



DESIGN GUIDE

Sika AnchorFix[®]-2020

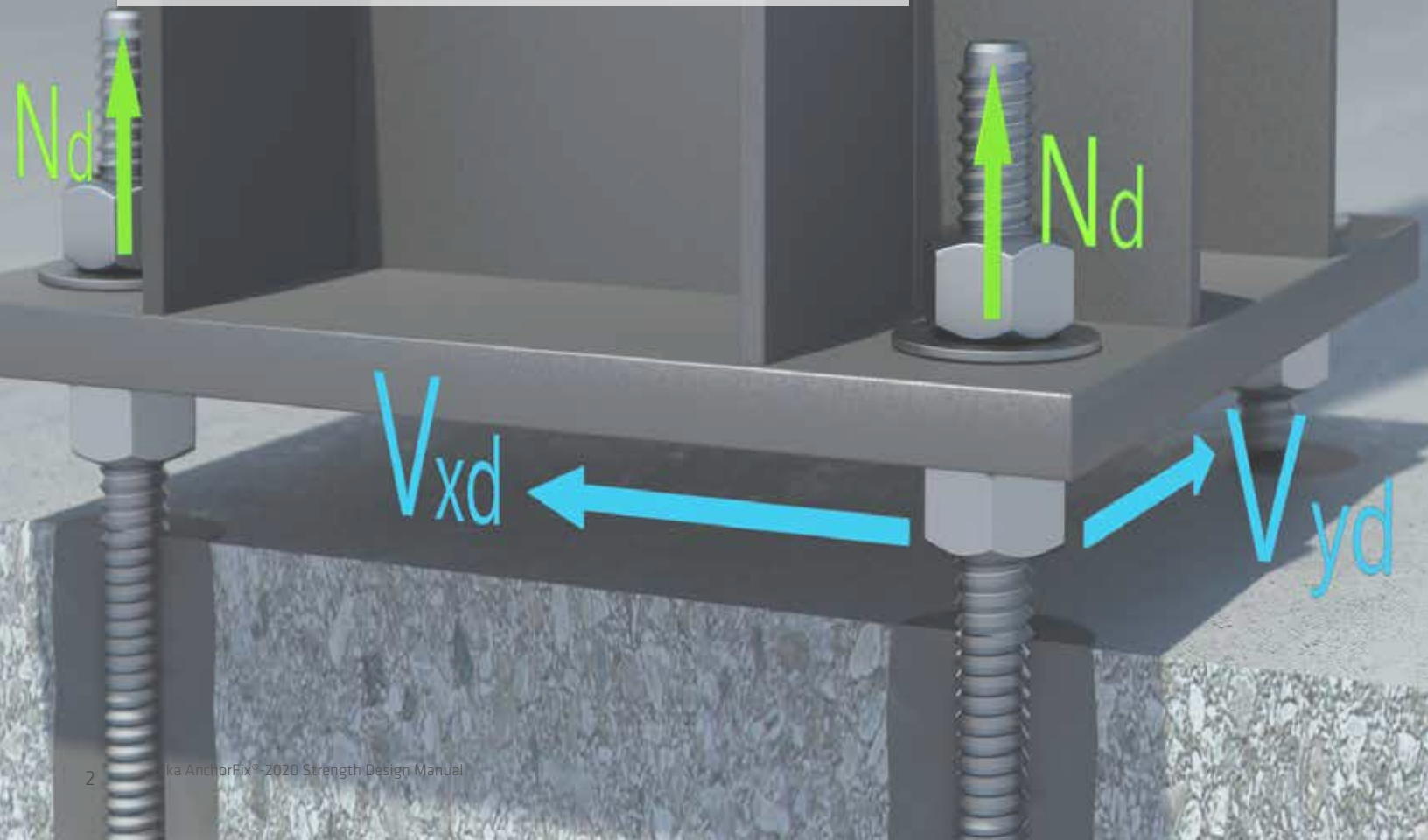
STRENGTH DESIGN MANUAL

BUILDING TRUST
CONSTRUIRE LA CONFIANCE



CONTENT

04	General Information (Tables 1, 2)
05	Specifications and Physical Properties (Tables 3, 4)
06	Steel Design Information (Tables 5, 6)
08	Concrete Breakout Design Information (Tables 7, 8)
09	Bond Strength Design Information (Tables, 9, 10, 11, 12)
14	Tension Design Strength in Dry Hole Condition (Tables 13, 14, 15, 16)
18	Accessories



Sika AnchorFix®-2020

PRODUCT DESCRIPTION

Sika AnchorFix®-2020 is a two-component, solvent and styrene-free, epoxy acrylate-based anchoring adhesive engineered for application down to -10 °C. Sika AnchorFix®-2020 achieves high early strengths quickly in numerous base materials and is suitable for medium / heavy loads in both structural and non-structural applications.

FEATURES

- Fast curing - cures down to -10 °C when material is pre-conditioned to 5 °C.
- Cartridge format compatible with standard application guns.
- High load capacity.
- Suitable for cracked and uncracked concrete.
- Styrene-free, VOC-compliant and odourless.
- Non-sag, may be applied overhead.
- Sets up in dry or damp holes.
- Approved for threaded rods and reinforcing bars in concrete.
- Approved for threaded bars and sockets in masonry.
- Reduced edge and spacing values allowing critical applications.
- Reduced drilling diameters of 2 mm clearance resulting in economic installation.
- Flexible embedment depths from 8d -12d.
- Resistant to a wide range of chemicals. Contact Sika Canada for detailed information.

Head Type					Base Material				Corrosion Resistance			Features										
Stud (Externally Threaded)	Flush or Internally Threaded	Rebar	Hex Bolt	Round/ Mushroom	Concrete	Lightweight Concrete	Grout-filled Block	Hollow Block/ Brick	Hot-Dip Galvanized Steel	304 Stainless Steel	316 Stainless Steel	Seismic	Cracked Concrete	Uncracked Concrete	Dry / Water-Saturated Concrete	Water-filled	Unreinforced Brick	Oversized Holes	Cored Holes	Submerged	Overhead	
■	■	■			■	■	■	■	■	■	■	■*	■	■	■	■						■

* Only with threaded rods

APPROVALS AND LISTINGS

- ANSI/NSF Standard 61 approved for contact with potable water.
- Seismic Design Categories: C, D, E & F under the IBC or IRC.
- ES to AC308 by IAPMO (ER-0601) - approved for cracked and uncracked concrete.
- Evaluation in progress for The Road Authority (TRA) and Ministry of Transportation of Ontario (MTO) - 9.30.25 prequalification list for Structural Dowel Adhesives - Acrylic and Epoxy Resins.
- Ministère des Transports du Québec
- IBC/IRC

PACKAGING

- 300 mL (10.1 US fl. oz) Single piston cartridge, (12 per case)
- 825 mL (27.8 US fl. oz) Side-by-side 10:1 cartridge, (6 per case)

SHELF LIFE

12 months if stored properly in original and unopened packaging, in cool and dry conditions, out of direct sunlight, and at temperatures between 5 and 25 °C (41 and 77 °F). Pre-condition product to 23 °C (73 °F) to ease application when using hand dispensers and working at low temperatures.

HEALTH AND SAFETY

For information and advice on the safe handling, storage and disposal of chemical products, users should refer to the most recent Safety Data Sheet containing physical, ecological, toxicological and other safety-related data.

GENERAL INFORMATION

Table 1

INSTALLATION INFORMATION

Characteristic	Symbol	Units	Nominal Anchor Element Size								
Fractional Threaded Rods (in)	Size	d_o	in	-	3/8	1/2	5/8	3/4	1	-	1-1/4
	Drill Size	d_o	in	-	1/2	9/16	11/16	13/16	1-1/16	-	1-3/8
US Reinforcing Bars	Size	d_o	in	-	#3	#4	#5	#6	#8	-	#10
	Drill Size	d_o	in	-	9/16	5/8	3/4	1	1-1/4	-	1-5/8
Embedment Depth Range for US / fractional Sized Anchors	$h_{ef,min}$	in	-	2-3/8	2 -3/4	3-1/8	3-1/2	4	-	5	
	$h_{ef,min}$	in	-	7-1/2	10	12-1/2	15	20	-	25	
Metric Threaded Rods	Size	d_o	mm	M8	M10	M12	M16	M20	M24	M27	M30
	Drill Size	d_o	mm	10	12	14	18	22	26	30	35
Embedment Depth Range for Metric Threaded Rods	$h_{ef,min}$	mm	60	70	80	90	90	102	108	127	
	$h_{ef,max}$	mm	160	200	240	320	400	480	540	600	
Metric Reinforcing Bars	Size	d_o	mm	08	0 10	0 12	0 16	020	025	-	032
	Drill Size	d_o	mm	12	14	16	20	25	32	-	40
Embedment Depth Range for Metric Reinforcing Bars	$h_{ef,min}$	mm	60	70	80	90	90	102	-	127	
	$h_{ef,max}$	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	$h_{ef,min}$	-	$2.0 h_{ef}$								
Critical Edge Distance	C_{ac}	-	See Section 3.2.6 of IAPMO UES ER-0601								
Minimum Edge Distance	C_{min}	-	$0.5 h_{ef}$								
Minimum Anchor Spacing	S_{min}	-	$0.5 h_{ef}$								

For SI: 1 in = 25.4 mm, 1 lbf = 4.448 N. For lb/in units: 1 mm = 0.03937 in, 1 N = 0.2248 lbf.
 For use with the design provisions of ACI 318-14 Ch. 17 or ACI 318-11 Appendix D as applicable, ICC-ESAC308, Section 4.2 and IAPMO UES ER-0601.
 For No. 8 rebar an 1-1/4" ANSI drill bit is also suitable for use.
 Torque may not be applied to the anchors until the full cure time of the adhesive has been achieved.
 For ASTM A36/F1554 Grade 36 carbon steel threaded rods with 3/8-inch-diameter, $T_{max} = 11$ ft-lb.
 For installations at the reduced minimum edge distance, $C_{min,red}$, the maximum torque applied must be max torque reduced, $T_{max,red}$.
 For installations at the reduced minimum edge distance, $C_{min,red}$, the minimum spacing, $S_{min} = 5 \times da$.

Table 2

WORKING (GEL) AND LOADING (CURE) TIMES

Concrete Temperature	Gel Time ¹	Cure Time ²
-10 to 5 °C	15 min	12 h
5 to 10 °C	10 min	145 min
10 to 15 °C	8 min	85 min
15 to 20 °C	6 min	75 min
20 to 25 °C	5 min	50 min
25 to 30 °C	4 min	40 min
30 to 35 °C	2 min	30 min

Cartridge shall be conditioned to a minimum 5 °C prior to use.

¹Gel time refers to the highest temperature in the range.
²Cure time refers to the lowest temperature in the range.

SPECIFICATIONS AND PHYSICAL PROPERTIES

Table 3

COMMON THREADED CARBON AND STAINLESS STEEL ROD MATERIALS

Threaded Rod Specification		Units	Minimum Specified Ultimate Strength	Minimum Specified Yield Strength	f_{uta} / f_{ya}	Minimum Percent Elongation	Minimum Percent Reduction of Area	Specification for Nuts
Carbon Steel	ASTM F1554 Grade 36 (A 307 Gr.C) ¹	MPa (psi)	400 (58 000)	250 (36 000)	1.61	23	40	ASTM A194 Grade A
	ASTM A193 Grade B7 ¹	MPa (psi)	860 (125 000)	725 (105 000)	1.19	16	50	ASTM A194
	ISO 898-1 Class 5.8 ¹	MPa (psi)	500 (72 500)	400 (58 000)	1.25	22	35	DIN 934 (Grade 6)
	ISO 898-1 Class 8.8 ²	MPa (psi)	800 (116 000)	640 (92 800)	1.25	12	52	DIN 934 (Grade 8)
Stainless Steel	ASTM F593 CW1 (1/4 - 5/8) ²	MPa (psi)	690 (100 000)	450 (65 000)	1.54	20	-	F594
	ASTM F593 CW2 (3/4 - 1 1/4) ²	MPa (psi)	585 (85 000)	310 (45 000)	1.89	25	-	F594
	ASTM F593 SH1 ²	MPa (psi)	800 (115 000)	620 (90 000)	1.28	12	-	-
	ASTM F593 SH2 ²	MPa (psi)	725 (105 000)	480 (70 000)	1.50	15	-	-
	ASTM F593 SH3 ²	MPa (psi)	655 (95 000)	380 (55 000)	1.73	20	-	-
	ISO 3506 -1 A4-70 ²	MPa (psi)	700 (101 500)	450 (65 250)	1.56	40	-	ISO 4032
	ISO 3506-1 A4-80 ²	MPa (psi)	800 (116 000)	600 (87 000)	1.33	30	-	-

For SI: 1 in = 25.4 mm, 1 lbf = 4.448 N. For lb/in units: 1 mm = 0.03937 in, 1 N = 0.2248 lbf.

¹ Rods are considered ductile steel elements in accordance with Sections 4.3.4.1, 4.3.4.2 and 4.3.5 of IAPMO UES ER-0601.

² Rods are considered brittle steel elements in accordance with Sections 4.3.4.1, 4.3.4.2 and 4.3.5 of IAPMO UES ER-0601.

Table 4

COMMON STEEL DEFORMED REINFORCING BARS

Reinforcing Bar Specification	Units	Minimum Specified Ultimate Strength, f_{uta}	Minimum Specified Yield Strength, f_{ya}
ASTM A615 Grade 40	MPa (psi)	415 (60 000)	275 (40 000)
ASTM A615 Grade 60	MPa (psi)	620 (90 000)	415 (60 000)
DIN 488 BSt 500	MPa (psi)	550 (79 750)	500 (72 500)

For SI: 1 in = 25.4 mm, 1 lbf = 4.448 N. For lb/in units: 1 mm = 0.03937 in, 1 N = 0.2248 lbf.

STEEL DESIGN INFORMATION

Table 5

US CUSTOMARY STEEL THREADED RODS AND REINFORCING BAR STEEL GRADES¹

	Characteristic	Symbol	Units	Nominal Anchor Element Diameter					
				3/8	1/2	5/8	3/4	1	1-1/4
Fractional Threaded Rods	Nominal Anchor Diameter	d_a	in	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}	kN (lb)	20 (4495)	36.6 (8230)	58.3 (13 110)	86.2 (19 370)	156.4 (35 150)	250.0 (56 200)
	Tension Resistance of Carbon Steel ASTM A 193 B7	N_{sa}	kN (lb)	43.1 (9690)	78.9 (17 740)	125.7 (28 250)	185.7 (41 750)	337.0 (75 750)	538.8 (121 125)
	Tension Resistance of Stainless Steel ASTM F 593 CW1	N_{sa}	kN (lb)	34.5 (7750)	63.1 (14 190)	100.5 (22 600)	-	-	-
	Tension Resistance of Stainless Steel ASTM F 593 CW2	N_{sa}	kN (lb)	-	-	-	126.3 (28 390)	229.1 (51 510)	366.4 (82 365)
	Tension Resistance of Stainless Steel ASTM F 593 SH1	N_{sa}	kN (lb)	39.7 (8915)	72.6 (16 320)	115.6 (25 990)	-	-	-
	Tension Resistance of Stainless Steel ASTM F 593 SH2	N_{sa}	kN (lb)	-	-	-	156.0 (35 070)	283.0 (63 630)	-
	Tension Resistance of Stainless Steel ASTM F 593 SH3	N_{sa}	kN (lb)	-	-	-	-	-	409.5 (92 055)
	Shear Resistance of Carbon Steel ASTM F 1554 Grade 36 (A 307 Gr. C)	V_{sa}	kN (lb)	10.0 (2250)	220.0 (4940)	35.0 (7865)	51.7 (11 625)	938 (21 090)	150.0 (33 720)
	Shear Resistance of Carbon Steel ASTM A 193 B7	V_{sa}	kN (lb)	21.6 (4845)	47.4 (10 645)	75.4 (16 950)	111.4 (25 050)	202.2 (45 450)	323.3 (72 675)
	Shear Resistance of Stainless Steel ASTM F 593 CW1	V_{sa}	kN (lb)	17.2 (3875)	31.6 (7095)	50.3 (11 300)	-	-	-
	Shear Resistance of Stainless Steel ASTM F 593 CW2	V_{sa}	kN (lb)	-	-	-	63.1 (14 195)	114.6 (25 755)	183.2 (41 185)
	Shear Resistance of Stainless Steel ASTM F 593 SH1	V_{sa}	kN (lb)	19.8 (4455)	43.5 (9790)	69.4 (15 595)	-	-	-
	Shear Resistance of Stainless Steel ASTM F 593 SH2	V_{sa}	kN (lb)	-	-	-	78.0 (17 535)	141.5 (31 815)	-
	Shear Resistance of Stainless Steel ASTM F 593 SH3	V_{sa}	kN (lb)	-	-	-	-	-	204.8 (46 030)
	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	in	3/8 (#3)	1/2 (#4)	5/8 (#5)	3/4 (#6)	1.000
Stress Area ²		A_{se}	in ²	0.11	0.20	0.31	0.44	0.79	1.27
Tension Resistance of Reinforcing Bars ASTM A 615 Grade 40		N_{sa}	kN (lb)	29.4 (6600)	53.4 (12 000)	82.7 (18 600)	117.4 (26 400)	210.8 (47 400)	339.0 (76 200)
Tension Resistance of Reinforcing Bars ASTM A 615 Grade 60		N_{sa}	kN (lb)	44.0 (9900)	80.1 (18 000)	124.1 (27 900)	176.1 (39 600)	316.3 (71 100)	508.4 (114 300)
Shear Resistance of Reinforcing Bars ASTM A 615 Grade 40		V_{sa}	kN (lb)	17.6 (3960)	32.0 (7200)	49.6 (11 160)	70.5 (15 840)	126.5 (28 440)	203.4 (45 720)
Shear Resistance of Reinforcing Bars ASTM A 615 Grade 60		V_{sa}	kN (lb)	26.4 (5940)	48.0 (10 800)	74.5 (16 740)	105.7 (23 760)	189.8 (42 660)	305.1 (68 580)
Strength Reduction Factor for Tension Steel Failure ³		ϕ	-	0.75					
Strength Reduction Factor for Shear Steel Failure ³		ϕ	-	0.65					

For SI: 1 in = 25.4 mm, 1 lbf = 4.448 N. For lb/in units: 1 mm = 0.03937 in, 1 N = 0.2248 lbf.

¹Values 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). Nuts and washers shall be appropriate for the rod as set forth in Table 3 of this report.

²Stress area is minimum stress area applicable for either tension or shear.

³Tabulated value of ϕ complies with ACI 318-14 17.3.3 (ACI 318-11 D.4.3) and applies when the load combinations of Section 1605.1 of the IBC or ACI 318-14

5.3 (ACI 318-11 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.

STEEL DESIGN INFORMATION

Table 6

METRIC THREADED ROD AND REINFORCING BAR STEEL GRADES¹

	Characteristic	Symbol	Units	Nominal Anchor Element Diameter							
				M8	M10	M12	M16	M20	M24	M27	M30
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 (4144)	29.0 (6519)	42.0 (9476)	78.5 (17 647)	122.5 (27 539)	176.5 (39 679)	229.5 (51 594)	280.5 (63 059)
	Tension Resistance of Carbon Steel ISO 898 Class 8.8	N_{sa}	kN (lb)	29.3 (6582)	46.5 (10 431)	67.5 (15 161)	125.5 (28 236)	196.0 (44 063)	282.5 (63 486)	367.0 (82 550)	449.0 (100 894)
	Tension Resistance of Stainless Steel ISO 3506-1 A4-70	N_{sa}	kN (lb)	26.0 (5845)	40.6 (9127)	59.0 (13 266)	109.9 (24 707)	171.5 (38 555)	247.1 (55 550)	321.0 (72 163)	392.7 (88 282)
	Tension Resistance of Stainless Steel ISO 3506-1 A4-80	N_{sa}	kN (lb)	29.0 (6519)	46.6 (10 431)	67.4 (15 161)	125.6 (28 236)	196.0 (44 063)	282.4 (63 486)	367.0 (82 504)	448.8 (100 894)
	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 (10 588)	73.5 (16 523)	106.0 (23 807)	137.5 (30 956)	168.5 (37 835)
	Shear Resistance of Carbon Steel ISO 898 Class 8.8	V_{sa}	kN (lb)	17.6 (3949)	23.0 (52 16)	40.5 (9097)	75.5 (16 942)	117.5 (26 438)	169.5 (38 092)	220.5 (49 530)	269.5 (60 537)
	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 (14 824)	102.9 (32 133)	148.3 (33 330)	161.0 (36 194)	235.6 (52 969)
	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 (16 942)	117.6 (26 438)	169.4 (38 092)	184.0 (41 364)	269.3 (60 537)
	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	10	12	16					
	Stress Area ²	A_{se}	mm ²	78.5	113.0	201.0					
	Tension Resistance of Reinforcing Bars DIN 488 BSt 500	N_{sa}	kN (lb)	43.2 (9706)	62.2 (13 972)	110.6 (24 853)					
	Shear Resistance of Reinforcing Bars DIN 488 BSt 500	V_{sa}	kN (lb)	25.9 (5824)	37.3 (8383)	66.3 (14 912)					
	Strength Reduction Factor for Tension Steel Failure ³	ϕ	-	0.65							
	Strength Reduction Factor for Shear Steel Failure ³	ϕ	-	0.60							

For SI: 1 in = 25.4 mm, 1 lbf = 4.448 N. For lb/in units: 1 mm = 0.03937 in, 1 N = 0.2248 lbf.

¹Values 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). Nuts and washers shall be appropriate for the rod as set forth in Table 3 of this report.

²Stress area is minimum stress area applicable for either tension or shear.

³Tabulated value of ϕ complies with ACI 318-14 17.3.3 (ACI 318-11 D.4.3) and applies when the load combinations of 1605.1 of the IBC or ACI 318-14 5.3 (ACI 318-11 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.

CONCRETE BREAKOUT DESIGN INFORMATION

Table 7

FRACTIONALLY SIZED THREADED RODS AND US REINFORCING BARS

Design Information	Symbol	Units	Nominal Anchor Element Diameter					
			3/8 in #3	1/2 in #4	5/8 in #5	3/4 in #6	1 in #8	1-1/4 in #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}	mm in	$C_{ac} = h_{ef} \cdot \left(\frac{\tau_{uncr}}{8} \right)^{0.4} \cdot [3.1-0.7 \frac{h}{h_{ef}}] \mid C_{ac} = h_{ef} \cdot \left(\frac{\tau_{uncr}}{1160} \right)^{0.4} \cdot [3.1-0.7 \frac{h}{h_{ef}}]$					
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					

Table 8

METRIC SIZED THREADED RODS AND METRIC SIZED REINFORCING BARS

Design Information	Symbol	Units	Nominal Anchor Element Diameter							
			M8 8 mm	M10 10 mm	M12 12 mm	M16 16 mm	M20 20 mm	M24 24 mm	M27 27 mm	M30 30 mm
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}	mm in	$C_{ac} = h_{ef} \cdot \left(\frac{\tau_{uncr}}{8} \right)^{0.4} \cdot [3.1-0.7 \frac{h}{h_{ef}}] \mid C_{ac} = h_{ef} \cdot \left(\frac{\tau_{uncr}}{1160} \right)^{0.4} \cdot [3.1-0.7 \frac{h}{h_{ef}}]$							
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							

For SI: 1 in = 25.4 mm, 1 lbf = 4.448 N. For lb/in units: 1 mm = 0.03937 in, 1 N = 0.2248 lbf.

1. Characteristic bond strengths are for dry concrete, Max. LTT = 50 °C; Max. STT = 80 °C.

2. For installation between the minimum edge distance, c_{min} , and the reduced minimum edge distance, $c_{min,red}$, the maximum torque applied must be reduced (multiplied) by a factor of 0.45.

3. $\tau_{k,uncr}$ need not be taken as greater than: $\frac{\tau_{k,uncr} = k_{uncr} \cdot \sqrt{h_{ef} \cdot f_c}}{\pi \cdot d}$ and $\frac{h}{h_{ef}}$ need not be taken as larger than 2.4.

4. Condition A requires supplemental reinforcement, while Condition B applies where supplemental reinforcement is not provided or where pryout governs, as set forth in ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. The tabulated value of $f_{applies}$ when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of f must be determined in accordance with ACI 318 D.4.4.

BOND STRENGTH DESIGN INFORMATION

Table 9

FRACTIONAL STEEL THREADED RODS IN HAMMER DRILLED HOLES

Design Information	Symbol	Units	Nominal Anchor Element Diameter						
			3/8 in	1/2 in	5/8 in	3/4 in	1 in	1-1/4 in	
Minimum Embedment Depth	$h_{ef, min}$	in	2-3/8	2-3/4	3-1/4	3-1/2	4	5	
Maximum Embedment Depth	$h_{ef, max}$	in	7-1/2	10	12-1/2	15	20	25	
Characteristic Bond Strength in Uncracked Concrete for Sustained Tension Loading ^{2,3}	$\tau_{k, sust, uncr}$	N/mm ² (psi)	9.10 (1320)	8.53 (1237)	7.95 (1154)	7.38 (1070)	-	-	
Characteristic Bond Strength in Uncracked Concrete for Short Term Loads ^{2,3}	$\tau_{k, uncr}$	N/mm ² (psi)	9.10 (1320)	8.53 (1237)	7.95 (1154)	7.38 (1070)	-	-	
Characteristic Bond Strength in Cracked Concrete for Sustained Tension Loading ^{2,3}	$\tau_{k, sust, uncr}$	N/mm ² (psi)	4.13 (598)	5.63 (817)	5.30 (769)	4.96 (720)	4.29 (623)	3.57 (518)	
Characteristic Bond Strength in Cracked Concrete for Short Term Loads ^{2,3}	$\tau_{k, cr}$	N/mm ² (psi)	4.13 (598)	5.63 (817)	5.30 (769)	4.96 (720)	4.29 (623)	3.57 (518)	
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		$\phi_{N, seis}$	-	1.00	0.41	0.54	1.00	0.50	0.96

For S1: 1 in = 25.4 mm, 1 lbf = 4.448 N. For lb/in units: 1 mm = 0.03937 in, 1 N = 0.2248 lbf.

¹Bond strength values correspond to concrete compressive strength, $f'_c = 2500$ psi. Bond strength values shall not be increased for concrete compressive strength.

²Maximum long term temperature: 50 °C; maximum short-term temperature: 80 °C.

³Short 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.

⁴The tabulated value of ϕ applies when load combinations of Section 1605.2 of the IBC or ACI 318-14 5.3 (ACI 318-11 9.2), are used in accordance with ACI 318-14 17.3.3 (ACI 318-11 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 D.4.4.

⁵The values of ϕ correspond to Condition B as described in ACI 318-14 17.3.3 (ACI 318-11 D.4.3) 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.

BOND STRENGTH DESIGN INFORMATION

Table 10

METRIC STEEL THREADED RODS IN HAMMER DRILLED HOLES

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	$h_{ef,max}$	mm	160	200	240	320	400	480	540	600	
Characteristic Bond Strength in Uncracked Concrete for Sustained Tension Loading ^{2,3}	$\tau_{k,sust,uncr}$	N/mm ² (psi)	9.38 (1360)	9.02 (1308)	8.65 (1255)	7.93 (1150)	7.21 (1045)	-	-	-	
Characteristic Bond Strength in Uncracked Concrete for Short Term Loads ^{2,3}	$\tau_{k,uncr}$	N/mm ² (psi)	9.38 (1360)	9.02 (1308)	8.65 (1255)	7.93 (1150)	7.21 (1045)	-	-	-	
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
		\emptyset_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
		\emptyset_{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
		\emptyset_{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
		\emptyset_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
		\emptyset_{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
		\emptyset_{wf}	-	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Reduction for Seismic Tension		$a_{N,seis}$	-	0.34	0.41	0.54	0.36	0.50	0.50	0.45	

For SI: 1 in = 25.4 mm, 1 lbf = 4.448 N. For lb/in units: 1 mm = 0.03937 in, 1 N = 0.2248 lbf.

¹Bond strength values correspond to concrete compressive strength, $f'_c = 2500$ psi. Bond strength values shall not be increased for concrete compressive strength.

²Maximum long term temperature: 50 °C; maximum short-term temperature: 80 °C.

³Short 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.

⁴The tabulated value of \emptyset applies when load combinations of Section 1605.2 of the IBC or ACI 318-14 5.3 (ACI 318-11 9.2), are used in accordance with ACI 318-14 17.3.3 (ACI 318-11 D.4.3). If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of \emptyset shall be determined in accordance with ACI 318-11 D.4.4.

⁵The values of \emptyset correspond to Condition B as described in ACI 318-14 17.3.3 (ACI 318-11 D.4.3) 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 \emptyset shall be determined.

BOND STRENGTH DESIGN INFORMATION

Table 11

US REINFORCING BARS IN HAMMER DRILLED HOLES USED AS ANCHOR ELEMENTS

Design Information	Symbol	Units	Nominal Anchor Element Diameter				
			#3	#4	#5	#6	
Minimum Embedment Depth	$h_{ef,min}$	in	2-3/8	2-3/4	3-1/4	3-1/2	
Maximum Embedment Depth	$h_{ef,max}$	in	7-1/2	10	12-1/2	15	
Characteristic Bond Strength in Uncracked Concrete for Sustained Tension Loading ^{2,3}	$\tau_{k,sust,uncr}$	N/mm ² (psi)	8.70 (1262)	8.10 (1174)	7.49 (1087)	6.89 (1000)	
Characteristic Bond Strength in Uncracked Concrete for Short Term Loads ^{2,3}	$\tau_{k,uncr}$	N/mm ² (psi)	8.70 (1262)	8.10 (1174)	7.49 (1087)	6.89 (1000)	
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

For SI: 1 in = 25.4 mm, 1 lbf = 4.448 N. For lb/in units: 1 mm = 0.03937 in, 1 N = 0.2248 lbf.

¹Bond strength values correspond to concrete compressive strength, $f'_c = 2500$ psi. Bond strength values shall not be increased for concrete compressive strength.

²Maximum long term temperature: 50 °C; maximum short-term temperature: 80 °C.

³Short 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.

⁴The tabulated value of ϕ applies when load combinations of Section 1605.2 of the IBC or ACI 318-14 5.3 (ACI 318-11 9.2), are used in accordance with ACI 318-14 17.3.3 (ACI 318-11 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 D.4.4.

⁵The values of ϕ correspond to Condition B as described in ACI 318-14 17.3.3 (ACI 318-11 D.4.3) 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.

BOND STRENGTH DESIGN INFORMATION

Table 12

METRIC REINFORCING BARS IN HAMMER DRILLED HOLES USED AS ANCHOR ELEMENTS

Design Information		Symbol	Units	Nominal Anchor Element Diameter		
				ø10 mm	ø12 mm	ø16 mm
Minimum Embedment Depth		$h_{ef,min}$	mm	60	70	83
Maximum Embedment Depth		$h_{ef,max}$	mm	200	240	320
Characteristic Bond Strength in Uncracked Concrete for Sustained Tension Loading ^{2,3}		$\tau_{k,sust,uncr}$	N/mm ² (psi)	8.61 (1249)	8.23 (1193)	7.47 (1083)
Characteristic Bond Strength in Uncracked Concrete for Short Term Loads ^{2,3}		$\tau_{k,uncr}$	N/mm ² (psi)	8.61 (1249)	8.23 (1193)	7.47 (1083)
Permissible Installation Conditions, Periodic Special Inspection	Dry Concrete	<i>Anchor Category</i>	-	2	2	2
		ϕ_d	-	0.55	0.55	0.55
	Water-saturated Concrete	<i>Anchor Category</i>	-	1	2	2
		ϕ_{ws}	-	0.65	0.55	0.55
	Water-filled Holes	<i>Anchor Category</i>	-	3	3	3
		ϕ_{wf}	-	0.45	0.45	0.45
Permissible Installation Conditions, Continuous Special Inspection	Dry Concrete	<i>Anchor Category</i>	-	1	1	1
		ϕ_d	-	0.65	0.65	0.65
	Water-saturated Concrete	<i>Anchor Category</i>	-	1	1	1
		ϕ_{ws}	-	0.65	0.65	0.65
	Water-filled Holes	<i>Anchor Category</i>	-	1	1	1
		ϕ_{wf}	-	0.65	0.65	0.65

For SI: 1 in = 25.4 mm, 1 lbf = 4.448 N. For lb/in units: 1 mm = 0.03937 in, 1 N = 0.2248 lbf.

¹Bond strength values correspond to concrete compressive strength, $f'_c = 2500$ psi. Bond strength values shall not be increased for concrete compressive strength.

²Maximum long term temperature: 50 °C; maximum short-term temperature: 80 °C.

³Short 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.

⁴The tabulated value of ϕ applies when load combinations of Section 1605.2 of the IBC or ACI 318-14 5.3 (ACI 318-11 9.2), are used in accordance with ACI 318-14 17.3.3 (ACI 318-11 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 D.4.4.

⁵The values of ϕ correspond to Condition B as described in ACI 318-14 17.3.3 (ACI 318-11 D.4.3) 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.

WHERE TO USE



Cracked
Concrete



Uncracked
Concrete



Dry/
Water-Saturated
Concrete



Water-Filled
Holes



Overhead



Seismic

TENSION DESIGN STRENGTH IN DRY HOLE CONDITION

**Normal Weight Uncracked Concrete
Drilled with Hammer Drill and Carbide Bit
Temperature Range: 50 to 80 °C (122 to 176 °F)**

Table 13

Nominal Size	Embed. Depth	Minimum Concrete Compressive Strength, f'c				
		17.2 MPa (2500 psi) ØN _a or ØN _{cb}	20.7 MPa (3000 psi) ØN _a or ØN _{cb}	27.6 MPa (4000 psi) ØN _a or ØN _{cb}	41.4 MPa (6000 psi) ØN _a or ØN _{cb}	55.2 MPa (8000 psi) ØN _a or ØN _{cb}
3/8	60 (2-3/8)	10.68 (2401)	10.68 (2401)	10.68 (2401)	10.68 (2401)	10.68 (2401)
	76 (3)	13.49 (3032)	13.49 (3032)	13.49 (3032)	13.49 (3032)	13.49 (3032)
	114 (4-1/2)	20.23 (4549)	20.23 (4549)	20.23 (4549)	20.23 (4549)	20.23 (4549)
	191 (7-1/2)	33.72 (7581)	33.72 (7581)	33.72 (7581)	33.72 (7581)	33.72 (7581)
1/2	70 (2-3/4)	15.45 (3473)	15.45 (3473)	15.45 (3473)	15.45 (3473)	15.45 (3473)
	102 (4)	22.47 (5052)	22.47 (5052)	22.47 (5052)	22.47 (5052)	22.47 (5052)
	152 (6)	33.71 (7578)	33.71 (7578)	33.71 (7578)	33.71 (7578)	33.71 (7578)
	254 (10)	56.18 (12 630)	56.18 (12 630)	56.18 (12 630)	56.18 (12 630)	56.18 (12 630)
5/8	79 (3-1/8)	19.17 (4309)	20.47 (4603)	20.47 (4603)	20.47 (4603)	20.47 (4603)
	127 (5)	32.76 (7364)	32.76 (7364)	32.76 (7364)	32.76 (7364)	32.76 (7364)
	191 (7-1/2)	49.13 (11 046)	49.13 (11 046)	49.13 (11 046)	49.13 (11 046)	49.13 (11 046)
	318 (12-1/2)	81.89 (18 410)	81.89 (18 410)	81.89 (18 410)	81.89 (18 410)	81.89 (18 410)
3/4	89 (3-1/2)	22.72 (5107)	24.89 (5595)	25.51 (5736)	25.51 (5736)	25.51 (5736)
	152 (6)	43.73 (9832)	43.73 (9832)	43.73 (9832)	43.73 (9832)	43.73 (9832)
	229 (9)	65.60 (14 749)	65.60 (14 749)	65.60 (14 749)	65.60 (14 749)	65.60 (14 749)
	381 (15)	109.34 (24 581)	109.34 (24 581)	109.34 (24 581)	109.34 (24 581)	109.34 (24 581)
1	4	Not Applicable				
	8					
	12					
	20					
1-1/4	5	Not Applicable				
	10					
	15					
	25					

1. Values provided are for illustration purposes only and apply to single anchors installed in normal weight concrete without reduction for close edge or anchor spacing.
2. Calculations were performed according to ACI 318-14 Ch17 and ICC-ES AC308 for the load levels corresponding to the listed failure modes (Concrete Breakout Strength and Bond Strength). This must be checked against the corresponding steel strength with the lowest load controlling.
3. Tabular values are for static loads only. Periodic Special Inspection must be performed.
4. Where anchors are subjected to combined tension and shear loads the interaction of shear and tension must be checked according to ACI 318-14 Ch17.
5. Interpolation of tabulated values is not permitted.

**Normal Weight Cracked Concrete
Drilled with Hammer Drill and Carbide Bit
Temperature Range: 50 to 80 °C (122 to 176 °F)**

Table 14

Nominal Size	Embed. Depth	Minimum Concrete Compressive Strength, f'c				
		17.2 MPa (2500 psi) ØN _a or ØN _{cb}	20.7 MPa (3000 psi) ØN _a or ØN _{cb}	27.6 MPa (4000 psi) ØN _a or ØN _{cb}	41.4 MPa (6000 psi) ØN _a or ØN _{cb}	55.2 MPa (8000 psi) ØN _a or ØN _{cb}
3/8	60 (2-3/8)	4.84 (1088)	4.84 (1088)	4.84 (1088)	4.84 (1088)	4.84 (1088)
	76 (3)	6.11 (1374)	6.11 (1374)	6.11 (1374)	6.11 (1374)	6.11 (1374)
	114 (4-1/2)	9.17 (2061)	9.17 (2061)	9.17 (2061)	9.17 (2061)	9.17 (2061)
	191 (7-1/2)	15.28 (3434)	15.28 (3434)	15.28 (3434)	15.28 (3434)	15.28 (3434)
	70 (2-3/4)	10.20 (2294)	10.20 (2294)	10.20 (2294)	10.20 (2294)	10.20 (2294)
1/2	102 (4)	14.84 (3337)	14.84 (3337)	14.84 (3337)	14.84 (3337)	14.84 (3337)
	152 (6)	22.26 (5005)	22.26 (5005)	22.26 (5005)	22.26 (5005)	22.26 (5005)
	254 (10)	37.10 (8342)	37.10 (8342)	37.10 (8342)	37.10 (8342)	37.10 (8342)
	79 (3-1/8)	13.58 (3052)	13.64 (3067)	13.64 (3067)	13.64 (3067)	13.64 (3067)
	127 (5)	21.83 (4907)	21.83 (4907)	21.83 (4907)	21.83 (4907)	21.83 (4907)
5/8	191 (7-1/2)	32.74 (7361)	32.74 (7361)	32.74 (7361)	32.74 (7361)	32.74 (7361)
	318 (12-1/2)	54.57 (12 268)	54.57 (12 268)	54.57 (12 268)	54.57 (12 268)	54.57 (12 268)
	89 (3-1/2)	16.09 (3618)	17.17 (3859)	17.17 (3859)	17.17 (3859)	17.17 (3859)
	152 (6)	29.43 (6616)	29.43 (6616)	29.43 (6616)	29.43 (6616)	29.43 (6616)
	229 (9)	44.14 (9924)	44.14 (9924)	44.14 (9924)	44.14 (9924)	44.14 (9924)
3/4	381 (15)	73.57 (16 540)	73.57 (16 540)	73.57 (16 540)	73.57 (16 540)	73.57 (16 540)
	102 (4)	19.66 (4420)	21.54 (4842)	22.63 (5089)	22.63 (5089)	22.63 (5089)
	203 (8)	45.27 (10 178)	45.27 (10 178)	45.27 (10 178)	45.27 (10 178)	45.27 (10 178)
	305 (12)	67.90 (15 266)	67.90 (15 266)	67.90 (15 266)	67.90 (15 266)	67.90 (15 266)
	508 (20)	113.17 (25 444)	113.17 (25 444)	113.17 (25 444)	113.17 (25 444)	113.17 (25 444)
1	127 (5)	27.48 (6177)	29.41 (6611)	29.41 (6611)	29.41 (6611)	29.41 (6611)
	254 (10)	58.81 (13 222)	58.81 (13 222)	58.81 (13 222)	58.81 (13 222)	58.81 (13 222)
	381 (15)	88.22 (19 833)	88.22 (19 833)	88.22 (19 833)	88.22 (19 833)	88.22 (19 833)
	635 (25)	147.03 (33 055)	147.03 (33 055)	147.03 (33 055)	147.03 (33 055)	147.03 (33 055)
	25 (1)	33.055 (7460)	33.055 (7460)	33.055 (7460)	33.055 (7460)	33.055 (7460)

1. Values provided are for illustration purposes only and apply to single anchors installed in normal weight concrete without reduction for close edge or anchor spacing.
2. Calculations were performed according to ACI 318-14 Ch17 and ICC-ES AC308 for the load levels corresponding to the listed failure modes (Concrete Breakout Strength and Bond Strength). This must be checked against the corresponding steel strength with the lowest load controlling.
3. Tabular values are for static loads only. Periodic Special Inspection must be performed.
4. Where anchors are subjected to combined tension and shear loads the interaction of shear and tension must be checked according to ACI 318-14 Ch17.
5. Interpolation of tabulated values is not permitted.

SHEAR DESIGN STRENGTH IN DRY HOLE CONDITION

**Normal Weight Uncracked Concrete
Drilled with Hammer Drill and Carbide Bit
Temperature Range: 50 to 80 °C (122 to 176 °F)**

Table 15

Nominal Size	Embed. Depth	Minimum Concrete Compressive Strength, f _c				
		17.2 MPa (2500 psi) øV _a or øV _{cb}	20.7 MPa (3000 psi) øV _a or øV _{cb}	27.6 MPa (4000 psi) øV _a or øV _{cb}	41.4 MPa (6000 psi) øV _a or øV _{cb}	55.2 MPa (8000 psi) øV _a or øV _{cb}
3/8	60 (2-3/8)	8.46 (1903)	9.27 (2084)	10.70 (2407)	11.50 (2585)	11.50 (2585)
	76 (3)	12.59 (2830)	13.79 (3100)	15.92 (3580)	19.50 (4385)	22.52 (5063)
	114 (4-1/2)	23.13 (5199)	25.33 (5696)	29.25 (6577)	35.83 (8055)	41.37 (9301)
	191 (7-1/2)	49.76 (11 188)	54.51 (12 255)	62.94 (14 151)	72.63 (16 328)	72.63 (16 328)
	70 (2-3/4)	11.38 (2559)	12.47 (2804)	14.40 (3237)	17.64 (3965)	20.36 (4578)
1/2	102 (4)	21.53 (4839)	23.58 (5301)	27.23 (6121)	33.35 (7497)	38.51 (8657)
	152 (6)	39.54 (8890)	43.32 (9739)	50.02 (11 245)	61.26 (13 773)	70.74 (15 903)
	254 (10)	85.09 (19 129)	93.21 (20 955)	107.63 (24 196)	121.00 (27 203)	121.00 (27 203)
	79 (3-1/8)	13.95 (3136)	15.28 (3435)	17.64 (3966)	21.61 (4858)	24.95 (5609)
	127 (5)	32.26 (7253)	35.34 (7945)	40.81 (9174)	49.98 (11 236)	57.71 (12 974)
5/8	191 (7-1/2)	59.27 (13 324)	64.92 (14 596)	74.97 (16 854)	91.81 (20 642)	105.83 (23 792)
	318 (12-1/2)	127.52 (28 669)	139.69 (31 405)	161.30 (36 264)	176.38 (39 653)	176.38 (39 653)
	89 (3-1/2)	16.56 (3724)	18.15 (4079)	20.95 (4710)	25.66 (5769)	29.63 (6662)
	152 (6)	44.40 (9981)	48.63 (10 934)	56.16 (12 625)	68.78 (15 462)	79.42 (17 854)
	229 (9)	81.56 (18 336)	89.34 (20 086)	103.16 (23 194)	126.35 (28 406)	141.30 (31 766)
3/4	381 (15)	175.49 (39 453)	192.24 (43 219)	221.98 (49 905)	235.49 (52 944)	235.49 (52 944)
	25					

1. Values provided are for illustration purposes only and apply to single anchors installed in normal weight concrete without reduction for close edge or anchor spacing.
2. Calculations were performed according to ACI 318-14 Ch17 and ICC-ES AC308 for the load levels corresponding to the listed failure modes (Concrete Breakout Strength and Concrete Pryout Strength). This must be checked against the corresponding steel strength with the lowest load controlling.
3. Tabular values are for static loads only. Periodic Special Inspection must be performed.
4. Where anchors are subjected to combined tension and shear loads the interaction of shear and tension must be checked according to ACI 318-14 Ch17.
5. Interpolation of tabulated values is not permitted.

**Normal Weight Cracked Concrete
Drilled with Hammer Drill and Carbide Bit
Temperature Range: 50 to 80 °C (122 to 176 °F)**

Table 16

Nominal Size	Embed. Depth	Minimum Concrete Compressive Strength, f'c				
		17.2 MPa (2500 psi) ØV _a or ØV _{cb}	20.7 MPa (3000 psi) ØV _a or ØV _{cb}	27.6 MPa (4000 psi) ØV _a or ØV _{cb}	41.4 MPa (6000 psi) ØV _a or ØV _{cb}	55.2 MPa (8000 psi) ØV _a or ØV _{cb}
3/8	60 (2-3/8)	5.21 (1171)	5.21 (1171)	5.21 (1171)	5.21 (1171)	5.21 (1171)
	76 (3)	12.59 (2830)	13.16 (2959)	13.16 (2959)	13.16 (2959)	13.16 (2959)
	114 (4-1/2)	19.74 (4438)	19.74 (4438)	19.74 (4438)	19.74 (4438)	19.74 (4438)
	191 (7-1/2)	32.90 (7397)	32.90 (7397)	32.90 (7397)	32.90 (7397)	32.90 (7397)
	70 (2-3/4)	11.38 (2559)	12.47 (2804)	14.40 (3237)	17.64 (3965)	20.36 (4578)
1/2	102 (4)	21.53 (4839)	23.58 (5301)	27.23 (6121)	31.97 (7187)	31.97 (7187)
	152 (6)	39.54 (8890)	43.32 (9739)	47.95 (10 780)	47.95 (10 780)	47.95 (10 780)
	254 (10)	79.92 (17 967)	79.92 (17 967)	79.92 (17 967)	79.92 (17 967)	79.92 (17 967)
	79 (3-1/8)	13.95 (3136)	15.28 (3435)	17.64 (3966)	21.61 (4858)	24.95 (5609)
	127 (5)	32.26 (7 253)	35.34 (7 945)	40.81 (9174)	47.01 (10 569)	47.01 (10 569)
5/8	191 (7-1/2)	59.27 (13 324)	64.92 (14 596)	70.52 (15 854)	70.52 (15 854)	70.52 (15 854)
	318 (12-1/2)	117.53 (26 424)	117.53 (26 424)	117.53 (26 424)	117.53 (26 424)	117.53 (26 424)
	89 (3-1/2)	16.56 (3724)	18.15 (4079)	20.95 (4710)	25.66 (5769)	29.63 (6662)
	152 (6)	44.40 (9 981)	48.63 (10 934)	56.16 (12 625)	63.39 (14 250)	63.39 (14 250)
	229 (9)	81.56 (18 336)	89.34 (20 086)	95.08 (21 375)	95.08 (21 375)	95.08 (21 375)
3/4	381 (15)	158.46 (35 626)	158.46 (35 626)	158.46 (35 626)	158.46 (35 626)	158.46 (35 626)
	102 (4)	19.85 (4462)	21.74 (4888)	25.10 (5644)	30.74 (6912)	35.50 (7981)
	203 (8)	75.78 (17 038)	83.02 (18 664)	95.86 (21 921)	97.50 (21 921)	97.50 (21 921)
	305 (12)	139.23 (31 301)	146.26 (32 881)	146.26 (32 881)	146.26 (32 881)	146.26 (32 881)
	508 (20)	243.76 (54 802)	243.76 (54 802)	243.76 (54 802)	243.76 (54 802)	243.76 (54 802)
1-1/4	127 (5)	29.00 (6520)	31.77 (7142)	36.68 (8247)	44.93 (10 101)	51.88 (11 663)
	254 (10)	116.00 (26 080)	126.67 (28 479)	126.67 (28 479)	126.67 (28 479)	126.67 (28 479)
	381 (15)	190.01 (42 718)	190.01 (42 718)	190.01 (42 718)	190.01 (42 718)	190.01 (42 718)
	635 (25)	316.68 (71 196)	316.68 (71 196)	316.68 (71 196)	316.68 (71 196)	316.68 (71 196)

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2. Calculations were performed according to ACI 318-14 Ch17 and ICC-ES AC308 for the load levels corresponding to the listed failure modes (Concrete Breakout Strength and Concrete Pryout Strength). This must be checked against the corresponding steel strength with the lowest load controlling.
3. Tabular values are for static loads only. Periodic Special Inspection must be performed.
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5. Interpolation of tabulated values is not permitted.

ACCESSORIES

DISPENSING TOOLS

**Battery Side-by-Side
Dispenser**



Manual IK Dispenser



**Manual Side-by-Side
Dispenser**



**Pneumatic Side-by-Side
Dispenser**



PACKAGING CONFIGURATIONS



Single Piston

300 ml (10.1 US fl. oz)



Side-by-Side Cartridge

825 ml (27.8 US fl. oz)



MIXER NOZZLE

KW

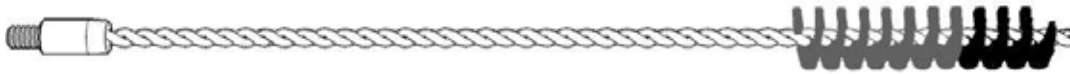


HOLE CLEANING BRUSHES

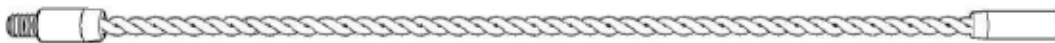
Hole cleaning brush with loop handle



Hole cleaning brush with male ferrule



Hole cleaning brush extension piece



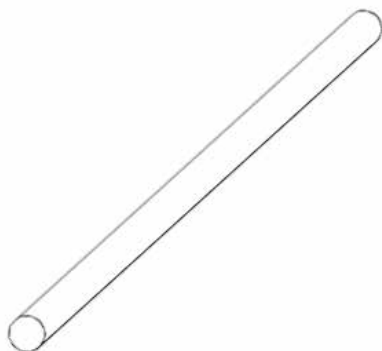
Hole cleaning brush extension handle



Hole Cleaning Brush	H14	H20	H29	H40
Brush Diameter, d_b	14 mm	20 mm	29 mm	40 mm

EXTENSION TUBES AND RESIN STOPPERS

Straight Extensions
(11 mm OD)



Flexible Tubes
(14 mm OD)



Resin Stoppers



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