Snake+ *Internally Threaded Screw Anchor*

PRODUCT DESCRIPTION

The Snake+ anchor is an internally threaded, self-tapping screw anchor designed for performance in cracked and uncracked concrete. Suitable base materials include normal-weight concrete, structural sand-lightweight concrete and concrete over steel deck. The Snake+ screw anchor is installed into a drilled hole with a power tool and a Snake+ setting tool. After installation a steel insert element is threaded into the anchor body.

GENERAL APPLICATIONS AND USES

- Suspending conduit
- Cable trays and strut
- Pipe supports
- Fire sprinklers
- Interior applications/low level corrosion environment
- Tension zone areas
- Seismic and wind loading applications
- Suspended lighting

FEATURES AND BENEFITS

+ Designed for use in holes drilled with standard ANSI carbide drill bits
+ Anchor design allows for shallow embedment and mechanically interlocks with base material
+ Internally threaded anchor for easy adjustment and removability of threaded rod or bolt
+ Fast anchor installation with a powered impact wrench
+ Hammer not used for installation

APPROVALS AND LISTINGS

International Code Council, Evaluation Service (ICC-ES), ESR-2272
Code compliant with the 2006 IBC, 2006 IRC, 2003 IBC, 2003 IRC and 1997 UBC
Tested in accordance with ACI 355.2 and ICC-ES AC193 for use in structural concrete under the design provisions of ACI 318 (Strength Design method using Appendix D)
Evaluated and qualified by an accredited independent testing laboratory for recognition in cracked and uncracked concrete including seismic and wind loading (Category 1 anchor)
Evaluated and qualified by an accredited independent testing laboratory for reliability against brittle failure, e.g. hydrogen embrittlement
FM Global (Factory Mutual) - File No. 3024502
Pipe hanger components for automatic sprinkler systems

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring and 05090-Metal Fastenings.*
Internally threaded anchors shall be Snake+ as supplied by Powers Fasteners, Inc., Brewster, NY. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

MATERIAL SPECIFICATIONS

Anchor Component	Specification
Anchor body	Case hardened carbon steel
Plating	Zinc plating according to ASTM B 633, SC1, Type III (Fe/Zn 5) Minimum plating requirement for mild Service Condition

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Snake+

INTERNAL THREAD VERSION

Unified coarse thread (UNC)

ANCHOR MATERIALS

Zinc plated carbon steel body

ANCHOR SIZE RANGE (TYP.)

3/8″ diameter

SUITABLE BASE MATERIALS

Normal-weight concrete
Structural sand-lightweight concrete
Concrete over steel deck

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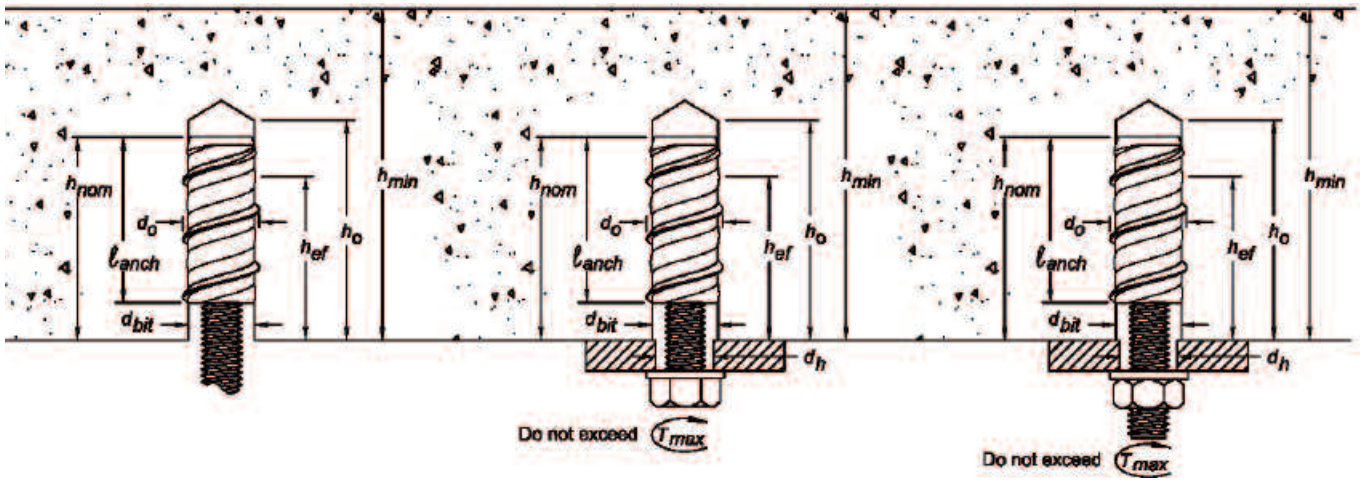
INSTALLATION SPECIFICATIONS

Installation Information for Snake+ Screw Anchor

Anchor Property / Setting Information	Notation	Units	Nominal Anchor Size
			3/8"
Nominal outside anchor diameter	d_o	in. (mm)	1/2 (12.7)
Internal thread diameter (UNC)	d	in. (mm)	0.375 (9.5)
Minimum drill bit diameter	d_{bit}	in.	1/2 ANSI
Minimum nominal embedment depth	h_{nom}	in. (mm)	1-5/8 (41)
Effective embedment	h_{ef}	in. (mm)	1.10 (28)
Minimum hole depth	h_o	in. (mm)	2 (51)
Minimum concrete member thickness[1]	h_{min}	in. (mm)	4 (102)
Overall anchor length	ℓ_{anch}	in. (mm)	1-1/4 (32)
Minimum edge distance[1]	c_{min}	in. (mm)	3 (76)
Minimum spacing distance[1]	s_{min}	in. (mm)	3 (76)
Critical edge distance[1]	c_{ac}	in. (mm)	3 (76)
Maximum impact wrench power (torque)	T_{screw}	ft.-lb. (N-m)	345 (468)
Minimum diameter of hole clearance in fixture for steel insert element (following anchor installation)	d_h	in. (mm)	7/16 (11)
Maximum tightening torque of steel insert element (threaded rod or bolt)	T_{max}	ft.-lb. (N-m)	8 (11)

1. For installations through the soffit of steel deck into concrete, see the installation detail. Anchors in the lower flute may be installed with a maximum 1-inch offset in either direction from center of the flute. In addition, anchors shall have an axial spacing along the flute equal to the greater of $3h_{ef}$ or 1.5 times the flute width.

Dimensional Sketch for Snake+ Screw Anchor Installed with Steel Insert Element



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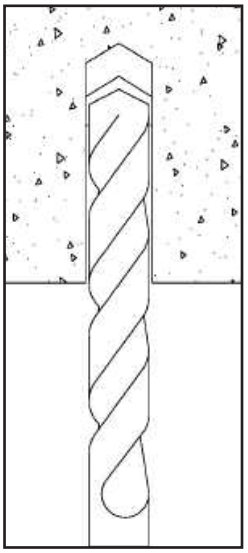
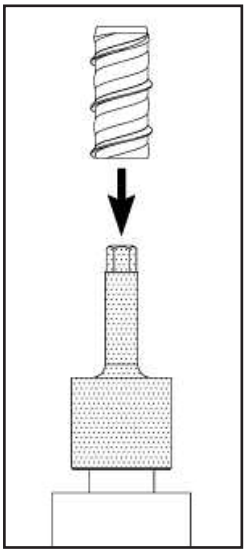
INSTALLATION INSTRUCTIONS

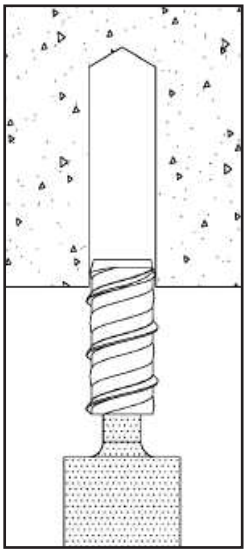
Installation Instructions for Snake+ Screw Anchor



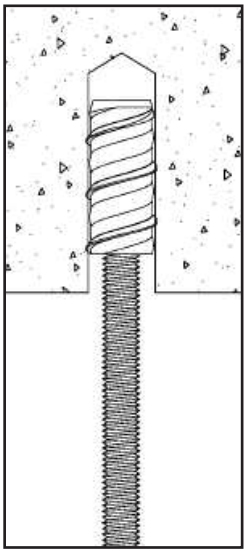
1.) *Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the carbide drill bit used should meet the requirements of ANSI Standard B212.15.*



2.) *Select a powered impact wrench that does not exceed the maximum torque, T_{screw}, for the selected anchor diameter. Attach the Snake+ setting tool supplied by Powers Fasteners to the impact wrench. Mount the anchor onto the setting tool.*

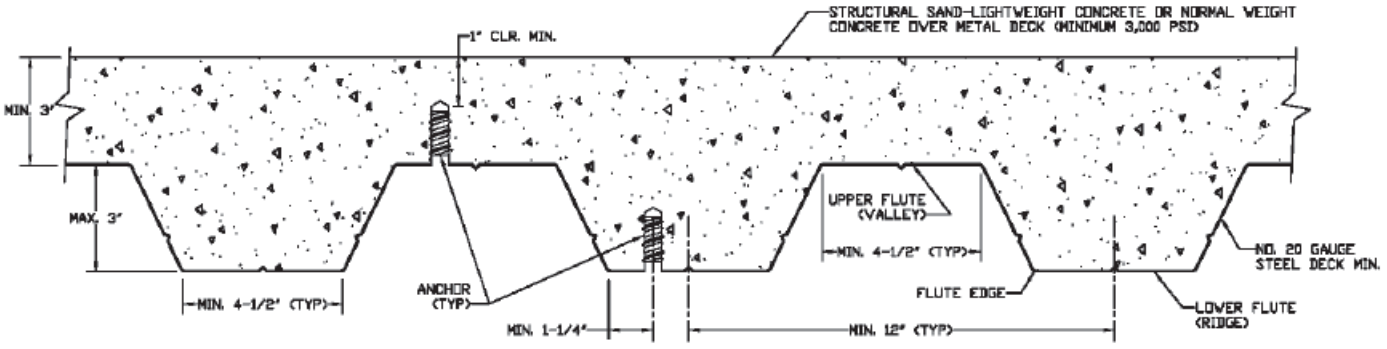


3.) *Drive the anchor into the hole until the shoulder of the Snake+ setting tool comes into contact with the surface of the base material. Do not spin the setting tool off the anchor to disengage.*



4.) *Insert threaded rod or a bolt into the Snake+, taking care not to exceed the maximum specified tightening torque of the steel insert element, T_{max}. Minimum thread engagement should be at least one anchor diameter.*

Installation Detail for Snake+ Screw Anchor Installed Through Soffit Steel Deck into Concrete



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PERFORMANCE DATA

Tension Design Information (For use with load combinations taken from ACI 318 Section 9.2)[1,2,3]

Design Characteristic	Notation	Units	Nominal Anchor Size	
			3/8"	
Anchor category	1, 2 or 3	-	1	
Nominal embedment depth	h_{nom}	in.	1-5/8	
STEEL STRENGTH IN TENSION[4]				
Minimum specified yield strength of steel insert element (threaded rod or bolt)	f_y	ksi (N/mm²)	SAE J429, Grade 2	36.0 (248)
		ksi (N/mm²)	ASTM A193, Grade B7	105.0 (724)
Minimum specified ultimate strength of steel insert element (threaded rod or bolt)	f_{ut}	ksi (N/mm²)	SAE J429, Grade 2	58.0 (400)
		ksi (N/mm²)	ASTM A193, Grade B7	125.0 (862)
Effective tensile stress area of steel insert element (threaded rod or bolt)	A_{se}	in² (mm²)	0.0775 (50)	
Steel strength in tension	N_{sa}	lb (kN)	SAE J429, Grade 2	4,495 (20.0)
		lb (kN)	ASTM A193, Grade B7	9,685 (43.1)
Reduction factor for steel strength[3]	ϕ	-	0.65	
CONCRETE BREAKOUT STRENGTH IN TENSION[8]				
Effective embedment	h_{ef}	in. (mm)	1.10 (28)	
Effectiveness factor for uncracked concrete	k_{uncr}	-	24	
Effectiveness factor for cracked concrete	k_{cr}	-	17	
Modification factor for cracked and uncracked concrete[5]	$\psi_{c,N}$	-	1.0 See note 5	
Critical edge distance	c_{ac}	in. (mm)	3 (76)	
Reduction factor for concrete breakout strength[3]	ϕ	-	0.65 (Condition B)	
PULLOUT STRENGTH IN TENSION (NON-SEISMIC APPLICATIONS)[8]				
Characteristic pullout strength, uncracked concrete (2,500 psi)[6]	$N_{p,uncr}$	lb (kN)	See note 7	
Characteristic pullout strength, cracked concrete (2,500 psi)[6]	$N_{p,cr}$	lb (kN)	See note 7	
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)	
PULLOUT STRENGTH IN TENSION FOR SEISMIC APPLICATIONS[8]				
Characteristic pullout strength, seismic[6,9]	N_{eq}	lb (kN)	See note 7	
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)	
PULLOUT STRENGTH IN TENSION FOR STRUCTURAL SAND-LIGHTWEIGHT AND NORMAL-WEIGHT CONCRETE OVER STEEL DECK				
Characteristic pullout strength, uncracked concrete over steel deck[10]	$N_{p,deck,uncr}$	lb (kN)	1,515 (6.7)	
Characteristic pullout strength, cracked concrete over steel deck[10]	$N_{p,deck,cr}$	lb (kN)	1,075 (4.8)	
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)	

1. The data in this table is intended to be used with the design provisions of ACI 318 Appendix D; for anchors resisting seismic load combinations the additional requirements of Section D.3.3 shall apply.
2. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of ACI 318 Section 9.2. If the load combinations of ACI 318 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 Section D.4.5.
4. It is assumed that the threaded rod or bolt used with the Snake+ anchor will be a ductile steel element as defined by ACI 318 Section D.1. However, the anchor steel is classified as non-ductile in seismic tension calculations. Steel failure does not control in this condition.
5. For all design cases use $\psi_{c,N} = 1.0$. Select appropriate effectiveness factor for cracked concrete (k_{cr}) or uncracked concrete (k_{uncr}).
6. For all design cases use $\psi_{c,P} = 1.0$. For concrete compressive strength greater than 2,500 psi, N_{pn} = (Pullout strength value from table)*(specified concrete compressive strength/2500)$^{0.5}$.
7. Pullout strength will not control design of indicated anchors. Do not calculate pullout strength for indicated anchor size and embedment.
8. Anchors are permitted to be used in structural sand-lightweight concrete provided that N_b and N_{pn} are multiplied by a factor of 0.60 (not required for steel deck).
9. Reported values for characteristic pullout strength in tension for seismic applications are based on test results per ACI 355.2, Section 9.5.
10. Values for $N_{p,\ deck}$ are for structural sand-lightweight concrete ($f'_{c,\ min}$ = 3,000 psi) and additional lightweight concrete reduction factors need not be applied. In addition, evaluation for the concrete breakout capacity in accordance with ACI 318 Section D.5.2 is not required for anchors installed in the flute (soffit). (e))

PERFORMANCE DATA

Shear Design Information (For use with load combinations taken from ACI 318 Section 9.2)[1,2,3]

Design Characteristic	Notation	Units	Nominal Anchor Size	
			3/8"	
Anchor category	1, 2 or 3	-	1	
Nominal embedment depth	h_{nom}	in.	1-5/8	
STEEL STRENGTH IN SHEAR[4]				
Minimum specified yield strength of steel insert element (threaded rod or bolt)	f_y	ksi (N/mm²)	SAE J429, Grade 2	36.0 (248)
		ksi (N/mm²)	ASTM A193, Grade B7	105.0 (724)
Minimum specified ultimate strength of steel insert element (threaded rod or bolt)	f_{ut}	ksi (N/mm²)	SAE J429, Grade 2	58.0 (400)
		ksi (N/mm²)	ASTM A193, Grade B7	125.0 (862)
Steel strength in shear	V_{sa}	lb (kN)	SAE J429, Grade 2	770 (3.4)
		lb (kN)	ASTM A193, Grade B7	1,655 (7.4)
Reduction factor for steel strength[3]	ϕ	-	0.65	
CONCRETE BREAKOUT STRENGTH IN SHEAR[5]				
Load bearing length of anchor (h_{ef} or $8d_o$, whichever is less)	ℓ_e	in. (mm)	1.10 (28)	
Reduction factor for concrete breakout strength[3]	ϕ	-	0.70 (Condition B)	
CONCRETE PRYOUT STRENGTH IN SHEAR[5]				
Coefficient for pryout strength (1.0 for $h_{ef} < 2.5$ in, 2.0 for $h_{ef} \geq 2.5$ in.)	k_{cp}	-	1.0	
Effective embedment	h_{ef}	in. (mm)	1.10 (28)	
Reduction factor for pryout strength[3]	ϕ	-	0.70 (Condition B)	
STEEL STRENGTH IN SHEAR FOR SEISMIC APPLICATIONS[5]				
Steel strength in shear, seismic[6]	V_{eq}	lb (kN)	SAE J429, Grade 2	770 (3.4)
		lb (kN)	ASTM A193, Grade B7	1,655 (7.4)
Reduction factor for steel strength in shear for seismic[3]	ϕ	-	0.65	
STEEL STRENGTH IN SHEAR FOR STRUCTURAL SAND-LIGHTWEIGHT AND NORMAL-WEIGHT CONCRETE OVER STEEL DECK[8]				
Steel strength in shear, concrete over steel deck[7]	$V_{sa,deck}$	lb (kN)	SAE J429, Grade 2	770 (3.4)
		lb (kN)	ASTM A193, Grade B7	1,655 (7.4)
Reduction factor for steel strength in shear for steel deck[3]	ϕ	-	0.65	

1. The data in this table is intended to be used with the design provisions of ACI 318 Appendix D; For anchors resisting seismic load combinations the additional requirements of Section D.3.3 shall apply.
2. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of ACI 318 Section 9.2. If the load combinations of ACI 318 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 Section D.4.5.
4. It is assumed that the threaded rod or bolt used with the Snake+ anchor will be a ductile steel element as defined by ACI 318 Section D.1. Linear interpolation may be used to derive shear values for steel strength of ductile anchor insert elements that have strengths between the minimum specified ultimate steel strengths listed by using the following equations: $V_{sa} = V_{s,\,deck} = 0.0132 f_{ut}$ (Imperial; lbs, psi) or $V_{sa} = V_{s,\,deck} = 0.00853 f_{ut}$ (Metric; kN, MPa).
5. Anchors are permitted to be used in structural sand-lightweight concrete provided that V_b and V_{cp} are multiplied by a factor of 0.60 (not required for steel deck).
6. Reported values for steel strength in shear for seismic applications are based on test results per ACI 355.2, Section 9.6.
7. Values for $V_{sa,\,deck}$ are for structual sand-lightweight concrete ($f'_{c,\,min} = 3{,}000$ psi) and additional lightweight concrete reduction factors need not be applied. In addition, evaluation for the concrete breakout capacity in accordance with ACI 318 Section D.6.2 and the pryout capacity in accordance with Section D.6.3 are not required for anchors installed in the flute (soffit).
8. Shear loads for anchors installed through steel deck into concrete may be applied in any direction.

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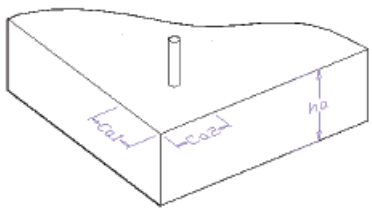
Factored Design Strength (ϕN_n and ϕV_n) Calculated in Accordance with ACI 318-05 Appendix D:



1. Tabular values are are provided for illustration and applicable for single anchors installed in normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac} (table values based on $c_{a1} = c_{ac}$).
   - c_{a2} is greater than or equal to 1.5 c_{a1}.
2. Calculations were performed according to ACI 318-05 Appendix D. The load level corresponding to the controlling failure mode is listed (e.g. For *tension:* steel, concrete breakout and pullout; For *shear:* steel, concrete breakout and pryout). Furthermore, the capacities for concrete breakout strength in tension and pryout strength in shear are calculated using the effective embedment values, h_{ef}, for the selected anchors as noted in the design information tables. Please also reference the installation specifications for more information.
3. Strength reduction factors (ϕ) were based on ACI 318 Section 9.2 for load combinations. Condition B is assumed.
4. Tabular values are permitted for static loads only, seismic loading is not permitted with these tables.
5. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318 Appendix D.
6. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318 Appendix D. For other design conditions including seismic considerations please see ACI 318 Appendix D.

Tension and Shear Factored Design Strength for Snake+ in Cracked Concrete

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Steel Insert Element *(Threaded Rod or Bolt)*	Minimum Concrete Compressive Strength, $f'c$ (psi)									
			2,500		3,000		4,000		6,000		8,000	
			ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)
3/8	1-5/8	SAE J429 Grade 2	635	**500**	700	**500**	805	**500**	985	**500**	1,140	**500**
	1-5/8	ASTM A193 Grade B7	635	685	700	750	805	870	985	970	1,140	1,065

Tension and Shear Factored Design Strength for Snake+ in Uncracked Concrete

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Steel Insert Element *(Threaded Rod or Bolt)*	Minimum Concrete Compressive Strength, $f'c$ (psi)									
			2,500		3,000		4,000		6,000		8,000	
			ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)
3/8	1-5/8	SAE J429 Grade 2	900	**500**	985	**500**	1,140	**500**	1,395	**500**	1,610	**500**
	1-5/8	ASTM A193 Grade B7	900	970	985	1,060	1,140	**1,080**	1,395	**1,080**	1,610	**1,080**

Legend

- Steel Strength Controls
- Concrete Breakout Strength Controls
- Anchor Pullout/Pryout Strength Controls

ORDERING INFORMATION

Carbon Steel Snake+ Screw Anchor

Cat. No.	Anchor Size	Nominal Embedment	Internal Thread Depth	Std. Box	Std. Ctn.
6401SD	3/8″	1-5/8″	11/16″	50	500

Setting Tool for Snake+ Screw Anchor

Cat. No.	Driver	Anchor Size	Std. Box
6407SD	1/2″ square	3/8″	1

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