Section 1. PRODUCT DESCRIPTION

Description

WCF-E3 is a best-performing two-component 3:1 ratio pure epoxy based bonded anchoring system, which offers extremely high load-bearing capacity in both cracked and uncracked concrete. For professional use in highest load/heavy duty structural anchoring. Offer highest performance for most demanding applications.

It has excellent performance at 50°C long-term service temperature range, making it the ideal choice for hot climates such as the Middle East, Southeast Asia or India.

Storage

Cartridges should be stored in their original packaging, the correct way up and in cool dry conditions (+5°C to +25°C) out of direct sunlight. When stored correctly, the shelf life will be for 24 months from the date of manufacture.

Base materials

- Cracked concrete
- Uncracked concrete
- Hard natural stone
- Solid rock

Safety

For health and safety information, please refer to the relevant Safety Data Sheet.

Accessories

- Applicators
- Mixing nozzles
- Cleaning brushes
- Extension tubes
- Resin stoppers

Features

- Installations in dry, wet and flooded holes
- Excellent fire resistance
- Fixings close to free edges
- Overhead applications
- Mixed colour: pink
- Anchoring without expansion pressure
- Extremely high load capacity
- Available in side-by-side cartridges (585ml)
- Component volume ratio of 3:1
- Extended gel/open time

Approvals & Tests

- ETA Option 1 for cracked and uncracked concrete; EAD 330499-01-0601
- ETA for post-installed rebar connections; EAD 330087-01-0601; approved for 100 years service life
- Qualifies for LEED v.4.1 BETA (FEBRUARY 2021) Specifications
- Bond Strength Reduction factor for Post-Installed Rebar connection when exposed to fire.
- WRAS Approved for use in potable water
- Approved for seismic action Categories C1 & C2 accoding to EN 1992-4

Uses/Applications

- Fixing into cracked concrete
- Post-installed rebar connections
- Crash barriers
- Structural steel-to-concrete connections
- Anchoring of threaded bars in seismic regions.

Section 2. WORKING & LOADING TIMES

Cartridge Temperature	**T Work (minutes)**	**Base Material Temperature**	**T Load**
Minimum +10°C	300	+5°C	24 hours
Minimum +10°C	150	+5°C to +10°C	24 hours
+10°C to +15°C	40	+10°C to +15°C	18 hours
+15°C to +20°C	25	+15°C to +20°C	12 hours
+20°C to +25°C	18	+20°C to +25°C	8 hours
+25°C to +30°C	12	+25°C to +30°C	6 hours
+30°C to +35°C	8	+30°C to +35°C	4 hours
+35°C to +40°C	6	+35°C to +40°C	2 hours

Note: T Work is typical gel time at highest base material temperature in the range. T Load is minimum curing time required until load can be applied at the lowest base material temperature in the range

Section 3. PHYSICAL PROPERTIES

Property		Value	Unit	Test Standard
Density		1,5	g/cm³	ASTM D 1875 @ +20°C
Compressive Strength	24 hrs	90	N/mm²	ASTM D 695 @ +20°C
	7 days	100		
Tensile Strength	24 hrs	25	N/mm²	ASTM D 638 @ +20°C
	7 days	27		
Elongation at Break	24 hrs	6,6	%	ASTM D 638 @ +20°C
	7 days	5,7		
Tensile Modulus	24 hrs	6.7	GN/m²	ASTM D 638 @ +20°C
	7 days	8.0		
Flexural Strength	24 hrs	45	N/mm²	ASTM D 790 @ +20°C
HDT	7 days	49	°C	ASTM D 648 @ +20°C
VOC		4	g/l	ASTM D 2369

Section 4. CHEMICAL RESISTANCE

Chemical mortar has undergone extensive chemical resistance testing. The results are summarised in the table below

Chemical Environment	**Concentration**	**Result**
Aqueous Solution Acetic Acid	10%	C
Acetone	100%	✗
Aqueous Solution Aluminium Chloride	Saturated	✓
Aqueous Solution Aluminium Nitrate	10%	✓
Ammonia Solution	5%	✓
Jet Fuel	100%	C
Benzene	100%	C
Benzoic Acid	Saturated	✓
Benzyl Alcohol	100%	✗
Sodium Hypochlorite Solution	5 - 15%	✓
Butyl Alcohol	100%	C
Calcium Sulphate Aqueous Solution	Saturated	✓

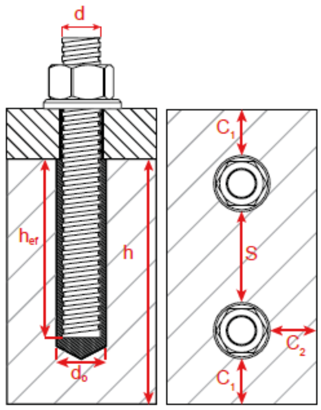
Chemical Environment	**Concentration**	**Result**
Hexane	100%	C
Hydrochloric Acid	10%	✓
	15%	✓
	25%	C
Hydrogen Sulphide Gas	100%	✓
Isoproyl Alcohol	100%	✗
Linseed Oil	100%	✓
Lubricating Oil	100%	✓
Mineral Oil	100%	✓
Paraffin / Kerosene (Domestic)	100%	C
Phenol Aqueous Solution	1%	C
Phosphoric Acid	50%	✓
Potassium Hydroxide	10% / pH13	✓
Sea Water	100%	C

Carbon Monoxide	Gas	✓
Carbon Tetrachloride	100%	C
Chlorine Water	Saturated	✗
Chloro Benzene	100%	✗
Citric Acid Aqueous Solution	Saturated	✓
Cyclohexanol	100%	✓
Diesel Fuel	100%	C
Diethylene Glycol	100%	✓
Ethanol	95%	✗
Ethanol Aqueous Solution	20%	C
Heptane	100%	C

Styrene	100%	C
Sulphur Dioxide Solution	10%	✓
Sulphur Dioxide (40°C)	5%	✓
Sulphuric Acid	10%	✓
	50%	✓
Turpentine	100%	C
White Spirit	100%	✓
Xylene	100%	C

✓ = Resistant to 75°C with at least 80% of physical properties retained. C = Contact only to a maximum of 25°C. ✗ = Not resistant.

Section 5. INSTALLATION PARAMETERS – THREADED RODS



Property			Anchor Diameter							
			M8	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Nominal Drill Hole Diameter	d_0	mm	10	12	14	18	22	26	30	35
Cleaning Brush Diameter	d_b	mm	11	14	14/15	22	24	31	31	38
Torque Moment	max T_{fixt}	Nm	10	20	40	80	120	160	180	200
Embedment depth for $h_{ef,min}$	h_{ef}	mm	60	60	70	80	90	96	108	120
Embedment depth for $h_{ef,max}$	h_{ef}	mm	160	200	240	320	400	480	540	600
Depth of drill hole	h_0	mm	h_{ef} +5	h_{ef} +5	h_{ef} +5	h_{ef} +5	h_{ef} +5	h_{ef} +5	h_{ef} +5	h_{ef} +5
Minimum Edge Distance	c_{min}	mm	40	40	40	40	50	50	50	60
Minimum Anchor Spacing	s_{min}	mm	40	40	40	40	50	50	50	60
Minimum Member Thickness	h_{min}	mm	h_{ef} + 30 mm ≥ 100 mm			h_{ef} + $2d_0$				

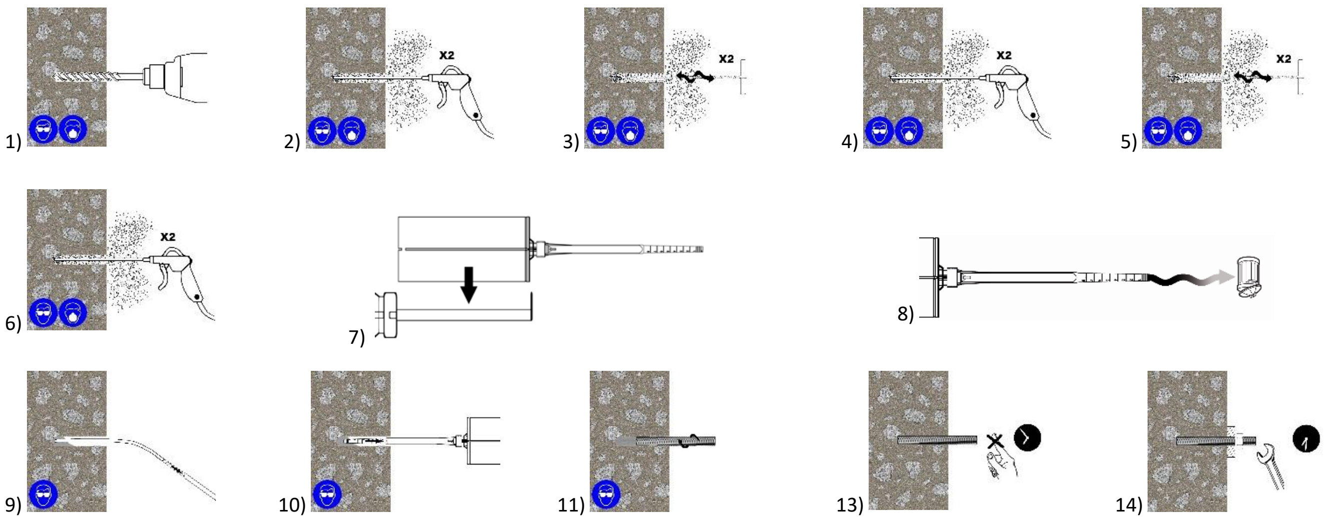
Section 6. INSTALLATION PARAMETERS - REBARS

Property			**Anchor Diameter**						
			8mm	**10mm**	**12mm**	**16mm**	**20mm**	**25mm**	**32mm**
Nominal Drill Hole Diameter	d_0	mm	12	14	16	20	25	32	40
Cleaning Brush Diameter	d_b	mm	12/13	14/15	18	22	27	35	43
Torque Moment	T_{inst}	Nm	10	20	40	80	120	180	200
Embedment depth for $h_{ef,min}$	h_{ef}	mm	60	60	70	80	90	100	128
Embedment depth for $h_{ef,max}$	h_{ef}	mm	160	200	240	320	400	500	640
Depth of drill hole	h_0	mm	h_{ef} +5	h_{ef} +5	h_{ef} +5	h_{ef} +5	h_{ef} +5	h_{ef} +5	h_{ef} +5
Minimum Edge Distance	c_{min}	mm	40	40	40	40	50	50	70
Minimum Anchor Spacing	s_{min}	mm	40	40	40	40	50	50	70
Minimum Member Thickness	h_{min}	mm	h_{ef} + 30 mm ≥ 100 mm			h_{ef} + $2d_0$			

Section 7. HORIZONTAL INSTALLATION INSTRUCTIONS

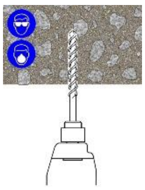
Before commencing installation ensure the operative is equipped with appropriate personal protection equipment, SDS Hammer Drill, Air, Hole Cleaning Brush, good quality Dispensing Tool – either manual or power operated, Chemical cartridge with mixing nozzle and extension tube, if needed.

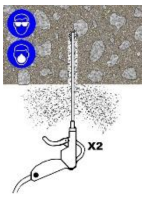
1. Using the SDS Hammer Drill in rotary hammer mode for drilling, with a carbide tipped drill bit of the appropriate size, drill the hole to the specified hole diameter and depth.
2. Insert the Air Lance to the bottom of the hole and depress the trigger for 2 seconds. The compressed air must be clean – free from water and oil – and at a minimum pressure of 6bar. **Perform the blowing operation twice.**
3. Select the correct size Hole Cleaning Brush. Ensure that the brush is in good condition and the correct diameter. Insert the brush to the bottom of the hole, using a brush extension if needed to reach the bottom of the hole and withdraw with a twisting motion. *There should be positive interaction between the steel bristles of the brush and the sides of the drilled hole*. **Perform the brushing operation twice.**
4. Repeat 2
5. Repeat 3
6. Repeat 2
7. Select the appropriate static mixer nozzle, checking that the mixing elements are present and correct **(do not modify the mixer)**. Attach mixer nozzle to the cartridge. Check the Dispensing Tool is in good working order. Place the cartridge into the dispensing tool.
8. Extrude some resin to waste until an even-coloured mixture is extruded. The cartridge is now ready for use.
9. Attach an extension tube with resin stopper (if required) to the end of the mixing nozzle with a push fit (the extension tubes may be pushed into the resin stoppers and are held in place with a coarse internal thread).
10. Insert the mixing nozzle to the bottom of the hole. Extrude the resin and slowly withdraw the nozzle from the hole. **Ensure no air voids are created** as the nozzle is withdrawn. Inject resin until the hole is approximately ¾ full and remove the nozzle from the hole.
11. Select the steel anchor element ensuring it is free from oil or other contaminants, and mark with the required embedment depth. Insert the steel element into the hole using a back and forth twisting motion to ensure complete cover, until it reaches the bottom of the hole. Excess resin will be expelled from the hole evenly around the steel element and there shall be no gaps between the anchor element and the wall of the drilled hole.
12. Clean any excess resin from around the mouth of the hole.
13. Do not disturb the anchor until at least the minimum cure time has elapsed. Refer to the Working and Load Timetable to determine the appropriate cure time.
14. Position the fixture and tighten the anchor to the appropriate installation torque. **Do not over-torque the anchor as this could adversely affect its performance.**

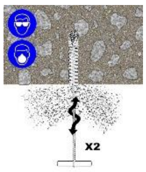


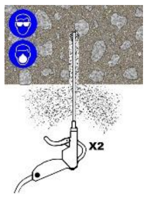
Section 8. OVERHEAD INSTALLATION INSTRUCTIONS

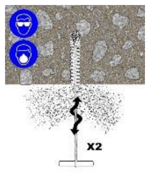
1. Using the SDS Hammer Drill in rotary hammer mode for drilling, with a carbide tipped drill bit of the appropriate size, drill the hole to the specified hole diameter and depth.
2. Insert the Air Lance to the bottom of the hole and depress the trigger for 2 seconds. The compressed air must be clean – free from water and oil – and at a minimum pressure of 6bar. **Perform the blowing operation twice.**
3. Select the correct size Hole Cleaning Brush. Ensure that the brush is in good condition and the correct diameter. Insert the brush to the bottom of the hole, using a brush extension if needed to reach the bottom of the hole and withdraw with a twisting motion. *There should be positive interaction between the steel bristles of the brush and the sides of the drilled hole*. **Perform the brushing operation twice.**
4. Repeat 2
5. Repeat 3
6. Repeat 2
7. Select the appropriate static mixer nozzle, checking that the mixing elements are present and correct **(do not modify the mixer)**. Attach mixer nozzle to the cartridge. Check the Dispensing Tool is in good working order. Place the cartridge into the dispensing tool.
8. Extrude some resin to waste until an even-coloured mixture is extruded. The cartridge is now ready for use.
9. Attach an extension tube with resin stopper (if required) to the end of the mixing nozzle with a push fit (the extension tubes may be pushed into the resin stoppers and are held in place with a coarse internal thread).
10. Insert the mixing nozzle to the bottom of the hole. Extrude the resin and slowly withdraw the nozzle from the hole. **Ensure no air voids are created** as the nozzle is withdrawn. Inject resin until the hole is approximately ¾ full and remove the nozzle from the hole.
11. Select the steel anchor element ensuring it is free from oil or other contaminants, and mark with the required embedment depth. Insert the steel element into the hole using a back and forth twisting motion to ensure complete cover, until it reaches the bottom of the hole. Excess resin will be expelled from the hole evenly around the steel element and there shall be no gaps between the anchor element and the wall of the drilled hole.
12. Clean any excess resin from around the mouth of the hole.
13. Do not disturb the anchor until at least the minimum cure time has elapsed. Refer to the Working and Load Timetable to determine the appropriate cure time.
14. Position the fixture and tighten the anchor to the appropriate installation torque. **Do not over-torque the anchor as this could adversely affect its performance.**

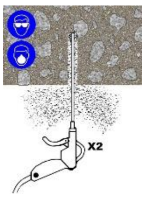
1) 

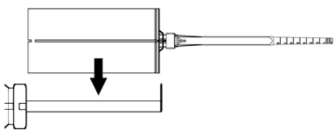
2) 

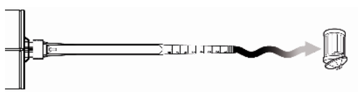
3) 

4) 

5) 

6) 

7) 

8) 

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Section 9. STEEL FAILURE IN TENSION – THREADED RODS

Characteristic resistance values under tension loading

Steel Grade			Anchor Diameter							
			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}	(-)	2,00							
Steel Grade **5.8**	$N_{Rk,s}$	(kN)	18	29	42	79	123	177	230	281
Partial Safety Factor	γ_{Ms}	(-)	1,50							
Steel Grade **8.8**	$N_{Rk,s}$	(kN)	29	46	67	126	196	282	367	449
Partial Safety Factor	γ_{Ms}	(-)	1,50							
Steel Grade **10.9***	$N_{Rk,s}$	(kN)	37	58	84	157	245	353	459	561
Partial Safety Factor	γ_{Ms}	(-)	1,33							
Stainless Steel **A2-70, A4-70**	$N_{Rk,s}$	(kN)	26	41	59	110	172	247	321	393
Partial Safety Factor	γ_{Ms}	(-)	1,87							
Stainless Steel **A4-80**	$N_{Rk,s}$	(kN)	29	46	67	126	196	282	367	449
Partial Safety Factor	γ_{Ms}	(-)	1,60							
Stainless Steel **1.4529**	$N_{Rk,s}$	(kN)	26	41	59	110	172	247	321	393
Partial Safety Factor	γ_{Ms}	(-)	1,50							
Stainless Steel **1.4565**	$N_{Rk,s}$	(kN)	26	41	59	110	172	247	321	393
Partial Safety Factor	γ_{Ms}	(-)	1,87							

**Galvanised rod of high strength are sensitive to hydrogen embrittlement*

Section 10. CHARACTERISTIC VALUES FOR STEEL FAILURE (SHEAR – WITHOUT LEVER ARM) - THREADED RODS

Threaded Rods - Characteristic Values for Steel Failure (Shear – without lever arm)										
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel Grade **4.6**	$V_{Rk,s}$	kN	7	12	17	31	49	71	92	112
Partial Safety Factor	γ_{Ms}	[-]	1.67							
Steel Grade **5.8**	$V_{Rk,s}$	kN	9	15	21	39	61	88	115	140
Partial Safety Factor	γ_{Ms}	[-]	1.25							
Steel Grade **8.8**	$V_{Rk,s}$	kN	15	23	34	63	98	141	184	224
Partial Safety Factor	γ_{Ms}	[-]	1.25							
Steel Grade **10.9***	$V_{Rk,s}$	kN	18	29	42	79	123	177	230	281
Partial Safety Factor	γ_{Ms}	[-]	1.50							
Stainless Steel Grade **A2-70, A4-70**	$V_{Rk,s}$	kN	13	20	30	55	86	124	161	196
Partial Safety Factor	γ_{Ms}	[-]	1.56							
Stainless Steel Grade **A4-80**	$V_{Rk,s}$	kN	15	23	34	63	98	141	184	224
Partial Safety Factor	γ_{Ms}	[-]	1.33							
Stainless Steel Grade **1.4529**	$V_{Rk,s}$	kN	13	20	30	55	86	124	161	196
Partial Safety Factor	γ_{Ms}	[-]	1.25							
Stainless Steel Grade **1.4565**	$V_{Rk,s}$	kN	13	20	30	55	86	124	161	196
Partial Safety Factor	γ_{Ms}	[-]	1,56							

Section 11. CHARACTERISTIC VALUES FOR STEEL FAILURE (SHEAR – WITH LEVER ARM) - THREADED RODS

Threaded Rods - Characteristic Values for Steel Failure (Shear – 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}	[-]	1.67							
Steel Grade **5.8**	$M^0_{Rk,s}$	N.m	19	37	66	166	325	561	832	1125
Partial Safety Factor	γ_{Ms}	[-]	1.25							
Steel Grade **8.8**	$M^0_{Rk,s}$	N.m	30	60	105	266	519	898	1332	1799

Partial Safety Factor	γ_{Ms}	[-]	1.25							
Steel Grade **10.9***	$M^0_{Rk,s}$	N.m	37	75	131	333	649	1123	1664	2249
Partial Safety Factor	γ_{Ms}	[-]	1.50							
Stainless Steel Grade **A4-70**	$M^0_{Rk,s}$	N.m	26	52	92	233	454	786	1165	1574
Partial Safety Factor	γ_{Ms}	[-]	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}	[-]	1.33							
Stainless Steel Grade **1.4529**	$M^0_{Rk,s}$	N.m	26	52	92	233	454	786	1165	1574
Partial Safety Factor	γ_{Ms}	[-]	1.25							
Stainless Steel Grade **1.4565**	$M^0_{Rk,s}$	N.m	26	52	92	233	454	786	1165	1574
Partial Safety Factor	γ_{Ms}	[-]	1,56							
Concrete pry-out failure										
Factor for resistance to pry-out failure	K_8	[-]	2							

Section 12. STEEL FAILURE IN TENSION – REINFORCING BARS

Characteristic resistance values under tension loading

Steel Grade			**Anchor Diameter**						
			8mm	**10mm**	**12mm**	**16mm**	**20mm**	**25mm**	**32mm**
Rebar **BSt 500**	$N_{Rk,s}$	(kN)	28	43	62	111	173	270	442
Partial Safety Factor	γ_{Ms}	(-)	1,40						

Section 13. CHARACTERISTIC RESISTANCE – COMBINED PULL-OUT & CONCRETE CONE FAILURE USING THREADED RODS

Working life of 50 years

Dry / Wet Concrete | Temperature Range: -40°C to +70°C

Property				**Anchor Diameter**							
				M8	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Characteristic Bond Strength in Uncracked Concrete		τ_{Rk}	N/mm²	14,0	13,0	13,0	12,0	12,0	11,0	10,0	9,0
Factor for Uncracked Concrete Strength	C25/30	Ψ_c	-	1,02							
	C30/37			1,04							
	C35/45			1,06							
	C40/50			1,07							
	C45/55			1,08							
	C50/60			1,09							
Partial Safety Factor		γ_{Mp}	-	1,5							
Characteristic Bond Strength in Cracked Concrete		τ_{Rk}	N/mm²	8,0	8,0	7,5	7,5	7,0	7,0	5,0	5,0
Factor for Cracked Concrete Strength	C25/30	Ψ_c	-	1,02							
	C30/37			1,04							
	C35/45			1,06							
	C40/50			1,07							
	C45/55			1,08							
	C50/60			1,09							
Partial Safety Factor		γ_{Mp}	-	1,5							

Section 14. SPLITTING FAILURE

Property			**Anchor Diameter**							
			M8	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Characteristic Edge Distance	$c_{cr,sp}$	mm	$2h_{ef}$							

Characteristic Anchor Spacing	$s_{cr,sp}$	mm	$2c_{cr,sp}$
Partial Safety Factor	γ_{Msp}	-	1,5

Section 15. RESISTANCE VALUES FOR THREADED RODS IN UNCRACKED CONCRETE

Combined Pullout & Concrete Cone Failure and Concrete Cone Failure| Temperature Range: -40°C to +70°C

Property			Anchor Diameter							
			M8	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Effective Embedment Depth = MIN	h_{ef}	mm	60	60	70	80	90	96	108	120
Characteristic Resistance	N_{Rk}	kN	21.11	22.86	28.81	35.20	42.00	46.27	55.21	64.67
Design Resistance	N_{Rd}	kN	14.07	15.24	19.21	23.47	28.00	30.85	36.81	43.11
Controlling Resistance			Pullout	Concrete Cone	Concrete Cone	Concrete Cone	Concrete Cone	Concrete Cone	Concrete Cone	Concrete Cone
Effective Embedment Depth = 8d	h_{ef}	mm	64	80	96	128	160	192	216	240
Characteristic Resistance	N_{Rk}	kN	22.52	32.67	46.27	71.24	99.56	130.88	156.17	182.90
Design Resistance	N_{Rd}	kN	15.01	21.78	30.85	47.49	66.37	87.25	104.11	121.94
Controlling Resistance			Pullout	Pullout	Concrete Cone	Concrete Cone	Concrete Cone	Concrete Cone	Concrete Cone	Concrete Cone
Effective Embedment Depth = STD	h_{ef}	mm	80	90	110	128	170	240	270	300
Characteristic Resistance	N_{Rk}	kN	28.15	36.76	53.91	71.24	109.04	182.90	218.25	254.47
Design Resistance	N_{Rd}	kN	18.77	24.50	35.94	47.49	72.69	121.94	145.50	169.65
Controlling Resistance			Pullout	Pullout	Pullout	Concrete Cone	Concrete Cone	Concrete Cone	Concrete Cone	Pullout
Effective Embedment Depth = 12d	h_{ef}	mm	96	120	144	192	240	288	324	360
Characteristic Resistance	N_{Rk}	kN	33.78	49.01	70.57	115.81	180.96	238.86	274.83	305.36
Design Resistance	N_{Rd}	kN	22.52	32.67	47.05	77.21	120.64	159.24	183.22	203.58
Controlling Resistance			Pullout	Pullout	Pullout	Pullout	Pullout	Pullout	Pullout	Pullout
Effective Embedment Depth = 20d	h_{ef}	mm	160	200	240	320	400	480	540	600
Characteristic Resistance	N_{Rk}	kN	56.30	81.68	117.62	193.02	301.59	398.10	458.04	508.94
Design Resistance	N_{Rd}	kN	37.53	54.45	78.41	128.68	201.06	265.40	305.36	339.29
Controlling Resistance			Pullout	Pullout	Pullout	Pullout	Pullout	Pullout	Pullout	Pullout

1. Resistance values are based on combined pullout & concrete cone failure and concrete cone failure according to EC2-4. Resistance for steel failure must also be considered - the lowest value controls.
2. Resistance values are for single anchors without close edges or eccentric loading considerations.
3. Tabulated values correspond to the above stated temperature range and installation conditions only.
4. Long term temperatures are those that remain roughly constant over prolonged periods. Short term temperatures occur over brief intervals, e.g.: diurnal cycling.

5. The compressive strength of the concrete ($f_{ck,cylinder}$) is assumed to be 20 N/mm².
6. Tabulated resistance values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.

Section 16. RESISTANCE VALUES FOR THREADED RODS IN CRACKED CONCRETE

Combined Pullout & Concrete Cone Failure and Concrete Cone Failure | Temperature Range: -40°C to +70°C

Property			Anchor Diameter							
			M8	M10	M12	M16	M20	M24	M27	M30
Effective Embedment Depth = MIN	h_{ef}	mm	60	60	70	80	90	96	108	120
Characteristic Resistance	N_{Rk}	kN	12.06	15.08	19.79	24.64	29.40	32.39	38.65	45.27
Design Resistance	N_{Rd}	kN	8.04	10.05	13.19	16.43	19.60	21.59	25.77	30.18
Controlling Resistance			Pullout	Pullout	Pullout	Concrete Cone	Concrete Cone	Concrete Cone	Concrete Cone	Concrete Cone
Effective Embedment Depth = 8d	h_{ef}	mm	64	80	96	128	160	192	216	240
Characteristic Resistance	N_{Rk}	kN	12.87	20.11	27.14	48.25	69.69	91.61	91.61	113.10
Design Resistance	N_{Rd}	kN	8.58	13.40	18.10	32.17	46.46	61.08	61.07	75.40
Controlling Resistance			Pullout	Pullout	Pullout	Pullout	Concrete Cone	Concrete Cone	Pullout	Pullout
Effective Embedment Depth = STD	h_{ef}	mm	80	90	110	128	170	240	270	300
Characteristic Resistance	N_{Rk}	kN	16.08	22.62	31.10	48.25	74.77	126.67	114.51	141.37
Design Resistance	N_{Rd}	kN	10.72	15.08	20.73	32.17	49.85	84.45	76.34	94.25
Controlling Resistance			Pullout	Pullout	Pullout	Pullout	Pullout	Pullout	Pullout	Pullout
Effective Embedment Depth = 12d	h_{ef}	mm	96	120	144	192	240	288	324	360
Characteristic Resistance	N_{Rk}	kN	19.30	30.16	40.72	72.38	105.56	152.00	137.41	169.65
Design Resistance	N_{Rd}	kN	12.87	20.11	27.14	48.25	70.37	101.34	91.61	113.10
Controlling Resistance			Pullout	Pullout	Pullout	Pullout	Pullout	Pullout	Pullout	Pullout
Effective Embedment Depth = 20d	h_{ef}	mm	160	200	240	320	400	480	540	600
Characteristic Resistance	N_{Rk}	kN	32.17	50.27	67.86	120.64	175.93	253.34	229.02	282.74
Design Resistance	N_{Rd}	kN	21.45	33.51	45.24	80.42	117.29	168.89	152.68	188.50
Controlling Resistance			Pullout	Pullout	Pullout	Pullout	Pullout	Pullout	Pullout	Pullout

1. Resistance values are based on combined pullout & concrete cone failure and concrete cone failure according to EC2-4. Resistance for steel failure must also be considered - the lowest value controls.
2. Resistance values are for single anchors without close edges or eccentric loading considerations.
3. Tabulated values correspond to the above stated temperature range and installation conditions only.
4. Long term temperatures are those that remain roughly constant over prolonged periods. Short term temperatures occur over brief intervals, e.g.: diurnal cycling.
5. The compressive strength of the concrete ($f_{ck,cylinder}$) is assumed to be 20 N/mm².
6. Tabulated resistance values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.

Section 17. CHARACTERISTIC RESISTANCE FOR SEISMIC LOADING CATEGORY C1 – COMBINED PULL-OUT & CONCRETE CONE FAILURE USING THREADED RODS

Working life of 50 years

Dry / Wet Concrete | Temperature Range: -40°C to +70°C

Seismic Loading Category C1		Anchor Diameter							
		M8	M10	M12	M16	M20	M24	M27	M30
Characteristic Bond Strength	τ_{Rk} (N/mm²)	8,0	8,0	7,5	7,5	7,0	7,0	5,0	4,5
Partial Safety Factor	γ_{Mp}	1,5							

Section 18. RESISTANCE VALUES TO TENSION LOADS FOR THREADED RODS – SEISMIC LOADING CATEGORY C1

Combined Pullout & Concrete Cone Failure and Concrete Cone Failure | Temperature Range: -40°C to +70°C

Property			Anchor Diameter							
			M8	M10	M12	M16	M20	M24	M27	M30
Effective Embedment Depth = MIN	h_{ef}	mm	60	60	70	80	90	96	108	120
Characteristic Resistance	N_{Rk}	kN	12.06	15.08	19.79	24.64	29.40	32.39	38.65	45.27
Design Resistance	N_{Rd}	kN	8.04	10.05	13.19	16.43	19.60	21.59	25.77	30.18
Controlling Resistance			Pullout	Pullout	Pullout	Concrete Cone	Concrete Cone	Concrete Cone	Concrete Cone	Concrete Cone
Effective Embedment Depth = 8d	h_{ef}	mm	64	80	96	128	160	192	216	240
Characteristic Resistance	N_{Rk}	kN	12.87	20.11	27.14	48.25	69.69	91.61	91.61	101.79
Design Resistance	N_{Rd}	kN	8.58	13.40	18.10	32.17	46.46	61.08	61.07	67.86
Controlling Resistance			Pullout	Pullout	Pullout	Pullout	Concrete Cone	Concrete Cone	Pullout	Pullout
Effective Embedment Depth = STD	h_{ef}	mm	80	90	110	128	170	240	270	300
Characteristic Resistance	N_{Rk}	kN	16.08	22.62	31.10	48.25	74.77	126.67	114.51	127.23
Design Resistance	N_{Rd}	kN	10.72	15.08	20.73	32.17	49.85	84.45	76.34	84.82
Controlling Resistance			Pullout	Pullout	Pullout	Pullout	Pullout	Pullout	Pullout	Pullout
Effective Embedment Depth = 12d	h_{ef}	mm	96	120	144	192	240	288	324	360
Characteristic Resistance	N_{Rk}	kN	19.30	30.16	40.72	72.38	105.56	152.00	137.41	152.68
Design Resistance	N_{Rd}	kN	12.87	20.11	27.14	48.25	70.37	101.34	91.61	101.79
Controlling Resistance			Pullout	Pullout	Pullout	Pullout	Pullout	Pullout	Pullout	Pullout
Effective Embedment Depth = 20d	h_{ef}	mm	160	200	240	320	400	480	540	600
Characteristic Resistance	N_{Rk}	kN	32.17	50.27	67.86	120.64	175.93	253.34	229.02	254.47
Design Resistance	N_{Rd}	kN	21.45	33.51	45.24	80.42	117.29	168.89	152.68	169.65
Controlling Resistance			Pullout	Pullout	Pullout	Pullout	Pullout	Pullout	Pullout	Pullout

1. Resistance values are based on combined pullout & concrete cone failure and concrete cone failure according to EC2-4. Resistance for steel failure must also be considered - the lowest value controls.
2. Resistance values are for single anchors without close edges or eccentric loading considerations.
3. Tabulated values correspond to the above stated temperature range and installation conditions only.
4. Long term temperatures are those that remain roughly constant over prolonged periods. Short term temperatures occur over brief intervals, e.g.: diurnal cycling.
5. The compressive strength of the concrete ($f_{ck,cylinder}$) is assumed to be 20 N/mm².
6. Tabulated resistance values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.

Section 19. CHARACTERISTIC RESISTANCE SEISMIC LOADING CATEGORY C2 – COMBINED PULL-OUT & CONCRETE CONE FAILURE USING THREADED RODS

Working life of 50 years
Dry / Wet Concrete | Temperature Range: -40°C to +70°C

Seismic Loading Category C2			**Anchor Diameter**		
			M12	**M16**	**M20**
Characteristic Bond Strength in Cracked Concrete under Seismic action (Performance Category C2)	τ_{Rk}	N/mm²	3,2	3,7	4,2
Partial Safety Factor	γ_{Mp}	-	1,5		

Section 20. RESISTANCE VALUES TO TENSION LOADS FOR THREADED RODS – SEISMIC LOADING CATEGORY C2

Combined Pullout & Concrete Cone Failure and Concrete Cone Failure | Temperature Range: -40°C to +70°C

Property			Anchor Diameter		
			M12	**M16**	**M20**
Effective Embedment Depth = MIN	h_{ef}	mm	70	80	90
Characteristic Resistance	N_{Rk}	kN	8,44	14,88	23,75
Design Resistance	N_{Rd}	kN	5,63	9,92	15,83
Controlling Resistance			Pullout	Pullout	Pullout
Effective Embedment Depth = 8d	h_{ef}	mm	96	128	160
Characteristic Resistance	N_{Rk}	kN	11,58	23,81	42,22
Design Resistance	N_{Rd}	kN	7,72	15,87	28,15
Controlling Resistance			Pullout	Pullout	Pullout
Effective Embedment Depth = STD	h_{ef}	mm	110	128	170
Characteristic Resistance	N_{Rk}	kN	13,27	23,81	44,86
Design Resistance	N_{Rd}	kN	8,85	15,87	29,91
Controlling Resistance			Pullout	Pullout	Pullout
Effective Embedment Depth = 12d	h_{ef}	mm	144	192	240
Characteristic Resistance	N_{Rk}	kN	17,37	35,71	63,33
Design Resistance	N_{Rd}	kN	11,58	23,81	42,22
Controlling Resistance			Pullout	Pullout	Pullout

Effective Embedment Depth = 20d	h_{ef}	mm	240	320	400
Characteristic Resistance	N_{Rk}	kN	28,95	59,51	105,56
Design Resistance	N_{Rd}	kN	19,30	39,68	70,37
Controlling Resistance			Pullout	Pullout	Pullout

1. Resistance values are based on combined pullout & concrete cone failure and concrete cone failure according to EC2-4. Resistance for steel failure must also be considered - the lowest value controls.
2. Resistance values are for single anchors without close edges or eccentric loading considerations.
3. Tabulated values correspond to the above stated temperature range and installation conditions only.
4. Long term temperatures are those that remain roughly constant over prolonged periods. Short term temperatures occur over brief intervals, e.g.: diurnal cycling.
5. The compressive strength of the concrete (fck,cylinder) is assumed to be 20 N/mm2.
6. Tabulated resistance values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.

Section 21. CHARACTERISTIC RESISTANCE – COMBINED PULL-OUT & CONCRETE CONE FAILURE USING REINFORCING BARS

Working life of 50 years
Dry / Wet Concrete | Temperature Range:-40°C to +70°C

Property				**Anchor Diameter**						
				8mm	**10mm**	**12mm**	**16mm**	**20mm**	**25mm**	**32mm**
Characteristic Bond Strength in Uncracked Concrete		τ_{Rk}	N/mm²	12,0	12,0	12,0	11,0	11,0	11,0	7,0
Factor for Uncracked Concrete Strength	C25/30	Ψ_c	-	1,02						
	C30/37			1,04						
	C35/45			1,06						
	C40/50			1,07						
	C45/55			1,08						
	C50/60			1,09						
Partial Safety Factor (Dry & wet)		γ_{Mp}	-	1,5						
Partial Safety Factor (Flooded)		γ_{Mp}	-	1.8						
Characteristic Bond Strength in Cracked Concrete		τ_{Rk}	N/mm²	7,0	10,0	9,0	9,0	8,0	8,0	5,0
Factor for Cracked Concrete Strength	C25/30	Ψ_c	-	1,02						
	C30/37			1,04						
	C35/45			1,06						
	C40/50			1,07						
	C45/55			1,08						
	C50/60			1,09						
Partial Safety Factor (Dry & wet)		γ_{Mp}	-	1,5						
Partial Safety Factor (Flooded)		γ_{Mp}	-	1.8						

Section 22. SPLITTING FAILURE

Property			Anchor Diameter 8mm	10mm	12mm	16mm	20mm	25mm	32mm
Critical Edge Distance	$c_{cr,sp}$	mm	$2h_{ef}$						
Critical Anchor Spacing	$s_{cr,sp}$	mm	$2c_{cr,sp}$						
Partial Safety Factor	γ_{Msp}	-	1,5						

Section 23. RESISTANCE VALUES FOR REINFORCING BARS IN UNCRACKED CONCRETE

Combined Pullout & Concrete Cone Failure and Concrete Cone Failure | Temperature Range: -40°C to +70°C

Property			Anchor Diameter 8mm	10mm	12mm	16mm	20mm	25mm	32mm
Effective Embedment Depth = MIN	h_{ef}	mm	60	60	70	80	90	100	128
Characteristic Resistance	N_{Rk}	kN	18.10	22.62	28.81	35.20	42.00	49.19	71.24
Design Resistance	N_{Rd}	kN	12.06	15.08	19.21	23.47	28.00	32.80	47.49
Controlling Resistance			Pullout	Pullout	Concrete Cone	Concrete Cone	Concrete Cone	Concrete Cone	Concrete Cone
Effective Embedment Depth = 8d	h_{ef}	mm	64	80	96	128	160	200	256
Characteristic Resistance	N_{Rk}	kN	19.30	30.16	43.43	70.77	99.56	139.14	152.00
Design Resistance	N_{Rd}	kN	12.87	20.11	28.95	47.18	66.37	92.76	101.34
Controlling Resistance			Pullout	Pullout	Pullout	Pullout	Concrete Cone	Concrete Cone	Pullout
Effective Embedment Depth = STD	h_{ef}	mm	80	90	110	128	170	250	300
Characteristic Resistance	N_{Rk}	kN	24.13	33.93	49.76	70.77	109.04	194.45	178.13
Design Resistance	N_{Rd}	kN	16.08	22.62	33.18	47.18	72.69	129.64	118.75
Controlling Resistance			Pullout	Pullout	Pullout	Pullout	Concrete Cone	Concrete Cone	Pullout
Effective Embedment Depth = 12d	h_{ef}	mm	96	120	144	192	240	300	384
Characteristic Resistance	N_{Rk}	kN	28.95	45.24	65.14	106.16	165.88	248.81	228.00
Design Resistance	N_{Rd}	kN	19.30	30.16	43.43	70.77	110.58	165.88	152.00
Controlling Resistance			Pullout	Pullout	Pullout	Pullout	Pullout	Pullout	Pullout
Effective Embedment Depth = 20d	h_{ef}	mm	160	200	240	320	400	500	640
Characteristic Resistance	N_{Rk}	kN	48.25	75.40	108.57	176.93	276.46	414.69	380.01
Design Resistance	N_{Rd}	kN	32.17	50.27	72.38	117.96	184.31	276.46	253.34
Controlling Resistance			Pullout	Pullout	Pullout	Pullout	Pullout	Pullout	Pullout

1. Resistance values are based on combined pullout & concrete cone failure and concrete cone failure according to EC2-4. Resistance for steel failure must also be considered - the lowest value controls.

2. Resistance values are for single anchors without close edges or eccentric loading considerations.

3. Tabulated values correspond to the above stated temperature range and installation conditions only.
4. Long term temperatures are those that remain roughly constant over prolonged periods. Short term temperatures occur over brief intervals, e.g.: diurnal cycling.
5. The compressive strength of the concrete (fck,cylinder) is assumed to be 20 N/mm2.
6. Tabulated resistance values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.

Section 24. RESISTANCE VALUES FOR REINFORCING BARS IN CRACKED CONCRETE

Combined Pullout & Concrete Cone Failure and Concrete Cone Failure | Temperature Range: -40°C to +70°C

Property			Anchor Diameter						
			8mm	**10mm**	**12mm**	**16mm**	**20mm**	**25mm**	**32mm**
Effective Embedment Depth = MIN	h_{ef}	mm	60	60	70	80	90	100	128
Characteristic Resistance	N_{Rk}	kN	10.56	16.00	20.17	24.64	29.40	34.44	49.87
Design Resistance	N_{Rd}	kN	7.04	10.67	13.45	16.43	19.60	22.96	33.25
Controlling Resistance			Pullout	Concrete Cone	Concrete Cone	Concrete Cone	Concrete Cone	Concrete Cone	Concrete Cone
Effective Embedment Depth = 8d	h_{ef}	mm	64	80	96	128	160	200	256
Characteristic Resistance	N_{Rk}	kN	11.26	24.64	32.39	49.87	69.69	97.40	108.57
Design Resistance	N_{Rd}	kN	7.51	16.43	21.59	33.25	46.46	64.93	72.38
Controlling Resistance			Pullout	Concrete Cone	Concrete Cone	Concrete Cone	Concrete Cone	Concrete Cone	Pullout
Effective Embedment Depth = STD	h_{ef}	mm	80	90	110	128	170	250	300
Characteristic Resistance	N_{Rk}	kN	14.07	28.27	37.32	49.87	76.33	136.12	127.23
Design Resistance	N_{Rd}	kN	9.38	18.85	24.88	33.25	50.88	90.75	84.82
Controlling Resistance			Pullout	Pullout	Pullout	Concrete Cone	Concrete Cone	Concrete Cone	Pullout
Effective Embedment Depth = 12d	h_{ef}	mm	96	120	144	192	240	300	384
Characteristic Resistance	N_{Rk}	kN	16.89	37.70	48.86	86.86	120.64	178.93	162.86
Design Resistance	N_{Rd}	kN	11.26	25.13	32.57	57.91	80.42	119.29	108.57
Controlling Resistance			Pullout	Pullout	Pullout	Pullout	Pullout	Concrete Cone	Pullout
Effective Embedment Depth = 20d	h_{ef}	mm	160	200	240	320	400	500	640
Characteristic Resistance	N_{Rk}	kN	28.15	62.83	81.43	144.76	201.06	301.59	271.43
Design Resistance	N_{Rd}	kN	18.77	41.89	54.29	96.51	134.04	201.06	180.96
Controlling Resistance			Pullout	Pullout	Pullout	Pullout	Pullout	Pullout	Pullout

1. Resistance values are based on combined pullout & concrete cone failure and concrete cone failure according to EC2-4. Resistance for steel failure must also be considered - the lowest value controls.
2. Resistance values are for single anchors without close edges or eccentric loading considerations.
3. Tabulated values correspond to the above stated temperature range and installation conditions only.
4. Long term temperatures are those that remain roughly constant over prolonged periods. Short term temperatures occur over brief intervals, e.g.: diurnal cycling.
5. The compressive strength of the concrete (fck,cylinder) is assumed to be 20 N/mm2.
6. Tabulated resistance values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.

Section 25. CHARACTERISTIC RESISTANCE FOR SEISMIC LOADING CATEGORY C1 – COMBINED PULL-OUT & CONCRETE CONE FAILURE USING REBARS

Working life of 50 years

Seismic Loading Category C1		Anchor Diameter					
		10mm	**12mm**	**16mm**	**20mm**	**25mm**	**32mm**
Characteristic Bond Strength in Cracked Concrete under Seismic action (Performance Category C1)	τ_{Rk} (N/mm²)	8,9	9,0	9,0	8,0	7,5	4,8
Partial Safety Factor (Dry & Wet)	γ_{Mp}	1,5	1,5	1,5	1,5	1,5	1,5

Section 26. RESISTANCE VALUES TO TENSION LOADS FOR REINFORCING BARS IN CRACKED CONCRETE – SEISMIC LOADING CATEGORY C1

Combined Pullout & Concrete Cone Failure and Concrete Cone Failure | Temperature Range: -40°C to +70°C

Property			Anchor Diameter					
			10mm	**12mm**	**16mm**	**20mm**	**25mm**	**32mm**
Effective Embedment Depth = MIN	h_{ef}	mm	60	70	80	90	96	108
Characteristic Resistance	N_{Rk}	kN	16.00	20.17	24.64	29.40	32.39	38.65
Design Resistance	N_{Rd}	kN	10.67	13.45	16.43	19.60	21.59	25.77
Controlling Resistance			Concrete Cone	Concrete Cone	Concrete Cone	Concrete Cone	Concrete Cone	Concrete Cone
Effective Embedment Depth = 8d	h_{ef}	mm	80	96	128	160	200	256
Characteristic Resistance	N_{Rk}	kN	22.37	32.39	49.87	69.69	97.40	123.53
Design Resistance	N_{Rd}	kN	14.91	21.59	33.25	46.46	64.93	82.35
Controlling Resistance			Pullout	Concrete Cone	Concrete Cone	Concrete Cone	Concrete Cone	Pullout
Effective Embedment Depth = 10d	h_{ef}	mm	100	120	160	200	250	320
Characteristic Resistance	N_{Rk}	kN	27.96	40.72	69.69	97.40	136.12	154.42
Design Resistance	N_{Rd}	kN	18.64	27.14	46.46	64.93	90.75	102.94
Controlling Resistance			Pullout	Pullout	Concrete Cone	Concrete Cone	Concrete Cone	Pullout
Effective Embedment Depth = 12d	h_{ef}	mm	120	144	192	240	300	384
Characteristic Resistance	N_{Rk}	kN	33.55	48.86	86.86	120.64	176.71	185.30
Design Resistance	N_{Rd}	kN	22.37	32.57	57.91	80.42	117.81	123.53
Controlling Resistance			Pullout	Pullout	Pullout	Pullout	Pullout	Pullout
Effective Embedment Depth = 20d	h_{ef}	mm	200	240	320	400	500	640
Characteristic Resistance	N_{Rk}	kN	55.92	81.43	144.76	201.06	294.52	308.83
Design Resistance	N_{Rd}	kN	37.28	54.29	96.51	134.04	196.35	205.89
Controlling Resistance			Pullout	Pullout	Pullout	Pullout	Pullout	Pullout

1. Resistance values are based on combined pullout & concrete cone failure and concrete cone failure according to EC2-4. Resistance for steel failure must also be considered - the lowest value controls.
2. Resistance values are for single anchors without close edges or eccentric loading considerations.
3. Tabulated values correspond to the above stated temperature range and installation conditions only.

4. Long term temperatures are those that remain roughly constant over prolonged periods. Short term temperatures occur over brief intervals, e.g.: diurnal cycling.
5. The compressive strength of the concrete (fck,cylinder) is assumed to be 20 N/mm2.
6. Tabulated resistance values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.

Section 27. INSTALLATION PARAMETERS FOR POST-INSTALLED REBAR CONNECTIONS

Rebar		Drill Hole Diameter (mm)	Cleaning Brush diameter (mm)	Min. Anchorage Length (mm)	Min. Lap/Splice Length (mm)	Max. Embedment Depth (mm)
Diameter (mm)	**$f_{y,k}$ (N/mm²)**					
8	500	12	12/13	113	200	400
10	500	14	14/15	142	200	500
12	500	16	18	170	200	600
14	500	18	22	198	210	700
16	500	20	22	227	240	800
20	500	25	27	284	300	1000
25	500	32	35	354	375	1000
28	500	35	38	397	420	1000
32	500	40	43	454	480	1000

Section 28. DESIGN BOND STRENGTH VALUES – HAMMER DRILLED OR COMPRESSED AIR DRILLED HOLES

Working life of 50 and 100 years

Design values of the ultimate bond resistance fbd in N/mm2 for rotary hammer drilling and compressed air drilling for good bond conditions.

Rebar Ø (mm)	Concrete Class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
8	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3
10	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3
12	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3
14	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3
16	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3
20	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3
25	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3
28	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3
32	1,6	2,0	2,3	2,7	3,0	3,4	3,7	3,7	3,7

Tabulated values are valid for good bond conditions according to EN 1992-1-1. For all other bond conditions multiply the values of f_{bd} by 0.7.

Section 29. DESIGN BOND STRENGTH VALUES – DIAMOND CORE DRILLED HOLES

Working life of 50 and 100 years

Design values of the ultimate bond resistance f_{bd} in N/mm² for diamond core drilling for good bond conditions

Rebar Ø (mm)	Concrete Class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
8	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3
10	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3
12	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3
14	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3
16	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3
20	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3
25	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3
28	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,0
32	1,6	2,0	2,3	2,7	3,0	3,4	3,4	3,4	3,4

Tabulated values are valid for good bond conditions according to EN 1992-1-1. For all other bond conditions multiply the values of f_{bd} by 0.7.

IMPORTANT NOTES

Use in Porous Substrates
This bonded anchor is not intended for use as a cosmetic or decorative product. When anchoring into porous or reconstituted stone it is recommended that technical assistance is sought. Due to the nature of the product, migration of the monomer in the resin may cause staining in certain materials. If you are still uncertain, it is advisable to test the resin by applying it in a small, discrete area and testing before using the resin on the project.

Important Note
Whilst all reasonable care is taken in compiling technical data on the Company's products, all recommendations or suggestions regarding the use of such products are made without guarantee, since the conditions of use are beyond the control of the Company. It is the customer's responsibility to satisfy himself that each product is fit for the purpose for which he intends to use it, that the actual conditions of use are suitable and that, in the light of our continual research and development programme the information relating to each product has not been superseded.