ET-3G™ Epoxy Adhesive

ET-3G Cure Schedule

Base Material Temperature		Gel Time (minutes)	Cure Time (hr.)
°F	°C		
50	10	100	72
60	16	75	48
70	21	50	24
90	32	30	24
110	43	18	24

For water-saturated concrete, the cure times must be doubled.

ET-3G Typical Properties

Property		Class C (>60°F)	Test Method
Consistency		Non-sag	ASTM C881
Bond Strength, Slant Shear	Hardened to Hardened Concrete, 2-Day Cure[1]	2,600 psi	ASTM C882
	Hardened to Hardened Concrete, 14-Day Cure[1]	2,900 psi	
	Fresh to Hardened Concrete, 14-Day Cure[2]	2,000 psi	
Compressive Yield Strength, 7-Day Cure[1]		13,000 psi	ASTM D695
Compressive Modulus, 7-Day Cure[1]		580,000 psi	ASTM D695
Heat Deflection Temperature, 7-Day Cure[2]		132°F (56°C)	ASTM D648
Glass Transition Temperature, 7-Day Cure[2]		124°F (51°C)	ASTM E1356
Decomposition Temperature, 24-Hour Cure[2]		500°F (260°C)	ASTM E2550
Water Absorption, 24-Hours, 7-Day Cure[2]		0.15%	ASTM D570
Shore D Hardness, 24-Hour Cure[2]		84	ASTM D2240
Linear Coefficient of Shrinkage, 7-Day Cure[2]		0.002 in./in.	ASTM D2566
Coefficient of Thermal Expansion[2]		2.4 x 10^{-5} in./in.°F	ASTM C531

1. Material and curing conditions: 60° ± 2°F.
2. Material and curing conditions: 73° ± 2°F.

ET-3G Installation Information and Additional Data for Threaded Rod and Rebar[1]

IBC *

Characteristic		Symbol	Units	Nominal Anchor Diameter (in.) / Rebar Size						
				⅜ / #3	½ / #4	⅝ / #5	¾ / #6	⅞ / #7	1 / #8	1¼ / #10
Installation Information										
Drill Bit Diameter		d_{hole}	in.	½	⅝	¾	⅞	1	1⅛	1⅜
Maximum Tightening Torque		T_{inst}	ft.-lb.	10	20	30	45	60	80	125
Permitted Embedment Depth Range	Minimum	h_{ef}	in.	2⅜	2¾	3⅛	3½	3¾	4	5
	Maximum	h_{ef}	in.	7½	10	12½	15	17½	20	25
Minimum Concrete Thickness		h_{min}	in.	$h_{ef} + 5d_{hole}$						
Critical Edge Distance[2]		c_{ac}	in.	See footnote 2						
Minimum Edge Distance		c_{min}	in.	1¾						2¾
Minimum Anchor Spacing		s_{min}	in.	3						6

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-19, ACI 318-14 and ACI 318-11.
2. $c_{ac} = h_{ef}\,(\tau_{k,uncr}/1{,}160)^{0.4} \times [3.1 - 0.7(h/h_{ef})]$, where:
   $[h/h_{ef}] \le 2.4$
   $\tau_{k,uncr}$ = the characteristic bond strength in uncracked concrete, given in the tables that follow $\le k_{uncr}\,((h_{ef} \times f'_c)^{0.5}/(\pi \times d_{hole}))$
   h = the member thickness (inches)
   h_{ef} = the embedment depth (inches)

*See p. 14 for an explanation of the load table icons.

ET-3G™ Design Information — Concrete

ET-3G Tension Strength Design Data for Threaded Rod[1,11]

Characteristic			Symbol	Units	Nominal Anchor Diameter (in.)						
					⅜	½	⅝	¾	⅞	1	1¼
Steel Strength in Tension											
Threaded Rod	Minimum Tensile Stress Area		A_{se}	in²	0.078	0.142	0.226	0.334	0.462	0.606	0.969
	Tension Resistance of Steel — ASTM F1554, Grade 36		N_{sa}	lb.	4,525	8,235	13,110	19,370	26,795	35,150	56,200
	Tension Resistance of Steel — ASTM A193, Grade B7				9,750	17,750	28,250	41,750	57,750	75,750	121,125
	Tension Resistance of Steel — Type 410 Stainless (ASTM A193, Grade B6)				8,580	15,620	24,860	36,740	50,820	66,660	106,590
	Tension Resistance of Steel — Types 304 and 316 Stainless (ASTM A193, Grade B8 and B8M)				4,445	8,095	12,880	19,040	26,335	34,540	55,235
	Strength Reduction Factor — Steel Failure		ϕ	—	0.75[7]						
Concrete Breakout Strength in Tension (2,500 psi ≤ f'_c ≤ 8,000 psi)[10]											
Effectiveness Factor — Uncracked Concrete			k_{uncr}	—	24						
Effectiveness Factor — Cracked Concrete			k_{cr}	—	17						
Strength Reduction Factor — Breakout Failure			ϕ	—	0.65[7]						
Bond Strength in Tension (2,500 psi ≤ f'_c ≤ 8,000 psi)[10]											
Uncracked Concrete[2,3,4]	Characteristic Bond Strength[5]		$\tau_{k,uncr}$	psi	See **strongtie.com** for values						
	Permitted Embedment Depth Range	Minimum	h_{ef}	in.	2⅜	2¾	3⅛	3½	3¾	4	5
		Maximum			7½	10	12½	15	17½	20	25
Cracked Concrete[2,3,4]	Characteristic Bond Strength[5,8,9]		$\tau_{k,cr}$	psi	See **strongtie.com** for values						
	Permitted Embedment Depth Range	Minimum	h_{ef}	in.	3	4	5	6	7	8	10
		Maximum			7½	10	12½	15	17½	20	25
Bond Strength in Tension — Bond Strength Reduction Factors for Continuous Special Inspection											
Strength Reduction Factor — Dry Concrete			$\phi_{dry,ci}$	—	0.65[7]						
Strength Reduction Factor — Water-Saturated Concrete — $h_{ef} \le 12d_a$			$\phi_{sat,ci}$	—	0.55[7]	0.45[7]					
Additional Factor for Water-Saturated Concrete — $h_{ef} \le 12d_a$			$K_{sat,ci}$[6]	—	1					0.84	
Strength Reduction Factor — Water-Saturated Concrete — $h_{ef} > 12d_a$			$\phi_{sat,ci}$	—	0.45[7]						
Additional Factor for Water-Saturated Concrete — $h_{ef} > 12d_a$			$K_{sat,ci}$[6]	—	0.57						
Bond Strength in Tension — Bond Strength Reduction Factors for Periodic Special Inspection											
Strength Reduction Factor — Dry Concrete			$\phi_{dry,pi}$	—	0.55[7]						
Strength Reduction Factor — Water-Saturated Concrete — $h_{ef} \le 12d_a$			$\phi_{sat,pi}$	—	0.45[7]						
Additional Factor for Water-Saturated Concrete — $h_{ef} \le 12d_a$			$K_{sat,pi}$[6]	—	1	0.93				0.71	
Strength Reduction Factor — Water-Saturated Concrete — $h_{ef} > 12d_a$			$\phi_{sat,pi}$	—	0.45[7]						
Additional Factor for Water-Saturated Concrete — $h_{ef} > 12d_a$			$K_{sat,pi}$[6]	—	0.48						

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-19, ACI 318-14 and ACI 318-11.
2. Temperature Range: Maximum short-term temperature = 150°F, Maximum long-term temperature = 110°F.
3. Short-term concrete temperatures are those that occur over short intervals (diurnal cycling).
4. Long-term temperatures are roughly constant over significant periods of time.
5. For anchors that only resist wind or seismic loads, bond strengths may be increased by 72%.
6. In water-saturated concrete, multiply $\tau_{k,uncr}$ and $\tau_{k,cr}$ by K_{sat}.
7. The tabulated value of ϕ applies when the load combinations from the IBC or ACI 318 are used and the requirements of ACI 318-19 17.5.3, ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, are met. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
8. For anchors installed in regions assigned to Seismic Design Category C, D, E or F, the bond strength values for ⅞" anchors must be multiplied by $\alpha_{N,seis} = 0.80$.
9. For anchors installed in regions assigned to Seismic Design Category C, D, E or F, the bond strength values for 1" anchors must be multiplied by $\alpha_{N,seis} = 0.92$.
10. The values of f'_c used for calculation purposes must not exceed 8,000 psi (55.1 MPa) for uncracked concrete. The value of f'_c used for calculation purposes must not exceed 2,500 psi (17.2 MPa) for tension resistance in cracked concrete.
11. For lightweight concrete, the modification factor for bond strength shall be as given in ACI 318-19 17.2.4, ACI 318-14 17.2.6 or ACI 318-11 D.3.6, as applicable, where applicable.

*See p. 14 for an explanation of the load table icons.

ET-3G™ Design Information — Concrete

ET-3G Tension Strength Design Data for Rebar[1,9]

*

Characteristic			Symbol	Units	Rebar Size #3	#4	#5	#6	#7	#8	#10
Steel Strength in Tension											
Rebar	Minimum Tensile Stress Area		A_{se}	in^2	0.11	0.2	0.31	0.44	0.6	0.79	1.23
Rebar	Tension Resistance of Steel — Rebar (ASTM A615 Grade 60)		N_{sa}	lb.	9,900	18,000	27,900	39,600	54,000	71,100	110,700
Rebar	Strength Reduction Factor — Steel Failure		ϕ	—	0.65[7]						
Concrete Breakout Strength in Tension (2,500 psi ≤ f'_c ≤ 8,000 psi)[8]											
Effectiveness Factor — Uncracked Concrete			k_{uncr}	—	24						
Effectiveness Factor — Cracked Concrete			k_{cr}	—	17						
Strength Reduction Factor — Breakout Failure			ϕ	—	0.65[7]						
Bond Strength in Tension (2,500 psi ≤ f'_c ≤ 8,000 psi)[8]											
Uncracked Concrete[2,3,4]	Characteristic Bond Strength[5]		$\tau_{k,uncr}$	psi	See **strongtie.com** for values						
Uncracked Concrete[2,3,4]	Permitted Embedment Depth Range	Minimum	h_{ef}	in.	2⅜	2¾	3⅛	3½	3¾	4	5
Uncracked Concrete[2,3,4]	Permitted Embedment Depth Range	Maximum	h_{ef}	in.	7½	10	12½	15	17½	20	25
Cracked Concrete[2,3,4]	Characteristic Bond Strength[5]		$\tau_{k,cr}$	psi	See **strongtie.com** for values						
Cracked Concrete[2,3,4]	Permitted Embedment Depth Range	Minimum	h_{ef}	in.	3	4	5	6	7	8	10
Cracked Concrete[2,3,4]	Permitted Embedment Depth Range	Maximum	h_{ef}	in.	7½	10	12½	15	17½	20	25
Bond Strength in Tension — Bond Strength Reduction Factors for Continuous Special Inspection											
Strength Reduction Factor — Dry Concrete			$\phi_{dry,ci}$	—	0.65[7]						
Strength Reduction Factor — Water-Saturated Concrete – $h_{ef} \leq 12d_a$			$\phi_{sat,ci}$	—	0.55[7]		0.45[7]				
Additional Factor for Water-Saturated Concrete – $h_{ef} \leq 12d_a$			$K_{sat,ci}$[6]	—	1					0.84	
Strength Reduction Factor — Water-Saturated Concrete – $h_{ef} > 12d_a$			$\phi_{sat,ci}$	—	0.45[7]						
Additional Factor for Water-Saturated Concrete – $h_{ef} > 12d_a$			$K_{sat,ci}$[6]	—	0.57						
Bond Strength in Tension — Bond Strength Reduction Factors for Periodic Special Inspection											
Strength Reduction Factor — Dry Concrete			$\phi_{dry,pi}$	—	0.55[7]						
Strength Reduction Factor — Water-Saturated Concrete – $h_{ef} \leq 12d_a$			$\phi_{sat,pi}$	—	0.45[7]						
Additional Factor for Water-Saturated Concrete – $h_{ef} \leq 12d_a$			$K_{sat,pi}$[6]	—	1		0.93			0.71	
Strength Reduction Factor — Water-Saturated Concrete – $h_{ef} > 12d_a$			$\phi_{sat,pi}$	—	0.45[7]						
Additional Factor for Water-Saturated Concrete – $h_{ef} > 12d_a$			$K_{sat,pi}$[6]	—	0.48						

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-19, ACI 318-14 and ACI 318-11.
2. Temperature Range: Maximum short-term temperature = 150°F, Maximum long-term temperature = 110°F.
3. Short-term concrete temperatures are those that occur over short intervals (diurnal cycling).
4. Long-term temperatures are roughly constant over significant periods of time.
5. For anchors that only resist wind or seismic loads, bond strengths may be increased by 72%.
6. In water-saturated concrete, multiply $\tau_{k,uncr}$ and $\tau_{k,cr}$ by K_{sat}.
7. The tabulated value of ϕ applies when the load combinations from the IBC or ACI 318 are used and the requirements of ACI 318-19 17.5.3, ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, are met. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
8. The values of f'_c used for calculation purposes must not exceed 8,000 psi (55.1 MPa) for uncracked concrete. The value of f'_c used for calculation purposes must not exceed 2,500 psi (17.2 MPa) for tension resistance in cracked concrete.
9. For lightweight concrete, the modification factor for bond strength shall be as given in ACI 318-19 17.2.4, ACI 318-14 17.2.6 or ACI 318-11 D.3.6, as applicable, where applicable.

*See p. 14 for an explanation of the load table icons.

ET-3G™ Design Information — Concrete

ET-3G Shear Strength Design Data for Threaded Rod[1]

IBC *

Characteristic		Symbol	Units	Nominal Anchor Diameter (in.)						
				3/8	1/2	5/8	3/4	7/8	1	1 1/4
Steel Strength in Shear										
Threaded Rod	Minimum Shear Stress Area	A_{se}	in.^{2}	0.078	0.142	0.226	0.334	0.462	0.606	0.969
	Shear Resistance of Steel — ASTM F1554, Grade 36	V_{sa}	lb.	2,260	4,940	7,865	11,625	16,080	21,090	33,720
	Shear Resistance of Steel — ASTM A193, Grade B7			4,875	10,650	16,950	25,050	34,650	45,450	72,675
	Shear Resistance of Steel — Type 410 Stainless (ASTM A193, Grade B6)			4,290	9,370	14,910	22,040	30,490	40,000	63,955
	Shear Resistance of Steel — Types 304 and 316 Stainless (ASTM A193, Grade B8 & B8M)			2,225	4,855	7,730	11,420	15,800	20,725	33,140
	Reduction for Seismic Shear — ASTM F1554, Grade 36	$\alpha_{V,seis}$[3]	—	0.87	0.78	0.68				0.65
	Reduction for Seismic Shear — ASTM A193, Grade B7			0.87	0.78	0.68				0.65
	Reduction for Seismic Shear — Stainless (ASTM A193, Grade B6)			0.69	0.82	0.75			0.83	0.72
	Reduction for Seismic Shear — Stainless (ASTM A193, Grade B8 & B8M)			0.69	0.82	0.75			0.83	0.72
	Strength Reduction Factor — Steel Failure	ϕ	—	0.65[2]						
Concrete Breakout Strength in Shear										
Outside Diameter of Anchor		d_o	in.	0.375	0.5	0.625	0.75	0.875	1	1.25
Load Bearing Length of Anchor in Shear		ℓ_e	in.	Min. of h_{ef} and 8 times anchor diameter						
Strength Reduction Factor — Breakout Failure		ϕ	—	0.70[2]						
Concrete Pryout Strength in Shear										
Coefficient for Pryout Strength		k_{cp}	—	1.0 for $h_{ef} < 2.50$"; 2.0 for $h_{ef} \geq 2.50$"						
Strength Reduction Factor — Pryout Failure		ϕ	—	0.70[2]						

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-19, ACI 318-14 and ACI 318-11.
2. The tabulated value of ϕ applies when the load combinations from the IBC or ACI 318 are used and the requirements of ACI 318-19 17.5.3, ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, are met. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
3. The values of V_{sa} are applicable for both cracked concrete and uncracked concrete. For anchors installed in regions assigned to Seismic Design Category C, D, E or F, V_{sa} must be multiplied by $\alpha_{V,seis}$ for the corresponding anchor steel type.

*See p. 14 for an explanation of the load table icons.

ET-3G™ Design Information — Concrete

ET-3G Shear Strength Design Data for Rebar[1]

Characteristic		Symbol	Units	Rebar Size						
				#3	#4	#5	#6	#7	#8	#10
Steel Strength in Shear										
Rebar	Minimum Shear Stress Area	A_{se}	in²	0.11	0.2	0.31	0.44	0.6	0.79	1.23
	Shear Resistance of Steel — Rebar (ASTM A615 Grade 60)	V_{sa}	lb.	4,950	10,800	16,740	23,760	32,400	42,660	66,420
	Reduction for Seismic Shear — Rebar (ASTM A615 Grade 60)	$\alpha_{V,seis}$[3]	—	0.85	0.88	0.84		0.77		0.59
	Strength Reduction Factor — Steel Failure	ϕ	—	0.60[2]						
Concrete Breakout Strength in Shear										
Outside Diameter of Anchor		d_o	in.	0.375	0.5	0.625	0.75	0.875	1	1.25
Load-Bearing Length of Anchor in Shear		ℓ_e	in.	Min. of h_{ef} and 8 times anchor diameter						
Strength Reduction Factor — Breakout Failure		ϕ	—	0.70[2]						
Concrete Pryout Strength in Shear										
Coefficient for Pryout Strength		k_{cp}	—	1.0 for $h_{ef} < 2.50$"; 2.0 for $h_{ef} \geq 2.50$"						
Strength Reduction Factor — Pryout Failure		ϕ	—	0.70[2]						

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-19, ACI 318-14 and ACI 318-11.
2. The tabulated value of ϕ applies when the load combinations from the IBC or ACI 318 are used and the requirements of ACI 318-19 17.5.3, ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, are met. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
3. The values of V_{sa} are applicable for both cracked concrete and uncracked concrete. For anchors installed in regions assigned to Seismic Design Category C, D, E or F, V_{sa} must be multiplied by $\alpha_{V,seis}$.

For additional load tables, visit **strongtie.com/et3g**.

*See p. 14 for an explanation of the load table icons.

ET-3G™ Design Information — Concrete

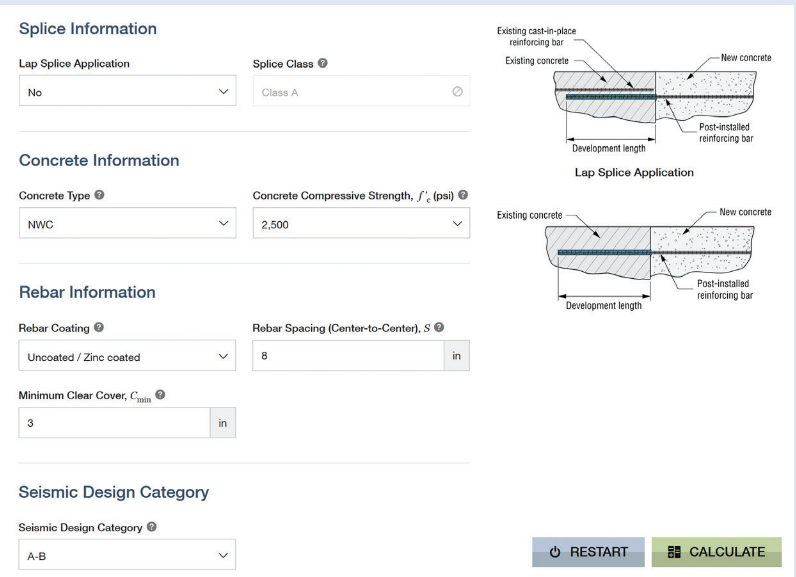
ET-3G Development Length for Rebar Dowels

Rebar Size	Drill Bit Diameter (in.)	Clear Cover in. (mm)	Development Length, in. (mm)				
			f'_c = 2,500 psi (17.2 MPa) Concrete	f'_c = 3,000 psi (20.7 MPa) Concrete	f'_c = 4,000 psi (27.6 MPa) Concrete	f'_c = 6,000 psi (41.4 MPa) Concrete	f'_c = 8,000 psi (55.2 MPa) Concrete
#3 (9.5)	½	1½ (38)	12 (305)	12 (305)	12 (305)	12 (305)	12 (305)
#4 (12.7)	⅝	1½ (38)	14.4 (366)	14 (356)	12 (305)	12 (305)	12 (305)
#5 (15.9)	¾	1½ (38)	18 (457)	17 (432)	14.2 (361)	12 (305)	12 (305)
#6 (19.1)	⅞	1½ (38)	21.6 (549)	20 (508)	17.1 (434)	14 (356)	13 (330)
#7 (22.2)	1	3 (76)	31.5 (800)	29 (737)	25 (635)	21 (533)	18 (457)
#8 (25.4)	1⅛	3 (76)	36 (914)	33 (838)	28.5 (724)	24 (610)	21 (533)
#9 (28.7)	1⅜	3 (76)	40.5 (1,029)	38 (965)	32 (813)	27 (686)	23 (584)
#10 (32.3)	1⅜	3 (76)	45 (1,143)	42 (1,067)	35.6 (904)	30 (762)	26 (660)
#11 (35.8)	1¾	3 (76)	51 (1,295)	47 (1,194)	41 (1,041)	33 (838)	29 (737)

1. Tabulated development lengths are for static, wind and seismic load cases in Seismic Design Category A and B. Development lengths in SDC C through F must comply with ACI 318-19 and ACI 318-14 Chapter 18 or ACI 318-11 Chapter 12, as applicable. The value of f'_c used to calculate development lengths shall not exceed 2,500 psi in SDC C through F.
2. Rebar is assumed to be ASTM A615 Grade 60 or A706 (f_y = 60,000 psi). For rebar with a higher yield strength, multiply tabulated values by f_y / 60,000 psi.
3. Concrete is assumed to be normal-weight concrete. For lightweight concrete, multiply tabulated values by 1.33.
4. Tabulated values assume bottom cover of less than 12" cast below rebars (Ψ_t = 1.0).
5. Uncoated rebar must be used.
6. The value of K_{tr} is assumed to be 0. Refer to ACI 318-19 Section 25.4.2.4, ACI 318-14 Section 25.4.2.3 or ACI 318-11 Section 12.2.3.

Rebar Development Length Calculator

Rebar Development Length Calculator is a web application that supports the design of post-installed rebar in concrete applications by calculating the necessary tension and compression development lengths required in accordance with ACI 318-19 / ACI 318-14.



*See p. 14 for an explanation of the load table icons.

SIMPSON Strong-Tie

ET-3G™ Design Information — Masonry

ET-3G Epoxy Anchor Installation Information — Fully Grouted CMU Construction — Face of Wall

IBC *

Installation Information	Symbol	Units	Nominal Rod Diameter / Rebar Size			
			⅜" / #3	½" / #4	⅝" / #5	¾" / #6
Drill Bit Diameter — Threaded Rod	d_o	in.	7⁄16	9⁄16	11⁄16	⅞
Drill Bit Diameter — Rebar	d_o	in.	½	⅝	¾	⅞
Minimum Embedment Depth	$h_{ef,min}$	in.	3	3	3	3

ET-3G Epoxy Anchor Installation Information — Fully Grouted CMU Construction — Top of Wall

IBC *

Installation Information	Symbol	Units	Nominal Rod Diameter / Rebar Size		
			½" / #4	⅝" / #5	⅞"
Drill Bit Diameter — Threaded Rod	d_o	in.	9⁄16	11⁄16	1
Drill Bit Diameter — Rebar	d_o	in.	⅝	¾	—
Minimum Embedment Depth	$h_{ef,min}$	in.	3	3	3

ET-3G Epoxy Anchor Installation Information — Ungrouted CMU Construction

IBC *

Installation Information	Symbol	Units	Nominal Rod Diameter		
			⅜"	½"	⅝"
Drill Bit Diameter	d_o	in.	9⁄16	¾	⅞
Embedment Depth	$h_{ef,min}$	in.	3½	3½	3½

Please see the ET-3G product page at **strongtie.com** and ICC-ES ESR Report for load data.

*See p. 14 for an explanation of the load table icons.