

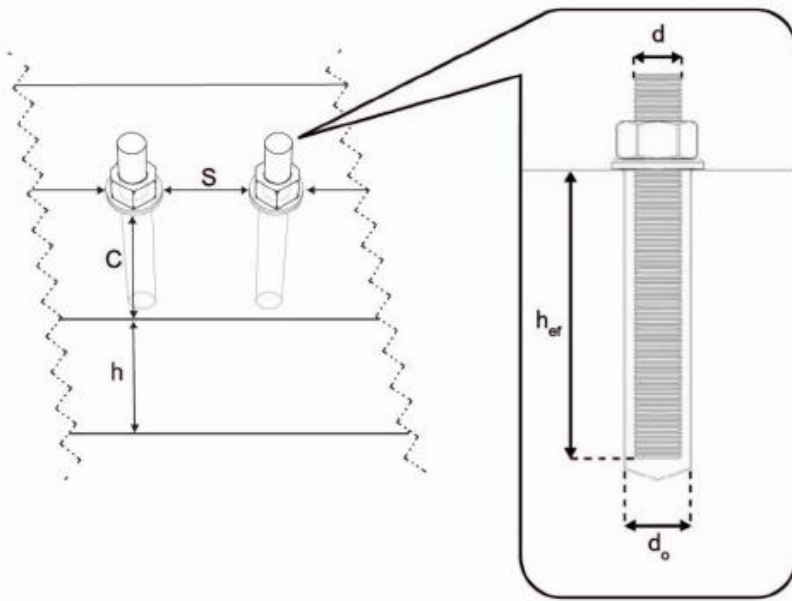
Sika AnchorFix[®]-2020 Technical Documentation

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Sika AnchorFix[®]-2020
300ml & 825ml

Sika AnchorFix®-2020



Glossary	
d	anchor nominal diameter
d _o	drilled hole diameter
h _{ef}	effective bond length
C	close edge distance
S	anchor spacing
h	concrete member thickness

Installation Parameters

Characteristic		Symbol	Unit	Nominal Anchor Element Size							
				-	3/8	1/2	5/8	3/4	1	-	1 1/4
Fractional Threaded Rods	Nominal Anchor Size	d _a	inch	-	3/8	1/2	5/8	3/4	1	-	1 1/4
	Drill Size	d _o	inch	-	1/2	9/16	11/16	13/16	1 1/16	-	1 3/8
	Minimum Embedment Depth	h _{ef,min}	inch	-	2 3/8	2 3/4	3 1/8	3 1/2	4	-	5
	Maximum Embedment Depth	h _{ef,max}	inch	-	7 1/2	10	12 1/2	15	20	-	25
US Reinforcing Bars	Nominal Anchor Size	d _a	inch	-	#3	#4	#5	#6	#8	-	#10
	Drill Size	d _o	inch	-	9/16	5/8	3/4	1	1 1/4	-	1 5/8
	Minimum Embedment Depth	h _{ef,min}	inch	-	2 3/8	2 3/4	3 1/8	3 1/2	4	-	5
	Maximum Embedment Depth	h _{ef,max}	inch	-	7 1/2	10	12 1/2	15	20	-	25
Metric Threaded Rods	Nominal Anchor Size	d _a	mm	M8	M10	M12	M16	M20	M24	M27	M30
	Drill Size	d _o	mm	10	12	14	18	22	26	30	35
	Minimum Embedment Depth	h _{ef,min}	mm	60	70	80	90	90	102	108	127
	Maximum Embedment Depth	h _{ef,max}	mm	160	200	240	320	400	480	540	600
Metric Reinforcing Bars	Nominal Anchor Size	d _a	mm	8	10	12	16	20	25	-	32
	Drill Size	d _o	mm	12	14	16	20	25	32	-	40
	Minimum Embedment Depth	h _{ef,min}	mm	60	70	80	90	90	102	-	127
	Maximum Embedment Depth	h _{ef,max}	mm	160	200	240	320	400	500	-	640
Maximum Tightening Torque		T _{inst}	ft.lb (Nm)	7 (10)	15 (20)	30 (40)	60 (80)	110 (150)	145 (200)	160 (216)	200 (275)
Minimum Concrete Thickness		h _{min}	-	2.0 h _{ef}							
Critical Edge Distance		C _{ac}	inch	$h_{ef} (T_{k,uncr} / 1160)^{0.4} \times [3.1 - 0.7 (h / h_{ef})]$							
			mm	$h_{ef} (T_{k,uncr} / 8)^{0.4} \times [3.1 - 0.7 (h / h_{ef})]$							
Minimum Edge Distance		C _{min}	-	0.5 h _{ef}							
Minimum Anchor Spacing		S _{min}	-								

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Steel Design Information for Fractional Threaded Rods and US Reinforcing Bars (Strength Design)

Characteristic		Symbol	Units	Nominal Anchor Element Diameter					
Fractional Threaded Rods	Nominal Anchor Diameter	d_a	inch	3/8	1/2	5/8	3/4	1	1-1/4
	Stress Area ²	A_{se}	in. ²	0.078	0.142	0.226	0.334	0.606	0.969
	Tension Resistance of Carbon Steel ASTM F 1554 Grade 36 (A 307 Gr. C)	N_{sa}	lb (kN)	4495 (20.0)	8230 (36.6)	13110 (58.3)	19370 (86.2)	35150 (156.4)	56200 (250.0)
	Tension Resistance of Carbon Steel ASTM A 193 B7	N_{sa}	lb (kN)	9690 (43.1)	17740 (78.9)	28250 (125.7)	41750 (185.7)	75750 (337.0)	121125 (538.8)
	Tension Resistance of Stainless Steel ASTM F 593 CW1	N_{sa}	lb (kN)	7750 (34.5)	14190 (63.1)	22600 (100.5)	-	-	-
	Tension Resistance of Stainless Steel ASTM F 593 CW2	N_{sa}	lb (kN)	-	-	-	28390 (126.3)	51510 (229.1)	82365 (366.4)
	Tension Resistance of Stainless Steel ASTM F 593 SH1	N_{sa}	lb (kN)	8915 (39.7)	16320 (72.6)	25990 (115.6)	-	-	-
	Tension Resistance of Stainless Steel ASTM F 593 SH2	N_{sa}	lb (kN)	-	-	-	35070 (156.0)	63630 (283.0)	-
	Tension Resistance of Stainless Steel ASTM F 593 SH3	N_{sa}	lb (kN)	-	-	-	-	-	92055 (409.5)
	Shear Resistance of Carbon Steel ASTM F 1554 Grade 36 (A 307 Gr. C)	V_{sa}	lb (kN)	2250 (10.0)	4940 (22.0)	7865 (35.0)	11625 (51.7)	21090 (93.8)	33720 (150.0)
	Shear Resistance of Carbon Steel ASTM A 193 B7	V_{sa}	lb (kN)	4845 (21.6)	10645 (47.4)	16950 (75.4)	25050 (111.4)	45450 (202.2)	72675 (323.3)
	Shear Resistance of Stainless Steel ASTM F 593 CW1	V_{sa}	lb (kN)	3875 (17.2)	7095 (31.6)	11300 (50.3)	-	-	-
	Shear Resistance of Stainless Steel ASTM F 593 CW2	V_{sa}	lb (kN)	-	-	-	14195 (63.1)	25755 (114.6)	41185 (183.2)
	Shear Resistance of Stainless Steel ASTM F 593 SH1	V_{sa}	lb (kN)	4455 (19.8)	9790 (43.5)	15595 (69.4)	-	-	-
	Shear Resistance of Stainless Steel ASTM F 593 SH2	V_{sa}	lb (kN)	-	-	-	17535 (78.0)	31815 (141.5)	-
	Shear Resistance of Stainless Steel ASTM F 593 SH3	V_{sa}	lb (kN)	-	-	-	-	-	46030 (204.8)
	Strength Reduction Factor for Tension Steel Failure ³	ϕ	-	0.75					
	Strength Reduction Factor for Shear Steel Failure ³	ϕ	-	0.65					
	Reduction for Seismic Shear	$\alpha_{V,seis}$	-	0.73	0.73	0.67	0.67	0.61	0.46
	US Reinforcing Bar	Nominal Anchor Diameter	d_a	inch	#3	#4	#5	#6	-
Stress Area ²		A_{se}	in. ²	0.11	0.20	0.31	0.44	-	-
Tension Resistance of Reinforcing Bars ASTM A 615 Grade 40		N_{sa}	lb (kN)	6600 (29.4)	12000 (53.4)	18600 (82.7)	26400 (117.4)	-	-
Tension Resistance of Reinforcing Bars ASTM A 615 Grade 60		N_{sa}	lb (kN)	9900 (44.0)	18000 (80.1)	27900 (124.1)	39600 (176.1)	-	-
Shear Resistance of Reinforcing Bars ASTM A 615 Grade 40		V_{sa}	lb (kN)	3960 (17.6)	7200 (32.0)	11160 (49.6)	15840 (70.5)	-	-
Shear Resistance of Reinforcing Bars ASTM A 615 Grade 60		V_{sa}	lb (kN)	5940 (26.4)	10800 (48.0)	16740 (74.5)	23760 (105.7)	-	-
Strength Reduction Factor for Tension Steel Failure ³		ϕ	-	0.75				-	-
Strength Reduction Factor for Shear Steel Failure ³		ϕ	-	0.65				-	-

1. Values provided for common rod material types are based on specified strength and calculated in accordance with ACI 318-14 Eq. (17.4.1.2) and Eq. (17.5.1.2b) or ACI 318-11 Eq. (D-2) and Eq. (D-29).
2. Stress area is minimum stress area applicable for either tension or shear.
3. Tabulated value of ϕ complies with ACI 318-14 Section 17.3.3 (ACI 318-11 Section D.4.3) and applies when the load combinations of Section 1605.1 of the IBC or ACI 318-14 Section 5.3 (ACI 318-11 Section 9.2) are used. When the load combinations in ACI 318 Appendix C are used, the appropriate value of ϕ shall be determined in accordance with ACI 318-11 D.4.4.

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Steel Design Information for Metric Threaded Rods and Reinforcing Bars (Strength Design)

Characteristic		Symbol	Units	Nominal Anchor Element Diameter							
Metric Threaded Rods	Nominal Anchor Diameter	d_a	mm	M8	M10	M12	M16	M20	M24	M27	M30
	Stress Area ²	A_{se}	mm ²	36.6	58.0	84.3	157.0	245.0	353.0	459.0	561.0
	Tension Resistance of Carbon Steel ISO 898 Class 5.8	N_{sa}	kN (lb)	18.3 (4414)	29.0 (6519)	42.0 (9476)	78.5 (17647)	122.5 (27539)	176.5 (39679)	229.5 (51594)	280.5 (63059)
	Tension Resistance of Carbon Steel ISO 898 Class 8.8	N_{sa}	kN (lb)	29.3 (6582)	46.5 (10431)	67.5 (15161)	125.5 (28236)	196.0 (44063)	282.5 (63486)	367.0 (82550)	449.0 (100894)
	Tension Resistance of Stainless Steel ISO 3506-1 A4-70	N_{sa}	kN (lb)	26.0 (5845)	40.6 (9127)	59.0 (13266)	109.9 (24707)	171.5 (38555)	247.1 (55550)	321.0 (72163)	392.7 (88282)
	Tension Resistance of Stainless Steel ISO 3506-1 A4-80	N_{sa}	kN (lb)	29.0 (6519)	46.6 (10431)	67.4 (15161)	125.6 (28236)	196.0 (44063)	282.4 (63486)	367.0 (82504)	448.8 (100894)
	Shear Resistance of Carbon Steel ISO 898 Class 5.8	V_{sa}	kN (lb)	11.0 (2648)	14.5 (3260)	25.5 (5685)	47.0 (10588)	73.5 (16523)	106.0 (23807)	137.5 (30956)	168.5 (37835)
	Shear Resistance of Carbon Steel ISO 898 Class 8.8	V_{sa}	kN (lb)	17.6 (3949)	23.0 (5216)	40.5 (9097)	75.5 (16942)	117.5 (26438)	169.5 (38092)	220.5 (49530)	269.5 (60537)
	Shear Resistance of Stainless Steel ISO 3506-1 A4-70	V_{sa}	kN (lb)	13.0 (2922)	24.4 (5476)	35.4 (7960)	65.9 (14824)	102.9 (23133)	148.3 (33330)	161.0 (36194)	235.6 (52969)
	Shear Resistance of Stainless Steel ISO 3506-1 A4-80	V_{sa}	kN (lb)	15.0 (3372)	27.8 (6259)	40.5 (9097)	75.4 (16942)	117.6 (26438)	169.4 (38092)	184.0 (41364)	269.3 (60537)
	Strength Reduction Factor for Tension Steel Failure ³	ϕ	-	0.65							
	Strength Reduction Factor for Shear Steel Failure ³	ϕ	-	0.60							
	Reduction for Seismic Shear	$\alpha_{v,seis}$	-	-	0.66	0.67	0.77	0.66	0.61	0.59	0.59
	Metric Rebar	Nominal Anchor Diameter	d_a	mm		10mm	12mm	16mm			
Stress Area ²		A_{se}	mm ²		78.5	113.0	201.0				
Tension Resistance of Reinforcing Bars DIN 488 B St 500		N_{sa}	kN (lb)		43.2 (9706)	62.2 (13972)	110.6 (24853)				
Shear Resistance of Reinforcing Bars DIN 488 B St 500		V_{sa}	kN (lb)		25.9 (5824)	37.3 (8383)	66.3 (14912)				
Strength Reduction Factor for Tension Steel Failure ³		ϕ	-	0.65							
Strength Reduction Factor for Shear Steel Failure ³		ϕ	-	0.60							

1. Values provided for common rod material types are based on specified strength and calculated in accordance with ACI 318-14 Eq. (17.4.1.2) and Eq. (17.5.1.2b) or ACI 318-11 Eq. (D-2) and Eq. (D-29).
2. Stress area is minimum stress area applicable for either tension or shear.
3. Tabulated value of ϕ complies with ACI 318-14 Section 17.3.3 (ACI 318-11 Section D.4.3) and applies when the load combinations of Section 1605.1 of the IBC or ACI 318-14 Section 5.3 (ACI 318-11 Section 9.2) are used. When the load combinations in ACI 318-11 Appendix C are used, the appropriate value of ϕ shall be determined in accordance with ACI 318-11 D.4.4.

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Concrete Breakout Design Information for Fractional Anchor Elements (Strength Design)

Design Information	Symbol	Units	Nominal Anchor Element Diameter					
			3/8"	1/2"	5/8"	3/4"	1"	1-1/4"
			#3	#4	#5	#6	#8	#10
Effectiveness Factor for Cracked Concrete	$k_{c,cr}$	in-lb (SI)	17 (7.1)					
Effectiveness Factor for Uncracked Concrete	$k_{c,uncr}$	in-lb (SI)	24 (10)					
Minimum Embedment Depth	$h_{ef,min}$	in.	2-3/8	2-3/4	3-1/8	3-1/2	4	5
Maximum Embedment Depth	$h_{ef,max}$	in.	7-1/2	10	12-1/2	15	20	25
Minimum Edge Distance	c_{min}	in.	0.5 h_{ef}					
Minimum Anchor Spacing	s_{min}	in.	0.5 h_{ef}					
Critical Edge Distance	c_{ac}	in.	See Section 3.1.10 of this report					
Minimum Concrete Thickness	h_{min}	in.	2.0 h_{ef}					
Strength Reduction Factor for Tension, Concrete Failure Modes, Condition B	ϕ	-	0.65					
Strength Reduction Factor for Shear, Concrete Failure Modes, Condition B	ϕ	-	0.70					

Concrete Breakout Design Information for Metric Anchor Elements (Strength Design)

Design Information	Symbol	Units	Nominal Anchor Element Diameter							
			M8	M10	M12	M16	M20	M24	M27	M30
			8mm	10mm	12mm	16mm	20mm	24mm	27mm	30mm
Effectiveness Factor for Cracked Concrete	$k_{c,cr}$	in-lb (SI)	17 (7.1)							
Effectiveness Factor for Uncracked Concrete	$k_{c,uncr}$	in-lb (SI)	24 (10)							
Minimum Embedment Depth for Threaded Rods	$h_{ef,min}$	mm	60	70	80	90	90	102	108	127
Maximum Embedment Depth for Threaded Rods	$h_{ef,max}$	mm	191	254	318	381	445	508	540	635
Minimum Embedment Depth for Rebars	$h_{ef,min}$	mm	-	70	80	90	90	102	-	127
Maximum Embedment Depth for Rebars	$h_{ef,max}$	mm	-	254	318	381	445	508	-	635
Minimum Edge Distance	c_{min}	in.	0.5 h_{ef}							
Minimum Anchor Spacing	s_{min}	in.	0.5 h_{ef}							
Critical Edge Distance	c_{ac}	in.	See Section 3.1.10 of this report							
Minimum Concrete Thickness	h_{min}	in.	2.0 h_{ef}							
Strength Reduction Factor for Tension, Concrete Failure Modes, Condition B	ϕ	-	0.65							
Strength Reduction Factor for Shear, Concrete Failure Modes, Condition B	ϕ	-	0.70							

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Bond Strength Design Information for Fractional Threaded Rods in Hammer Drilled Holes (Strength Design)

Design Information		Symbol	Units	Nominal Anchor Element Diameter					
				3/8"	1/2"	5/8"	3/4"	1"	1-1/4"
Minimum Embedment Depth		$h_{ef,min}$	inch	2-3/8	2-3/4	3-1/4	3-1/2	4	5
Maximum Embedment Depth ⁶		$h_{ef,max}$	inch	7-1/2	10	12-1/2	15	20	25
Characteristic Bond Strength in Uncracked Concrete for Sustained Tension Loading ^{2,3}		$\tau_{k,sust,uncr}$	psi (N/mm ²)	1,320 (9.10)	1,237 (8.53)	1,154 (7.95)	1,070 (7.38)	-	-
Characteristic Bond Strength in Uncracked Concrete for Short Term Loads ^{2,3}		$\tau_{k,uncr}$	psi (N/mm ²)	1,320 (9.10)	1,237 (8.53)	1,154 (7.95)	1,070 (7.38)	-	-
Characteristic Bond Strength in Cracked Concrete for Sustained Tension Loading ^{2,3}		$\tau_{k,sust,cr}$	psi (N/mm ²)	598 (4.13)	817 (5.63)	769 (5.30)	720 (4.96)	623 (4.29)	518 (3.57)
Characteristic Bond Strength in Cracked Concrete for Short Term Loads ^{2,3}		$\tau_{k,cr}$	psi (N/mm ²)	598 (4.13)	817 (5.63)	769 (5.30)	720 (4.96)	623 (4.29)	518 (3.57)
Permissible Installation Conditions, Periodic Special Inspection	Dry Concrete	Anchor Category	-	2	2	2	2	2	3
		ϕ_d	-	0.55	0.55	0.55	0.55	0.55	0.45
	Water-saturated Concrete	Anchor Category	-	1	2	2	2	2	2
		ϕ_{ws}	-	0.65	0.55	0.55	0.55	0.55	0.55
	Water-filled Holes	Anchor Category	-	3	3	3	3	3	3
		ϕ_{wf}	-	0.45	0.45	0.45	0.45	0.45	0.45
Permissible Installation Conditions, Continuous Special Inspection	Dry Concrete	Anchor Category	-	1	1	1	1	1	1
		ϕ_d	-	0.65	0.65	0.65	0.65	0.65	0.65
	Water-saturated Concrete	Anchor Category	-	1	1	1	1	1	1
		ϕ_{ws}	-	0.65	0.65	0.65	0.65	0.65	0.65
	Water-filled Holes	Anchor Category	-	1	1	1	1	1	1
		ϕ_{wf}	-	0.65	0.65	0.65	0.65	0.65	0.65
Reduction for Seismic Tension		$\alpha_{N,seis}$	-	1.00	0.41	0.54	1.00	0.50	0.96

- Bond strength values correspond to concrete compressive strength, $f'_c = 2,500$ psi. Bond strength values shall not be increased for concrete compressive strength.
- Maximum long term temperature: 122°F (+50°C); maximum short term temperature: 176°F (+80°C).³ Short term elevated concrete temperatures are those that occur over brief intervals, e.g. transient or part of a regular cycle of heating and cooling, such as day-night temperature rise and fall. Long term elevated concrete temperatures are roughly constant over significant periods of time.
- The tabulated value of ϕ applies when load combinations of Section 1605.2 of the IBC or ACI 318-14 Section 5.3 (ACI 318-11 Section 9.2), are used in accordance with ACI 318-14 Section 17.3.3 (ACI 318-11 Section D.4.3). If the load combinations of ACI 318 Appendix C are used, the appropriate value of ϕ shall be determined in accordance with ACI 318 D.4.4.
- The values of ϕ correspond to Condition B as described in Section 17.3.3 of ACI 318-14 (Section D.4.3 of ACI 318-11) for post-installed anchors designed using the load combinations of IBC Section 1605.2. If the load combinations in ACI 318-11 Appendix C are used, the corresponding value of ϕ shall be determined.
- For overhead installations, the 2KPS XS-E system is limited to $h_{ef,max} = 18d_a$.

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Bond Strength Design Information for Metric Threaded Rods in Hammer Drilled Holes (Strength Design)

Design Information	Symbol	Units	Nominal Anchor Element Diameter								
			M8	M10	M12	M16	M20	M24	M27	M30	
Minimum Embedment Depth	$h_{ef,min}$	mm	60	60	70	83	89	102	108	127	
Maximum Embedment Depth ⁶	$h_{ef,max}$	mm	160	200	240	320	400	480	540	600	
Characteristic Bond Strength in Uncracked Concrete for Sustained Tension Loading ^{2,3}	$\tau_{k,sust,ungr}$	N/mm ² (psi)	9.38 (1,360)	9.02 (1,308)	8.65 (1,255)	7.93 (1,150)	7.21 (1,045)	-	-	-	
Characteristic Bond Strength in Uncracked Concrete for Short Term Loads ^{2,3}	$\tau_{k,ungr}$	N/mm ² (psi)	9.38 (1,360)	9.02 (1,308)	8.65 (1,255)	7.93 (1,150)	7.21 (1,045)	-	-	-	
Characteristic Bond Strength in Cracked Concrete for Sustained Tension Loading ^{2,3}	$\tau_{k,sust,cr}$	N/mm ² (psi)	6.13 (889)	5.78 (839)	5.71 (828)	5.29 (767)	4.86 (705)	3.97 (576)	4.07 (590)	3.75 (545)	
Characteristic Bond Strength in Cracked Concrete for Short Term Loads ^{2,3}	$\tau_{k,cr}$	N/mm ² (psi)	6.13 (889)	5.78 (839)	5.71 (828)	5.29 (767)	4.86 (705)	3.97 (576)	4.07 (590)	3.75 (545)	
Permissible Installation Conditions, Periodic Special Inspection	Dry Concrete	Anchor Category	-	2	2	2	2	2	2	3	3
		ϕ_d	-	0.55	0.55	0.55	0.55	0.55	0.55	0.45	0.45
	Water-saturated Concrete	Anchor Category	-	1	1	2	2	2	2	2	2
		ϕ_{ws}	-	0.65	0.65	0.55	0.55	0.55	0.55	0.55	0.55
Water-filled Holes	Anchor Category	-	3	3	3	3	3	3	3	3	
	ϕ_{wf}	-	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	
Permissible Installation Conditions, Continuous Special Inspection	Dry Concrete	Anchor Category	-	1	1	1	1	1	1	1	1
		ϕ_d	-	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
	Water-saturated Concrete	Anchor Category	-	1	1	1	1	1	1	1	1
		ϕ_{ws}	-	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
	Water-filled Holes	Anchor Category	-	1	1	1	1	1	1	1	1
		ϕ_{wf}	-	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Reduction for Seismic Tension	$\alpha_{N,seis}$	-	-	0.34	0.41	0.54	0.36	0.50	0.50	0.45	

- Bond strength values correspond to concrete compressive strength, $f_c = 2,500$ psi. Bond strength values shall not be increased for concrete compressive strength.
- Maximum long term temperature: 122°F (+50°C); maximum short term temperature: 176°F (+80°C).
- Short term elevated concrete temperatures are those that occur over brief intervals, e.g. transient or part of a regular cycle of heating and cooling, such as day-night temperature rise and fall. Long term elevated concrete temperatures are roughly constant over significant periods of time.
- The tabulated value of ϕ applies when load combinations of Section 1605.2 of the IBC or ACI 318-14 Section 5.3 (ACI 318-11 Section 9.2), are used in accordance with ACI 318-14 Section 17.3.3 (ACI 318-11 D.4.3). If the load combinations of ACI 318 Appendix C are used, the appropriate value of ϕ shall be determined in accordance with ACI 318-11 D.4.4.
- The values of ϕ correspond to Condition B as described in Section 17.3.3 of ACI 318-14 (Section D.4.3 of ACI 318-11) for post-installed anchors designed using the load combinations of IBC Section 1605.2. If the load combinations in ACI 318-11 Appendix C are used, the corresponding value of ϕ shall be determined.
- For overhead installations, the 2KPS XS-E system is limited to $h_{ef,max} = 18d_a$.

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Bond Strength Design Information for US Reinforcing Bars in Hammer Drilled Holes (Strength Design)

Design Information		Symbol	Units	Nominal Anchor Element Diameter			
				#3	#4	#5	#6
Minimum Embedment Depth		$h_{ef,min}$	inch	2-3/8	2-3/4	3-1/4	3-1/2
Maximum Embedment Depth ⁶		$h_{ef,max}$	inch	7-1/2	10	12-1/2	15
Characteristic Bond Strength in Uncracked Concrete for Sustained Tension Loading ^{2,3}		$\tau_{k,sust,unscr}$	psi (N/mm ²)	1,262 (8.70)	1,174 (8.10)	1,087 (7.49)	1,000 (6.89)
Characteristic Bond Strength in Uncracked Concrete for Short Term Loads ^{2,3}		$\tau_{k,unscr}$	psi (N/mm ²)	1,262 (8.70)	1,174 (8.10)	1,087 (7.49)	1,000 (6.89)
Permissible Installation Conditions, Periodic Special Inspection	Dry Concrete	Anchor Category	-	2	2	2	2
		ϕ_d	-	0.55	0.55	0.55	0.55
	Water-saturated Concrete	Anchor Category	-	1	2	2	2
		ϕ_{ws}	-	0.65	0.55	0.55	0.55
	Water-filled Holes	Anchor Category	-	3	3	3	3
		ϕ_{wf}	-	0.45	0.45	0.45	0.45
Permissible Installation Conditions, Continuous Special Inspection	Dry Concrete	Anchor Category	-	1	1	1	1
		ϕ_d	-	0.65	0.65	0.65	0.65
	Water-saturated Concrete	Anchor Category	-	1	1	1	1
		ϕ_{ws}	-	0.65	0.65	0.65	0.65
	Water-filled Holes	Anchor Category	-	1	1	1	1
		ϕ_{wf}	-	0.65	0.65	0.65	0.65

- Bond strength values correspond to concrete compressive strengths, $f'_c = 2,500$ psi. Bond strength values shall not be increased for concrete compressive strength.
- Maximum long term temperature: 122°F (+50°C); maximum short term temperature: 176°F (+80°C).
- Short term elevated concrete temperatures are those that occur over brief intervals, e.g. transient or part of a regular cycle of heating and cooling, such as day-night temperature rise and fall. Long term elevated concrete temperatures are roughly constant over significant periods of time.
- The tabulated value of ϕ applies when load combinations of Section 1605.2 of the IBC or ACI 318-14 Section 5.3 (ACI 318-11 Section 9.2), are used in accordance with ACI 318-14 Section 17.3.3 (ACI 318-11 Section D.4.3). If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ shall be determined in accordance with ACI 318 D.4.4.
- The values of ϕ correspond to Condition B as described in Section 17.3.3 of ACI 318-14 (Section D.4.3 of ACI 318-11) for post-installed anchors designed using the load combinations of IBC Section 1605.2. If the load combinations in ACI 318-11 Appendix C are used, the corresponding value of ϕ shall be determined.
- For overhead installations, the 2KPS XS-E system is limited to $h_{ef,max} = 18d_a$.

Bond Strength Design Information for Metric Reinforcing Bars in Hammer Drilled Holes (Strength Design)

Design Information		Symbol	Units	Nominal Anchor Element Diameter		
				Ø10mm	Ø12mm	Ø16mm
Minimum Embedment Depth		$h_{ef,min}$	mm	60	70	83
Maximum Embedment Depth ⁶		$h_{ef,max}$	mm	200	240	320
Characteristic Bond Strength in Uncracked Concrete for Sustained Tension Loading ^{2,3}		$\tau_{k,sust,unscr}$	N/mm ² (psi)	8.61 (1,249)	8.23 (1,193)	7.47 (1,083)
Characteristic Bond Strength in Uncracked Concrete for Short Term Loads ^{2,3}		$\tau_{k,unscr}$	N/mm ² (psi)	8.61 (1,249)	8.23 (1,193)	7.47 (1,083)
Permissible Installation Conditions, Periodic Special Inspection	Dry Concrete	Anchor Category	-	2	2	2
		ϕ_d	-	0.55	0.55	0.55
	Water-saturated Concrete	Anchor Category	-	1	2	2
		ϕ_{ws}	-	0.65	0.55	0.55
	Water-filled Holes	Anchor Category	-	3	3	3
		ϕ_{wf}	-	0.45	0.45	0.45
Permissible Installation Conditions, Continuous Special Inspection	Dry Concrete	Anchor Category	-	1	1	1
		ϕ_d	-	0.65	0.65	0.65
	Water-saturated Concrete	Anchor Category	-	1	1	1
		ϕ_{ws}	-	0.65	0.65	0.65
	Water-filled Holes	Anchor Category	-	1	1	1
		ϕ_{wf}	-	0.65	0.65	0.65

- Bond strength values correspond to concrete compressive strength, $f'_c = 2,500$ psi. Bond strength values shall not be increased for concrete compressive strength.
- Maximum long term temperature: 122°F (+50°C); maximum short term temperature: 176°F (+80°C).
- Short term elevated concrete temperatures are those that occur over brief intervals, e.g. transient or part of a regular cycle of heating and cooling, such as day-night temperature rise and fall. Long term elevated concrete temperatures are roughly constant over significant periods of time.
- The tabulated value of ϕ applies when load combinations of Section 1605.2 of the IBC or ACI 318-14 Section 5.3 (ACI 318-11 Section 9.2), are used in accordance with ACI 318-14 Section 17.3.3 (ACI 318-11 Section D.4.3). If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ shall be determined in accordance with ACI 318-11 Section D.4.4.
- The values of ϕ correspond to Condition B as described in Section 17.3.3 of ACI 318-14 (Section D.4.3 of ACI 318-11) for post-installed anchors designed using the load combinations of IBC Section 1605.2. If the load combinations in ACI 318-11 Appendix C are used, the corresponding value of ϕ shall be determined.
- For overhead installations, the 2KPS XS-E system is limited to $h_{ef,max} = 18d_a$.

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Strength Design Values

METRIC THREADED RODS IN UNCRACKED CONCRETE

MAX. LONG TERM TEMP.: 50°C (122°F); MAX. SHORT TERM TEMP.: 80°C (176°F)

Anchor Dia.	h_{ef} (mm)	$f'_c = 17.2$ MPa		$f'_c = 27.5$ MPa		$f'_c = 41.3$ MPa		$f'_c = 55.1$ MPa	
		ϕN_n (kN)	ϕV_n (kN)	ϕN_n (kN)	ϕV_n (kN)	ϕN_n (kN)	ϕV_n (kN)	ϕN_n (kN)	ϕV_n (kN)
M8	60	7.8	16.8	7.8	18.4	7.8	18.4	7.8	18.4
	110	14.3	33.7	14.3	33.7	14.3	33.7	14.3	33.7
	160	20.7	49.0	20.7	49.0	20.7	49.0	20.7	49.0
M10	60	9.4	15.7	9.4	19.8	9.4	22.1	9.4	22.1
	130	20.3	47.9	20.3	47.9	20.3	47.9	20.3	47.9
	200	31.2	73.7	31.2	73.7	31.2	73.7	31.2	73.7
M12	70	12.6	19.1	12.6	24.2	12.6	29.6	12.6	29.7
	155	27.8	65.7	27.8	65.7	27.8	65.7	27.8	65.7
	240	43.0	101.7	43.0	101.7	43.0	101.7	43.0	101.7
M16	83	18.2	22.3	18.2	29.0	18.2	35.5	18.2	41.0
	202	44.2	94.5	44.2	104.4	44.2	104.4	44.2	104.4
	320	70.2	165.8	70.2	165.8	70.2	165.8	70.2	165.8
M20	89	22.2	21.4	22.2	29.5	22.2	36.1	22.2	41.7
	245	60.9	119.3	60.9	144.0	60.9	144.0	60.9	144.0
	400	99.7	235.6	99.7	235.6	99.7	235.6	99.7	235.6

1. Tabulated values are calculated according to ACI318 for concrete cone failure and bond failure. Values must be compared to the relevant steel strength information with the lowest value controlling.

2. Values are calculated assuming Condition B - without supplementary reinforcement.

3. Values are only valid for the given temperature range for anchors installed in dry concrete of compressive strength shown.

4. Tabulated values are valid for single anchors without consideration for close edges or anchor spacing.

5. Strength reduction factors have been developed in accordance with ACI355.4 and ICC-ES AC308.

6. Calculated values assume sustained tension load acting on the anchor.

7. Calculated values are for illustrative purposes only. Anchor design must be conducted by an engineer with experience in the design of fasteners and independently verified.

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METRIC THREADED RODS IN CRACKED CONCRETE

MAX. LONG TERM TEMP.: 50°C (122°F); MAX. SHORT TERM TEMP.: 80°C (176°F)

Anchor Dia. (inch)	h_{ef} (inch)	$f'_c = 17.2 \text{ MPa}$		$f'_c = 27.5 \text{ MPa}$		$f'_c = 41.3 \text{ MPa}$		$f'_c = 55.1 \text{ MPa}$	
		ϕN_n (kN)	ϕV_n (kN)	ϕN_n (kN)	ϕV_n (kN)	ϕN_n (kN)	ϕV_n (kN)	ϕN_n (kN)	ϕV_n (kN)
M8	60	5.1	12.0	5.1	12.0	5.1	12.0	5.1	12.0
	110	9.3	22.0	9.3	22.0	9.3	22.0	9.3	22.0
	160	13.6	32.0	13.6	32.0	13.6	32.0	13.6	32.0
M10	60	6.0	12.0	6.0	14.2	6.0	14.2	6.0	14.2
	130	13.0	30.7	13.0	30.7	13.0	30.7	13.0	30.7
	200	20.0	47.2	20.0	47.2	20.0	47.2	20.0	47.2
M12	70	8.3	14.9	8.3	18.9	8.3	19.6	8.3	19.6
	155	18.4	43.4	18.4	43.4	18.4	43.4	18.4	43.4
	240	28.4	67.2	28.4	67.2	28.4	67.2	28.4	67.2
M16	83	12.1	18.0	12.1	22.7	12.1	27.8	12.1	28.7
	202	29.5	69.7	29.5	69.7	29.5	69.7	29.5	69.7
	320	46.8	110.6	46.8	110.6	46.8	110.6	46.8	110.6
M20	89	14.9	17.4	14.9	23.2	14.9	28.5	14.9	32.9
	245	41.1	94.1	41.1	97.1	41.1	97.1	41.1	97.1
	400	67.2	158.8	67.2	158.8	67.2	158.8	67.2	158.8
M24	102	16.8	19.8	16.8	25.0	16.8	30.7	16.8	35.4
	291	47.9	108.3	47.9	113.2	47.9	113.2	47.9	113.2
	480	79.0	186.8	79.0	186.8	79.0	186.8	79.0	186.8
M27	108	16.8	20.2	16.8	27.3	16.8	33.5	16.8	38.7
	324	50.3	129.1	50.3	145.4	50.3	145.4	50.3	145.4
	540	83.9	242.4	83.9	242.4	83.9	242.4	83.9	242.4
M30	127	20.2	25.6	20.2	33.6	20.2	41.1	20.2	47.5
	364	57.8	146.0	57.8	167.0	57.8	167.0	57.8	167.0
	600	95.4	275.7	95.4	275.7	95.4	275.7	95.4	275.7

1. Tabulated values are calculated according to ACI318 for concrete cone failure and bond failure. Values must be compared to the relevant steel strength information with the lowest value controlling.

2. Values are calculated assuming Condition B - without supplementary reinforcement.

3. Values are only valid for the given temperature range for anchors installed in dry concrete of compressive strength shown.

4. Tabulated values are valid for single anchors without consideration for close edges or anchor spacing.

5. Strength reduction factors have been developed in accordance with ACI355.4 and ICC-ES AC308.

6. Calculated values assume sustained tension load acting on the anchor.

7. Calculated values are for illustrative purposes only. Anchor design must be conducted by an engineer with experience in the design of fasteners and independently verified.

Sika AnchorFix®-2020

FRACTIONAL SIZED THREADED RODS IN UNCRACKED CONCRETE

MAX. LONG TERM TEMP.: 50°C (122°F); MAX. SHORT TERM TEMP.: 80°C (176°F)

Anchor Dia. (inch)	h_{ef} (inch)	$f'_c = 2,500$ psi		$f'_c = 4,000$ psi		$f'_c = 6,000$ psi		$f'_c = 8,000$ psi	
		ϕN_n (lbf)	ϕV_n (lbf)	ϕN_n (lbf)	ϕV_n (lbf)	ϕN_n (lbf)	ϕV_n (lbf)	ϕN_n (lbf)	ϕV_n (lbf)
3/8	2 3/8	2,031	2,401	2,031	2,401	2,031	2,401	2,031	2,401
	5	4,276	9,347	4,276	11,372	4,276	11,372	4,276	11,372
	7 1/2	6,415	14,390	6,415	15,162	6,415	15,162	6,415	15,162
1/2	2 3/4	2,939	3,073	2,939	3,887	2,939	4,760	2,939	5,497
	6 1/2	6,946	11,817	6,946	14,947	6,946	17,050	6,946	17,050
	10	10,687	21,308	10,687	25,260	10,687	25,260	10,687	25,260
5/8	3 1/8	3,894	3,432	3,894	4,516	3,894	5,531	3,894	6,387
	8	9,970	13,275	9,970	16,792	9,970	20,566	9,970	22,092
	12 1/2	15,578	28,564	15,578	36,130	15,578	36,820	15,578	36,820
3/4	3 1/2	4,853	3,772	4,853	5,116	4,853	6,266	4,853	7,235
	9	12,480	18,086	12,480	22,877	12,480	28,019	12,480	31,136
	15	20,799	35,883	20,799	45,389	20,799	49,162	20,799	49,162

1. Tabulated values are calculated according to ACI318 for concrete cone failure and bond failure. Values must be compared to the relevant steel strength information with the lowest value controlling.
2. Values are calculated assuming Condition B - without supplementary reinforcement.
3. Values are only valid for the given temperature range for anchors installed in dry concrete of compressive strength shown.
4. Tabulated values are valid for single anchors without consideration for close edges or anchor spacing.
5. Strength reduction factors have been developed in accordance with ACI355.4 and ICC-ES AC308.
6. Calculated values assume sustained tension load acting on the anchor.
7. Calculated values are for illustrative purposes only. Anchor design must be conducted by an engineer with experience in the design of fasteners and independently verified.

Sika AnchorFix®-2020

FRACTIONAL SIZED THREADED RODS IN CRACKED CONCRETE

MAX. LONG TERM TEMP.: 50°C (122°F); MAX. SHORT TERM TEMP.: 80°C (176°F)

Anchor Dia. (inch)	h_{ef} (inch)	$f'_c = 2,500$ psi		$f'_c = 4,000$ psi		$f'_c = 6,000$ psi		$f'_c = 8,000$ psi	
		ϕN_n (lbf)	ϕV_n (lbf)	ϕN_n (lbf)	ϕV_n (lbf)	ϕN_n (lbf)	ϕV_n (lbf)	ϕN_n (lbf)	ϕV_n (lbf)
3/8	2 3/8	920	1,088	920	1,088	920	1,088	920	1,088
	5	1,937	4,579	1,937	4,579	1,937	4,579	1,937	4,579
	7 1/2	2,906	6,869	2,906	6,869	2,906	6,869	2,906	6,869
1/2	2 3/4	1,941	2,396	1,941	3,031	1,941	3,712	1,941	4,286
	6 1/2	4,588	8,706	4,588	10,844	4,588	10,844	4,588	10,844
	10	7,058	16,613	7,058	16,683	7,058	16,683	7,058	16,683
5/8	3 1/8	2,595	2,791	2,595	3,540	2,595	4,336	2,595	5,006
	8	6,644	11,463	6,644	14,500	6,644	15,703	6,644	15,703
	12 1/2	10,381	22,390	10,381	24,536	10,381	24,536	10,381	24,536
3/4	3 1/2	3,266	3,067	3,266	4,034	3,266	4,940	3,266	5,704
	9	8,397	13,149	8,397	16,632	8,397	19,849	8,397	19,849
	15	13,996	28,292	13,996	33,081	13,996	33,081	13,996	33,081
1	4	4,306	3,282	4,306	4,518	4,306	5,534	4,306	6,390
	12	12,918	18,560	12,918	23,477	12,918	28,754	12,918	30,533
	20	21,529	39,936	21,529	50,515	21,529	50,888	21,529	50,888
1 1/4	5	4,577	4,290	4,577	5,652	4,577	6,923	4,577	7,994
	15	13,731	23,220	13,731	29,371	13,731	35,972	13,731	39,667
	25	22,885	49,961	22,885	63,196	22,885	66,111	22,885	66,111

1. Tabulated values are calculated according to ACI318 for concrete cone failure and bond failure. Values must be compared to the relevant steel strength information with the lowest value controlling.
2. Values are calculated assuming Condition B - without supplementary reinforcement.
3. Values are only valid for the given temperature range for anchors installed in dry concrete of compressive strength shown.
4. Tabulated values are valid for single anchors without consideration for close edges or anchor spacing.
5. Strength reduction factors have been developed in accordance with ACI355.4 and ICC-ES AC308.
6. Calculated values assume sustained tension load acting on the anchor.
7. Calculated values are for illustrative purposes only. Anchor design must be conducted by an engineer with experience in the design of fasteners and independently verified.

Sika AnchorFix®-2020

METRIC REINFORCING BARS IN UNCRACKED CONCRETE

MAX. LONG TERM TEMP.: 50°C (122°F); MAX. SHORT TERM TEMP.: 80°C (176°F)

Anchor Dia.	h_{ef} (mm)	$f'_c = 17.2 \text{ MPa}$		$f'_c = 27.5 \text{ MPa}$		$f'_c = 41.3 \text{ MPa}$		$f'_c = 55.1 \text{ MPa}$	
		ϕN_n (kN)	ϕV_n (kN)	ϕN_n (kN)	ϕV_n (kN)	ϕN_n (kN)	ϕV_n (kN)	ϕN_n (kN)	ϕV_n (kN)
10	60	8.9	15.2	8.9	19.3	8.9	21.1	8.9	21.1
	130	19.3	45.7	19.3	45.7	19.3	45.7	19.3	45.7
	200	29.8	70.3	29.8	70.3	29.8	70.3	29.8	70.3
12	70	11.9	18.6	11.9	23.5	11.9	28.2	11.9	28.2
	155	26.4	62.5	26.4	62.5	26.4	62.5	26.4	62.5
	240	41.0	96.8	41.0	96.8	41.0	96.8	41.0	96.8
16	83	17.1	22.1	17.1	27.9	17.1	34.2	17.1	39.5
	200	41.3	91.1	41.3	98.4	41.3	98.4	41.3	98.4
	320	66.1	156.2	66.1	156.2	66.1	156.2	66.1	156.2

US CUSTOMARY REINFORCING BARS IN UNCRACKED CONCRETE

MAX. LONG TERM TEMP.: 50°C (122°F); MAX. SHORT TERM TEMP.: 80°C (176°F)

Anchor Dia. (inch)	h_{ef} (inch)	$f'_c = 2,500 \text{ psi}$		$f'_c = 4,000 \text{ psi}$		$f'_c = 6,000 \text{ psi}$		$f'_c = 8,000 \text{ psi}$	
		ϕN_n (lbf)	ϕV_n (lbf)	ϕN_n (lbf)	ϕV_n (lbf)	ϕN_n (lbf)	ϕV_n (lbf)	ϕN_n (lbf)	ϕV_n (lbf)
#3	2 3/8	1,942	2,295	1,942	2,295	1,942	2,295	1,942	2,295
	5	4,089	9,098	4,089	10,872	4,089	10,872	4,089	10,872
	7 1/2	6,133	14,007	6,133	14,496	6,133	14,496	6,133	14,496
#4	2 3/4	2,789	2,978	2,789	3,767	2,789	4,613	2,789	5,327
	6 1/2	6,593	11,452	6,593	14,486	6,593	16,182	6,593	16,182
	10	10,143	20,650	10,143	23,973	10,143	23,973	10,143	23,973
#5	3 1/4	3,815	3,432	3,815	4,357	3,815	5,336	3,815	6,162
	8	9,391	12,807	9,391	16,200	9,391	19,841	9,391	20,810
	12 1/2	14,673	27,557	14,673	34,683	14,673	34,683	14,673	34,683
#6	3 1/2	4,536	3,772	4,536	4,912	4,536	6,016	4,536	6,947
	9	11,663	17,366	11,663	21,967	11,663	26,904	11,663	29,099
	15	19,439	34,456	19,439	43,583	19,439	45,946	19,439	45,946

1. Tabulated values are calculated according to ACI318 for concrete cone failure and bond failure. Values must be compared to the relevant steel strength information with the lowest value controlling.
2. Values are calculated assuming Condition B - without supplementary reinforcement.
3. Values are only valid for the given temperature range for anchors installed in dry concrete of compressive strength shown.
4. Tabulated values are valid for single anchors without consideration for close edges or anchor spacing.
5. Strength reduction factors have been developed in accordance with ACI355.4 and ICC-ES AC308.
6. Calculated values assume sustained tension load acting on the anchor.
7. Calculated values are for illustrative purposes only. Anchor design must be conducted by an engineer with experience in the design of fasteners and independently verified.