AT-3G™ High-Strength Hybrid Acrylic Adhesive

AT-3G Cure Schedule

Base Material Temperature		Gel Time (minutes)	Cure Time (hr.)
°F	°C		
23	−5	50	5
32	0	25	3½
41	5	15	2
50	10	10	1
59	15	6	40 min.
68	20	3	30 min.
86	30	2	30 min.
104	40	2	30 min.

1. For water-saturated concrete, the cure times must be doubled.
2. Cartridge temperature must be between 41°F (5°C) and 104°F (40°C) at the time of installation.
3. For installation in temperatures below 23°F (−5°C), see p. 241 (Supplemental Section) for more information.

AT-3G Typical Properties

Property		Class A (35°–40°F)	Class B (40°–60°F)	Class C (>60°F)	Test Method
Consistency		Non-sag	Non-sag	Non-sag	ASTM C881
Bond Strength, Slant Shear	Hardened-to-Hardened Concrete, 2-Day Cure[1]	2,800 psi	2,800 psi	2,820 psi	ASTM C882
	Hardened-to-Hardened Concrete, 14-Day Cure[1]	3,200 psi	3,100 psi	3,250 psi	
Compressive Yield Strength, 7-Day Cure[2]		10,300 psi	13,400 psi	15,000 psi	ASTM D695
Compressive Modulus, 7-Day Cure[2]		1,400,000 psi	1,550,000 psi	1,650,000 psi	ASTM D695
Heat Deflection Temperature, 7-Day Cure[3]		258°F (126°C)			ASTM D648
Glass Transition Temperature, 7-Day Cure[3]		237°F (114°C)			ASTM E1640
Decomposition Temperature, 24-Hour Cure[3]		480°F (250°C)			ASTM E2550
Water Absorption, 24 Hours, 7-Day Cure[3]		0.90%			ASTM D570
Shore D Hardness, 24-Hour Cure[3]		81			ASTM D2240
Linear Coefficient of Shrinkage, 7-Day Cure[3]		0.000 in./in.			ASTM D2566
Coefficient of Thermal Expansion[3]		2.6×10^{-5} in./in.°F			ASTM C531

1. Material and curing conditions: Class A at 35° ± 2°F, Class B at 40° ± 2°F, Class C at 60° ± 2°F.
2. Material and curing conditions: Class A at 0° ± 2°F, Class B at 40° ± 2°F, Class C at 60° ± 2°F.
3. Material and curing conditions: 73° ± 2°F.

AT-3G Installation Information and Additional Data for Threaded Rod and Rebar in Normal-Weight Concrete[1]

IBC *

Characteristic	Symbol	Units	Nominal Rod Diameter (in.) / Rebar Size						
			⅜ / #3	½ / #4	⅝ / #5	¾ / #6	⅞ / #7	1 / #8	1¼ / #9
Drill Bit Diameter for Threaded Rod	d_{hole}	in.	7⁄16	9⁄16	11⁄16	⅞	1	1⅛	1⅜
Drill Bit Diameter for Rebar	d_{hole}	in.	½	⅝	¾	⅞	1	1⅛	1⅜
Maximum Tightening Torque for Threaded Rod	T_{inst}	ft.-lb.	15	30	44	66	96	147	221
Maximum Tightening Torque for Rebar	T_{inst}	ft.-lb.	15	30	44	66	96	147	185
Minimum Embedment Depth for Threaded Rod or Rebar	$h_{ef,\,min}$	in.	2⅜	2¾	3⅛	3½	3½	4	5
Maximum Embedment Depth for Threaded Rod	$h_{ef,\,max}$	in.	7½	10	12½	15	17½	20	25
Maximum Embedment Depth for Rebar	$h_{ef,\,max}$	in.	7½	10	12½	15	17½	20	22½
Minimum Concrete Thickness	h_{min}	in.	h_{ef} + 1¼		$h_{ef} + 2d_{hole}$				
Critical Edge Distance	c_{ac}	in.	See footnote 2						
Minimum Edge Distance	c_{min}	in.	1⅝	1¾	2	2⅜	2½	2¾	3¼
Minimum Anchor Spacing	s_{min}	in.	1⅞	2½	3	3¾	4¼	4¾	5⅞

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:

   $[h/h_{ef}] \leq 2.4$

   $\tau_{k,uncr}$ = the characteristic bond strength in uncracked concrete, given in the tables that follow $\leq k_{uncr}((h_{ef} \times f'_c)^{0.5}/(\pi \times d_a))$

   h = the member thickness (inches)

   h_{ef} = the embedment depth (inches)

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

AT-3G™ Design Information — Concrete

AT-3G Tension Strength Design Data for Threaded Rod[1,8]

Characteristic		Symbol	Units	Nominal Rod Diameter (in.)						
				⅜	½	⅝	¾	⅞	1	1¼
Steel Strength in Tension										
Minimum Tensile Stress Area		A_{se}	in.^{2}	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.	4,495	8,230	13,110	19,400	26,780	35,130	56,210
Tension Resistance of Steel — ASTM F1554, Grade 55		N_{sa}	lb.	5,815	10,645	16,950	25,090	34,630	45,430	72,685
Tension Resistance of Steel — ASTM A193, Grade B7 and ASTM F1554, Grade 105		N_{sa}	lb.	9,685	17,735	28,250	41,810	57,710	75,710	121,135
Tension Resistance of Steel — ASTM A449		N_{sa}	lb.	9,300	17,030	27,120	40,140	55,405	72,685	101,755
Tension Resistance of Steel — ASTM F593 CW (Types 304 and 316 Stainless Steel)		N_{sa}	lb.	7,750	17,190	22,600	28,430	39,245	51,485	82,370
Tension Resistance of Steel — ASTM A193, Grade B8/B8M, Class 2B (Types 304 and 316 Stainless Steel)		N_{sa}	lb.	7,365	13,480	21,470	31,780	43,860	57,540	92,065
Strength Reduction Factor for Tension — Steel Failure		ϕ	—	0.75[6]						
Concrete Breakout Strength in Tension (2,500 psi ≤ f'_c ≤ 8,000 psi)										
Effectiveness Factor for Cracked Concrete		$k_{c,cr}$	—	17						
Effectiveness Factor for Uncracked Concrete		$k_{c,uncr}$	—	24						
Strength Reduction Factor — Concrete Breakout Failure in Tension		ϕ	—	0.65[6]						
Bond Strength in Tension (2,500 psi ≤ f'_c ≤ 8,000 psi)[7]										
Minimum Embedment		$h_{ef,min}$	in.	2⅜	2¾	3⅛	3½	3½	4	5
Maximum Embedment		$h_{ef,max}$	in.	7½	10	12½	15	17½	20	25
Temperature Range A[2,5]	Characteristic Bond Strength in Uncracked Concrete[9]	$\tau_{k,uncr}$	psi	2,600	2,415	2,260	2,140	2,055	2,000	1,990
Temperature Range A[2,5]	Characteristic Bond Strength in Cracked Concrete[9]	$\tau_{k,cr}$	psi	1,040	1,040	1,110	1,220	1,210	1,205	1,145
Temperature Range B[3,5]	Characteristic Bond Strength in Uncracked Concrete[9]	$\tau_{k,uncr}$	psi	2,265	2,100	1,970	1,865	1,785	1,740	1,730
Temperature Range B[3,5]	Characteristic Bond Strength in Cracked Concrete[9]	$\tau_{k,cr}$	psi	905	905	965	1,060	1,055	1,050	995
Temperature Range C[4,5]	Characteristic Bond Strength in Uncracked Concrete[9]	$\tau_{k,uncr}$	psi	1,630	1,515	1,420	1,345	1,290	1,255	1,250
Temperature Range C[4,5]	Characteristic Bond Strength in Cracked Concrete[9]	$\tau_{k,cr}$	psi	650	655	695	765	760	755	720
Anchor Category	Dry Concrete	—	—	1						
Strength Reduction Factor	Dry Concrete	ϕ_{dry}	—	0.65[6]						
Anchor Category	Water-Saturated Concrete	—	—	2						
Strength Reduction Factor	Water-Saturated Concrete	ϕ_{ws}	—	0.55[6]						
Anchor Category	Water-Filled Hole	—	—	3						
Strength Reduction Factor	Water-Filled Hole	ϕ_{wf}	—	0.45[6]						
Reduction Factor for Seismic Tension		$\alpha_{N,seis}$[10]	—	0.95						

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 A: Maximum short-term temperature = 176°F, Maximum long-term temperature = 122°F.
3. Temperature Range B: Maximum short-term temperature = 248°F, Maximum long-term temperature = 161°F.
4. Temperature Range C: Maximum short-term temperature = 320°F, Maximum long-term temperature = 212°F.
5. Short-term concrete temperatures are those that occur over short intervals (diurnal cycling). Long-term temperatures are roughly constant over significant periods of time.
6. 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.
7. Bond strength values shown are for normal-weight concrete having a compressive strength of f'_c = 2,500 psi. For higher compressive strengths up to 8,000 psi, the tabulated characteristic bond strength may be increased by a factor of $(f'_c/2{,}500)^{0.10}$.
8. 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.
9. Characteristic bond strength values are for sustained loads, including dead and live loads. For load combinations consisting of short-term loads only such as wind, bond strengths may be increased by 23% for Temperature Range C.
10. For anchors installed in regions assigned to Seismic Design Category C, D, E or F, the bond strength values must be multiplied by $\alpha_{N,seis}$.

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

AT-3G™ Design Information — Concrete

AT-3G Tension Strength Design Data for Rebar[1,8]

Characteristic		Symbol	Units	#3	#4	#5	#6	#7	#8	#9
				Rebar Size						
Steel Strength in Tension										
Minimum Tensile Stress Area		A_{se}	in.²	0.11	0.20	0.31	0.44	0.60	0.79	1.00
Tension Resistance of Steel — ASTM A615 Grade 60		N_{sa}	lb.	9,900	18,000	27,900	39,600	54,000	71,100	90,000
Tension Resistance of Steel — ASTM A706 Grade 60		N_{sa}	lb.	8,800	16,000	24,800	35,200	48,000	63,200	80,000
Tension Resistance of Steel — ASTM A615 Grade 40		N_{sa}	lb.	6,600	12,000	18,600	26,400	Sizes not available		
Strength Reduction Factor for Tension — Steel Failure — ASTM A615 Grades 40 and 60		ϕ	—	0.65[6]						
Strength Reduction Factor for Tension — Steel Failure — ASTM A706		ϕ	—	0.75[6]						
Concrete Breakout Strength in Tension (2,500 psi ≤ f'_c ≤ 8,000 psi)										
Effectiveness Factor for Cracked Concrete		$k_{c,cr}$	—	17						
Effectiveness Factor for Uncracked Concrete		$k_{c,uncr}$	—	24						
Strength Reduction Factor — Concrete Breakout Failure in Tension		ϕ	—	0.65[6]						
Bond Strength in Tension (2,500 psi ≤ f'_c ≤ 8,000 psi)[7]										
Minimum Embedment		$h_{ef,min}$	in.	2⅜	2¾	3⅛	3½	3½	4	4½
Maximum Embedment		$h_{ef,max}$	in.	7½	10	12½	15	17½	20	22½
Temperature Range A[2,5]	Characteristic Bond Strength in Uncracked Concrete[9]	$\tau_{k,uncr}$	psi	2,200	2,100	2,030	1,970	1,920	1,880	1,845
Temperature Range A[2,5]	Characteristic Bond Strength in Cracked Concrete[9]	$\tau_{k,cr}$	psi	1,090	1,055	1,130	1,170	1,175	1,155	1,140
Temperature Range B[3,5]	Characteristic Bond Strength in Uncracked Concrete[9]	$\tau_{k,uncr}$	psi	1,915	1,830	1,765	1,715	1,670	1,635	1,615
Temperature Range B[3,5]	Characteristic Bond Strength in Cracked Concrete[9]	$\tau_{k,cr}$	psi	945	915	980	1,015	1,020	1,005	995
Temperature Range C[4,5]	Characteristic Bond Strength in Uncracked Concrete[9]	$\tau_{k,uncr}$	psi	1,380	1,315	1,270	1,235	1205	1,180	1,155
Temperature Range C[4,5]	Characteristic Bond Strength in Cracked Concrete[9]	$\tau_{k,cr}$	psi	680	660	705	735	735	725	715
Anchor Category	Dry Concrete	—	—	1						
Strength Reduction Factor	Dry Concrete	ϕ_{dry}	—	0.65[6]						
Anchor Category	Water-Saturated Concrete	—	—	2						
Strength Reduction Factor	Water-Saturated Concrete	ϕ_{ws}	—	0.55[6]						
Anchor Category	Water-Filled Hole	—	—	3						
Strength Reduction Factor	Water-Filled Hole	ϕ_{wf}	—	0.45[6]						
Reduction Factor for Seismic Tension		$\alpha_{N,seis}$[10]	—	0.95	0.95	1.00	1.00	1.00	1.00	1.00

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 A: Maximum short-term temperature = 176°F, Maximum long-term temperature = 122°F.
3. Temperature Range B: Maximum short-term temperature = 248°F, Maximum long-term temperature = 161°F.
4. Temperature Range C: Maximum short-term temperature = 320°F, Maximum long-term temperature = 212°F.
5. Short-term concrete temperatures are those that occur over short intervals (diurnal cycling). Long-term temperatures are roughly constant over significant periods of time.
6. 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.
7. Bond strength values shown are for normal-weight concrete having a compressive strength of f'_C = 2,500 psi. For higher compressive strengths up to 8,000 psi, the tabulated characteristic bond strength may be increased by a factor of $(f'_C/2{,}500)^{0.10}$.
8. 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.
9. Characteristic bond strength values are for sustained loads, including dead and live loads. For load combinations consisting of short-term loads only such as wind, bond strengths may be increased by 23% for Temperature Range C.
10. For anchors installed in regions assigned to Seismic Design Category C, D, E or F, the bond strength values must be multiplied by $\alpha_{N,seis}$.

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

AT-3G™ Design Information — Concrete

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

Characteristic	Symbol	Units	Nominal Rod Diameter (in.)						
			⅜	½	⅝	¾	⅞	1	1¼
Steel Strength in Shear									
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.	2,695	4,940	7,860	11,640	16,070	21,080	33,725
Shear Resistance of Steel — ASTM F1554, Grade 55	V_{sa}	lb.	3,490	6,385	10,170	15,055	20,780	27,260	43,610
Shear Resistance of Steel — ASTM A193, Grade B7 and ASTM F1554, Grade 105	V_{sa}	lb.	5,810	10,640	16,950	25,085	34,625	45,425	72,680
Shear Resistance of Steel — ASTM A449	V_{sa}	lb.	5,580	10,220	16,270	24,085	33,240	43,610	61,055
Shear Resistance of Steel — ASTM F593 CW (Types 304 and 316 Stainless Steel)	V_{sa}	lb.	4,650	8,515	13,560	17,060	23,545	30,890	49,425
Shear Resistance of Steel — ASTM A193, Grade B8/B8M, Class 2B (Types 304 and 316 Stainless Steel)	V_{sa}	lb.	4,420	8,090	12,880	19,070	26,320	34,525	55,240
Reduction Factor for Seismic Shear	$\alpha_{V,seis}$[3]	—	0.65						
Strength Reduction Factor for Shear — Steel Failure	ϕ	—	0.65[2]						
Concrete Breakout Strength in Shear									
Outside Diameter of Anchor	d_a	in.	0.375	0.5	0.625	0.75	0.875	1	1.25
Load-Bearing Length of Anchor in Shear	ℓ_e	in.	Minimum of h_{ef} and 8x anchor diameter						
Strength Reduction Factor for Shear — Breakout Failure	ϕ	—	0.70[2]						
Concrete Pryout Strength in Shear									
Load-Bearing Length of Anchor in Shear	k_{cp}	in.	1.0 for $h_{ef} < 2.50$"; 2.0 for $h_{ef} \geq 2.50$"						
Strength Reduction Factor for Shear — Breakout 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.

For additional load tables, visit **strongtie.com/at3g**.

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

AT-3G™ Design Information — Concrete

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

IBC *

Characteristic	Symbol	Units	Nominal Rod Diameter (in.)						
			#3	#4	#5	#6	#7	#8	#9
Steel Strength in Shear									
Minimum Shear Stress Area	A_{se}	in.[2]	0.11	0.20	0.31	0.44	0.60	0.79	1.00
Shear Resistance of Steel — ASTM A615 Grade 60	V_{sa}	lb.	5,940	10,800	16,740	23,760	32,400	42,660	54,000
Shear Resistance of Steel — ASTM A706 Grade 60			5,280	9,600	14,880	21,120	28,800	37,920	48,000
Shear Resistance of Steel — ASTM A615 Grade 40			3,960	7,200	11,160	15,840	Sizes not available		
Reduction Factor for Seismic Shear	$\alpha_{V,seis}$[3]	—	0.65						
Strength Reduction Factor for Shear — Steel Failure — ASTM A615 Grades 40 and 60	ϕ	—	0.60[2]						
Strength Reduction Factor for Shear — Steel Failure — ASTM A706	ϕ	—	0.65[2]						
Concrete Breakout Strength in Shear									
Outside Diameter of Anchor	d_a	in.	0.375	0.5	0.625	0.75	0.875	1	1.25
Load-Bearing Length of Anchor in Shear	ℓ_e	in.	Minimum of h_{ef} and 8x anchor diameter						
Strength Reduction Factor for Shear — Breakout Failure	ϕ	—	0.70[2]						
Concrete Pryout Strength in Shear									
Load-Bearing Length of Anchor in Shear	k_{cp}	in.	1.0 for $h_{ef} < 2.50$"; 2.0 for $h_{ef} \geq 2.50$"						
Strength Reduction Factor for Shear — Breakout 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.

AT-3G Development Length for Rebar Dowels

IBC *

Rebar Size	Drill Bit Diameter (in.)	Clear Cover (in.)	Development Length (in.)				
			f'_c = 2,500 psi Concrete	f'_c = 3,000 psi Concrete	f'_c = 4,000 psi Concrete	f'_c = 6,000 psi Concrete	f'_c = 8,000 psi Concrete
#3	½	1³⁄₁₆	12	12	12	12	12
#4	⅝	1³⁄₁₆	14.4	14	12	12	12
#5	¾	1³⁄₁₆	18	17	14.2	12	12
#6	⅞	1³⁄₁₆	21.6	20	17.1	14	13
#7	1	1⁹⁄₁₆	31.5	29	25	21	18
#8	1⅛	1⁹⁄₁₆	36	33	28.5	24	21
#9	1⅜	1⁹⁄₁₆	40.5	38	32	27	23

1. Tabulated development lengths are for static, wind and seismic load cases in Seismic Design Category A and B. Development lengths in Seismic Design Category C through F must comply with ACI 318-19 and ACI 318-14 Chapter 18 or ACI 318-11 Chapter 21, as applicable.
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. Tabulated values assume bottom cover less that 12" cast below rebars (Ψ_1 = 1.0).
4. Uncoated rebar must be used.
5. 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.

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