Anchoring, Fastening and Restoration Systems
for Concrete and Masonry

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Strength Beyond Steel

At Simpson Strong-Tie, we don't just deliver products. We deliver our commitment to your success.

From anchoring adhesives and mechanical anchors to direct fastening for concrete, steel, CMU and metal decking — we have the quality solutions you need to secure, repair and protect your structures.

Every innovative, high-performance product in this catalog is backed by our unparalleled engineering expertise, field support and customer service. So you can feel confident knowing you're building the safest, strongest structures possible.

Technical insight. Project design. Sales assistance. Problem solving is our passion — and our teams are here to support you whenever and wherever you need them.

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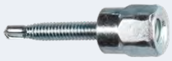
SIMPSON STRONG-TIE COMPANY INC.
Simpson Strong-Tie Company Inc.
Division 6
SET-3G

Product Selection Guide

Product			Page No.	Tested Base Materials and Code Listings							Other Listings
				Concrete		Concrete on Metal Deck	CMU		Unreinforced Clay Brick Masonry	Other	
				Cracked	Uncracked		Grout-Filled	Hollow			
Adhesive Anchors	NEW SET-3G™		21	ESR-4057 (City of L.A. Report within ESR)		—	—	—	—	—	NSF/ANSI Std 61 ASTM C881/ AASHTO M-235, DOT
	SET-XP®		28	ESR-2508, RR25744, FL-17449.2		—	ER-265, RR25965, FL-16230.3	ER-265, RR25965, FL-16230.3	—	—	NSF/ANSI Std 61 ASTM C881/ AASHTO M-235, DOT
	ET-HP®		44	ESR-3372, FL-17449.1		—	ER-241 FL-16230.2	—	ESR-3638, RR25120	—	ASTM C881/ AASHTO M-235, DOT
	SET		54	—	Non-IBC	—	Non-IBC	Non-IBC	ESR-1772, FL-15730.5	—	NSF/ANSI Std 61 ASTM C881/ AASHTO M-235, DOT
	AT-XP®		74	ER-263, RR25960, FL-16230.1		—	ER-281, RR25966, FL-16230.1	—	—	—	NSF/ANSI Std 61 ASTM C881/ AASHTO M-235, DOT
	AT		84	—	Non-IBC	—	Non-IBC	Non-IBC	ESR-1958	—	ASTM C881/ AASHTO M-235, DOT
Restoration Solutions	ETI-SLV		219	—	—	—	—	—	—	—	ASTM C881/ AASHTO M-235
	ETI-LV		219	—	—	—	—	—	—	—	NSF/ANSI Std 61 ASTM C881/ AASHTO M-235
	ETI-GV		219	—	—	—	—	—	—	—	ASTM C881/ AASHTO M-235
	Crack-Pac®		221	—	—	—	—	—	—	—	ASTM C881/ AASHTO M-235
	Crack-Pac® Flex H_2O		223	—	—	—	—	—	—	—	ASTM C881/ AASHTO M-235
	Heli-Tie™		232	—	Non-IBC	—	Non-IBC	Non-IBC	Non-IBC	Wood Metal Stud	—

Refer to footnotes on page 6.

	Product		Page No.	Tested Base Materials and Code Listings							Other Listings
				Concrete		Concrete on Metal Deck	CMU		Unreinforced Clay Brick Masonry	Other	
				Cracked	Uncracked		Grout-Filled	Hollow			
Mechanical Anchors	Titen HD® (THD)		115	ESR-2713, RR25741, FL-15730.6			ESR-1056, RR25560, FL-15730.6	IBC	—	—	FM, DOT
	NEW Stainless-Steel Titen HD® (THD-SS)		124	ER-493			ESR-1056, RR25560, FL-15730.6	IBC	—	—	FM, DOT
	Titen HD® Rod Coupler (THD-RC)		131	Non-IBC	—	—	—	—	—	—	—
	Strong-Bolt® 2 (STB2)		133	ESR-3037, RR25891, FL-15731.2		ESR-3037 RR25891 FL-15731.2	ER-240, RR25936 FL-16230.4	—	—	—	UL, FM, DOT
	Wedge-All® (WA)		147	—	Non-IBC	Non-IBC	ESR-1396, FL-15730.7	—	—	—	UL, FM, DOT
	Sleeve-All® (SL)		160	—	Non-IBC	—	Non-IBC	—	—	—	UL, FM, DOT
	Easy-Set (EZAC)		164	—	Non-IBC	—	—	—	—	—	—
	Tie-Wire (TW)		165	—	Non-IBC	Non-IBC	—	—	—	—	—
	NEW Titen® 2 (TTN2)		167	—	ER-449, FL-16230	—	ER-466, FL-16230		—	—	—
	Stainless Steel Titen® (TTN)		172	—	FL-2355.1		FL-2355.1		—	—	—
	NEW Titen HD® Rod Hanger (THD-RH)		174	ESR-2713, RR25741, FL-15730.6		ESR-2713 RR25741	—	—	—	—	FM
	NEW Steel Rod Hanger (RSH, RSV)		178	—	—	—	—	—	—	IBC (Steel)	UL, FM

Refer to footnotes on page 6.

Product Selection Guide

Product			Page No.	Tested Base Materials and Code Listings							Other Listings
				Concrete		Concrete on Metal Deck	CMU		Unreinforced Clay Brick Masonry	Other	
				Cracked	Uncracked		Grout-Filled	Hollow			
Mechanical Anchors	Wood Rod Hanger (RWH, RWV)		180	—	—	—	—	—	—	IBC (Wood)	UL, FM
	Drop-In (DIAB)		182	—	Non-IBC	Non-IBC	—	—	—	Non-IBC (Hollow Core Panel)	UL, FM
	Stainless Steel Drop-In (DIA-SS)		187	—	Non-IBC	Non-IBC	—	—	—	—	UL, FM, DOT
	Hollow Drop-In (HDIA)		192	—	Non-IBC	—	—	IBC	—	—	UL,FM
	Zinc Nailon™ (ZN)		196	—	Non-IBC	—	—	—	—	—	—
	Crimp Drive® (CD)		197	—	Non-IBC	Non-IBC	—	—	—	—	FM
	Split Drive (CSD, DSD)		201	—	Non-IBC	—	—	—	—	—	—
	NEW FlipToggle® (FT)		203	—	—	—	—	Non-IBC	—	Drywall	—
	Sure Wall (SWN, SWZ)		205	—	—	—	—	—	—	Drywall	—
Direct Fastening	Powder-Actuated Fasteners		207	—	ESR-2138, RR25469, FL-15730.3, FL-15730.4	ESR-2138, RR25469, FL-15730.3, FL-15730.4	ESR-2138, RR25469, FL-15730.3, FL-15730.4	ESR-2138, RR25469, FL-15730.3, FL-15730.4	—	Steel ESR-2138, RR25469, FL-15730.3, FL-15730.4	FM
	Gas-Actuated Fasteners		208	—	ESR-2811, RR25837, FL-15730.1 FL-15730.2	ESR-2811, RR25837, FL-15730.1 FL-15730.2	ESR-2811, RR25837, FL-15730.1 FL-15730.2	ESR-2811, RR25837, FL-15730.1 FL-15730.2	—	Steel, ESR-2811, FL-15730.1, FL-15730.2	—

ESR — ICC-ES code report available at **icc-es.org**.

ER — IAPMO UES code report available at **iapmoes.org**.

RR — City of Los Angeles research report available.

FL — Florida building code approval available.

IBC — Load data is available in this catalog intended for use under IBC, but code listings are not available.

Non-IBC — Load data is available in this catalog, but it is outside the scope of the current IBC. May be permitted for non-IBC applications.

UL — Underwriters Laboratories listing available.

FM — Factory Mutual listing available.

DOT — Various departments of transportation listings available. See **strongtie.com/DOT** for details.

Consult the code listings for more detailed information on which models of each product are covered by the listing.

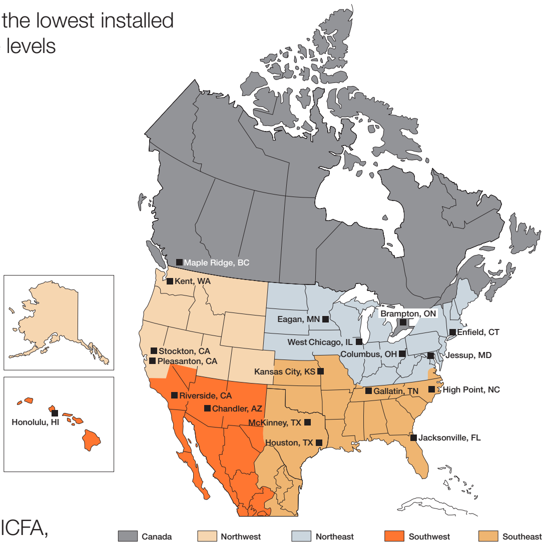
Simpson Strong-Tie Company Inc.

For more than 60 years, Simpson Strong-Tie has focused on creating structural products that help people build safer and stronger homes and buildings. A leader in structural systems research and technology, Simpson Strong-Tie is one of the largest suppliers of structural building products in the world. The Simpson Strong-Tie commitment to product development, engineering, testing and training is evident in the consistent quality and delivery of its products and services.

For more information, visit the company's website at **strongtie.com**.

The Simpson Strong-Tie Company Inc. "No Equal" pledge includes:

- Quality products value-engineered for the lowest installed cost at the highest-rated performance levels
- The most thoroughly tested and evaluated products in the industry
- Strategically located manufacturing and warehouse facilities
- National code agency listings
- The largest number of patented connectors in the industry
- Global locations with an international sales team
- In-house R&D and tool and die professionals
- In-house product testing and quality control engineers
- Support of industry groups including AISI, AITC, ASTM, ASCE, AWC, AWPA, ACI, AISC, CSI, CFSEI, ICFA, NBMDA, NLBMDA, SDI, SETMA, SFA, SFIA, STAFDA, SREA, NFBA, TPI, WDSC, WIJMA, WTCA and local engineering groups



The Simpson Strong-Tie Quality Policy

We help people build safer structures economically. We do this by designing, engineering and manufacturing "No Equal" structural connectors and other related products that meet or exceed our customers' needs and expectations. Everyone is responsible for product quality and is committed to ensuring the effectiveness of the Quality Management System.

Karen Colonias
Chief Executive Officer

Getting Fast Technical Support

When you call for engineering technical support, we can help you quickly if you have the following information at hand. This will help us to serve you promptly and efficiently.

- Which Simpson Strong-Tie® catalog are you using? *(See the front cover for the form number.)*
- Which Simpson Strong-Tie product are you using?
- What are the design requirements (i.e., loads, anchor diameter, base material, edge/spacing distance, etc.)?

We Are ISO 9001-2008 Registered

Simpson Strong-Tie is an ISO 9001-2008 registered company. ISO 9001-2008 is an internationally recognized quality assurance system that lets our domestic and international customers know they can count on the consistent quality of Simpson Strong-Tie® products and services.

nqa.
ISO 9001
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Product Identification Key

Products and additional information are divided into eight general categories, identified by tabs along the page's outer edge.

Table of Contents

Adhesive Anchors

Mechanical Anchors

Direct Fastening

Restoration Solutions

Carbide Drill Bits and Accessories

Additional Information

New products are shown with the NEW symbol.

Speed Clean™ DXS Dust Extraction System

The Speed Clean DXS dust extraction system is a drilling system that reduces the health risks from airborne silica dust exposure caused by the hole-drilling and cleaning process. This drilling method creates holes qualified for adhesive or mechanical anchor installation, while eliminating the need for the blow-brush-blow hole-cleaning process. Speed Clean drills and cleans holes to meet published bond strengths of AT-XP®, SET-XP® and SET-3G™ anchoring adhesives (code listed for these adhesive products). Simpson Strong-Tie is proud to offer Speed Clean DXS drill bits that allow dust and debris to be removed through the hollow center of the bit during drilling. When used with a suitable rotary hammer and vacuum, the system removes dust from the hole at the moment it is created.

See p. 244 for more information.

SET-3G™ High-Strength Anchoring Adhesive

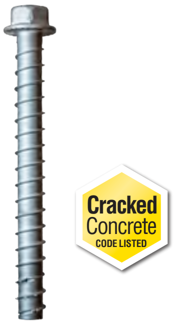
SET-3G™, Simpson Strong-Tie premium epoxy anchoring adhesive, is formulated to provide superior performance at elevated temperature, ideal for installing anchors in cracked and uncracked concrete. Superior bond strengths allow for ductile anchorage solutions in some cases.

See p. 21 for more information.

SET-3G Wire Brushes / Extensions / T-Handles

Specifically designed for use with SET-3G. The matched-tolerance wire brush heads, extension and T-handle components have threaded ends which may be joined together to permit hole cleaning with fewer brush strokes at embedments up to 20 times the anchor diameter.

See p. 106 for more information.



Stainless-Steel Titen HD® Heavy-Duty Screw Anchor

The THDSS is ideal for concrete and masonry and is the ultimate choice for fast and efficient installation combined with long-lasting corrosion resistance. The THDSS is made with Type 316 and 304 stainless steel that gets its cutting ability from a proprietary bi-metal design that incorporates a carbon-steel helical-coil thread brazed onto the shank of the anchor. The serrated carbon-steel leading thread cuts a channel for the stainless-steel threads to engage into. The carbon steel helical-coil has been minimized to significantly reduce the adverse effects of steel corrosion in concrete.

See p. 124 for more information.

Strong-Bolt® 2 Type 304 Stainless-Steel Wedge Anchor

The Strong-Bolt 2 wedge anchor is now available in Type 304 stainless steel in standard sizes. Previously available only in Type 316 and carbon steel, the additional product offering allows you to choose the best material solution for your job. The Strong-Bolt 2 wedge anchor is an optimal choice for cracked and uncracked concrete.

See p. 133 for more information.

Titen® 2 Concrete and Masonry Screw

With patented undercutting threads that make installation easier and increase load capacity, the Titen® 2 concrete and masonry screw is ideal for attaching all types of components to concrete and masonry. The improved thread design undercuts the base material more efficiently, reducing installation torque and making it easier to drive without binding, snapping or stripping, even during installation into hard base material.

See p. 167 for more information.

Titen HD® Threaded Rod Hanger

The Titen HD® threaded rod hanger is a high-strength screw anchor designed to suspend threaded rod from concrete slabs and beams or concrete over metal in order to hang pipes, cable trays and HVAC equipment. The anchor offers low installation torque with no secondary setting, and has been tested to offer industry-leading performance in cracked and uncracked concrete — even in seismic loading conditions.

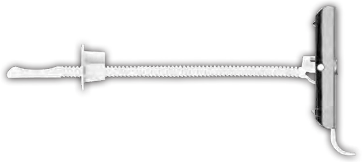
See p. 174 for more information.

Steel Rod Hanger Threaded Rod Anchor System

The steel rod hanger is a one-piece fastening system for suspending ¼" and ⅜" threaded rod. Vertical rod hangers are designed to suspend threaded rod in overhead applications from steel joists and beams. Horizontal rod hangers are available for applications requiring installation into the side of joists, columns and overhead members. Both rod hangers provide attachment points for use in pipe hanging, fire protection, electrical conduit and cable-tray applications. Recommended for use in dry, interior, non-corrosive environments only.

See p. 178 for more information.

New Products



FlipToggle® Anchor

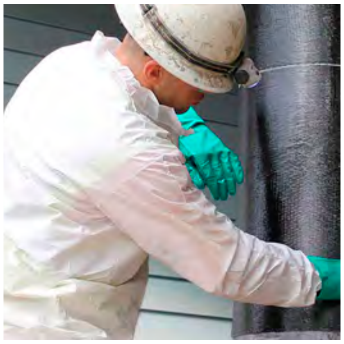
The FlipToggle is the only single-strap design that takes the guesswork out of hollow-wall anchoring. Its unique design securely holds the toggle for easy insertion into the predrilled hole. Once inserted, the spring tab flips the toggle into the right position so that when the collar is tightened the anchor is ready for the bolt provided.

See p. 203 for more information.

FX-70® Structural Repair and Protection System

FX-70, which has been used successfully for more than 40 years, uses high-strength fiberglass jackets and high-strength water-insensitive grouting materials to repair and protect wood, steel and concrete structural members.

See p. 236 for more information.



CSS Composite Strengthening Systems™

Simpson Strong-Tie® Composite Strengthening Systems (CSS) provide efficient solutions for the structural reinforcement and retrofit of aging, damaged or overloaded concrete, masonry, steel and timber structures.

See p. 238 for more information.

Using Data Tables and Load Tables

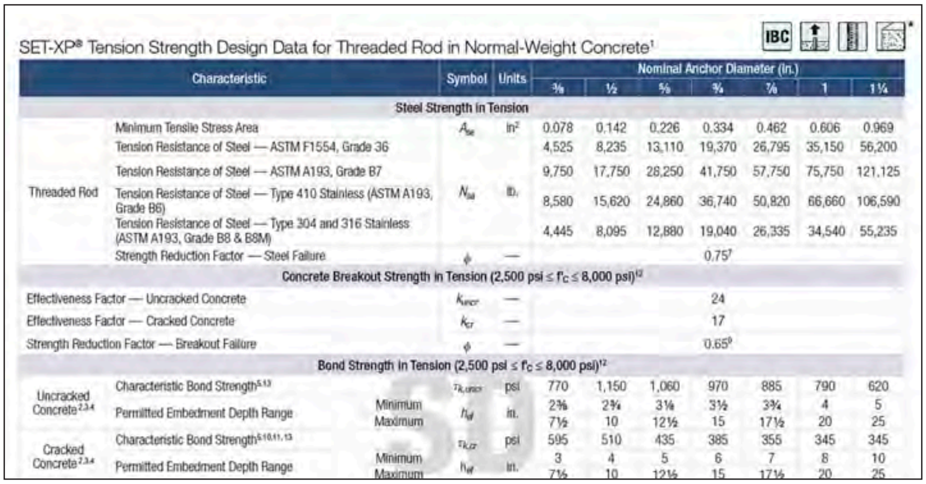
This catalog contains both strength design data tables and allowable load tables. Some allowable load tables for concrete were established under old qualification standards that are no longer valid under the IBC. The following icons indicate whether or not a given table is intended to be used under the IBC (or under other building codes that use the IBC as their basis):

IBC	~~IBC~~
Valid for International Building Code	**Not Valid for International Building Code**

Tables that are "not valid for International Building Code" may be used where the Designer determines that other building codes or regulations permit it — for example, under AASTHO or temporary construction.

Strength Design Data Tables

Under the IBC, strength design (see p. 256) must be used for cast-in-place and post-installed mechanical and adhesive anchors that are installed into concrete. The design data from these tables are to be used with the design provisions of ACI 318-14 Chapter 17, ACI 318-11 Appendix D, IBC Chapter 19 and the respective ICC-ES Acceptance Criteria. Strength design data tables are watermarked with the letters "SD." Given the complexity of strength design calculations, Designers may find Simpson Strong-Tie® Anchor Designer™ software (**strongtie.com/software**) to be a great time saver for computing anchor design strengths using the tabulated design data.



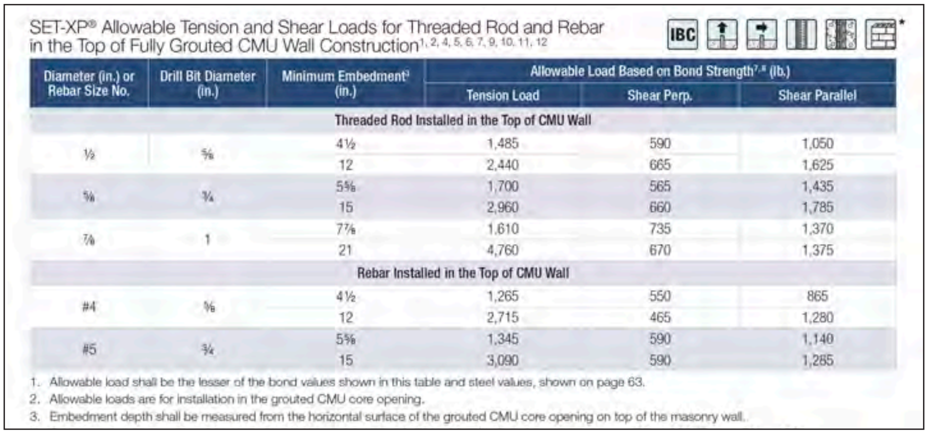
SET-XP® Tension Strength Design Data for Threaded Rod in Normal-Weight Concrete[1]

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 F1554, Grade 36		N_{sa}	lb.	4,525	8,235	13,110	19,370	26,795	35,150	56,200
	Tension Resistance of Steel — ASTM A193, Grade B7				9,750	17,750	28,250	41,750	57,750	75,750	121,125
	Tension Resistance of Steel — Type 410 Stainless (ASTM A193, Grade B6)				8,580	15,620	24,860	36,740	50,820	66,660	106,590
	Tension Resistance of Steel — Type 304 and 316 Stainless (ASTM A193, Grade B8 & B8M)				4,445	8,095	12,880	19,040	26,335	34,540	55,235
	Strength Reduction Factor — Steel Failure		ϕ	—	0.75[7]						
Concrete Breakout Strength in Tension (2,500 psi ≤ f'c ≤ 8,000 psi)[12]											
Effectiveness Factor — Uncracked Concrete			k_{uncr}	—	24						
Effectiveness Factor — Cracked Concrete			k_{cr}	—	17						
Strength Reduction Factor — Breakout Failure			ϕ	—	0.65[9]						
Bond Strength in Tension (2,500 psi ≤ f'c ≤ 8,000 psi)[12]											
Uncracked Concrete[2,3,4]	Characteristic Bond Strength[5,13]		$\tau_{k,uncr}$	psi	770	1,150	1,060	970	885	790	620
	Permitted Embedment Depth Range	Minimum	h_{ef}	in.	2⅜	2¾	3⅛	3½	3¾	4	5
		Maximum			7½	10	12½	15	17½	20	25
Cracked Concrete[2,3,4]	Characteristic Bond Strength[5,10,11,13]		$\tau_{k,cr}$	psi	595	510	435	385	355	345	345
	Permitted Embedment Depth Range	Minimum	h_{ef}	in.	3	4	5	6	7	8	10
		Maximum			7½	10	12½	15	17½	20	25

Example Strength Design Data Table

Allowable Load Tables

Under the IBC, allowable stress design (see p. 254) may be used for cast-in-place and post-installed adhesive and mechanical anchors installed into masonry or for gas/powder-actuated fasteners installed into concrete, masonry or steel.



SET-XP® Allowable Tension and Shear Loads for Threaded Rod and Rebar in the Top of Fully Grouted CMU Wall Construction[1, 2, 4, 5, 6, 7, 9, 10, 11, 12]

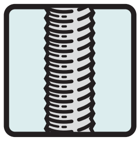
Diameter (in.) or Rebar Size No.	Drill Bit Diameter (in.)	Minimum Embedment[3] (in.)	Allowable Load Based on Bond Strength[7,8] (lb.)		
			Tension Load	Shear Perp.	Shear Parallel
Threaded Rod Installed in the Top of CMU Wall					
½	⅝	4½	1,485	590	1,050
		12	2,440	665	1,625
⅝	¾	5⅝	1,700	565	1,435
		15	2,960	660	1,785
⅞	1	7⅞	1,610	735	1,370
		21	4,760	670	1,375
Rebar Installed in the Top of CMU Wall					
#4	⅝	4½	1,265	550	865
		12	2,715	465	1,280
#5	¾	5⅝	1,345	590	1,140
		15	3,090	590	1,285

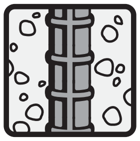
1. Allowable load shall be the lesser of the bond values shown in this table and steel values, shown on page 63.
2. Allowable loads are for installation in the grouted CMU core opening.
3. Embedment depth shall be measured from the horizontal surface of the grouted CMU core opening on top of the masonry wall.

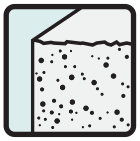
Example Allowable Load Table

Table Icon System

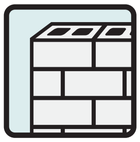
In order to facilitate easier identification of performance data, the following icon system has been incorporated into the sections of the catalog with multiple load tables. These icons will appear in the heading of the table to promote easier visual identification of the type of load, insert type and substrate addressed in the table. Icons are intended for quick identification. All specific information regarding suitability should be read from the table itself.

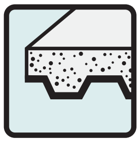

Threaded Rod

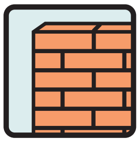

Rebar

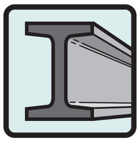

Normal-Weight Concrete

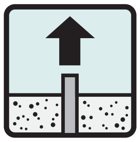
Lightweight Concrete

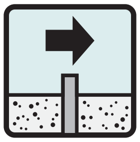

Concrete Block (CMU)

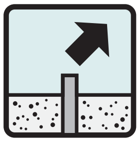

Lightweight Concrete over Metal Deck

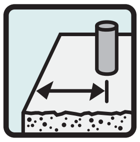

Unreinforced Brick (URM)

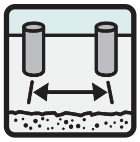

Steel


Tension Load


Shear Load


Oblique Load


Edge Distance


Spacing

Valid for International Building Code

Not Valid for International Building Code

General Notes

These general notes are provided to ensure proper installation of Simpson Strong-Tie Company Inc. products and must be followed fully.

a. Simpson Strong-Tie Company Inc. reserves the right to change specifications, designs, and models without notice or liability for such changes. Please refer to **strongtie.com** for the latest product updates, availability and load tables.

b. Unless otherwise noted, dimensions are in inches and loads are in pounds.

c. Do not overload, which will jeopardize the anchorage. Service loads shall not exceed published allowable loads. Factored loads shall not exceed design strengths calculated in accordance with published design data.

d. Some hardened fasteners may experience premature failure if exposed to moisture. These fasteners are recommended to be used in dry interior applications.

e. Do not weld products listed in this catalog. Some steel types have poor weldability and a tendency to crack when welded.

Warning

Simpson Strong-Tie Company Inc. anchors, fasteners and connectors are designed and tested to provide specified design loads. To obtain optimal performance from Simpson Strong-Tie products and to achieve maximum allowable design load, the products must be properly installed and used in accordance with the installation instructions and design limits provided by Simpson Strong-Tie. To ensure proper installation and use, Designers and installers must carefully read the General Notes, General Instructions to the Installer and General Instructions to the Designer contained in this catalog, as well as consult the applicable catalog pages for specific product installation instructions and notes. Please always consult the Simpson Strong-Tie website at strongtie.com for updates regarding all Simpson Strong-Tie products.

Proper product installation requires careful attention to all notes and instructions, including the following basic rules:

1. Be familiar with the application and correct use of the anchor, connector or fastener.
2. Follow all installation instructions provided in the catalog, website, *Installer's Pocket Guide* or any other Simpson Strong-Tie publication.
3. Follow all product-related warnings provided in the catalog, website or any other Simpson Strong-Tie publication.
4. Install anchors, connectors and fasteners in accordance with their intended use.
5. Install all anchors, connectors and fasteners per installation instructions provided by Simpson Strong-Tie.
6. When using power tools to install fasteners: (a) use proper fastener type for direct fastening tool; (b) use proper powder or gas loads; and (c) follow appropriate safety precautions as outlined in this catalog, on the website or in the tool Operator's Manual.

In addition to following the basic rules provided above as well as all notes, warnings and instructions provided in the catalog, installers, Designers, engineers and consumers should consult the Simpson Strong-Tie website at strongtie.com to obtain additional design and installation information, including:

- Instructional builder/contractor training kits containing an instructional video, an instructor guide and a student guide in both English and Spanish;
- *Installer's Pocket Guide* (form S-INSTALL; contact Simpson Strong-Tie for more information), which is designed specifically for installers and uses detailed graphics and minimal text in both English and Spanish to explain visually how to install many key products;
- Information on workshops Simpson Strong-Tie conducts at various training centers throughout the United States;
- Product-specific installation videos;
- Specialty catalogs;
- Code reports – Simpson Strong-Tie® Code Report Finder software;
- Technical fliers, bulletins and engineering letters;
- Master format specifications;
- Material safety data sheets;
- Corrosion information;
- Adhesive cartridge estimator;
- Simpson Strong-Tie Anchor Designer™ software;
- Simpson Strong-Tie AutoCAD® menu;
- Simpson Strong-Tie CFS Designer™ software;
- Simpson Strong-Tie Connector Selector™ software;
- Connector selection guides for engineered wood products (by manufacturer);
- Simpson Strong-Tie Strong-Wall® Selector software;
- Simpson Strong-Tie Strong Frame® Selector;
- Simpson Strong-Tie Fastener Finder; and
- Answers to frequently asked questions and technical topics.

Failure to fully follow all of the notes and instructions provided by Simpson Strong-Tie may result in improper installation of products. Improperly installed products may not perform to the specifications set forth in this catalog and may reduce a structure's ability to resist the movement, stress and loading that occur from gravity loads as well as impact events such as earthquakes and high-velocity winds.

Simpson Strong-Tie Company Inc. does not guarantee the performance or safety of products that are modified, improperly installed or not used in accordance with the design and load limits set forth in this catalog.

General Instructions for the Installer

These general instructions for the installer are provided to ensure the proper selection and installation of Simpson Strong-Tie products and must be followed carefully. They are in addition to the specific design and installation instructions and notes provided for each particular product, all of which should be consulted prior to and during the installation of Simpson Strong-Tie products.

a. Do not modify Simpson Strong-Tie products as the performance of modified products may be substantially weakened. Simpson Strong-Tie will not warrant or guarantee the performance of such modified products.

b. Do not alter installation procedures from those set forth in this catalog.

c. Drill holes for post-installed anchors with carbide-tipped drills meeting the diameter requirements of ANSI B212.15 (shown in the table to the right). A properly sized hole is critical to the performance of post-installed anchors. Rotary-hammered drills with light, high-frequency impact are recommended for drilling holes. When holes are to be drilled in archaic or hollow base materials, the drill should be set to "rotation only" mode.

d. Failure to apply the recommended installation torque can result in excessive displacement of the anchor under load or premature failure of the anchor. These anchors will lose pre-tension after setting due to pre-load relaxation. See p. 250 for more information.

e. Do not disturb, make attachments, or apply load to adhesive anchors prior to the full cure of the adhesive.

f. Use proper safety equipment.

Finished Diameters for Rotary and Rotary-Hammer Carbide-Tipped Concrete Drills per ANSI B212.15

Nominal Drill Bit Diameter (in.)	Tolerance Range Minimum (in.)	Tolerance Range Maximum (in.)
1⁄8	0.134	0.140
5⁄32	0.165	0.171
3⁄16	0.198	0.206
7⁄32	0.229	0.237
1⁄4	0.260	0.268
5⁄16	0.327	0.335
3⁄8	0.390	0.398
7⁄16	0.458	0.468
1⁄2	0.520	0.530
9⁄16	0.582	0.592
5⁄8	0.650	0.660
11⁄16	0.713	0.723
3⁄4	0.775	0.787
13⁄16	0.837	0.849
27⁄32	0.869	0.881
7⁄8	0.905	0.917
15⁄16	0.968	0.980
1	1.030	1.042
1 1⁄8	1.160	1.175
1 3⁄16	1.223	1.238
1 1⁄4	1.285	1.300
1 5⁄16	1.352	1.367
1 3⁄8	1.410	1.425
1 7⁄16	1.472	1.487
1 1⁄2	1.535	1.550
1 9⁄16	1.588	1.608
1 5⁄8	1.655	1.675
1 3⁄4	1.772	1.792
2	2.008	2.028

Additional Instructions for the Installer for Gas- and Powder-Actuated Fastening

Before operating any Simpson Strong-Tie gas- or powder-actuated tool, you must read and understand the Operator's Manual and be trained by an authorized instructor in the operation of the tool. Simpson Strong-Tie recommends you read and fully understand the safety guidelines of the tool you use. To become a Certified Operator of Simpson Strong-Tie gas- and powder-actuated tools, you must pass a test and receive a certified operator card. Test and Operator's Manual are included with each tool kit. Extra copies may be obtained by contacting Simpson Strong-Tie at (800) 999-5099.

To avoid serious injury or death:

a. Always make sure that the operators and bystanders wear safety glasses. Hearing and head protection is also recommended.

b. Always post warning signs within the area when gas- or powder-actuated tools are in use. Signs should state "Tool in Use."

c. Always store gas- and powder-actuated tools unloaded. Store tools and powder loads in a locked container out of reach of children.

d. Never place any part of your body over the front muzzle of the tool, even if no fastener is present. The fastener, pin or tool piston can cause serious injury or death in the event of accidental discharge.

e. Never attempt to bypass or circumvent any of the safety features on a gas- or powder-actuated tool.

f. Always keep the tool pointed in a safe direction.

g. Always keep your finger off the trigger.

h. Always keep the tool unloaded until ready to use.

i. Always hold the tool perpendicular (90°) to the fastening surface to prevent ricocheting fasteners. Use the spall guard whenever possible.

j. Never attempt to fasten into thin, brittle or very hard materials such as glass, tile or cast iron as these materials are inappropriate. Conduct a pre-punch test to determine base material adequacy.

k. Never attempt to fasten into soft material such as drywall or wood. Fastening through soft materials into appropriate base material may be allowed if the application is appropriate.

l. Never attempt to fasten to a spalled, cracked or uneven surface.

m. Re-driving of pins is not recommended.

General Instructions for the Designer

These general instructions for the Designer are provided to ensure the proper selection and installation of Simpson Strong-Tie® products and must be followed carefully. They are in addition to the specific design and installation instructions and notes provided for each particular product, all of which should be consulted prior to and during the design process.

a. The term "Designer" used throughout this catalog is intended to mean a licensed/certified building design professional, a licensed professional engineer or a licensed architect.

b. All connected members and related elements shall be designed by the Designer and must have sufficient strength (bending, shear, etc.) to resist the design loads.

c. When the allowable stress design method is used, the design service load shall not exceed the published allowable loads reduced by load-adjustment factors for temperature, spacing and edge distance.

d. When the strength design method is used, the factored loads shall not exceed the design strengths calculated in accordance with the published design data.

e. Simpson Strong-Tie strongly recommends the following addition to construction drawings and specifications: "Simpson Strong-Tie products are specifically required to meet the structural calculations. Before substituting another brand, confirm load capacity based on reliable published testing data or calculations. The Designer should evaluate and give written approval for substitution prior to installation."

f. Where used in this catalog, "IBC" refers to the 2015 International Building Code, and "ACI 318" refers to ACI 318-14 Building Code Requirements for Structural Concrete. Local and/or regional building codes may require meeting special conditions. Building codes often require special inspection of anchors. For compliance with these requirements, contact the local building authority. Except where mandated by code, Simpson Strong-Tie products do not require special inspection.

g. Allowable loads and design strengths are determined from test results, calculations and experience. These are guide values for sound base materials with known properties. Due to variation in base materials and site conditions, site-specific testing should be conducted if exact performance in a specific base material at a specific site must be known.

h. Unless stated otherwise, tests conducted to derive performance information were performed in members with thickness at least 1.5 times the anchor embedment depth. Anchoring into thinner members requires the evaluation and judgment of a qualified Designer.

i. Tests are conducted with anchors installed perpendicular (±6° from a vertical reference) from a vertical reference to the surface of the base material. Deviations can result in anchor bending stresses and reduce the load-carrying capacity of the anchor.

j. Allowable loads and design strengths do not consider bending stresses due to shear loads applied with large eccentricities.

k. Metal anchors and fasteners will corrode and may lose load-carrying capacity when installed in corrosive environments or exposed to corrosive materials. See p. 248.

l. Mechanical anchors should not be installed into concrete that is less than 7 days old. The allowable loads and design strengths of mechanical anchors that are installed into concrete less than 28 days old should be based on the actual compressive strength of the concrete at the time of installation.

m. Nominal embedment depth ("embedment depth") is the distance from the surface of the base material to the installed end of the anchor and is measured prior to application of an installation torque (if applicable). Effective embedment depth is the distance from the surface of the base material to the deepest point at which the load is transferred to the base material.

n. Drill bits shall meet the diameter requirements of ANSI B212.15. For adhesive anchor installations in oversized holes, see p. 250. For adhesive anchor installations into core-drilled holes, see p. 251.

o. Threaded-rod inserts for adhesive anchors shall be oil-free UNC fully threaded steel. Bare steel, zinc plating, mechanical galvanizing or hot-dip galvanizing coatings are acceptable.

p. Allowable loads and design strengths are generally based on testing of adhesive anchors installed into dry holes. For installations into damp, wet and submerged environments, see p. 251.

q. ACI 318 states that adhesive anchors should not be installed into concrete that is less than 21 days old. For information on adhesive anchors installed into concrete less than 21 days old, see p. 250.

r. Adhesive anchors can be affected by elevated base material temperature. See p. 251.

s. Anchors are permitted to support fire-resistant construction provided at least one of the following conditions is fulfilled: (a) anchors are used to resist wind or seismic forces only; (b) anchors that support gravity-load-bearing structural elements are within a fire-resistive envelope or a fire-resistive membrane, are protected by approved fire-resistive materials, or have been evaluated for resistance to fire exposure in accordance with recognized standards; or (c) anchors are used to support non-structural elements.

t. Exposure to some chemicals may degrade the bond strength of adhesive anchors. Refer to the product description for chemical resistance information or refer to see p. 252.

Limited Warranty

Simpson Strong-Tie Company Inc. warrants catalog products to be free from defects in material or manufacturing. Simpson Strong-Tie Company Inc. products are further warranted for adequacy of design when used in accordance with design limits in this catalog and when properly specified, installed and maintained. This warranty does not apply to uses not in compliance with specific applications and installations set forth in this catalog, or to non-catalog or modified products, or to deterioration due to environmental conditions.

Simpson Strong-Tie® anchors, fasteners and connectors are designed to enable structures to resist the movement, stress and loading that results from impact events such as earthquakes and high-velocity winds. Other Simpson Strong-Tie products are designed to the load capacities and uses listed in this catalog. Properly installed Simpson Strong-Tie products will perform in accordance with the specifications set forth in the applicable Simpson Strong-Tie catalog. Additional performance limitations for specific products may be listed on the applicable catalog pages.

Due to the particular characteristics of potential impact events, the specific design and location of the structure, the building materials used, the quality of construction, and the condition of the soils involved, damage may nonetheless result to a structure and its contents even if the loads resulting from the impact event do not exceed Simpson Strong-Tie catalog specifications and Simpson Strong-Tie connectors are properly installed in accordance with applicable building codes.

All warranty obligations of Simpson Strong-Tie Company Inc. shall be limited, at the discretion of Simpson Strong-Tie Company Inc., to repair or replacement of the defective part. These remedies shall constitute the sole obligation of Simpson Strong-Tie Company Inc. and the sole remedy of purchaser under this warranty. In no event will Simpson Strong-Tie Company Inc. be responsible for incidental, consequential, or special loss or damage, however caused.

This warranty is expressly in lieu of all other warranties, expressed or implied, including warranties of merchantability or fitness for a particular purpose, all such other warranties being hereby expressly excluded. This warranty may change periodically – consult our website **strongtie.com** for current information.

Terms and Conditions of Sale

Product Use

Products in this catalog are designed and manufactured for the specific purposes shown, and should not be used with other connectors not approved by a qualified Designer. Modifications to products or changes in installations should only be made by a qualified Designer. The performance of such modified products or altered installations is the sole responsibility of the Designer.

Indemnity

Customers or Designers modifying products or installations, or designing non-catalog products for fabrication by Simpson Strong-Tie Company Inc. shall, regardless of specific instructions to the user, indemnify, defend and hold harmless Simpson Strong-Tie Company Inc. for any and all claimed loss or damage occasioned in whole or in part by non-catalog or modified products.

Non-Catalog And Modified Products

Consult Simpson Strong-Tie Company Inc. for applications for which there is no catalog product, or for connectors for use in hostile environments, with excessive wood shrinkage, or with abnormal loading or erection requirements.

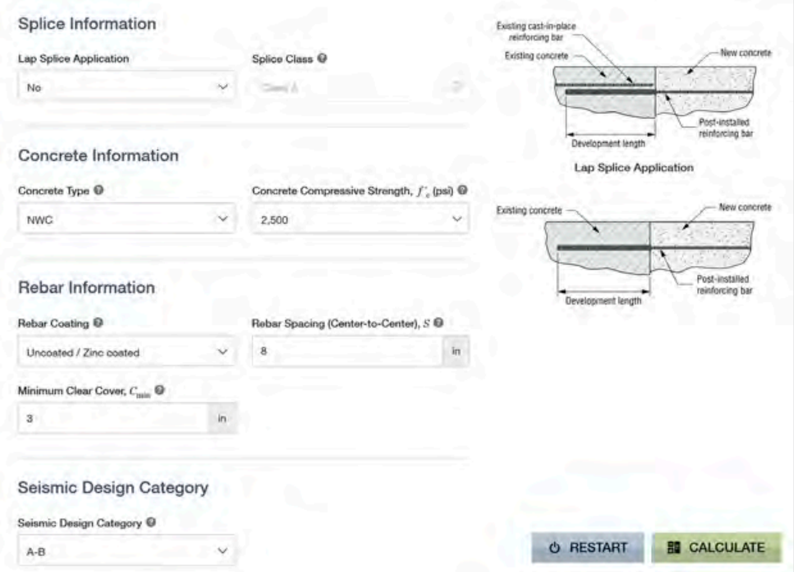
Non-catalog products must be designed by the customer and will be fabricated by Simpson Strong-Tie in accordance with customer specifications.

Simpson Strong-Tie cannot and does not make any representations regarding the suitability of use or load-carrying capacities of non-catalog products. Simpson Strong-Tie provides no warranty, express or implied, on non-catalog products. F.O.B. Shipping Point unless otherwise specified.

Anchor Software and Web Apps

Rebar Development Length Calculator

Rebar Development Length Calculator is a web application that supports the design of post-installed rebar in concrete applications by calculating the necessary tension and compression development lengths required in accordance with ACI 318-14 / ACI 318-11.



Splice Information

Lap Splice Application: No

Splice Class

Concrete Information

Concrete Type: NWC

Concrete Compressive Strength, f'_c (psi): 2,500

Rebar Information

Rebar Coating: Uncoated / Zinc coated

Rebar Spacing (Center-to-Center), S: 8 in

Minimum Clear Cover, C_{min}: 3 in

Seismic Design Category

Seismic Design Category: A-B

Visit: **strongtie.com/softwareandwebapplications/category.**

Adhesive Cartridge Estimator

If you need to know how much adhesive to use for your next project, the Adhesive Cartridge Estimator makes it easy to estimate just how much is required. All you have to do is input the size and number of adhesive anchors to get the number of adhesive cartridges necessary for the job. And you can print the results for future reference.

Adhesive Cartridge Estimator: SET-3G™

The Adhesive Cartridge Estimator makes it easy to estimate how much adhesive you need for your project! Input size and number of adhesive anchors to get the number of adhesive cartridges needed for the job. Results may be printed for future reference.

Select an Adhesive

- SET-3G™ Epoxy Anchoring Adhesive
- SET-XP® High-Strength Epoxy Anchoring Adhesive for Cracked and Uncracked Concrete
- AT-XP® Fast-Curing Anchoring Adhesive for Cracked and Uncracked Concrete
- ET-HP® Anchoring Adhesive
- SET® Epoxy Anchoring Adhesive
- AT High-Strength Acrylic-Based Anchoring Adhesive

SET-3G: Threaded Rod Installation Details

1. Rod Diameter: Select
2. Drill Bit Diameter: Select
3. Hole Depth (inches): Enter depth in inches
4. Number of Installations: Number of holes to fill

Version 2.1.0

Visit: **strongtie.com/softwareandwebapplications/category.**

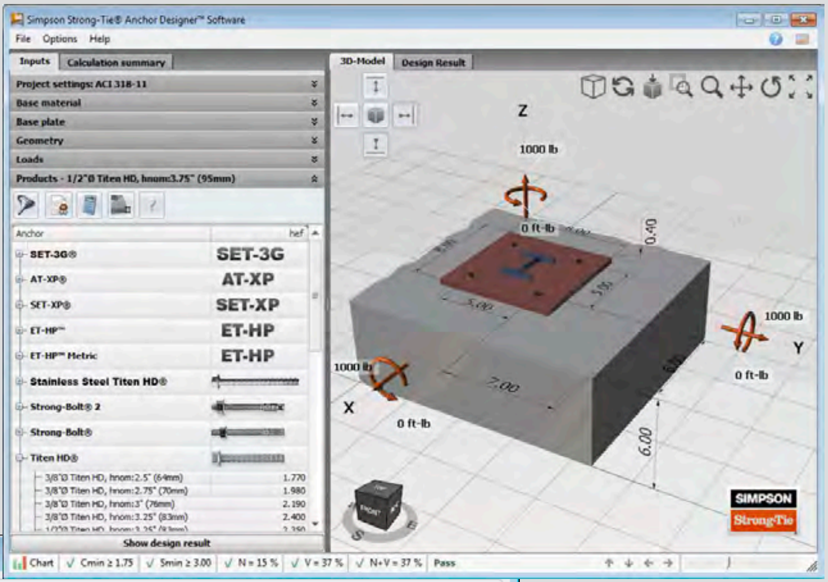
Anchor Designer™ Software for ACI 318, ETAG and CSA

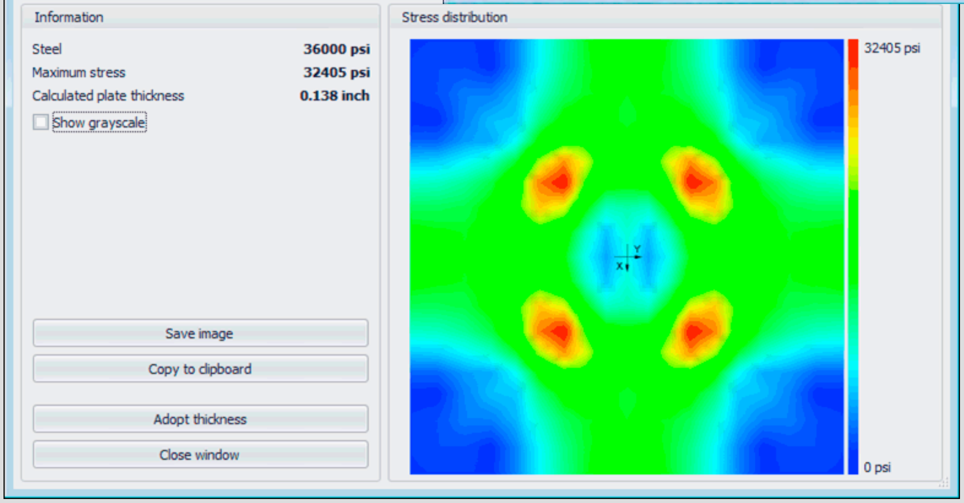
Simpson Strong-Tie® Anchor Designer Software is the latest anchorage design tool for structural engineers to satisfy the strength design provisions of ACI 318-14 Chapter 17 / ACI 318-11 Appendix D, CAN / CSA A23.3 Annex D, ETAG 001 Annex C or EOTA TR029 design methodologies. Anchor Designer will quickly and accurately analyze an existing design or suggest anchorage solutions based upon user-defined design elements in cracked and uncracked concrete conditions.

The real-time design is visually represented in a fully-interactive 3D graphic user interface, supports Imperial and Metric-sized Simpson Strong-Tie mechanical and adhesive anchors, and offers cast-in-place anchor solutions. Anchor Designer can calculate single anchor solutions or up to 16 anchors in a single plate.

Additional features include:

- Easy-to-use menus.
- Ability to calculate single anchor model or to calculate multiple anchor models at once.
- Multi-lingual options include English, German, French, Spanish, Polish and Danish languages.
- Rectangular and circular base plate geometries with the option to include slotted holes.
- And much more!





Steel 36000 psi
Maximum stress 32405 psi
Calculated plate thickness 0.138 inch

Visit: **strongtie.com/softwareandwebapplications/category.**

Adhesive Anchors

SET-3G™ High-Strength Epoxy Adhesive

SET-3G is the latest innovation in epoxy anchoring adhesives from Simpson Strong-Tie. Formulated to provide superior performance in cracked and uncracked concrete at elevated temperatures, SET-3G installs and performs in a variety of environmental conditions and temperature extremes. The exceptional bond strength of SET-3G results in high design strengths.

Features

- Exceptional performance — superior bond-strength values at even long-term elevated temperature of 110°F (43°C) using optimized drill bit diameters
- Tested in accordance with ICC-ES AC308 and ACI 355.4 for use in cracked and uncracked normal-weight and lightweight concrete
- Design flexibility — can be specified for dry or water-saturated conditions when in-service temperatures range from -40°F (-40°C) to 176°F (80°C)
- Jobsite versatility — can be installed in dry, water-saturated or water-filled holes in base materials with temperatures between 40°F (4°C) and 100°F (38°C)
- Maximized production and safety — qualified for installation using the Speed Clean™ DXS dust extraction drilling system as an alternative to the conventional blow-brush-blow hole-cleaning method
- Wire brush hole-cleaning system for conventional blow-brush-blow cleaning method
- Available in two cartridge configurations for maximum versatility — 8.5 oz. coaxial or 22 oz. side-by-side cartridges dispensed using manual, battery or pneumatic dispensing tools
- With higher bond strengths, ductile solutions can often be achieved with SET-3G in high seismic areas
- 1:1 ratio, two-component, high-strength, epoxy-based anchoring adhesive formula
- Two-year shelf life for unopened cartridges stored between 45°F (7°C) and 90°F (32°C)
- Low-odor formulation
- When properly mixed, SET-3G will be a uniform gray color
- Volatile organic compound (VOC) — 1.9 g/L
- Manufactured in the USA using global materials
- Tested per ACI355.4
- SET-3G code listed for installation with the Speed Clean™ DXS drill bits without any further cleaning (ICC-ES ESR-4057)

Applications

- Threaded rod anchor and rebar dowel installations in cracked and uncracked concrete under a wide variety of environmental installation and use conditions
- Installation in downward, horizontal and upwardly inclined (including overhead) orientations
- Qualified for use in structures assigned to Seismic Design Categories A through F

Codes

ICC-ES ESR-4057 (concrete); City of Los Angeles (see ICC-ES ESR-4057); AASHTO M235 and ASTM C881, Types I and IV, Grade 3, Class C; NSF/ANSI Standard 61 (300 in.^{2} / 1,000 gal.)

Chemical Resistance

Contact Simpson Strong-Tie for information.

SET-3G Adhesive

Installation and Application Instructions

(See also pp. 100–102)

- Surfaces to receive epoxy must be clean per approved hole cleaning method.
- Base-material temperatures must be 40°F (4°C) or above at the time of installation. For best results, adhesive should be conditioned to a temperature between 70°F (21°C) and 80°F (37°C) at the time of installation.
- To warm cold adhesive, store cartridges in a warm, uniformly heated area or storage container. Do not immerse cartridges in water or use microwave to facilitate warming.
- Mixed material can harden in the dispensing nozzle within 30 minutes at 70°F (21°C).

Note: For full installation instructions, see product packaging or visit **strongtie.com/set3g**.

SET-3G™ High-Strength Epoxy Adhesive

SET-3G Adhesive Cartridge System

Model No.	Capacity (ounces)	Cartridge Type	Carton Quantity	Dispensing Tool(s)	Mixing Nozzle
SET3G10[2]	8.5	Coaxial	12	CDT10S	EMN22I
SET3G22-N[1]	22	Side-by-side	10	EDT22S, EDTA22P, EDTA22CKT	EMN22I

1. One EMN21I mixing nozzle and one extension are supplied with each cartridge.
2. Two EMN22I mixing nozzles and two nozzle extensions are supplied with each cartridge.
3. Cartridge estimation guidelines are available at **strongtie.com/apps**.
4. Use only Simpson Strong-Tie® mixing nozzles in accordance with Simpson Strong-Tie instructions. Modification or improper use of mixing nozzle may impair SET-3G adhesive performance.

SET-3G Cure Schedule[1, 2]

Concrete Temperature		Gel Time	Cure Time
(°F)	(°C)	(min.)	(hr.)
40	4	120	192
50	10	75	72
60	16	50	48
70	21	35	24
90	32	25	24
100	38	15	24

For SI: 1°F = (°C x $\frac{9}{5}$) + 32.

1. For water-saturated concrete and water-filled holes, the cure times should be doubled.
2. For installation of anchors in concrete where the temperature is below 70°F (21°C), the adhesive must be conditioned to a minimum temperature of 70°F (21°C).

Test Criteria

Anchors installed with SET-3G adhesive have been tested in accordance with ICC-ES *Acceptance Criteria for Adhesive Anchors in Concrete Elements* (AC308).

Property	**Test Method**	**Result***
Consistency	ASTM C881	Passed, non-sag
Heat deflection	ASTM D648	147°F
Bond strength (moist cure)	ASTM C882	3,306 psi at 2 days
Water absorption	ASTM D570	0.13%
Compressive yield strength	ASTM D695	15,390 psi
Compressive modulus	ASTM D695	991,830 psi
Shore D durometer	ASTM D2240	84
Gel time	ASTM C881	52 minutes
Volatile Organic Compound (VOC)	—	1.9 g/L

*Material and curing conditions: 73 ± 2°F, unless otherwise noted.

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

IBC *

Characteristic	Symbol	Units	Nominal Anchor Diameter d_a (in.) / Rebar Size						
			⅜ / #3	½ / #4	⅝ / #5	¾ / #6	⅞ / #7	1 / #8	1¼ / #10
Installation Information									
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	T_{inst}	ft.-lb.	15	30	60	100	125	150	200
Minimum Embedment Depth	$h_{ef,\ min}$	in.	2⅜	2¾	3⅛	3½	3¾	4	5
Maximum Embedment Depth	$h_{ef,\ max}$	in.	7½	10	12½	15	17½	20	25
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.	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 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:

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

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

h = the member thickness (inches)

h_{ef} = the embedment depth (inches)

* See p. 13 for an explanation of the load table icons.

SET-3G Tension Strength Design Data for Threaded Rod in Normal-Weight Concrete[1, 8]

IBC *

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.	4,525	8,235	13,110	19,370	26,795	35,150	56,200
Tension Resistance of Steel — ASTM F1554, Grade 55					5,850	10,650	16,950	25,050	34,650	45,450	72,675
Tension Resistance of Steel — ASTM A193, Grade B7					9,750	17,750	28,250	41,750	57,750	75,750	121,125
Tension Resistance of Steel — Stainless Steel ASTM A193, Grade B8 and B8M (Types 304 and 316)					4,445	8,095	12,880	19,040	26,335	34,540	55,235
Tension Resistance of Steel — Stainless Steel ASTM F593 CW (Types 304 and 316)					7,800	14,200	22,600	28,390	39,270	51,510	82,365
Tension Resistance of Steel — Stainless Steel ASTM A193, Grade B6 (Type 410)					8,580	15,620	24,860	36,740	50,820	66,660	106,590
Strength Reduction Factor for Tension — Steel Failure			ϕ	—	0.75^5						
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	3¾	4	5
Maximum Embedment			$h_{ef,max}$	in.	7½	10	12½	15	17½	20	25
Continuous Inspection	Temperature Range A^{2,4}	Characteristic Bond Strength in Cracked Concrete^9	$\tau_{k,cr}$	psi	1,448	1,402	1,356	1,310	1,265	1,219	1,128
		Characteristic Bond Strength in Uncracked Concrete^9	$\tau_{k,uncr}$	psi	2,357	2,260	2,162	2,064	1,967	1,868	1,672
	Temperature Range B^{3,4}	Characteristic Bond Strength in Cracked Concrete^9	$\tau_{k,cr}$	psi	1,201	1,163	1,125	1,087	1,050	1,012	936
		Characteristic Bond Strength in Uncracked Concrete^9	$\tau_{k,uncr}$	psi	1,957	1,876	1,795	1,713	1,632	1,551	1,388
	Anchor Category	Dry Concrete	—	—	1						
	Strength Reduction Factor	Dry Concrete	$\phi_{dry,ci}$	—	0.65^{10}						
	Anchor Category	Water-Saturated Concrete, or Water-Filled Hole	—	—	3		2				
	Strength Reduction Factor	Water-Saturated Concrete, or Water-Filled Hole	$\phi_{wet,ci}$	—	0.45^{10}		0.55^{10}				
Periodic Inspection	Temperature Range A^{2,4}	Characteristic Bond Strength in Cracked Concrete^9	$\tau_{k,cr}$	psi	1,346	1,304	1,356	1,310	1,265	1,219	1,128
		Characteristic Bond Strength in Uncracked Concrete^9	$\tau_{k,uncr}$	psi	2,192	2,102	2,162	2,064	1,967	1,868	1,672
	Temperature Range B^{3,4}	Characteristic Bond Strength in Cracked Concrete^9	$\tau_{k,cr}$	psi	1,117	1,082	1,125	1087	1,050	1,012	936
		Characteristic Bond Strength in Uncracked Concrete^9	$\tau_{k,uncr}$	psi	1,820	1,744	1,795	1,713	1,632	1,551	1,388
	Anchor Category	Dry Concrete		—	2		1				
	Strength Reduction Factor	Dry Concrete	$\phi_{dry,pi}$	—	0.55^{10}		0.65^{10}				
	Anchor Category	Water-Saturated Concrete, or Water-Filled Hole	—	—	3						
	Strength Reduction Factor	Water-Saturated Concrete, or Water-Filled Hole	$\phi_{wet,pi}$	—	0.45^{10}						
Reduction Factor for Seismic Tension			$\alpha_{N,seis}{}^{11}$	—	1.0	0.9	1.0	1.0	1.0	1.0	1.0

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 and ACI 318-11.
2. Temperature Range A: Maximum short-term temperature = 160°F, maximum long-term temperature = 110°F.
3. Temperature Range B: Maximum short-term temperature = 176°F, maximum long-term temperature = 110°F.
4. Short-term concrete temperatures are those that occur over short intervals (diurnal cycling). Long-term temperatures are roughly constant over significant periods of time.
5. The tabulated value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 9.2 are used. 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.
6. The tabulated value of ϕ applies when both the load combinations of ACI 318-14 5.3, or ACI 318-11 9.2 are used and the requirements of ACI 318-14 17.3.3 (c) or ACI 318-11 D.4.3 (c), as applicable, for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318 D.4.4 (c) for Condition B 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 $(f'_C/2{,}500)^{0.35}$ for uncracked concrete and a factor of $(f'_C/2{,}500)^{0.24}$ for cracked concrete.
8. For lightweight concrete, the modification factor for bond strength shall be as given in 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.
10. The tabulated value of ϕ applies when both the load combinations of ACI 318-14 5.3, or ACI 318-11 9.2 are used and the requirements of ACI 318-14 17.3.3 (c) or ACI 318-11 D.4.3 (c), as applicable, for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318 D.4.4(c) for Condition B to determine the appropriate value of ϕ.
11. 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. 13 for an explanation of the load table icons.

SET-3G™ Design Information — Concrete

SET-3G Tension Strength Design Data for Rebar in Normal-Weight Concrete[1,8]

*

Characteristic			Symbol	Units	Rebar Size						
					#3	#4	#5	#6	#7	#8	#10
Steel Strength in Tension											
Minimum Tensile Stress Area			A_{se}	in.^{2}	0.11	0.20	0.31	0.44	0.60	0.79	1.27
Tension Resistance of Steel — Rebar (ASTM A615 Grade 60)			N_{sa}	lb.	9,900	18,000	27,900	39,600	54,000	71,100	114,300
Tension Resistance of Steel — Rebar (ASTM A706 Grade 60)					8,800	16,000	24,800	35,200	48,000	63,200	101,600
Strength Reduction Factor for Tension — Steel Failure			ϕ	—	0.75[5]						
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	3¾	4	5
Maximum Embedment			$h_{ef,max}$	in.	7½	10	12½	15	17½	20	25
Continuous Inspection	Temperature Range A[2,4]	Characteristic Bond Strength in Cracked Concrete[9]	$\tau_{k,cr}$	psi	1,448	1,402	1,356	1,310	1,265	1,219	1,128
		Characteristic Bond Strength in Uncracked Concrete[9]	$\tau_{k,uncr}$	psi	2,269	2,145	2,022	1,898	1,774	1,651	1,403
	Temperature Range B[3,4]	Characteristic Bond Strength in Cracked Concrete[9]	$\tau_{k,cr}$	psi	1,201	1,163	1,125	1,087	1,050	1,012	936
		Characteristic Bond Strength in Uncracked Concrete[9]	$\tau_{k,uncr}$	psi	1,883	1,781	1,678	1,575	1,473	1,370	1,165
	Anchor Category	Dry Concrete	—	—	1						
	Strength Reduction Factor	Dry Concrete	$\phi_{dry,ci}$	—	0.65[10]						
	Anchor Category	Water-Saturated Concrete, or Water-Filled Hole	—	—	3		2				
	Strength Reduction Factor	Water-Saturated Concrete, or Water-Filled Hole	$\phi_{wet,ci}$	—	0.45[10]		0.55[10]				
Periodic Inspection	Temperature Range A[2,4]	Characteristic Bond Strength in Cracked Concrete[9]	$\tau_{k,cr}$	psi	1,346	1,304	1,356	1,310	1,265	1,219	1,128
		Characteristic Bond Strength in Uncracked Concrete[9]	$\tau_{k,uncr}$	psi	2,110	1,995	2,022	1,898	1,774	1,651	1,403
	Temperature Range B[3,4]	Characteristic Bond Strength in Cracked Concrete[9]	$\tau_{k,cr}$	psi	1,117	1,082	1,125	1,087	1,050	1,012	936
		Characteristic Bond Strength in Uncracked Concrete[9]	$\tau_{k,uncr}$	psi	1,751	1,656	1,678	1,575	1,473	1,370	1,165
	Anchor Category	Dry Concrete	—	—	2		1				
	Strength Reduction Factor	Dry Concrete	$\phi_{dry,pi}$	—	0.55[10]		0.65[10]				
	Anchor Category	Water-Saturated Concrete, or Water-Filled Hole	—	—	3						
	Strength Reduction Factor	Water-Saturated Concrete, or Water-Filled Hole	$\phi_{wet,pi}$	—	0.45[10]						
Reduction Factor for Seismic Tension			$\alpha_{N,seis}$[11]	—	1.0	1.0	1.0	1.0	1.0	1.0	1.0

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 and ACI 318-11.
2. Temperature Range A: Maximum short-term temperature = 160°F, maximum long-term temperature = 110°F.
3. Temperature Range B: Maximum short-term temperature = 176°F, maximum long-term temperature = 110°F.
4. Short-term concrete temperatures are those that occur over short intervals (diurnal cycling). Long-term temperatures are roughly constant over significant periods of time.
5. The tabulated value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 9.2 are used. 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.
6. The tabulated value of ϕ applies when both the load combinations of ACI 318-14 5.3, or ACI 318-11 9.2 are used and the requirements of ACI 318-14 17.3.3 (c) or ACI 318-11 D.4.3 (c), as applicable, for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318 D.4.4(c) for Condition B 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 $(f'_c/2{,}500)^{0.36}$ for uncracked concrete and a factor of $(f'_c/2{,}500)^{0.25}$ for cracked concrete.
8. For lightweight concrete, the modification factor for bond strength shall be as given in 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.
10. The tabulated value of ϕ applies when both the load combinations of ACI 318-14 5.3, or ACI 318-11 9.2 are used and the requirements of ACI 318-14 17.3.3 (c) or ACI 318-11 D.4.3 (c), as applicable, for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318 D.4.4(c) for Condition B to determine the appropriate value of ϕ.
11. 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. 13 for an explanation of the load table icons.

SET-3G™ Design Information — Concrete

SET-3G Shear Strength Design Data for Threaded Rod in Normal-Weight Concrete[1]

IBC *

Characteristic	Symbol	Units	Nominal Rod Diameter (in.)						
			3/8	1/2	5/8	3/4	7/8	1	1 1/4
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.	2,715	4,940	7,865	11,625	16,080	21,090	33,720
Shear Resistance of Steel — ASTM F1554, Grade 55			3,510	6,390	10,170	15,030	20,790	27,270	43,605
Shear Resistance of Steel — ASTM A193, Grade B7			5,850	10,650	16,950	25,050	34,650	45,450	72,675
Reduction factor for Seismic Shear — Carbon Streel	$\alpha_{V,seis}$[4]	—	0.75					1.0	
Shear Resistance of Steel — Stainless Steel ASTM A193, Grade B8 and B8M (Types 304 and 316)	V_{sa}	lb.	2,665	4,855	7,730	11,425	15,800	20,725	33,140
Shear Resistance of Steel — Stainless Steel ASTM F593 CW (Types 304 and 316)			4,680	8,520	13,560	17,035	23,560	30,905	49,420
Shear Resistance of Steel — Stainless Steel ASTM A193, Grade B6 (Type 410)			5,150	9,370	14,915	22,040	30,490	40,000	63,955
Reduction factor for Seismic Shear — Stainless Steel	$\alpha_{V,seis}$[4]	—	0.80		0.75			1.0	
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.	h_{ef}						
Strength Reduction Factor for Shear — Breakout Failure	ϕ	—	0.70[3]						
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[3]						

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 and ACI 318-11.
2. The tabulated value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 9.2 are used. 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 tabulated value of ϕ applies when both the load combinations of ACI 318-14 5.3, or ACI 318-11 9.2 are used and the requirements of ACI 318-14 17.3.3 (c) or ACI 318-11 D.4.3 (c), as applicable, for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318 D.4.4 (c) for Condition B to determine the appropriate value of ϕ.
4. 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 α_{Vseis} for the corresponding anchor steel type.

* See p. 13 for an explanation of the load table icons.

SET-3G™ Design Information — Concrete

SET-3G Shear Strength Design Data for Rebar in Normal-Weight Concrete[1]

IBC *

Characteristic	Symbol	Units	Nominal Rod Diameter (in.)						
			#3	#4	#5	#6	#7	#8	#10
Steel Strength in Shear									
Minimum Shear Stress Area	A_{se}	in.^{2}	0.110	0.200	0.310	0.440	0.600	0.790	1.270
Shear Resistance of Steel — Rebar (ASTM A615 Grade 60)	V_{sa}	lb.	5,940	10,800	16,740	23,760	32,400	42,660	68,580
Shear Resistance of Steel — Rebar (ASTM A706 Grade 60)			5,280	9,600	14,880	21,120	28,800	37,920	60,960
Reduction Factor for Seismic Shear — Rebar (ASTM A615 Grade 60)	$\alpha_{V,seis}$[4]	—	0.60					0.8	
Reduction Factor for Seismic Shear — Rebar (ASTM A706 Grade 60)			0.60					0.8	
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.	h_{ef}						
Strength Reduction Factor for Shear — Breakout Failure	ϕ	—	0.70[3]						
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[3]						

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 and ACI 318-11.
2. The tabulated value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 9.2 are used. 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 tabulated value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 9.2 are used and the requirements of ACI 318-14 17.3.3 (c) or ACI 318-11 D.4.3 (c), as applicable, for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318 D.4.4 (c) for Condition B to determine the appropriate value of ϕ.
4. 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 α_{Vseis} for the corresponding anchor steel type.

For additional load tables, visit **strongtie.com/set3g**.

* See p. 13 for an explanation of the load table icons.

SET-XP® High-Strength Epoxy Adhesive

SET-XP epoxy anchoring adhesive is a high-strength formula for anchoring and doweling in cracked and uncracked concrete and masonry applications. It is a two-part system with the resin and hardener being simultaneously dispensed and mixed through the mixing nozzle. When properly mixed, adhesive will be a uniform teal color for easy post-installation identification.

Features

- 1:1 two-component, high-solids, epoxy-based anchoring adhesive formula
- Passed the demanding ICC-ES AC308 adverse-condition tests pertaining to elevated temperatures and long-term sustained loads
- Code listed under the IBC/IRC for cracked and uncracked concrete per ICC-ES ESR-2508
- Code listed under the IBC/IRC for masonry per IAPMO UES ER-265
- Code-listed equivalent to cast-in-place reinforcing bars governed by ACI 318 and IBC Chapter 19
- Suitable for use under static and seismic loading conditions in cracked and uncracked concrete and masonry
- Cure times: 24 hours at 70°F (21°C), 72 hours at 50°F (10°C)
- Easy hole-cleaning — no power-brushing required
- Suitable for use in dry or water-saturated concrete
- For best results, store between 45°F (7°C) and 90°F (32°C)
- Available in 8.5 oz., 22 oz. and 56 oz. cartridges for application versatility
- Manufactured in the USA using global materials
- SET-XP is code listed for installation with the Speed Clean™ DXS drill bits without any further cleaning (ICC-ES ESR-2508)
- Tested per ACI 355.4 and AC308

SET-XP Adhesive

Applications

- Threaded rod anchoring and rebar doweling into concrete and masonry
- Recognized per AC308 to be used for rebar development and splice length design provisions of ACI 318
- Suitable for horizontal, vertical and overhead applications
- Multiple DOT listings — refer to **strongtie.com/DOT** for current approvals

Codes

ICC-ES ESR-2508 (concrete); IAPMO UES ER-265 (masonry); City of L.A. RR25744 (concrete), RR25965 (masonry); Florida FL-17449.2 (concrete), FL-16230.3 (masonry); AASHTO M-235 and ASTM C881 (Type I and IV, Grade 3, Class C); NSF/ANSI Standard 61 (216 in.^{2}/1,000 gal.)

Chemical Resistance

See pp. 252–253

Installation and Application Instructions

(See also pp. 100–102)

- Surfaces to receive epoxy must be clean.
- Base material temperature must be 50°F (10°C) or above at the time of installation. For best results, material should be between 70°F (21°C) and 80°F (27°C) at time of application.
- To warm cold material, store cartridges in a warm, uniformly heated area or storage container. Do not immerse cartridges in water or use microwave to facilitate warming.
- Mixed material in nozzle can harden in 30 minutes at temperatures of 70°F (21°C) and above.

Suggested Specifications

See **strongtie.com** for more information.

Test Criteria

Anchors installed with SET-XP adhesive have been tested in accordance with ICC-ES *Acceptance Criteria for Post-Installed Adhesive Anchors in Masonry Elements* (AC58) and *Adhesive Anchors in Concrete Elements* (AC308).

Property	**Test Method**	**Result***
Consistency	ASTM C881	Passed, non-sag
Glass transition temperature	ASTM E1356	155°F
Bond strength (moist cure)	ASTM C882	2,916 psi at 2 days
Water absorption	ASTM D570	0.10%
Compressive yield strength	ASTM D695	14,110 psi
Compressive modulus	ASTM D695	612,970 psi
Shore D Durometer	ASTM D2240	84
Gel time	ASTM C881	60 minutes
Volatile Organic Compound (VOC)	—	3 g/L

*Material and curing conditions: 73 ± 2°F, unless otherwise noted.

SET-XP Cartridge System

Model No.	Capacity (ounces)	Cartridge Type	Carton Quantity	Dispensing Tool(s)	Mixing Nozzle
SET-XP10[4]	8.5	Single	12	CDT10S	EMN22I
SET-XP22	22	Side-by-Side	10	EDT22S, EDTA22P, EDTA22CKT	
SET-XP22-N[5]	22	Side-by-Side	10	EDT22S, EDTA22P, EDTA22CKT	
SET-XP56	56	Side-by-Side	6	EDTA56P	

1. Cartridge estimation guidelines are available at **strongtie.com/apps**.
2. Detailed information on dispensing tools, mixing nozzles and other adhesive accessories is available at **strongtie.com**.
3. Use only Simpson Strong-Tie mixing nozzles in accordance with Simpson Strong-Tie instructions. Modification or improper use of mixing nozzle may impair SET-XP adhesive performance.
4. Two EMN22I mixing nozzles and two nozzle extensions are supplied with each cartridge.
5. One EMN22I mixing nozzle and one nozzle extension are supplied with each cartridge.

Cure Schedule

Base Material Temperature		Gel Time (minutes)	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 must be doubled.

SET-XP® Design Information — Concrete

SET-XP 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	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.	$h_{ef} + 5d_{hole}$						
Critical Edge Distance[2]		c_{ac}	in.	See footnote 2						
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 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 $\leq k_{uncr} ((h_{ef} \times f'_c)^{0.5}/(\pi \times d_{hole}))$

h = the member thickness (inches)

h_{ef} = the embedment depth (inches)

* See p. 13 for an explanation of the load table icons.

SET-XP® Design Information — Concrete

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

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}	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.	4,525	8,235	13,110	19,370	26,795	35,150	56,200
	Tension Resistance of Steel — ASTM A193, Grade B7				9,750	17,750	28,250	41,750	57,750	75,750	121,125
	Tension Resistance of Steel — Type 410 Stainless (ASTM A193, Grade B6)				8,580	15,620	24,860	36,740	50,820	66,660	106,590
	Tension Resistance of Steel — Type 304 and 316 Stainless (ASTM A193, Grade B8 and B8M)				4,445	8,095	12,880	19,040	26,335	34,540	55,235
	Strength Reduction Factor — Steel Failure		ϕ	—	0.75[7]						
Concrete Breakout Strength in Tension (2,500 psi ≤ f'_c ≤ 8,000 psi)[12]											
Effectiveness Factor — Uncracked Concrete			k_{uncr}	—	24						
Effectiveness Factor — Cracked Concrete			k_{cr}	—	17						
Strength Reduction Factor — Breakout Failure			ϕ	—	0.65[9]						
Bond Strength in Tension (2,500 psi ≤ f'_c ≤ 8,000 psi)[12]											
Uncracked Concrete[2,3,4]	Characteristic Bond Strength[5,13]		$\tau_{k,uncr}$	psi	770	1,150	1,060	970	885	790	620
	Permitted Embedment Depth Range	Minimum	h_{ef}	in.	2⅜	2¾	3⅛	3½	3¾	4	5
		Maximum			7½	10	12½	15	17½	20	25
Cracked Concrete[2,3,4]	Characteristic Bond Strength[5,10,11,13]		$\tau_{k,cr}$	psi	595	510	435	385	355	345	345
	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[8]						
Strength Reduction Factor — Water-Saturated Concrete — $h_{ef} \le 12d_a$			$\phi_{sat,ci}$	—	0.55[8]		0.45[8]				
Additional Factor for Water-Saturated Concrete — $h_{ef} \le 12d_a$			$K_{sat,ci}$[6]	—	N/A		1			0.84	
Strength Reduction Factor — Water-Saturated Concrete — $h_{ef} > 12d_a$			$\phi_{sat,ci}$	—	0.45[8]						
Additional Factor for Water-Saturated Concrete — $h_{ef} > 12d_a$			$K_{sat,ci}$[6]	—	0.57						
Bond Strength in Tension — Bond Strength Reduction Factors for Periodic Special Inspection											
Strength Reduction Factor — Dry Concrete			$\phi_{dry,pi}$	—	0.55[8]						
Strength Reduction Factor — Water-Saturated Concrete — $h_{ef} \le 12d_a$			$\phi_{sat,pi}$	—	0.45[8]						
Additional Factor for Water-Saturated Concrete — $h_{ef} \le 12d_a$			$K_{sat,pi}$[6]	—	1		0.93			0.71	
Strength Reduction Factor — Water-Saturated Concrete — $h_{ef} > 12d_a$			$\phi_{sat,pi}$	—	0.45[8]						
Additional Factor for Water-Saturated Concrete — $h_{ef} > 12d_a$			$K_{sat,pi}$[6]	—	0.48						

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 or ACI 318-11.
2. Temperature Range: Maximum short-term temperature of 150°F. Maximum long-term temperature of 110°F.
3. Short-term concrete temperatures are those that occur over short intervals (diurnal cycling).
4. Long-term concrete temperatures are constant temperatures over a significant time period.
5. For anchors that only resist wind or seismic loads, bond strengths may be increased by 72%.
6. In water-saturated concrete, multiply $\tau_{k,uncr}$ and $\tau_{k,cr}$ by K_{sat}.
7. The value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
8. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.4 (c) for Condition B are met. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
9. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.4 (c) for Condition B are met. If the load combinations of ACI 318-11 Section 9.2 are used and the requirements of ACI 318-11 D.4.4 (c) for Condition A are met, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.5 to determine the appropriate value of ϕ.
10. 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 $\alpha_{N,seis} = 0.80$.
11. 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 $\alpha_{N,seis} = 0.92$.
12. The values of f'_c used for calculation purposes must not exceed 8,000 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.
13. For applications where maximum short-term temperature is 110ºF (43ºC) and the maximum long-term temperature is 75ºF (24ºC), bond strengths may be increased 93%. No additional increase is permitted for anchors that only resist wind or seismic loads.

* See p. 13 for an explanation of the load table icons.

SET-XP Tension Strength Design Data for Rebar in Normal-Weight Concrete[1]

Characteristic			Symbol	Units	Rebar Size						
					#3	#4	#5	#6	#7	#8	#10
Steel Strength in Tension											
Rebar	Minimum Tensile Stress Area		A_{se}	in^2	0.11	0.2	0.31	0.44	0.6	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[7]						
Concrete Breakout Strength in Tension (2,500 psi ≤ f'_c ≤ 8,000 psi)[10]											
Effectiveness Factor — Uncracked Concrete			k_{uncr}	—	24						
Effectiveness Factor — Cracked Concrete			k_{cr}	—	17						
Strength Reduction Factor — Breakout Failure			ϕ	—	0.65[9]						
Bond Strength in Tension (2,500 psi ≤ f'_c ≤ 8,000 psi)[10]											
Uncracked Concrete [2,3,4]	Characteristic Bond Strength[5,11]		$\tau_{k,uncr}$	psi	895	870	845	820	795	770	720
	Permitted Embedment Depth Range	Minimum	h_{ef}	in.	2⅜	2¾	3⅛	3½	3¾	4	5
		Maximum			7½	10	12½	15	17½	20	25
Cracked Concrete [2,3,4]	Characteristic Bond Strength[5,11]		$\tau_{k,cr}$	psi	365	735	660	590	515	440	275
	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[8]						
Strength Reduction Factor — Water-Saturated Concrete – $h_{ef} \le 12d_a$			$\phi_{sat,ci}$	—	0.55[8]		0.45[8]				
Additional Factor for Water-Saturated Concrete – $h_{ef} \le 12d_a$			$K_{sat,ci}$[6]	—	N/A		1			0.84	
Strength Reduction Factor — Water-Saturated Concrete – $h_{ef} > 12d_a$			$\phi_{sat,ci}$	—	0.45[8]						
Additional Factor for Water-Saturated Concrete – $h_{ef} > 12d_a$			$K_{sat,ci}$[6]	—	0.57						
Bond Strength in Tension — Bond Strength Reduction Factors for Periodic Special Inspection											
Strength Reduction Factor — Dry Concrete			$\phi_{dry,pi}$	—	0.55[8]						
Strength Reduction Factor — Water-Saturated Concrete – $h_{ef} \le 12d_a$			$\phi_{sat,pi}$	—	0.45[8]						
Additional Factor for Water-Saturated Concrete – $h_{ef} \le 12d_a$			$K_{sat,pi}$[6]	—	1		0.93			0.71	
Strength Reduction Factor — Water-Saturated Concrete – $h_{ef} > 12d_a$			$\phi_{sat,pi}$	—	0.45[8]						
Additional Factor for Water-Saturated Concrete – $h_{ef} > 12d_a$			$K_{sat,pi}$[6]	—	0.48						

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 or ACI 318-11.
2. Temperature Range: Maximum short-term temperature of 150°F. Maximum long-term temperature of 110°F.
3. Short-term concrete temperatures are those that occur over short intervals (diurnal cycling).
4. Long-term concrete temperatures are constant temperatures over a significant time period.
5. For anchors that only resist wind or seismic loads, bond strengths may be increased by 72%.
6. In water-saturated concrete, multiply $\tau_{k,uncr}$ and $\tau_{k,cr}$ by K_{sat}.
7. The value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
8. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.4 (c) for Condition B are met. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
9. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.4 (c) for Condition B are met. If the load combinations of ACI 318-11 Section 9.2 are used and the requirements of ACI 318-11 D.4.4 (c) for Condition A are met, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.5 to determine the appropriate value of ϕ.
10. The values of f'_c used for calculation purposes must not exceed 8,000 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.
11. For applications where maximum short-term temperature is 110°F (43°C) and the maximum long-term temperature is 75°F (24°C), bond strengths may be increased 93%. No additional increase is permitted for anchors that only resist wind or seismic loads.

* See p. 13 for an explanation of the load table icons.

SET-XP Shear Strength Design Data for Threaded Rod in Normal-Weight Concrete[1]

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}	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.	2,260	4,940	7,865	11,625	16,080	21,090	33,720
	Shear Resistance of Steel — ASTM A193, Grade B7			4,875	10,650	16,950	25,050	34,650	45,450	72,675
	Shear Resistance of Steel — Type 410 Stainless (ASTM A193, Grade B6)			4,290	9,370	14,910	22,040	30,490	40,000	63,955
	Shear Resistance of Steel — Type 304 and 316 Stainless (ASTM A193, Grade B8 & B8M)			2,225	4,855	7,730	11,420	15,800	20,725	33,140
	Reduction for Seismic Shear — ASTM F1554, Grade 36	$\alpha_{V,seis}$[5]	—	0.87	0.78	0.68				0.65
	Reduction for Seismic Shear — ASTM A193, Grade B7			0.87	0.78	0.68				0.65
	Reduction for Seismic Shear — Stainless (ASTM A193, Grade B6)			0.69	0.82	0.75			0.83	0.72
	Reduction for Seismic Shear — Stainless (ASTM A193, Grade B8 & B8M)			0.69	0.82	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	0.5	0.625	0.75	0.875	1	1.25
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}	—	1.0 for $h_{ef} < 2.50$"; 2.0 for $h_{ef} \geq 2.50$"						
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 ACI 318-14 and ACI 318-11.
2. The value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
3. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3 (c) for Condition B are met. If the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3 (c) for Condition A are met, refer to ACI 318-11 D.4.3 to determine the appropriate value of ϕ. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
4. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 5.3 or ACI 318-11 D.4.3 (c) for Condition B are met. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
5. 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.

* See p. 13 for an explanation of the load table icons.

SET-XP Shear Strength Design Data for Rebar in Normal-Weight Concrete[1]

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	0.2	0.31	0.44	0.6	0.79	1.23
	Shear Resistance of Steel — Rebar (ASTM A615 Grade 60)	V_{sa}	lb.	4,950	10,800	16,740	23,760	32,400	42,660	66,420
	Reduction for Seismic Shear — Rebar (ASTM A615 Grade 60)	$\alpha_{V,seis}$[5]	—	0.85	0.88	0.84		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	0.5	0.625	0.75	0.875	1	1.25
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}	—	1.0 for $h_{ef} < 2.50"$; 2.0 for $h_{ef} \geq 2.50"$						
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 ACI 318-14 or ACI 318-11.
2. The value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
3. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3 (c) for Condition B are met. If the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3 (c) for Condition A are met, refer to ACI 318-11 D.4.3 to determine the appropriate value of ϕ. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
4. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 5.3 or ACI 318-11 D.4.3 (c) for Condition B are met. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
5. 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 additional load tables, visit **strongtie.com/setxp**.

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* See p. 13 for an explanation of the load table icons.

SET-XP® Design Information — Concrete

SET-XP Development Length for Rebar Dowels in Normal-Weight Concrete

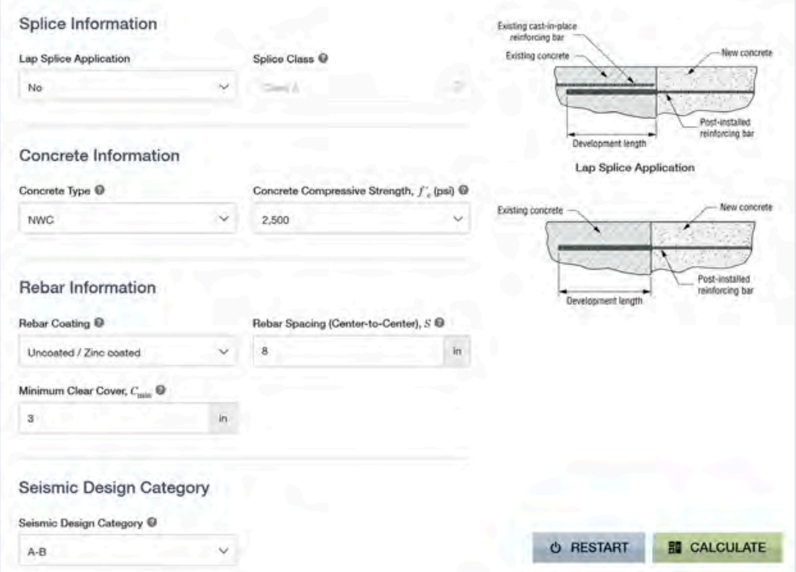
IBC *

Rebar Size	Drill Bit Diameter (in.)	Clear Cover in. (mm)	Development Length, in. (mm)				
			f'_c = 2,500 psi (17.2 MPa) Concrete	f'_c = 3,000 psi (20.7 MPa) Concrete	f'_c = 4,000 psi (27.6 MPa) Concrete	f'_c = 6,000 psi (41.4 MPa) Concrete	f'_c = 8,000 psi (55.2 MPa) Concrete
#3 (9.5)	½	**1½** (38)	**12** (305)	**12** (305)	**12** (305)	**12** (305)	**12** (305)
#4 (12.7)	⅝	**1½** (38)	**14.4** (366)	**14** (356)	**12** (305)	**12** (305)	**12** (305)
#5 (15.9)	¾	**1½** (38)	**18** (457)	**17** (432)	**14.2** (361)	**12** (305)	**12** (305)
#6 (19.1)	⅞	**1½** (38)	**21.6** (549)	**20** (508)	**17.1** (434)	**14** (356)	**13** (330)
#7 (22.2)	1	**3** (76)	**31.5** (800)	**29** (737)	**25** (635)	**21** (533)	**18** (457)
#8 (25.4)	1⅛	**3** (76)	**36** (914)	**33** (838)	**28.5** (724)	**24** (610)	**21** (533)
#9 (28.7)	1⅜	**3** (76)	**40.5** (1,029)	**38** (965)	**32** (813)	**27** (686)	**23** (584)
#10 (32.3)	1⅜	**3** (76)	**45** (1,143)	**42** (1,067)	**35.6** (904)	**30** (762)	**26** (660)
#11 (35.8)	1¾	**3** (76)	**51** (1,295)	**47** (1,194)	**41** (1,041)	**33** (838)	**29** (737)

1. Tabulated development lengths are for static, wind and seismic load cases in Seismic Design Category A and B. Development lengths in SDC C through F must comply with ACI 318-14 Chapter 18 or ACI 318-11 Chapter 12, as applicable. The value of f'_c used to calculate development lengths shall not exceed 2,500 psi in SDC C through F.
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.
4. Tabulated values assume bottom cover of less than 12" cast below rebars (Ψ_t = 1.0).
5. Uncoated rebar must be used.
6. The value of K_{tr} is assumed to be 0. Refer to ACI 318 Section 12.2.3.

Rebar Development Length Calculator

Rebar Development Length Calculator is a web application that supports the design of post-installed rebar in concrete applications by calculating the necessary tension and compression development lengths required in accordance with ACI 318-14 / ACI 318-11.



Splice Information

Lap Splice Application: No

Splice Class: Class A

Concrete Information

Concrete Type: NWC

Concrete Compressive Strength, f'_c (psi): 2,500

Rebar Information

Rebar Coating: Uncoated / Zinc coated

Rebar Spacing (Center-to-Center), S: 8 in

Minimum Clear Cover, C_{min}: 3 in

Seismic Design Category

Seismic Design Category: A-B

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* See p. 13 for an explanation of the load table icons.

SET-XP® Design Information — Masonry

SET-XP Allowable Tension and Shear Loads for Threaded Rod and Rebar in the Face of Fully Grouted CMU Wall Construction[1, 3, 4, 5, 6, 8, 9, 10, 11]

Diameter (in.) or Rebar Size No.	Drill Bit Diameter (in.)	Minimum Embedment[2] (in.)	Allowable Load Based on Bond Strength[7] (lb.)	
			Tension Load	Shear Load
Threaded Rod Installed in the Face of CMU Wall				
⅜	½	3⅜	1,490	1,145
½	⅝	4½	1,825	1,350
⅝	¾	5⅝	1,895	1,350
¾	⅞	6½	1,895	1,350
Rebar Installed in the Face of CMU Wall				
#3	½	3⅜	1,395	1,460
#4	⅝	4½	1,835	1,505
#5	¾	5⅝	2,185	1,505

1. Allowable load shall be the lesser of the bond values shown in this table and steel values, shown on p. 43.
2. Embedment depth shall be measured from the outside face of masonry wall.
3. Critical and minimum edge distance and spacing shall comply with the information on p. 37. Figure 2 on p. 37 illustrates critical and minimum edge and end distances.
4. Minimum allowable nominal width of CMU wall shall be 8 inches. No more than one anchor shall be permitted per masonry cell.
5. Anchors shall be permitted to be installed at any location in the face of the fully grouted masonry wall construction (cell, web, bed joint), except anchors shall not be installed within 1½ inches of the head joint, as show in Figure 2 on p. 37.
6. Tabulated allowable load values are for anchors installed in fully grouted masonry walls.
7. Tabulated allowable loads are based on a safety factor of 5.0 .
8. Tabulated allowable load values shall be adjusted for increased base material temperatures in accordance with Figure 1 below, as applicable.
9. Threaded rod and rebar installed in fully grouted masonry walls are permitted to resist dead, live, seismic and wind loads.
10. Threaded rod shall meet or exceed the tensile strength of ASTM F1554, Grade 36 steel, which is 58,000 psi.
11. For installations exposed to severe, moderate or negligible exterior weathering conditions, as defined in Figure 1 of ASTM C62, allowable tension loads shall be multiplied by 0.80.

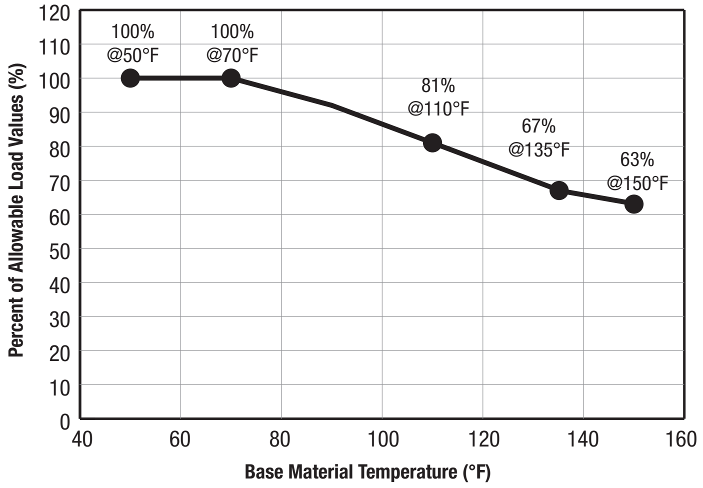


Figure 1. Load Capacity Based on In-Service Temperature for SET-XP® Epoxy Adhesive in the Face of Fully Grouted CMU Wall Construction

* See p. 13 for an explanation of the load table icons.

SET-XP Edge Distance and Spacing Requirements and Allowable Load Reduction Factors — Threaded Rod and Rebar in the Face of Fully Grouted CMU Wall Construction[7]

*

Rod Dia. (in.) or Rebar Size No.	Minimum Embed. Depth (in.)	Edge or End Distance[1,8]						Spacing[2,9]				
		Critical (Full Anchor Capacity)[3]		Minimum (Reduced Anchor Capacity)[4]				Critical (Full Anchor Capacity)[5]		Minimum (Reduced Anchor Capacity)[6]		
		Critical Edge or End Distance, C_{cr} (in.)	Allowable Load Reduction Factor	Minimum Edge or End Distance, C_{min} (in.)	Allowable Load Reduction Factor			Critical Spacing, S_{cr} (in.)	Allowable Load Reduction Factor	Minimum Spacing, S_{min} (in.)	Allowable Load Reduction Factor	
		Load Direction		Load Direction				Load Direction		Load Direction		
		Tension or Shear	Tension or Shear	Tension or Shear	Tension	Shear[10]		Tension or Shear	Tension or Shear	Tension or Shear	Tension	Shear
						Perp.	Para.					
⅜	3⅜	12	1.00	4	0.91	0.72	0.94	8	1.00	4	1.00	1.00
½	4½	12	1.00	4	1.00	0.58	0.87	8	1.00	4	0.82	1.00
⅝	5⅝	12	1.00	4	1.00	0.48	0.87	8	1.00	4	0.82	1.00
¾	6½	12	1.00	4	1.00	0.44	0.85	8	1.00	4	0.82	1.00
#3	3⅜	12	1.00	4	0.96	0.62	0.84	8	1.00	4	0.87	0.91
#4	4½	12	1.00	4	0.88	0.54	0.82	8	1.00	4	0.87	0.91
#5	5⅝	12	1.00	4	0.88	0.43	0.82	8	1.00	4	0.87	1.00

1. Edge distance (C_{cr} or C_{min}) is the distance measured from anchor centerline to edge or end of CMU masonry wall. Refer to Figure 2 below for an illustration showing critical and minimum edge and end distances.
2. Anchor spacing (S_{cr} or S_{min}) is the distance measured from centerline to centerline of two anchors.
3. Critical edge distance, C_{cr}, is the least edge distance at which tabulated allowable load of an anchor is achieved where a load reduction factor equals 1.0 (no load reduction).
4. Minimum edge distance, C_{min}, is the least edge distance where an anchor has an allowable load capacity which shall be determined by multiplying the allowable loads assigned to anchors installed at critical edge distance, C_{cr}, by the load reduction factors shown above.
5. Critical spacing, S_{cr}, is the least anchor spacing at which tabulated allowable load of an anchor is achieved such that anchor performance is not influenced by adjacent anchors.
6. Minimum spacing, S_{min}, is the least spacing where an anchors has an allowable load capacity, which shall be determined by multiplying the allowable loads assigned to anchors installed at critical spacing distance, S_{cr}, by the load reduction factors shown above.
7. Reduction factors are cumulative. Multiple reduction factors for more than one spacing or edge or end distance shall be calculated separately and multiplied.
8. Load reduction factor for anchors loaded in tension or shear with edge distances between critical and minimum shall be obtained by linear interpolation.
9. Load reduction factor for anchors loaded in tension with spacing between critical and minimum shall be obtained by linear interpolation.
10. Perpendicular shear loads act towards the edge or end. Parallel shear loads act parallel to the edge or end (see Figure 5 on page 39). Perpendicular and parallel shear load reduction factors are cumulative when the anchor is located between the critical minimum edge and end distance.

Shaded area = Placement for full and reduced allowable load capacity in grout-filled CMU

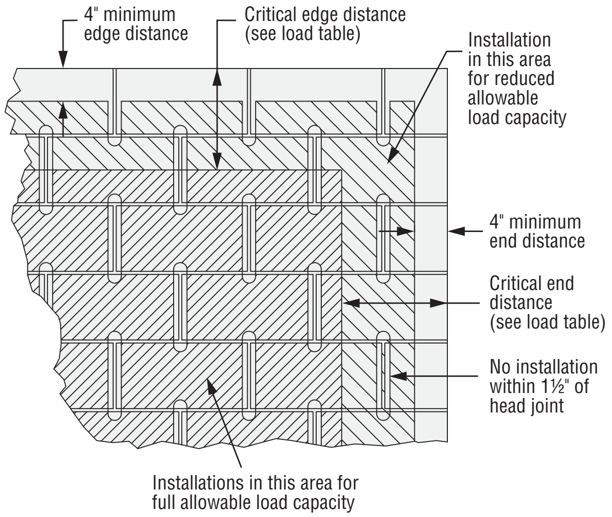


Figure 2. Allowable Anchor Locations for Full and Reduced Load Capacity When Installation Is in the Face of Fully Grouted CMU Masonry Wall Construction

* See p. 13 for an explanation of the load table icons.

SET-XP® Design Information — Masonry

SET-XP Allowable Tension and Shear Loads for Threaded Rod and Rebar in the Top of Fully Grouted CMU Wall Construction[1, 2, 4, 5, 6, 7, 9, 10, 11, 12]

Diameter (in.) or Rebar Size No.	Drill Bit Diameter (in.)	Minimum Embedment[3] (in.)	Allowable Load Based on Bond Strength[7, 8] (lb.)		
			Tension Load	Shear Perp.	Shear Parallel
Threaded Rod Installed in the Top of CMU Wall					
½	⅝	4½	1,485	590	1,050
		12	2,440	665	1,625
⅝	¾	5⅝	1,700	565	1,435
		15	2,960	660	1,785
⅞	1	7⅞	1,610	735	1,370
		21	4,760	670	1,375
Rebar Installed in the Top of CMU Wall					
#4	⅝	4½	1,265	550	865
		12	2,715	465	1,280
#5	¾	5⅝	1,345	590	1,140
		15	3,090	590	1,285

1. Allowable load shall be the lesser of the bond values shown in this table and steel values, shown on p. 43.
2. Allowable loads are for installation in the grouted CMU core opening.
3. Embedment depth shall be measured from the horizontal surface of the grouted CMU core opening on top of the masonry wall.
4. Critical and minimum edge distance, end distance and spacing shall comply with the information on pp. 39 and 40. Figures 3A and 3B on p. 39 illustrate critical and minimum edge and end distances.
5. Minimum allowable nominal width of CMU wall shall be 8 inches (203 mm).
6. Anchors are permitted to be installed in the CMU core opening shown in Figures 3A and 3B on p. 39. Anchors are limited to one installation per CMU core opening.
7. Tabulated allowable load values are for anchors installed in fully grouted masonry walls.
8. Tabulated allowable loads are based on a safety factor of 5.0 .
9. Tabulated allowable load values shall be adjusted for increased base material temperatures in accordance with Figure 1 on p. 36, as applicable.
10. Threaded rod and rebar installed in fully grouted masonry walls with SET-XP® adhesive are permitted to resist dead, live, seismic and wind loads.
11. Threaded rod shall meet or exceed the tensile strength of ASTM F1554, Grade 36 steel, which is 58,000 psi.
12. For installations exposed to severe, moderate or negligible exterior weathering conditions, as defined in Figure 1 of ASTM C62, allowable tension loads shall be multiplied by 0.80.

* See p. 13 for an explanation of the load table icons.

SET-XP® Design Information — Masonry

SET-XP Edge and End Distance Requirements and Allowable Load Reduction Factors — Threaded Rod and Rebar in the Top of Fully Grouted CMU Wall Construction[1,4,5] *

Rod Dia. (in.) or Rebar Size No.	Minimum Embed. Depth (in.)	Critical (Full Anchor Capacity)[2]			Minimum End (Reduced Anchor Capacity)[3]				Minimum Edge (Reduced Anchor Capacity)[6]			
		Critical Edge, C_{cr} (in.)	Critical End Distance, C_{cr} (in.)	Allowable Load Reduction Factor	Minimum End Distance, C_{min} (in.)	Minimum End Allowable Load Reduction Factor			Minimum Edge, C_{min} (in.)	Allowable Load Reduction Factor		
		Load Direction			Load Direction				Load Direction			
		Tension or Shear	Tension or Shear	Tension or Shear	Tension or Shear	Tension	Shear[6]		Tension or Shear	Tension	Shear[6]	
							Perp.	Parallel			Perp.	Parallel
½	4½	2¾	20	1.00	3¹³⁄₁₆	0.88	0.84	0.66	1¾	0.83	0.63	0.77
	12	2¾	20	1.00	3¹³⁄₁₆	0.64	0.91	0.34	1¾	0.95	0.55	0.69
⅝	5⅝	2¾	20	1.00	4¼	0.90	1.00	0.50	1¾	0.82	0.57	0.71
	15	2¾	20	1.00	4¼	0.38	0.85	0.29	1¾	0.91	0.72	0.73
⅞	7⅞	2¾	20	1.00	4¼	0.98	0.72	0.57	—	—	—	—
	21	2¾	20	1.00	4¼	0.63	0.96	0.64	—	—	—	—
#4	4½	2¾	20	1.00	4¼	0.96	0.90	0.76	—	—	—	—
	12	2¾	20	1.00	4¼	0.58	1.00	0.46	—	—	—	—
#5	5⅝	2¾	20	1.00	4¼	1.00	0.86	0.60	—	—	—	—
	15	2¾	20	1.00	4¼	0.41	0.76	0.49	—	—	—	—

1. Edge and end distances (C_{cr} or C_{min}) are the distances measured from anchor centerline to edge or end of CMU masonry wall. Refer to Figures 3A and 3B below for illustrations showing critical and minimum edge and end distances.
2. Critical edge and end distances, C_{cr}, are the least edge distances at which tabulated allowable load of an anchor is achieved where a load reduction factor equals 1.0 (no load reduction).
3. Minimum edge and end distances, C_{min}, are the least edge distances where an anchor has an allowable load capacity, which shall be determined by multiplying the allowable loads assigned to anchors installed at critical edge distance, C_{cr}, by the load reduction factors shown above.
4. Reduction factors are cumulative. Multiple reduction factors for more than one spacing or edge or end distance shall be calculated separately and multiplied.
5. Load reduction factor for anchors loaded in tension or shear with edge distances between critical and minimum shall be obtained by linear interpolation.
6. Perpendicular shear loads act towards the edge or end. Parallel shear loads act parallel to the edge or end (see Figure 5 below). Perpendicular and parallel shear load reduction factors are cumulative when the anchor is located between the critical minimum edge and end distance.

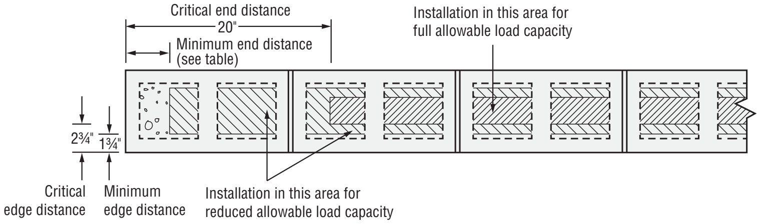


Figure 3A. Allowable Anchor Locations of ½"- and ⅝"-Diameter Threaded Rod for Full and Reduced Load Capacity When Installation Is in the Top of Fully Grouted CMU Masonry Wall Construction

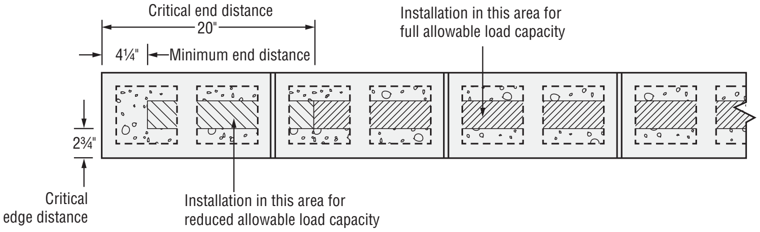
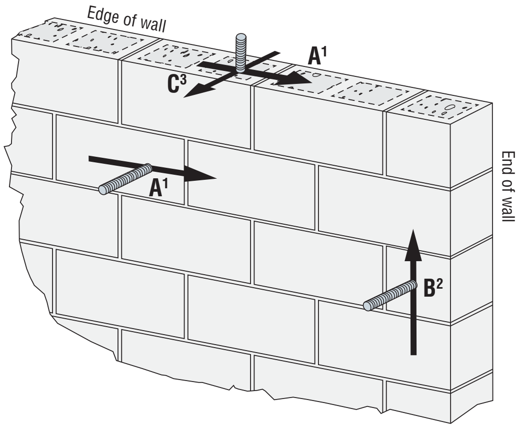


Figure 3B. Allowable Anchor Locations of ⅞"-Diameter Threaded Rod and #4 and #5 Rebar for Full and Reduced Load Capacity When Installation Is in the Top of Fully Grouted CMU Masonry Wall Construction



1. Direction of shear load A is parallel to edge of wall and perpendicular to end of wall.
2. Direction of shear load B is parallel to end of wall and perpendicular to edge of wall.
3. Direction of shear load C is perpendicular to edge of wall.

Figure 5. Direction of Shear Load in Relation to Edge and End of Wall

* See p. 13 for an explanation of the load table icons.

SET-XP® Design Information — Masonry

SET-XP Spacing Distance Requirements and Allowable Load Reduction Factors — Threaded Rod and Rebar in the Top of Fully Grouted CMU Wall Construction[1,4,5]

Rod Dia. (in.) or Rebar Size No.	Minimum Embed. Depth (in.)	Critical Spacing (Full Anchor Capacity)[2]		Minimum Spacing (Reduced Anchor Capacity)[3]		
		Critical Spacing, S_{cr} (in.)	Allowable Load Reduction Factor	Minimum Spacing, S_{cr} (in.)	Allowable Load Reduction Factor	
		Load Direction		Load Direction		
		Tension or Shear	Tension or Shear	Tension or Shear	Tension	Shear
½	4½	18	1.00	8	0.80	0.92
	12	48	1.00	8	0.63	0.98
⅝	5⅝	22.5	1.00	8	0.86	1.00
	15	60	1.00	8	0.56	1.00
⅞	7⅞	31.5	1.00	8	0.84	0.82
	21	84	1.00	8	0.51	0.98
#4	4½	18	1.00	8	0.97	0.93
	12	48	1.00	8	0.75	1.00
#5	5⅝	22.5	1.00	8	1.00	1.00
	15	60	1.00	8	0.82	1.00

1. Anchor spacing (S_{cr} or S_{min}) is the distance measured from centerline to centerline of two anchors.
2. Critical spacing, S_{cr}, is the least anchor spacing at which tabulated allowable load of an anchor is achieved such that anchor perofrmance is not influenced by adjacent anchors.
3. Minimum spacing, S_{min}, is the least spacing where an anchor has an allowable load capacity, which shall be determined by multiplying the allowable loads assigned to anchors installed at critical spacing distance, S_{cr}, by the load reduction factors shown above.
4. Reduction factors are cumulative. Multiple reduction factors for more than one spacing or edge or end distance shall be calculated separately and multiplied.
5. Load reduction factor for anchors loaded in tension or shear with edge distances between critical and minimum shall be obtained by linear interpolation.

* See p. 13 for an explanation of the load table icons.

SET-XP® Design Information — Masonry

SET-XP Allowable Tension and Shear Loads — Threaded Rod in the Face of Hollow CMU Wall Construction[1,3,4,5,6,8,9,10,11]

IBC *

Diameter (in.)	Drill Bit Diameter (in.)	Minimum Embed.[2] (in.)	Allowable Load Based on Bond Strength[7] (lb.)	
			Tension	Shear
⅜	9⁄16	1¼	213	384
½	¾	1¼	218	409
⅝	⅞	1¼	223	433

1. Allowable load shall be the lesser of bond values shown in this table and steel values shown on p. 43.
2. Embedment depth is considered the minimum wall thickness of 8" x 8" x 16" ASTM C90 concrete masonry blocks, and is measured from the outside to the inside face of the block wall. The minimum length Opti-Mesh plastic screen tube for use in hollow CMU is 3½".
3. Critical and minimum edge distance and spacing shall comply with the information provided on p. 42. Figure 4 on p. 42 illustrates critical and minimum edge and end distances.
4. Anchors are permitted to be installed in the face shell of hollow masonry wall construction as shown in Figure 4.
5. Anchors are limited to one or two anchors per masonry cell and must comply with the spacing and edge distance requirements provided.
6. Tabulated load values are for anchors installed in hollow masonry walls.
7. Tabulated allowable loads are based on a safety factor of 5.0.
8. Tabulated allowable load values shall be adjusted for increased base material temperatures in accordance with Figure 1 on p. 36, as applicable.
9. Threaded rods installed in hollow masonry walls with SET-XP® adhesive are permitted to resist dead, live load and wind load applications.
10. Threaded rods must meet or exceed the tensile strength of ASTM F1554, Grade 36, which is 58,000 psi.
11. For installations exposed to severe, moderate or negligible exterior weathering conditions, as defined in Figure 1 of ASTM C62, allowable tension loads must be multiplied by 0.80.

* See p. 13 for an explanation of the load table icons.

SET-XP Edge, End and Spacing Distance Requirements and Allowable Load Reduction Factors — Threaded Rod in the Face of Hollow CMU Wall Construction[7]

Rod Diameter (in.)	Edge or End Distance[1,8]					Spacing[2,9]				
	Critical (Full Anchor Capacity)[3]		Minimum (Reduced Anchor Capacity)[4]			Critical (Full Anchor Capacity)[5]		Minimum (Reduced Anchor Capacity)[6]		
	Critical Edge or End Distance, C_{cr} (in.)	Allowable Load Reduction Factor	Minimum Edge or End Distance, C_{min} (in.)	Allowable Load Reduction Factor		Critical Spacing, S_{cr} (in.)	Allowable Load Reduction Factor	Minimum Spacing, S_{min} (in.)	Allowable Load Reduction Factor	
	Load Direction		Load Direction			Load Direction		Load Direction		
	Tension or Shear	Tension or Shear	Tension or Shear	Tension	Shear[10]	Tension or Shear	Tension or Shear	Tension or Shear	Tension	Shear
⅜	12	1.00	4	1.00	0.74	8	1.00	4	0.82	0.73
½	12	1.00	4	0.96	0.69	8	1.00	4	0.79	0.73
⅝	12	1.00	4	0.96	0.55	8	1.00	4	0.75	0.73

1. Edge and end distances (C_{cr} or C_{min}) are the distances measured from anchor centerline to edge or end of CMU masonry wall. Refer to Figure 4 below for an illustration showing critical and minimum edge and end distances.
2. Anchor spacing (S_{cr} or S_{min}) is the distance measured from centerline to centerline of two anchors.
3. Critical edge and end distances, C_{cr}, are the least edge distances at which tabulated allowable load of an anchor is achieved where a load reduction factor equals 1.0 (no load reduction).
4. Minimum edge and end distances, C_{min}, are the least edge distances where an anchor has an allowable load capacity which shall be determined by multiplying the allowable loads assigned to anchors installed at critical edge distance, C_{cr}, by the load reduction factors shown above.
5. Critical spacing, S_{cr}, is the least anchor spacing at which tabulated allowable load of an anchor is achieved such that anchor performance is not influenced by adjacent anchors.
6. Minimum spacing, S_{min}, is the least spacing where an anchors has an allowable load capacity, which shall be determined by multiplying the allowable loads assigned to anchors installed at critical spacing distance, S_{cr}, by the load reduction factors shown above.
7. Reduction factors are cumulative. Multiple reduction factors for more than one spacing or edge or end distance shall be calculated separately and multiplied.
8. Load reduction factor for anchors loaded in tension or shear with edge distances between critical and minimum shall be obtained by linear interpolation.
9. Load reduction factor for anchors loaded in tension with spacing between critical and minimum shall be obtained by linear interpolation.
10. Perpendicular shear loads act toward the edge or end. Parallel shear loads act parallel to the edge or end (see Figure 5 on p. 39). Perpendicular and parallel shear load reduction factors are cumulative when the anchor is located between the critical minimum edge and end distance.

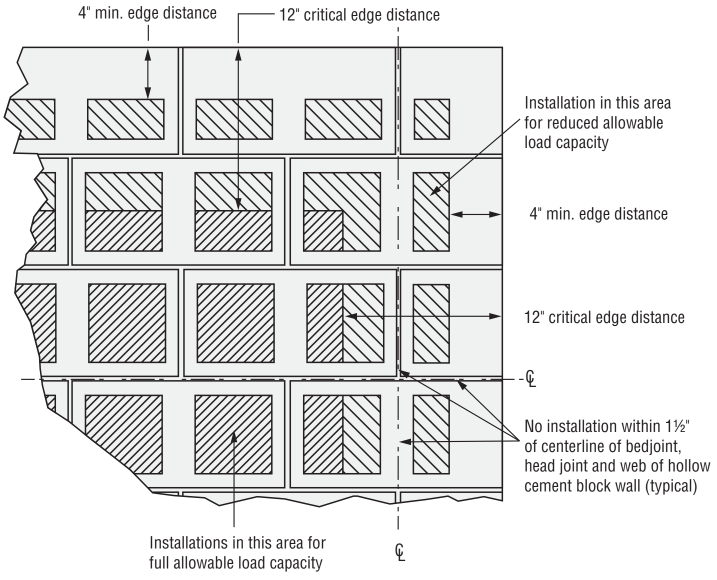


Figure 4. Allowable Anchor Locations for Full and Reduced Load Capacity When Installation Is in the Face of Hollow CMU Masonry Wall Construction

* See p. 13 for an explanation of the load table icons.

SET-XP® Design Information — Steel

SET-XP Allowable Tension and Shear Loads — Threaded Rod Based on Steel Strength[1]

IBC *

Threaded Rod Diameter (in.)	Tensile Stress Area (in.^{2})	Tension Load Based on Steel Strength[2] (lb.)				Shear Load Based on Steel Strength [3] (lb.)			
				Stainless Steel				Stainless Steel	
		ASTM F1554 Grade 36[4]	ASTM A193 Grade B7[6]	ASTM A193 Grade B6[5]	ASTM A193 Grades B8 and B8M[7]	ASTM F1554 Grade 36[4]	ASTM A193 Grade B7[6]	ASTM A193 Grade B6[5]	ASTM A193 Grades B8 and B8M[7]
⅜	0.078	1,495	3,220	2,830	1,930	770	1,660	1,460	995
½	0.142	2,720	5,860	5,155	3,515	1,400	3,020	2,655	1,810
⅝	0.226	4,325	9,325	8,205	5,595	2,230	4,805	4,225	2,880
¾	0.334	6,395	13,780	12,125	8,265	3,295	7,100	6,245	4,260
⅞	0.462	8,845	19,055	16,770	11,435	4,555	9,815	8,640	5,890

1. Allowable load shall be the lesser of bond values given on pp. 36, 38 or 41 and steel values in the table above.
2. Allowable Tension Steel Strength is based on the following equation: $F_V = 0.33 \times F_u \times$ Tensile Stress Area.
3. Allowable Shear Steel Strength is based on the following equation: $F_V = 0.17 \times F_u \times$ Tensile Stress Area.
4. Minimum specified tensile strength (F_u = 58,000 psi) of ASTM F1554, Grade 36 used to calculate allowable steel strength.
5. Minimum specified tensile strength (F_u = 110,000 psi) of ASTM A193, Grade B6 used to calculate allowable steel strength.
6. Minimum specified tensile strength (F_u = 125,000 psi) of ASTM A193, Grade B7 used to calculate allowable steel strength.
7. Minimum specified tensile strength (F_u = 75,000 psi) of ASTM A193, Grades B8 and B8M used to calculate allowable steel strength.

SET-XP® Allowable Tension and Shear Loads — Deformed Reinforcing Bar Based on Steel Strength[1]

IBC *

Rebar Size	Tensile Stress Area (in.^{2})	Tension Load (lb.)		Shear Load (lb.)	
		Based on Steel Strength		Based on Steel Strength	
		ASTM A615 Grade 40[2]	ASTM A615 Grade 60[3]	ASTM A615 Grade 40[4,5]	ASTM A615 Grade 60[4,6]
#3	0.11	2,200	2,640	1,310	1,685
#4	0.20	4,000	4,800	2,380	3,060
#5	0.31	6,200	7,400	3,690	4,745

1. Allowable load shall be the lesser of bond values given on pp. 36, 38 or 41 and steel values in the table above.
2. Allowable Tension Steel Strength is based on AC58 Section 3.3.3 (20,000 psi x tensile stress area) for Grade 40 rebar.
3. Allowable Tension Steel Strength is based on AC58 Section 3.3.3 (24,000 psi x tensile stress area) for Grade 60 rebar.
4. Allowable Shear Steel Strength is based on AC58 Section 3.3.3 ($F_V = 0.17 \times F_u \times$ Tensile Stress Area.)
5. F_u = 70,000 psi for Grade 40 rebar.
6. F_u = 90,000 psi for Grade 60 rebar.

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* See p. 13 for an explanation of the load table icons.

ET-HP® Epoxy Adhesive

ET-HP is a two-component, high-solids, epoxy-based system for use as a high-strength, non-shrink anchor-grouting material. Resin and hardener are dispensed and mixed simultaneously through the static mixing nozzle. ET-HP is formulated for anchoring threaded rod and rebar into concrete (cracked/uncracked) and masonry.

Features

- Passed the demanding ICC-ES AC308 adverse-condition tests pertaining to elevated temperatures and long-term sustained loads
- Code listed under the IBC/IRC for cracked and uncracked concrete per ICC-ES ESR-3372
- Code listed under the IBC/IRC for masonry per IAPMO UES ER-241
- Suitable for use under static and seismic loading conditions in cracked and uncracked concrete and masonry
- Cure times: 24 hours at 70°F (21°C), 72 hours at 50°F (10°C)
- Easy hole-cleaning — no power-brushing required
- Suitable for use in dry or water-saturated concrete
- When properly mixed, adhesive will be a uniform gray color
- Available in 22 oz. cartridges packaged either with or without nozzles and in 1-gallon, 10-gallon, and 100-gallon kits for high-volume applications utilizing metering pumps
- Manufactured in the USA using global materials
- Tested per ACI 355.4 and AC308

Applications

- Threaded rod anchoring and rebar doweling into concrete and unreinforced masonry
- Suitable for horizontal, vertical and overhead applications
- Multiple DOT listings — refer to **strongtie.com/DOT** for current approvals

Codes:

ICC-ES ESR-3372 (concrete); ICC-ES ESR-3638 (unreinforced masonry); IAPMO UES ER-241 (masonry); City of L.A. RR25120 (unreinforced masonry); AASHTO M-235 and ASTM C881 (Type IV, Grade 3, Class C); multiple DOT listings; FL-17449.1; FL-16230.2

Chemical Resistance

See pp. 252–253

Installation and Application Instructions

(See also pp. 100–105)

- Surfaces to receive epoxy must be clean.
- Base material temperature must be 50°F (10°C) or above at the time of installation. For best results, material should be 70°F (21°C) to 80°F (27°C) at time of application.
- To warm cold material, store cartridges in a warm, uniformly heated area or storage container. Do not immerse cartridges in water or use microwave to facilitate warming.
- Mixed material in nozzle can harden in 30 minutes at temperatures of 70°F (21°C) and above.

Suggested Specifications

See **strongtie.com** for more information.

ET-HP Adhesive

ET-HP® Epoxy Adhesive

Test Criteria

Anchors installed with ET-HP adhesive have been tested in accordance with ICC-ES Acceptance Criteria for Post-Installed *Adhesive Anchors in Masonry Elements* (AC58) *and Adhesive Anchors in Concrete Elements* (AC308).

Property	**Test Method**	**Result***
Consistency	ASTM C881	Non-sag/thixotropic paste
Heat deflection	ASTM D648	145°F (63°C)
Glass transition temperature	ASTM D648	168°F (76°C)
Bond strength (moist cure, 60°F)	ASTM C882	2,963 psi (2 days) 3,002 psi (14 days)
Water absorption	ASTM D570	0.0% (24 hours)
Compressive yield strength (cured 60°F)	ASTM D695	14,260 psi (7 days)
Compressive modulus	ASTM D695	775,850 psi (7 days)
Gel time	ASTM C881	10 minutes
Shore D Durometer	ASTM D2240	87
Volatile Organic Compound (VOC)	—	3 g/L

*Material and curing conditions: 73 ± 2°F unless otherwise noted.

ET-HP Package Systems

Model No.	Capacity (ounces)	Package Type	Carton Quantity	Dispensing Tools	Mixing Nozzle
ET-HP22-N[4]	22	Side-by-side	10	EDT22S	EMN22I
ET-HP22	22	Side-by-side	10	EDT22CKT	EMN22I
ETHP1KT	1-gallon kit (231)	(2) ½-gallon pails	1 kit	Metering pump[5]	EMN37A
ETHP10KT	10-gallon kit (2,310)	(2) 5-gallon pails	1 kit	Metering pump[5]	EMN37A
ETHP100KT	100-gallon kit (23,100)	(2) 50-gallon pails	1 kit	Metering pump[5]	EMN37A

1. Cartridge estimation guidelines are available at **strongtie.com/apps**.
2. Detailed information on dispensing tools, mixing nozzles and other adhesive accessories is available at **strongtie.com**.
3. Use only Simpson Strong-Tie® mixing nozzles in accordance with Simpson Strong-Tie instructions. Modification or improper use of mixing nozzle may impair ET-HP adhesive performance.
4. One EMN22i mixing nozzle and one nozzle extension are supplied with each cartridge.
5. Metering pumps are offered by third-party manufacturers.

Cure Schedule

Base Material Temperature		Gel Time (minutes)	Cure Time[1] (hrs.)
°F	°C		
50	10	45	72
60	16	30	24
80	27	20	24
100	38	15	24

1. For water-saturated concrete, the cure times must be doubled.

ET-HP® Design Information — Concrete

ET-HP Installation Information and Additional Data for Threaded Rod and Rebar in Normal-Weight Concrete[1]

IBC *

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	Minimum	h_{ef}	in.	2⅜	2¾	3⅛	3½	3¾	4	5
	Maximum	h_{ef}	in.	4½	6	7½	9	10½	12	15
Minimum Concrete Thickness		h_{min}	in.	$h_{ef} + 5d_{hole}$						
Critical Edge Distance[2]		c_{ac}	in.	See foonote 2						
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 ACI 318-14 and ACI 318-11.
2. $c_{ac} = h_{ef}(\tau_{k,uncr}/1160)^{0.4}$ x $[3.1 – 0.7(h/h_{ef})]$, 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. 13 for an explanation of the load table icons.

ET-HP® Design Information — Concrete

ET-HP Tension Strength Design Data for Threaded Rod in Normal-Weight Concrete[1]

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}	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.	4,525	8,235	13,110	19,370	26,795	35,150	56,200
	Tension Resistance of Steel — ASTM A193, Grade B7				9,750	17,750	28,250	41,750	57,750	75,750	121,125
	Tension Resistance of Steel — Type 410 Stainless (ASTM A193, Grade B6)				8,580	15,620	24,860	36,740	50,820	66,660	106,590
	Tension Resistance of Steel — Type 304 and 316 Stainless (ASTM A193, Grade B8 & B8M)				4,445	8,095	12,880	19,040	26,335	34,540	55,235
	Strength Reduction Factor — Steel Failure		ϕ	—	0.75[6]						
Concrete Breakout Strength in Tension (2,500 psi ≤ f'_c ≤ 8,000 psi)[12]											
Effectiveness Factor — Uncracked Concrete			k_{uncr}	—	24						
Effectiveness Factor — Cracked Concrete			k_{cr}	—	17						
Strength Reduction Factor — Breakout Failure			ϕ	—	0.65[8]						
Bond Strength in Tension (2,500 psi ≤ f'_c ≤ 8,000 psi)[12]											
Uncracked Concrete[2,3,4]	Characteristic Bond Strength[5,13]		$\tau_{k,uncr}$	psi	390	380	370	360	350	335	315
	Permitted Embedment Depth Range	Minimum	h_{ef}	in.	2⅜	2¾	3⅛	3½	3¾	4	5
		Maximum			4½	6	7½	9	10½	12	15
Cracked Concrete[2,3,4]	Characteristic Bond Strength[5,9,10,11,12,13]		$\tau_{k,cr}$	psi	160	200	160	205	190	165	140
	Permitted Embedment Depth Range	Minimum	h_{ef}	in.	2⅜	2¾	3⅛	3½	3¾	4	5
		Maximum			4½	6	7½	9	10½	12	15
Bond Strength in Tension — Bond Strength Reduction Factors for Periodic Special Inspection											
Strength Reduction Factor — Dry Concrete			ϕ_{dry}	—	0.65[7]						
Strength Reduction Factor — Water-Saturated Concrete			ϕ_{sat}	—	0.45[7]						

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 or ACI 318-11.
2. Temperature Range: Maximum short-term temperature of 150°F (66ºC). Maximum long-term temperature of 110°F (43°C).
3. Short-term concrete temperatures are those that occur over short intervals (diurnal cycling).
4. Long-term concrete temperatures are constant temperatures over a significant time period.
5. For anchors that only resist wind or seismic loads, bond strengths may be multiplied by 2.70.
6. The value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
7. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.4 (c) for Condition B are met. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.5 to determine the appropriate value of ϕ.
8. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.4 (c) for Condition B are met. If the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-11 D.4.4 (c) for Condition A are met, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.5 to determine the appropriate value of ϕ.
9. For anchors installed in regions assigned to Seismic Design Category C, D, E or F, the bond strength values for ⅜" and 1¼" anchors must be multiplied by $\alpha_{N,seis}$ = 0.78.
10. For anchors installed in regions assigned to Seismic Design Category C, D, E or F, the bond strength values for ½", ⅝" and ¾" anchors must be multiplied by $\alpha_{N,seis}$ = 0.85.
11. 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 $\alpha_{N,seis}$ = 0.82.
12. 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 $\alpha_{N,seis}$ = 0.70.
13. For applications where maximum short-term temperature is 110ºF (43ºC) and the maximum long-term temperature is 75°F (24°C), bond strengths may be multiplied by 3.50. No additional increase is permitted for anchors that only resist wind or seismic loads.

* See p. 13 for an explanation of the load table icons.

ET-HP® Design Information — Concrete

IBC *

ET-HP Tension Strength Design Data for Rebar in Normal-Weight Concrete[1]

Characteristic			Symbol	Units	Rebar Size						
					#3	#4	#5	#6	#7	#8	#10
Steel Strength in Tension											
Rebar	Minimum Tensile Stress Area		A_{se}	in^2	0.11	0.2	0.31	0.44	0.6	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[6]						
Concrete Breakout Strength in Tension (2,500 psi ≤ f'_c ≤ 8,000 psi)											
Effectiveness Factor — Uncracked Concrete			k_{uncr}	—	24						
Effectiveness Factor — Cracked Concrete			k_{cr}	—	17						
Strength Reduction Factor — Breakout Failure			ϕ	—	0.65[8]						
Bond Strength in Tension (2,500 psi ≤ f'_c ≤ 8,000 psi)											
Uncracked Concrete[2,3,4]	Characteristic Bond Strength[5,9]		$\tau_{k,uncr}$	psi	370	360	350	335	325	315	295
	Permitted Embedment Depth Range	Minimum	h_{ef}	in.	2⅜	2¾	3⅛	3½	3¾	4	5
		Maximum			4½	6	7½	9	10½	12	15
Cracked Concrete[2,3,4]	Characteristic Bond Strength[5,9]		$\tau_{k,cr}$	psi	130	140	155	165	180	190	215
	Permitted Embedment Depth Range	Minimum	h_{ef}	in.	2⅜	2¾	3⅛	3½	3¾	4	5
		Maximum			4½	6	7½	9	10½	12	15
Bond Strength in Tension — Bond Strength Reduction Factors for Periodic and Continuous Special Inspection											
Strength Reduction Factor — Dry Concrete			ϕ_{dry}	—	0.65[7]						
Strength Reduction Factor — Water-Saturated Concrete			ϕ_{sat}	—	0.45[7]						

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 or ACI 318-11.
2. Temperature Range: Maximum short-term temperature of 150°F (66°C). Maximum long-term temperature of 110°F (43°C).
3. Short-term concrete temperatures are those that occur over short intervals (diurnal cycling).
4. Long-term concrete temperatures are constant temperatures over a significant time period.
5. For anchors that only resist wind or seismic loads, bond strengths may be multiplied by 2.70.
6. The value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
7. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.4 (c) for Condition B are met. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.5 to determine the appropriate value of ϕ.
8. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.4 (c) for Condition B are met. If the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-11 D.4.4 (c) for Condition A are met, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.5 to determine the appropriate value of ϕ.
9. For applications where maximum short-term temperature is 110ºF (43ºC) and the maximum long-term temperature is 75ºF (24ºC), bond strengths may be multiplied by 3.50. No additional increase is permitted for anchors that only resist wind or seismic loads.

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* See p. 13 for an explanation of the load table icons.

ET-HP Shear Strength Design Data for Threaded Rod in Normal-Weight Concrete[1]

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}	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.	2,260	4,940	7,865	11,625	16,080	21,090	33,720
	Shear Resistance of Steel — ASTM A193, Grade B7			4,875	10,650	16,950	25,050	34,650	45,450	72,675
	Shear Resistance of Steel — Type 410 Stainless (ASTM A193, Grade B6)			4,290	9,370	14,910	22,040	30,490	40,000	63,955
	Shear Resistance of Steel — Type 304 and 316 Stainless (ASTM A193, Grade B8 & B8M)			2,225	4,855	7,730	11,420	15,800	20,725	33,140
	Reduction for Seismic Shear — ASTM F1554, Grade 36	$\alpha_{V,seis}$[5]	—	0.63		0.85			0.75	
	Reduction for Seismic Shear — ASTM A193, Grade B7			0.63		0.85			0.75	
	Reduction for Seismic Shear — Stainless (ASTM A193, Grade B6)			0.60		0.85			0.75	
	Reduction for Seismic Shear — Stainless (ASTM A193, Grade B8 & B8M)			0.60		0.85			0.75	
	Strength Reduction Factor — Steel Failure	ϕ	—	0.65[2]						
Concrete Breakout Strength in Shear										
Outside Diameter of Anchor		d_o	in.	0.375	0.5	0.625	0.75	0.875	1	1.25
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}	—	1.0 for $h_{ef} < 2.50$"; 2.0 for $h_{ef} \geq 2.50$"						
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 ACI 318-14 and ACI 318-11.
2. The value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
3. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 and ACI 318-11 D.4.3 (c) for Condition B are met. If the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 and ACI 318-11 D.4.3 (c) for Condition A are met, refer to ACI 318-14 17.3.3 and ACI 318-11 D.4.3 to determine the appropriate value of ϕ. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-14 and ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
4. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 and ACI 318-11 D.4.3 (c) for Condition B are met. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-14 and ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
5. 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.

* See p. 13 for an explanation of the load table icons.

IBC *

ET-HP Shear Strength Design Data for Rebar in Normal-Weight Concrete[1]

Characteristic		Symbol	Units	Rebar Size						
				#3	#4	#5	#6	#7	#8	#10
Steel Strength in Shear										
Rebar	Minimum Shear Stress Area	A_{se}	in.^{2}	0.11	0.2	0.31	0.44	0.6	0.79	1.23
	Shear Resistance of Steel — Rebar (ASTM A615 Grade 60)	V_{sa}	lb.	4,950	10,800	16,740	23,760	32,400	42,660	66,420
	Reduction for Seismic Shear — Rebar (ASTM A615 Grade 60)	$\alpha_{V,seis}$[5]	—	0.6		0.8			0.75	
	Strength Reduction Factor — Steel Failure	ϕ	—	0.60[2]						
Concrete Breakout Strength in Shear										
Outside Diameter of Anchor		d_o	in.	0.375	0.5	0.625	0.75	0.875	1	1.25
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}	—	1.0 for $h_{ef} < 2.50$"; 2.0 for $h_{ef} \geq 2.50$"						
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 ACI 318-14 or ACI 318-11.
2. The value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
3. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 and ACI 318-11 D.4.3 (c) for Condition B are met. If the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 and ACI 318-11 D.4.3 (c) for Condition A are met, refer to ACI 318-14 17.3.3 and ACI 318-11 D.4.3 to determine the appropriate value of ϕ. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-14 and ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
4. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 and ACI 318-11 D.4.3 (c) for Condition B are met. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-14 and ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
5. 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 additional load tables, visit **strongtie.com/ethp**.

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* See p. 13 for an explanation of the load table icons.

ET-HP® Design Information — Masonry

ET-HP Allowable Tension and Shear Loads for Threaded Rod and Rebar in the Face of Fully Grouted CMU Wall Construction[1, 3, 4, 5, 6, 8, 9, 10, 11, 12] *

Diameter (in.) or Rebar Size No.	Drill Bit Diameter (in.)	Minimum Embedment[2] (in.)	Allowable Load Based on Bond Strength[7] (lb.)	
			Tension Load	Shear Load
Threaded Rod Installed in the Face of CMU Wall				
⅜	½	3⅜	1,425	845
½	⅝	4½	1,425	1,470
⅝	¾	5⅝	1,560	1,835
¾	⅞	6½	1,560	2,050
Rebar Installed in the Face of CMU Wall				
#3	½	3⅜	1,275	1,335
#4	⅝	4½	1,435	1,355
#5	¾	5⅝	1,550	1,355

1. Allowable load shall be the lesser of the bond values shown in this table and steel values, shown on p. 53.
2. Embedment depth shall be measured from the outside face of masonry wall.
3. Critical and minimum edge distance and spacing shall comply with the information on p. 52. Figure 2 on p. 52 illustrates critical and minimum edge and end distances.
4. Minimum allowable nominal width of CMU wall shall be 8 inches. The minimum allowable member thickness shall be no less than 1½ times the actual anchor embedment.
5. No more than one anchor shall be permitted per masonry cell.
6. Anchors shall be permitted to be installed at any location in the face of the fully grouted masonry wall construction (cell, web, bed joint), except anchors shall not be installed within 1½ inches of the head joint, as show in Figure 2 on p. 52.
7. Tabulated allowable load values are for anchors installed in fully grouted masonry walls.
8. Tabulated allowable loads are based on a safety factor of 5.0.
9. Tabulated allowable load values shall be adjusted for increased base material temperatures in accordance with Figure 1 below, as applicable.
10. Threaded rod and rebar installed in fully grouted masonry walls with ET-HP® are permitted to resist dead, live, seismic and wind loads.
11. Threaded rod shall meet or exceed the tensile strength of ASTM F1554, Grade 36 steel, which is 58,000 psi.
12. For installations exposed to severe, moderate or negligible exterior weathering conditions, as defined in Figure 1 of ASTM C62, allowable tension loads shall be multiplied by 0.80.

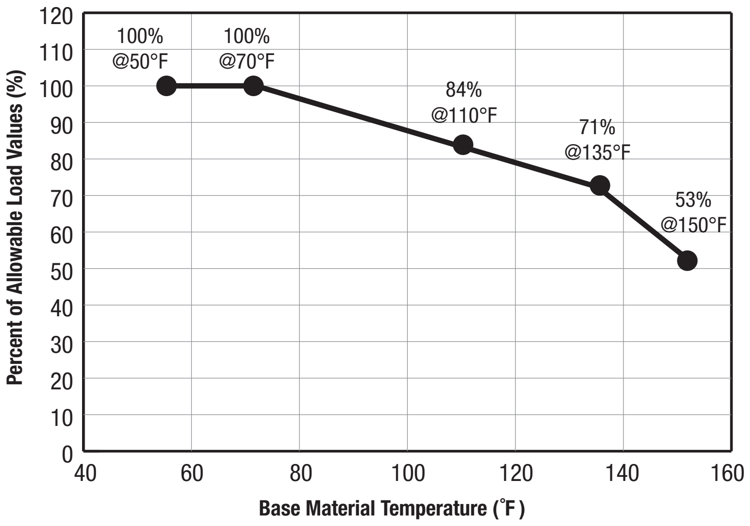


Figure 1. Load Capacity Based on In-Service Temperature for ET-HP Epoxy Adhesive in the Face of Fully Grouted CMU Wall Construction

* See p. 13 for an explanation of the load table icons.

ET-HP® Design Information — Masonry

ET-HP Edge Distance and Spacing Requirements and Allowable Load Reduction Factors — Threaded Rod and Rebar in the Face of Fully Grouted CMU Wall Construction[2,7]

Rod Dia. (in.) or Rebar Size No.	Minimum Embed. Depth (in.)	Edge or End Distance[1,8]						Spacing[2,9]				
		Critical (Full Anchor Capacity)[3]		Minimum (Reduced Anchor Capacity)[4]				Critical (Full Anchor Capacity)[5]		Minimum (Reduced Anchor Capacity)[6]		
		Critical Edge or End Distance, C_{cr} (in.)	Allowable Load Reduction Factor	Minimum Edge or End Distance, C_{min} (in.)	Allowable Load Reduction Factor			Critical Spacing, S_{cr} (in.)	Allowable Load Reduction Factor	Minimum Spacing, S_{min} (in.)	Allowable Load Reduction Factor	
		Load Direction		Load Direction				Load Direction		Load Direction		
		Tension or Shear	Tension or Shear	Tension or Shear	Tension	Shear[10]		Tension or Shear	Tension or Shear	Tension or Shear	Tension	Shear
						Perp.	Parallel					
⅜	3⅜	12	1.00	4	0.76	1.00	1.00	8	1.00	4	0.47	0.94
½	4½	12	1.00	4	1.00	0.92	0.9	8	1.00	4	0.60	0.96
⅝	5⅝	12	1.00	4	1.00	0.55	0.86	8	1.00	4	0.72	0.98
¾	6½	12	1.00	4	1.00	0.55	0.86	8	1.00	4	0.85	1.00
#3	3⅜	12	1.00	4	0.96	0.86	1.00	8	1.00	4	0.37	0.92
#4	4½	12	1.00	4	1.00	0.71	1.00	8	1.00	4	0.69	0.96
#5	5⅝	12	1.00	4	1.00	0.71	1.00	8	1.00	4	1.00	1.00

1. Edge distance (C_{cr} or C_{min}) is the distance measured from anchor centerline to edge or end of CMU masonry wall. Refer to Figure 2 below for an illustration showing critical and minimum edge and end distances.
2. Anchor spacing (S_{cr} or S_{min}) is the distance measured from centerline to centerline of two anchors.
3. Critical edge distance, C_{cr}, is the least edge distance at which tabulated allowable load of an anchor is achieved where a load reduction factor equals 1.0 (no load reduction).
4. Minimum edge distance, C_{min}, is the least edge distance where an anchor has an allowable load capacity which shall be determined by multiplying the allowable loads assigned to anchors installed at critical edge distance, C_{cr}, by the load reduction factors shown above.
5. Critical spacing, S_{cr}, is the least anchor spacing at which tabulated allowable load of an anchor is achieved such that anchor performance is not influenced by adjacent anchors.
6. Minimum spacing, S_{min}, is the least spacing where an anchors has an allowable load capacity, which shall be determined by multiplying the allowable loads assigned to anchors installed at critical spacing distance, S_{cr}, by the load reduction factors shown above.
7. Reduction factors are cumulative. Multiple reduction factors for more than one spacing or edge or end distance shall be calculated separately and multiplied.
8. Load reduction factor for anchors loaded in tension or shear with edge distances between critical and minimum shall be obtained by linear interpolation.
9. Load reduction factor for anchors loaded in tension with spacing between critical and minimum shall be obtained by linear interpolation.
10. Perpendicular shear loads act towards the edge or end. Parallel shear loads act parallel to the edge or end (see Figure 3 below). Perpendicular and parallel shear load reduction factors are cumulative when the anchor is located between the critical minimum edge and end distance.

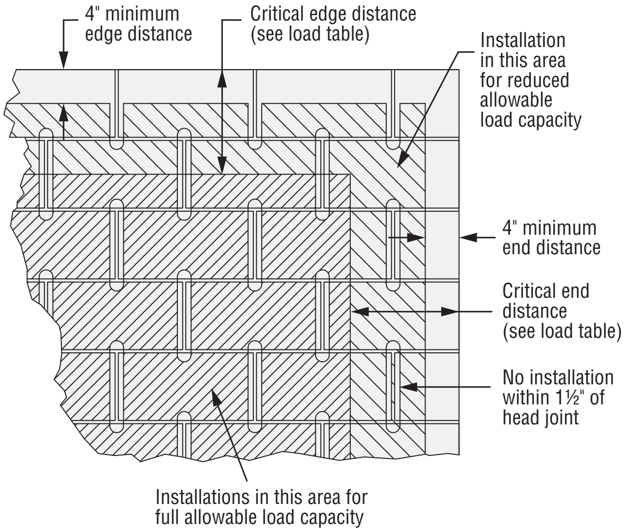


Figure 2. Allowable Anchor Placement in Grouted CMU Face Shell

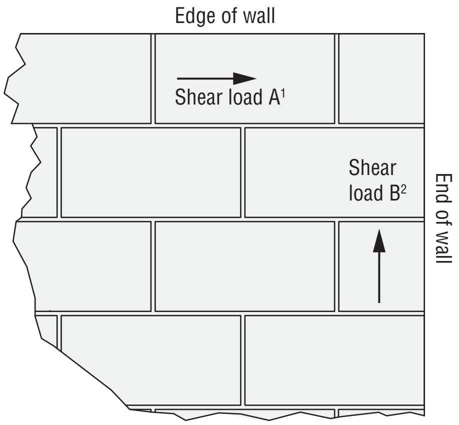


Figure 3. Direction of Shear Load in Relation to Edge and End of Wall

1. Direction of Shear Load A is parallel to edge of wall and perpendicular to end of wall.
2. Direction of Shear Load B is parallel to end of wall and perpendicular to edge of wall.

* See p. 13 for an explanation of the load table icons.

ET-HP® Design Information — Masonry

ET-HP Allowable Tension and Shear Loads — Threaded Rod Based on Steel Strength[1]

IBC *

Threaded Rod Diameter (in.)	Tensile Stress Area (in.^{2})	Tension Load Based on Steel Strength[2] (lb.)				Shear Load Based on Steel Strength[3] (lb.)			
		ASTM F1554 Grade 36[4]	ASTM A193 Grade B7[6]	Stainless Steel		ASTM F1554 Grade 36[4]	ASTMA 193 Grade B7[6]	Stainless Steel	
				ASTM A193 Grade B6[5]	ASTM A193 Grades B8 and B8M[7]			ASTM A193 Grade B6[5]	ASTM A193 Grades B8 and B8M[7]
⅜	0.078	1,495	3,220	2,830	1,930	770	1,660	1,460	995
½	0.142	2,720	5,860	5,155	3,515	1,400	3,020	2,655	1,810
⅝	0.226	4,325	9,325	8,205	5,595	2,230	4,805	4,225	2,880
¾	0.334	6,395	13,780	12,125	8,265	3,295	7,100	6,245	4,260

1. Allowable load shall be the lesser of bond values given on p. 51 and steel values in the table above.
2. Allowable Tension Steel Strength is based on the following equation: $F_v = 0.33 \times F_u \times$ Tensile Stress Area.
3. Allowable Shear Steel Strength is based on the following equation: $F_v = 0.17 \times F_u \times$ Tensile Stress Area.
4. Minimum specified tensile strength (F_u = 58,000 psi) of ASTM F1554, Grade 36 used to calculate allowable steel strength.
5. Minimum specified tensile strength (F_u = 110,000 psi) of ASTM A193, Grade B6 used to calculate allowable steel strength.
6. Minimum specified tensile strength (F_u = 125,000 psi) of ASTM A193, Grade B7 used to calculate allowable steel strength.
7. Minimum specified tensile strength (F_u = 75,000 psi) of ASTM A193, Grades B8 and B8M used to calculate allowable steel strength.

ET-HP Allowable Tension and Shear Loads — Deformed Reinforcing Bar Based on Steel Strength[1]

IBC *

Rebar Size	Tensile Stress Area (in.^{2})	Tension Load (lb.) Based on Steel Strength		Shear Load (lb.) Based on Steel Strength	
		ASTM A615 Grade 40[2]	ASTM A615 Grade 60[3]	ASTM A615 Grade 40[4,5]	ASTM A615 Grade 60[4,6]
#3	0.11	2,200	2,640	1,310	1,685
#4	0.20	4,000	4,800	2,380	3,060
#5	0.31	6,200	7,400	3,690	4,745

1. Allowable load shall be the lesser of bond values given on p. 51 and steel values in the table above.
2. Allowable Tension Steel Strength is based on AC58 Section 3.3.3 (20,000 psi x tensile stress area) for Grade 40 rebar.
3. Allowable Tension Steel Strength is based on AC58 Section 3.3.3 (24,000 psi x tensile stress area) for Grade 60 rebar.
4. Allowable Shear Steel Strength is based on AC58 Section 3.3.3 ($F_v = 0.17 \times F_u \times$ Tensile Stress Area).
5. F_u = 70,000 psi for Grade 40 rebar.
6. F_u = 90,000 psi for Grade 60 rebar.

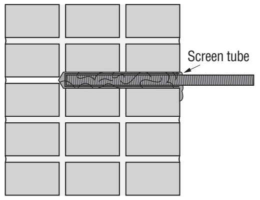
ET-HP Allowable Tension and Shear Loads for Installations in Unreinforced Brick Masonry Walls — Minimum URM Wall Thickness is 13" (3 wythes thick)

IBC *

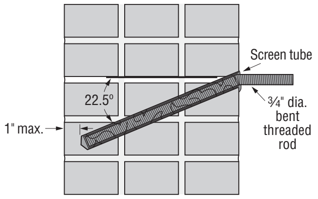
Rod Dia. in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Min. Edge/End Dist. in. (mm)	Min. Vertical Spacing Dist. in. (mm)	Min. Horiz. Spacing Dist. in. (mm)	Tension Load Based on URM Strength	Shear Load Based on URM Strength
						Minimum Net Mortar Strength = 50 psi	Minimum Net Mortar Strength = 50 psi
						Allowable lb. (kN)	Allowable lb. (kN)
Configuration A (Simpson Strong-Tie® ETS Screen Tube Required)							
¾ (19.1)	1	8 (203)	24 (610)	18 (457)	18 (457)	—	1,000 (4.4)
Configuration B (Simpson Strong-Tie® ETS Screen Tube Required)							
¾ (19.1)	1	13 (330)	16 (406)	18 (457)	24 (610)	1,200 (5.3)	1,000 (4.4)
Configuration C (Simpson Strong-Tie® ETS Screen Tube and AST Steel Sleeve Required)							
⅝ (15.9)	1	**	24 (610)	18 (457)	18 (457)	1,200 (5.3)	750 (3.3)

1. Threaded rods must comply with ASTM F1554 Grade 36 minimum.
2. All holes are drilled with a 1"-diameter carbide-tipped drill bit with the drill set in the rotation-only mode.
3. The unreinforced brick walls must have a minimum thickness of 13 inches (three wythes of brick).
4. The allowable load is applicable only where in-place shear tests indicate minimum net mortar strength of 50 psi.
5. The allowable load for Configuration B and C anchors subjected to a combined tension and shear load is determined by assuming a straight-line relationship between allowable tension and shear.
6. The anchors installed in unreinforced brick walls are limited to resisting seismic or wind forces only.
7. Configuration A has a straight threaded rod or rebar embedded 8 inches into the wall with a 31⁄32"-diameter by 8-inch-long screen tube (part # ETS758). This configuration is designed to resist shear loads only.
8. Configuration B has a ¾" threaded rod bent and installed at a 22.5-degree angle and installed 13 inches into the wall, to within 1-inch (maximum) of the exterior wall surface. This configuration is designed to resist tension and shear loads. The pre-bent threaded rod is installed with a 31⁄32" diameter by 13-inch-long screen tube (part # ETS7513).
9. Configuration C is designed to resist tension and shear forces. It consists of a ⅝"-diameter, ASTM F1554 Grade 36 threaded rod and an 8"-long sleeve (part # AST800) and a 31⁄32"-diameter by 8-inch-long screen tube (part # ETS758). The steel sleeve has a plastic plug in one end. A 6" by 6" by ⅜" thick ASTM A 36 steel plate is located on the back face of the wall.
10. Special inspection requirements are determined by local jurisdiction and must be confirmed by the local building official.
11. Refer to in-service temperature sensitivity chart for allowable load adjustment for temperature.

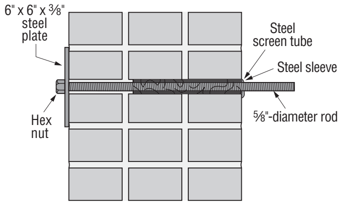
* See p. 13 for an explanation of the load table icons.



Configuration A (Shear)



Configuration B (Tension and Shear)



Configuration C (Tension and Shear)

Installation Instructions for Configuration C

1. Drill hole perpendicular to the wall to a depth of 8" with a 1"-diameter carbide-tipped drill bit (rotation-only mode).
2. Clean hole with oil-free compressed air and a nylon brush.
3. Fill 8" steel screen tube with mixed adhesive and insert into hole.
4. Insert steel sleeve slowly into screen tube (adhesive will displace).
5. Allow adhesive to cure (see cure schedule).
6. Drill through plastic plug in (inside) end of steel sleeve with ⅝" bit.
7. Drill completely through the wall with ⅝" carbide-tipped concrete drill bit (rotation-only mode).
8. Insert ⅝" rod through hole and attach metal plate and nut.

SET Epoxy Adhesive

SET is a high-strength, non-shrink, epoxy-based adhesive formulated for anchoring and doweling threaded rod and rebar. Resin and hardener are dispensed and mixed simultaneously through the mixing nozzle.

Features

- Code listed under the IBC/IRC for URM per ICC-ES ESR-1772
- Meets or exceeds the requirements of ASTM C881 specification for Type I and IV, Grade 3, Class C
- Cure times — 24 hours at 65°F (18°C), 72 hours at 40°F (4°C)
- Easy hole-cleaning procedure — no power-brushing required
- Suitable for use in damp or wet anchor sites
- When properly mixed, adhesive will be a uniform gray color
- Available in 22 oz. cartridge for application versatility
- Manufactured in the USA using global materials

Applications

- Threaded rod anchoring and rebar doweling into concrete, masonry and URM (red brick)
- Pick-proof sealant around doors, windows and fixtures
- Paste-over for crack injection preparation
- Bonding hardened concrete to hardened concrete
- CalTrans and multiple DOT listings; refer to **strongtie.com/DOT**

Codes

ICC-ES ESR-1772 (unreinforced masonry); Florida FL15730.5; AASHTO M-235 and ASTM C881 (Type I and IV, Grade 3, Class C); CalTrans Approved; Multiple DOT listings; NSF/ANSI Standard 61 (216 in.^{2}/1,000 gal.)

Chemical Resistance

See pp. 252–253

Installation and Application Instructions

(See also pp. 100–105)

- Surfaces to receive epoxy must be clean.
- Base material temperature must be 40°F (4°C) or above at the time of installation. For best results, material should be 70° (21°C)–80°F (27°C) at time of application.
- To warm cold material, store cartridges in a warm, uniformly heated area or storage container. Do not immerse cartridges in water or use microwave to facilitate warming.
- Mixed material in nozzle can harden in 30 minutes at temperatures of 70°F (21°C) and above.

Suggested Specifications

See **strongtie.com** for more information.

SET Adhesive

SET Epoxy Adhesive

Test Criteria

Anchors installed with SET adhesive have been tested in accordance with ICC-ES *Acceptance Criteria for Anchors in Unreinforced Masonry Elements* (AC60).

Property	**Test Method**	**Result***
Consistency	ASTM C881	Non-sag/thixotropic paste
Heat deflection temperature	ASTM D648	136°F (58°C)
Bond strength (moist cure)	ASTM C882	3,218 psi (2 days) 3,366 psi (14 days)
Water absorption	ASTM D570	0.11% (24 hours)
Compressive yield strength	ASTM D695	5,065 psi (24 hours) 12,650 psi (7 days)
Compressive modulus	ASTM D695	439,000 psi (7 days)
Shore D Durometer	ASTM D2240	81
Gel time (75°F)	ASTM C881	30 minutes — 60 gram mass 60 minutes — thin film
VOC	ASTM D2369	6 g/L

*Material and curing conditions: 73 ± 2°F, unless otherwise noted.

SET Cartridge System

Model No.	Capacity (ounces)	Cartridge Type	Carton Quantity	Dispensing Tools	Mixing Nozzle
SET22	22	Side-by-side	10	EDT22S, EDTA22CKT EDTA22P	EMN22I
SET22-N[4]	22	Side-by-side	10		EMN22I

1. Cartridge estimation guidelines are available at **strongtie.com/apps**.
2. Detailed information on dispensing tools, mixing nozzles and other adhesive accessories is available at **strongtie.com**.
3. Use only Simpson Strong-Tie mixing nozzles in accordance with Simpson Strong-Tie instructions. Modification or improper use of mixing nozzle may impair SET adhesive performance.
4. One EMN22I mixing nozzle and one nozzle extension are supplied with each cartridge.

Cure Schedule

Base Material Temperature		Cure Time (hrs.)
°F	°C	
40	4	72
65	18	24
85	29	20
90	32	16

For water-saturated concrete (including damp and water-filled holes), the cure times must be doubled.

In-Service Temperature Sensitivity

Base Material Temperature		Percent Allowable Load
°F	°C	
40	4	100%
70	21	100%
110	43	100%
135	57	75%
150	66	44%
180	82	20%

1. Percent allowable load may be linearly interpolated for intermediate base material temperatures.
2. °C = (°F-32) / 1.8

SET Design Information — Concrete

SET Allowable Tension Loads for Threaded Rod Anchors in Normal-Weight Concrete (continued on next page)

*

Rod Dia. in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing Dist. in. (mm)	Tension Load Based on Bond Strength						Tension Load Based on Steel Strength		
					f'$_c$ ≥ 2,000 psi (13.8 MPa) Concrete			f'$_c$ ≥ 4,000 psi (27.6 MPa) Concrete			F1554 Grade 36	A193 GR B7	F593 304SS
					Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allow. lb. (kN)	Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allow. lb. (kN)	Allow. lb. (kN)	Allow. lb. (kN)	Allow. lb. (kN)
⅜ (9.5)	½	1¾ (44)	2⅝ (67)	7 (178)	1,900 (8.5)	485 (2.2)	475 (2.1)	1,900 (8.5)	—	475 (2.1)	2,105 (9.4)	4,535 (20.2)	3,630 (16.1)
		3½ (89)	5¼ (133)	14 (356)	10,200 (45.4)	119 (0.5)	2,550 (11.3)	10,280 (45.7)	97 (0.4)	2,570 (11.4)			
		4½ (114)	6¾ (171)	18 (457)	10,613 (47.2)	84 (0.4)	2,655 (11.8)	10,613 (47.2)	—	2,655 (11.8)			
½ (12.7)	⅝	2⅛ (54)	3³⁄₁₆ (81)	8½ (216)	7,216 (32.1)	1,163 (5.2)	1,805 (8.0)	7,216 (32.1)	—	1,805 (8.0)	3,750 (16.7)	8,080 (35.9)	6,470 (28.8)
		4¼ (108)	6⅜ (162)	17 (432)	17,700 (78.7)	629 (2.8)	4,425 (19.7)	18,400 (81.8)	788 (3.5)	4,600 (20.5)			
		6 (152)	9 (229)	24 (610)	18,556 (82.5)	853 (3.8)	4,640 (20.6)	18,556 (82.5)	—	4,640 (20.6)			
⅝ (15.9)	¾	2½ (64)	3¾ (95)	10 (254)	6,780 (30.2)	315 (1.4)	1,695 (7.5)	6,780 (30.2)	—	1,695 (7.5)	5,875 (26.1)	12,660 (56.3)	10,120 (45.0)
		3¾ (95)	5⅝ (143)	15 (381)	—	—	4,190 (18.6)	—	—	4,875 (21.7)			
		5 (127)	7½ (191)	20 (508)	26,700 (118.8)	1,121 (5.0)	6,680 (29.7)	32,200 (143.2)	964 (4.3)	8,050 (35.8)			
		7³⁄₁₆ (183)	10⅞ (276)	28¾ (730)	—	—	7,515 (33.4)	—	—	8,200 (36.5)			
		9⅜ (238)	14⅛ (359)	37½ (953)	33,402 (148.6)	1,198 (5.3)	8,350 (37.1)	33,402 (148.6)	—	8,350 (37.1)			
¾ (19.1)	⅞	3⅜ (86)	5¹⁄₁₆ (129)	13½ (343)	15,456 (68.8)	2,621 (11.7)	3,865 (17.2)	15,456 (68.8)	—	3,865 (17.2)	8,460 (37.6)	18,230 (81.1)	12,400 (55.2)
		5¹⁄₁₆ (129)	7⅝ (194)	20¼ (514)	—	—	7,195 (32.0)	—	—	7,245 (32.2)			
		6¾ (171)	10⅛ (257)	27 (686)	42,100 (187.3)	1,945 (8.7)	10,525 (46.8)	42,480 (189.0)	1,575 (7.0)	10,620 (47.2)			
		9 (229)	13½ (343)	36 (914)	—	—	11,220 (49.9)	—	—	11,265 (50.1)			
		11¼ (286)	16⅞ (429)	45 (1,143)	47,634 (211.9)	608 (2.7)	11,910 (53.0)	47,634 (211.9)	—	11,910 (53.0)			

See notes on next page.

⅞"–1¼" diameters on next page →

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* See p. 13 for an explanation of the load table icons.

SET Allowable Tension Loads for Threaded Rod Anchors in Normal-Weight Concrete (continued from previous page)

Rod Dia. in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing Dist. in. (mm)	Tension Load Based on Bond Strength						Tension Load Based on Steel Strength		
					$f'_c \geq$ 2,000 psi (13.8 MPa) Concrete			$f'_c \geq$ 4,000 psi (27.6 MPa) Concrete			F1554 Grade 36	A193 GR B7	F593 304SS
					Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allow. lb. (kN)	Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allow. lb. (kN)	Allow. lb. (kN)	Allow. lb. (kN)	Allow. lb. (kN)
⅞ (22.2)	1	3⅞ (98)	5¹³⁄₁₆ (148)	15½ (394)	19,120 (85.1)	1,239 (5.5)	4,780 (21.3)	19,120 (85.1)	—	4,780 (21.3)	11,500 (51.2)	24,785 (110.2)	16,860 (75.0)
		5¹³⁄₁₆ (148)	8¾ (222)	23¼ (591)	—	—	8,535 (38.0)	—	—	9,250 (41.1)			
		7¾ (197)	11⅝ (295)	31 (787)	49,160 (218.7)	2,149 (9.6)	12,290 (54.7)	54,880 (244.1)	1,050 (4.7)	13,720 (61.0)			
		10⁷⁄₁₆ (265)	15⅝ (397)	41¾ (1,060)	—	—	14,480 (64.4)	—	—	15,195 (67.6)			
		13⅛ (333)	19⅝ (498)	52½ (1,334)	66,679 (296.6)	506 (2.3)	16,670 (74.2)	66,679 (296.6)	—	16,670 (74.2)			
1 (25.4)	1⅛	4½ (114)	6¾ (171)	18 (457)	20,076 (89.3)	2,388 (10.6)	5,020 (22.3)	20,076 (89.3)	—	5,020 (22.3)	15,025 (66.8)	32,380 (144.0)	22,020 (97.9)
		6¾ (171)	10⅛ (257)	27 (686)	—	—	10,020 (44.6)	—	—	10,640 (47.3)			
		9 (229)	13½ (343)	36 (914)	60,060 (267.2)	5,472 (24.3)	15,015 (66.8)	65,020 (289.2)	2,924 (13.0)	16,255 (72.3)			
		12 (305)	18 (457)	48 (1,219)	—	—	17,810 (79.2)	—	—	18,430 (82.0)			
		15 (381)	22½ (572)	60 (1,524)	82,401 (366.5)	6,432 (28.6)	20,600 (91.6)	82,401 (366.5)	—	20,600 (91.6)			
1⅛ (28.6)	1¼	5⅛ (130)	7¾ (197)	20½ (521)	27,560 (122.6)	—	6,890 (30.6)	27,560 (122.6)	—	6,890 (30.6)	19,025 (84.6)	41,000 (182.4)	27,880 (124.0)
		7⅝ (194)	11½ (292)	30½ (775)	—	—	12,105 (53.8)	—	—	12,500 (55.6)			
		10⅛ (257)	15¼ (387)	40½ (1,029)	69,200 (307.8)	—	17,300 (77.0)	72,340 (321.8)	—	18,085 (80.4)			
		13½ (343)	20¼ (514)	54 (1,372)	—	—	21,380 (95.1)	—	—	21,770 (96.8)			
		16⅞ (429)	25⅜ (645)	67½ (1,715)	101,820 (452.9)	—	25,455 (113.2)	101,820 (452.9)	—	25,455 (113.2)			
1¼ (31.8)	1⅜	5⅝ (143)	8⁷⁄₁₆ (214)	22½ (572)	35,858 (159.5)	2,389 (10.6)	8,965 (39.9)	35,858 (159.5)	—	8,965 (39.9)	23,490 (104.5)	50,620 (225.2)	34,425 (153.1)
		8⁷⁄₁₆ (214)	12¾ (324)	33¾ (857)	—	—	14,115 (62.8)	—	—	14,115 (62.8)			
		11¼ (286)	16⅞ (429)	45 (1,143)	77,045 (342.7)	7,024 (31.2)	19,260 (85.7)	77,045 (342.7)	—	19,260 (85.7)			
		15 (381)	22½ (572)	60 (1,524)	—	—	24,965 (111.0)	—	—	24,965 (111.0)			
		18¾ (476)	28⅛ (714)	75 (1,905)	122,681 (545.7)	10,940 (48.7)	30,670 (136.4)	122,681 (545.7)	—	30,670 (136.4)			

1. Allowable load must be the lesser of the bond or steel strength.
2. The allowable loads listed under allowable bond are based on a safety factor of 4.0.
3. Refer to allowable load-adjustment factors for spacing and edge distance on pp. 68 and 70.
4. Refer to in-service temperature sensitivity chart for allowable load adjustment for temperature.
5. Anchors are permitted to be used within fire-resistive construction, provided the anchors resist wind or seismic loads only. For use in fire-resistive construction, the anchors can also be permitted to be used to resist gravity loads, provided special consideration has been given to fire-exposure conditions.
6. Anchors are not permitted to resist tension forces in overhead or wall installations unless proper consideration is given to fire-exposure and elevated-temperature conditions.
7. Allowable load based on bond strength may be interpolated for concrete compressive strengths between 2,000 psi and 4,000 psi.

* See p. 13 for an explanation of the load table icons.

SET Design Information — Concrete

SET Allowable Shear Loads for Threaded Rod Anchors in Normal-Weight Concrete

Rod Dia. in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing Dist. in. (mm)	Shear Load Based on Concrete Edge Distance			Shear Load Based on Steel Strength		
					$f'_c \geq$ 2,000 psi (13.8 MPa) Concrete			F1554 Grade 36	A193 GR B7	F593 304SS
					Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)
3⁄8 (9.5)	1⁄2	**1¾** (44)	**5¼** (133)	**2⅝** (67)	**4,573** (20.3)	**317** (1.4)	**1,145** (5.1)	**1,085** (4.8)	**2,340** (10.4)	**1,870** (8.3)
		3½ (89)		**5¼** (133)	**6,935** (30.8)	**965** (4.3)	**1,735** (7.7)			
		4½ (114)		**5¼** (133)	—	—	**1,735** (7.7)			
½ (12.7)	⅝	**2⅛** (54)	**6⅜** (162)	**3¼** (83)	**7,001** (31.1)	**437** (1.9)	**1,750** (7.8)	**1,930** (8.6)	**4,160** (18.5)	**3,330** (14.8)
		4¼ (108)		**6⅜** (162)	**11,116** (49.4)	**1,696** (7.5)	**2,780** (12.4)			
		6 (152)		**6⅜** (162)	—	—	**2,780** (12.4)			
⅝ (15.9)	¾	**2½** (64)	**7½** (191)	**3¾** (95)	**14,427** (64.2)	**826** (3.7)	**3,605** (16.0)	**3,025** (13.5)	**6,520** (29.0)	**5,220** (23.2)
		5 (127)		**7½** (191)	**19,501** (86.7)	**1,027** (4.6)	**4,875** (21.7)			
		9⅜ (238)		**7½** (191)	—	—	**4,875** (21.7)			
¾ (19.1)	⅞	**3⅜** (86)	**10⅛** (257)	**5⅛** (130)	**21,180** (94.2)	**942** (4.2)	**5,295** (23.6)	**4,360** (19.4)	**9,390** (41.8)	**6,385** (28.4)
		6¾ (171)		**10⅛** (257)	**25,244** (112.3)	**2,538** (11.3)	**6,310** (28.1)			
		11¼ (286)		**10⅛** (257)	—	—	**6,310** (28.1)			
⅞ (22.2)	1	**3⅞** (98)	**11⅝** (295)	**5⅞** (149)	**28,333** (126.0)	**2,406** (10.7)	**7,085** (31.5)	**5,925** (26.4)	**12,770** (56.8)	**8,685** (38.6)
		7¾ (197)		**11⅝** (295)	**33,533** (149.2)	**2,793** (12.4)	**8,385** (37.3)			
		13⅛ (333)		**11⅝** (295)	—	—	**8,385** (37.3)			
1 (25.4)	1⅛	**4½** (114)	**13½** (343)	**6¾** (171)	**30,520** (135.8)	**2,166** (9.6)	**7,630** (33.9)	**7,740** (34.4)	**16,680** (74.2)	**11,345** (50.5)
		9 (229)		**13½** (343)	**50,187** (223.2)	**2,176** (9.7)	**12,545** (55.8)			
		15 (381)		**13½** (343)	—	—	**12,545** (55.8)			
1⅛ (28.6)	1¼	**5⅛** (130)	**15¼** (387)	**7¾** (197)	**41,325** (183.8)	—	**10,330** (46.0)	**9,800** (43.6)	**21,125** (94.0)	**14,365** (63.9)
		10⅛ (257)		**15¼** (387)	**58,285** (259.3)	—	**14,570** (64.8)			
		16⅞ (429)		**15¼** (387)	—	—	**14,570** (64.8)			
1¼ (31.8)	1⅜	**5⅝** (143)	**16⅞** (429)	**8½** (216)	**52,130** (231.9)	**3,969** (17.7)	**13,035** (58.0)	**12,100** (53.8)	**26,075** (116.0)	**17,730** (78.9)
		11¼ (286)		**16⅞** (429)	**66,383** (295.3)	**3,948** (17.6)	**16,595** (73.8)			
		18¾ (476)		**16⅞** (429)	—	—	**16,595** (73.8)			

1. Allowable load must be the lesser of the load based on concrete edge distance or steel strength.
2. The allowable loads based on concrete edge distance are based on a safety factor of 4.0.
3. Refer to allowable load-adjustment factors for spacing and edge distance on pp. 69 and 71.
4. Refer to in-service temperature sensitivity chart for allowable load adjustment for temperature.
5. Anchors are permitted to be used within fire-resistive construction, provided the anchors resist wind or seismic loads only. For use in fire-resistive construction, the anchors can also be permitted to be used to resist gravity loads, provided special consideration has been given to fire-exposure conditions.

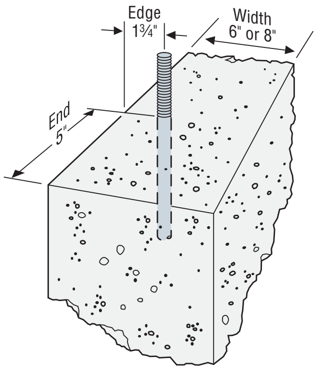
* See p. 13 for an explanation of the load table icons.

SET Design Information — Concrete

SET Allowable Tension Loads for Threaded Rod Anchors in Normal-Weight Concrete Stemwall *

Rod Dia. in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Stemwall Width in. (mm)	Min. Edge Dist. in. (mm)	Min. End Dist. in. (mm)	Tension Load Based on Bond Strength		Tension Load Based on Steel Strength
						f'$_c$ ≥ 2,500 psi (17.2 MPa) Concrete		F1554 Grade 36
						Ultimate lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)
⅝ (15.9)	¾	10 (254.0)	6 (152.4)	1¾ (44.5)	5 (127.0)	13,634 (60.6)	3,410 (15.2)	5,875 (26.1)
⅞ (22.2)	1	15 (381.0)	8 (203.2)	1¾ (44.5)	5 (127.0)	22,664 (100.8)	5,665 (25.2)	11,500 (51.2)

1. Allowable load must be the lesser of the bond or steel strength.
2. The allowable loads listed under allowable bond are based on a safety factor of 4.0.
3. Refer to in-service temperature sensitivity chart for allowable load adjustment for temperature.
4. Anchors are permitted to be used within fire-resistive construction, provided the anchors resist wind or seismic loads only. For use in fire-resistive construction, the anchors can also be permitted to be used to resist gravity loads, provided special consideration has been given to fire-exposure conditions.



Edge and End Distances for Threaded Rod in Concrete Foundation Stemwall

SET Allowable Shear Loads for Threaded Rod Anchors in Normal-Weight Concrete, Load Applied Parallel to Concrete Edge *

Rod Dia. in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Min. Edge Dist. in. (mm)	Min. End Dist. in. (mm)	Shear Load Based on Concrete Edge Distance			Shear Load Based on Steel Strength
					f'$_c$ ≥ 2,000 psi (13.8 MPa) Concrete			F1554 Grade 36
					Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)
½ (12.7)	⅝	4¼ (108.0)	1¾ (44.5)	8½ (219.9)	8,496 (37.8)	654 (2.9)	2,125 (9.5)	1,930 (8.6)
⅝ (15.9)	¾	5 (127.0)	1¾ (44.5)	10 (254.0)	8,857 (39.4)	225 (1.0)	2,215 (9.9)	3,025 (13.5)

1. Allowable load must be the lesser of the load based on concrete edge distance, steel strength or wood bearing capacity.
2. The allowable loads based on concrete edge distance are based on a safety factor of 4.0.
3. Refer to allowable load-adjustment factors for spacing on p. 71.
4. Refer to in-service temperature sensitivity chart for allowable load adjustment for temperature.
5. Anchors are permitted to be used within fire-resistive construction, provided the anchors resist wind or seismic loads only. For use in fire-resistive construction, the anchors can also be permitted to be used to resist gravity loads, provided special consideration has been given to fire-exposure conditions.

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* See p. 13 for an explanation of the load table icons.

SET Design Information — Concrete

SET Allowable Tension Loads for Rebar Dowels in Normal-Weight Concrete

Rebar Size No. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing Dist. in. (mm)	Tension Load Based on Bond Strength						Tension Load Based on Steel Strength
					$f'_c \geq$ 2,000 psi (13.8 MPa) Concrete			$f'_c \geq$ 4,000 psi (27.6 MPa) Concrete			ASTM A615 Grade 60 Rebar
					Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allow. lb. (kN)	Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allow. lb. (kN)	Allowable lb. (kN)
#4 (12.7)	⅝	**4¼** (108)	**6⅜** (162)	**17** (432)	**16,480** (73.3)	**245** (1.1)	**4,120** (18.3)	**18,320** (81.5)	**560** (2.5)	**4,580** (20.4)	**4,800** (21.4)
		6 (152)	**9** (229)	**24** (610)	**19,360** (86.1)	**678** (3.0)	**4,840** (21.5)	**19,360** (86.1)	—	**4,840** (21.5)	
#5 (15.9)	¾	**5** (127)	**7½** (191)	**20** (508)	**24,600** (109.4)	**2,598** (11.6)	**6,150** (27.4)	**26,040** (115.8)	**1,740** (7.7)	**6,510** (29.0)	**7,440** (33.1)
		9⅜ (238)	**14⅛** (359)	**37½** (953)	**48,380** (215.2)	**2,841** (12.6)	**12,095** (53.8)	**48,380** (215.2)	—	**12,095** (53.8)	
#6 (19.1)	⅞	**6¾** (171)	**10⅛** (257)	**27** (686)	**38,380** (170.7)	**4,044** (18.0)	**9,595** (42.7)	**40,500** (180.2)	**1,533** (6.8)	**10,125** (45.0)	**10,560** (47.0)
		11¼ (286)	**16⅞** (429)	**45** (1,143)	**65,020** (289.2)	**3,152** (14.0)	**16,255** (72.3)	**65,020** (289.2)	—	**16,255** (72.3)	
#7 (22.2)	1	**7¾** (197)	**11⅝** (295)	**31** (787)	**47,760** (212.4)	**1,266** (5.6)	**11,940** (53.1)	**47,760** (212.4)	—	**11,940** (53.1)	**14,400** (64.1)
		13⅛ (333)	**19⅝** (498)	**52½** (1,334)	**81,560** (362.8)	**3,575** (15.9)	**20,390** (90.7)	**81,560** (362.8)	—	**20,390** (90.7)	
#8 (25.4)	1⅛	**9** (229)	**13½** (343)	**36** (914)	**53,680** (238.8)	—	**13,420** (59.7)	**53,680** (238.8)	—	**13,420** (59.7)	**18,960** (84.3)
		15 (381)	**22½** (572)	**60** (1,524)	**94,240** (419.2)	**7,520** (33.5)	**23,560** (104.8)	**94,240** (419.2)	—	**23,560** (104.8)	
#9 (28.6)	1¼	**10⅛** (257)	**15¼** (387)	**40½** (1,029)	**53,680** (238.8)	**7,977** (35.5)	**13,420** (59.7)	**53,680** (238.8)	—	**13,420** (59.7)	**24,000** (106.8)
		16⅞ (429)	**25⅜** (645)	**67½** (1,715)	**111,460** (495.8)	**5,753** (25.6)	**27,865** (123.9)	**111,460** (495.8)	—	**27,865** (123.9)	
#10 (31.8)	1½	**11¼** (286)	**16⅞** (429)	**45** (1,143)	**76,000** (338.1)	**1,408** (6.3)	**19,000** (84.5)	**76,000** (338.1)	—	**19,000** (84.5)	**30,480** (135.6)
		18¾ (476)	**28** (711)	**75** (1,905)	**125,840** (559.8)	**9,551** (42.5)	**31,460** (139.9)	**125,840** (559.8)	—	**31,460** (139.9)	
#11 (34.9)	1⅝	**12⅜** (314)	**18⅝** (473)	**49½** (1,257)	**87,500** (389.2)	**3,498** (15.6)	**21,875** (97.3)	**87,500** (389.2)	—	**21,875** (97.3)	**37,440** (166.5)
		20⅝ (524)	**28** (711)	**82½** (2,096)	**132,080** (587.5)	**11,297** (50.3)	**33,020** (146.9)	**132,080** (587.5)	—	**33,020** (146.9)	

1. Allowable load must be the lesser of the bond or steel strength.
2. The allowable loads listed under allowable bond are based on a safety factor of 4.0.
3. Refer to allowable load-adjustment factors for spacing and edge distance on pp. 68 and 70.
4. Refer to in-service temperature sensitivity chart for allowable load adjustment for temperature.
5. Anchors are permitted to be used within fire-resistive construction, provided the anchors resist wind or seismic loads only. For use in fire-resistive construction, the anchors can also be permitted to be used to resist gravity loads, provided special consideration has been given to fire-exposure conditions.
6. Anchors are not permitted to resist tension forces in overhead or wall installations unless proper consideration is given to fire exposure and elevated-temperature conditions.
7. Allowable load based on bond strength may be interpolated for concrete compressive strengths between 2,000 psi and 4,000 psi.

* See p. 13 for an explanation of the load table icons.

SET Design Information — Concrete

SET Allowable Shear Loads for Rebar Dowels in Normal-Weight Concrete

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Rebar Size No. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing Dist. in. (mm)	Shear Load Based on Concrete Edge Distance			Shear Load Based on Steel Strength
					f'c ≥ 2,000 psi (13.8 MPa) Concrete			ASTM A615 Grade 60 Rebar
					Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allow. lb. (kN)	Allowable lb. (kN)
#4 (12.7)	⅝	**4¼** (108)	**6⅜** (162)	**6⅜** (162)	**15,156** (67.4)	**542** (2.4)	**3,790** (16.9)	**3,060** (13.6)
		6 (152)			**15,156** (67.4)	—	**3,790** (16.9)	
#5 (15.9)	¾	**5** (127)	**7½** (191)	**7½** (191)	**24,245** (107.8)	**1,121** (5.0)	**6,060** (27.0)	**4,740** (21.1)
		9⅜ (238)			**24,245** (107.8)	—	**6,060** (27.0)	
#6 (19.1)	⅞	**6¾** (171)	**10⅛** (257)	**10⅛** (257)	**33,195** (147.7)	**2,314** (10.3)	**8,300** (36.9)	**6,730** (29.9)
		11¼ (286)			**33,195** (147.7)	—	**8,300** (36.9)	
#7 (22.2)	1	**7¾** (197)	**11⅝** (295)	**11⅝** (295)	**47,017** (209.1)	**2,227** (9.9)	**11,755** (52.3)	**9,180** (40.8)
		13⅛ (333)			**47,017** (209.1)	—	**11,755** (52.3)	
#8 (25.4)	1⅛	**9** (229)	**13½** (343)	**13½** (343)	**58,880** (261.9)	—	**14,720** (65.5)	**12,085** (53.8)
		15 (381)			**58,880** (261.9)	—	**14,720** (65.5)	
#9 (28.6)	1¼	**10⅛** (257)	**15¼** (387)	**15¼** (387)	**58,880** (261.9)	**1,487** (6.6)	**14,720** (65.5)	**15,300** (68.1)
		16⅞ (429)			**58,880** (261.9)	—	**14,720** (65.5)	
#10 (31.8)	1½	**11¼** (286)	**16⅞** (429)	**16⅞** (429)	**65,840** (292.9)	**7,120** (31.7)	**16,460** (73.2)	**19,430** (86.4)
		18¾ (476)			**65,840** (292.9)	—	**16,460** (73.2)	
#11 (34.9)	1⅝	**12⅜** (314)	**18⅝** (473)	**18⅝** (473)	**81,400** (362.1)	**9,596** (42.7)	**20,350** (90.5)	**23,870** (106.2)
		20⅝ (524)			**81,400** (362.1)	—	**20,350** (90.5)	

1. Allowable load must be the lesser of the load based on concrete edge distance or steel strength.
2. The allowable loads based on concrete edge distance are based on a safety factor of 4.0.
3. Refer to allowable load-adjustment factors for spacing and edge distance on pp. 71 and 72.
4. Refer to in-service temperature sensitivity chart for allowable load adjustment for temperature.
5. Anchors are permitted to be used within fire-resistive construction, provided the anchors resist wind or seismic loads only. For use in fire-resistive construction, the anchors can also be permitted to be used to resist gravity loads, provided special consideration has been given to fire-exposure conditions.

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* See p. 13 for an explanation of the load table icons.

SET Allowable Tension Loads for Threaded Rod Anchors in Sand-Lightweight Concrete

Rod Dia. in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing Dist. in. (mm)	Tension Load Based on Bond Strength			Tension Load Based on Steel Strength		
					f'_c ≥ 3,000 psi (20.7 MPa) Lightweight Concrete			F1554 Grade 36	A193 GR B7	F593 304SS
					Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)
⅜ (9.5)	½	1¾ (44)	2⅝ (67)	3½ (89)	2,400 (10.7)	540 (2.4)	600 (2.7)	2,105 (9.4)	4,535 (20.2)	3,630 (16.1)
		3½ (89)	5¼ (133)	7 (178)	6,220 (27.7)	422 (1.9)	1,555 (6.9)			
½ (12.7)	⅝	2⅛ (54)	3⅛ (79)	4¼ (108)	2,900 (12.9)	550 (2.4)	725 (3.2)	3,750 (16.7)	8,080 (35.9)	6,470 (28.8)
		4¼ (108)	6⅜ (162)	8½ (216)	6,720 (29.9)	1,087 (4.8)	1,680 (7.5)			
⅝ (15.9)	¾	2½ (64)	3¾ (95)	5 (127)	4,820 (21.4)	327 (1.5)	1,205 (5.4)	5,875 (26.1)	12,660 (56.3)	10,120 (45.0)
		5 (127)	7½ (191)	10 (254)	9,160 (40.7)	1,677 (7.5)	2,290 (10.2)			

1. Allowable load must be the lesser of the bond or steel strength.
2. The allowable loads listed under allowable bond are based on a safety factor of 4.0.
3. 100% of the allowable load is permitted at critical spacing. No reduction in spacing is allowed.
4. Refer to allowable load-adjustment factors for edge distance on p. 72.
5. Refer to in-service temperature sensitivity chart for allowable load adjustment for temperature.
6. Anchors are permitted to be used within fire-resistive construction, provided the anchors resist wind or seismic loads only. For use in fire-resistive construction, the anchors can also be permitted to be used to resist gravity loads, provided special consideration has been given to fire-exposure conditions.
7. Anchors are not permitted to resist tension forces in overhead or wall installations unless proper consideration is given to fire-exposure and elevated-temperature conditions.

SET Allowable Shear Loads for Threaded Rod Anchors in Sand-Lightweight Concrete

Rod Dia. in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing Dist. in. (mm)	Shear Load Based on Concrete Edge Distance			Shear Load Based on Steel Strength		
					f'_c ≥ 3,000 psi (20.7 MPa) Lightweight Concrete			F1554 Grade 36	A193 GR B7	F593 304SS
					Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)
⅜ (9.5)	½	1¾ (44)	2⅝ (67)	3½ (89)	2,364 (10.5)	129 (0.6)	590 (2.6)	1,085 (4.8)	2,340 (10.4)	1,870 (8.3)
		3½ (89)	5¼ (133)	7 (178)	5,784 (25.7)	547 (2.4)	1,445 (6.4)			
½ (12.7)	⅝	2⅛ (54)	3⅛ (79)	4¼ (108)	2,948 (13.1)	224 (1.0)	735 (3.3)	1,930 (8.6)	4,160 (18.5)	3,330 (14.8)
		4¼ (108)	6⅜ (162)	8½ (216)	8,436 (37.5)	891 (4.0)	2,110 (9.4)			
⅝ (15.9)	¾	2½ (64)	3¾ (95)	5 (127)	3,584 (15.9)	1,072 (4.8)	895 (4.0)	3,025 (13.5)	6,520 (29.0)	5,220 (23.2)
		5 (127)	7½ (191)	10 (254)	11,784 (52.4)	650 (2.9)	2,945 (13.1)			

1. Allowable load must be the lesser of the load based on concrete edge distance or steel strength.
2. The allowable loads based on concrete edge distance are based on a safety factor of 4.0.
3. 100% of the allowable load is permitted at critical spacing. No reduction in spacing is allowed.
4. Refer to allowable load-adjustment factors for edge distance on p. 72.
5. Refer to in-service temperature sensitivity chart for allowable load adjustment for temperature.
6. Anchors are permitted to be used within fire-resistive construction, provided the anchors resist wind or seismic loads only. For use in fire-resistive construction, the anchors can also be permitted to be used to resist gravity loads, provided special consideration has been given to fire-exposure conditions.

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* See p. 13 for an explanation of the load table icons.

SET Design Information — Masonry

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

IBC *

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 lb. (kN)	Allowable lb. (kN)	Ultimate lb. (kN)	Allowable lb. (kN)
Anchor Installed Anywhere on the Face of the CMU Wall (See Figure 1)									
½ (12.7)	⅝	**4¼** (108)	**17** (432)	**17** (432)	**17** (432)	**6,496** (28.9)	**1,300** (5.8)	**6,766** (30.1)	**1,355** (6.0)
⅝ (15.9)	¾	**5** (127)	**20** (508)	**20** (508)	**20** (508)	**8,232** (36.6)	**1,645** (7.3)	**13,676** (60.8)	**2,735** (12.2)
¾ (19.1)	⅞	**6¾** (171)	**27** (686)	**27** (686)	**27** (686)	**15,656** (69.6)	**3,130** (13.9)	**17,578** (78.2)	**3,515** (15.6)

1. Threaded rods must comply with ASTM F1554 Grade 36 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 1,500 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.
7. Refer to allowable load-adjustment factors for end distance, edge distance and spacing on p. 73.

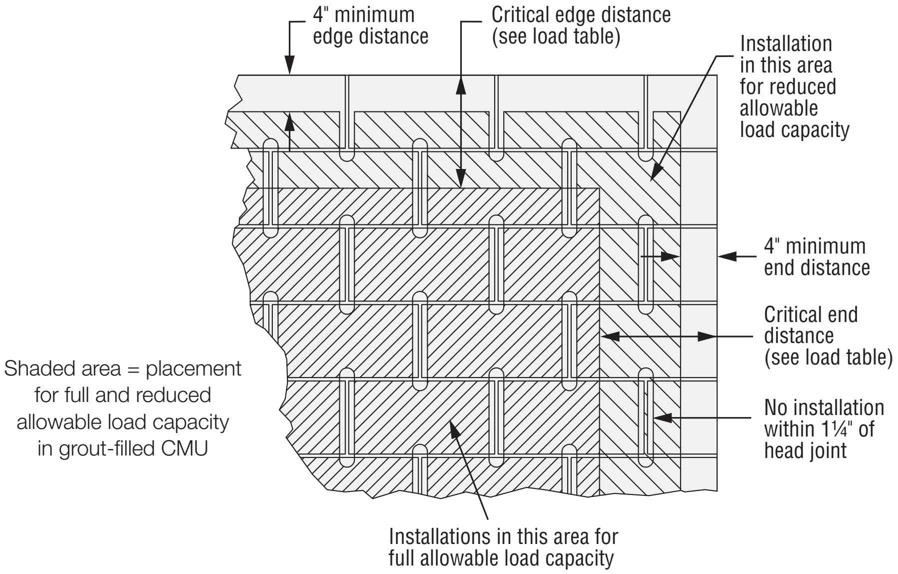

Figure 1

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* See p. 13 for an explanation of the load table icons.

SET Allowable Tension and Shear Loads for Threaded Rod Anchors in 6- and 8-inch Lightweight, Medium-Weight and Normal-Weight Grout-Filled CMU — Anchor Installed in Cell Opening (Top of Wall)

Rod Dia. in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Min. Edge Dist. in. (mm)	Min. End Dist. in. (mm)	Min. Spacing Dist. in. (mm)	6- and 8-inch Grout-Filled CMU Allowable Loads Based on CMU Strength			
						Tension		Shear	
						Ultimate lb. (kN)	Allowable lb. (kN)	Ultimate lb. (kN)	Allowable lb. (kN)
Allowable Tension and Shear Values EXCLUDING Earthquake Loads[1]									
⅝ (15.9)	¾	5 (127)	3 (76)	3½ (89)	20 (508)	12,573 (55.9)	2,515 (11.2)	9,530 (42.4)	1,905 (8.5)
¾ (19.1)	⅞	5 (127)	3 (76)	3½ (89)	20 (508)	—	2,515 (11.2)	—	1,905 (8.5)
⅞ (22.2)	1	12 (305)	2 (51)	3⅞ (98)	48 (1,219)	8,908 (39.6)	1,780 (7.9)	—	—
Allowable Tension and Shear Values INCLUDING Earthquake Loads[2]									
⅝ (15.9)	¾	5 (127)	3 (76)	3½ (89)	20 (508)	6,500 (28.9)	1,300 (5.8)	6,780 (30.2)	1,355 (6.0)
¾ (19.1)	⅞	5 (127)	3 (76)	3½ (89)	20 (508)	—	1,300 (5.8)	—	1,355 (6.0)

1. Allowable tension and shear values EXCLUDING earthquake loads may not be increased for wind forces.
2. Allowable tension and shear values INCLUDING earthquake loads may be increased 33⅓% for wind forces or seismic forces where permitted by code.
3. Also see notes 1–3 and 5–7 on next page.

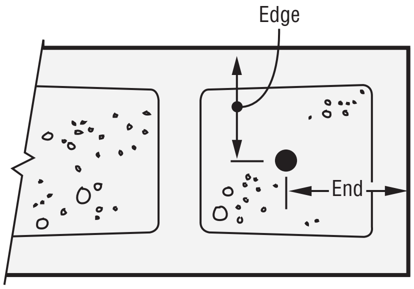

Figure 2. Anchor Installed in Cell Opening (Top of Wall)

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* See p. 13 for an explanation of the load table icons.

SET Design Information — Masonry

SET Allowable Tension and Shear Loads for Threaded Rod Anchors in Lightweight, Medium-Weight and Normal-Weight Hollow CMU

Rod Dia. in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Min. Edge Dist. in. (mm)	Min. End Dist. in. (mm)	6- and 8-inch Hollow CMU Allowable Loads Based on CMU Strength			
					Tension		Shear	
					Ultimate lb. (kN)	Allowable lb. (kN)	Ultimate lb. (kN)	Allowable lb. (kN)
Anchor Installed in Face Shell with Simpson Strong-Tie® Epoxy Carbon-Steel Screen Tube								
⅝ (15.9)	⅞	3½ (88.9)	4 (101.6)	4⅝ (117.5)	881 (3.9)	175 (0.8)	1,440 (6.4)	290 (1.3)
¾ (19.1)	1	3½ (88.9)	4 (101.6)	4⅝ (117.5)	—	175 (0.8)	—	290 (1.3)

1. Threaded rods must comply with ASTM F1554 Grade 36 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 1,500 psi.
3. Embedment depth is measured from the outside face of the concrete masonry unit for installations through a face shell.
4. Allowable loads may not be increased for short-term loading due to wind forces or seismic forces.
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.
7. Anchors must be spaced a minimum distance of four times the anchor embedment.
8. Set drill to rotation-only mode when drilling into hollow CMU.

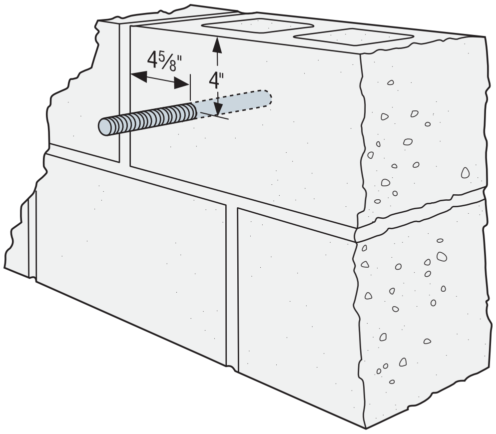

Figure 3. Anchor Installed in Face Shell with Screen Tube in Hollow Cell

Adhesive Anchors

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* See p. 13 for an explanation of the load table icons.

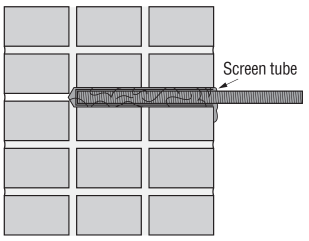
SET Design Information — Masonry

SET Allowable Tension and Shear Loads for Installations in Unreinforced Brick Masonry Walls — Minimum URM Wall Thickness is 13" (3 wythes thick)

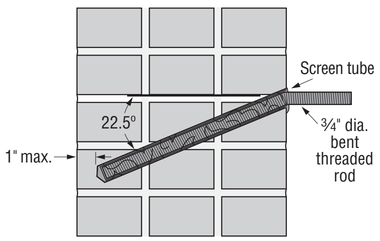
IBC *

Rod/Rebar Dia./Size in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Min. Edge/End Dist. in. (mm)	Min. Vertical Spacing Dist. in. (mm)	Min. Horiz. Spacing Dist. in. (mm)	Tension Load Based on URM Strength Allowable lb. (kN)	Shear Load Based on URM Strength Allowable lb. (kN)
Configuration A (Simpson Strong-Tie® ETS Screen Tube Required)							
¾ (19.1)	1	8 (203)	16 (406)	16 (406)	16 (406)	—	1,000 (4.4)
#5 (15.9)	1	8 (203)	16 (406)	16 (406)	16 (406)	—	750 (3.3)
#6 (19.1)	1	8 (203)	16 (406)	16 (406)	16 (406)	—	1,000 (4.4)
Configuration B (Simpson Strong-Tie ETS Screen Tube Required)							
¾ (19.1)	1	13 (330)	16 (406)	16 (406)	16 (406)	1,200 (5.3)	1,000 (4.4)
Configuration C (Simpson Strong-Tie ETS Screen Tube and AST Steel Sleeve Required)							
⅝ (15.9)	1	**	16 (406)	16 (406)	16 (406)	1,200 (5.3)	750 (3.3)

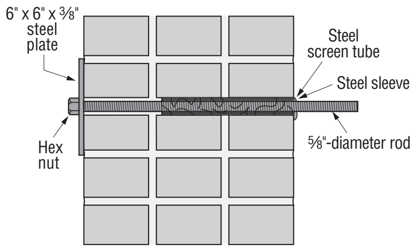
1. Threaded rods must comply with ASTM F1554 Grade 36 minimum.
2. All holes are drilled with a 1" diameter carbide-tipped drill bit with the drill set in the rotation-only mode.
3. The unreinforced brick walls must have a minimum thickness of 13 inches (three wythes of brick).
4. The allowable load is applicable only where in-place shear tests indicate minimum net mortar strength of 50 psi. For installations using a wet diamond core-drill bit, the allowable load is applicable only where in-place shear tests indicate minimum net mortar strength of 325 psi.
5. The allowable load for Configuration B and C anchors subjected to a combined tension and shear load is determined by assuming a straight-line relationship between allowable tension and shear.
6. The anchors installed in unreinforced brick walls are limited to resisting seismic or wind forces only.
7. Configuration A has a straight threaded rod or rebar embedded 8 inches into the wall with a 31/32" diameter by 8-inch long screen tube (part # ETS758). This configuration is designed to resist shear loads only.
8. Configuration B has a ¾" threaded rod bent and installed at a 22.5-degree angle and installed 13 inches into the wall, to within 1-inch (maximum) of the exterior wall surface. This configuration is designed to resist tension and shear loads. The pre-bent threaded rod is installed with a 31/32" diameter by 13-inch long screen tube (part # ETS7513).
9. Configuration C is designed to resist tension and shear forces. It consists of a ⅝" diameter, ASTM F1554 Grade 36 threaded rod and an 8" long sleeve (part # AST800) and a 31/32" diameter by 8-inch long screen tube (part # ETS758). The steel sleeve has a plastic plug in one end. A 6" by 6" by ⅜" thick ASTM A 36 steel plate is located on the back face of the wall.
10. Special inspection requirements are determined by local jurisdiction and must be confirmed by the local building official.
11. Refer to in-service temperature sensitivity chart for allowable load adjustment for temperature.



Configuration A (Shear)



Configuration B (Tension and Shear)



Configuration C (Tension and Shear)

Installation Instructions for Configuration C

1. Drill hole perpendicular to the wall to a depth of 8" with a 1" diameter carbide-tipped drill bit (rotation only mode).
2. Clean hole with oil-free compressed air and a nylon brush.
3. Fill 8" steel screen tube with mixed adhesive and insert into hole.
4. Insert steel sleeve slowly into screen tube (adhesive will displace).
5. Allow adhesive to cure (see cure schedule).
6. Drill through plastic plug in (inside) end of steel sleeve with ⅝" bit.
7. Drill completely through the wall with ⅝" carbide tipped concrete drill bit (rotation mode only).
8. Insert ⅝" rod through hole and attach metal plate and nut.

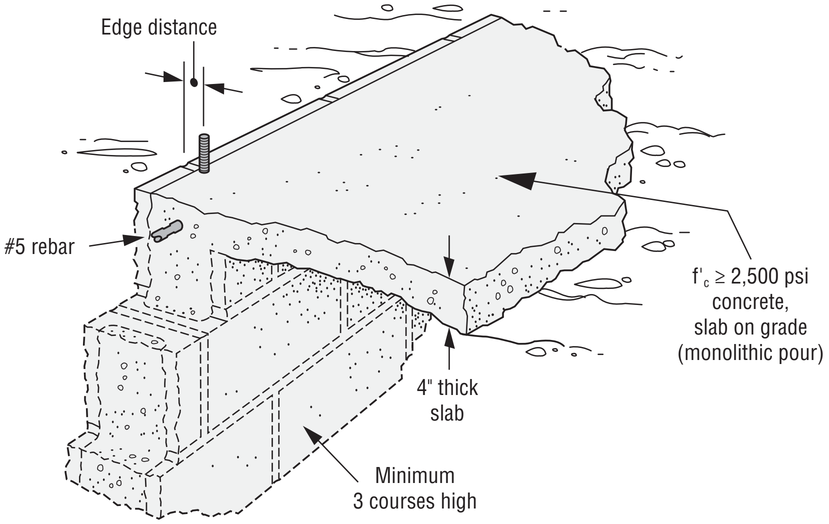
* See p. 13 for an explanation of the load table icons.

SET Design Information — Masonry

SET Allowable Tension Loads for Threaded Rod Anchors in 8" Lightweight, Medium-Weight and Normal-Weight CMU Chair Blocks Filled with Normal-Weight Concrete

Rod Dia. in. (mm)	Drill Bit Dia. in.	Min. Embed. Depth in. (mm)	Min. Edge Dist. in. (mm)	Critical Spacing Dist. in. (mm)	8-inch Concrete-Filled CMU Chair Block	
					Allowable Tension Loads Based on CMU Strength	
					Ultimate lb. (kN)	Allowable lb. (kN)
½ (12.7)	⅝	4½ (114)	1¾ (44.5)	18 (457)	4,810 (21.4)	960 (4.3)
		7 (178)	1¾ (44.5)	28 (711)	7,715 (34.3)	1,545 (6.9)
⅝ (15.9)	¾	4½ (114)	1¾ (44.5)	18 (457)	4,955 (22.0)	990 (4.4)
		7 (178)	1¾ (44.5)	28 (711)	7,600 (33.8)	1,520 (6.8)
		12 (305)	1¾ (44.5)	48 (1,219)	12,200 (54.4)	2,440 (10.9)

1. Threaded rods must comply with ASTM F1554 Grade 36 minimum.
2. Values are for 8-inch-wide concrete masonry units CMU filled with concrete with minimum compressive strength of 2,500 psi and poured monolithically with the floor slab.
3. Center #5 rebar in CMU cell and concrete slab as shown.
4. The tabulated allowable loads are based on a safety factor of 5.0.



* See p. 13 for an explanation of the load table icons.

SET Design Information — Concrete

SET Allowable Load-Adjustment Factors in Normal-Weight Concrete: Edge Distance, Tension Load

How to use these charts

1. The following tables are for reduced edge distance.
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 edge distance (c_{act}) at which the anchor is to be installed.
5. The load-adjustment factor (f_c) 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 are multiplied together.
8. Adjustment factors do not apply to allowable steel strength values.
9. Adjustment factors are to be applied to allowable tension load based on bond strength values only.

Edge Distance Tension (f_c)

*

Edge Dist. c_{act} (in.)	**Dia.**	**⅜**			**½**			**⅝**			**¾**		
	Rebar					**#4**			**#5**			**#6**	
	E	**1¾**	**3½**	**4½**	**2⅛**	**4¼**	**6**	**2½**	**5**	**9⅜**	**3⅜**	**6¾**	**11¼**
	c_{cr}	**2⅝**	**5¼**	**6¾**	**3¼**	**6⅜**	**9**	**3¾**	**7½**	**14⅛**	**5⅛**	**10⅛**	**16⅞**
	c_{min}	**1¾**	**1¾**	**1¾**	**1¾**	**1¾**	**1¾**	**1¾**	**1¾**	**1¾**	**1¾**	**1¾**	**1¾**
	f_{cmin}	**0.65**	**0.65**	**0.69**	**0.65**	**0.65**	**0.59**	**0.48**	**0.48**	**0.64**	**0.48**	**0.48**	**0.57**
1¾		0.65	0.65	0.69	0.65	0.65	0.59	0.48	0.48	0.64	0.48	0.48	0.57
2		0.75	0.68	0.71	0.71	0.67	0.60	0.55	0.50	0.65	0.52	0.50	0.58
3		1.00	0.78	0.77	0.95	0.74	0.66	0.81	0.59	0.68	0.68	0.56	0.61
4			0.88	0.83	1.00	0.82	0.72	1.00	0.68	0.71	0.83	0.62	0.63
5			0.98	0.89		0.90	0.77		0.77	0.73	0.99	0.68	0.66
6			1.00	0.95		0.97	0.83		0.86	0.76	1.00	0.74	0.69
7				1.00		1.00	0.89		0.95	0.79		0.81	0.72
8							0.94		1.00	0.82		0.87	0.75
9							1.00			0.85		0.93	0.78
10										0.88		0.99	0.80
11										0.91		1.00	0.83
12										0.94			0.86
14										1.00			0.92
16													0.98
17													1.00

See notes on the next page.

Edge Distance Tension (f_c) (continued)

*

Edge Dist. c_{act} (in.)	**Dia.**	**⅞**			**1**			**1⅛**			**1¼**				
	Rebar		**#7**			**#8**			**#9**			**#10**		**#11**	
	E	**3⅞**	**7¾**	**13⅛**	**4½**	**9**	**15**	**5⅛**	**10⅛**	**16⅞**	**5⅝**	**11¼**	**18¾**	**12⅜**	**20⅝**
	c_{cr}	**5⅞**	**11⅝**	**19⅝**	**6¾**	**13½**	**22½**	**7¾**	**15¼**	**25⅜**	**8½**	**16⅞**	**28⅛**	**28⅛**	**28⅛**
	c_{min}	**1¾**	**1¾**	**1¾**	**1¾**	**1¾**	**1¾**	**2¾**	**2¾**	**2¾**	**2¾**	**2¾**	**2¾**	**2¾**	**2¾**
	f_{cmin}	**0.48**	**0.48**	**0.52**	**0.48**	**0.48**	**0.47**	**0.58**	**0.58**	**0.51**	**0.58**	**0.58**	**0.51**	**0.58**	**0.51**
1¾		0.48	0.48	0.52	0.48	0.48	0.47								
2¾		0.61	0.53	0.55	0.58	0.52	0.50	0.58	0.58	0.51	0.58	0.58	0.51	0.58	0.51
4		0.77	0.60	0.58	0.71	0.58	0.53	0.69	0.62	0.54	0.67	0.62	0.53	0.61	0.53
6		1.00	0.70	0.63	0.92	0.67	0.58	0.85	0.69	0.58	0.82	0.68	0.57	0.67	0.57
8			0.81	0.69	1.00	0.76	0.63	1.00	0.76	0.62	0.97	0.74	0.61	0.72	0.61
10			0.91	0.74		0.85	0.68		0.82	0.67	1.00	0.80	0.65	0.77	0.65
12			1.00	0.80		0.93	0.73		0.89	0.71		0.86	0.69	0.82	0.69
14				0.85		1.00	0.78		0.96	0.75		0.91	0.73	0.88	0.73
16				0.90			0.83		1.00	0.80		0.97	0.77	0.93	0.77
18				0.96			0.89			0.84		1.00	0.80	0.98	0.81
20				1.00			0.94			0.88			0.84	1.00	0.84
24							1.00			0.97			0.92		0.92
28										1.00			1.00		1.00

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* See p. 13 for an explanation of the load table icons.

SET Allowable Load-Adjustment Factors in Normal-Weight Concrete: Edge Distance, Shear Load

How to use these charts

1. The following tables are for reduced edge distance.
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 edge distance (c_{act}) at which the anchor is to be installed.
5. The load-adjustment factor (f_c) 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 are multiplied together.
8. Adjustment factors do not apply to allowable steel strength values.
9. Adjustment factors are to be applied to allowable shear load based on concrete edge distance values only.

Edge Distance Shear (f_c)

*

Edge Dist. c_{act} (in.)	Dia.	⅜			½			½	⅝			⅝	¾			¾
	Rebar						#4				#5				#6	
	E	1¾	3½	4½	2⅛	4¼	4¼	6	2½	5	5	9⅜	3⅜	6¾	6¾	11¼
	c_{cr}	5¼	5¼	5¼	6⅜	6⅜	6⅜	6⅜	7½	7½	7½	7½	10⅛	10⅛	10⅛	10⅛
	c_{min}	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾
	f_{cmin}	**0.49**	**0.32**	**0.35**	**0.37**	**0.20**	**0.25**	**0.24**	**0.18**	**0.15**	**0.21**	**0.19**	**0.16**	**0.16**	**0.18**	**0.15**
1¾		0.49	0.32	0.35	0.37	0.20	0.25	0.24	0.18	0.15	0.21	0.19	0.16	0.16	0.18	0.15
2		0.53	0.37	0.40	0.40	0.24	0.29	0.28	0.22	0.19	0.24	0.23	0.19	0.19	0.20	0.18
3		0.67	0.56	0.58	0.54	0.42	0.45	0.45	0.36	0.33	0.38	0.37	0.29	0.29	0.30	0.28
4		0.82	0.76	0.77	0.68	0.59	0.61	0.61	0.50	0.48	0.52	0.51	0.39	0.39	0.40	0.38
5		0.96	0.95	0.95	0.81	0.76	0.78	0.77	0.64	0.63	0.66	0.65	0.49	0.49	0.50	0.48
6		1.00	1.00	1.00	0.95	0.94	0.94	0.94	0.79	0.78	0.79	0.79	0.59	0.59	0.60	0.58
7					1.00	1.00	1.00	1.00	0.93	0.93	0.93	0.93	0.69	0.69	0.69	0.68
8									1.00	1.00	1.00	1.00	0.79	0.79	0.79	0.78
9													0.89	0.89	0.89	0.89
10													0.99	0.99	0.99	0.99
11													1.00	1.00	1.00	1.00

See notes below.

Edge Distance Shear (f_c) (continued)

*

Edge Dist. c_{act} (in.)	Dia.	⅞			⅞	1			1	1⅛			1¼				
	Rebar			#7				#8			#9			#10		#11	
	E	3⅞	7¾	7¾	13⅛	4½	9	9	15	5⅛	10⅛	16⅞	5⅝	11¼	18¾	12⅜	20⅝
	c_{cr}	11⅝	11⅝	11⅝	11⅝	13½	13½	13½	13½	15¼	15¼	15¼	16⅞	16⅞	16⅞	18⅝	18⅝
	c_{min}	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	2¾	2¾	2¾	2¾	2¾	2¾	2¾	2¾
	f_{cmin}	**0.14**	**0.13**	**0.14**	**0.10**	**0.14**	**0.10**	**0.12**	**0.10**	**0.17**	**0.16**	**0.12**	**0.17**	**0.16**	**0.12**	**0.16**	**0.12**
1¾		0.14	0.13	0.14	0.10	0.14	0.10	0.12	0.10								
2¾		0.23	0.22	0.23	0.19	0.21	0.18	0.19	0.18	0.17	0.16	0.12	0.17	0.16	0.12	0.16	0.12
3		0.25	0.24	0.25	0.21	0.23	0.20	0.21	0.20	0.19	0.18	0.14	0.18	0.17	0.14	0.17	0.13
4		0.34	0.33	0.34	0.31	0.30	0.27	0.29	0.27	0.25	0.24	0.21	0.24	0.23	0.20	0.23	0.19
5		0.42	0.42	0.42	0.40	0.38	0.35	0.36	0.35	0.32	0.31	0.28	0.30	0.29	0.26	0.28	0.24
6		0.51	0.50	0.51	0.49	0.45	0.43	0.44	0.43	0.39	0.38	0.35	0.36	0.35	0.32	0.33	0.30
7		0.60	0.59	0.60	0.58	0.52	0.50	0.51	0.50	0.45	0.45	0.42	0.42	0.41	0.38	0.38	0.36
8		0.68	0.68	0.68	0.67	0.60	0.58	0.59	0.58	0.52	0.51	0.49	0.48	0.47	0.45	0.44	0.41
9		0.77	0.77	0.77	0.76	0.67	0.66	0.66	0.66	0.59	0.58	0.56	0.54	0.53	0.51	0.49	0.47
10		0.86	0.86	0.86	0.85	0.74	0.73	0.74	0.73	0.65	0.65	0.63	0.60	0.59	0.57	0.54	0.52
11		0.95	0.94	0.95	0.94	0.82	0.81	0.81	0.81	0.72	0.71	0.70	0.65	0.65	0.63	0.60	0.58
12		1.00	1.00	1.00	1.00	0.89	0.89	0.89	0.89	0.78	0.78	0.77	0.71	0.71	0.70	0.65	0.63
13						0.96	0.96	0.96	0.96	0.85	0.85	0.84	0.77	0.77	0.76	0.70	0.69
14						1.00	1.00	1.00	1.00	0.92	0.92	0.91	0.83	0.83	0.82	0.76	0.74
15										0.98	0.98	0.98	0.89	0.89	0.88	0.81	0.80
16										1.00	1.00	1.00	0.95	0.95	0.95	0.86	0.85
17													1.00	1.00	1.00	0.91	0.91
18⅝																1.00	1.00

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

* See p. 13 for an explanation of the load table icons.

SET Design Information — Concrete

SET Allowable Load-Adjustment Factors in Normal-Weight Concrete: Spacing, Tension Load

How to use these charts

1. The following tables are for reduced 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 spacing (s_{act}) at which the anchor is to be installed.
5. The load-adjustment factor (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 spacings are multiplied together.
8. Adjustment factors do not apply to allowable steel strength values.
9. Adjustment factors are to be applied to allowable tension load based on bond strength values only.

Spacing Tension (f_s)

*

s_{act} (in.)	Dia.	⅜			½			⅝			¾		
	Rebar					#4			#5			#6	
	E	1¾	3½	4½	2⅛	4¼	6	2½	5	9⅜	3⅜	6¾	11¼
	s_{cr}	7	14	18	8½	17	24	10	20	37½	13½	27	45
	s_{min}	⅞	1¾	2¼	1⅛	2⅛	3	1¼	2½	4¾	1¾	3⅜	5⅝
	f_{smin}	**0.52**	**0.89**	**0.90**	**0.52**	**0.89**	**0.90**	**0.52**	**0.89**	**0.90**	**0.52**	**0.89**	**0.90**
⅞		0.52											
1		0.53											
2		0.61	0.89		0.58			0.56			0.53		
4		0.76	0.91	0.91	0.71	0.90	0.90	0.67	0.90		0.61	0.89	
6		0.92	0.93	0.92	0.84	0.92	0.91	0.78	0.91	0.90	0.69	0.90	0.90
8		1.00	0.95	0.94	0.97	0.93	0.92	0.89	0.92	0.91	0.78	0.91	0.91
10			0.96	0.95	1.00	0.95	0.93	1.00	0.94	0.92	0.86	0.92	0.91
12			0.98	0.96		0.96	0.94		0.95	0.92	0.94	0.93	0.92
14			1.00	0.97		0.98	0.95		0.96	0.93	1.02	0.94	0.92
16				0.99		0.99	0.96		0.97	0.93		0.95	0.93
18				1.00		1.00	0.97		0.99	0.94		0.96	0.93
20							0.98		1.00	0.95		0.97	0.94
24							1.00			0.96		0.99	0.95
28										0.97		1.00	0.96
32										0.98			0.97
36										1.00			0.98
40										1.00			0.99
45													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. $f_s = f_{smin} + [(1 - f_{smin}) (s_{act} - s_{min}) / (s_{cr} - s_{min})]$

Spacing Tension (f_s) (continued)

*

s_{act} (in.)	Dia.	⅞			1			1⅛			1¼				
	Rebar		#7			#8			#9			#10		#11	
	E	3⅞	7¾	13⅛	4½	9	15	5⅛	10⅛	16⅞	5⅝	11¼	18¾	12⅜	20⅝
	s_{cr}	15½	31	52½	18	36	60	20½	40½	67½	22½	45	75	49½	82½
	s_{min}	2	3⅞	6⅝	2¼	4½	7½	2⅝	5⅛	8½	2⅞	5⅝	9⅜	6¼	10⅜
	f_{smin}	**0.52**	**0.89**	**0.90**	**0.52**	**0.89**	**0.90**	**0.52**	**0.89**	**0.90**	**0.52**	**0.89**	**0.90**	**0.89**	**0.90**
2		0.52													
3		0.56			0.54			0.53			0.52				
4		0.59	0.89		0.57			0.56			0.55				
5		0.63	0.89		0.60	0.89		0.58			0.57				
6		0.66	0.90		0.63	0.90		0.61	0.89		0.60	0.89			
8		0.73	0.91	0.90	0.70	0.90	0.90	0.66	0.90		0.65	0.90		0.89	
10		0.80	0.91	0.91	0.76	0.91	0.90	0.72	0.91	0.90	0.69	0.90	0.90	0.90	
12		0.88	0.92	0.91	0.82	0.92	0.91	0.77	0.91	0.91	0.74	0.91	0.90	0.90	0.90
14		0.95	0.93	0.92	0.88	0.92	0.91	0.83	0.92	0.91	0.79	0.91	0.91	0.91	0.91
16		1.00	0.94	0.92	0.94	0.93	0.92	0.88	0.92	0.91	0.84	0.92	0.91	0.91	0.91
20			0.96	0.93	1.00	0.94	0.92	0.99	0.94	0.92	0.94	0.93	0.92	0.92	0.91
24			0.97	0.94		0.96	0.93	1.00	0.95	0.93	1.00	0.94	0.92	0.94	0.92
28			0.99	0.95		0.97	0.94		0.96	0.93		0.95	0.93	0.95	0.92
32			1.00	0.96		0.99	0.95		0.97	0.94		0.96	0.93	0.96	0.93
36				0.96		1.00	0.95		0.99	0.95		0.97	0.94	0.97	0.94
40				0.97			0.96		1.00	0.95		0.99	0.95	0.98	0.94
50				0.99			0.98			0.97		1.00	0.96	1.00	0.95
60				1.00			1.00			0.99			0.98		0.97
70										1.00			0.99		0.98
75													1.00		0.99
82½															1.00

See notes above.

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* See p. 13 for an explanation of the load table icons.

SET Design Information — Concrete

SET Allowable Load-Adjustment Factors in Normal-Weight Concrete: Spacing, Shear Load

How to use these charts

1. The following tables are for reduced 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 spacing (s_{act}) at which the anchor is to be installed.
5. The load-adjustment factor (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 spacings are multiplied together.
8. Adjustment factors do not apply to allowable steel strength values.
9. Adjustment factors are to be applied to allowable shear load based on concrete edge distance values only.

Spacing Shear (f_s)

*

s_{act} (in.)	Dia.	3⁄8		1⁄2		5⁄8		3⁄4		7⁄8		1		1 1⁄8		1 1⁄4		
	Rebar				**#4**		**#5**		**#6**		**#7**		**#8**		**#9**		**#10**	**#11**
	E	**1 3⁄4**	**3 1⁄2**	**2 1⁄8**	**4 1⁄4**	**2 1⁄2**	**5**	**3 3⁄8**	**6 3⁄4**	**3 7⁄8**	**7 3⁄4**	**4 1⁄2**	**9**	**5 1⁄8**	**10 1⁄8**	**5 5⁄8**	**11 1⁄4**	**12 3⁄8**
	s_{cr}	**2 5⁄8**	**5 1⁄4**	**3 1⁄4**	**6 3⁄8**	**3 3⁄4**	**7 1⁄2**	**5 1⁄8**	**10 1⁄8**	**5 7⁄8**	**11 5⁄8**	**6 3⁄4**	**13 1⁄2**	**7 3⁄4**	**15 1⁄4**	**8 1⁄2**	**16 7⁄8**	**18 5⁄8**
	s_{min}	**7⁄8**	**1 3⁄4**	**1 1⁄8**	**2 1⁄8**	**1 1⁄4**	**2 1⁄2**	**1 3⁄4**	**3 3⁄8**	**2**	**3 7⁄8**	**2 1⁄4**	**4 1⁄2**	**2 5⁄8**	**5 1⁄8**	**2 7⁄8**	**5 5⁄8**	**6 1⁄4**
	f_{smin}	**0.90**	**0.83**	**0.90**	**0.83**	**0.90**	**0.83**	**0.90**	**0.83**	**0.90**	**0.83**	**0.90**	**0.83**	**0.90**	**0.83**	**0.90**	**0.83**	**0.83**
7⁄8		0.90																
1		0.91																
1 1⁄2		0.94		0.92		0.91												
2		0.96	0.84	0.94		0.93		0.91		0.90								
2 1⁄2		0.99	0.87	0.96	0.85	0.95	0.83	0.92		0.91		0.91						
3		1.00	0.89	0.99	0.87	0.97	0.85	0.94		0.93		0.92		0.91		0.90		
3 1⁄2			0.92	1.00	0.89	0.99	0.86	0.95	0.83	0.94		0.93		0.92		0.91		
4			0.94		0.91	1.00	0.88	0.97	0.85	0.95	0.83	0.94		0.93		0.92		
5			0.99		0.95		0.92	1.00	0.87	0.98	0.85	0.96	0.84	0.95		0.94		
6			1.00		0.99		0.95		0.90	1.00	0.88	0.98	0.86	0.97	0.84	0.96	0.84	
7					1.00		0.98		0.92		0.90	1.00	0.88	0.99	0.86	0.97	0.85	0.84
8							1.00		0.95		0.92		0.90	1.00	0.88	0.99	0.87	0.85
9									0.97		0.94		0.92		0.90	1.00	0.88	0.87
10									1.00		0.96		0.93		0.91		0.90	0.88
12											1.00		0.97		0.95		0.93	0.91
14													1.00		0.98		0.96	0.94
16															1.00		0.99	0.96
17																	1.00	0.98
18 5⁄8																		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. $f_s = f_{smin} + [(1 - f_{smin}) (s_{act} - s_{min}) / (s_{cr} - s_{min})]$.

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* See p. 13 for an explanation of the load table icons.

SET Design Information — Concrete

SET Allowable Load-Adjustment Factors in Sand-Lightweight Concrete: Edge Distance, Tension and Shear Loads

How to use these charts

1. The following tables are for reduced edge distance only.
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 edge distance (c_{act}) at which the anchor is to be installed.
5. The load-adjustment factor (f_c) 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 are multiplied together.
8. Adjustment factors do not apply to allowable steel strength values.
9. Adjustment factors are to be applied to allowable tension load based on bond strength values or allowable shear load based on concrete edge distance values only.

Edge Distance Tension (f_c)

IBC LW *

Edge Dist. c_{act} (in.)	Dia.	⅜		½		⅝	
	E	1¾	3½	2⅛	4¼	2½	5
	c_{cr}	2⅝	5¼	3⅛	6⅜	3¾	7½
	c_{min}	1¾	1¾	1¾	1¾	1¾	1¾
	f_{cmin}	**0.65**	**0.65**	**0.65**	**0.65**	**0.48**	**0.48**
1¾		0.65	0.65	0.65	0.65	0.48	0.48
2		0.75	0.68	0.71	0.67	0.55	0.50
2¼		0.85	0.70	0.78	0.69	0.61	0.53
2½		0.95	0.73	0.84	0.71	0.68	0.55
2¾		1.00	0.75	0.90	0.73	0.74	0.57
3			0.78	0.97	0.74	0.81	0.59
3¼			0.80	1.00	0.76	0.87	0.62
3½			0.83		0.78	0.94	0.64
3¾			0.85		0.80	1.00	0.66
4			0.88		0.82		0.68
4¼			0.90		0.84		0.71
4½			0.93		0.86		0.73
4¾			0.95		0.88		0.75
5			0.98		0.90		0.77
5¼			1.00		0.91		0.80
5½					0.93		0.82
5¾					0.95		0.84
6					0.97		0.86
6¼					0.99		0.89
6½					1.00		0.91
6¾							0.93
7							0.95
7¼							0.98
7½							1.00

Edge Distance Shear (f_c)

IBC LW *

Edge Dist. c_{act} (in.)	Dia.	⅜		½		⅝	
	E	1¾	3½	2⅛	4¼	2½	5
	c_{cr}	2⅝	5¼	3⅛	6⅜	3¾	7½
	c_{min}	1¾	1¾	1¾	1¾	1¾	1¾
	f_{cmin}	**0.25**	**0.25**	**0.20**	**0.20**	**0.15**	**0.15**
1¾		0.25	0.25	0.20	0.20	0.15	0.15
2		0.46	0.30	0.35	0.24	0.26	0.19
2¼		0.68	0.36	0.49	0.29	0.36	0.22
2½		0.89	0.41	0.64	0.33	0.47	0.26
2¾		1.00	0.46	0.78	0.37	0.58	0.30
3			0.52	0.93	0.42	0.68	0.33
3¼			0.57	1.00	0.46	0.79	0.37
3½			0.63		0.50	0.89	0.41
3¾			0.68		0.55	1.00	0.45
4			0.73		0.59		0.48
4¼			0.79		0.63		0.52
4½			0.84		0.68		0.56
4¾			0.89		0.72		0.59
5			0.95		0.76		0.63
5¼			1.00		0.81		0.67
5½					0.85		0.70
5¾					0.89		0.74
6					0.94		0.78
6¼					0.98		0.82
6½					1.00		0.85
6¾							0.89
7							0.93
7¼							0.96
7½							1.00

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

* See p. 13 for an explanation of the load table icons.

SET Allowable Load-Adjustment Factors 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 Distance Tension (f_c)

IBC *

c_{act} (in.)	Dia.	½	⅝	¾
	E	4¼	5	6¾
	c_{cr}	17	20	27
	c_{min}	4	4	4
	f_{cmin}	1.00	0.84	0.54**
4		1.00	0.84	0.54
8		1.00	0.88	0.62
12		1.00	0.92	0.70
16		1.00	0.96	0.78
17		1.00	0.97	0.80
20			1.00	0.86
24				0.94
27				1.00

See notes below.

Edge Distance Tension (f_c)

IBC *

c_{act} (in.)	Dia.	½	⅝	¾
	E	4¼	5	6¾
	c_{cr}	17	20	27
	c_{min}	4	4	4
	f_{cmin}	1.00	0.84	0.54**
4		1.00	0.84	0.54
8		1.00	0.88	0.62
12		1.00	0.92	0.70
16		1.00	0.96	0.78
17		1.00	0.97	0.80
20			1.00	0.86
24				0.94
27				1.00

See notes below.

** The allowable tension load reduction factor is permitted to equal 1.0 provided both of the following conditions are met: (a) The anchor is installed with a minimum end distance, C_{min}, between 4 inches and 8 inches; and (b) a masonry return wall of identical construction is on the opposite side (such as two masonry walls intersecting at a building corner).

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

IBC *

c_{act} (in.)	Dia.	½	⅝	¾
	E	4¼	5	6¾
	c_{cr}	17	20	27
	c_{min}	4	4	4
	f_{cmin}	0.43	0.25	0.25
4		0.43	0.25	0.25
8		0.61	0.44	0.38
12		0.78	0.63	0.51
16		0.96	0.81	0.64
17		1.00	0.86	0.67
20			1.00	0.77
24				0.90
27				1.00

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

IBC *

c_{act} (in.)	Dia.	½	⅝	¾
	E	4¼	5	6¾
	c_{cr}	17	20	27
	c_{min}	4	4	4
	f_{cmin}	0.95	0.51	0.45
4		0.95	0.51	0.45
8		0.97	0.63	0.55
12		0.98	0.76	0.64
16		1.00	0.88	0.74
17		1.00	0.91	0.76
20			1.00	0.83
24				0.93
27				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. $f_c = f_{cmin} + [(1 - fcmin)\,(c_{act} - c_{min}) / (c_{cr} - c_{min})]$.

Spacing Tension (f_s)

IBC *

s_{act} (in.)	Dia.	½	⅝	¾
	E	4¼	5	6¾
	s_{cr}	17	20	27
	s_{min}	8	8	8
	f_{smin}	0.89	0.81	0.59
8		0.89	0.81	0.59
12		0.94	0.87	0.68
16		0.99	0.94	0.76
17		1.00	0.95	0.78
20			1.00	0.85
24				0.94
27				1.00

Spacing Shear (f_s)

IBC *

s_{act} (in.)	Dia.	½	⅝	¾
	E	4¼	5	6¾
	s_{cr}	17	20	27
	s_{min}	8	8	8
	f_{smin}	1.00	1.00	1.00
8		1.00 for all spacing ≥ 8 in.		
12				
16				
17				
20				
24				
27				

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. $f_s = f_{smin} + [(1 - f_{smin})\,(s_{act} - s_{min}) / (s_{cr} - s_{min})]$.

* See p. 13 for an explanation of the load table icons.

AT-XP® High-Strength Acrylic Adhesive

Formulated for high-strength anchorage of threaded rod and rebar into cracked and uncracked concrete and masonry under a wide range of conditions, AT-XP adhesive dispenses easily in cold or warm environments and in below-freezing temperatures with no need to warm the cartridge. When mixed properly, this low-odor formula is a dark teal color for easy post-installation identification.

Features

- Passed the demanding ICC-ES AC308 adverse-condition tests pertaining to reduced and elevated temperatures and long-term sustained loads
- Tested per ACI 355.4 and AC308
- Code listed under the IBC/IRC for cracked and uncracked concrete per IAPMO UES ER-263 and City of L.A. RR25960
- Code listed under the IBC/IRC for masonry per IAPMO UES ER-281 and City of L.A. RR25966
- AT-XP is code listed for installation with the Speed Clean™ DXS system without any further cleaning (AT-XP: IAPMO-UES ER-263)
- 10:1 two-component high-strength, acrylic-based anchoring adhesive
- Suitable for use under static and seismic loading conditions in cracked and uncracked concrete as well as masonry
- Easy hole-cleaning procedure — no power-brushing required
- Suitable for use in dry or water-saturated concrete
- For best results, store between 14°F (–10°C) and 80°F (27°C)
- Cures in substrate temperatures as low as 14°F (–10°C) in 24 hours or less
- Available in 9.4 oz., 12.5 oz. and 30 oz. cartridges for application versatility
- Volatile Organic Compound (VOC) — 30 g/L
- Manufactured in the USA using global materials

AT-XP Adhesive

Applications

- Threaded rod anchoring and rebar doweling into concrete and masonry
- Suitable for horizontal, vertical and overhead applications

Codes

IAPMO UES ER-263 (concrete); IAPMO UES ER-281 (masonry); City of L.A. RR25960 (concrete), RR25966 (masonry); FL-16230.1; NSF/ANSI Standard 61 (43.2 in.^{2}/1,000 gal.); AASHTO M-235 and ASTM C881 (Type I and IV, Grade 3, Class C — except AT-XP is a non-epoxy formulated for fast cure time)

Chemical Resistance

See pp. 252–253

Installation and Application Instructions

(See also pp. 100–105)

- Surfaces to receive adhesive must be clean.
- Base material temperature must be 14°F or above at the time of installation. For best results, material should be 14°F (–10°C) to 80°F (27°C) at time of application.
- To warm cold material, store cartridges in a warm, uniformly heated area or storage container. Do not immerse cartridges in water or use microwave to facilitate warming.
- Mixed material in nozzle can harden in 3–4 minutes at temperatures of 70°F (21°C) and above.

Suggested Specifications

See **strongtie.com** for more information.

AT-XP® High-Strength Acrylic Adhesive

AT-XP Adhesive Cartridge System

Model No.	Capacity ounces (cubic in.)	Cartridge Type	Carton Qty.	Dispensing Tool	Mixing Nozzle
AT-XP10[5]	9.4 (16.9)	Coaxial	6	CDT10S	AMN19Q
AT-XP13[4]	12.5 (22.5)	Side-by-side	10	ADT813S	
AT-XP30[4]	30 (54)	Side-by-side	5	ADT30S ADTA30P or ADTA30CKT	

1. Cartridge estimation guidelines are available at **strongtie.com/apps**.
2. Detailed information on dispensing tools, mixing nozzles and other adhesive accessories is available at **strongtie.com**.
3. Use only Simpson Strong-Tie® mixing nozzles in accordance with Simpson Strong-Tie instructions. Modification or improper use of mixing nozzle may impair AT-XP adhesive performance.
4. One AMN19Q mixing nozzle and one nozzle extension are supplied with each cartridge.
5. Two AMN19Q mixing nozzles and two nozzle extensions are supplied with each cartridge.

Cure Schedule

Base Material Temperature		Gel Time (minutes)	Cure Time (hrs.)
°F	°C		
14	−10	30	24
32	0	15	8
50	10	7	3
68	20	4	1
86	30	1½	30 min.
100	38	1	20 min.

For water-saturated concrete, the cure times must be doubled.

Test Criteria

Anchors installed with AT-XP adhesive have been tested in accordance with ICC-ES *Acceptance Criteria for Post-Installed Adhesive Anchors in Masonry Elements (AC58) and Adhesive Anchors in Concrete Elements (AC308).*

Property	**Test Method**	**Result***
Consistency	ASTM C881	Passed, non-sag
Heat deflection	ASTM D648	253°F (123°C)
Bond strength (moist cure, 60°F)	ASTM C882	3,227 psi (2 days) 3,560 psi (14 days)
Water absorption	ASTM D570	0.10% (24 hours)
Compressive yield strength (cured 60°F)	ASTM D695	18,860 psi
Compressive modulus (cured 60°F)	ASTM D695	718,250 psi
Gel time	ASTM C881	5 minutes
Shrinkage coefficient	ASTM D2566	0.002 in./in.

*Material and curing conditions: 73 ± 2°F, unless otherwise noted.

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

IBC *

Characteristic		Symbol	Units	Nominal Anchor Diameter d_a (in.) / Rebar Size						
				⅜ / #3	½ / #4	⅝ / #5	¾ / #6	⅞ / #7	1 / #8	1¼ / #10
Installation Information										
Drill Bit Diameter for Threaded Rod		d_{hole}	in.	7⁄16	9⁄16	11⁄16	13⁄16	1	1⅛	1⅜
Drill Bit Diameter for Rebar		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.	$h_{ef} + 5d_{hole}$						
Critical Edge Distance[2]		c_{ac}	in.	See foonote 2						
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 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. 13 for an explanation of the load table icons.

AT-XP® Design Information — Concrete

IBC *

AT-XP Tension Strength Design Data for Threaded Rod in Normal-Weight Concrete[1]

Characteristic			Symbol	Units	Nominal Anchor Diameter d_a (in.)						
					3⁄8	1⁄2	5⁄8	3⁄4	7⁄8	1	1¼
Steel Strength in Tension											
Threaded Rod	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.	4,525	8,235	13,110	19,370	26,795	35,150	56,200
	Tension Resistance of Steel — ASTM A193, Grade B7				9,750	17,750	28,250	41,750	57,750	75,750	121,125
	Tension Resistance of Steel — Type 410 Stainless (ASTM A193, Grade B6)				8,580	15,620	24,860	36,740	50,820	66,660	106,590
	Tension Resistance of Steel — Type 304 and 316 Stainless (ASTM A193, Grade B8 and B8M)				4,445	8,095	12,880	19,040	26,335	34,540	55,235
	Strength Reduction Factor — Steel Failure		ϕ	—	0.75[6]						
Concrete Breakout Strength in Tension (2,500 psi ≤ f'_c ≤ 8,000 psi)											
Effectiveness Factor — Uncracked Concrete			k_{uncr}	—	24						
Effectiveness Factor — Cracked Concrete			k_{cr}	—	17						
Strength Reduction Factor — Breakout Failure			ϕ	—	0.65[8]						
Bond Strength in Tension (2,500 psi ≤ f'_c ≤ 8,000 psi)											
Uncracked Concrete [2,3,4]	Characteristic Bond Strength		$\tau_{k,uncr}$	psi	1,390	1,590	1,715	1,770	1,750	1,655	1,250
	Permitted Embedment Depth Range	Minimum	h_{ef}	in.	2⅜	2¾	3⅛	3½	3¾	4	5
		Maximum			7½	10	12½	15	17½	20	25
Cracked Concrete [2,3,4]	Characteristic Bond Strength[9,10,11]		$\tau_{k,cr}$	psi	1,085	1,035	980	950	815	800	700
	Permitted Embedment Depth Range	Minimum	h_{ef}	in.	3	3	3⅛	3½	3¾	4	5
		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			ϕ_{dry}	—	0.65[7]					0.55[7]	
Strength Reduction Factor — Water-Saturated Concrete			ϕ_{sat}	—	0.45[7]						
Additional Factor for Water-Saturated Concrete			K_{sat}	—	0.54[5]		0.77[5]			0.96[5]	
Bond Strength in Tension — Bond Strength Reduction Factors for Periodic Special Inspection											
Strength Reduction Factor — Dry Concrete			ϕ_{dry}	—	0.55[7]					0.45[7]	
Strength Reduction Factor — Water-Saturated Concrete			ϕ_{sat}	—	0.45[7]						
Additional Factor for Water-Saturated Concrete			K_{sat}	—	0.46[5]		0.65[5]			0.81[5]	

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 and ACI 318-11.
2. Temperature Range: Maximum short-term temperature of 180°F. Maximum long-term temperature of 110°F.
3. Short-term concrete temperatures are those that occur over short intervals (diurnal cycling).
4. Long-term concrete temperatures are constant temperatures over a significant time period.
5. In water-saturated concrete, multiply $\tau_{k,uncr}$ and $\tau_{k,cr}$ by K_{sat}.
6. The value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
7. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3 (c) for Condition B are met. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
8. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3 (c) for Condition B are met. If the load combinations of ACI 318 Section 9.2 are used and the requirements of ACI 318-11 D.4.3 (c) for Condition A are met, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
9. For anchors installed in regions assigned to Seismic Design Category C, D, E or F, the bond strength values for ½", ⅝", ¾" and 1" anchors must be multiplied by $\alpha_{N,seis} = 0.85$.
10. For anchors installed in regions assigned to Seismic Design Category C, D, E or F, the bond strength values for 1¼" anchors must be multiplied by $\alpha_{N,seis} = 0.75$.
11. 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 $\alpha_{N,seis} = 0.59$.

* See p. 13 for an explanation of the load table icons.

AT-XP® Design Information — Concrete

IBC *

AT-XP Tension Strength Design Data for Rebar in Normal-Weight Concrete[1]

Characteristic			Symbol	Units	Rebar Size						
					#3	#4	#5	#6	#7	#8	#10
Steel Strength in Tension											
Rebar	Minimum Tensile Stress Area		A_{se}	in.^{2}	0.11	0.2	0.31	0.44	0.6	0.79	1.27
	Tension Resistance of Steel — Rebar (ASTM A615 Grade 60)		N_{sa}	lb.	9,900	18,000	27,900	39,600	54,000	71,100	114,300
	Tension Resistance of Steel — Rebar (ASTM A706 Grade 60)				8,800	16,000	24,800	35,200	48,000	63,200	101,600
	Strength Reduction Factor — Steel Failure		ϕ	—	0.75[6]						
Concrete Breakout Strength in Tension (2,500 psi ≤ f'_c ≤ 8,000 psi)											
Effectiveness Factor — Uncracked Concrete			k_{uncr}	—	24						
Effectiveness Factor — Cracked Concrete			k_{cr}		17						
Strength Reduction Factor — Breakout Failure			ϕ	—	0.65[8]						
Bond Strength in Tension (2,500 psi ≤ f'_c ≤ 8,000 psi)											
Uncracked Concrete [2,3,4]	Characteristic Bond Strength		$\tau_{k,uncr}$	psi	1,010	990	970	955	935	915	875
	Permitted Embedment Depth Range	Minimum	h_{ef}	in.	2⅜	2¾	3⅛	3½	3¾	4	5
		Maximum			7½	10	12½	15	17½	20	25
Cracked Concrete [2,3,4]	Characteristic Bond Strength		$\tau_{k,cr}$	psi	340	770	780	790	795	795	820
	Permitted Embedment Depth Range	Minimum	h_{ef}	in.	3	3	3⅛	3½	3¾	4	5
		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			ϕ_{dry}	—	0.65[7]					0.55[7]	
Strength Reduction Factor — Water-Saturated Concrete			ϕ_{sat}	—	0.45[7]						
Additional Factor for Water-Saturated Concrete			K_{sat}	—	0.54[5]		0.77[5]			0.96[5]	
Bond Strength in Tension — Bond Strength Reduction Factors for Periodic Special Inspection											
Strength Reduction Factor — Dry Concrete			ϕ_{dry}	—	0.55[7]					0.45[7]	
Strength Reduction Factor — Water-Saturated Concrete			ϕ_{sat}	—	0.45[7]						
Additional Factor for Water-Saturated Concrete			K_{sat}	—	0.46[5]		0.65[5]			0.81[5]	

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 and ACI 318-11.
2. Temperature Range: Maximum short-term temperature of 180°F. Maximum long-term temperature of 110°F.
3. Short-term concrete temperatures are those that occur over short intervals (diurnal cycling).
4. Long-term concrete temperatures are constant temperatures over a significant time period.
5. In water-saturated concrete, multiply $\tau_{k,uncr}$ and $\tau_{k,cr}$ by K_{sat}.
6. The value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
7. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3 (c) for Condition B are met. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
8. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3 (c) for Condition B are met. If the load combinations of ACI 318 Section 9.2 are used and the requirements of ACI 318-11 D.4.3 (c) for Condition A are met, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.

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* See p. 13 for an explanation of the load table icons.

AT-XP® Design Information — Concrete

AT-XP Shear Strength Design Data for Threaded Rod in Normal-Weight Concrete[1]

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}	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.	2,260	4,940	7,865	11,625	16,080	21,090	33,720
	Shear Resistance of Steel — ASTM A193, Grade B7			4,875	10,650	16,950	25,050	34,650	45,450	72,675
	Shear Resistance of Steel — Type 410 Stainless (ASTM A193, Grade B6)			4,290	9,370	14,910	22,040	30,490	40,000	63,955
	Shear Resistance of Steel — Type 304 and 316 Stainless (ASTM A193, Grade B8 and B8M)			2,225	4,855	7,730	11,425	15,800	20,725	33,140
	Reduction for Seismic Shear — ASTM F1554, Grade 36	$\alpha_{V,seis}$[5]	—	0.85						
	Reduction for Seismic Shear — ASTM A193, Grade B7			0.85						
	Reduction for Seismic Shear — Type 410 Stainless (ASTM A193, Grade B6)			0.85	0.75					0.85
	Reduction for Seismic Shear — Type 304 and 316 Stainless (ASTM A193, Grade B8 and B8M)			0.85	0.75					0.85
	Strength Reduction Factor — Steel Failure	ϕ	—	0.65[2]						
Concrete Breakout Strength in Shear										
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.	h_{ef}						
Strength Reduction Factor — Breakout Failure		ϕ	—	0.70[3]						
Concrete Pryout Strength in Shear										
Coefficient for Pryout Strength		k_{cp}	—	1.0 for $h_{ef} < 2.50$"; 2.0 for $h_{ef} \geq 2.50$"						
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 ACI 318-14 and ACI 318-11.
2. The value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
3. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3 (c) for Condition B are met. If the load combinations of ACI 318 Section 9.2 are used and the requirements of ACI 318-11 D.4.3 (c) for Condition A are met, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
4. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3 (c) for Condition B are met. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
5. 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.

* See p. 13 for an explanation of the load table icons.

AT-XP® Design Information — Concrete

AT-XP Shear Strength Design Data for Rebar in Normal-Weight Concrete[1]

IBC *

Characteristic		Symbol	Units	Rebar Size						
				#3	#4	#5	#6	#7	#8	#10
Steel Strength in Shear										
Rebar	Minimum Shear Stress Area	A_{se}	in.^{2}	0.11	0.2	0.31	0.44	0.6	0.79	1.27
	Shear Resistance of Steel — Rebar (ASTM A615 Grade 60)	V_{sa}	lb.	4,950	10,800	16,740	23,760	32,400	42,660	68,580
	Shear Resistance of Steel — Rebar (ASTM A706 Grade 60)			4,400	9,600	14,880	21,120	28,800	37,920	60,960
	Reduction for Seismic Shear — Rebar (ASTM A615 Grade 60)	$\alpha_{V,seis}$[5]	—	0.56			0.80			
	Reduction for Seismic Shear — Rebar (ASTM A706 Grade 60)			0.56			0.80			
	Strength Reduction Factor — Steel Failure	ϕ		0.65[2]						
Concrete Breakout Strength in Shear										
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.	h_{ef}						
Strength Reduction Factor — Breakout Failure		ϕ	—	0.70[3]						
Concrete Pryout Strength in Shear										
Coefficient for Pryout Strength		k_{cp}	—	1.0 for $h_{ef} < 2.50$"; 2.0 for $h_{ef} \geq 2.50$"						
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 ACI 318-14 and ACI 318-11.
2. The value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
3. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3 (c) for Condition B are met. If the load combinations of ACI 318 Section 9.2 are used and the requirements of ACI 318-11 D.4.3 (c) for Condition A are met, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
4. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3 (c) for Condition B are met. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
5. 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/atxp**.

* See p. 13 for an explanation of the load table icons.

AT-XP® Design Information — Masonry

AT-XP Allowable Tension and Shear Loads for Threaded Rod and Rebar in the Face of Fully Grouted CMU Wall Construction[1, 3, 4, 5, 6, 8, 9, 10, 11]

Diameter (in.) or Rebar Size No.	Drill Bit Diameter (in.)	Minimum Embedment[2] (in.)	Allowable Load Based on Bond Strength[7] (lb.)	
			Tension Load	Shear Load
Threaded Rod Installed in the Face of CMU Wall				
⅜	½	3⅜	1,265	1,135
½	⅝	4½	1,910	1,660
⅝	¾	5⅝	2,215	1,810
¾	⅞	6½	2,260	1,810
Rebar Installed in the Face of CMU Wall				
#3	½	3⅜	1,180	1,315
#4	⅝	4½	1,720	1,565
#5	¾	5⅝	1,835	1,565

1. Allowable load shall be the lesser of the bond values shown in this table and steel values, shown on p. 83.
2. Embedment depth shall be measured from the outside face of masonry wall.
3. Critical and minimum edge distance and spacing shall comply with the information on p. 82. Figure 2 on p. 82 illustrates critical and minimum edge and end distances.
4. Minimum allowable nominal width of CMU wall shall be 8". No more than one anchor shall be permitted per masonry cell.
5. Anchors shall be permitted to be installed at any location in the face of the fully grouted masonry wall construction (cell, web, bed joint), except anchors shall not be installed within 1½ inches of the head joint, as show in Figure 2 on p. 82.
6. Tabulated allowable load values are for anchors installed in fully grouted masonry walls.
7. Tabulated allowable loads are based on a safety factor of 5.0.
8. Tabulated allowable load values shall be adjusted for increased base material temperatures in accordance with Figure 1 below, as applicable.
9. Threaded rod and rebar installed in fully grouted masonry walls are permitted to resist dead, live, seismic and wind loads.
10. Threaded rod shall meet or exceed the tensile strength of ASTM F1554, Grade 36 steel, which is 58,000 psi.
11. For installations exposed to severe, moderate or negligible exterior weathering conditions, as defined in Figure 1 of ASTM C62, allowable tension loads shall be multiplied by 0.80.

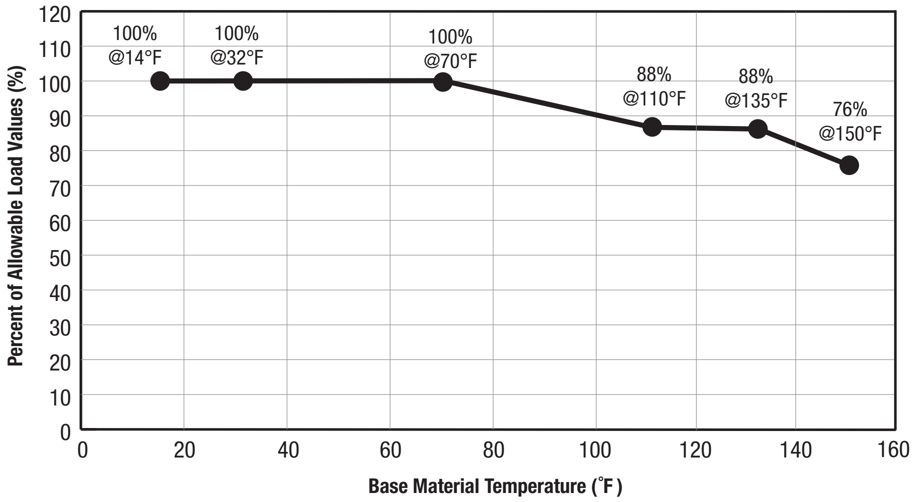

Figure 1. Load Capacity Based on In-Service Temperature for AT-XP® Adhesive in the Face of Fully Grouted CMU Wall Construction

* See p. 13 for an explanation of the load table icons.

AT-XP® Design Information — Masonry

AT-XP Edge Distance and Spacing Requirements and Allowable Load Reduction Factors — Threaded Rod and Rebar in the Face of Fully Grouted CMU Wall Construction[7]

IBC *

Rod Dia. (in.) or Rebar Size No.	Minimum Embed. Depth (in.)	Edge or Edge Distance[1,8]						Spacing[2,9]				
		Critical (Full Anchor Capacity)[3]		Minimum (Reduced Anchor Capacity)[4]				Critical (Full Anchor Capacity)[5]		Minimum (Reduced Anchor Capacity)[6]		
		Critical Edge or End Distance, C_{cr} (in.)	Allowable Load Reduction Factor	Minimum Edge or End Distance, C_{min} (in.)	Allowable Load Reduction Factor			Critical Spacing, S_{cr} (in.)	Allowable Load Reduction Factor	Minimum Spacing, S_{min} (in.)	Allowable Load Reduction Factor	
		Load Direction		Load Direction				Load Direction		Load Direction		
		Tension or Shear	Tension or Shear	Tension or Shear	Tension	Shear[10]		Tension or Shear	Tension or Shear	Tension or Shear	Tension	Shear
						Perp.	Para.					
⅜	3⅜	12	1.00	4	1.00	0.76	0.94	8	1.00	4	1.00	1.00
½	4½	12	1.00	4	0.90	0.57	0.94	8	1.00	4	1.00	1.00
⅝	5⅝	12	1.00	4	0.72	0.47	0.94	8	1.00	4	1.00	1.00
¾	6½	12	1.00	4	0.72	0.47	0.94	8	1.00	4	1.00	1.00
#3	3⅜	12	1.00	4	1.00	0.62	0.95	8	1.00	4	1.00	1.00
#4	4½	12	1.00	4	1.00	0.37	0.82	8	1.00	4	1.00	0.89
#5	5⅝	12	1.00	4	1.00	0.37	0.82	8	1.00	4	1.00	0.89

1. Edge distance (C_{cr} or C_{min}) is the distance measured from anchor centerline to edge or end of CMU masonry wall. Refer to Figure 2 below for an illustration showing critical and minimum edge and end distances.
2. Anchor spacing (S_{cr} or S_{min}) is the distance measured from centerline to centerline of two anchors.
3. Critical edge distance, C_{cr}, is the least edge distance at which tabulated allowable load of an anchor is achieved where a load reduction factor equals 1.0 (no load reduction).
4. Minimum edge distance, C_{min}, is the least edge distance where an anchor has an allowable load capacity which shall be determined by multiplying the allowable loads assigned to anchors installed at critical edge distance, C_{cr}, by the load reduction factors shown above.
5. Critical spacing, S_{cr}, is the least anchor spacing at which tabulated allowable load of an anchor is achieved such that anchor performance is not influenced by adjacent anchors.
6. Minimum spacing, S_{min}, is the least spacing where an anchors has an allowable load capacity , which shall be determined by multiplying the allowable loads assigned to anchors installed at critical spacing distance, S_{cr}, by the load reduction factors shown above.
7. Reduction factors are cumulative. Multiple reduction factors for more than one spacing or edge or end distance shall be calculated separately and multiplied.
8. Load reduction factor for anchors loaded in tension or shear with edge distances between critical and minimum shall be obtained by linear interpolation.
9. Load reduction factor for anchors loaded in tension with spacing between critical and minimum shall be obtained by linear interpolation.
10. Perpendicular shear loads act towards the edge or end. Parallel shear loads act parallel to the edge or end (see Figure 3 below). Perpendicular and parallel shear load reduction factors are cumulative when the anchor is located between the critical minimum edge and end distance.

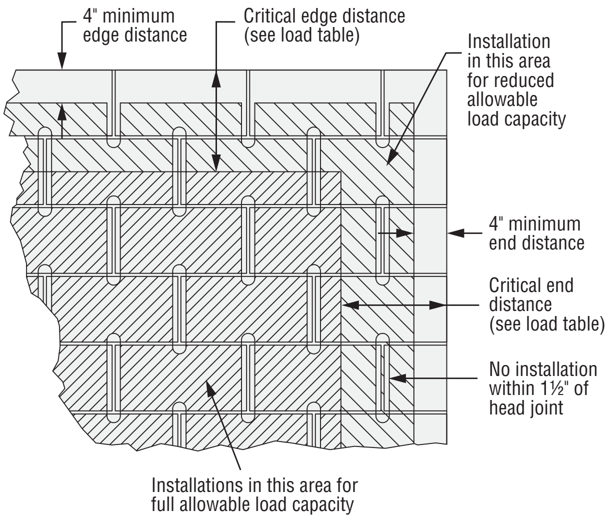

Figure 2. Allowable Anchor Locations for Full and Reduced Load Capacity When Installation Is in the Face of Fully Grouted CMU Masonry Wall Construction

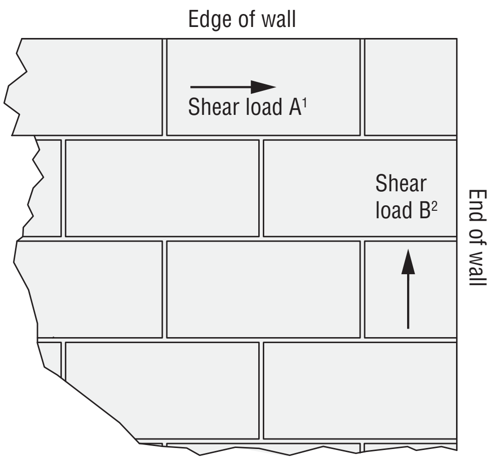

Figure 3. Direction of Shear Load in Relation to Edge and End of Wall

1. Direction of Shear Load A is parallel to edge of wall and perpendicular to end of wall.
2. Direction of Shear Load B is parallel to end of wall and perpendicular to edge of wall.

* See p. 13 for an explanation of the load table icons.

AT-XP® Design Information — Steel

AT-XP Allowable Tension and Shear Loads — Threaded Rod Based on Steel Strength[1]

Threaded Rod Diameter (in.)	Tensile Stress Area (in.^{2})	Tension Load Based on Steel Strength[2] (lb.)				Shear Load Based on Steel Strength[3] (lb.)			
				Stainless Steel				Stainless Steel	
		ASTM F1554 Grade 36[4]	ASTM A193 Grade B7[6]	ASTM A193 Grade B6[5]	ASTM A193 Grades B8 and B8M[7]	ASTM F1554 Grade 36[4]	ASTM A193 Grade B7[6]	ASTM A193 Grade B6[5]	ASTM A193 Grades B8 and B8M[7]
⅜	0.078	1,495	3,220	2,830	1,930	770	1,660	1,460	995
½	0.142	2,720	5,860	5,155	3,515	1,400	3,020	2,655	1,810
⅝	0.226	4,325	9,325	8,205	5,595	2,230	4,805	4,225	2,880
¾	0.334	6,395	13,780	12,125	8,265	3,295	7,100	6,245	4,260

1. Allowable load shall be the lesser of bond values given on p. 81 and steel values in the table above.
2. Allowable Tension Steel Strength is based on the following equation: F_V = 0.33 x F_U x Tensile Stress Area.
3. Allowable Shear Steel Strength is based on the following equation: F_V = 0.17 x F_U x Tensile Stress Area.
4. Minimum specified tensile strength (F_U = 58,000 psi) of ASTM F1554, Grade 36 used to calculate allowable steel strength.
5. Minimum specified tensile strength (F_U = 110,000 psi) of ASTM A193, Grade B6 used to calculate allowable steel strength.
6. Minimum specified tensile strength (F_U = 125,000 psi) of ASTM A193, Grade B7 used to calculate allowable steel strength.
7. Minimum specified tensile strength (F_U = 75,000 psi) of ASTM A193, Grades B8 and B8M used to calculate allowable steel strength.

AT-XP Allowable Tension and Shear Loads — Deformed Reinforcing Bar Based on Steel Strength[1]

Drill Bit Diameter (in.)	Minimum Embedment[2] (in.)	Tension Load (lb.)		Shear Load (lb.)	
		Based on Steel Strength		Based on Steel Strength	
		ASTM A615 Grade 40[2]	ASTM A615 Grade 60[3]	ASTM A615 Grade 40[4,5]	ASTM A615 Grade 60[4,6]
#3	0.11	2,200	2,640	1,310	1,685
#4	0.20	4,000	4,800	2,380	3,060
#5	0.31	6,200	7,400	3,690	4,745

1. Allowable load shall be the lesser of bond values given on p. 81 and steel values in the table above.
2. Allowable Tension Steel Strength is based on AC58 Section 3.3.3 (20,000 psi x tensile stress area) for Grade 40 rebar.
3. Allowable Tension Steel Strength is based on AC58 Section 3.3.3 (24,000 psi x tensile stress area) for Grade 60 rebar.
4. Allowable Shear Steel Strength is based on AC58 Section 3.3.3 (F_V = 0.17 x F_U x Tensile Stress Area).
5. F_U = 70,000 psi for Grade 40 rebar.
6. F_U = 90,000 psi for Grade 60 rebar

* See p. 13 for an explanation of the load table icons.

AT Acrylic Adhesive

AT is a high-strength, acrylic-based adhesive anchoring system, formulated for use as a high-strength anchor-grouting material in a wide range of temperature conditions. It is a two-part system, with the resin and initiator being simultaneously dispensed and mixed through the mixing nozzle.

Features

- Code listed under the IBC/IRC for URM per ICC-ES ESR-1958
- Cure times — 24 hours at 0°F (–18°C), 1 hour at 60°F (16°C)
- Non-sag gel formulation ideal for horizontal, vertical and overhead applications
- Easy hole-cleaning procedure — no power-brushing required
- Suitable for use in damp or wet anchor sites
- When properly mixed, adhesive will be a uniform gray color
- Available in 12.5 oz. and 30 oz. cartridges for application versatility
- Manufactured in the USA using global materials

Applications

- Threaded rod anchoring and rebar doweling into concrete, masonry and URM (red brick)
- Multiple DOT listings — refer to **strongtie.com/DOT** for current approvals

Codes

ICC-ES ESR-1958 (URM); AASHTO M-235 and ASTM C881 (Type I and IV, Grade 3, Class A, B and C — except AT adhesive is a non-epoxy formulated for fast cure time); multiple DOT listings (refer to **strongtie.com/DOT**).

Chemical Resistance

See pp. 252–253

Installation and Application Instructions

(See also pp. 100–105)

- Surfaces to receive adhesive must be clean.
- Base material temperature must be 0°F (–18°C) or above at the time of installation.
- For information on installations below 0°F (–18°C), contact Simpson Strong-Tie.
- Mixed material in nozzle can harden in 5–7 minutes at temperatures of 70°F (21°C) and above.

Suggested Specifications

See **strongtie.com** for more information.

AT Adhesive

AT Acrylic Adhesive

Test Criteria

Anchors installed with AT adhesive have been tested in accordance with ICC-ES *Acceptance Criteria for Anchors in Unreinforced Masonry Elements* (AC60).

Property	**Test Method**	**Result***
Consistency	ASTM C881	Non-sag/thixotropic paste
Heat deflection	ASTM D648	142°F (61°C)
Bond strength (moist cure, 60°F)	ASTM C882	2,960 psi (2 days) 3,567 psi (14 days)
Water absorption	ASTM D570	0.25% (24 hours)
Compressive yield strength (cured 60°F)	ASTM D695	10,930 psi (7 days)
Compressive modulus (cured 60°F)	ASTM D695	502,330 psi (7 days)
Shore D hardness	ASTM D2240	91
Gel time	ASTM C881	5 minutes
VOC	ASTM D2369	25 g/L
Shrinkage coefficient	ASTM D2566	0.004 in./in.

*Material and curing conditions: 73 ± 2°F, unless otherwise noted.

AT Adhesive Cartridge Systems

Model No.	Capacity (ounces)	Cartridge Type	Carton Quantity	Dispensing Tools	Mixing Nozzle
AT13[4]	12.5	Side-by-side	10	ADT813S	AMN19Q
AT30[4]	30	Side-by-side	5	ADT30S, ADTA30CKT ADTA30P	

1. Cartridge estimation guidelines are available at **strongtie.com/apps**.
2. Detailed information on dispensing tools, mixing nozzles and other adhesive accessories is available at **strongtie.com**.
3. Use only Simpson Strong-Tie mixing nozzles in accordance with Simpson Strong-Tie instructions. Modification or improper use of mixing nozzle may impair AT adhesive performance.
4. One AMN19Q mixing nozzle and one nozzle extension are supplied with each cartridge.

In-Service Temperature Sensitivity

Base Material Temperature		Percent Allowable Load for $TEMP_{inst}$ = 0°F	Percent Allowable Load for $TEMP_{inst}$ ≥ 70°F
°F	°C		
0	-18	100%	100%
32	0	100%	100%
70	21	100%	100%
110	43	82%	82%
135	57	74%	82%
150	66	38%	65%
180	82	22%	28%

1. Refer to in-service temperature sensitivity chart for allowable bond strength reduction for in-service temperature. See p. 251.
2. $TEMP_{inst}$ is the base material temperature during installation and curing of the adhesive.
3. Percent allowable load for $TEMP_{inst}$ = 0°F (-18°C) is to be used for $TEMP_{inst}$ between 0°F (-18°C) and 70°F (21°C).
4. Percent allowable load may be linearly interpolated for intermediate base material in-service temperatures.
5. °C = (°F-32) / 1.8

Cure Schedule

Base Material Temperature		Cure Time (hrs.)
°F	°C	
0	-18	24
25	-4	8
40	4	4
60	16	1
70	21	30 min.
100	38	20 min.

AT Design Information — Concrete

AT Allowable Tension Loads for Threaded Rod Anchors in Normal-Weight Concrete (continued on next page)

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Rod Dia. in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing Dist. in. (mm)	Tension Load Based on Bond Strength			Tension Load Based on Steel Strength		
					$f'_c \geq$ 2,000 psi (13.8 MPa) Concrete			F1554 Grade 36	A193 GR B7	F593 304SS
					Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)
⅜ (9.5)	7⁄16	1¾ (44)	2⅝ (67)	7 (178)	3,362 (15.0)	99 (0.4)	840 (3.7)	2,105 (9.4)	4,535 (20.2)	3,630 (16.1)
		3½ (89)	5¼ (133)	6⅛ (156)	8,937 (39.8)	314 (1.4)	2,235 (9.9)			
		4½ (114)	6¾ (171)	18 (457)	10,411 (46.3)	525 (2.3)	2,605 (11.6)			
½ (12.7)	9⁄16	2⅛ (54)	3 3⁄16 (81)	8½ (216)	5,252 (23.4)	501 (2.2)	1,315 (5.8)	3,750 (16.7)	8,080 (35.9)	6,470 (28.8)
		4¼ (108)	6⅜ (162)	7½ (191)	16,668 (74.1)	822 (3.7)	4,165 (18.5)			
		6 (152)	9 (229)	24 (610)	19,182 (85.3)	331 (1.5)	4,795 (21.3)			
⅝ (15.9)	11⁄16	2½ (64)	3¾ (95)	10 (254)	8,495 (37.8)	561 (2.5)	2,125 (9.5)	5,875 (26.1)	12,660 (56.3)	10,120 (45.0)
		4 (102)	5⅝ (143)	16 (406)	—	—	4,315 (19.2)			
		5½ (140)	7½ (191)	9⅝ (244)	26,025 (115.8)	1,866 (8.3)	6,505 (28.9)			
		7 7⁄16 (189)	10⅞ (276)	29¾ (756)	—	—	7,215 (32.1)			
		9⅜ (238)	14⅛ (359)	37½ (953)	31,683 (140.9)	1,571 (7.0)	7,920 (35.2)			

See notes on next page.

¾"–1¼" diameters on next page →

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* See p. 13 for an explanation of the load table icons.

AT Allowable Tension Loads for Threaded Rod Anchors in Normal-Weight Concrete (continued from previous page)

*

Rod Dia. in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing Dist. in. (mm)	Tension Load Based on Bond Strength			Tension Load Based on Steel Strength		
					$f'_c \geq$ 2,000 psi (13.8 MPa) Concrete			F1554 Grade 36	A193 GR B7	F593 304SS
					Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)
¾ (19.1)	¹³⁄₁₆	3⅜ (86)	5¹⁄₁₆ (129)	13½ (343)	12,991 (57.8)	725 (3.2)	3,250 (14.5)	8,460 (37.6)	18,230 (81.1)	12,400 (55.2)
		5¹⁄₁₆ (129)	7⅝ (194)	20¼ (514)	—	—	6,330 (28.2)			
		6¾ (171)	10⅛ (257)	11⅞ (302)	37,616 (167.3)	1,817 (8.1)	9,405 (41.8)			
		9 (229)	13½ (343)	36 (914)	—	—	10,000 (44.5)			
		11¼ (286)	16⅞ (429)	45 (1,143)	42,381 (188.5)	683 (3.0)	10,595 (47.1)			
⅞ (22.2)	1	3⅞ (98)	5¹³⁄₁₆ (148)	15½ (394)	14,206 (63.2)	457 (2.0)	3,550 (15.8)	11,500 (51.2)	24,785 (110.2)	16,860 (75.0)
		5¹³⁄₁₆ (148)	8¾ (222)	23¼ (591)	—	—	7,130 (31.7)			
		7¾ (197)	11⅝ (295)	13⅝ (346)	42,848 (190.6)	3,155 (14.0)	10,710 (47.6)			
		10⁷⁄₁₆ (265)	15⅝ (397)	41¾ (1,060)	—	—	12,250 (54.5)			
		13⅛ (333)	19⅝ (498)	52½ (1,334)	55,148 (245.3)	5,673 (25.2)	13,785 (61.3)			
1 (25.4)	1¹⁄₁₆	4½ (114)	6¾ (171)	18 (457)	20,797 (92.5)	1,763 (7.8)	5,200 (23.1)	15,025 (66.8)	32,380 (144.0)	22,020 (97.9)
		6¾ (171)	10⅛ (257)	27 (686)	—	—	10,165 (45.2)			
		9 (229)	13½ (343)	15¾ (400)	60,504 (269.1)	2,065 (9.2)	15,125 (67.3)			
		12 (305)	18 (457)	48 (1,219)	—	—	17,880 (79.5)			
		15 (381)	22½ (572)	60 (1,524)	82,529 (367.1)	5,146 (22.9)	20,630 (91.8)			
1⅛ (28.6)	1³⁄₁₆	5⅛ (130)	7¾ (197)	20½ (521)	26,600 (118.3)	—	6,650 (29.6)	19,025 (84.6)	41,000 (182.4)	27,880 (124.0)
		7⅝ (194)	11½ (292)	30½ (775)	—	—	11,780 (52.4)			
		10⅛ (257)	15¼ (387)	17¾ (451)	67,600 (300.7)	—	16,900 (75.2)			
		13½ (343)	20¼ (514)	54 (1,372)	—	—	21,385 (95.1)			
		16⅞ (429)	25⅜ (645)	67½ (1,715)	103,460 (460.2)	—	25,865 (115.1)			
1¼ (31.8)	1⁵⁄₁₆	5⅝ (143)	8⁷⁄₁₆ (214)	22½ (572)	32,368 (144.0)	2,054 (9.1)	8,090 (36.0)	23,490 (104.5)	50,620 (225.2)	34,420 (153.1)
		8⁷⁄₁₆ (214)	12¾ (324)	33¾ (857)	—	—	13,090 (58.2)			
		11¼ (286)	16⅞ (429)	19¾ (502)	72,363 (321.9)	7,457 (33.2)	18,090 (80.5)			
		15 (381)	22½ (572)	60 (1,524)	—	—	24,860 (110.6)			
		18¾ (476)	28⅛ (714)	75 (1,905)	126,500 (562.7)	15,813 (70.3)	31,625 (140.7)			

1. Reference p. 250 for oversize holes.
2. Allowable load must be the lesser of the bond or steel strength.
3. The allowable loads listed under allowable bond are based on a safety factor of 4.0.
4. Refer to allowable load-adjustment factors for spacing and edge distance on pp. 95, 97 and 98.
5. Refer to in-service temperature sensitivity chart for allowable load adjustment for temperature.
6. Anchors are permitted to be used within fire-resistive construction, provided the anchors resist wind or seismic loads only. For use in fire-resistive construction, the anchors can also be permitted to be used to resist gravity loads, provided special consideration has been given to fire-exposure conditions.
7. Anchors are not permitted to resist tension forces in overhead or wall installations unless proper consideration is given to fire-exposure and elevated-temperature conditions.

* See p. 13 for an explanation of the load table icons.

AT Allowable Shear Loads for Threaded Rod Anchors in Normal-Weight Concrete

Rod Dia. in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing Dist. in. (mm)	Shear Load Based on Concrete Edge Distance			Shear Load Based on Steel Strength		
					$f'_c \geq$ 2,000 psi (13.8 MPa) Concrete			F1554 Grade 36	A193 GR B7	F593 304SS
					Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)
⅜ (9.5)	7⁄16	1¾ (44)	5¼ (133)	2⅝ (67)	4,869 (21.7)	369 (1.6)	1,215 (5.4)	1,085 (4.8)	2,340 (10.4)	1,870 (8.3)
		3½ (89)		5¼ (133)	5,540 (24.6)	620 (2.8)	1,385 (6.2)			
		4½ (114)		5¼ (133)	—	—	1,385 (6.2)			
½ (12.7)	9⁄16	2⅛ (54)	6⅜ (162)	3¼ (83)	8,318 (37.0)	643 (2.9)	2,080 (9.3)	1,930 (8.6)	4,160 (18.5)	3,330 (14.8)
		4¼ (108)		6⅜ (162)	9,998 (44.5)	522 (2.3)	2,500 (11.1)			
		6 (152)		6⅜ (162)	—	—	2,500 (11.1)			
⅝ (15.9)	11⁄16	2½ (64)	7½ (191)	3¾ (95)	14,806 (65.9)	728 (3.2)	3,700 (16.5)	3,025 (13.5)	6,520 (29.0)	5,220 (23.2)
		5½ (140)		8¼ (210)	15,692 (69.8)	305 (1.4)	3,925 (17.5)			
		9⅜ (238)		8¼ (210)	—	—	3,925 (17.5)			
¾ (19.1)	13⁄16	3⅜ (86)	10⅛ (257)	5⅛ (130)	20,350 (90.5)	—	5,090 (22.6)	4,360 (19.4)	9,390 (41.8)	6,385 (28.4)
		6¾ (171)		10⅛ (257)	20,350 (90.5)	1,521 (6.8)	5,090 (22.6)			
		11¼ (286)		10⅛ (257)	—	—	5,090 (22.6)			
⅞ (22.2)	1	3⅞ (98)	11⅝ (295)	5⅞ (149)	27,475 (122.2)	1,655 (7.4)	6,870 (30.6)	5,925 (26.4)	12,770 (56.8)	8,685 (38.6)
		7¾ (197)		11⅝ (295)	30,876 (137.3)	1,714 (7.6)	7,720 (34.3)			
		13⅛ (333)		11⅝ (295)	—	—	7,720 (34.3)			
1 (25.4)	1⅟16	4½ (114)	13½ (343)	6¾ (171)	32,687 (145.4)	2,287 (10.2)	8,170 (36.3)	7,740 (34.4)	16,680 (74.2)	11,345 (50.5)
		9 (229)		13½ (343)	33,858 (150.6)	2,035 (9.1)	8,465 (37.7)			
		15 (381)		13½ (343)	—	—	8,465 (37.7)			
1⅛ (28.6)	1³⁄16	5⅛ (130)	15¼ (387)	7¾ (197)	41,536 (184.8)	—	10,385 (46.2)	9,800 (43.6)	21,125 (94.0)	14,365 (63.9)
		10⅛ (257)		15¼ (387)	49,812 (221.6)	—	12,455 (55.4)			
		16⅞ (429)		15¼ (387)	—	—	12,455 (55.4)			
1¼ (31.8)	1⁵⁄16	5⅝ (143)	16⅞ (429)	8½ (216)	50,385 (224.1)	1,090 (4.8)	12,595 (56.0)	12,100 (53.8)	26,075 (116.0)	17,730 (78.9)
		11¼ (286)		16⅞ (429)	65,765 (292.5)	4,636 (20.6)	16,440 (73.1)			
		18¾ (476)		16⅞ (429)	—	—	16,440 (73.1)			

1. Allowable load must be the lesser of the load based on concrete edge distance or steel strength.
2. The allowable loads based on concrete edge distance are based on a safety factor of 4.0.
3. Refer to allowable load-adjustment factors for spacing and edge distance on pp. 96 and 98.
4. Refer to in-service temperature sensitivity chart for allowable load adjustment for temperature.
5. Anchors are permitted to be used within fire-resistive construction, provided the anchors resist wind or seismic loads only. For use in fire-resistive construction, the anchors can also be permitted to be used to resist gravity loads, provided special consideration has been given to fire-exposure conditions.

* See p. 13 for an explanation of the load table icons.

AT Allowable Tension Loads for Rebar Dowels in Normal-Weight Concrete

Rebar Size No. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing Dist. in. (mm)	Tension Load Based on Bond Strength						Tension Load Based on Steel Strength
					f'c ≥ 2,000 psi (13.8 MPa) Concrete			f'c ≥ 4,000 psi (27.6 MPa) Concrete			ASTM A615 Grade 60 Rebar
					Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allowable lb. (kN)	Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)
#3 (9.5)	½	3½ (89)	5¼ (133)	6⅛ (156)	8,245 (36.7)	849 (3.8)	2,060 (9.2)	—	—	2,060 (9.2)	2,640 (11.7)
		4½ (114)	5¼ (133)	6⅛ (156)	—	—	2,060 (9.2)	—	—	2,060 (9.2)	
#4 (12.7)	9⁄16	4¼ (108)	6⅜ (162)	7½ (191)	12,743 (56.7)	1,760 (7.8)	3,185 (14.2)	—	—	3,185 (14.2)	4,800 (21.4)
		5⅞ (149)	8⅞ (225)	23½ (597)	—	—	3,185 (14.2)	—	—	3,985 (17.7)	
		7½ (191)	11¼ (286)	30 (762)	—	—	3,185 (14.2)	19,124 (85.1)	854 (3.8)	4,780 (21.3)	
#5 (15.9)	¾	5½ (140)	7½ (191)	9⅝ (244)	20,396 (90.7)	1,412 (6.3)	5,100 (22.7)	—	—	5,100 (22.7)	7,440 (33.1)
		7¼ (184)	10⅞ (276)	29 (737)	—	—	5,100 (22.7)	—	—	6,095 (27.1)	
		9⅜ (191)	14⅛ (359)	37½ (953)	—	—	5,100 (22.7)	28,115 (125.1)	1,496 (6.7)	7,030 (31.3)	
#6 (19.1)	⅞	6¾ (171)	10⅛ (257)	11⅞ (302)	31,839 (141.6)	1,454 (6.5)	7,960 (35.4)	—	—	7,960 (35.4)	10,560 (47.0)
		9 (229)	13½ (343)	36 (914)	—	—	7,960 (35.4)	—	—	8,730 (38.8)	
		11¼ (286)	16⅞ (429)	45 (1,143)	—	—	7,960 (35.4)	37,992 (169.0)	1,999 (8.9)	9,500 (42.3)	
#7 (22.2)	1	7¾ (197)	11⅝ (295)	13⅝ (346)	35,250 (156.8)	2,693 (12.0)	8,815 (39.2)	—	—	8,815 (39.2)	14,400 (64.1)
		10½ (267)	15¾ (400)	42 (1,067)	—	—	8,815 (39.2)	—	—	10,815 (48.1)	
		13⅛ (333)	19⅝ (498)	52½ (1,334)	—	—	8,815 (39.2)	50,889 (226.4)	3,717 (16.5)	12,720 (56.6)	
#8 (25.4)	1⅛	9 (229)	13½ (343)	15¾ (400)	49,973 (222.3)	5,023 (22.3)	12,495 (55.6)	—	—	12,495 (55.6)	18,960 (84.3)
		12 (305)	18 (457)	48 (1,219)	—	—	12,495 (55.6)	—	—	16,325 (72.6)	
		15 (381)	22½ (572)	60 (1,524)	—	—	12,495 (55.6)	80,598 (358.5)	2,195 (9.8)	20,150 (89.6)	
#9 (28.6)	1¼	16⅞ (429)	25⅜ (645)	67½ (1,715)	—	—	—	96,096 (427.5)	489 (2.2)	24,025 (106.9)	24,000 (106.8)
#10 (31.8)	1⅜	18¾ (476)	28⅛ (714)	75 (1,905)	—	—	—	124,031 (551.7)	2,447 (10.9)	31,010 (137.9)	30,480 (135.6)
#11 (34.9)	1⅝	20⅝ (524)	31 (787)	82½ (2,096)	—	—	—	166,059 (738.7)	4,222 (18.8)	41,515 (184.7)	37,440 (166.5)

1. Allowable load must be the lesser of the bond or steel strength.
2. The allowable loads listed under allowable bond are based on a safety factor of 4.0.
3. Refer to allowable load-adjustment factors for spacing and edge distance on pp. 95, 97 and 98.
4. Refer to in-service temperature sensitivity chart for allowable load adjustment for temperature.
5. Anchors are permitted to be used within fire-resistive construction, provided the anchors resist wind or seismic loads only. For use in fire-resistive construction, the anchors can also be permitted to be used to resist gravity loads, provided special consideration has been given to fire-exposure conditions.
6. Anchors are not permitted to resist tension forces in overhead or wall installations unless proper consideration is given to fire-exposure and elevated-temperature conditions.

* See p. 13 for an explanation of the load table icons.

AT Design Information — Concrete

AT Allowable Shear Loads for Rebar Dowels in Normal-Weight Concrete*

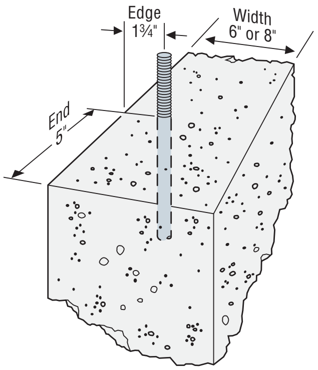
Rebar Size No. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing Dist. in. (mm)	Shear Load Based on Concrete Edge Distance			Shear Load Based on Steel Strength
					f'_c ≥ 2,000 psi (13.8 MPa) Concrete			ASTM A615 Grade 60 Rebar
					Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)
#3 (9.5)	½	**3½** (89)	**6** (152)	**5¼** (133)	**8,294** (36.9)	**515** (2.3)	**2,075** (9.2)	**1,680** (7.5)
		4½ (114)			—	—	**2,075** (9.2)	
#4 (12.7)	⁹⁄₁₆	**4¼** (108)	**8** (203)	**6⅜** (162)	**11,012** (49.0)	**383** (1.7)	**2,755** (12.3)	**3,060** (13.6)
		7½ (191)			—	—	**2,755** (12.3)	
#5 (15.9)	¾	**5½** (140)	**10** (254)	**8¼** (210)	**15,758** (70.1)	**1,154** (5.1)	**3,940** (17.5)	**4,740** (21.1)
		9⅜ (238)			—	—	**3,940** (17.5)	
#6 (19.1)	⅞	**6¾** (171)	**12** (305)	**10⅛** (257)	**23,314** (103.7)	**1,494** (6.6)	**5,830** (25.9)	**6,730** (29.9)
		11¼ (286)			—	—	**5,830** (25.9)	
#7 (22.2)	1	**7¾** (197)	**14** (356)	**11⅝** (295)	**32,662** (145.3)	**5,588** (24.9)	**8,165** (36.3)	**9,180** (40.8)
		13⅛ (333)			—	—	**8,165** (36.3)	
#8 (25.4)	1⅛	**9** (229)	**16** (406)	**13½** (343)	**33,428** (148.7)	**2,319** (10.3)	**8,360** (37.2)	**12,085** (53.8)
		15 (381)			—	—	**8,360** (37.2)	

1. Allowable load must be the lesser of the load based on concrete edge distance or steel strength.
2. The allowable loads based on concrete edge distance are based on a safety factor of 4.0.
3. Refer to allowable load-adjustment factors for spacing and edge distance on pp. 96 and 98.
4. Refer to in-service temperature sensitivity chart for allowable load adjustment for temperature.
5. Anchors are permitted to be used within fire-resistive construction, provided the anchors resist wind or seismic loads only. For use in fire-resistive construction, the anchors can also be permitted to be used to resist gravity loads, provided special consideration has been given to fire-exposure conditions.

AT Allowable Tension Loads for Threaded Rod Anchors in Normal-Weight Concrete Stemwall*

Rod Dia. in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Stemwall Width in. (mm)	Min. Edge Dist. in. (mm)	Min. End Dist. in. (mm)	Tension Load Based on Bond Strength		Tension Load Based on Steel Strength
						f'_c ≥ 2,500 psi (17.2 MPa) Concrete		F1554 Grade 36
						Ultimate lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)
⅝ (15.9)	¹¹⁄₁₆	10 (254.0)	6 (152.4)	1¾ (44.5)	5 (127.0)	12,913 (57.4)	3,230 (14.4)	5,875 (26.1)
⅞ (22.2)	1	15 (381.0)	8 (203.2)	1¾ (44.5)	5 (127.0)	21,838 (97.1)	5,460 (24.3)	11,500 (51.2)

1. Allowable load must be the lesser of the bond or steel strength.
2. The allowable loads listed under allowable bond are based on a safety factor of 4.0.
3. Refer to in-service temperature sensitivity chart for allowable load adjustment for temperature.
4. Anchors are permitted to be used within fire-resistive construction, provided the anchors resist wind or seismic loads only. For use in fire-resistive construction, the anchors can also be permitted to be used to resist gravity loads, provided special consideration has been given to fire-exposure conditions.



Edge and End Distances for Threaded Rod in Concrete Foundation Stemwall Corner Installation

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* See p. 13 for an explanation of the load table icons.

AT Design Information — Concrete

AT Allowable Tension Loads for Threaded Rod Anchors in Sand-Lightweight Concrete

IBC LW *

Rod Dia. in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing Dist. in. (mm)	Tension Load Based on Bond Strength			Tension Load Based on Steel Strength		
					f'_c ≥ 3,000 psi (20.7 MPa) Lightweight Concrete			F1554 Grade 36	A193 GR B7	F593 304SS
					Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)
⅜ (9.5)	7⁄16	1¾ (44)	2⅝ (67)	3½ (89)	2,842 (12.6)	226 (1.0)	710 (3.2)	2,105 (9.4)	4,535 (20.2)	3,630 (16.1)
		3½ (89)	5¼ (133)	7 (178)	5,132 (22.8)	762 (3.4)	1,280 (5.7)			
½ (12.7)	9⁄16	2⅛ (54)	3⅛ (79)	4¼ (108)	4,415 (19.6)	454 (2.0)	1,100 (4.9)	3,750 (16.7)	8,080 (35.9)	6,470 (28.8)
		4¼ (108)	6⅜ (162)	8½ (216)	6,709 (29.8)	1,002 (4.5)	1,675 (7.5)			
⅝ (15.9)	11⁄16	2½ (64)	3¾ (95)	5 (127)	5,568 (24.8)	498 (2.2)	1,390 (6.2)	5,875 (26.1)	12,660 (56.3)	10,120 (45.0)
		5 (127)	7½ (191)	10 (254)	6,298 (28.0)	1,155 (5.1)	1,575 (7.0)			

1. Allowable load must be the lesser of the bond or steel strength.
2. 100% of the allowable load is permitted at critical spacing. No reduction in spacing is allowed.
3. Refer to allowable load-adjustment factors for edge distance on p. 99.
4. Refer to in-service temperature sensitivity chart for allowable load adjustment for temperature.
5. Anchors are permitted to be used within fire-resistive construction, provided the anchors resist wind or seismic loads only. For use in fire-resistive construction, the anchors can also be permitted to be used to resist gravity loads, provided special consideration has been given to fire-exposure conditions.
6. Anchors are not permitted to resist tension forces in overhead or wall installations unless proper consideration is given to fire-exposure and elevated-temperature conditions.
7. The allowable loads listed under allowable bond are based on a safety factor of 4.0.

AT Allowable Shear Loads for Threaded Rod Anchors in Sand-Lightweight Concrete

IBC LW *

Rod Dia. in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing Dist. in. (mm)	Shear Load Based on Concrete Edge Distance			Shear Load Based on Steel Strength		
					f'_c ≥ 3,000 psi (20.7 MPa) Lightweight Concrete			F1554 Grade 36	A193 GR B7	F593 304SS
					Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)
⅜ (9.5)	7⁄16	1¾ (44)	2⅝ (67)	3½ (89)	3,042 (13.5)	249 (1.1)	760 (3.4)	1,085 (4.8)	2,340 (10.4)	1,870 (8.3)
		3½ (89)	5¼ (133)	7 (178)	5,320 (23.7)	187 (0.8)	1,330 (5.9)			
½ (12.7)	9⁄16	2⅛ (54)	3⅛ (79)	4¼ (108)	4,076 (18.1)	458 (2.0)	1,020 (4.5)	1,930 (8.6)	4,160 (18.5)	3,330 (14.8)
		4¼ (108)	6⅜ (162)	8½ (216)	9,838 (43.8)	625 (2.8)	2,460 (10.9)			
⅝ (15.9)	11⁄16	2½ (64)	3¾ (95)	5 (127)	5,360 (23.8)	351 (1.6)	1,340 (6.0)	3,025 (13.5)	6,520 (29.0)	5,220 (23.2)
		5 (127)	7½ (191)	10 (254)	12,430 (55.3)	518 (2.3)	3,105 (13.8)			

1. Allowable load must be the lesser of the load based on concrete edge distance or steel strength.
2. The allowable loads based on concrete edge distance are based on a safety factor of 4.0.
3. Refer to allowable load-adjustment factors for edge distance on p. 99.
4. Refer to in-service temperature sensitivity chart for allowable load adjustment for temperature.
5. Anchors are permitted to be used within fire-resistive construction, provided the anchors resist wind or seismic loads only. For use in fire-resistive construction, the anchors can also be permitted to be used to resist gravity loads, provided special consideration has been given to fire-exposure conditions.
6. 100% of the allowable load is permitted at critical spacing. No reduction in spacing is allowed.

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* See p. 13 for an explanation of the load table icons.

AT Design Information — Masonry

AT Allowable Tension and Shear Loads for Threaded Rod Anchors in 6- and 8-Inch Normal-Weight Grout-Filled CMU *

Rod Dia. in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Min. Edge Dist. in. (mm)	Min. End Dist. in. (mm)	Min. Spacing Dist. in. (mm)	6-Inch Grout-Filled CMU Allowable Loads Based on CMU Strength		8-Inch Grout-Filled CMU Allowable Loads Based on CMU Strength	
						Tension	Shear	Tension	Shear
						Allowable lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)
Anchor Installed in Face Shell (See Figure 1)									
½ (12.7)	9⁄16	4¼ (108)	12 (305)	12 (305)	17 (432)	770 (3.4)	1,325 (5.9)	770 (3.4)	1,325 (5.9)
¾ (19.1)	13⁄16	6¾ (171)	12 (305)	4 (102)	27 (686)	—	—	1,375 (6.1)	—
				12 (305)	27 (686)	—	—	—	2,670 (11.9)
Anchor Installed in Mortar "T" Joint (See Figure 2)									
¾ (19.1)	13⁄16	6¾ (171)	16 (406)	8 (203)	27 (686)	—	—	—	1,030 (4.6)

See notes 1–7 below.

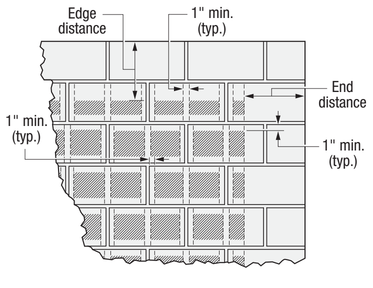

Figure 1. Allowable Anchor Placement in Grouted CMU Face Shell

AT Allowable Tension and Shear Loads for Threaded Rod Anchors in 6- and 8-Inch Normal-Weight Grout-Filled CMU *

Rod Dia. in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Min. Edge Dist. in. (mm)	Min. End Dist. in. (mm)	Min. Spacing Dist. in. (mm)	6- and 8-Inch Grout-Filled CMU Allowable Loads Based on CMU Strength		
						Tension	Shear Perpendicular^8	Shear Parallel^9
						Allowable lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)
Anchor Installed in Cell Opening (Top-of-Wall) (See Figure 3)								
½ (12.7)	9⁄16	4¼ (108)	1¾ (44)	11 (279)	17 (432)	650 (2.9)	285 (1.3)	705 (3.1)
⅝ (15.9)	11⁄16	5 (127)	1¾ (44)	11 (279)	20 (508)	815 3.6	330 (1.5)	755 (3.4)
		12 (305)	1¾ (44)	11 (279)	48 (1,219)	1,120 (5.0)	410 (1.8)	815 (3.6)
⅞ (22.2)	1	12 (305)	1¾ (44)	11 (279)	48 (1,219)	1,385 (6.2)	290 (1.3)	1,030 (4.6)

1. Threaded rods must comply with ASTM F1554 Grade 36 minimum.
2. Values for 6- and 8-inch wide concrete masonry units (CMU) with a minimum specified compressive strength of masonry, f'$_m$, at 28 days is 1,500 psi.
3. Embedment depth is measured from the outside face of the concrete masonry unit for installations through a face shell.
4. Allowable loads may be increased 33⅓% for short-term loading due to wind 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.
7. Anchors must be spaced a minimum distance of four times the anchor embedment.
8. Shear load applied perpendicular to edge of CMU wall.
9. Shear load applied parallel to edge of CMU wall.

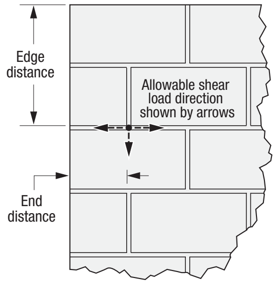

Figure 2. Anchor Placement in Grouted CMU Mortar "T" Joint

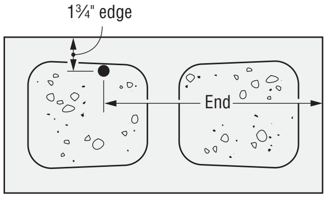

Figure 3. Anchor Installed in Cell Opening (Top of Wall)

AT Allowable Tension and Shear Loads for Threaded Rod Anchors in Lightweight, Medium-Weight and Normal-Weight Hollow CMU *

Rod Dia. in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Min. Edge Dist. in. (mm)	Min. End Dist. in. (mm)	6- and 8-Inch Hollow CMU Allowable Loads Based on CMU Strength			
					Tension		Shear	
					Ultimate lb. (kN)	Allowable lb. (kN)	Ultimate lb. (kN)	Allowable lb. (kN)
Anchor Installed in Face Shell with Simpson Stong-Tie® Stainless-Steel Screen Tube (See Figure 4)								
⅜ (9.5)	9⁄16	3½ (88.9)	4 (101.6)	4⅝ (117.5)	1,400 (6.2)	280 (1.2)	1,326 (5.9)	265 (1.2)
½ (12.7)	11⁄16	3½ (88.9)	4 (101.6)	4⅝ (117.5)	—	280 (1.2)	—	265 (1.2)
⅝ (15.9)	⅞	3 (76.2)	4 (101.6)	4⅝ (117.5)	—	280 (1.2)	—	265 (1.2)

1. See notes 1, 2, 3, 5, 6, 7 above.
2. Set drill to rotation-only mode when drilling into hollow CMU.

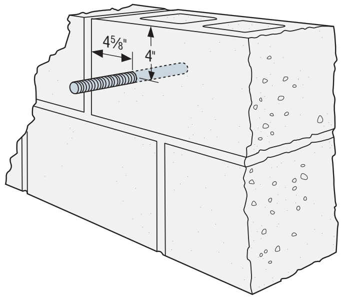

Figure 4. Anchor Installed in Face Shell with Screen Tube in Hollow Cell

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* See p. 13 for an explanation of the load table icons.

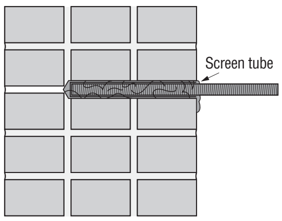
AT Design Information — Masonry

AT Allowable Tension and Shear Loads for Installations in Unreinforced Brick Masonry Walls — Minimum URM Wall Thickness is 13" (3 wythes thick)

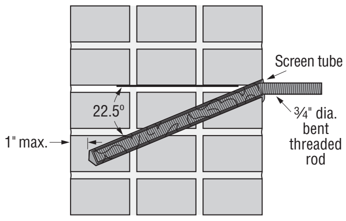
IBC *

Rod/Rebar Dia./Size in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Min. Edge/End Dist. in. (mm)	Min. Vertical Spacing Dist. in. (mm)	Min. Horiz. Spacing Dist. in. (mm)	Tension Load Based on URM Strength	Shear Load Based on URM Strength
						Minimum Net Mortar Strength = 50 psi	Minimum Net Mortar Strength = 50 psi
						Allowable lb. (kN)	Allowable lb. (kN)
Configuration A (Simpson Strong-Tie® ATS Screen Tube Required)							
¾ (19.1)	1	8 (203)	24 (610)	18 (457)	18 (457)	—	1,000 (4.4)
#5 (15.9)	1	8 (203)	24 (610)	18 (457)	18 (457)	—	750 (3.3)
#6 (19.1)	1	8 (203)	24 (610)	18 (457)	18 (457)	—	1,000 (4.4)
Configuration B (Simpson Strong-Tie ATS Screen Tube Required)							
¾ (19.1)	1	13 (330)	16 (406)	18 (457)	24 (610)	1,200 (5.3)	1,000 (4.4)
Configuration C (Simpson Strong-Tie ATS Screen Tube and AST Steel Sleeve Required)							
⅝ (15.9)	1	**	24 (610)	18 (457)	18 (457)	1,200 (5.3)	750 (3.3)

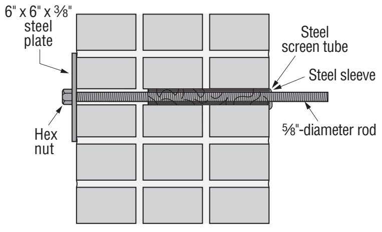
1. Threaded rods must comply with ASTM F1554 Grade 36 minimum.
2. All holes are drilled with a 1" diameter carbide-tipped drill bit with the drill set in the rotation-only mode.
3. The unreinforced brick walls must have a minimum thickness of 13 inches (three wythes of brick).
4. The allowable load is applicable only where in-place shear tests indicate minimum net mortar strength of 50 psi.
5. The allowable load for Configuration B and C anchors subjected to a combined tension and shear load is determined by assuming a straight-line relationship between allowable tension and shear.
6. The anchors installed in unreinforced brick walls are limited to resisting seismic or wind forces only.
7. Configuration A has a straight threaded rod or rebar embedded 8 inches into the wall with a 31/32" diameter by 8-inch long screen tube (part # ATS758). This configuration is designed to resist shear loads only.
8. Configuration B has a ¾" threaded rod bent and installed at a 22.5-degree angle and installed 13 inches into the wall, to within 1-inch (maximum) of the exterior wall surface. This configuration is designed to resist tension and shear loads. The pre-bent threaded rod is installed with a 31/32" diameter by 13-inch long screen tube (part # ATS7513).
9. Configuration C is designed to resist tension and shear forces. It consists of a ⅝" diameter, ASTM F1554 Grade 36 threaded rod and an 8" long steel sleeve (part # AST800) and a 31/32" diameter by 8-inch long screen tube (part # ATS758). The steel sleeve has a plastic plug in one end. A 6" by 6" by ⅜" thick ASTM A 36 steel plate is located on the back face of the wall.
10. Special inspection requirements are determined by local jurisdiction and must be confirmed by the local building official.
11. Refer to in-service temperature sensitivity chart for allowable load adjustment for temperature.



Configuration A
(Shear)



Configuration B
(Tension and Shear)



Configuration C
(Tension and Shear)

Installation Instructions for Configuration C

1. Drill hole perpendicular to the wall to a depth of 8" with a 1"-diameter carbide-tipped drill bit (rotation only mode).
2. Clean hole with oil-free compressed air and a nylon brush.
3. Fill 8" steel screen tube with mixed adhesive and insert into hole.
4. Insert steel sleeve slowly into screen tube (adhesive will displace).
5. Allow adhesive to cure (see cure schedule).
6. Drill through plastic plug in (inside) end of steel sleeve with ⅝" bit.
7. Drill completely through the wall with ⅝" carbide tipped concrete drill bit (rotation mode only).
8. Insert ⅝" rod through hole and attach metal plate and nut.

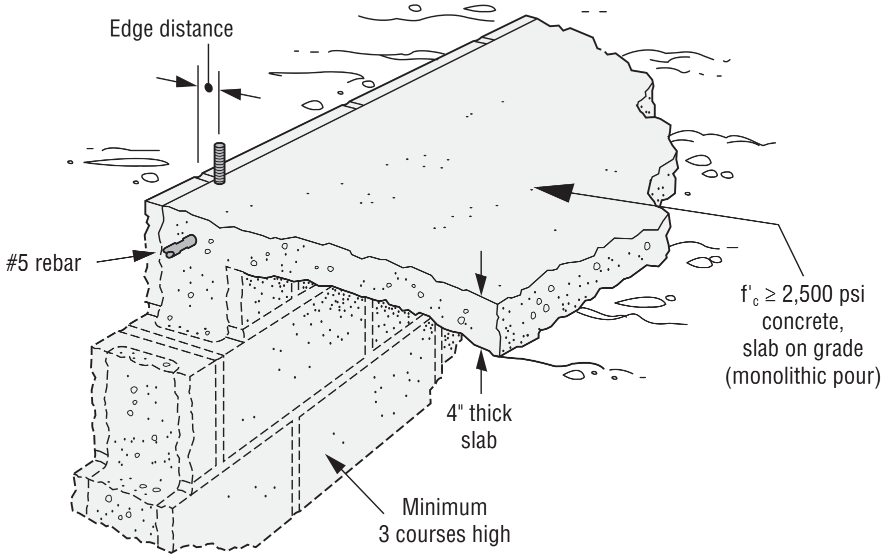
* See p. 13 for an explanation of the load table icons.

AT Design Information — Masonry

AT Allowable Tension Loads for Threaded Rod Anchors in 8-inch Lightweight, Medium-Weight and Normal-Weight CMU Chair Blocks Filled with Normal-Weight Concrete

Rod Dia. in. (mm)	Drill Bit Dia. in.	Min. Embed. Depth in. (mm)	Min. Edge Dist. in. (mm)	Critical Spacing Dist. in. (mm)	8-inch Concrete-Filled CMU Chair Block	
					Allowable Tension Loads Based on CMU Strength	
					Ultimate lb. (kN)	Allowable lb. (kN)
½ (12.7)	9⁄16	4½ (114)	1¾ (44.5)	18 (457)	3,540 (15.7)	710 (3.2)
		7 (178)	1¾ (44.5)	28 (711)	6,285 (28.0)	1,255 (5.6)
		12 (305)	1¾ (44.5)	48 (1,220)	18,950 (84.3)	3,750 (16.7)
⅝ (15.9)	11⁄16	4½ (114)	1¾ (44.5)	18 (457)	4,775 (21.2)	955 (4.2)
		7 (178)	1¾ (44.5)	28 (711)	7,960 (35.4)	1,590 (7.1)
		12 (305)	1¾ (44.5)	48 (1,219)	—	3,400 (15.1)
		15 (381)	1¾ (44.5)	60 (1,524)	22,425 (99.8)	4,485 (20.0)

1. Threaded rods must comply with ASTM F1554 Grade 36 minimum.
2. Values are for 8-inch wide concrete masonry units CMU filled with concrete with minimum compressive strength of 2,500 psi and poured monolithically with the floor slab.
3. Center #5 rebar in CMU cell and concrete slab as shown.
4. The tabulated allowable loads are based on a safety factor of 5.0.



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* See p. 13 for an explanation of the load table icons.

AT Design Information — Concrete

AT Allowable Load Adjustment Factors in Normal-Weight Concrete: Edge Distance, Tension Load

How to use these charts

1. The following tables are for reduced edge distance.
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 edge distance (c_{act}) at which the anchor is to be installed.
5. The load-adjustment factor (f_c) 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 are multiplied together.
8. Adjustment factors do not apply to allowable steel strength values.
9. Adjustment factors are to be applied to allowable tension load based on bond strength values only.

Edge Distance Tension (f_c)

*

Edge Dist. c_{act} (in.)	Dia.	⅜			½				⅝			¾		
	Rebar		#3			#4		#4		#5			#6	
	E	1¾	3½	4½	2⅛	4¼	6	7½	2½	5½	9⅜	3⅜	6¾	11¼
	c_{cr}	2⅝	5¼	6¾	3³⁄₁₆	6⅜	9	11¼	3¾	7½	14⅛	5¹⁄₁₆	10⅛	16⅞
	c_{min}	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾
	f_{cmin}	**0.59**	**0.59**	**0.65**	**0.50**	**0.50**	**0.65**	**0.65**	**0.50**	**0.50**	**0.61**	**0.50**	**0.50**	**0.56**
1¾		0.59	0.59	0.65	0.50	0.50	0.65	0.65	0.50	0.50	0.61	0.50	0.50	0.56
2		0.71	0.62	0.67	0.59	0.53	0.66	0.66	0.56	0.52	0.62	0.54	0.51	0.57
3		1.00	0.74	0.74	0.93	0.64	0.71	0.70	0.81	0.61	0.65	0.69	0.57	0.60
4			0.85	0.81	1.00	0.74	0.76	0.73	1.00	0.70	0.68	0.84	0.63	0.63
5			0.97	0.88		0.85	0.81	0.77		0.78	0.71	0.99	0.69	0.65
6			1.00	0.95		0.96	0.86	0.81		0.87	0.74	1.00	0.75	0.68
7				1.00		1.00	0.90	0.84		0.96	0.78		0.81	0.71
8							0.95	0.88		1.00	0.81		0.87	0.74
9							1.00	0.92			0.84		0.93	0.77
10								0.95			0.87		0.99	0.80
11								0.99			0.90		1.00	0.83
12								1.00			0.93			0.86
13											0.96			0.89
14											1.00			0.92
15														0.95
16														0.97
17														1.00

See notes below.

Edge Distance Tension (f_c) (continued)

*

Edge Dist. c_{act} (in.)	Dia.	⅞			1			1⅛			1¼			
	Rebar		#7			#8				#9			#10	#11
	E	3⅞	7¾	13⅛	4½	9	15	5⅛	10⅛	16⅞	5⅝	11¼	18¾	20⅝
	c_{cr}	5¹³⁄₁₆	11⅝	19⅝	6¾	13½	22½	7¾	15¼	25⅜	8⁷⁄₁₆	16⅞	28⅛	31
	c_{min}	1¾	1¾	1¾	1¾	1¾	1¾	2¾	2¾	2¾	2¾	2¾	2¾	2¾
	f_{cmin}	**0.49**	**0.49**	**0.52**	**0.44**	**0.44**	**0.39**	**0.47**	**0.47**	**0.43**	**0.47**	**0.47**	**0.43**	**0.43**
1¾		0.49	0.49	0.52	0.44	0.44	0.39							
2¾		0.62	0.54	0.55	0.55	0.49	0.42	0.47	0.47	0.43	0.47	0.47	0.43	0.43
4		0.77	0.61	0.58	0.69	0.55	0.46	0.60	0.52	0.46	0.59	0.52	0.46	0.46
6		1.00	0.71	0.63	0.92	0.64	0.51	0.81	0.61	0.51	0.77	0.59	0.50	0.50
8			0.81	0.69	1.00	0.74	0.57	1.00	0.69	0.56	0.96	0.67	0.55	0.54
10			0.92	0.74		0.83	0.63		0.78	0.61	1.00	0.74	0.59	0.58
12			1.00	0.80		0.93	0.69		0.86	0.66		0.82	0.64	0.62
14				0.85		1.00	0.75		0.95	0.71		0.89	0.68	0.66
16				0.90			0.81		1.00	0.76		0.97	0.73	0.70
18				0.96			0.87			0.81		1.00	0.77	0.74
20				1.00			0.93			0.86			0.82	0.78
22							0.99			0.91			0.86	0.82
24							1.00			0.97			0.91	0.86
26										1.00			0.95	0.90
28													1.00	0.94
30														0.98
32														1.00

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

* See p. 13 for an explanation of the load table icons.

AT Design Information — Concrete

AT Allowable Load Adjustment Factors in Normal-Weight Concrete: Edge Distance, Shear Load

How to use these charts

1. The following tables are for reduced edge distance.
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 edge distance (c_{act}) at which the anchor is to be installed.
5. The load-adjustment factor (f_c) 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 are multiplied together.
8. Adjustment factors do not apply to allowable steel strength values.
9. Adjustment factors are to be applied to allowable shear load based on concrete edge distance values only.

Edge Distance Shear (f_c)

Edge Dist. c_{act} (in.)	Dia.	3⁄8					1⁄2					5⁄8					3⁄4				
	Rebar				#3					#4					#5					#6	
	E	1¾	3½	4½	3½	4½	2⅛	4¼	6	4¼	7½	2½	5½	9⅜	5½	9⅜	3⅜	6¾	11¼	6¾	11¼
	c_{cr}	5¼	5¼	5¼	6	6	6⅜	6⅜	6⅜	8	8	7½	7½	7½	10	10	10⅛	10⅛	10⅛	12	12
	c_{min}	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾
	f_{cmin}	**0.40**	**0.35**	**0.39**	**0.19**	**0.39**	**0.18**	**0.15**	**0.25**	**0.16**	**0.25**	**0.12**	**0.11**	**0.14**	**0.10**	**0.14**	**0.10**	**0.11**	**0.14**	**0.10**	**0.14**
1¾		0.40	0.35	0.39	0.19	0.39	0.18	0.15	0.25	0.16	0.25	0.12	0.11	0.14	0.10	0.14	0.10	0.11	0.14	0.10	0.14
2¾		0.57	0.54	0.56	0.38	0.53	0.36	0.33	0.41	0.29	0.37	0.27	0.26	0.29	0.21	0.24	0.21	0.22	0.24	0.19	0.22
3		0.61	0.58	0.61	0.43	0.57	0.40	0.38	0.45	0.33	0.40	0.31	0.30	0.33	0.24	0.27	0.23	0.24	0.27	0.21	0.24
3½		0.70	0.68	0.70	0.52	0.64	0.49	0.47	0.53	0.40	0.46	0.39	0.38	0.40	0.29	0.32	0.29	0.30	0.32	0.25	0.29
4		0.79	0.77	0.78	0.62	0.71	0.58	0.56	0.61	0.46	0.52	0.46	0.46	0.48	0.35	0.37	0.34	0.35	0.37	0.30	0.33
4½		0.87	0.86	0.87	0.71	0.78	0.67	0.66	0.70	0.53	0.58	0.54	0.54	0.55	0.40	0.43	0.40	0.40	0.42	0.34	0.37
5		0.96	0.95	0.96	0.81	0.86	0.76	0.75	0.78	0.60	0.64	0.62	0.61	0.63	0.45	0.48	0.45	0.46	0.47	0.39	0.41
5½		1.00	1.00	1.00	0.90	0.93	0.84	0.84	0.86	0.66	0.70	0.69	0.69	0.70	0.51	0.53	0.50	0.51	0.53	0.43	0.45
6					1.00	1.00	0.93	0.93	0.94	0.73	0.76	0.77	0.77	0.78	0.56	0.58	0.56	0.56	0.58	0.47	0.50
6½							1.00	1.00	1.00	0.80	0.82	0.85	0.85	0.85	0.62	0.64	0.61	0.61	0.63	0.52	0.54
7										0.87	0.88	0.92	0.92	0.93	0.67	0.69	0.66	0.67	0.68	0.56	0.58
7½										0.93	0.94	1.00	1.00	1.00	0.73	0.74	0.72	0.72	0.73	0.60	0.62
8										1.00	1.00				0.78	0.79	0.77	0.77	0.78	0.65	0.66
8½															0.84	0.84	0.83	0.83	0.83	0.69	0.71
9															0.89	0.90	0.88	0.88	0.88	0.74	0.75
9½															0.95	0.95	0.93	0.93	0.94	0.78	0.79
10															1.00	1.00	0.99	0.99	0.99	0.82	0.83
10½																	1.00	1.00	1.00	0.87	0.87
11																				0.91	0.92
11½																				0.96	0.96
12																				1.00	1.00

See notes below.

Edge Distance Shear (f_c) (continued)

Edge Dist. c_{act} (in.)	Dia.	7⁄8					1					1⅛			1¼		
	Rebar				#7					#8							
	E	3⅞	7¾	13⅛	7¾	13⅛	4½	9	15	9	15	5⅛	10⅛	16⅞	5⅝	11¼	18¾
	c_{cr}	11⅝	11⅝	11⅝	14	14	13½	13½	13½	16	16	15¼	15¼	15¼	16⅞	16⅞	16⅞
	c_{min}	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	2¾	2¾	2¾	2¾	2¾	2¾
	f_{cmin}	**0.09**	**0.08**	**0.09**	**0.09**	**0.09**	**0.08**	**0.08**	**0.09**	**0.08**	**0.09**	**0.14**	**0.12**	**0.12**	**0.14**	**0.12**	**0.12**
1¾		0.09	0.08	0.09	0.09	0.09	0.08	0.08	0.09	0.08	0.09						
2¾		0.18	0.17	0.18	0.16	0.16	0.16	0.16	0.17	0.14	0.15	0.14	0.12	0.12	0.14	0.12	0.12
3		0.21	0.20	0.21	0.18	0.18	0.18	0.18	0.19	0.16	0.17	0.16	0.14	0.14	0.16	0.14	0.14
4		0.30	0.29	0.30	0.26	0.26	0.26	0.26	0.26	0.23	0.23	0.23	0.21	0.21	0.22	0.20	0.20
5		0.39	0.38	0.39	0.33	0.33	0.33	0.33	0.34	0.29	0.30	0.29	0.28	0.28	0.28	0.26	0.26
6		0.48	0.48	0.48	0.41	0.41	0.41	0.41	0.42	0.35	0.36	0.36	0.35	0.35	0.34	0.32	0.32
7		0.57	0.57	0.57	0.48	0.48	0.49	0.49	0.50	0.42	0.43	0.43	0.42	0.42	0.40	0.38	0.38
8		0.67	0.66	0.67	0.55	0.55	0.57	0.57	0.57	0.48	0.49	0.50	0.49	0.49	0.46	0.45	0.45
9		0.76	0.76	0.76	0.63	0.63	0.65	0.65	0.65	0.55	0.55	0.57	0.56	0.56	0.52	0.51	0.51
10		0.85	0.85	0.85	0.70	0.70	0.73	0.73	0.73	0.61	0.62	0.64	0.63	0.63	0.58	0.57	0.57
11		0.94	0.94	0.94	0.78	0.78	0.80	0.80	0.81	0.68	0.68	0.71	0.70	0.70	0.64	0.63	0.63
12		1.00	1.00	1.00	0.85	0.85	0.88	0.88	0.88	0.74	0.74	0.78	0.77	0.77	0.70	0.70	0.70
13					0.93	0.93	0.96	0.96	0.96	0.81	0.81	0.85	0.84	0.84	0.76	0.76	0.76
14					1.00	1.00	1.00	1.00	1.00	0.87	0.87	0.91	0.91	0.91	0.82	0.82	0.82
15										0.94	0.94	0.98	0.98	0.98	0.89	0.88	0.88
16										1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95
17															1.00	1.00	1.00

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

* See p. 13 for an explanation of the load table icons.

AT Allowable Load Adjustment Factors in Normal-Weight Concrete: Spacing, Tension Load

How to use these charts

1. The following tables are for reduced 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 spacing (s_{act}) at which the anchor is to be installed.
5. The load-adjustment factor (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 spacings are multiplied together.
8. Adjustment factors do not apply to allowable steel strength values
9. Adjustment factors are to be applied to allowable tension load based on bond strength values only.

Spacing Tension (f_s)

s_{act} (in.)	**Dia.**	⅜			½				⅝			¾		
	Rebar		**#3**			**#4**		**#4**		**#5**			**#6**	
	E	**1¾**	**3½**	**4½**	**2⅛**	**4¼**	**6**	**7½**	**2½**	**5½**	**9⅜**	**3⅜**	**6¾**	**11¼**
	s_{cr}	**7**	**6⅛**	**18**	**8½**	**7½**	**24**	**30**	**10**	**9⅝**	**37½**	**13½**	**11⅞**	**45**
	s_{min}	**⅞**	**1¾**	**2¼**	**1⅛**	**2⅛**	**3**	**3¾**	**1¼**	**2¾**	**4¾**	**1¾**	**3⅜**	**5⅝**
	f_{smin}	**0.57**	**0.58**	**0.80**	**0.57**	**0.58**	**0.80**	**0.80**	**0.57**	**0.58**	**0.80**	**0.57**	**0.58**	**0.80**
⅞		0.57												
1		0.58												
1½		0.61			0.59				0.58					
2		0.65	0.60		0.62				0.61			0.58		
2½		0.68	0.64	0.80	0.65	0.61			0.63			0.60		
3		0.72	0.68	0.81	0.67	0.64	0.80		0.66	0.59		0.61		
3½		0.75	0.72	0.82	0.70	0.68	0.80		0.68	0.62		0.63	0.59	
4		0.79	0.76	0.82	0.73	0.71	0.81	0.80	0.71	0.65		0.65	0.61	
5		0.86	0.84	0.83	0.78	0.79	0.82	0.81	0.75	0.71	0.80	0.68	0.66	
6		0.93	0.92	0.85	0.84	0.86	0.83	0.82	0.80	0.77	0.81	0.72	0.71	0.80
7		1.00	1.00	0.86	0.89	0.93	0.84	0.82	0.85	0.83	0.81	0.75	0.76	0.81
8				0.87	0.95	1.00	0.85	0.83	0.90	0.88	0.82	0.79	0.81	0.81
9				0.89	1.00		0.86	0.84	0.95	0.94	0.82	0.82	0.85	0.82
10				0.90			0.87	0.84	1.00	1.00	0.83	0.86	0.90	0.82
12				0.92			0.89	0.86			0.84	0.93	1.00	0.83
14				0.95			0.90	0.87			0.85	1.00		0.84
16				0.97			0.92	0.89			0.86			0.85
18				1.00			0.94	0.90			0.88			0.86
20							0.96	0.92			0.89			0.87
24							1.00	0.94			0.91			0.89
28								0.97			0.93			0.91
32								1.00			0.95			0.93
36											0.98			0.95
40											1.00			0.97
45														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. $f_s = f_{smin} + [(1 - f_{smin}) (s_{act} - s_{min}) / (s_{cr} - s_{min})]$.

⅞"–1¼" diameters on next page →

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* See p. 13 for an explanation of the load table icons.

Spacing Tension (f_S) (continued)

s_{act} (in.)	Dia.	⅞			1			1⅛			1¼			
	Rebar		#7			#8				#9			#10	#11
	E	3⅞	7¾	13⅛	4½	9	15	5⅛	10⅛	16⅞	5⅝	11¼	18¾	20⅝
	s_{cr}	15½	13⅝	52½	18	15¾	60	20½	17¾	67½	22½	19¾	75	82½
	s_{min}	2	3⅞	6⅝	2¼	4½	7½	2⅝	5⅛	8½	2⅞	5⅝	9⅜	10⅜
	f_{smin}	0.57	0.58	0.80	0.57	0.58	0.80	0.57	0.58	0.80	0.57	0.58	0.80	0.80
2		0.57												
3		0.60			0.59			0.58			0.57			
4		0.63	0.59		0.62			0.60			0.59			
5		0.67	0.63		0.65	0.60		0.63			0.62			
6		0.70	0.67		0.67	0.64		0.65	0.61		0.64	0.59		
8		0.76	0.76	0.81	0.73	0.71	0.80	0.70	0.68		0.68	0.65		
10		0.82	0.84	0.81	0.78	0.79	0.81	0.75	0.74	0.81	0.73	0.71	0.80	
12		0.89	0.93	0.82	0.84	0.86	0.82	0.80	0.81	0.81	0.77	0.77	0.81	0.80
14		0.95	1.00	0.83	0.89	0.93	0.82	0.84	0.88	0.82	0.81	0.83	0.81	0.81
16		1.00		0.84	0.95	1.00	0.83	0.89	0.94	0.83	0.86	0.89	0.82	0.82
20				0.86	1.00		0.85	0.99	1.00	0.84	0.95	1.00	0.83	0.83
24				0.88			0.86	1.00		0.85	1.00		0.84	0.84
28				0.89			0.88			0.87			0.86	0.85
32				0.91			0.89			0.88			0.87	0.86
36				0.93			0.91			0.89			0.88	0.87
40				0.95			0.92			0.91			0.89	0.88
50				0.99			0.96			0.94			0.92	0.91
60				1.00			1.00			0.97			0.95	0.94
70										1.00			0.98	0.97
80													1.00	0.99
83														1.00

See notes on previous page.

AT Allowable Load Adjustment Factors in Normal-Weight Concrete: Spacing, Shear Load

How to use these charts

1. The following tables are for reduced 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 spacing (s_{act}) at which the anchor is to be installed.
5. The load-adjustment factor (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 spacings are multiplied together.
8. Adjustment factors do not apply to allowable steel strength values.
9. Adjustment factors are to be applied to allowable shear load based on concrete edge distance values only.

Spacing Shear (f_S)

s_{act} (in.)	Dia.	⅜		½		⅝		¾		⅞		1		1⅛		1¼	
	Rebar		#3		#4		#5		#6		#7		#8				
	E	1¾	3½	2⅛	4¼	2½	5½	3⅜	6¾	3⅞	7¾	4½	9	5⅛	10⅛	5⅝	11¼
	s_{cr}	2⅝	5¼	3¼	6⅜	3¾	8¼	5⅛	10⅛	5⅞	11⅝	6¾	13½	7¾	15¼	8½	16⅞
	s_{min}	⅞	1¾	1⅛	2⅛	1¼	2¾	1¾	3⅜	2	3⅞	2¼	4½	2⅝	5⅛	2⅞	5⅝
	f_{smin}	0.90	0.83	0.90	0.83	0.90	0.83	0.90	0.83	0.90	0.83	0.90	0.83	0.90	0.83	0.90	0.83
⅞		0.90															
1		0.91															
1½		0.94		0.92		0.91											
2		0.96	0.84	0.94		0.93		0.91		0.90							
2½		0.99	0.87	0.96	0.85	0.95		0.92		0.91		0.91					
3		1.00	0.89	0.99	0.87	0.97	0.84	0.94		0.93		0.92		0.91		0.90	
3½			0.92	1.00	0.89	0.99	0.85	0.95	0.83	0.94		0.93		0.92		0.91	
4			0.94		0.91	1.00	0.87	0.97	0.85	0.95	0.83	0.94		0.93		0.92	
5			0.99		0.95		0.90	1.00	0.87	0.98	0.85	0.96	0.84	0.95		0.94	
6			1.00		0.99		0.93		0.90	1.00	0.88	0.98	0.86	0.97	0.84	0.96	0.84
7					1.00		0.96		0.92		0.90	1.00	0.88	0.99	0.86	0.97	0.85
8							0.99		0.95		0.92		0.90	1.00	0.88	0.99	0.87
9							1.00		0.97		0.94		0.92		0.90	1.00	0.88
10									1.00		0.96		0.93		0.91		0.90
12											1.00		0.97		0.95		0.93
14													1.00		0.98		0.96
16															1.00		0.99
17																	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. $f_s = f_{smin} + [(1 - f_{smin}) (s_{act} - s_{min}) / (s_{cr} - s_{min})]$.

* See p. 13 for an explanation of the load table icons.

AT Design Information — Concrete

AT Allowable Load Adjustment Factors in Sand-Lightweight Concrete: Edge Distance, Tension and Shear Loads

How to use these charts

1. The following tables are for reduced edge distance only.
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 edge distance (c_{act}) at which the anchor is to be installed.
5. The load-adjustment factor (f_c) 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 are multiplied together.
8. Adjustment factors do not apply to allowable steel strength values.
9. Adjustment factors are to be applied to allowable tension load based on bond strength values or allowable shear load based on concrete edge distance values only.

Edge Distance Tension (f_c)

Edge Dist. c_{act} (in.)	**Dia.**	**⅜**		**½**		**⅝**	
	E	**1¾**	**3½**	**2⅛**	**4¼**	**2½**	**5**
	c_{cr}	**2⅝**	**5¼**	**3⅛**	**6⅜**	**3¾**	**7½**
	c_{min}	**1¾**	**1¾**	**1¾**	**1¾**	**1¾**	**1¾**
	f_{cmin}	**0.59**	**0.59**	**0.50**	**0.50**	**0.50**	**0.50**
1¾		0.59	0.59	0.50	0.50	0.50	0.50
2		0.71	0.62	0.59	0.53	0.56	0.52
2¼		0.82	0.65	0.68	0.55	0.63	0.54
2½		0.94	0.68	0.77	0.58	0.69	0.57
2¾		1.00	0.71	0.86	0.61	0.75	0.59
3			0.74	0.95	0.64	0.81	0.61
3¼			0.77	1.00	0.66	0.88	0.63
3½			0.80		0.69	0.94	0.65
3¾			0.82		0.72	1.00	0.67
4			0.85		0.74		0.70
4¼			0.88		0.77		0.72
4½			0.91		0.80		0.74
4¾			0.94		0.82		0.76
5			0.97		0.85		0.78
5¼			1.00		0.88		0.80
5½					0.91		0.83
5¾					0.93		0.85
6					0.96		0.87
6¼					0.99		0.89
6½					1.00		0.91
6¾							0.93
7							0.96
7¼							0.98
7½							1.00

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

Edge Distance Shear (f_c)

Edge Dist. c_{act} (in.)	**Dia.**	**⅜**		**½**		**⅝**	
	E	**1¾**	**3½**	**2⅛**	**4¼**	**2½**	**5**
	c_{cr}	**2⅝**	**5¼**	**3⅛**	**6⅜**	**3¾**	**7½**
	c_{min}	**1¾**	**1¾**	**1¾**	**1¾**	**1¾**	**1¾**
	f_{cmin}	**0.40**	**0.35**	**0.18**	**0.15**	**0.12**	**0.11**
1¾		0.40	0.35	0.18	0.15	0.12	0.11
2		0.57	0.40	0.33	0.20	0.23	0.15
2¼		0.74	0.44	0.48	0.24	0.34	0.19
2½		0.91	0.49	0.63	0.29	0.45	0.23
2¾		1.00	0.54	0.78	0.33	0.56	0.26
3			0.58	0.93	0.38	0.67	0.30
3¼			0.63	1.00	0.43	0.78	0.34
3½			0.68		0.47	0.89	0.38
3¾			0.72		0.52	1.00	0.42
4			0.77		0.56		0.46
4¼			0.81		0.61		0.50
4½			0.86		0.66		0.54
4¾			0.91		0.70		0.57
5			0.95		0.75		0.61
5¼			1.00		0.79		0.65
5½					0.84		0.69
5¾					0.89		0.73
6					0.93		0.77
6¼					0.98		0.81
6½					1.00		0.85
6¾							0.88
7							0.92
7¼							0.96
7½							1.00

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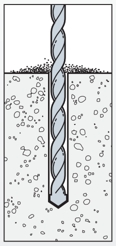
* See p. 13 for an explanation of the load table icons.

Adhesive Anchoring Installation Instructions

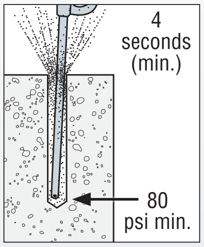
NOTE: Always check expiration date on product label. Do not use expired product.

WARNING: When drilling and cleaning hole, use eye and lung protection. When installing adhesive, use eye and skin protection.

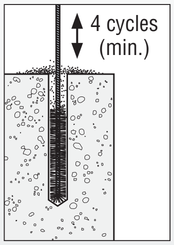
1A Hole Preparation — Horizontal, Vertical and Overhead Applications (SET-XP®, AT-XP®, ET-HP®, AT and SET)



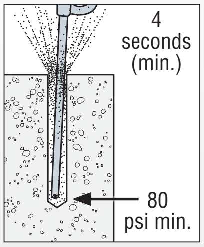
1. Drill. Drill hole to specified diameter and depth.



2. Blow. Remove dust from hole with oil-free compressed air for a minimum of four seconds. Compressed air nozzle must reach the bottom of the hole.



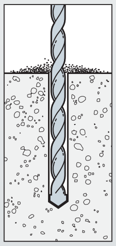
3. Brush. Clean with a nylon brush for a minimum of four cycles. Brush should provide resistance to insertion. If no resistance is felt, the brush is worn and must be replaced.



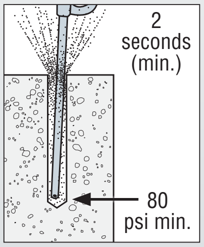
4. Blow. Remove dust from hole with oil-free compressed air for a minimum of four seconds. Compressed air nozzle must reach the bottom of the hole.

Visit **strongtie.com** for proper brush part number.

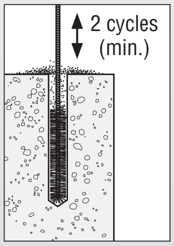
Hole Preparation — Horizontal, Vertical and Overhead Applications (SET-3G™)



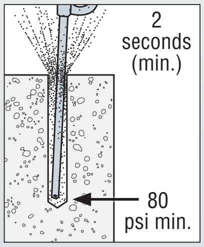
1. Drill. Drill hole to specified diameter and depth.



2. Blow. Remove dust from hole with oil-free compressed air for a minimum of two seconds. Compressed air nozzle must reach the bottom of the hole.



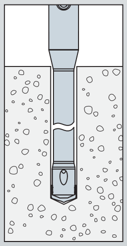
3. Brush. Clean with a steel wire brush for a minimum of two cycles. Brush should provide resistance to insertion. If no resistance is felt, the brush is worn and must be replaced.



4. Blow. Remove dust from hole with oil-free compressed air for a minimum of two seconds. Compressed air nozzle must reach the bottom of the hole.

Visit **strongtie.com** for proper brush part number.

1B Hole Preparation Vacuum Dust Extraction System with Bosch® / Simpson Strong-Tie® DXS Hollow Carbide Drill Bit — Horizontal, Vertical and Overhead Applications



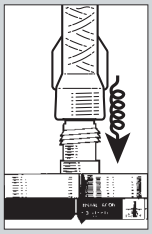
1. Drill. Drill hole to specified diameter and depth using a Bosch / Simpson Strong-Tie DXS hollow carbide drill bit and vacuum dust extraction system.

Bosch / Simpson Strong-Tie DXS drill bit used with the vacuum dust extraction system.

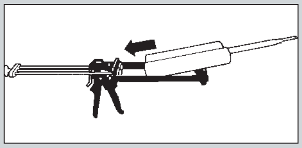
2 Cartridge Preparation

1. Check. Check expiration date on product label. **Do not use expired product.** Product is usable until end of printed expiration month.

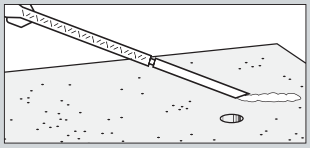
2. Open. Open cartridge per package instructions.



3. Attach. Attach proper Simpson Strong-Tie® nozzle and extension to cartridge. Do not modify nozzle.



4. Insert. Insert cartridge into dispensing tool.



5. Dispense. Dispense adhesive to the side until properly mixed (uniform color).

Refer to **strongtie.com** for proper mixing nozzle and dispensing tool part number.

Installation instructions continued on p. 101. →

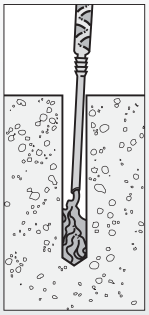
Adhesive Anchoring Installation Instructions

FOR SOLID BASE MATERIALS

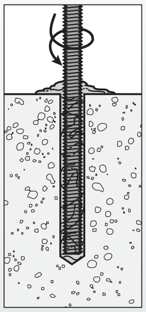
3A Filling the Hole — Vertical Anchorage

Prepare the hole per "Hole Preparation" instructions on product label.

Dry and Damp Holes:

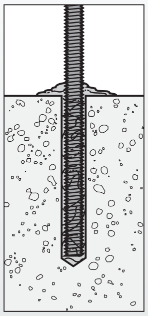


1. Fill.
Fill hole ½ to ⅔ full, starting from bottom of hole to prevent air pockets. Withdraw nozzle as hole fills up.



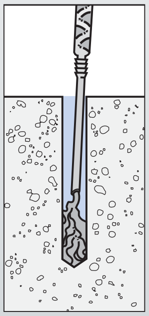
2. Insert.
Insert clean, oil-free anchor, turning slowly until the anchor contacts the bottom of the hole.

Threaded rod or rebar

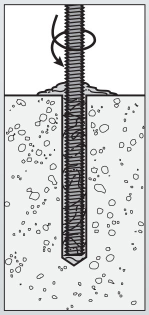


3. Do not disturb.
Do not disturb anchor until fully cured.(See cure schedule for specific adhesive.)

Water-Filled Holes:

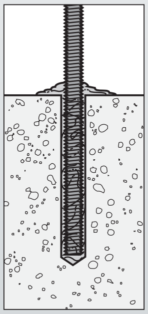


1. Fill.
Fill hole completely full, starting from bottom of hole to prevent water pockets. Withdraw nozzle as hole fills up.



2. Insert.
Insert clean, oil-free anchor, turning slowly until the anchor contacts the bottom of the hole.

Threaded rod or rebar



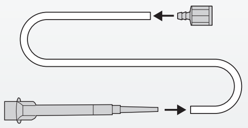
3. Do not disturb.
Do not disturb anchor until fully cured. (See cure schedule.)

Note: Nozzle extensions may be needed for deep holes.

Installation instructions continued on p. 102. →

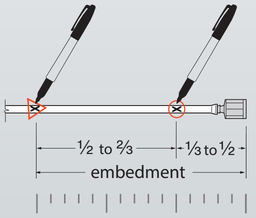
3B Filling the Hole — Horizontal and Overhead Anchorage

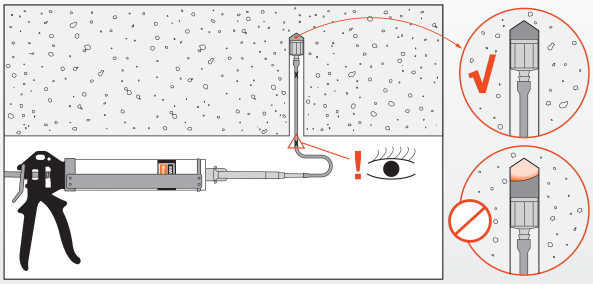
Prepare the hole per "Hole Preparation" instructions on product label



Step 1:

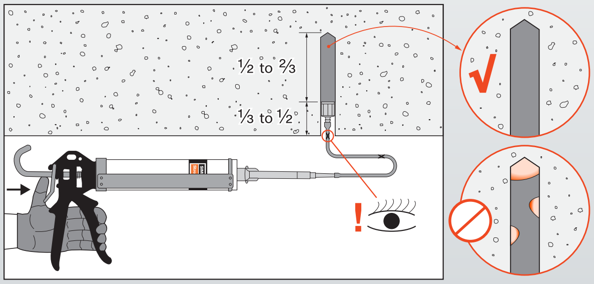
- Attach the piston plug to one end of the flexible tubing (PPFT25)
- Cut tubing to the length needed for the application, mark tubing as noted below and attach other end of tubing to the mixing nozzle
- If using a pneumatic dispensing tool, regulate air pressure to 80–100 psi





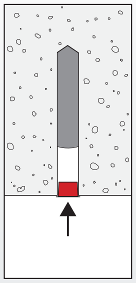
Step 2:

- Insert the piston plug to the back of the drilled hole and dispense adhesive



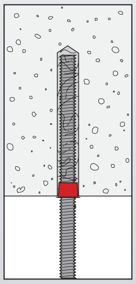
Step 3:

- Fill the hole ½ to ⅔ full
- **Note:** as adhesive is dispensed into the drilled hole, the piston plug will slowly displace out of the hole due to back pressure, preventing air gaps



Step 4:

- Install the appropriate Simpson Strong-Tie adhesive retaining cap



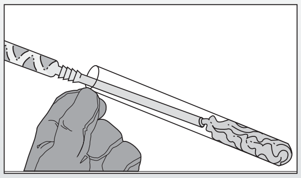
Step 5:

- Place either threaded rod or rebar through the adhesive retaining cap and into adhesive-filled hole
- Turn rod/rebar slowly until the insert bottoms out
- Do not disturb until fully cured

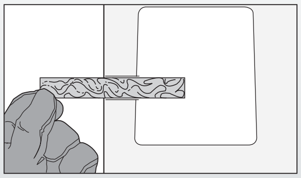
FOR HOLLOW BASE MATERIALS

3C Filling the Hole — When Anchoring with Screens: For AT, SET-XP® and SET Adhesives

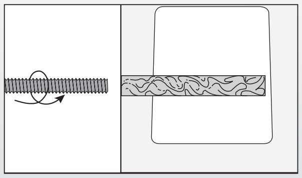
Prepare the hole per instructions on "Hole Preparation."



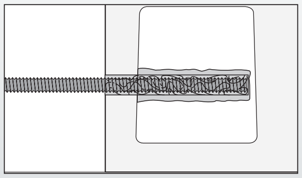
1. Fill.
Fill screen completely. Fill from the bottom of the screen and withdraw the nozzle as the screen fills to prevent air pockets. (Opti-Mesh screens: Close integral cap after filling.)



2. Insert.
Insert adhesive-filled screen into hole.



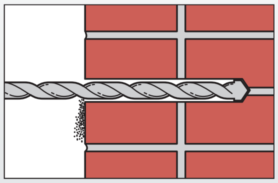
3. Insert.
Insert clean, oil-free anchor, turning slowly until the anchor contacts the bottom of the screen.



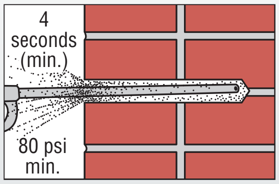
4. Do not disturb.
Do not disturb anchor until fully cured. (See cure schedule for specific adhesive.)

FOR UNREINFORCED BRICK MASONRY

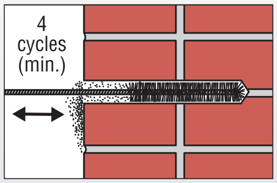
1A Hole Preparation — For Configurations A and C (Horizontal) and B (22½° Downward) Installations with a Carbide-Tipped Drill Bit.



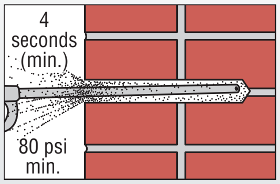
1. Drill.
Drill 1"-diameter hole to specified depth with a carbide-tipped drill bit, using rotation only mode. For Configurations A and C, drill 8" deep. For Configuration B, drill to within 1" of the opposite side of wall (minimum 13" deep).



2. Blow.
Remove dust from hole with oil-free compressed air for a minimum of four seconds. Compressed air nozzle MUST reach the bottom of the hole.

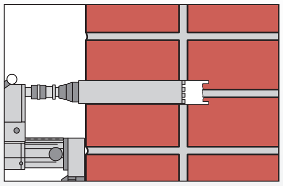


3. Brush.
Clean with a nylon brush for a minimum of four cycles. Brush MUST reach the bottom of the hole. Brush should provide resistance to insertion. If no resistance is felt, the brush is worn and must be replaced.

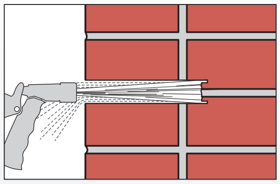


4. Blow.
Remove dust from hole with oil-free compressed air for a minimum of four seconds. Compressed air nozzle MUST reach the bottom of the hole.

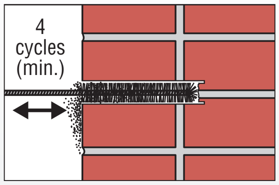
1B Hole Preparation — For using SET Adhesive Configurations A and C (Horizontal) and B (22½° Downward) Installations with a Wet Diamond Core-Drill Bit. (See p. 66, footnote 4.)



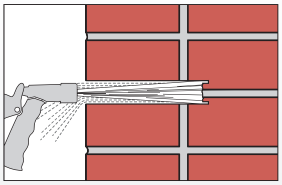
1. Drill.
Drill hole to specified depth with 1"-diameter wet diamond core-drill bit. For Configurations A and C, drill 8" deep. For Configuration B, drill to within 1" of the opposite side of wall (minimum 13" deep).



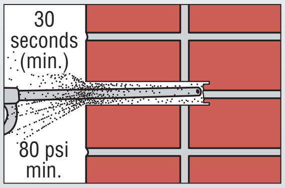
2. Flush.
Flush out hole with pressurized water until water runs clear.



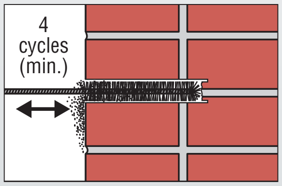
3. Brush.
Clean with a nylon brush (Simpson Strong-Tie part number ETB10) for a minimum of four brush strokes. Brush MUST reach the bottom of the hole. Brush should provide resistance to insertion. If no resistance is felt, the brush is worn and must be replaced.



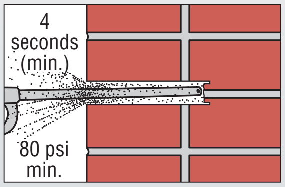
4. Flush.
Flush out hole with pressurized water until water runs clear.



5. Blow.
Remove free standing water from hole with oil-free compressed air and blow out hole for a minimum of 30 seconds. Compressed air nozzle MUST reach the bottom of the hole.



6. Brush.
Clean with a nylon brush (Simpson Strong-Tie part number ETB10) for a minimum of four brush strokes. Brush MUST reach the bottom of the hole. Brush should provide resistance to insertion. If no resistance is felt, the brush is worn and must be replaced.



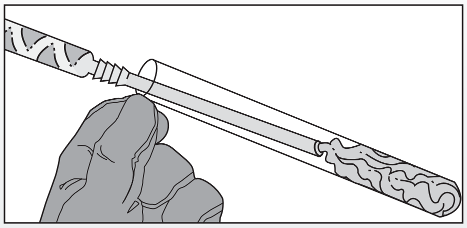
7. Blow.
Blow hole with oil-free compressed air for a minimum of four seconds. Compressed air nozzle MUST reach the bottom of the hole.

Installation instructions continued on p. 104. →

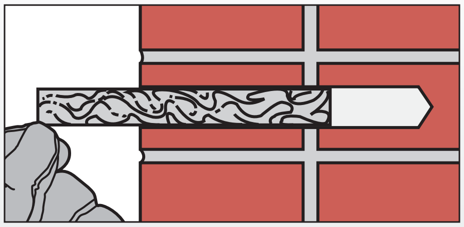
2 Cartridge Preparation

Reference p. 100 for cartridge preparation.

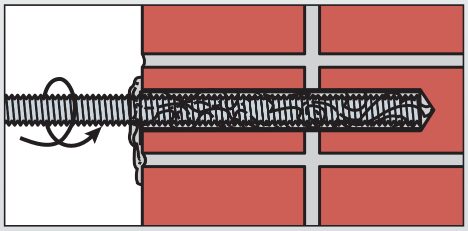
3A Filling the Hole — For Configurations A (Horizontal) and B (22½-Degree Downward) Installations.



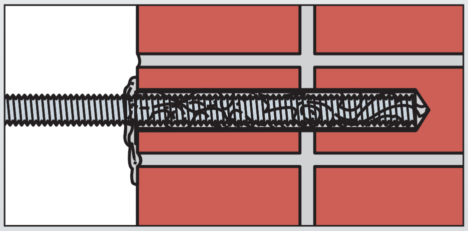
1. Fill.
Fill screen completely. Fill from the bottom of the screen and withdraw the nozzle as the screen fills to prevent air pockets.



2. Insert.
Insert adhesive filled screen into hole.



3. Insert.
Insert clean, oil-free anchor, turning slowly until the anchor contacts the bottom of the screen.

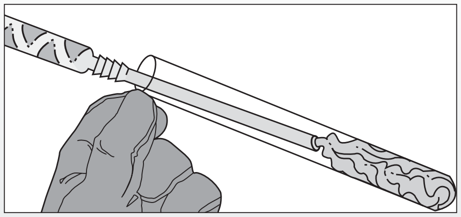


4. Do not disturb.
Do not disturb anchor until fully cured.
(See cure schedule for specific adhesive.)

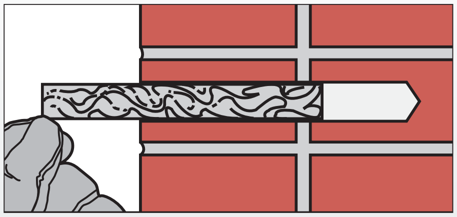
Note: Steel wire mesh screens may be used for Configurations A and B.

Installation instructions continued on p. 105. →

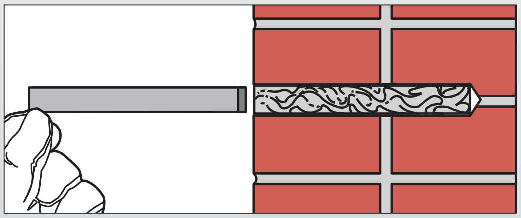
3B **Filling the Hole —** For Configuration C (Horizontal Through-Bolt) Installation.



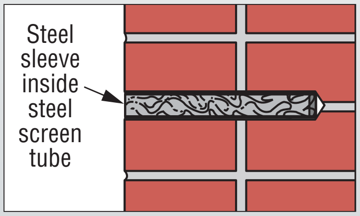
1. Fill.
Fill screen completely. Fill from the bottom of the screen and withdraw the nozzle as the screen fills to prevent air pockets.



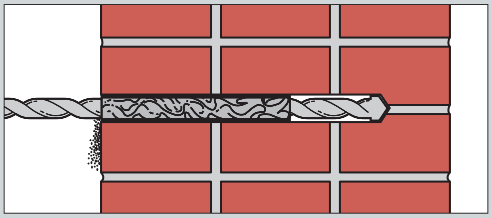
2. Insert.
Insert adhesive filled screen into hole.



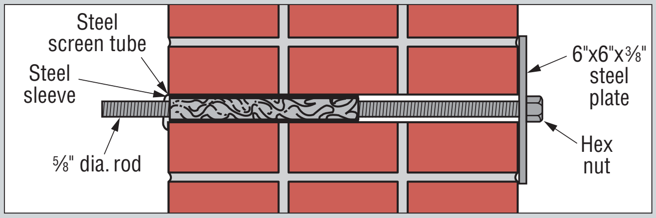
3. Insert.
Insert steel sleeve (capped end first) slowly into screen tube (adhesive will displace).



4. Cure
Allow adhesive to cure (see Cure Time Table 1).



5. Drill.
Drill through plastic plug in (inside) end of steel sleeve and completely through the wall with ⅝" carbide tipped concrete drill bit (rotation mode only).



6. Insert.
Insert ⅝" rod through hole and attach metal plate and nut.

Note: Steel wire mesh screens shall be used for Configuration C.

Hole-Cleaning Brushes

Brushes are used for cleaning drilled holes prior to adhesive installation.

Note: The standard hole-cleaning method (blow-brush-blow) can be avoided by using the Speed Clean™ vacuum dust extraction system (DXS) with SET-XP®, AT-XP® and SET-3G™. See p. 244 for details.

Nylon Brush — Standard

(For use with SET-XP, AT-XP, ET-HP®, AT and SET)

Model No.	Hole Diameter (in.)	Anchor Diameter (in.)	Rebar Size	Usable Length (in.)	Carton Qty.
ETB4	⅜ – 7⁄16	¼ – 5⁄16	—	7	24
ETB6	½ – ¾	⅜ – ⅝	#3 – #5	15	24
ETB8	13⁄16 – ⅞	¾	#6	15	24
ETB8L	13⁄16 – ⅞	¾	#6	23	24
ETB10	1 – 1⅛	⅞ – 1	#7 – #8	28	24
ETB12	1 3⁄16 – 1⅜	1¼	#10	33	24

1. All standard nylon brushes are one-piece which includes a twisted wire handle.

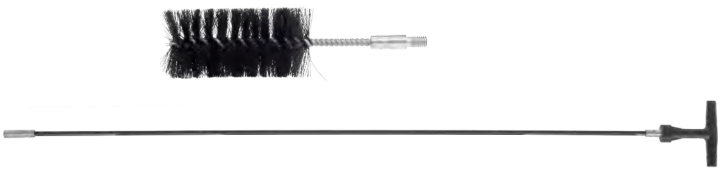
Nylon Brush — Rebar

(For use with SET-XP)

Model No.	Hole Diameter (in.)	Rebar Size	Usable Length (in.)	Carton Qty.
ETB6R	½ – ¾	#3 – #5	6	25
ETB8R	⅞	#6	6	25
ETB10R	1 – 1⅛	#7 – #8	8	25
ETB12R	1⅜	#10	8	25
ETB14R	1¾	#11	7	25
ETBR-EXT	T-handle and extension		35¼	25

1. ETBR-EXT is required for use with all sizes of rebar nylon brushes.
2. To obtain total usable length, add the usable length for each part used.

NEW



Wire Brush — Standard

(For use with SET-3G)

Model No.	Hole Diameter (in.)	Anchor Diameter (in.)	Rebar Size	Usable Length (in.)	Carton Qty.
ETB43S	7⁄16	⅜	—	5	25
ETB50S	½	—	#3	5	25
ETB56S	9⁄16	½	—	5	25
ETB62S	⅝	—	#4	5	25
ETB68S	11⁄16	⅝	—	5	25
ETB75S	¾	—	#5	5	25
ETB87S	⅞	¾	#6	5	25
ETB100S	1	⅞	#7	5	25
ETB112S	1⅛	1	#8	5	25
ETB137S	1⅜	1¼	#10	5	25
ETBS-TH	T-handle			8½	25
ETBS-EXT	Extension			11½	25

1. T-handle is required for use with all sizes of standard wire brush.
2. To obtain total usable length, add the usable length for each part used.

NEW

Piston Plug Delivery System

The Simpson Strong-Tie® Piston Plug Delivery System for adhesives offers you an easy-to-use, reliable and less time-consuming means to dispense adhesive into drilled holes for threaded rod and rebar dowel installations in overhead, upwardly inclined and horizontal orientations. The matched tolerance design between the piston plug and drilled hole virtually eliminates the formation of voids and air pockets during adhesive dispensing.

The Piston Plug Delivery System consists of three components: piston plug, flexible extension tubing, and adhesive retaining cap.

Features

- Designed for dispensing adhesive into drilled holes in overhead, upwardly inclined and horizontal orientations, as well as deep embedments
- Suitable for use with all Simpson Strong-Tie anchoring adhesives
- Adhesive piston plugs are sized to fit each drilled hole diameter
- Model number is embossed on each adhesive piston plug for identification
- A barbed end provides a reliable connection to the flexible extension tubing
- Flexible extension tubing is available in 25-foot-long rolls to be cut to required lengths

Use the piston plug delivery system with all Simpson Strong-Tie® adhesive products:

SET-3G™

SET-XP®

SET

AT-XP®

AT

ET-HP®

Adhesive Accessories

Piston Plugs

Model No.	Hole Size (in.)	Pkg. Quantity	Carton Quantity*
PP56-RP10	9⁄16	10	100
PP62-RP10	⅝	10	100
PP68-RP10	11⁄16	10	100
PP75-RP10	¾	10	100
PP81-RP10	13⁄16	10	100
PP87-RP10	⅞	10	100
PP100-RP10	1	10	100
PP112-RP10	1⅛	10	100
PP137-RP10	1⅜	10	100
PP175-RP10	1¾	10	100

*10 packages of 10.

Tubing

Model No.	Description	Package Quantity
PPFT25	Piston Plug Flexible Extension Tubing — 25 ft. roll	1

Adhesive Retaining Caps

Adhesive retaining caps make overhead and horizontal installation easier by preventing the adhesive from running out of the hole. They also center the rod in the hole, making them ideal for applications where precise anchor placement is required. It may be necessary to provide support for the anchor during cure time. Adhesive retaining caps are not designed to support the weight of the anchor in overhead installations. Adhesive retaining caps should be used for horizontal and overhead adhesive installations. ARCs may be used in conjunction with the Piston Plug Delivery system.

Material: Plastic

Adhesive Retaining Caps

Retaining Caps

Model No.	Hole Size (in.)	Anchor Diameter (in.)	Rebar Size	Cap Depth (in.)	Package Qty.	Carton Qty* (ea.)
ARC37A-RP25	7⁄16	⅜	#3	7⁄16	25	200
ARC37-RP25	½	⅜		7⁄16	25	200
ARC50A-RP25	9⁄16	½	#4	½	25	200
ARC50-RP25	⅝	½		½	25	200
ARC62A-RP25	11⁄16	⅝	#5	9⁄16	25	200
ARC62-RP25	¾	⅝		9⁄16	25	200
ARC75A-RP25	13⁄16	¾	#6	9⁄16	25	200
ARC75-RP25	⅞	¾		9⁄16	25	200
ARC87-RP25	1	⅞	#7	11⁄16	25	200
ARC100A-RP25	1 1⁄16	1	#8	11⁄16	25	200
ARC100-RP25	1⅛	1		11⁄16	25	200
ARC125-RP25	1⅜	1¼	#10	⅞	25	200
ARC137-RP25	1¾	—	#11	11⁄16	25	200

*Cartons contain 8 packages of 25.

Opti-Mesh Adhesive-Anchoring Screen Tubes

Screen tubes are vital to the performance of adhesive anchors in base materials that are hollow or contain voids, such as hollow block and brick. The Simpson Strong-Tie® Opti-Mesh screen tube with woven mesh insert provides the advantages of a plastic screen tube while providing superior performance to steel screen tubes and competitive plastic screen tubes.

Material: Plastic

Caution: Screen tubes are designed for a specific adhesive type.

⚠ Epoxy screen tubes must be used with SET-XP® formulations.

Integral Cap: Serves to center and secure the rod in the screen tube, while displaying important information such as rod diameter, drill bit diameter and the Simpson Strong-Tie® "≠" symbol for easy inspection after installation. The cap also prevents adhesive from running out the front of the screen tube.

Flanges: Prevents the screen tube from slipping into over-drilled holes. Allows screen tube to function in holes that are drilled too deep.

Open-Mesh Collar: This section of larger mesh allows extra adhesive to flow out the screen tube behind the face shell of hollow block applications. The extra "collar" of adhesive increases bearing area and results in higher load capacities in hollow concrete block.

Color-Coded, Formula-Specific Mesh: The openings between the woven mesh screen tube strands are sized to allow only the right amount of adhesive to flow through the screen tube to bond with the base material while the balance remains in the screen to bond the rod. The acrylic screen tube mesh is white, while the epoxy screen tube mesh is black.

U.S. Patent
6,837,018

Epoxy Adhesive Screen Tube
(mesh is black)

Acrylic Adhesive Screen Tube
(mesh is white)

The integral cap centers the rod and displays drill bit and rod diameter.

Opti-Mesh Adhesive-Anchoring Screen Tubes (cont.)

Screen Tubes — Plastic

For Rod Diameter (in.)	Hole Size (in.)	Length (in.)	Epoxy Model No. SET-XP®	Carton Qty.
3⁄8	9⁄16	3½	EWS373P	150
		6	EWS376P	150
		10	EWS3710P	100
½	¾	3½	EWS503P	100
		6	EWS506P	100
		10	EWS5010P	50
5⁄8	7⁄8	3½	EWS623P	50
		6	EWS626P	50
		10	EWS6210P	25
¾	1	8	EWS758P	25
		13	EWS7513P	25

Specially sized holes in Opti-Mesh screens allow for adhesive to seep out at the appropriate location at the hollow portion of the CMU to create a better bond to the face shell.

Steel Adhesive-Anchoring Screen Tubes

Screen tubes are used in hollow base material applications to contain adhesive around the anchor and prevent it from running into voids. Simpson Strong-Tie® screen tubes are specifically designed to work with AT, SET and ET-HP® adhesives in order to precisely control the amount of adhesive that passes through the mesh. This results in thorough coating and bonding of the rod to the screen tube and base material. Order screen tubes based upon rod diameter and adhesive type. The actual outside diameter of the screen tube is larger than the rod diameter.

Material: Acrylic screen tubes: 50 mesh stainless steel
Epoxy screen tubes: 60 mesh carbon steel

Caution: Screen tubes are designed for a specific adhesive type. Epoxy screen tubes must be used with SET or ET-HP® formulations and acrylic screen tubes must be used with AT.

Epoxy Screen Tube
(acrylic screen tubes similar)

Screen tubes are for use in hollow CMU, hollow brick and unreinforced masonry applications. Contact Simpson Strong-Tie for information on special-order sizes.

Screen Tubes

For Rod Diameter (in.)	Hole Size (in.)	Acrylic Stainless Steel Screen Tubes for AT		Epoxy Carbon Steel Screen Tubes for SET and ET-HP		Carton Qty.
		Actual Screen Size O.D./Length (in.)	Model No.	Actual Screen Size O.D./Length (in.)	Model No.	
⅜	9⁄16	15⁄32 x 3½	ATS373	—	—	150
		15⁄32 x 6	ATS376	15⁄32 x 6	ETS376	150
		—	—	15⁄32 x 10	ETS3710	100
½	11⁄16	19⁄32 x 3½	ATS503	—	—	100
		19⁄32 x 6	ATS506	19⁄32 x 6	ETS506	100
		19⁄32 x 10	ATS5010	19⁄32 x 10	ETS5010	50
⅝	⅞	25⁄32 x 3	ATS623	—	—	50
		25⁄32 x 6	ATS626	25⁄32 x 6	ETS626	50
		25⁄32 x 10	ATS6210	25⁄32 x 10	ETS6210	25
		25⁄32 x 13	ATS6213	25⁄32 x 13	ETS6213	25
¾	1	31⁄32 x 8	ATS758	31⁄32 x 8	ETS758	25
		31⁄32 x 13	ATS7513	31⁄32 x 13	ETS7513	25
		31⁄32 x 17	ATS7517	31⁄32 x 17	ETS7517	25
		—	—	31⁄32 x 21	ETS7521	25

Adhesive Shear Tubes

Used in conjunction with anchoring adhesive and screen tubes, adhesive shear tubes transfer anchor shear loads over a larger area, reducing localized crushing in unreinforced masonry installations. Required for through-bolt applications per ICC-ES's unreinforced masonry anchorage "Configuration C" detail. For detailed installation instructions, refer to the appropriate adhesive anchor ICC-ES report.

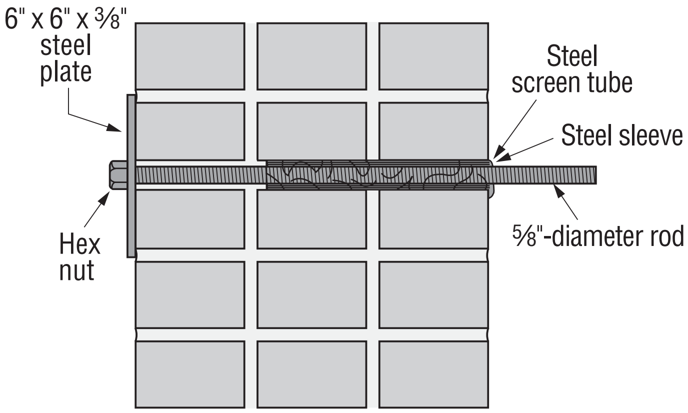
Material: Steel

Finish: Zinc-plated

Adhesive Shear Tube

Description (in.)	Model No.	For use with Simpson Strong-Tie Screen Model No.[1]	Drill Bit Diameter (in.)	Threaded Rod Diameter (in.)	Carton Qty.
13⁄16 x 8	AST800	ETS758, ATS758	1	5⁄8	1

1. Screens sold separately. Not for use with Simpson Strong-Tie plastic Opti-Mesh screen tubes.



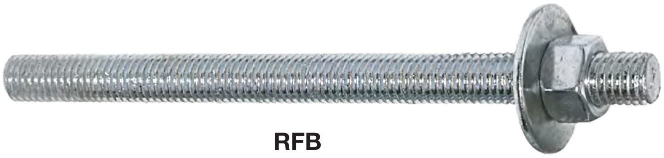
Configuration C

Retrofit Bolts

RFBs are pre-cut threaded rod, supplied with nut and washer. For use with Simpson Strong-Tie adhesives. May be ordered in bulk without the nut and washer. Use with Simpson Strong-Tie adhesives to anchor into existing concrete and masonry. Each end of the threaded rod is stamped with the rod length in inches and our "No-Equal" symbol for easy identification after installation.

Material: ASTM F1554 Grade 36

Coating: Zinc-plated, hot-dip galvanized



RFB
Retrofit Bolts

Description Diameter Length	Zinc-Plated Model No.	Hot-Dip Galvanized Model No.	Carton Qty.	Retail Pack[2]
½" x 4"	RFB#4x4	RFB#4x4HDG	50	—
½" x 5"	RFB#4x5	RFB#4x5HDG	50	10
½" x 6"	RFB#4x6	RFB#4x6HDG	50	10
½" x 7"	RFB#4x7	RFB#4x7HDG	50	10
½" x 8"	—	RFB#4x8HDG	—	10
½" x 10"	RFB#4x10	RFB#4x10HDG	25	10
⅝" x 5"	RFB#5x5	RFB#5x5HDG	50	10
⅝" x 8"	RFB#5x8	RFB#5x8HDG	50	10
⅝" x 10"	RFB#5x10	RFB#5x10HDG	50	10
⅝" x 12"	—	RFB#5x12HDG	—	10
⅝" x 16"	RFB#5x16	RFB#5x16HDG	25	10
¾" x 10½"	RFB#6x10.5	RFB#6x10.5HDG	25	—

1. Bulk quantities do not include the nut and washer and must be ordered with a "-B" suffix (example: RFB#4x5-B). Hot-dip galvanized RFBs not available in bulk.
2. Retail packs must be ordered with an "-R" suffix (example: RFB#5x12HDG-R).

Mechanical Anchors

Titen HD® Heavy-Duty Screw Anchor

The original high-strength screw anchor for use in cracked and uncracked concrete, as well as uncracked masonry. The Titen HD offers low installation torque and outstanding performance. Designed and tested in dry, interior, non-corrosive environments or temporary outdoor applications, the Titen HD demonstrates industry-leading performance even in seismic conditions.

Features

- Code listed under IBC/IRC in accordance with ICC-ES AC193 and ACI 355.2 for cracked and uncracked concrete per ICC-ES ESR-2713
- Code listed under IBC/IRC in accordance with ICC-ES AC106 for masonry per ICC-ES ESR-1056
- Qualified for static and seismic loading conditions
- Thread design undercuts to efficiently transfer the load to the base material
- Standard fractional sizes
- Specialized heat-treating process creates tip hardness for better cutting without compromising the ductility
- No special drill bit required — designed to install using standard-sized ANSI tolerance drill bits
- Testing shows the Titen HD installs in concrete with 50% less torque than competitor anchors
- Hex-washer head requires no separate washer, unless required by code, and provides a clean installed appearance
- Removable — ideal for temporary anchoring (e.g., formwork, bracing) or applications where fixtures may need to be moved
- Reuse of the anchor to achieve listed load values is not recommended

Codes: ICC-ES ESR-2713 (concrete); ICC-ES ESR-1056 (masonry); City of L.A. RR25741 (concrete), RR25560 (masonry); Florida FL-15730.6; FM 3017082, 3035761 and 3043442; Multiple DOT listings

Material: Carbon steel

Coating: Zinc plated or mechanically galvanized.
Not recommended for permanent exterior use or highly corrosive environments.

Titen HD Screw Anchor
U.S. Patent 6,623,228

Cracked Concrete CODE LISTED

Serrated teeth on the tip of the Titen HD® screw anchor facilitate cutting and reduce installation torque.

Installation

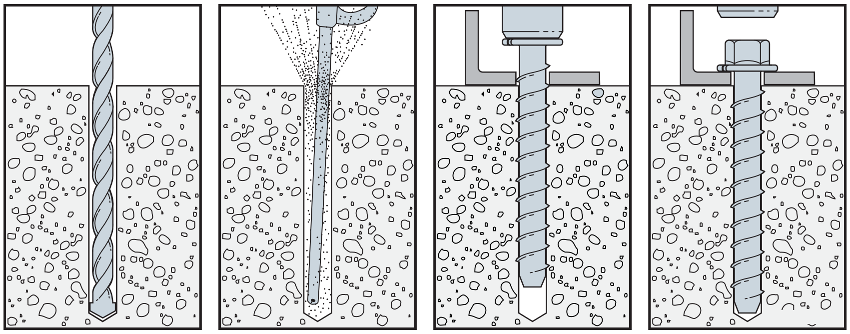
⚠ Holes in metal fixtures to be mounted should match the diameter specified in the table below.
Use a Titen HD screw anchor one time only — installing the anchor multiple times may result in excessive thread wear and reduce load capacity.

⚠ Do not use impact wrenches to install into hollow CMU.

⚠ **Caution:** Oversized holes in base material will reduce or eliminate the mechanical interlock of the threads with the base material and reduce the anchor's load capacity.

1. Drill a hole in the base material using a carbide drill bit the same diameter as the nominal diameter of the anchor to be installed. Drill the hole to the specified embedment depth plus minimum hole depth overall (see table below right) to allow the thread tapping dust to settle, and blow it clean using compressed air. (Overhead installations need not be blown clean.) Alternatively, drill the hole deep enough to accommodate embedment depth and the dust from drilling and tapping.
2. Insert the anchor through the fixture and into the hole.
3. Tighten the anchor into the base material until the hex-washer head contacts the fixture.

Installation Sequence



Additional Installation Information for Structural Steel

Titen HD® Diameter (in.)	Wrench Size (in.)	Recommended Steel Fixture Hole Size (in.)	Minimum Hole Depth Overdrill (in.)
1⁄4	3⁄8	3⁄8 to 7⁄16	1⁄8
3⁄8	9⁄16	1⁄2 to 9⁄16	1⁄4
1⁄2	3⁄4	5⁄8 to 11⁄16	1⁄2
5⁄8	15⁄16	3⁄4 to 13⁄16	1⁄2
3⁄4	1 1⁄8	7⁄8 to 15⁄16	1⁄2

Suggested fixture hole sizes are for structural steel thicker than 12 gauge only. Larger holes are not required for wood or cold-formed steel members.

Titen HD® Heavy-Duty Screw Anchor

Titen HD Anchor Product Data — Zinc Plated

Size (in.)	Model No.	Drill Bit Dia. (in.)	Wrench Size (in.)	Quantity	
				Box	Carton
¼ x 1⅞	THDB25178H	¼	⅜	100	500
¼ x 2¾	THDB25234H	¼	⅜	50	250
¼ x 3	THDB25300H	¼	⅜	50	250
¼ x 3½	THDB25312H	¼	⅜	50	250
¼ x 4	THDB25400H	¼	⅜	50	250
⅜ x 1¾	THD37134H†	⅜	9⁄16	50	250
⅜ x 2½	THD37212H†	⅜	9⁄16	50	200
⅜ x 3	THD37300H	⅜	9⁄16	50	200
⅜ x 4	THD37400H	⅜	9⁄16	50	200
⅜ x 5	THD37500H	⅜	9⁄16	50	100
⅜ x 6	THD37600H	⅜	9⁄16	50	100
½ x 3	THD50300H	½	¾	25	100
½ x 4	THD50400H	½	¾	20	80
½ x 5	THD50500H	½	¾	20	80
½ x 6	THD50600H	½	¾	20	80
½ x 6½	THD50612H	½	¾	20	40
½ x 8	THD50800H	½	¾	20	40
½ x 12	THD501200H	½	¾	5	25
½ x 13	THD501300H	½	¾	5	25
½ x 14	THD501400H	½	¾	5	25
½ x 15	THD501500H	½	¾	5	25
⅝ x 4	THDB62400H	⅝	15⁄16	10	40
⅝ x 5	THDB62500H	⅝	15⁄16	10	40
⅝ x 6	THDB62600H	⅝	15⁄16	10	40
⅝ x 6½	THDB62612H	⅝	15⁄16	10	40
⅝ x 8	THDB62800H	⅝	15⁄16	10	20
⅝ x 10	THDB62100H	⅝	15⁄16	10	20
¾ x 4	THD75400H	¾	1⅛	10	40
¾ x 5	THD75500H	¾	1⅛	5	20
¾ x 6	THDT75600H	¾	1⅛	5	20
¾ x 7	THD75700H	¾	1⅛	5	10
¾ x 8½	THD75812H	¾	1⅛	5	10
¾ x 10	THD75100H	¾	1⅛	5	10

† These models do not meet minimum embedment depth requirements for strength design and require maximum installation torque of 25 ft. – lb. using a torque wrench, driver drill or cordless ¼" impact driver with a maximum permitted torque rating of 100 ft. – lb.

Titen HD Anchor Product Data — Mechanically Galvanized

Size (in.)	Model No.	Drill Bit Dia. (in.)	Wrench Size (in.)	Quantity	
				Box	Carton
⅜ x 3	THD37300HMG	⅜	9⁄16	50	200
⅜ x 4	THD37400HMG			50	200
⅜ x 5	THD37500HMG			50	100
⅜ x 6	THD37600HMG			50	100
½ x 4	THD50400HMG	½	¾	20	80
½ x 5	THD50500HMG			20	80
½ x 6	THD50600HMG			20	80
½ x 6½	THD50612HMG			20	40
½ x 8	THD50800HMG			20	40
⅝ x 5	THDB62500HMG	⅝	15⁄16	10	40
⅝ x 6	THDB62600HMG			10	40
⅝ x 6½	THDB62612HMG			10	40
⅝ x 8	THDB62800HMG			10	20
¾ x 6	THDT75600HMG	¾	1⅛	5	20
¾ x 8½	THD75812HMG			5	10
¾ x 10	THD75100HMG			5	10

Mechanical galvanizing meets ASTM B695, Class 65, Type 1. Intended for some pressure-treated wood sill plate applications. Not for use in other corrosive or outdoor environments. See p. 248 or visit **strongtie.com/info** for more corrosion information.

Titen HD Installation Information and Additional Data[1]

IBC LW *

Characteristic	Symbol	Units	Nominal Anchor Diameter, d_a (in.)									
			¼		⅜		½		⅝		¾	
Installation Information												
Drill Bit Diameter	d_{bit}	in.	¼		⅜		½		⅝		¾	
Baseplate Clearance Hole Diameter	d_c	in.	⅜		½		⅝		¾		⅞	
Maximum Installation Torque	$T_{inst,max}$	ft.-lbf	24[2]		50[2]		65[2]		100[2]		150[2]	
Maximum Impact Wrench Torque Rating	$T_{impact,max}$	ft.-lbf	125[3]		150[3]		340[3]		340[3]		385[3]	
Minimum Hole Depth	h_{hole}	in.	1¾	2⅝	2¾	3½	3¾	4½	4½	6	6	6¾
Nominal Embedment Depth	h_{nom}	in.	1⅝	2½	2½	3¼	3¼	4	4	5½	5½	6¼
Critical Edge Distance	c_{ac}	in.	3	6	2 11⁄16	3⅝	3 9⁄16	4½	4½	6⅜	6⅜	7 5⁄16
Minimum Edge Distance	c_{min}	in.	1½		1¾							
Minimum Spacing	s_{min}	in.	3									
Minimum Concrete Thickness	h_{min}	in.	3¼	3½	4	5	5	6¼	6	8½	8¾	10
Additional Data												
Anchor Category	Category	—	1									
Yield Strength	f_{ya}	psi	100,000		97,000							
Tensile Strength	f_{uta}	psi	125,000		110,000							
Minimum Tensile and Shear Stress Area	A_{se}	in²	0.042		0.099		0.183		0.276		0.414	
Axial Stiffness in Service Load Range – Uncracked Concrete	β_{uncr}	lb./in.	202,000		715,000							
Axial Stiffness in Service Load Range – Cracked Concrete	β_{cr}	lb./in.	173,000		345,000							

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 and ACI 318 Appendix D.
2. $T_{inst,max}$ is the maximum permitted installation torque for the embedment depth range covered by this table using a torque wrench.
3. $T_{impact,max}$ is the maximum permitted torque rating for impact wrenches for the embedment depth range covered by this table.

* See p. 13 for an explanation of the load table icons.

Titen HD® Design Information — Concrete

IBC *

Titen HD Tension Strength Design Data[1]

Characteristic	Symbol	Units	Nominal Anchor Diameter, d_a (in.)									
			¼		⅜		½		⅝		¾	
Nominal Embedment Depth	h_{nom}	in.	1⅝	2½	2½	3¼	3¼	4	4	5½	5½	6¼
Steel Strength in Tension												
Tension Resistance of Steel	N_{sa}	lb.	5,195		10,890		20,130		30,360		45,540	
Strength Reduction Factor — Steel Failure	ϕ_{sa}	—	0.65[2]									
Concrete Breakout Strength in Tension[6,8]												
Effective Embedment Depth	h_{ef}	in.	1.19	1.94	1.77	2.40	2.35	2.99	2.97	4.24	4.22	4.86
Critical Edge Distance[6]	c_{ac}	in.	3	6	2^11^⁄16	3⅝	3^9^⁄16	4½	4½	6 ⅜	6⅜	7^5^⁄16
Effectiveness Factor — Uncracked Concrete	k_{uncr}	—	30	24								
Effectiveness Factor — Cracked Concrete	k_{cr}	—	17									
Modification Factor	$\psi_{c,N}$	—	1.0									
Strength Reduction Factor — Concrete Breakout Failure	ϕ_{cb}	—	0.65[7]									
Pullout Strength in Tension[8]												
Pullout Resistance, Uncracked Concrete (f'_c = 2,500 psi)	$N_{p,uncr}$	lb.	—[3]	—[3]	2,700[4]	—[3]	—[3]	—[3]	—[3]	9,810[4]	—[3]	—[3]
Pullout Resistance, Cracked Concrete (f'_c = 2,500 psi)	$N_{p,cr}$	lb.	—[3]	1,905[4]	1,235[4]	2,700[4]	—[3]	—[3]	3,040[4]	5,570[4]	6,070[4]	7,195[4]
Strength Reduction Factor — Concrete Pullout Failure	ϕ_p	—	0.65[5]									
Breakout or Pullout Strength in Tension for Seismic Applications[8]												
Nominal Pullout Strength for Seismic Loads (f'_c = 2,500 psi)	$N_{p,eq}$	lb.	—[3]	1,905[4]	1,235[4]	2,700[4]	—[3]	—[3]	3,040[4]	5,570[4]	6,070[4]	7,195[4]
Strength Reduction Factor — Breakout or Pullout Failure	ϕ_{eq}	—	0.65[5]									

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 and ACI 318-11 Appendix D, except as modified below.
2. The tabulated value of ϕ_{sa} applies when the load combinations of Section 1605.2.1 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ_{sa} must be determined in accordance with ACI 318-11 D.4.4. Anchors are considered brittle steel elements.
3. Pullout strength is not reported since concrete breakout controls.
4. Adjust the characteristic pullout resistance for other concrete compressive strengths by multiplying the tabular value by $(f'_{c,specified} / 2{,}500)^{0.5}$.
5. The tabulated value of ϕ_p or ϕ_{eq} applies when the load combinations of Section 1605.2.1 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3.(c) or ACI 318-11 D.4.3(c) for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, appropriate value of ϕ must be determined in accordance with ACI 318-11 Section D.4.4(c).
6. The modification factor $\psi_{cp,N}$ = 1.0 for cracked concrete. Otherwise, the modification factor for uncracked concrete without supplementary reinforcement to control splitting is either:

   (1) $\psi_{cp,N} = 1.0$ if $c_{a,min} \ge c_{ac}$ or (2) $\psi_{cp,N} = \frac{c_{a,min}}{c_{ac}} \ge \frac{1.5h_{ef}}{c_{ac}}$ if $c_{a,min} < c_{ac}$

   The modification factor, $\psi_{cp,N}$ is applied to the nominal concrete breakout strength, N_{cb} or N_{cbg}.
7. The tabulated value of ϕ_{cb} applies when both the load combinations of Section 1605.2.1 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition B are met. Condition B applies where supplementary reinforcement is not provided. For installations where complying supplementary reinforcement can be verified, the ϕ_{cb} factors described in ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition A are allowed. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ_{cb} must be determined in accordance with ACI 318-11 D.4.4(c).

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* See p. 13 for an explanation of the load table icons.

Titen HD Shear Strength Design Data[1]

Characteristic	Symbol	Units	Nominal Anchor Diameter, d_a (in.)									
			¼[5]		⅜		½		⅝[5]		¾	
Nominal Embedment Depth	h_{nom}	in.	1⅝	2½	2½	3¼	3¼	4	4	5½	5½	6¼
Steel Strength in Shear												
Shear Resistance of Steel	V_{sa}	lb.	2,020		4,460		7,455		10,000		16,840	
Strength Reduction Factor — Steel Failure	ϕ_{sa}	—	0.60[2]									
Concrete Breakout Strength in Shear[6]												
Outside Diameter	d_a	in.	0.25		0.375		0.500		0.625		0.750	
Load Bearing Length of Anchor in Shear	ℓ_e	in.	1.19	1.94	1.77	2.40	2.35	2.99	2.97	4.24	4.22	4.86
Strength Reduction Factor — Concrete Breakout Failure	ϕ_{cb}	—	0.70[4]									
Concrete Pryout Strength in Shear												
Coefficient for Pryout Strength	k_{cp}	lb.	1.0					2.0				
Strength Reduction Factor — Concrete Pryout Failure	ϕ_{cp}	—	0.70[4]									
Steel Strength in Shear for Seismic Applications												
Shear Resistance for Seismic Loads	V_{eq}	lb.	1,695		2,855		4,790		8,000		9,350	
Strength Reduction Factor — Steel Failure	ϕ_{eq}	—	0.60[2]									

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 and ACI 318-11 Appendix D, except as modified below.
2. The tabulated value of ϕ_{sa} applies when the load combinations of Section 1605.2.1 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ_{sa} must be determined in accordance with ACI 318 D.4.4.
3. The tabulated value of ϕ_{cb} applies when both the load combinations of Section 1605.2.1 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition B are met. Condition B applies where supplementary reinforcement is not provided. For installations where complying supplementary reinforcement can be verified, the ϕ_{cb} factors described in ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition A are allowed. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ_{cb} must be determined in accordance with ACI 318-11 D.4.4(c).
4. The tabulated value of ϕ_{cp} applies when both the load combinations of IBC Section 1605.2, ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, appropriate value of ϕ_{cp} must be determined in accordance with ACI 318-11 Section D.4.4(c).

Titen HD Tension and Shear Strength Design Data for the Soffit of Normal-Weight or Sand-Lightweight Concrete over Metal Deck[1,6,8]

Characteristic	Symbol	Units	Nominal Anchor Diameter, d_a (in.)									
			Lower Flute						Upper Flute			
			Figure 2		Figure 1				Figure 2		Figure 1	
			¼[8]		⅜		½		¼[8]		⅜	½
Nominal Embedment Depth	h_{nom}	in.	1⅝	2½	1⅞	2½	2	3½	1⅝	2½	1⅞	2
Effective Embedment Depth	h_{ef}	in.	1.19	1.94	1.23	1.77	1.29	2.56	1.19	1.94	1.23	1.29
Pullout Resistance, concrete on metal deck (cracked)[2,3,4]	$N_{p,deck,cr}$	lb.	420	535	375	870	905	2,040	655	1,195	500	1,700
Pullout Resistance, concrete on metal deck (uncracked)[2,3,4]	$N_{p,deck,uncr}$	lb.	995	1,275	825	1,905	1,295	2,910	1,555	2,850	1,095	2,430
Steel Strength in Shear, concrete on metal deck[5]	$V_{sa,\,deck}$	lb.	1,335	1,745	2,240	2,395	2,435	4,430	2,010	2,420	4,180	7,145
Steel Strength in Shear, Seismic	$V_{sa,\,deck,eq}$	lb.	870	1,135	1,434	1,533	1,565	2,846	1,305	1,575	2,676	4,591

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 and ACI 318-11 Appendix D, except as modified below.
2. Concrete compressive strength shall be 3,000 psi minimum. The characteristic pullout resistance for greater compressive strengths shall be increased by multiplying the tabular value by $(f'_{c,specified}/3{,}000)^{0.5}$.
3. For anchors installed in the soffit of sand-lightweight or normal-weight concrete over metal deck floor and roof assemblies, as shown in Figure 1 and Figure 2, calculation of the concrete breakout strength may be omitted.
4. In accordance with ACI 318-14 Section 17.4.3.2 or ACI 318-11 Section D.5.3.2, the nominal pullout strength in cracked concrete for anchors installed in the soffit of sand-lightweight or normal-weight concrete over metal deck floor and roof assemblies $N_{p,deck,cr}$ shall be substituted for $N_{p,cr}$. Where analysis indicates no cracking at service loads, the normal pullout strength in uncracked concrete $N_{p,deck,uncr}$ shall be substituted for $N_{p,uncr}$.
5. In accordance with ACI 318-14 Section 17.5.1.2(C) or ACI 318-11 Section D.6.1.2(c), the shear strength for anchors installed in the soffit of sand-lightweight or normal-weight concrete over metal deck floor and roof assemblies $V_{sa,deck}$ and $V_{sa,deck,eq}$ shall be substituted for V_{sa}.
6. Minimum edge distance to edge of panel is $2h_{ef}$.
7. The minimum anchor spacing along the flute must be the greater of $3h_{ef}$, or 1.5 times the flute width.

* See p. 13 for an explanation of the load table icons.

Titen HD® Design Information — Concrete

Titen HD Anchor Tension and Shear Strength Design Data in the Topside of Normal-Weight Concrete or Sand-Lightweight Concrete over Metal Deck

IBC *

Design Information	Symbol	Units	Nominal Anchor Diameter, d_a (in.)	
			Figure 3	Figure 3
			¼	⅜
Nominal Embedment Depth	h_{nom}	in.	1⅝	2½
Effective Embedment Depth	h_{ef}	in.	1.19	1.77
Minimum Concrete Thickness	$h_{min,deck}$	in.	2½	3¼
Critical Edge Distance	$c_{ac,deck,top}$	in.	3¾	7¼
Minimum Edge Distance	$c_{min,deck,top}$	in.	3½	3
Minimum Spacing	$s_{min,deck,top}$	in.	3½	3

1. For anchors installed in the topside of concrete-filled deck assemblies, as shown in Figures 2 and 3, the nominal concrete breakout strength of a single anchor or group of anchors in shear, V_{cb} or V_{cbg}, respectively, must be calculated in accordance with ACI 318-14 Section 17.5.2 or ACI 318-11 Section D.6.2, using the actual member thickness, $h_{min,deck}$, in the determination of A_{vc}.
2. Design capacity shall be based on calculations according to values in the tables featured on pp. 116–118.
3. Minimum flute depth (distance from top of flute to bottom of flute) is 1½" (see Figures 2 and 3).
4. Steel deck thickness shall be minimum 20 gauge.
5. Minimum concrete thickness ($h_{min,deck}$) refers to concrete thickness above upper flute (see Figures 2 and 3).

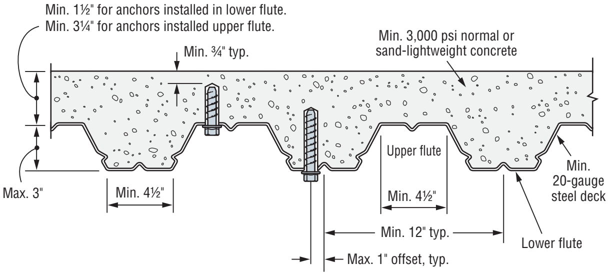

Figure 1. Installation of ⅜"- and ½"-Diameter Anchors in the Soffit of Concrete over Metal Deck

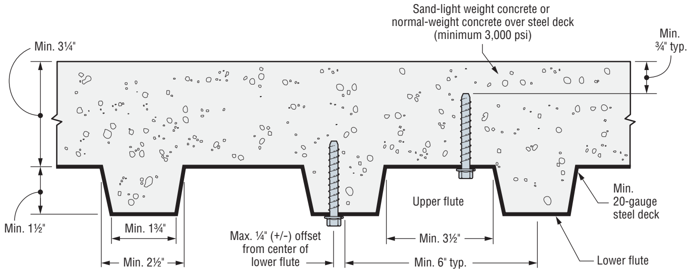

Figure 2. Installation of ¼"-Diameter Anchors in the Soffit of Concrete over Metal Deck

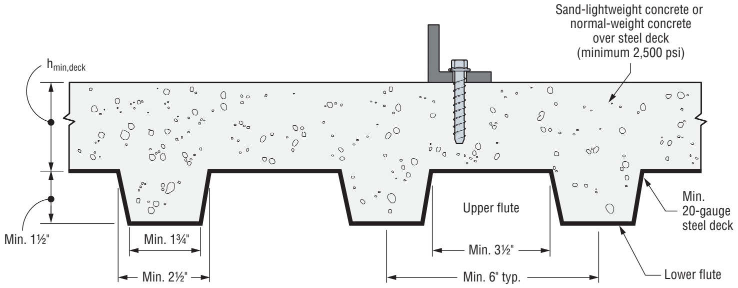

Figure 3. Installation of ¼"- and ⅜"-Diameter Anchors in the Topside of Concrete over Metal Deck

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* See p. 13 for an explanation of the load table icons.

Titen HD Allowable Tension and Shear Loads in 8" Lightweight, Medium-Weight and Normal-Weight Grout-Filled CMU *

Size 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)	Values for 8" Lightweight, Medium-Weight or Normal-Weight Grout-Filled CMU			
						Tension Load		Shear Load	
						Ultimate lb. (kN)	Allowable lb. (kN)	Ultimate lb. (kN)	Allowable lb. (kN)
Anchor Installed in the Face of the CMU Wall (See Figure 4)									
⅜ (9.5)	⅜	2¾ (70)	12 (305)	12 (305)	6 (152)	2,390 (10.6)	480 (2.1)	4,340 (19.3)	870 (3.9)
½ (12.7)	½	3½ (89)	12 (305)	12 (305)	8 (203)	3,440 (15.3)	690 (3.1)	6,920 (30.8)	1,385 (6.2)
⅝ (15.9)	⅝	4½ (114)	12 (305)	12 (305)	10 (254)	5,300 (23.6)	1,060 (4.7)	10,420 (46.4)	2,085 (9.3)
¾ (19.1)	¾	5½ (140)	12 (305)	12 (305)	12 (305)	7,990 (35.5)	1,600 (7.1)	15,000 (66.7)	3,000 (13.3)

1. The tabulated allowable loads are based on a safety factor of 5.0 for installations under the IBC and IRC.
2. Values for 8"-wide, lightweight, medium-weight and normal-weight concrete masonry units.
3. The masonry units must be fully grouted.
4. The minimum specified compressive strength of masonry, f'$_m$, at 28 days is 1,500 psi.
5. Embedment depth is measured from the outside face of the concrete masonry unit.
6. Allowable loads may be increased 33⅓% for short-term loading due to wind or seismic forces where permitted by code.
7. Grout-filled CMU wall design must satisfy applicable design standards and be capable of withstanding applied loads.
8. Refer to allowable load-adjustment factors for spacing and edge distance on p. 123.

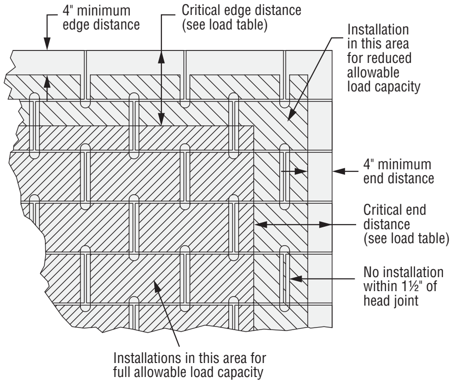

Figure 4. Shaded Area = Placement for Full and Reduced Allowable Load Capacity in Grout-Filled CMU

Titen HD Allowable Tension and Shear Loads in 8" Lightweight, Medium-Weight and Normal-Weight Hollow CMU *

Size in. (mm)	Drill Bit Dia. in.	Embed. Depth[4] in. (mm)	Min. Edge Dist. in. (mm)	Min. End Dist. in. (mm)	8" Hollow CMU Loads Based on CMU Strength			
					Tension Load		Shear Load	
					Ultimate lb. (kN)	Allowable lb. (kN)	Ultimate lb. (kN)	Allowable lb. (kN)
Anchor Installed in Face Shell (See Figure 5)								
⅜ (9.5)	⅜	1¾ (45)	4 (102)	4⅝ (117)	720 (3.2)	145 (0.6)	1,240 (5.5)	250 (1.1)
½ (12.7)	½	1¾ (45)	4 (102)	4⅝ (117)	760 (3.4)	150 (0.7)	1,240 (5.5)	250 (1.1)
⅝ (15.9)	⅝	1¾ (45)	4 (102)	4⅝ (117)	800 (3.6)	160 (0.7)	1,240 (5.5)	250 (1.1)
¾ (19.1)	¾	1¾ (45)	4 (102)	4⅝ (117)	880 (3.9)	175 (0.8)	1,240 (5.5)	250 (1.1)

1. The tabulated allowable loads are based on a safety factor of 5.0 for installations under the IBC and IRC.
2. Values for 8"-wide, lightweight, medium-weight and normal-weight concrete masonry units.
3. The minimum specified compressive strength of masonry, f'$_m$, at 28 days is 1,500 psi.
4. Embedment depth is measured from the outside face of the concrete masonry unit and is based on the anchor being embedded an additional ½"- through 1¼"-thick face shell.
5. Allowable loads may not be increased for short-term loading due to wind or seismic forces. CMU wall design must satisfy applicable design standards and be capable of withstanding applied loads.
6. Do not use impact wrenches to install in hollow CMU.
7. Set drill to rotation-only mode when drilling into hollow CMU.

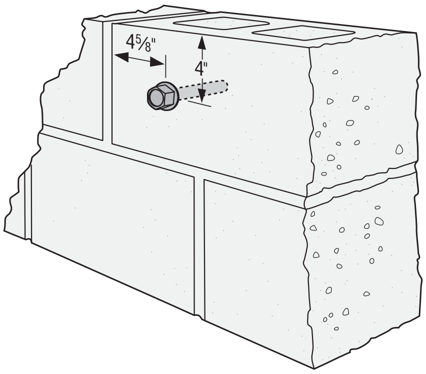

Figure 5

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* See p. 13 for an explanation of the load table icons.

Titen HD® Design Information — Masonry

Titen HD® Allowable Tension and Shear Loads in 8" Lightweight, Medium-Weight and Normal-Weight Grout-Filled CMU Stemwall

Size in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Min. Edge Dist. in. (mm)	Min. End Dist. in. (mm)	Critical Spacing Dist. in. (mm)	8" Grout-Filled CMU Allowable Loads Based on CMU Strength					
						Tension		Shear Perp. to Edge		Shear Parallel to Edge	
						Ultimate lb. (kN)	Allowable lb. (kN)	Ultimate lb. (kN)	Allowable lb. (kN)	Ultimate lb. (kN)	Allowable lb. (kN)
Anchor Installed in Cell Opening or Web (Top of Wall) (See Figure 6)											
½ (12.7)	½	**4½** (114)	**1¾** (45)	**8** (203)	**8** (203)	**2,860** (12.7)	**570** (2.5)	**800** (3.6)	**160** (0.7)	**2,920** (13.0)	**585** (2.6)
⅝ (15.9)	⅝	**4½** (114)	**1¾** (45)	**10** (254)	**10** (254)	**2,860** (12.7)	**570** (2.5)	**800** (3.6)	**160** (0.7)	**3,380** (15.0)	**675** (3.0)

1. The tabulated allowable loads are based on a safety factor of 5.0 for installations under the IBC and IRC.
2. Values are for 8"-wide, lightweight, medium-weight and normal-weight concrete masonry units.
3. The masonry units must be fully grouted.
4. The minimum specified compressive strength of masonry, f'_m, at 28 days is 1,500 psi.
5. Allowable loads may be increased 33⅓% for short-term loading due to wind or seismic forces where permitted by code.
6. Grout-filled CMU wall design must satisfy applicable design standards and be capable of withstanding applied design loads.
7. Loads are based on anchor installed in either the web or grout-filled cell opening in the top of wall.

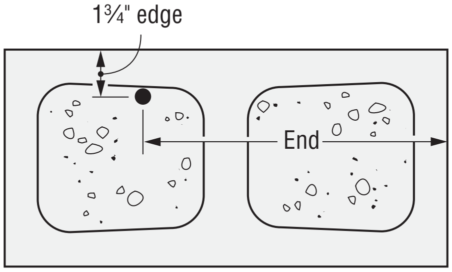

Figure 6. Anchor Installed in Top of Wall

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* See p. 13 for an explanation of the load table icons.

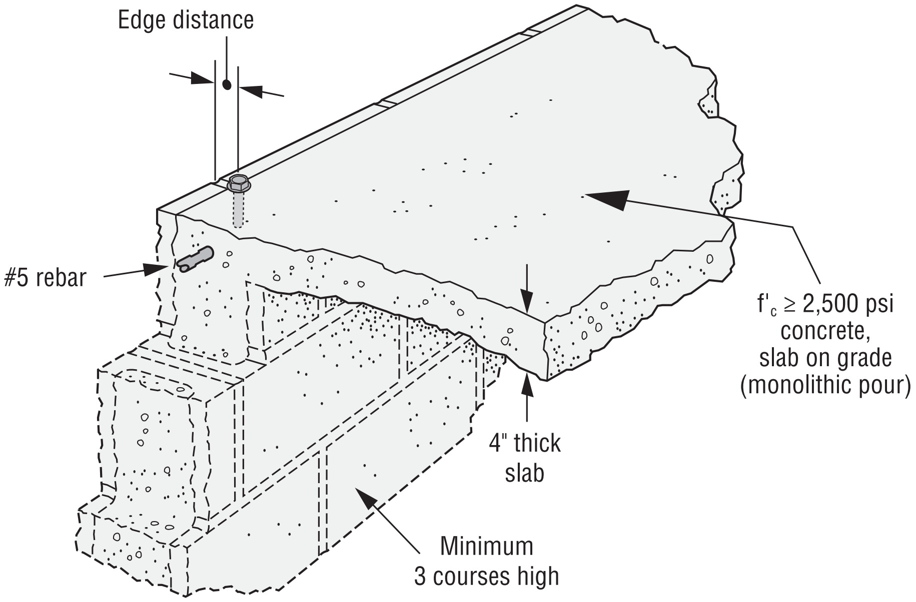
Titen HD® Design Information — Masonry

Titen HD Allowable Tension Loads for 8" Lightweight, Medium-Weight and Normal-Weight CMU Chair Blocks Filled with Normal-Weight Concrete

IBC ⬆ ▦ *

Size in. (mm)	Drill Bit Dia. (in.)	Min. Embed. Depth in. (mm)	Min. Edge Dist. in. (mm)	Critical Spacing in. (mm)	8" Concrete-Filled CMU Chair Block Allowable Tension Loads Based on CMU Strength	
					Ultimate lb. (kN)	Allowable lb. (kN)
⅜ (9.5)	⅜	2⅜ (60)	1¾ (44)	9½ (241)	3,175 (14.1)	635 (2.8)
		3⅜ (86)	1¾ (44)	13½ (343)	5,175 (23.0)	1,035 (4.6)
		5 (127)	2¼ (57)	20 (508)	10,584 (47.1)	2,115 (9.4)
½ (12.7)	½	8 (203)	2¼ (57)	32 (813)	13,722 (61.0)	2,754 (12.2)
		10 (254)	2¼ (57)	40 (1016)	16,630 (74.0)	3,325 (14.8)
⅝ (15.9)	⅝	5½ (140)	1¾ (44)	22 (559)	9,025 (40.1)	1,805 (8.1)

1. The tabulated allowable loads are based on a safety factor of 5.0.
2. Values are for 8"-wide concrete masonry units (CMU) filled with concrete, with minimum compressive strength of 2,500 psi and poured monolithically with the floor slab.
3. Center #5 rebar in CMU cell and concrete slab as shown in the illustration below.



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* See p. 13 for an explanation of the load table icons.

Titen HD® Design Information — Masonry

Load-Adjustment Factors for Titen HD Anchors in Face-of-Wall Installation in 8" Grout-Filled CMU: Edge Distance and Spacing, Tension and Shear Loads

How to use these charts:

1. The following tables are for reduced 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 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 spacings are multiplied together.

Edge or End Distance Tension (f_c)

c_{act} (in.)	Dia.	⅜	½	⅝	¾
	E	2¾	3½	4½	5½
	c_{cr}	12	12	12	12
	c_{min}	4	4	4	4
	f_{cmin}	**1.00**	**1.00**	**0.83**	**0.66**
4		1.00	1.00	0.83	0.66
6		1.00	1.00	0.87	0.75
8		1.00	1.00	0.92	0.83
10		1.00	1.00	0.96	0.92
12		1.00	1.00	1.00	1.00

IBC *

See notes below.

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

c_{act} (in.)	Dia.	⅜	½	⅝	¾
	E	2¾	3½	4½	5½
	c_{cr}	12	12	12	12
	c_{min}	4	4	4	4
	f_{cmin}	**0.77**	**0.48**	**0.46**	**0.44**
4		0.77	0.48	0.46	0.44
6		0.83	0.61	0.60	0.58
8		0.89	0.74	0.73	0.72
10		0.94	0.87	0.87	0.86
12		1.00	1.00	1.00	1.00

IBC *

See notes below.

Edge or End Distance Shear (f_c) Shear Load Perpendicular to Edge or End (Directed Towards Edge or End)

c_{act} (in.)	Dia.	⅜	½	⅝	¾
	E	2¾	3½	4½	5½
	c_{cr}	12	12	12	12
	c_{min}	4	4	4	4
	f_{cmin}	**0.58**	**0.38**	**0.30**	**0.21**
4		0.58	0.38	0.30	0.21
6		0.69	0.54	0.48	0.41
8		0.79	0.69	0.65	0.61
10		0.90	0.85	0.83	0.80
12		1.00	1.00	1.00	1.00

IBC *

Edge or End Distance Shear (f_c) Shear Load Perpendicular to Edge or End (Directed Away From Edge or End)

c_{act} (in.)	Dia.	⅜	½	⅝	¾
	E	2¾	3½	4½	5½
	c_{cr}	12	12	12	12
	c_{min}	4	4	4	4
	f_{cmin}	**0.89**	**0.79**	**0.58**	**0.38**
4		0.89	0.79	0.58	0.38
6		0.92	0.84	0.69	0.54
8		0.95	0.90	0.79	0.69
10		0.97	0.95	0.90	0.85
12		1.00	1.00	1.00	1.00

IBC *

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)

s_{act} (in.)	Dia.	⅜	½	⅝	¾
	E	2¾	3½	4½	5½
	s_{cr}	6	8	10	12
	s_{min}	3	4	5	6
	f_{smin}	**0.87**	**0.69**	**0.59**	**0.50**
3		0.87			
4		0.91	0.69		
5		0.96	0.77	0.59	
6		1.00	0.85	0.67	0.50
8			1.00	0.84	0.67
10				1.00	0.83
12					1.00

IBC *

Spacing Shear (f_s)

s_{act} (in.)	Dia.	⅜	½	⅝	¾
	E	2¾	3½	4½	5½
	s_{cr}	6	8	10	12
	s_{min}	3	4	5	6
	f_{smin}	**0.62**	**0.62**	**0.62**	**0.62**
3		0.62			
4		0.75	0.62		
5		0.87	0.72	0.62	
6		1.00	0.81	0.70	0.62
8			1.00	0.85	0.75
10				1.00	0.87
12					1.00

IBC *

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. $f_s = f_{smin} + [(1 - f_{smin})\ (s_{act} - s_{min})\ /\ (s_{cr} - s_{min})]$.

* See p. 13 for an explanation of the load table icons.

Stainless-Steel Titen HD® Heavy-Duty Screw Anchor

The Next Era of Stainless-Steel Screw Anchor for Concrete and Masonry

Titen HD screw anchors are a trusted anchor solution because they offer the performance that specifiers need and the ease of installation that contractors demand. Until now, however, they were not for use in permanent exterior or corrosive environments. The Titen HD stainless-steel screw anchor for concrete and masonry sets the new standard for when the job calls for installation in multiple types of environments. It is the ultimate choice to provide fast and efficient installation, combined with long-lasting corrosion resistance for an unsurpassed peace-of-mind.

Innovative — The serrated carbon-steel threads on the tip of the stainless-steel Titen HD are vital because they undercut the concrete as the anchor is driven into the hole, making way for the rest of the threads to interlock with the concrete. In order for these threads to be durable enough to cut into the concrete, they are formed from carbon steel that is then hardened and brazed onto the tip of the anchor.

Corrosion Resistant — For dry, interior applications, carbon-steel corrosion is not a risk, but in any kind of exterior, coastal or chemical environment the anchor would be susceptible to corrosion. With the introduction of the THDSS, there is finally a state-of-the-art anchor solution that combines the corrosion resistance of Type 300 Series stainless steel with the undercutting ability of heat-treated carbon-steel cutting threads.

Features:

- THDSS is now the first stainless-steel screw anchor available in ⅝" and ¾" diameters, in addition to the ⅜" and ½" sizes
- Ideal for exterior or corrosive environments
- Less carbon steel, less expansion
- Installs with an impact wrench or by hand tool
- Code listed in IAPMO UES ER-493 (concrete) and ICC-ES ESR-1056 (masonry)
- Tested per ACI355.2 and AC193

Material: Type 316 and Type 304 stainless steel with carbon-steel lead threads

Installation

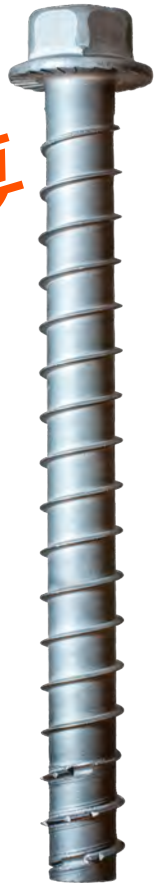
⚠ **Caution:** Holes in steel fixtures to be mounted should match the diameter specified in the table below if steel is thicker than 12 gauge.

⚠ **Caution:** Use a Titen HD screw anchor one time only — installing the anchor multiple times may result in excessive thread wear and reduce load capacity.

Do not use impact wrenches to install into hollow CMU.

⚠ **Caution:** Oversized holes in base material will reduce or eliminate the mechanical interlock of the threads with the base material and reduce the anchor's load capacity.

1. Drill a hole in the base material using a carbide drill bit (complying with ANSI B212.15) with the same diameter as the nominal diameter of the anchor to be installed. Drill the hole to the specified minimum hole depth overdrill (see table below) to allow the thread tapping dust to settle, and blow it clean using compressed air. (Overhead installations need not be blown clean.) Alternatively, drill the hole deep enough to accommodate embedment depth and the dust from drilling and tapping.
2. Insert the anchor through the fixture and into the hole.
3. Tighten the anchor into the base material until the hex-washer head contacts the fixture.



Stainless-Steel Titen HD® Screw Anchor

U.S. Patent 8,747,042 B2

Innovative carbon-steel thread effectively cuts the concrete while significantly limiting the amount of carbon steel in the anchor, minimizing the amount of corrosion potential that can occur in a exterior corrosive environment.

Anatomy of the Stainless-Steel Titen HD® (THDSS)

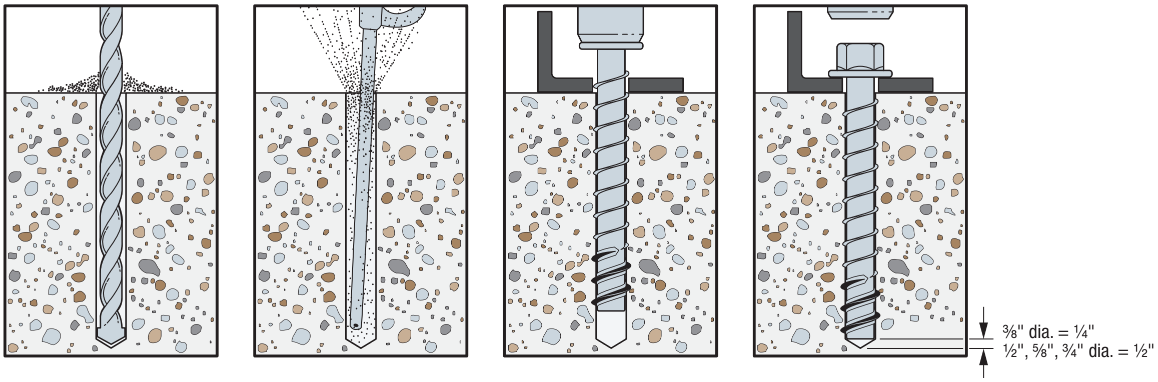
The THDSS screw anchor gets its cutting ability from a proprietary bi-metal design that incorporates a carbon-steel helical-coil thread brazed into the shank of the anchor. The serrated carbon-steel leading thread cuts a channel for the stainless-steel threads to engage into.

Additional Installation Information

Titen HD® Diameter (in.)	Wrench Size (in.)	Recommended Steel Fixture Hole Size (in.)	Min. Hole Depth Overdrill (in.)
⅜	9/16	½ to 9/16	¼
½	¾	⅝ to 11/16	½
⅝	15/16	¾ to 13/16	½
¾	1 ⅛	⅞ to 15/16	½

Suggested fixture hole sizes are for structural steel thicker than 12 gauge only. Larger holes are not required for wood or cold-formed steel members.

Installation Sequence



Stainless-Steel Titen HD® Design Information — Concrete

Stainless-Steel Titen HD Anchor Product Data

Size (in.)	Model No. (Type 316)	Model No. (Type 304)	Drill Bit Dia. (in.)	Wrench Size (in.)	Quantity	
					Box	Carton
⅜ x 3	THD37300H6SS	THD37300H4SS	⅜	9/16	50	200
⅜ x 4	THD37400H6SS	THD37400H4SS	⅜	9/16	50	200
⅜ x 5	THD37500H6SS	THD37500H4SS	⅜	9/16	50	100
⅜ x 6	THD37600H6SS	THD37600H4SS	⅜	9/16	50	100
½ x 3	THD50300H6SS	THD50300H4SS	½	¾	25	100
½ x 4	THD50400H6SS	THD50400H4SS	½	¾	20	80
½ x 5	THD50500H6SS	THD50500H4SS	½	¾	20	80
½ x 6	THD50600H6SS	THD50600H4SS	½	¾	20	80
½ x 6½	THD50612H6SS	THD50612H4SS	½	¾	20	40
½ x 8	THD50800H6SS	THD50800H4SS	½	¾	20	40
⅝ x 4	THDB62400H6SS	THDB62400H4SS	⅝	15/16	10	40
⅝ x 5	THDB62500H6SS	THDB62500H4SS	⅝	15/16	10	40
⅝ x 6	THDB62600H6SS	THDB62600H4SS	⅝	15/16	10	40
⅝ x 6½	THDB62612H6SS	THDB62612H4SS	⅝	15/16	10	40
⅝ x 8	THDB62800H6SS	THDB62800H4SS	⅝	15/16	10	20
¾ x 4	THD75400H6SS	THD75400H4SS	¾	1⅛	10	40
¾ x 5	THD75500H6SS	THD75500H4SS	¾	1⅛	5	20
¾ x 6	THD75600H6SS	THD75600H4SS	¾	1⅛	5	20
¾ x 7	THD75700H6SS	THD75700H4SS	¾	1⅛	5	10
¾ x 8½	THD75812H6SS	THD75812H4SS	¾	1⅛	5	10

Stainless-Steel Titen HD Installation Information[1]

IBC LW *

Characteristic	Symbol	Units	Nominal Anchor Diameter (in.)								
			⅜		½			⅝		¾	
Installation Information											
Nominal Diameter	$d_a(d_o)$[4]	in.	⅜		½			⅝		¾	
Drill Bit Diameter	d_{bit}	in.	⅜		½			⅝		¾	
Minimum Baseplate Clearance Hole Diameter[2]	d_c	in.	½		⅝			¾		⅞	
Maximum Installation Torque[3]	$T_{inst,max}$	ft.-lbf.	40		70			85		150	
Maximum Impact Wrench Torque Rating	$T_{impact,max}$	ft.-lbf.	150		345			345		380	
Minimum Hole Depth	h_{hole}	in.	2¾	3½	3¾		4½	4½	6	6	6¾
Nominal Embedment Depth	h_{nom}	in.	2½	3¼	3¼		4	4	5½	5½	6¼
Effective Embedment Depth	h_{ef}	in.	1.40	2.04	1.86		2.50	2.31	3.59	3.49	4.13
Critical Edge Distance	c_{ac}	in.	4½	5½	6		5¾	6	6⅜	6¾	7⅜
Minimum Edge Distance	c_{min}	in.	1¾	1¾	1¾	2¼	1¾	1¾	1¾	1¾	1¾
Minimum Spacing	s_{min}	in.	3	3	4	3	3	3	3	3	3
Minimum Concrete Thickness	h_{min}	in.	4	5	5		6¼	6	8½	8¾	10
Anchor Data											
Yield Strength	f_{ya}	psi	98,400		91,200			83,200		92,000	
Tensile Strength	f_{uta}	psi	123,000		114,000			104,000		115,000	
Minimum Tensile and Shear Stress Area	A_{se}[5]	in.^{2}	0.099		0.1832			0.276		0.414	
Axial Stiffness in Service Load Range — Uncracked Concrete	β_{uncr}	lb./in.	807,700		269,085			111,040		102,035	
Axial Stiffness in Service Load Range — Cracked Concrete	β_{cr}	lb./in.	113,540		93,675			94,400		70,910	

For **SI**: 1 in. = 25.4 mm, 1 ft.-lbf. = 1.356 N-m, 1 psi = 6.89 kPa, 1 in.^{2} = 645 mm^2, 1 lb./in. = 0.175 N/mm.

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable.
2. The minimum hole size must comply with applicable code requirements for the connected element.
3. $T_{inst,max}$ applies to installations using a calibrated torque wrench.
4. For the 2006 IBC d_o replaces d_a. The notation in parenthesis is for the 2006 IBC.

* See p. 13 for an explanation of the load table icons.

Stainless-Steel Titen HD® Design Information — Concrete

Stainless-Steel Titen HD Characteristic Tension Strength Design Values[1,5]

IBC LW *

Characteristic	Symbol	Units	Nominal Anchor Diameter (in.)							
			⅜		½		⅝		¾	
Anchor Category	1, 2 or 3	—	1							
Nominal Embedment Depth	h_{nom}	in.	2½	3¼	3¼	4	4	5½	5½	6¼
Steel Strength in Tension (ACI 318-14 17.4.1 or ACI 318-11 Section D.5.1)										
Tension Resistance of Steel	N_{sa}	lbf.	12,177		20,885		28,723		47,606	
Strength Reduction Factor — Steel Failure[2]	ϕ_{sa}	—	0.75							
Concrete Breakout Strength in Tension (ACI 318-14 17.4.2 or ACI 318 Section D.5.2)										
Effective Embedment Depth	h_{ef}	in.	1.40	2.04	1.86	2.50	2.31	3.59	3.49	4.13
Critical Edge Distance	c_{ac}	in.	4½	5½	6	5¾	6	6⅜	6¾	7⅜
Effectiveness Factor — Uncracked Concrete	k_{uncr}	—	27	24	27	24	24	24	27	27
Effectiveness Factor — Cracked Concrete	k_{cr}	—	21	17	17	17	17	17	17	21
Modification Factor	$\Psi_{c,N}$	—	1							
Strength Reduction Factor — Concrete Breakout Failure[3]	ϕ_{cb}	—	0.65							
Pullout Strength in Tension (ACI 318-14 17.4.3 or ACI 318-11 Section D.5.3)										
Pullout Resistance Uncracked Concrete (f'_c = 2,500 psi)	$N_{p,uncr}$	lbf.	N/A[4]	N/A[4]	N/A[4]	N/A[4]	3,820[5]	9,080[7]	N/A[4]	N/A[4]
Pullout Resistance Cracked Concrete (f'_c = 2,500 psi)	$N_{p,cr}$	lbf.	1,675[5]	2,415[5]	1,995[5]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]
Strength Reduction Factor — Pullout Failure[6]	ϕ_p	—	0.65							
Tension Strength for Seismic Applications (ACI 318-14 17.2.3.3 or ACI 318-11 Section D.3.3.3)										
Nominal Pullout Strength for Seismic Loads (f'_c = 2,500 psi)	$N_{p,eq}$	lbf.	1,675[5]	2,415[5]	1,995[5]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]
Strength Reduction Factor for Pullout Failure[6]	ϕ_{eq}	—	0.65							

For **SI**: 1 in. = 25.4 mm, 1 ft.-lbf. = 1.356 N-m, 1 psi = 6.89 kPa, 1 in.^{2} = 645 mm^2, 1 lb./in. = 0.175 N/mm.

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable.
2. The tabulated value of ϕ_{sa} applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4(b), as applicable.
3. The tabulated values of ϕ_{cb} applies when both the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used and the requirements of ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition B are met. Condition B applies where supplementary reinforcement is not provided in concrete. For installations where complying reinforcement can be verified, the ϕ_{cb} factors described in ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c), as applicable, may be used for Condition A. If the load combinations of ACI 318 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4(c) for Condition B.
4. N/A denotes that pullout resistance does not govern and does not need to be considered.
5. The characteristic pullout resistance for greater compressive strengths may be increased by multiplying the tabular value by $(f'_c/2{,}500)^{0.5.}$
6. The tabulated values of ϕ_p or ϕ_{eq} applies when both the load combinations of ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used and the requirements of ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition B are met. If the load combinations of ACI 318 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4(c) for Condition B.
7. The characteristic pullout resistance for greater compressive strengths may be increased by multiplying the tabular value by $(f'_c/2{,}500)^{0.4}$.

* See p. 13 for an explanation of the load table icons.

Stainless-Steel Titen HD® Design Information — Concrete

Stainless-Steel Titen HD Characteristic Shear Strength Design Values[1]

Characteristic	Symbol	Units	Nominal Anchor Diameter (in.)							
			⅜		½		⅝		¾	
Anchor Category	1, 2 or 3	—	1							
Nominal Embedment Depth	h_{nom}	in.	2½	3¼	3¼	4	4	5½	5½	6¼
Steel Strength in Shear (ACI 318-14 17.5.1 or ACI 318-11 Section D.6.1)										
Shear Resistance of Steel	V_{sa}	lbf.	3,790	4,780	6,024	7,633	10,422	10,649	13,710	19,161
Strength Reduction Factor — Steel Failure[2]	ϕ_{sa}	—	0.65							
Concrete Breakout Strength in Shear (ACI 318-14 17.5.2 or ACI 318-11 Section D.6.2)										
Nominal Diameter	$d_a(d_o)$[4]	in.	0.375		0.500		0.625		0.750	
Load Bearing Length of Anchor in Shear	l_e	in.	1.40	2.04	1.86	2.50	2.31	3.59	3.49	4.13
Strength Reduction Factor — Concrete Breakout Failure[3]	ϕ_{cb}	—	0.70							
Concrete Pryout Strength in Shear (ACI 318-14 17.5.3 or ACI 318-11 Section D.6.3)										
Coefficient for Pryout Strength	k_{cp}	—	1.0			2.0	1.0	2.0		
Strength Reduction Factor — Concrete Pryout Failure[4]	ϕ_{cp}	—	0.70							
Shear Strength for Seismic Applications (ACI 318-14 17.2.3.3 or ACI 318-11 Section D.3.3.3)										
Shear Resistance — Single Anchor for Seismic Loads (f'_C = 2,500 psi)	$V_{sa,eq}$	lbf.	3,790	4,780	5,345	6,773	9,367	9,367	10,969	10,969
Strength Reduction Factor — Steel Failure[2]	ϕ_{eq}	—	0.65							

For **SI**: 1 in. = 25.4mm, 1 lbf. = 4.45N.

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable.
2. The tabulated value of ϕ_{sa} and ϕ_{eq} applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used. If the load combinations of ACI 318 Appendix C are used, the appropriate value of f must be determined in accordance with ACI 318 D.4.4(b).
3. The tabulated value of ϕ_{cb} applies when both the load combinations of Section 1605.2.1 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition B are met. Condition B applies where supplementary reinforcement is not provided. For installations where complying supplementary reinforcement can be verified, the ϕ_{cb} factors described in ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition A are allowed. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ_{cb} must be determined in accordance with ACI 318-11 D.4.4(c).
4. The tabulated value of ϕ_{cp} applies when both the load combinations of IBC Section 1605.2, ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, appropriate value of ϕ_{cp} must be determined in accordance with ACI 318-11 Section D.4.4(c).
5. The notation in parenthesis is for the 2006 IBC.

* See p. 13 for an explanation of the load table icons.

Stainless-Steel Titen HD® Design Information — Masonry

Stainless-Steel Titen HD Allowable Tension and Shear Loads in 8" Lightweight, Medium-Weight and Normal-Weight Grout-Filled CMU

IBC *

Size 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)	Values for 8" Lightweight, Medium-Weight or Normal-Weight Grout-Filled CMU			
						Tension Load		Shear Load	
						Ultimate lb. (kN)	Allowable lb. (kN)	Ultimate lb. (kN)	Allowable lb. (kN)
Anchor Installed in the Face of the CMU Wall (See Figure 1)									
⅜ (9.5)	⅜	2¾ (70)	12 (305)	12 (305)	8 (203)	2,125 (9.5)	425 (1.9)	2,850 (12.7)	570 (2.5)
½ (12.7)	½	3½ (89)	12 (305)	12 (305)	8 (203)	3,325 (14.8)	665 (3.0)	4,950 (22.0)	990 (4.4)
⅝ (15.9)	⅝	4½ (114)	12 (305)	12 (305)	8 (203)	3,850 (17.1)	770 (3.4)	4,925 (21.9)	985 (4.4)
¾ (19.1)	¾	5½ (140)	12 (305)	12 (305)	8 (203)	5,200 (23.1)	1,040 (4.6)	4,450 (19.8)	890 (4.0)

1. The tabulated allowable loads are based on a safety factor of 5.0 for installations under the IBC and IRC.
2. Values for 8"-wide, lightweight, medium-weight and normal-weight concrete masonry units.
3. The masonry units must be fully grouted.
4. The minimum specified compressive strength of masonry, f'$_m$, at 28 days is 2,000 psi.
5. Embedment depth is measured from the outside face of the concrete masonry unit.
6. Allowable loads may be increased 33⅓% for short-term loading due to wind or seismic forces where permitted by code.
7. Grout-filled CMU wall design must satisfy applicable design standards and be capable of withstanding applied loads.
8. Refer to allowable load-adjustment factors for spacing and edge distance on p. 129.

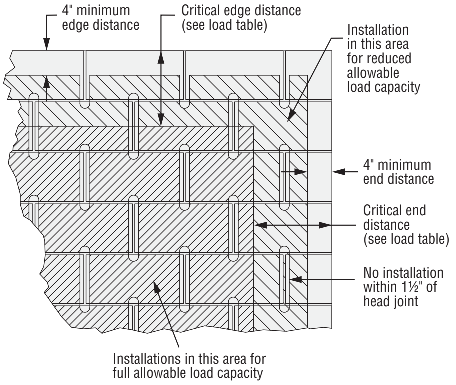


Figure 1. Shaded Area = Placement for Full and Reduced Allowable Load Capacity in Grout-Filled CMU

Stainless-Steel Titen HD Allowable Tension and Shear Loads in 8" Lightweight, Medium-Weight and Normal-Weight Hollow CMU

IBC *

Size in. (mm)	Drill Bit Dia. in.	Min. Embed. Depth⁴ in. (mm)	Critial Edge Dist. in. (mm)	Critical Spacing Dist. in. (mm)	8" Hollow CMU Loads Based on CMU Strength			
					Tension Load		Shear Load	
					Ultimate lb. (kN)	Allowable lb. (kN)	Ultimate lb. (kN)	Allowable lb. (kN)
Anchor Installed in Face Shell (See Figure 2)								
⅜ (9.5)	⅜	2½ (64)	12 (305)	8 (203)	925 (4.1)	185 (0.8)	2,250 (10.0)	450 (2.0)
½ (12.7)	½	2½ (64)	12 (305)	8 (203)	1,025 (4.6)	205 (0.9)	2,325 (10.3)	465 (2.1)
⅝ (15.9)	⅝	2½ (64)	12 (305)	8 (203)	550 (2.4)	110 (0.5)	2,025 (9.0)	405 (1.8)
¾ (19.1)	¾	2½ (64)	12 (305)	8 (203)	775 (3.4)	155 (0.7)	1,975 (8.8)	395 (1.8)

1. The tabulated allowable loads are based on a safety factor of 5.0 for installations under the IBC and IRC.
2. Values for 8"-wide, lightweight, medium-weight and normal-weight concrete masonry units.
3. The minimum specified compressive strength of masonry, f'$_m$, at 28 days is 2,000 psi.
4. Embedment depth is measured from the outside face of the concrete masonry unit and is based on the anchor being embedded an additional 1¼" through 1¼"-thick face shell.
5. Allowable loads may not be increased for short-term loading due to wind or seismic forces. CMU wall design must satisfy applicable design standards and be capable of withstanding applied loads.
6. Do not use impact wrenches to install in hollow CMU.
7. Set drill to rotation-only mode when drilling into hollow CMU.
8. Refer to allowable load-adjustment factors for spacing and edge distance on p. 129.
9. Anchors must be installed a minimum of 1½" from vertical head joints and T-joints. Refer to Figure 2 for permitted and prohibited anchor installation locations.

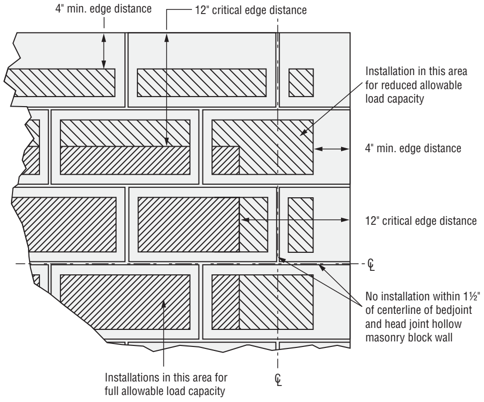


Figure 2. Stainless-Steel Titen HD Screw Anchor Installed in the Face of Hollow CMU Wall Construction

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* See p. 13 for an explanation of the load table icons.

Stainless-Steel Titen HD® Design Information — Masonry

Load-Adjustment Factors for Stainless-Steel Titen HD Anchors in Face-of-Wall Installation in 8" Grout-Filled CMU: Edge Distance and Spacing, Tension and Shear Loads

How to use these charts:

1. The following tables are for reduced 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 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 spacings are multiplied together.

Edge or End Distance Tension (f_c)

c_{act} (in.)	Dia.	⅜	½	⅝	¾
	E	2¾	3½	4½	5½
	c_{cr}	12	12	12	12
	c_{min}	4	4	4	4
	f_{cmin}	0.80	0.81	1.00	1.00
4		0.80	0.81	1.00	1.00
6		0.85	0.86	1.00	1.00
8		0.90	0.91	1.00	1.00
10		0.95	0.95	1.00	1.00
12		1.00	1.00	1.00	1.00

IBC*

See notes below.

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

c_{act} (in.)	Dia.	⅜	½	⅝	¾
	E	2¾	3½	4½	5½
	c_{cr}	12	12	12	12
	c_{min}	4	4	4	4
	f_{cmin}	0.88	0.56	0.65	0.84
4		0.88	0.56	0.65	0.84
6		0.91	0.67	0.74	0.88
8		0.94	0.78	0.83	0.92
10		0.97	0.89	0.91	0.96
12		1.00	1.00	1.00	1.00

IBC*

See notes below.

Edge or End Distance Shear (f_c) Shear Load Perpendicular to Edge or End (Directed Toward Edge or End)

c_{act} (in.)	Dia.	⅜	½	⅝	¾
	E	2¾	3½	4½	5½
	c_{cr}	12	12	12	12
	c_{min}	4	4	4	4
	f_{cmin}	0.93	0.48	0.66	0.69
4		0.93	0.48	0.66	0.69
6		0.95	0.61	0.75	0.77
8		0.97	0.74	0.83	0.85
10		0.98	0.87	0.92	0.92
12		1.00	1.00	1.00	1.00

IBC*

Edge or End Distance Shear (f_c) Shear Load Perpendicular to Edge or End (Directed Away from Edge or End)

c_{act} (in.)	Dia.	⅜	½	⅝	¾
	E	2¾	3½	4½	5½
	c_{cr}	12	12	12	12
	c_{min}	4	4	4	4
	f_{cmin}	0.93	0.48	0.66	0.69
4		0.93	0.48	0.66	0.69
6		0.95	0.61	0.75	0.77
8		0.97	0.74	0.83	0.85
10		0.98	0.87	0.92	0.92
12		1.00	1.00	1.00	1.00

IBC*

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)

s_{act} (in.)	Dia.	⅜	½	⅝	¾
	E	2¾	3½	4½	5½
	s_{cr}	8	8	8	8
	s_{min}	4	4	4	4
	f_{smin}	0.81	0.79	0.87	0.78
4		0.81	0.79	0.87	0.78
6		0.91	0.90	0.94	0.89
8		1.00	1.00	1.00	1.00

IBC*

Spacing Shear (f_s)

s_{act} (in.)	Dia.	⅜	½	⅝	¾
	E	2¾	3½	4½	5½
	s_{cr}	8	8	8	8
	s_{min}	4	4	4	4
	f_{smin}	1.00	0.86	0.90	0.94
4		1.00	0.86	0.90	0.94
6		1.00	0.93	0.95	0.97
8		1.00	1.00	1.00	1.00

IBC*

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. $f_s = f_{smin} + [(1 - f_{smin}) (s_{act} - s_{min}) / (s_{cr} - s_{min})]$.

* See p. 13 for an explanation of the load table icons.

Stainless-Steel Titen HD® Design Information — Masonry

Load-Adjustment Factors for Stainless-Steel Titen HD Anchors in Face-of-Wall Installation in 8" Hollow CMU: Edge Distance and Spacing, Tension and Shear Loads

How to use these charts:

1. The following tables are for reduced 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 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 spacings are multiplied together.

Edge Distance Tension (f_c)

c_{act} (in.)	Dia.	⅜	½	⅝	¾
	E	2½	2½	2½	2½
	c_{cr}	12	12	12	12
	c_{min}	4	4	4	4
	f_{cmin}	**1.00**	**1.00**	**1.00**	**1.00**
4		1.00	1.00	1.00	1.00
6		1.00	1.00	1.00	1.00
8		1.00	1.00	1.00	1.00
10		1.00	1.00	1.00	1.00
12		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. $f_c = f_{cmin} + [(1 - f_{cmin}) (c_{act} - c_{min}) / (c_{cr} - c_{min})]$.

Edge Distance Shear (f_c)

c_{act} (in.)	Dia.	⅜	½	⅝	¾
	E	2½	2½	2½	2½
	c_{cr}	12	12	12	12
	c_{min}	4	4	4	4
	f_{cmin}	**0.78**	**0.63**	**0.55**	**0.51**
4		0.78	0.63	0.55	0.51
6		0.84	0.72	0.66	0.63
8		0.89	0.82	0.78	0.76
10		0.95	0.91	0.89	0.88
12		1.00	1.00	1.00	1.00

Spacing Tension (f_s)
One Anchor per Cell

c_{act} (in.)	Dia.	⅜	½	⅝	¾
	E	2½	2½	2½	2½
	c_{cr}	8	8	8	8
	c_{min}	4	4	4	4
	f_{cmin}	**0.72**	**0.87**	**0.89**	**0.70**
4		0.72	0.87	0.89	0.70
6		0.86	0.94	0.95	0.85
8		1.00	1.00	1.00	1.00

See notes below.

Spacing Tension (f_s)
Two Anchors per Cell

c_{act} (in.)	Dia.	⅜	½	⅝	¾
	E	2½	2½	2½	2½
	c_{cr}	8	8	8	8
	c_{min}	4	4	4	4
	f_{cmin}	**1.00**	**1.00**	**1.00**	**0.78**
4		1.00	1.00	1.00	0.78
6		1.00	1.00	1.00	0.89
8		1.00	1.00	1.00	1.00

See notes below.

Spacing Shear (f_s)
One Anchor per Cell

s_{act} (in.)	Dia.	⅜	½	⅝	¾
	E	2½	2½	2½	2½
	s_{cr}	8	8	8	8
	s_{min}	4	4	4	4
	f_{smin}	**0.81**	**1.00**	**0.71**	**0.74**
4		0.81	1.00	0.71	0.74
6		0.91	1.00	0.86	0.87
8		1.00	1.00	1.00	1.00

Spacing Shear (f_s)
Two Anchors per Cell

s_{act} (in.)	Dia.	⅜	½	⅝	¾
	E	2½	2½	2½	2½
	s_{cr}	8	8	8	8
	s_{min}	4	4	4	4
	f_{smin}	**0.76**	**1.00**	**0.75**	**0.75**
4		0.76	1.00	0.75	0.75
6		0.88	1.00	0.88	0.88
8		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. $f_s = f_{smin} + [(1 - f_{smin}) (s_{act} - s_{min}) / (s_{cr} - s_{min})]$.

* See p. 13 for an explanation of the load table icons.

Titen HD® Rod Coupler

The Titen HD rod coupler is designed to be used in conjunction with a single or multi-story rod tie-down system. This anchor provides a fast and simple way to attach threaded rod to a concrete stem wall or thickened slab footing. Unlike adhesive anchors, the installation requires no special tools, cure time or secondary setting process; just drill a hole and drive the anchor.

Features

- The serrated cutting teeth and patented thread design enable the Titen HD rod voupler to be installed quickly and easily. Less installation time translates to lower installed cost
- The specialized heat treating process creates tip hardness to facilitate cutting while the body remain ductile
- No special setting tools are required. The Titen HD rod coupler installs with regular or hammer drill, ANSI size bits and standard sockets
- Compatible with threaded rods in ⅜" and ½" diameters

Material: Carbon steel

Coating: Zinc plated

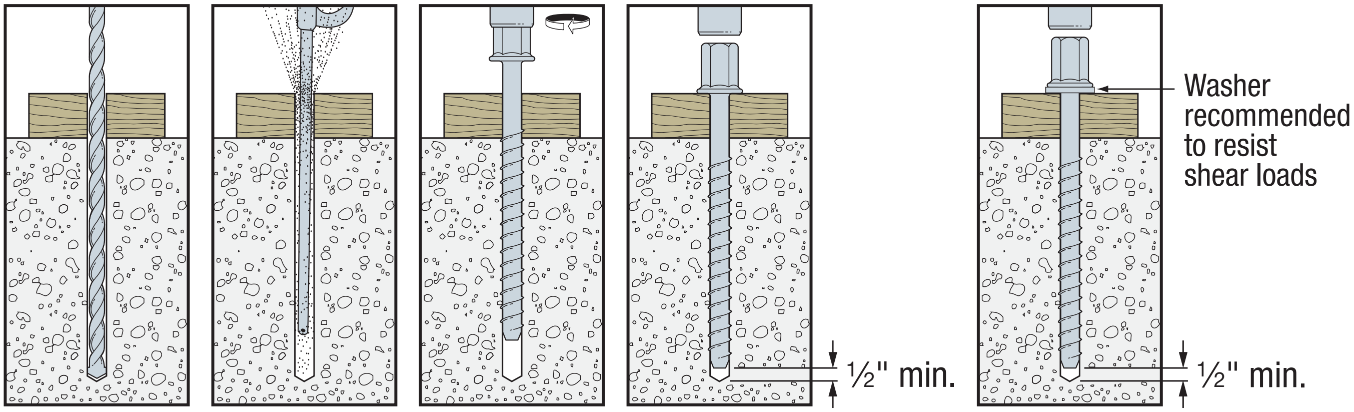
Installation

⚠ **Caution:** Oversized holes in the base material will reduce or eliminate the mechanical interlock of the threads with base material and will reduce the anchor's load capacity. Use a Titen HD Rod Coupler one time only. Installing the anchor multiple times may result in excessive thread wear and reduce load capacity.

1. Drill a hole using the specified diameter carbide bit into the base material to a depth of at least ½" deeper than the required embedment.
2. Blow the hole clean of dust and debris using compressed air. Overhead application need not be blown clean.
3. Tighten the anchor with appropriate size socket until the head sits flush against base material.

Titen HD Rod Coupler
U.S. Patent 6,623,228

Installation Sequence



Titen HD® Rod Coupler

Titen HD Rod Coupler Product Data

Size (in)	Model No.	Accepts Rod Diameter (in.)	Drill Bit Diameter (in)	Wrench Size (in)	Quantity	
					Box	Carton
⅜ x 6¾	THD37634RC	⅜	⅜	⁹⁄₁₆	50	100
½ x 9¾	THD50934RC	½	½	¾	20	40

Titen HD Rod Coupler Allowable Tension Loads in Normal-Weight Concrete Stemwall

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Size in. (mm)	Drill Bit Diameter in.	Embed. Depth in. (mm)	Stemwall Width in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Minimum Spacing Distance in. (mm)	Tension Load Based on Concrete Strength		Tension Load Based on Connected Rod Strength
							$f'_c \geq$ 2,500 psi (17.2 MPa) Concrete		A307 (SAE 1018)
							Ultimate lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)
⅜ (9.5)	⅜	5 (127)	8 (203)	1¾ (45)	10 (254)	20 (508)	8,900 (39.6)	2,225 (9.9)	2,105 (9.4)
½ (12.7)	½	8 (203)	8 (203)	1¾ (45)	16 (406)	32 (813)	15,540 (69.1)	3,885 (17.3)	3,750 (16.7)

1. Allowable load must be the lesser of the concrete or steel strength.
2. The allowable loads based on concrete strength are based on a factor of safety of 4.0.
3. The allowable load based on steel strength is limited by the strength of the coupler nut supplied with this anchor. Use of higher-strength rod will not increase allowable loads.
4. The minimum concrete thickness is 1.5 times the embedment depth.
5. Tension and shear loads may be combined using the straight-line interaction equation (n = 1).

Titen HD Rod Coupler Allowable Shear Loads in Normal-Weight Concrete Stemwall, Load Applied Parallel to Concrete Edge

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Size in. (mm)	Drill Bit Diameter in.	Embed. Depth in. (mm)	Stemwall Width in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Minimum Spacing Distance in. (mm)	Shear Load Based on Concrete Edge Distance	
							$f'_c \geq$ 2,500 psi (17.2 MPa) Concrete	
							Ultimate lb. (kN)	Allowable lb. (kN)
½ (12.7)	½	8 (203)	8 (203)	1¾ (45)	16 (406)	32 (813)	6,200 (27.6)	1,550 (6.9)

1. Install with a washer (not supplied with anchor) when used to resist shear loads.
2. The allowable load based on concrete edge distance is based on a factor of safety of 4.0. Steel strength does not control.
3. The minimum concrete thickness is 1.5 times the embedment depth.
4. Tension and shear loads may be combined using the straight-line interaction equation (n = 1).

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* See p. 13 for an explanation of the load table icons.

Strong-Bolt® 2 Wedge Anchor

A wedge-type expansion anchor designed for optimal performance in cracked and uncracked concrete as well as uncracked masonry. The Strong-Bolt 2 is available in carbon steel, Type 304 and Type 316 stainless steel.

Features

- Code listed under IBC/IRC for cracked and uncracked concrete per ICC-ES ESR-3037
- Code listed under IBC/IRC for masonry per IAPMO UES ER-240
- Qualified for static and seismic loading conditions (seismic design categories A through F)
- Suitable for horizontal, vertical and overhead applications
- Qualified for minimum concrete thickness of 3¼", and lightweight concrete-over-metal deck thickness of 2½" and 3¼"
- Standard (ANSI) fractional sizes: fits standard fixtures and installs with common drill bit and tool sizes
- Tested per ACI355.2 and AC193

Code: ICC-ES ESR-3037 (concrete); IAPMO UES ER-240 (carbon steel in CMU); City of L.A. RR25891 (concrete), RR25936 (carbon steel in CMU); Florida FL-15731.2; FL-16230.4; UL File Ex3605; FM 3043342 and 3047639; Mulitiple DOT listings; meets the requirements of Federal Specifications A-A-1923A, Type 4

Installation

⚠ Do not use an impact wrench to set or tighten the Strong-Bolt 2 anchor.

⚠ **Caution:** Oversized holes in the base material will make it difficult to set the anchor and will reduce the anchor's load capacity.

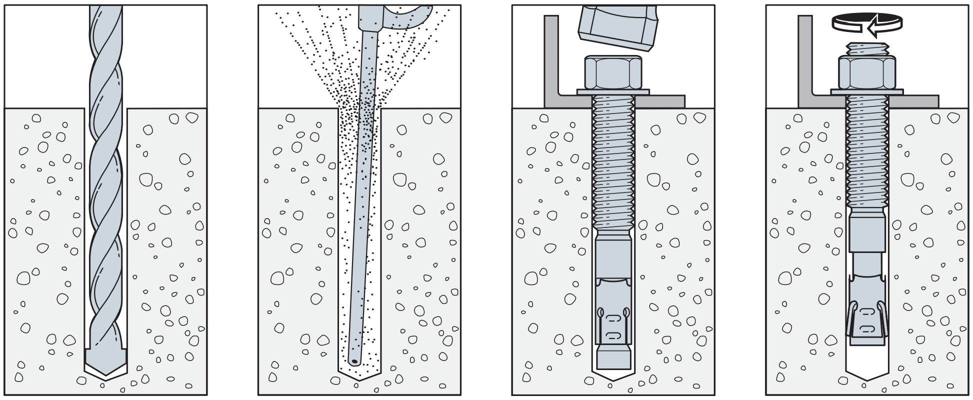
1. Drill a hole in the base material using a carbide drill bit the same diameter as the nominal diameter of the anchor to be installed. Drill the hole to the specified minimum hole depth, and blow it clean using compressed air. (Overhead installations need not be blown clean.) Alternatively, drill the hole deep enough to accommodate embedment depth and dust from drilling.
2. Assemble the anchor with nut and washer so the top of the nut is flush with the top of the anchor. Place the anchor in the fixture, and drive it into the hole until the washer and nut are tight against the fixture.
3. Tighten to the required installation torque.

Cracked Concrete CODE LISTED

Strong-Bolt 2 Wedge Anchor

Head Stamp
The head is stamped with the length identification letter, bracketed top and bottom by horizontal lines.

Installation Sequence



Strong-Bolt® 2 Wedge Anchor

Material Specifications

Anchor Body	Nut	Washer	Clip
Carbon Steel	Carbon Steel, ASTM A 563, Grade A	Carbon Steel ASTM F844	Carbon Steel, ASTM A 568
Type 304 Stainless Steel	Type 304 Stainless Steel	Type 304 Stainless Steel	Type 304 or 316 Stainless Steel
Type 316 Stainless Steel	Type 316 Stainless Steel	Type 316 Stainless Steel	Type 316 Stainless Steel

NEW

Strong-Bolt 2 Anchor Installation Data

Strong-Bolt 2 Diameter (in.)	¼	⅜	½	⅝	¾	1
Drill Bit Size (in.)	¼	⅜	½	⅝	¾	1
Min. Fixture Hole (in.)	5⁄16	7⁄16	9⁄16	11⁄16	⅞	1⅛
Wrench Size (in.)	7⁄16	9⁄16	¾	15⁄16	1⅛	1½
Concrete Installation Torque (ft.-lbf.) Carbon Steel	4	30	65	80	150	230
Concrete Installation Torque (ft.-lbf.) Stainless Steel	4	30	60	80	150	—

Length Identification Head Marks on Strong-Bolt® 2 Wedge Anchors (corresponds to length of anchor – inches)

Mark	Units	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
From	in.	1½	2	2½	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	11	12	13	14	15	16	17	18
Up To But Not Including	in.	2	2½	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	11	12	13	14	15	16	17	18	19

Strong-Bolt® 2 Wedge Anchor

Strong-Bolt 2 Anchor Product Data

Size (in.)	Carbon Steel Model No.	NEW Type 304 Stainless Steel Model No.	Type 316 Stainless Steel Model No.	Drill Bit Diameter (in.)	Thread Length (in.)	Quantity	
						Box	Carton
¼ x 1¾	STB2-25134	STB2-251344SS	STB2-251346SS	¼	1⁵⁄₁₆	100	500
¼ x 2¼	STB2-25214	STB2-252144SS	STB2-252146SS	¼	1⁷⁄₁₆	100	500
¼ x 3¼	STB2-25314	STB2-253144SS	STB2-253146SS	¼	2⁷⁄₁₆	100	500
⅜ x 2¾	STB2-37234	STB2-372344SS	STB2-372346SS	⅜	1⁵⁄₁₆	50	250
⅜ x 3	STB2-37300	STB2-373004SS	STB2-373006SS	⅜	1⁹⁄₁₆	50	250
⅜ x 3½	STB2-37312	STB2-373124SS	STB2-373126SS	⅜	2¹⁄₁₆	50	250
⅜ x 3¾	STB2-37334	STB2-373344SS	STB2-373346SS	⅜	2⁵⁄₁₆	50	250
⅜ x 5	STB2-37500	STB2-375004SS	STB2-375006SS	⅜	3⁹⁄₁₆	50	200
⅜ x 7	STB2-37700	STB2-377004SS	STB2-377006SS	⅜	5⁹⁄₁₆	50	200
½ x 3¾	STB2-50334	STB2-503344SS	STB2-503346SS	½	2¹⁄₁₆	25	125
½ x 4¼	STB2-50414	STB2-504144SS	STB2-504146SS	½	2⁹⁄₁₆	25	100
½ x 4¾	STB2-50434	STB2-504344SS	STB2-504346SS	½	3¹⁄₁₆	25	100
½ x 5½	STB2-50512	STB2-505124SS	STB2-505126SS	½	3¹³⁄₁₆	25	100
½ x 7	STB2-50700	STB2-507004SS	STB2-507006SS	½	5⁵⁄₁₆	25	100
½ x 8½	STB2-50812	STB2-508124SS	STB2-508126SS	½	6	25	50
½ x 10	STB2-50100	STB2-501004SS	STB2-501006SS	½	6	25	50
⅝ x 4½	STB2-62412	STB2-624124SS	STB2-624126SS	⅝	2⁷⁄₁₆	20	80
⅝ x 5	STB2-62500	STB2-625004SS	STB2-625006SS	⅝	2¹⁵⁄₁₆	20	80
⅝ x 6	STB2-62600	STB2-626004SS	STB2-626006SS	⅝	3¹⁵⁄₁₆	20	80
⅝ x 7	STB2-62700	STB2-627004SS	STB2-627006SS	⅝	4¹⁵⁄₁₆	20	80
⅝ x 8½	STB2-62812	STB2-628124SS	STB2-628126SS	⅝	6	20	40
⅝ x 10	STB2-62100	STB2-621004SS	STB2-621006SS	⅝	6	10	20
¾ x 5½	STB2-75512	STB2-755124SS	STB2-755126SS	¾	3³⁄₁₆	10	40
¾ x 6¼	STB2-75614	STB2-756144SS	STB2-756146SS	¾	3¹⁵⁄₁₆	10	40
¾ x 7	STB2-75700	STB2-757004SS	STB2-757006SS	¾	4¹¹⁄₁₆	10	40
¾ x 8½	STB2-75812	STB2-758124SS	STB2-758126SS	¾	6	10	20
¾ x 10	STB2-75100	—	—	¾	6	10	20
1 x 7	STB2-100700	—	—	1	3½	5	20
1 x 10	STB2-1001000	—	—	1	3½	5	10
1 x 13	STB2-1001300	—	—	1	3½	5	10

Strong-Bolt® 2 Design Information — Concrete

Carbon-Steel Strong-Bolt 2 Installation Information[1]

Characteristic	Symbol	Units	Nominal Anchor Diameter, d_a (in.)											
			¼[4]	⅜[5]		½[5]			⅝[5]		¾[5]		1[5]	
Installation Information														
Nominal Diameter	d_a	in.	¼	⅜		½			⅝		¾		1	
Drill Bit Diameter	d	in.	¼	⅜		½			⅝		¾		1	
Baseplate Clearance Hole Diameter[2]	d_c	in.	5⁄16	7⁄16		9⁄16			11⁄16		⅞		1⅛	
Installation Torque	T_{inst}	ft-lbf	4	30		60			90		150		230	
Nominal Embedment Depth	h_{nom}	in.	1¾	1⅞	2⅞	2¾		3⅞	3⅜	5⅛	4⅛	5¾	5¼	9¾
Effective Embedment Depth	h_{ef}	in.	1½	1½	2½	2¼		3⅜	2¾	4½	3⅜	5	4½	9
Minimum Hole Depth	h_{hole}	in.	1⅞	2	3	3		4⅛	3⅝	5⅜	4⅜	6	5½	10
Minimum Overall Anchor Length	ℓ_{anch}	in.	2¼	2¾	3½	3¾		5½	4½	6	5½	7	7	13
Critical Edge Distance	c_{ac}	in.	2½	6½	6	6½	6½	7½	7½	9	9	8	18	13½
Minimum Edge Distance	c_{min}	in.	1¾	6		7	4	4	6½		6½		8	
	for $s \geq$	in.	—	—		—	—	—	—		8		—	
Minimum Spacing	s_{min}	in.	2¼	3		7	4	4	5		7		8	
	for $c \geq$	in.	—	—		—	—	—	—		8		—	
Minimum Concrete Thickness	h_{min}	in	3¼	3¼	4½	4½	5½	6	5½	7⅞	6¾	8¾	8	13½
Additional Data														
Yield Strength	f_{ya}	psi	56,000	92,000		85,000					70,000		60,000	
Tensile Strength	f_{uta}	psi	70,000	115,000							110,000		78,000	
Minimum Tensile and Shear Stress Area	A_{se}	in.^{2}	0.0318	0.0514		0.105			0.166		0.270		0.472	
Axial Stiffness in Service Load Range — Cracked and Uncracked Concrete	β	lb./in.	73,700[3]	34,820		63,570			91,370		118,840		299,600	

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D.
2. The clearance must comply with applicable code requirements for the connected element.
3. The tabulated value of β for ¼"-diameter carbon steel Strong-Bolt 2 anchor is for installations in uncracked concrete only.
4. The ¼"-diameter (6.4mm) anchor may be installed in top of uncracked normal-weight and sand-lightweight concrete over profile steel deck, where concrete thickness above upper flute meets the minimum thickness specified in this table.
5. The ⅜"- through 1"-diameter (9.5mm through 25.4mm) anchors may be installed in top of cracked and uncracked normal-weight and sand-lightweight concrete over profile steel deck, where concrete thickness above upper flute meets the minimum thickness specified in this table.

* See p.13 for an explanation of the load table icons.

Strong-Bolt® 2 Design Information — Concrete

IBC LW *

Stainless-Steel Strong-Bolt 2 Installation Information[1]

Characteristic	Symbol	Units	Nominal Anchor Diameter, d_a (in.)									
			¼[4]	⅜[5]		½[5]			⅝[5]		¾[5]	
Installation Information												
Nominal Diameter	d_a	in.	¼	⅜		½			⅝		¾	
Drill Bit Diameter	d	in.	¼	⅜		½			⅝		¾	
Baseplate Clearance Hole Diameter[2]	d_c	in.	5⁄16	7⁄16		9⁄16			11⁄16		⅞	
Installation Torque	T_{inst}	ft-lbf	4	30		65			80		150	
Nominal Embedment Depth	h_{nom}	in.	1¾	1⅞	2⅞	2¾	3⅞		3⅜	5⅛	4⅛	5¾
Effective Embedment Depth	h_{ef}	in.	1½	1½	2½	2¼	3⅜		2¾	4½	3⅜	5
Minimum Hole Depth	h_{hole}	in.	1⅞	2	3	3	4⅛		3⅝	5⅜	4⅜	6
Minimum Overall Anchor Length	ℓ_{anch}	in.	2¼	2¾	3½	3¾	5½		4½	6	5½	7
Critical Edge Distance	c_{ac}	in.	2½	6½	8½	4½	7		7½	9	8	8
Minimum Edge Distance	c_{min}	in.	1¾	6		6½	5	4	4		6	
	for $s \geq$	in.	—	10		—	—	8	8		—	
Minimum Spacing	s_{min}	in.	2¼	3		8	5½	4	6¼		6½	
	for $c \geq$	in.	—	10		—	—	8	5½		—	
Minimum Concrete Thickness	h_{min}	in.	3¼	3¼	4½	4½	6		5½	7⅞	6¾	8¾
Additional Data												
Yield Strength	f_{ya}	psi	96,000	80,000		92,000			82,000		68,000	
Tensile Strength	f_{uta}	psi	120,000	100,000		115,000			108,000		95,000	
Minimum Tensile and Shear Stress Area	A_{se}	in.^{2}	0.0255	0.0514		0.105			0.166		0.270	
Axial Stiffness in Service Load Range — Cracked and Uncracked Concrete	β	lb./in.	54,430[3]	29,150		54,900			61,270		154,290	

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D.
2. The clearance must comply with applicable code requirements for the connected element.
3. The tabulated value of β for ¼"-diameter stainless-steel Strong-Bolt 2 anchor is for installtions in uncracked concrete only.
4. The ¼"-diameter (6.4mm) anchor may be installed in top of uncracked normal-weight and sand-lightweight concrete over profile steel deck, where concrete thickness above upper flute meets the minimum thickness specified in this table.
5. The ⅜"- through ¾"-diameter (9.5mm through 19.1mm) anchors may be installed in top of cracked and uncracked normal-weight and sand-lightweight concrete over profile steel deck, where concrete thickness above upper flute meets the minimum thickness specified in this table.

* See p. 13 for an explanation of the load table icons.

Carbon-Steel Strong-Bolt 2 Tension Strength Design Data[1]

Characteristic	Symbol	Units	Nominal Anchor Diameter, d_a (in.)										
			¼[8]	⅜[9]		½[9]		⅝[9]		¾[9]		1[9]	
Anchor Category	1, 2 or 3	—	1									2	
Nominal Embedment Depth	h_{nom}	in.	1¾	1⅞	2⅞	2¾	3⅞	3⅜	5⅛	4⅛	5¾	5¼	9¾
Steel Strength in Tension (ACI 318 Section D.5.1)													
Steel Strength in Tension	N_{sa}	lb.	2,225	5,600		12,100		19,070		29,700		36,815	
Strength Reduction Factor — Steel Failure[2]	ϕ_{sa}	—	0.75									0.65	
Concrete Breakout Strength in Tension (ACI 318 Section D.5.2)[10]													
Effective Embedment Depth	h_{ef}	in.	1½	1½	2½	2¼	3⅜	2¾	4½	3⅜	5	4½	9
Critical Edge Distance	c_{ac}	in.	2½	6½	6	6½	7½	7½	9	9	8	18	13½
Effectiveness Factor — Uncracked Concrete	k_{uncr}	—	24										
Effectiveness Factor — Cracked Concrete	k_{cr}	—	—[7]	17									
Modification Factor	$\psi_{c,N}$	—	—[7]	1.00									
Strength Reduction Factor — Concrete Breakout Failure[3]	ϕ_{cb}	—	0.65									0.55	
Pullout Strength in Tension (ACI 318 Section D.5.3)[10]													
Pullout Strength, Cracked Concrete (f'_c = 2,500 psi)	$N_{p,cr}$	lb.	—[7]	1,300[5]	2,775[5]	N/A[4]	3,735[5]	N/A[4]	6,985[5]	N/A[4]	8,500[5]	7,700[5]	11,185[5]
Pullout Strength, Uncracked Concrete (f'_c = 2,500 psi)	$N_{p,uncr}$	lb.	N/A[4]	N/A[4]	3,340[5]	3,615[5]	5,255[5]	N/A[4]	9,025[5]	7,115[5]	8,870[5]	8,360[5]	9,690[5]
Strength Reduction Factor — Pullout Failure[6]	ϕ_p	—	0.65									0.55	
Tensile Strength for Seismic Applications (ACI 318 Section D.3.3.)[10]													
Tension Strength of Single Anchor for Seismic Loads (f'_c = 2,500 psi)	$N_{p.eq}$	lb.	—[7]	1,300[5]	2,775[5]	N/A[4]	3,735[5]	N/A[4]	6,985[5]	N/A[4]	8,500[5]	7,700[5]	11,185[5]
Strength Reduction Factor — Pullout Failure[6]	ϕ_{eq}	—	0.65									0.55	

1. The information presented in this table must be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable, except as modified below.
2. The tabulated value of ϕ_{sa} applies when the load combinations of Section 1605.2.1 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ_{sa} must be determined in accordance with ACI 318-11 D.4.4.
3. The tabulated value of ϕ_{cb} applies when both the load combinations of Section 1605.2.1 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition B are met. Condition B applies where supplementary reinforcement is not provided. For installations where complying supplementary reinforcement can be verified, the ϕ_{cb} factors described in ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition A are allowed. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ_{cb} must be determined in accordance with ACI 318-11 D.4.4(c).
4. N/A (not applicable) denotes that pullout resistance does not need to be considered.
5. The characteristic pullout strength for greater concrete compressive strengths shall be increased by multiplying the tabular value by $(f'_c/2{,}500\ \text{psi})^{0.5}$.
6. The tabulated value of ϕ_p or ϕ_{eq} applies when the load combinations of Section 1605.2.1 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3.(c) or ACI 318-11 D.4.3(c) for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, appropriate value of ϕ must be determined in accordance with ACI 318-11 Section D.4.4(c).
7. The ¼"-diameter carbon steel Strong-Bolt 2 anchor installation in cracked concrete is beyond the scope of this table.
8. The ¼"-diameter (6.4mm) anchor may be installed in top of uncracked normal-weight and sand-lightweight concrete over profile steel deck, where concrete thickness above upper flute meets the minimum thickness specified in the table on p. 136.
9. The ⅜"- through ¾"-diameter (9.5mm through 25.4mm) anchors may be installed in top of cracked and uncracked normal-weight and sand-lightweight concrete over profile steel deck, where concrete thickness above upper flute meets the minimum thickness specified in the table on p. 136.

* See p. 13 for an explanation of the load table icons.

Strong-Bolt® 2 Design Information — Concrete

Stainless-Steel Strong-Bolt 2 Tension Strength Design Data[1] *

Characteristic	Symbol	Units	Nominal Anchor Diameter, d_a (in.)								
			¼[10]	⅜[11]		½[11]		⅝[11]		¾[11]	
Anchor Category	1, 2 or 3	—	1								
Nominal Embedment Depth	h_{nom}	in.	1¾	1⅞	2⅞	2¾	3⅞	3⅜	5⅛	4⅛	5¾
Steel Strength in Tension (ACI 318 Section D.5.1)											
Steel Strength in Tension	N_{sa}	lb.	3,060	5,140		12,075		17,930		25,650	
Strength Reduction Factor — Steel Failure[2]	ϕ_{sa}	—	0.75								
Concrete Breakout Strength in Tension (ACI 318 Section D.5.2)[12]											
Effective Embedment Depth	h_{ef}	in.	1½	1½	2½	2¼	3⅜	2¾	4½	3⅜	5
Critical Edge Distance	c_{ac}	in.	2½	6½	8½	4½	7	7½	9	8	8
Effectiveness Factor — Uncracked Concrete	k_{uncr}	—	24								
Effectiveness Factor — Cracked Concrete	k_{cr}	—	—[9]	17							
Modification Factor	$\psi_{c,N}$	—	—[9]	1.00							
Strength Reduction Factor — Concrete Breakout Failure[3]	ϕ_{cb}	—	0.65								
Pullout Strength in Tension (ACI 318 Section D.5.3)[12]											
Pullout Strength, Cracked Concrete (f'_c = 2,500 psi)	$N_{p,cr}$	lb.	—[9]	1,720[6]	3,145[6]	2,560[5]	4,305[5]	N/A[4]	6,545[7]	N/A[4]	8,230[5]
Pullout Strength, Uncracked Concrete (f'_c = 2,500 psi)	$N_{p,uncr}$	lb.	1,925[7]	N/A[4]	4,770[6]	3,230[5]	4,495[5]	N/A[4]	7,615[5]	7,725[7]	9,625[7]
Strength Reduction Factor — Pullout Failure[8]	ϕ_p	—	0.65								
Tensile Strength for Seismic Applications (ACI 318 Section D.3.3.)[12]											
Tension Strength of Single Anchor for Seismic Loads (f'_c = 2,500 psi)	$N_{p,eq}$	lb.	—[9]	1,720[6]	2,830[6]	2,560[5]	4,305[5]	N/A[4]	6,545[7]	N/A[4]	8,230[5]
Strength Reduction Factor — Pullout Failure[8]	ϕ_{eq}	—	0.65								

1. The information presented in this table must be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable, except as modified below.
2. The tabulated value of ϕ_{sa} applies when the load combinations of Section 1605.2.1 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ_{sa} must be determined in accordance with ACI 318-11 D.4.4.
3. The tabulated value of ϕ_{cb} applies when both the load combinations of Section 1605.2.1 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition B are met. Condition B applies where supplementary reinforcement is not provided. For installations where complying supplementary reinforcement can be verified, the ϕ_{cb} factors described in ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition A are allowed. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ_{cb} must be determined in accordance with ACI 318-11 D.4.4(c).
4. N/A (not applicable) denotes that pullout resistance does not need to be considered.
5. The characteristic pullout strength for greater concrete compressive strengths shall be increased by multiplying the tabular value by $(f'_c/2{,}500 \text{ psi})^{0.5}$.
6. The characteristic pullout strength for greater concrete compressive strengths shall be increased by multiplying the tabular value by $(f'_c/2{,}500 \text{ psi})^{0.3}$.
7. The characteristic pullout strength for greater concrete compressive strengths shall be increased by multiplying the tabular value by $(f'_c/2{,}500 \text{ psi})^{0.4}$.
8. The tabulated value of ϕ_p or ϕ_{eq} applies when the load combinations of Section 1605.2.1 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3.(c) or ACI 318-11 D.4.3(c) for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, appropriate value of ϕ must be determined in accordance with ACI 318-11 Section D.4.4(c).
9. The ¼"-diameter stainless-steel Strong-Bolt 2 anchor installation in cracked concrete is beyond the scope of this table.
10. The ¼"-diameter (6.4mm) anchor may be installed in top of uncracked normal-weight and sand-lightweight concrete over profile steel deck, where concrete thickness above upper flute meets the minimum thickness specified in the table on p. 136.
11. The ⅜"- through ¾"-diameter (9.5mm through 19.1mm) anchors may be installed in top of cracked and uncracked normal-weight and sand-lightweight concrete over profile steel deck, where concrete thickness above upper flute meets the minimum thickness specified in the table on p. 136.

* See p. 13 for an explanation of the load table icons.

Carbon-Steel Strong-Bolt 2 Shear Strength Design Data[1]

Characteristic	Symbol	Units	Nominal Anchor Diameter, d_a (in.)										
			¼[6]	⅜[7]		½[7]		⅝[7]		¾[7]		1[7]	
Anchor Category	1, 2 or 3	—	1									2	
Nominal Embedment Depth	h_{nom}	in.	1¾	1⅞	2⅞	2¾	3⅞	3⅜	5⅛	4⅛	5¾	5¼	9¾
Steel Strength in Shear (ACI 318 Section D.6.1)													
Steel Strength in Shear	V_{sa}	lb.	965	1,800		7,235		11,035		14,480		15,020	
Strength Reduction Factor — Steel Failure[2]	ϕ_{sa}	—	0.65									0.60	
Concrete Breakout Strength in Shear (ACI 318 Section D.6.2)[8]													
Outside Diameter	d_a	in.	0.25	0.375		0.500		0.625		0.750		1.00	
Load-Bearing Length of Anchor in Shear	ℓ_e	in.	1.500	1.500	2.500	2.250	3.375	2.750	4.500	3.375	5.000	4.500	8.000
Strength Reduction Factor — Concrete Breakout Failure[2]	ϕ_{cb}	—	0.70										
Concrete Pryout Strength in Shear (ACI 318 Section D.6.3)													
Coefficient for Pryout Strength	k_{cp}	—	1.0		2.0	1.0	2.0						
Effective Embedment Depth	h_{ef}	in.	1½	1½	2½	2¼	3⅜	2¾	4½	3⅜	5	4½	9
Strength Reduction Factor — Concrete Pryout Failure[4]	ϕ_{cp}	—	0.70										
Steel Strength in Shear for Seismic Applications(ACI 318 Section D.3.3.)													
Shear Strength of Single Anchor for Seismic Loads (f'_c = 2,500 psi)	$V_{sa.eq}$	lb.	—[5]	1,800		6,510		9,930		11,775		15,020	
Strength Reduction Factor — Steel Failure[2]	ϕ_{sa}	—	0.65									0.60	

1. The information presented in this table must be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, except as modified below.
2. The tabulated value of ϕ_{sa} applies when the load combinations of Section 1605.2.1 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ_{sa} must be determined in accordance with ACI 318 D.4.4.
3. The tabulated value of ϕ_{cb} applies when both the load combinations of Section 1605.2.1 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition B are met. Condition B applies where supplementary reinforcement is not provided. For installations where complying supplementary reinforcement can be verified, the ϕ_{cb} factors described in ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition A are allowed. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ_{cb} must be determined in accordance with ACI 318-11 D.4.4(c).
4. The tabulated value of ϕ_{cp} applies when both the load combinations of IBC Section 1605.2, ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, appropriate value of ϕ_{cp} must be determined in accordance with ACI 318-11 Section D.4.4(c).
5. The ¼"-diameter carbon steel Strong-Bolt 2 anchor installation in cracked concrete is beyond the scope of this table.
6. The ¼"-diameter (6.4mm) anchor may be installed in top of uncracked normal-weight and sand-lightweight concrete over profile steel deck, where concrete thickness above upper flute meets the minimum thickness specified in the table on p. 136.
7. The ⅜"- through 1"-diameter (9.5mm through 25.4mm) anchors may be installed in top of cracked and uncracked normal-weight and sand-lightweight concrete over profile steel deck, where concrete thickness above upper flute meets the minimum thickness specified in the table on p. 136.

* See p. 13 for an explanation of the load table icons.

Strong-Bolt® 2 Design Information — Concrete

Stainless-Steel Strong-Bolt 2 Shear Strength Design Data[1]

Characteristic	Symbol	Units	Nominal Anchor Diameter, d_a (in.)								
			¼[6]	⅜[7]		½[7]		⅝[7]		¾[7]	
Anchor Category	1, 2 or 3	—	1								
Nominal Embedment Depth	h_{nom}	in.	1¾	1⅞	2⅞	2¾	3⅞	3⅜	5⅛	4⅛	5¾
Steel Strength in Shear (ACI 318 Section D.6.1)											
Steel Strength in Shear	V_{sa}	lb.	1,605	3,085		7,245		6,745	10,760	15,045	
Strength Reduction Factor — Steel Failure[2]	ϕ_{sa}	—	0.65								
Concrete Breakout Strength in Shear (ACI 318 Section D.6.2)[8]											
Outside Diameter	d_a	in.	0.250	0.375		0.500		0.625		0.750	
Load Bearing Length of Anchor in Shear	ℓ_e	in.	1.500	1.500	2.500	2.250	3.375	2.750	4.500	3.375	5.000
Strength Reduction Factor — Concrete Breakout Failure[3]	ϕ_{cb}	—	0.70								
Concrete Pryout Strength in Shear (ACI 318 Section D.6.3)											
Coefficient for Pryout Strength	k_{cp}	—	1.0		2.0	1.0	2.0				
Effective Embedment Depth	h_{ef}	in.	1½	1½	2½	2¼	3⅜	2¾	4½	3⅜	5
Strength Reduction Factor — Concrete Pryout Failure[4]	ϕ_{cp}	—	0.70								
Steel Strength in Shear for Seismic Applications (ACI 318 Section D.3.3.)											
Shear Strength of Single Anchor for Seismic Loads (f'_c = 2,500 psi)	$V_{sa.eq}$	lb.	—[5]	3,085		6,100		6,745	10,760	13,620	
Strength Reduction Factor — Steel Failure[2]	ϕ_{sa}	—	0.65								

1. The information presented in this table must be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, except as modified below.
2. The tabulated value of ϕ_{sa} applies when the load combinations of Section 1605.2.1 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ_{sa} must be determined in accordance with ACI 318 D.4.4.
3. The tabulated value of ϕ_{cb} applies when both the load combinations of Section 1605.2.1 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition B are met. Condition B applies where supplementary reinforcement is not provided. For installations where complying supplementary reinforcement can be verified, the ϕ_{cb} factors described in ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition A are allowed. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ_{cb} must be determined in accordance with ACI 318-11 D.4.4(c).
4. The tabulated value of ϕ_{cp} applies when both the load combinations of IBC Section 1605.2, ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, appropriate value of ϕ_{cp} must be determined in accordance with ACI 318-11 Section D.4.4(c).
5. The ¼"-diameter stainless-steel Strong-Bolt 2 anchor installation in cracked concrete is beyond the scope of this table.
6. The ¼"-diameter (6.4mm) anchor may be installed in top of uncracked normal-weight and sand-lightweight concrete over profile steel deck, where concrete thickness above upper flute meets the minimum thickness specified in the table on p. 136.
7. The ⅜"- through ¾"-diameter (9.5mm through 19.1mm) anchors may be installed in top of cracked and uncracked normal-weight and sand-lightweight concrete over profile steel deck, where concrete thickness above upper flute meets the minimum thickness specified in the table on p. 136.

* See p. 13 for an explanation of the load table icons.

Strong-Bolt® 2 Design Information — Concrete

Carbon-Steel Strong-Bolt 2 Information for Installation in the Topside of Concrete-Filled Profile Steel Deck Floor and Roof Assemblies[1,2,3,4]

IBC *

Design Information	Symbol	Units	Nominal Anchor Diameter (in.)		
			⅜		½
Nominal Embedment Depth	h_{nom}	in.	1⅞		2¾
Effective Embedment Depth	h_{ef}	in.	1½		2¼
Minimum Concrete Thickness[5]	$h_{min,deck}$	in.	2½	3¼	3¼
Critical Edge Distance	$c_{ac,deck,top}$	in.	4¾	4	4
Minimum Edge Distance	$c_{min,deck,top}$	in.	4¾	4½	4¾
Minimum Spacing	$s_{min,deck,top}$	in.	7	6½	8

For **SI**: 1 inch = 25.4mm; 1 lbf = 4.45N

1. Installation must comply with the table on p. 136 and Figure 1 below.
2. Design capacity shall be based on calculations according to values in the tables on pp. 138 and 140.
3. Minimum flute depth (distance from top of flute to bottom of flute) is 1½".
4. Steel deck thickness shall be a minimum 20 gauge.
5. Minimum concrete thickness ($h_{min,deck}$) refers to concrete thickness above upper flute.

Stainless-Steel Strong-Bolt 2 Information for Installation in the Topside of Concrete-Filled Profile Steel Deck Floor and Roof Assemblies[1,2,3,4]

IBC *

Design Information	Symbol	Units	Nominal Anchor Diameter (in.)		
			⅜		½
Nominal Embedment Depth	h_{nom}	in.	1⅞		2¾
Effective Embedment Depth	h_{ef}	in.	1½		2¼
Minimum Concrete Thickness[5]	$h_{min,deck}$	in.	2½	3¼	3¼
Critical Edge Distance	$c_{ac,deck,top}$	in.	4¾	4	4
Minimum Edge Distance	$c_{min,deck,top}$	in.	4¾		6
Minimum Spacing	$s_{min,deck,top}$	in.	6½		8

For **SI**: 1 inch = 25.4mm; 1 lbf = 4.45N

1. Installation must comply with the table on p. 137 and Figure 1 below.
2. Design capacity shall be based on calculations according to values in the tables on pp. 139 and 141.
3. Minimum flute depth (distance from top of flute to bottom of flute) is 1½".
4. Steel deck thickness shall be a minimum 20 gauge.
5. Minimum concrete thickness ($h_{min,deck}$) refers to concrete thickness above upper flute.

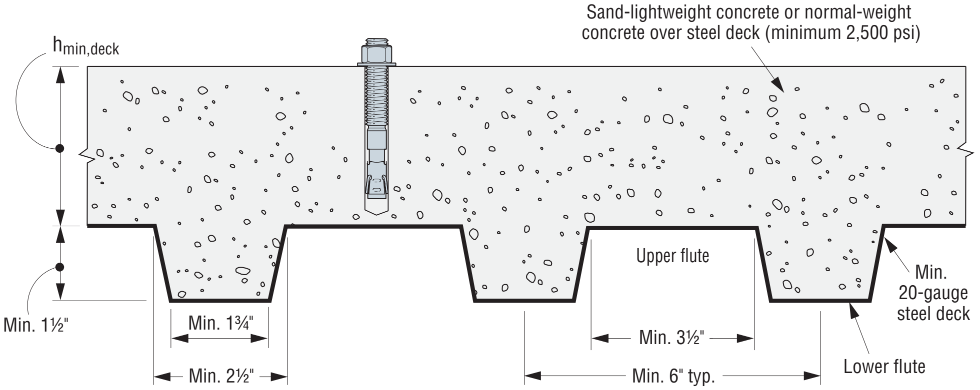


Figure 1

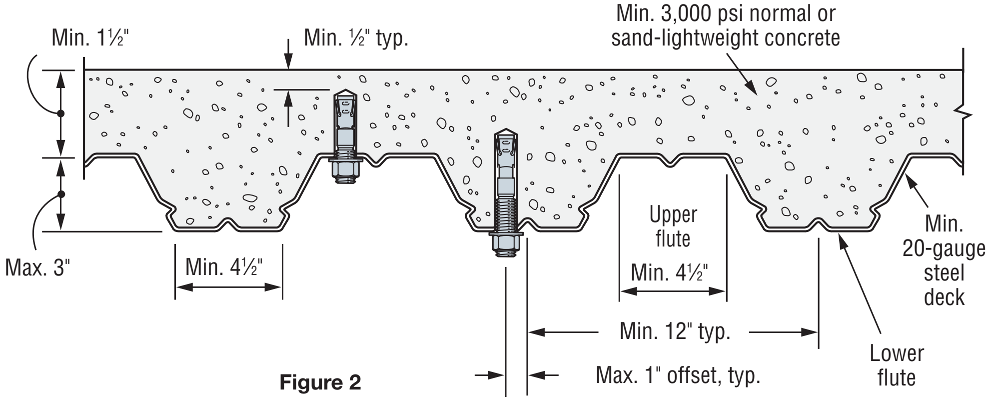


Figure 2

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* See p. 13 for an explanation of the load table icons.

Strong-Bolt® 2 Design Information — Concrete

Carbon-Steel Strong-Bolt 2 Tension and Shear Strength Design Data for the Soffit of Concrete over Profile Steel Deck Floor and Roof Assemblies[1,2,6,8,9]

Characteristic	Symbol	Units	Nominal Anchor Diameter (in.)								
			Carbon Steel								
			Lower Flute							Upper Flute	
			⅜		½		⅝		¾	⅜	½
Nominal Embedment Depth	h_{nom}	in.	2	3⅜	2¾	4½	3⅜	5⅝	4⅛	2	2¾
Effective Embedment Depth	h_{ef}	in.	1⅝	3	2¼	4	2¾	5	3⅜	1⅝	2¼
Installation Torque	T_{inst}	ft.-lbf.	30		60		90		150	30	60
Pullout Strength, concrete on metal deck (cracked)[3,4]	$N_{p,deck,cr}$	lb.	1,040[7]	2,615[7]	2,040[7]	2,730[7]	2,615[7]	4,990[7]	2,815[7]	1,340[7]	3,785[7]
Pullout Strength, concrete on metal deck (uncracked)[3,4]	$N_{p,deck,uncr}$	lb.	1,765[7]	3,150[7]	2,580[7]	3,840[7]	3,685[7]	6,565[7]	3,800[7]	2,275[7]	4,795[7]
Pullout Strength, concrete on metal deck (seismic)[3,4]	$N_{p,deck,eq}$	lb.	1,040[7]	2,615[7]	2,040[7]	2,730[7]	2,615[7]	4,990[7]	2,815[7]	1,340[7]	3,785[7]
Steel Strength in Shear, concrete on metal deck[5]	$V_{sa,deck}$	lb.	1,595	3,490	2,135	4,580	2,640	7,000	4,535	3,545	5,920
Steel Strength in Shear, concrete on metal deck (seismic)[5]	$V_{sa,deck,eq}$	lb.	1,595	3,490	1,920	4,120	2,375	6,300	3,690	3,545	5,330

1. The information presented in this table must be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, except as modified below.
2. Profile steel deck must comply with the configuration in Figure 2 on the previous page, and have a minimum base-steel thickness of 0.035 inch (20 gauge). Steel must comply with ASTM A 653/A 653M SS Grade 33 with minimum yield strength of 33,000 psi. Concrete compressive strength shall be 3,000 psi minimum.
3. For anchors installed in the soffit of sand-lightweight or normal-weight concrete over metal deck floor and roof assemblies, calculation of the concrete breakout strength may be omitted.
4. In accordance with ACI 318-14 Section 17.4.3.2 or ACI 318-11 Section D.5.3.2, the nominal pullout strength in cracked concrete for anchors installed in the soffit of sand-lightweight or normal-weight concrete over metal deck floor and rood assemblies $N_{p,deck,cr}$ shall be substituted for $N_{p,cr}$. Where analysis indicates no cracking at service loads, the normal pullout strength in uncracked concrete $N_{p,deck,uncr}$ shall be substituted for $N_{p,uncr}$. For seismic loads, $N_{p,deck,eq}$ shall be substituted for N_p.
5. In accordance with ACI 318-14 Section 17.5.1.2(C) or ACI 318-11 Section D.6.1.2(c), the shear strength for anchors installed in the soffit of sand-lightweight or normal-weight concrete over metal deck floor and rood assemblies V_{sa},deck shall be substituted for V_{sa}. For seismic loads, $V_{sa,deck,eq}$ shall be substituted for V_{sa}.
6. The minimum anchor spacing along the flute must be the greater of 3.0h_{ef} or 1.5 times the flute width.
7. The characteristic pull-out strength for greater concrete compressive strengths shall be increased by multiplying the tabular value by $(f'_c / 3{,}000\text{ psi})^{0.5}$.
8. Concrete shall be normal-weight or structural sand-lightweight concrete having a minimum specified compressive strength, f'_c, of 3,000 psi.
9. Minimum distance to edge of panel is 2h_{ef}.

Stainless-Steel Strong-Bolt 2 Tension and Shear Strength Design Data for the Soffit of Concrete over Profile Steel Deck Floor and Roof Assemblies[1,2,6,10,11]

Characteristic	Symbol	Units	Stainless Steel								
			Lower Flute							Upper Flute	
			⅜		½		⅝		¾	⅜	½
Nominal Embedment Depth	h_{nom}	in.	2	3⅜	2¾	4½	3⅜	5⅝	4⅛	2	2¾
Effective Embedment Depth	h_{ef}	in.	1⅝	3	2¼	4	2¾	5	3⅜	1⅝	2¼
Installation Torque	T_{inst}	ft.-lbf.	30		65		80		150	30	65
Pullout Strength, concrete on metal deck (cracked)[3]	$N_{p,deck,cr}$	lb.	1,230[8]	2,605[8]	1,990[7]	2,550[7]	1,750[9]	4,020[9]	3,030[7]	1,550[8]	2,055[7]
Pullout Strength, concrete on metal deck (uncracked)[3]	$N_{p,deck,uncr}$	lb.	1,580[8]	3,950[8]	2,475[7]	2,660[7]	2,470[7]	5,000[7]	4,275[9]	1,990[8]	2,560[7]
Pullout Strength, concrete on metal deck (seismic)[5]	$N_{p,deck,eq}$	lb.	1,230[8]	2,345[8]	1,990[7]	2,550[7]	1,750[9]	4,020[9]	3,030[7]	1,550[8]	2,055[7]
Steel Strength in Shear, concrete on metal deck[4]	$V_{sa,deck}$	lb.	2,285	3,085	3,430	4,680	3,235	5,430	6,135	3,085	5,955
Steel Strength in Shear, concrete on metal deck (seismic)[5]	$V_{sa,deck,eq}$	lb.	2,285	3,085	2,400	3,275	3,235	5,430	5,520	3,085	4,170

1. The information presented in this table must be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, except as modified below.
2. Profile steel deck must comply with the configuration in Figure 2 on the previous page, and have a minimum base-steel thickness of 0.035 inch (20 gauge). Steel must comply with ASTM A 653/A 653M SS Grade 33 with minimum yield strength of 33,000 psi. Concrete compressive strength shall be 3,000 psi minimum.
3. For anchors installed in the soffit of sand-lightweight or normal-weight concrete over metal deck floor and roof assemblies, calculation of the concrete breakout strength may be omitted.
4. In accordance with ACI 318-14 Section 17.4.3.2 or ACI 318-11 Section D.5.3.2, the nominal pullout strength in cracked concrete for anchors installed in the soffit of sand-lightweight or normal-weight concrete over metal deck floor and rood assemblies $N_{p,deck,cr}$ shall be substituted for $N_{p,cr}$. Where analysis indicates no cracking at service loads, the normal pullout strength in uncracked concrete $N_{p,deck,uncr}$ shall be substituted for $N_{p,uncr}$. For seismic loads, $N_{p,deck,eq}$ shall be substituted for N_p.
5. In accordance with ACI 318-14 Section 17.5.1.2(C) or ACI 318-11 Section D.6.1.2(c), the shear strength for anchors installed in the soffit of sand-lightweight or normal-weight concrete over metal deck floor and rood assemblies V_{sa},deck shall be substituted for V_{sa}. For seismic loads, $V_{sa,\ deck,eq}$ shall be substituted for V_{sa}.
6. The minimum anchor spacing along the flute must be the greater of 3.0h_{ef} or 1.5 times the flute width.
7. The characteristic pull-out strength for greater concrete compressive strengths shall be increased by multiplying the tabular value by $(f'_c / 3{,}000\text{ psi})^{0.5}$.
8. The characteristic pull-out strength for greater concrete compressive strengths shall be increased by multiplying the tabular value by $(f'_c / 3{,}000\text{ psi})^{0.3}$.
9. The characteristic pull-out strength for greater concrete compressive strengths shall be increased by multiplying the tabular value by $(f'_c / 3{,}000\text{ psi})^{0.4}$.
10. Concrete shall be normal-weight or structural sand-lightweight concrete having a minimum specified compressive strength, f'_c, of 3,000 psi.
11. Minimum distance to edge of panel is 2h_{ef}.

* See p. 13 for an explanation of the load table icons.

Strong-Bolt® 2 Design Information — Concrete

Carbon-Steel Strong-Bolt 2 Anchor Tension and Shear Strength Design Data for the Soffit of Concrete over Profile Steel Deck, Floor and Roof Assemblies[1,2,6,8,9]

IBC *

Characteristic	Symbol	Units	Carbon Steel Nominal Anchor Diameter (in.)					
			Installed in Lower Flute					
			⅜		½		⅝	
Nominal Embedment Depth	h_{nom}	in.	2	3⅜	2¾	4½	3⅜	5⅝
Effective Embedment Depth	h_{ef}	in.	1⅝	3	2¼	4	2¾	5
Minimum Hole Depth	h_{hole}	in.	2⅛	3½	3	4¾	3⅝	5⅝
Minimum Concrete Thickness	$h_{min,deck}$	in.	2	2	2	3¼	2	3¼
Installation Torque	T_{inst}	ft.-lbf.	30		60		90	
Pullout Strength, concrete on metal deck (cracked)[3,4,7]	$N_{p,deck,cr}$	lb.	1,295	2,705	2,585	4,385	3,015	5,120
Pullout Strength, concrete on metal deck (uncracked)[3,4,7]	$N_{p,deck,uncr}$	lb.	2,195	3,260	3,270	6,165	4,250	6,735
Pullout Strength, concrete on metal deck (seismic)[3,4,7]	$N_{p,deck,eq}$	lb.	1,295	2,705	2,585	4,385	3,015	5,120
Steel Strength in Shear, concrete on metal deck[5]	$V_{sa,deck}$	lb.	1,535	3,420	2,785	5,950	3,395	6,745
Steel Strength in Shear, concrete on metal deck (seismic)[5]	$V_{sa,deck,eq}$	lb.	1,535	3,420	2,505	5,350	3,055	6,070

1. The information presented in this table must be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, except as modified below.
2. Profile steel deck must comply with the configuration in Figure 3 below, and have a minimum base-steel thickness of 0.035 inch (20 gauge). Steel must comply with ASTM A 653/A 653M SS Grade 50 with minimum yield strength of 50,000 psi. Concrete compressive strength shall be 3,000 psi minimum.
3. For anchors installed in the soffit of sand-lightweight or normal-weight concrete over metal deck floor and roof assemblies, calculation of the concrete breakout strength may be omitted.
4. In accordance with ACI 318-14 Section 17.4.3.2 or ACI 318-11 Section D.5.3.2, the nominal pullout strength in cracked concrete for anchors installed in the soffit of sand-lightweight or normal-weight concrete over metal deck floor and rood assemblies $N_{p,deck,cr}$ shall be substituted for $N_{p,cr}$. Where analysis indicates no cracking at service loads, the normal pullout strength in uncracked concrete $N_{p,deck,uncr}$ shall be substituted for $N_{p,uncr}$. For seismic loads, $N_{p,deck,eq}$ shall be substituted for N_p.
5. In accordance with ACI 318-14 Section 17.5.1.2(c) or ACI 318-11, the shear strength for anchors installed in the soffit of sand-lightweight or normal-weight concrete over metal deck floor and rood assemblies V_{sa},deck shall be substituted for V_{sa}. For seismic loads, $V_{sa,deck,eq}$ shall be substituted for V_{sa}.
6. The minimum anchor spacing along the flute must be the greater of $3.0h_{ef}$ or 1.5 times the flute width.
7. The characteristic pull-out strength for greater concrete compressive strengths shall be increased by multiplying the tabular value by $(f'_c / 3,000 \text{ psi})^{0.5}$.
8. Concrete shall be normal-weight or structural sand-lightweight concrete having a minimum specified compressive strength, f'_c, of 3,000 psi.
9. Minimum distance to edge of panel is $2h_{ef}$.

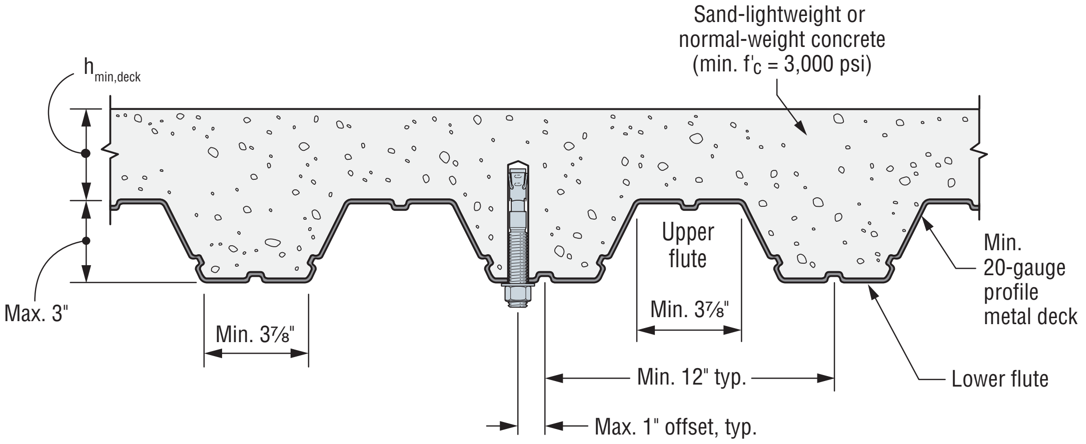


Figure 3

* See p. 13 for an explanation of the load table icons.

Strong-Bolt® 2 Design Information — Masonry

Carbon-Steel Strong-Bolt 2 Tension and Shear Loads in 8" Lightweight, Medium-Weight and Normal-Weight Grout-Filled CMU

Size in. (mm)	Drill Bit Dia. (in.)	Min. Embed. Depth in. (mm)	Install. Torque ft.-lb. (N-m)	Critical Edge Dist. in. (mm)	Critical End Dist. in. (mm)	Critical Spacing in. (mm)	Tension Load		Shear Load	
							Ultimate lb. (kN)	Allowable lb. (kN)	Ultimate lb. (kN)	Allowable lb. (kN)
Anchor Installed in the Face of the CMU Wall (See Figure 1)										
¼ (6.4)	¼	1¾ (45)	4 (5.4)	12 (305)	12 (305)	8 (203)	1,150 (5.1)	230 (1.0)	1,500 (6.7)	300 (1.3)
⅜ (9.5)	⅜	2⅝ (67)	20 (27.1)	12 (305)	12 (305)	8 (203)	2,185 (9.7)	435 (1.9)	3,875 (17.2)	775 (3.4)
½ (12.7)	½	3½ (89)	35 (47.5)	12 (305)	12 (305)	8 (203)	2,645 (11.8)	530 (2.4)	5,055 (22.5)	1,010 (4.5)
⅝ (15.9)	⅝	4⅜ (111)	55 (74.6)	20 (508)	20 (508)	8 (203)	4,460 (19.8)	890 (4.0)	8,815 (39.2)	1,765 (7.9)
¾ (19.1)	¾	5¼ (133)	100 (135.6)	20 (508)	20 (508)	8 (203)	5,240 (23.3)	1,050 (4.7)	12,450 (55.4)	2,490 (11.1)

1. The tabulated allowable loads are based on a safety factor of 5.0 for installation under the IBC and IRC.
2. Listed loads may be applied to installations on the face of the CMU wall at least 1¼" away from headjoints.
3. Values for 8"-wide concrete masonry units (CMU) with a minimum specified compressive strength of masonry, f'$_m$, at 28 days is 1,500 psi.
4. Embedment depth is measured from the outside face of the concrete masonry unit.
5. Tension and shear loads may be combined using the parabolic interaction equation (n = ⁵⁄₃).
6. Refer to allowable load adjustment factors for edge distance and spacing on p. 146.
7. Allowable loads may be increased 33⅓% for short-term loading due to wind forces or seismic forces where permitted by code.

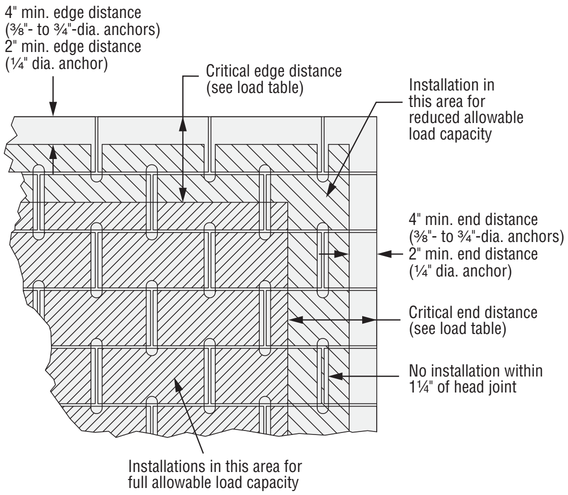


Figure 1

Carbon-Steel Strong-Bolt 2 Tension and Shear Loads in 8" Lightweight, Medium-weight and Normal-Weight Grout-Filled CMU

Size in. (mm)	Drill Bit Dia. in.	Min. Embed. Depth. in. (mm)	Install. Torque ft.-lb. (N-m)	Min. Edge. Dist. in. (mm)	Critical End Dist. in. (mm)	Critical Spacing in. (mm)	Tension Load		Shear Load Perp. To Edge		Shear Load Parallel To Edge	
							Ultimate lb. (kN)	Allowable lb. (kN)	Ultimate lb. (kN)	Allowable lb. (kN)	Ultimate lb. (kN)	Allowable lb. (kN)
Anchor Installed in Cell Opening or Web (Top of Wall) (See Figure 2)												
½ (12.7)	½	3½ (89)	35 (47.5)	1¾ (45)	12 (305)	8 (203)	2,080 (9.3)	415 (1.8)	1,165 (5.2)	235 (1.0)	3,360 (14.9)	670 (3.0)
⅝ (15.9)	⅝	4⅜ (111)	55 (74.6)	1¾ (45)	12 (305)	8 (203)	3,200 (14.2)	640 (2.8)	1,370 (6.1)	275 (1.2)	3,845 (17.1)	770 (3.4)

1. The tabulated allowable loads are based on a safety factor of 5.0 for installation under the IBC and IRC.
2. Values for 8"-wide concrete masonry units (CMU) with a minimum specified compressive strength of masonry, f'$_m$, at 28 days is 1,500 psi.
3. Tension and shear loads may be combined using the parabolic interaction equation (n = ⁵⁄₃).
4. Refer to allowable load adjustment factors for edge distance and spacing on p. 146.
5. Allowable loads may be increased 33⅓% for short-term loading due to wind forces or seismic forces where permitted by code.

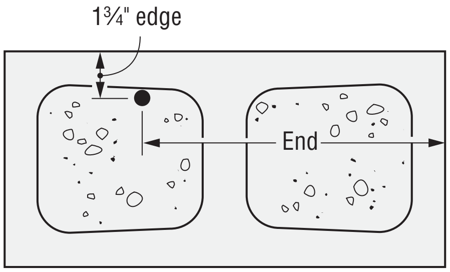


Figure 2

* See p. 13 for an explanation of the load table icons.

Strong-Bolt® 2 Design Information — Masonry

Carbon-Steel Strong-Bolt 2 Allowable Load Adjustment Factors for Face-of-Wall Installation in 8" Grout-Filled CMU: Edge Distance and Spacing, Tension and Shear Loads

How to use these charts:

1. The following tables are for reduced 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 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 spacings are multiplied together.

Edge or End Distance Tension (f_c)

IBC *

c_{act} (in.)	Dia.	¼	⅜	½	⅝	¾
	E	1¾	2⅝	3½	4⅜	5¼
	c_{cr}	12	12	12	20	20
	c_{min}	2	4	4	4	4
	f_{cmin}	1.00	1.00	1.00	1.00	0.97
2		1.00				
4		1.00	1.00	1.00	1.00	0.97
6		1.00	1.00	1.00	1.00	0.97
8		1.00	1.00	1.00	1.00	0.98
10		1.00	1.00	1.00	1.00	0.98
12		1.00	1.00	1.00	1.00	0.99
14					1.00	0.99
16					1.00	0.99
18					1.00	1.00
20					1.00	1.00

Edge or End Distance Shear (f_c)

IBC *

c_{act} (in.)	Dia.	¼	⅜	½	⅝	¾
	E	1¾	2⅝	3½	4⅜	5¼
	c_{cr}	12	12	12	20	20
	c_{min}	2	4	4	4	4
	f_{cmin}	0.88	0.71	0.60	0.36	0.28
2		0.88				
4		0.90	0.71	0.60	0.36	0.28
6		0.93	0.78	0.70	0.44	0.37
8		0.95	0.86	0.80	0.52	0.46
10		0.98	0.93	0.90	0.60	0.55
12		1.00	1.00	1.00	0.68	0.64
14					0.76	0.73
16					0.84	0.82
18					0.92	0.91
20					1.00	1.00

Spacing Tension (f_s)

IBC *

s_{act} (in.)	Dia.	¼	⅜	½	⅝	¾
	E	1¾	2⅝	3½	4⅜	5¼
	s_{cr}	8	8	8	8	8
	s_{min}	4	4	4	4	4
	f_{smin}	1.00	1.00	0.93	0.86	0.80
4		1.00	1.00	0.93	0.86	0.80
6		1.00	1.00	0.97	0.93	0.90
8		1.00	1.00	1.00	1.00	1.00

Spacing Shear (f_s)

IBC *

s_{act} (in.)	Dia.	¼	⅜	½	⅝	¾
	E	1¾	2⅝	3½	4⅜	5¼
	s_{cr}	8	8	8	8	8
	s_{min}	4	4	4	4	4
	f_{smin}	1.00	1.00	1.00	1.00	1.00
4		1.00	1.00	1.00	1.00	1.00
6		1.00	1.00	1.00	1.00	1.00
8		1.00	1.00	1.00	1.00	1.00

Load Adjustment Factors for Carbon-Steel Strong-Bolt 2 Wedge Anchors in Top-of-Wall Installation in 8" Grout-Filled CMU: Edge Distance and Spacing, Tension and Shear Loads

End Distance Tension (f_c)

IBC *

s_{act} (in.)	Dia.	½	⅝
	E	3½	4⅜
	c_{cr}	12	12
	c_{min}	4	4
	f_{cmin}	1.00	1.00
4		1.00	1.00
6		1.00	1.00
8		1.00	1.00
10		1.00	1.00
12		1.00	1.00

End Distance Shear Perpendicular to Edge (f_c)

IBC *

c_{act} (in.)	Dia.	½	⅝
	E	3½	4⅜
	c_{cr}	12	12
	c_{min}	4	4
	f_{cmin}	0.90	0.83
4		0.90	0.83
6		0.93	0.87
8		0.95	0.92
10		0.98	0.96
12		1.00	1.00

End Distance Shear Parallel to Edge (f_c)

IBC *

c_{act} (in.)	Dia.	½	⅝
	E	3½	4⅜
	c_{cr}	12	12
	c_{min}	4	4
	f_{cmin}	0.53	0.50
4		0.53	0.50
6		0.65	0.63
8		0.77	0.75
10		0.88	0.88
12		1.00	1.00

Spacing Tension (f_s)

IBC *

s_{act} (in.)	Dia.	½	⅝
	E	3½	4⅜
	s_{cr}	8	8
	s_{min}	4	4
	f_{cmin}	0.93	0.86
4		0.93	0.86
6		0.97	0.93
8		1.00	1.00

Spacing Shear Perpendicular or Parallel to Edge (f_s)

IBC *

s_{act} (in.)	Dia.	½	⅝
	E	3½	4⅜
	s_{cr}	8	8
	s_{min}	4	4
	f_{cmin}	1.00	1.00
4		1.00	1.00
6		1.00	1.00
8		1.00	1.00

* See p. 13 for an explanation of the load table icons.

Wedge-All® Wedge Anchor

A non-bottom-bearing, wedge-style expansion anchor for use in solid concrete or grout-filled masonry. The Wedge-All wedge anchor is available in carbon steel with zinc or mechanically galvanized coating, as well as Types 303/304 and Type 316 stainless steel. Threaded studs are set by tightening the nut to the specified torque. The Wedge-All is code listed for grout-filled masonry applications.

Features

- Code-listed under IBC/IRC for grout-filled CMU per ICC-ES ESR-1396
- One-piece, wrap-around clip ensures uniform holding capacity
- Threaded end is chamfered for ease of starting nut
- Available in a wide range of diameters and lengths

Codes: ICC-ES ESR-1396 (CMU); Florida FL-15730.7; FM 3017082 and 3131136; UL File Ex3605; Mulitiple DOT listings; meets the requirements of Federal Specification A-A-1923A, Type 4

Material: Carbon or stainless steel (Types 303/304; Type 316)

Coating: Carbon steel anchors are available zinc plated or mechanically galvanized

Installation

⚠ Do not use an impact wrench to set or tighten anchors.

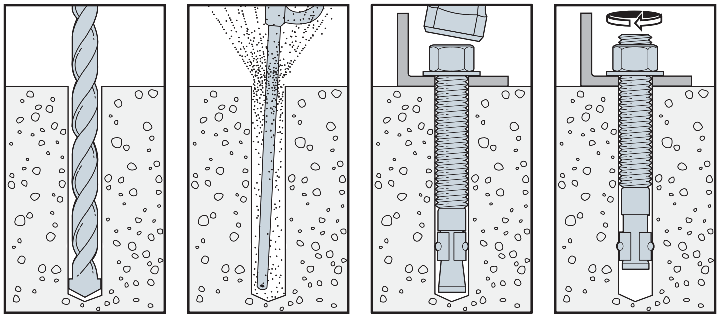
⚠ **Caution:** Oversized holes in the base material will make it difficult to set the anchor and will reduce the anchor's load capacity.

1. Drill a hole in base material using a carbide drill bit the same diameter as the nominal diameter of the anchor to be installed. Drill the hole to the specified embedment depth, and blow it clean using compressed air. (Overhead installations need not be blown clean.) Alternatively, drill the hole deep enough to accommodate the embedment depth and the dust from drilling.
2. Assemble the anchor with nut and washer so the top of the nut is flush with the top of the anchor. Place the anchor in the fixture, and drive it into the hole until the washer and nut are tight against the fixture.
3. Tighten to the required installation torque.

Wedge-All Anchor

Head Stamp
The head is stamped with the length identification letter.

Installation Sequence



Wedge-All Anchor Installation Data

Wedge-All Diameter (in.)	¼	⅜	½	⅝	¾	⅞	1	1¼
Drill Bit Size (in.)	¼	⅜	½	⅝	¾	⅞	1	1¼
Min. Fixture Hole (in.)	5⁄16	7⁄16	9⁄16	11⁄16	⅞	1	1⅛	1⅜
Wrench Size (in.)	7⁄16	9⁄16	¾	15⁄16	1⅛	1 5⁄16	1½	1⅞

Length Identification Head Marks on Wedge-All Anchors (corresponds to length of anchor — inches).

Mark	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
From	1½	2	2½	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	11	12	13	14	15	16	17	18
Up To But Not Including	2	2½	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	11	12	13	14	15	16	17	18	19

Wedge-All® Wedge Anchor

Wedge-All Anchor Product Data — Carbon Steel: Zinc Plated and Mechanically Galvanized

Size (in.)	Zinc Plated Model No.	Mechanically Galvanized Model No.	Drill Bit Dia. (in.)	Thread Length (in.)	Quantity	
					Box	Carton
¼ x 1¾	—	WA25134MG	¼	15⁄16	100	500
¼ x 2¼	—	WA25214MG		1 7⁄16	100	500
¼ x 3¼	—	WA25314MG		2 7⁄16	100	500
⅜ x 2¼	WA37214	WA37214MG	⅜	1⅛	50	250
⅜ x 2¾	WA37234	WA37234MG		1⅝	50	250
⅜ x 3	WA37300	WA37300MG		1⅞	50	250
⅜ x 3½	WA37312	WA37312MG		2½	50	250
⅜ x 3¾	WA37334	WA37334MG		2⅝	50	250
⅜ x 5	WA37500	WA37500MG		3⅞	50	200
⅜ x 7	WA37700	WA37700MG		5⅞	50	200
½ x 2¾	WA50234	WA50234MG	½	1 5⁄16	25	125
½ x 3¾	WA50334	WA50334MG		2 5⁄16	25	125
½ x 4¼	WA50414	WA50414MG		2 13⁄16	25	100
½ x 5½	WA50512	WA50512MG		4 1⁄16	25	100
½ x 7	WA50700	WA50700MG		4 9⁄16	25	100
½ x 8½	WA50812	WA50812MG		6	25	50
½ x 10	WA50100	WA50100MG		6	25	50
½ x 12	WA50120	WA50120MG		6	25	50
⅝ x 3½	WA62312	WA62312MG	⅝	1⅞	20	80
⅝ x 4½	WA62412	WA62412MG		2⅞	20	80
⅝ x 5	WA62500	WA62500MG		3⅜	20	80
⅝ x 6	WA62600	WA62600MG		4⅜	20	80
⅝ x 7	WA62700	WA62700MG		5⅜	20	80
⅝ x 8½	WA62812	WA62812MG		6	20	40
⅝ x 10	WA62100	WA62100MG		6	10	20
⅝ x 12	WA62120	WA62120MG		6	10	20
¾ x 4¼	WA75414	WA75414MG	¾	2⅜	10	40
¾ x 4¾	WA75434	WA75434MG		2⅞	10	40
¾ x 5½	WA75512	WA75512MG		3⅝	10	40
¾ x 6¼	WA75614	WA75614MG		4⅜	10	40
¾ x 7	WA75700	WA75700MG		5⅛	10	40
¾ x 8½	WA75812	WA75812MG		6	10	20
¾ x 10	WA75100	WA75100MG		6	10	20
¾ x 12	WA75120	WA75120MG		6	5	10
⅞ x 6	WA87600	WA87600MG	⅞	2⅛	5	20
⅞ x 8	WA87800	WA87800MG		2⅛	5	10
⅞ x 10	WA87100	WA87100MG		2⅛	5	10
⅞ x 12	WA87120	WA87120MG		2⅛	5	10
1 x 6	WA16000	WA16000MG	1	2¼	5	20
1 x 9	WA19000	WA19000MG		2¼	5	10
1 x 12	WA11200	WA11200MG		2¼	5	10
1¼ x 9	WA12590	—	1¼	2¾	5	10
1¼ x 12	WA12512	—		2¾	5	10

1. The published length is the overall length of the anchor. Allow one anchor diameter for the nut and washer thickness plus the fixture thickness when selecting the minimum length.

Material Specifications

Carbon Steel — Zinc Plated			
Component Materials			
Anchor Body	Nut	Washer	Clip
Material meets minimum 70,000 psi tensile strength	Carbon Steel ASTM A 563, Grade A	Carbon Steel	Carbon Steel

Material Specifications

Carbon Steel — Mechanically Galvanized[1]			
Component Materials			
Anchor Body	Nut	Washer	Clip
Material meets minimum 70,000 psi tensile strength	Carbon Steel ASTM A 563, Grade A	Carbon Steel	Carbon Steel

1. Mechanical Galvanizing meets ASTM B695, Class 55, Type 1.

Wedge-All® Wedge Anchor

Wedge-All Anchor Product Data — Stainless Steel

Size (in.)	Type 303/304 Stainless Model No.[2]	Type 316 Stainless Model No.	Drill Bit Dia. (in.)	Thread Length (in.)	Quantity	
					Box	Carton
⅜ x 2¼	WA37214**4SS**	WA37214**6SS**	⅜	1⅛	50	250
⅜ x 2¾	WA37234**4SS**	WA37234**6SS**		1⅝	50	250
⅜ x 3	WA37300**4SS**	WA37300**6SS**		1⅞	50	250
⅜ x 3½	WA37312**4SS**	WA37312**6SS**		2½	50	250
⅜ x 3¾	WA37334**4SS**	WA37334**6SS**		2⅝	50	250
⅜ x 5	WA37500**4SS**	WA37500**6SS**		3⅞	50	200
⅜ x 7	WA37700**4SS**	WA37700**6SS**		5⅞	50	200
½ x 2¾	WA50234**4SS**	WA50234**6SS**	½	1⁵⁄₁₆	25	125
½ x 3¾	WA50334**4SS**	WA50334**6SS**		2⁵⁄₁₆	25	125
½ x 4¼	WA50414**4SS**	WA50414**6SS**		2¹³⁄₁₆	25	100
½ x 5½	WA50512**4SS**	WA50512**6SS**		4¹⁄₁₆	25	100
½ x 7	WA50700**4SS**	WA50700**6SS**		5⁹⁄₁₆	25	100
½ x 8½	WA50812**4SS**	WA50812**6SS**		2	25	50
½ x 10	WA50100**SS**	—		2	25	50
½ x 12	WA50120**SS**	—		2	25	50
⅝ x 3½	WA62312**4SS**	WA62312**6SS**	⅝	1⅞	20	80
⅝ x 4½	WA62412**4SS**	WA62412**6SS**		2⅞	20	80
⅝ x 5	WA62500**4SS**	WA62500**6SS**		3⅜	20	80
⅝ x 6	WA62600**4SS**	WA62600**6SS**		4⅜	20	80
⅝ x 7	WA62700**4SS**	WA62700**6SS**		5⅜	20	80
⅝ x 8½	WA62812**4SS**	WA62812**6SS**		2	20	40
⅝ x 10	WA62100**SS**	WA621003**SS**		2	10	20
⅝ x 12	WA62120**SS**	WA621203**SS**		2	10	20
¾ x 4¼	WA75414**4SS**	WA75414**6SS**	¾	2⅜	10	40
¾ x 4¾	WA75434**4SS**	WA75434**6SS**		2⅞	10	40
¾ x 5½	WA75512**4SS**	WA75512**6SS**		3⅝	10	40
¾ x 6¼	WA75614**4SS**	WA75614**6SS**		4⅜	10	40
¾ x 7	WA75700**4SS**	WA75700**6SS**		5⅛	10	40
¾ x 8½	WA75812**4SS**	WA75812**6SS**		2¼	10	20
¾ x 10	WA75100**SS**	WA751003**SS**		2¼	10	20
¾ x 12	WA75120**SS**	WA751203**SS**		2¼	5	10
⅞ x 6	WA87600**SS**	WA876003**SS**	⅞	2⅛	5	20
⅞ x 8	WA87800**SS**	WA878003**SS**		2⅛	5	10
⅞ x 10	WA87100**SS**	WA871003**SS**		2⅛	5	10
⅞ x 12	WA87120**SS**	—		2⅛	5	10
1 x 6	WA16000**SS**	WA160003**SS**	1	2¼	5	20
1 x 9	WA19000**SS**	WA190003**SS**		2¼	5	10
1 x 12	WA11200**SS**	WA112003**SS**		2¼	5	10

1. The published length is the overall length of the anchor. Allow one anchor diameter for the nut and washer thickness plus the fixture thickness when selecting a length.
2. Anchors with the “SS” suffix in the model number are manufactured from Type 303 stainless steel; the remaining anchors (with the “4SS” suffix) are manufactured from Type 304 stainless steel. Types 303 and 304 stainless steel perform equally well in certain corrosive environments.

Material Specifications

Type 303/304 Stainless Steel[1]			
Component Materials			
Anchor Body	Nut	Washer	Clip
Type 303 or 304 stainless steel	Type 304 stainless steel	Type 304 stainless steel	Type 304 or 316 stainless steel

1. Types 303 and 304 stainless steels perform equally well in certain corrosive environments. Larger sizes are manufactured from Type 303.

Material Specifications

Type 316 Stainless Steel[1]			
Component Materials			
Anchor Body	Nut	Washer	Clip
Type 316 stainless steel	Type 316 stainless steel	Type 316 stainless steel	Type 316 stainless steel

1. Type 316 stainless steel provides the greatest degree of corrosion resistance offered by Simpson Strong-Tie.

Wedge-All® Design Information — Concrete

Carbon-Steel Wedge-All Allowable Tension Loads in Normal-Weight Concrete*

Size in. (mm)	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing in. (mm)	Tension Load							Install. Torque ft.-lb. (N-m)
				f'c ≥ 2,000 psi (13.8 MPa) Concrete			f'c ≥ 3,000 psi (20.7 MPa) Concrete	f'c ≥ 4,000 psi (27.6 MPa) Concrete			
				Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)	Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allowable lb. (kN)	
¼ (6.4)	1⅛ (29)	2½ (64)	1⅝ (41)	680 (3.0)	167 (0.7)	170 (0.8)	205 (0.9)	960 (4.3)	233 (1.0)	240 (1.1)	8 (10.8)
	2¼ (57)	2½ (64)	3⅛ (79)	1,920 (8.5)	286 (1.3)	480 (2.1)	530 (2.4)	2,320 (10.3)	105 (0.5)	580 (2.6)	
⅜ (9.5)	1¾ (44)	3¾ (95)	2⅜ (60)	1,560 (6.9)	261 (1.2)	390 (1.7)	555 (2.5)	2,880 (12.8)	588 (2.6)	720 (3.2)	30 (40.7)
	2⅝ (67)	3¾ (95)	3⅝ (92)	3,360 (14.9)	464 (2.1)	840 (3.7)	1,100 (4.9)	5,440 (24.2)	553 (2.5)	1,360 (6.0)	
	3⅜ (86)	3¾ (95)	4¾ (121)	3,680 (16.4)	585 (2.6)	920 (4.1)	1,140 (5.1)	5,440 (24.2)	318 (1.4)	1,360 (6.0)	
½ (12.7)	2¼ (57)	5 (127)	3⅛ (79)	3,280 (14.6)	871 (3.9)	820 (3.6)	1,070 (4.8)	5,280 (23.5)	849 (3.8)	1,320 (5.9)	60 (81.3)
	3⅜ (86)	5 (127)	4¾ (121)	6,040 (26.9)	654 (2.9)	1,510 (6.7)	1,985 (8.8)	9,840 (43.8)	1,303 (5.8)	2,460 (10.9)	
	4½ (114)	5 (127)	6¼ (159)	6,960 (31.0)	839 (3.7)	1,740 (7.7)	2,350 (10.5)	11,840 (52.7)	2,462 (11.0)	2,960 (13.2)	
⅝ (15.9)	2¾ (70)	6¼ (159)	3⅞ (98)	4,520 (20.1)	120 (0.5)	1,130 (5.0)	1,640 (7.3)	8,600 (38.3)	729 (3.2)	2,150 (9.6)	90 (122.0)
	4½ (114)	6¼ (159)	6¼ (159)	8,200 (36.5)	612 (2.7)	2,050 (9.1)	2,990 (13.3)	15,720 (69.9)	1,224 (5.4)	3,930 (17.5)	
	5½ (140)	6¼ (159)	7¾ (197)	8,200 (36.5)	639 (2.8)	2,050 (9.1)	2,990 (13.3)	15,720 (69.9)	1,116 (5.0)	3,930 (17.5)	
¾ (19.1)	3⅜ (86)	7½ (191)	4¾ (121)	6,760 (30.1)	1,452 (6.5)	1,690 (7.5)	2,090 (9.3)	9,960 (44.3)	1,324 (5.9)	2,490 (11.1)	150 (203.4)
	5 (127)	7½ (191)	7 (178)	10,040 (44.7)	544 (2.4)	2,510 (11.2)	3,225 (14.3)	15,760 (70.1)	1,550 (6.9)	3,940 (17.5)	
	6¾ (171)	7½ (191)	9½ (241)	10,040 (44.7)	1,588 (7.1)	2,510 (11.2)	3,380 (15.0)	17,000 (75.6)	1,668 (7.4)	4,250 (18.9)	
⅞ (22.2)	3⅞ (98)	8¾ (222)	5⅜ (137)	7,480 (33.3)	821 (3.7)	1,870 (8.3)	2,275 (10.1)	10,720 (47.7)	1,253 (5.6)	2,680 (11.9)	200 (271.2)
	7⅞ (200)	8¾ (222)	11 (279)	17,040 (75.8)	1,566 (7.0)	4,260 (18.9)	4,670 (20.8)	20,320 (90.4)	2,401 (10.7)	5,080 (22.6)	
1 (25.4)	4½ (114)	10 (254)	6¼ (159)	11,550 (51.4)	1,830 (8.1)	2,888 (12.8)	2,891 (12.9)	11,760 (52.3)	1,407 (6.3)	2,940 (13.1)	225 (305.1)
	9 (229)	10 (254)	12⅝ (321)	15,570 (69.3)	2,337 (10.4)	3,893 (17.3)	4,766 (21.2)	22,560 (100.4)	1,209 (5.4)	5,640 (25.1)	
1¼ (31.8)	5⅝ (143)	12½ (318)	7⅞ (200)	11,370 (50.6)	1,010 (4.5)	2,843 (12.6)	3,743 (16.6)	18,570 (82.6)	469 (2.1)	4,643 (20.7)	400 (542.3)
	9½ (241)	12½ (318)	13¼ (337)	15,120 (67.3)	2,438 (10.8)	3,780 (16.8)	6,476 (28.8)	36,690 (163.2)	1,270 (5.6)	9,173 (40.8)	

1. The allowable loads listed are based on a safety factor of 4.0.
2. Refer to allowable load-adjustment factors for edge distance and spacing on pp. 155 and 157.
3. Drill bit diameter used in base material corresponds to nominal anchor diameter.
4. Allowable loads may be linearly interpolated between concrete strengths listed.
5. The minimum concrete thickness is 1½ times the embedment depth.

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* See p. 13 for an explanation of the load table icons.

Wedge-All® Design Information — Concrete

Carbon-Steel Wedge-All Allowable Shear Loads in Normal-Weight Concrete

Size in. (mm)	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing in. (mm)	Shear Load					Install. Torque ft.-lb. (N-m)
				$f'_c \geq$ 2,000 psi (13.8 MPa) Concrete			$f'_c \geq$ 3,000 psi (20.7 MPa) Concrete	$f'_c \geq$ 4,000 psi (27.6 MPa) Concrete	
				Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)	
¼ (6.4)	1⅛ (29)	2½ (64)	1⅝ (41)	920 (4.1)	47 (0.2)	230 (1.0)	230 (1.0)	230 (1.0)	8 (10.8)
	2¼ (57)	2½ (64)	3⅛ (79)	—	—	230 (1.0)	230 (1.0)	230 (1.0)	
⅜ (9.5)	1¾ (44)	3¾ (95)	2⅜ (60)	2,280 (10.1)	96 (0.4)	570 (2.5)	570 (2.5)	570 (2.5)	30 (40.7)
	2⅝ (67)	3¾ (95)	3⅝ (92)	4,220 (18.8)	384 (1.7)	1,055 (4.7)	1,055 (4.7)	1,055 (4.7)	
	3⅜ (86)	3¾ (95)	4¾ (121)	—	—	1,055 (4.7)	1,055 (4.7)	1,055 (4.7)	
½ (12.7)	2¼ (57)	5 (127)	3⅛ (79)	6,560 (29.2)	850 (3.8)	1,345 (6.0)	1,485 (6.6)	1,625 (7.2)	60 (81.3)
	3⅜ (86)	5 (127)	4¾ (121)	8,160 (36.3)	880 (3.9)	1,675 (7.5)	1,850 (8.2)	2,020 (9.0)	
	4½ (114)	5 (127)	6¼ (159)	—	—	1,675 (7.5)	1,850 (8.2)	2,020 (9.0)	
⅝ (15.9)	2¾ (70)	6¼ (159)	3⅞ (98)	8,720 (38.8)	1,699 (7.6)	1,620 (7.2)	1,900 (8.5)	2,180 (9.7)	90 (122.0)
	4½ (114)	6¼ (159)	6¼ (159)	12,570 (55.9)	396 (1.8)	2,330 (10.4)	2,740 (12.2)	3,145 (14.0)	
	5½ (140)	6¼ (159)	7¾ (197)	—	—	2,330 (10.4)	2,740 (12.2)	3,145 (14.0)	
¾ (19.1)	3⅜ (86)	7½ (191)	4¾ (121)	11,360 (50.5)	792 (3.5)	2,840 (12.6)	2,840 (12.6)	2,840 (12.6)	150 (203.4)
	5 (127)	7½ (191)	7 (178)	18,430 (82.0)	1,921 (8.5)	4,610 (20.5)	4,610 (20.5)	4,610 (20.5)	
	6¾ (171)	7½ (191)	9½ (241)	—	—	4,610 (20.5)	4,610 (20.5)	4,610 (20.5)	
⅞ (22.2)	3⅞ (98)	8¾ (222)	5⅜ (137)	13,760 (61.2)	2,059 (9.2)	3,440 (15.3)	3,440 (15.3)	3,440 (15.3)	200 (271.2)
	7⅞ (200)	8¾ (222)	11 (279)	22,300 (99.2)	477 (2.1)	5,575 (24.8)	5,575 (24.8)	5,575 (24.8)	
1 (25.4)	4½ (114)	10 (254)	6¼ (159)	22,519 (100.2)	1,156 (5.1)	5,730 (25.5)	5,730 (25.5)	5,730 (25.5)	300 (406.7)
	9 (229)	10 (254)	12⅝ (321)	25,380 (112.9)	729 (3.2)	6,345 (28.2)	6,345 (28.2)	6,345 (28.2)	
1¼ (31.8)	5⅝ (143)	12½ (318)	7⅞ (200)	29,320 (130.4)	2,099 (9.3)	7,330 (32.6)	7,330 (32.6)	7,330 (32.6)	400 (542.3)
	9½ (241)	12½ (318)	13¼ (337)	—	—	7,330 (32.6)	7,330 (32.6)	7,330 (32.6)	

1. The allowable loads listed are based on a safety factor of 4.0.
2. Refer to allowable load-adjustment factors for spacing and edge distance on pp. 155, 156 and 158.
3. Drill bit diameter used in base material corresponds to nominal anchor diameter.
4. Allowable loads may be linearly interpolated between concrete strengths listed.
5. The minimum concrete thickness is 1½ times the embedment depth.

* See p. 13 for an explanation of the load table icons.

Wedge-All® Design Information — Concrete

Stainless-Steel Wedge-All Allowable Tension Loads in Normal-Weight Concrete

Size in. (mm)	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing in. (mm)	Allowable Tension Load lb. (kN)			Install. Torque ft.-lb. (N-m)
				f'c ≥ 2,000 psi (13.8 MPa) Concrete	f'c ≥ 3,000 psi (20.7 MPa) Concrete	f'c ≥ 4,000 psi (27.6 MPa) Concrete	
¼ (6.4)	1⅛ (29)	2½ (64)	1⅝ (41)	155 (0.7)	185 (0.8)	215 (1.0)	8 (10.8)
	2¼ (57)	2½ (64)	3⅛ (79)	430 (1.9)	475 (2.1)	520 (2.3)	
⅜ (9.5)	1¾ (44)	3¾ (95)	2⅜ (60)	350 (1.6)	500 (2.2)	650 (2.9)	30 (40.7)
	2⅝ (67)	3¾ (95)	3⅝ (92)	755 (3.4)	990 (4.4)	1,225 (5.4)	
	3⅜ (86)	3¾ (95)	4¾ (121)	830 (3.7)	1,025 (4.6)	1,225 (5.4)	
½ (12.7)	2¼ (57)	5 (127)	3⅛ (79)	740 (3.3)	965 (4.3)	1,190 (5.3)	60 (81.3)
	3⅜ (86)	5 (127)	4¾ (121)	1,360 (6.0)	1,785 (7.9)	2,215 (9.9)	
	4½ (114)	5 (127)	6¼ (159)	1,565 (7.0)	2,115 (9.4)	2,665 (11.9)	
⅝ (15.9)	2¾ (70)	6¼ (159)	3⅞ (98)	1,015 (4.5)	1,475 (6.6)	1,935 (8.6)	90 (122.0)
	4½ (114)	6¼ (159)	6¼ (159)	1,845 (8.2)	2,690 (12.0)	3,535 (15.7)	
	5½ (140)	6¼ (159)	7¾ (197)	1,845 (8.2)	2,690 (12.0)	3,535 (15.7)	
¾ (19.1)	3⅜ (86)	7½ (191)	4¾ (121)	1,520 (6.8)	1,880 (8.4)	2,240 (10.0)	150 (203.4)
	5 (127)	7½ (191)	7 (178)	2,260 (10.1)	2,905 (12.9)	3,545 (15.8)	
	6¾ (171)	7½ (191)	9½ (241)	2,260 (10.1)	3,040 (13.5)	3,825 (17.0)	
⅞ (22.2)	3⅞ (98)	8¾ (222)	5⅜ (137)	1,685 (7.5)	2,050 (9.1)	2,410 (10.7)	200 (271.2)
	7⅞ (200)	8¾ (222)	11 (279)	3,835 (17.1)	4,205 (18.7)	4,570 (20.3)	
1 (25.4)	4½ (114)	10 (254)	6¼ (159)	2,599 (11.6)	2,621 (11.7)	2,648 (11.8)	225 (305.1)
	9 (229)	10 (254)	12⅝ (321)	3,503 (15.6)	4,290 (19.1)	5,078 (22.6)	
1¼ (31.8)	5⅝ (143)	12½ (318)	7⅞ (200)	2,558 (11.4)	3,368 (15.0)	4,178 (18.6)	400 (542.3)
	9½ (241)	12½ (318)	13¼ (337)	3,401 (15.1)	5,828 (25.9)	8,254 (36.7)	

1. The allowable loads listed are based on a safety factor of 4.0.
2. Refer to allowable load-adjustment factors for edge distance and spacing on pp. 155 and 157.
3. Drill bit diameter used in base material corresponds to nominal anchor diameter.
4. Allowable loads may be linearly interpolated between concrete strengths listed.
5. The minimum concrete thickness is 1½ times the embedment depth.

* See p. 13 for an explanation of the load table icons.

Wedge-All® Design Information — Concrete

Stainless-Steel Wedge-All Allowable Shear Loads in Normal-Weight Concrete

*

Size in. (mm)	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing in. (mm)	Allowable Shear Load lb. (kN)			Install. Torque ft.-lb. (N-m)
				$f'_c \geq$ 2,000 psi (13.8 MPa) Concrete	$f'_c \geq$ 3,000 psi (20.7 MPa) Concrete	$f'_c \geq$ 4,000 psi (27.6 MPa) Concrete	
¼ (6.4)	1⅛ (29)	2½ (64)	1⅝ (41)	265 (1.2)	265 (1.2)	265 (1.2)	8 (10.8)
	2¼ (57)	2½ (64)	3⅛ (79)	265 (1.2)	265 (1.2)	265 (1.2)	
⅜ (9.5)	1¾ (44)	3¾ (95)	2⅜ (60)	655 (2.9)	655 (2.9)	655 (2.9)	30 (40.7)
	2⅝ (67)	3¾ (95)	3⅝ (92)	1,215 (5.4)	1,215 (5.4)	1,215 (5.4)	
	3⅜ (86)	3¾ (95)	4¾ (121)	1,215 (5.4)	1,215 (5.4)	1,215 (5.4)	
½ (12.7)	2¼ (57)	5 (127)	3⅛ (79)	1,545 (6.9)	1,710 (7.6)	1,870 (8.3)	60 (81.3)
	3⅜ (86)	5 (127)	4¾ (121)	1,925 (8.6)	2,130 (9.5)	2,325 (10.3)	
	4½ (114)	5 (127)	6¼ (159)	1,925 (8.6)	2,130 (9.5)	2,325 (10.3)	
⅝ (15.9)	2¾ (70)	6¼ (159)	3⅞ (98)	1,865 (8.3)	2,185 (9.7)	2,505 (11.1)	90 (122.0)
	4½ (114)	6¼ (159)	6¼ (159)	2,680 (11.9)	3,150 (14.0)	3,615 (16.1)	
	5½ (140)	6¼ (159)	7¾ (197)	2,680 (11.9)	3,150 (14.0)	3,615 (16.1)	
¾ (19.1)	3⅜ (86)	7½ (191)	4¾ (121)	3,265 (14.5)	3,265 (14.5)	3,265 (14.5)	150 (203.4)
	5 (127)	7½ (191)	7 (178)	5,300 (23.6)	5,300 (23.6)	5,300 (23.6)	
	6¾ (171)	7½ (191)	9½ (241)	5,300 (23.6)	5,300 (23.6)	5,300 (23.6)	
⅞ (22.2)	3⅞ (98)	8¾ (222)	5⅜ (137)	3,955 (17.6)	3,955 (17.6)	3,955 (17.6)	200 (271.2)
	7⅞ (200)	8¾ (222)	11 (279)	6,410 (28.5)	6,410 (28.5)	6,410 (28.5)	
1 (25.4)	4½ (114)	10 (254)	6¼ (159)	6,590 (29.3)	6,590 (29.3)	6,590 (29.3)	300 (406.7)
	9 (229)	10 (254)	12⅝ (321)	7,295 (32.4)	7,295 (32.4)	7,295 (32.4)	
1¼ (31.8)	5⅝ (143)	12½ (318)	7⅞ (200)	8,430 (37.5)	8,430 (37.5)	8,430 (37.5)	400 (542.3)
	9½ (241)	12½ (318)	13¼ (337)	8,430 (37.5)	8,430 (37.5)	8,430 (37.5)	

1. The allowable loads listed are based on a safety factor of 4.0.
2. Refer to allowable load-adjustment factors for spacing and edge distance on pp. 155, 156 and 158.
3. Drill bit diameter used in base material corresponds to nominal anchor diameter.
4. Allowable loads may be linearly interpolated between concrete strengths listed.
5. The minimum concrete thickness is 1½ times the embedment depth.

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* See p. 13 for an explanation of the load table icons.

Wedge-All® Design Information — Concrete and Masonry

Carbon-Steel Wedge-All Allowable Tension Loads in Sand-Lightweight Concrete over Metal Deck

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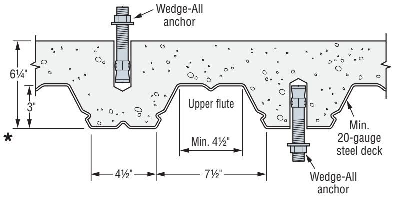
Size in. (mm)	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing in. (mm)	Tension Load (Install in Concrete)			Tension Load (Install through Metal Deck)			Install. Torque ft.-lb. (N-m)
				f'$_c$ ≥ 3,000 psi (20.7 MPa) Concrete			f'$_c$ ≥ 3,000 psi (20.7 MPa) Concrete			
				Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allow. lb. (kN)	Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allow. lb. (kN)	
¼ (6.4)	1½ (38)	3⅜ (86)	2¾ (70)	—	—	—	1,440 (6.4)	167 (0.7)	360 (1.6)	—
½ (12.7)	2¼ (57)	6¾ (171)	4⅛ (105)	3,880 (17.3)	228 (1.0)	970 (4.3)	3,860 (17.2)	564 (2.5)	965 (4.3)	60 (81.3)
⅝ (15.9)	2¾ (70)	8⅜ (213)	5 (127)	5,920 (26.3)	239 (1.1)	1,480 (6.6)	5,220 (23.2)	370 (1.6)	1,305 (5.8)	90 (122.0)
¾ (19.1)	3⅜ (>86)	10 (254)	6⅛ (156)	7,140 (31.8)	537 (2.4)	1,785 (7.9)	6,600 (29.4)	903 (4.0)	1,650 (7.3)	150 (203.4)

See notes 1–7 below.



Lightweight Concrete on Metal Deck

Carbon-Steel Wedge-All Allowable Shear Loads in Sand-Lightweight Concrete over Metal Deck

*

Size in. (mm)	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing in. (mm)	Shear Load (Install in Concrete)			Shear Load (Install through Metal Deck)			Install. Torque ft.-lb. (N-m)
				f'$_c$ ≥ 3,000 psi (20.7 MPa) Concrete			f'$_c$ ≥ 3,000 psi (20.7 MPa) Concrete			
				Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allow. lb. (kN)	Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allow. lb. (kN)	
¼ (6.4)	1½ (38)	3⅜ (86)	2¾ (70)	—	—	—	1,660 (7.4)	627 (2.8)	415 (1.8)	—
½ (12.7)	2¼ (57)	6¾ (171)	4⅛ (105)	5,575 (24.8)	377 (1.7)	1,395 (6.2)	7,260 (32.3)	607 (2.7)	1,815 (8.1)	60 (81.3)
⅝ (15.9)	2¾ (70)	8⅜ (213)	5 (127)	8,900 (39.6)	742 (3.3)	2,225 (9.9)	8,560 (38.1)	114 (0.5)	2,140 (9.5)	90 (122.0)
¾ (19.1)	3⅜ (86)	10 (254)	6⅛ (156)	10,400 (46.3)	495 (2.2)	2,600 (11.6)	11,040 (49.1)	321 (1.4)	2,760 (12.3)	150 (203.4)

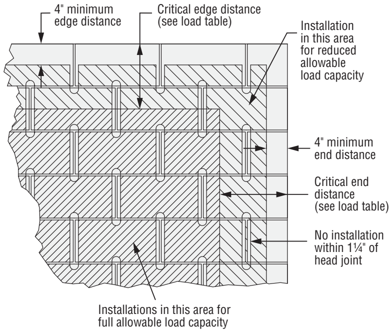
1. The allowable loads listed are based on a safety factor of 4.0.
2. Refer to allowable load-adjustment factors for edge distance on p. 159.
3. 100% of the allowable load is permitted at critical spacing. Loads at reduced spacing have not been determined.
4. Drill bit diameter used in base material corresponds to nominal anchor diameter.
5. The minimum concrete thickness is 1½ times the embedment depth.
6. Metal deck must be minimum 20 gauge.
7. Anchors installed in the bottom flute of the steel deck must have a minimum allowable edge distance of 1½" from the inclined edge of the bottom flute.

Carbon-Steel Wedge-All Allowable Tension and Shear Loads in Grout-Filled CMU

*

Size in. (mm)	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical End Dist. in. (mm)	Critical Spacing in. (mm)	8" Grout-Filled CMU Allowable Load Based on CMU Strength						Install. Torque ft.-lb. (N-m)
					Tension Load			Shear Load			
					Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allow. lb. (kN)	Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allow. lb. (kN)	
Anchor Installed on the Face of the CMU Wall at Least 1¼ inch Away from Head Joint (See Figure)											
⅜ (9.5)	2⅝ (67)	10½ (267)	10½ (267)	10½ (267)	1,700 (7.6)	129 (0.6)	340 (1.5)	3,360 (14.9)	223 (1.0)	670 (3.0)	30 (40.7)
½ (12.7)	3½ (89)	14 (356)	14 (356)	14 (356)	2,120 (9.4)	129 (0.6)	425 (1.9)	5,360 (23.8)	617 (2.7)	1,070 (4.8)	35 (47.4)
⅝ (15.9)	4⅜ (111)	17½ (445)	17½ (445)	17½ (445)	3,120 (13.9)	342 (1.5)	625 (2.8)	8,180 (36.4)	513 (2.3)	1,635 (7.3)	55 (74.5)
¾ (19.1)	5¼ (133)	21 (533)	21 (533)	21 (533)	4,320 (19.2)	248 (1.1)	865 (3.8)	10,160 (45.2)	801 (3.6)	2,030 (9.0)	120 (162.6)

1. The tabulated allowable loads are based on a safety factor of 5.0 for installations under the IBC and IRC.
2. Listed loads may be applied to installations on the face of the CMU wall at least 1¼" away from headjoints.
3. Values for 8"-wide concrete masonry units (CMU) with a minimum specified compressive strength of masonry, f'$_m$, at 28 days is 1,500 psi.
4. Embedment depth is measured from the outside face of the concrete masonry unit.
5. Drill bit diameter used in base material corresponds to nominal anchor diameter.
6. Allowable loads may be increased 33⅓% for short-term loading due to wind and seismic forces, where permitted by code.
7. Tension and shear loads for the Wedge-All anchor may be combined using the parabolic interaction equation (n = ⅚).
8. Refer to allowable load-adjustment factors for edge distance on p. 159.



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

* See p. 13 for an explanation of the load table icons.

Wedge-All® Design Information — Concrete

Allowable Load-Adjustment Factors for Carbon-Steel and Stainless-Steel Wedge-All Anchors in Normal-Weight Concrete: Edge Distance, Tension and Shear Loads

How to use these charts:

1. The following tables are for reduced edge distance.
2. Locate the anchor size to be used for either a tension and/or shear load application.
3. Locate the edge distance (c_{act}) at which the anchor is to be installed.
4. The load adjustment factor (f_c) is the intersection of the row and column.
5. Multiply the allowable load by the applicable load adjustment factor.
6. Reduction factors for multiple edges are multiplied together.

Edge Distance Tension (f_c)

Edge Dist. c_{act} (in.)	**Size**	**¼**	**⅜**	**½**	**⅝**	**¾**	**⅞**	**1**	**1¼**
	c_{cr}	**2½**	**3¾**	**5**	**6¼**	**7½**	**8¾**	**10**	**12½**
	c_{min}	**1**	**1½**	**2**	**2½**	**3**	**3½**	**4**	**5**
	f_{cmin}	**0.70**	**0.70**	**0.70**	**0.70**	**0.70**	**0.70**	**0.70**	**0.70**
1		0.70							
1½		0.80	0.70						
2		0.90	0.77	0.70					
2½		1.00	0.83	0.75	0.70				
3			0.90	0.80	0.74	0.70			
3½			0.97	0.85	0.78	0.73	0.70		
3¾			1.00	0.88	0.80	0.75	0.71		
4				0.90	0.82	0.77	0.73	0.70	
4½				0.95	0.86	0.80	0.76	0.73	
5				1.00	0.90	0.83	0.79	0.75	0.70
5½					0.94	0.87	0.81	0.78	0.72
6					0.98	0.90	0.84	0.80	0.74
6¼					1.00	0.92	0.86	0.81	0.75
6½						0.93	0.87	0.83	0.76
7						0.97	0.90	0.85	0.78
7½						1.00	0.93	0.88	0.80
8							0.96	0.90	0.82
8½							0.99	0.93	0.84
8¾							1.00	0.94	0.85
10								1.00	0.90
12½									1.00
15									

See notes below.

Edge Distance Shear (f_c) (Shear Applied Perpendicular to Edge)

Edge Dist. c_{act} (in.)	**Size**	**¼**	**⅜**	**½**	**⅝**	**¾**	**⅞**	**1**	**1¼**
	c_{cr}	**2½**	**3¾**	**5**	**6¼**	**7½**	**8¾**	**10**	**12½**
	c_{min}	**1**	**1½**	**2**	**2½**	**3**	**3½**	**4**	**5**
	f_{cmin}	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**
1		0.30							
1½		0.53	0.30						
2		0.77	0.46	0.30					
2½		1.00	0.61	0.42	0.30				
3			0.77	0.53	0.39	0.30			
3½			0.92	0.65	0.49	0.38	0.30		
3¾			1.00	0.71	0.53	0.42	0.33		
4				0.77	0.58	0.46	0.37	0.30	
4½				0.88	0.67	0.53	0.43	0.36	
5				1.00	0.77	0.61	0.50	0.42	0.30
5½					0.86	0.69	0.57	0.48	0.35
6					0.95	0.77	0.63	0.53	0.39
6¼					1.00	0.81	0.67	0.56	0.42
6½						0.84	0.70	0.59	0.44
7						0.92	0.77	0.65	0.49
7½						1.00	0.83	0.71	0.53
8							0.90	0.77	0.58
8½							0.97	0.83	0.63
8¾							1.00	0.85	0.65
10								1.00	0.77
12½									1.00
15									

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

Load-Adjustment Factors for Reduced Spacing:
Critical spacing is listed in the load tables. No adjustment in load is required when the anchors are spaced at critical spacing.
No additional testing has been performed to determine the adjustment factors for spacing dimensions less than those listed in the load tables.

* See p. 13 for an explanation of the load table icons.

Allowable Load-Adjustment Factors for Carbon-Steel and Stainless-Steel Wedge-All Anchors in Normal-Weight Concrete: Edge Distance and Shear Load Applied Parallel to Edge

How to use these charts:

1. The following tables are for reduced edge distance.
2. Locate the anchor size to be used for a shear load application.
3. Locate the edge distance ($c_{act||}$) at which the anchor is to be installed.
4. The load adjustment factor ($\phi_{c||}$) is the intersection of the row and column.
5. Multiply the allowable load by the applicable load adjustment factor.
6. Reduction factors for multiple edges are multiplied together.

Edge Distance Shear ($f_{c||}$) (Shear Applied Parallel to Edge with End Distance ≥ ED_{min}) *

Edge Dist. $c_{act||}$ (in.)	**Size**	**¼**	**⅜**	**½**	**⅝**	**¾**	**⅞**	**1**	**1¼**
	E	**2¼**	**3⅜**	**4½**	**5½**	**6¾**	**7⅞**	**9**	**9½**
	ED_{min}	**9**	**13½**	**18**	**22**	**27**	**31½**	**36**	**38**
	$c_{cr||}$	**2½**	**3¾**	**5**	**6¼**	**7½**	**8¾**	**10**	**12½**
	$c_{min||}$	**1**	**1½**	**2**	**2½**	**3**	**3½**	**4**	**5**
	$f_{cmin||}$	**1.00**	**0.93**	**0.70**	**0.62**	**0.62**	**0.62**	**0.62**	**0.62**
1		1.00							
1½		1.00	0.93						
2		1.00	0.95	0.70					
2½		1.00	0.96	0.75	0.62				
3			0.98	0.80	0.67	0.62			
3½			0.99	0.85	0.72	0.66	0.62		
4			1.00	0.90	0.77	0.70	0.66	0.62	
5				1.00	0.87	0.79	0.73	0.68	0.62
6					0.97	0.87	0.80	0.75	0.67
7					1.00	0.96	0.87	0.81	0.72
8						1.00	0.95	0.87	0.77
9							1.00	0.94	0.82
10								1.00	0.87
11									0.92
12									0.97
13									1.00

1. Table is not applicable to anchors with $ED < ED_{min}$. Factors from this table may not be combined with load-adjustment factors for shear loads applied perpendicular to edge.
2. $c_{act||}$ = actual edge distance (measured perpendicular to direction of shear load) at which anchor is installed (inches).
3. $c_{cr||}$ = critical edge distance (measured perpendicular to direction of shear load) for 100% load (inches).
4. $c_{min||}$ = minimum edge distance (measured perpendicular to direction of shear load) for reduced load (inches).
5. ED = actual end distance (measured parallel to direction of shear load) at which anchor is installed (inches).
6. ED_{min} = minimum edge distance (measured parallel to direction of shear load).
7. $f_{c||}$ = adjustment factor for allowable load at actual edge distance.
8. $f_{ccr||}$ = adjustment factor for allowable load at critical edge distance. $f_{ccr||}$ is always = 1.00.
9. $f_{cmin||}$ = adjustment factor for allowable load at minimum edge distance.
10. $f_{c||} = f_{cmin||} + [(1 - f_{cmin||}) (c_{act||} - c_{min||}) / (c_{cr||} - c_{min||})]$.

* See p. 13 for an explanation of the load table icons.

Wedge-All® Design Information — Concrete

Allowable Load-Adjustment Factors for Carbon-Steel and Stainless-Steel Wedge-All Anchors in Normal-Weight Concrete: Spacing, Tension Loads

How to use these charts:

1. The following tables are for reduced spacing.
2. Locate the anchor size to be used for a tension load application.
3. Locate the anchor embedment (E) used for a tension load application.
4. Locate the spacing (s_{act}) at which the anchor is to be installed.
5. The load adjustment factor (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 spacings are multiplied together.

Spacing Tension (f_s)

s_{act} (in.)	Dia.	¼		⅜			½			⅝		
	E	1⅛	2¼	1¾	2⅝	3⅜	2¼	3⅜	4½	2¾	4½	5½
	s_{cr}	1⅝	3⅛	2⅜	3⅝	4¾	3⅛	4¾	6¼	3⅞	6¼	7¾
	s_{min}	⅝	1⅛	⅞	1⅜	1¾	1⅛	1¾	2¼	1⅜	2¼	2¾
	f_{smin}	**0.43**	**0.70**	**0.43**	**0.43**	**0.70**	**0.43**	**0.43**	**0.70**	**0.43**	**0.43**	**0.70**
¾		0.50										
1		0.64		0.48								
1¼		0.79	0.72	0.57			0.47					
1½		0.93	0.76	0.67	0.46		0.54			0.46		
1¾		1.00	0.79	0.76	0.53	0.70	0.61	0.43		0.52		
2			0.83	0.86	0.59	0.73	0.68	0.48		0.57		
2¼			0.87	0.95	0.65	0.75	0.75	0.53	0.70	0.63	0.43	
2½			0.91	1.00	0.72	0.78	0.82	0.57	0.72	0.69	0.47	
2¾			0.94		0.78	0.80	0.89	0.62	0.74	0.74	0.50	0.70
3			0.98		0.84	0.83	0.96	0.67	0.76	0.80	0.54	0.72
3½			1.00		0.97	0.88	1.00	0.76	0.79	0.91	0.61	0.75
4					1.00	0.93		0.86	0.83	1.00	0.68	0.78
4½						0.98		0.95	0.87		0.75	0.81
5						1.00		1.00	0.91		0.82	0.84
6									0.98		0.96	0.90
7									1.00		1.00	0.96
8												1.00

*

See notes below.

Spacing Tension (f_s)

s_{act} (in.)	Dia.	¾			⅞		1		1¼	
	E	3⅜	5	6¾	3⅞	7⅞	4½	9	5⅝	9½
	s_{cr}	4¾	7	9½	5⅜	11	6¼	12⅝	7⅞	13¼
	s_{min}	1¾	2½	3⅜	2	4	2¼	4½	2⅞	4¾
	f_{smin}	**0.43**	**0.43**	**0.70**	**0.43**	**0.70**	**0.43**	**0.70**	**0.43**	**0.70**
2		0.48			0.43					
3		0.67	0.49		0.60		0.54		0.46	
4		0.86	0.62	0.73	0.77	0.70	0.68		0.57	
5		1.00	0.75	0.78	0.94	0.74	0.82	0.72	0.68	0.71
6			0.87	0.83	1.00	0.79	0.96	0.76	0.79	0.74
7			1.00	0.88		0.83	1.00	0.79	0.90	0.78
8				0.93		0.87		0.83	1.00	0.81
9				0.98		0.91		0.87		0.85
10				1.00		0.96		0.90		0.89
11						1.00		0.94		0.92
12								0.98		0.96
13								1.00		0.99
14										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. $f_s = f_{smin} + [(1 - f_{smin}) (s_{act} - s_{min}) / (s_{cr} - s_{min})]$.

* See p. 13 for an explanation of the load table icons.

Wedge-All® Design Information — Concrete

Allowable Load-Adjustment Factors for Carbon-Steel and Stainless-Steel Wedge-All Anchors in Normal-Weight Concrete: Spacing, Shear Loads

How to use these charts:

1. The following tables are for reduced spacing.
2. Locate the anchor size to be used for a shear load application.
3. Locate the anchor embedment (E) used for a shear load application.
4. Locate the spacing (s_{act}) at which the anchor is to be installed.
5. The load adjustment factor (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 spacings are multiplied together.

Spacing Shear (f_s)

s_{act} (in.)	**Dia.**	¼		⅜			½			⅝		
	E	**1⅛**	**2¼**	**1¾**	**2⅝**	**3⅜**	**2¼**	**3⅜**	**4½**	**2¾**	**4½**	**5½**
	s_{cr}	**1⅝**	**3⅛**	**2⅜**	**3⅝**	**4¾**	**3⅛**	**4¾**	**6¼**	**3⅞**	**6¼**	**7¾**
	s_{min}	**⅝**	**1⅛**	**⅞**	**1⅜**	**1¾**	**1⅛**	**1¾**	**2¼**	**1⅜**	**2¼**	**2¾**
	f_{smin}	**0.79**	**0.79**	**0.79**	**0.79**	**0.79**	**0.79**	**0.79**	**0.79**	**0.79**	**0.79**	**0.79**
¾		0.82										
1		0.87		0.81								
1¼		0.92	0.80	0.84			0.80					
1½		0.97	0.83	0.88	0.80		0.83			0.80		
1¾		1.00	0.86	0.91	0.83	0.79	0.86	0.79		0.82		
2			0.88	0.95	0.85	0.81	0.88	0.81		0.84		
2¼			0.91	0.98	0.87	0.83	0.91	0.83	0.79	0.86	0.79	
2½			0.93	1.00	0.90	0.84	0.93	0.84	0.80	0.88	0.80	
2¾			0.96		0.92	0.86	0.96	0.86	0.82	0.91	0.82	0.79
3			0.99		0.94	0.88	0.99	0.88	0.83	0.93	0.83	0.80
3½			1.00		0.99	0.91	1.00	0.91	0.86	0.97	0.86	0.82
4					1.00	0.95		0.95	0.88	1.00	0.88	0.84
4½						0.98		0.98	0.91		0.91	0.86
5						1.00		1.00	0.93		0.93	0.88
6									0.99		0.99	0.93
7									1.00		1.00	0.97
8												1.00

See notes below.

Spacing Shear (f_s)

s_{act} (in.)	**Dia.**	¾			⅞		1		1¼	
	E	**3⅜**	**5**	**6¾**	**3⅞**	**7⅞**	**4½**	**9**	**5⅝**	**9½**
	s_{cr}	**4¾**	**7**	**9½**	**5⅝**	**11**	**6¼**	**12⅝**	**7⅞**	**13¼**
	s_{min}	**1¾**	**2½**	**3⅜**	**2**	**4**	**2¼**	**4½**	**2⅞**	**4¾**
	f_{smin}	**0.79**	**0.79**	**0.79**	**0.79**	**0.79**	**0.79**	**0.79**	**0.79**	**0.79**
2		0.81			0.79					
3		0.88	0.81		0.85		0.83		0.80	
4		0.95	0.86	0.81	0.91	0.79	0.88		0.84	
5		1.00	0.91	0.85	0.98	0.82	0.93	0.80	0.88	0.80
6			0.95	0.88	1.00	0.85	0.99	0.83	0.92	0.82
7			1.00	0.91		0.88	1.00	0.85	0.96	0.85
8				0.95		0.91		0.88	1.00	0.87
9				0.98		0.94		0.91		0.90
10				1.00		0.97		0.93		0.92
11						1.00		0.96		0.94
12								0.98		0.97
13								1.00		0.99
14										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. $f_s = f_{smin} + [(1 - f_{smin}) (s_{act} - s_{min}) / (s_{cr} - s_{min})]$.

* See p. 13 for an explanation of the load table icons.

Allowable Load-Adjustment Factors for Carbon-Steel Wedge-All Anchors in Sand-Lightweight Concrete: Edge Distance, Tension and Shear Loads

How to use these charts:

1. The following tables are for reduced edge distance.
2. Locate the anchor size to be used for either a tension and/or shear load application.
3. Locate the edge distance (c_{act}) at which the anchor is to be installed.
4. The load adjustment factor (f_c) is the intersection of the row and column.
5. Multiply the allowable load by the applicable load adjustment factor.
6. Reduction factors for multiple edges are multiplied together.

Edge Distance Tension (f_c)

Edge Dist. c_{act} (in.)	Size	¼	½	⅝	¾
	c_{cr}	**3⅜**	**6¾**	**8⅜**	**10**
	c_{min}	**1⅜**	**2¾**	**3⅜**	**4**
	f_{cmin}	**0.70**	**0.70**	**0.70**	**0.70**
1⅜		0.70			
1½		0.72			
2		0.79			
2½		0.87			
2¾		0.91	0.70		
3		0.94	0.72		
3⅜		1.00	0.75	0.70	
3½			0.76	0.71	
4			0.79	0.74	0.70
4½			0.83	0.77	0.73
5			0.87	0.80	0.75
5½			0.91	0.83	0.78
6			0.94	0.86	0.80
6½			0.98	0.89	0.83
6¾			1.00	0.90	0.84
7				0.92	0.85
7½				0.95	0.88
8				0.98	0.90
8⅜				1.00	0.92
8½					0.93
9					0.95
9½					0.98
10					1.00

See notes below.

* IBC

Edge Distance Shear (f_c)
(Shear Applied Perpendicular to Edge)

Edge Dist. c_{act} (in.)	Size	¼	½	⅝	¾
	c_{cr}	**3⅜**	**6¾**	**8⅜**	**10**
	c_{min}	**1⅜**	**2¾**	**3⅜**	**4**
	f_{cmin}	**0.30**	**0.30**	**0.30**	**0.30**
1⅜		0.30			
1½		0.34			
2		0.52			
2½		0.69			
2¾		0.78	0.30		
3		0.87	0.34		
3⅜		1.00	0.41	0.30	
3½			0.43	0.32	
4			0.52	0.39	0.30
4½			0.61	0.46	0.36
5			0.69	0.53	0.42
5½			0.78	0.60	0.48
6			0.87	0.67	0.53
6½			0.96	0.74	0.59
6¾			1.00	0.77	0.62
7				0.81	0.65
7½				0.88	0.71
8				0.95	0.77
8⅜				1.00	0.81
8½					0.83
9					0.88
9½					0.94
10					1.00

See notes below.

* IBC

Load Adjustment Factors for Carbon-Steel Wedge-All® Anchors in Face-of-Wall Installation in 8" Grout-Filled CMU: Edge Distance, Tension and Shear Loads

Edge Distance Tension (f_c)

Edge Dist. c_{act} (in.)	Size	⅜	½	⅝	¾
	c_{cr}	**10½**	**14**	**17½**	**21**
	c_{min}	**4**	**4**	**4**	**4**
	f_{cmin}	**1.00**	**1.00**	**0.80**	**0.80**
4		1.00	1.00	0.80	0.80
6		1.00	1.00	0.83	0.82
8		1.00	1.00	0.86	0.85
10½		1.00	1.00	0.90	0.88
12			1.00	0.92	0.89
14			1.00	0.95	0.92
16				0.98	0.94
17½				1.00	0.96
21					1.00

* IBC

Edge Distance Shear (f_c)

Edge Dist. c_{act} (in.)	Size	⅜	½	⅝	¾
	c_{cr}	**10½**	**14**	**17½**	**21**
	c_{min}	**4**	**4**	**4**	**4**
	f_{cmin}	**0.79**	**0.52**	**0.32**	**0.32**
4		0.79	0.52	0.32	0.32
6		0.85	0.62	0.42	0.40
8		0.92	0.71	0.52	0.48
10½		1.00	0.83	0.65	0.58
12			0.90	0.72	0.64
14			1.00	0.82	0.72
16				0.92	0.80
17½				1.00	0.86
21					1.00

* IBC

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

Load-Adjustment Factors for Reduced Spacing:

Critical spacing is listed in the load tables. No adjustment in load is required when the anchors are spaced at critical spacing. No additional testing has been performed to determine the adjustment factors for spacing dimensions less than those listed in the load tables.

* See p. 13 for an explanation of the load table icons.

Sleeve-All® Sleeve Anchor

Sleeve-All expanding anchors are pre-assembled, expanding sleeve anchors for use in all types of solid base materials. This anchor is available in acorn, hex, rod coupler, flat or round head style for a wide range of applications.

Codes: Factory Mutual 3017082, 3026805 and 3029959 (⅜" – ½" diameter); Underwriters Laboratories File Ex3605 (⅜" – ¾" diameter); Mulitiple DOT listings; meets the requirements of Federal Specification A-A-1922A

Material: Carbon steel or stainless steel

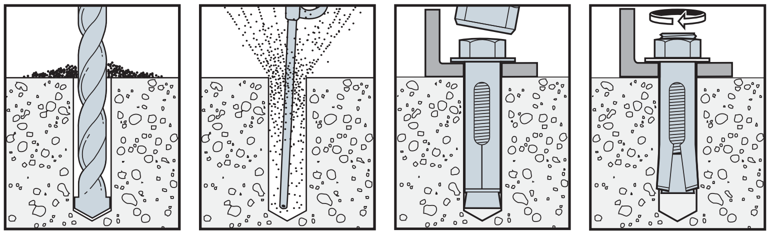
Coating: Carbon steel anchors are zinc plated

Installation

1. Drill a hole in the base material using a carbide drill bit the same diameter as the nominal diameter of the anchor to be installed.
2. Drill the hole to the specified embedment depth, and blow it clean using compressed air. (Overhead installations need not be blown clean.) Alternatively, drill the hole deep enough to accommodate embedment depth and the dust from drilling.
3. Place the anchor in the fixture, and drive it into the hole until the washer and nut are tight against the fixture.
4. Tighten to required installation torque.

⚠ **Caution:** Oversized holes will make it difficult to set the anchor and will reduce the anchor's load capacity.

Installation Sequence



Hex

Acorn

Rod Coupler

Round

Flat Head
(Phillips drive)

Material Specifications

Anchor Component	Zinc-Plated Carbon Steel	304 Stainless Steel
Anchor Body	Material meets minimum 50,000 psi tensile	Type 304
Sleeve	SAE J403, Grade 1008 cold-rolled steel	Type 304
Nut	Commercial Grade, meets requirements of ASTM A563 Grade A	Type 304
Washer	SAE J403, Grade 1008/1010 cold-rolled steel	Type 304

Sleeve-All Anchor Installation Data

Sleeve-All Diameter (in.)	¼	5/16	⅜	½	⅝	¾
Installation Torque (ft.-lb.)	5	8	15	25	50	90
Drill Bit Size (in.)	¼	5/16	⅜	½	⅝	¾
Wrench Size[1] (in.)	⅜	7/16	½	9/16	¾	15/16
Wrench Size for Coupler Nut (in.)			½	⅝	¾	—

1. Applies to acorn- and hex-head configurations only.

Sleeve-All® Sleeve Anchor

Sleeve-All Anchor Product Data — Zinc-Plated Carbon Steel

Size (in.)	Model No.	Head Style	Bolt Diameter – Threads per inch	Max. Fixture Thickness (in.)	Quantity	
					Box	Carton
¼ x 1⅜	SL25138A	Acorn Head	3⁄16–24	¼	100	500
¼ x 2¼	SL25214A			1⅛	100	500
5⁄16 x 1½	SL31112H	Hex Head	¼–20	⅜	100	500
5⁄16 x 2½	SL31212H			1 1⁄16	50	250
⅜ x 1⅞	SL37178H		5⁄16–18	⅜	50	250
⅜ x 3	SL37300H			1½	50	200
⅜ x 4	SL37400H			2¼	50	200
½ x 2¼	SL50214H		⅜–16	½	50	200
½ x 3	SL50300H			¾	25	100
½ x 4	SL50400H			1¾	25	100
½ x 6	SL50600H			3⅜	20	80
⅝ x 2¼	SL62214H		½–13	½	25	100
⅝ x 3	SL62300H			¾	20	80
⅝ x 4¼	SL62414H			1½	10	40
⅝ x 6	SL62600H			3¼	10	40
¾ x 2½	SL75212H		⅝–11	½	10	40
¾ x 4¼	SL75414H			⅞	10	40
¾ x 6¼	SL75614H			2⅞	5	20
¼ x 2	SL25200PF	Phillips Flat Head	3⁄16–24	⅞	100	500
¼ x 3	SL25300PF			1⅞	50	250
5⁄16 x 2½	SL31212PF		¼–20	1 1⁄16	50	250
5⁄16 x 3½	SL31312PF			2 1⁄16	50	250
⅜ x 2¾	SL37234PF		5⁄16–18	1¼	50	200
⅜ x 4	SL37400PF			2½	50	200
⅜ x 5	SL37500PF			3½	50	200
⅜ x 6	SL37600PF			4½	50	200
¼ x 2¾	SL25234R	Round Head	3⁄16–24	⅞	50	250

Sleeve-All Anchor Product Data — Stainless Steel

Size (in.)	Model No.	Head Style	Bolt Diameter – Threads per inch	Max. Fixture Thickness (in.)	Quantity	
					Box	Carton
⅜ x 1⅞	SL37178HSS	Hex Head	5⁄16–18	⅜	50	250
⅜ x 3	SL37300HSS			1½	50	200
½ x 3	SL50300HSS		⅜–16	¾	25	100
½ x 4	SL50400HSS			1¾	25	100

Sleeve-All Anchor (with rod coupler) Product Data — Zinc-Plated Carbon Steel

Size (in.)	Model No.	Accepts Rod Diameter (in.)	Wrench Size	Quantity	
				Box	Carton
⅜ x 1⅞	SL37178C	⅜	½	50	200
½ x 2¼	SL50214C	½	⅝	25	100
⅝ x 2¼	SL62214C	⅝	¾	20	80

Length Identification Head Marks on Sleeve-All Anchors (corresponds to length of anchor — inches)

Mark	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
From	1½	2	2½	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	11	12	13	14	15	16	17	18
Up To But Not Including	2	2½	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	11	12	13	14	15	16	17	18	19

Sleeve-All® Design Information — Concrete and Masonry

Allowable Tension and Shear Loads for Sleeve-All in Normal-Weight Concrete

Size in. (mm)	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing Dist. in. (mm)	Tension Load						Shear Load			Install. Torque ft.-lb. (N-m)
				$f'_c \geq$ 2,000 psi (13.8 MPa) Concrete			$f'_c \geq$ 4,000 psi (27.6 MPa) Concrete			$f'_c \geq$ 2,000 psi (13.8 MPa) Concrete			
				Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allow. lb. (kN)	Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allow. lb. (kN)	Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allow. lb. (kN)	
¼ (6.4)	1⅛ (29)	2½ (64)	4½ (114)	880 (3.9)	94 (0.4)	220 (1.0)	1,320 (5.9)	189 (0.8)	330 (1.5)	1,440 (6.4)	90 (0.4)	360 (1.6)	5 (7)
5⁄16 (7.9)	1 (25)	3⅛ (79)	5¾ (146)	930 (4.1)	201 (0.9)	230 (1.0)	1,095 (4.9)	118 (0.5)	275 (1.2)	1,480 (6.6)	264 (1.2)	370 (1.6)	8 (11)
	17⁄16 (37)	3⅛ (79)	5¾ (146)	1,120 (5.0)	113 (0.5)	280 (1.2)	1,320 (5.9)	350 (1.6)	330 (1.5)	2,160 (9.6)	113 (0.5)	540 (2.4)	8 (11)
⅜ (9.5)	1½ (38)	3¾ (95)	6 (152)	1,600 (7.1)	294 (1.3)	400 (1.8)	2,680 (11.9)	450 (2.0)	670 (3.0)	3,080 (13.7)	223 (1.0)	770 (3.4)	15 (20)
½ (12.7)	1¾ (45)	5 (127)	9 (229)	2,900 (12.9)	369 (1.6)	725 (3.2)	3,480 (15.5)	529 (2.4)	870 (3.9)	4,250 (18.9)	659 (2.9)	1,060 (4.7)	25 (34)
	2¼ (57)	5 (127)	9 (229)	3,160 (14.1)	254 (1.1)	790 (3.5)	4,760 (21.2)	485 (2.2)	1,190 (5.3)	5,000 (22.2)	473 (2.1)	1,250 (5.6)	25 (34)
⅝ (15.9)	1¾ (45)	6¼ (159)	11 (279)	3,200 (14.2)	588 (2.6)	800 (3.6)	3,825 (17.0)	243 (1.1)	955 (4.2)	4,625 (20.6)	747 (3.3)	1,155 (5.1)	50 (68)
	2¾ (70)	6¼ (159)	11 (279)	4,200 (18.7)	681 (3.0)	1,050 (4.7)	6,160 (27.4)	1,772 (7.9)	1,540 (6.9)	8,520 (37.9)	713 (3.2)	2,130 (9.5)	50 (68)
¾ (19.1)	2 (51)	7½ (191)	13½ (343)	3,200 (14.2)	588 (2.6)	800 (3.6)	4,465 (19.9)	1,017 (4.5)	1,115 (5.0)	5,080 (22.6)	771 (3.4)	1,270 (5.6)	90 (122)
	3⅜ (86)	7½ (191)	13½ (343)	6,400 (28.5)	665 (3.0)	1,600 (7.1)	9,520 (42.3)	674 (3.0)	2,380 (10.6)	10,040 (44.7)	955 (4.2)	2,510 (11.2)	90 (122)

1. The tabulated allowable loads are based on a safety factor of 4.0.
2. Allowable loads may not be increased for short-term loading due to wind or seismic forces.
3. Refer to allowable load-adjustment factors for spacing and edge distance on p. 163.
4. Drill bit diameter used in base material corresponds to nominal anchor diameter.
5. Allowable tension loads may be linearly interpolated between concrete strengths listed.
6. The minimum concrete thickness is 1½ times the embedment depth.

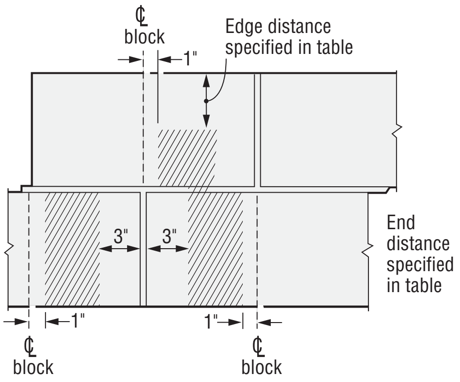
Allowable Tension and Shear Loads for ⅜" Sleeve-All in Grout-Filled CMU (Anchor Installed in Horizontal Mortar Joint or Face Shell)

Size in. (mm)	Embed. Depth in. (mm)	Min. Edge Dist. in. (mm)	Min. End Dist. in. (mm)	Min. Spacing in. (mm)	Tension Load		Shear Load		Install. Torque ft.-lb. (N-m)
					Ultimate lb. (kN)	Allow. lb. (kN)	Ultimate lb. (kN)	Allow. lb. (kN)	
⅜ (9.5)	1½ (38)	16 (406)	16 (406)	24 (610)	2,000 (8.9)	400 (1.8)	2,300 (10.2)	460 (2.0)	15 (20)

See notes beneath following table.

Allowable Tension and Shear Loads for Sleeve-All in Grout-Filled CMU

Size in. (mm)	Embed. Depth in. (mm)	Min. Edge Dist. in. (mm)	Min. End Dist. in. (mm)	Min. Spacing in. (mm)	Tension Load		Shear Load		Install. Torque ft.-lb. (N-m)
					Ultimate lb. (kN)	Allow. lb. (kN)	Ultimate lb. (kN)	Allow. lb. (kN)	
Anchor Installed in a Single Face Shell									
⅜ (9.5)	1½ (38)	12 (305)	12 (305)	24 (610)	1,746 (7.8)	350 (1.6)	2,871 (12.8)	575 (2.6)	15 (20)
½ (12.7)	2¼ (57)	12 (305)	12 (305)	24 (610)	3,384 (15.1)	675 (3.0)	5,670 (25.2)	1,135 (5.0)	25 (34)
⅝ (15.9)	2¾ (70)	12 (305)	12 (305)	24 (610)	3,970 (17.7)	795 (3.5)	8,171 (36.3)	1,635 (7.3)	50 (68)
¾ (19.1)	3⅜ (86)	12 (305)	12 (305)	24 (610)	6,395 (28.4)	1,280 (5.7)	12,386 (55.1)	2,475 (11.0)	90 (122)
Anchor Installed in Mortar "T" Joint									
⅜ (9.5)	1½ (38)	8 (203)	8 (203)	24 (610)	1,927 (8.6)	385 (1.7)	3,436 (15.3)	685 (3.0)	15 (20)
½ (12.7)	2¼ (57)	8 (203)	8 (203)	24 (610)	3,849 (17.1)	770 (3.4)	5,856 (26.0)	1,170 (5.2)	25 (34)
⅝ (15.9)	2¾ (70)	8 (203)	8 (203)	24 (610)	4,625 (20.6)	925 (4.1)	7,040 (31.3)	1,410 (6.3)	50 (68)
¾ (19.1)	3⅜ (86)	8 (203)	8 (203)	24 (610)	5,483 (24.4)	1,095 (4.9)	7,869 (35.0)	1,575 (7.0)	90 (122)



Face Shell Installation

Allowable anchor placement in grout-filled CMU shown by shaded areas.

1. The tabulated allowable loads are based on a safety factor of 5.0.
2. Listed loads may be applied to installations through a face shell with the following placement guidelines:
   a. Minimum 3" from vertical mortar joint.
   b. Minimum 1" from vertical cell centerline.
3. Values for 6"- and 8"-wide concrete masonry units (CMU) with a minimum specified compressive strength of masonry, f'_m, at 28 days is 1,500 psi.
4. Embedment depth is measured from the outside face of the concrete masonry unit.
5. Drill bit diameter used in base material corresponds to nominal anchor diameter.

* See p. 13 for an explanation of the load table icons.

Sleeve-All® Design Information — Concrete

Allowable Load-Adjustment Factors for Sleeve-All Anchors in Normal-Weight Concrete: Edge Distance and Spacing, Tension and Shear Loads

How to use these charts:

1. The following tables are for reduced edge distance and spacing.
2. Locate the anchor size to be used for either a tension and/or shear load application.
3. Locate the edge distance (c_{act}) or spacing (s_{act}) at which the anchor is to be installed.
4. The load adjustment factor (f_c or f_s) is the intersection of the row and column.
5. Multiply the allowable load by the applicable load adjustment factor.
6. Reduction factors for multiple edges or spacing are multiplied together.

Edge Distance Tension (f_c)

Edge Dist. c_{act} (in.)	Size	¼	⁵⁄₁₆	⅜	½	⅝	¾
	c_{cr}	2½	3⅛	3¾	5	6¼	7½
	c_{min}	1¼	1⁹⁄₁₆	1⅞	2½	3⅛	3¾
	f_{cmin}	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**
1¼		0.60					
1½		0.68					
1⁹⁄₁₆		0.70	0.60				
1⅞		0.80	0.68	0.60			
2		0.84	0.71	0.63			
2½		1.00	0.84	0.73	0.60		
3			0.97	0.84	0.68		
3⅛			1.00	0.87	0.70	0.60	
3½				0.95	0.76	0.65	
3¾				1.00	0.80	0.68	0.60
4					0.84	0.71	0.63
4½					0.92	0.78	0.68
5					1.00	0.84	0.73
5½						0.90	0.79
6						0.97	0.84
6¼						1.00	0.87
6½							0.89
7							0.95
7½							1.00

See notes below.

Edge Distance Shear (f_c)

Edge Dist. c_{act} (in.)	Size	¼	⁵⁄₁₆	⅜	½	⅝	¾
	c_{cr}	2½	3⅛	3¾	5	6¼	7½
	c_{min}	1¼	1⁹⁄₁₆	1⅞	2½	3⅛	3¾
	f_{cmin}	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**
1¼		0.30					
1½		0.44					
1⁹⁄₁₆		0.48	0.30				
1⅞		0.65	0.44	0.30			
2		0.72	0.50	0.35			
2½		1.00	0.72	0.53	0.30		
3			0.94	0.72	0.44		
3⅛			1.00	0.77	0.48	0.30	
3½				0.91	0.58	0.38	
3¾				1.00	0.65	0.44	0.30
4					0.72	0.50	0.35
4½					0.86	0.61	0.44
5					1.00	0.72	0.53
5½						0.83	0.63
6						0.94	0.72
6¼						1.00	0.77
6½							0.81
7							0.91
7½							1.00

1. c_{act} = actual edge distance at which anchor is installed (inches).
2. c_{cr} = critical edge distance for 100% load (inches).
3. c_{min} = minimum edge distance for reduced load (inches).
4. f_c = adjustment factor for allowable load at actual edge distance.
5. f_{cccr} = adjustment factor for allowable load at critical edge distance. f_{cccr} is always = 1.00.
6. f_{cmin} = adjustment factor for allowable load at minimum edge distance.
7. $f_c = f_{cmin} + [(1 – f_{smin}) (c_{act} – c_{min}) / (c_{cr} – c_{min})]$.

* See p. 13 for an explanation of the load table icons.

Spacing Tension and Shear (f_s)

s_{act} (in.)	Size	¼	⁵⁄₁₆	⅜	½	⅝	¾
	s_{cr}	4½	5¾	6	9	11	13½
	s_{min}	2¼	2⅞	3	4½	5½	6¾
	f_{smin}	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**
2¼		0.50					
2½		0.56					
2⅞		0.64	0.50				
3		0.67	0.52	0.50			
3½		0.78	0.61	0.58			
4		0.89	0.70	0.67			
4½		1.00	0.78	0.75	0.50		
5			0.87	0.83	0.56		
5½			0.96	0.92	0.61	0.50	
5¾			1.00	0.96	0.64	0.52	
6				1.00	0.67	0.55	
6½					0.72	0.59	
6¾					0.75	0.61	0.50
7					0.78	0.64	0.52
8					0.89	0.73	0.59
9					1.00	0.82	0.67
10						0.91	0.74
11						1.00	0.81
12							0.89
13							0.96
13½							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. $f_s = f_{smin} + [(1 – f_{smin}) (s_{act} – s_{min}) / (s_{cr} – s_{min})]$.

Easy-Set Pin-Drive Expansion Anchor

The Easy-Set is a pin-drive expansion anchor for medium- and heavy-duty fastening applications into concrete and grout-filled block. Integrated nut and washer help keep track of parts.

Material: Carbon steel

Coating: Yellow zinc dichromate plated

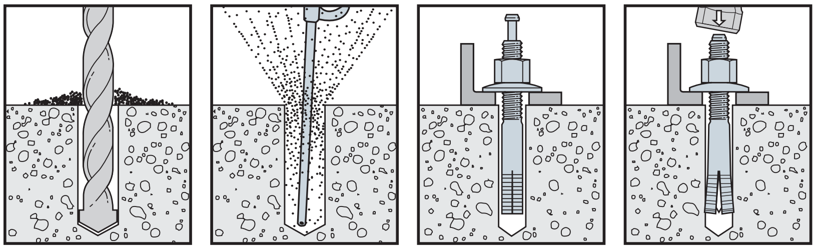
Installation

⚠ **Caution:** Oversized holes in the base material will make it difficult to set the anchor and will reduce the anchor's load capacity.

1. Drill a hole in the base material using a carbide drill bit the same diameter as the nominal diameter of the anchor to be installed. Drill the hole to the specified embedment depth plus ¼" to allow for pin extension and blow it clean using compressed air. (Overhead installations need not be blown clean.) Alternatively, drill the hole deep enough to accommodate embedment depth and the dust from drilling.
2. Adjust the nut for required embedment. Place the anchor through the fixture and into the hole.
3. Hammer the center pin until the bottom of the head is flush with top of anchor.

Easy-Set (EZAC)

Installation Sequence



EZAC Product Data

Size (in.)	Model No.	Thread Length (in.)	Quantity	
			Box	Carton
⅜ x 2⅜	EZAC37238	1	50	250
⅜ x 3½	EZAC37312	1⅛	50	250
⅜ x 4¾	EZAC37434	1½	50	200
½ x 2¾	EZAC50234	1	25	125
½ x 3½	EZAC50312	1⅛	25	125
½ x 4¾	EZAC50434	1½	25	100
½ x 6	EZAC50600	2	25	100
⅝ x 4	EZAC62400	1⅝	15	60
⅝ x 4¾	EZAC62434	1⅝	15	60
⅝ x 6	EZAC62600	2	15	60

Easy-Set Anchor Installation Data

Easy-Set Diameter (in.)	⅜	½	⅝
Drill Bit Size (in.)	⅜	½	⅝
Min. Fixture Hole Size (in.)	7⁄16	9⁄16	11⁄16
Wrench Size (in.)	9⁄16	¾	15⁄16

EZAC Allowable Tension and Shear Loads in Normal-Weight Concrete

IBC ↑ → ▨ *

Size in.	Embed. Depth in. (mm)	Drill Bit Dia. In.	Critical Edge Dist. In. (mm)	Critical Spacing Dist. In. (mm)	Tension Load	Shear Load
					$f'_c \geq$ 2,000 psi (13.8 MPa) Concrete	
					Allowable lb. (kN)	
⅜	**1¾** (44)	⅜	**2¾** (70)	**5¼** (133)	**630** (2.8)	**645** (2.9)
½	**2½** (64)	½	**3⅜** (86)	**6¾** (171)	**1,005** (4.5)	**1,230** (5.5)
⅝	**3** (76)	⅝	**4¼** (108)	**9** (229)	**1,515** (6.7)	**1,325** (5.9)

1. The allowable loads listed are based on a safety factor of 4.0.
2. 100% of the allowable load is permitted at critical spacing and critical edge distance. Allowable loads at lesser spacings and edge distance have not been determined.
3. The minimum concrete thickness is 1½ times the embedment depth.
4. Tension and shear loads for the EZAC anchor may be combined using the straight-line interaction equation (n = 1).

* See p. 13 for an explanation of the load table icons.

Tie-Wire Wedge Anchor

The Simpson Strong-Tie tie-wire anchor is a wedge-style expansion anchor for use in normal-weight concrete or in concrete over metal deck. With a tri-segmented, dual-embossed clip, the tie-wire anchor is ideal for the installation of acoustic ceiling grid and is easily set with the claw of a hammer.

Features

- ¼" eyelet for easy threading of wire
- Sets with claw of hammer
- Tri-segmented clip — each segment adjusts independently to hole irregularities
- Dual embossments on each clip segment enable the clip to undercut into the concrete, increasing follow-up expansion
- Wedge-style expansion anchor for use in normal weight concrete or concrete over metal deck

Material: Carbon steel

Coating: Zinc plated

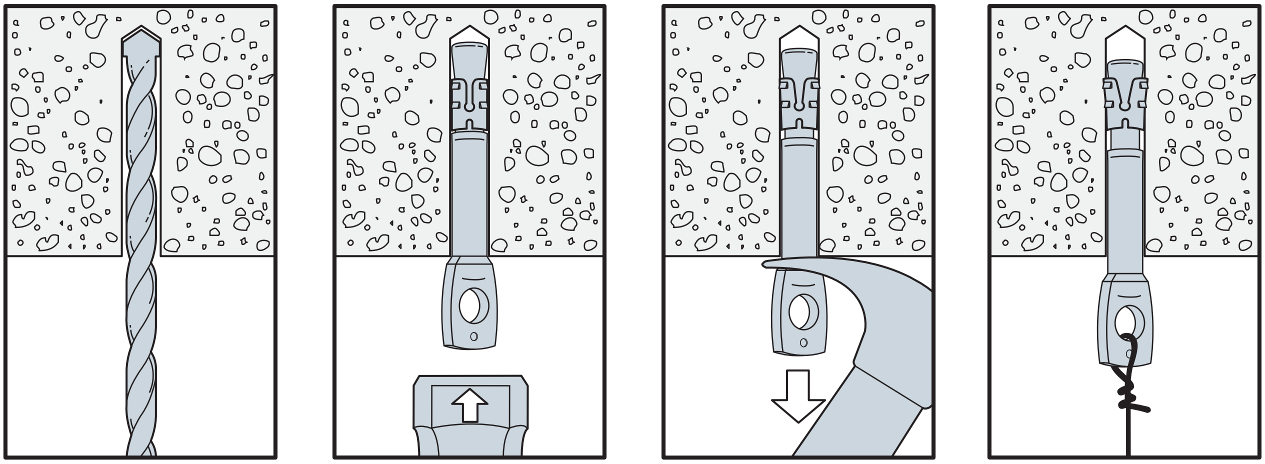
Installation

1. Drill a hole at least 1½" deep using a ¼"-diameter carbide tipped bit.
2. Drive the anchor into the hole until the bottom of the head is flush with the base material.
3. Set the anchor by prying/pulling the head with the claw end of the hammer.

Tie-Wire

Size (in.)	Model No.	Drill Bit Diameter (in.)	Eyelet Hole Size (in.)	Quantity	
				Box	Carton
¼" x 1½"	TW25112	¼	¼	100	500

Installation Sequence



Tie-Wire Design Information — Concrete

Allowable Tension and Shear Loads for Tie-Wire Anchor in Normal-Weight Concrete

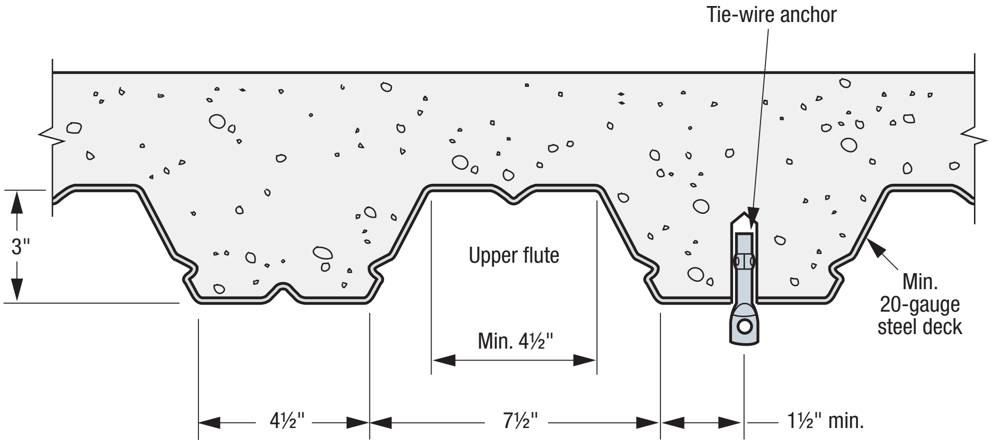
Size in. (mm)	Drill Bit Diameter in.	Embed Depth in. (mm)	Critical End Dist. in. (mm)	Critical Spacing in. (mm)	Tension Load		Shear Load	
					f'$_c$ ≥ 2,500 psi (17.2 MPa)		f'$_c$ ≥ 2,500 psi (17.2 MPa)	
					Ultimate lb. (kN)	Allowable lb. (kN)	Ultimate lb. (kN)	Allowable lb. (kN)
¼ (6.4)	¼	1½ (38)	2½ (64)	5 (127)	1,155 (5.1)	290 (1.3)	380 (1.7)	95 (0.4)

1. The allowable loads listed are based on a safety factor of 4.0.
2. The minimum concrete thickness is 1½ times the embedment depth.

Allowable Tension and Shear Loads for Tie-Wire Anchor in the Soffit of Normal-Weight Concrete or Sand-Lightweight Concrete over Metal Deck

Size in. (mm)	Drill Bit Dia in.	Embed Depth in. (mm)	Critical End Dist.⁵ in. (mm)	Critical Spacing in. (mm)	Tension Load		Shear Load	
					f'$_c$ ≥ 3,000 psi (20.7 MPa)		f'$_c$ ≥ 3,000 psi (20.7 MPa)	
					Ultimate lb. (kN)	Allowable lb. (kN)	Ultimate lb. (kN)	Allowable lb. (kN)
¼ (6.4)	¼	1½ (38)	2½ (64)	5 (127)	1,155 (5.1)	290 (1.3)	460 (2.0)	115 (0.5)

1. The allowable loads listed are based on a safety factor of 4.0.
2. The minimum concrete thickness is 1½ times the embedment depth.
3. Metal deck must be minimum 20-gauge thick with minimum yield strength of 33 ksi.
4. Anchors installed in the bottom flute of the steel deck must have a minimum edge distance of 1½" away from inclined edge of the bottom flute. See the figure below.
5. Critical end distance is defined as the distance from the end of the slab in the direction of the flute.



Installation in the Soffit of Concrete over Metal Deck

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* See p. 13 for an explanation of the load table icons.

Titen® 2 Concrete and Masonry Screw

The Titen 2 concrete and masonry screw is ideal for attaching all types of components to concrete and masonry. The improved thread design undercuts the base material more efficiently, reducing installation torque and making it easier to drive without binding, snapping or stripping, even during installation into hard base material.

Features

- Patented undercutting threads reduce installation torque
- Innovative design increases load capacity
- Code listed in accordance with ICC-ES AC193 for concrete application (IAPMO UES ER-449) and ICC-ES AC106 for masonry application (IAPMO UES ER-466)
- Suitable for near-edge concrete installations without expansion forces and cracking
- Installs with Standard ANSI drill bits (bit included in larger count boxes)
- Preservative treated wood applications: suited for use in non-ammonia formulations of CCA, ACQ-C, ACQ-D, CA-B, BX/DOT and zinc borate
- Use in dry interior environments only

Codes: IAPMO UES ER-449 (concrete); IAPMO UES ER-466 (masonry)

Material: Carbon steel

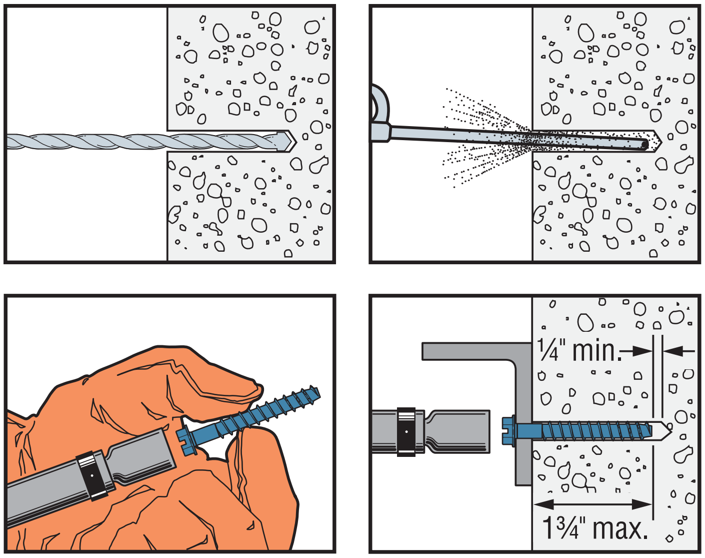
Coating: Zinc plated with baked-on ceramic coating

Titen 2
Hex-Head Screw

Phillips flat head for flush or countersunk applications

Serrated cutting teeth reduce torque for reliable installations
U.S. Patent 9,523,393

Installation Sequence



Blue Titen 2 Product Data

Size (in.)	Head Style	Model No.	Drill Bit Diameter (in.)	Quantity	
				Box	Carton
3⁄16 x 1¼	¼" Hex	TTN2-18114H	5⁄32	100	1,600
3⁄16 x 1¾		TTN2-18134H		100	500
3⁄16 x 2¼		TTN2-18214H		100	500
3⁄16 x 2¾		TTN2-18234H		100	500
3⁄16 x 3¼		TTN2-18314H		100	400
3⁄16 x 3¾		TTN2-18334H		100	400
3⁄16 x 4		TTN2-18400H		100	1,600
¼ x 1¼	5⁄16" Hex	TTN2-25114H	3⁄16	100	1,600
¼ x 1¾		TTN2-25134H		100	500
¼ x 2¼		TTN2-25214H		100	500
¼ x 2¾		TTN2-25234H		100	500
¼ x 3¼		TTN2-25314H		100	400
¼ x 3¾		TTN2-25334H		100	400
¼ x 4		TTN2-25400H		100	1,600
¼ x 5		TTN2-25500H		100	500
¼ x 6		TTN2-25600H		100	500
3⁄16 x 1¼	#2 Phillips Flat	TTN2-18114PF	5⁄32	100	500
3⁄16 x 1¾		TTN2-18134PF		100	500
3⁄16 x 2¼		TTN2-18214PF		100	500
3⁄16 x 2¾		TTN2-18234PF		100	400
3⁄16 x 3¼		TTN2-18314PF		100	400
3⁄16 x 3¾		TTN2-18334PF		100	400
3⁄16 x 4		TTN2-18400PF		100	400
¼ x 1¼	#3 Phillips Flat	TTN2-25114PF	3⁄16	100	500
¼ x 1¾		TTN2-25134PF		100	400
¼ x 2¼		TTN2-25214PF		100	400
¼ x 2¾		TTN2-25234PF		100	400
¼ x 3¼		TTN2-25314PF		100	400
¼ x 3¾		TTN2-25334PF		100	400
¼ x 4		TTN2-25400PF		100	400
¼ x 5		TTN2-25500PF		100	400
¼ x 6		TTN2-25600PF		100	400

White Titen 2 Product Data (Phillips Flat-Head)

Size (in.)	Head Style	Model No.	Drill Bit Diameter (in.)	Quantity	
				Box	Carton
3⁄16 x 1¼	#2 Phillips Flat	TTN2W18114PF	5⁄32	100	1,600
3⁄16 x 1¾		TTN2W18134PF		100	500
3⁄16 x 2¼		TTN2W18214PF		100	500
3⁄16 x 2¾		TTN2W18234PF		100	500
3⁄16 x 3¼		TTN2W18314PF		100	400
3⁄16 x 3¾		TTN2W18334PF		100	400
¼ x 1¼	#3 Phillips Flat	TTN2W25114PF	3⁄16	100	1,600
¼ x 1¾		TTN2W25134PF		100	500
¼ x 2¼		TTN2W25214PF		100	500
¼ x 2¾		TTN2W25234PF		100	500
¼ x 3¼		TTN2W25314PF		100	400
¼ x 3¾		TTN2W25334PF		100	400

Titen 2 Installation Information and Additional Data[1]

IBC LW *

Characteristic	Symbol	Units	Nominal Anchor Diameter (in.)	
			3/16	¼
Installation Information				
Drill Bit Diameter	d	in.	5/32	3/16
Minimum Baseplate Clearance Hole Diameter	d_c	in.	¼	5/16
Minimum Hole Depth	h_{hole}	in.	2¼	2¼
Embedment Depth	h_{nom}	in.	1¾	1¾
Effective Embedment Depth	h_{ef}	in.	1.30	1.30
Critical Edge Distance	c_{ac}	in.	3	3
Minimum Edge Distance	c_{min}	in.	1¾	1¾
Minimum Spacing	s_{min}	in.	1	2
Minimum Concrete Thickness	h_{min}	in.	3¼	3¼
Additional Data				
Yield Strength	f_{ya}	psi	100,000	
Tensile Strength	f_{uta}	psi	125,000	
Minimum Tensile and Shear Stress Area	A_{se}	in.^{2}	0.017	0.025

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D.

Titen 2 Tension Strength Design Data[1]

IBC LW *

Characteristic	Symbol	Units	Nominal Anchor Diameter (in.)	
			3/16	¼
Anchor Category	1, 2 or 3	—	1	
Embedment Depth	h_{nom}	in.	1¾	1¾
Steel Strength in Tension				
Tension Resistance of Steel	N_{sa}	lb.	2,175	3,175
Strength Reduction Factor — Steel Failure	ϕ_{sa}	—	0.65[2]	
Concrete Breakout Strength in Tension[6]				
Effective Embedment Depth	h_{ef}	in.	1.30	1.30
Critical Edge Distance	c_{ac}	in.	3	3
Effectiveness Factor — Uncracked Concrete	k_{uncr}	—	24	
Modification Factor	$\Psi_{c,N}$		1.0	
Strength Reduction Factor — Concrete Breakout Failure	ϕ_{cb}	—	0.65[3]	
Pullout Strength in Tension[6]				
Pullout Resistance Uncracked Concrete (f'_c = 2,500 psi)[4]	$N_{p,uncr}$	lb.	1,900	1,900
Strength Reduction Factor — Pullout Failure	ϕ_p	—	0.65[5]	

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D.
2. The tabulated value of ϕ_{sa} applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 Section D.4.4.
3. The tabulated value of ϕ_{cb} applies when both the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 Section 17.3.3 (c) or ACI 318-11 Section D.4.3, as applicable, for Condition B are met. Condition B applies where supplementary reinforcement is not provided. For installations where complying supplementary reinforcement can be verified, the ϕ_{cb} factor described in ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3, as applicable, for Condition A are allowed. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 Section D.4.4.
4. The characteristic pullout resistance for greater compressive strengths may be increased by multiplying the tabular value by $(f'_c/2{,}500)^{0.5}$.
5. The tabulated value of ϕ_p applies when both the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 Section 17.3.3 (c) or ACI 318-11 Section D.4.3(c) for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 Section D.4.4 for Condition B.

* See p. 13 for an explanation of the load table icons.

Titen 2 Shear Strength Design Data[1]

Characteristic	Symbol	Units	Nominal Anchor Diameter (in.)	
			³⁄₁₆	¼
Anchor Category	1, 2 or 3	—	1	
Embedment Depth	h_{nom}	in.	1¾	1¾
Steel Strength in Shear				
Shear Resistance of Steel	V_{sa}	lb.	990	1,510
Strength Reduction Factor — Steel Failure	ϕ_{sa}	—	0.60[2]	
Concrete Breakout Strength in Shear[4]				
Outside Diameter	d_a	in.	0.149	0.180
Load Bearing Length of Anchor in Shear	l_e	in.	1.30	1.30
Strength Reduction Factor — Concrete Breakout Failure	ϕ_{cb}	—	0.70[3]	
Concrete Pryout Strength in Shear				
Coefficient for Pryout Strength	k_{cp}	—	1.0	
Strength Reduction Factor — Concrete Pryout Failure	ϕ_{cp}	—	0.70[4]	

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D.
2. The tabulated value of ϕ_{sa} applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 Section D.4.4.
3. The tabulated value of ϕ_{cb} applies when both the load combinations of Section 1605.2.1 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition B are met. Condition B applies where supplementary reinforcement is not provided. For installations where complying supplementary reinforcement can be verified, the ϕ_{cb} factors described in ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition A are allowed. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ_{cb} must be determined in accordance with ACI 318-11 D.4.4(c).
4. The tabulated value of ϕ_{cp} applies when both the load combinations of IBC Section 1605.2, ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, appropriate value of ϕ_{cp} must be determined in accordance with ACI 318-11 Section D.4.4(c).

Allowable Tension Load for Titen 2 Screw Anchor Installed in Grouted CMU Wall Faces[1,2,3]

Anchor Diameter (in.)	Embedment Depth (in.)	Minimum Dimensions			Allowable Load (lb.)
		Spacing (in.)	Edge (in.)	End (in.)	
³⁄₁₆	2	3	3⅞	3⅞	346
³⁄₁₆	2	3	1½	3⅞	315
¼	2	4	3⅞	3⅞	277
¼	2	4	1½	3⅞	272

1. The tabulated values are for screw anchors installed in minimum 8"-wide grouted concrete masonry walls having reached a minimum of f'_m of 1,500 psi at time of installation.
2. Embedment is measured from the masonry surface to the embedded end of the screw anchor.
3. Screw anchors must be installed in grouted cell. The minimum edge and end distances must be maintained.
4. Allowable loads are based on a safety factor of 5.0 for installations under the IBC and IRC.

Allowable Shear Load for Titen 2 Screw Anchor Installed in Grouted CMU Wall Faces[1,2,3]

Anchor Diameter (in.)	Embedment Depth (in.)	Minimum Dimensions			Direction of Loading	Allowable Load (lb.)
		Spacing (in.)	Edge (in.)	End (in.)		
³⁄₁₆	2	3	3⅞	3⅞	Toward edge, parallel to wall end	224
³⁄₁₆	2	3	1½	3⅞	Toward wall end, parallel to wall edge	238
¼	2	4	3⅞	3⅞	Toward edge, parallel to wall end	309
¼	2	4	1½	3⅞	Toward wall end, parallel to wall edge	277

1. The tabulated values are for screw anchors installed in minimum 8"-wide grouted concrete masonry walls having reached a minimum of f'_m of 1,500 psi at time of installation.
2. Embedment is measured from the masonry surface to the embedded end of the screw anchor.
3. Screw anchors must be installed in grouted cell. The minimum edge and end distances must be maintained.
4. Allowable loads are based on a safety factor of 5.0 for installations under the IBC and IRC.

* See p. 13 for an explanation of the load table icons.

Allowable Tension Load for Titen 2 Screw Anchor Installed in Hollow CMU Wall Faces[1,2,3]

IBC *

Anchor Diameter (in.)	Embedment Depth (in.)	Minimum Dimensions			Allowable Load (lb.)
		Spacing (in.)	Edge (in.)	End (in.)	
3⁄16	1¼	3	3⅞	3⅞	151
¼	1¼	4	3⅞	3⅞	153

1. The tabulated values are for screw anchors installed in minimum 8"-wide ungrouted concrete masonry walls having reached a minimum of f'_m of 1,500 psi at time of installation.
2. Embedment is measured from the masonry surface to the embedded end of the screw anchor.
3. Screw anchors may be installed at any location in the wall face provided the minimum edge and end distances are maintained.
4. Allowable loads are based on a safety factor of 5.0 for installations under the IBC and IRC.

Allowable Shear Load for Titen 2 Screw Anchor Installed in Hollow CMU Wall Faces[1,2,3]

IBC *

Anchor Diameter (in.)	Embedment Depth (in.)	Minimum Dimensions			Direction of Loading	Allowable Load (lb.)
		Spacing (in.)	Edge (in.)	End (in.)		
3⁄16	1¼	3	3⅞	3⅞	Toward edge, parallel to wall end	168
¼	1¼	4	3⅞	3⅞	Toward edge, parallel to wall end	163

1. The tabulated values are for screw anchors installed in minimum 8"-wide ungrouted concrete masonry walls having reached a minimum of f'_m of 1,500 psi at time of installation.
2. Embedment is measured from the masonry surface to the embedded end of the screw anchor.
3. Screw anchors may be installed at any location in the wall face provided the minimum edge and end distances are maintained.
4. Allowable loads are based on a safety factor of 5.0 for installations under the IBC and IRC.

* See p. 13 for an explanation of the load table icons.

Titen® Stainless Steel Concrete and Masonry Screw

Stainless steel Titen screws are ideal for attaching various types of components to concrete and masonry, such as fastening electrical boxes or light fixtures. They offer the versatility of our standard Titen screws with enhanced corrosion protection. Available in hex and Phillips flat head.

Features

- Suitable for concrete, brick, grout-filled CMU and hollow-block applications
- Suitable for some preservative-treated wood applications
- Acceptable for exterior use
- Titen drill bits included in each box
- Available in lengths from 1¼"–4"

Material: Type 410 stainless steel

Coating: Zinc plated with a protective overcoat

Installation

⚠ **Caution:** Industry studies show that hardened fasteners can experience performance problems in wet or corrosive environments. Steps must be taken to prevent inadvertent sustained loads above the listed allowable loads. Overtightening and bending moments can initiate cracks detrimental to the hardened screw's performance. Use the Simpson Strong-Tie Titen installation tool kit as it has a bit that is designed to reduce the potential for overtightening the screw.

⚠ **Caution:** Oversized holes in the base material will reduce or eliminate the mechanical interlock of the threads with the base material and will reduce the anchor's load capacity.

1. Drill a hole in the base material using the appropriate diameter carbide drill bit as specified in the table. Drill the hole to the specified embedment depth plus ½" to allow the thread tapping dust to settle and blow it clean using compressed air. Overhead installations need not be blown clean. Alternatively, drill the hole deep enough to accommodate embedment depth and dust from drilling and tapping.
2. Position fixture, insert screw and tighten using drill and Titen screw installation tool fitted with a hex socket or phillips bit.

Preservative-treated wood applications: suitable for use in non-ammonia formulations of CCA, ACQ-C, ACQ-D, CA-B, SBX/DOT and zinc borate. Acceptable for use in exterior environments. Use caution not to damage coating during installation. The 410 stainless-steel Titen with top coat provides "medium" corrosion protection. Recommendations are based on testing and experience at time of publication and may change. Simpson Strong-Tie cannot provide estimates on service life of screws.

Titen
Stainless-Steel
Phillips Flat Head Screw
(PFSS)

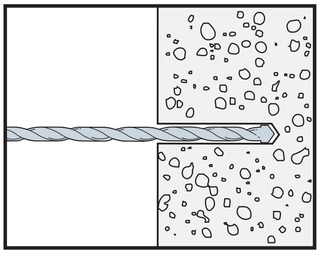
Titen
Stainless-Steel
Hex-Head Screw
(HSS)

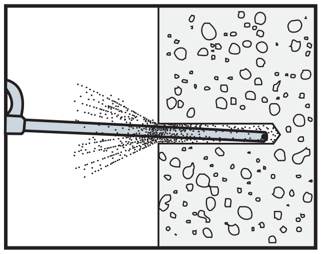
Stainless-Steel Titen Product Data

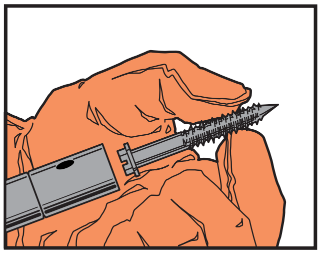
Size (in.)	Head Style	Model No.	Drill Bit Diameter (in.)	Quantity	
				Box	Carton
¼ x 1¼	Hex-Head	TTN25114HSS	³⁄₁₆	100	1600
¼ x 1¾		TTN25134HSS		100	500
¼ x 2¼		TTN25214HSS		100	500
¼ x 2¾		TTN25234HSS		100	500
¼ x 3¼		TTN25314HSS		100	400
¼ x 3¾		TTN25334HSS		100	400
¼ x 4		TTN25400HSS		100	400
¼ x 1¼	Phillips Flat-Head	TTN25114PFSS	³⁄₁₆	100	1600
¼ x 1¾		TTN25134PFSS		100	500
¼ x 2¼		TTN25214PFSS		100	500
¼ x 2¾		TTN25234PFSS		100	500
¼ x 3¼		TTN25314PFSS		100	400
¼ x 3¾		TTN25334PFSS		100	400
¼ x 4		TTN25400PFSS		100	400

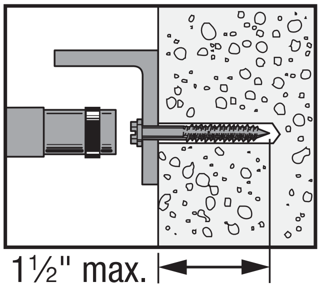
One drill bit is included in each box.

Installation Sequence









Titen® Stainless Steel Concrete and Masonry Screw

Stainless-Steel Titen Allowable Tension and Shear Loads in Normal-Weight Concrete

Dia. in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Critical Spacing in. (mm)	Critical Edge Dist. in. (mm)	Tension Load				Shear Load	
					f'$_c$ ≥ 2,000 psi (13.8 MPa) Concrete		f'$_c$ ≥ 4,000 psi (27.6 MPa) Concrete		f'$_c$ ≥ 2,000 psi (13.8 MPa) Concrete	
					Ultimate lb. (kN)	Allow. lb. (kN)	Ultimate lb. (kN)	Allow. lb. (kN)	Ultimate lb. (kN)	Allow. lb. (kN)
¼ (6.4)	3⁄16	1 (25.4)	3 (76.2)	1 ½ (38.1)	**600** (2.7)	**150** (0.7)	**935** (4.2)	**235** (1.0)	**760** (3.4)	**190** (0.8)
¼ (6.4)	3⁄16	1 ½ (38.1)	3 (76.2)	1 ½ (38.1)	**1,040** (4.6)	**260** (1.2)	**1,760** (7.8)	**440** (2.0)	**810** (3.6)	**200** (0.9)

1. Maximum anchor embedment is 1 ½" (38.1 mm).
2. Minimum concrete thickness is 1.5 x embedment.

Stainless-Steel Titen Allowable Tensionand Shear Loads in Face Shell of Hollow and Grout-Filled CMU

Dia. in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Critical Spacing in. (mm)	Critical Edge Dist. in. (mm)	Values for 6" or 8" Lightweight, Medium-Weight or Normal-Weight CMU			
					Tension Load		Shear Load	
					Ultimate lb. (kN)	Allow. lb. (kN)	Ultimate lb. (kN)	Allow. lb. (kN)
¼ (6.4)	3⁄16	1 (25.4)	4 (101.6)	1 ½ (38.1)	**550** (2.4)	**110** (0.5)	**495** (2.2)	**100** (0.4)

1. The tabulated allowable loads are based on a safety factor of 5.0.
2. Maximum anchor embedment is 1 ½" (38.1 mm).

Length Identification Head Marks on Stainless-Steel Titen Screw Anchors (corresponds to anchor length in inches)

Length ID Marking on Head		—	A	B	C	D	E	F	G	H	I	J
Length of Anchor (in.)	From	1	1½	2	2½	3	3½	4	4½	5	5½	6
	Up To But Not Including	1 ½	2	2½	3	3½	4	4½	5	5½	6	6½

For SI: 1 inch = 25.4 mm.

* See p. 13 for an explanation of the load table icons.

Titen HD® Threaded Rod Hanger

The Titen HD threaded rod hanger is a high-strength screw anchor designed to suspend threaded rod from concrete slabs, beams or concrete over metal in order to hang pipes, cable trays and other HVAC equipment. The anchor offers low installation torque with no secondary setting, and has been tested to offer industry-leading performance in cracked and uncracked concrete — even in seismic loading conditions.

Cracked Concrete CODE LISTED

Features

- Thread design undercuts to efficiently transfer the load to the base material
- Serrated cutting teeth and patented thread design enable quick and easy installation
- Specialized heat-treating process creates tip hardness to facilitate cutting while the anchor body remains ductile
- Designed to install using a rotary hammer or hammer drill with standard ANSI drill bits — no special tools required
- Installs with standard-sized sockets
- Code listed for cracked and uncracked concrete applications under the 2015, 2012 and 2009 IBC/IRC, per ICC-ES ESR-2713
- UL/FM listed

Codes: ICC-ES ESR-2713; City of L.A. RR25741; Florida FL-15730.6; Factory Mutual 3031136 (THD50234RH) and 3061897 (THDB37158RH)

Material: Carbon steel

Coating: Zinc plated

THD50234RH
(⅜"-dia. shank)

NEW

THDB25158RH
(¼"-dia. shank)

NEW

THDB37158RH
(¼"-dia. shank)

U.S. Patent 6,623,228

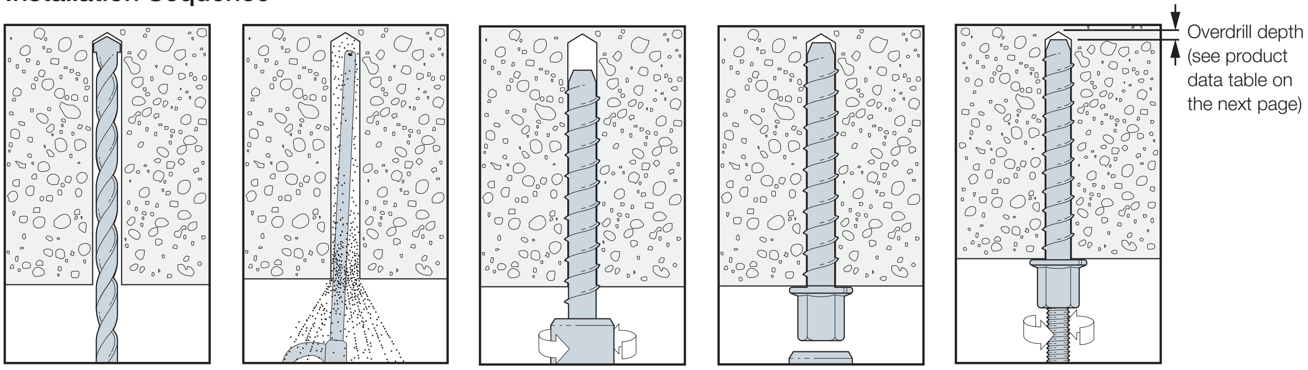
Installation

Caution: Oversized holes in the base material will reduce or eliminate the mechanical interlock of the threads with base material and will reduce the anchor's load capacity.

Caution: Use a Titen HD® rod hanger one time only. Installing the anchor multiple times may result in excessive thread wear and reduce load capacity.

1. Drill a hole using the specified diameter carbide bit into the base material to the specified embedment depth plus minimum hole depth overdrill (see the product data table on the next page).
2. Blow the hole clean of dust and debris using compressed air.
3. Install with a torque wrench, driver drill, hammer drill or cordless impact wrench.
4. Fully insert threaded rod.

Installation Sequence



Titen HD® Rod Hanger Design Information — Concrete

Titen HD Threaded Rod Hanger Product Data

Size (in.)	Model No.	Accepts Rod Dia. (in.)	Drill Bit Dia. (in.)	Wrench Size (in.)	Min. Embed. (in.)	Hole Depth Overdrill (in.)	Quantity	
							Box	Carton
¼ x 1⅝	THDB25158RH	¼	¼	⅜	1⅝	⅛	100	500
⅜ x 1⅝	THDB37158RH	⅜	¼	½	1⅝	⅛	50	200
½ x 2¾	THD50234RH	½	⅜	11⁄16	2½	¼	50	100

Titen HD Threaded Rod Hanger Installation Information and Additional Data[1]

Characteristic	Symbol	Units	Model Number	
			NEW THDB25158RH THDB37158RH	THD50234RH
Installation Information				
Rod Hanger Diameter	d_o	in.	¼ or ⅜	½
Drill Bit Diameter	d_{bit}	in.	¼	⅜
Maximum Installation Torque[2]	$T_{inst,max}$	ft.-lb.	24	50
Maximum Impact Wrench Torque Rating[3]	$T_{impact,max}$	ft.-lb.	125	150
Minimum Hole Depth	h_{hole}	in.	1¾	3
Embedment Depth	h_{nom}	in.	1⅝	2¾
Effective Embedment Depth	h_{ef}	in.	1.19	1.77
Critical Edge Distance	c_{ac}	in.	3	2 11⁄16
Minimum Edge Distance	c_{min}	in.	1½	1¾
Minimum Spacing	s_{min}	in.	1½	3
Minimum Concrete Thickness	h_{min}	in.	3¼	4¼
Anchor Data				
Yield Strength	f_{ya}	psi	100,000	97,000
Tensile Strength	f_{uta}	psi	125,000	110,000
Minimum Tensile and Shear Stress Area	A_{se}	in.^{2}	0.042	0.099
Axial Stiffness in Service Load Range — Uncracked Concrete	β_{uncr}	lb./in.	202,000	715,000
Axial Stiffness in Service Load Range — Cracked Concrete	β_{cr}	lb./in.	173,000	345,000

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11.
2. $T_{inst,max}$ is the maximum permitted installation torque for installations using a torque wrench.
3. $T_{impact,max}$ is the maximum permitted torque rating for impact wrenches.

Titen HD® Rod Hanger Design Information — Concrete

Titen HD Threaded Rod Hanger Tension Strength Design Data for Installations in Concrete[1]

Characteristic	Symbol	Units	Model Number	
			THDB25158RH THDB37158RH	THD50234RH
Anchor Category	1, 2 or 3	—	1	
Embedment Depth	h_{nom}	in.	1⅝	2½
Steel Strength in Tension (ACI 318-14 17.4.1 or ACI 318-11 Section D.5.1)				
Tension Resistance of Steel	N_{sa}	lb.	5,195	10,890
Strength Reduction Factor — Steel Failure[2]	ϕ_{sa}	—	0.65	
Concrete Breakout Strength in Tension (ACI 318-14 17.4.2 or ACI 318-11 Section D.5.2)				
Effective Embedment Depth	h_{ef}	in.	1.19	1.77
Critical Edge Distance	c_{ac}	in.	3	$2\frac{11}{16}$
Effectiveness Factor — Uncracked Concrete	k_{uncr}	—	30	24
Effectiveness Factor — Cracked Concrete	k_{cr}	—	17	
Modification Factor	$\psi_{c,N}$	—	1.0	
Strength Reduction Factor — Concrete Breakout Failure[3]	ϕ_{cb}	—	0.65	
Pullout Strength in Tension (ACI 318-14 17.4.3 or ACI 318-11 Section D.5.3)				
Pullout Resistance — Uncracked Concrete (f'_c = 2,500 psi)	$N_{p,uncr}$	lb.	N/A[4]	2,025[5]
Pullout Resistance — Cracked Concrete (f'_c = 2,500 psi)	$N_{p,cr}$	lb.	N/A[4]	1,235[5]
Strength Reduction Factor — Pullout Failure[6]	ϕ_p	—	0.65	
Tension Strength for Seismic Applications (ACI 318-14 17.2.3.3 or ACI 318-11 Section D.3.3.3)				
Nominal Pullout Strength for Seismic Loads (f'_c = 2,500 psi)	$N_{p,eq}$	lb.	N/A[4]	1,235[5]
Strength Reduction Factor — Pullout Failure[6]	ϕ_{eq}	—	0.65	

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable.
2. The tabulated value of ϕ_{sa} applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4(b), as applicable.
3. The tabulated values of ϕ_{cb} applies when both the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used and the requirements of ACI 318-11 D.4.3(c) for Condition B are met. Condition B applies where supplementary reinforcement is not provided in concrete. For installations were complying reinforcement can be verified, the ϕ_{cb} factors described in ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c), as applicable, may be used for Condition A. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4(c) for Condition B.
4. As described in this report, N/A denotes that pullout resistance does not govern and does not need to be considered.
5. The characteristic pullout resistance for greater compressive strengths may be increased by multiplying the tabular value by $(f'_c/2,500)^{0.5}$.
6. The tabulated values of ϕ_p or ϕ_{eq} applies when both the load combinations of ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used and the requirements of ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition B are met. Condition B applies where supplementary reinforcement is not provided in concrete. For installations were complying reinforcement can be verified, the ϕ_p or ϕ_{eq} factors described in ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c), as applicable, may be used for Condition A. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4(c) for Condition B.

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* See p. 13 for an explanation of the load table icons.

Titen HD® Rod Hanger Design Information — Concrete

Titen HD Threaded Rod Hanger Tension Strength Design Data for Installations in the Lower and Upper Flute of Normal-Weight or Sand-Lightweight Concrete Through Metal Deck[1,2,5,6]

IBC *

Characteristic	Symbol	Units	Model No.		
			Lower Flute		Upper Flute
			Figure 2	Figure 1	Figure 2
			THDB25158RH THDB37158RH	THD50234RH	THDB25158RH THDB37158RH
Minimum Hole Depth	h_{hole}	in.	1¾	3	1¾
Embedment Depth	h_{nom}	in.	1⅝	2½	1⅝
Effective Embedment Depth	h_{ef}	in.	1.19	1.77	1.19
Pullout Resistance – Cracked Concrete[2,3,4]	$N_{p,deck,cr}$	lbf.	420	870	655
Pullout Resistance – Uncracked Concrete[2,3,4]	$N_{p,deck,uncr}$	lbf.	995	1,430	1,555

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable.
2. Concrete compressive strength shall be 3,000 psi minimum. The characteristic pullout resistance for greater compressive strengths shall be increased by multiplying the tabular value by $(f'_{c,specified}/3{,}000\ \text{psi})^{0.5}$.
3. For anchors installed in the soffit of sand-lightweight or normal-weight concrete over metal deck floor and roof assemblies, as shown in Figure 1 or Figure 2, calculation of the concrete breakout strength may be omitted.
4. In accordance with ACI 318-14 Section 17.4.3.2 or ACI 318-11 Section D.5.3.2, the nominal pullout strength in cracked concrete for anchors installed in the soffit of sand-lightweight or normal-weight-concrete-over-metal-deck floor and roof assemblies $N_{p,deck,cr}$ shall be substituted for $N_{p,cr}$. Where analysis indicates no cracking at service loads, the normal pullout strength in uncracked concrete $N_{p,deck,uncr}$ shall be substituted for $N_{p,uncr}$.
5. Minimum distance to edge of panel is $2h_{ef}$.
6. The minimum anchor spacing along the flute must be the greater of $3h_{ef}$ or 1.5 times the flute width.

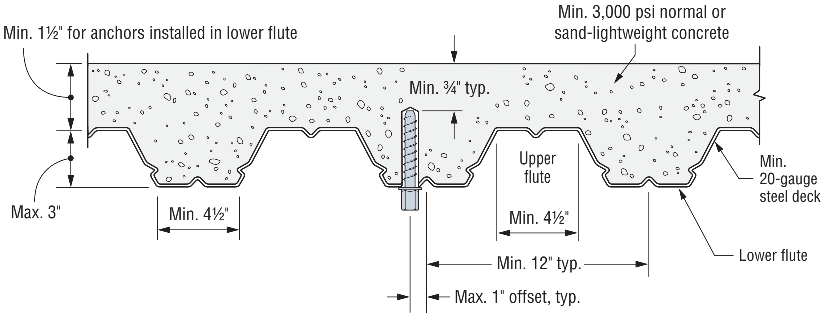


Figure 1. THD50234RH Installation in Concrete over Metal Deck

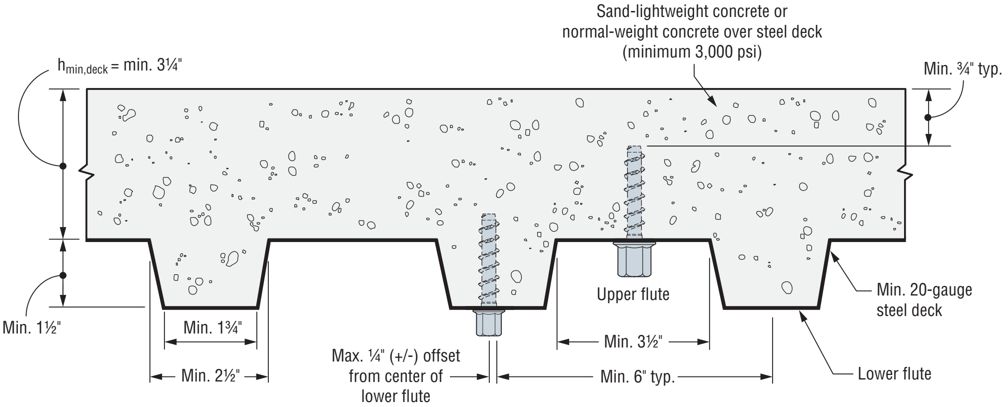


Figure 2. THDB25158RH and THDB37158RH Installation in Concrete over Metal Deck

* See p. 13 for an explanation of the load table icons.

Steel Rod Hanger Threaded Rod Anchor System

The Simpson Strong-Tie® steel rod hanger is a one-piece fastening system for suspending ¼" and ⅜" threaded rod. Vertical rod hangers are designed to suspend threaded rod in overhead applications from steel joists and beams. Horizontal rod hangers are available for applications requiring installation into the side of joists, columns and overhead members. Both rod hangers provide attachment points for use in pipe hanging, fire protection, electrical conduit and cable-tray applications. Recommended for use in dry, interior, non-corrosive environments only.

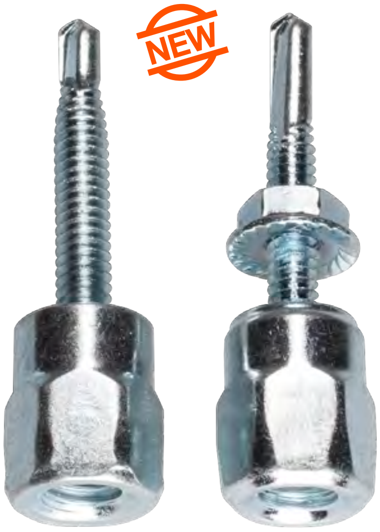
Features

- Threaded anchors for rod-hanging applications in steel members
- Suitable to be installed horizontally or vertically in overhead applications
- Self-drilling, no predrilling required, easily installed with a drill or screw gun
- Custom-matched nut driver sets anchor to optimal depth
- UL / FM listed

RSH
Horizontal Steel Rod Hangers

Steel Rod Hangers

Rod Diameter (in.)	Size	Model No.	Drill Point	Application	Steel Thickness Range	Quantity	
						Box	Carton
¼	¼" x 1" with nut	RSH25100N	#3	Horizontal	20 ga. – 12 ga.	25	250
¼	#12–20 x 1½"	RSH25112-5	#5		20 ga. – ¼"		
⅜	¼" x 1" with nut	RSH37100N	#3		20 ga. – 12 ga.		
⅜	#12–20 x 1½"	RSH37112N-5	#5		20 ga. – ¼"		
¼	¼" x 1"	RSV25100	#3	Vertical	20 ga. – 12 ga.	25	250
⅜	¼" x 1" with nut	RSV37100N	#3		20 ga. – 12 ga.		
⅜	¼" x 1½"	RSV37112	#3		20 ga. – 14 ga.		
⅜	¼" x 1½" with nut	RSV37112N	#3		20 ga. – 14 ga.		
⅜	#12–20 x 1½"	RSV37112N-5	#5		20 ga. – ¼"		
⅜	¼" x 2"	RSV37200	#3		20 ga. – 14 ga.		



RSV
Vertical Steel Rod Hangers

Nut Driver

Custom-matched nut driver sets the rod hangers to optimal depth every time.

Model No.	Description	Quantity	
		Box	Carton
RND62	Nut driver	1 blister	10

RND62

Steel Rod Hanger Threaded Rod Anchor System

Ultimate and Allowable Loads for Vertical Steel Rod Hangers *

Model No.	Rod Dia. (in.)	Size (in.)	Loads in Various Steel Thicknesses														UL Listed Steel Thickness Range	FM Listed Steel Thickness Range
			33 mil (20 ga.)		43 mil (18 ga.)		54 mil (16 ga.)		68 mil (14 ga.)		97 mil (12 ga.)		3⁄16"		¼"			
			Ult. (lb.)	Allow. (lb.)	Ult. (lb.)	Allow. (lb.)	Ult. (lb.)	Allow. (lb.)	Ult. (lb.)	Allow. (lb.)	Ult. (lb.)	Allow. (lb.)	Ult. (lb.)	Allow. (lb.)	Ult. (lb.)	Allow. (lb.)		
RSV25100	¼	¼ x 1	355	130	575	190	880	325	1,110	410	2,050	760	—	—	—	—	—	—
RSV37100N[3]	⅜	¼ x 1	1,370	505	1,980	730	3,405	1,260	3,890	1,440	3,900	1,440	—	—	—	—	20 ga. – 12 ga.	16 ga. – 12 ga.
RSV37112	⅜	¼ x 1½	355	130	575	190	880	325	1,110	410	—	—	—	—	—	—	—	—
RSV37112N[3]	⅜	¼ x 1½	1,370	505	1,980	730	3,405	1,260	3,890	1,440	—	—	—	—	—	—	20 ga. – 14 ga.	16 ga. – 14 ga.
RSV37200	⅜	¼ x 2	355	130	575	190	880	325	1,110	410	—	—	—	—	—	—	—	—
RSV37112N-5[3]	⅜	#12–20 x 1½	1,370	505	1,980	730	2,185	730	2,185	730	2,560	940	3,290	1,095	3,290	1,095	20 ga. – ¼"	16 ga. – ¼"

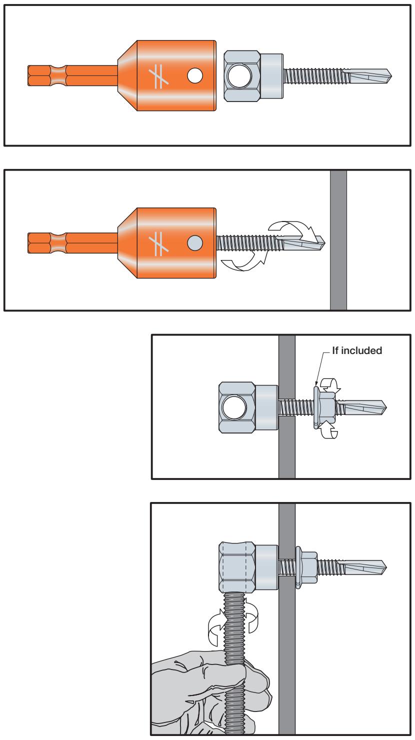
Footnotes below apply to both tables.

Ultimate and Allowable Loads for Horizontal Steel Rod Hangers *

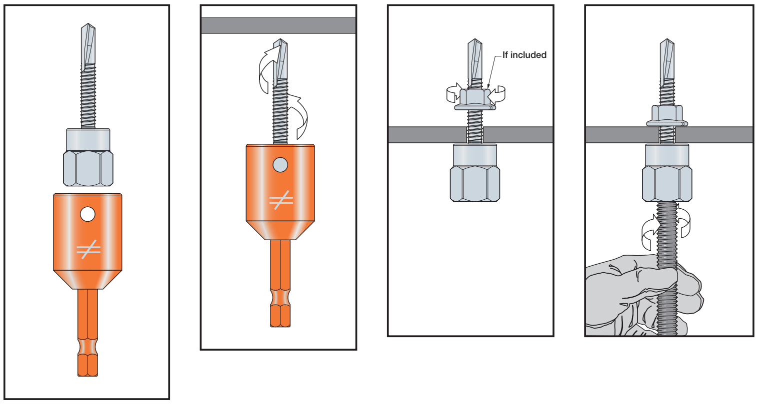
Model No.	Rod Dia. (in.)	Size (in.)	Loads in Various Steel Thicknesses														UL Listed Steel Thickness Range	FM Listed Steel Thickness Range
			33 mil (20 ga.)		43 mil (18 ga.)		54 mil (16 ga.)		68 mil (14 ga.)		97 mil (12 ga.)		3⁄16"		¼"			
			Ult. (lb.)	Allow. (lb.)	Ult. (lb.)	Allow. (lb.)	Ult. (lb.)	Allow. (lb.)	Ult. (lb.)	Allow. (lb.)	Ult. (lb.)	Allow. (lb.)	Ult. (lb.)	Allow. (lb.)	Ult. (lb.)	Allow. (lb.)		
RSH25112-5	¼	#12–20 x 1½	420	155	685	255	835	310	930	310	1,240	425	1,270	425	1,350	500	—	—
RSH25100N[3]	¼	¼ x 1	1,150	385	1,235	455	1,235	455	1,235	455	1,480	545	—	—	—	—	—	—
RSH37100N[3]	⅜	¼ x 1	1,575	525	1,865	665	1,865	665	1,865	665	1,865	665	—	—	—	—	18 ga. – 12 ga.	16 ga. – 12 ga.
RSH37112N-5[3]	⅜	#12–20 x 1½	1,490	550	1,490	550	1,490	550	1,490	550	1,490	550	1,490	550	1,490	550	18 ga. – ¼"	16 ga. – ¼"

1. Allowable loads are based on a factor of safety calculated in accordance with AISI S100 Section F1.
2. Mechanical and plumbing design codes may prescribe lower allowable loads. Verify with local codes.
3. Model requires installation with supplied retaining nut.
4. Values are based on steel members with the following minimum yield and tensile strengths:
   - 43 mil (18 ga.) and 33 mil (20 ga.): F_y = 33 ksi and F_u = 45 ksi
   - 54 mil (16 ga.) to 97 mil (12 ga.): F_y = 50 ksi and F_u = 65 ksi
   - 3⁄16" and ¼": F_y = 36 ksi and F_u = 58 ksi.
5. Minimum edge distance must be 1" and minimum spacing must be 2".
6. Acceptability of base material deflection due to imposed loads must be investigated separately.

Horizontal Installation



Vertical Installation



* See p. 13 for an explanation of the load table icons.

Wood Rod Hanger Threaded Rod Anchor System

The wood rod hanger from Simpson Strong-Tie is a one-piece fastening system for suspending ¼" or ⅜" threaded rod. Vertical rod hangers are designed to suspend threaded rod in overhead applications from wood members. Horizontal rod hangers are available for applications requiring installation into the side of joists, columns and overhead members. Both rod hangers provide attachment points for use in pipe hanging, fire protection, electrical conduit and cable-tray applications. Recommended for use in dry, interior, non-corrosive environments only.

Features

- Threaded anchors for rod-hanging applications in wood
- Suitable for installation horizontally or vertically in overhead applications
- No predrilling required
- Easily installed with a drill or screw gun
- Type-17 point provides for fast starts
- UL/FM Listed

Material: Carbon steel

Coating: Zinc plated

RWV
Vertical Wood
Rod Hanger

RWH
Horizontal Wood
Rod Hanger

Wood Rod Hangers

Rod Diameter (in.)	Size (in.)	Model No.	Application	Point Style	Quantity	
					Box	Carton
¼	¼ x 2	RWV25200	Vertical	Type 17	25	250
⅜	¼ x 1	RWV37100				
⅜	¼ x 2	RWV37200				
⅜	5⁄16 x 2½	RWV37212				
¼	¼ x 1	RWH25100	Horizontal	Type 17	25	250
⅜	¼ x 2	RWH37200				
⅜	5⁄16 x 2½	RWH37212				

Type-17 point for use in wood

Wood Rod Hanger Design Information — Wood

Tension Wood Rod Hanger Allowable Loads

Model No.	Rod Dia. (in.)	Size (in.)	Minimum Edge Dist. (in.)	Minimum End Dist. (in.)	Minimum Spacing (in.)	Loads							
						DF		SP		SPF		UL Approval	FM Approval
						Ultimate lb.	Allowable lb.	Ultimate lb.	Allowable lb.	Ultimate lb.	Allowable lb.	Pipe Size in.	Pipe Size in.
RWV25200	¼	¼ x 2	¾	2¾	2¾	1,875	375	2,165	435	1,540	310	—	—
RWV37100	⅜	¼ x 1				765	155	950	190	525	105	—	—
RWV37200	⅜	¼ x 2				1,875	375	2,165	435	1,540	310	3	—
RWV37212	⅜	5⁄16 x 2½		3¼	3¼	3,015	605	2,960	590	2,470	495	4	4

1. Load values are based on full shank penetration into the wood member.
2. Allowable loads may be increased by CD = 1.6 for wind or earthquake.
3. Allowable loads are based on a factor of safety of 5.0.
4. Mechanical and plumbing design codes may prescribe lower allowable loads. Verify with local codes.
5. Allowable loads are based on Douglas Fir-Larch (DF), Southern Pine (SP) and Spruce-Pine-Fir (SPF) wood members having a minimum specific gravity of 0.50, 0.55 and 0.42, respectively.

Shear Wood Rod Hanger Allowable Loads

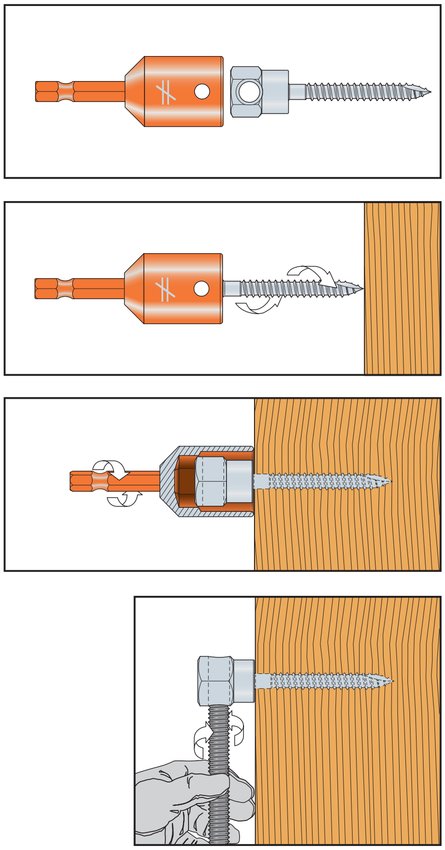
Model No.	Rod Dia. (in.)	Size (in.)	Minimum Edge Distance (in.)	Minimum End Distance (in.)	Minimum Spacing (in.)	Loads						UL Approval
						DF		SP		SPF		
						Ultimate lb.	Allowable lb.	Ultimate lb.	Allowable lb.	Ultimate lb.	Allowable lb.	Pipe Size (in.)
RWH25100	¼	¼ x 1	1	2¾	2¾	555	110	680	135	430	85	—
RWH37200	⅜	¼ x 2	2½			1,205	240	1,115	225	1,650	330	3
RWH37212	⅜	5⁄16 x 2½		3¼	3¼	1,145	230	1,320	265	1,190	240	3

1. Load values are based on full shank penetration into the wood member.
2. Allowable loads may not be increased for short-term loading.
3. Allowable loads are based on a factor of safety of 5.0.
4. Mechanical and plumbing design codes may prescribe lower allowable loads. Verify with local codes.
5. Allowable loads are based on Douglas Fir-Larch (DF), Southern Pine (SP) and Spruce-Pine-Fir (SPF) wood members having a minimum specific gravity of 0.50, 0.55 and 0.42, respectively.

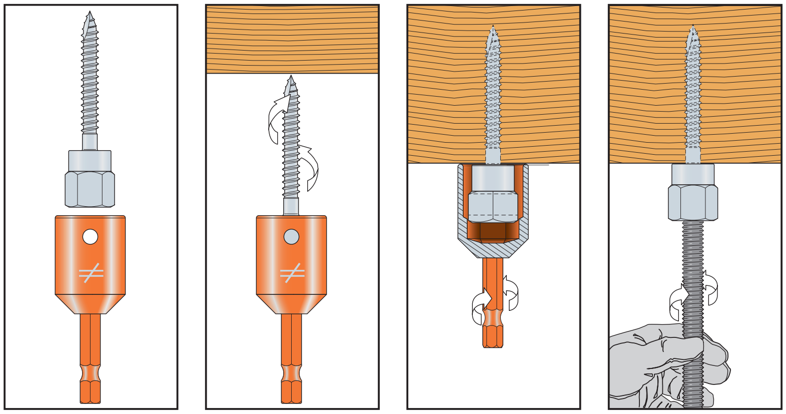
Installation Sequence

1. Attach RND62 nut driver to a drill.
2. Insert rod hanger into the RND62 nut driver.
3. Using rotation-only mode, drive rod hanger until it contacts the surface. Do not over-tighten. RND62 nut driver will disengage the rod hanger at the appropriate depth to prevent over-driving.
4. Insert threaded rod. Minimum thread engagement should be equal to the nominal diameter of the threaded insert.

Horizontal Wood Rod Hanger



Vertical Wood Rod Hanger



* See p. 13 for an explanation of the load table icons.

Drop-In Internally Threaded Anchor (DIAB)

Expansion shell anchors for use in solid base materials

Simpson Strong-Tie introduces a new, redesigned Drop-In Anchor (DIAB) that provides easier installation into base materials. Improved geometry in the preassembled expansion plug improves setting capability so the anchor installs with 40% fewer hammer strikes than previous versions. These displacement-controlled expansion anchors are easily set by driving the plug toward the bottom of the anchor using either the hand- or power-setting tools. DIAB anchors feature a positive-set marking indicator at the top of the anchor — helping you see more clearly when proper installation has taken place.

Use a Simpson Strong-Tie fixed-depth stop bit to take the guesswork out of drilling to the correct depth. The fluted design of the tip draws debris away from the hole during drilling, allowing for a cleaner installation.

Key features

- New design offers easier installation then previous drop-in anchor design — sets with 40% fewer hammer hits
- Positive-set marking system indicates when anchor is properly set
- Lipped drop-in version available for flush installation
- Hand- and power-setting tools available for fast, easy and economical installation
- Fixed-depth stop bit helps you drill to the correct depth every time
- Available in coil-thread version for ½" and ¾" coil-thread rod

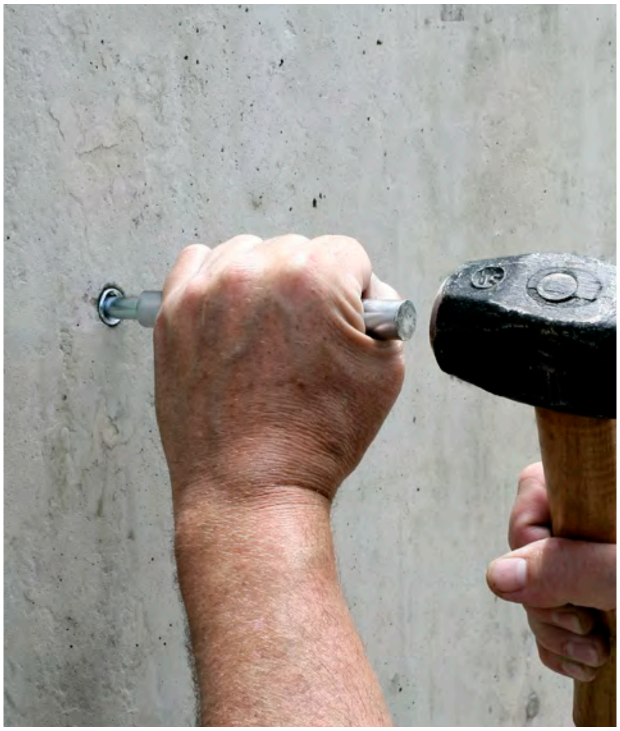
Material: Carbon steel

Coating: Zinc plated

Drop-In

Lipped Drop-In

Coil-Thread Drop-In



Anchor being set with hand setting tool.

Anchor being set with SDS setting tool.

Positive set indicator.

Drop-In Internally Threaded Anchor (DIAB)

Drop-In Anchor

Rod Size (in.)	Model No.	Drill Bit Dia. (in.)	Bolt Threads (per in.)	Body Length (in.)	Thread Length (in.)	Quantity	
						Box	Carton
¼	DIAB25	⅜	20	1	⅜	100	500
⅜	DIAB37	½	16	1⁹⁄₁₆	⅝	50	250
½	DIAB50	⅝	13	2	¾	50	200
⅝	DIAB62	⅞	11	2½	1	25	100
¾	DIAB75	1	10	3⅛	1¼	20	80


Drop-In

Lipped Drop-In Anchor

Rod Size (in.)	Model No.	Drill Bit Dia. (in.)	Bolt Threads (per in.)	Body Length (in.)	Thread Length (in.)	Quantity	
						Box	Carton
¼	DIABL25	⅜	20	1	⅜	100	500
⅜	DIABL37	½	16	1⁹⁄₁₆	⅝	50	250
½	DIABL50	⅝	13	2	¾	50	200


Lipped Drop-In

Coil-Thread Drop-In Anchor

Rod Size (in.)	Model No.	Drill Bit Dia. (in.)	Bolt Threads (per in.)	Body Length (in.)	Thread Length (in.)	Quantity	
						Box	Carton
½	DIAB50C[1]	⅝	6	2	¾	50	200
¾	DIAB75C[1]	1	4½	3⅛	1¼	20	80

1. DIAB50C and DIAB75C accept ½" and ¾" coil-thread rod, respectively.

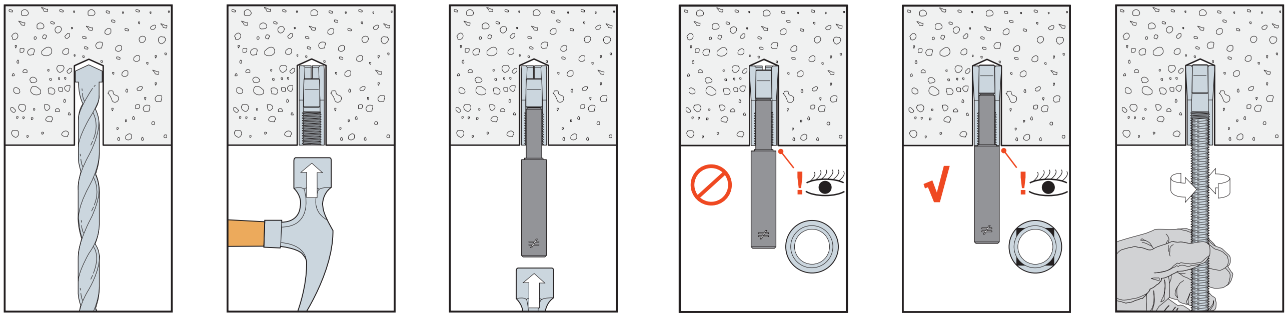

Coil-Thread Drop-In

Drop-In Internally Threaded Anchor (DIAB)

DIAB Manual Installation

⚠ **Caution:** Oversized holes will reduce the anchors load capacity

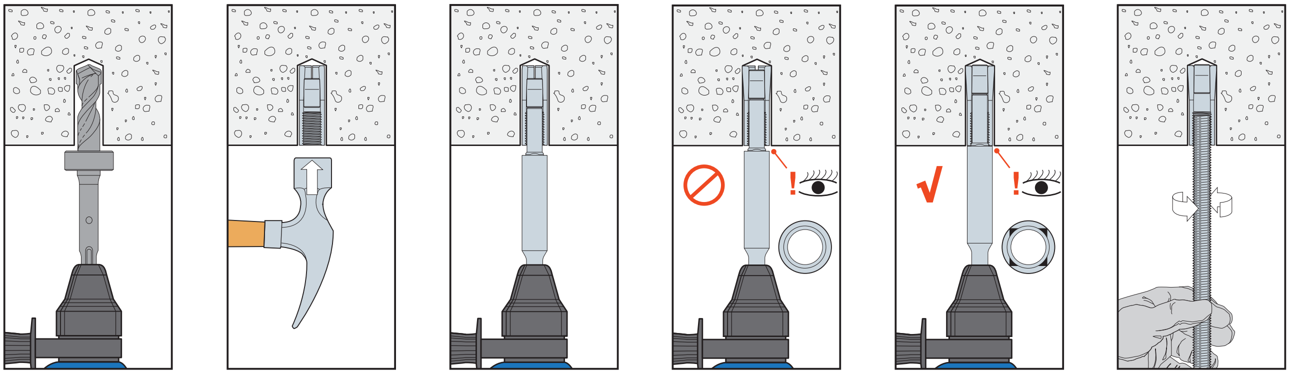
1. Drill a hole in the base material using the appropriate diameter carbide drill bit or fixed depth bit as specified in the table. Drill the hole to the specified embedment. For fixed depth bits drill the hole until the shoulder of the bit contacts the surface of the base material. Then blow the hole clean of dust and debris using compressed air. Overhead installations need not be blown clean.
2. Insert the anchor into the hole. Tap with hammer until flush against the surface.
3. Using the designated Drop-In setting tool, drive expander plug towards the bottom of the anchor until the shoulder of the setting tool makes contact with the top of the anchor. When properly set 4 indentations will be visible on the top of the anchor indicating full expansion.
4. Insert bolt or threaded rod. Minimum thread engagement should be equal to the nominal diameter of the threaded insert.



DIAB SDS Installation

⚠ **Caution:** Oversized holes will reduce the anchors load capacity

1. Drill a hole in the base material using the appropriate diameter carbide drill bit or fixed depth drill bit as specified in the table. Drill the hole to the specified embedment. For fixed depth bits drill the hole until the shoulder of the bit contacts the surface of the base material. Then blow the hole clean of dust and debris using compressed air. Overhead installations need not be blown clean.
2. Insert the anchor into the hole. Tap with hammer until flush against the surface.
3. Attach SDS Drop-In setting tool to a drill. Drive expander plug towards the bottom of the anchor using only hammer mode until the shoulder of the setting tool makes contact with the top of the anchor. When properly set 4 indentations will be visible on the top of the anchor indicating full expansion.
4. Insert bolt or threaded rod. Minimum thread engagement should be equal to the nominal diameter of the threaded insert.



Drop-In (DIAB) Design Information — Concrete

DIAB Allowable Tension and Shear Loads in Normal-Weight Concrete

*

Model No.	Rod Size in. (mm)	Drill Bit Dia. In.	Embed Depth In. (mm)	Critical Edge Dist. In. (mm)	Critical Spacing In. (mm)	$f'_c \geq$ 2,500 psi (17.2 MPa)				$f'_c \geq$ 4,000 psi (27.6 MPa)			
						Tension Load		Shear Load		Tension Load		Shear Load	
						Ultimate lb. (kN)	Allowable lb. (kN)	Ultimate lb. (kN)	Allowable lb. (kN)	Ultimate lb. (kN)	Allowable lb. (kN)	Ultimate lb. (kN)	Allowable lb. (kN)
DIAB25 DIABL25	¼ (6.4)	⅜	1 (25)	3 (76)	4 (102)	1,565 (7.0)	390 (1.7)	1,840 (8.2)	460 (2.0)	1,965 (8.7)	490 (2.2)	1,840 (8.2)	460 (2.0)
DIAB37 DIABL37	⅜ (9.5)	½	1⁹⁄₁₆ (40)	4½ (114)	6 (152)	2,950 (13.1)	740 (3.3)	4,775 (21.2)	1,195 (5.3)	3,910 (17.4)	980 (4.4)	4,775 (21.2)	1,195 (5.3)
DIAB50 DIABL50 DIAB50C	½ (12.7)	⅝	2 (51)	6 (152)	8 (203)	5,190 (23.1)	1,300 (5.8)	6,760 (30.1)	1,690 (7.5)	6,515 (29.0)	1,630 (7.3)	6,760 (30.1)	1,690 (7.5)
DIAB62	⅝ (15.9)	⅞	2½ (64)	7½ (191)	10 (254)	7,010 (31.2)	1,755 (7.8)	12,190 (54.2)	3,050 (13.6)	9,060 (40.3)	2,265 (10.1)	12,190 (54.2)	3,050 (13.6)
DIAB75 DIAB75C	¾ (19.1)	1	3⅛ (79)	9 (229)	12½ (318)	9,485 (42.2)	2,370 (10.5)	15,960 (71.0)	3,990 (17.7)	11,660 (51.9)	2,915 (13.0)	15,960 (71.0)	3,990 (17.7)

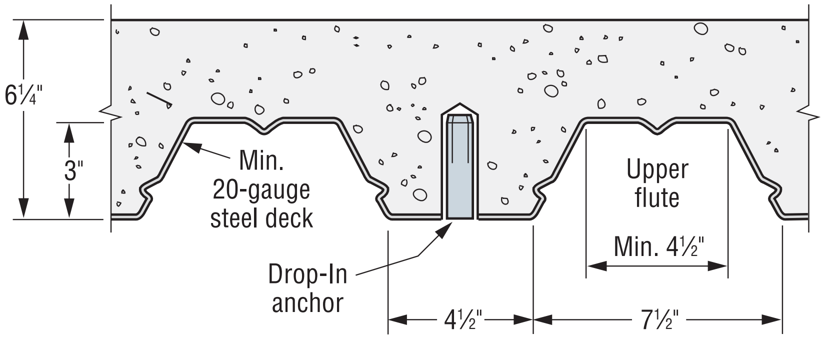
1. The allowable loads listed are based on a safety factor of 4.0.
2. Refer to allowable load-adjustment factors for edge distance and spacing on p. 186.
3. Allowable loads may be linearly interpolated between concrete strength listed.
4. The minimum concrete thickness is 1½ times the embedment depth.
5. Allowable loads may not be increased for short-term loading due to wind or seismic forces.

DIAB Allowable Tension and Shear Loads in Soffit of Sand-Lightweight Concrete over Metal Deck

*

Model No.	Rod Size in. (mm)	Drill Bit Dia. In.	Embed Depth In. (mm)	Critical End Dist.[6] In. (mm)	Critical Spacing In. (mm)	$f'_c \geq$ 3,000. psi (20.7 MPa)			
						Tension Load		Shear Load	
						Ultimate lb. (kN)	Allowable lb. (kN)	Ultimate lb. (kN)	Allowable lb. (kN)
DIAB37 DIABL37	⅜ (9.5)	½	1⁹⁄₁₆ (40)	4½ (114)	6 (152)	2,895 (12.9)	725 (3.2)	3,530 (15.7)	885 (3.9)
DIAB50 DIABL50 DIAB50C	½ (12.7)	⅝	2 (51)	6 (152)	8 (203)	4,100 (18.2)	1,025 (4.6)	4,685 (20.8)	1,170 (5.2)

1. The allowable loads listed are based on a safety factor of 4.0.
2. Allowable loads may not be increased for short-term loading due to wind or seismic forces.
3. Refer to allowable load-adjustment factors for edge distance and spacing on p. 186.
4. Anchors were installed in the center of the bottom flute of the steel deck.
5. Metal deck must be minimum 20-gauge thick with minimum yield strength of 33 ksi.
6. Critical end distance is defined as the distance from end of the slab in the direction of the flute.



Lightweight Concrete over Metal Deck

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* See p. 13 for an explanation of the load table icons.

Allowable Load-Adjustment Factors for Drop-In Anchor (DIAB) in Normal-Weight Concrete and Sand-Lightweight Concrete over Metal Deck: Edge Distance and Spacing, Tension and Shear Loads

How to use these charts:

1. The following tables are for reduced edge distance and spacing.
2. Locate the anchor size to be used for either a tension and/or a shear load application.
3. Locate the edge distance (c_{act}) or spacing (s_{act}) at which the anchor is to be installed.
4. The load adjustment factor (f_c or f_s) is the intersection of the row and column.
5. Multiply the allowable load by the applicable load adjustment factor.
6. Reduction factors for multiple edges or spacing are multiplied together.

Edge Distance Tension (f_c)

Edge Dist. c_{act} (in.)	Size	¼	⅜	½	⅝	¾
	c_{cr}	3	4½	6	7½	9
	c_{min}	1¾	2⅝	3½	4⅜	5¼
	f_{cmin}	0.77	0.77	0.77	0.77	0.77
1¾		0.77				
2		0.82				
2½		0.91				
2⅝		0.93	0.77			
3		1.00	0.82			
3½			0.88	0.77		
4			0.94	0.82		
4⅜			0.98	0.85	0.77	
4½			1.00	0.86	0.78	
5				0.91	0.82	
5¼				0.93	0.83	0.77
5½				0.95	0.85	0.79
6				1.00	0.89	0.82
6½					0.93	0.85
7					0.96	0.88
7½					1.00	0.91
8						0.94
8½						0.97
9						1.00

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

Edge Distance Shear (f_c)

Edge Dist. c_{act} (in.)	Size	¼	⅜	½	⅝	¾
	c_{cr}	3	4½	6	7½	9
	c_{min}	1¾	2⅝	3½	4⅜	5¼
	f_{cmin}	0.54	0.54	0.64	0.64	0.64
1¾		0.54				
2		0.63				
2½		0.82				
2⅝		0.86	0.54			
3		1.00	0.63			
3½			0.75	0.64		
4			0.88	0.71		
4⅜			0.97	0.77	0.64	
4½			1.00	0.78	0.65	
5				0.86	0.71	
5¼				0.89	0.74	0.64
5½				0.93	0.77	0.66
6				1.00	0.83	0.71
6½					0.88	0.76
7					0.94	0.81
7½					1.00	0.86
8						0.90
8½						0.95
9						1.00

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

Spacing Tension (f_s)

Spacing s_{act} (in.)	Size	¼	⅜	½	⅝	¾
	s_{cr}	4	6	8	10	12½
	s_{min}	1½	2¼	3	3¾	4¾
	f_{smin}	0.72	0.72	0.80	0.80	0.80
1½		0.72				
2		0.78				
2¼		0.80	0.72			
2½		0.83	0.74			
3		0.89	0.78	0.80		
3½		0.94	0.81	0.82		
3¾		0.97	0.83	0.83	0.80	
4		1.00	0.85	0.84	0.81	
4½			0.89	0.86	0.82	
4¾			0.91	0.87	0.83	0.80
5			0.93	0.88	0.84	0.81
5½			0.96	0.90	0.86	0.82
6			1.00	0.92	0.87	0.83
6½				0.94	0.89	0.85
7				0.96	0.90	0.86
7½				0.98	0.92	0.87
8				1.00	0.94	0.88
8½					0.95	0.90
9					0.97	0.91
9½					0.98	0.92
10					1.00	0.94
10½						0.95
11						0.96
11½						0.97
12						0.99
12½						1.00

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

Spacing Shear (f_s)

Spacing s_{act} (in.)	Size	¼	⅜	½	⅝	¾
	s_{cr}	4	6	8	10	12½
	s_{min}	1½	2¼	3	3¾	4¾
	f_{smin}	1.00	1.00	1.00	1.00	1.00
1½		1.00				
2		1.00				
2¼		1.00	1.00			
2½		1.00	1.00			
3		1.00	1.00	1.00		
3½		1.00	1.00	1.00		
3¾		1.00	1.00	1.00	1.00	
4		1.00	1.00	1.00	1.00	
4½			1.00	1.00	1.00	
4¾			1.00	1.00	1.00	1.00
5			1.00	1.00	1.00	1.00
5½			1.00	1.00	1.00	1.00
6			1.00	1.00	1.00	1.00
6½				1.00	1.00	1.00
7				1.00	1.00	1.00
7½				1.00	1.00	1.00
8				1.00	1.00	1.00
8½					1.00	1.00
9					1.00	1.00
9½					1.00	1.00
10					1.00	1.00
10½						1.00
11						1.00
11½						1.00
12						1.00
12½						1.00

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

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

Drop-In Short / Drop-In Stainless Steel Internally Threaded Anchor (DIA)

Drop-in anchors are internally threaded drop-in expansion anchors for use in flush-mount applications in solid base materials. Available in stainless steel (DIA) or short (DIAS) version. Minimum thread engagement should be equal to the nominal diameter of the threaded insert.

Features

- Lipped edge (DIAS) eliminates need for precisely drilled hole depth
- Hand- and power-setting tools available for fast, easy and economical installation
- Fixed-depth stop bit helps you drill to the correct depth every time
- Short length (DIAS) enables shallow embedment to help avoid drilling into rebar or pre-stressed/post-tensioned cables
- Short drop-in anchors include a setting tool compatible with the anchor to ensure consistent installation

Material: Stainless steel and carbon steel

Coating: Carbon steel; zinc plated

Codes: DOT; Factory Mutual 3017082; Underwriters Laboratories File Ex3605. Meets requirements of Federal Specifications A-A-55614, Type I.

⚠ **Caution:** 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.

Drop-In
Stainless Steel

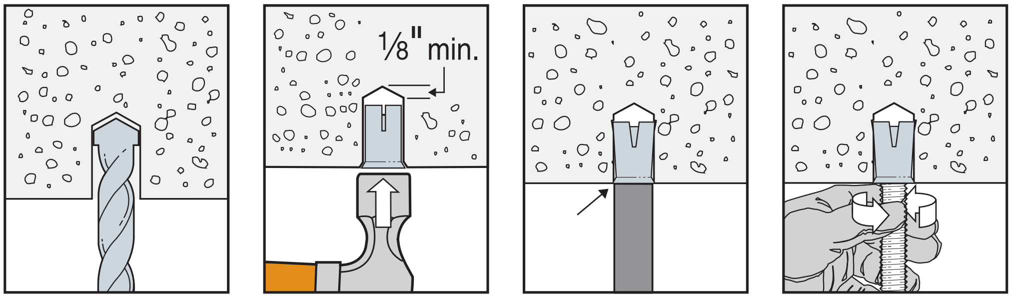
Short
Drop-In

Installation

1. Drill a hole in the base material using the appropriate diameter carbide drill bit as specified in the table. Drill the hole to the specified embedment depth plus ⅛" for flush mounting. Blow the hole clean using compressed air. Overhead installations need not be blown clean.
2. Insert designated anchor into hole. Tap with hammer until flush against surface.
3. Using the designated drop-in setting tool, drive expander plug toward the bottom of the anchor until shoulder of setting tool makes contact with the top of the anchor.
4. Minimum thread engagement should be equal to the nominal diameter of the threaded insert.

⚠ **Caution:** Oversized holes will make it difficult to set the anchor and will reduce the anchor's load capacity.

Installation Sequence



Drop-In Anchor Product Data — Stainless Steel

Rod Size (in.)	Type 303/304 Stainless Model No.	Type 316 Stainless Model No.	Drill Bit Diameter (in.)	Bolt Threads (per in.)	Body Length (in.)	Thread Length (in.)	Quantity	
							Box	Carton
¼	DIA25SS	DIA256SS	⅜	20	1	⅜	100	500
⅜	DIA37SS	DIA376SS	½	16	1⁹⁄₁₆	⅝	50	250
½	DIA50SS	DIA506SS	⅝	13	2	¾	50	200
⅝	DIA62SS	—	⅞	11	2½	1	25	100
¾	DIA75SS	—	1	10	3⅛	1¼	20	80

Drop-In Short / Drop-In Stainless Steel Internally Threaded Anchor (DIA)

Short Drop-In Anchor Product Data

Rod Size (in.)	Model No.	Drill Bit Diameter (in.)	Bolt Threads (per in.)	Body Length (in.)	Thread Length (in.)	Quantity	
						Box	Carton
⅜	DIA37S[1]	½	16	¾	¼	100	500
½	DIA50S[1]	⅝	13	1	5⁄16	50	200

1. A dedicated setting tool is included with each box of DIA37S and DIA50S.

Material Specifications

Anchor Component	Component Material		
	Zinc Plated Carbon Steel	Type 303/304 Stainless Steel	Type 316 Stainless Steel
Anchor Body	Meets minimum 70,000 psi tensile	AISI 303. Meets chemical requirements of ASTM A582	Type 316
Expander Plug	Meets minimum 50,000 psi tensile	AISI 303	Type 316
Thread	UNC/Coil-thread	UNC	UNC

Allowable Tension Loads for Drop-In (Stainless Steel) Anchor in Normal-Weight Concrete

IBC *

Rod Size in. (mm)	Drill Bit Dia. (in.)	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing in. (mm)	Tension Load						
					$f'_c \geq 2,000$ psi (13.8 MPa) Concrete			$f'_c \geq 3,000$ psi (20.7 MPa) Concrete	$f'_c \geq 4,000$ psi (27.6 MPa) Concrete		
					Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)	Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allowable lb. (kN)
¼ (6.4)	⅜	1 (25)	3 (76)	4 (102)	1,400 (6.2)	201 (0.9)	350 (1.6)	405 (1.8)	1,840 (8.2)	451 (2.0)	460 (2.0)
⅜ (9.5)	½	1 9⁄16 (40)	4½ (114)	6 (152)	2,400 (10.7)	251 (1.1)	600 (2.7)	795 (3.5)	3,960 (17.6)	367 (1.6)	990 (4.4)
½ (12.7)	⅝	2 (51)	6 (152)	8 (203)	3,320 (14.8)	372 (1.7)	830 (3.7)	1,178 (5.2)	6,100 (27.1)	422 (1.9)	1,525 (6.8)
⅝ (15.9)	⅞	2½ (64)	7½ (191)	10 (254)	5,040 (22.4)	689 (3.1)	1,260 (5.6)	1,715 (7.6)	8,680 (38.6)	971 (4.3)	2,170 (9.7)
¾ (19.1)	1	3⅛ (79)	9 (229)	12½ (318)	8,160 (36.3)	961 (4.3)	2,040 (9.1)	2,365 (10.5)	10,760 (47.9)	1,696 (7.5)	2,690 (12.0)

See foonotes below.

Allowable Shear Loads for Drop-In (Stainless Steel) Anchor in Normal-Weight Concrete

IBC *

Rod Size in. (mm)	Drill Bit Dia. in.	Embed. Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing in. (mm)	Shear Load				
					$f'_c \geq 2,000$ psi (13.8 MPa) Concrete			$f'_c \geq 3,000$ psi (20.7 MPa) Concrete	$f'_c \geq 4,000$ psi (27.6 MPa) Concrete
					Ultimate lb. (kN)	Std. Dev. lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)
¼ (6.4)	⅜	1 (25)	3½ (89)	4 (102)	1,960 (8.7)	178 (0.8)	490 (2.2)	490 (2.2)	490 (2.2)
⅜ (9.5)	½	1 9⁄16 (40)	5¼ (133)	6 (152)	3,240 (14.4)	351 (1.6)	810 (3.6)	925 (4.1)	1,040 (4.6)
½ (12.7)	⅝	2 (51)	7 (178)	8 (203)	7,000 (31.1)	562 (2.5)	1,750 (7.8)	1,750 (7.8)	1,750 (7.8)
⅝ (15.9)	⅞	2½ (64)	8¾ (222)	10 (254)	11,080 (49.3)	923 (4.1)	2,770 (12.3)	2,770 (12.3)	2,770 (12.3)
¾ (19.1)	1	3⅛ (79)	10½ (267)	12½ (318)	13,800 (61.4)	1,781 (7.9)	3,450 (15.3)	3,725 (16.6)	4,000 (17.8)

1. The allowable loads listed are based on a safety factor of 4.0.
2. Refer to allowable load-adjustment factors for edge distance and spacing on p. 190.
3. Allowable loads may be linearly interpolated between concrete strengths listed.
4. The minimum concrete thickness is 1½ times the embedment depth.

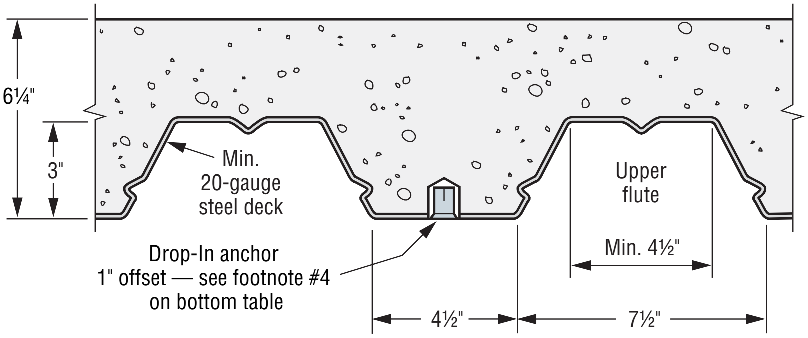
* See p. 13 for an explanation of the load table icons.

Drop-In (DIA) Design Information — Concrete

Allowable Tension and Shear Loads for ⅜" and ½" Short Drop-In Anchor in Sand-Lightweight Concrete Fill over Metal Deck

Model No.	Rod Size (in.)	Drill Bit Dia. (in.)	Emb. Depth (in.)	Tension Critical End Distance (in.)	Shear Critical End Distance (in.)	Critical Spacing (in.)	Install through the Lower Flute or Upper Flute of Metal Deck, f'$_c$ ≥ 3,000 psi Concrete (20.7 MPa)			
							Tension Load		Shear Load	
							Ultimate (lb.)	Allowable (lb.)	Ultimate (lb.)	Allowable (lb.)
DIA37S	⅜	½	¾	6	7	8	1,344	335	1,649	410
DIA50S	½	⅝	1	8	9⅜	10⅝	1,711	430	2,070	515

1. The allowable loads listed are based on a safety factor of 4.0.
2. Allowable loads may not be increased for short-term loading due to wind or seismic forces.
3. Refer to allowable load-adjustment factors for edge distances and spacing on p. 190.
4. Anchors were installed with a 1" offset from the centerline of the flute.



Lightweight Concrete over Metal Deck

Allowable Tension and Shear Loads for ⅜" and ½" Short Drop-In Anchor in Normal-Weight Concrete

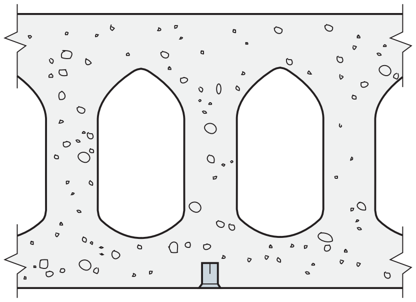
Model No.	Rod Size (in.)	Drill Bit Dia. (in.)	Emb. Depth (in.)	Tension Critical Edge Distance (in.)	Shear Critical Edge Distance (in.)	Critical Spacing (in.)	Normal-Weight Concrete, f'$_c$ ≥ 2500 psi				Normal-Weight Concrete, f'$_c$ ≥ 4,000 psi			
							Tension Load		Shear Load		Tension Load		Shear Load	
							Ultimate (lb.)	Allowable (lb.)	Ultimate (lb.)	Allowable (lb.)	Ultimate (lb.)	Allowable (lb.)	Ultimate (lb.)	Allowable (lb.)
DIA37S	⅜	½	¾	4½	5¼	3	1,500	375	2,274	570	2,170	540	3,482	870
DIA50S	½	⅝	1	6	7	4	2,039	510	3,224	805	3,420	855	5,173	1,295

1. The allowable loads listed are based on a safety factor of 4.0.
2. Allowable loads may not be increased for short-term loading due to wind or seismic forces.
3. Refer to allowable load-adjustment factors for edge distances and spacing on p. 190.
4. Allowable loads may be linearly interpolated between concrete strengths.
5. The minimum concrete thickness is 1½ times the embedment depth.

Allowable Tension and Shear Loads for ⅜" and ½" Short Drop-In Anchor in Hollow-Core Concrete Panel

Model No.	Rod Size (in.)	Drill Bit Dia. (in.)	Emb. Depth (in.)	Tension Critical Edge Distance (in.)	Shear Critical Edge Distance (in.)	Critical Spacing (in.)	Hollow Core Concrete Panel, f'$_c$ ≥ 4,000 psi			
							Tension Load		Shear Load	
							Ultimate (lb.)	Allowable (lb.)	Ultimate (lb.)	Allowable (lb.)
DIA37S	⅜	½	¾	4½	5¼	3	1,860	465	3,308	825
DIA50S	½	⅝	1	6	7	4	2,650	660	4,950	1,235

1. The allowable loads listed are based on a safety factor of 4.0.
2. Allowable loads may not be increased for short-term loading due to wind or seismic forces.
3. Refer to allowable load-adjustment factors for edge distances and spacing on p. 190.
4. Allowable loads may be linearly interpolated between concrete strengths.



Hollow-Core Concrete Panel
(anchor can be installed below web or hollow core)

* See p. 13 for an explanation of the load table icons.

Drop-In (DIA) Design Information — Concrete

Allowable Load-Adjustment Factors for Drop-In (Stainless Steel) and Short Drop-In Anchors in Normal-Weight Concrete: Edge Distance and Spacing, Tension and Shear Loads

How to use these charts:

1. The following tables are for reduced edge distance and spacing.
2. Locate the anchor size to be used for either a tension and/or shear load application.
3. Locate the edge distance (c_{act}) or spacing (s_{act}) at which the anchor is to be installed.
4. The load adjustment factor (f_c or f_s) is the intersection of the row and column.
5. Multiply the allowable load by the applicable load adjustment factor.
6. Reduction factors for multiple edges or spacing are multiplied together.

Edge Distance Tension (f_c) *

Edge Dist. c_{act} (in.)	Size	¼	⅜	½	⅝	¾
	c_{cr}	3	4½	6	7½	9
	c_{min}	1¾	2⅝	3½	4⅜	5¼
	f_{cmin}	0.65	0.65	0.65	0.65	0.65
1¾		0.65				
2		0.72				
2½		0.86				
2⅝		0.90	0.65			
3		1.00	0.72			
3½			0.81	0.65		
4			0.91	0.72		
4⅜			0.98	0.77	0.65	
4½			1.00	0.79	0.66	
5				0.86	0.72	
5¼				0.90	0.75	0.65
5½				0.93	0.78	0.67
6				1.00	0.83	0.72
6½					0.89	0.77
7					0.94	0.81
7½					1.00	0.86
8						0.91
8½						0.95
9						1.00

See notes below.

Edge Distance Shear (f_c) *

Edge Dist. c_{act} (in.)	Size	¼	⅜	½	⅝	¾
	c_{cr}	3½	5¼	7	8¾	10½
	c_{min}	1¾	2⅝	3½	4⅜	5¼
	f_{cmin}	0.45	0.45	0.45	0.45	0.45
1¾		0.45				
2		0.53				
2½		0.69				
2⅝		0.73	0.45			
3		0.84	0.53			
3½		1.00	0.63	0.45		
4			0.74	0.53		
4⅜			0.82	0.59	0.45	
4½			0.84	0.61	0.47	
5			0.95	0.69	0.53	
5¼			1.00	0.73	0.56	0.45
5½				0.76	0.59	0.48
6				0.84	0.65	0.53
6½				0.92	0.72	0.58
7				1.00	0.78	0.63
7½					0.84	0.69
8					0.91	0.74
8½					0.97	0.79
8¾					1.00	0.82
9						0.84
9½						0.90
10						0.95
10½						1.00

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

* See p. 13 for an explanation of the load table icons.

Spacing Tension and Shear (f_s) *

s_{act} (in.)	Size	¼	⅜[9]	⅜	½[10]	½	⅝	¾
	E	1	¾	1½	1	2	2½	3⅛
	s_{cr}	4	3	6	4	8	10	12½
	s_{min}	2	1½	3	2	4	5	6¼
	f_{smin}	0.50	0.50	0.50	0.50	0.50	0.50	0.50
1½			0.50					
2		0.50	0.67		0.50			
2½		0.63	0.83		0.63			
3		0.75	1.00	0.50	0.75			
3½		0.88		0.58	0.88			
4		1.00		0.67	1.00	0.50		
4½				0.75		0.56		
5				0.83		0.63	0.50	
5½				0.92		0.69	0.55	
6				1.00		0.75	0.60	
6¼						0.78	0.63	0.50
7						0.88	0.70	0.56
8						1.00	0.80	0.64
9							0.90	0.72
10							1.00	0.80
11								0.88
12								0.96
12½								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. $f_s = f_{smin} + [(1 - f_{smin}) (s_{act} - s_{min}) / (s_{cr} - s_{min})]$.
9. ⅜" short drop-in (DIA37S).
10. ½" short Drop-in (DIA50S)

Drop-In (DIA) Design Information — Concrete

Allowable Load-Adjustment Factors for Short Drop-in Anchors in Sand-Lightweight Concrete over Metal Deck: Edge Distance and Spacing, Tension and Shear Loads

How to use these charts:

1. The following tables are for reduced edge distance and spacing.
2. Locate the anchor size to be used for either a tension and/or shear load application.
3. Locate the edge distance (c_{act}) or spacing (s_{act}) at which the anchor is to be installed.
4. The load adjustment factor (f_c or f_s) is the intersection of the row and column.
5. Multiply the allowable load by the applicable load adjustment factor.
6. Reduction factors for multiple edges or spacing are multiplied together.

Edge Distance Tension (f_c)

Edge Dist. c_{act} (in.)	Size	3⁄8	1⁄2
	c_{cr}	6	8
	c_{min}	3½	4¾
	f_{cmin}	**0.65**	**0.65**
3½		0.65	
4		0.72	
4½		0.79	
4¾		0.83	0.65
5		0.86	0.68
5½		0.93	0.73
6		1.00	0.78
6½			0.84
7			0.89
7½			0.95
8			1.00

See notes below.

Edge Distance Shear (f_c)

Edge Dist. c_{act} (in.)	Size	3⁄8	1⁄2
	c_{cr}	7	9⅜
	c_{min}	3½	4¾
	f_{cmin}	**0.45**	**0.45**
3½		0.45	
4		0.53	
4½		0.61	
4¾		0.65	0.45
5		0.69	0.48
5½		0.76	0.54
6		0.84	0.60
6½		0.92	0.66
7		1.00	0.72
7½			0.78
8			0.84
8½			0.90
9			0.96
9⅜			1.00

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

Spacing Tension and Shear (f_s)

s_{act} (in.)	Size	3⁄8	1⁄2
	s_{cr}	8	10⅝
	s_{min}	4	5¼
	f_{smin}	**0.50**	**0.50**
4		0.50	
4½		0.56	
5		0.63	
5¼		0.66	0.50
6		0.75	0.57
6½		0.81	0.62
7		0.88	0.66
7½		0.94	0.71
8		1.00	0.76
8½			0.80
9			0.85
9½			0.90
10			0.94
10⅝			1.00

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

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* See p. 13 for an explanation of the load table icons.

Hollow Drop-In Internally Threaded Anchor

The Simpson Strong-Tie® Hollow Drop-In Anchor (HDIA) is an internally threaded, flush-mount expansion anchor for use in hollow materials such as CMU and hollow-core plank, as well as in solid base materials such as brick, normal-weight and lightweight concrete.

Features:

- Suitable for suspending conduit, cable trays, pipe supports, fire sprinklers and suspended lighting into concrete
- Expansion design allows HDIA to anchor into CMU, hollow-core plank, brick, normal-weight concrete and lightweight concrete
- Internally threaded anchor allows for easy bolt removal

Material: Die-cast Zamac 3 alloy shell with carbon-steel cone or 304 stainless-steel cone

Codes: Factory Mutual 3053987 (⅜"–½" diameter)
Underwriters Laboratories EX3605 (⅜"–½" diameter)

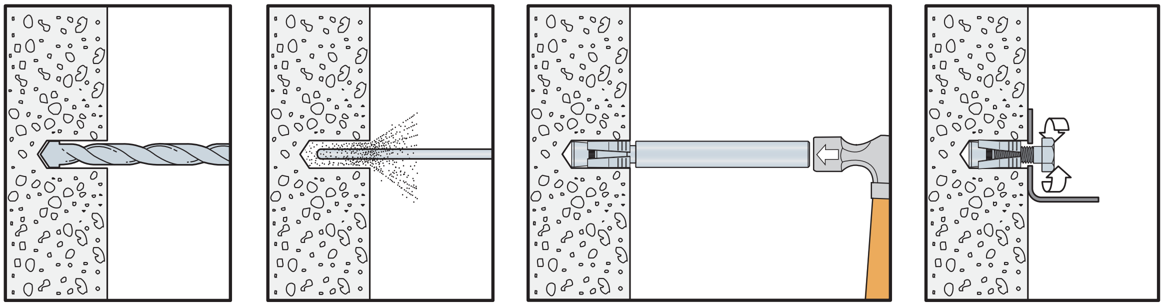
Hollow Drop-In Anchor

Size (in.)	Model No.	Drill Bit Diameter (in.)	Threads (per in.)	Overall Anchor Length (in.)	Quantity	
					Package Qty.	Carton Qty.
¼	HDIA25	⅜	20	¾	100	1,600
¼	HDIA25SS	⅜	20	¾	100	1,600
⁵⁄₁₆	HDIA31	⅝	18	1¼	50	200
⅜	HDIA37	⅝	16	1¼	50	200
⅜	HDIA37SS	⅝	16	1¼	50	200
½	HDIA50	¾	13	1¾	50	200
⅝	HDIA62	1	11	2	25	125

Hollow Drop-In Internally Threaded Anchor

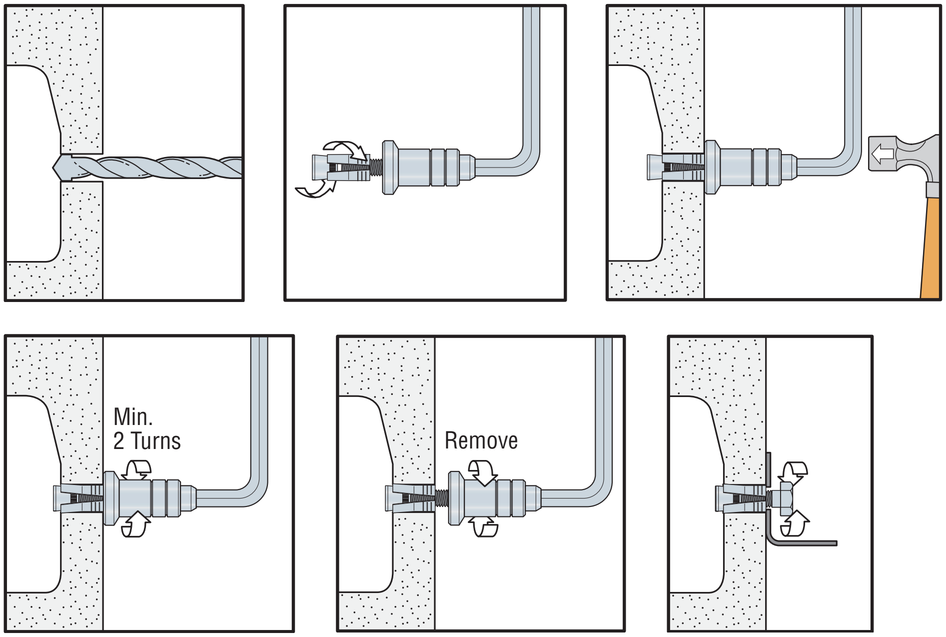
Installation Instructions — Solid Base (using solid setting tool)

- Drill a hole in the base material using the appropriate diameter carbide drill bit as specified in the table. Drill the hole to the specified embedment depth.
- Blow the hole clean using compressed air. Overhead installations need not be blown clean.
- Insert the HDIA into hole. Tap with hammer until flush against surface.
- Using the designated setting tool, drive the anchor to the bottom of the drilled hole. After the anchor reaches the bottom of the drilled hole, perform an additional 3 hammer blows against the setting tool to drive the anchor body over the cone.
- Position fixture; insert fastener and tighten.



Installation Instructions — Hollow Base (using hollow setting tool)

- Drill a hole in the base material using the appropriate diameter carbide drill bit as specified in the table.
- Thread the HDIA onto the designated setting tool for hollow base materials.
- Insert the HDIA into the hole. Tap the setting tool until the face of the tool contacts the surface.
- Rotate the setting tool a minimum of 2 turns to set the anchor.
- Remove the setting tool.
- Position fixture; insert fastener and tighten.



Hollow Drop-In Design Information — Concrete and Masonry

Allowable Tension Loads for Hollow Drop-In Anchor in Normal-Weight Concrete

*

Model No.	Size in. (mm)	Drill Bit Dia. in. (mm)	Embed Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing in. (mm)	Tension Load			
						f'_c ≥ 2,500 psi (17.2 MPa)		f'_c ≥ 4,000 psi (27.6 MPa)	
						Ultimate lb. (kN)	Allowable lb. (kN)	Ultimate lb. (kN)	Allowable lb. (kN)
HDIA25, HDIA25SS	¼ (6.4)	⅜ (9.5)	⅞ (22)	2⅝ (67)	3½ (89)	1,180 (5.2)	295 (1.3)	1,220 (5.4)	305 (1.4)
HDIA31	5⁄16 (7.9)	⅝ (15.9)	1½ (38)	4½ (114)	6 (152)	3,000 (13.3)	750 (3.3)	3,420 (15.2)	855 (3.8)
HDIA37, HDIA37SS	⅜ (9.5)	⅝ (15.9)	1½ (38)	4½ (114)	6 (152)	3,000 (13.3)	750 (3.3)	3,420 (15.2)	855 (3.8)
HDIA50	½ (12.7)	¾ (19.1)	2 (51)	6 (152)	8 (203)	4,260 (18.9)	1,065 (4.7)	5,500 (24.5)	1,375 (6.1)
HDIA62	⅝ (15.9)	1 (25.4)	2¼ (57)	6¾ (171)	9 (229)	6,100 (27.1)	1,525 (6.8)	6,300 (28.0)	1,575 (7.0)

1. The allowable loads listed are based on a safety factor of 4.0.
2. The minimum concrete thickness is 1½ times the embedment depth.
3. Allowable loads may be linearly interpolated between concrete strengths listed.

Allowable Shear Loads for Hollow Drop-In Anchor in Normal-Weight Concrete

*

Model No.	Size in. (mm)	Drill Bit Dia. in. (mm)	Embed Depth in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing in. (mm)	Shear Load Based on Anchor Strength		Shear Load Based on Steel Strength	
						f'_c ≥ 2,500 psi (17.2 MPa)		F1554 Grade 36	A193 Grade B7
						Ultimate lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)
HDIA25, HDIA25SS	¼ (6.4)	⅜ (9.5)	⅞ (22)	2⅝ (67)	3½ (89)	1,840 (8.2)	460 (2.0)	485 (2.2)	1,045 (4.6)
HDIA31	5⁄16 (7.9)	⅝ (15.9)	1½ (38)	4½ (114)	6 (152)	2,660 (11.8)	665 (3.0)	755 (3.4)	1,630 (7.3)
HDIA37, HDIA37SS	⅜ (9.5)	⅝ (15.9)	1½ (38)	4½ (114)	6 (152)	3,580 (15.9)	895 (4.0)	1,085 (4.8)	2,340 (10.4)
HDIA50	½ (12.7)	¾ (19.1)	2 (51)	6 (152)	8 (203)	8,220 (36.6)	2,055 (9.1)	1,930 (8.6)	4,160 (18.5)
HDIA62	⅝ (15.9)	1 (25.4)	2¼ (57)	6¾ (171)	9 (229)	10,180 (45.3)	2,545 (11.3)	3,025 (13.5)	6,520 (29.0)

1. The allowable loads listed are based on a safety factor of 4.0.
2. The minimum concrete thickness is 1½ times the embedment depth.
3. Allowable load must be the lesser of the load based on anchor strength or steel strength.

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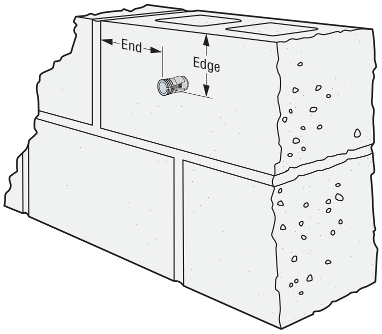
* See p. 13 for an explanation of the load table icons.

Hollow Drop-In Design Information — Concrete and Masonry

Allowable Tension and Shear Loads for Hollow Drop-In Anchor in 8" Lightweight, Medium-Weight and Normal-Weight Hollow CMU

Model No.	Size in. (mm)	Drill Bit Dia. in. (mm)	Embed Depth[4] in. (mm)	Minimum Edge Dist. in. (mm)	Minimum End Dist. in. (mm)	Minimum Spacing in. (mm)	Tension Load		Shear Load	
							Ultimate lb. (kN)	Allowable lb. (kN)	Ultimate lb. (kN)	Allowable lb. (kN)
HDIA25, HDIA25SS	¼ (6.4)	⅜ (9.5)	¾ (19)	4 (102)	4⅝ (117)	8 (203)	500 (2.2)	100 (0.4)	975 (4.3)	195 (0.9)
HDIA31	5⁄16 (7.9)	⅝ (15.9)	1¼ (32)	4 (102)	4⅝ (117)	8 (203)	500 (2.2)	100 (0.4)	1,450 (6.4)	290 (1.3)
HDIA37, HDIA37SS	⅜ (9.5)	⅝ (15.9)	1¼ (32)	4 (102)	4⅝ (117)	8 (203)	500 (2.2)	100 (0.4)	1,450 (6.4)	290 (1.3)
HDIA50	½ (12.7)	¾ (19.1)	1¾ (44)	4 (102)	4⅝ (117)	8 (203)	1,525 (6.8)	305 (1.4)	2,300 (10.2)	460 (2.0)
HDIA62	⅝ (15.9)	1 (25.4)	2 (51)	4 (102)	4⅝ (117)	8 (203)	1,525 (6.8)	305 (1.4)	2,325 (10.3)	465 (2.1)

1. The allowable loads listed are based on a safety factor of 5.0.
2. Values for 8-inch wide lightweight, medium-weight, and normal-weight CMU.
3. The minimum specified compressive strength of masonry, f'_m, at 28 days with a minimum face shell thickness of 1¼" is 1,500 psi.
4. The installed end of the anchor may extend into the CMU cavity depending upon face shell thickness.



Tension and Shear Loads for Hollow Drop-In Anchor in Hollow-Core Concrete Panel

Model No.	Size in. (mm)	Drill Bit Dia. in. (mm)	Embed Depth[4] in. (mm)	Critical Edge Dist. in. (mm)	Critical Spacing in. (mm)	Tension Load		Shear Load Based on Anchor Strength		Shear Load Based on Steel Strength of Threaded Rod	
						$f'_c \geq$ 5,000 psi (34.5 Mpa)		$f'_c \geq$ 5,000 psi (34.5 MPa)		F1554 Grade 36	A193 Grade B7
						Ultimate lb. (kN)	Allowable lb. (kN)	Ultimate lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)
HDIA25, HDIA25SS	¼ (6.4)	⅜ (9.5)	¾ (19)	3 (76)	4½ (114)	1,340 (6.0)	335 (1.5)	2,040 (9.1)	510 (2.3)	485 (2.2)	1,045 (4.6)
HDIA31	5⁄16 (7.9)	⅝ (15.9)	1¼ (32)	5 (127)	7½ (191)	1,820 (8.1)	455 (2.0)	3,240 (14.4)	810 (3.6)	755 (3.4)	1,630 (7.3)
HDIA37, HDIA37SS	⅜ (9.5)	⅝ (15.9)	1¼ (32)	5 (127)	7½ (191)	1,820 (8.1)	455 (2.0)	4,560 (20.3)	1,140 (5.1)	1,085 (4.8)	2,340 (10.4)
HDIA50	½ (12.7)	¾ (19.1)	1¾ (44)	7 (178)	10½ (267)	2,840 (12.6)	710 (3.2)	5,820 (25.9)	1,455 (6.5)	1,930 (8.6)	4,160 (18.5)
HDIA62	⅝ (15.9)	1 (25.4)	2 (51)	8 (203)	12 (305)	2,980 (13.3)	745 (3.3)	8,700 (38.7)	2,175 (9.7)	3,025 (13.5)	6,520 (29.0)

1. The allowable loads listed are based on a safety factor of 4.0.
2. The minimum concrete cover over the open cores is 1¼".
3. The minimum specified compressive strength of the concrete used in the hollow-core panel, f'_c, is 5,000 psi (34.5 MPa).
4. The installed end of the anchor may extend into the panel cavity depending upon face shell thickness.

* See p. 13 for an explanation of the load table icons.

Zinc Nailon™ Pin Drive Anchors

Zinc Nailon anchors are low-cost, easy-to-install anchors for applications under static loads.

Features

- Available with carbon and stainless-steel pins
- Pin and head configuration designed to make anchor tamper-resistant

Materials

- Body — Die-cast Zamac 3 alloy
- Pin — Carbon steel; Type 304 stainless steel

Code: Meets Federal Specification A-A-1925A, Type 1

Installation

⚠ **Caution:** Not for use in overhead applications.

⚠ **Caution:** Nailon anchors are not recommended for eccentric tension (prying) loads — capacity will be greatly reduced in such applications

1. Drill a hole in base material using a carbide drill bit the same diameter as the nominal diameter of the anchor to be installed. Drill the hole to specified embedment depth, plus ¼" for pin extension, and blow hole clean using compressed air. Alternatively, drill the hole deep enough to accommodate embedment depth and dust from drilling.
2. Position fixture and insert Nailon anchor.
3. Tap with hammer until flush with fixture, then drive pin until flush with top of head.

Zinc Nailon Anchor
(Mushroom)

Zinc Nailon Product Data

Size (in.)	Carbon Steel Pin Model No.	Stainless Steel Pin Model No.	Quantity		
			Box	Carton	Bulk
³⁄₁₆ x ⅞	ZN18078	—	100	1,600	3,000
¼ x ¾	ZN25034	ZN25034SS	100	500	2,000
¼ x 1	ZN25100	ZN25100SS	100	500	1,500
¼ x 1¼	ZN25114	ZN25114SS	100	500	1,500
¼ x 1½	ZN25112	ZN25112SS	100	500	1,000
¼ x 2	ZN25200	ZN25200SS	100	400	1,000
¼ x 2½	ZN25212	ZN25212SS	100	400	1,000
¼ x 3	ZN25300	ZN25300SS	100	400	1,000

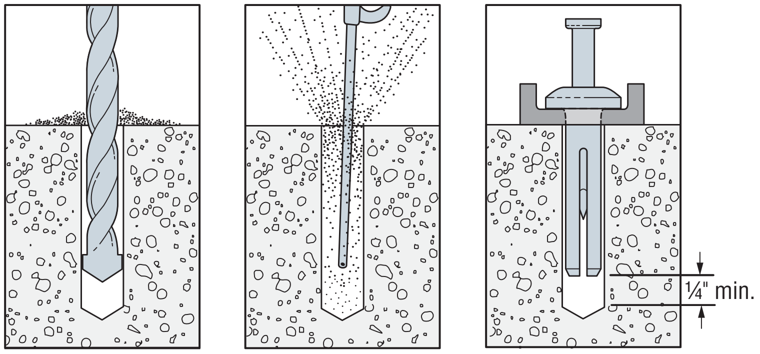
Allowable Tension and Shear Loads for Zinc Nailon in Normal-Weight Concrete

IBC *

Size (in.)	Drill Bit Dia. (in.)	Embed. Depth (in.)	Ultimate Loads (lb.)		Allowable Loads (lb.)[1]	
			f'*c* ≥ 3,000 psi		f'*c* ≥ 3,000 psi	
			Tension	Shear	Tension	Shear
³⁄₁₆	³⁄₁₆	⅝	460	465	115	115
¼	¼	⅝	590	635	150	160
		¾	780	765	195	190
		1½	1,050	1,050	265	265

1. The allowable loads are based on a safety factor of 4.0.

Installation Sequence



* See p. 13 for an explanation of the load table icons.

Crimp Drive® Anchor

The crimp anchor is an easy-to-install expansion anchor for use in concrete and grout-filled block. The pre-formed curvature along the shaft creates an expansion mechanism that secures the anchor in place and eliminates the need for a secondary tightening procedure. This speeds up anchor installation and reduces the overall cost.

Five crimp anchor head styles are available to handle different applications that include fastening wood or light-gauge steel, attaching concrete formwork, hanging overhead support for sprinkler pipes or suspended ceiling panels.

Material: Carbon steel, stainless steel

Coating: Zinc plated and mechanically galvanized

Codes: Factory Mutual 3031136 for the ⅜" Rod Coupler.

Head Styles: Mushroom, rod coupler, countersunk, tie-wire and duplex

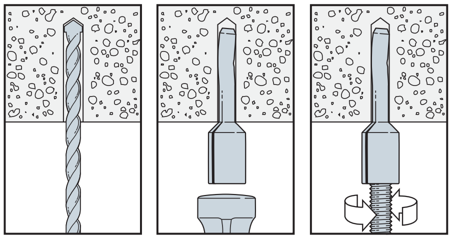
Installation

Warning: Industry studies show that hardened fasteners can experience performance problems in wet or corrosive environments. Accordingly, with the exception of the duplex anchor, use these products in dry, interior and non-corrosive environments only.

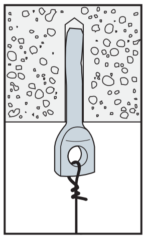
1. Drill a hole using the specified diameter carbide bit into the base material to a depth of at least ½" deeper than the required embedment.
2. Blow the hole clean of dust and debris using compressed air. Overhead application need not be blown clean. Where a fixture is used, drive the anchor through the fixture into the hole until the head sits flush against the fixture.
3. Be sure the anchor is driven to the required embedment depth. The rod coupler and tie-wire models should be driven in until the head is seated against the surface of the base material.

Installation Sequence

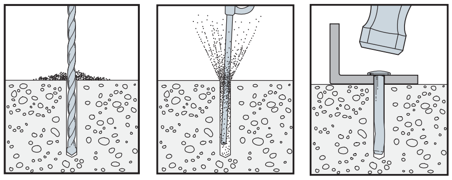
Rod Coupler



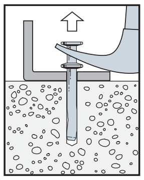
Tie-Wire



Mushroom Head

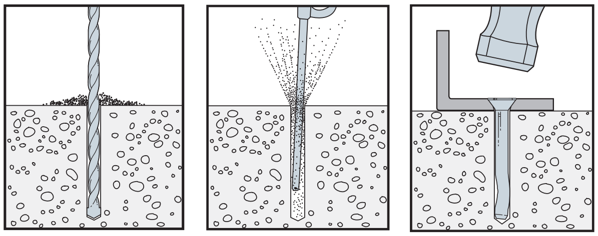


Duplex



Duplex-head anchor may be removed with a claw hammer

Countersunk Head Installation Sequence



Mushroom Head

Rod Coupler

Countersunk Head

Tie-Wire

Duplex

Crimp Drive® Anchor

Crimp Drive Anchor Product Data

Size (in.)	Model No.	Head Style/ Finish	Drill Bit Dia. (in.)	Min. Fixture Hole Size	Min. Embed. (in.)	Quantity	
						Pkg. Qty.	Carton Qty.
³⁄₁₆ x 1¼	CD18114M	Mushroom Head / Zinc Plated	³⁄₁₆	¼	⅞	100	1,600
³⁄₁₆ x 2	CD18200M				1¼	100	500
³⁄₁₆ x 2½	CD18212M				1¼	100	500
³⁄₁₆ x 3	CD18300M				1¼	100	500
³⁄₁₆ x 3½	CD18312M				1¼	100	500
³⁄₁₆ x 4	CD18400M				1¼	100	500
¼ x 1	CD25100M		¼	⁵⁄₁₆	⅞	100	1,600
¼ x 1¼	CD25114M				⅞	100	1,600
¼ x 1½	CD25112M				1¼	100	1,600
¼ x 2	CD25200M				1¼	100	500
¼ x 2½	CD25212M				1¼	100	500
¼ x 3	CD25300M				1¼	100	500
¼ x 3½	CD25312M				1¼	100	500
¼ x 4	CD25400M				1¼	100	500
⅜ x 2	CD37200M		⅜	⁷⁄₁₆	1¾	25	125
⅜ x 3	CD37300M				1¾	25	125
¼ x 3	CD25300MG	Mushroom Head / Mechanically Galvanized	¼	⁵⁄₁₆	1¼	100	500
¼" rod coupler	CD25114RC	Rod Coupler / Zinc Plated	³⁄₁₆	N/A	1¼	100	500
⅜" rod coupler	CD37112RC		¼	N/A	1½	50	250
³⁄₁₆ x 2½	CD18212C	Countersunk Head / Zinc Plated	³⁄₁₆	¼	1¼	100	500
³⁄₁₆ x 3	CD18300C				1¼	100	500
³⁄₁₆ x 4	CD18400C				1¼	100	500
¼ x 1½	CD25112C		¼	⁵⁄₁₆	1¼	100	500
¼ x 2	CD25200C				1¼	100	500
¼ x 2½	CD25212C				1¼	100	500
¼ x 3	CD25300C				1¼	100	500
¼ x 3½	CD25312C				1¼	100	400
¼ x 4	CD25400C				1¼	100	400
¼ x 3	CD25300CMG	Countersunk Head / Mechanically Galvanized[1]	¼	⁵⁄₁₆	1¼	100	500
¼ x 4	CD25400CMG				1¼	100	400
¼" Tie Wire	CD25118T	Tie Wire/Zinc Plated	¼	N/A	1⅛	100	500
¼" duplex	CD25234D	Duplex Head/Zinc Plated	¼	⁵⁄₁₆	1¼	100	500

1. Mechanical galvanizing meets ASTM B695, Class 55, Type 1. Intended for some pressure-treated wood sill plate applications. Not for use in other corrosive or outdoor environments. See p. 248 for details.

Length Identification Head Marks on Mushroom, Countersunk and Duplex-Head Crimp Drive Anchors (corresponds to length of anchor — inches)

Mark	□	A	B	C	D	E	F
From	1	1½	2	2½	3	3½	4
Up To But Not Including	1½	2	2½	3	3½	4	4½

Crimp Drive® Design Information — Concrete

Carbon-Steel Crimp Drive Allowable Tension and Shear Loads in Normal-Weight Concrete

*

Size (in.)	Drill Bit Diameter (in.)	Embed. Depth (in.)	Minimum Spacing (in.)	Minimum Edge Distance (in.)	Tension Load		Shear Load	
					$f'_c \geq$ 2,000 psi Concrete	$f'_c \geq$ 4,000 psi Concrete	$f'_c \geq$ 2,000 psi Concrete	$f'_c \geq$ 4,000 psi Concrete
					Allowable Load (lb.)	Allowable Load (lb.)	Allowable Load (lb.)	Allowable Load (lb.)
Mushroom/Countersunk Head								
³⁄₁₆	³⁄₁₆	1¼	3	3	145	250	340	450
¼	¼	1¼	3	3	175	275	395	610
⅜	⅜	1¾	4	4	365	780	755	1,305
Duplex Head								
¼	¼	1¼	3	3	175	275	395	610
Tie Wire								
¼	¼	1⅛	3	3	155	215	265	325
Rod Coupler[4]								
¼	³⁄₁₆	1¼	3	3	145	250	—	—
⅜	¼	1½	4	4	265	600	—	—

1. The allowable loads listed are based on a safety factor of 4.0.
2. The minimum concrete thickness is 1½ times the embedment depth.
3. Allowable loads may be linearly interpolated between concrete strengths listed.
4. For rod coupler, mechanical and plumbing design codes may prescribe lower allowable loads; verify with local codes.

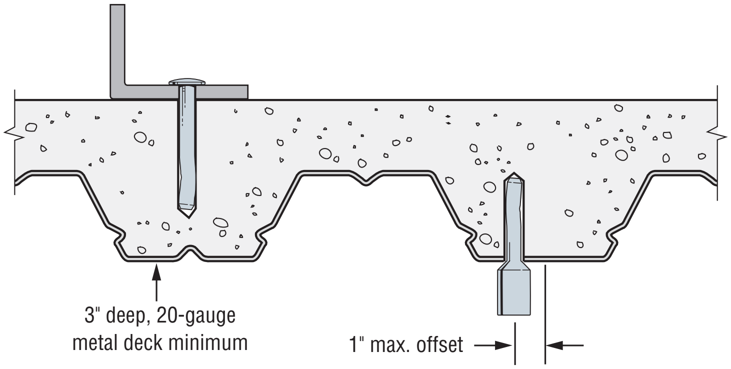
* See p. 13 for an explanation of the load table icons.

Crimp Drive® Design Information — Concrete

Carbon-Steel Crimp Drive Allowable Tension and Shear Loads in Sand-Lightweight Concrete over Metal Deck

Size (in.)	Drill Bit Diameter (in.)	Embed. Depth (in.)	Minimum Spacing (in.)	Minimum Edge Distance (in.)	Tension Load (Install in Concrete)	Tension Load (Install through Metal Deck)	Shear Load (Install in Concrete)	Shear Load (Install through Metal Deck)
					$f'_c \geq$ 3,000 psi Concrete	$f'_c \geq$ 3,000 psi Concrete	$f'_c \geq$ 3,000 psi Concrete	$f'_c \geq$ 3,000 psi Concrete
					Allowable Load (lb.)	Allowable Load (lb.)	Allowable Load (lb.)	Allowable Load (lb.)
Mushroom/Countersunk Head								
3⁄16	3⁄16	1¼	4	4	115	85	345	600
¼	¼	1¼	4	4	145	130	375	890
⅜	⅜	1¾	5½	5½	315	330	1,030	1,085
Duplex Head								
¼	¼	1¼	4	4	145	130	375	890
Tie Wire								
¼	¼	1⅛	3	3	130	90	275	210
Rod Coupler[4]								
¼	3⁄16	1¼	4	4	115	85	–	–
⅜	¼	1½	5	5	300	280	–	–

1. The allowable loads listed are based on a safety factor of 4.0.
2. The minimum concrete thickness is 1½ times the embedment depth.
3. Anchors may be installed off-center in the flute, up to 1" from the center of flute.
4. Anchor may be installed in either upper or lower flute.
5. Deck profile shall be 3" deep, 20-gauge minimum.
6. For rod coupler, mechanical and plumbing design codes may prescribe lower allowable loads; verify with local codes.



Sand-Lightweight Concrete on Metal Deck

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* See p. 13 for an explanation of the load table icons.

CSD/DSD Split-Drive Anchors

The Split-Drive anchor is a one-piece expansion anchor that can be installed in concrete, grout-filled block and stone. As the anchor is driven in, the split-type expansion mechanism on the working end compresses and exerts force against the walls of the hole.

Features

- Available in countersunk (CSD) and duplex-head (DSD) styles
- DSD anchor can be removed with a claw hammer for temporary applications

Material: Carbon steel

Coating: Zinc plated; mechanically galvanized

Installation

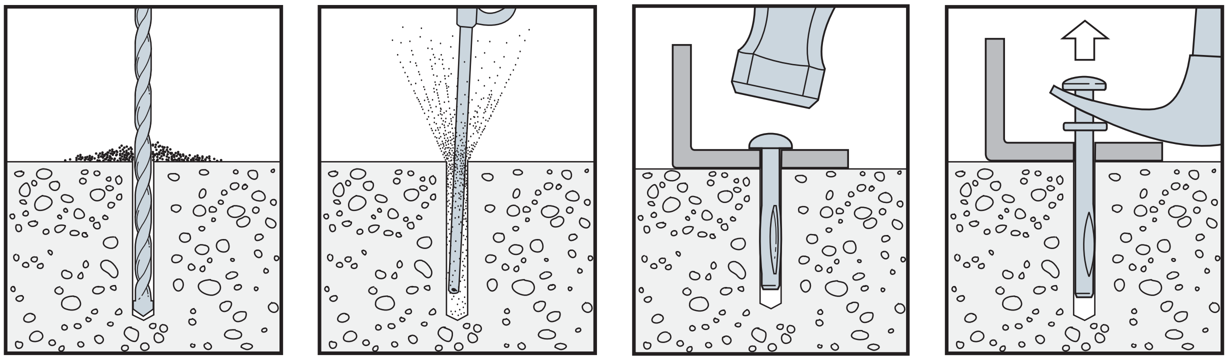
⚠ **Warning (CSD only):** Industry studies show that hardened fasteners can experience performance problems in wet or corrosive environments. Accordingly, use these products in dry, interior and non-corrosive environments only.

⚠ **Caution:** Oversized holes in the base material will greatly reduce the anchor's load capacity. For CSD, embedment depths greater than 1½" may cause bending during installation.

1. Drill a hole in base material using a ¼"-diameter carbide-tipped drill. Drill hole to specified embedment depth and blow clean using compressed air. (Overhead installation need not be blown clean.) Alternatively, drill hole deep enough to accommodate embedment depth and dust from drilling. Position fixture and insert split-drive anchor through fixture hole.
2. For CSD, ⅜"-diameter fixture hole is recommended for hard fixtures such as steel. For DSD, 5⁄16"-diameter fixture hole is recommended.
3. Drive anchor until head is flush against fixture.

DSD *(duplex)* **CSD** *(countersunk)*

Installation Sequence



DSD anchor may be removed with a claw hammer

CSD/DSD Split-Drive Anchors

CSD/DSD Product Data

Size (in.)	Model No.	Head Style/Finish	Drill Bit Diameter (in.)	Quantity	
				Box	Carton
¼ x 1½	CSD25112	Countersunk Head – Zinc Plated	¼	100	500
¼ x 2	CSD25200			100	500
¼ x 2½	CSD25212			100	500
¼ x 3	CSD25300			100	400
¼ x 3½	CSD25312			100	400
¼ x 4	CSD25400			100	400
¼ x 3	CSD25300MG	Countersunk Head – Mechanically Galvanized[1]	¼	100	400
¼ x 4	CSD25400MG			100	400
¼ x 3	DSD25300	Duplex Head – Zinc Plated	¼	100	400

1. Mechanical galvanizing meets ASTM B695, Class 55, Type 1. Intended for some preservative-treated wood sill plate applications. Not for use in other corrosive or outdoor environments. See p. 248 for details.

CSD Allowable Tension and Shear Loads in Normal-Weight Concrete

Size (in.)	Drill Bit Diameter (in.)	Embed. Depth (in.)	Minimum Spacing (in.)	Minimum Edge Distance (in.)	Tension Load (lb.)		Shear Load (lb.)	
					$f'_c \geq$ 2,000 psi		$f'_c \geq$ 2,000 psi	
					Ultimate Load	Allowable Load	Ultimate Load	Allowable Load
¼	¼	1¼	2½	3	655	165	970	240

DSD Allowable Tension and Shear Loads in Normal-Weight Concrete

Size (in.)	Drill Bit Diameter (in.)	Embed. Depth (in.)	Minimum Spacing (in.)	Minimum Edge Distance (in.)	Concrete Compressive Strength (psi)	Tension Load (lb.)		Shear Load (lb.)	
						Ultimate Load	Allowable Load	Ultimate Load	Allowable Load
¼	¼	1¼	2½	3	2,500	800	200	2,480	620
¼	¼	1¼	2½	3	4,000	1,060	265	2,740	685

* See p. 13 for an explanation of the load table icons.

FlipToggle® Anchor

The FlipToggle is a single-strap hollow-wall anchor. Its unique design securely holds the toggle for easy insertion into the predrilled hole. Once inserted, the spring tab flips the toggle into the right position so that when the collar is tightened the anchor is ready for the bolt. No jammed toggles, broken straps or misaligned bolts.

Features

- Installs into drywall and hollow CMU up to 2⅛" thick with a 2½" bolt
- Bolt sizes: ³⁄₁₆"–24 thread and ¼"–20 thread
- Simple one-strap design holds toggle perfectly aligned for easy bolt insertion
- This collar ensures centered bolt placement in the hole and does not embed the bolt into the drywall, eliminating the potential for sagging fixtures

NEW

FlipToggle Product Data with Bolts

Bolt Thread	Bolt Length (in.)	Model No.	Parts Per Each/Unit	Pack*	Carton
Clamshell					
³⁄₁₆"–24	2½	FT18250C2	2	5 clamshells	10 packs / 50 clamshells
¼"–20	2½	FT25250C2	2	5 clamshells	10 packs / 50 clamshells
³⁄₁₆"–24	2½	FT18250C10	10	5 clamshells	10 packs / 50 clamshells
¼"–20	2½	FT25250C10	10	5 clamshells	10 packs / 50 clamshells
³⁄₁₆"–24	2½	FT18250C25	25	—	5 clamshells
¼"–20	2½	FT25250C25	25	—	5 clamshells
Retail Box					
³⁄₁₆"–24	2½	FT18250R100	100	—	5 retail boxes
¼"–20	2½	FT25250R100	100	—	5 retail boxes

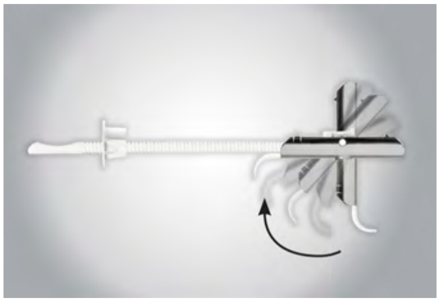
* Distributer to order in full pack quanitities

FlipToggle Product Data — No Bolts

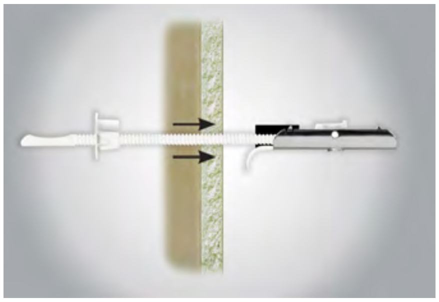
Size	Model No.	Parts Per Each/Unit	Carton
Retail Box			
³⁄₁₆"–24	FT18NBR50	50	10 retail boxes
¼"–20	FT25NBR50	50	10 retail boxes
³⁄₁₆"–24	FT18NBR100	100	5 retail boxes
¼"–20	FT25NBR100	100	5 retail boxes

FlipToggle® Anchor

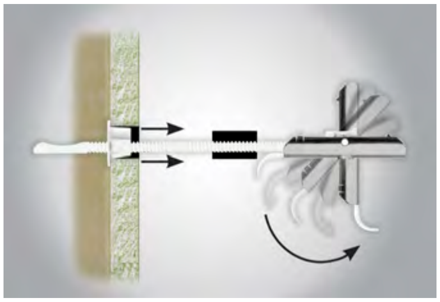
FlipToggle installs in four easy steps: fold, insert, flip and tighten — it's that quick!



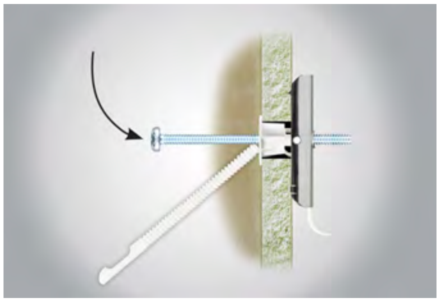
1. Drill a ½" hole. Flip the head of the FlipToggle to align with strap.



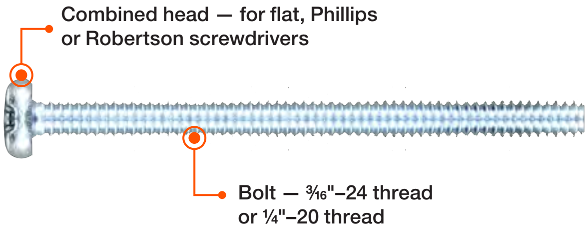
2. Insert the FlipToggle into the drilled hole. When the head is fully inserted, pull the strap to flip the toggle flat against the back of the wall.

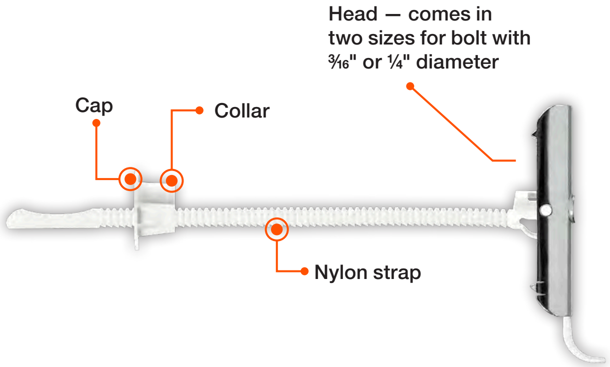


3. Push the collar into the drilled hole until the cap is flush with the wall. Hold the cap against the wall while pulling the strap toward you until it feels reasonably tight.



4. Snap off strap flush with collar. Insert the bolt through the fixture into the anchor and tighten securely.





FlipToggle Loads

IBC *

Material	Size	Drill Size	Tension Loads (lb.)	
			Ultimate	Safe
Drywall ½"	3/16"–24	½"	178	89
	¼"–20	½"	181	90
Drywall ⅝"	3/16"–24	½"	294	147
	¼"–20	½"	299	149
Hollow Block	3/16"–24	½"	807	403
	¼"–20	½"	1,030	515

Safe tension loads listed are based on a safety factor of 2.0.
Due to variation in base material, a higher safety factor may be applied.

* See p. 13 for an explanation of the load table icons.

Sure Wall Drywall Anchor

Sure Wall anchors are self-drilling drywall anchors and provide excellent holding value and greater capacity than screws alone. This anchor cuts threads into drywall, greatly increasing the bearing surface and strength of the fastening.

Features

- Self-drilling — may be installed in gypsum board drywall with only a screwdriver
- Easy to remove and reinstall

Material: Die-cast zinc or reinforced nylon

Sure Wall Nylon

Sure Wall Zinc

Sure Wall Product Data

Screw Size	Model No.		Style	Quantity		Applications
	Packaged with Screws	Packaged without Screws		Box	Carton	
#6 x ⅞	SWN06S-R100	SWN06-R100	Nylon	100	500	⅜", ½" drywall, ceiling tile
#8 x 1¼	SWN08LS-R100	SWN08L-R100	Nylon	100	500	⅜", ½" drywall, ceiling tile
#6 x ⅞	SWZ06S-R100	SWZ06-R100	Zinc	100	500	⅜", ½" drywall, ceiling tile, plaster, pegboard
#8 x 1¼	SWZ08LS-R100	SWZ08L-R100	Zinc	100	500	⅜", ½", ⅝" drywall, plaster

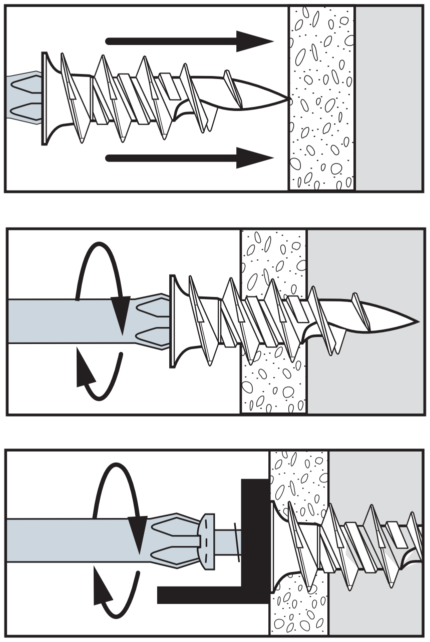
Sure Wall Tension and Shear Loads in ½" Drywall

IBC *

Model No.	Screw Size	Allowable Loads	
		Tension (lb.)	Shear (lb.)
SWN06S	#6	10	30
SWN08LS	#8	10	50
SWZ06S	#6	10	30
SWZ08LS	#8	10	50

1. The allowable loads are baswed on a safety factor of 4.0.
2. The allowable loads listed are based on single anchor tests.
3. The performance of multiple anchors spaced closely together has not been investigated.

Installation Sequence



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* See p. 13 for an explanation of the load table icons.

Direct Fastening Solutions

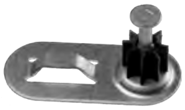
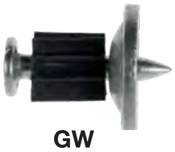
Powder-Actuated Tool / Fastener Suitability

This matrix matches Simpson Strong-Tie powder-actuated tools with the fasteners typically used with each tool.

Fasteners		General-Purpose Tools		
		PT-27 	PT-22A-RB 	PT-22HA-RB 
0.300"-Headed Fasteners with 0.157" Shank Diameter				
PDPA-XXX		Max. 2½"	Max. 2½"	Max. 2½"
PDPAWL-XXX		✓	Max. 2½"	Max. 2½"
PDPWL-XXXSS		✓	Max. 2½"	Max. 2½"
PDPAS-XXX				
PDPAT-XXX		✓	✓	✓
PCLDPA-XXX		✓	✓	✓
PECLDPA-XXX		✓	✓	✓
PTRHA3-XXX		✓	✓	✓
0.300"-Headed Fasteners with 0.145" Shank Diameter				
PINW-XXX		✓	✓	✓
PINWP-XXX		Max. 2½"	Max. 2½"	Max. 2½"
PHBC-XXX		✓	✓	✓
PCC-XXX		✓	✓	✓
PBXDP-100		✓	✓	✓
8 mm-Headed Fasteners				
PKP-250		✓	✓	✓
⅜"-Headed Fasteners / Threaded Studs				
PSLV3-XXX				

See **strongtie.com** for more tool and fastener product information.

Gas Tool / Fastener Suitability

Gas Tool GCN-MEP	
Fuel Cell GFCXX	
0.106"-Diameter Shank Pins GDP U.S. Patent 605,016	
0.118"- / 0.102"-Diameter Stepped-Shank Pins GDPS	
Spiral Knurl Pins GDPSK	
Mechanical Electrical Plumbing Pins	 **GRH**  **GCL**  **GCT**  **GTS**  **GCC**  **GAC**  **GW**  **GTH**

See Product Guide and **strongtie.com** for additional information.

Gas- and Powder-Actuated Fasteners Design Information – Concrete

Powder-Actuated and Gas-Actuated Fasteners — Allowable Tension Loads in Normal-Weight Concrete

IBC *

Direct Fastening Type	Model No.	Shank Diameter in. (mm)	Minimum Penetration in. (mm)	Minimum Edge Distance in. (mm)	Minimum Spacing in. (mm)	Allowable Tension Load — lb. (kN)					
						f'_c ≥ 2,000 psi (13.8 MPa) Concrete	f'_c ≥ 2,500 psi (17.2 MPa) Concrete	f'_c ≥ 3,000 psi (20.7 MPa) Concrete	f'_c ≥ 4,000 psi (27.6 MPa) Concrete	f'_c ≥ 5,000 psi (34.5 MPa) Concrete	f'_c ≥ 6,000 psi (41.3 MPa) Concrete
Powder Actuated	PDPA PDPAT PDPAWL	**0.157** (4.0)	¾ (19)	**3.5** (89)	**5** (127)	—	**110** (0.49)	**110** (0.49)	**110** (0.49)	—	**110** (0.49)
			1 (25)	**3.5** (89)	**5** (127)	—	**210** (0.93)	**240** (1.07)	**310** (1.38)	—	**160** (0.71)
			1¼ (32)	**3.5** (89)	**5** (127)	—	**320** (1.42)	**340** (1.51)	**380** (1.69)	—	**365** (1.62)
			1½ (38)	**3.5** (89)	**5** (127)	—	**375** (1.67)	**400** (1.78)	**450** (2.00)	—	**465** (2.07)
	PINW PINWP	**0.145** (3.7)	1 (25)	**3** (76)	**4** (102)	**45** (0.20)	**70** (0.31)	**100** (0.44)	**150** (0.67)	—	**150** (0.67)
			1¼ (32)	**3** (76)	**4** (102)	**140** (0.62)	**195** (0.87)	**255** (1.13)	**370** (1.65)	—	**370** (1.65)
	PDPWL-SS		1 (25)	**3** (76)	**4** (102)	**60** (0.27)	—	—	—	—	—
	PSLV3	**0.205** (5.2)	1¼ (32)	**4** (102)	**6** (152)	—	**260** (1.16)	—	—	—	—
Gas Actuated	GDP	**0.106** (2.7)	⅝ (16)	**3** (76)	**4** (102)	**25** (0.11)	**25** (0.11)	**30** (0.13)	**45** (0.20)	**45** (0.20)	—
			¾ (19)	**3** (76)	**4** (102)	**30** (0.13)	**30** (0.13)	**30** (0.13)	**30** (0.13)	**30** (0.13)	—
	GW-75 GW-100 GTH	**0.125** (3.2)	⅝ (16)	**3** (76)	**4** (102)	**60** (0.27)	**65** (0.29)	**70** (0.31)	**95** (0.42)	—	—
			¾ (19)	**3** (76)	**4** (102)	**85** (0.38)	**95** (0.42)	**105** (0.47)	**190** (0.85)	—	—

1. The fasteners must not be driven until the concrete has reached the designated minimum compressive strength.
2. Minimum concrete thickness must be three times the fastener embedment into the concrete.
3. The allowable tension values are only for the fastener in the concrete. Members connected to the concrete must be investigated in accordance with accepted design criteria.
4. The allowable load values listed are for static load conditions. Refer to ICC-ES ESR-2138 and ESR-2811 code reports for seismic load conditions.

Powder-Actuated and Gas-Actuated Fasteners — Allowable Shear Loads in Normal-Weight Concrete

IBC *

Direct Fastening Type	Model No.	Shank Diameter in. (mm)	Minimum Penetration in. (mm)	Minimum Edge Distance in. (mm)	Minimum Spacing in. (mm)	Allowable Shear Load — lb. (kN)					
						f'_c ≥ 2,000 psi (13.8 MPa) Concrete	f'_c ≥ 2,500 psi (17.2 MPa) Concrete	f'_c ≥ 3,000 psi (20.7 MPa) Concrete	f'_c ≥ 4,000 psi (27.6 MPa) Concrete	f'_c ≥ 5,000 psi (34.5 MPa) Concrete	f'_c ≥ 6,000 psi (41.3 MPa) Concrete
Powder Actuated	PDPA PDPAT PDPAWL	**0.157** (4.0)	¾ (19)	**3.5** (89)	**5** (127)	—	**120** (0.53)	**125** (0.56)	**135** (0.60)	—	**130** (0.58)
			1 (25)	**3.5** (89)	**5** (127)	—	**285** (1.27)	**290** (1.29)	**310** (1.38)	—	**350** (1.56)
			1¼ (32)	**3.5** (89)	**5** (127)	—	**360** (1.60)	**380** (1.69)	**420** (1.87)	—	**390** (1.73)
			1½ (38)	**3.5** (89)	**5** (127)	—	**405** (1.80)	**430** (1.91)	**485** (2.16)	—	**495** (2.20)
	PINW PINWP	**0.145** (3.7)	1 (25)	**3** (76)	**4** (102)	**120** (0.53)	**140** (0.62)	**165** (0.73)	**205** (0.91)	—	**205** (0.91)
			1¼ (32)	**3** (76)	**4** (102)	**265** (1.18)	**265** (1.18)	**265** (1.18)	**265** (1.18)	—	**265** (1.18)
	PDPWL-SS		1 (25)	**3** (76)	**4** (102)	**195** (0.87)	—	—	—	—	—
Gas Actuated	GDP	**0.106** (2.7)	⅝ (16)	**3** (76)	**4** (102)	**25** (0.11)	**25** (0.11)	**25** (0.11)	**25** (0.11)	**25** (0.11)	—
			¾ (19)	**3** (76)	**4** (102)	**45** (0.20)	**50** (0.22)	**55** (0.24)	**75** (0.33)	**75** (0.33)	—
	GW-75 GW-100 GTH	**0.125** (3.2)	⅝ (16)	**3** (76)	**4** (102)	**55** (0.24)	**60** (0.27)	**65** (0.29)	**95** (0.42)	—	—
			¾ (19)	**3** (76)	**4** (102)	**120** (0.53)	**135** (0.60)	**145** (0.64)	**215** (0.96)	—	—

1. The fasteners must not be driven until the concrete has reached the designated minimum compressive strength.
2. Minimum concrete thickness must be three times the fastener embedment into the concrete.
3. The allowable shear values are only for the fastener in the concrete. Members connected to the concrete must be investigated in accordance with accepted design criteria.
4. The allowable load values listed are for static load conditions. Refer to ICC-ES ESR-2138 and ESR-2811 code reports for seismic load conditions.

* See p. 13 for an explanation of the load table icons.

Powder-Actuated and Gas-Actuated Assemblies — Allowable Tension Loads in Normal-Weight Concrete

IBC *

Direct Fastening Type	Model No.	Shank Diameter in. (mm)	Minimum Penetration in. (mm)	Minimum Edge Distance in. (mm)	Minimum Spacing in. (mm)	Allowable Tension Load — lb. (kN)					
						f'c ≥ 2,000 psi (13.8 MPa) Concrete	f'c ≥ 2,500 psi (17.2 MPa) Concrete	f'c ≥ 3,000 psi (20.7 MPa) Concrete	f'c ≥ 4,000 psi (27.6 MPa) Concrete	f'c ≥ 5,000 psi (34.5 MPa) Concrete	f'c ≥ 6,000 psi (41.3 MPa) Concrete
Powder Actuated	PCLDPA	**0.157** (4.0)	¾ (19)	**3.5** (89)	**5** (102)	**70** (0.31)	—	—	**120** (0.53)	—	**130** (0.58)
			1 (25)	**3.5** (89)	**5** (102)	**175** (0.78)	—	—	**180** (0.80)	—	**190** (0.85)
			1¼ (32)	**3.5** (89)	**5** (102)	**210** (0.93)	—	—	**210** (0.93)	—	**190** (0.85)
	PECLDPA	**0.157** (4.0)	⅞ (22)	**3.5** (89)	**5** (102)	**90** (0.40)	—	—	**110** (0.49)	—	**85** (0.38)
			1 (25)	**3.5** (89)	**5** (102)	**180** (0.80)	—	—	**155** (0.69)	—	**180** (0.80)
	PTRHA3 PTRHA4	**0.157** (4.0)	**1** (25)	**3.5** (89)	**5** (102)	**180** (0.80)	—	—	**190** (0.85)	—	**180** (0.80)
			1¼ (32)	**3.5** (89)	**5** (102)	**185** (0.82)	—	—	**220** (0.98)	—	**190** (0.85)
Gas Actuated	GRH25 GRH37	**0.125** (3.2)	¾ (19)	**3** (76)	**4** (102)	—	**85** (0.38)	**115** (0.51)	**160** (0.71)	**165** (0.73)	**165** (0.73)
	GAC	**0.125** (3.2)	¾ (19)	**3** (76)	**4** (102)	—	**105** (0.47)	**120** (0.53)	**150** (0.67)	**170** (0.76)	**195** (0.87)

1. The fasteners must not be driven until the concrete has reached the designated minimum compressive strength.
2. Minimum concrete thickness must be three times the fastener embedment into the concrete.
3. The allowable tension values are only for the fastener in the concrete. Members connected to the concrete must be investigated in accordance with accepted design criteria.
4. The allowable load values listed are for static load conditions. Refer to ICC-ES ESR-2138 and ESR-2811 code reports for seismic load conditions.

Powder-Actuated and Gas-Actuated Assemblies — Allowable Oblique Loads in Normal-Weight Concrete

IBC *

Direct Fastening Type	Model No.	Shank Diameter in. (mm)	Minimum Penetration in. (mm)	Minimum Edge Distance in. (mm)	Minimum Spacing in. (mm)	Allowable Oblique Load — lb. (kN)					
						f'c ≥ 2,000 psi (13.8 MPa) Concrete	f'c ≥ 2,500 psi (17.2 MPa) Concrete	f'c ≥ 3,000 psi (20.7 MPa) Concrete	f'c ≥ 4,000 psi (27.6 MPa) Concrete	f'c ≥ 5,000 psi (34.5 MPa) Concrete	f'c ≥ 6,000 psi (41.3 MPa) Concrete
Powder Actuated	PCLDPA	**0.157** (4.0)	¾ (19)	**3.5** (89)	**5** (102)	**115** (0.51)	—	—	**105** (0.47)	—	**140** (0.62)
			1 (25)	**3.5** (89)	**5** (102)	**255** (1.13)	—	—	**240** (1.07)	—	**245** (1.09)
			1¼ (32)	**3.5** (89)	**5** (102)	**250** (1.11)	—	—	**265** (1.18)	—	**265** (1.18)
	PECLDPA	**0.157** (4.0)	⅞ (22)	**3.5** (89)	**5** (102)	**135** (0.60)	—	—	**130** (0.58)	—	**115** (0.51)
			1 (25)	**3.5** (89)	**5** (102)	**225** (1.00)	—	—	**230** (1.02)	—	**255** (1.13)
Gas Actuated	GAC	**0.125** (3.2)	¾ (19)	**3** (76)	**4** (102)	—	**130** (0.58)	**135** (0.60)	**145** (0.64)	**155** (0.69)	**175** (0.78)

1. The fasteners must not be driven until the concrete has reached the designated minimum compressive strength.
2. Minimum concrete thickness must be three times the fastener embedment into the concrete.
3. The allowable oblique values are only for the fastener in the concrete. Members connected to the concrete must be investigated in accordance with accepted design criteria.
4. Oblique load direction is 45° from the concrete member surface.
5. The allowable load values listed are for static load conditions. Refer to ICC-ES ESR-2138 and ESR-2811 code reports for seismic load conditions.

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* See p. 13 for an explanation of the load table icons.

Powder-Actuated Fasteners — Allowable Tension and Shear Loads for Attachment of Wood Sill Plates to Normal-Weight Concrete

IBC *

Direct Fastening Type	Model No.	Overall Length in. (mm)	Nominal Head Diameter in. (mm)	Shank Diameter in. (mm)	Washer Thickness in. (mm)	Washer Bearing Area in.^{2} (mm^2)	$f'_c \geq$ 2,500 psi (17.2 MPa)	
							Allowable Tension Load lb. (kN)	Allowable Shear Load lb. (kN)
Powder Actuated	PDPAWL-287 PDPAWL-287MG	**2⅞** (73)	**0.300** (7.6)	**0.157** (4.0)	**0.070** (1.8)	**0.767** (495)	**200** (0.89)	**205** (0.91)

1. The fasteners must not be driven until the concrete has reached the designated minimum compressive strength.
2. Minimum concrete thickness must be three times the fastener embedment into the concrete.
3. The allowable tension and shear values are only for the fastener in the concrete. Members connected to the concrete must be investigated in accordance with accepted design criteria.
4. Minimum concrete edge distance is 1¾ inches.
5. Only mechanically galvanized fasteners may be used to attach preservative-treated wood to concrete.
6. Minimum spacing shall be 4" on center.
7. The allowable load values listed are for static load conditions. Refer to ICC-ES ESR-2138 code report for seismic load conditions.

Spacing of Powder-Actuated Fasteners for Attachment of Wood Sill Plates to Normal-Weight Concrete

IBC *

Direct Fastening Type	Model No.	Overall Length in. (mm)	Nominal Head Diameter in. (mm)	Shank Diameter in. (mm)	Maximum Spacing in. (mm)
					Interior Nonstructural Walls[2]
Powder Actuated	PDPAWL-287[3] PDPAWL-287MG[3]	**2⅞** (73)	**0.300** (7.6)	**0.157** (4.0)	**48** (1,219)

1. Spacings are based upon the attachment of 2-inch (nominal thickness) wood sill plates, with specific gravity of 0.50 or greater, to concrete floor slabs or footings.
2. All walls shall have fasteners placed at 6 inches from ends of sill plates, with maximum spacing as shown in the table.
3. Fasteners shall not be driven until the concrete has reached a compressive strength of 2,500 psi. Minimum edge distance is 1¾ inches.
4. The maximum horizontal transverse load on the wall shall be 5 psf.
5. The maximum wall height shall be 14 feet.
6. For exterior walls and interior structural walls, this table is not applicable and allowable loads must be used .
7. Walls shall be laterally supported at the top and the bottom.
8. Minimum spacing shall be 4" on center.
9. Only mechanically galvanized fasteners may be used to attach preservative-treated wood to concrete.

* See p. 13 for an explanation of the load table icons.

Powder-Actuated and Gas-Actuated Fasteners — Allowable Tension Loads in Sand-Lightweight Concrete over Metal Deck

IBC LW*

Direct Fastening Type	Model No.	Shank Diameter in. (mm)	Minimum Penetration in. (mm)	Allowable Tension Load — lb. (kN)				
				Installed in Concrete[4]	Installed Thru. 3" "W" Deck with 3¼" Concrete Fill[5]	Installed Thru. 3" "W" Deck with 2¼" Concrete Fill[6]	Installed Thru. 1.5" "B" Deck with 2¼" Concrete Fill[7]	Installed Thru. 1.5" "B" Deck with 2" Concrete Fill[8]
				$f'_c \geq$ 3,000 psi (20.7 MPa) Concrete				
Powder Actuated	PDPA PDPAT PDPAWL	**0.157** (4.0)	**¾** (19)	**85** (0.38)	**105** (0.47)	—	—	**160** (0.71)
			1 (25)	**150** (0.67)	**145** (0.64)	—	—	**210** (0.93)
			1¼ (32)	**320** (1.42)	**170** (0.76)	—	—	**265** (1.18)
			1½ (38)	**385** (1.71)	**325** (1.45)	—	—	—
	PINW PINWP	**0.145** (3.7)	**⅞** (22)	**85** (0.38)	**40** (0.18)	—	—	—
	PSLV3	**0.205** (5.2)	**1¼** (32)	—	**225** (1.00)	—	—	—
Gas Actuated	GDP	**0.106** (2.7)	**⅝** (16)	**75** (0.33)	—	**60** (0.27)	**65** (0.29)	—
			¾ (19)	**105** (0.47)	—	**60** (0.27)	**130** (0.58)	—
	GW-75 GW-100 GTH	**0.125** (3.2)	**⅝** (16)	**60** (0.27)	—	**35** (0.16)	—	—
			¾ (19)	**115** (0.51)	—	**55** (0.24)	—	—

1. The fastener shall not be driven until the concrete has reached the designated compressive strength.
2. The allowable tension values are for the fastener only. Members connected to the concrete must be invegisated separately in accordance with accepted design criteria.
3. Metal deck must be minimum 20 gauge and have a minimum yield strength of 38,000 psi.
4. The minimum fastener spacing is 4". The minimum edge distances are 3½" and 3" for powder-actuated fasteners and gas-actuated fasteners, respectively.
5. The fastener shall be installed minimum 1½" from the edge of flute and 4" from the end of the deck. The minimum fastener spacing is 4".
6. The fastener shall be installed minimum 1" from the edge of flute and 3" from the end of the deck. The minimum fastener spacing is 4". For GW and GTH fasteners, the fastener must be a minimum of 1⅛" from the edge of flute.
7. The fastener shall be installed minimum ⅞" from the edge of flute. For inverted 1.5" "B" deck configuration, the fastener must be a minimum of 1" from the edge of flute. Fastener must be installed miminim 3" from the end of the deck. The minimum fastener spacing is 4".
8. The fastener shall be installed minimum ⅞" from the edge of flute and 4" from the end of the deck. The minimum fastener spacing is 4".
9. The allowable load values listed are for static load conditions. Refer to ICC-ES ESR-2138 and ESR-2811 code reports for seismic load conditions.

* See p. 13 for an explanation of the load table icons.

Powder-Actuated and Gas-Actuated Fasteners — Allowable Shear Loads in Sand-Lightweight Concrete over Metal Deck

Direct Fastening Type	Model No.	Shank Diameter in. (mm)	Minimum Penetration in. (mm)	Allowable Shear Load — lb. (kN)				
				Installed in Concrete[9]	Installed Thru. 3" "W" Deck with 3¼" Concrete Fill[5]	Installed Thru. 3" "W" Deck with 2¼" Concrete Fill[6]	Installed Thru. 1.5" "B" Deck with 2¼" Concrete Fill[7]	Installed Thru. 1.5" "B" Deck with 2" Concrete Fill[8]
				$f'_c \geq$ 3,000 psi (20.7 MPa) Concrete				
Powder Actuated	PDPA PDPAT PDPAWL	**0.157** (4.0)	¾ (19)	**105** (0.47)	**280** (1.25)	—	—	**275** (1.22)
			1 (25)	**225** (1.00)	**280** (1.25)	—	—	**370** (1.65)
			1¼ (32)	**420** (1.87)	**320** (1.42)	—	—	**460** (2.05)
			1½ (38)	**455** (2.02)	**520** (2.31)	—	—	—
	PINW PINWP	**0.145** (3.7)	⅞ (22)	**250** (1.11)	**275** (1.22)	—	—	—
	PSLV3	**0.205** (5.2)	1¼ (32)	—	**225** (1.00)	—	—	—
Gas Actuated	GDP	**0.106** (2.7)	⅝ (16)	**35** (0.16)	—	**180** (0.80)	**195** (0.87)	—
			¾ (19)	**140** (0.62)	—	**180** (0.80)	**270** (1.20)	—
	GW-75 GW-100 GTH	**0.125** (3.2)	⅝ (16)	**110** (0.49)	—	**215** (0.96)	—	—
			¾ (19)	**130** (0.58)	—	**235** (1.05)	—	—

1. The fastener shall not be driven until the concrete has reached the designated compressive strength.
2. The allowable shear values are for the fastener only. Members connected to the concrete must be invesigated separately in accordance with accepted design criteria.
3. Metal deck must be minimum 20 gauge and have a minimum yield strength of 38,000 psi.
4. Shear values are for loads applied toward edge of flute.
5. The fastener shall be installed minimum 1½" from the edge of flute and 4" from the end of the deck. The minimum fastener spacing is 4".
6. The fastener shall be installed minimum 1" from the edge of flute and 3" from the end of the deck. The minimum fastener spacing is 4". For GW and GTH fasteners, the fastener must be a minimum of 1⅛" from the edge of flute.
7. The fastener shall be installed minimum ⅞" from the edge of flute. For inverted 1.5" "B" deck configuration, the fastener must be a minimum of 1" from the edge of flute. Fastener must be installed miminim 3" from the end of the deck. The minimum fastener spacing is 4".
8. The fastener shall be installed minimum ⅞" from the edge of flute and 4" from the end of the deck. The minimum fastener spacing is 4".
9. The minimum fastener spacing is 4". The minimum edge distances are 3½" and 3" for powder-actuated fasteners and gas-actuated fasteners, respectively.
10. The allowable load values listed are for static load conditions. Refer to ICC-ES ESR-2138 and ESR-2811 code reports for seismic load conditions.

* See p. 13 for an explanation of the load table icons.

Powder-Actuated and Gas-Actuated Assemblies – Allowable Tension Loads in Sand-Lightweight Concrete over Metal Deck

IBC *

Direct Fastening Type	Model No.	Shank Diameter in. (mm)	Minimum Penetration in. (mm)	Allowable Tension Load — lb. (kN)			
				Installed Thru. 3" "W" Deck with 2½" Concrete Fill[4]	Installed Thru. 3" "W" Deck with 2¼" Concrete Fill[5]	Installed Thru. 1.5" "B" Deck with 2¼" Concrete Fill[6]	Installed Thru. 1.5" "B" Deck with 2" Concrete Fill[7]
				$f'_c \geq$ 3,000 psi (20.7 MPa) Concrete			
Powder Actuated	PTRHA3 PTRHA4	**0.157** (4.0)	1 (25)	**160** (0.71)	—	—	**175** (0.78)
			1¼ (32)	**160** (0.71)	—	—	**175** (0.78)
	PCLDPA	**0.157** (4.0)	¾ (19)	**115** (0.51)	—	—	**60** (0.27)
			1 (25)	**140** (0.62)	—	—	**160** (0.71)
			1¼ (32)	**160** (0.71)	—	—	**180** (0.80)
	PECDLPA	**0.157** (4.0)	⅞ (22)	**80** (0.36)	—	—	**95** (0.40)
			1 (25)	**120** (0.53)	—	—	**135** (0.60)
Gas Actuated	GRH25 GRH37	**0.125** (3.2)	¾ (19)	—	**95** (0.42)	**95** (0.42)	—
	GAC	**0.125** (3.2)	¾ (19)	—	**105** (0.47)	**90** (0.40)	—

1. The fastener shall not be driven until the concrete has reached the designated compressive strength.
2. The allowable tension values are for the fastener only. Members connected to the concrete must be invesigated separately in accordance with accepted design criteria.
3. Metal deck must be minimum 20 gauge and have a minimum yield strength of 38,000 psi.
4. The fastener shall be installed minimum 1½" from the edge of flute and 4" from the end of the deck. The minimum fastener spacing is 4".
5. The fastener shall be installed minimum 1" from the edge of flute and 3" from the end of the deck. The minimum fastener spacing is 4".
6. The fastener shall be installed minimum ⅞" from the edge of flute and 3" from the end of the deck. The minimum fastener spacing is 4".
7. The fastener shall be installed minimum ⅞" from the edge of flute and 4" from the end of the deck. The minimum fastener spacing is 4".
8. The allowable load values listed are for static load conditions. Refer to ICC-ES ESR-2138 and ESR-2811 code reports for seismic load conditions.

Powder-Actuated and Gas-Actuated Assemblies – Allowable Oblique Loads in Sand-Lightweight Concrete over Metal Deck

IBC *

Direct Fastening Type	Model No.	Shank Diameter in. (mm)	Minimum Penetration in. (mm)	Allowable Oblique Load — lb. (kN)			
				Installed Thru. 3" "W" Deck with 2½" Concrete Fill[4]	Installed Thru. 3" "W" Deck with 2¼" Concrete Fill[5]	Installed Thru. 1.5" "B" Deck with 2¼" Concrete Fill[6]	Installed Thru. 1.5" "B" Deck with 2" Concrete Fill[7]
				$f'_c \geq$ 3,000 psi (20.7 MPa) Concrete			
Powder Actuated	PCLDPA	**0.157** (4.0)	¾ (19)	**155** (0.69)	—	—	**175** (0.78)
			1 (25)	**175** (0.78)	—	—	**240** (1.07)
			1¼ (32)	**185** (0.82)	—	—	**280** (1.25)
	PECDLPA	**0.157** (4.0)	⅞ (22)	**110** (0.49)	—	—	**110** (0.49)
			1 (25)	**145** (0.64)	—	—	**175** (0.78)
Gas Actuated	GAC	**0.125** (3.2)	¾ (19)	—	**120** (0.53)	**90** (0.40)	—

1. The fastener shall not be driven until the concrete has reached the designated compressive strength.
2. The allowable oblique values are for the fastener only. Members connected to the concrete must be invesigated separately in accordance with accepted design criteria.
3. Metal deck must be minimum 20 gauge and have a minimum yield strength of 38,000 psi.
4. The fastener shall be installed minimum 1½" from the edge of flute and 4" from the end of the deck. The minimum fastener spacing is 4".
5. The fastener shall be installed minimum 1" from the edge of flute and 3" from the end of the deck. The minimum fastener spacing is 4".
6. The fastener shall be installed minimum ⅞" from the edge of flute and 3" from the end of the deck. The minimum fastener spacing is 4".
7. The fastener shall be installed minimum ⅞" from the edge of flute and 4" from the end of the deck. The minimum fastener spacing is 4".
8. Oblique load direction is 45° from the concrete member surface.
9. The allowable load values listed are for static load conditions. Refer to ICC-ES ESR-2138 and ESR-2811 code reports for seismic load conditions.

* See p. 13 for an explanation of the load table icons.

Gas- and Powder-Actuated Fasteners Design Information – CMU

Powder-Actuated and Gas-Actuated Fasteners — Allowable Tension and Shear Loads in Hollow and Grout-Filled CMU[4,5,8]

IBC *

Direct Fastening Type	Model No.	Shank Diameter in. (mm)	Minimum Penetration in. (mm)	Minimum Edge Distance in. (mm)	8-inch Hollow CMU		8-inch Grout-Filled CMU	
					Tension Load	Shear Load	Tension Load	Shear Load
					Allowable lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)	Allowable lb. (kN)
Powder Actuated	PDPA PDPAT PDPAWL	**0.157** (4.0)	**1¾** (44)	**3½** (89)	**125**[1] (0.56)	**210**[1] (0.93)	**190**[3] (0.85)	**245**[3] (1.09)
	PINW PINWP	**0.145** (3.7)	**1¾** (44)	**3½** (89)	**110**[1] (0.49)	**200**[1] (0.89)	—	—
Gas Actuated	GDP	**0.106** (2.7)	**⅝** (16)	**3** (76)	**35**[1] (0.16)	**50**[1] (0.22)	—	—
	GW-75 GW-100 GTH	**0.125** 3.2)	**⅝** (16)	**3** (76)	**55**[2] (0.24)	**65**[2] (0.29)	—	—

1. Allowable values for fasteners in hollow lightweight concrete masonry units conforming to ASTM C90.
2. Allowable values for fasteners in hollow medium-weight concrete masonry units conforming to ASTM C90.
3. Allowable values for fasteners in grout-filled lightweight concrete masonry units conforming to ASTM C90 with coarse grout confroming to ASTM C746.
4. The minimum allowable nominal size of the CMU must be 8 inches high by 8 inches wider by 16" long, with a minimum 1 ¼"-thick face shell thickness.
5. Allowable values are for fasteners installed in the center of a CMU face shell. See Figure 1 for the applicable placement zone. Only one fastener may be installed at each cell.
6. Minimum penetration is measured from the outside face of the CMU.
7. Allowable values are for the fastener only. Members connected to the CMU must be investigated separately in accordance with accepted design criteria.
8. The allowable load values listed are for static load conditions. Refer to ICC-ES ESR-2138 and ESR-2811 code reports for seismic load conditions.

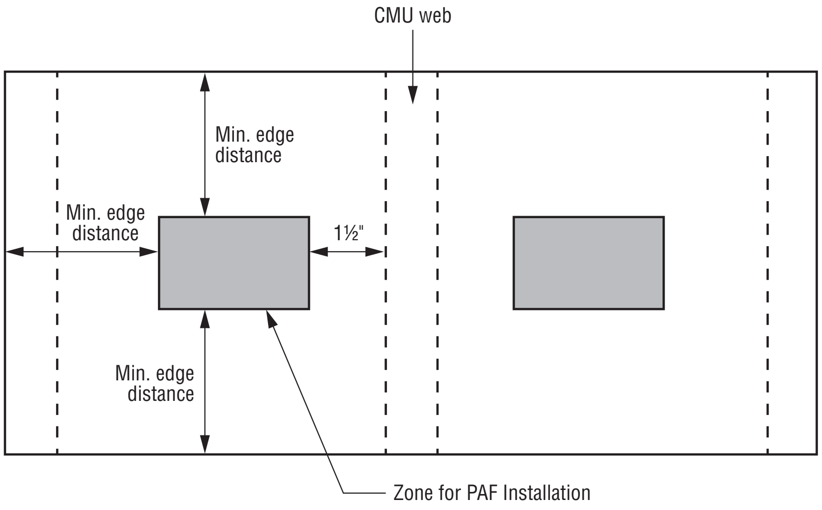


Figure 1. Zone for fastener installation in face shell of CMU

* See p. 13 for an explanation of the load table icons.

Gas- and Powder-Actuated Fasteners Design Information – Steel

Powder-Actuated and Gas-Actuated Fasteners — Allowable Tension Loads in Steel[1]

Direct Fastening Type	Model No.	Shank Diameter[10] in. (mm)	Minimum Edge Distance in. (mm)	Minimum Spacing in. (mm)	Minimum Steel Strength[3]	Allowable Tension Load — lb. (kN)					
						⅛"-Thick Steel	³⁄₁₆"-Thick Steel	¼"-Thick Steel	⅜"-Thick Steel	½"-Thick Steel	¾"-Thick Steel
Powder Actuated	PDPA PDPAT PDPAWL	**0.157** (4.0)	**0.5** (13)	**1** (25)	ASTM A36	—	**260** (1.16)	**370** (1.65)	**380**[7] (1.69)	**530**[7] (2.36)	**195**[4] (0.87)
			0.5 (13)	**1** (25)	ASTM A572 Gr. 50 or ASTM A992	—	**305** (1.36)	**335** (1.49)	**355**[7] (1.58)	**485**[5] (2.16)	**170**[6] (0.76)
	PINW PINWP	**0.145** (3.7)	**0.5** (13)	**1** (25)	ASTM A36	—	**155** (0.69)	—	—	—	—
	PSLV3 Smooth shank	**0.205** (5.2)	**1** (25)	**1½** (38)	ASTM A36	—	**270** (1.20)	**680** (3.02)	—	—	—
	PSLV3-12575K Knurled shank	**0.205** (5.2)	**1** (25)	**1½** (38)	ASTM A36	—	**270** (1.20)	**870** (3.87)	—	—	—
Gas Actuated	GDP	**0.106** (2.7)	**0.5** (13)	**1** (25)	ASTM A36	**125** (0.56)	**210** (0.93)	**220** (0.98)	—	—	—
			0.5 (13)	**1** (25)	ASTM A572 Gr. 50 or ASTM A992	—	**225** (1.00)	**185** (0.82)	—	—	—
	GDPS	**0.118/0.102** (3.0/2.6)	**0.5** (13)	**1** (25)	ASTM A36	—	**95** (0.42)	**170** (0.76)	**165**[8] (0.73)	**145**[8] (0.64)	—
			0.5 (13)	**1** (25)	ASTM A572 Gr. 50 or ASTM A992	—	**110** (0.49)	**170** (0.76)	**155**[8] (0.69)	—	—
	GW-50	**0.128/0.110** (3.3/2.8)	**0.5** (13)	**1** (25)	ASTM A36	—	**225** (1.00)	**275** (1.22)	**245**[9] (1.09)	—	—
			0.5 (13)	**1** (25)	ASTM A572 Gr. 50 or ASTM A992	—	**240** (1.07)	**215**[9] (0.96)	**280**[9] (1.25)	—	—

1. The entire pointed portion of the fastener must penetrate through the steel to obtain the tabulated values, unless otherwise indicated.
2. The allowable tension values are for the fastener only. Members connected to the steel must be investigated separately in accordance with accepted design criteria.
3. Steel strength must comply with the minimum requirements of ASTM A 36 (F_y = 36 ksi, F_u = 58 ksi), ASTM A 572, Grade 50 (F_y = 50 ksi, F_u = 65 ksi), or ASTM A992 (F_y = 50 ksi, F_u = 65 ksi).
4. Based upon minimum penetration depth of 0.46" (11.7 mm).
5. Based upon minimum penetration depth of 0.58" (14.7 mm).
6. Based upon minimum penetration depth of 0.36" (9.1 mm).
7. The fastener must be driven to where the point of the fastener penetrates through the steel.
8. Based upon minimum penetration depth of 0.35" (8.9 mm).
9. Based upon minimum penetration depth of 0.25" (6.4 mm).
10. For stepped shank fasteners: (Diameter of shank above the step)/(Diameter of shank below the step.)
11. The allowable load values listed are for static load conditions. Refer to ICC-ES ESR-2138 and ESR-2811 code reports for seismic load conditions.

* See p. 13 for an explanation of the load table icons.

Gas- and Powder-Actuated Fasteners Design Information – Steel

Powder-Actuated and Gas-Actuated Fasteners — Allowable Shear Loads in Steel[1]

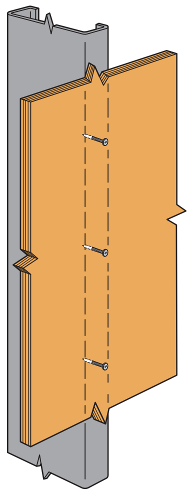
Direct Fastening Type	Model No.	Shank Diameter[10] in. (mm)	Minimum Edge Distance in. (mm)	Minimum Spacing in. (mm)	Minimum Steel Strength[3]	Allowable Shear Load — lb. (kN)					
						1/8"-Thick Steel	3/16"-Thick Steel	1/4"-Thick Steel	3/8"-Thick Steel	1/2"-Thick Steel	3/4"-Thick Steel
Powder Actuated	PDPA, PDPAT, PDPAWL	**0.157** (4.0)	**0.5** (13)	**1** (25)	ASTM A36	—	**410** (1.82)	**365** (1.62)	**385**[7] (1.71)	**385**[7] (1.71)	**325**[4] (1.45)
					ASTM A572 Gr. 50 or ASTM A992	—	**420** (1.87)	**365** (1.62)	**290**[7] (1.29)	**275**[7] (1.22)	**275**[7] (1.22)
	PINW PINWP	**0.145** (3.7)	**0.5** (13)	**1** (25)	ASTM A36	—	**395** (1.76)	—	—	—	—
	PSLV3 Smooth shank	**0.205** (5.2)	**1** (25)	**1½** (38)	ASTM A36	—	**770** (3.43)	**1,120** (4.98)	—	—	—
	PSLV3-12575K Knurled shank	**0.205** (5.2)	**1** (25)	**1½** (38)	ASTM A36	—	**930** (4.14)	**1,130** (5.03)	—	—	—
Gas Actuated	GDP	**0.106** (2.7)	**0.5** (13)	**1** (25)	ASTM A36	**285** (1.27)	**225** (1.00)	**205** (0.91)	—	—	—
			0.5 (13)	**1** (25)	ASTM A572 Gr. 50 or ASTM A992	—	**250** (1.11)	**145** (0.64)	—	—	—
	GDPS	**0.118/0.102** (3.0/2.6)	**0.5** (13)	**1** (25)	ASTM A36	—	**180** (0.80)	**265** (1.18)	**225**[8] (1.00)	**225**[8] (1.00)	—
			0.5 (13)	**1** (25)	ASTM A572 Gr. 50 or ASTM A992	—	**205** (0.91)	**305** (1.36)	**205**[8] (0.91)	—	—
	GW-50	**0.128/0.110** (3.3/2.8)	**0.5** (13)	**1** (25)	ASTM A36	—	**400** (1.78)	**345** (1.53)	**310**[9] (1.38)	—	—
			0.5 (13)	**1** (25)	ASTM A572 Gr. 50 or ASTM A992	—	**380** (1.69)	**325**[9] (1.45)	**350**[9] (1.56)	—	—

1. The entire pointed portion of the fastener must penetrate through the steel to obtain the tabulated values, unless otherwise indicated.
2. The allowable shear values are for the fastener only. Members connected to the steel must be investigated separately in accordance with accepted design criteria.
3. Steel strength must comply with the minimum requirements of ASTM A 36 (F_y = 36 ksi, F_u = 58 ksi), ASTM A 572, Grade 50 (F_y = 50 ksi, F_u = 65 ksi), or ASTM A992 (F_y = 50 ksi, F_u = 65 ksi).
4. Based upon minimum penetration depth of 0.46" (11.7 mm).
5. Based upon minimum penetration depth of 0.58" (14.7 mm).
6. Based upon minimum penetration depth of 0.36" (9.1 mm).
7. The fastener must be driven to where the point of the fastener penetrates through the steel.
8. Based upon minimum penetration depth of 0.35" (8.9 mm).
9. Based upon minimum penetration depth of 0.25" (6.4 mm).
10. For stepped shank fasteners: (Diameter of shank above the step)/(Diameter of shank below the step).
11. The allowable load values listed are for static load conditions. Refer to ICC-ES ESR-2138 and ESR-2811 code reports for seismic load conditions.

Spiral Knurl Pin Allowable Tension and Shear Loads in Cold-Formed Steel Studs, 33 ksi Minimum Yield Strength

Model No.	Shank Diameter in. (mm)	Minimum Edge Dist. in. (mm)	Minimum Spacing in. (mm)	Designation Thickness mil (gauge)	Allowable Loads	
					Tension lb. (kN)	Shear lb. (kN)
GDPSK-138	**0.109** (2.8)	**13/16** (2.1)	**4** (102)	**33** (20)	**30** (0.13)	**70** (0.31)
				43 (18)	**48** (0.21)	**89** (0.40)
				54 (16)	**92** (0.41)	**150** (0.67)
				68 (14)	**73** (0.32)	**218** (0.97)

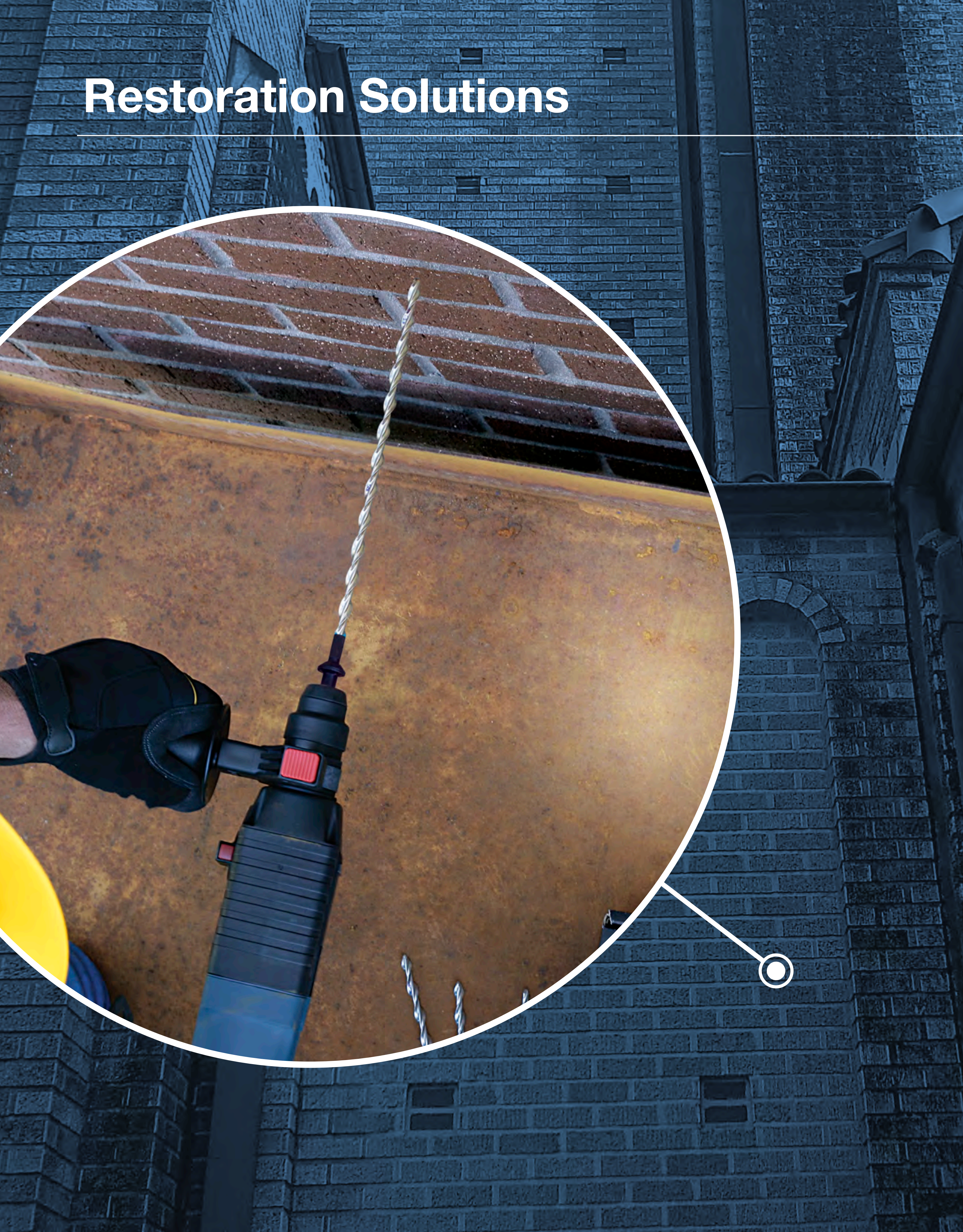
1. Entire pointed portion of the fastener must penetrate through the steel to obtain tabulated values.
2. The allowable tension and shear values are for the fastener only. Members connected to the steel must be investigated separately in accordance with accepted design criteria.
3. Fastener is to be installed in the center of the stud flange.
4. Loads are based on cold-formed steel members with a minimum yield strength, F_y = 33 ksi and tensile strength, F_u = 45 ksi for 33 mil (20 ga.) and 43 mil (18 ga.), and minimum yield strength, F_y = 50 ksi and tensile strength, F_u = 65 ksi for 54 mil (16 ga.) and 68 mil (14 ga.)



Typical GDPSK Installation

* See p. 13 for an explanation of the load table icons.

Restoration Solutions



ETI Injection Epoxy

ETI injection epoxies are two-component, high-solids formulations for the injection into cracks in concrete. Dispensed through a static mixing nozzle using either a manual, battery-powered or a pneumatic dispensing tool, these epoxies provide a waterproof, high strength (structural) repair.

ETI-SLV

Features

- Bonds chemically to concrete, providing load-bearing applications (meets the requirements of ASTM C 881 for structural repair epoxy)
- Formulated for maximum penetration under pressure (all viscosities)
- Seals out moisture, protecting rebar in the concrete from corrosion and flooring from moisture damage
- Reliable mixing and ratio control when used with the Simpson Strong-Tie® Optimix® static mixing nozzle (included with cartridge)
- Suitable for pressure injection
- Non-shrink material resists oils, salts and mild chemicals
- Final product color: ETI-SLV – dark purple / black; ETI-LV – amber; ETI-GV – gray

ETI-SLV Super-Low-Viscosity Epoxy

- Super-low viscosity (350 cP) repairs hairline cracks (0.002") and cracks up to ¼" in width
- Penetrates smallest cracks
- Meets or exceeds AASHTO M-235 and ASTM C881 Type I and IV, Grade 1, Class B and C

ETI-LV

ETI-LV Low-Viscosity Epoxy

- Repairs fine to medium cracks 1⁄64" to ¼" in width
- Offers low surface tension to effectively penetrate narrow cracks
- Approved under NSF/ANSI standard 61
- Meets or exceeds AASHTO M-235 and ASTM C881 Type I and IV, Grade 1, Class C

ETI-GV Gel-Viscosity Epoxy

- Gel-viscosity (non-sag) epoxy repairs medium cracks 3⁄32" – ¼" in width
- Decreases in viscosity under pressure, increasing flow
- Suitable for use as pick-proof sealant around doors, windows and fixtures
- Meets or exceeds AASHTO M-235 and ASTM C881 Type I and IV, Grade 3, Class C

ETI-GV

Application Considerations

- Suitable for repairing non-moving cracks in concrete walls, floors, slabs, columns and beams.
- ETI can be used to inject cracks in damp or wet conditions (non-seeping or non-leaking conditions only) with excellent results.
- Apply to concrete 60°F or above. For best results, warm material to 60°F or above prior to application.
- Mixed material in nozzle and injection fitting hardens in 15 minutes (ETI-SLV), and in 60 minutes (ET-LV, ETI-GV) at temperatures of 40°F or above

Shelf Life: 24 months from date of manufacture in unopened cartridge

Storage Conditions: For best results, store between 45°F and 95°F

Injection Instructions: See pp. 227–231

ETI Injection Epoxy

Property		Test Method	ETI-SLV Results*	ETI-LV Results*	ETI-GV Results*
Viscosity (75°F)		ASTM D2556	350 cP	1,790 cP	Non-sag gel
Bond Strength (moist cure)	@ 2 days	ASTM C882	3,100 psi	2,500 psi	1,110 psi
	@ 14 days		3,900 psi	2,530 psi	3,990 psi
Tensile Strength		ASTM D638	10,200 psi	7,470 psi	—
Tensile Elongation at Break		ASTM D638	2.1%	7.7%	—
Compressive Yield Strength		ASTM D695	16,500 psi	12,500 psi	11,600 psi
Compressive Modulus		ASTM D695	569,000 psi	342,000 psi	403,000 psi
Heat Deflection Temperature		ASTM D648	140°F	130°F	131°F
Water Absorption (24-hour soak)		ASTM D570	0.25%	0.76%	0.58%
Linear Coefficient of Shrinkage		ASTM D2556	0.0035	0.0040	0.0000
Gel Time (60-gram mass)		ASTM C881	16 min.	68 min.	60 min.
Volatile Organic Compounds (VOC)		EPA Method 24 ASTM D2369	23 g/L	6 g/L	4 g/L
Mixing Ratio by Volume (Part A:Part B)		—	2:1	1:1	1:1

*Material and curing conditions: 73 ± 2°F

ETI Cartridge System[1]

Model No.	Capacity ounces (cubic in.)	Dispensing Tool	Mixing Nozzle
ETISLV	16.5 (29.8)	EDT22S	EMN022 (included)
ETILV22	22 (39.7)		
ETIGV22			

1. Bulk containers also available. Contact Simpson Strong-Tie for details.
2. Use only appropriate Simpson Strong-Tie® mixing nozzles in accordance with Simpson Strong-Tie instructions. Modification or improper use of mixing nozzle may impair epoxy performance.
3. EDT22S tool must be configured for 2:1 cartridge ratio.

Crack-Pac® Injection Epoxy

The Crack-Pac injection epoxy is designed to repair cracks in concrete ranging from ¹⁄₆₄" to ¼" wide in concrete walls, floors, slabs, columns and beams. The mixed adhesive has the viscosity of a light oil and a low surface tension, allowing it to penetrate fine to medium-width cracks in dry, damp or wet conditions with excellent results. Resin is contained in the cartridge and hardener is contained in the nozzle.

Features

- Dispenses with a standard caulking tool, no special dispensing tool needed
- Clean and easy to mix
- Seals out moisture, protecting rebar in the concrete from corrosion and flooring from moisture damage
- Chemically bonds with the concrete to restore strength
- Non-shrink material resistant to oils, salts and mild chemicals
- Meets the requirements of AASHTO M-235 and ASTM C881, Type I, Grade 1, Class C

Application Considerations

- Suitable for repair of cracks ranging from ¹⁄₆₄" to ¼" wide in concrete walls, floors, slabs, columns and beams
- Can be used to inject cracks in dry, damp or wet conditions with excellent results. Not for use in actively leaking cracks.
- In order for components to mix properly, the resin and hardener must be conditioned to 60°F–80°F before mixing

Shelf Life: 24 months from date of manufacture, unopened

Usage Temperature: 60°F to 90°F

Storage Conditions: For best results, store between 45°F and 95°F

Injection Instructions: See pp. 227–231

Crack-Pac Injection Epoxy (ETIPAC10)

Dispensing Systems: U.S. Patents 6,737,000 and 6,896,001 B2

Crack-Pac® Injection Epoxy

Crack-Pac Kit (ETIPAC10KT)

Crack-Pac injection epoxy is also available in the Crack-Pac Injection Kit (ETIPAC10KT). The kit includes everything needed to pressure inject cracks.

- 2 Crack-Pac cartridge/nozzle sets (ETIPAC10)
- 12 E-Z-Click injection ports
- 2 E-Z-Click injection fittings with 12" tubing
- 1 pint of ETR paste-over epoxy
  (8 oz. of resin + 8 oz. of hardener)
- 4 disposable wood paste-over applicators
- 1 pair latex gloves
- Installation video

Property		**Test Method**	**Results***
Viscosity		ASTM D2556	1,400 cP
Bond Strength (moist cure)	@ 2 days	ASTM C882	2,010 psi
	@ 14 days	ASTM C882	3,830 psi
Tensile Strength		ASTM D638	5,860 psi
Tensile Elongation at Break		ASTM D638	14.0%
Compressive Yield Strength		ASTM D695	11,300 psi
Compressive Modulus		ASTM D695	319,000 psi
Flexural Strength		ASTM D790	8,020 psi
Water Absorption (24-hour soak)		ASTM D570	0.08%
Linear Coefficient of Shrinkage		ASTM D2556	0.0020
Gel Time (60-gram mass)		ASTM C881	16 min.
Full, Mixed Cartridge		—	30 min.
Volatile Organic Compounds (VOC)		EPA Method 24 ASTM D2369	7 g/L
Initial Cure		—	24 hours
Mixing Ratio by Volume (Part A:Part B)		—	8:1

*Material and curing conditions: 73 ± 2°F

Crack-Pac Cartridge System

Model No.	Capacity (ounces)	Cartridge Type	Carton Quantity	Dispensing Tool
ETIPAC10	9	Single	12	CDT10S
ETIPAC10KT	18	Single	2 (kits)	

Crack-Pac® Flex-H_2O™ Polyurethane Crack Sealer

The Crack-Pac Flex-H_2O polyurethane injection resin seals leaking cracks, voids or fractures from 1⁄32" to 1⁄4" wide in concrete or solid masonry. Designed to perform in applications where water is seeping or mildly leaking from the crack, the polyurethane is packaged in the cartridge and an accelerator is packaged in the nozzle. When the resin encounters water as it is injected into the crack, it becomes an expanding foam that provides a flexible seal in leaking and non-leaking cracks.

Features

- Can be dispensed with a standard caulking tool
- Can also be used on dry cracks if water is introduced to affected area
- Can be used with a reduced amount or without accelerator to slow down reaction time
- Expands to fill voids and seal the affected area
- Fast reacting — reaction begins within 1 minute after exposure to moisture; expansion may be completed within 3 minutes (depending on the amount of moisture and the ambient temperature)
- 20:1 expansion ratio (unrestricted rise) means less material needed

Application Considerations

- Suitable for sealing cracks ranging from 1⁄32" to 1⁄4" wide in concrete and solid masonry.
- Suitable for repair of cracks in dry, damp and wet conditions with excellent results. Designed to perform in applications where water is seeping or mildly leaking from the crack.
- In order for components to mix properly, the resin and hardener must be conditioned to 60°F–90°F before mixing.

Shelf Life: 12 months from the date of manufacture, unopened

Usage Temperature: 60°F to 90°F

Storage Conditions: For best results, store in a dry area between 45°F and 90°F. Product is very moisture sensitive.

Installation Instructions: See pp. 227–231

Accessories: See p. 226 for information on crack repair accessories.

Crack-Pac Flex-H_2O Crack Sealer (CPFH09)

Dispensing System:
U.S. Patents 6,737,000 and
6,896,001 B2

Crack-Pac® Flex-H_2O™ Polyurethane Crack Sealer

Crack-Pac Flex-H_2O Kit (CPFH09KT)

Crack-Pac Flex-H_2O injection epoxy is also available in the Crack-Pac Flex-H_2O Injection Kit (CPFH09KT). The kit includes everything needed to pressure inject cracks.

- 2 Crack-Pac Flex-H_2O cartridge/nozzle sets (CPFH09)
- 12 E-Z-Click injection ports
- 2 E-Z-Click injection fittings with 12" tubing
- 1 pint of ETR paste-over epoxy
  (8 oz. of resin + 8 oz. of hardener)
- 4 disposable wood paste-over applicators
- 1 pair latex gloves

Crack-Pac Flex-H_2O Packaging

Model No.	Capacity	Cartridge Type	Carton Quantity	Dispensing Tool
CPFH09	9 ounces	Single	12	CDT10S
CPFH09KT	18 ounces	Single	2 (kits)	
FH05[1]	5 gallons resin	Pail	1	—
	16 ounces catalyst			

1. For standard reaction time, use 30:1 resin to catalyst ration.
   For a faster reaction time, add more catalyst; for a slower reaction time, use less.

CIP / ETR Paste-Over and Crack Sealants

CIP and ETR are fast-curing epoxy used to paste-over and seal cracks while securing injection ports to the surface of concrete substrates prior to injecting an epoxy or urethane crack repair product. When properly mixed, the products will be a uniform gray color and can be left in place or removed after the repair is complete.

Features

- 1:1 two component, high solids, epoxy amine based adhesive
- Mixed material is a uniform gray color
- Non-sag paste consistency for horizontal, vertical or overhead applications
- Fast cure times for shorter times between paste-over and injection
- Manufactured in the USA using global materials

CIP-LO Low Odor Paste-Over Epoxy and Crack Sealant

- Low odor formulation
- Strong substrate bond; requires chipping to remove
- Gel Time — 6 minutes at 72°F (22°C), 28 minutes at 40°F (4°C)
- Cure Time — 75 minutes at 72°F (22°C), 2 hours at 60°F (16°C) and 4–5 hours at 40°F (4°C)
- Volatile organic compound (VOC) — 4 g/L
- Available in a 22 oz. side-by-side cartridge

CIP-F Flexible Paste-Over Adhesive and Crack Sealant

- Remains flexible after cure for easier removal
- Moderate substrate bond; peels away for removal
- Gel Time — 4 minutes at 72°F (22°C), 9 minutes at 40°F (4°C)
- Cure Time — 1 hour at 72°F (22°C), and 3 hours at 40°F (4°C)
- Volatile organic compound (VOC) — 0 g/L
- Available in a 22 oz. side-by-side cartridge

CIP-LO

CIP-F

ETR Concrete Repair and Paste-Over Epoxy

- Canisters are mixed manually and do not require dispensing tool
- Each package contains enough material to cover approximately eight lineal feet of cracks
- Volatile organic compound (VOC) — 7 g/L
- Available in two 8 fl. oz. canisters

ETR16

Application Considerations

- Apply to concrete 40°F (4°C) or above. For best results, warm material to 65°F (16°C) or above prior to application.

Shelf Life: 24 months from date of manufacture, unopened for CIP-LO and ETR; 12 months from date of manufacture, unopened for CIP-F

Storage Conditions: For best results, store between 45°F (7°C) and 90°F (32°C) for CIP-LO and ETR; 60°F (16°C) – 95°F (35°C) for CIP-F

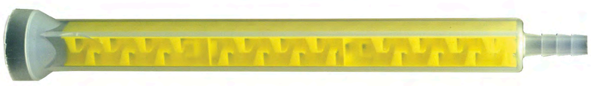
Installation Instructions: See pp. 227–231

Paste-Over and Crack Sealants

Model No.	Capacity (oz.)	Cartridge	Mixing Nozzle	Dispensing Tool	Package Quantity	Carton Quantity
CIPLO22	22	Side-by-side	EMN22I	EDT22S, EDTA22CKT	1	10
CIP-F22[1]	22	Side-by-side	EMNCIPF22	EDTA22P	1	10
ETR16	16	—	—	—	1	4

[1] One EMNCIPF22 mixing nozzle is supplied with each cartridge.

Crack Repair Accessories



EMN022 Optimix®
Mixing Nozzle

Mixing Nozzles

Model No.	Description	Package Quantity	Carton Quantity
EMNCIPF22-RP5	Mixing nozzle for CIPF-22 epoxy	5	25
EMN022-RP6	Optimix mixing nozzle for ETI epoxies	6	30

1. 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.
2. Includes retaining nuts.

E-Z-Click
Ports and Injection Fitting

EIPX-EZ
Corner Mount/
Drilled-In Port

EIP-EZA
Flush-Mount Port

Injection Ports and Injection Fittings

Model No.	Description	Package Contents		Carton Quantity
		Ports	E-Z Click Injection Fitting	
EIP-EZAKT	E-Z Click flush mount injection ports	20	1	5 kits
EIP-EZA		1 each	—	100
EIPX-EZKT	E-Z Click corner mount or drill in injection port	20	1	5 kits
EIPX-EZ-RP20		20	—	100 (5 packs)
EIF-EZ	E-Z Click injection fitting	—	1 each	10

1. EIPX intended for use as a surface-mount port in corners and as a drilled-in port on flat surfaces.

Detailed information on the full line of Simpson Strong-Tie® manual and pneumatic dispensing tools is available on **strongtie.com**.

Crack Injection Guide

Important: These instructions are intended as recommended guidelines. Due to the variability of field conditions, selection of the proper material for the intended application and installation is the sole responsibility of the applicator.

Epoxy injection is an economical method of repairing non-moving cracks in concrete walls, slabs, columns and piers and is capable of restoring the concrete to its pre-cracked strength. Prior to doing any injection it is necessary to determine the cause of the crack. If the source of cracking has not been determined and remedied, the concrete may crack again.

Materials

- ETI-SLV for repair of hairline cracks (0.002") and those up to ¼" in width.
- ETI-LV for repair of fine to medium-width cracks (Suggested width range: 1/64"–¼").
- ETI-GV for repair of medium-width cracks (Suggested width range: 3/32"–¼").
- Crack-Pac® injection epoxy for repair of fine to medium non-structural cracks (Suggested width range: 1/64"–¼").
- Crack-Pac Flex-H_2O polyurethane crack sealer for repair of fine- to medium-width cracks (Suggested width range: 1/32"–¼").
- CIP-LO, CIP-F and ETR are recommended for paste-over of crack surface and installation of injection ports. ET-HP, ETR or SET adhesives may also be used as a substitute. (SET is the only paste-over epoxy approved for NSF/ANSI Standard 61.)
- E-Z-Click™ injection ports, fittings and other suitable accessories.

Estimating Guide for Epoxy Crack Injection

Width of Crack (in.)	Concrete Thickness (in.)	ETI-LV, ETI-GV	ETI-SLV	Crack-Pac	Crack-Pac Flex-H_2O
		Approx. Coverage per 22 oz. Cartridge (linear ft.)	Approx. Coverage per 16.5 oz. Cartridge (linear ft.)	Approx. Coverage per 9 oz. Cartridge (linear ft.)	Approx. Coverage per 9 oz. Cartridge (linear ft.)
1/64	4	47.7	35.7	18.4	—
	6	31.8	23.8	12.3	—
	8	23.8	17.9	9.2	—
	10	19.1	14.3	7.4	—
1/32	4	23.8	17.9	9.2	108.0
	6	15.9	11.9	6.1	72.0
	8	11.9	8.9	4.6	54.0
	10	9.5	7.1	3.7	43.2
1/16	4	11.9	8.9	4.6	54.0
	6	7.9	6.0	3.1	36.0
	8	6.0	4.5	2.3	27.0
	10	4.8	3.6	1.8	21.6
⅛	4	6.0	4.5	2.3	27.0
	6	4.0	3.0	1.5	18.0
	8	3.0	2.2	1.2	13.5
	10	2.4	1.8	0.9	10.8
3/16	4	4.0	3.0	1.5	18.0
	6	2.6	2.0	1.0	12.0
	8	2.0	1.5	0.8	9.0
	10	1.6	1.2	0.6	7.2
¼	4	3.0	2.2	1.2	13.5
	6	2.0	1.5	1.8	9.0
	8	1.5	1.1	0.6	6.8
	10	1.2	0.9	0.5	5.4

Coverage listed is approximate and will vary depending on waste and condition of concrete.

Crack Injection Guide

Preparation of the Crack for Injection

Clean the crack and the surface surrounding it to allow the paste-over to bond to sound concrete. At a minimum, the surface to receive paste-over should be brushed with a wire brush. Oil, grease or other surface contaminant must be removed in order to allow the paste-over to bond properly. Take care not to impact any debris into the crack during cleaning. Using clean, oil-free compressed air, blow out the crack to remove any dust, debris or standing water. Best results will be obtained if the crack is dry at the time of injection. If water is continually seeping from the crack, the flow must be stopped in order for epoxy injection to yield a suitable repair. Other materials such as polyurethane resins may be required to repair an actively leaking crack.

For many applications, additional preparation is necessary in order to seal the crack. Where a surfacing material has been removed using an acid or chemical solvent, prepare the crack as follows:

1. Using clean, compressed air, blow out any remaining debris and liquid.
2. Remove residue by high-pressure washing or steam cleaning.
3. Blow any remaining water from the crack with clean compressed air.

If a coating, sealant or paint has been applied to the concrete, it must be removed before placing the paste-over epoxy. Under the pressure of injection, these materials may lift and cause a leak. If the surface coating is covering the crack, it may be necessary to route out the opening of the crack in a "V" shape using a grinder in order to get past the surface contamination.

Sealing of the Crack and Attachment of E-Z-Click™ Injection Ports

1. To adhere the port to the concrete, apply a small amount of paste-over around the bottom of the port base (Picture 1). Place the port at one end of the crack and repeat until the entire crack is ported (Picture 2). As a rule of thumb, injection ports should be placed 8" apart along the length of the crack.

Important: Do not allow paste-over to block the port or the crack under it; this is where the injection epoxy must enter the crack.

2. Using a putty knife or other paste-over tool, generously work paste-over along the entire length of the crack (Picture 3). Take care to mound the paste-over around the base of the port to approximately ¼" thick extending 1" out from the base of the port and to work out any holes in the material. It is recommended that the paste-over should be a minimum of 3⁄16" thick and 1" wide along the crack. Insufficient paste-over will result in leaks under the pressure of injection. If the crack passes completely through the concrete element, seal the back of the crack, if possible. If not, epoxy may be able to run out the back side of the crack, resulting in an ineffective repair.
3. Allow the paste-over to harden before beginning injection. Note: CIP-LO, CIP-F and ETR epoxies are fast-cure materials and may harden prematurely if left in a mixed mass on the mixing surface while installing ports. Spreading paste-over into a thin film (approximately ⅛") on the mixing surface will slow curing by allowing the heat from the reaction to dissipate.

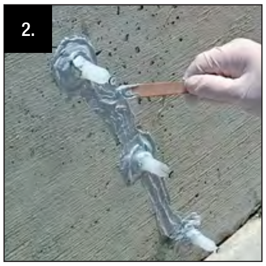
Injection Procedure for ETI-SLV, ETI-LV, ETI-GV and Crack-Pac® Injection Epoxy

1. Follow cartridge preparation instructions on the cartridge label. Verify that the material flowing from the Optimix® mixing nozzle is a uniform and consistent color: for ETI-SLV, the mixed product is black; ETI-LV is transparent amber; and ETI-GV is grey. For Crack-Pac injection epoxy, verify that the mixed material in the cartridge is a transparent amber color.
2. Attach the E-Z-Click fitting to the end of the nozzle by pushing the tubing over the barbs at the end of the nozzle. Make sure that all ports are pushed in to the open position.
3. Attach the E-Z-Click injection fitting to the first E-Z-Click port until it clicks into place. Make sure that the heads of all the ports are pushed in to the open position. In vertical applications, begin injection at the lowest port and work your way up. In a horizontal application, start at one end of the crack and work your way to the other end.
4. Inject epoxy into the first port until it will no longer flow into the crack. If epoxy shows at the next port and the first port still accepts material, close the second port and continue to inject into the first port until it accepts no more epoxy. Continue closing ports where epoxy appears until the first port refuses epoxy. When the first port reaches the point of refusal, brace the base of the port and pull out gently on the head of the port to close it. Pulling too hard may dislodge the port from the surface of the concrete, causing a leak. Depress the metal tab on the head of the E-Z-Click fitting and remove it from the port.
5. Go to the last port where epoxy appeared while injecting the first port, open it, and continue injection at this port. If the epoxy has set up and the port is bonded closed, move to the next clean port and repeat the process until every portion of the crack has refused epoxy.

1.

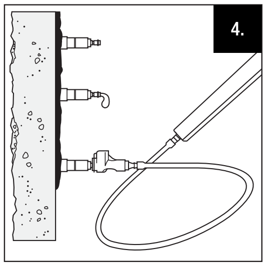
1.1

2.



3.

4.



While this method may appear to leave some ports uninjected, it provides maximum pressure to force the epoxy into the smaller areas of the crack. Moving to the next port as soon as epoxy appears will allow the epoxy to travel along the wider parts of the crack to the next ports rather than force it into the crack before it travels to the next ports.

Injection Tips

- If using a pneumatic dispensing tool, set the tool at a low setting when beginning injection and increase pressure if necessary to get the epoxy to flow.
- For narrow cracks, it may be necessary to increase the pressure gradually until the epoxy begins to flow. It may also be necessary to wait for a few minutes for the epoxy to fill the crack and travel to the next port.
- If desired, once the injection epoxy has cured, remove the injection ports and paste-over. An epoxy-based paste-over can be removed with a chisel, scraper or grinder. The paste-over can be simply peeled off if CIP-F is used. Using a heat gun to soften the epoxy is recommended when using a chisel or scraper.
- Mixing nozzles can be used for multiple cartridges as long as the epoxy does not harden in the nozzle. For injection epoxies in side-by-side cartridges, care must be taken to ensure the level of material is the same on both parts of the cartridge. This can be done by checking for air in the cartridge and the positions of the wipers in the back of the cartridge. If the liquid levels are off by more than ⅛", then Step 1 from the injection procedures must be repeated.

Troubleshooting

Epoxy is flowing into the crack, but not showing up at the next port.

This can indicate that the crack either expands and/or branches off under the surface of the concrete. Continue to inject and fill these voids. In situations where the crack penetrates completely through the concrete element, and the back-side of the concrete element cannot be sealed (e.g., basement walls, or footings with backfill), longer injection time may not force the epoxy to the next port. This most likely indicates that epoxy is running out the unsealed back side of the crack. In this case, the application may require a gel viscosity injection epoxy (ETI-GV) or may not be suitable for epoxy injection repair without excavation and sealing of the back side of the crack.

Epoxy is leaking from the pasted-over crack or around injection ports.

Stop injecting. If using a fast-cure paste-over material (ETR or CIP), wipe off the leaking injection epoxy with a cotton cloth and reapply the paste-over material. Wait approximately 10–15 minutes to allow the epoxy to begin to harden. If the leak is large (e.g., the port broke off of the concrete surface), it is a good idea to wait approximately 30 minutes, or longer as necessary, to allow the paste-over to cure more completely. Check to see that the epoxy is hard before reinjecting, or the paste-over or ports may leak. Another option for small leaks is to clean off the injection epoxy and use paraffin or crayon to seal the holes.

More epoxy is being used than estimated.

This may indicate that the crack either expands or branches off below the surface. Continue to inject and fill these voids. This may also indicate that epoxy is running out the back side of the crack. If the crack penetrates completely through the concrete element and cannot be sealed, the application may require a gel viscosity injection epoxy (ETI-GV) or may not be suitable for injection repair.

Back pressure is preventing epoxy from flowing.
This can indicate several situations:

- The crack is not continuous, and the portion being injected is full. (See above instructions about injection after the port has reached refusal.)
- The port is not aligned over the crack properly.
- The crack is blocked by debris.
- The injection epoxy used has too high a viscosity.
- If the mixing nozzle has been allowed to sit for a few minutes full of epoxy, the material may have hardened in the nozzle. Attach the E-Z-Click™ fitting to a port at another uninjected location on the crack and attempt to inject. If the epoxy still won't flow, chances are the epoxy has hardened in the nozzle. If so, replace the nozzle.

Less epoxy is being used than estimated.

This may indicate that the crack is shallower than originally thought, or the epoxy is not penetrating the crack sufficiently before moving to the next port. Reinject some ports with a lower-viscosity epoxy to see if the crack will take more epoxy. Another option is to heat the epoxy to a temperature of 80–100°F, which will reduce its viscosity and allow it to penetrate into small cracks easier. The epoxy should be heated uniformly; do not overheat cartridge.

Injection Procedure for Crack-Pac® Flex-H_2O™ Crack Sealer

1. Follow cartridge preparation instructions on the cartridge label. Verify that the material flowing from the nozzle is a uniform green color.
2. Attach the E-Z-Click™ fitting to the end of the nozzle by pushing the tubing over the barbs at the end of the nozzle. Make sure that all ports are pushed into the open position.
3. Attach the E-Z-Click injection fitting to the first E-Z-Click port until it clicks into place. Make sure that the head of the port is pushed into the open position. In vertical applications, begin injection at the lowest port and work your way up. In a horizontal application, start at one end of the crack and work your way to the other end.
4. Inject polyurethane into the first port until material shows at the next port. Remove the E-Z-Click fitting by bracing the base of the port and pulling out gently on the head of the port to close it. Pulling too hard may dislodge the port from the surface of the concrete, causing a leak. Depress the metal tab on the head of the E-Z-Click fitting and remove it from the port.
5. Move to the next port and repeat until all ports have been injected.

Injection Tips for Crack-Pac Flex-H_2O Crack Sealer

- For narrow cracks, it may be necessary to increase the pressure gradually until the polyurethane begins to flow. It may also be necessary to wait a few minutes for the material to fill the crack and travel to the next port.
- If desired, once the polyurethane has cured, remove the injection ports and paste-over epoxy or hydraulic cement. The paste-over can be removed with a chisel, scraper or grinder.

Troubleshooting for Crack-Pac Flex-H_2O Crack Sealer

Polyurethane is flowing into the crack, but not showing up at the next port.

This can indicate that either the crack expands and/or branches off under the surface of the concrete. Continue to inject and fill these voids. This can indicate that the crack either expands and/or branches off under the surface of the concrete. Continue to inject and fill these voids. In situations where the crack penetrates completely through the concrete element, and the back-side of the concrete element cannot be sealed (e.g., basement walls, or footings with backfill), longer injection time may not force the epoxy to the next port. This most likely indicates that epoxy is running out the unsealed back side of the crack. In this case, the application may require a gel viscosity injection epoxy (ETI-GV) or may not be suitable for epoxy injection repair without excavation and sealing of the back side of the crack.

Back pressure is preventing polyurethane from flowing.

This can indicate several situations:

- The crack is not continuous and the portion being injected is full.
- The port is not aligned over the crack properly.
- The crack is blocked by debris.

Polyurethane is leaking from the pasted-over crack or around injection ports.

Stop injecting. If using a fast cure paste-over material (ETR or CIP), wipe off the leaking injection epoxy with a cotton cloth and reapply the paste over material. Wait a approximately 10–15 minutes to allow the paste-over to begin to harden. If the leak is large (e.g., the port broke off of the concrete surface), it is a good idea to wait approximately 30 minutes, or longer as necessary, to allow the paste-over to cure more completely. Check to see that the paste-over is hard before reinjecting or the paste-over or ports may leak.

Another option for small leaks is to clean off the injection adhesive and use paraffin or crayon to seal the holes.

More polyurethane is being used than estimated.

This may indicate that the crack either expands or branches off below the surface. Continue to inject and fill these voids.

Less polyurethane is being used than estimated.

This may indicate that the crack is shallower than originally thought, or the polyurethane is not penetrating the crack sufficiently before moving to the next port.

Gravity-Feed Procedure

In some horizontal applications where complete penetration isn't a requirement, cracks can be repaired using the gravity-feed method.

1. Follow cartridge preparation instructions on the cartridge label. Verify that the material flowing from the Optimix® mixing nozzle is a uniform and consistent color: For ETI-SLV, the mixed product is black, while ETI-LV is transparent amber. For Crack-Pac® injection epoxy, verify that the mixed material in the cartridge is a transparent amber color.
2. Starting at one end of the crack, slowly dispense epoxy into the crack, moving along the crack as it fills. It will probably be necessary to do multiple passes in order to fill the crack. It is possible that the epoxy will take some time to run into the crack, and the crack may appear empty several hours after the initial application. Reapply epoxy until the crack is filled.
3. In situations where the crack completely penetrates the member (e.g., concrete slab), the material may continue to run through the crack into the subgrade. It may be possible to use a small amount of coarse, dry sand to act as a barrier for the injection epoxy. Place the sand in the crack to a level no more than ¼" thickness of the member and apply the injection epoxy as described in step 2. The epoxy level will drop as it penetrates the sand, but should cure and provide a seal to the bottom of the crack. Reapply the epoxy until the crack is filled. In some cases, application of sand is impractical or not permitted and epoxy repair may not provide a complete and effective repair. Use of a gel viscosity injection epoxy (ETI-GV) may permit a surface repair to the crack with partial penetration.

Heli-Tie™ Helical Wall Tie

The Heli-Tie helical wall tie is a stainless-steel tie used to anchor building façades to structural members or to stabilize brick walls.

The helical design allows the tie to be driven quickly and easily into a predrilled pilot hole (or embedded into mortar joints in new construction) to provide a mechanical connection between a masonry façade and its backup material. As it is driven, the fins of the tie undercut the masonry to provide an expansion-free anchorage that will withstand tension and compression loads.

The Heli-Tie wall tie is installed into a predrilled hole using a proprietary setting tool with an SDS-PLUS shank rotohammer to drive and countersink the tie. Heli-Tie wall ties perform in concrete and masonry as well as wood and steel studs.

Features

Heli-Tie Helical Wall Tie
U.S. Patent 7,269,987

- Installs quickly and easily — with the rotohammer in hammer mode, the tie installs faster than competitive products.
- Provides an inconspicuous repair that preserves the appearance of the building. After installation, the tie is countersunk up to ½" below the surface, allowing the tie location to be patched.
- Larger core diameter provides higher torsional capacity, resulting in less deflection due to “uncoiling” under load.
- Fractionally sized anchor — no metric drill bits required.
- Patented manufacturing process results in a more uniform helix along the entire tie, allowing easier driving and better interlock with the substrate.

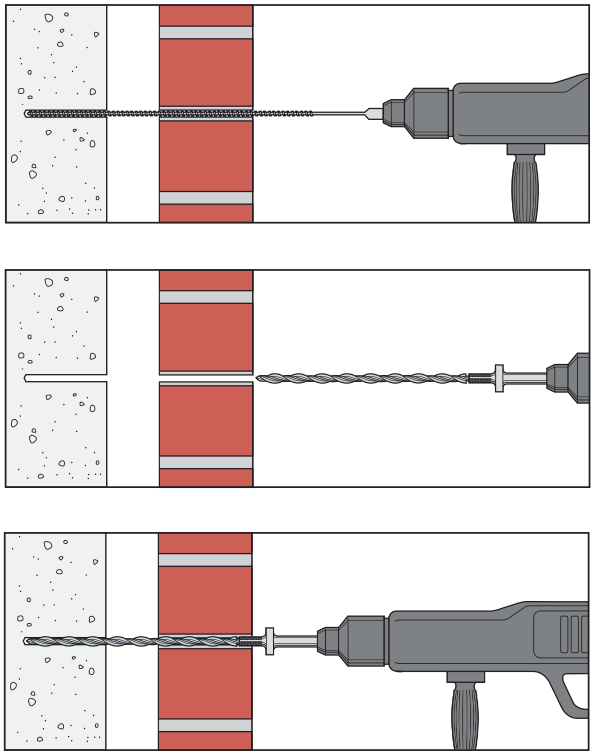
Material: Type 304 stainless steel (Type 316 available by special order — contact Simpson Strong-Tie for details)

Test Criteria: CSA A370

Installation

- Drill pilot hole through the façade material and into the backup material to the specified embedment depth + 1" using appropriate drill bit(s) in the chart below. Drill should be in rotation-only mode when drilling into soft masonry or into hollow backing material.
- Position blue end of the Heli-Tie fastener in the installation tool and insert the tie into the pilot hole.
- With the SDS-plus® rotohammer in hammer mode, drive the tie until the tip of the installation tool enters the exterior surface of the masonry and countersinks the tie below the surface. Patch the hole in the façade with a matching masonry mortar.

Installation Sequence



Heli-Tie Helical Wall Tie Product Data

Size (in.)	Model No.	Drill Bit Diameter (in.)	Quantity	
			Box	Carton
⅜ x 7	HELI37700A	7⁄32 or ¼	50	400
⅜ x 8	HELI37800A		50	400
⅜ x 9	HELI37900A		50	400
⅜ x 10	HELI371000A		50	200
⅜ x 11	HELI371100A		50	200
⅜ x 12	HELI371200A		50	200
⅜ x 14	HELI371400A		50	200
⅜ x 16	HELI371600A		50	200
⅜ x 18	HELI371800A		50	200
⅜ x 20	HELI372000A		50	200

Special-order lengths are also available; contact Simpson Strong-Tie for details.

Heli-Tie™ Design Information

Guide Tension Loads in Various Base Materials

Size in. (mm)	Base Material	Anchor Location	Drill Bit Diameter in.	Min. Embed. Depth in. (mm)	Tension Load[1]		
					Ultimate[2] lb. (kN)	Load at Max. Permitted Displ.[3] lb. (kN)	Standard Deviation lb. (kN)
⅜ (9.0)	Solid brick[4]	Mortar bed joint	7⁄32	3 (76)	**570** (2.5)	**240** (1.1)	**79** (0.4)
			¼		**365** (1.6)	**130** (0.6)	**46** (0.2)
		Brick face	7⁄32		**1,310** (5.8)	**565** (2.5)	**84** (0.4)
			¼		**815** (3.6)	**350** (1.6)	**60** (0.3)
	Hollow brick[5]	Mortar bed joint	7⁄32		**530** (2.4)	**285** (1.3)	**79** (0.4)
		Brick face	7⁄32		**775** (3.4)	**405** (1.8)	**47** (0.2)
			¼		**510** (2.3)	**185** (0.8)	**20** (0.1)
	Grout-filled CMU[6]	Center of face shell	7⁄32	2¾ (70)	**1,170** (5.2)	**405** (1.8)	**79** (0.4)
			¼		**830** (3.7)	**350** (1.6)	**60** (0.3)
		Web	7⁄32		**1,160** (5.2)	**440** (2.0)	**56** (0.2)
			¼		**810** (3.6)	**330** (1.5)	**100** (0.4)
		Mortar bed joint	7⁄32		**720** (3.2)	**320** (1.4)	**71** (0.3)
			¼		**530** (2.4)	**205** (0.9)	**58** (0.3)
	Hollow CMU[7]	Center of face shell	7⁄32		**790** (3.5)	**305** (1.4)	**56** (0.2)
			¼		**505** (2.2)	**255** (1.1)	**46** (0.2)
		Web	7⁄32		**1,200** (5.3)	**445** (2.0)	**50** (0.2)
			¼		**675** (3.0)	**385** (1.7)	**96** (0.4)
	Normal-weight concrete[8]	—	7⁄32	1¾ (44)	**880** (3.9)	**410** (1.8)	**76** (0.3)
			¼	2¾ (70)	**990** (4.4)	**380** (1.7)	**96** (0.4)
	2x4 wood stud[9,11]	Center of thin edge	7⁄32	2¾ (70)	**590** (2.6)	**370** (1.6)	**24** (0.1)
			¼		**450** (2.0)	**260** (1.2)	**6** (0.0)
	Metal stud[10,11]	Center of flange	7⁄32	1 (25)	**200** (0.9)	**120** (0.5)	**8** (0.0)
			¼		**155** (0.7)	**95** (0.4)	**2** (0.0)

⚠ **Caution:** Loads are guide values based on laboratory testing. Onsite testing shall be performed for verification of capacity since base material quality can vary widely.

1. Tabulated loads are guide values based on laboratory testing. Onsite testing shall be performed for verification of capacity since base material quality can vary widely.
2. Ultimate load is average load at failure of the base material. Heli-Tie fastener average ultimate steel strength is 3,885 lb. and does not govern.
3. Load at maximum permitted displacement is average load at displacement of 0.157 inches (4 mm). The designer shall apply a suitable factor of safety to these numbers to derive allowable service loads.
4. Solid brick values for nominal 4-inch-wide solid brick conforming to ASTM C62/C216, Grade SW. Type N mortar is prepared in accordance with IBC Section 2103.2.
5. Hollow brick values for nominal 4-inch-wide hollow brick conforming to ASTM C216/C652, Grade SW, Type HBS, Class H40V. Mortar is prepared in accordance with IBC Section 2103.2.
6. Grout-filled CMU values for nominal 8-inch-wide lightweight, medium-weight and normal-weight concrete masonry units. The masonry units must be fully grouted. Values for nominal 8-inch-wide concrete masonry units (CMU) with a minimum specified compressive strength of masonry, f'_m, at 28 days is 1,500 psi.
7. Hollow CMU values for 8-inch-wide lightweight, medium-weight and normal-weight concrete masonry units.
8. Normal-weight concrete values for concrete with minimum specified compressive strength of 2,500 psi.
9. 2x4 wood stud values for nominal 2x4 Spruce-Pine-Fir.
10. Metal stud values for 20-gauge C-shape metal stud.
11. For retrofits, due to difficulty of locating center of 2x4 or metal stud flange, install Heli-Tie from interior of building.
12. For new construction, anchor one end of tie into backup material. Embed other end into veneer mortar joint.

Heli-Tie™ Design Information

Compression (Buckling) Loads[1]

Size in. (mm)	Unsupported Length in. (mm)	Ultimate Compression Load[1] lb. (kN)
⅜ (9.0)	**1** (25)	**1,905** (8.5)
	2 (50)	**1,310** (5.8)
	4 (100)	**980** (4.4)
	6 (150)	**785** (3.5)

1. The Designer shall apply a suitable factor of safety to these numbers to derive allowable service loads.

Heli-Tie Fastener Installation Tool — Model HELITOOL37A

Required for correct installation of Heli-Tie wall ties. Speeds up installation and automatically countersinks the tie into the façade material.

HELITOOL37A

Heli-Tie Wall Tie Tension Tester — Model HELITEST37A

Recommended equipment for onsite testing to accurately determine load values in any specific structure, the Heli-Tie wall tie tension tester features a key specifically designed to grip the Heli-Tie fastener and provide accurate results. Replacement test keys sold separately (Model HELIKEY37A).

Contact Simpson Strong-Tie for Heli-Tie onsite testing procedures.

HELITEST37A **HELIKEY37A**

Heli-Tie™ Helical Stitching Tie

The Simpson Strong-Tie® Heli-Tie helical stitching tie provides a unique solution to the preservation and repair of damaged brick and masonry structures. Ties are grouted into existing masonry joints to repair cracks and increase strength with minimum disturbance. Made of Type 304 stainless steel, the Heli-Tie stitching tie features radial fins formed on the steel wire via cold rolling process, increasing the tensile strength of the tie.

HELIST254000

Features

- Helical design distributes loads uniformly over a large surface area
- Installs into the mortar joint to provide an inconspicuous repair and preserve the appearance of the structure
- Type 304 stainless steel offers superior corrosion resistance to mild steel reinforcement
- Patented manufacturing process results in consistent, uniform helix configuration (U.S. Patent 7,269,987)
- Batch number printed on each tie for easy identification and inspection

HELIST254000: ¼" x 40" stitching tie
(special lengths are available upon request)

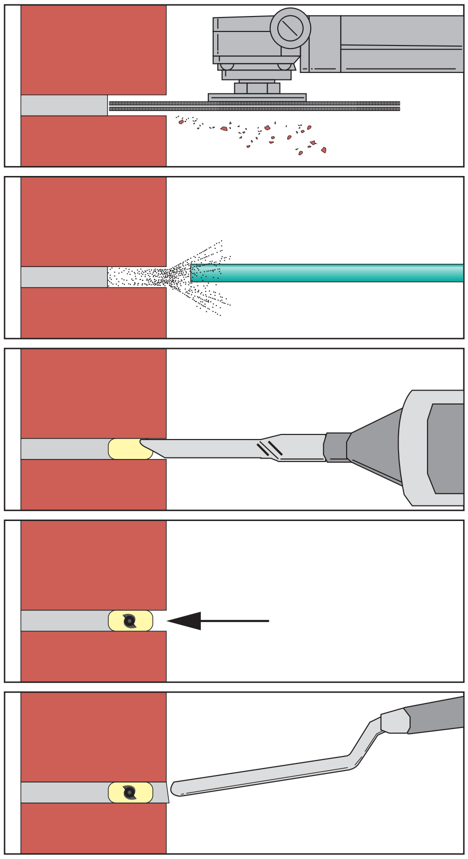
Material: Type 304 stainless steel

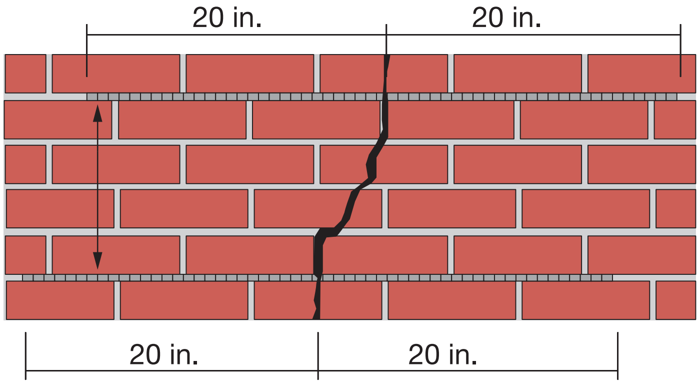
Ordering Information: Sold in tubes of 10

Installation Instructions

- Chase bed joint 20" on either side of the affected area to a depth of approximately 1¼" with a rotary grinding wheel. Vertical spacing of installation sites should be 12" for red brick or "every other course" for concrete masonry units.
- Clear bed joint of all loose debris.
- Mix non-shrink repair grout or mortar per product instructions and place into the prepared bed joint, filling the void to approximately two-thirds of its depth. Simpson Strong-Tie FX-263 repair mortar should be used.
- Embed the tie at one-half the depth of the void. Trowel displaced grout to fully encapsulate the tie.
- Fill any remaining voids and vertical cracks with non-shrink repair grout or other repair mortar to conceal repair site.

Installation Sequence





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FX-70 Structural Pile Repair and Protection System for Concrete, Timber and Steel Structures

Degradation of structures at the waterline is common in marine environments. Tidal action, river current, saltwater exposure, chemical intrusion, floating debris, marine borers, electrolysis, wet-dry cycles and general weathering are all examples of destructive marine factors addressed by the FX-70 Structural Repair and Protection System.

The FX-70 system features custom-made tongue-and-groove seamed fiberglass jackets that provide a corrosion-resistant protective shell for the life of the repair. High-strength repair grouts are used to strengthen and protect damaged piles. These products displace existing water and can be easily pumped or poured into the FX-70 jacket even while it is submerged in water.

FX-70 System Advantages

- Economically repair damage to concrete, timber and steel pilings without taking the structure out of service
- No need for cofferdams or dewatering
- No need for heavy lifting equipment
- Resists corrosion, deterioration, weathering and abrasion to protect and prevent deterioration of steel, concrete and timber pilings
- Low-impact installation in marine environments
- Easily blends with existing structure
- Economically repair damage to timber piles without taking the structure out of service
- Protect or prevent further deterioration of and steel pilings instead of replacing them
- Manufactured in the U.S.

To learn more, visit **strongtie.com/fx70** or call (800) 999-5099.

Restoration Solutions

Flier F-R-FX70

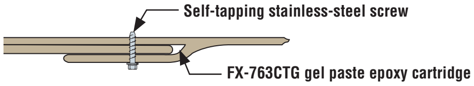
Watch How to Install FX-70 Jackets in Water at **strongtie.com/ videolibrary**.

FX-70® Structural Pile Repair and Protection System

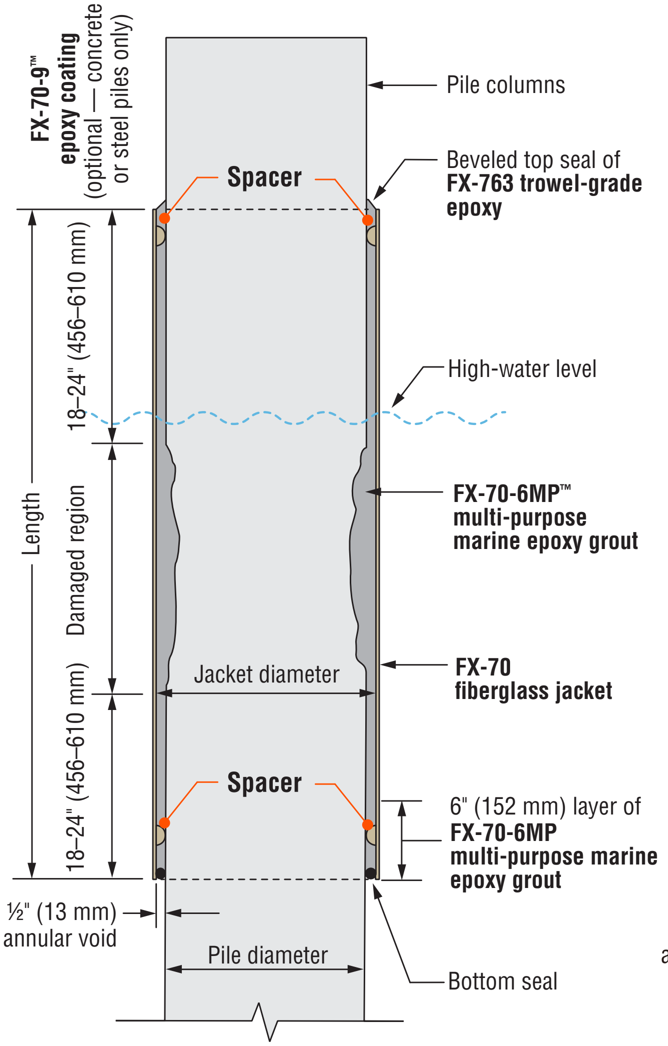
The FX-70 structural pile repair and protection system is customized to the exact specifications of each job, manufactured in the U.S.A., and shipped directly to your job site. The FX-70 tongue-and-groove seamed jacket provides a corrosion-resistant shell with over 40 years of demonstrated in-service performance.

Components

Cross-Section of Tongue-and-Groove Joint

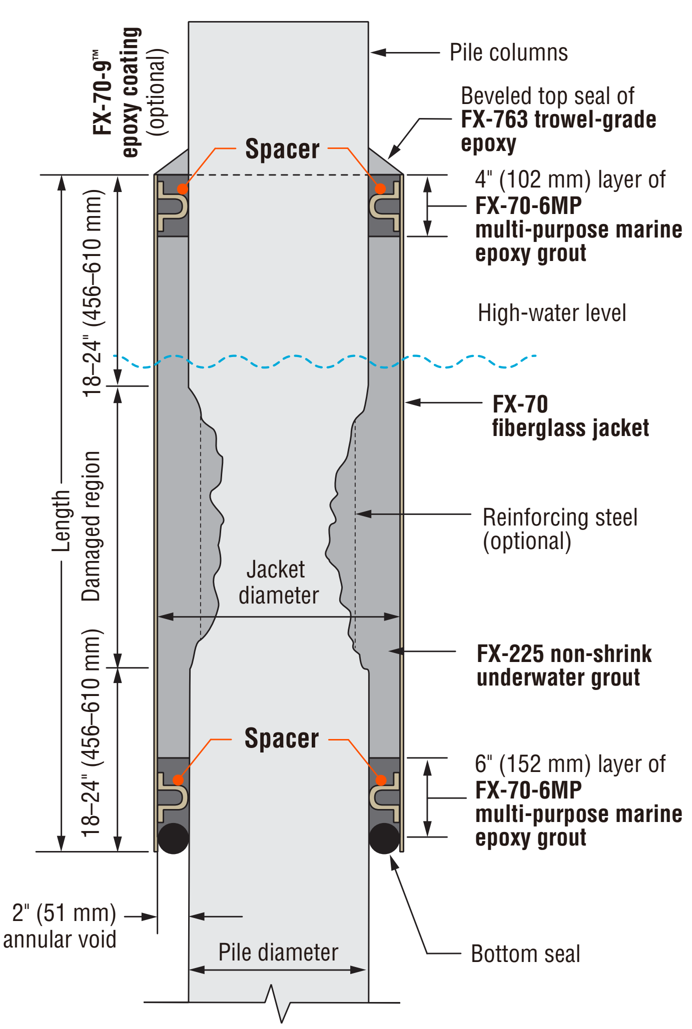


For Section Loss ≤ 25%

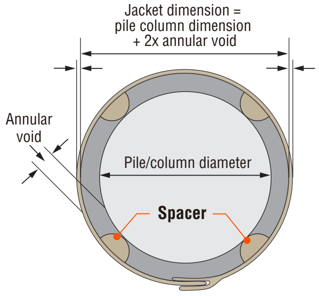


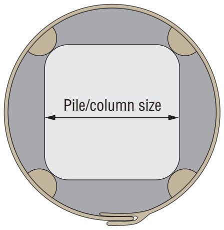
- **FX-70-6MP multi-purpose marine epoxy grout** used for bottom seal and repair
- Typical annular void of ½" (13 mm)
- ¾" (19 mm) annular void for H-piles

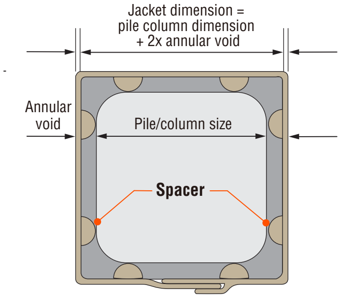
For Section Loss > 25%

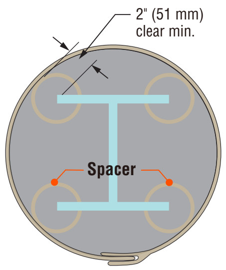


- **FX-70-6MP multi-purpose marine epoxy grout** used for top and bottom seal
- **FX-225 non-shrink underwater grout** used for repair
- Typical annular void of 2" (51 mm)









Your Full-Solution Partner for Composite Strengthening Systems

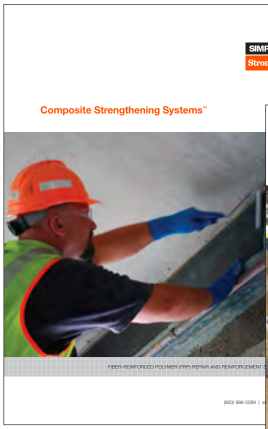
Simpson Strong-Tie® Composite Strengthening Systems (CSS) provide efficient solutions for the structural reinforcement and retrofit of aging, damaged or overloaded concrete, masonry, steel and timber structures.

The primary benefit of Composite Strengthening Systems versus traditional retrofit methods is that significant flexural, axial or shear strength gains can be realized with an easy-to-apply composite that does not add significant weight or mass to the structure. Many times it is the most economical choice given the reduced prep and labor costs and may be installed without taking the structure out of service.

CSS Advantages

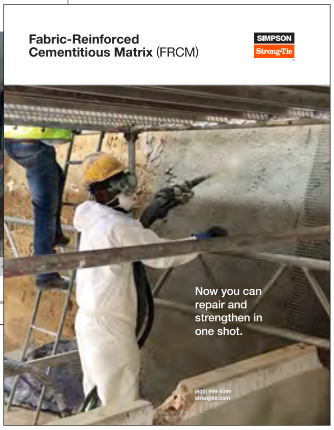
- No-cost in-house engineering and technical support
- Economically increase capacity without significantly increasing weight or mass
- Extremely high tensile strength
- Very lightweight and user-friendly installation
- Non-corrosive
- Low aesthetic impact
- Compatible with many finishes and protective coatings
- Many times it is the most economical choice given the reduced prep and labor costs

For complete information regarding specific products suitable to your unique situation or condition, please visit **strongtie.com/css** or call your local RPS specialist at (800) 999-5099.



Composite Strengthening Systems™

Flier F-R-CSS



Fabric-Reinforced Cementitious Matrix (FRCM)

Now you can repair and strengthen in one shot.

Flier F-R-FRCM

CSS Solutions

CSS enhances the structural capacity of existing structural elements which require additional strengthening, rehabilitation and repair in such applications as seismic retrofit, structural preservation, force protection, blast mitigation, and corrosion-related repair and rehabilitation. CSS effectively increases capacity where adding weight or mass through traditional strengthening methods is not feasible.

System Solutions for Reinforcement

Type	Slab	Beam	Wall	Column/Pile
Externally Applied Laminates	Flexural/Collector	Flexural/Collector	Tensile/Flexural	Flexural
Near-Surface Mounted Laminates	Flexural/Collector	Flexural/Collector	Tensile/Flexural	Flexural
Fabrics	Flexural/Collector	Shear/Flexural/Collector	Shear/Flexural/Tensile	Shear/Flexural/Confinement
FRCM	Flexural/Collector	Shear/Flexural/Collector	Shear/Flexural/Tensile	Shear/Flexural/Confinement

1. **Slab** — Adds collector reinforcement, negative (not shown) and positive moment flexural capacity
2. **Slab opening** — Trim reinforcement
3. **Beam** — Laminates, FRCM or fabrics for flexure and/or collector reinforcement, fabrics or FRCM for shear stirrup reinforcement and potential use of FRP anchors (shown in orange)
4. **Wall** — Stiffening, flexural, shear or tensile reinforcement with FRCM, fabrics and/or laminates
5. **New wall opening** — Trim reinforcement
6. **Column wrapping** — Full column wrap to achieve required strengthening, possibly with additional near-surface mounted laminates, FRCM or fabric for flexure; effective solution for under-reinforced column ties
7. **Protective coating** — High-performance protection against exposure, corrosion, chemical attack, abrasion, fire resistance and other environmental factors

Components

Fabric

Several types of code-listed* and non-code-listed FRP fabrics including carbon fiber and E-glass are available to meet specifier and contractor requirements. Field lamination provides flexibility and short installation time, resulting in lower labor costs and less downtime than are usual with traditional retrofit methods.

- Conforms to any shape
- Can be cut/field-adjusted to address odd shapes/orientations
- May be placed in multiple layers for increased capacity gain
- Variety of tow orientation/composition allows for design flexibility

Carbon Fiber Fabrics

CSS-CUCF11*	Code-Listed Unidirectional Carbon Fabric — 11 oz./yd.^{2} (370 g/m^2)
CSS-CUCF22*	Code-Listed Unidirectional Carbon Fabric — 22 oz./yd.^{2} (740 g/m^2)
CSS-CUCF44*	Code-Listed Unidirectional Carbon Fabric — 44 oz./yd.^{2} (1,490 g/m^2)
CSS-UCF10	Unidirectional Carbon Fabric — 10 oz./yd.^{2} (340 g/m^2)
CSS-UCF20	Unidirectional Carbon Fabric — 20 oz./yd.^{2} (680 g/m^2)
CSS-BCF06	Bidirectional Carbon Fabric (0/90°) — 6 oz./yd.^{2} (204 g/m^2)
CSS-BCF018	Bidirectional Carbon Fabric (0/90°) — 18 oz./yd.^{2} (611 g/m^2)
CSS-BCF418	Bidirectional Carbon Fabric (+/- 45°) — 18 oz./yd.^{2} (611 g/m^2)

E-Glass Fiber Fabrics

CSS-CBGF424*	Code-Listed Bidirectional E-Glass Fabric (+/- 45) — 24 oz./yd.^{2} (814 g/m^2)
CSS-BGF012	Bidirectional E-Glass Fabric (0/90°) — 12 oz./yd.^{2} (407 g/m^2)
CSS-BGF018	Bidirectional E-Glass Fabric (0/90°) — 18 oz./yd.^{2} (611 g/m^2)
CSS-CUGF27*	Code-Listed Unidirectional E-Glass Fabric 27 oz./yd.^{2} (915 g/m^2)

Carbon and E-Glass Anchors

High-strength FRP anchors are field laminated and used to carry load into the concrete to effectively improve bond strength, or through the concrete to transfer load for increased capacity. Termination and through anchors in carbon and E-glass fiber are available in diameters from ¼ in. (6.4 mm) to 1½ in. (38.1 mm) in commonly used stock and custom lengths.

CSS-CA	Carbon Fiber Anchor
CSS-GA	E-Glass Fiber Anchor

Epoxies

CSS-ES-3KT	Epoxy Primer and Saturant — 3 US gallon (11.4 L)
CSS-ES-150KT	Epoxy Primer and Saturant — 150 US gallon (567.8 L)
CSS-EP-3KT	Epoxy Paste and Filler — 3 US gallon (11.4 L)
CSS-UES-3KT	Underwater Epoxy Saturant — 3 US gallon (11.4 L)

Protective Coatings

FX505XXXX-5	FX-505 Water-Based Acrylic Coating — 5 US gallon (18.9 L)
FX70-9XKT3	FX-70-9™ Epoxy Coating — 3 US gallon (11.4 L) kit
FX70-9XKT15	FX-70-9 Epoxy Coating — 15 US gallon (56.8 L) kit
FX207KT1-1	FX-207 Slurry Seal — 3.3 US gallon (12.5 L) kit

Fire Insulation

FX-207 Slurry Seal may be applied over CSS FRP materials for fire insulation and flame-spread/smoke-developed coating providing a 4-hour rated system per ASTM E119 and UL 263 and a Class A finish for ASTM E84 flame-spread and smoke-developed classification.

CLASSIFIED c UL US Structural concrete fiber-reinforced composite system fire resistance classification. See UL Fire Resistance Directory (R37897).

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* Code-listed fabrics and laminates (ICC-ES ESR-3403) have been evaluated per ICC-ES AC125 for Concrete and Reinforced and Unreinforced Masonry Strengthening Using Externally Bonded Fiber-Reinforced Polymer (FRP) Composite Systems.


Unidirectional Carbon Fabric


Unidirectional E-Glass Fabric


Carbon Termination Anchor


FX-70-9 Epoxy Coating applied over Carbon Fiber Fabric

Components (cont.)

Precured Carbon-Fiber Laminate

CSS-CUCL is an epoxy-based, pultruded, unidirectional, high-strength, non-corrosive carbon-fiber-reinforced polymer (CFRP) precured laminate for both surface mounted and near surface mounted (NSM) structural reinforcement applications.

- Code listed (ICC-ES ESR-3403) per ICC-ES AC125
- No field saturation required
- Highest tensile capacity available
- Lower overall installed cost/labor savings
- Available in a variety of widths and thicknesses and may be cut to length

CSS-CUCL*	Code-Listed Unidirectional Carbon Laminate

Precured Carbon-Fiber Laminate

Fabric-Reinforced Cementitious Matrix (FRCM)

Repair, protect and strengthen aging, damaged or overloaded concrete and masonry structures in one application and significantly reduce your installed cost. FRCM or Fabric-Reinforced Cementitious Matrix combines high-performance sprayable mortar with carbon-fiber grid to create thin-walled, reinforced concrete shells without adding significant weight or mass to the structure.

Benefits

- Repair and strengthen structures using only a thin layer of material
- Can be applied in multiple grid layers (four maximum) to achieve desired strengthening
- Lightweight system for vertical surfaces and overhead applications
- Suitable for harsh environments or service conditions including marine locations, elevated temperatures, humidity, abrasion and UV
- Works on damp substrates
- Installation process is similar to that for wet shotcrete repair mortars
- Quick installation with less preparation than traditional shotcrete repairs with rebar
- Does not create a vapor barrier
- Matches substrate finish

CSS-CM	Cementitious Matrix — 55 lb. (24.9 kg) bag
CSS-BCG19550	Bidirectional Carbon Grid
CSS-HBCG19550	Heavy Bidirectional Carbon Grid
CSS-UCG19550	Unidirectional Carbon Grid

These products are part of the tested assembly in UL Design No. N859, which achieved a four-hour fire rating when subjected to ASTM E119 / UL 263 full-scale fire testing. Please refer to UL Online Certifications Directory for the UL listing.

Fabric-Reinforced Cementitious Matrix (FRCM)

No-Cost Engineering and Technical Services

We recognize that specifying Simpson Strong-Tie® Composite Strengthening Systems™ is unlike choosing any other product we offer. Leverage our expertise to help with your strengthening designs.

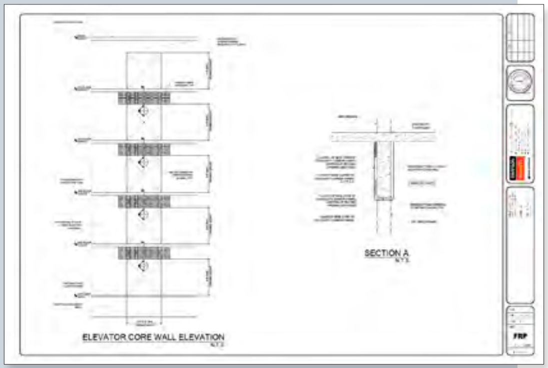
Our Complimentary Engineering and Technical Services Include:

Assessment

- Feasibility studies to ensure suitable solutions for your application
- Partnering with trained and licensed contractors to provide rough order-of-magnitude (ROM) budget estimates

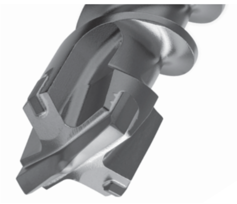
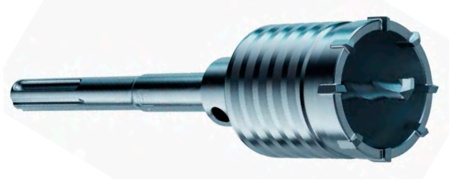
Complete Engineering Package

- Complete engineering package
- Specifications prepared to your unique project requirements
- Detailed proposal documentation, including drawings
- Calculations provided for Engineer of Record reference during submittal review
- Calculations for each unique element
- Elevation drawings for each element and component
- Typical detail sheet showing installation details
- General notes to include in the plans
- Signed and sealed documents for all 50 states and throughout Canada



Carbide Drill Bits

Drill Bit Matrix

Shank Types	 **SDS-MAX**  **SDS-PLUS**  **Spline**  **Straight**  **Spline** *(design disables rotohammer rotation)*  **¾" Hex**
Drill Bits	 **Solid-Tip Carbide Drill Bit**  **Quad Head**  **Standard Two-Cutter Head**
Rebar / Plate Cutters	 **Plate Cutter Detail**  **Rebar Cutter Detail**
Demolition Chisels	 **Scraper**  **Flat Chisel**  **Bull Point Chisel**  **Asphalt Cutter**  **Bushing Tool Head**  **Ground Rod Driver**  **Clay Spade**  **Scaler**
Core Bits	 **One-Piece Core Bit**

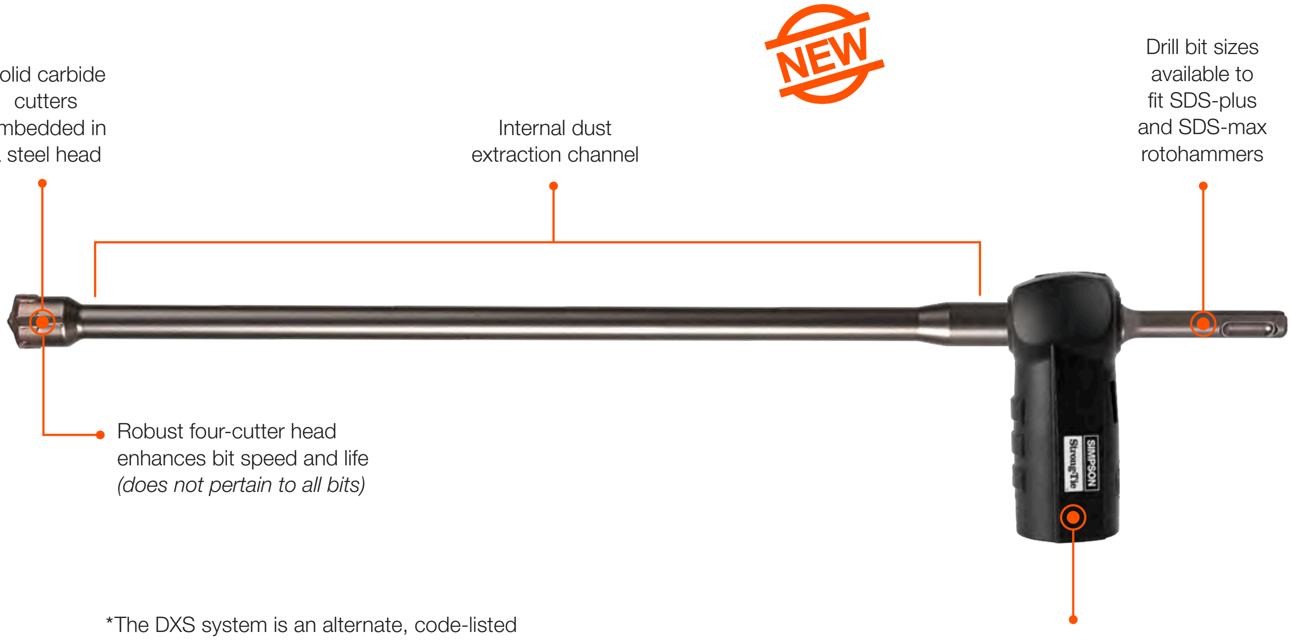
See Product Guide and **strongtie.com** for additional information.

DXS Drill Bits for Concrete and Masonry

At the heart of the Speed Clean™ DXS system is a proprietary Bosch® bit design that allows dust and debris to be removed through the hollow center of the bit during drilling. When used with a suitable rotary hammer and HEPA vacuum, the system removes dust from the hole at the moment it is created.

Minimum vacuum airflow: 129 cfm with auto-filter cleaner

Maximum hammer no-load RPM: 760



*The DXS system is an alternate, code-listed procedure to the standard 'drill-blow-brush-blow' procedure for Simpson Strong-Tie® SET-XP®, AT-XP® and SET-3G™ adhesives.

Construction **Solutions**

BOSCH Invented for life | SIMPSON Strong-Tie

Through collaborative efforts such as the Speed Clean DXS dust extraction system, Bosch and Simpson Strong-Tie are committed to optimizing every step of the installation process to save time on the jobsite and ensure the performance of the anchor. Our goal as technology leaders in our industries is to combine our talents and decades of experience to provide choices that help projects come in on time and under budget.

DXS Drill Bits for Concrete and Masonry

Speed Clean™ DXS Dust Extraction Drill Bits
Code Tested with AT-XP®, SET-XP® and SET-3G™ Adhesives

Model No.	Description	Size (in.)	Drilling Depth (in.)	Threaded Rod Anchor (in.)	Rebar Anchor	Threaded Rod Anchor Products	Rebar Anchor Products
DXS-PL04313	SDS-plus®, 2 cutter	7⁄16 x 13	7½	⅜	—	AT-XP and SET-3G	—
DXS-PL05013	SDS-plus®, 2 cutter	½ x 13	7½	⅜	#3	SET-XP	SET-XP, AT-XP and SET-3G
DXS-PL05615	SDS-plus®, 2 cutter	9⁄16 x 15	10	½	—	AT-XP and SET-3G	—
DXS-PL06215Q	SDS-plus®, 4 cutter	⅝ x 15	10	½	#4	SET-XP	SET-XP, AT-XP and SET-3G
DXS-PL06818Q	SDS-plus®, 4 cutter	11⁄16 x 18	12½	⅝	—	AT-XP and SET-3G	—
DXS-PL07518Q	SDS-plus®, 4 cutter	¾ x 18	12½	⅝	#5	SET-XP	SET-XP, AT-XP and SET-3G
DXS-MX07521Q	SDS-max®, 4 cutter	¾ x 21	12½	⅝	#5	SET-XP	SET-XP, AT-XP and SET-3G
DXS-MX08125Q	SDS-max®, 4 cutter	13⁄16 x 25	15	¾	—	AT-XP	—
DXS-MX08725Q	SDS-max®, 4 cutter	⅞ x 25	15	¾	#6	SET-XP and SET-3G	SET-XP, AT-XP and SET-3G
DXS-MX10027Q	SDS-max®, 4 cutter	1 x 27	17½	⅞	#7	SET-XP, AT-XP and SET-3G	SET-XP, AT-XP and SET-3G
DXS-MX11229Q	SDS-max®, 4 cutter	1⅛ x 29	20	1	#8	SET-XP, AT-XP and SET-3G	SET-XP, AT-XP and SET-3G
DXS-MX13734Q	SDS-max®, 4 cutter	1⅜ x 29	25	1¼	#10	SET-XP, AT-XP and SET-3G	SET-XP, AT-XP and SET-3G

Speed Clean DXS Dust Extraction Adapters

Model No.	Description	Retail Package	Carton Quantity
DXS-MXADP	SDS-max adapter	1 adapter	10
DXS-PLADP	SDS-plus adapter	1 adapter	10

Appendix – Supplemental Topics

Appendix — Supplemental Topics

To keep you as informed as possible, the following topics are included in this Appendix:

Supplemental Topics for Anchors

I. Base Materials

"Base material" is a generic industry term that refers to the element or substrate to be anchored to. Base materials include concrete, brick, concrete block (CMU) and structural tile, to name a few. The most common type of base material where adhesive and mechanical anchors are used is concrete.

Concrete – Concrete can be cast-in-place or precast concrete. Concrete has excellent compressive strength, but relatively low tensile strength. Cast-in-place (or sometimes called "poured in place") concrete is placed in forms erected on the building site. Cast-in-place concrete can be either normal-weight or lightweight concrete. Lightweight concrete is often specified when it is desirable to reduce the weight of the building structure.

Lightweight concrete differs from normal-weight concrete by the weight of aggregate used in the mixture. Normal-weight concrete has a unit weight of approximately 150 pounds per cubic foot compared to approximately 115 pounds per cubic foot for lightweight concrete.

The type of aggregate used in concrete can affect the tension capacity of an adhesive anchor. Presently, the relationship between aggregate properties and anchor performance is not well understood. Test results should not be assumed to be representative of expected performance in all types of concrete aggregate.

Prefabricated concrete is also referred to as "precast concrete". Precast concrete can be made at a prefabricating plant or site-cast in forms constructed on the job. Precast concrete members may be solid or may contain hollow cores. Many precast components have thinner cross sections than cast in place concrete. Precast concrete may use either normal or lightweight concrete. Reinforced concrete contains steel bars, cable, wire mesh or random glass fibers. The addition of reinforcing material enables concrete to resist tensile stresses which lead to cracking.

The compressive strength of concrete can range from 2,000 psi to over 20,000 psi, depending on the mixture and how it is cured. Most concrete mixes are designed to obtain the desired properties within 28 days after being cast.

Concrete Masonry Units (CMU) — Block is typically formed with large hollow cores. Block with a minimum 75% solid cross section is called solid block even though it contains hollow cores. In many parts of the country building codes require steel reinforcing bars to be placed in the hollow cores, and the cores to be filled solid with grout.

In some areas of the eastern United States, past practice was to mix concrete with coal cinders to make cinder blocks. Although cinder blocks are no longer made, there are many existing buildings where they can be found. Cinder blocks require special attention as they soften with age.

Brick — Clay brick is formed solid or with hollow cores. The use of either type will vary in different parts of the United States. Brick can be difficult to drill and anchor into. Most brick is hard and brittle. Old, red clay brick is often very soft and is easily over-drilled. Either of these situations can cause problems in drilling and anchoring. The most common use of brick today is for building facades (curtain wall or brick veneer) and not for structural applications. Brick facade is attached to the structure by the use of brick ties spaced at intervals throughout the wall. In older buildings, multiple widths, or "wythes" of solid brick were used to form the structural walls. Three and four wythe walls were common wall thicknesses.

Clay Tile — Clay tile block is formed with hollow cores and narrow cavity wall cross sections. Clay tile is very brittle, making drilling difficult without breaking the block. Caution must be used in attempting to drill and fasten into clay tile.

II. Anchor Failure Modes

Four different tension failure modes and three different shear failure modes are generally observed for post-installed anchors under tension loading.

Failure Modes

Tension	Shear
Steel Fracture Breakout Pullout (Mechanical Anchor) Bond Failure (Adhesive Anchor)	Steel Fracture Breakout Pryout

Breakout Failure — Breakout failure occurs when the base material ruptures, often producing a cone-shaped failure surface when anchors are located away from edges, or producing a spall when anchors are located near edges. Breakout failure can occur for both mechanical and adhesive anchors and is generally observed at shallower embedment depths, and for installations at less than critical spacings or edge distances.

Pullout Failure — Pullout failure occurs when a mechanical anchor pulls out of the drilled hole, leaving the base material otherwise largely intact.

Bond Failure — Bond failure occurs when an adhesive anchor pulls out of the drilled hole due to an adhesion failure at the adhesive-to-base-material interface, or when there is a cohesive failure within the adhesive itself. When bond failure occurs, a shallow cone-shaped breakout failure surface will often form near the base material surface. This breakout surface is not the primary failure mechanism.

Pryout Failure — Pryout failure occurs for shallowly embedded anchors when a base material failure surface is pried out "behind" the anchor, opposite the direction of the applied shear force.

Steel Fracture — Steel fracture occurs when anchor spacings, edge distances and embedment depths are great enough to prevent the base-material–related failure modes listed above and the steel strength of the mechanical anchor or adhesive anchor insert is the limiting strength.

III. Corrosion Resistance

Many environments and materials can cause corrosion, including ocean salt air, fire-retardants, fumes, fertilizers, preservative-treated wood, de-icing salts, dissimilar metals and more. Metal fixtures, fasteners and anchors can corrode and lose load-carrying capacity when installed in corrosive environments or when installed in contact with corrosive materials.

The many variables present in a building environment make it impossible to accurately predict if, or when, corrosion will begin or reach a critical level. This relative uncertainty makes it crucial that specifiers and users are knowledgeable about the potential risks and select a product suitable for the intended use. It is also prudent that regular maintenance and periodic inspections are performed, especially for outdoor applications.

It is common to see some corrosion in outdoor applications. Even stainless steel can corrode. The presence of some corrosion does not mean that load capacity has been affected or that failure is imminent. If significant corrosion is apparent or suspected, then the fixtures, fasteners and connectors should be inspected by a qualified engineer or qualified inspector. Replacement of affected components may be appropriate.

Chemical Attack — Chemical attack occurs when the anchor material is not resistant to a substance with which it is in contact. Chemical-resistance information regarding anchoring adhesives is found on p. 252–253.

Supplemental Topics for Anchors

Some wood-preservative chemicals and fire-retardant chemicals and retentions pose increased corrosion potential and are more corrosive to steel anchors and fasteners than others. Additional information on this subject is available at **strongtie.com**.

We have attempted to provide basic knowledge on the subject of corrosion here, but it is important to fully educate yourself by reviewing our technical bulletins on the topic (**strongtie.com/info**) and also by reviewing information, literature and evaluation reports published by others.

Galvanic Corrosion — Galvanic corrosion occurs when two electrochemically dissimilar metals contact each other in the presence of an electrolyte (such as water) that acts as a conductive path for metal ions to move from the more anodic to the more cathodic metal. In the galvanic couple, the more anodic metal will corrode preferentially. The Galvanic Series of Metals table provides a qualitative guide to the potential for two metals to interact galvanically. Metals in the same group (see table) have similar electrochemical potentials. The farther the metals are apart on the table, the greater the difference in electrochemical potential, and the more rapidly galvanic corrosion will occur. Corrosion also increases with increasing conductivity of the electrolyte.

Good detailing practice, including the following, can help reduce the possibility of galvanic corrosion of anchors:

- Use of anchors and metals with similar electrochemical potentials
- Separating dissimilar metals with insulating materials
- Ensuring that the anchor is the anode, when dissimilar materials are present.
- Preventing exposure to and pooling of electrolytes

Galvanic Series of Metals

Corroded End (Anode)
Magnesium Magnesium alloys Zinc
Aluminum 1100 Cadmium Aluminum 2024-T4 Iron and Steel
Lead Tin Nickel (active) Inconel Ni-Cr alloy (active) Hastelloy alloy C (active)
Brasses Copper Cu-Ni alloys Monel
Nickel (passive)
304 stainless steel (passive) 316 stainless steel (passive) Hasteloy alloy C (passive)
Silver Titanium Graphite Gold Platinum
Protected End (Cathode)

Hydrogen-Assisted Stress-Corrosion Cracking

Some hardened fasteners may experience premature failure if exposed to moisture as a result of hydrogen-assisted stress-corrosion cracking. These fasteners are recommended specifically for use in dry, interior locations.

Guidelines for Selecting Corrosion-Resistant Anchors and Fasteners

Evaluate the Application

Consider the importance of the connection.

Evaluate the Exposure

Consider these moisture and treatment chemical exposure conditions:

- **Dry Service:** Generally INTERIOR applications and includes wall and ceiling cavities, raised floor applications in enclosed buildings that have been designed to prevent condensation and exposure to other sources of moisture. Prolonged exposure during construction should also be considered, as this may constitute a Wet Service or Elevated Service Condition.
- **Wet Service:** Generally EXTERIOR construction in conditions other than Elevated Service. These include Exterior Protected and Exposed and General Use Ground Contact as described by the AWPA UC4A.
- **Elevated Service:** Includes fumes, fertilizers, soil, some preservative-treated wood (AWPA UC4B and UC4C), industrial zones, acid rain and other corrosive elements.
- **Uncertain:** Unknown exposure, materials or treatment chemicals.
- **Ocean/Water Front:** Marine environments that include airborne chlorides and some splash. Environments with de-icing salts are included.
- **Treatment Chemicals:** See AWPA Use Category Designations. The preservative-treated wood supplier should provide all of the pertinent information about the wood being used. The information should include Use Category Designation, wood species group, wood treatment chemical and chemical retention. See appropriate evaluation reports for corrosion effects of treatment chemicals and fastener corrosion resistance recommendations.

Use the Simpson Strong-Tie® Corrosion Classification Table

If the treatment chemical information is incomplete, Simpson Strong-Tie recommends the use of a 300-series stainless-steel product. Also if the treatment chemical is not shown in the Corrosion Classification Table, then Simpson Strong-Tie has not evaluated it and cannot make any recommendations other than the use of coatings and materials in the Severe category. Manufacturers may independently provide test results of other product information; Simpson Strong-Tie expresses no opinion regarding such information.

Minimum Corrosion Resistance Recommendations

Corrosion Resistance Classification	Material or Coating
Low	ZN
	Zinc plated
Medium	Mechanically galvanized (ASTM B695-Class 55)[1]
	Ceramic coating
	Hot-dip galvanized (ASTM A153-Class C)
	Type 410 stainless steel with protective top coat
High	Type 302, 303 or 304 stainless steel
Severe	Type 316 stainless steel

[1] Mechanically galvanized Titen HD® anchors are recommended only for temporary outdoor service.

Supplemental Topics for Anchors

Corrosion Resistance Classifications

Environment	Material To Be Fastened						
	Untreated Wood or Other Material	Preservative-Treated Wood					FRT Wood
		SBX-DOT Zinc Borate	Chemical Retention ≤ AWPA, UC4A	Chemical Retention > AWPA, UC4A	ACZA	Other or Uncertain	
Dry Service	Low	Low	Low	High	High	High	Med
Wet Service	Med	N/A	Med	High	High	High	High
Elevated Service	High	N/A	Severe	Severe	High	Severe	N/A
Uncertain	High	High	High	Severe	High	Severe	High
Ocean/Waterfront	Severe	N/A	Severe	Severe	Severe	Severe	N/A

1. These are general guidelines that may not consider all application criteria. Refer to product-specific information for additional guidance.
2. Type 316/305/304 stainless-steel products are recommended where preservative-treated wood used in ground contact has chemical retention level greater than those for AWPA UC4A; CA-C, 0.15 pcf; CA-B, 0.21 pcf; micronized CA-C, 0.14 pcf; micronized CA-B, 0.15 pcf; ACQ-Type D (or C), 0.40 pcf.
3. Testing by Simpson Strong-Tie following ICC-ES AC257 showed that mechanical galvanization (ASTM B695, Class 55), Quik Guard coating, and Double Barrier coating will provide corrosion resistance equivalent to hot-dip galvanization (ASTM A153, Class D) in contact with chemically treated wood in dry service and wet service exposures (AWPA UC1 – UC4A, ICC-ES AC257 Exposure Conditions 1 and 3) and will perform adequately subject to regular maintenance and periodic inspection.
4. Mechanical galvanizations C3 and N2000 should not be used in conditions that would be more corrosive than AWPA UC3A (exterior, above ground, rapid water run off).
5. If uncertain about Use Category, treatment chemical, or environment, use Types 316/305/304 stainless steel, silicon bronze or copper fasteners.
6. Some treated wood may have excess surface chemicals making it potentially more corrosive than lower retentions. If this condition is suspected, use Types 316/305/304 stainless steel, silicon bronze or copper fasteners.
7. Types 316/305/304 stainless steel, silicon bronze or copper fasteners are the best recommendation for ocean salt-air and other chloride-containing environments. Hot-dip galvanized fasteners with at least ASTM A153, Class C protection can also be an alternate for some applications in environments with ocean air and/or elevated wood moisture content.

IV. Mechanical Anchors

Pre-Load Relaxation

Expansion anchors that have been set to the required installation torque in concrete will experience a reduction in pre-tension (due to torque) within several hours. This is known as pre-load relaxation. The high compression stresses placed on the concrete cause it to deform which results in a relaxation of the pre-tension force in the anchor. Tension in this context refers to the internal stresses induced in the anchor as a result of applied torque and does not refer to anchor capacity. Historical data shows it is normal for the initial tension values to decrease by as much as 40–60% within the first few hours after installation. Retorquing the anchor to the initial installation torque is not recommended or necessary.

V. Adhesive Anchors

Installation into Green Concrete

The strength design data for adhesive anchors in this catalog are based on installations into concrete that is at least 21-days old. For anchors installed into concrete that has cured for less than 21 days, refer to the following modification factors that should be applied to the published adhesive bond strength.

Products	Concrete Age When Installed	Concrete Age When Loaded	Bond Strength Factor
AT AT-XP ET-HP SET SET-XP SET-3G	14 days	21 days	1.0
		14 days	0.9
	7 days	21 days	1.0
		7 days	0.7

Oversized Holes

The performance data for adhesive anchors are based upon anchor tests in which holes were drilled with carbide-tipped drill bits of the same diameter listed in the product's load table. Additional static tension tests were conducted to qualify anchors installed with SET-3G™, SET, SET-XP®, ET-HP® and AT adhesives for installation in holes with diameters larger than those listed in the load tables. The tables indicate the acceptable range of drilled hole sizes and the corresponding tension-load reduction factor (if any). The same conclusions also apply to the published shear load values. Drilled holes outside of the accepted range shown in the charts are not recommended.

SET Adhesive — Acceptable Hole Diameter

Insert Diameter (in.)	Acceptable Hole Diameter Range (in.)	Acceptable Load Reduction Factor
⅜	½ – ¾	1.0
½	⅝ – 1⁵⁄₁₆	1.0
⅝	¾ – 1⅛	1.0
¾	⅞ – 1⁵⁄₁₆	1.0
⅞	1 – 1½	1.0
1	1⅛ – 1¹¹⁄₁₆	1.0
1⅛	1¼ – 1⅞	1.0
1¼	1⅜ – 2¹⁄₁₆	1.0
1⅜	1½ – 2¼	1.0

SET-XP and ET-HP Adhesives — Acceptable Hole Diameter

Insert Diameter (in.)	Acceptable Hole Diameter Range (in.)	Acceptable Load Reduction Factor
½	⅝ – ¾	1.0
⅝	¾ – ¹⁵⁄₁₆	1.0
¾	⅞ – 1⅛	1.0
⅞	1 – 1⁵⁄₁₆	1.0
1	1⅛ – 1½	1.0
1¼	1⅜ – 1⅞	1.0

AT Adhesive — Acceptable Hole Diameter

Insert Diameter (in.)	Acceptable Hole Diameter Range (in.)	Acceptable Load Reduction Factor
⅜	7⁄16 – ½	1.0
½	9⁄16 – ⅝	1.0
⅝	11⁄16 – ¾	1.0
¾	13⁄16 – ⅞	1.0
⅞	1	1.0
1	1 1⁄16 – 1⅛	0.75 for 1⅛ only

AT-XP and SET-3G Adhesive — Acceptable Hole Diameter

Insert Diameter (in.)	Acceptable Hole Diameter Range (in.)	Acceptable Load Reduction Factor
⅜	7⁄16 – ½	1.0
½	9⁄16 – ⅝	1.0
⅝	11⁄16 – ¾	1.0

Core-Drilled Holes

The performance data for adhesive anchors are based upon anchor tests in which holes were drilled with carbide-tipped drill bits. Additional static tension tests were conducted to qualify anchors installed with SET-3G™, SET-XP®, ET-HP®, SET and AT anchoring adhesives for installation in holes drilled with diamond-core bits. In these tests, the diameter of the diamond-core bit matched the diameter of the carbide-tipped drill bit recommended in the product's load table. The test results showed that no reduction of the published allowable tension load for SET and AT anchoring adhesives is necessary for this condition. SET-3G, SET-XP, and ET-HP anchoring adhesive require a reduction factor of 0.7 is applied to the characteristic bond strength (τ_k). The same conclusions also apply to the published allowable shear loads. Tests conducted in core-drilled holes are for non-IBC jurisdictions.

Installation in Damp, Wet and Submerged Environments

SET-XP®, SET-3G™, ET-HP® and AT-XP®:
The performance data for adhesive anchors using SET-XP, SET-3G, ET-HP and AT-XP adhesives are based upon tests according to ICC-ES AC308. This criteria requires adhesive anchors that are to be installed in outdoor environments to be tested in water-saturated concrete holes that have been cleaned with less than the amount of hole cleaning recommended by the manufacturer. A product's sensitivity to this installation condition is considered in determining the product's "Anchor Category" (strength reduction factor).

SET-XP, ET-HP and AT-XP may be installed in dry or water-saturated concrete.

SET-3G may be installed in dry, water-saturated or water-filled holes in concrete.

Reliability Testing per ICC-ES AC308 is defined as:

- Dry Concrete — Cured concrete whose moisture content is in equilibrium with surrounding non-precipitate atmospheric conditions.
- Water-Saturated Concrete — Cured concrete that is covered with water and water saturated.
- Submerged Concrete — Cured concrete that is covered with water and water saturated.
- Water-Filled Hole — Drilled hole in water-saturated concrete that is clean yet contains standing water at the time of installation.

SET and AT:
The performance data for adhesive anchors using SET and AT adhesives are based upon tests in which anchors are installed in dry holes. Additional static tension tests were conducted for some products in damp holes, water-filled holes and submerged holes.

The legacy test results show that no reduction of the published allowable tension load is necessary for SET and AT adhesives in damp holes, or for SET and AT adhesives in water-filled holes. For SET and AT adhesives in submerged holes, the test results show that a reduction factor of 0.60 is applicable. The same conclusions also apply to the published allowable shear load values.

Reliability Testing per ICC-ES AC58 is defined as:

- Dry Concrete — Cured concrete whose moisture content is in equilibrium with surrounding non-precipitate atmospheric conditions.
- Damp Hole — A damp hole, as defined in ASTM E1512 and referenced in ICC-ES AC58, is a drilled hole that has been properly drilled, cleaned and then is filled with standing water for seven days. After seven days, the standing water is blown out of the hole with compressed air and the adhesive anchor is installed.
- Water-Filled Hole — A water-filled hole is defined similarly to a damp hole; however, the standing water is not blown out of the hole. Instead, the adhesive is injected directly into the water-filled hole (from the bottom of the hole up) and the insert is installed.
- Submerged Hole — A submerged hole is similar to a water-filled hole with one major exception — in addition to standing water within the hole, water also completely covers the surface of the base material.

*Note that drilling debris and sludge should be removed from the drilled hole prior to installation. ICC-ES AC58 does not address this condition.

Elevated In-Service Temperature

The performance of all adhesive anchors is affected by elevated base material temperature. The in-service temperature sensitivity table provided for each adhesive provides the information necessary to apply the appropriate load adjustment factor to either the allowable tension based on bond strength or allowable shear based on concrete edge distance for a given base material temperature. While there is no commonly used method to determine the exact load-adjustment factor, there are a few guidelines to keep in mind when designing an anchor that will be subject to elevated base-material temperature. In any case, the final decision must be made by a qualified design professional using sound engineering judgment:

- When designing an anchor connection to resist wind and/or seismic forces only, the effect of fire (elevated temperature) may be disregarded.
- The base-material temperature represents the average internal temperature and, hence, the temperature along the entire bonded length of the anchor.
- The effects of elevated temperature may be temporary. If the in-service temperature of the base material is elevated such that a load-adjustment factor is applicable but, over time, the temperature is reduced to a temperature below which a load-adjustment factor is applicable, the full allowable load based on bond strength is still applicable. This is applicable provided that the degradation temperature of the anchoring adhesive (350°F for SET-3G, SET-XP, SET, ET-HP, AT-XP and AT adhesives) has not been reached.

Chemical Resistance of Adhesive Anchors

- Samples of Simpson Strong-Tie® anchoring adhesives were immersed in the chemicals shown here until they exhibited minimal weight change (indicating saturation) or for a maximum of three months.
- The samples were then tested according to ASTM D 543 Standard Practices for Evaluating the Resistance of Plastics to Chemical Changes, Procedures I & II, and either ASTMD 790 Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials or ASTM D 695 Standard Test Method for Compressive Properties of Rigid Plastics.
- In cases where mild chemicals were evaluated, the exposure was accelerated per ASTM D 3045 Standard Practice for Heat Aging of Plastics Without Load.
- Samples showing no visible damage and demonstrating statistically equivalent strength and elastic modulus as compared to control samples were classified as "Resistant" (R).
  - These adhesives are considered suitable for continuous exposure to the identified chemical when used as a part of an adhesive anchor assembly.
- Samples exhibiting slight damage, such as swelling or crazing, or not demonstrating both statistically equivalent strength and elastic modulus as compared to control samples were classified a "Non-Resistant" (NR).
  - These adhesives are considered suitable for periodic exposure to the identified chemical if the chemical will be diluted and washed away from the adhesive anchor assembly after exposure, or if only emergency contact with the chemical is expected and subsequent replacement of the anchor would be undertaken.
  - Some manufacturers refer to this as "limited resistance" or "partial resistance" in their literature.
- Samples that were completely destroyed by the chemical, or that demonstrated a significant loss in strength after exposure were classified as "Failed" (F).
  - These adhesives are considered unsuitable for exposure to the identified chemical.

Note: In most actual service conditions, the majority of the anchoring adhesive is not exposed to the chemical and thus some period of time is required for the chemical to saturate the entire adhesive. An adhesive anchor would be expected to maintain bond strength and creep resistance until a significant portion of the adhesive is saturated.

Chemical	Concentration	AT-XP	SET-XP	ET-HP	AT	SET
Acetic Acid	Glacial	NR	F	F	F	F
	5%	R	F	F	R	F
Acetone	100%	F	F	F	—	—
Aluminum Ammonium Sulfate (Ammonium Alum)	10%	R	R	R	R	R
Aluminum Chloride	10%	R	R	R	—	—
Aluminum Potassium Sulfate (Potassium Alum)	10%	R	R	R	R	R
Aluminum Sulfate (Alum)	15%	R	R	R	R	R
Ammonium Hydroxide (Ammonia)	28%	NR	R	NR	R	R
	10%	R	R	R	R	R
	pH = 10	R	R	R	—	—
Ammonium Nitrate	15%	R	R	R	R	R
Ammonium Sulfate	15%	R	R	R	R	R
Automotive Antifreeze	50%	R	R	R	—	—
Aviation Fuel (JP5)	100%	R	R	R	—	—
Brake Fluid (DOT3)	100%	R	NR	F	—	—
Calcium Hydroxide	10%	R	R	R	—	—
Calcium Hypochlorite (Chlorinated Lime)	15%	R	R	R	R	R
Calcium Oxide (Lime)	5%	R	R	R	R	R
Carbolic Acid	10%	NR	F	F	—	—
	5%	NR	F	F	—	—
Carbon Tetrachloride	100%	R	R	R	—	—
Chromic Acid	40%	R	NR	NR	—	—
Citric Acid	10%	R	R	R	—	—
Copper Sulfate	10%	R	R	R	—	—
Detergent (ASTM D543)	100%	R	R	R	—	—
Diesel Oil	100%	R	R	NR	—	—
Ethanol, Aqueous	95%	NR	F	F	—	—
	50%	NR	NR	NR	—	—
Ethanol, Denatured	100%	R	F	F	—	—
Ethylene Glycol	100%	R	R	R	—	—
Fluorosilicic Acid	25%	R	R	R	R	R
Formic Acid	Concentrated	F	F	F	—	—
	10%	R	F	F	—	—
Gasoline	100%	R	R	R	—	—
Hydrochloric Acid	Concentrated	NR	F	F	R	F
	10%	R	NR	F	R	NR
	pH = 3	R	R	R	—	—
Hydrogen Peroxide	30%	R	F	F	R	F
	3%	R	R	R	R	NR
Iron (II) Chloride (Ferrous Chloride)	15%	R	R	R	R	R
Iron (III) Chloride (Ferric Chloride)	15%	R	R	R	R	NR
Iron (III) Sulfate (Ferric Sulfate)	10%	R	R	F	—	—
Isopropanol	100%	R	F	F	—	—
Lactic Acid	85%	R	F	F	—	—
	10%	R	F	F	—	—
Machine Oil	100%	R	R	R	—	—
Methanol	100%	NR	F	F	—	—
Methyl Ethyl Ketone	100%	NR	F	F	—	—

Chemical	Concentration	AT-XP	SET-XP	ET-HP	AT	SET
Methyl Isobutyl Ketone	100%	NR	NR	NR	—	—
Mineral Oil	100%	R	R	R	—	—
Mineral Spirits	100%	R	R	R	—	—
Mixture of Amines[1]	100%	R	F	F	—	—
Mixture of Aromatics[2]	100%	NR	NR	R	—	—
Motor Oil (5W30)	100%	R	R	R	—	—
N,N-Diethyaniline	100%	R	R	R	—	—
Nitric Acid	Concentrated	F	F	F	F	F
	40%	NR	F	F	F	F
	10%	R	R	F	R	NR
	pH = 3	R	R	R	—	—
Phosphoric Acid	85%	R	F	F	F	F
	40%	R	F	F	R	NR
	10%	R	F	F	R	NR
	pH = 3	R	R	R	—	—
Potassium Hydroxide	40%	NR	R	NR	—	—
	10%	NR	R	R	—	—
	pH = 13.2	R	R	R	—	—
Potassium Permanganate	10%	R	R	R	R	R
Propylene Glycol	100%	R	R	NR	—	—
Seawater (ASTM D1141)	100%	R	R	R	—	—
Soap (ASTM D543)	100%	R	R	R	—	—
Sodium Bicarbonate	10%	R	R	R	R	R
Sodium Bisulfite	15%	R	R	R	R	NR
Sodium Carbonate	15%	R	R	R	R	R
Sodium Chloride	15%	R	R	R	R	R
Sodium Fluoride	10%	R	R	R	R	R
Sodium Hexafluorosilicate (Sodium Silicon Fluoride)	5%	R	R	R	R	R
Sodium Hydrosulfide	10%	R	R	R	—	—
Sodium Hydroxide	60%	R	R	R	—	—
	40%	R	R	R	—	—
	10%	R	R	R	—	—
	pH = 10	R	R	R	—	—
Sodium Hypochlorite (Bleach)	25%	R	R	R	R	R
	10%	R	R	R	R	R
Sodium Nitrate	15%	R	R	R	R	R
Sodium Phosphate (Trisodium Phosphate)	10%	R	R	R	R	R
Sodium Silicate	50%	R	R	R	R	R
Sulfuric Acid	Concentrated	F	F	F	F	F
	30%	R	NR	F	R	NR
	3%	R	NR	F	R	NR
	pH = 3	R	R	R	—	—
Toluene	100%	NR	F	NR	—	—
Triethanol Amine	100%	R	NR	R	—	—
Turpentine	100%	R	R	R	—	—
Water	100%	R	R	R	R	R
Xylene	100%	NR	NR	R	—	—

"R" – Resistant, "NR" – Non-Resistant, "F" – Failed, "—" – Not tested

1. triethanol amine, n-butylamine, N,N-dimethylamine
2. toluene, methyl naphthalene, xylene

Glossary

ACI — American Concrete Institute

ACRYLIC — Polymer based on resins prepared from a combination of acrylic and methacrylic esters.

ADHESIVE ANCHOR — Typically, a threaded rod or rebar that is installed in a predrilled hole in a base material with a two-part chemical compound.

ADMIXTURE — A material other than water, aggregate or hydraulic cement used as an ingredient of concrete and added to concrete before or during its mixing to modify its properties.

AERATED CONCRETE — Concrete that has been mixed with air-entraining additives to protect against freeze-thaw damage and provide additional workability.

AGGREGATE — A granular material, such as sand, gravel, crushed stone and iron blast-furnace slag, used with a cementing medium to form a hydraulic cement concrete or mortar.

AISC — American Institute of Steel Construction

ALLOWABLE LOAD — The maximum design load that can be applied to an anchor. Allowable loads for mechanical and adhesive anchors are based on applying a factor of safety to the average ultimate load.

ALLOWABLE STRESS DESIGN (ASD) — A design method in which an anchor is selected such that service loads do not exceed the anchor's allowable load. The allowable load is the average ultimate load divided by a factor of safety.

AMINE CURING AGENT — Reactive ingredient used as a setting agent for epoxy resins to form highly crosslinked polymers.

ANCHOR CATEGORY — The classification for an anchor that is established by the performance of the anchor in reliability tests such as sensitivity to reduced installation effort for mechanical anchors or sensitivity to hole cleaning for adhesive anchors.

ANSI — American National Standards Institute

ASTM — American Society for Testing and Materials

BASE MATERIAL — The substrate (concrete, CMU, etc.) into which adhesive or mechanical anchors are to be installed.

BOND STRENGTH — The mechanical interlock or chemical bonding capacity of an adhesive to both the insert and the base material.

BRICK — A solid masonry unit of clay or shale formed into a rectangular prism while plastic and burned or fired in a kiln that may have cores or cells comprising less than 25% of the cross sectional area.

CAMA — Concrete Anchor Manufacturer's Association

CAST-IN-PLACE ANCHOR — A headed bolt, stud or hooked bolt installed into formwork prior to placing concrete.

CHARACTERISTIC DESIGN VALUE — The nominal strength for which there is 90% confidence that there is a 95% probability of the actual strength exceeding the nominal strength.

CONCRETE — A mixture of Portland cement or any other hydraulic cement, fine aggregate, coarse aggregate and water, with or without admixtures. Approximate weight is 150 pcf.

CONCRETE BRICK — A solid concrete masonry unit (CMU) made from Portland cement, water, and aggregates.

CONCRETE COMPRESSIVE STRENGTH (f'_c) — The specified compressive load carrying capacity of concrete used in design, expressed in pounds per square inch (psi) or megapascals (MPa).

CONCRETE MASONRY UNIT (CMU) — A hollow or solid masonry unit made from cementitious materials, water and aggregates.

CORE DRILL — A method of drilling a smooth wall hole in a base material using a special drill attachment.

CREEP — Displacement under a sustained load over time.

CURE TIME — The elapsed time required for an adhesive anchor to develop its ultimate carrying capacity.

DESIGN LOAD — The calculated maximum load that is to be applied to the anchor for the life of the structure.

DESIGN STRENGTH — The nominal strength of an anchor calculated per ACI 318, ICC-ES AC193 or ICC-ES AC308 and then multiplied by a strength reduction factor (ϕ).

DROP-IN ANCHOR — A post-installed mechanical anchor consisting of an internally-threaded steel shell and a tapered expander plug. The bottom end of the steel shell is slotted longitudinally into equal segments. The anchor is installed in a pre-drilled hole using a hammer and a hand-setting tool. The anchor is set when the tapered expander plug is driven toward the bottom end of the anchor such that the shoulder of the hand-setting tool makes contact with the top end of the anchor. A drop-in anchor may also be referred to as a displacement controlled expansion anchor.

DUCTILITY — A material under tensile stress with an elongation of at least 14% and an area reduction of at least 30% prior to rupture.

DUCTILE ANCHOR SYSTEM — The behavior of an anchor system where a ductile steel insert governs the design over concrete breakout, pullout and adhesive bond.

DYNAMIC LOAD — A load whose magnitude varies with time.

EDGE DISTANCE:

EDGE DISTANCE (C) — The measure between the anchor centerline and the free edge of the concrete or masonry member.

CRITICAL EDGE DISTANCE (C_{cr} or C_{ac}) — The least edge distance at which the allowable load capacity of an anchor is applicable without reductions.

MINIMUM EDGE DISTANCE (C_{min}) — The least edge distance at which the anchors are tested for recognition.

EFFECTIVE EMBEDMENT DEPTH — The dimension measured from the concrete surface to the deepest point at which the anchor tension load is transferred to the concrete.

EMBEDMENT DEPTH — The distance from the top surface of the base material to the installed end of the anchor. In the case of a post-installed mechanical anchor, the embedment depth is measured prior to application of the installation torque.

EPOXY RESIN — A viscous liquid containing epoxide groups that can be crosslinked into final form by means of a chemical reaction with a variety of setting agents.

Glossary

EXPANSION ANCHOR — A mechanical fastener placed in hardened concrete or assembled masonry, designed to expand in a self-drilled or predrilled hole of a specified size and engage the sides of the hole in one or more locations to develop shear and/or tension resistance to applied loads without grout, adhesive or drypack.

FATIGUE LOAD TEST — A test in which the anchor is subjected to a specified load magnitude for 2 x 10^6 cycles in order to establish the endurance limit of the anchor.

GEL TIME — The elapsed time at which an adhesive begins to increase in viscosity and becomes resistant to flow.

GROUT — A mixture of cementitious material and aggregate to which sufficient water is added to produce pouring consistency without segregation of the constituents.

GROUTED MASONRY (or GROUT-FILLED MASONRY) — Hollow-unit masonry in which the cells are filled solidly with grout. Also, double or triple-wythe wall construction in which the cavity(s) or collar joint(s) is filled solidly with grout.

HOT-DIP GALVANIZED — A part coated with a relatively thick layer of zinc by means of dipping the part in molten zinc.

IAPMO UES — IAPMO Uniform Evaluation Service. An ISO 17065 ANSI-accredited company that issues evaluation reports expressing a professional opinion as to a product's building code compliance.

IBC — International Building Code.

ICC-ES — ICC Evaluation Service. An ISO 17065 ANSI-accredited company that issues evaluation reports expressing a professional opinion as to a product's building code compliance.

LEGACY ACCEPTANCE CRITERIA — A past version of an ICC-ES anchor qualification criteria. These are no longer current standards, but are the basis for legacy allowable load data for anchors in concrete. These standards have been replaced by modern standards such as ICC-ES AC193 and AC308.

LIGHTWEIGHT CONCRETE — Concrete containing lightweight aggregate. The unit weight of lightweight concrete is not to exceed 115 pcf.

MASONRY — Brick, structural clay tile, stone, concrete masonry units or a combination thereof bonded together with mortar.

MECHANICALLY GALVANIZED — A part coated with a layer of zinc by means of mechanical impact. The thickest levels of mechanical galvanizing (ASTM B695, Class 55 or greater) are considered to be alternatives to hot-dip galvanizing and provide a medium level of corrosion resistance.

MORTAR — A mixture of cementitious materials, fine aggregate and water used to bond masonry units together.

NOMINAL STRENGTH — The strength of an element as calculated per ACI 318, ICC-ES AC193 or ICC-ES AC308.

NORMAL WEIGHT CONCRETE — Concrete containing normal weight aggregate. The unit weight of normal weight concrete is approximately 150 pcf.

OBLIQUE LOAD — A load that is applied to an anchor, which can be resolved into tension and shear components.

PLAIN CONCRETE — Structural concrete with no reinforcement or with less reinforcement than the minimum specified for reinforced concrete.

PORTLAND CEMENT — Hydraulic cement consisting of finely pulverized compounds of silica, lime and alumina.

POST-INSTALLED ANCHOR — Either a mechanical or adhesive anchor installed in a pre-drilled hole in the base material.

POST-TENSION — A method of prestressing in which tendons are tensioned after concrete has hardened.

POT LIFE — The length of time a mixed adhesive remains workable (flowable) before hardening.

PRECAST CONCRETE — A concrete structural element cast elsewhere than its final position in the structure.

PRESTRESSED CONCRETE — Structural concrete in which internal stresses have been introduced to reduce potential tensile stresses in concrete resulting from loads.

PRETENSIONING — A method of prestressing in which tendons are tensioned before concrete is placed.

REBAR — Deformed reinforcing steel which comply with ASTM A615.

REINFORCED CONCRETE — Structural concrete reinforced with no less than the minimum amount of prestressed tendons or nonprestressed reinforcement specified in ACI 318.

REINFORCED MASONRY — Masonry units and reinforcing steel bonded with mortar and/or grout in such a manner that the components act together in resisting forces.

REQUIRED STRENGTH — The factored loads and factored load combinations that must be resisted by an anchor.

SCREEN TUBE — Typically a wire or plastic mesh tube used with adhesives for anchoring into hollow base materials to prevent the adhesive from flowing uncontrolled into voids.

SCREW ANCHOR — A post-installed anchor that is a threaded mechanical fastener placed in a predrilled hole. The anchor derives its tensile holding strength from the mechanical interlock of the fastener threads with the grooves cut into the concrete during the anchor installation.

SHEAR LOAD — A load applied perpendicular to the axis of an anchor.

SHOTCRETE — Concrete that is pneumatically projected onto a surface at high velocity. Also known as gunite.

SLEEVE ANCHOR — A post-installed mechanical anchor consisting of a steel stud with nut and washer, threaded on the top end and a formed uniform tapered mandrel on the opposite end around which a full length expansion sleeve formed from sheet steel is positioned. The anchor is installed in a predrilled hole and set by tightening the nut by torquing thereby causing the expansion sleeve to expand over the tapered mandrel to engage the base material.

Glossary

SPACING:

SPACING (S) — The measure between anchors, centerline-to-centerline distance.

CRITICAL SPACING (S_{cr}) — The least anchor spacing distance at which the allowable load capacity of an anchor is applicable such that the anchor is not influenced by neighboring anchors.

MINIMUM SPACING (S_{min}) — The least anchor spacing at which the anchors are tested for recognition.

STAINLESS STEEL — A family of iron alloys containing a minimum of 12% chromium. Type-316 stainless steel provides greater corrosion resistance than Types 303 or 304.

STANDARD DEVIATION — As it pertains to this catalog, a statistical measure of how widely dispersed the individual test results were from the published average ultimate loads.

STATIC LOAD — A load whose magnitude does not vary appreciably over time.

STRENGTH DESIGN (SD) — A design method in which an anchor is selected such that the anchor's design strength is equal to or greater than the anchor's required strength.

STRENGTH REDUCTION FACTOR (φ) — A factor applied to the nominal strength to allow for variations in material strengths and dimensions, inaccuracies in design equations, required ductility and reliability, and the importance of the anchor in the structure.

TENDON — In pretensioned applications, the tendon is the prestressing steel. In post-tensioned applications, the tendon is a complete assembly consisting of anchorages, prestressing steel, and sheathing with coating for unbonded applications or ducts with grout for bonded applications.

TENSION LOAD — A load applied parallel to the axis of an anchor.

THIXOTROPIC — The ability of a fluid to become less viscous (resistant to flow) under shear, then thicken when the shear force is removed.

TORQUE — The measure of the force applied to produce rotational motion usually measured in foot-pounds. Torque is determined by multiplying the applied force by the distance from the pivot point to the point where the force is applied.

ULTIMATE LOAD — The average value of the maximum loads that were achieved when five or more samples of a given product were installed and statically load tested to failure under similar conditions. The ultimate load is used to derive the allowable load by applying a factor of safety.

UNDERCUT ANCHOR — A post-installed anchor that develops its tensile strength from the mechanical interlock provided by undercutting of the concrete at the embedded end of the anchor.

UNREINFORCED MASONRY (URM) — A form of clay brick masonry bearing wall construction consisting of multiple wythes periodically interconnected with header courses. In addition, this type of wall construction contains less than the minimum amounts of reinforcement as defined for reinforced masonry walls.

WEDGE ANCHOR — A post-installed mechanical anchor consisting of a steel stud with nut and washer, threaded on the top end and a formed uniform tapered mandrel on the opposite end around which an expansion clip formed from sheet steel is positioned. The anchor is installed in a predrilled hole and set by tightening the nut by torquing, thereby causing the expansion clip to expand over the tapered mandrel to engage the base material. A wedge anchor may also be referred to as a torque controlled expansion anchor.

WYTHE — A continuous vertical section of masonry one unit in thickness.

ZINC PLATED — A part coated with a relatively thin layer of zinc by means of electroplating.

Alphabetical Index of Products

Alphabetical Index of Products

The next generation of Simpson Strong-Tie® epoxy adhesive is more reliable and versatile. With a code report ICC-ES ESR-4057, the high-strength SET-3G™ anchoring adhesive performs in extreme in-service temperatures (from –40°F to 176°F) as well as in dry or water-saturated concrete environments to provide the high bond strength values and performance needed for adhesive anchoring applications on your projects.

Specify SET-3G adhesive for your next project. Visit **strongtie.com/set3g** or call us at (800) 999-5099.

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