

# Technical Documentation

## Sika AnchorFix® -2+

### Product Information

Sika Limited



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# SIKA ANCHORFIX®-2+

## Chemical Resistance

The chemical mortar has undergone extensive chemical resistance testing. The results are summarised in the table below (continued overleaf).

Chemical Environment	Concentration	Result
Aqueous Solution Acetic Acid	10%	✓
Acetone	100%	✗
Aqueous Solution Aluminium Chloride	Saturated	✓
Aqueous Solution Aluminium Nitrate	10%	✓
Ammonia Solution	5%	✓
Jet Fuel	100%	✓
Benzene	100%	✗
Benzoic Acid	Saturated	✓
Benzyl Alcohol	100%	✗
Sodium Hypochlorite Solution	5 - 15%	C
Butyl Alcohol	100%	C
Calcium Sulphate Aqueous Solution	Saturated	✓
Carbon Monoxide	Gas	✓
Carbon Tetrachloride	100%	✓
Chlorine Water	Saturated	✓
Chloro Benzene	100%	✗
Citric Acid Aqueous Solution	Saturated	✓
Cyclohexanol	100%	✓
Diesel Fuel	100%	✓
Diethylene Glycol	100%	✓
Ethanol	95%	C
Ethanol Aqueous Solution	20%	C
Heptane	100%	✓
Hexane	100%	C
Hydrochloric Acid	10%	✓
	15%	✓
	25%	C
Hydrogen Sulphide Gas	100%	✓
Isopropyl Alcohol	100%	C
Linseed Oil	100%	✓
Lubricating Oil	100%	✓
Mineral Oil	100%	✓
Paraffin / Kerosene (Domestic)	100%	✓
Phenol Aqueous Solution	1%	✗
Phosphoric Acid	50%	✓
Potassium Hydroxide	10% / pH13	C
Sea Water	100%	✓
Styrene	100%	✗
Sulphur Dioxide Solution	10%	✓
Sulphur Dioxide (40°C)	5%	✓

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Sulphuric Acid	10%	✓
	50%	✓
Turpentine	100%	C
White Spirit	100%	✓
Xylene	100%	✗

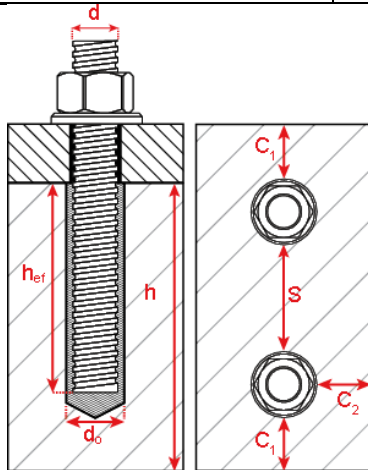
✓ = Resistant to 75°C with at least 80% of physical properties retained.

C = Contact only to a maximum of 25°C.

✗ = Not Resistant

## INSTALLATION PARAMETERS OF THREADED BARS

Size			M8	M10	M12	M16	M20	M24	M27	M30
Nominal drill hole diameter	Ød <sub>0</sub>	[mm]	10	12	14	18	22	26	30	35
Diameter of cleaning brush d <sub>b</sub>	d <sub>b</sub>	[mm]	14	14	20	20	29	29	40	40
Torque moment T <sub>inst</sub>	T <sub>inst</sub>	[Nm]	10	20	40	80	150	200	240	275
h <sub>ef,min</sub> = 8d										
Depth of drill hole h <sub>0</sub>	h <sub>0</sub>	[mm]	64	80	96	128	160	192	216	240
Minimum edge distance c <sub>min</sub>	c <sub>min</sub>	[mm]	35	40	50	65	80	96	110	120
Minimum spacing s <sub>min</sub>	s <sub>min</sub>	[mm]	35	40	50	65	80	96	110	120
Minimum thickness of member h <sub>min</sub>	h <sub>min</sub>	[mm]	h <sub>ef</sub> + 30 mm ≥ 100 mm				h <sub>ef</sub> + 2d <sub>0</sub>			
h <sub>ef,max</sub> = 20d										
Depth of drill hole h <sub>0</sub>	h <sub>0</sub>	[mm]	160	200	240	320	400	480	540	600
Minimum edge distance c <sub>min</sub>	c <sub>min</sub>	[mm]	80	100	120	160	200	240	270	300
Minimum spacing s <sub>min</sub>	s <sub>min</sub>	[mm]	80	100	120	160	200	240	270	300
Minimum thickness of member h <sub>min</sub>	h <sub>min</sub>	[mm]	h <sub>ef</sub> + 30 mm ≥ 100 mm				h <sub>ef</sub> + 2d <sub>0</sub>			



## INSTALLATION PARAMETERS OF REINFORCING BARS USED AS ANCHORS

Size			$\varnothing 8$	$\varnothing 10$	$\varnothing 12$	$\varnothing 16$	$\varnothing 20$	$\varnothing 25$	$\varnothing 32$
Nominal drill hole diameter	$\varnothing d_0$	[mm]	12	14	16	20	25	32	40
Diameter of cleaning brush $d_b$	$d_b$	[mm]	14	14	19	22	29	40	42
$h_{ef,min} = 8d$									
Depth of drill hole $h_0$	$h_0$	[mm]	64	80	96	128	160	200	256
Minimum edge distance $c_{min}$	$c_{min}$	[mm]	35	40	50	65	80	100	130
Minimum spacing $s_{min}$	$s_{min}$	[mm]	35	40	50	65	80	100	130

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Minimum thickness of member $h_{min}$	$h_{min}$	[mm]	$h_{ef} + 30 \text{ mm} \geq 100 \text{ mm}$				$h_{ef} + 2d_0$		
$h_{ef,max} = 20d$									
Depth of drill hole $h_0$	$h_0$	[mm]	160	200	240	320	400	500	640
Minimum edge distance $c_{min}$	$c_{min}$	[mm]	80	100	120	160	200	250	320
Minimum spacing $s_{min}$	$s_{min}$	[mm]	80	100	120	160	200	250	320
Minimum thickness of member $h_{min}$	$h_{min}$	[mm]	$h_{ef} + 30 \text{ mm} \geq 100 \text{ mm}$				$h_{ef} + 2d_0$		

## STEEL FAILURE INFORMATION - THREADED BARS

### Characteristic resistance values to tension load

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	$\gamma_{Ms}$	[-]	2							
Steel grade 5.8	$N_{Rk,s}$	[kN]	18	29	42	79	123	177	230	281
Partial safety factor	$\gamma_{Ms}$	[-]	1.5							
Steel grade 8.8	$N_{Rk,s}$	[kN]	29	46	67	126	196	282	367	449
Partial safety factor	$\gamma_{Ms}$	[-]	1.5							
Steel grade 10.9	$N_{Rk,s}$	[kN]	37	58	84	157	245	353	459	561
Partial safety factor	$\gamma_{Ms}$	[-]	1.4							
Stainless steel grade A4-70	$N_{Rk,s}$	[kN]	26	41	59	110	172	247	321	393
Partial safety factor	$\gamma_{Ms}$	[-]	1.9							
Stainless steel grade A4-80	$N_{Rk,s}$	[kN]	29	46	67	126	196	282	367	449
Partial safety factor	$\gamma_{Ms}$	[-]	1.6							
Stainless steel grade 1.4529	$N_{Rk,s}$	[kN]	26	41	59	110	172	247	321	393

### Characteristic resistance values to shear load

Steel Failure - Without lever arm										
Size			M8	M10	M12	M16	M20	M24	M27	M30
Steel grade 4.8	$V_{Rk,s}$	[kN]	7	12	17	31	49	71	92	112
Partial safety factor	$\gamma_{Ms}$	[-]	1.67							
Steel grade 5.8	$V_{Rk,s}$	[kN]	9	15	21	39	61	88	115	140
Partial safety factor	$\gamma_{Ms}$	[-]	1.25							
Steel grade 8.8	$V_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
Partial safety factor	$\gamma_{Ms}$	[-]	1.25							
Steel grade 10.9	$V_{Rk,s}$	[kN]	18	29	42	79	123	177	230	281
Partial safety factor	$\gamma_{Ms}$	[-]	1.5							
Stainless steel grade A4-70	$V_{Rk,s}$	[kN]	13	20	30	55	86	124	161	196
Partial safety factor	$\gamma_{Ms}$	[-]	1.56							
Stainless steel grade A4-80	$V_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
Partial safety factor	$\gamma_{Ms}$	[-]	1.33							
Stainless steel grade 1.4529	$V_{Rk,s}$	[kN]	13	20	30	55	86	124	161	196
Partial safety factor	$\gamma_{Ms}$	[-]	1.25							

Steel Failure - With lever arm										
Size			M8	M10	M12	M16	M20	M24	M27	M30
Steel grade 4.8	$V_{Rk,s}$	[kN]	15	30	52	133	260	449	666	900
Partial safety factor	$\gamma_{Ms}$	[-]	1.67							
Steel grade 5.8	$V_{Rk,s}$	[kN]	19	37	66	166	325	561	832	1125
Partial safety factor	$\gamma_{Ms}$	[-]	1.25							
Steel grade 8.8	$V_{Rk,s}$	[kN]	30	60	105	266	519	898	1332	1799
Partial safety factor	$\gamma_{Ms}$	[-]	1.25							
Steel grade 10.9	$V_{Rk,s}$	[kN]	37	75	131	333	649	1123	1664	2249
Partial safety factor	$\gamma_{Ms}$	[-]	1.50							
Stainless steel grade A4-70	$V_{Rk,s}$	[kN]	26	52	92	233	454	786	1165	1574
Partial safety factor	$\gamma_{Ms}$	[-]	1.56							

Stainless steel grade A4-80	$V_{Rk,s}$	[kN]	30	60	105	266	519	898	1332	1799
Partial safety factor	$\gamma_{Ms}$	[-]	1.33							
Stainless steel grade 1.4529	$V_{Rk,s}$	[kN]	26	52	92	233	454	786	1165	1574
Partial safety factor	$\gamma_{Ms}$	[-]	1.25							
Concrete pryout failure										
Factor k from TR 029 Design of bonded anchors pt 5.2.3.3			2							
Partial safety factor	$\gamma_{Ms}$	[-]	1.5							

## USING SIKA ANCHORFIX® -2+ WITH THREADED BARS

### 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										
Characteristic bond resistance dry/wet concrete	$\tau_{Rk}$	[N/mm <sup>2</sup> ]	11	10	9.5	9.0	8.5	8.0	6.5	5.5
Partial safety factor	$\gamma_{Mc}$	[-]	1.8						2.1	

## TENSION LOAD CALCULATIONS FOR COMBINED CONCRETE CONE & PULLOUT FAILURE AT VARIOUS EMBEDMENT DEPTHS

Using threaded rods in dry / wet, uncracked, C20/25 concrete. Temperature range -40°C to +80°C.

Property	Symbol	Unit	Anchor Size							
			M8	M10	M12	M16	M20	M24	M27	M30
Effective Embedment Depth = 8d	$h_{ef}$	mm	64	80	96	128	160	192	216	240
Characteristic Load (Combined Concrete Cone & Pullout Failure)	$N^0_{Rk,p}$	kN	17.69	25.13	34.38	57.91	85.45	115.81	119.09	124.41
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80	1.80	2.10	2.10
Effective Embedment Depth = 10d	$h_{ef}$	mm	80	100	120	160	200	240	270	300
Characteristic Load (Combined Concrete Cone & Pullout Failure)	$N^0_{Rk,p}$	kN	22.12	31.42	42.98	72.38	106.81	144.76	148.86	155.51
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80	1.80	2.10	2.10
Effective Embedment Depth = STD	$h_{ef}$	mm	80	90	110	128	170	210	270	300
Characteristic Load (Combined Concrete Cone & Pullout Failure)	$N^0_{Rk,p}$	kN	22.12	28.27	39.40	57.91	90.79	126.67	148.86	155.51
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80	1.80	2.10	2.10
Effective Embedment Depth = 12d	$h_{ef}$	mm	96	120	144	192	240	288	324	360
Characteristic Load (Combined Concrete Cone & Pullout Failure)	$N^0_{Rk,p}$	kN	26.54	37.70	51.57	86.86	128.18	173.72	178.64	186.61
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80	1.80	2.10	2.10
Effective Embedment Depth = 14d	$h_{ef}$	mm	112	140	168	224	280	336	378	420
Characteristic Load (Combined Concrete Cone & Pullout Failure)	$N^0_{Rk,p}$	kN	30.96	43.98	60.17	101.34	149.54	202.67	208.41	217.71
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80	1.80	2.10	2.10
Effective Embedment Depth = 16d	$h_{ef}$	mm	128	160	192	256	320	384	432	480
Characteristic Load (Combined Concrete Cone & Pullout Failure)	$N^0_{Rk,p}$	kN	35.39	50.27	68.76	115.81	170.90	231.62	238.18	248.81
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80	1.80	2.10	2.10
Effective Embedment Depth = 18d	$h_{ef}$	mm	144	180	216	288	360	432	486	540



Characteristic Load (Combined Concrete Cone & Pullout Failure)	$N_{Rk,p}^0$	kN	39.81	56.55	77.36	130.29	192.27	260.58	267.96	279.92
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80	1.80	2.10	2.10
Effective Embedment Depth = 20d	$h_{ef}$	mm	160	200	240	320	400	480	540	600
Characteristic Load (Combined Concrete Cone & Pullout Failure)	$N_{Rk,p}^0$	kN	44.23	62.83	85.95	144.76	213.63	289.53	297.73	311.02
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80	1.80	2.10	2.10

<sup>1.</sup> Characteristic loads are valid for combined concrete cone and pullout failure as defined by TR029 only. All other failure modes, including steel failure, detailed in TR029 as well as including combined effects of tension and shear, must be considered in accordance with TR029.

<sup>2.</sup> Characteristic loads are valid for single anchors without close edge, anchor spacing or eccentric loading considerations.

<sup>3.</sup> Tabulated values are valid for temperature range -40°C to +80°C (Max LTT = +50°C; Max STT = +80°C).

<sup>4.</sup> Tabulated values are only valid for the installation conditions stated. Other conditions, such as different temperature ranges, may affect the performance of the product.

<sup>5.</sup> Long term temperatures are those that remain roughly constant over prolonged periods. Short term temperatures occur over brief intervals, eg: diurnal cycling.

<sup>6.</sup> The compressive strength of the concrete ( $f_{ck,cube}$ ) is assumed to be 25 N/mm<sup>2</sup> for C20/25 concrete.

<sup>7.</sup> Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.

## TENSION LOAD CALCULATIONS FOR COMBINED CONCRETE CONE & PULLOUT FAILURE AT 8D EMBEDMENT DEPTH

Using threaded rods in dry / wet, uncracked, C20/25 concrete. Temperature range -40°C to +80°C.

Property	Symbol	Unit	Anchor Size							
			M8	M10	M12	M16	M20	M24	M27	M30
Nominal Anchor Diameter	d	mm	8	10	12	16	20	24	27	30
Characteristic Bond Strength	$\tau_{Rk}$	N/mm <sup>2</sup>	11.00	10.00	9.50	9.00	8.50	8.00	6.50	5.50
Effective Embedment Depth	$h_{ef}$	mm	64	80	96	128	160	192	216	240
Characteristic Load (Combined Concrete Cone and Pullout Failure)	$N_{Rk,p}^0$	kN	17.69	25.13	34.38	57.91	85.45	115.81	119.09	124.41
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80	1.80	2.10	2.10
Characteristic Anchor Spacing (Splitting Failure)	$S_{cr,sp}$	mm	192	240	288	384	480	576	648	720
Characteristic Edge Distance (Splitting Failure)	$C_{cr,sp}$	mm	96	120	144	192	240	288	324	360
Characteristic Anchor Spacing (Combined Concrete Cone and Pullout Failure)	$S_{cr,Np}$	mm	192	231	270	351	426	496	503	514
Characteristic Edge Distance (Combined Concrete Cone and Pullout Failure)	$C_{cr,Np}$	mm	96	115	135	175	213	248	251	257

<sup>1.</sup> Characteristic loads are valid for combined concrete cone and pullout failure as defined by TR029 only. All other failure modes, including steel failure, detailed in TR029 as well as including combined effects of tension and shear, must be considered in accordance with TR029.

<sup>2.</sup> Characteristic loads are valid for single anchors without close edge, anchor spacing or eccentric loading considerations.

<sup>3.</sup> Tabulated values are valid for temperature range -40°C to +80°C (Max LTT = +50°C; Max STT = +80°C).

<sup>4.</sup> Tabulated values are only valid for the installation conditions stated. Other conditions, such as different temperature ranges, may affect the performance of the product.

<sup>5.</sup> Long term temperatures are those that remain roughly constant over prolonged periods. Short term temperatures occur over brief intervals, eg: diurnal cycling.

<sup>6.</sup> The compressive strength of the concrete ( $f_{ck,cube}$ ) is assumed to be 25 N/mm<sup>2</sup> for C20/25 concrete.

<sup>7.</sup> Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.

## Reduction factors for close edge:

Combined concrete cone and pullout failure

Close Edge Distance, C (mm)	Anchor Size	Anchor Size							
		M8	M10	M12	M16	M20	M24	M27	M30
35	0.55								
40	0.58	0.54							
50	0.65	0.59	0.56						
60	0.72	0.65	0.60						
65	0.76	0.68	0.63	0.56					
70	0.79	0.71	0.65	0.57					
80	0.87	0.77	0.70	0.61	0.56				
90	0.95	0.83	0.75	0.65	0.59				
96	N/R	0.87	0.78	0.67	0.61	0.57			
100		0.90	0.80	0.68	0.62	0.58			
110		0.96	0.86	0.72	0.65	0.60	0.60		
115		N/R	0.88	0.74	0.66	0.61	0.61		
120			0.91	0.76	0.68	0.63	0.62	0.62	
130			0.97	0.80	0.71	0.65	0.65	0.64	
135			N/R	0.82	0.73	0.67	0.66	0.65	
140				0.85	0.74	0.68	0.68	0.67	
150				0.89	0.78	0.71	0.70	0.69	
160				0.93	0.81	0.74	0.73	0.72	
170				0.98	0.84	0.76	0.76	0.75	
175				N/R	0.86	0.78	0.77	0.76	
180					0.88	0.79	0.78	0.77	
190					0.92	0.82	0.81	0.80	
200					0.95	0.85	0.84	0.83	
213					N/R	0.89	0.88	0.87	
220						0.91	0.90	0.89	
240						0.97	0.96	0.95	
248						N/R	0.99	0.97	
251							N/R	0.98	
257								N/R	

- Tabulated values are only applicable for instances where combined concrete cone and pullout failure is the controlling failure mode as described by TR029. All other failure modes must be considered and different reduction factors may apply.
- Tabulated values are based on a single anchor with a single close edge. Tabulated values must not be used if multiple close edges exist.
- Anchors with geometry different to that defined in the above table must be considered separately and the tabulated values must not be used.
- Interpolation is allowed.
- Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.
- Close edge distances must exceed or be equal to the minimum close edge distance ( $C_{min}$ ) as defined in the ETA.

## Reduction factors for anchor spacing:

Combined concrete cone and pullout failure

Anchor Spacing Distance, S (mm)	Anchor Size	Anchor Size							
		M8	M10	M12	M16	M20	M24	M27	M30
35	0.65								
40	0.66	0.65							
50	0.69	0.66	0.65						
60	0.71	0.68	0.66						
65	0.72	0.69	0.67	0.63					
70	0.73	0.70	0.68	0.64					
80	0.75	0.72	0.69	0.65	0.63				
90	0.78	0.74	0.71	0.67	0.64				
96	0.79	0.75	0.72	0.67	0.64	0.62			
100	0.80	0.76	0.73	0.68	0.65	0.63			
110	0.82	0.78	0.74	0.69	0.66	0.64	0.66		
120	0.84	0.80	0.76	0.70	0.67	0.65	0.67	0.68	
150	0.91	0.85	0.81	0.74	0.70	0.67	0.69	0.70	
192	N/R	0.93	0.88	0.80	0.75	0.71	0.73	0.74	
200		0.94	0.89	0.81	0.76	0.72	0.74	0.74	
231		N/R	0.94	0.85	0.79	0.75	0.76	0.77	
250			0.97	0.87	0.81	0.77	0.78	0.79	
270			N/R	0.90	0.83	0.79	0.80	0.80	
300				0.94	0.87	0.82	0.83	0.83	
351				N/R	0.92	0.86	0.87	0.87	
400					0.97	0.91	0.91	0.91	
426					N/R	0.94	0.93	0.93	
450						0.96	0.96	0.95	
496						N/R	0.99	0.99	
503							N/R	0.99	
514								N/R	

- Tabulated values are only applicable for instances where combined concrete cone and pullout failure is the controlling failure mode as described by TR029. All other failure modes must be considered and different reduction factors may apply.
- Tabulated values are based on a group of 2 anchors with the geometry defined by "S" and "Scr,Np" but without close edge considerations.
- Anchors with geometry different to that defined in the above table must be considered separately and the tabulated values must not be used.
- Interpolation is allowed.
- Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.
- Anchor spacing distances must exceed or be equal to the minimum anchor spacing ( $S_{min}$ ) as defined in the ETA.

# TENSION LOAD CALCULATIONS FOR COMBINED CONCRETE CONE & PULLOUT FAILURE AT STD EMBEDMENT DEPTH

Using threaded rods in dry / wet, uncracked, C20/25 concrete. Temperature range -40°C to +80°C.

Property	Symbol	Unit	Anchor Size							
			M8	M10	M12	M16	M20	M24	M27	M30
Nominal Anchor Diameter	d	mm	8	10	12	16	20	24	27	30
Characteristic Bond Strength	$\tau_{Rk}$	N/mm <sup>2</sup>	11.00	10.00	9.50	9.00	8.50	8.00	6.50	5.50
Effective Embedment Depth	$h_{ef}$	mm	80	90	110	128	170	210	270	300
Characteristic Load (Combined Concrete Cone and Pullout Failure)	$N_{Rk,p}^0$	kN	22.12	28.27	39.40	57.91	90.79	126.67	148.86	155.51
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80	1.80	2.10	2.10
Characteristic Anchor Spacing (Splitting Failure)	$S_{cr,sp}$	mm	240	270	330	384	510	630	810	900
Characteristic Edge Distance (Splitting Failure)	$C_{cr,sp}$	mm	120	135	165	192	255	315	405	450
Characteristic Anchor Spacing (Combined Concrete Cone and Pullout Failure)	$S_{cr,Np}$	mm	194	231	270	351	426	496	503	514
Characteristic Edge Distance (Combined Concrete Cone and Pullout Failure)	$C_{cr,Np}$	mm	97	115	135	175	213	248	251	257

<sup>1</sup>. Characteristic loads are valid for combined concrete cone and pullout failure as defined by TR029 only. All other failure modes, including steel failure, detailed in TR029 as well  
02

### Reduction factors for close edge:

Combined concrete cone and pullout failure

	X	Anchor Size							
		M8	M10	M12	M16	M20	M24	M27	M30
Close Edge Distance, C (mm)	40	0.58							
	45	0.61	0.57						
	50	0.65	0.59	0.56					
	55	0.68	0.62	0.58					
	60	0.72	0.65	0.60	0.54				
	65	0.75	0.68	0.63	0.56				
	70	0.79	0.71	0.65	0.57	0.53			
	80	0.87	0.77	0.70	0.61	0.56			
	85	0.90	0.80	0.72	0.63	0.57			
	90	0.94	0.83	0.75	0.65	0.59	0.55		
	97	N/R	0.88	0.79	0.67	0.61	0.57		
	100		0.90	0.80	0.68	0.62	0.58		
	105		0.93	0.83	0.70	0.63	0.59		
	115		N/R	0.88	0.74	0.66	0.61		
	135			N/R	0.82	0.73	0.67	0.66	
	150				0.89	0.78	0.71	0.70	0.69
	175				N/R	0.86	0.78	0.77	0.76
	200					0.95	0.85	0.84	0.83
	213					N/R	0.89	0.88	0.87
	225						0.93	0.92	0.90
	248						N/R	0.99	0.97
	251							N/R	0.98
	257								N/R

1. Tabulated values are only applicable for instances where combined concrete cone and pullout failure is the controlling failure mode as described by TR029. All other failure modes must be considered and different reduction factors may apply.
2. Tabulated values are based on a single anchor with a single close edge. Tabulated values must not be used if multiple close edges exist.
3. Anchors with geometry different to that defined in the above table must be considered separately and the tabulated values must not be used.
4. Interpolation is allowed.
5. Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.
6. Close edge distances must exceed or be equal to the minimum close edge distance ( $C_{min}$ ) as defined in the ETA.

### Reduction factors for anchor spacing:

Combined concrete cone and pullout failure

	X	Anchor Size							
		M8	M10	M12	M16	M20	M24	M27	M30
Anchor Spacing Distance, S (mm)	40	0.67							
	45	0.68	0.66						
	50	0.70	0.67						
	55	0.71	0.68	0.66					
	60	0.72	0.69	0.67					
	65	0.73	0.70	0.68	0.63				
	70	0.74	0.71	0.69	0.64				
	80	0.76	0.73	0.70	0.65				
	85	0.77	0.74	0.71	0.66	0.64			
	90	0.78	0.75	0.72	0.67	0.64			
	100	0.80	0.76	0.73	0.68	0.65			
	105	0.81	0.77	0.74	0.69	0.66	0.64		
	120	0.85	0.80	0.77	0.70	0.67	0.65		
	135	0.88	0.83	0.79	0.72	0.69	0.67	0.69	
	140	0.89	0.84	0.80	0.73	0.70	0.67	0.70	
	150	0.91	0.86	0.81	0.74	0.71	0.68	0.70	0.71
	194	N/R	0.93	0.88	0.80	0.75	0.72	0.74	0.75
	200		0.95	0.89	0.81	0.76	0.73	0.75	0.75
	231		N/R	0.94	0.85	0.79	0.76	0.77	0.78
	250			0.97	0.87	0.81	0.77	0.79	0.79
	270			N/R	0.90	0.84	0.79	0.81	0.81
	300				0.94	0.87	0.82	0.83	0.83
	351				N/R	0.92	0.87	0.88	0.87
	400					0.97	0.91	0.92	0.91
	426					N/R	0.94	0.94	0.93
	450						0.96	0.96	0.95
	496						N/R	0.99	0.99
	503							N/R	0.99
	514								N/R

1. Tabulated values are only applicable for instances where combined concrete cone and pullout failure is the controlling failure mode as described by TR029. All other failure modes must be considered and different reduction factors may apply.
2. Tabulated values are based on a group of 2 anchors with the geometry defined by "S" and " $S_{cr,Np}$ " but without close edge considerations.
3. Anchors with geometry different to that defined in the above table must be considered separately and the tabulated values must not be used.
4. Interpolation is allowed.
5. Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.
6. Anchor spacing distances must exceed or be equal to the minimum anchor spacing ( $S_{min}$ ) as defined in the ETA.

# TENSION LOAD CALCULATIONS FOR COMBINED CONCRETE CONE & PULLOUT FAILURE AT 20D EMBEDMENT DEPTH

Using threaded rods in dry / wet, uncracked, C20/25 concrete. Temperature range -40°C to +80°C.

Property	Symbol	Unit	Anchor Size							
			M8	M10	M12	M16	M20	M24	M27	M30
Nominal Anchor Diameter	d	mm	8	10	12	16	20	24	27	30
Characteristic Bond Strength	$\tau_{Rk}$	N/mm <sup>2</sup>	11.00	10.00	9.50	9.00	8.50	8.00	6.50	5.50
Effective Embedment Depth	$h_{ef}$	mm	160	200	240	320	400	480	540	600
Characteristic Load (Combined Concrete Cone and Pullout Failure)	$N_{Rk,p}^0$	kN	44.23	62.83	85.95	144.76	213.63	289.53	297.73	311.02
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80	1.80	2.10	2.10
Characteristic Anchor Spacing (Splitting Failure)	$S_{cr,sp}$	mm	480	600	720	960	1200	1440	1620	1800
Characteristic Edge Distance (Splitting Failure)	$C_{cr,sp}$	mm	240	300	360	480	600	720	810	900
Characteristic Anchor Spacing (Combined Concrete Cone and Pullout Failure)	$S_{cr,Np}$	mm	194	231	270	351	426	496	503	514
Characteristic Edge Distance (Combined Concrete Cone and Pullout Failure)	$C_{cr,Np}$	mm	97	115	135	175	213	248	251	257

<sup>1</sup>. Characteristic loads are valid for combined concrete cone and pullout failure as defined by TR029 only. All other failure modes, including steel failure, detailed in TR029 as well as including combined effects of tension and shear, must be considered in accordance with TR029.

<sup>2</sup>. Characteristic loads are valid for single anchors without close edge, anchor spacing or eccentric loading considerations.

<sup>3</sup>. Tabulated values are valid for temperature range -40°C to +80°C (Max LTT = +50°C; Max STT = +80°C).

<sup>4</sup>. Tabulated values are only valid for the installation conditions stated. Other conditions, such as different temperature ranges, may affect the performance of the product.

<sup>5</sup>. Long term temperatures are those that remain roughly constant over prolonged periods. Short term temperatures occur over brief intervals, eg: diurnal cycling.

<sup>6</sup>. The compressive strength of the concrete ( $f_{ck,cube}$ ) is assumed to be 25 N/mm<sup>2</sup> for C20/25 concrete.

<sup>7</sup>. Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.

## Reduction factors for close edge:

Combined concrete cone and pullout failure

	X	Anchor Size							
		M8	M10	M12	M16	M20	M24	M27	M30
Close Edge Distance, C (mm)	80	0.87							
	90	0.94							
	97	N/R							
	100		0.90						
	115		N/R						
	120			0.91					
	130			0.97					
	135			N/R					
	140								
	150								
	160				0.93				
	170				0.98				
	175				N/R				
	180								
	190								
	200					0.95			
	213					N/R			
	220								
	240						0.97		
	248						N/R		
	251								
	257								
	260								
	270							N/R	
	280								
	300								N/R

1. Tabulated values are only applicable for instances where combined concrete cone and pullout failure is the controlling failure mode as described by TR029. All other failure modes must be considered and different reduction factors may apply.
2. Tabulated values are based on a single anchor with a single close edge. Tabulated values must not be used if multiple close edges exist.
3. Anchors with geometry different to that defined in the above table must be considered separately and the tabulated values must not be used.
4. Interpolation is allowed.
5. Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.
6. Close edge distances must exceed or be equal to the minimum close edge distance ( $C_{min}$ ) as defined in the ETA.

## Reduction factors for anchor spacing:

Combined concrete cone and pullout failure

	X	Anchor Size							
		M8	M10	M12	M16	M20	M24	M27	M30
Anchor Spacing Distance, S (mm)	80	0.78							
	90	0.80							
	100	0.82	0.79						
	120	0.86	0.82	0.79					
	140	0.90	0.86	0.82					
	160	0.94	0.89	0.85	0.79				
	180	0.97	0.92	0.88	0.81				
	194	N/R	0.94	0.90	0.83				
	200		0.95	0.90	0.84	0.79			
	220		0.98	0.93	0.86	0.81			
	231		N/R	0.95	0.87	0.82			
	240			0.96	0.88	0.83	0.80		
	260			0.99	0.90	0.85	0.81		
	270			N/R	0.91	0.86	0.82	0.83	
	280				0.92	0.87	0.83	0.83	
	300				0.95	0.89	0.85	0.85	0.85
	351				N/R	0.93	0.89	0.89	0.89
	400					0.98	0.93	0.92	0.92
	426					N/R	0.95	0.94	0.94
	450						0.96	0.96	0.96
	496						N/R	0.99	0.99
	503							N/R	0.99
	514								N/R

1. Tabulated values are only applicable for instances where combined concrete cone and pullout failure is the controlling failure mode as described by TR029. All other failure modes must be considered and different reduction factors may apply.
2. Tabulated values are based on a group of 2 anchors with the geometry defined by "S" and " $S_{cr,Np}$ " but without close edge considerations.
3. Anchors with geometry different to that defined in the above table must be considered separately and the tabulated values must not be used.
4. Interpolation is allowed.
5. Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.
6. Anchor spacing distances must exceed or be equal to the minimum anchor spacing ( $S_{min}$ ) as defined in the ETA.

## USING SIKA ANCHORFIX®-2+ WITH THREADED BARS

### Combined pullout and concrete cone failure cracked concrete C20/25

Size			M10	M12	M16	M20	M24
Characteristic bond resistance in cracked concrete							
Characteristic bond resistance dry/wet concrete	$\tau_{Rk}$	[N/mm²]	5.0	5.0	5.0	4.5	4.5
Partial safety factor	$\gamma_{Mc}$	[-]	1.8				

## TENSION LOAD CALCULATIONS FOR COMBINED CONCRETE CONE & PULLOUT FAILURE AT VARIOUS EMBEDMENT DEPTHS

Using threaded rods in dry / wet, cracked, C20/25 concrete. Temperature range -40°C to +80°C.

Property	Symbol	Unit	Anchor Size				
			M10	M12	M16	M20	M24
Effective Embedment Depth = 8d	$h_{ef}$	mm	80	96	128	160	192
Characteristic Load (Combined Concrete Cone & Pullout Failure)	$N^0_{Rk,p}$	kN	12.57	18.10	32.17	45.24	65.14
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80
Effective Embedment Depth = 10d	$h_{ef}$	mm	100	120	160	200	240
Characteristic Load (Combined Concrete Cone & Pullout Failure)	$N^0_{Rk,p}$	kN	15.71	22.62	40.21	56.55	81.43
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80
Effective Embedment Depth = STD	$h_{ef}$	mm	90	110	128	170	210
Characteristic Load (Combined Concrete Cone & Pullout Failure)	$N^0_{Rk,p}$	kN	14.14	20.73	32.17	48.07	71.25
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80
Effective Embedment Depth = 12d	$h_{ef}$	mm	120	144	192	240	288
Characteristic Load (Combined Concrete Cone & Pullout Failure)	$N^0_{Rk,p}$	kN	18.85	27.14	48.25	67.86	97.72
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80
Effective Embedment Depth = 14d	$h_{ef}$	mm	140	168	224	280	336
Characteristic Load (Combined Concrete Cone & Pullout Failure)	$N^0_{Rk,p}$	kN	21.99	31.67	56.30	79.17	114.00
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80
Effective Embedment Depth = 16d	$h_{ef}$	mm	160	192	256	320	384
Characteristic Load (Combined Concrete Cone & Pullout Failure)	$N^0_{Rk,p}$	kN	25.13	36.19	64.34	90.48	130.29
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80
Effective Embedment Depth = 18d	$h_{ef}$	mm	180	216	288	360	432
Characteristic Load (Combined Concrete Cone & Pullout Failure)	$N^0_{Rk,p}$	kN	28.27	40.72	72.38	101.79	146.57
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80
Effective Embedment Depth = 20d	$h_{ef}$	mm	200	240	320	400	480
Characteristic Load (Combined Concrete Cone & Pullout Failure)	$N^0_{Rk,p}$	kN	31.42	45.24	80.42	113.10	162.86
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80

<sup>1</sup> Characteristic loads are valid for combined concrete cone and pullout failure as defined by TR029 only. All other failure modes, including steel failure, detailed in TR029 as well as including combined effects of tension and shear, must be considered in accordance with TR029.

<sup>2</sup> Characteristic loads are valid for single anchors without close edge, anchor spacing or eccentric loading considerations.

<sup>3</sup> Tabulated values are valid for temperature range -40°C to +80°C (Max LTT = +50°C; Max STT = +80°C).

<sup>4</sup> Tabulated values are only valid for the installation conditions stated. Other conditions, such as different temperature ranges, may affect the performance of the product.

<sup>5</sup> Long term temperatures are those that remain roughly constant over prolonged periods. Short term temperatures occur over brief intervals, eg: diurnal cycling.

<sup>6</sup> The compressive strength of the concrete ( $f_{ck,cube}$ ) is assumed to be 25 N/mm<sup>2</sup> for C20/25 concrete.

<sup>7</sup> Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.

#### Technical Documentation

Sika AnchorFix-2+

11, 2025, 01

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# TENSION LOAD CALCULATIONS FOR COMBINED CONCRETE CONE & PULLOUT FAILURE AT 8D EMBEDMENT DEPTH

Using threaded rods in dry / wet, cracked, C20/25 concrete. Temperature range -40°C to +80°C.

Property	Symbol	Unit	Anchor Size				
			M10	M12	M16	M20	M24
Nominal Anchor Diameter	d	mm	10	12	16	20	24
Characteristic Bond Strength	$\tau_{Rk}$	N/mm <sup>2</sup>	5.00	5.00	5.00	4.50	4.50
Effective Embedment Depth	$h_{ef}$	mm	80	96	128	160	192
Characteristic Load (Combined Concrete Cone and Pullout Failure)	$N_{Rk,p}^0$	kN	12.57	18.10	32.17	45.24	65.14
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80
Characteristic Anchor Spacing (Splitting Failure)	$S_{cr,sp}$	mm	240	288	384	480	576
Characteristic Edge Distance (Splitting Failure)	$C_{cr,sp}$	mm	120	144	192	240	288
Characteristic Anchor Spacing (Combined Concrete Cone and Pullout Failure)	$S_{cr,Np}$	mm	163	196	261	310	372
Characteristic Edge Distance (Combined Concrete Cone and Pullout Failure)	$C_{cr,Np}$	mm	82	98	131	155	186

<sup>1</sup> Characteristic loads are valid for combined concrete cone and pullout failure as defined by TR029 only. All other failure modes, including steel failure, detailed in TR029 as well as including combined effects of tension and shear, must be considered in accordance with TR029.

<sup>2</sup> Characteristic loads are valid for single anchors without close edge, anchor spacing or eccentric loading considerations.

<sup>3</sup> Tabulated values are valid for temperature range -40°C to +80°C (Max LTT = +50°C; Max STT = +80°C).

<sup>4</sup> Tabulated values are only valid for the installation conditions stated. Other conditions, such as different temperature ranges, may affect the performance of the product.

<sup>5</sup> Long term temperatures are those that remain roughly constant over prolonged periods. Short term temperatures occur over brief intervals, eg: diurnal cycling.

<sup>6</sup> The compressive strength of the concrete ( $f_{ck,cube}$ ) is assumed to be 25 N/mm<sup>2</sup> for C20/25 concrete.

<sup>7</sup> Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.



### Reduction factors for close edge:

Combined concrete cone and pullout failure

	Close Edge Distance, C (mm)	Anchor Size	Anchor Size				
			M10	M12	M16	M20	M24
	40		0.63				
	50		0.71	0.64			
	60		0.80	0.71			
	65		0.84	0.75	0.64		
	70		0.89	0.78	0.66		
	80		0.98	0.86	0.71	0.65	
	90		N/R	0.87	0.72	0.66	
	96			0.94	0.77	0.69	0.65
	100			0.98	0.80	0.72	0.66
	110			N/R	0.81	0.73	0.66
	115				0.82	0.74	0.70
	120				0.88	0.78	0.74
	130				0.94	0.83	0.78
	135				N/R	0.88	0.81
	140					0.92	0.85
	150					0.97	0.87
	160					N/R	0.89
	170						0.93
	175						0.97
	180						N/R
	190						
	200						
	213						
	220						
	240						
	248						
	251						
	257						

- Tabulated values are only applicable for instances where combined concrete cone and pullout failure is the controlling failure mode as described by TR029. All other failure modes must be considered and different reduction factors may apply.
- Tabulated values are based on a single anchor with a single close edge. Tabulated values must not be used if multiple close edges exist.
- Anchors with geometry different to that defined in the above table must be considered separately and the tabulated values must not be used.
- Interpolation is allowed.
- Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.
- Close edge distances must exceed or be equal to the minimum close edge distance ( $C_{min}$ ) as defined in the ETA.

### Reduction factors for anchor spacing:

Combined concrete cone and pullout failure

	Anchor Spacing Distance, S (mm)	Anchor Size	Anchor Size				
			M10	M12	M16	M20	M24
	40		0.71				
	50		0.73	0.71			
	60		0.76	0.73			
	65		0.77	0.74	0.69		
	70		0.78	0.75	0.70		
	80		0.81	0.77	0.72	0.69	
	90		0.83	0.79	0.73	0.71	
	96		0.84	0.80	0.74	0.72	0.69
	100		0.85	0.81	0.75	0.72	0.69
	120		0.90	0.85	0.78	0.75	0.71
	140		0.95	0.89	0.81	0.78	0.74
	160		0.99	0.93	0.84	0.80	0.76
	163		N/R	0.94	0.85	0.81	0.76
	180			0.97	0.88	0.83	0.78
	196			N/R	0.90	0.85	0.80
	200				0.91	0.86	0.81
	220				0.94	0.88	0.83
	240				0.97	0.91	0.85
	261				N/R	0.94	0.88
	280					0.96	0.90
	300					0.99	0.92
	310					N/R	0.93
	320						0.94
	340						0.96
	360						0.99
	372						N/R

- Tabulated values are only applicable for instances where combined concrete cone and pullout failure is the controlling failure mode as described by TR029. All other failure modes must be considered and different reduction factors may apply.
- Tabulated values are based on a group of 2 anchors with the geometry defined by "S" and " $S_{cr,NB}$ " but without close edge considerations.
- Anchors with geometry different to that defined in the above table must be considered separately and the tabulated values must not be used.
- Interpolation is allowed.
- Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.
- Anchor spacing distances must exceed or be equal to the minimum anchor spacing ( $S_{min}$ ) as defined in the ETA.

## TENSION LOAD CALCULATIONS FOR COMBINED CONCRETE CONE & PULLOUT FAILURE AT STD EMBEDMENT DEPTH

Using threaded rods in dry / wet, cracked, C20/25 concrete. Temperature range -40°C to +80°C.

Property	Symbol	Unit	Anchor Size				
			M10	M12	M16	M20	M24
Nominal Anchor Diameter	d	mm	10	12	16	20	24
Characteristic Bond Strength	$\tau_{Rk}$	N/mm <sup>2</sup>	5.00	5.00	5.00	4.50	4.50
Effective Embedment Depth	$h_{ef}$	mm	90	110	128	170	210
Characteristic Load (Combined Concrete Cone and Pullout Failure)	$N^0_{Rk,p}$	kN	14.14	20.73	32.17	48.07	71.25
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80
Characteristic Anchor Spacing (Splitting Failure)	$S_{cr,sp}$	mm	270	330	384	510	630
Characteristic Edge Distance (Splitting Failure)	$C_{cr,sp}$	mm	135	165	192	255	315
Characteristic Anchor Spacing (Combined Concrete Cone and Pullout Failure)	$S_{cr,Np}$	mm	163	196	261	310	372
Characteristic Edge Distance (Combined Concrete Cone and Pullout Failure)	$C_{cr,Np}$	mm	82	98	131	155	186

<sup>1</sup> Characteristic loads are valid for combined concrete cone and pullout failure as defined by TR029 only. All other failure modes, including steel failure, detailed in TR029 as well as including combined effects of tension and shear, must be considered in accordance with TR029.

<sup>2</sup> Characteristic loads are valid for single anchors without close edge, anchor spacing or eccentric loading considerations.

<sup>3</sup> Tabulated values are valid for temperature range -40°C to +80°C (Max LTT = +50°C; Max STT = +80°C).

<sup>4</sup> Tabulated values are only valid for the installation conditions stated. Other conditions, such as different temperature ranges, may affect the performance of the product.

<sup>5</sup> Long term temperatures are those that remain roughly constant over prolonged periods. Short term temperatures occur over brief intervals, eg: diurnal cycling.

<sup>6</sup> The compressive strength of the concrete ( $f_{ck,cube}$ ) is assumed to be 25 N/mm<sup>2</sup> for C20/25 concrete.

<sup>7</sup> Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.

### Reduction factors for anchor spacing:

Combined concrete cone and pullout failure

		Anchor Size				
		M10	M12	M16	M20	M24
Anchor Spacing Distance, S (mm)	45	0.72				
	50	0.74				
	55	0.75	0.72			
	60	0.76	0.73			
	65	0.77	0.74	0.69		
	70	0.78	0.75	0.70		
	80	0.81	0.77	0.72		
	90	0.83	0.79	0.73	0.71	
	100	0.86	0.81	0.75	0.72	
	105	0.87	0.82	0.76	0.73	0.70
	120	0.90	0.85	0.78	0.75	0.72
	140	0.95	0.89	0.81	0.78	0.74
	160	0.99	0.93	0.84	0.81	0.76
	163	N/R	0.94	0.85	0.81	0.77
	180		0.97	0.88	0.83	0.79
	196		N/R	0.90	0.85	0.80
	200			0.91	0.86	0.81
	220			0.94	0.88	0.83
	240			0.97	0.91	0.85
	261			N/R	0.94	0.88
	280				0.96	0.90
	300				0.99	0.92
	310				N/R	0.93
	320					0.94
	340					0.97
	360					0.99
	372					N/R

1. Tabulated values are only applicable for instances where combined concrete cone and pullout failure is the controlling failure mode as described by TR029. All other failure modes must be considered and different reduction factors may apply.
2. Tabulated values are based on a single anchor with a single close edge. Tabulated values must not be used if multiple close edges exist.
3. Anchors with geometry different to that defined in the above table must be considered separately and the tabulated values must not be used.
4. Interpolation is allowed.
5. Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.
6. Close edge distances must exceed or be equal to the minimum close edge distance ( $C_{min}$ ) as defined in the ETA.

### Reduction factors for close edge:

Combined concrete cone and pullout failure

		Anchor Size				
		M10	M12	M16	M20	M24
Close Edge Distance, C (mm)	45	0.67				
	50	0.71				
	55	0.75	0.68			
	60	0.80	0.71			
	65	0.84	0.75	0.64		
	70	0.89	0.78	0.66		
	80	0.98	0.86	0.71		
	82	N/R	0.87	0.72		
	85		0.90	0.74	0.67	
	90		0.94	0.77	0.69	
	98		N/R	0.81	0.73	
	100			0.82	0.74	
	105			0.85	0.76	0.68
	110			0.88	0.78	0.70
	120			0.94	0.83	0.74
	131			N/R	0.88	0.78
	140				0.92	0.81
	150				0.97	0.85
	155				N/R	0.87
	160					0.89
	170					0.93
	180					0.97
	186					N/R

1. Tabulated values are only applicable for instances where combined concrete cone and pullout failure is the controlling failure mode as described by TR029. All other failure modes must be considered and different reduction factors may apply.
2. Tabulated values are based on a group of 2 anchors with the geometry defined by "S" and "S<sub>cr,Nb</sub>" but without close edge considerations.
3. Anchors with geometry different to that defined in the above table must be considered separately and the tabulated values must not be used.
4. Interpolation is allowed.
5. Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.
6. Anchor spacing distances must exceed or be equal to the minimum anchor spacing ( $S_{min}$ ) as defined in the ETA.

# TENSION LOAD CALCULATIONS FOR COMBINED CONCRETE CONE & PULLOUT FAILURE AT 20D EMBEDMENT DEPTH

Using threaded rods in dry / wet, cracked, C20/25 concrete. Temperature range -40°C to +80°C.

Property	Symbol	Unit	Anchor Size				
			M10	M12	M16	M20	M24
Nominal Anchor Diameter	d	mm	10	12	16	20	24
Characteristic Bond Strength	$\tau_{Rk}$	N/mm <sup>2</sup>	5.00	5.00	5.00	4.50	4.50
Effective Embedment Depth	$h_{ef}$	mm	200	240	320	400	480
Characteristic Load (Combined Concrete Cone and Pullout Failure)	$N_{Rk,p}^0$	kN	31.42	45.24	80.42	113.10	162.86
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80
Characteristic Anchor Spacing (Splitting Failure)	$S_{cr,sp}$	mm	600	720	960	1200	1440
Characteristic Edge Distance (Splitting Failure)	$C_{cr,sp}$	mm	300	360	480	600	720
Characteristic Anchor Spacing (Combined Concrete Cone and Pullout Failure)	$S_{cr,Np}$	mm	163	196	261	310	372
Characteristic Edge Distance (Combined Concrete Cone and Pullout Failure)	$C_{cr,Np}$	mm	82	98	131	155	186

<sup>1</sup>. Characteristic loads are valid for combined concrete cone and pullout failure as defined by TR029 only. All other failure modes, including steel failure, detailed in TR029 as well as including combined effects of tension and shear, must be considered in accordance with TR029.

<sup>2</sup>. Characteristic loads are valid for single anchors without close edge, anchor spacing or eccentric loading considerations.

<sup>3</sup>. Tabulated values are valid for temperature range -40°C to +80°C (Max LTT = +50°C; Max STT = +80°C).

<sup>4</sup>. Tabulated values are only valid for the installation conditions stated. Other conditions, such as different temperature ranges, may affect the performance of the product.

<sup>5</sup>. Long term temperatures are those that remain roughly constant over prolonged periods. Short term temperatures occur over brief intervals, eg: diurnal cycling.

<sup>6</sup>. The compressive strength of the concrete ( $f_{ck,cube}$ ) is assumed to be 25 N/mm<sup>2</sup> for C20/25 concrete.

<sup>7</sup>. Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.

### Reduction factors for anchor spacing:

Combined concrete cone and pullout failure

		Anchor Size				
		M10	M12	M16	M20	M24
Anchor Spacing Distance, S (mm)	100	0.87				
	110	0.89				
	120	0.91	0.86			
	130	0.93	0.88			
	140	0.95	0.90			
	150	0.97	0.92			
	160	0.99	0.94	0.86		
	163	N/R	0.94	0.87		
	170		0.96	0.88		
	180		0.97	0.89		
	190		0.99	0.90		
	196		N/R	0.91		
	200			0.92	0.87	
	220			0.94	0.90	
	240			0.97	0.92	0.87
	261			N/R	0.94	0.89
	280				0.97	0.91
	300				0.99	0.93
	310				N/R	0.94
	320					0.95
	340					0.97
	360					0.99
	372					N/R

<sup>1</sup> Tabulated values are only applicable for instances where combined concrete cone and pullout failure is the controlling failure mode as described by TR029. All other failure modes must be considered and different reduction factors may apply.

<sup>2</sup> Tabulated values are based on a group of 2 anchors with the geometry defined by "S" and "S<sub>cr,Np</sub>" but without close edge considerations.

<sup>3</sup> Anchors with geometry different to that defined in the above table must be considered separately and the tabulated values must not be used.

<sup>4</sup> Interpolation is allowed.

<sup>5</sup> Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.

<sup>6</sup> Anchor spacing distances must exceed or be equal to the minimum anchor spacing (S<sub>min</sub>) as defined in the ETA.

### Reduction factors for close edge:

Combined concrete cone and pullout failure

		Anchor Size				
		M10	M12	M16	M20	M24
Close Edge Distance, C	100	N/R				
	110					
	120		N/R			
	130					
	140					
	160			N/R		
	180					
	200				N/R	
	220					
	240					N/R

<sup>1</sup> Tabulated values are only applicable for instances where combined concrete cone and pullout failure is the controlling failure mode as described by TR029. All other failure modes must be considered and different reduction factors may apply.

<sup>2</sup> Tabulated values are based on a single anchor with a single close edge. Tabulated values must not be used if multiple close edges exist.

<sup>3</sup> Anchors with geometry different to that defined in the above table must be considered separately and the tabulated values must not be used.

<sup>4</sup> Interpolation is allowed.

<sup>5</sup> Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.

<sup>6</sup> Close edge distances must exceed or be equal to the minimum close edge distance (C<sub>min</sub>) as defined in the ETA.

## USING SIKA ANCHORFIX® -2+ WITH REINFORCING BARS

### Combined pullout and concrete cone failure in non-cracked concrete C20/25

Size			Ø8mm	Ø10m m	Ø12m m	Ø16m m	Ø20m m	Ø25m m	Ø32m m
Characteristic bond resistance in non-cracked concrete									
Characteristic bond resistance dry/wet concrete	$\tau_{Rk}$	[N/mm²]	12	10	10	9.0	9.0	9.0	5.5
Partial safety factor	$\gamma_{Mc}$	[-]	1.8						

Technical Documentation

Sika AnchorFix-2+

11, 2025, 01

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# TENSION LOAD CALCULATIONS FOR COMBINED CONCRETE CONE & PULLOUT FAILURE AT VARIOUS EMBEDMENT DEPTHS

Using reinforcing bars in dry / wet, uncracked, C20/25 concrete. Temperature range -40°C to +80°C.

Property	Symbol	Unit	Anchor Size						
			Ø8mm	Ø10mm	Ø12mm	Ø16mm	Ø20mm	Ø25mm	Ø32mm
Effective Embedment Depth = 8d	$h_{ef}$	mm	64	80	96	128	160	200	256
Characteristic Load (Combined Concrete Cone & Pullout Failure)	$N_{Rk,p}^0$	kN	19.30	25.13	36.19	57.91	90.48	141.37	141.55
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80	1.80	1.80
Effective Embedment Depth = 10d	$h_{ef}$	mm	80	100	120	160	200	250	320
Characteristic Load (Combined Concrete Cone & Pullout Failure)	$N_{Rk,p}^0$	kN	24.13	31.42	45.24	72.38	113.10	176.71	176.93
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80	1.80	1.80
Effective Embedment Depth = STD	$h_{ef}$	mm	80	90	110	128	170	210	300
Characteristic Load (Combined Concrete Cone & Pullout Failure)	$N_{Rk,p}^0$	kN	24.13	28.27	41.47	57.91	96.13	148.44	165.88
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80	1.80	1.80
Effective Embedment Depth = 12d	$h_{ef}$	mm	96	120	144	192	240	300	384
Characteristic Load (Combined Concrete Cone & Pullout Failure)	$N_{Rk,p}^0$	kN	28.95	37.70	54.29	86.86	135.72	212.06	212.32
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80	1.80	1.80
Effective Embedment Depth = 14d	$h_{ef}$	mm	112	140	168	224	280	350	448
Characteristic Load (Combined Concrete Cone & Pullout Failure)	$N_{Rk,p}^0$	kN	33.78	43.98	63.33	101.34	158.34	247.40	247.71
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80	1.80	1.80
Effective Embedment Depth = 16d	$h_{ef}$	mm	128	160	192	256	320	400	512
Characteristic Load (Combined Concrete Cone & Pullout Failure)	$N_{Rk,p}^0$	kN	38.60	50.27	72.38	115.81	180.96	282.74	283.10
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80	1.80	1.80
Effective Embedment Depth = 18d	$h_{ef}$	mm	144	180	216	288	360	450	576
Characteristic Load (Combined Concrete Cone & Pullout Failure)	$N_{Rk,p}^0$	kN	43.43	56.55	81.43	130.29	203.58	318.09	318.48
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80	1.80	1.80
Effective Embedment Depth = 20d	$h_{ef}$	mm	160	200	240	320	400	500	640
Characteristic Load (Combined Concrete Cone & Pullout Failure)	$N_{Rk,p}^0$	kN	48.25	62.83	90.48	144.76	226.19	353.43	353.87
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80	1.80	1.80

<sup>1</sup> Characteristic loads are valid for combined concrete cone and pullout failure as defined by TR029 only. All other failure modes, including steel failure, detailed in TR029 as well as including combined effects of tension and shear, must be considered in accordance with TR029.

<sup>2</sup> Characteristic loads are valid for single anchors without close edge, anchor spacing or eccentric loading considerations.

<sup>3</sup> Tabulated values are valid for temperature range -40°C to +80°C (Max LTT = +50°C; Max STT = +80°C).

<sup>4</sup> Tabulated values are only valid for the installation conditions stated. Other conditions, such as different temperature ranges, may affect the performance of the product.

<sup>5</sup> Long term temperatures are those that remain roughly constant over prolonged periods. Short term temperatures occur over brief intervals, eg: diurnal cycling.

<sup>6</sup> The compressive strength of the concrete ( $f_{ck,cube}$ ) is assumed to be 25 N/mm<sup>2</sup> for C20/25 concrete.

<sup>7</sup> Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.

# TENSION LOAD CALCULATIONS FOR COMBINED CONCRETE CONE & PULLOUT FAILURE AT 8D EMBEDMENT DEPTH

Using reinforcing bars in dry / wet, uncracked, C20/25 concrete. Temperature range -40°C to +80°C.

Property	Symbol	Unit	Anchor Size						
			Ø8mm	Ø10m	Ø12m	Ø16m	Ø20m	Ø25m	Ø32m
Nominal Anchor Diameter	d	mm	8	10	12	16	20	25	32
Characteristic Bond Strength	$\tau_{Rk}$	N/mm <sup>2</sup>	12.00	10.00	10.00	9.00	9.00	9.00	5.50
Effective Embedment Depth	$h_{ef}$	mm	64	80	96	128	160	200	256
Characteristic Load (Combined Concrete Cone and Pullout Failure)	$N_{Rk,p}^0$	kN	19.30	25.13	36.19	57.91	90.48	141.37	141.55
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80	1.80	1.80
Characteristic Anchor Spacing (Splitting Failure)	$S_{cr,sp}$	mm	192	240	288	384	480	600	768
Characteristic Edge Distance (Splitting Failure)	$C_{cr,sp}$	mm	96	120	144	192	240	300	384
Characteristic Anchor Spacing (Combined Concrete Cone and Pullout Failure)	$S_{cr,Np}$	mm	192	231	277	351	438	548	548
Characteristic Edge Distance (Combined Concrete Cone and Pullout Failure)	$C_{cr,Np}$	mm	96	115	139	175	219	274	274

<sup>1</sup> Characteristic loads are valid for combined concrete cone and pullout failure as defined by TR029 only. All other failure modes, including steel failure, detailed in TR029 as well as including combined effects of tension and shear, must be considered in accordance with TR029.

<sup>2</sup> Characteristic loads are valid for single anchors without close edge, anchor spacing or eccentric loading considerations.

<sup>3</sup> Tabulated values are valid for temperature range -40°C to +80°C (Max LTT = +50°C; Max STT = +80°C).

<sup>4</sup> Tabulated values are only valid for the installation conditions stated. Other conditions, such as different temperature ranges, may affect the performance of the product.

<sup>5</sup> Long term temperatures are those that remain roughly constant over prolonged periods. Short term temperatures occur over brief intervals, eg: diurnal cycling.

<sup>6</sup> The compressive strength of the concrete ( $f_{ck,cube}$ ) is assumed to be 25 N/mm<sup>2</sup> for C20/25 concrete.

<sup>7</sup> Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.

### Reduction factors for close edge:

Combined concrete cone and pullout failure

	X	Anchor Size						
		Ø8mm	Ø10m	Ø12m	Ø16m	Ø20m	Ø25m	Ø32m
Close Edge Distance, C (mm)	35	0.55						
	40	0.58	0.54					
	50	0.65	0.59	0.55				
	60	0.72	0.65	0.59				
	65	0.76	0.68	0.62	0.56			
	70	0.79	0.71	0.64	0.57			
	80	0.87	0.77	0.69	0.61	0.55		
	90	0.95	0.83	0.74	0.65	0.58		
	96	N/R	0.87	0.77	0.67	0.60		
	100		0.90	0.79	0.68	0.61	0.55	
	115		N/R	0.87	0.74	0.65	0.59	
	120			0.90	0.76	0.67	0.60	
	130			0.95	0.80	0.70	0.62	0.62
	139			N/R	0.84	0.73	0.64	0.64
	140				0.85	0.73	0.64	0.64
	150				0.89	0.76	0.67	0.67
	160				0.93	0.80	0.69	0.69
	170				0.98	0.83	0.72	0.72
	175				N/R	0.85	0.73	0.73
	180					0.86	0.74	0.74
	190					0.90	0.77	0.77
	200					0.93	0.80	0.79
	219					N/R	0.85	0.85
	240						0.90	0.90
	260						0.96	0.96
	270						0.99	0.99
	274						N/R	N/R

1. Tabulated values are only applicable for instances where combined concrete cone and pullout failure is the controlling failure mode as described by TR029. All other failure modes must be considered and different reduction factors may apply.
2. Tabulated values are based on a single anchor with a single close edge. Tabulated values must not be used if multiple close edges exist.
3. Anchors with geometry different to that defined in the above table must be considered separately and the tabulated values must not be used.
4. Interpolation is allowed.
5. Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.
6. Close edge distances must exceed or be equal to the minimum close edge distance ( $C_{min}$ ) as defined in the ETA.

### Reduction factors for anchor spacing:

Combined concrete cone and pullout failure

	X	Anchor Size						
		Ø8mm	Ø10m	Ø12m	Ø16m	Ø20m	Ø25m	Ø32m
Anchor Spacing Distance, S (mm)	35	0.64						
	40	0.65	0.65					
	50	0.67	0.66	0.64				
	60	0.70	0.68	0.65				
	65	0.71	0.69	0.66	0.63			
	70	0.72	0.70	0.67	0.64			
	80	0.74	0.72	0.69	0.65	0.61		
	90	0.77	0.74	0.70	0.67	0.62		
	100	0.79	0.76	0.72	0.68	0.64	0.59	
	120	0.84	0.80	0.75	0.70	0.66	0.61	
	130	0.86	0.82	0.77	0.72	0.67	0.62	0.68
	140	0.88	0.83	0.78	0.73	0.68	0.63	0.68
	160	0.93	0.87	0.81	0.76	0.70	0.65	0.70
	180	0.97	0.91	0.85	0.78	0.72	0.67	0.71
	192	N/R	0.93	0.87	0.80	0.74	0.68	0.72
	200		0.94	0.88	0.81	0.74	0.68	0.73
	220		0.98	0.91	0.83	0.77	0.70	0.75
	231		N/R	0.93	0.85	0.78	0.71	0.76
	240			0.94	0.86	0.79	0.72	0.76
	260			0.97	0.89	0.81	0.74	0.78
	277			N/R	0.91	0.83	0.75	0.79
	280				0.91	0.83	0.76	0.79
	300				0.94	0.85	0.77	0.81
	351				N/R	0.91	0.82	0.85
	400					0.96	0.87	0.89
	438					N/R	0.90	0.92
	450						0.91	0.93
	500						0.96	0.96
	548						N/R	N/R

1. Tabulated values are only applicable for instances where combined concrete cone and pullout failure is the controlling failure mode as described by TR029. All other failure modes must be considered and different reduction factors may apply.
2. Tabulated values are based on a group of 2 anchors with the geometry defined by "S" and " $S_{CL,NP}$ " but without close edge considerations.
3. Anchors with geometry different to that defined in the above table must be considered separately and the tabulated values must not be used.
4. Interpolation is allowed.
5. Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.
6. Anchor spacing distances must exceed or be equal to the minimum anchor spacing ( $S_{min}$ ) as defined in the ETA.



# TENSION LOAD CALCULATIONS FOR COMBINED CONCRETE CONE & PULLOUT FAILURE AT STD EMBEDMENT DEPTH

Using reinforcing bars in dry / wet, uncracked, C20/25 concrete. Temperature range -40°C to +80°C.

Property	Symbol	Unit	Anchor Size						
			Ø8mm	Ø10m	Ø12m	Ø16m	Ø20m	Ø25m	Ø32m
Nominal Anchor Diameter	d	mm	8	10	12	16	20	25	32
Characteristic Bond Strength	$\tau_{Rk}$	N/mm <sup>2</sup>	12.00	10.00	10.00	9.00	9.00	9.00	5.50
Effective Embedment Depth	$h_{ef}$	mm	80	90	110	128	170	210	300
Characteristic Load (Combined Concrete Cone and Pullout Failure)	$N_{Rk,p}^0$	kN	24.13	28.27	41.47	57.91	96.13	148.44	165.88
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80	1.80	1.80
Characteristic Anchor Spacing (Splitting Failure)	$S_{cr,sp}$	mm	240	270	330	384	510	630	900
Characteristic Edge Distance (Splitting Failure)	$C_{cr,sp}$	mm	120	135	165	192	255	315	450
Characteristic Anchor Spacing (Combined Concrete Cone and Pullout Failure)	$S_{cr,Np}$	mm	202	231	277	351	438	548	548
Characteristic Edge Distance (Combined Concrete Cone and Pullout Failure)	$C_{cr,Np}$	mm	101	115	139	175	219	274	274

<sup>1</sup> Characteristic loads are valid for combined concrete cone and pullout failure as defined by TR029 only. All other failure modes, including steel failure, detailed in TR029 as well as including combined effects of tension and shear, must be considered in accordance with TR029.

<sup>2</sup> Characteristic loads are valid for single anchors without close edge, anchor spacing or eccentric loading considerations.

<sup>3</sup> Tabulated values are valid for temperature range -40°C to +80°C (Max LTT = +50°C; Max STT = +80°C).

<sup>4</sup> Tabulated values are only valid for the installation conditions stated. Other conditions, such as different temperature ranges, may affect the performance of the product.

<sup>5</sup> Long term temperatures are those that remain roughly constant over prolonged periods. Short term temperatures occur over brief intervals, eg: diurnal cycling.

<sup>6</sup> The compressive strength of the concrete ( $f_{ck,cube}$ ) is assumed to be 25 N/mm<sup>2</sup> for C20/25 concrete.

<sup>7</sup> Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.

### Reduction factors for close edge:

Combined concrete cone and pullout failure

	Close Edge Distance, C (mm)	Anchor Size	Anchor Size						
			Ø8mm	Ø10m	Ø12m	Ø16m	Ø20m	Ø25m	Ø32m
	40	U.S /							
	45	0.60	0.57						
	50	0.63	0.59						
	55	0.67	0.62	0.57					
	60	0.70	0.65	0.59					
	65	0.73	0.68	0.62	0.56				
	70	0.77	0.71	0.64	0.57				
	80	0.84	0.77	0.69	0.61				
	85	0.88	0.80	0.71	0.63	0.57			
	90	0.91	0.83	0.74	0.65	0.58			
	101	N/R	0.90	0.79	0.69	0.61			
	105		0.93	0.82	0.70	0.62	0.56		
	110		0.96	0.84	0.72	0.64	0.58		
	115		N/R	0.87	0.74	0.65	0.59		
	120			0.90	0.76	0.67	0.60		
	130			0.95	0.80	0.70	0.62		
	139			N/R	0.84	0.73	0.64		
	140				0.85	0.73	0.64		
	150				0.89	0.76	0.67	0.67	
	160				0.93	0.80	0.69	0.69	
	170				0.98	0.83	0.72	0.72	
	175				N/R	0.85	0.73	0.73	
	180					0.86	0.74	0.74	
	190					0.90	0.77	0.77	
	200					0.93	0.80	0.79	
	220					N/R	0.85	0.85	
	240						0.90	0.90	
	260						0.96	0.96	
	274						N/R	N/R	

1. Tabulated values are only applicable for instances where combined concrete cone and pullout failure is the controlling failure mode as described by TR029. All other failure modes must be considered and different reduction factors may apply.
2. Tabulated values are based on a single anchor with a single close edge. Tabulated values must not be used if multiple close edges exist.
3. Anchors with geometry different to that defined in the above table must be considered separately and the tabulated values must not be used.
4. Interpolation is allowed.
5. Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.
6. Close edge distances must exceed or be equal to the minimum close edge distance ( $C_{min}$ ) as defined in the ETA.

### Reduction factors for anchor spacing:

Combined concrete cone and pullout failure

	Anchor Spacing Distance, S (mm)	Anchor Size	Anchor Size						
			Ø8mm	Ø10m	Ø12m	Ø16m	Ø20m	Ø25m	Ø32m
	40	U.bb							
	45	0.67	0.66						
	50	0.68	0.67						
	55	0.69	0.68	0.65					
	60	0.70	0.69	0.66					
	65	0.71	0.70	0.67	0.63				
	70	0.72	0.71	0.68	0.64				
	80	0.75	0.73	0.69	0.65				
	85	0.76	0.74	0.70	0.66	0.62			
	90	0.77	0.75	0.71	0.67	0.63			
	100	0.79	0.76	0.72	0.68	0.64			
	105	0.80	0.77	0.73	0.69	0.65	0.60		
	125	0.84	0.81	0.76	0.71	0.67	0.62		
	150	0.89	0.86	0.80	0.74	0.69	0.64	0.70	
	175	0.94	0.90	0.84	0.78	0.72	0.66	0.72	
	202	N/R	0.95	0.89	0.81	0.75	0.69	0.74	
	225		0.99	0.92	0.84	0.77	0.71	0.76	
	231		N/R	0.93	0.85	0.78	0.72	0.76	
	250			0.96	0.87	0.80	0.73	0.78	
	277			N/R	0.91	0.83	0.76	0.80	
	300				0.94	0.85	0.78	0.81	
	351				N/R	0.91	0.82	0.85	
	400					0.96	0.87	0.89	
	438					N/R	0.90	0.92	
	450						0.91	0.93	
	500						0.96	0.96	
	548						N/R	N/R	

1. Tabulated values are only applicable for instances where combined concrete cone and pullout failure is the controlling failure mode as described by TR029. All other failure modes must be considered and different reduction factors may apply.
2. Tabulated values are based on a group of 2 anchors with the geometry defined by "S" and "S<sub>cr,Np</sub>" but without close edge considerations.
3. Anchors with geometry different to that defined in the above table must be considered separately and the tabulated values must not be used.
4. Interpolation is allowed.
5. Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.
6. Anchor spacing distances must exceed or be equal to the minimum anchor spacing ( $S_{min}$ ) as defined in the ETA.

# TENSION LOAD CALCULATIONS FOR COMBINED CONCRETE CONE & PULLOUT FAILURE AT 20D EMBEDMENT DEPTH

Using reinforcing bars in dry / wet, uncracked, C20/25 concrete. Temperature range -40°C to +80°C.

Property	Symbol	Unit	Anchor Size						
			Ø8mm	Ø10m	Ø12m	Ø16m	Ø20m	Ø25m	Ø32m
Nominal Anchor Diameter	d	mm	8	10	12	16	20	25	32
Characteristic Bond Strength	$\tau_{Rk}$	N/mm <sup>2</sup>	12.00	10.00	10.00	9.00	9.00	9.00	5.50
Effective Embedment Depth	$h_{ef}$	mm	160	200	240	320	400	500	640
Characteristic Load (Combined Concrete Cone and Pullout Failure)	$N^0_{Rk,p}$	kN	48.25	62.83	90.48	144.76	226.19	353.43	353.87
Partial Safety Factor	$\gamma_{Mc}$	-	1.80	1.80	1.80	1.80	1.80	1.80	1.80
Characteristic Anchor Spacing (Splitting Failure)	$S_{cr,sp}$	mm	480	600	720	960	1200	1500	1920
Characteristic Edge Distance (Splitting Failure)	$C_{cr,sp}$	mm	240	300	360	480	600	750	960
Characteristic Anchor Spacing (Combined Concrete Cone and Pullout Failure)	$S_{cr,Np}$	mm	202	231	277	351	438	548	548
Characteristic Edge Distance (Combined Concrete Cone and Pullout Failure)	$C_{cr,Np}$	mm	101	115	139	175	219	274	274

<sup>1</sup> Characteristic loads are valid for combined concrete cone and pullout failure as defined by TR029 only. All other failure modes, including steel failure, detailed in TR029 as well as including combined effects of tension and shear, must be considered in accordance with TR029.

<sup>2</sup> Characteristic loads are valid for single anchors without close edge, anchor spacing or eccentric loading considerations.

<sup>3</sup> Tabulated values are valid for temperature range -40°C to +80°C (Max LTT = +50°C; Max STT = +80°C).

<sup>4</sup> Tabulated values are only valid for the installation conditions stated. Other conditions, such as different temperature ranges, may affect the performance of the product.

<sup>5</sup> Long term temperatures are those that remain roughly constant over prolonged periods. Short term temperatures occur over brief intervals, eg: diurnal cycling.

<sup>6</sup> The compressive strength of the concrete ( $f_{ck,cube}$ ) is assumed to be 25 N/mm<sup>2</sup> for C20/25 concrete.

<sup>7</sup> Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.

### Reduction factors for close edge:

Combined concrete cone and pullout failure

	Close Edge Distance, C (mm)	Anchor Size	Anchor Size						
			Ø8mm	Ø10m	Ø12m	Ø16m	Ø20m	Ø25m	Ø32m
	80		0.84						
	90		0.91						
	100		0.99	0.90					
	101		1.00	0.90					
	110			0.96					
	115			N/R					
	120				0.90				
	130				0.95				
	139				N/R				
	140								
	150								
	160					0.93			
	170					0.98			
	175					N/R			
	180								
	190								
	200					0.93			
	219					N/R			
	220								
	240								
	250						0.93		
	260						0.96		
	274						N/R		
	280								
	300								
	320								N/R

1. Tabulated values are only applicable for instances where combined concrete cone and pullout failure is the controlling failure mode as described by TR029. All other failure modes must be considered and different reduction factors may apply.
2. Tabulated values are based on a single anchor with a single close edge. Tabulated values must not be used if multiple close edges exist.
3. Anchors with geometry different to that defined in the above table must be considered separately and the tabulated values must not be used.
4. Interpolation is allowed.
5. Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.
6. Close edge distances must exceed or be equal to the minimum close edge distance ( $C_{min}$ ) as defined in the ETA.

### Reduction factors for anchor spacing:

Combined concrete cone and pullout failure

	Anchor Spacing Distance, S (mm)	Anchor Size	Anchor Size						
			Ø8mm	Ø10m	Ø12m	Ø16m	Ø20m	Ø25m	Ø32m
	80		0.77						
	90		0.79						
	100		0.81	0.79					
	120		0.85	0.82	0.78				
	140		0.89	0.86	0.81				
	160		0.92	0.89	0.84	0.79			
	180		0.96	0.92	0.87	0.81			
	200		0.99	0.95	0.90	0.84	0.78		
	202		N/R	0.96	0.90	0.84	0.79		
	225			0.99	0.93	0.86	0.81		
	231			N/R	0.94	0.87	0.81		
	250				0.96	0.89	0.83	0.78	
	277				N/R	0.92	0.86	0.80	
	300					0.95	0.88	0.82	
	320					0.97	0.90	0.83	0.85
	325					0.97	0.90	0.83	0.85
	351					N/R	0.92	0.85	0.87
	375						0.94	0.87	0.89
	400						0.97	0.89	0.90
	438						N/R	0.92	0.93
	450							0.93	0.94
	500							0.97	0.97
	548							N/R	N/R

1. Tabulated values are only applicable for instances where combined concrete cone and pullout failure is the controlling failure mode as described by TR029. All other failure modes must be considered and different reduction factors may apply.
2. Tabulated values are based on a group of 2 anchors with the geometry defined by "S" and " $S_{cr,Np}$ " but without close edge considerations.
3. Anchors with geometry different to that defined in the above table must be considered separately and the tabulated values must not be used.
4. Interpolation is allowed.
5. Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.
6. Anchor spacing distances must exceed or be equal to the minimum anchor spacing ( $S_{min}$ ) as defined in the ETA.

# USING SIKA ANCHORFIX®-2+ WITH POST-INSTALLED REBAR CONNECTIONS

## Installation parameters

Rebar		Drill Hole (mm)	Cleaning Brush* (mm)	Min. Anchorage Length (mm)	Min. Lap/Splice Length (mm)	Max. Embedment Depth (mm)
Diameter (mm)	$f_{y,k}$ (N/mm <sup>2</sup> )					
8	500	12 (10)	14	114	200	400
10	500	14 (12)	14	142	200	500
12	500	16	19	171	200	600
14	500	18	22	199	210	700
16	500	20	22	227	240	800
20	500	25	29	284	300	1000
25	500	32	40	355	375	1000
28	500	35	40	595	630	1000
32	500	40	42	681	720	1000

\* Values in parenthesis represent alternative drilling diameters.

## DESIGN BOND STRENGTH VALUES

Design values of the ultimate bond resistance  $f_{bd}$  in N/mm<sup>2</sup> for rotary hammer drilling and compressed air drilling for good bond conditions.

Rebar $\varnothing$ (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									
12									
14									
16									
20									
25									
28									
32									

Tabulated values for  $f_{bd}$  are valid for good bond conditions according to EN 1992-1-1. For all other bond conditions multiply the values for  $f_{bd}$  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 themselves that each product is fit for the purpose for which they intend 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.