FRIULSIDER YOUR FIXING FACTORY

Declaration of Performance

DoP nr. kemhybrid

Bonded anchor resin in cartridge

CE

1. Identification of the product: **KEM HYBRID**

2. Identification code (art. 11.4), for the batch or serial number see packaging:

Type of Cartridge	Format	Cod.
Coaxial	150-280-300-330-380-410-420 ml	93600000000 /01-02-03-04-05-06-07-08 (420ml)

3. Intended use:

Generic type	Bonded anchor for anchorage of **Threaded Rod** and **Rebar** as **ETA-16/0957**
Base Material	**Concrete** C20/25 to C50/60 acc. to EN206-1
Use category	▪ Installation in dry, wet concrete and flooded boreholes ▪ Overhead installation
Material & Durability	▪ Threaded rod Galvanized cl.4.6 to cl.8.8 acc. to EN ISO898 for dry internal conditions ▪ Threaded rod Stainless Steel cl. A4-70 acc. to EN ISO3506 for internal and external use without particular aggressive conditions ▪ Threaded rod High Resistant Stainless Steel HCR-70 acc. to EN ISO3506 for all conditions ▪ Rebar Class B and C as EN 1992-1-1:2004+AC:2010, Annex C
Loading	**Static, quasi-static and Seismic load**
Temperature Range	- 40°C to +80°C max long term temperature +50°C and max short term temperature +80°C - 40°C to +120°C max long term temperature +72°C and max short term temperature +120°C - 40°C to +160°C max long term temperature +100°C and max short term temperature +160°C
Fire Reaction	A1 according to EN 13501-1

Generic type	Bonded anchor for anchorage of **Post-Installed Rebar Connection** as **ETA-16/0961**
Base material	Non-carbonated Concrete C12/15 to C50/60 acc. to EN206-1 [max 0,4 % CL]
Use category	▪ Installation in dry and wet concrete (not flooded boreholes) ▪ Overlap joint with existing reinforcement in a building component ▪ Anchoring of the reinforcement at a slab or beam support ▪ Anchoring of reinforcement of building components stressed primarily in compression ▪ Anchoring of reinforcement to cover the envelope line of tensile force in the bending member
Material & Durability	▪ Rebar Class B and C as EN 1992-1-1:2004+AC:2010, Annex C ▪ ZA Tension Anchor B500 B as DIN 488 for internal and external use without particular aggressive conditions ▪ ZA Tension Anchor Stainless Steel A4 as DIN 488 for internal and external use without particular aggressive conditions ▪ ZA Tension Anchor High Resistance Stainless Steel HCR as DIN 488 for all conditions
Loading	**Static, quasi-static and Fire exposure as EN1992-1**
Temperature Range	-40°C to +80°C max long term temperature +50°C and max short term temperature +80°C
Fire Reaction	A1 according to EN 13501-1

4. Manufacturer (art. 11.5): **Friulsider** SpA via trieste,1 - 33048 San Giovanni al Natisone (UD) - Italy

5. Authorised representative (art. 12.2): Not Relevant

6. System of Assessment AVCP (annex V): **System 1**

7/8. Harmonised Specification & Notified Body:

	Name of Body	System of Assessment	Reference	EAD / hEN Document
Technical Specification Document	DiBt [TAB]	1	ETA-16/0957	**EAD 330499-01-0601**
Constancy of Performance & FPC	MPA Darmstadt 1343 [NB]	1	1343-CPR-M 527-9	**EAD 330499-01-0601**
Technical Specification Document	DiBt [TAB]	1	ETA-16/0961	**EAD 330087-00-0601**
Constancy of Performance & FPC	MPA Darmstadt 1343 [NB]	1	1343-CPR-M 527-8	EAD 330087-00-0601

9. Declared Performance: **See Annexes**

10. The performance of the product identified in points 1 and 2 is in conformity with declared performance in point 9. This declaration of performance is issued under the sole responsibility of Friulsider SpA.

Signed for and behalf of the manufacturer by:

Function	Name	Signature	Place and date of issue
Technical Manager	Raffaele Palmieri		San Giovanni al Natisone, 06-03-2020

ANNEX I°

Declared Performances acc. to **ETA-16/0957** & EAD 330499-01-0601 - **Design method** acc. to **EN 1992-4:2018**

ESSENTIAL CHARACTERISTICS				PERFORMANCE - **THREADED RODS**							
Installation parameters		**d**		**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
d_0	Nominal diameter of drill bit		[mm]	10	12	14	18	22	28	30	35
h_{ef}	Effective embedment depth	$h_{ef,min}$	[mm]	60	60	70	80	90	96	108	120
		$h_{ef,std}$	[mm]	80	90	110	125	170	210	240	270
		$h_{ef,max}$	[mm]	160	200	240	320	400	480	540	600
h_{min}	Minimum thickness of the concrete member		[mm]	$h_{ef} + 30 \geq 100$mm			$h_{ef} + 2 \cdot d_0$				
T_{inst}	Torque moment (max)		[Nm]	10	20	40	60	100	170	250	300
s_{min}	Minimum spacing		[mm]	40	50	60	75	95	115	125	140
c_{min}	Minimum edge distance		[mm]	35	40	45	50	60	65	75	80
TENSION Steel failure											
$N_{Rk,s}$	Tension Steel characteristic failure	cl. 4.8 - 4.6	[kN]	15	23	34	63	98	141	184	224
		cl. 5.8 - 5.6	[kN]	18	29	42	78	122	176	230	280
		cl. 8.8	[kN]	29	46	67	125	196	282	368	449
		A4-70 (50)	[kN]	26	41	59	110	171	247	(230)	(281)
$\gamma_{m,sN}$ [1)]	Partial safety factor	cl. 4.6-5.6	[-]	2,0							
		cl. 4.8-5.8-8.8	[-]	1,5							
		A4-70 (50)	[-]	1,87						(2,86)	
Combined pull-out and concrete failure				M8	M10	M12	M16	M20	M24	M27	M30
$\tau_{Rk,ucr}$	Characteristic bond resistance for **un-cracked concrete** C20/25	80°/50°C	[MPa]	**17**	**17**	**16**	**15**	**14**	**13**	**13**	**13**
		120°/72°C	[Mpa]	**15**	**14**	**14**	**13**	**12**	**12**	**11**	**11**
		160°/100°C	[MPa]	**12**	**11**	**11**	**10**	**9.5**	**9**	**9**	**9**
$\tau_{Rk,cr}$ $\tau_{Rk,seisC1}$	Characteristic bond resistance for **cracked concrete** C20/25 and **Seismic Category C1**	80°/50°C	[MPa]	**7,0**	**7,5**	**8**	**9**	**8,5**	**7**	**7**	**7**
		120°/72°C	[Mpa]	**6**	**6,5**	**7**	**7,5**	**7**	**6**	**6**	**6**
		160°/100°C	[MPa]	**5,5**	**5,5**	**6**	**6,5**	**6**	**5,5**	**5,5**	**5,5**
$\tau_{Rk,seisC2}$	Characteristic bond resistance for **Seismic Category C2**	80°/50°C	[MPa]	-	-	**3,6**	**3,5**	**3,3**	**2,3**	-	-
		120°/72°C	[Mpa]	-	-	**3,1**	**3**	**2,8**	**2**	-	-
		160°/100°C	[MPa]	-	-	**2,5**	**2,7**	**2,5**	**1,8**	-	-
ψ_c	Increasing factor for concrete	C30/37	[-]	1,04							
		C40/50	[-]	1,08							
		C50/60	[-]	1,10							
ψ_c	Increasing factor for concrete for **Seismic** action	from C25/30 to C50/60	[-]	1,0							
ψ^0_{sus}	Reduction factor for concrete C20/25 cracked, un-cracked and Seismic action	80°/50°C	[-]	0,79							
		120°/72°C	[-]	0,75							
		160°/100°C	[-]	0,66							
Concrete cone failure											
$K_{cr,N}$	Factor acc. to EN 1992-4 § 7.2.1.4 cracked		[-]	7,7							
$K_{ucr,N}$	Factor acc. to EN 1992-4 § 7.2.1.4 un-cracked		[-]	11,0							
$c_{cr,N}$	Critical edge distance		[mm]	$1,5 \cdot h_{ef}$							
$s_{cr,N}$	Critical spacing		[mm]	$2,0 \cdot c_{cr,N}$							
Splitting failure											
$c_{cr,sp}$	Critical edge distance for Splitting	$h / h_{ef} \geq 2,0$	[mm]	$1,0 \cdot h_{ef}$							
		$2,0 > h / h_{ef} > 1,3$		$2,0 \cdot h_{ef} \cdot (2,5 - h / h_{ef})$							
		$h / h_{ef} \leq 1,3$		$2,4 \cdot h_{ef}$							
$s_{cr,sp}$	Critical spacing for Splitting		[mm]	$2,0 \cdot C_{cr,sp}$							
$\gamma_2 = \gamma_{inst}$	Installation safety factor **MAC** [1)]		[-]	1,2				-			
	Installation safety factor **CAC (HDB)** [1)]		[-]	1,0 (1,2)							
	Installation safety factor **CAC** [1)] for flooded borehole		[-]	1,4							
Displacement under Tension Load in Concrete				M8	M10	M12	M16	M20	M24	M27	M30
δ_{N0}	Short term displacement **un-cracked concrete**	80°/50°C	[mm/MPa]	0,031	0,032	0,034	0,037	0,039	0,042	0,044	0,046
		120°/72°C		0,032	0,034	0,035	0,038	0,041	0,044	0,046	0,048
		160°/100°C		0,121	0,126	0,131	0,142	0,153	0,163	0,171	0,179
$\delta_{N\infty}$	Long term displacement **un-cracked concrete**	80°/50°C	[mm/MPa]	0,040	0,042	0,044	0,047	0,051	0,054	0,057	0,060
		120°/72°C		0,042	0,044	0,045	0,049	0,053	0,056	0,059	0,062
		160°/100°C		0,124	0,129	0,135	0,146	0,157	0,168	0,176	0,184
δ_{N0}	Short term displacement **cracked concrete** and **Seismic C1**	80°/50°C	[mm/MPa]	0,081	0,083	0,085	0,090	0,095	0,099	0,103	0,106
		120°/72°C		0,084	0,086	0,088	0,093	0,098	0,103	0,107	0,110
		160°/100°C		0,312	0,321	0,330	0,349	0,367	0,385	0,399	0,412
$\delta_{N\infty}$	Long term displacement **cracked concrete** and **Seismic C1**	80°/50°C	[mm/MPa]	0,104	0,107	0,110	0,116	0,122	0,128	0,133	0,137
		120°/72°C		0,108	0,111	0,114	0,121	0,127	0,133	0,138	0,143
		160°/100°C		0,321	0,330	0,340	0,358	0,377	0,396	0,410	0,424
$\delta_{N,eq(DLS)}$	Displacement for **Seismic C2** at DLS		[mm]	-	-	0,24	0,27	0,29	0,27	-	-
$\delta_{N,eq(ULS)}$	Displacement for **Seismic C2** at ULS			-	-	0,55	0,51	0,50	0,58	-	-

[1)] CAC = Cleaning with Compressed air, MAC = Cleaning with Manual Hand Pump and HDB = cleaning with Hollow drill bit system

ANNEX II°

Declared Performances acc. to **ETA-16/0957** & ETAG001 p.1-5 - **Design method** acc. to **EN 1992-4:2018**

ESSENTIAL CHARACTERISTICS				PERFORMANCE - **THREADED RODS**							
SHEAR Steel failure				**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
$V_{Rk,s}$	Shear Steel characteristic failure	cl. 4.8 - 4.6	[kN]	9	14	20	38	59	85	110	135
		cl. 5.8 - 5.6	[kN]	11	17	25	47	74	106	138	168
		cl. 8.8	[kN]	15	23	34	63	98	141	184	224
		A4-70 (50)	[kN]	13	20	30	55	86	124	(115)	(140)
$V_{Rk,s,eq,C1}$	Shear Steel characteristic failure **Seismic C1**		[kN]	0,70 • $V_{Rk,s}$							
$V_{Rk,s,eq,C2}$	Shear Steel characteristic failure **Seismic C2**		[kN]	-	-	0,70 • $V_{Rk,s}$				-	-
$M^0_{Rk,s}$	Characteristic Bending Moment	cl. 4.8 - 4.6	[Nm]	15	30	52	133	260	449	666	900
		cl. 5.8 - 5.6	[Nm]	19	37	65	166	324	560	833	1123
		cl. 8.8	[Nm]	30	60	105	266	519	896	1333	1797
		A4-70 (50)	[Nm]	26	52	92	232	454	784	(832)	(1125)
$M^0_{Rk,s,C1}$	Characteristic Bending Moment Seismic C1		[kN]	NPD [No Performance Data]							
$M^0_{Rk,s,C2}$	Characteristic Bending Moment Seismic C2		[kN]	NPD [No Performance Data]							
$\gamma_{m,sV}$	Partial safety factor	cl. 4.6-5.6	[-]	1,67							
		cl. 4.8-5.8-8.8	[-]	1,25							
		A4-70 (50)	[-]	1,56						(2,38)	
k_7	Ductility factor acc. to EN 1992-4 § 7.2.2.3.1		[-]	1,0							
Concrete pry-out failure											
k_8	Factor acc. to EN 1992-4 § 7.2.2.4		[-]	2,0							
$\gamma_2 = \gamma_{inst}$	Installation safety factor		[-]	1,0							
Concrete edge failure				*see CEN/TS 1992-4-5 Section 6.3.4*							
l_f	Effective length of anchor		[-]	l_f = min (h_{ef}; 12 • d_{nom})						l_f = min (h_{ef};300mm)	
d_{nom}	Outside diameter of anchor		[mm]	8	10	12	16	20	24	27	30
$\gamma_2 = \gamma_{inst}$	Installation safety factor		[-]	1,0							
Displacement under Shear Load				M8	M10	M12	M16	M20	M24	M27	M30
δ_{V0}	Short term displacement in **Concrete** and **Seismic C1**		[mm/kN]	0,06	0,06	0,05	0,04	0,04	0,03	0,03	0,03
$\delta_{V\infty}$	Long term displacement in **Concrete** and **Seismic C1**		[mm/kN]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,05
$\delta_{V,eq(DLS)}$	Displacement for **Seismic C2** at DLS(1)		[mm]	-	-	3,6	3,0	3,1	3,5	-	-
$\delta_{V,eq(ULS)}$	Displacement for **Seismic C2** at ULS(1)		[mm]	-	-	7	6,6	7,0	9,3	-	-

(1)DLS= damage limitation state, ULS=ultimate limit state.

ANNEX III°

Declared Performances acc. to **ETA-16/0957** & EAD 330499-01-0601 - **Design method** acc. to **EN 1992-4:2018**

ESSENTIAL CHARACTERISTICS				PERFORMANCE - **REBAR**								
Installation parameters			**d**	**Ø8**	**Ø 10**	**Ø 12**	**Ø 14**	**Ø 16**	**Ø 20**	**Ø 25**	**Ø 28**	**Ø 32**
d_0	Nominal diameter of drill bit		[mm]	12	14	16	18	20	25	32	35	40
h_{ef}	Effective embedment depth	$h_{ef,min}$	[mm]	60	60	70	75	80	90	100	112	128
		$h_{ef,std}$	[mm]	80	90	110	115	125	170	210	250	280
		$h_{ef,max}$	[mm]	160	200	240	280	320	400	500	560	640
h_{min}	Minimum thickness of the concrete member		[mm]	$h_{ef} + 30 \geq 100$		$h_{ef} + 2 \cdot d_0$						
s_{min}	Minimum spacing		[mm]	40	50	60	70	75	95	120	130	150
c_{min}	Minimum edge distance		[mm]	35	40	45	50	50	60	70	75	85
TENSION Steel failure												
$N_{Rk,s}$	Tension Steel characteristic failure		[kN]	$A_s \cdot f_{uk}$ [2]								
$A_{,s}$	Area resistant		[mm²]	50	79	113	154	201	314	491	616	804
$\gamma_{m,sN}$	Partial safety factor		[-]	1,4 [3]								
Combined pull-out and concrete cone failure				Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 25	Ø 28	Ø 32
$\tau_{Rk,ucr}$	Characteristic bond resistance in **un-cracked concrete C20/25**	80°/50°C	[MPa]	**14**	**14**	**14**	**14**	**13**	**13**	**13**	**13**	**13**
		120°/72°C	[MPa]	**13**	**12**	**12**	**12**	**12**	**11**	**11**	**11**	**11**
		160°/100°C	[MPa]	**9,5**	**9,5**	**9,5**	**9**	**9**	**9**	**9**	**8,5**	**8,5**
$\tau_{Rk,cr}$	Characteristic bond resistance in **cracked concrete C20/25**	80°/50°C	[MPa]	**5,5**	**5,5**	**6**	**6**	**7,5**	**7,5**	**7,5**	**7,5**	**8**
		120°/72°C	[MPa]	**4,5**	**5**	**5**	**5,5**	**6,5**	**6,5**	**6,5**	**6,5**	**7**
		160°/100°C	[MPa]	**4**	**4,5**	**4,5**	**5**	**5,5**	**6**	**6**	**5,5**	**6,5**
ψ_c	Increasing factor for concrete	C30/37	[-]	1,04								
		C40/50	[-]	1,08								
		C50/60	[-]	1,10								
ψ_c	Increasing factor for concrete for **Seismic** action	da C25/30 a C50/60	[-]	1,0								
ψ^0_{sus}	Reduction factor for concrete C20/25 cracked, un-cracked and Seismic action	80°/50°C	[-]	0,79								
		120°/72°C	[-]	0,75								
		160°/100°C	[-]	0,66								
Concrete cone failure												
$k_{cr,N}$	Factor acc. to EN 1992-4 § 7.2.1.4 cracked		[-]	7,7								
$k_{ucr,N}$	Factor acc. to EN 1992-4 § 7.2.1.4 un-cracked		[-]	11								
$c_{cr,N}$	Critical edge distance		[mm]	$1,5 \cdot h_{ef}$								
$s_{cr,N}$	Critical spacing		[mm]	$2,0 \cdot c_{cr,N}$								
Splitting failure				Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 25	Ø 28	Ø 32
$c_{cr,sp}$	Critical edge distance for Splitting	$h / h_{ef} \geq 2,0$	[mm]	$1,0 \cdot h_{ef}$								
		$2,0 > h / h_{ef} > 1,3$		$2,0 \cdot h_{ef} \cdot (2,5 - h / h_{ef})$								
		$h / h_{ef} \leq 1,3$		$2,4 \cdot h_{ef}$								
$s_{cr,sp}$	Critical spacing for Splitting		[mm]	$2,0 \cdot C_{cr,sp}$								
$\gamma_2 = \gamma_{inst}$	Installation safety factor **MAC** [1]		[-]	1,2					-			
	Installation safety factor **CAC (HDB)** [1]		[-]	1,0 (1,2)								
	Installation safety factor **CAC** [1] for flooded borehole		[-]	1,4								
Displacement under Tension Load				**Ø8**	**Ø 10**	**Ø 12**	**Ø 14**	**Ø 16**	**Ø 20**	**Ø 25**	**Ø 28**	**Ø 32**
δ_{N0}	Short term displacement **un-cracked concrete**	80°/50°C	[mm/MPa]	0,031	0,032	0,034	0,035	0,037	0,039	0,043	0,045	0,048
		120°/72°C		0,032	0,034	0,035	0,036	0,038	0,041	0,045	0,047	0,050
		160°/100°C		0,121	0,126	0,131	0,137	0,142	0,153	0,164	0,172	0,186
$\delta_{N\infty}$	Long term displacement **un-cracked concrete**	80°/50°C	[mm/MPa]	0,040	0,042	0,044	0,045	0,047	0,051	0,055	0,058	0,063
		120°/72°C		0,042	0,044	0,045	0,047	0,049	0,053	0,057	0,060	0,065
		160°/100°C		0,124	0,129	0,135	0,141	0,146	0,157	0,169	0,177	0,192
δ_{N0}	Short term displacement **cracked concrete** and **Seismic C1**	80°/50°C	[mm/MPa]	0,081	0,083	0,085	0,087	0,090	0,095	0,099	0,103	0,108
		120°/72°C		0,084	0,086	0,088	0,090	0,093	0,098	0,103	0,107	0,113
		160°/100°C		0,312	0,321	0,330	0,340	0,349	0,367	0,385	0,399	0,425
$\delta_{N\infty}$	Long term displacement **cracked concrete** and **Seismic C1**	80°/50°C	[mm/MPa]	0,104	0,107	0,110	0,113	0,116	0,122	0,128	0,133	0,141
		120°/72°C		0,108	0,111	0,114	0,118	0,121	0,127	0,133	0,138	0,148
		160°/100°C		0,321	0,330	0,340	0,349	0,358	0,377	0,396	0,410	0,449

[1] CAC = Cleaning with Compressed air, MAC = Cleaning with Manual Hand Pump and HDB = cleaning with Hollow drill bit system

[2] f_{uk} shall be taken from the specifications of reinforcing bars

[3] In absence of other national regulations.

[4] Calculation of the displacement = $\delta_N \times \tau$ ($\tau = \tau_{rk} / \gamma_2 \times 1,5 \times 1,4$)

ANNEX IV°

Declared Performances acc. to **ETA-16/0957** & 330499-01-0601 **- Design method** acc. to **EN 1992-4:2018**

ESSENTIAL CHARACTERISTICS			PERFORMANCE - **REBAR**								
SHEAR Steel failure			**Ø8**	**Ø 10**	**Ø 12**	**Ø 14**	**Ø 16**	**Ø 20**	**Ø 25**	**Ø 28**	**Ø 32**
$V_{Rk,s}$	Shear Steel characteristic failure	[kN]	$0,5 \cdot N_{rk,s}$								
$V_{Rk,s,eq,C1}$	Shear Steel characteristic failure **Seismic C1**	[kN]	$0,37 \cdot N_{rk,s}$								
$M^0_{Rk,s}$	Bending Moment characteristic failure	[Nm]	$1,2 \cdot W_{el} \cdot f_{uk}$ [1)]								
$M^0_{Rk,s,eq,C1}$	Bending Moment characteristic failure Seismic C1	[Nm]	NPD [No Performance Data]								
W_{el}	Elastic section modulus	[mm^3]	50	98	170	269	402	785	1534	2155	3217
$\gamma_{m,sV}$	Partial safety factor	[-]	1,5 [2)]								
k_7	Ductility factor acc. to EN 1992-4 § 7.2.2.3.1	[-]	0,8								
Concrete Pryout failure											
k_8	Factor acc. to EN 1992-4 § 7.2.2.4	[-]	2,0								
$\gamma_2 = \gamma_{inst}$	Installation safety factor	[-]	1,0								
Concrete Edge failure											
l_f	Effective length of anchor	[-]	min (h_{ef}; 12•d_{nom})						min (h_{ef}; 300mm)		
d_{nom}	Outside diameter of anchor	[mm]	8	10	12	14	16	20	25	28	32
$\gamma_2 = \gamma_{inst}$	Installation safety factor	[-]	1,0								
Displacement under Shear Load [3)]			Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 25	Ø 28	Ø 32
δ_{V0}	Short term displacement in **Concrete** and **Seismic C1**	[mm/kN]	0,06	0,05	0,05	0,04	0,04	0,04	0,03	0,03	0,03
$\delta_{V\infty}$	Long term displacement in **Concrete** and **Seismic C1**	[mm/kN]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,04	0,04

[1)] f_{uk} shall be taken from the specifications of reinforcing bars

[2)] In absence of other national regulations

[3)] Calculation of the displacement = $\delta_V \times V$ ($V = V_{Rk,s} / \gamma_2 \times 1,5 \times 1,4$)

ANNEX V°

Declared Performances acc. to **ETA-16/0961** & EAD 330087-00-0601 **Design method** acc. to **EN 1992-1-1:2004+AC:2010** and **ETA-16/0961**												
ESSENTIAL CHARACTERISTICS					PERFORMANCE **POST-INSTALLED REBAR CONNECTION**							
Installation parameters				**d**	**Ø8**	**Ø10**	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø22**	**Ø24**	**Ø25**	**Ø28**	**Ø32**
d_0	Nominal diameter of drill bit			[mm]	12	14	16	18	20	25	28	32	32	35	40
$\ell_{v,MAX}$	Maximum embedment depth			[mm]	see table B6 of ETA-16/0961										
$\ell_{b,min}$	Minimum anchorage length			[mm]	§ 8.6 - § 8.7 EN 1992-1-1:2004+AC2010										
$\ell_{0,min}$	Lap length			[mm]	§ 8.11 EN 1992-1-1:2004+AC2010										
α_{lb}	Amplification factor for $\ell_{b,min}$ and $\ell_{0,min}$			[-]	1,0										
c [1) 2)]	Minimum concrete cover min c	Without drilling Aid	hammer drilling HD	[mm]	30 mm + 0,06•l_v ≥ 2•Ø								40 mm + 0,06•l_v ≥ 2•Ø		
			compr. air drilling CD	[mm]	50 mm + 0,08•l_v								60 mm + 0,08•l_v		
		With drilling Aid	hammer drilling HD	[mm]	30 mm + 0,02•l_v ≥ 2•Ø								40 mm + 0,02•l_v ≥ 2•Ø		
			compr. air drilling CD	[mm]	50 mm + 0,02•l_v								60 mm + 0,02•l_v		
s_{min}	Minimum spacing			[mm]	≥ 5•Ø ≥ 50 mm										
Design values of ultimate bond resistance												
f_{bd}	**Bond design value resistance** *"for all drilling methods for good conditions"*		C12/15	[N/mm²]	**1,6**										
			C16/20	[N/mm²]	**2,0**										
			C20/25	[N/mm²]	**2,3**										
			C25/30	[N/mm²]	**2,7**										
			C30/37	[N/mm²]	**3,0**										
			C35/45	[N/mm²]	**3,4**										
			C40/50	[N/mm²]	**3,7**										
			C45/55	[N/mm²]	**4,0**										
			C50/60	[N/mm²]	**4,3**										
$f_{bd,c}$	*"for all other bond conditions"*			[N/mm²]	f_{bd} • **0,7**										
FIRE EXPOSURE Design method acc. to **EN 1992-1-1:2004+AC:2008**												
$f_{bd,fi}$	**Bond design value resistance Under FIRE EXPOSURE**			[N/mm²]	[3)] $f_{bd,fi} = k_{b,fi}(\theta) \cdot f_{bd} \cdot \gamma_c / \gamma_{M,fi}$										

1) Not allowed Diamond Drilling
2) The minimum concrete cover acc. EC 1992-1-1:2004+AC:2010 must be observed
3) With: $k_{b,fi}(\theta)$ = reduction factor under fire exposure (see graphics below)
   f_{bd} = see table above
   γ_c = partial safety factor acc.to EN 1992-1-1
   $\gamma_{M,fi}$ = partial safety factor acc.to EN 1992-1-2 under fire exposure

Example graph of Reduction factor $k_{b,fi}(\theta)$ for concrete classes C20/25 for good bond conditions: