melléklet B1
Terhelés	ETA-13/1002 melléklet B1
Anyaga	ETA-13/1002 melléklet A3/A4
Hőmérséklet-tartomány	ETA-13/1002 melléklet B1

4. A gyártó neve, bejegyzett kereskedelmi neve és címe a 11. cikk 5. bekezdése alapján:
   KEW Kunststofferzeugnisse GmbH Wilthen
   Dresdener Straße 19
   02681 Wilthen
   Germany

5. Az esetleges meghatalmazott neve a 12. cikk 2. bekezdése alapján:
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6. Az építési termék teljesítményének vizsgálatára és értékelésére alkalmazott rendszer(ek) a V melléklet szerint:
   Rendszer 1

7. A teljesítmény-nyilatkozathoz használt harmonizált szabvány:
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8.

A teljesímény-nyilatkozat alapjául szolgáló tanúsítvány kibocsájtója:

Cseh Állami Építésügyi Intézet, Prága

Tanúsítvány:

ETA-13/1002 -től 30.10.2017

A vizsgálati eljárás alapja:

ETAG 001 - 1. rész és 5. rész , változat 2013

A tanúsítványt kiadó szerv 1020-CPR a Rendszer 1
szerint feladatként határozta meg:

i) A termék bevizsgálása
ii) A gyártó üzem és az üzemi gyártásellenőrzés megismerése;
iii) Folyamatos ellenőrzés, az üzemi gyártásellenőrzés véleményezése, minősítése.

és az alábbit adta ki: 1020-CPR-090-039708

9. Tanúsított teljesítmény:

Fontos ismertetőjegyek	Mérési módszer	Teljesítmény		Harmonizált műszaki specifikáció
		Menetes rúd	Betonacél	
Tipikus húzófeszültség	ETAG 001mint EAD	ETA-13/1002 melléklet C1 / C5	ETA-13/1002 melléklet C2 / C6	ETAG 001mint EAD
Elmozdulás húzófeszültség alatt	ETAG 001mint EAD	ETA-13/1002 melléklet C9	ETA-13/1002 melléklet C10	
Tipikus értékek nyírófeszültség alatt	ETAG 001mint EAD	ETA-13/1002 melléklet C3 / C7	ETA-13/1002 melléklet C4 / C8	
Elmozdulás nyírófeszültség alatt	ETAG 001mint EAD	ETA-13/1002 melléklet C9	ETA-13/1002 melléklet C10	
Tipikus értékek szeizmikus terhelésnél. Teljesítmény kategória: 1	ETAG 001mint EAD	ETA-13/1002 melléklet C11	-	

Ha a 37. vagy 38. cikk szerint a vizsgálathoz különleges műszaki specifikációt használtak, követelmények, amelyeknek a termék megfelel:

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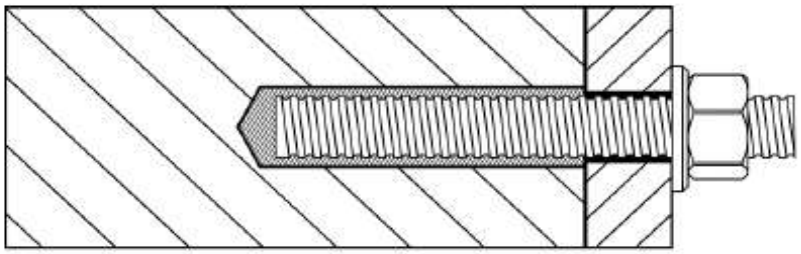
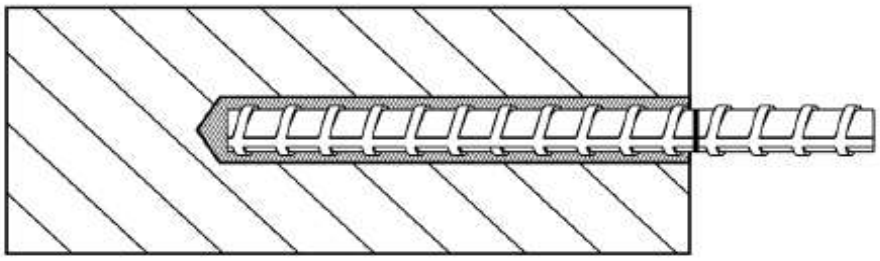
10. A termék teljesítménye az 1. és 2. pont szerint megfelel a 9. pontban leírtaknak. Ezen a teljesítmény-nyilatkozat kiadásáért egyedül a 4. pontban megadott gyártó felelős. A gyártó nevében aláírja:

André Gedan
(Kereskedelmi - és marketing igazgató)
Wilthen, 13.06.2019

Threaded rod



Reinforcing bar



VM EP, VM EW, VM ES	Annex A 1
Product description Installed conditions	

Coaxial cartridge
VM EP, VM EW, VM ES

150 ml
380 ml
400 ml
410 ml

Side by side cartridge
VM EP, VM EW, VM ES

350 ml
825 ml

Two part foil in a single piston component cartridge
VM EP, VM EW, VM ES

150 ml
170 ml
300 ml
550 ml
850 ml

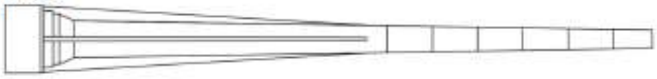
Peeler cartridge
VM EP, VM EW, VM ES

280 ml

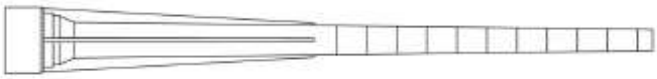
Marking of the mortar cartridges
Identifying mark of the producer, Trade name, Charge code number, Storage life, Curing and processing time

Mixing nozzle

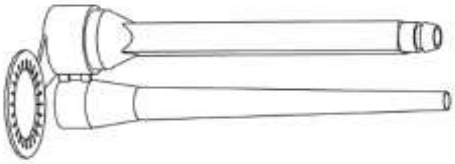
VSM



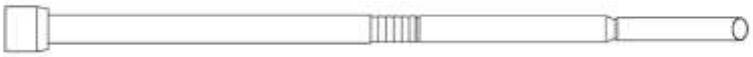
VKM



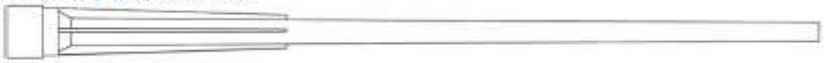
VDM



VLM

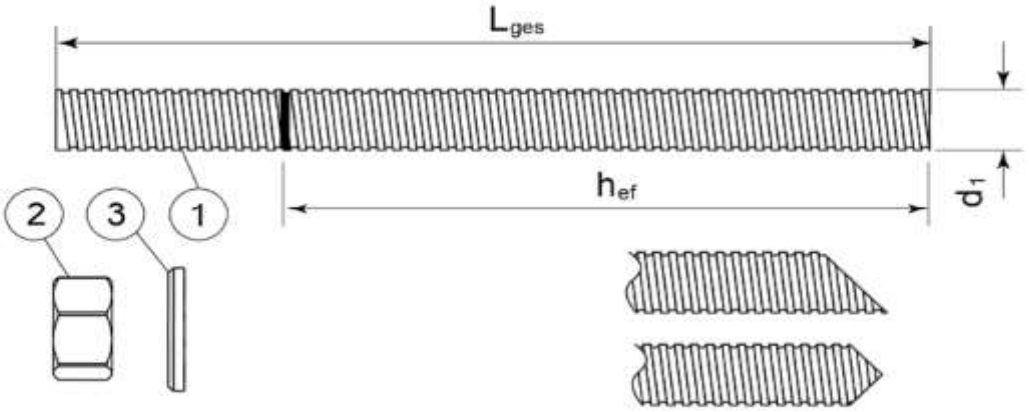


VRM for use with 850



VM EP, VM EW, VM ES	**Annex A 2**
Product description Injection system	

Threaded rod M8, M10, M12, M16, M20, M24, M27, M30



Standard commercial threaded rod with marked embedment depth

Part	Designation	Material
Steel, zinc plated ≥ 5 µm acc. to EN ISO 4042 or Steel, Hot-dip galvanized ≥ 40 µm acc. to EN ISO 1461 and EN ISO 10684 or Steel, zinc diffusion coating ≥ 15 µm acc. to EN 13811		
1	Anchor rod	Steel, EN 10087 or EN 10263 Property class 4.6, 5.8, 8.8, 10.9* EN ISO 898-1
2	Hexagon nut EN ISO 4032	According to threaded rod, EN 20898-2
3	Washer EN ISO 887, EN ISO 7089, EN ISO 7093 or EN ISO 7094	According to threaded rod
Stainless steel		
1	Anchor rod	Material: A2-70, A4-70, A4-80, EN ISO 3506
2	Hexagon nut EN ISO 4032	According to threaded rod
3	Washer EN ISO 887, EN ISO 7089, EN ISO 7093 or EN ISO 7094	According to threaded rod
High corrosion resistant steel		
1	Anchor rod	Material: 1.4529, 1.4565, EN 10088-1
2	Hexagon nut EN ISO 4032	According to threaded rod
3	Washer EN ISO 887, EN ISO 7089, EN ISO 7093 or EN ISO 7094	According to threaded rod

*Galvanized rod of high strength are sensitive to hydrogen induced brittle failure

VM EP, VM EW, VM ES	**Annex A 3**
Product description Threaded rod and materials	

Rebar Ø8, Ø10, Ø12, Ø16, Ø20, Ø25, Ø32

Standard commercial reinforcing bar with marked embedment depth

Product form		Bars and de-coiled rods	
Class		B	C
Characteristic yield strength f_{yk} or $f_{0,2k}$ (MPa)		400 to 600	
Minimum value of $k = (f_t/f_y)_k$		≥ 1,08	≥ 1,15 < 1,35
Characteristic strain at maximum force ε_{uk} (%)		≥ 5,0	≥ 7,5
Bendability		Bend/Rebend test	
Maximum deviation from nominal mass (individual bar) (%)	Nominal bar size (mm) ≤ 8 > 8	 ±6,0 ±4,5	
Bond: Minimum relative rib area, $f_{R,min}$	Nominal bar size (mm) 8 to 12 > 12	 0,040 0,056	

VM EP, VM EW, VM ES	Annex A 4
Product description Rebars and materials	

Specifications of intended use

Anchorages subject to:
- Static and quasi-static load.
- Seismic performance category C1: threaded rod size M10, M12, M16, M20, M24

Base materials
- Non-cracked concrete.
- Cracked and non-cracked concrete for threaded rod size M10, M12, M16, M20, M24
- Reinforced or unreinforced normal weight concrete of strength class C20/25 at minimum and C50/60 at maximum according EN 206-1:2000-12.

Temperature range:
- -40°C to +80°C (max. short. term temperature +80°C and max. long term temperature +50°C)

Use conditions (Environmental conditions)
- Structures subject to dry internal conditions (zinc coated steel, stainless steel, high corrosion resistance steel).
- Structures subject to external atmospheric exposure including industrial and marine environment, if no particular aggressive conditions exist (stainless steel, high corrosion resistance steel).
- Structures subject to permanently damp internal condition, if no particular aggressive conditions exist (stainless steel, high corrosion resistance steel).
- Structures subject to permanently damp internal condition, with particular aggressive conditions exist (high corrosion resistance 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).

Use categories:
- Category 2 – installation in dry or wet concrete or in flooded hole.

Design:
- The anchorages are designed in accordance with the EOTA Technical Report TR 029 "Design of bonded anchors" 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.
- Anchorages under seismic actions (cracked concrete) have to be designed in accordance with EOTA Technical Report TR 045 "Design of Metal Anchors under Seismic Action".

Installation:
- Dry or wet concrete or flooded hole.
- Hole drilling by hammer drill mode.
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.

VM EP, VM EW, VM ES	Annex B 1
Intended use Specifications	

Applicator gun

A

B

C

D

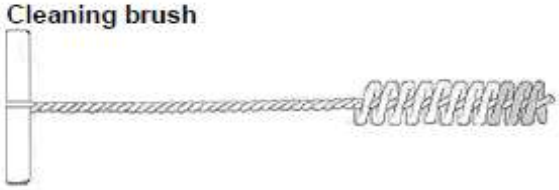
E

F

G

Applicator gun	A	B	C	D	E	F	G
Cartridge	Coaxial 380ml 400ml 410ml	Side by side 350ml	Foil capsule 150ml 300ml 550ml	Foil capsule 150ml 300ml Peeler 280ml	Coaxial 150ml	Side by side 825ml	Foil capsule 850ml

Cleaning brush



VM EP, VM EW, VM ES	Annex B 2
Intended use Applicator guns Cleaning brush	

Installation instructions

1. Drill the hole to the correct diameter and depth using a rotary percussion drilling machine.

2. Thoroughly clean the hole in the following sequence using the Brush with the required extensions and a blow pump:

   Blow Clean x2.
   Brush Clean x2.
   Blow Clean x2.
   Brush Clean x2.
   Blow Clean x2.

   Remove standing water from the hole prior to cleaning to achieve maximum performance.

3. Select the appropriate static mixer nozzle for the installation, open the cartridge/cut foil pack and screw nozzle onto the mouth of the cartridge. Insert the cartridge into a good quality applicator (gun).

4. Extrude the first part of the cartridge to waste until an even colour has been achieved without streaking in the resin.

5. If necessary, cut the extension tube to the depth of the hole and push onto the end of the mixer nozzle, and fit the correct resin stopper to the other end.

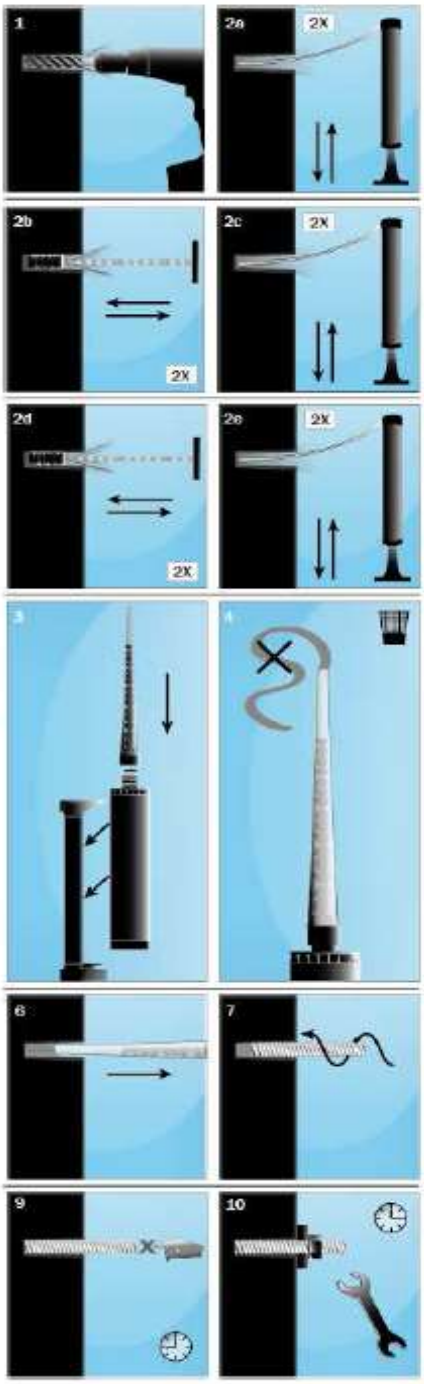
6. Insert the mixer nozzle (or the extension tube with resin stopper when necessary) to the bottom of the hole. Begin to extrude the resin and slowly withdraw the mixer nozzle from the hole ensuring that there are no air voids as the mixer nozzle is withdrawn. Fill the hole to approximately ½ to ¾ full and withdraw the nozzle completely.

7. Insert the clean threaded bar, free from oil or other release agents, to the bottom of the hole using a back and forth twisting motion ensuring all the threads are thoroughly coated. Adjust to the correct position within the stated working time.

8. Excess resin will be expelled from the hole evenly around the steel element showing that the hole is full.
   This excess resin should be removed from around the mouth of the hole before it sets.

9. Leave the anchor to cure.
   Do not disturb the anchor until the appropriate loading time has elapsed depending on the substrate conditions and ambient temperature.

10. Attach the fixture and tighten the nut to the recommended torque.
    Do not overtighten.



VM EP, VM EW, VM ES	Annex B 3
Intended use Installation procedure	

Table B1: Installation parameters of threaded rod

Size			M8	M10	M12	M16	M20	M24	M27	M30
Nominal drill hole diameter	$Ød_0$	[mm]	10	12	14	18	22	26	30	35
Diameter of cleaning brush	d_b	[mm]	14	14	20	20	29	29	40	40
Torque moment	T_{inst}	[Nm]	10	20	40	80	150	200	240	275
$h_{ef,min}$ = 8d										
Depth of drill hole	h_0	[mm]	64	80	96	128	160	192	216	240
Minimum edge distance	c_{min}	[mm]	35	40	50	65	80	96	110	120
Minimum spacing	s_{min}	[mm]	35	40	50	65	80	96	110	120
Minimum thickness of member	h_{min}	[mm]	h_{ef} + 30 mm ≥ 100 mm				h_{ef} + $2d_0$			
$h_{ef,max}$ = 20d										
Depth of drill hole	h_0	[mm]	160	200	240	320	400	480	540	600
Minimum edge distance	c_{min}	[mm]	80	100	120	160	200	240	270	300
Minimum spacing	s_{min}	[mm]	80	100	120	160	200	240	270	300
Minimum thickness of member	h_{min}	[mm]	h_{ef} + 30 mm ≥ 100 mm				h_{ef} + $2d_0$			

Table B2: Installation parameters of rebar

Size			Ø8	Ø10	Ø12	Ø16	Ø20	Ø25	Ø32
Nominal drill hole diameter	$Ød_0$	[mm]	12	14	16	20	25	32	40
Diameter of cleaning brush	d_b	[mm]	14	14	19	22	29	40	42
$h_{ef,min}$ = 8d									
Depth of drill hole	h_0	[mm]	64	80	96	128	160	200	256
Minimum edge distance	c_{min}	[mm]	35	40	50	65	80	100	130
Minimum spacing	s_{min}	[mm]	35	40	50	65	80	100	130
Minimum thickness of member	h_{min}	[mm]	h_{ef} + 30 mm ≥ 100 mm				h_{ef} + $2d_0$		
$h_{ef,max}$ = 20d									
Depth of drill hole	h_0	[mm]	160	200	240	320	400	500	640
Minimum edge distance	c_{min}	[mm]	80	100	120	160	200	250	320
Minimum spacing	s_{min}	[mm]	80	100	120	160	200	250	320
Minimum thickness of member	h_{min}	[mm]	h_{ef} + 30 mm ≥ 100 mm				h_{ef} + $2d_0$		

Table B3: Cleaning

All diameters
- 2 x blowing
- 2 x brushing
- 2 x blowing
- 2 x brushing
- 2 x blowing

Table B4: Minimum curing time

VM EP

Application temperature	Processing time	Load time
+5 to +10°C	10 mins	145 mins
+10 to +15°C	8 mins	85 mins
+15 to +20°C	6 mins	75 mins
+20 to +25°C	5 mins	50 mins
+25 to +30°C	4 mins	40 mins

Processing time refers to the highest temperature in the range.
Load time refers to the lowest temperature in the range.
Cartridge must be conditioned to a minimum +5°C.

VM ES

Application temperature	Processing time	Load time
+15 to +20°C	15 mins	5 hours
+20 to +25°C	10 mins	145 mins
+25 to +30°C	7.5 mins	85 mins
+30 to +35°C	5 mins	50 mins
+35 to +40°C	3.5 mins	40 mins

Processing time refers to the highest temperature in the range.
Load time refers to the lowest temperature in the range.
Cartridge must be conditioned to a minimum +15°C.

VM EW

Application temperature	Processing time	Load time
-10 to -5°C	50 mins	12 hours
-5 to 0°C	15 mins	100 mins
0 to +5°C	10 mins	75 mins
+5 to +20°C	5 mins	50 mins
+20°C	100 second	20 mins

Processing time refers to the highest temperature in the range.
Load time refers to the lowest temperature in the range.
Cartridge must be conditioned to a minimum 0°C.

VM EP, VM EW, VM ES

Intended use
Installation parameters
Curing time

Annex B 4

Table C1: Design method TR 029
Characteristic values of resistance to tension load of threaded rod

Steel failure – Characteristic resistance										
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel grade **4.6**	$N_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
Partial safety factor	γ_{Ms} [1)]	[-]	2,00							
Steel grade **5.8**	$N_{Rk,s}$	[kN]	18	29	42	79	123	177	230	281
Partial safety factor	γ_{Ms} [1)]	[-]	1,50							
Steel grade **8.8**	$N_{Rk,s}$	[kN]	29	46	67	126	196	282	367	449
Partial safety factor	γ_{Ms} [1)]	[-]	1,50							
Steel grade **10.9**	$N_{Rk,s}$	[kN]	37	58	84	157	245	353	459	561
Partial safety factor	γ_{Ms} [1)]	[-]	1,33							
Stainless steel grade **A2-70, A4-70**	$N_{Rk,s}$	[kN]	26	41	59	110	172	247	321	393
Partial safety factor	γ_{Ms} [1)]	[-]	1,87							
Stainless steel grade **A4-80**	$N_{Rk,s}$	[kN]	29	46	67	126	196	282	367	449
Partial safety factor	γ_{Ms} [1)]	[-]	1,60							
Stainless steel grade **1.4529**	$N_{Rk,s}$	[kN]	26	41	59	110	172	247	321	393
Partial safety factor	γ_{Ms} [1)]	[-]	1,50							
Stainless steel grade **1.4565**	$N_{Rk,s}$	[kN]	26	41	59	110	172	247	321	393
Partial safety factor	γ_{Ms} [1)]	[-]	1,87							

Combined pullout and concrete cone failure in non-cracked concrete C20/25										
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Characteristic bond resistance in non-cracked concrete										
Dry and wet concrete	τ_{Rk}	[N/mm²]	10	9,5	9,5	9	8,5	8	6,5	5,5
Partial safety factor	γ_{Mc} [1)]	[-]	1,8 [2)]						2,1 [3)]	
Flooded hole	τ_{Rk}	[N/mm²]	8,5	7,5	7	7	6,5	5,5		
Partial safety factor	γ_{Mc} [1)]	[-]	2,1 [3)]							
Factor for concrete C50/60	ψ_c	[-]	1							

Combined pullout and concrete cone failure in cracked concrete C20/25								
Size			**M10**	**M12**	**M16**	**M20**	**M24**
Characteristic bond resistance in cracked concrete							
Dry and wet concrete	τ_{Rk}	[N/mm²]	4,5	4,5	4,5	4	4
Partial safety factor	γ_{Mc} [1)]	[-]	1,8 [2)]				
Flooded hole	τ_{Rk}	[N/mm²]	4,5	4,5	4,5	4	4
Partial safety factor	γ_{Mc} [1)]	[-]	2,1 [3)]				
Factor for cracked concrete C30/37 C40/50 C50/60	ψ_c	[-]	1,12 1,23 1,30				

Splitting failure										
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Edge distance	$c_{cr,sp}$	[mm]	$1,5h_{ef}$							
Spacing	$s_{cr,sp}$	[mm]	$3,0h_{ef}$							
Partial safety factor	γ_{Msp} [1)]	[-]	1,8							

[1)] In absence of national regulations
[2)] The partial safety factor γ_2=1,2 is included
[3)] The partial safety factor γ_2=1,4 is included

VM EP, VM EW, VM ES

Performances
Design according to TR 029
Characteristic resistance for tension loads - threaded rod

Annex C 1

Table C2: Design method TR 029
Characteristic values of resistance to tension load of rebar

Steel failure – Characteristic resistance									
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Rebar BSt 500 S	$N_{Rk,s}$	[kN]	28	43	62	111	173	270	442
Partial safety factor	γ_{Ms} [1)]	[-]	1,4						

Combined pullout and concrete cone failure in non-cracked concrete C20/25									
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Characteristic bond resistance in non-cracked concrete									
Dry and wet concrete	τ_{Rk}	[N/mm²]	11	9,5	9,5	9	8,5	8,5	5,5
Partial safety factor	γ_{Mc} [1)]	[-]	1,8 [2)]						
Flooded hole	τ_{Rk}	[N/mm²]	11	9,5	9,5	9	8,5	8,5	5,5
Partial safety factor	γ_{Mc} [1)]	[-]	2,1 [3)]						
Factor for concrete C50/60	ψ_c	[-]	1						

Splitting failure									
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Edge distance	$c_{cr,sp}$	[mm]	$1{,}5h_{ef}$						
Spacing	$s_{cr,sp}$	[mm]	$3{,}0h_{ef}$						
Partial safety factor	γ_{Msp} [1)]	[-]	1,8						

[1)] In absence of national regulations
[2)] The partial safety factor γ_2=1,2 is included
[3)] The partial safety factor γ_2=1,4 is included

VM EP, VM EW, VM ES	
Performances Design according to TR 029 Characteristic resistance for tension loads - rebar	**Annex C 2**

Table C3: Design method TR 029
Characteristic values of resistance to shear load of threaded rod

Steel failure without lever arm										
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel grade **4.6**	$V^0_{Rk,s}$	[kN]	7	12	17	31	49	71	92	112
Partial safety factor	γ_{Ms} [1)]	[-]	1,67							
Steel grade **5.8**	$V^0_{Rk,s}$	[kN]	9	15	21	39	61	88	115	140
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Steel grade **8.8**	$V^0_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Steel grade **10.9**	$V^0_{Rk,s}$	[kN]	18	29	42	79	123	177	230	281
Partial safety factor	γ_{Ms} [1)]	[-]	1,5							
Stainless steel grade **A2-70, A4-70**	$V^0_{Rk,s}$	[kN]	13	20	30	55	86	124	161	196
Partial safety factor	γ_{Ms} [1)]	[-]	1,56							
Stainless steel grade **A4-80**	$V^0_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
Partial safety factor	γ_{Ms} [1)]	[-]	1,33							
Stainless steel grade **1.4529**	$V^0_{Rk,s}$	[kN]	13	20	30	55	86	124	161	196
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Stainless steel grade **1.4565**	$V^0_{Rk,s}$	[kN]	13	20	30	55	86	124	161	196
Partial safety factor	γ_{Ms} [1)]	[-]	1,56							

Steel failure with lever arm										
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel grade **4.6**	$M^{0}_{Rk,s}$	[N.m]	15	30	52	133	260	449	666	900
Partial safety factor	γ_{Ms} [1)]	[-]	1,67							
Steel grade **5.8**	$M^{0}_{Rk,s}$	[N.m]	19	37	66	166	325	561	832	1125
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Steel grade **8.8**	$M^{0}_{Rk,s}$	[N.m]	30	60	105	266	519	898	1332	1799
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Steel grade **10.9**	$M^{0}_{Rk,s}$	[N.m]	37	75	131	333	649	1123	1664	2249
Partial safety factor	γ_{Ms} [1)]	[-]	1,50							
Stainless steel grade **A2-70, A4-70**	$M^{0}_{Rk,s}$	[N.m]	26	52	92	233	454	786	1165	1574
Partial safety factor	γ_{Ms} [1)]	[-]	1,56							
Stainless steel grade **A4-80**	$M^{0}_{Rk,s}$	[N.m]	30	60	105	266	519	898	1332	1799
Partial safety factor	γ_{Ms} [1)]	[-]	1,33							
Stainless steel grade **1.4529**	$M^{0}_{Rk,s}$	[N.m]	26	52	92	233	454	786	1165	1574
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Stainless steel grade **1.4565**	$M^{0}_{Rk,s}$	[N.m]	26	52	92	233	454	786	1165	1574
Partial safety factor	γ_{Ms} [1)]	[-]	1,56							
Concrete pryout failure										
Factor *k* from TR 029 Design of bonded anchors, Part 5.2.3.3			2							
Partial safety factor	γ_{Mp} [1)]	[-]	1,5							

Concrete edge failure										
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
See section 5.2.3.4 of Technical Report TR 029 for the Design of Bonded Anchors										
Partial safety factor	γ_{Mc} [1)]	[-]	1,5							

[1)] In absence of national regulations

VM EP, VM EW, VM ES	
Performances Design according to TR 029 Characteristic resistance for shear loads - threaded rod	**Annex C 3**

Table C4: Design method TR 029
Characteristic values of resistance to shear load of rebar

Steel failure without lever arm									
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Rebar BSt 500 S	$V_{Rk,s}$	[kN]	14	22	31	55	86	135	221
Partial safety factor	γ_{Ms} [1)]	[-]	1,5						

Steel failure with lever arm									
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Rebar BSt 500 S	$M^0_{Rk,s}$	[N.m]	33	65	112	265	518	1013	2122
Partial safety factor	γ_{Ms} [1)]	[-]	1,5						
Concrete pryout failure									
Factor *k* from TR 029 Design of bonded anchors, Part 5.2.3.3			2						
Partial safety factor	γ_{Mp} [1)]	[-]	1,5						

Concrete edge failure									
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
See section 5.2.3.4 of Technical Report TR 029 for the Design of Bonded Anchors									
Partial safety factor	γ_{Mc} [1)]	[-]	1,5						

[1)] In absence of national regulations

VM EP, VM EW, VM ES	Annex C 4
Performances Design according to TR 029 Characteristic resistance for shear loads - rebar	

Table C5: Design method CEN/TS 1992-4
Characteristic values of resistance to tension load of threaded rod

Steel failure – Characteristic resistance										
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel grade **4.6**	$N_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
Partial safety factor	γ_{Ms} [1)]	[-]	2,00							
Steel grade **5.8**	$N_{Rk,s}$	[kN]	18	29	42	79	123	177	230	281
Partial safety factor	γ_{Ms} [1)]	[-]	1,50							
Steel grade **8.8**	$N_{Rk,s}$	[kN]	29	46	67	126	196	282	367	449
Partial safety factor	γ_{Ms} [1)]	[-]	1,50							
Steel grade **10.9**	$N_{Rk,s}$	[kN]	37	58	84	157	245	353	459	561
Partial safety factor	γ_{Ms} [1)]	[-]	1,33							
Stainless steel grade **A2-70, A4-70**	$N_{Rk,s}$	[kN]	26	41	59	110	172	247	321	393
Partial safety factor	γ_{Ms} [1)]	[-]	1,87							
Stainless steel grade **A4-80**	$N_{Rk,s}$	[kN]	29	46	67	126	196	282	367	449
Partial safety factor	γ_{Ms} [1)]	[-]	1,60							
Stainless steel grade **1.4529**	$N_{Rk,s}$	[kN]	26	41	59	110	172	247	321	393
Partial safety factor	γ_{Ms} [1)]	[-]	1,50							
Stainless steel grade **1.4565**	$N_{Rk,s}$	[kN]	26	41	59	110	172	247	321	393
Partial safety factor	γ_{Ms} [1)]	[-]	1,87							
Combined pullout and concrete cone failure in non-cracked concrete C20/25										
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Characteristic bond resistance in non-cracked concrete										
Dry and wet concrete	τ_{Rk}	[N/mm²]	10	9,5	9,5	9	8,5	8	6,5	5,5
Partial safety factor	γ_{Mc} [1)]	[-]	1,8 [2)]						2,1 [3)]	
Flooded hole	τ_{Rk}	[N/mm²]	8,5	7,5	7	7	6,5	5,5		
Partial safety factor	γ_{Mc} [1)]	[-]	2,1 [3)]							
Factor for concrete C50/60	ψ_c	[-]	1							
Factor according to CEN/TS 1992-4-5 Section 6.2.2	k_8		10,1							
Combined pullout and concrete cone failure in cracked concrete C20/25										
Size				**M10**		**M12**		**M16**	**M20**	**M24**
Characteristic bond resistance in cracked concrete										
Dry and wet concrete	τ_{Rk}	[N/mm²]		4,5		4,5		4,5	4	4
Partial safety factor	γ_{Mc} [1)]	[-]		1,8 [2)]						
Flooded hole	τ_{Rk}	[N/mm²]		4,5		4,5		4,5	4	4
Partial safety factor	γ_{Mc} [1)]	[-]		2,1 [3)]						
Factor for cracked concrete C30/37	ψ_c	[-]		1,12						
Factor for cracked concrete C40/50	ψ_c	[-]		1,23						
Factor for cracked concrete C50/60	ψ_c	[-]		1,30						
Factor according to CEN/TS 1992-4-5 Section 6.2.2	k_8			7,2						
Concrete cone failure										
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Factor according to CEN/TS 1992-4-5 Section 6.2.3	k_{ucr}		10,1							
	k_{cr}			7,2						
Edge distance	$c_{cr,N}$	[mm]	$1,5h_{ef}$							
Spacing	$s_{cr,N}$	[mm]	$3,0h_{ef}$							
Splitting failure										
Edge distance	$c_{cr,sp}$	[mm]	$1,5h_{ef}$							
Spacing	$s_{cr,sp}$	[mm]	$3,0h_{ef}$							
Partial safety factor	γ_{Msp} [1)]	[-]	1,8							

[1)] In absence of national regulations
[2)] The partial safety factor γ_2=1,2 is included
[3)] The partial safety factor γ_2=1,4 is included

VM EP, VM EW, VM ES

Performances
Design according to CEN/TS 1992-4
Characteristic resistance for tension loads - threaded rod

Annex C 5

Table C6: Design method CEN/TS 1992-4
Characteristic values of resistance to tension load of rebar

Steel failure – Characteristic resistance									
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Rebar BSt 500 S	$N_{Rk,s}$	[kN]	28	43	62	111	173	270	442
Partial safety factor	γ_{Ms} [1]	[-]	1,4						

Combined pullout and concrete cone failure in non-cracked concrete C20/25									
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Characteristic bond resistance in non-cracked concrete									
Dry and wet concrete	τ_{Rk}	[N/mm²]	11	9,5	9,5	9	8,5	8,5	5,5
Partial safety factor	γ_{Mc} [1]	[-]	1,8 [2]						
Flooded hole	τ_{Rk}	[N/mm²]	11	9,5	9,5	9	8,5	8,5	5,5
Partial safety factor	γ_{Mc} [1]	[-]	2,1 [3]						
Factor for concrete C50/60	ψ_{c}	[-]	1						
Factor according to CEN/TS 1992-4-5 Section 6.2.2	k_8		10,1						

Concrete cone failure									
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Factor according to CEN/TS 1992-4-5 Section 6.2.3	k_{ucr}		10,1						
Edge distance	$c_{cr,N}$	[mm]	$1,5h_{ef}$						
Spacing	$s_{cr,N}$	[mm]	$3,0h_{ef}$						
Splitting failure									
Edge distance	$c_{cr,sp}$	[mm]	$1,5h_{ef}$						
Spacing	$s_{cr,sp}$	[mm]	$3,0h_{ef}$						
Partial safety factor	γ_{Msp} [1]	[-]	1,8						

[1] In absence of national regulations
[2] The partial safety factor γ_2=1,2 is included
[3] The partial safety factor γ_2=1,4 is included

VM EP, VM EW, VM ES	**Annex C 6**
Performances Design according to CEN/TS 1992-4 Characteristic resistance for tension loads - rebar	

Table C7: Design method CEN/TS 1992-4
Characteristic values of resistance to shear load of threaded rod

Steel failure without lever arm									
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel grade **4.6**	$V^0_{Rk,s}$	[kN]	7	12	17	31	49	71	92	112
Partial safety factor	γ_{Ms} [1)]	[-]	1,67							
Steel grade **5.8**	$V^0_{Rk,s}$	[kN]	9	15	21	39	61	88	115	140
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Steel grade **8.8**	$V^0_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Steel grade **10.9**	$V^0_{Rk,s}$	[kN]	18	29	42	79	123	177	230	281
Partial safety factor	γ_{Ms} [1)]	[-]	1,5							
Stainless steel grade **A2-70, A4-70**	$V^0_{Rk,s}$	[kN]	13	20	30	55	86	124	161	196
Partial safety factor	γ_{Ms} [1)]	[-]	1,56							
Stainless steel grade **A4-80**	$V^0_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
Partial safety factor	γ_{Ms} [1)]	[-]	1,33							
Stainless steel grade **1.4529**	$V^0_{Rk,s}$	[kN]	13	20	30	55	86	124	161	196
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Stainless steel grade **1.4565**	$V^0_{Rk,s}$	[kN]	13	20	30	55	86	124	161	196
Partial safety factor	γ_{Ms} [1)]	[-]	1,56							
Ductility factor according to CEN/TS 1992-4-5 Section 6.3.2.1		k_2	0,8							
Steel failure with lever arm									
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel grade **4.6**	$M^0_{Rk,s}$	[N.m]	15	30	52	133	260	449	666	900
Partial safety factor	γ_{Ms} [1)]	[-]	1,67							
Steel grade **5.8**	$M^0_{Rk,s}$	[N.m]	19	37	66	166	325	561	832	1125
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Steel grade **8.8**	$M^0_{Rk,s}$	[N.m]	30	60	105	266	519	898	1332	1799
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Steel grade **10.9**	$M^0_{Rk,s}$	[N.m]	37	75	131	333	649	1123	1664	2249
Partial safety factor	γ_{Ms} [1)]	[-]	1,50							
Stainless steel grade **A2-70, A4-70**	$M^0_{Rk,s}$	[N.m]	26	52	92	233	454	786	1165	1574
Partial safety factor	γ_{Ms} [1)]	[-]	1,56							
Stainless steel grade **A4-80**	$M^0_{Rk,s}$	[N.m]	30	60	105	266	519	898	1332	1799
Partial safety factor	γ_{Ms} [1)]	[-]	1,33							
Stainless steel grade **1.4529**	$M^0_{Rk,s}$	[N.m]	26	52	92	233	454	786	1165	1574
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Stainless steel grade **1.4565**	$M^0_{Rk,s}$	[N.m]	26	52	92	233	454	786	1165	1574
Partial safety factor	γ_{Ms} [1)]	[-]	1,56							
Concrete pryout failure									
Factor according to CEN/TS 1992-4-5 Section 6.3.3		k_3	2,0							
Partial safety factor	γ_{Mp} [1)]	[-]	1,5							
Concrete edge failure									
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
See section 6.3.4 of CEN/TS 1992-4-5										
Effective length of anchor	l_f	[mm]	$l_f = \min(h_{ef}; 8\,d_{nom})$							
Outside diameter of anchor	d_{nom}	[mm]	8	10	12	16	20	24	27	30
Partial safety factor	γ_{Mc} [1)]	[-]	1,5							

[1)] In absence of national regulations

VM EP, VM EW, VM ES

Performances
Design according to CEN/TS 1992-4
Characteristic resistance for shear loads - threaded rod

Annex C 7

Table C8: Design method CEN/TS 1992-4
Characteristic values of resistance to shear load of rebar

Steel failure without lever arm									
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Rebar BSt 500 S	$V_{Rk,s}$	[kN]	14	22	31	55	86	135	221
Partial safety factor	γ_{Ms} [1)]	[-]	1,5						
Ductility factor according to CEN/TS 1992-4-5 Section 6.3.2.1	k_2		0,8						

Steel failure with lever arm									
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Rebar BSt 500 S	$M^0_{Rk,s}$	[N.m]	33	65	112	265	518	1013	2122
Partial safety factor	γ_{Ms} [1)]	[-]	1,5						
Concrete pryout failure									
Factor according to CEN/TS 1992-4-5 Section 6.3.3	k_3		2,0						
Partial safety factor	γ_{Mp} [1)]	[-]	1,5						

Concrete edge failure									
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
See section 6.3.4 of CEN/TS 1992-4-5									
Effective length of anchor	l_f	[mm]	$l_f = \min(h_{ef}; 8\ d_{nom})$						
Outside diameter of anchor	d_{nom}	[mm]	8	10	12	16	20	24	30
Partial safety factor	γ_{Mc} [1)]	[-]	1,5						

[1)] In absence of national regulations

VM EP, VM EW, VM ES	**Annex C 8**
Performances Design according to CEN/TS 1992-4 Characteristic resistance for shear loads - rebar	

Table C9: Displacement of threaded rod under tension and shear load

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete										
Tension load	F	[kN]	6,3	7,9	11,9	15,9	23,8	29,8	37,7	45,6
Displacement	δ_{N0}	[mm]	0,3	0,3	0,3	0,3	0,4	0,5	0,5	0,5
	$\delta_{N\infty}$	[mm]	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5
Shear load	F	[kN]	3,1	5,0	7,2	13,5	21,0	30,3	39,4	48,0
Displacement	δ_{V0}	[mm]	1,5	1,5	1,5	1,5	2,0	2,5	2,5	2,5
	$\delta_{V\infty}$	[mm]	2,3	2,3	2,3	2,3	3,0	3,8	3,8	3,8
Cracked concrete										
Tension load	F	[kN]		5,1	7,4	13,1	20,5	24,6		
Displacement	δ_{N0}	[mm]		0,4	0,7	0,7	0,7	0,6		

Table C10: Displacement of rebar under tension and shear load

Rebar size			Ø8	Ø10	Ø12	Ø16	Ø20	Ø25	Ø32
Non-cracked concrete									
Tension load	F	[kN]	7,9	9,9	13,9	23,8	29,8	55,6	55,6
Displacement	δ_{N0}	[mm]	0,3	0,3	0,3	0,4	0,4	0,5	0,5
	$\delta_{N\infty}$	[mm]	0,5	0,5	0,5	0,5	0,5	0,5	0,5
Shear load	F	[kN]	5,9	9,3	13,3	23,7	37,0	57,9	94,8
Displacement	δ_{V0}	[mm]	0,3	0,4	0,4	0,4	0,4	0,5	0,9
	$\delta_{V\infty}$	[mm]	0,5	0,6	0,6	0,6	0,6	0,8	1,4

Table C11: Characteristic values of resistance under seismic action category C1 for threaded rods

Size			M10	M12	M16	M20	M24
Tension load							
Steel failure							
Characteristic resistance grade **4.6**	$N_{Rk,s,seis}$	[kN]	23	34	63	98	141
Partial safety factor	γ_{Ms} [1)]	[-]			2,00		
Characteristic resistance grade **5.8**	$N_{Rk,s,seis}$	[kN]	29	42	79	123	177
Partial safety factor	γ_{Ms} [1)]	[-]			1,50		
Characteristic resistance grade **8.8**	$N_{Rk,s,seis}$	[kN]	46	67	126	196	282
Partial safety factor	γ_{Ms} [1)]	[-]			1,50		
Characteristic resistance grade **10.9**	$N_{Rk,s,seis}$	[kN]	58	84	157	245	353
Partial safety factor	γ_{Ms} [1)]	[-]			1,33		
Characteristic resistance **A2-70, A4-70**	$N_{Rk,s,seis}$	[kN]	41	59	110	172	247
Partial safety factor	γ_{Ms} [1)]	[-]			1,87		
Characteristic resistance **A4-80**	$N_{Rk,s,seis}$	[kN]	46	67	126	196	282
Partial safety factor	γ_{Ms} [1)]	[-]			1,60		
Characteristic resistance **1.4529**	$N_{Rk,s,seis}$	[kN]	41	59	110	172	247
Partial safety factor	γ_{Ms} [1)]	[-]			1,50		
Characteristic resistance **1.4565**	$N_{Rk,s,seis}$	[kN]	41	59	110	172	247
Partial safety factor	γ_{Ms} [1)]	[-]			1,87		
Combined pull-out and concrete cone failure							
Dry and wet concrete	$\tau_{Rk,seis,C1}$	[N/mm²]	3,5	3,5	3,5	3,5	3,5
Partial safety factor	γ_{Mc} [1)]	[-]			1,8 [2)]		
Flooded hole	$\tau_{Rk,seis,C1}$	[N/mm²]	3,5	3,5	3,5	3,5	3,5
Partial safety factor	γ_{Mc} [1)]	[-]			2,1 [3)]		
Shear load							
Steel failure without lever arm							
Characteristic resistance grade **4.6**	$V_{Rk,s,seis}$	[kN]	7	10	23	30	40
Partial safety factor	γ_{Ms} [1)]	[-]			1,67		
Characteristic resistance grade **5.8**	$V_{Rk,s,seis}$	[kN]	9	13	28	38	51
Partial safety factor	γ_{Ms} [1)]	[-]			1,25		
Characteristic resistance grade **8.8**	$V_{Rk,s,seis}$	[kN]	14	21	45	61	81
Partial safety factor	γ_{Ms} [1)]	[-]			1,25		
Characteristic resistance grade **10.9**	$V_{Rk,s,seis}$	[kN]	18	26	56	76	101
Partial safety factor	γ_{Ms} [1)]	[-]			1,50		
Characteristic resistance **A2-70, A4-70**	$V_{Rk,s,seis}$	[kN]	12	18	39	53	71
Partial safety factor	γ_{Ms} [1)]	[-]			1,56		
Characteristic resistance **A4-80**	$V_{Rk,s,seis}$	[kN]	14	21	45	61	81
Partial safety factor	γ_{Ms} [1)]	[-]			1,33		
Characteristic resistance **1.4529**	$V_{Rk,s,seis}$	[kN]	12	18	39	53	71
Partial safety factor	γ_{Ms} [1)]	[-]			1,25		
Characteristic resistance **1.4565**	$V_{Rk,s,seis}$	[kN]	12	18	39	53	71
Partial safety factor	γ_{Ms} [1)]	[-]			1,56		

[1)] In absence of national regulations
[2)] The partial safety factor γ_2=1,2 is included
[3)] The partial safety factor γ_2=1,4 is included

Note: Rebars are not qualified for seismic design

VM EP, VM EW, VM ES	
Performances Reduction factors for seismic design	**Annex C 11**