PRODUCT SUBMITTAL / SUBSTITUTION REQUEST

TO:

PROJECT:

SPECIFIED ITEM:

Section *Page* *Paragraph* *Description*

PRODUCT SUBMITTAL / SUBSTITUTION REQUESTED:

The Vertigo+ one piece, all steel threaded fastening system for suspending threaded rod.

The attached submittal package includes the product description, specifications, drawings, and performance data for use in the evaluation of the request.

SUBMITTED BY:

Name: *Signature:*

Company:

Address:

Date: *Telephone:* *Fax:*

FOR USE BY THE ARCHITECT AND/OR ENGINEER

☐ ***Approved*** ☐ ***Approved as Noted*** ☐ ***Not Approved***

(If not approved, please briefly explain why the product was not accepted.)

By: *Date:*

Remarks:

Vertigo™ + *Rod Hanger Anchors*

PRODUCT DESCRIPTION

Vertigo+ is a one-piece, all steel threaded fastening system for suspending threaded rod in pipe hanging, fire protection, electrical conduit and cable-tray applications. They can be installed in a variety of base materials including normal-weight concrete, structural sand-lightweight concrete and concrete over steel deck. Vertigo+ accepts threaded rods and bolts in 1/4", 3/8" and 1/2" diameters. Vertigo+ anchors are designed for simple fast installations and for reliable performance in cracked and uncracked concrete.

GENERAL APPLICATIONS

- Hanging pipe and sprinkler systems
- Suspending conduit and cable trays
- Lighting systems and overhead utilities
- HVAC ductwork and strut channels
- Suspended ceilings

FEATURES AND BENEFITS

+ Simple system for all rod hanging applications in concrete
+ Internally threaded coupler for easy removability of service items
+ Ease and speed of installation and attachment
+ Lower in-place cost, when compared to traditional anchors
+ Can be installed with an adjustable torque impact driver
+ Consistent performance in high and low strength concrete

APPROVALS AND LISTINGS

International Code Concil, Evaluation Service (ICC-ES). ESR-2989 code compliant with the 2009 IBC, 2009 IRC, 2006 IBC, 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 anchors)

Evaluated and qualified by an accredited independent testing laboratory for reliability against brittle failure, e.g. hydrogen embrittlement

Evaluated and qualified by an accredited independent testing laboratory for supplemental recognition in redundant fastening applications

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring and 05090-Metal Fastenings.*

Anchors shall be Vertigo+ 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 / Coupler head	Case hardened low carbon steel
Plating	Zinc plating according to ASTM B 633, SC1, Type II (Fe/Zn 5) Minimum plating requirement for Mild Service Condition

SECTION CONTENTS Page No.

Concrete Vertigo+

INTERNAL THREAD VERSION

Unified coarse thread (UNC)

ANCHOR MATERIALS

Zinc Plated Carbon Steel
(Yellow Dichromate Finish)

ROD/ANCHOR SIZE RANGE (TYP.)

1/4" diameter through 1/2" diameter

SUITABLE BASE MATERIALS

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

TENSION ZONE CRACKED CONCRETE · SEISMIC REGION QUALIFICATION · ICC ES

This Product Available In

PDA®

Powers Design Assist
Real Time Anchor Design Software
www.powersdesignassist.com

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INSTALLATION SPECIFICATIONS

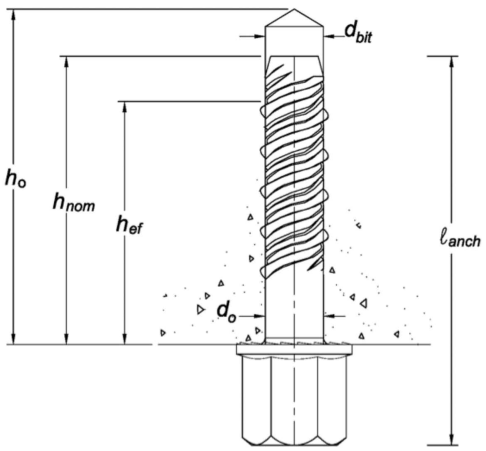
Installation Table for Vertigo+

Anchor Property/ Setting Information	Symbol	Units	Nominal Anchor Size / Threaded Coupler Diameter (in.)		
			1/4	3/8	1/2
Nominal anchor shank diameter	d_o	in.	0.375 (9.5)	0.375 (9.5)	0.375 (9.5)
Nominal drill bit diameter	d_{bit}	in.	3/8 Wedge-bit	3/8 Wedge-bit	3/8 Wedge-bit
Wedge-bit tolerance range	-	in.	0.385 to 0.389	0.385 to 0.389	0.385 to 0.389
Nominal embedment depth	h_{nom}	in. (mm)	2-1/8 (50.8)	2-1/8 (50.8)	2-1/8 (50.8)
Effective embedment	h_{ef}	in. (mm)	1.425 (36)	1.425 (36)	1.425 (36)
Minimum hole depth	h_o	in. (mm)	2-1/2 (64)	2-1/2 (64)	2-1/2 (64)
Minimum member thickness[1,2]	h_{min}	in. (mm)	4 (102)	4 (102)	4 (102)
Overall anchor length	ℓ_{anch}	in. (mm)	3 (76)	3 (76)	3 (76)
Minimum edge distance[1,2]	c_{min}	in. (mm)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)
Minimum spacing distance[1,2]	s_{min}	in. (mm)	2-1/2 (64)	2-1/2 (64)	2-1/2 (64)
Critical edge distance[1,2]	c_{ac}	in. (mm)	2-3/4 (70)	2-3/4 (70)	2-3/4 (70)
Maximum impact wrench power (torque)	T_{screw}	ft.-lb. (N-m)	185 (250)	185 (250)	185 (250)
Impact wrench / socket size	d_h	in.	11/16	11/16	11/16
Head height	-	in.	3/4	3/4	3/4

For SI: 1 inch = 25.4 mm, 1 ft-lbf = 1.356 N-m

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.
2. For use with the design provisions of ACI 318 Appendix D.

Vertigo+ Anchor Detail in Concrete



Hex Coupler Heads

1/4" 3/8" 1/2"

Matched Tolerance System

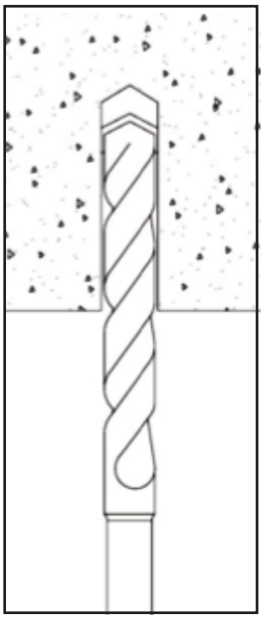
Blue tip

Blue Wedge-bit

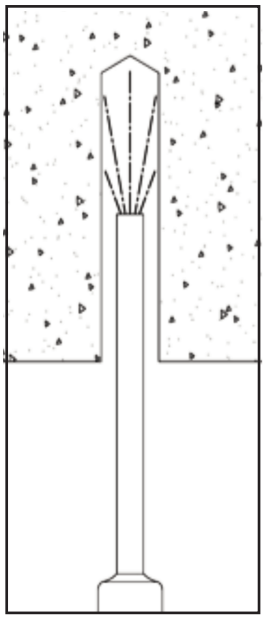
Designed and tested as a system for consistency and reliability

INSTALLATION INSTRUCTIONS

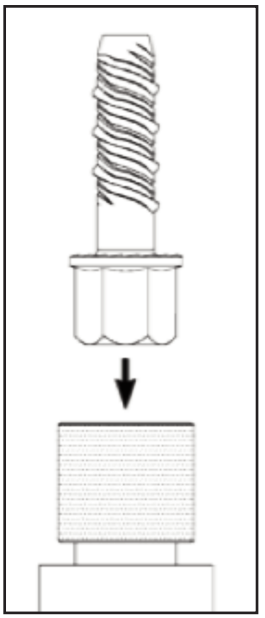
Installation Instructions for Vertigo+



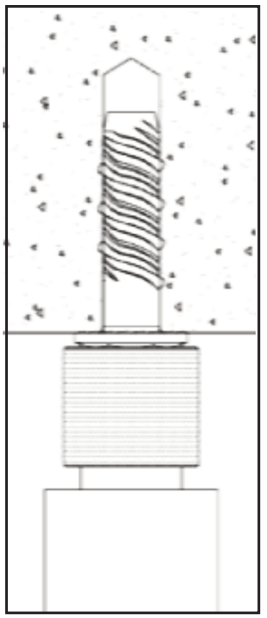
1.) Using the proper Wedge-bit size, drill a hole into the base material to the required depth. The tolerances of the Wedge-bit used must meet the requirements of the published Wedge-bit range.



2.) Remove dust and debris from the hole

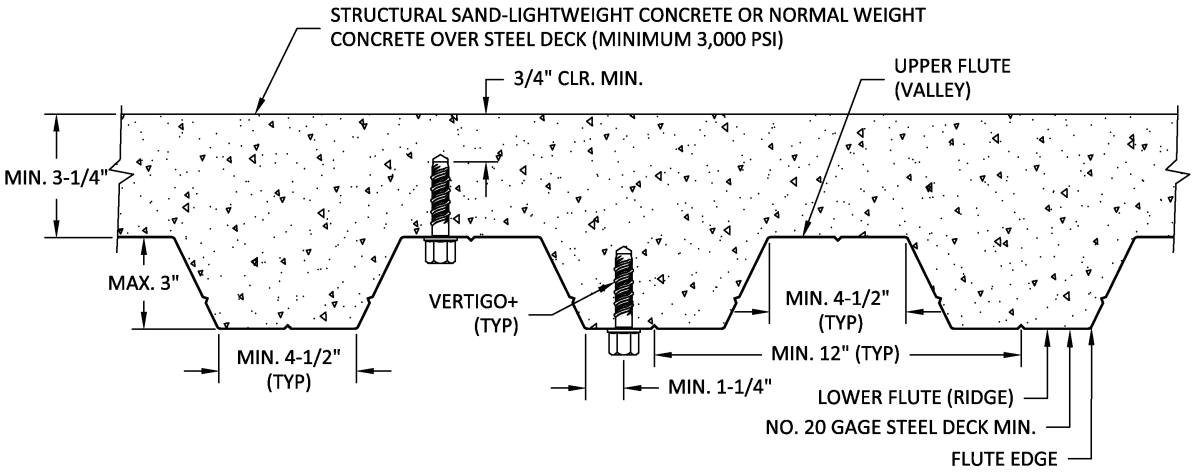


3.) Select a powered impact wrench that does not exceed the maximum torque, screw, for the selected anchor diameter. Attach an appropriate sized hex socket/driver to the impact wrench. Mount the screw anchor head into the socket.



4.) Drive the anchor into the hole until the head of the anchor comes into contact with the member surface. The anchor should be snug after installation. Do not spin the hex socket off the anchor to disengage. Insert threaded rod or bolt int Vertigo+.

Installation Detail for Vertigo+ Installed Through Soffit or Steel Deck into Concrete



PERFORMANCE DATA

Tension Design Information For Vertigo+ Anchors in Concrete (For use with load combinations taken from ACI 318 Section 9.2) [1,2]

Design Characteristic	Notation	Units	Nominal Anchor Size / Threaded Coupler Diameter (in.)		
			1/4	3/8	1/2
Anchor category	1, 2 or 3	-	1	1	1
Nominal embedment depth	h_{nom}	in.	2-1/8	2-1/8	2-1/8
STEEL STRENGTH IN TENSION[4]					
Minimum specified yield strength of steel insert element (threaded rod or bolt)	f_y	ksi (N/mm²)	36.0 (248)	36.0 (248)	36.0 (248)
Minimum specified ultimate strength of steel insert element (threaded rod or bolt)	f_{uta} [11]	ksi (N/mm²)	58.0 (400)	58.0 (400)	58.0 (400)
Effective tensile stress area of steel insert element (threaded rod or bolt)	$A_{se,N}$ [A_{se}] [12]	in² (mm²)	0.0318 (20.5)	0.0775 (50)	0.1419 (91.6)
Steel strength in tension	N_{sa} [11]	lb (kN)	1,845 (8.2)	4,495 (20)	8,230 (36.6)
Reduction factor for steel strength[3]	ϕ	-	0.65	0.65	0.65
CONCRETE BREAKOUT IN TENSION[8]					
Effective embedment	h_{ef}	in. (mm)	1.425 (36)	1.425 (36)	1.425 (36)
Effectiveness factor for uncracked concrete	k_{uncr}	-	24	24	24
Effectiveness factor for cracked concrete	k_{cr}	-	17	17	17
Modification factor for cracked and uncracked concrete[5]	$\Psi_{c,N}$ [11]	-	1 See note 5	1 See note 5	1 See note 5
Critical edge distance	c_{ac}	in. (mm)	2-3/4 (70)	2-3/4 (70)	2-3/4 (70)
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	See note 7	See note 7
Characteristic pullout strength, cracked concrete (2,500 psi)[6]	$N_{p,cr}$	lb (kN)	See note 7	See note 7	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 (2,500 psi)[6,9]	N_{eq} [11]	lb (kN)	1,085 (4.8)	1,085 (4.8)	1,085 (4.8)
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[6,10]	$N_{p,deck,uncr}$	lb (kN)	1,990 (8.9)	1,990 (8.9)	1,990 (8.9)
Characteristic pullout strength, cracked concrete over steel deck[6,10]	$N_{p,deck,cr}$	lb (kN)	1,410 (6.3)	1,410 (6.3)	1,410 (6.3)
Characteristic pullout strength, cracked concrete over steel deck seismic[6,10]	$N_{p,deck,eq}$	lb (kN)	1,060 (4.7)	1,060 (4.7)	1,060 (4.7)
Reduction factor for pullout strength[3]	ϕ	-			

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 ACI 318 D.3.3 must apply.
2. Installation must comply with printed instructions.
3. All values of ϕ were determined from the load combinations of UBC Section 1605.2.1, UBC Section 1612.2.1, or ACI 318 Section 9.2. If the load combinations of UBC Section 1902.2 or ACI 318 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.5. For reinforcement that meets ACI 318 Appendix D requirements for Condition A, see ACI 318 D.4.4 for the appropriate ϕ factor.
4. It is assumed that the threaded rod or bolt used with the Vertigo+ anchor will be a ductile steel element as defined by ACI 318 D.1.
5. For all design cases use $\Psi_{c,N} = 1.0$. The appropriate effectiveness factor for cracked concrete (k_{cr}) and uncracked concrete (k_{uncr}) must be selected.
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/$f'_{c,min}$)$^{.05}$ where the value of $f'_{c,min}$ is 2500 except in concrete over steel deck where the value of $f'_{c,min}$ is 3000.
7. Pullout strength does 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, N_{eq} and N_{pn} are multiplied by a factor of 0.60 (not required for steel deck).
9. Tabulated values for characteristic pullout strength in tension are for seismic applications and based on test results in accordance with 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 D.5.2 is not required for anchors installed in the flute (soffit).
11. For 2003 IBC, f_{uta} replaces f_{ut}; N_{sa} replaces N_s; $\Psi_{c,N}$ replaces Ψ_3; and N_{eq} replaces $N_{p,seis}$.
12. The notation in brackets is for the 2006 ICBC.

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PERFORMANCE DATA

Shear Design Information For Vertigo+ Anchors in Concrete (For use with load combinations taken from ACI 318 Section 9.2) [1,2]

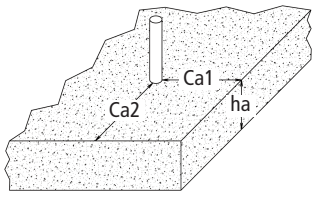
Design Characteristic	Notation	Units	Nominal Anchor Size / Threaded Coupler Diameter (in.)		
			1/4"	3/8"	1/2"
Anchor category	1, 2 or 3	-	1	1	1
Nominal embedment depth	h_{nom}	in.	2-1/8	2-1/8	2-1/8
STEEL STRENGTH IN SHEAR[4]					
Steel strength in shear[5]	V_{sa}[10]	lb (kN)	1,105 (4.9)	2,695 (12)	3,075 (13.7)
Reduction factor for steel strength[3]	ϕ	-	0.60	0.60	0.60
CONCRETE BREAKOUT IN SHEAR[6]					
Load bearing length of anchor (h_{ef} or $8d_o$, whichever is less)	ℓ_e[10]	in. (mm)	1.425 (36)	1.425 (36)	1.425 (36)
Nominal anchor diameter	d_a [d_o][11]	in. (mm)	0.375 (9.5)	0.375 (9.5)	0.375 (9.5)
Reduction factor for concrete breakout strength[3]	ϕ	-	0.70 (Condition B)		
PRYOUT STRENGTH IN SHEAR[6]					
Coefficient for pryout strength (1.0 for $h_{ef} < 2.5$ in, 2.0 for $h_{ef} \geq 2.5$ in)	k_{cp}	-	1	1	1
Reduction factor for pryout strength[3]	ϕ	-	0.70 (Condition B)		
STEEL STRENGTH IN SHEAR FOR SEISMIC APPLICATIONS					
Steel strength in shear, seismic[7]	V_{eq}[10]	lb (kN)	1,105 (4.9)	2,000 (8.9)	2,000 (8.9)
Reduction factor for steel strength in shear for seismic applications[3]	ϕ	-	0.60	0.60	0.60
STEEL STRENGTH IN SHEAR FOR STRUCTURAL SAND-LIGHTWEIGHT AND NORMAL-WEIGHT CONCRETE OVER STEEL DECK[9]					
Steel strength in shear, concrete over steel deck[8]	$V_{sa,deck}$	lb (kN)	1,105 (4.9)	1,975 (8.8)	2,495 (11.1)
Steel strength in shear, concrete over steel deck seismic[8]	$V_{sa,deck,eq}$	lb (kN)	1,105 (4.9)	1,480 (6.6)	1,620 (7.2)
Reduction factor for steel strength in shear for steel deck applications[3]	ϕ	-	0.60	0.60	0.60

For SI: 1 inch = 25.4 mm.

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 ACI 318 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 UBC Section 1605.2.1, UBC Section 1612.2.1, or ACI 318 Section 9.2. If the load combinations of UBC Section 1902.2 or ACI 318 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.5. For reinforcement that meets ACI 318 Appendix D requirements for Condition A, see ACI 318 D.4.4 for the appropriate ϕ factor.
4. It is assumed that the threaded rod or bolt used with the Vertigo+ anchor will be a ductile steel element as defined by ACI 318 D.1.
5. Tabulated values for steel strength in shear must be used for design. These tabulated values are lower than calculated results using equation D-20 in ACI 318-05 D.6.1.2 and D-18 in ACI 318-02, D.6.1.2.
6. 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).
7. Reported values for steel strength in shear for seismic applications are based on test results per ACI 355.2 Section 9.6.
8. Values for $V_{sa,deck}$ 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 D.6.2 and the pryout capacity in accordance with ACI 318 D.6.3 are not required for anchors installed in the flute (soffit).
9. Shear loads for anchors installed through steel deck into concrete may be applied in any direction.
10. For 2003 IBC, f_{uta} replaces f_{ut}; V_{sa} replaces V_s; ℓ_e replaces ℓ; and V_{eq} replaces $V_{s,seis}$.
11. The notation in brackets is for the 2006 IBC.

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

1. Tabular values are provided for illustration and are 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 considered 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 Design Strength for Vertigo+ 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.)
1/4	2-1/8	$f_u \geq$ 58ksi	940	**665**	1,030	**665**	1,190	**665**	**1,200**	**665**	**1,200**	**665**
3/8	2-1/8		940	940	1,030	1,030	1,190	1,190	1,460	1,460	1,685	**1,615**
1/2	2-1/8		940	1,015	1,030	1,110	1,190	1,280	1,460	1,570	1,685	1,810

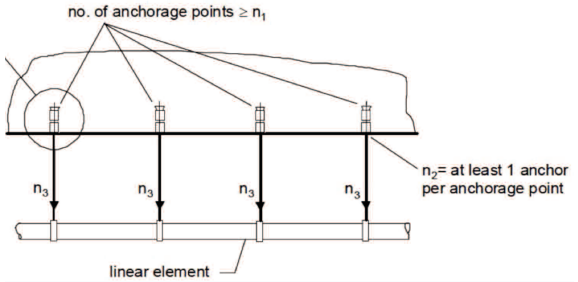
Tension and Shear Design Strength for Vertigo+ in Uncracked Concrete

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.)
1/4	2-1/8	$f_u \geq$ 58ksi	**1,200**	**665**	**1,200**	**665**	**1,200**	**665**	**1,200**	**665**	**1,200**	**665**
3/8	2-1/8		1,330	1,320	1,455	1,455	1,680	**1,615**	2,060	**1,615**	2,375	**1,615**
1/2	2-1/8		1,330	1,430	1,455	1,565	1,680	1,810	2,060	**1,845**	2,375	**1,845**

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

REDUNDANT FASTENING APPLICATIONS

For an anchoring system designed with redundancy, the load maintained by an anchor that experiences failure or excessive deflection can be transmitted to neighboring anchors without significant consequences to the fixture or remaining resistance of the anchoring system. In addition to the requirements for anchors, the fixture being attached shall be able to resist the forces acting on it assuming one of the fixing points is not carrying load. It is assumed that by adhering to the limits placed on n_1, n_2 and n_3 below, redundancy will be satisfied.



Anchors qualified for redundant applications may be designed for use in normal weight and sand-lightweight cracked and uncracked concrete. Concrete compressive strength of 2,500 psi shall be used for design. No increase in anchor capacity is permitted for concrete compressive strengths greater than 2,500 psi. The anchor installation is limited to concrete with a compressive strength of 8,500 psi or less.

Redundant applications shall be limited to structures assigned to Seismic Design Categories A or B only.

Redundant applications shall be limited to support of nonstructural elements.

Strength Design (Redundant Fastening):

For strength design, a redundant system is achieved by specifying and limiting the following variables

n_1 = the total number of anchorage points supporting the linear element

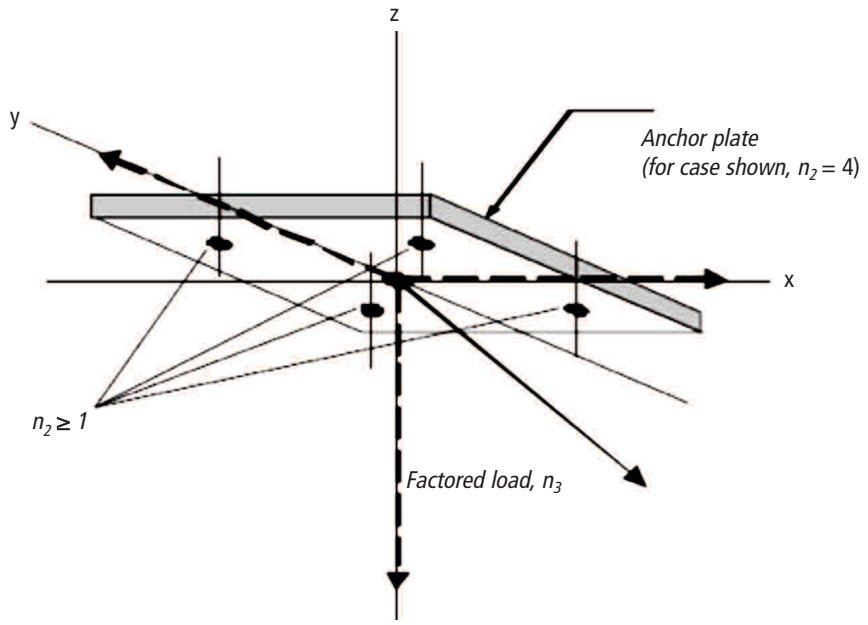
n_2 = number of anchors per anchorage point

n_3 = factored load at each anchorage point, lbs., using load combinations from IBC Section 1605.2.1 or ACI 318 Section 9.2

Allowable Stress Design (Redundant Fastening):

Design values for use with allowable stress design shall be established taking R_d, ASD = $\frac{\phi_{ra} . F_{ra}}{\propto}$

Where $\propto$ is the conversion factor calculated as the weighted average of the load factors fro the controlling load combination. The conversion factor, $\propto$ is equal to 1.4 assuming all dead load.



INSTALLATION SPECIFICATIONS

Installation Table for Vertigo+ Anchor in Redundant Fastening Applications

Anchor Property/ Setting Information	Symbol	Units	Nominal Anchor Size / Threaded Coupler Diameter (in.)		
			1/4	3/8	1/2
Nominal anchor shank diameter	d_o	in. (mm)	0.375 (9.5)	0.375 (9.5)	0.375 (9.5)
Nominal drill bit diameter	d_{bit}	in.	3/8" Wedge-bit	3/8" Wedge-bit	3/8" Wedge-bit
Wedge-bit tolerance range	-	in.	0.385 to 0389	0.385 to 0389	0.385 to 0389
Minimum nominal embedment depth	h_{nom}	in. (mm)	2-1/8 (50.8)	2-1/8 (50.8)	2-1/8 (50.8)
Effective embedment	h_{ef}	in. (mm)	1.425 (36)	1.425 (36)	1.425 (36)
Minimum hole depth	h_o	in. (mm)	2-1/2 (64)	2-1/2 (64)	2-1/2 (64)
Minimum member thickness	h_{min}	in. (mm)	3 (76.2)	3 (76.2)	3 (76.2)
Overall anchor length	ℓ_{anch}	in. (mm)	3 (76)	3 (76)	3 (76)
Minimum edge distance	c_{min}	in. (mm)	4 (102)	4 (102)	4 (102)
Minimum spacing distance	s_{min}	in. (mm)	8 (204)	8 (204)	8 (204)
Maximum impact wrench power (torque)	T_{screw}	ft.-lb. (N-m)	245 (332)	245 (332)	245 (332)
Impact wrench/socket size	d_h	in.	11/16	11/16	11/16
Head height	-	in.	3/4	3/4	3/4

PERFORMANCE DATA FOR REDUNDANT FASTENING APPLICATIONS

Redundant Fastening Design Information for Vertigo+ Anchors in Normal Weight Concrete and for Sand-Lightweight and Normal Weight Concrete over Steel Deck[1,2,3,4.5.6]

Design Characteristic	Notation	Units	Nominal Anchor Size / Threaded Coupler Diameter (in.)					
			1/4		3/8		1/2	
Anchor category	1, 2 or 3	-	1		1		1	
CHARACTERISTIC DESIGN STRENGTH (RESISTANCE) IN CRACKED OR UNCRACKED CONCRETE[4,5.6]								
Resistance, cracked or uncracked concrete (2,500psi)	F_{ra}	lb (kN)	Number of anchorage points		Number of anchorage points		Number of anchorage points	
			$n_1 \geq 4$	$n_1 \geq 3$	$n_1 \geq 4$	$n_1 \geq 3$	$n_1 \geq 4$	$n_1 \geq 3$
			675 (3.0)	450 (2.0)	675 (3.0)	450 (2.0)	675 (3.0)	450 (2.0)
Strength reduction factor	ϕ_{ra}	-	0.65		0.65		0.65	

1. The data in this table is intended to be used with the design provisions of this product; loads may be applied in any direction.
2. Installation must comply with published instructions and details.
3. All values of ø were determined from the load combinations of UBC Section 1605.2.1, UBC Section 1612.2.1, or ACI 318 Section 9.2.
4. It is assumed that the threaded rod or bolt used with the Vertigo+ anchor has minimum specified properties as listed in the table above or an equivalent steel element.
5. Anchors are permitted to be used in structural sand-lightweight concrete provided the resistance value is multiplied by 0.6.
6. 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.

PERFORMANCE DATA (ALLOWABLE STRESS DESIGN)

Ultimate Load Capacities for Vertigo+ in Normal-Weight Concrete[1,2]

Nominal Anchor Size / Threaded Coupler Diameter in. (mm)	Nominal Anchor Shank Diameter d_o in. (mm)	Minimum Embedment Depth h_{nom} in. (mm)	Minimum Concrete Compressive Strength f'_c							
			2,500 psi (17.2 MPa)		3,000 psi (20.7 MPa)		4,000 psi (27.6 MPa)		6,000 psi (41.4 MPa)	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.3)	3/8 (9.5)	2-1/8 (54.0)	3,260 (14.5)	2,850 (12.7)	3,570 (15.9)	2,850 (12.7)	4,205 (18.8)	2,850 (12.7)	5,150 (23.0)	2,850 (12.7)
3/8 (9.5)	3/8 (9.5)	2-1/8 (54.0)	3,260 (14.5)	4,235 (18.9)	3,570 (15.9)	4,235 (18.9)	4,205 (18.8)	4,235 (18.9)	5,150 (23.0)	4,235 (18.9)
1/2 (12.7)	3/8 (9.5)	2-1/8 (54.0)	3,260 (14.5)	4,235 (18.9)	3,570 (15.9)	4,235 (18.9)	4,205 (18.8)	4,235 (18.9)	5,150 (23.0)	4,235 (18.9)

1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load.

Allowable Load Capacities for Vertigo+ in Normal-Weight Concrete[1]

Nominal Anchor Size / Threaded Coupler Diameter in. (mm)	Nominal Anchor Shank Diameter d_o in. (mm)	Minimum Embedment Depth h_{nom} in. (mm)	Minimum Concrete Compressive Strength f'_c							
			2,500 psi (17.2 MPa)		3,000 psi (20.7 MPa)		4,000 psi (27.6 MPa)		6,000 psi (41.4 MPa)	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.3)	3/8 (9.5)	2 1/8 (54.0)	815 (3.6)	485 (2.2)	890 (4.0)	485 (2.2)	1,050 (4.7)	485 (2.2)	1,290 (5.7)	485 (2.2)
3/8 (9.5)	3/8 (9.5)	2 1/8 (54.0)	815 (3.6)	1,060 (4.7)	890 (4.0)	1,060 (4.7)	1,050 (4.7)	1,060 (4.7)	1,290 (5.7)	1,060 (4.7)
1/2 (12.7)	3/8 (9.5)	2 1/8 (54.0)	815 (3.6)	1,060 (4.7)	890 (4.0)	1,060 (4.7)	1,050 (4.7)	1,060 (4.7)	1,290 (5.7)	1,060 (4.7)

1. Allowable load capacities are calculated using an applied safety factor of 4.0.

ORDERING INFORMATION

Vertigo+ Rod Hanger (Carbon Steel w/Blue Tip)

Cat. No.	Rod Dia.	Screw Shank Size and Length	Thread Style	Pre-Drill Diameter	Std. Box	Std. Ctn.
7180SD	1/4"	3/8" x 2-1/8"	Wedge-Bolt+	3/8" Wedge-Bit	50	250
7181SD	3/8"					
7182SD	1/2"					
An SDS 3/8" x 6" Wedge-Bit (Cat# 01316 is included in each box of Vertigo+)						

Wedge-Bits

Cat. No.	Wedge-Bit Description	Usable Length	Std. Box	Std. Ctn.
01316	SDS 3/8" x 6"	4"	1	1
01380	HD Straight Shank 3/8" x 6"	4"	5	25

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