SET-XP™ *Structural Epoxy-Tie Anchoring Adhesive for Cracked and Uncracked Concrete*

TESTED TO MEET IBC® 2006

SIMPSON StrongTie ANCHOR SYSTEMS

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 2006 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 the IXP™ anchor, all thread 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 26–28

INSTALLATION: See pages 31–31

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™ Epoxy-Tie® adhesive have been tested in accordance with ICC-ES's *Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements (AC308)* for the following:

- Seismic and wind loading in cracked and uncracked concrete
- Static tension and shear loading in cracked and uncracked concrete
- 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™

EMN22i

EDT22B

SET-XP™ Adhesive

ANCHOR DESIGNER ACI318 Software Supported

- IMPORTANT -
SEE Pages 31–32 FOR INSTALLATION INSTRUCTIONS

SET-XP Cartridge System

Model No.	Capacity ounces (cubic inches)	Cartridge Type	Carton Quantity	Dispensing tool(s)	Mixing Nozzle
SET-XP22	22 (39.7)	side-by-side	10	EDT22B, EDT22AP, EDT22CKT	EMN22i

1. Cartridge estimation guides are available on page 64.
2. Detailed information on dispensing tools, mixing nozzles and other adhesive accessories is available on pages 87–92.
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 Temerature		Cure Time
°F	°C	
50	10	72 hrs.
70	21	24 hrs.
90	32	24 hrs.
110	43	24 hrs.

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™ Epoxy-Tie® adhesive from Simpson Strong-Tie, Pleasanton, CA. Anchors shall be installed per Simpson Strong-Tie instructions for SET-XP Epoxy-Tie adhesive.

ACCESSORIES: See pages 87–92 for information on dispensing tools, mixing nozzles and other accessories.

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				
				½ / #4	⅝ / #5	¾ / #6	⅞ / #7	1 / #8
Installation Information								
Drill Bit Diameter		d	in.	⅝	¾	⅞	1	1⅛
Maximum Tightening Torque		T_{inst}	ft-lb	40	90	130	200	300
Permitted Embedment Depth (h_{ef}) Range[2]	Minimum	-	in.	2¾	3⅛	3½	3¾	4
	Maximum	-	in.	10	12½	15	17 1/2	20
Minimum Concrete Thickness		h_{min}	in.	2.25 x h_{ef}				
Critical Edge Distance		c_{ac}	in.	3 x h_{ef}				
Minimum Edge Distance		c_{min}	in.	1¾				
Minimum Anchor Spacing		s_{min}	in.	3				

1. The information presented in this table is to be used in conjunction with the design criteria of ICC-ES AC308. See pages 18–19.
2. Minimum and maximum embedment depths are set so as to fit the ICC-ES AC308 design model.

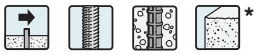
*See page 10 for an explanation of the load table icons

SET-XP™ Epoxy Tension Design Data for Threaded Rod and Rebar in Normal-Weight Concrete[1,12]

Characteristic			Symbol	Units	Nominal Anchor Diameter (inch) / Rebar Size				
					½ / #4	⅝ / #5	¾ / #6	⅞ / #7	1 / #8
Steel Strength in Tension									
Threaded Rod	Minimum Tensile Stress Area		A_{se}	in²	0.142	0.226	0.334	0.462	0.606
	Tension Resistance of Steel - ASTM A193, Grade B7		N_{sa}	lb.	17,750	28,250	41,750	57,750	75,750
	- ASTM A307, Grade C				8,235	13,110	19,370	26,795	35,150
	- Type 410 Stainless (ASTM A193, Grade B6)				15,620	24,860	36,740	50,820	66,660
	- Type 304 Stainless (ASTM A193, Grade B8)				10,650	16,950	25,050	34,650	45,450
	Strength Reduction Factor - Steel Failure		ϕ	-	0.75[9]				
Rebar	Minimum Tensile Stress Area		A_{se}	in²	0.20	0.31	0.44	0.60	0.79
	Tension Resistance of Steel - Rebar (ASTM A615, Grade 60)		N_{sa}	lb.	18,000	27,900	39,600	54,000	71,100
	Strength Reduction Factor - Steel Failure		ϕ	-	0.65[9]				
Concrete Breakout Strength in Tension									
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)									
Temp. Range 1 for Uncracked Concrete[2,4,5]	Characteristic Bond Strength[8]		$\tau_{k,uncr}$	psi	2,422	2,263	1,942	1,670	2,003
	Permitted Embedment Depth Range	Minimum	h_{ef}	in	2¾	3⅛	3½	3¾	4
		Maximum			10	12½	15	17½	20
Temp. Range 1 for Cracked Concrete[2,4,5]	Characteristic Bond Strength[8,13,14]		$\tau_{k,cr}$	psi	1,040	718	1,003	619	968
	Permitted Embedment Depth Range	Minimum	h_{ef}	in	4	5	6	7	8
		Maximum			10	12½	15	17½	20
Temp. Range 2 for Uncracked Concrete[3,4,5]	Characteristic Bond Strength[6,8]		$\tau_{k,uncr}$	psi	1,250	1,170	1,005	860	1,035
	Permitted Embedment Depth Range	Minimum	h_{ef}	in	2¾	3⅛	3½	3¾	4
		Maximum			10	12½	15	17½	20
Temp. Range 2 for Cracked Concrete[3,4,5]	Characteristic Bond Strength[6,8,13,14]		$\tau_{k,cr}$	psi	537	371	518	320	500
	Permitted Embedment Depth Range	Minimum	h_{ef}	in	4	5	6	7	8
		Maximum			10	12½	15	17½	20
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. See pages 18–19.
2. Temperature Range 1: Maximum short-term temperature of 110°F. Maximum long-term temperature of 75°F.
3. Temperature Range 2: Maximum short-term temperature of 150°F. Maximum long-term temperature of 110°F.
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. See page 18.
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 D4.5 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 D4.4(c) for Condition B are met. If the load combinations of ACI 318 Appendix C are used, refer to Section D4.5 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 D4.4(c) for Condition B are met. If the load combinations of ACI 318 Section 9.2 are used and the requirements of Section D4.4(c) for Condition A are met, refer to Section D4.4 to determine the appropriate value of ϕ. If the load combinations of ACI 318 Appendix C are used, refer to Section D4.5 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 7/8" anchors or #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 1" anchors or #8 rebar anchors must be multiplied by $\alpha_{N,seis}$ = 0.92

SET-XP™ Epoxy Shear Design Data for Threaded Rod and Rebar in Normal-Weight Concrete[1,5]



*See page 10 for an explanation of the load table icons

Characteristic		Symbol	Units	Nominal Anchor Diameter (inch) / Rebar Size				
				½ / #4	⅝ / #5	¾ / #6	⅞ / #7	1 / #8
Steel Strength in Shear								
Threaded Rod	Minimum Shear Stress Area	A_{se}	in²	0.142	0.226	0.334	0.462	0.606
	Shear Resistance of Steel - ASTM A193, Grade B7	V_{sa}[6]	lb.	10,650	16,950	25,050	34,650	45,450
	- ASTM A307, Grade C			4,940	7,865	11,625	16,080	21,090
	- Type 410 Stainless (ASTM A193, Grade B6)			9,370	14,910	22,040	30,490	40,000
	- Type 304 Stainless (ASTM A193, Grade B8)			6,390	10,170	15,030	20,790	27,270
	Reduction for Seismic Shear - ASTM A307, Grade C[6]	$\alpha_{V,seis}$	-	0.71				
	Reduction for Seismic Shear - ASTM A193, Grade B7[6]			0.71				
	Reduction for Seismic Shear - Stainless (ASTM A193, Grade B6)[6]			0.80				
	Reduction for Seismic Shear - Stainless (ASTM A193, Grade B8)[6]			0.80				
	Strength Reduction Factor - Steel Failure	ϕ	-	0.65[2]				
Rebar	Minimum Shear Stress Area	A_{se}	in²	0.20	0.31	0.44	0.60	0.79
	Shear Resistance of Steel - Rebar (ASTM A615, Grade 60)	V_{sa}[6]	lb.	10,800	16,740	23,760	32,400	42,660
	Reduction for Seismic Shear - Rebar (ASTM A615, Grade 60)[6]	$\alpha_{V,seis}$	-	0.80				
	Strength Reduction Factor - Steel Failure	ϕ	-	0.60[2]				
Concrete Breakout Strength in Shear								
Outside Diameter of Anchor		d_o	in.	0.500	0.625	0.750	0.875	1.000
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. See pages 18–19.
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 D4.5 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 D4.4(c) for Condition B are met. If the load combinations of ACI 318 Section 9.2 are used and the requirements of Section D4.4(c) for Condition A are met, refer to Section D4.4 to determine the appropriate value of ϕ. If the load combinations of ACI 318 Appendix C are used, refer to Section D4.5 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 D4.4(c) for Condition B are met. If the load combinations of ACI 318 Appendix C are used, refer to Section D4.5 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 anchor material.