SET-XP® *High-Strength Anchoring Adhesive for Cracked and Uncracked Concrete*

Cracked & Uncracked CONCRETE
IBC® 2009
ICC-ES ESR-2508

SIMPSON Strong-Tie®

SET-XP® is a 1:1 two-component, high-solids, epoxy-based anchoring adhesive formulated for optimum performance in both cracked and uncracked concrete. SET-XP® adhesive has been rigorously tested in accordance with ICC-ES AC308 and 2009 IBC requirements and has proven to offer increased reliability in the most adverse conditions, including performance in cracked concrete under static and seismic loading. SET-XP® adhesive is teal in color in order to be identified as a high-performance adhesive for adverse conditions. Resin and hardener are dispensed and mixed simultaneously through the mixing nozzle. SET-XP® adhesive exceeds the ASTM C881 specification for Type I and Type IV, Grade 3, Class C epoxy.

USES: When SET-XP® adhesive is used with all threaded rod or rebar, the system can be used in tension and seismic zones where there is a risk of cracks occurring that pass through the anchor location. It is also suitable for uncracked concrete conditions.

CODES: ICC-ES ESR-2508; City of L.A. pending; Florida FL 11506.5 NSF/ANSI Standard 61 (216 in²/1000 gal). ⚠ The load tables list values based upon results from the most recent testing and may not reflect those in current code reports. Where code jurisdictions apply, consult the current reports for applicable load values.

APPLICATION: Surfaces to receive epoxy must be clean. The base-material temperature must be 50° F or above at the time of installation. For best results, material should be 70–80° F at the time of application. Cartridges should not be immersed in water to facilitate warming. To warm cold material, the cartridges should be stored in a warm, uniformly-heated area or storage container for a sufficient time to allow epoxy to warm completely. Mixed material in nozzle can harden in 5–7 minutes at a temperature of 40° F or above.

DESIGN EXAMPLE: See pages 231, 235–237

INSTALLATION: See pages 70–71

SHELF LIFE: 24 months from date of manufacture in unopened side-by-side cartridge.

STORAGE CONDITIONS: For best results, store between 45–90° F. To store partially used cartridges, leave hardened nozzle in place. To re-use, attach new nozzle.

COLOR: Resin – white, hardener – black-green. When properly mixed, SET-XP adhesive will be a uniform teal color.

CLEAN UP: Uncured material – Wipe up with cotton cloths. If desired, scrub area with abrasive, waterbased cleaner and flush with water. If approved, solvents such as ketones (MEK, acetone, etc.), lacquer thinner or adhesive remover can be used. DO NOT USE SOLVENTS TO CLEAN ADHESIVE FROM SKIN. Take appropriate precautions when handling flammable solvents. Solvents may damage surfaces to which they are applied. Cured Material – chip or grind off surface.

TEST CRITERIA: Anchors installed with SET-XP® adhesive have been tested in accordance with ICC-ES's Acceptance Criteria for Post-Installed *Adhesive Anchors in Masonry Elements (AC58)* and *Adhesive Anchors in Concrete Elements (AC308)* for the following:

- Seismic and wind loading in cracked and uncracked concrete and uncracked masonry
- Static tension and shear loading in cracked and uncracked concrete and uncracked masonry
- Horizontal and overhead installations
- Long-term creep at elevated-temperatures
- Static loading at elevated-temperatures
- Damp holes
- Freeze-thaw conditions
- Critical and minimum edge distance and spacing

PROPERTY	TEST METHOD	RESULTS
Consistency	ASTM C881	Passed, non-sag
Glass transition temperature	ASTM E1356	155°F
Bond strength (moist cure)	ASTM C882	3,742 psi at 2 days
Water absorption	ASTM D570	0.10%
Compressive yield strength	ASTM D695	14,830 psi
Compressive modulus	ASTM D695	644,000 psi
Gel time	ASTM C881	49 minutes

CHEMICAL RESISTANCE: Very good to excellent against distilled water, in-organic acids and alkalis. Fair to good against organic acids and alkalis, and many organic solvents. Poor against ketones. For more detailed information visit our website or contact Simpson Strong-Tie.

SET-XP® 10

SET-XP® 22

SET-XP® 56

EMN22i

EDT22S

SET-XP Cartridge System

Model No.	Capacity ounces (cubic inches)	Cartridge Type	Carton Quantity	Dispensing tool(s)	Mixing Nozzle
SET-XP10	8.5 (16.2)	single	12	CDT10S	
SET-XP22	22 (39.7)	side-by-side	10	EDT22S EDTA22P EDT22CKT	EMN22i
SET-XP56	56 (101.1)	side-by-side	6	EDTA56P	

1. Cartridge estimation guides are available on pages 48–51.
2. Detailed information on dispensing tools, mixing nozzles and other adhesive accessories is available on pages 72–77.
3. Use only appropriate Simpson Strong-Tie mixing nozzle in accordance with Simpson Strong-Tie instructions. Modification or improper use of mixing nozzle may impair epoxy performance.

Cure Schedule

Base Material Temperature		Gel Time (mins.)	Cure Time (hrs.)
°F	°C		
50	10	75	72
60	16	60	48
70	21	45	24
90	32	35	24
110	43	20	24

For water-saturated concrete, the cure times are doubled.

SUGGESTED SPECIFICATION: Anchoring adhesive shall be a two-component high-solids, epoxy-based system supplied in manufacturer's standard cartridge and dispensed through a static-mixing nozzle supplied by the manufacturer. The adhesive anchor shall have been tested and qualified for performance in cracked and uncracked concrete per ICC-ES AC308. Adhesive shall be SET-XP® adhesive from Simpson Strong-Tie, Pleasanton, CA. Anchors shall be installed per Simpson Strong-Tie instructions for SET-XP epoxy adhesive.

ACCESSORIES: See pages 72–77 for information on dispensing tools, mixing nozzles and other accessories.

IMPORTANT – See Pages 70–71 for Installation Instructions

SET-XP® Epoxy Anchor Installation Information and Additional Data for Threaded Rod and Rebar in Normal-Weight Concrete[1]

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[2]	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.	$h_{ef} + 5d_o$						
Critical Edge Distance		c_{ac}	in.	3 x h_{ef}						
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 ICC-ES AC308.
2. Minimum and maximum embedment depths are are listed in accordance with ICC-ES AC308 requirements.

* See page 13 for an explanation of the load table icons

SET-XP Epoxy Anchor Tension Strength Design Data for Threaded Rod in Normal-Weight Concrete[1,12]

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 A193, Grade B7		N_{sa}	lb.	9,750	17,750	28,250	41,750	57,750	75,750	121,125
	- ASTM F1554, Grade 36		N_{sa}	lb.	4,525	8,235	13,110	19,370	26,795	35,150	56,200
	- Type 410 Stainless (ASTM A193, Grade B6)		N_{sa}	lb.	8,580	15,620	24,860	36,740	50,820	66,660	106,590
	- Type 304 and 316 Stainless (ASTM A193, Grade B8 and B8M)		N_{sa}	lb.	4,445	8,095	12,880	19,040	26,335	34,540	55,235
	Strength Reduction Factor - Steel Failure		ϕ	—	0.75[9]						
Concrete Breakout Strength in Tension (2,500 psi ≤ f'c ≤ 8,000 psi)[15]											
Effectiveness Factor - Uncracked Concrete			k_{uncr}	—	24						
Effectiveness Factor - Cracked Concrete			k_{cr}	—	17						
Strength Reduction Factor - Breakout Failure			ϕ	—	0.65[11]						
Bond Strength in Tension (2,500 psi ≤ f'c ≤ 8,000 psi)[15]											
Temp. Range 1 for Uncracked Concrete[2,4,5]	Characteristic Bond Strength[8]		$\tau_{k,uncr}$	psi	1,510	2,250	2,075	1,905	1,730	1,555	1,205
	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
Temp. Range 1 for Cracked Concrete[2,4,5]	Characteristic Bond Strength[8,13,14]		$\tau_{k,cr}$	psi	1,165	995	855	760	700	675	675
	Permitted Embedment Depth Range	Minimum	h_{ef}	in	3	4	5	6	7	8	10
		Maximum	h_{ef}	in	7½	10	12½	15	17½	20	25
Temp. Range 2 for Uncracked Concrete[3,4,5]	Characteristic Bond Strength[6,8]		$\tau_{k,uncr}$	psi	780	1,160	1,070	980	895	800	625
	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
Temp. Range 2 for Cracked Concrete[3,4,5]	Characteristic Bond Strength[6,8,13,14]		$\tau_{k,cr}$	psi	600	515	440	390	360	350	350
	Permitted Embedment Depth Range	Minimum	h_{ef}	in	3	4	5	6	7	8	10
		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[10]						
Strength Reduction Factor - Water-saturated Concrete			$\phi_{sat,ci}$	—	0.45[10]						
Additional Factor for Water-saturated Concrete[7]			$K_{sat,ci}$	—	0.57						
Bond Strength in Tension – Bond Strength Reduction Factors for Periodic Special Inspection											
Strength Reduction Factor - Dry Concrete			$\phi_{dry,pi}$	—	0.55[10]						
Strength Reduction Factor - Water-saturated Concrete			$\phi_{sat,pi}$	—	0.45[10]						
Additional Factor for Water-saturated Concrete[7]			$K_{sat,pi}$	—	0.48						

1. The information presented in this table is to be used in conjunction with the design criteria of ICC-ES AC308, except as modified below.
2. Temperature Range 1: Maximum short-term temperature of 110°F (43°C). Maximum long-term temperature of 75°F (24°C).
3. Temperature Range 2: Maximum short-term temperature of 150°F (66°C). Maximum long-term temperature of 110°F (43°C).
4. Short-term concrete temperatures are those that occur over short intervals (diurnal cycling).
5. Long-term concrete temperature are constant temperatures over a significant time period.
6. For anchors that only resist wind or seismic loads, bond strengths may be increased by 72%.
7. In water-saturated concrete, multiply $\tau_{k,uncr}$ and $\tau_{k,cr}$ by K_{sat}.
8. For anchors installed in overhead and subjected to tension resulting from sustained loading, multiply the value calculated for N_a according to ICC-ES AC308 by 0.75.
9. The value of ϕ applies when the load combinations of ACI 318 Section 9.2 are used. If the load combinations of ACI 318 Appendix C are used, refer to Section D.4.5 to determine the appropriate value of ϕ.
10. The value of ϕ applies when both the load combinations of ACI 318 Section 9.2 are used and the requirements of Section D.4.4(c) for Condition B are met. If the load combinations of ACI 318 Appendix C are used, refer to Section D.4.5 to determine the appropriate value of ϕ.
11. The value of ϕ applies when both the load combinations of ACI 318 Section 9.2 are used and the requirements of Section D.4.4(c) for Condition B are met. If the load combinations of ACI 318 Section 9.2 are used and the requirements of Section D.4.4(c) for Condition A are met, refer to Section D.4.4 to determine the appropriate value of ϕ. If the load combinations of ACI 318 Appendix C are used, refer to Section D.4.5 to determine the appropriate value of ϕ.
12. Sand-lightweight and all-lightweight concrete are beyond the scope of this table.
13. 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 $\alpha_{N,seis} = 0.80$.
14. 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 $\alpha_{N,seis} = 0.92$
15. The values of f'_c used for calculation purposes must not exceed 8000 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.

* See page 13 for an explanation of the load table icons

SET-XP® Epoxy Anchor Tension Strength Design Data for Rebar in Normal-Weight Concrete[1,12]

Characteristic			Symbol	Units	Rebar Size						
					#3	#4	#5	#6	#7	#8	#10
Steel Strength in Tension											
Rebar	Minimum Tensile Stress Area		A_{se}	in²	0.11	0.20	0.31	0.44	0.60	0.79	1.23
	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
	Strength Reduction Factor - Steel Failure		ϕ	—	0.65[9]						
Concrete Breakout Strength in Tension (2,500 psi ≤ f'_c ≤ 8,000 psi)[15]											
Effectiveness Factor - Uncracked Concrete			k_{uncr}	—	24						
Effectiveness Factor - Cracked Concrete			k_{cr}	—	17						
Strength Reduction Factor - Breakout Failure			ϕ	—	0.65[11]						
Bond Strength in Tension (2,500 psi ≤ f'_c ≤ 8,000 psi)[15]											
Temp. Range 1 for Uncracked Concrete[2,4,5]	Characteristic Bond Strength[8]		$\tau_{k,uncr}$	psi	1600						
	Permitted Embedment Depth Range	Minimum	h_{ef}	in	2⅜	2¾	3⅛	3½	3¾	4	5
		Maximum			7½	10	12½	15	17½	20	25
Temp. Range 1 for Cracked Concrete[2,4,5]	Characteristic Bond Strength[8,13,14]		$\tau_{k,cr}$	psi	1,165	995	855	760	700	675	675
	Permitted Embedment Depth Range	Minimum	h_{ef}	in	3	4	5	6	7	8	10
		Maximum			7½	10	12½	15	17½	20	25
Temp. Range 2 for Uncracked Concrete[3,4,5]	Characteristic Bond Strength[6,8]		$\tau_{k,uncr}$	psi	825						
	Permitted Embedment Depth Range	Minimum	h_{ef}	in	2⅜	2¾	3⅛	3½	3¾	4	5
		Maximum			7½	10	12½	15	17½	20	25
Temp. Range 2 for Cracked Concrete[3,4,5]	Characteristic Bond Strength[6,8,13,14]		$\tau_{k,cr}$	psi	600	515	440	390	360	350	350
	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[10]						
Strength Reduction Factor - Water-saturated Concrete			$\phi_{sat,ci}$	—	0.45[10]						
Additional Factor for Water-saturated Concrete[7]			$K_{sat,ci}$	—	0.57						
Bond Strength in Tension - Bond Strength Reduction Factors for Periodic Special Inspection											
Strength Reduction Factor - Dry Concrete			$\phi_{dry,pi}$	—	0.55[10]						
Strength Reduction Factor - Water-saturated Concrete			$\phi_{sat,pi}$	—	0.45[10]						
Additional Factor for Water-saturated Concrete[7]			$K_{sat,pi}$	—	0.48						

1. The information presented in this table is to be used in conjunction with the design criteria of ICC-ES AC308, except as modified below.
2. Temperature Range 1: Maximum short-term temperature of 110°F (43°C). Maximum long-term temperature of 75°F (24°C).
3. Temperature Range 2: Maximum short-term temperature of 150°F (66°C). Maximum long-term temperature of 110°F (43°C).
4. Short-term concrete temperatures are those that occur over short intervals (diurnal cycling).
5. Long-term concrete temperature are constant temperatures over a significant time period.
6. For anchors that only resist wind or seismic loads, bond strengths may be increased by 72%.
7. In water-saturated concrete, multiply $\tau_{k,uncr}$ and $\tau_{k,cr}$ by K_{sat}.
8. For anchors installed in overhead and subjected to tension resulting from sustained loading, multiply the value calculated for N_a according to ICC-ES AC308 by 0.75.
9. The value of ϕ applies when the load combinations of ACI 318 Section 9.2 are used. If the load combinations of ACI 318 Appendix C are used, refer to Section D.4.5 to determine the appropriate value of ϕ.
10. The value of ϕ applies when both the load combinations of ACI 318 Section 9.2 are used and the requirements of Section D.4.4(c) for Condition B are met. If the load combinations of ACI 318 Appendix C are used, refer to Section D.4.5 to determine the appropriate value of ϕ.
11. The value of ϕ applies when both the load combinations of ACI 318 Section 9.2 are used and the requirements of Section D.4.4(c) for Condition B are met. If the load combinations of ACI 318 Section 9.2 are used and the requirements of Section D.4.4(c) for Condition A are met, refer to Section D.4.4 to determine the appropriate value of ϕ. If the load combinations of ACI 318 Appendix C are used, refer to Section D.4.5 to determine the appropriate value of ϕ.
12. Sand-lightweight and all-lightweight concrete are beyond the scope of this table.
13. For anchors installed in regions assigned to Seismic Design Category C, D, E or F, the bond strength values for #7 rebar anchors must be multiplied by $\alpha_{N,seis} = 0.80$.
14. For anchors installed in regions assigned to Seismic Design Category C, D, E or F, the bond strength values for #8 rebar anchors must be multiplied by $\alpha_{N,seis} = 0.92$
15. The values of f'_c used for calculation purposes must not exceed 8000 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.

* See page 13 for an explanation of the load table icons

SET-XP® Epoxy Anchor Shear Strength Design Data for Threaded Rod in Normal-Weight Concrete[1,5]

Characteristic		Symbol	Units	Nominal Anchor Diameter (in.)						
				⅜	½	⅝	¾	⅞	1	1¼
Steel Strength in Shear										
Threaded Rod	Minimum Shear Stress Area	A_{se}	in²	0.078	0.142	0.226	0.334	0.462	0.606	0.969
	Shear Resistance of Steel - ASTM A193, Grade B7	V_{sa}[6]	lb.	4,875	10,650	16,950	25,050	34,650	45,450	72,675
	- ASTM F1554, Grade 36			2,260	4,940	7,865	11,625	16,080	21,090	33,720
	- Type 410 Stainless (ASTM A193, Grade B6)			4,290	9,370	14,910	22,040	30,490	40,000	63,955
	- Type 304 and 316 Stainless (ASTM A193, Grade B8 and B8M)			2,225	4,855	7,730	11,420	15,800	20,725	33,140
	Reduction for Seismic Shear - ASTM F1554, Grade 36[6]	$\alpha_{V,seis}$	—	0.87	0.78	0.68	0.68	0.68	0.68	0.65
	Reduction for Seismic Shear - ASTM A193, Grade B7[6]			0.87	0.78	0.68	0.68	0.68	0.68	0.65
	Reduction for Seismic Shear - Stainless (ASTM A193, Grade B6)[6]			0.69	0.82	0.75	0.75	0.75	0.83	0.72
	Reduction for Seismic Shear - Stainless (ASTM A193, Grade B8 and B8M)[6]			0.69	0.82	0.75	0.75	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	0.500	0.625	0.750	0.875	1.000	1.250
Load Bearing Length of Anchor in Shear		ℓ_e	in.	h_{ef}						
Strength Reduction Factor - Breakout Failure		ϕ	—	0.70[3]						
Concrete Pryout Strength in Shear										
Coefficient for Pryout Strength		k_{cp}	—	2.0						
Strength Reduction Factor - Pryout Failure		ϕ	—	0.70[4]						

1. The information presented in this table is to be used in conjunction with the design criteria of ICC-ES AC308, except as modified below.
2. The value of ϕ applies when the load combinations of ACI 318 Section 9.2 are used. If the load combinations of AC 318 Appendix C are used, refer to Section D.4.5 to determine the appropriate value of ϕ.
3. The value of ϕ applies when both the load combinations of ACI 318 Section 9.2 are used and the requirements of Section D.4.4(c) for Condition B are met. If the load combinations of ACI 318 Section 9.2 are used and the requirements of Section D.4.4(c) for Condition A are met, refer to Section D.4.4 to determine the appropriate value of ϕ. If the load combinations of ACI 318 Appendix C are used, refer to Section D.4.5 to determine the appropriate value of ϕ.
4. The value of ϕ applies when both the load combinations of ACI 318 Section 9.2 are used and the requirements of Section D.4.4(c) for Condition B are met. If the load combinations of ACI 318 Appendix C are used, refer to Section D.4.5 to determine the appropriate value of ϕ.
5. Sand-lightweight and all-lightweight concrete are beyond the scope of this table.
6. The values of V_{sa} are applicable for both cracked 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 threaded rod steel type.

* See page 13 for an explanation of the load table icons

SET-XP® Epoxy Anchor Shear Strength Design Data for Rebar in Normal-Weight Concrete[1,5]

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	0.20	0.31	0.44	0.60	0.79	1.23
	Shear Resistance of Steel - Rebar (ASTM A615, Grade 60)	V_{sa}[6]	lb.	4,950	10,800	16,740	23,760	32,400	42,660	66,420
	Reduction for Seismic Shear - Rebar (ASTM A615, Grade 60)[6]	$\alpha_{V,seis}$	—	0.85	0.88	0.84	0.84	0.77	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	0.500	0.625	0.750	0.875	1.000	1.250
Load Bearing Length of Anchor in Shear		ℓ_e	in.	h_{ef}						
Strength Reduction Factor - Breakout Failure		ϕ	—	0.70[3]						
Concrete Pryout Strength in Shear										
Coefficient for Pryout Strength		k_{cp}	—	2.0						
Strength Reduction Factor - Pryout Failure		ϕ	—	0.70[4]						

1. The information presented in this table is to be used in conjunction with the design criteria of ICC-ES AC308, except as modified below.
2. The value of ϕ applies when the load combinations of ACI 318 Section 9.2 are used. If the load combinations of AC 318 Appendix C are used, refer to Section D.4.5 to determine the appropriate value of ϕ.
3. The value of ϕ applies when both the load combinations of ACI 318 Section 9.2 are used and the requirements of Section D.4.4(c) for Condition B are met. If the load combinations of ACI 318 Section 9.2 are used and the requirements of Section D.4.4(c) for Condition A are met, refer to Section D.4.4 to determine the appropriate value of ϕ. If the load combinations of ACI 318 Appendix C are used, refer to Section D.4.5 to determine the appropriate value of ϕ.
4. The value of ϕ applies when both the load combinations of ACI 318 Section 9.2 are used and the requirements of Section D.4.4(c) for Condition B are met. If the load combinations of ACI 318 Appendix C are used, refer to Section D.4.5 to determine the appropriate value of ϕ.
5. Sand-lightweight and all-lightweight concrete are beyond the scope of this table.
6. The values of V_{sa} are applicable for both cracked and uncracked concrete. For anchors installed in regions assigned to Seismic Design Category C, D, E or F, V_{sa} must be multiplied by $\alpha_{V,seis}$.

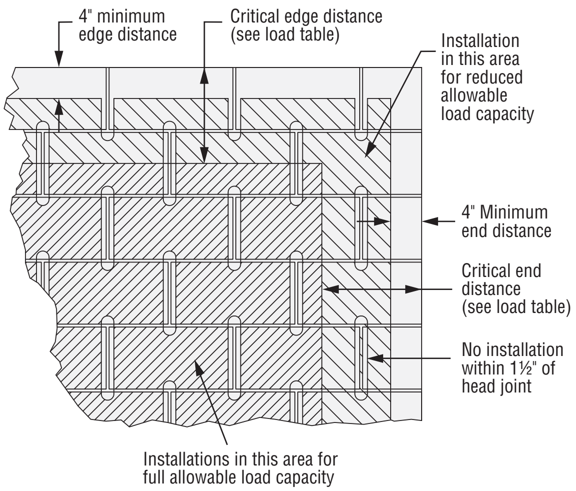
Tension and Shear Loads for Threaded Rod and Rebar Anchors in 8-inch Lightweight, Medium-Weight and Normal-Weight Grout Filled CMU

* See page 13 for an explanation of the load table icons

Rod Dia. in. (mm)	Drill Bit Dia. in.	Min. Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical End Dist. in. (mm)	Critical Spacing Dist. in. (mm)	8-inch Grout Filled CMU Allowable Loads Based on CMU Strength			
						Tension		Shear	
						Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)
Threaded Rod Anchors Installed on the Face of the CMU Wall (see Figure 1)									
⅜ (9.5)	½	3⅜ (86)	12 (305)	12 (305)	8 (203)	7,441 (33.1)	1,490 (6.6)	5,721 (25.4)	1,145 (5.1)
½ (12.7)	⅝	4½ (114)	12 (305)	12 (305)	8 (203)	9,125 (40.6)	1,825 (8.1)	6,997 (31.1)	1,350 (6.0)
⅝ (15.9)	¾	5⅝ (143)	12 (305)	12 (305)	8 (203)	9,618 (42.8)	1,895 (8.4)	6,887 (30.6)	1,350 (6.0)
¾ (19.1)	⅞	6½ (165)	12 (305)	12 (305)	8 (203)	9,480 (42.2)	1,895 (8.4)	6,747 (30.0)	1,350 (6.0)
Rebar Anchors Installed on the Face of the CMU Wall (see Figure 1)									
#3 (9.5)	½	3⅜ (86)	12 (305)	12 (305)	8 (203)	6,982 (31.1)	1,395 (6.2)	7,299 (32.5)	1,460 (6.5)
#4 (12.7)	⅝	4½ (114)	12 (305)	12 (305)	8 (203)	9,167 (40.8)	1,835 (8.2)	8,144 (36.2)	1,505 (6.7)
#5 (15.9)	¾	5⅝ (143)	12 (305)	12 (305)	8 (203)	10,925 (48.6)	2,185 (9.7)	7,530 (33.5)	1,505 (6.7)

1. Threaded rods must comply with ASTM F1554 Grade 36, Grade C minimum. Rebar must comply with ASTM A615, Grade 60 minimum.
2. Values for 8-inch wide concrete masonry units (CMU) with a minimum specified compressive strength of masonry, f'_m, at 28 days is 1500 psi.
3. Embedment depth is measured from the outside face of the concrete masonry unit.
4. Allowable loads may be increased 33⅓% for short-term loading due to wind forces or seismic forces where permitted by code.
5. Refer to in-service temperature sensitivity chart for allowable load adjustment for temperature.
6. The tabulated allowable loads are based on a safety factor of 5.0 for installations under the IBC and IRC.
7. Refer to allowable load-adjustment factors for end distance, edge distance and spacing on page 21.

Figure 1



Shaded Area = Placement for Full and Reduced Allowable Load Capacity in Grout-Filled CMU

In-Service Temperature Sensitivity

Base Material Temperature		Percent Allowable Load
°F	°C	
70	21	100%
110	43	89%
125	52	89%
135	57	74%
150	66	74%

1. Refer to temperature sensitivity chart for allowable bond strength reduction for temperature. See page 225 for more information.
2. Percent allowable load may be linearly interpolated for intermediate base material temperatures.
3. °C = (°F-32) / 1.8

Load-Adjustment Factors for SET-XP® Adhesive in Face of Wall Installation in 8" Grout-Filled CMU: End / Edge Distance and Spacing, Tension and Shear Loads

How to use these charts:

1. The following tables are for reduced end and edge distance and spacing.
2. Locate the anchor size to be used for either a tension and/or shear load application.
3. Locate the embedment (E) at which the anchor is to be installed.
4. Locate the end or edge distance (C_{act}) or spacing (S_{act}) at which the anchor is to be installed.
5. The load-adjustment factor (f_c or f_s) is the intersection of the row and column.
6. Multiply the allowable load by the applicable load-adjustment factor.
7. Reduction factors for multiple edges or spacing are multiplied together.
8. Adjustment factors do not apply to allowable steel strength values.
9. Adjustment factors are to be applied to allowable tension or shear load based on CMU strength values only.

End and Edge Distance Tension (f_c) *

* See page 13 for an explanation of the load table icons

Cact (in)	Dia.	⅜	½	⅝	¾	#3	#4	#5
	E	3⅜	4½	5⅝	6½	3⅜	4½	5⅝
	C_{cr}	12	12	12	12	12	12	12
	C_{min}	4	4	4	4	4	4	4
	f_{cmin}	0.91	1.00	1.00	1.00	0.96	0.88	0.88
4		0.91	1.00	1.00	1.00	0.96	0.88	0.88
6		0.93	1.00	1.00	1.00	0.97	0.91	0.91
8		0.96	1.00	1.00	1.00	0.98	0.94	0.94
10		0.98	1.00	1.00	1.00	0.99	0.97	0.97
12		1.00	1.00	1.00	1.00	1.00	1.00	1.00

See Notes Below

End and Edge Distance Shear (f_c) Shear Load Perpendicular to End or Edge *

Cact (in)	Dia.	⅜	½	⅝	¾	#3	#4	#5
	E	3⅜	4½	5⅝	6½	3⅜	4½	5⅝
	C_{cr}	12	12	12	12	12	12	12
	C_{min}	4	4	4	4	4	4	4
	f_{cmin}	0.72	0.58	0.48	0.44	0.62	0.54	0.43
4		0.72	0.58	0.48	0.44	0.62	0.54	0.43
6		0.79	0.69	0.61	0.58	0.72	0.66	0.57
8		0.86	0.79	0.74	0.72	0.81	0.77	0.72
10		0.93	0.90	0.87	0.86	0.91	0.89	0.86
12		1.00	1.00	1.00	1.00	1.00	1.00	1.00

End and Edge Distance Shear (f_c) Shear Load Parallel to End or Edge *

Cact (in)	Dia.	⅜	½	⅝	¾	#3	#4	#5
	E	3⅜	4½	5⅝	6½	3⅜	4½	5⅝
	C_{cr}	12	12	12	12	12	12	12
	C_{min}	4	4	4	4	4	4	4
	f_{cmin}	0.94	0.87	0.87	0.85	0.84	0.82	0.82
4		0.94	0.87	0.87	0.85	0.84	0.82	0.82
6		0.96	0.90	0.90	0.89	0.88	0.87	0.87
8		0.97	0.94	0.94	0.93	0.92	0.91	0.91
10		0.99	0.97	0.97	0.96	0.96	0.96	0.96
12		1.00	1.00	1.00	1.00	1.00	1.00	1.00

1. E = Embedment depth (inches).
2. C_{act} = actual end or edge distance at which anchor is installed (inches).
3. C_{cr} = critical end or edge distance for 100% load (inches).
4. C_{min} = minimum end or edge distance for reduced load (inches).
5. f_c = adjustment factor for allowable load at actual end or edge distance.
6. f_{ccr} = adjustment factor for allowable load at critical end or edge distance. f_{ccr} is always = 1.00.
7. f_{cmin} = adjustment factor for allowable load at minimum end or edge distance.
8. $f_c = f_{cmin} + [(1 - f_{cmin}) (C_{act} - C_{min}) / (C_{cr} - C_{min})]$.

Spacing Tension (f_s) *

Sact (in)	Dia.	⅜	½	⅝	¾	#3	#4	#5
	E	3⅜	4½	5⅝	6½	3⅜	4½	5⅝
	S_{cr}	8	8	8	8	8	8	8
	S_{min}	4	4	4	4	4	4	4
	f_{smin}	1.00	0.82	0.82	0.82	0.87	0.87	0.87
4		1.00	0.82	0.82	0.82	0.87	0.87	0.87
5		1.00	0.87	0.87	0.87	0.90	0.90	0.90
6		1.00	0.91	0.91	0.91	0.94	0.94	0.94
7		1.00	0.96	0.96	0.96	0.97	0.97	0.97
8		1.00	1.00	1.00	1.00	1.00	1.00	1.00

Spacing Shear (f_s) *

Sact (in)	Dia.	⅜	½	⅝	¾	#3	#4	#5
	E	3⅜	4½	5⅝	6½	3⅜	4½	5⅝
	S_{cr}	8	8	8	8	8	8	8
	S_{min}	4	4	4	4	4	4	4
	f_{smin}	1.00	1.00	1.00	1.00	0.91	0.91	1.00
4		1.00	1.00	1.00	1.00	0.91	0.91	1.00
5		1.00	1.00	1.00	1.00	0.93	0.93	1.00
6		1.00	1.00	1.00	1.00	0.96	0.96	1.00
7		1.00	1.00	1.00	1.00	0.98	0.98	1.00
8		1.00	1.00	1.00	1.00	1.00	1.00	1.00

1. E = Embedment depth (inches).
2. S_{act} = actual spacing distance at which anchors are installed (inches).
3. S_{cr} = critical spacing distance for 100% load (inches).
4. S_{min} = minimum spacing distance for reduced load (inches).
5. f_s = adjustment factor for allowable load at actual spacing distance.
6. f_{scr} = adjustment factor for allowable load at critical spacing distance. f_{scr} is always = 1.00.
7. f_{smin} = adjustment factor for allowable load at minimum spacing distance.
8. 8. $f_s = f_{smin} + [(1 - f_{smin}) (S_{act} - S_{min}) / (S_{cr} - S_{min})]$.