Powers FASTENERS

SPECIFICATION and DESIGN MANUAL

ANCHORING & FASTENING SYSTEMS

5th EDITION

Architectural and Engineering Specification and Design Manual 5th Edition

Anchoring & Fastening Systems

Powers FASTENERS

INTRODUCTION AND IMPORTANT INFORMATION

Powers Fasteners is the largest supplier of concrete and masonry anchors in North America and has been a leader in the fastening industry since 1921. Founded as the *Rawlplug Company Inc*, the Powers family changed the name to Powers Fasteners in 1989 as the company expanded internationally. Powers expansion into Australia, Asia and Europe dictated the name change from Rawlplug to Powers, a name which the Powers family owns worldwide. Powers is an ISO-9001 international anchoring products company with extensive manufacturing and engineering expertise in the following product groups: Mechanical anchors, Adhesive Anchoring Systems, Wall Anchors, Roofing Fasteners, Carbide Drill Bits, and powered forced-entry systems such as Powder Actuated and Gas Fastening.

We are pleased to present our 5th edition of the Powers Specification & Design Manual.
This comprehensive manual was developed for the design professional and specifier. It is a complete update to our previous technical manual and is based on over 85 years of industry experience. The manual contains the latest in anchor technology, testing standards, construction codes, and approval listings for every Powers product. This manual should be used as a benchmark engineering resource for selecting and specifying the proper products for your anchoring and fastening applications.

We strongly recommend the use of our website at *www.powers.com*
It contains the most up-to-date product information including product approvals and listings, MSDS sheets, submittal packages, general product information, software tools, contact information, and copies of our newsletter 'Concrete Evidence'. These resources and programs combined with over thirty stocking locations throughout North America provide the best possible engineering and field support available in the post-installed anchoring industry.

We invite you to utilize the other services we provide for design professionals.
Our engineering and field support teams offer educational seminars/workshops, technical support, and field-testing of all Powers Fasteners products. In addition, our national Powers Training Vehicle (PTV) program is also available for product installation demonstrations, instruction, and certification for designers and contractors. We have a fully dedicated staff of customer support specialists to answer all of your technical needs. If you should have any questions or feedback, please contact customer service at (914) 235-6300 or by email at *info@powers.com*.

We encourage you to improve your firm's specifications by adding our products into your design.
If you would like assistance writing our products into your specifications, please contact our engineering department at (800) 524-3244 or by email at *engineering@powers.com*. We look forward to earning your specification as well as working as a partner with you.

Quality Policy
Powers Fasteners, Inc. is committed to providing its customers with quality products and services that continually meet and exceed customer expectations.

NSF-ISR QUALITY SYSTEM REGISTERED TO ISO 9001:2000

Powers METAL MFG. CO.

Quality Statement
Powers Fasteners, Inc. is dedicated to a quality leadership position in the design and manufacture of products for the construction industry. This mission is achieved by all Powers Fasteners, Inc. employees being actively involved in satisfying the customer through quality offerings in design and manufacturing, promoting strength through education and training, continuously improve through teamwork and assuring environmental responsibility and a safe work place.

Jeffrey Powers
President

Christopher Powers
CEO

TABLE OF CONTENTS

Notes:

Post-Installed Anchor Technology

INTRODUCTION

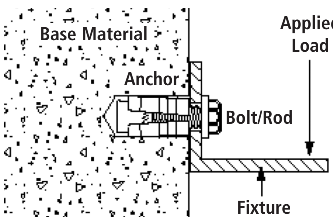
Post-installed anchors have been used since the early 1900's to secure building components. Originally, the anchor hole was manually drilled using a star type drill and a hammer. An anchor consisted of a wood or lead plug which was carved or molded to size and driven into the drilled hole. As a screw or nail was inserted in the plug, it expanded against the wall of the hole. Commercially manufactured anchors were first made from lead or fiber material in a variety of sizes to match a bolt or screw. The original *Rawlplug* anchor was developed in 1919. As the materials and techniques used in building construction changed, new anchors were developed to meet application needs.

During the second World War, powder-actuated fastening systems were developed for repairing damage to ships. After the war, use of powder-actuated fastening technology developed rapidly and became the standard method of attachment for many light duty applications in the construction industry. Today, a wide variety of anchors and fasteners are available including the use of gas fastening technology. Although the variety of choice provides the user with the opportunity to select the best product for a specific application, it also makes the selection process more difficult. For this reason, the load capacities and other criteria used to determine the type, size, and number of anchors or fasteners to be used for any given application need to be taken into consideration. As in all applications, the load capacity and other criteria used to determine an anchoring system's suitability should be reviewed and verified by the design professional responsible for the actual product installation.

SECTION CONTENTS Page No.

FASTENED ASSEMBLY

Before selection can take place, several factors should be considered and reviewed to determine their effect on the application. First, we need to consider the key components of the fastened assembly. The following diagram shows a typical fastened assembly using an anchor.



Some critical items to consider in the selection of a product include the following:

1. Base material in which the anchor or fastener will be installed.
2. Loads applied by the fixture or material to be fastened.
3. Anchor or fastener material and the bolt / threaded rod.
4. Installation procedures including the method of drilling or the installation tool used.
5. Effects of corrosion.
6. Dimensions of the base material including the material thickness, anchor or fastener spacing, and edge distance.

BASE MATERIALS

The materials used in building construction vary widely. Although fastening can occur in many materials, the base materials are often the weak link in the assembly design. The base material is a critical factor in the selection of an anchor or fastener because it must be able to sustain the applied loads. Base material strength can vary widely, and is a key factor in the performance of an anchor or fastener. Generally, products installed in stone and dense concrete can withstand far greater loads than those installed in softer materials such as lightweight concrete, block, or brick. Medium to heavy loads cannot be safely applied to materials such as stucco, grout, shotcrete or plaster. Prior to product installation, base materials should be fully cured. The following sections provide a descriptive summary of typical base materials for reference purposes. Refer to the individual product sections for details on suitable base materials. Individual standards and local codes should be consulted for complete design details.

Concrete

Reinforced concrete is formed using concrete meeting a certain compressive strength combined with reinforcing steel (rebar). The function of the concrete is to resist compressive forces while the reinforcing steel resists the tensile forces. Two primary factors are workability and strength. For fresh concrete, it must have the proper consistency or workability to enable it to be properly placed. Hardened concrete must be able to achieve the specified performance factors including the required compressive strength. The design and construction requirements for reinforced concrete buildings are published by the American Concrete Institute in document ACI 318, *Building Code Requirements for Reinforced Concrete.*

Concrete is a mixture of aggregate, cement, water, and additives. Its strength is achieved through the hydration of the cement component (usually portland) which is used to bind the aggregate together. The type of cement used depends on the requirements of the structure into which the concrete will be placed. The requirements are outlined in ASTM C 150. A concrete mix design consists of both fine and coarse aggregates. Fine aggregate is usually particles of sand less than 3/16" in diameter while the coarse aggregate is crushed stone or gravel greater than 3/16" in diameter as outlined in ASTM C 33 for normal-weight concrete. The aggregate used in normal- weight concrete ranges in weight from 135 to 165 pcf. For structural lightweight concrete, the

BASE MATERIAL (Continued)

aggregate such as that manufactured from expanded shale, slate, clay, or slag has a weight range of 55 to 75 pcf as listed in ASTM C 330. The unit weight for normal-weight concrete ranges from 145 to 155 pcf while structural lightweight concrete ranges from 100 to 115 pcf.

Structural lightweight concrete is used where it is desirable to decrease the weight of the building structure. It also has better fire resistance than normal-weight concrete. The strength and hardness of the aggregate will affect drilling speed, drill bit wear, and drill bit life. Anchors or fasteners installed in lightweight concrete may have load capacities which are up to 40% less than those installed in normal-weight. Job site tests are recommended. Another form of concrete is lightweight insulating concrete. This type of concrete is used for thermal insulating and should not be confused with structural lightweight. ASTM C 332 lists the aggregates used in lightweight insulating concrete in two groups. Group I includes aggregates such as perlite or vermiculite. These aggregates generally produce concrete ranging in weight from 15 to 50 pcf. The aggregates in Group II are prepared by expanding, calcining, or sintering products such as blast furnace slag, fly ash, shale, or slate. Natural materials such as pumice, scoria, or tuff are also included in Group II and produce a concrete with a weight range of 45 to 90 pcf. Lightweight insulating concrete typically has compressive strengths ranging from 100 to 300 psi. Job site performance tests are always required for installations in lightweight insulating concrete.

Admixtures are specified in a mix design to modify the concrete, either for placement characteristics or hardened properties. Air entraining admixtures which disperse tiny air bubbles throughout the concrete mix help to improve the freeze thaw resistance and increase workability. Examples of other admixtures are superplasticizers, which allow a reduction in the quantity of mixing water for much lower water-cement ratios, or products which accelerate or slow down the curing of the concrete.

While the type of cement, aggregate, and admixtures have an impact on the compressive strength of the concrete, the water-cement ratio is the primary factor affecting the strength. As the water-cement ratio decreases, the compressive strength of the concrete increases. In order to determine the compressive strength of concrete, test specimens are formed in cylinders approximately 6" in diameter and 12" in length according to ASTM C 31. The cylinders are broken according to ASTM C 39 at specified time intervals, usually 7 and 28 days, and the resulting strength is calculated to the nearest 10 psi increment.

The load capacities for installations in normal-weight concrete listed in this manual are for concrete which has achieved its designated 28 day compressive strength. For concrete that has not cured at least 21 days, expected load capacities would be for the actual compressive strength at the time of installation. Job site tests are recommended for installations in concrete where the material strength or condition is unknown or questionable. In some sections, load capacities are also listed for installations in structural lightweight concrete. The load capacities listed in this manual were conducted in unreinforced test members to provide baseline data which is usable regardless of the possible benefit of reinforcement.

To resist tensile forces, steel reinforcement such as deformed reinforcing bars or welded wire fabric are placed in the forms prior to the pouring of concrete. For prestressed or post-tensioned concrete construction, bars, wire, or strands may be used as the reinforcement. Smooth dowel bars are also used primarily to resist shear loads. The following tables list the dimensions and strengths of standard Grade 40 and Grade 60 deformed reinforcing bars according to ASTM A 615 and the building codes.

Rebar Size *d*	Rebar Area A_{br} in.^{2} (mm^2)	Grade 40 Rebar			Grade 60 Rebar		
		Allowable Tension lbs. (kN)	Yield Strength lbs. (kN)	Ultimate Strength lbs. (kN)	Allowable Tension lbs. (kN)	Yield Strength lbs. (kN)	Ultimate Strength lbs. (kN)
No. 3	0.110 (71.0)	2,200 (9.9)	4,400 (19.8)	7,700 (34.7)	2,640 (11.9)	6,600 (29.7)	9,900 (44.6)
No. 4	0.200 (129.0)	4,000 (18.0)	8,000 (36.0)	14,000 (63.0)	4,800 (21.6)	12,000 (54.0)	18,000 (81.0)
No. 5	0.310 (200.0)	6,200 (27.9)	12,400 (55.8)	21,700 (97.7)	7,440 (33.5)	18,600 (83.7)	27,900 (125.6)
No. 6	0.440 (283.9)	8,800 (39.6)	17,600 (79.2)	30,800 (138.6)	10,560 (47.5)	26,400 (118.8)	39,600 (178.2)
No. 7	0.600 (387.1)	12,000 (54.0)	24,000 (108.0)	42,000 (189.0)	14,400 (64.8)	36,000 (162.0)	54,000 (243.0)
No. 8	0.790 (509.7)	15,800 (71.1)	31,600 (142.2)	55,300 (248.9)	18,960 (85.3)	47,400 (213.3)	71,100 (320.0)
No. 9	1.000 (645.2)	20,000 (90.0)	40,000 (180.0)	70,000 (315.0)	24,000 (108.0)	60,000 (270.0)	90,000 (405.0)
No. 10	1.270 (819.4)	25,400 (114.3)	50,800 (228.6)	88,900 (400.1)	30,480 (137.2)	76,200 (342.9)	114,300 (514.4)
No. 11	1.560 (1,006.4)	31,200 (140.4)	62,400 (280.8)	109,200 (491.4)	37,440 (168.5)	93,600 (421.2)	140,400 (631.8)
No. 14	2.250 (1,451.6)	45,000 (202.5)	90,000 (405.0)	157,500 (708.8)	54,000 (243.0)	135,000 (607.5)	202,500 (911.3)
No. 18	4.000 (2,580.6)	80,000 (360.0)	160,000 (720.0)	280,000 (1,260.0)	96,000 (432.0)	240,000 (1,080.0)	360,000 (1,620.0)

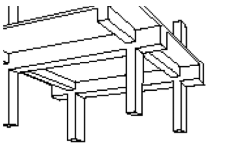
The strengths listed in the table above are calculated based on the following stresses. The allowable tensile stress, f_s, for the reinforcing is based on the building codes.

Grade 40 Rebar			Grade 60 Rebar		
Allowable Tension psi (MPa)	Yield Strength psi (MPa)	Ultimate Strength psi (MPa)	Allowable Tension psi (MPa)	Yield Strength psi (MPa)	Ultimate Strength psi (MPa)
20,000 (138.0)	40,000 (276.0)	70,000 (483.0)	24,000 (165.6)	60,000 (414.0)	90,000 (621.0)

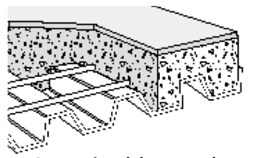
Generally, concrete is capable of sustaining a higher load than brick or block. As the embedment depth of an anchor or fastener is increased, the tension load will increase up to a point at which either the capacity of the expansion mechanism or bond is reached or the concrete fails locally. This phenomenon is discussed in the individual product sections.

BASE MATERIAL (Continued)

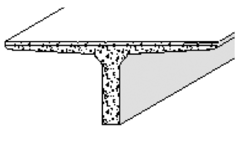
Common construction methods in which concrete can be used are shown in the following figures.



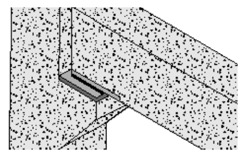
Poured in Place concrete using a form system



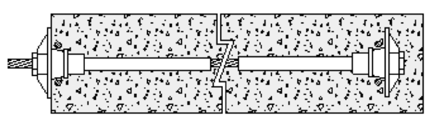
Composite slabs poured over steel deck



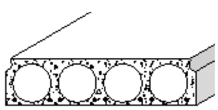
Precast tees



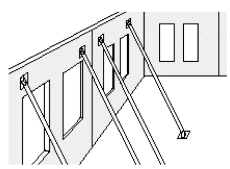
Precast beams and columns



Post-tensioned slabs and beams



Precast plank



Tilt-up wall panels

Testing has been done specifically in precast plank on the following products: 3/8” *Hollow-Set Dropin, Mini Dropin, Zamac Hammer-Screw, Lok-Bolt*, *3/8" Threaded Stud*. Contact Powers Fasteners for details on this test.

Refer to the section on *Tilt Wall Wedge-Bolt* for fastening down floor end brace shoes and attachment of lift plates for tilt-up wall panels.

Autoclaved Aerated Concrete (AAC)

Precast autoclaved aerated concrete (AAC) describes the lightweight concrete building material that is relatively new in the United States, but that has been used in other parts of the world for over 70 years. The raw materials used in the production of AAC are pulverized sand, water, cement, and lime – the same ingredients as conventional concrete, with the exception that there is no large aggregate in the mix. The raw materials are batched together to form a slurry. The slurry is cast into steel molds. Due to the chemical reactions that take place within the slurry, the material expands, encapsulating tiny air bubbles within the solid matrix. After setting, but before final hardening, the mass is machine cut into units of various sizes. The units are then steam-cured under pressure in autoclaves where the material is transformed into fully cured and hardened products.

AAC is available as block products in a multitude of combinations of thickness, height, length and compressive strength. AAC is also available as reinforced panels that can be used as non-load bearing vertical and horizontal exterior wall panels, load bearing vertical panels, and floor and roof panels. AAC products have been successfully used in various types of commercial and residential building construction as well as highway sound walls, mines, firewalls, and shaft wall construction.

Product specifications for AAC can be found in ASTM C 1386 for unreinforced block elements and in ASTM C 1452 for reinforced panel elements. The range for minimum compressive strength is 300 psi to 1000 psi, with 580 psi being the most common value. The range for dry bulk density is 25 pcf to 50 pcf, with most common products manufactured at approximately 31-37 pcf. Powers has tested various anchors and fasteners compatible with the unique lightweight properties of AAC. Please reference Appendix F for further information.

Masonry Materials

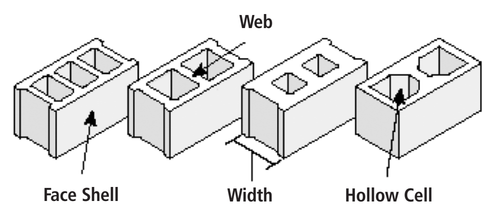
The strength of masonry walls is usually less than that of concrete and the consistency of these materials can vary on a regional basis. To form a wall, individual masonry units are bonded together with a cement mortar. A vertical row is called a course and a horizontal row is called a wythe. The strength of the mortar is often the critical factor in product performance. Anchors or fasteners may be installed in the horizontal mortar joint or directly into some types of masonry units. In field testing, products should be installed and loaded to simulate the actual placement. The reaction bridge used should span the joint or unit to provide an unrestrained test.

Hollow base materials require special care as the anchor or fastener must be properly sized to coincide with the wall thickness or selected to properly expand in the void for toggle type anchors. When using anchors, spalling can occur during the drilling process, further decreasing the wall thickness. Manufacturers of hollow base materials often specify a maximum load that can be applied to the material. Since the strength of masonry materials varies widely, job site tests are recommended to determine actual load capacities for critical applications.

Concrete Block

Masonry block is found in a variety of sizes and shapes depending upon the age and location of a building. Both hollow and solid styles which can be classified as load-bearing or non-load bearing are used. Load-bearing block, known as a concrete masonry unit (CMU) is generally suitable for anchoring or fastening. Job site tests are recommended for critical applications due to the wide variations in these materials. ASTM C 90 describes hollow and solid load-bearing concrete masonry units made from portland cement, water, and mineral aggregates, both normal, medium and lightweight.

Typical shapes for concrete masonry units are shown in the following diagrams. The term "face shell" refers to the outside face of the block while the term "web" refers to the interior portions between the hollow cells.



Typical CMU Shapes

BASE MATERIAL (Continued)

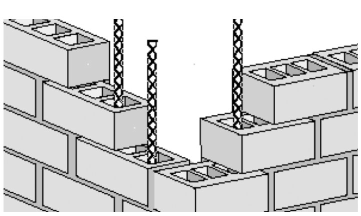
The difference between hollow and solid block is based on the cross sectional bearing area of the block. Solid block is defined as having a cross sectional bearing area which is not less than 75% of the gross area of the block measured in the same plane. Typical minimum dimensions for the face shell and web thickness based on ASTM C 90 are listed in the following table.

Nominal CMU Width in. (mm)	Face Shell Thickness in. (mm)	Web Thickness in. (mm)
3 (76.2)	3/4 (19.1)	3/4 (19.1)
4 (101.6)	3/4 (19.1)	3/4 (19.1)
6 (152.4)	1 (25.4)	1 (25.4)
8 (203.2)	1 1/4 (31.8)	1 1/4 (31.8)
10 (254.0)	1 3/8 (34.9)	1 1/8 (28.6)
	1 1/4 (31.8)	1 1/8 (28.6)
12 (304.8)	1 1/2 (38.1)	1 1/8 (28.6)
	1 1/4 (31.8)	1 1/8 (28.6)

One of the critical factors contributing to the strength of a masonry wall is the type of mortar used to bond the masonry units together. Mortar is made from a mixture of cement, very fine aggregate, and water. ASTM C 270 describes cement-lime and masonry cement mortars, each available in four types as summarized in the following table.

Mortar	Type	Compressive Strength psi
Cement-Lime	M	2,500
	S	1,800
	N	750
	O	350
Masonry/Cement	M	2,500
	S	1,800
	N	750
	O	350

To provide greater resistance to lateral loads, concrete masonry units are often strengthened with steel reinforcing bars. In this case, hollow units are grout filled to allow them to act together with the reinforcing bars.



Grout-filled Concrete Masonry

Experience has shown that the consistency of grout filled block varies widely. Voided areas are often a problem, therefore, job site performance tests are recommended.

In this manual, guide load capacities are published for some products installed in the face shell of hollow load-bearing concrete masonry units and at various embedments into grout filled units.

For hollow units, most anchors were tested in walls constructed using normal-weight concrete block meeting the requirements of ASTM C 90, Grade N. Power-actuated fasteners were tested in ASTM C 90, Grade N, lightweight block. Grade N signifies that it is suitable for use in exterior walls above or below grade which may or may not be exposed to moisture. The minimum compressive strength from the ASTM specification is 1,900 psi. Typical dimensions are nominally 8" x 8" x 16" with a face shell thickness of 1-1/4" to 1-1/2". For 75% solid block, typical face shell thickness is 2-1/4". Unless otherwise noted, products were installed in the center of the hollow cell. For anchors, the face shell thickness may be decreased by as much as 1/2" during the drilling operation due to spalling on the back side of the face shell.

Grout filled block walls were constructed using the hollow block described above which was then filled with fine grout as described in ASTM C 476. For anchor testing, both grout filled walls and hollow block walls used a Type N cement-lime mortar meeting ASTM C 270. A Type N cement-lime mortar meeting ASTM C 270 was also used to construct the test walls for power-actuated fasteners.

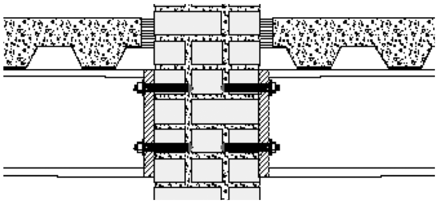
Brick

Brick units are found in a variety of shapes, sizes, and strengths depending upon the age and location of a building. Brick is manufactured from clay or shale which is extruded / wire-cut, machine molded, or handmade to shape then hardened through a firing process. In the natural state, a buff colored finish is obtained when using clay while shale produces a red shade. The addition of mineral pigments, glazes, or other compounds is used to change the visual impact of brick. Brick can be used to form a load bearing wall or used as a veneer or facade.

Brick is produced as a solid masonry unit or with cores during extrusion. The cores reduce the weight of the brick and help it to lay better. ASTM C 652 describes hollow brick masonry units. Hollow brick is defined as having a cross sectional bearing area which is less than 75% of the gross area of the brick measured in the same plane. Hollow brick units have stricter physical property requirements than those for structural clay tile. The cores often create a problem when attempting to install anchors because the resulting thin walls cannot sustain the high bearing stresses applied by a mechanical anchor. In this case, an adhesive anchor is recommended. Brick walls are generally not suitable for power-actuated fasteners.

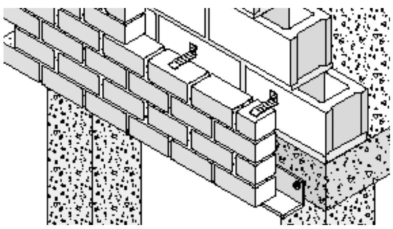
ASTM C 62 describes solid building brick while C 216 describes solid facing brick. To provide greater resistance to lateral loads, walls are often strengthened with steel reinforcing bars. The wythes of brick are tied together and then grout filled to allow them to act together with the reinforcing bars.

BASE MATERIAL (Continued)



Typical brick bearing wall

When brick is used as a building facade, it is important to properly tie it to the backup wall and structure using anchors manufactured from a non-corrosive material such as stainless steel.



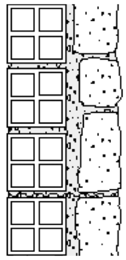
Brick facade (veneer) with ties – cavity walls

In this manual, guide load capacities are published for anchors installed in solid brick and in multiple wythe brick walls. Anchors were tested in walls constructed using brick meeting the requirements of ASTM C 62, Grade SW. Grade SW signifies that it is suitable for use in exterior walls exposed to severe weathering. The minimum compressive strength from the ASTM specification is 1,250 to 3,000 psi, however, actual strengths typically range as high as 6,000 to 8,000 psi. Both single and multiple wythe brick walls were constructed using a Type S cement-lime mortar meeting ASTM C 270.

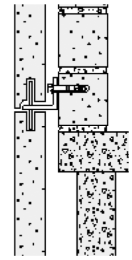
Stone

Natural stone is available in a variety of types, colors, and textures for use in many building applications. Naturally occurring rock which has been fabricated to a specific size and shape is referred to as dimension stone as opposed to broken or crushed stone such as that used for aggregate in concrete. The three common classes of rock used to fabricate dimension stone are igneous, metamorphic, and sedimentary. Granite is an igneous material while marble building stone is metamorphic. Both of these stones tend to be harder than limestone or sandstone which are sedimentary materials. The strength and the quality of stone can vary dramatically from each stone quarry and for different geological locations.

Generally, anchors installed in softer material such as limestone or sandstone will have capacities similar to those obtained in 2,000 psi concrete. In harder stone such as granite or marble, the capacities will be similar to 4,000 or 6,000 psi concrete. Job site tests are recommended because of the wide variation in the strengths of natural stone. Stone is not generally considered a suitable base material for power-actuated fasteners.



Stone with tile backup

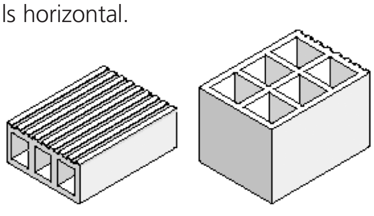


Stone facade

Dimension stone units can be used to form a load bearing wall and as a veneer or facade. Masonry constructed using stone with little or no shaping is referred to as rubble while that using precisely cut stone is called ashlar. When used as a building facade, it is important that the stone be properly tied to the backup wall using anchors manufactured from a non-corrosive material such as stainless steel. ASTM C 119 describes dimensional stone for use in building construction. Specifications for individual stone types include C 503 for marble, C 568 for limestone, C 615 for granite, and C 616 for quartz-based material.

Structural Clay Tile

Structural clay tile units are found in a variety of shapes, sizes, and strengths for use primarily in walls. The tile units are manufactured from clay, shale, or fire clay which is extruded to shape then hardened through a firing process. Finished units may have a natural finish or may be glazed. During the extrusion process, several continuous cells or hollow spaces are formed within the exterior shell of the tile. The typical thickness of the outer shell is 3/4" with a 1/2" thick interior web. End-construction tile is designed to be placed in a wall with the axis of the cells vertical while side-construction tile is placed with the axis of the cells horizontal.

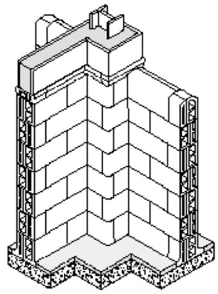


Typical clay tile shapes

These materials present a problem when attempting to install anchors because the resulting thin walls cannot sustain the high bearing stresses applied by a mechanical anchor. For light duty loads, a hollow wall anchor which opens behind the face shell may be used. For heavier loading, an adhesive anchor installed using a screen tube inserted through the face shell and interior web is suggested. In most cases, job site tests are recommended. Structural clay tile is not a suitable base material for power-actuated fasteners.

Structural clay tile units can be used to form a load bearing wall and as a veneer or facade. ASTM C 34 describes structural clay tile for load bearing walls. Tile of Grade LBX is suitable for exposure to weather while Grade LB is normally used in a protected environment. The minimum compressive strength for this type of unit ranges from 500 to 1400 psi depending upon the orientation and grade. Structural clay facing tile is described in ASTM C 212.

BASE MATERIAL (Continued)

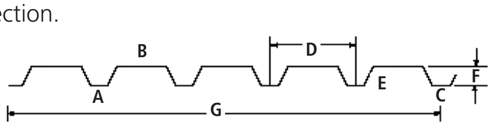


Structural clay partition

For non-load bearing applications, ASTM C 56 describes structural clay tile used primarily for partitions. This type of tile is sometimes referred to as architectural terra cotta although this term is more appropriately applied to ornamental building units. No minimum compressive strength is specified for this type of tile.

Steel Deck

Steel deck is available in many configurations for use as a floor deck (both composite and non-composite) or a roof deck. It is usually cold formed from steel sheet to provide the combination of deck type, depth, and gage (thickness) to meet the application requirements. A rib shape, formed in various depths and sizes, adds strength in flexure depending upon the length of span. Steel deck may be supplied uncoated, painted, or zinc coated according to ASTM A 525 in various thicknesses. Common zinc coating thicknesses are Grade 90 (0.90 oz./ft^2) and Grade 60 (0.60 oz./ft^2). The following diagram shows a typical steel deck cross section.



A – Rib
B – Top Flange
C – Side Lap
D – Module
E – Web
F – Depth
G – Coverage Width

Industry standards for the design, manufacture, and use of steel deck are provided by the Steel Deck Institute (SDI), Factory Mutual Research Corporation (now known as FM Global), and Underwriters Laboratories (UL). Material requirements are also listed in ASTM A 611 and A 446. The yield strength of the steel deck varies from 25,000 to 80,000 psi, depending on the grade. Today, steel deck is commonly specified by a decimal thickness rather than a gage number. For reference purposes, the following chart lists the gage number and the equivalent thickness of uncoated steel.

Steel Gage Number	Thickness in. (mm)	Steel Gage Number	Thickness in. (mm)
9	0.1495 (3.8)	19	0.0418 (1.1)
10	0.1345 (3.4)	20	0.0359 (0.9)
11	0.1196 (3.0)	21	0.0329 (0.8)
12	0.1046 (2.7)	22	0.0299 (0.8)
13	0.0897 (2.3)	23	0.0269 (0.7)
14	0.0747 (1.9)	24	0.0239 (0.6)
15	0.0673 (1.7)	25	0.0209 (0.5)
16	0.0598 (1.5)	26	0.0179 (0.5)
17	0.0538 (1.4)	27	0.0164 (0.4)
18	0.0474 (1.2)	28	0.0149 (0.4)

Steel floor deck used for composite construction with concrete fill has typical rib depths of 1-1/2", 2", and 3". Other depths up to 7-1/2" are available. This type of deck is normally manufactured to meet the requirements of Section A3 of the latest edition of the American Iron and Steel Institute (AISI) specification for the *Design of Cold-Formed Steel Structural Members,* with a minimum yield strength of 33,000 psi. Non-composite steel form deck is used as a permanent form for concrete slabs with rib depths ranging from 1/2" to 2".

For steel roof deck, the ribs are classified as narrow, intermediate, or wide with a 1-1/2" minimum depth spaced at 6" on center. Deep rib deck with a 3" minimum depth with ribs spaced at 8" on center is also available. Other types of steel decking include acoustical sound absorbing floor or roof decks, long span roof decks, and cellular roof decks.

Gypsum Concrete Deck

Gypsum concrete roof decks have been installed for over fifty years. They are manufactured from calcined gypsum, wood chips, shavings, or mineral aggregate and a large volume of water. Gypsum concrete decks were produced as a precast tongue and groove plank with metal wrapped edges or poured (cast) in place at the job site. Plank decks are often thinner (1-1/2" to 2") and denser than poured gypsum concrete. Like poured concrete, the density of gypsum varies widely based on the water to cement ratio used. Poured in place gypsum concrete is cast on form boards which are attached to the roof frame, usually bar joists. The product manufactured using wood chips was trade named Pyrofil, while the product with the mineral aggregate was called Thermofil.

ASTM C 317 describes mill-mixed gypsum concrete for use in poured in place roof decks. Once poured, the setting time ranges from a minimum of 20 minutes to a maximum of 90 minutes. The minimum compressive strength for gypsum concrete is 500 psi for Class A and 1000 psi for Class B. Precast deck may be higher in compressive strength and denser. Since the condition and strength of gypsum concrete varies widely, job site performance tests for roofing fasteners are always recommended.

BASE MATERIAL (Continued)

Structural Cement Wood Fiber

Structural cement wood fiber roof decks are composed of shredded strands of wood fiber held together with a mineral binder. This material serves as the structural deck with insulating value and often is exposed as the finished ceiling. It is produced in tile form for installation over bulb "T" subpurlins, plank form for attachment directly over the roof frame such as bar joists, and as form board for cast in place concrete. In some cases, the cement wood fiber deck may have a mortar or concrete slurry topping.

There are several types of cement wood fiber decks. Tectum is produced by Tectum, Inc. located in Newark, Ohio using fine Aspen wood fibers and a hydraulic binder. It is the lightest in weight of the cement wood fiber decks and has a white-brown color with even fiber distribution. Tectum II has a factory applied urethane foam layer for insulating value. Insulrock was marketed by Flintkote heavily in the northeastern United States. It has short chopped fibers pan-formed into deck tiles using a portland cement as the binder. The shorter fibers and heavy cement content visibly identify this product. Petrical, Permadeck, and Fibroplank are made with southern wood pine fibers bound together with portland cement. Permadeck and Fibroplank also make products similar to Tectum II. These decks can be identified by the dark gray cement around the perimeter. Other types may also be available.

The condition and strength of cement wood fiber decks varies widely, therefore job site performance tests for roofing fasteners are always recommended.

Structural Wood Panels

Structural wood panels are manufactured in several grades from dozens of wood species. Two types of these panels are plywood and oriented strand board (OSB).

Plywood used for structural applications is generally manufactured from softwood trees such as Douglas Fir, Western Hemlock, Southern Pine, and the true firs. Two types are typically available, "Exterior" with a waterproof glueline and "Exposure I", also with a waterproof glueline. Plywood is constructed from a series of veneers which are rated A (highest) to D (lowest). The panels are usually, but not always, made up of an odd number of veneers or plies which are bonded together in layers with the grain direction alternating at right angles. For exterior plywood, the minimum grade of veneer used is C. The structural wood panel industry has established a grade rating system to describe the overall panel based on the veneer grade used on the face and back of the panel such as A-C or B-B.

Oriented strand board (OSB) is constructed from softwood or hardwood strands which are compressed and glued with waterproof glue into panels. The panels are made up of an odd number of layers which are bonded together and oriented at right angles.

Plywood and OSB panels used for roof, wall, subfloor sheathing, and single layer floors are typically manufactured to performance standards. Job site tests are recommended for applications in these base materials.

Gypsum Wallboard

Gypsum wallboard is manufactured with an incombustible core, primarily gypsum, which is surfaced with paper bonded to the core. The back surface may also be coated with foil which acts as a vapor barrier and as a thermal insulator. Special application wallboard is available such as water resistant board and Type X which is a special fire resistant board. Regular gypsum wallboard is supplied in 4' widths in 1/4", 3/8", 1/2", and 5/8" thickness ranging in length from 4' to 16'. Gypsum wallboard is also available in 3/4", 1", and 2" thickness for use in enclosing shafts and as a sound reducing underlayment. Double layers of board are often used to achieve specific fire ratings.

ASTM C 36 describes gypsum wallboard. The density and strength of gypsum wallboard varies depending upon the manufacturer and region of the country. Other factors which affect the strength of the board are the thickness and humidity. Since there is a wide variation in the strength of the board, the load capacities published in this manual for anchors installed in gypsum wallboard should be used as a guide. For critical applications, job site tests should be performed.

CORROSION RESISTANCE

The corrosive environment in which an anchor or fastener will be installed should be considered. Corrosion can be described broadly as the destruction of a material due to chemical or electrochemical reactions based upon the application environment. Industry estimates of the annual cost of corrosion place it in the billions of dollars. The subject of corrosion is very complex and knowledge is constantly being gained based on industry experience. Chemical and electrochemical corrosion are described in the following two sections to provide a basic understanding of the process.

Chemical Corrosion

Direct chemical attack occurs when an anchor or fastener is immersed in the corrosive substance, typically a liquid or a gas. For example, an anchor used to restrain equipment in a water treatment tank would have to be made from a material which would be resistant to chlorine or other corrosive liquids present. This type of corrosion can also occur when a stone facade is attached to a backup wall. Mild acids can be formed in the wall cavity due to reaction of condensation with the attached stone. The product selected would have to be resistant to the type of acid formed.

Electrochemical Corrosion

All metals have an electrical potential which has been measured through research and ranked into an electromotive force series. When two metals of different electric potential are brought into contact in the presence of an electrolyte, the metal with the lower potential (least noble) will form the anode while the metal with the higher potential (most noble) will form the cathode. As current flows from the anode to the cathode, a chemical reaction will take place. The metal forming the anode will corrode and will deposit a layer of material on the metal forming the cathode. As the electric potential between two dissimilar metals increases, the stronger the current flow and corresponding rate of corrosion. The rate of corrosion will also be influenced by the conductivity of the electrolyte.

Galvanic Series

+ Corroded End (Anodic or least noble)

Magnesium
Magnesium alloys
Zinc
Aluminum 1100
Cadmium
Aluminum 2024-T4
Steel or Iron
Cast Iron
Chromium-iron (active)
Ni-Resist cast iron
Type 304 Stainless (active)
Type 316 Stainless (active)
Lead tin solders
Lead
Tin
Nickel (active)
Inconel nickel-chromium alloy (active)
Hastelloy Alloy C (active)
Brasses
Copper
Bronzes
Copper-nickel alloys
Monel nickel-copper alloy
Silver solder
Nickel (passive)
Inconel nickel-chromium alloy (passive)
Chromium-iron (passive)
Type 304 Stainless (passive)
Type 316 Stainless (passive)
Hastelloy Alloy C (passive)
Silver
Titanium
Graphite
Gold
Platinum

- Protected End (Cathodic or most noble)

In order to provide a more practical approach to understanding the electromotive force series, testing was conducted on commercial alloys and metals in sea water to develop a chart called the Galvanic Series. One of the reasons sea water was used as the electrolyte was because it has a high conductivity rate. The above chart lists a representative sample of dissimilar metals and indicates their relative potential for galvanic corrosion. When two dissimilar metals are in contact (coupled) in the presence of a conductive solution or electrolyte (i.e. water) electric current flows from the less noble (anodic) metal to the more noble (cathodic) metal. In any couple, the less noble metal is more active and corrodes while the more noble metal is galvanically protected.

To prevent galvanic corrosion, the following precautions can be used:

1. Use the same or similar metals in an assembly. Select metals which are close together in the Galvanic Series.
2. When dissimilar metals are connected in the presence of a conductive solution, separate them with dielectric materials such as insulation, a sealing washer, or a coating. Coatings should be kept in good repair to prevent accelerated attack at any imperfection.
3. Avoid combinations where the area of the less noble material is relatively small. It is good practice to use anchors or fasteners made from a metal which is more noble than that of the material being fastened.

In critical applications, testing should be conducted to simulate actual conditions.

Other types of electrochemical corrosion such as stress corrosion may need to be considered depending upon the application.

Coatings and Platings

A variety of coatings and platings are offered to resist various extremes of corrosion. A plating metal which is less noble (lower electric potential) than the base metal it is designed to protect is usually selected. When subjected to an electrochemical reaction, the plating will corrode or sacrifice while the base metal remains protected. Once the plating has been reduced significantly, the base material will then begin to corrode. If a plating metal which is more noble is selected, the base metal would begin to corrode immediately if the plating is damaged.

CORROSION RESISTANCE (Continued)

Zinc Coatings and Platings
For carbon steel anchors and fasteners, zinc is one of the most common plating materials used because it can be applied in a broad thickness range and because it is less noble than carbon steel. Zinc may be applied by electroplating, mechanical methods, or hot dip galvanizing.

The following table shows the typical mean corrosion rate of zinc based on data compiled by ASTM. Theoretically, the life expectancy of a zinc plating would be the thickness of the plating divided by the corrosion rate. These values should only be used as a guide since actual performance will vary with local conditions.

Atmosphere	Mean Corrosion Rate
Industrial	5.6 microns (0.00022") per year
Urban non-industrial or marine	1.5 microns (0.00006") per year
Suburban	1.3 microns (0.00005") per year
Rural	0.8 microns (0.00003") per year
Indoors	Considerably less than 0.5 microns (0.00002") per year

The standard zinc plating used on carbon steel anchors is applied using electroplating. The anchor components are immersed in a water based solution containing a zinc compound. An electrical current is then induced into the solution causing the zinc to precipitate out, depositing it onto the components. Powers carbon steel products are typically electroplated according to ASTM B 633, SC1, Type III. SC1 signifies Service Condition 1 which is for a mild environment with an average coating thickness of 5 microns (0.0002"). This condition is also classified as Fe/Zn 5. Type III indicates that a supplementary clear chromate treatment is applied over the zinc plating. Prior to applying the chromate treatment, heat treated products which are electroplated are normally baked to provide relief from any hydrogen trapped in the granular matrix.

Power-actuated fasteners are designed to be used in a non-corrosive atmosphere unless application specific corrosion testing has been performed. To reduce the possibility of the embrittlement of a heat treated part, the standard finish for all Powers' power-actuated fasteners is mechanically applied zinc meeting the requirements of ASTM B 695, Class 5, Type I. Class 5 signifies an average minimum coating thickness of 5 microns (0.0002"), while Type I indicates that there is no supplementary coating.

Heavier zinc platings or coatings are often described using the term galvanized. Another zinc coating which is available on some carbon steel anchors such as the *Power-Stud* is mechanically applied. To apply this coating, the anchor components and glass beads are placed in a chamber on an agitating machine. As the chamber is agitated, powdered zinc compound is gradually added allowing the glass beads to pound the zinc onto the surface of the anchor components. Carbon steel products which are coated using this method are mechanically galvanized according to ASTM, B 695, Class 65, Type I. Class 65 indicates that the average coating thickness is 66 microns (0.0026") while Type I denotes that a supplementary chromate treatment is not applied. Hot dip galvanizing is not recommended for mechanical expansion anchors as it tends to act as a lubricant which significantly alters the performance of the anchor. A mechanically applied coating will normally provide equivalent performance.

ASTM A 153, Type C describes the requirements for applying a zinc coating using a hot dip method. According to this specification, the average weight of the zinc coating applied to the surface of anchors over 3/8" in diameter should be 1.25 oz./ft.[2]. The specification also notes that 1.0 oz./ft.[2] corresponds to an average coating thickness of 1.7 mils (0.0017"). Based on this, 1.25 oz./ft. 2 x 1.7 = 2.13 mils (0.0023"), the required average minimum coating thickness. The average coating thickness on a component which has been mechanically applied according to ASTM B 695, Class 65 is 66 microns or 2.6 mils (0.0026") which exceeds the requirement for a hot dipped anchor.

Barrier Coatings
To provide increased protection from the effects of corrosion on smaller diameter anchors used in roofing applications, Powers has developed a proprietary fluoropolymer coating called *Perma-Seal™*. This coating provides better resistance to corrosion and abrasion than traditional zinc electroplating or mechanical galvanizing. Coatings of this type are often called barrier coatings because they seal the part as opposed to zinc platings which are sacrificial.

When a component is coated with *Perma-Seal™*., a zinc enriched phosphate base is first applied to the surface followed by a proprietary process during which a polymer based material is bonded over the base coat. This creates a finish which resists the corrosive environment created by the high saline (salt) content of most insulation boards, acid rain, and the acids which are produced by ponded water in most built-up or single ply roofing systems. Coatings of this type are typically tested according to DIN Standard 50018, 2.0S, which is a test method referred to as a Kesternich Test. As a measure of corrosion resistance when using this test method, Factory Mutual Standard 4470 (Now FM Global) establishes an allowable surface corrosion (red rust) limit of 15% of the surface area after 15 cycles of exposure. The *Perma-Seal™*. coating exceeds this requirement withstanding 30 cycles of exposure with less than 15% surface corrosion (red rust). Additional testing conducted in a salt spray chamber according to ASTM B 117 shows that the *Perma-Seal™*. coating can withstand over 1,000 hours of exposure with no surface corrosion.

Corrosion Resistant Materials

In addition to coatings and platings, Powers offers a variety of materials which provide varying degrees of corrosion resistance.

Stainless Steel
Stainless steels were originally named according to their chromium and nickel content. One of the first types developed contained 18% chromium and 8% nickel and was therefore called 18-8 stainless steel. As newer types of stainless steel were developed with properties to meet specific application needs, the American Iron And Steel Institute (AISI) established a standard numbering system to classify the various types of stainless steel. In order to be considered a stainless steel in the AISI system, an alloy must contain at least 11.5% chromium. Chromium-nickel alloys became the 300 series stainless steels while chromium alloys became the 400 series.

Stainless steels develop their resistance to corrosion by forming a thin, self healing, passive film of chromium oxide on their surface. During the forming or machining process, the surface of components made from stainless steel may become contaminated with small particles of foreign matter. In order to maintain the optimum performance of the stainless steel,

CORROSION RESISTANCE (Continued)

components are passivated after manufacturing. The basic passivation process involves cleaning or degreasing the components, immersion in a nitric acid bath, rinsing and drying. Once the process is complete, the oxide film is formed again without the entrapment of foreign particles.

The 300 series of stainless steels are austenitic alloys which are nonmagnetic and are not heat treatable, although they can be annealed. Anchors made from 300 series stainless steel can exhibit very slight magnetic properties due to the manufacturing process. In order to achieve higher tensile strengths, this series of stainless must be cold worked. For some components, a minimum yield strength is specified based on the work hardening which occurs during the cold forming process. In the industry, the term 18-8 is still used to generically describe the 300 series of alloys, especially Types 302, 303, and 304. Powers provides anchors formed from Types 303, 304, 304 Cu, and 316 stainless steel. Type 303 is used where machinability is required for products such as a *Steel Dropin* anchor. This type of stainless steel has a higher sulfur content than Type 304 which reduces drag on cutting tools, especially when forming internal threads. Type 304 and 304 Cu (302 HQ) stainless steels are used to form anchors such as the *Power-Stud* and the *Power-Bolt*. This type of stainless steel is one of the most widely specified. It is commonly used outdoors in a nonmarine environment and for applications in the food processing industry. For more severe corrosive environments, Type 316 stainless steel is available. Type 316 has a higher nickel content than Type 304 and the addition of molybdenum. This provides increased resistance to pitting caused by chlorides (salts) and corrosive attack by sulfurous acids such as those used in the paper industry.

Ferritic and martensitic alloys make up the 400 series of stainless steels. Generally, the martensitic alloys in this series are heat treatable, however, their corrosion resistance is well below that of a 300 series stainless steel. 400 series stainless steels also exhibit magnetic properties.

Other Materials

Depending upon the corrosive environment, Powers also provides several alternate materials which may be used instead of stainless steel. These materials include:

Lead	Zamac alloy	Engineered plastic

Corrosion Tests

Two methods that have been used to evaluate relative corrosion resistance are salt spray (fog) testing and a European test method, DIN Standard 50018, 2.0S, known as a Kesternich Test.

Salt Spray Testing

Salt spray testing, also known as salt fog testing, is conducted according to ASTM B 117. The components to be tested are prepared and suspended in a sealed chamber where they are subjected to a spray or fog of a neutral 5% salt solution which is atomized at a temperature of 95° F. Testing of this type was considered useful when evaluating the behavior of materials when subjected to a marine environment. Today the most common corrosion resistance testing is performed in the Kesternich Cabinet.

Kesternich Test

This test method is a far more severe measure of corrosion resistance when compared to the salt spray method. The components to be tested are prepared and placed in a special unit called a Kesternich Test Cabinet. Corrosion testing is conducted according to DIN Standard 50018, 2.0S. Two liters of distilled water are placed in the bottom of the cabinet and it is then sealed. Once sealed, two liters of sulfur dioxide are injected into the cabinet and the internal temperature is set to 104° F for the cycle. Each 24 hour cycle begins with 8 hours of exposure to the acidic bath created in the cabinet. The cabinet is then purged and opened, the test specimens are rinsed with distilled water then allowed to dry at room temperature for 16 hours. The test specimens are examined for surface corrosion (red rust) at the end of each cycle. The following table compares the relative surface corrosion (red rust) of various coatings, platings, and materials after 30 cycles of exposure in a Kesternich Test Cabinet.

Coating/Plating/Material	% Surface Corrosion
Cadium	100% after 4 cycles
Perma-Seal™	5 to 10% after 30 cycles
Stainless steel – Type 304	None after 30 cycles
Stainless steel – Type 316	None after 30 cycles
Stainless steel – Type 410	100% after 3 cycles
Stainless steel – Type 410 with Class 4 coating	5 to 10% after 30 cycles
Zinc with clear chromate (ASTM B 633)	100% after 3 cycles
Zinc with yellow dichromate (ASTM B 633)	100% after 3 cycles
Mechanically galvanized (ASTM B 695)	100% after 3 cycles
Zamac Alloy	None after 30 cycles

TESTING AND DATA FUNDAMENTALS

The fundamentals of anchor and fastener design include the calculation of allowable working load capacities based on laboratory test data conducted to simulate typical field conditions. Powers publishes ultimate and allowable load capacities for anchors installed in concrete and masonry units along with other appropriate base materials.

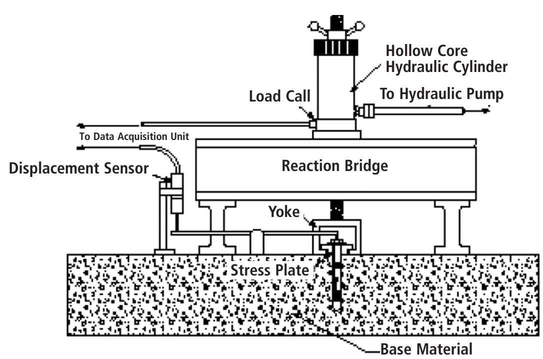
Test Procedures and Criteria

The test data for anchors published in this manual was developed according to ASTM E 488, *Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements.* Published load values are average ultimate (failure) loads based on actual testing in the base materials listed in the individual product sections. Each individual data point is typically the average of five or more individual tests.

For power-actuated fasteners, test data was developed according to ASTM E 1190, *Standard Test Methods for Strength of Powder Actuated Fasteners Installed in Structural Members.* Published load values are average ultimate (failure) loads based on actual testing in the base materials listed in the section on these fasteners. Each individual data point is typically the average of ten to thirty individual tests depending upon the coefficient of variation obtained. Since the compressive strength of concrete will influence the strength of an anchor or fastener, testing is usually conducted in several different strengths. Normally, the base materials are unreinforced to provide a worst case simulation.

Tension Test Data

Tension test data is sometimes referred to as pullout or tensile test data. A typical hydraulic test assembly used to perform a tension test on an anchor is shown in the following diagram. A similar assembly is used for testing powder actuated fasteners except that deflection is not measured.



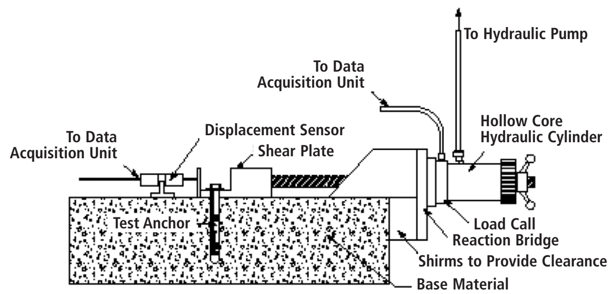
Typical static tension test assembly

The test equipment frame is designed to support the hydraulic test unit and span the test area so that reaction loading does not influence the test results. During testing, load is gradually applied to the anchor in an axial direction by a hydraulic cylinder while the displacement is measured using an electronic displacement sensor. The load is measured by a hollow core load cell and the resulting performance is recorded by a data acquisition unit. Loading is continued until the ultimate (failure) load is achieved. The ultimate load capacity recorded may be based on any one or combination of failure modes shown later in this manual.

During testing, the tension capacity of anchors and fasteners may increase with deeper embedments. This is due to the increased amount of base material available to resist the compressive forces applied by a mechanical expansion anchor, the increased compression area against the shank of a powder actuated fastener, or the increased surface area available for bonding with an adhesive type anchor. In some anchors, the capacity of the expansion mechanism may have been reached at the shallowest embedment and the load will not increase.

Shear Test Data

The typical setup for a hydraulic test unit used for applying a shear load to an anchor is shown in the following diagram. A similar set up would be used for testing powder actuated fasteners.



Typical shear test assembly

The test load is applied perpendicular to the anchor using the hydraulic equipment previously described. During testing of mechanical anchors, the shear capacity will increase as the embedment of the anchor increases, however, the increase may not be as significant as in tension. When a shear load is applied to a mechanical anchor, the anchor body resists the applied load by placing a bearing stress against the base material. Increasing the embedment will increase the area over which this stress is applied which in turn increases the resistance of the base material to the applied load. In addition, a mechanical anchor will tend to bend as a shear load is applied as the base material begins to crush. The applied load will actually be resisted by a combination of the bearing strength of the base material and the tension capacity of the anchor. Adhesive type anchors can usually develop the shear capacity of the anchor rod material at a medium or deep embedment when installed in concrete. Since the applied shear in most applications is through the threaded portion of an anchor or bolt, all shear testing simulates this situation. For bolt or screw style anchors, the design load should be the lesser of the allowable anchor load or load for the actual bolt or screw used. Machine bolts manufactured from Grade 5 steel are used in shear tests performed on bolt anchors.

Evaluation of Test Data

Within the industry, two methods of evaluating test data to determine the allowable working loads for anchors or fasteners are currently used. The first and most common, because of its ease of use, is the safety factor method. Using this method, an appropriate safety factor is applied to the average ultimate load obtained from testing.

Allowable load = Ultimate load / Safety Factor

TESTING AND DATA FUNDAMENTALS (Continued)

Design Safety Factors

Safety factors are used to account for field variations which may differ from the testing conditions in the laboratory. Typical minimum safety factors established by industry are as follows:

Product	Typical Safety Factor
Mechanical Anchors in Concrete	4 (UBC, IBC, IRC)
Mechanical Anchors in Masonry	4 (UBC) 5 (IBC, IRC)
Adhesive Anchors in Concrete with Creep Test	4 (UBC, IBC, IRC)
Adhesive Anchors in Concrete without Creep Test	5.33 (UBC, IBC, IRC)
Adhesive Anchors in Masonry with Creep Test	4 (UBC)
Adhesive Anchors in Masonry without Creep Test	5.33 (UBC)
Adhesive Anchors in Masonry with Creep Test	5 (IBC, IRC)
Adhesive Anchors in Masonry without Creep Test	6.77 (IBC, IRC)
Power-actuated Fasteners in Concrete or Masonry	5 to 8 (UBC, IBC, IRC)
Powder-actuated Fasteners in Steel	5 (UBC, IBC, IRC)

UBC – Uniform Building Code
IBC – International Building Code
IRC – International Residential Code

While the Building Codes utilize the typical safety factors listed above for a minimum recommended allowable design load, higher safety factors (10:1 or higher) may be appropriate for the following conditions:

- Overhead applications
- Vibratory loads (example, dynamic or shock loads)
- Safety and life critical applications
- Questionable base materials

Actual safety factors to be used should be determined by the design professional responsible for the product installation, based on the governing building code and after examining all influencing factors.

A second method which is used less frequently, but becoming more popular, is a statistical method in which the allowable working loads are based in part on the coefficient of variation (COV) obtained during testing. In most cases, the results obtained using the safety factor method are similar to those obtained when using the statistical method. Typical coefficients of variation are as follows:

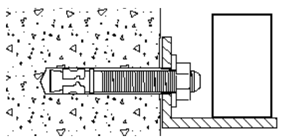
Product	COV
Mechanical Anchors	10 - 15%
Adhesive Anchors	10 - 15%
Power-actuated Fasteners in Steel	10 - 15%
Power-actuated Fasteners in Concrete	10 - 20%

Details on the use of appropriate safety factors are included in the sections describing anchor and power actuated fastener selection guidelines. Methods in Strength Design for concrete are expected to be used in the future as later editions of the International Building Code becomes more widely accepted. Contact Powers Fasteners for more information.

APPLIED LOADS

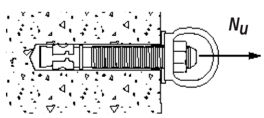
The type of load and the manner in which it is applied by the fixture or other attachment is a principle consideration in the selection of an anchor. Applied loads can be generically described as static, dynamic, or shock. Some anchor types are suitable for use with static loads only, while others can be subjected to dynamic or shock loads. The suitability of an anchor for a specific application should be determined by a qualified design professional responsible for the product installation.

Static Loads

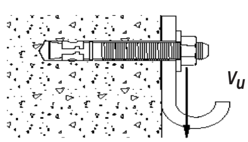


These are non-moving, constant loads such as those produced by an interior sign, cabinet, equipment, or other. A typical static load could be a combination of the dead load (weight of fixture) and the live load a fixture must support. Basic static load conditions are tension, shear, or a combination of both. To determine the allowable static working load, the industry practice is to reduce the ultimate load capacity of an anchor by a minimum safety factor. In cases of combined load, other reduction factors may be required.

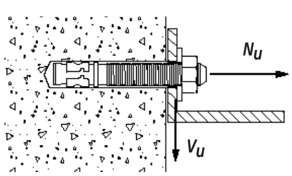
Tension Load
A tension load is applied directly in line with the axis of the anchor.



Shear Load
A shear load is applied perpendicularly across the anchor directly at the surface of the base material.



Combined Load
Most anchor installations are subjected to a combination of shear and tension loads.

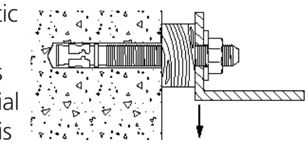


For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows based on the building codes:

$$\left(\frac{N_u}{N_n}\right)^{\frac{5}{3}} + \left(\frac{V_u}{V_n}\right)^{\frac{5}{3}} \leq 1 \quad \text{OR} \quad \left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

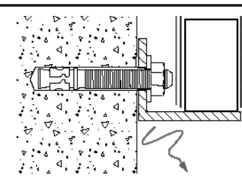
Bending Load



One often overlooked result of static load is bending. It is frequently necessary to place shims or spacers between the fixture and the material for alignment or leveling. When this occurs, it is often the strength of the anchor material or bolt material that determines the capacity of the connection. The load is applied at a distance from the surface of the base material creating a lever-type action on the anchor. Typical examples of this type of loading are the installation of windows using plastic horse shoe shims or machinery installations with shims below the base plate. In loading such as this, it is often the physical strength of the anchor material, not the tension and shear load capacities, that limit the strength of the anchorage. The allowable bending load should be calculated by a design professional based on the material from which an anchor is manufactured. In concrete or masonry materials, the bending arm used in the calculation should be increased to allow for spalling around the top of the anchor hole, usually by 1/2 to 1 anchor diameter.

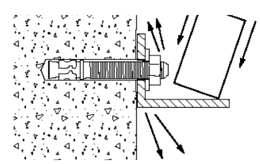
Dynamic and Shock Loads

Dynamic Loads



Dynamic loads are intermittent and varying loads such as those imposed by central air conditioning units, manufacturing machinery or earthquakes. They are normally the alternating or pulsating loads associated with vibration.

Shock Loads



Shock loads are instantaneous, periodic loads of high intensity such as those applied by an automobile striking a guard rail support or a truck hitting a dock bumper.

Standard industry practice with regard to safety factors varies depending upon the frequency and intensity of the load.

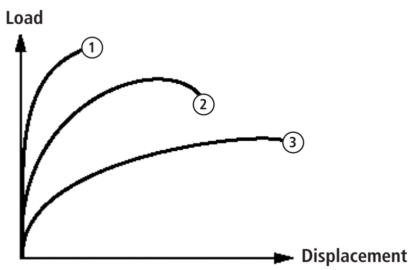
Safety factors for critical loads may be 10:1 or higher. Determination of the appropriate safety factor should be made by the design professional in charge of the actual product installation.

ANCHOR BEHAVIOR

The selection and specification of an anchor requires an understanding of basic anchor behavior or performance. A variety of performance attributes can be expected depending upon the type or style of anchor.

Displacement

As an anchor is loaded to its ultimate (failure) load capacity, displacement or movement of the anchor relative to the base material will occur. The amount of displacement will be affected by the anchor preload, the anchor material strength, the design of the expansion mechanism, and the strength of the base material. Typical load versus displacement curves are shown in the following diagram for three anchor types.



Curve 1 shows the typical performance of an adhesive type anchor. These anchors normally exhibit elastic behavior up to the ultimate load capacity. Performance will vary depending upon the type of adhesive used, the base material strength, and the strength of the anchor rod. A deformation controlled anchor such as a *Steel Dropin* anchor may also exhibit this type of behavior although the ultimate load capacity will normally be much less than that of an adhesive anchor. The compression force developed by a *Steel Dropin* is usually very high when compared to a torque controlled anchor resulting in low displacement characteristics.

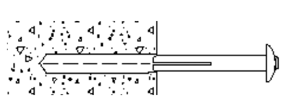
Typical performance of a torque controlled anchor such as the *Power-Bolt* or *Power-Stud* is shown in Curve 2. Displacement begins to occur after the initial preload in the anchor has been exceeded until the ultimate load capacity is achieved.

Anchors for use in light duty applications often exhibit the behavior shown in Curve 3. Once the working load has been exceeded, the anchor begins to displace or stretch until failure occurs.

Modes of Failure

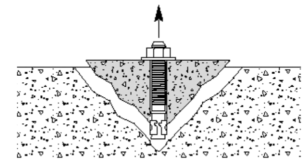
As an anchor is loaded to its ultimate capacity, the following modes of failure can occur.

Anchor Pullout



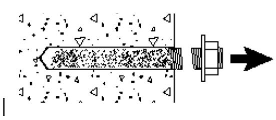
This type of failure occurs when the applied load is greater than the friction or compressive force developed between the anchor body and the base material. The anchor is unable to fully transfer the load to develop the strength of the base material. For adhesive anchors, this can occur with products which have a low bond strength or have been installed in a poorly prepared anchor hole.

Base Material Failure



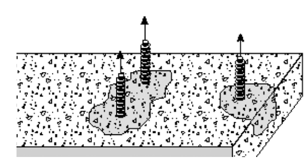
When the applied load is greater than the strength of the base material, the material pulls out or fails. In concrete, a shear cone will be pulled, usually for anchors installed at a shallow embedment in the range of 4 to 5 anchor diameters of depth. The angle of the shear cone has been assumed to be 35-45°, however, this can vary depending upon the anchor style and embedment depth. As the embedment of some anchor styles is increased to six diameters or beyond, the concrete can sustain the applied compression force and the load capacity of the anchor will increase up to a point at which either the capacity of the expansion mechanism or the bond is reached. At deeper embedments, the high compressive forces developed by the expansion mechanism of some anchors may cause localized failure of the concrete. In masonry, part of the individual unit may be pulled from the wall, especially in cases where the strength of the mortar may be low.

Anchor Material Failure



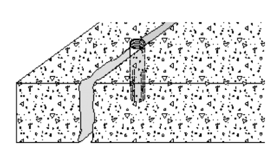
A failure of the anchor body or rod will occur when the applied load exceeds the strength of the material from which the anchor is manufactured. For mechanical anchors, this usually occurs for anchors which are embedded deep enough to develop the full strength of the expansion mechanism and the base material. For adhesive anchors, this will occur when the base material and bond strength of the adhesive is greater than the strength of the anchor rod.

Spacing or Edge Failure



The spacing and edge distance of installed anchors will affect the mode of failure along with the resulting ultimate load capacity. Anchors which are spaced close together will have a compound influence on the base material resulting in lower individual ultimate load capacities. For anchors installed close to an unsupported edge, the load capacity will be affected by both the direction of the load and the distance from the edge. As load is applied, a concrete cone type of failure will occur. This can be caused by the compressive forces generated by the expansion mechanism or by the stresses created by the applied load.

Base Material Splitting

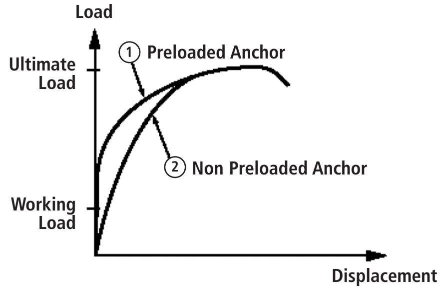


Concrete and masonry units must be of sufficient size to prevent cracking or splitting during anchor installation and as load is applied. The critical dimensions include the thickness and the width of the base material.

ANCHOR BEHAVIOR (Continued)

Anchor Preload

Anchor preload is developed by the setting action in a deformation controlled anchor or the tightening of a bolt/nut in a torque controlled anchor. When a load is applied to an anchor, significant displacement will not occur until the preload in the anchor has been exceeded. The amount of preload normally does not have any effect on ultimate load capacity provided the anchor is properly set. By tightening a torque controlled anchor a particular number of turns or to a specific torque level, the anchor is initially preloaded. This action will reduce the overall displacement of the anchor and normally ensures that elastic behavior will occur in the working load range. A preload may also be applied to achieve a clamping force between the fixture and the base material. The diagram below shows the effect of preload on the performance characteristics of two wedge anchor samples.

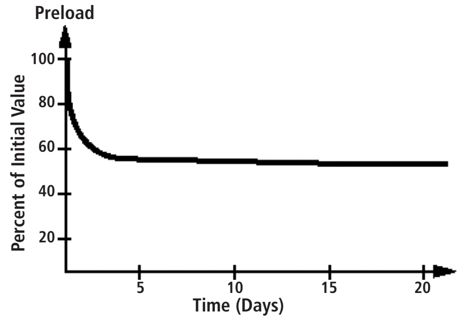


Effects of preload on anchor performance

In curve 1, the tightened anchor does not experience significant displacement until well above the working load. Curve 2 shows the performance of the anchor not tightened which experiences marked displacement in the working load range.

Preload Relaxation

In concrete, anchors which have been preloaded by tightening or the application of an installation torque will experience a phenomena called preload relaxation. This will also occur in masonry base materials. In a typical anchor installation, high bearing stresses against the concrete base material are created around the expansion mechanism of the anchor as it is preloaded. These high bearing stresses cause the concrete in the area of the expansion mechanism to creep which results in a slight movement of the anchor. This slight movement causes a reduction of preload and a corresponding reduction in the measured torque. Industry experience has shown that a decrease in preload in the range of 40 to 60 percent can be expected in normal-weight concrete. This will vary depending upon the modulus of elasticity of the concrete. The final preload is typically 1.5 to 2.0 times the working load based on the use of a safety factor of 4. Typical load relaxation is shown in the following diagram.



Typical preload relaxation

Relaxation begins immediately after tightening with most of the relaxation occurring during the first few hours after installation. For example, in an application where an installation torque of 60 foot-pounds is applied, a decrease in the torque measured 24 hours later to a level of 30 foot-pounds due to preload relaxation would be considered normal. Retorquing of the anchors may slightly increase the final value of the preload, however, this is not normally recommended as repeated tightening may eventually jack the anchor out of the base material.

ANCHOR MATERIAL SELECTION

The material from which an anchor is manufactured is generally capable of sustaining the published tension and shear loads. However, other conditions such as bending loads should be checked. In certain loading situations, the material strength may be the weak link. Bolts or other materials used in conjunction with an anchor should be capable of sustaining the applied load and should be installed to the minimum recommended thread engagement. For reference purposes, the minimum expected mechanical properties of commonly used carbon steel and stainless steel materials are listed in Appendix A4. The designations used are for externally threaded parts as assigned by the Society of Automotive Engineers (SAE), American Iron and Steel Institute (AISI) or the American Society for Testing and Materials (ASTM). Variations in strength will occur due to heat treating, strain hardening, or cold working. Consult the individual standards for details.

Allowable Steel Strength

In some cases, it may be desirable to calculate the allowable steel strength for a bolt or a threaded anchor rod. One method to calculate the allowable steel strength is based on the stresses as listed in the American Institute of Steel Construction (AISC) *Manual of Steel Construction, Allowable Stress Design*. Using this method, the allowable tensile stress, F_t , and the allowable shear stress, F_v, are calculated as follows:

$F_t = 0.33 \times F_u$
$F_v = 0.17 \times F_u$

Where F_u = minimum specified ultimate tensile strength for the steel material. This stress is then applied to the gross nominal area of the threaded section to calculate the load in pounds.

In addition to the load capability of the material, an anchor should be manufactured from material which is compatible with its intended use. For example, anchors manufactured from a material with a melting point of less than 1000° F are not normally recommended for overhead applications due to fire code regulations unless specific fire rating tests have been performed. Special materials may be required for corrosive environments and galvanic reactions.

Powers reserves the right to use alternate anchor materials which will perform in a similar manner depending upon production requirements.

Material Certifications

Powers provides the following types of certification for products when requested by the user.

Certificate of Compliance
This type of certification, sometimes called a Certificate of Conformance, lists the materials and plating used in the manufacture of a product referencing pertinent specifications or listings such as AISI, ASTM, SAE, UL, FM Global, or ICC/ICBO. All major components are described including nuts and washers. This is the most commonly requested type of certification. A Certificate of Compliance can be requested for any Powers product from the local branch office.

Mill Certifications
Requests for Mill Certifications usually apply to steel anchors. Mill Certifications provide full traceability of a finished product back to the original lot of steel from which it was produced and usually include the heat number, material identification, chemical analysis, and physical properties. In order to produce a part which is traceable back to the original Mill Certification, the raw steel material must be identified at the start of the manufacturing process. Powers is able to perform this type of service, however, these certifications can be supplied only on material that is ordered as a special.

A price and delivery quotation for any item requiring Mill Certifications can be obtained by contacting the local Powers Branch office. Certain projects in the United States specify that steel components installed on site be manufactured from raw material steel that is originally melted, milled, wired, etc in the U.S. market conditions at the time of manufacture of a particular anchor type and its components will determine the origin of raw material steel. The origin of the raw material used for the manufacture of anchors already stocked or sold from authorized Powers distributors typically cannot be certified. A special order for the manufacture of anchors made from 100% U.S. steel needs to be quoted. Minimum quantities of 25,000 to 50,000 pieces and minimum lead times of 2 to 8 weeks should be expected.

DESIGN RECOMMENDATIONS

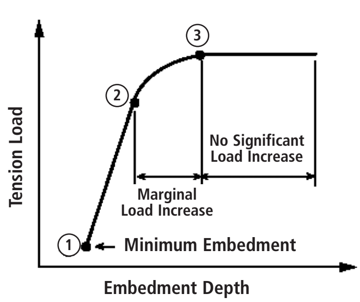
Allowable Load Capacities

The allowable load which may be applied to an anchor is calculated based upon applying a safety factor to the average ultimate load capacity obtained from testing. One purpose of a safety factor is to allow for field variations which may differ from the testing conditions in the laboratory. Examples of these variations include differences in the type and strength of base material, the setting method used, and long term performance factors. The standards established by industry is to reduce the ultimate load capacity by a minimum safety factor of 4 or 5 (or greater) depending upon the type of base material and governing building code to calculate the allowable working load. For example, an anchor which has an average ultimate tension load capacity in solid normal-weight concrete of 12,000 pounds would have a maximum allowable working load anchor of 3,000 pounds. Critical applications such as overhead applications or dynamic loading may require safety factors of 10 or higher. The allowable loads are recommendations, however, and local building codes should be consulted to determine the required safety factors. For adhesive anchors, maximum torque ranges are published with the load capacity charts for each adhesive anchoring system.

Depth of Embedment

The depth of embedment published for each anchor in the load capacity charts is critical to achieving the expected load capacities. This depth is measured from the surface of the base material to the bottom of the anchor. For mechanical expansion anchors, this would be the depth measured to the bottom of the anchor prior to actuation. For each anchor type, a minimum embedment depth is specified. This depth is typically the minimum required for proper anchor installation and reliable functioning. Attempting to install an anchor at less than the minimum required may overstress the base material causing it to fail when the anchor is expanded. In some masonry materials, the minimum depth may be decreased depending upon the anchor style as noted in the load tables.

As noted previously, the load capacity of some anchor types will increase with deeper embedments. For anchors which exhibit this behavior, multiple embedment depths and the corresponding load capacity are listed. As the embedment depth is increased, the load capacity will increase up to a transition point. This point is usually the maximum embedment depth listed. At this point, mechanical anchors may experience material failure or localized failure of the base material around the expansion mechanism. Adhesive type anchors may reach the capacity of the bond, the anchor rod material, or the capacity of the base material. The following diagram shows the typical performance of a mechanical anchor installed in concrete.



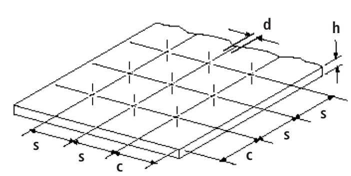
At the minimum embedment depth, the mode of failure at the ultimate load capacity is typically a concrete shear cone. As the anchor is installed at a deeper embedment depth, the size of the theoretical concrete shear cone increases, resulting in an increased load capacity. As the embedment depth is increased towards point 2, the mode of failure changes from a concrete shear cone to localized failure around the expansion mechanism. Beyond this point, marginal load capacity increases can be expected until the capacity of the expansion mechanism or anchor material is reached at embedment depths corresponding to point 3. The load capacity will not increase significantly for anchors installed at embedment depths beyond this point. This point is usually the deepest embedment listed in the anchor load capacity tables and is the maximum recommended. Applications which require an embedment deeper than those published should be tested to verify proper anchor performance. For applications requiring installation at embedment depths between those published, linear interpolation is permitted.

Base Material Strength

As discussed previously, the strength of the base materials in which anchors may be installed varies widely and is a key factor in the performance of an anchor. Powers publishes the average ultimate load capacities for anchors installed in concrete and masonry units along with other appropriate base materials depending upon the product. For installations in concrete, the load capacity of an anchor usually increases as the compressive strength increases. Most load capacities for anchors installed in concrete are published for minimum compressive strengths of 2,000, 4,000, and 6,000 psi. Linear interpolation of the data for intermediate compressive strengths is permissible. For masonry unit base materials, the published load capacities should be used as a guide since the consistency of these materials varies widely. Job site tests are recommended for critical applications in these materials.

Base Material Thickness

The minimum recommended thickness of solid concrete or masonry base material, *h*, when using a mechanical or adhesive anchor typically is 125% to 150% of the embedment to be used. For example, when installing an anchor to a depth of 4", the base material should be at least 5" thick. Conversely, the maximum embedment should be 80% of the base material thickness. If a concrete slab is 10" thick, an 8" depth would be the maximum recommended anchor embedment. This does not apply to products designed for installation in hollow base materials as noted in the individual anchor sections.

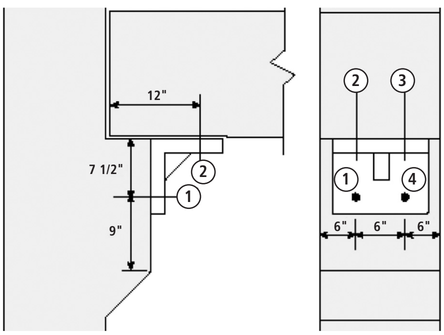


d = Anchor Size
s = Spacing
c = Edge Distance
h = Base Material Thickness

DESIGN RECOMMENDATIONS (Continued)

Design Example

The following example is provided as a reference to familiarize the designer with the use of spacing and edge distance reduction factors. The method employed can be used for either mechanical or adhesive anchors. In this application, a steel angle is to be fastened to a 6,000 psi precast structure to reinforce the existing column and beam connections as shown in the following diagram. The designer has previously calculated the service loads and would prefer to use 4 anchors. Based on the calculations, the required service loads for an anchor at location No. 1 would be 1,500 lbs. in tension and 2,200 lbs. in shear. The *Wedge-Bolt* anchor has been selected because of the finished appearance.



For an installation in 6,000 psi concrete, the following information is obtained from the load capacity chart for the carbon steel *Wedge-Bolt* anchor.

Anchor diameter: 3/4"
Embedment depth: 5"
Maximum Allowable Tension Load: 4,850 lbs.
Maximum Allowable Shear Load: 6,190 lbs.

The spacing and edge distance factors would be applied as follows. For anchor No. 1, the reductions which should be applied are for the influence of the spacing from anchor No. 4 and two edge distance influences (6" horizontally and 7 1/2" vertically). Refer to the *Load Adjustment Factors for Normal-Weight Concrete* tables for the applicable reduction factors located in the *Wedge-Bolt* product section of this manual.

Allowable Tension Load

For the 6" spacing, F_N = 0.75 (taken from the spacing table for tension).

For the 6" edge distance, F_N = 1.00 (taken from the edge distance table for tension).

For the 7 1/2" edge distance, F_N = 1.00 (taken from the edge distance table for tension).

The allowable tension load based on the reduction factors is calculated as follows:

Allowable Load = 4,850 x 0.75 x 1.00 x 1.00 = 3,635 lbs.

Allowable Shear Load

For the 6" spacing, F_V = 0.88 (taken from the spacing table for tension).

For the 6" edge distance, F_V = 0.62 (taken from the edge distance table for tension).

For the 7 1/2" edge distance, F_V = 0.81 (taken from the edge distance table for tension).

The allowable tension load based on the reduction factors is calculated as follows:

Allowable Load = 6,190 x 0.88 x 0.62 x 0.81 = 2,735 lbs.

Combined Loading

Once the allowable load capacities are established including the effects of spacing and edge distance, the combined loading formula should be checked.

$(1{,}500/3{,}635)^{5/3} + (2{,}200/2{,}735)^{5/3}$

$0.23 + 0.70 = 0.93 \leq 1$, OK.

The design approach would be similar for the remainder of the anchors.

Anchors for use in Seismic Design

Seismic design as based on the building codes require that building structures resist the effects of ground motion induced by an earthquake. Each structure is assigned to a seismic zone based on the location of the building site as referenced in the building codes.

Seismic design is complex as it considers several influencing factors such as site geology and soil characteristics, building occupancy categories, building configuration, structural systems, and lateral forces. Lateral forces are critical because of an earthquakes tendency to shake the building structure from side to side.

Anchors to be used for seismic loads will not be fully loaded in place until an earthquake occurs. Test methods have been developed to provide a criteria for evaluating the performance of both adhesive and mechanical anchors when subjected to simulated seismic loading. For tension, anchors are tested at both the shallowest and deepest embedment depth to be published. Anchors are subjected to a simulated seismic load cycle. In shear, anchors are tested at the shallowest embedment depth and are subjected to alternating load applications.

The criteria to be used as conditions of acceptance are as follows:

A) The anchors must withstand the loading cycles without failure.

B) The anchors must be able to attain at least 80% of the static ultimate tension or shear capacity.

Powers has conducted testing according to ASTM and ICC-ES (formerly ICBO-ES) Acceptance Criteria, including Seismic Qualification on several anchoring products. See individual product sections for more information.

INSTALLATION CRITERIA

As with any building component, proper installation is the key to a successful application once an anchor has been designed and properly selected.

Drilled Hole

A properly drilled hole is a critical factor both for ease of installation and optimum anchor performance. The anchors selected and the drill bits to be used should be specified as part of the total anchoring system. Most Powers anchors are designed to be installed in holes drilled with carbide tipped bits meeting the requirements of the American National Standards Institute (ANSI) Standard B212.15 unless otherwise specified. If alternate bit types are used, the tip tolerance should be within the ANSI range unless otherwise permitted. The following table lists the nominal drill bit diameter along with the tolerance range established by ANSI for the carbide tip.

Nominal Drill	ANSI Standard	Nominal Drill	ANSI Standard
1/8"	0.134-0.140"	11/16"	0.713-0.723"
5/32"	0.165-0.171"	3/4"	0.775-0.787"
11/64"	0.181-0.187"	27/32"	0.865-0.881"
3/16"	0.198-0.206"	7/8"	0.905-0.917"
7/32"	0.229-0.237"	15/16"	0.968-0.980"
1/4"	0.260-0.268"	1"	1.030-1.042"
9/32"	0.296-0.304"	1 1/8"	1.160-1.175"
5/16"	0.327-0.335"	1 1/4"	1.285-1.300"
3/8"	0.390-0.398"	1 3/8"	1.410-1.425"
7/16"	0.458-0.468"	1 1/2"	1.535-1.550"
1/2"	0.520-0.530"	1 5/8"	1.655-1.675"
9/16"	0.582-0.592	1 3/4"	1.772-1.792"
5/8"	0.650-0.660"	2"	2.008-2.028"

When drilling an anchor hole using a carbide tipped bit, the rotary hammer or hammer drill used transfers impact energy to the bit which forms the hole primarily due to a chiseling action. This action forms an anchor hole which has roughened walls. Mechanical anchors should not be installed in holes drilled with diamond tipped core bits this type of bit unless testing has been conducted to verify performance. Adhesive anchors should also be tested. A diamond tipped bit drills a hole which has very smooth walls which can cause some anchor types to slip and fail prematurely.

During the drilling operation, bit wear should be monitored to ensure that the carbide tip does not wear below the following limits to ensure proper anchor functioning. This is especially important when using mechanical anchors. Generally, mechanical anchors can be installed in holes drilled with bits which have worn, but are still in the acceptable range. This depends on the base material, so this information should be used as a guide.

Nominal Drill	Lower Wear	Nominal Drill	Lower Wear
3/16"	0.190"	5/8"	0.639"
1/4"	0.252"	3/4"	0.764"
5/16"	0.319"	7/8"	0.897"
3/8"	0.381"	1"	1.022"
1/2"	0.510"	1 1/4"	1.270"

Anchor holes should be drilled to the proper depth which is based on the anchor style. The recommended drilling depth is listed in the installation instructions for the individual products. When a one-step anchor such as a wedge style is installed, the expansion mechanism scrapes the walls of the anchor hole. This scraping action pushes concrete dust particles ahead of the anchor. When using this style of anchor, the purpose of drilling the anchor hole to the recommended depth is to allow a place for the dust to settle as the anchor is installed. Anchor holes should be thoroughly cleaned prior to installation of the anchor unless otherwise noted.

This procedure is easily accomplished using compressed air or a vacuum. Dust and other debris must be removed from the hole to allow an anchor to be installed to the required embedment and to ensure that the expansion mechanism can be properly actuated. Extra care should be taken when using adhesives including brushing of the anchor hole to ensure that a proper bond is developed.

Anchor Alignment

Anchors should be installed perpendicular to the surface of the base material. Within the industry, +/- 6° is typically used as the permissible deviation from perpendicular. If anchors are installed beyond this point, calculations to ensure that a bending load has not been created may need to be performed. Job site tests may be required to determine actual load capacities if anchors are not installed perpendicular to the surface of the base material.

Clearance Holes

Powers anchors are designed to be installed in holes drilled in concrete and masonry base materials with carbide tipped drill bits meeting the requirements of ANSI B212.15 as listed in the previous section unless otherwise noted. The actual hole diameter drilled in the base material using an ANSI Standard carbide tipped bit is larger than the nominal diameter. For example, a 1/2" nominal diameter drill bit has an actual O.D. of 0.520" to 0.530". When selecting the diameter of the hole to be pre-drilled in a fixture, the diameter of the hole selected should allow for proper anchor installation.

For through fixture installations, it is necessary to pre-drill or punch a minimum clearance hole in the fixture which is large enough to allow the carbide tipped bit and the anchor to pass through.

One-step mechanical expansion anchors require a pre-drilled hole in the fixture which is large enough for the expansion mechanism to be driven through. Normally, for mechanical expansion anchor sizes up to 7/8", the minimum clearance hole required is the anchor diameter plus 1/16". For sizes 1" and larger, the minimum clearance hole is the anchor diameter plus 1/8". This clearance hole should be adjusted to allow for any coating applied to the fixture.

As in all applications, the design professional responsible for the installation should determine the clearance hole to be used based on the anchor selected and relevant code requirements.

INSTALLATION CRITERIA (Continued)

Installation Torque

Certain anchor styles, sometimes referred to as torque controlled anchors, are actuated by tightening a bolt or nut. For typical field installations, the commonly recommended tightening procedure for anchors such as the *Power-Stud* or *Power-Bolt* is to apply 3 to 5 turns to the head of the bolt or nut from the finger tight position or to within the maximum guide torque range. This is usually sufficient to initially expand the anchors and is standard industry practice. In some cases, it may be desirable to specify an installation torque for an anchor.

The frictional characteristics which govern the torque-tension relationship for an anchor will vary depending upon the anchor type and the base material. Other factors which may affect the relationship are the effects of fixture coatings or platings, lubrication of the anchor components due to the use of sealants around the anchor hole, and the anchor material. Powers publishes guide installation torque values for anchors that are actuated by tightening a bolt or nut. These values are based on standard product installations and should be used as a guideline since performance may vary depending upon the application. For other anchor types such as adhesive anchors, a maximum torque may be published for use as a guide to prevent overloading when applying a clamping force to a fixture. These values may have to be reduced for installations in masonry materials. Suggested allowable torque range values are also provided in the product sections.

Test Torque

To establish application specific installation torque values, a job site test is recommended. A typical procedure includes the following: Install the anchor duplicating the actual application. Using a torque wrench, apply the recommended number of full turns from the finger tight position. The number of turns may vary depending upon the base material strength. Upon completion of the final turn, record the torque reading from the wrench. This should be performed on a minimum sample of 5 anchors averaging the results to establish an installation torque range.

Should anchor failures occur during this job site test procedure, average ultimate torque values should be compared to published torque recommendations and an appropriate factor of safety should be applied typically 2 to 2.5.

If previously installed anchors are to be inspected with a torque wrench, it should be noted that anchors experience a relaxation of preload which begins immediately after tightening due to creep within the concrete or masonry material. This phenomena is discussed in a previous section. The torque value measured after installation is typically 50% of that initially applied to set the anchor.

Notes:

MECHANICAL ANCHORS

SECTION CONTENTS

MECHANICAL ANCHOR SELECTION GUIDE

	Anchor Category	Expansion Anchors				Screw Anchors			Rod Hanging Systems		
	Product	Power-Bolt	Power-Stud	Lok-Bolt	Set-Bolt	Wedge-Bolt	Tilt Wall Wedge-Bolt	Tapper	Vertigo	Bang-It	Wood-Knocker
	Page	28	40	55	64	67	84	87	137	143	143
Base Material	Concrete	■	■	■	■	■	■	■	■	■	■
	Lightweight Concrete	■	■	■	□	■	■	■	■	■	■
	Hollow Core Plank	□		□		□	□	■	■		
	Grout-filled Concrete Masonry	■	□	□	□	■	□	■			
	Hollow Concrete Masonry	□		■		□	□	■			
	Solid Brick	■		■	□	■	□	■			
	Hollow Brick	□		□				□			
	Stone	□	□	□	□			□			
	Structural Clay Tile							□			
	Wood								■		
	Steel								■		
Anchor Diameter	3/16"							■			
	1/4"	■	■	■	■	■		■	■	■	■
	5/16"	■		■							
	3/8"	■	■	■	■	■		■	■	■	■
	1/2"	■	■	■	■	■			■	■	■
	5/8"	■	■	■		■				■	■
	3/4"	■	■	■		■	■			■	■
	7/8"		■							■	
	1"		■								
	1 1/4"		■								
Head Style	Finished Hex Head	■				■	■	■			
	Round / Acorn Head			■							
	Flat Head (Countersunk)	■		■		■	■	■			
	Mushroom Head										
	Removable	■				■	■	■	■		
	Tie-Wire Head		■	■							
	Tamperproof										
	Female Coupler		■	■						■	■
Working Load	Under 400 lbs.	■	■	■	■	■	■	■	■	■	■
	400 lbs. to 4,000 lbs.	■	■	■	■	■	■	■	■	■	■
	Over 4,000 lbs.	■	■			■	■				
Coating/Material	Coated / Plated Carbon Steel	■	■	■	■	■	■	■	■	■	■
	Galvanized Steel		■			■					
	Type 303/304 Stainless Steel	■	■	■				■			
	Type 316 Stainless Steel		■								
	Type 410 Stainless Steel					■		■			
	Perma-Seal Coated							■			
	Nylon / Plastic									■	■

MECHANICAL ANCHOR SELECTION GUIDE (Continued)

Anchor Category		Bolt and Shield Anchors								Pin Anchors		Nail Anchors		
	Product	Snake	Hollow-Set Dropin	Steel Dropin	Mini Dropin	Double	Single	Calk-In	Lag-Shield	Spike	Drive	Zamac Hammer-Screw	Zamac Nailin	Nylon Nailin
	Page	101	104	111	118	122	126	129	133	150	163	167	171	175
Base Material	Concrete	■	■	■	■	■	■	■	■	■	■	■	■	■
	Lightweight Concrete	■	□	■	■	□	□	□	□	■	□	□	□	□
	Hollow Core Plank	■	■		■							□	□	□
	Grout-filled Concrete Masonry	□	■		□	□	□	■	■	■	□	□	□	□
	Hollow Concrete Masonry		■			■		■	□			■	■	■
	Solid Brick		■			■	□	■	■	□	□	■	■	■
	Hollow Brick		□						□			□	□	□
	Stone		□	□	□	□	□	□	□	□	□	□	□	□
	Structural Clay Tile													
	Wood													
	Steel													
Anchor Diameter	3/16"									■	■		■	■
	1/4"	■	■	■	■	■	■	■	■	■	■	■	■	■
	5/16"		■			■	■	■	■					
	3/8"	■	■	■	■	■	■	■	■	■	■			
	1/2"		■	■	■	■	■	■	■	■	■			
	5/8"		■	■		■	■		■					
	3/4"			■		■	■		■					
Head Style	Mushroom Head									■	■	■	■	■
	Round Head													■
	Flat Head (Countersunk)									■	■		■	■
	Tie-Wire									■	■			
	Removable											■		
	Tamperproof									■	■		■	■
	Flush Mount	■	■	■	■	■	■	■	■			■		
Working Load	Under 400 lbs.	■	■	■	■	■	■	■	■	■	■	■	■	■
	400 lbs. to 4,000 lbs.	■	■	■	■	■	■	■	■	■	■	■		
	Over 4,000 lbs.			■		■	■							
Coating/Material	Coated / Plated Carbon Steel	■	■	■	■					■	■	■	■	■
	Galvanized Steel													
	Type 303/304 Stainless Steel		■	■								■	■	■
	Type 316 Stainless Steel			■						■				
	Type 410 Stainless Steel													
	Zamac Alloy		■			■	■	■	■			■	■	
	Perma-Seal Coated											■		
	Nylon / Plastic													■
	Lead							■						

Mechanical Anchoring

INTRODUCTION

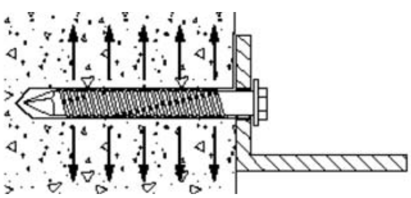
Mechanical expansion anchors can usually be loaded immediately after installation which may be an advantage in some applications as compared to bonded adhesive anchors which must be allowed to cure prior to loading. Steel expansion anchors generally have a greater resistance to the effects of elevated temperature when compared with adhesives such as ester based resins or epoxies. Mechanical anchors can also be described by their style, either male or female. Male style anchors are also referred to as stud type anchors such as a *Power-Stud* or *Power-Bolt*. Female anchors are often called shield or shell type anchors such as a *Steel Dropin*. The following sections describe five types of mechanical expansion anchor functioning.

SECTION CONTENTS Page No.

MECHANICAL ANCHOR FUNCTIONING

Screw Anchors

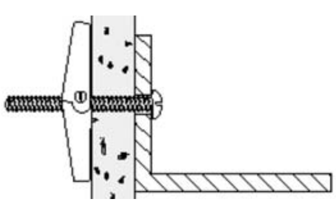
Anchors of this type develop their load capacity by creating an interlock between the anchor and the base material. In the most common systems, an undersized hole is drilled into the base material. As the anchor is driven in, a friction force is developed between the shank of the anchor and the base material. This type of anchor is suitable for sustaining light to heavy duty loads. Examples of concrete screw anchors are the *Tapper* and the *Wedge-Bolt*.



Screw Anchor (Tapper)

Clamping Anchors

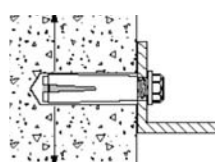
Clamping describes a type of anchor which is used for fastening to hollow base materials. Resistance to load is achieved by clamping the material to be fastened to the base material. The tension load is developed by spreading the load over a large bearing surface in the hollow base material while shear is resisted by the friction developed between the fixture and the base material. Examples of this type of anchor are *Toggle* or *Polly* anchors.



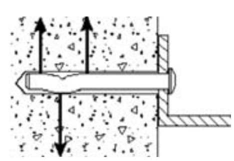
Clamping anchor (Toggle Bolt)

Compression Anchors

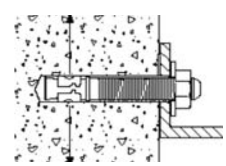
The term compression anchor can be used to describe the majority of concrete and masonry expansion anchors. Anchors of this type are designed with an expansion mechanism that compresses against the base material. The expansion mechanism may be a sleeve, slotted shell, slotted stud, or wedge assembly which is actuated by a tapered cone, tapered plug, nail, bolt, or screw depending upon the anchor style. The compression of the expansion mechanism against the wall of the drilled hole allows the anchor to transfer the load to the base material. Anchors which are expanded by tightening a bolt or nut are considered to be torque controlled while those that are actuated by driving a nail or plug are considered to be deformation controlled. Examples of torque controlled anchors are the *Power-Bolt* or *Power-Stud*. The *Steel Dropin* is an example of a deformation controlled anchor. A deformation controlled anchor can develop a higher initial compression force when compared to a torque controlled anchor. Compression anchors may also be pre-expanded. The expansion mechanism on an anchor of this style is actuated as it is compressed during the driving operation into the anchor hole. An example of this style of anchor is the *Spike*.



Fixed compression displacement controlled anchor (Steel Dropin)



Pre-expanded anchor (Spike)



Self-energizing torque controlled anchor (Power-Stud)

The expansion mechanism on a compression type anchor can be fixed or self energizing. An anchor with a fixed mechanism is usually deformation controlled with the amount of expansion being limited, such as a *Steel Dropin* anchor where an internal plug is set with a tool. If an overload condition occurs, an anchor with fixed mechanism will not expand any further. A self-energizing mechanism is often found on torque controlled anchors which will continue to expand if an overload condition occurs, such as a *Power-Bolt* or *Power-Stud*. When the applied load exceeds the pre-load in the anchor, it will expand or reset to take up the additional load. Some deflection or movement will usually occur providing a visual indication of a potential problem. This type of performance is also typical of a pre-expanded anchor such as the *Spike*.

Undercut Anchors

Undercut anchors expand at the bottom of the drilled hole similar to a compression type anchor except that the actual diameter of the expanded area is wider than the drilled hole, undercutting the base material similar to a dove tail slot. Anchors of this type can be self undercutting or may require a secondary drilling operation to form the undercut at the bottom of the drilled hole. During installation, as the expansion mechanism undercuts the base material, it forms a large bearing area which can transfer greater load to the base material.

PERFORMANCE DATA

The test data for mechanical anchors published in this manual was developed according to ASTM Standard E 488, *Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements*. Published load values are average ultimate (failure) loads based on actual testing in the base materials listed in the individual product sections. Each individual data point is typically the average of a minimum of five individual tests.

INSTALLATION GUIDELINES

Installation Torque

Certain anchor styles, sometimes referred to as torque-controlled anchors, are actuated by tightening a bolt or nut. For typical field installations, the commonly recommended tightening procedure for anchors such as the *Power-Stud* or *Power-Bolt* is to apply 3 to 5 turns to the head of the bolt or nut. This is usually sufficient to initially expand the anchors and is standard industry practice.

In some cases, it may be desirable to specify an installation torque for an anchor. The frictional characteristics which govern the torque-tension relationship for an anchor will vary depending upon the anchor type and the base material. Other factors which may affect the relationship are the effects of fixture coatings or platings, lubrication of the anchor components due to the use of sealants around the anchor hole, and the anchor material. Powers publishes guide installation torque values for anchors that are actuated by tightening a bolt or nut.

These values are based on standard product installations and should be used as a guideline since performance may vary depending upon the application. For other anchor types such as adhesive anchors, a maximum torque may be published for use as a guide to prevent overloading when applying a clamping force to a fixture. These values may have to be reduced for installations in masonry materials. Suggested allowable torque range values are also provided.

To establish application specific installation torque values, a job site test is recommended. A typical procedure includes the following: Install the anchor duplicating the actual application. Using a torque wrench, apply the recommended number of full turns from the finger tight position. The number of turns may vary depending upon the base material strength. Upon completion of the final turn, record the torque reading from the wrench. This should be performed on a minimum sample of five anchors averaging the results to establish an installation torque range. Should anchor failures occur during this job site test procedure, average ultimate torque values should be compared to published torque recommendations and an appropriate factor of safety should be applied typically 2 to 2.5.

If previously installed anchors are to be inspected with a torque wrench, it should be noted that anchors experience a relaxation of preload which begins immediately after tightening due to creep within the concrete or masonry material. This phenomena is discussed in a previous section. The torque value measured after installation is typically 50% of that initially applied to set the anchor.

Power-Bolt® *Heavy-Duty Sleeve Anchor*

PRODUCT DESCRIPTION

The Power-Bolt anchor, formerly known as the *Rawl-Bolt,* is a heavy duty sleeve style, self-locking anchor which is vibration resistant and removable. It is available with a finished hex head or flat head with a hex key insert and can be used in concrete, block, brick, or stone.

Expansion occurs at two locations within the drilled hole. First, the cone is pulled into the large triple-tined expansion sleeve, developing a mid-level, compression force. Further turning causes the threaded bolt to advance into the threads of the expander cone, forcing its four sections outward. This action undercuts the base material deep in the anchor hole, greatly increasing the holding power of the Power-Bolt. The bolt and cone remain locked together which prevents loosening under even the most severe vibratory conditions.

The Power-Bolt is also designed to draw the fixture into full bearing against the base material through the action of its flexible compression ring. As the anchor is being tightened, the compression ring will crush if necessary to tightly secure the fixture against the face of the base material.

The internal bolt of the Power-Bolt is removable and reusable in the same anchor hole making it ideal for applications such as mounting machinery which may need to be removed for service and for temporary applications such as heavy duty form work.

GENERAL APPLICATIONS AND USES

- Seismic Bracing and Vibratory Applications
- Column Base Plates and Mechanical Equipment
- Dock Bumpers and Support Ledgers
- Racking and Railing Attachments
- Overhead and Critical Anchoring

FEATURES AND BENEFITS

- High load capacity
- Tested in accordance with ASTM E488 and AC01 criteria
- Qualified for seismic and wind load applications
- Two-level expansion mechanism
- Suitable for vibratory, fatigue and shock loading
- Internal high strength bolt is removable and reusable
- Compression zone clamps fixture to the base material
- Low profile finished head design
- Fire tested per Ref. WFRA No. F91763

APPROVALS AND LISTINGS

International Code Council, Evaluation Service (ICC-ES) ESR-1532
(formerly listed in ICBO ES ER-5225)
Southern Building Code Conference International (SBCCI) #9943A
City of Los Angeles (COLA) Research Report LARR – 24960
Florida Building Code Approval – FL2209.4
Miami-Dade County Notice of Acceptance (NOA) 03-0303.14
Factory Mutual Research Corporation (FM Approvals) – File No. J.I. 1K8A3.AH
Underwriters Laboratory (UL Listed) – File No. EX1289
Federal GSA Specification – Meets the proof load requirements of FF-S-325C, Group II,
Type 3, Class 3 (superseded)
Various North American Departments of Transportation (DOT) – See www.powers.com

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring, 04081-Masonry Anchorage* and *05090-Metal Fastenings.* Expansion Anchors shall be Power-Bolt anchors as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS Page No.

Hex Head Power-Bolt

Flat Head Power-Bolt

HEAD STYLES

Finished Hex Head
Flat Head

ANCHOR MATERIALS

Zinc Plated Carbon Steel
Type 304 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

1/4" diameter x 1" length to
3/4" diameter x 8-1/4" length

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Structural Lightweight Concrete
Grouted Concrete Masonry
Hollow CMU
Brick Masonry
Stone

INSTALLATION SPECIFICATIONS

Carbon Steel Hex Head Power-Bolt

Dimension	Anchor Diameter, *d*					
	1/4"	**5/16"**	**3/8"**	**1/2"**	**5/8"**	**3/4"**
ANSI Drill Bit Size, d_{bit} (in.)	1/4	5/16	3/8	1/2	5/8	3/4
Fixture Clearance Hole, d_h (in.)	5/16	3/8	7/16	9/16	11/16	13/16
Internal Bolt Size (UNC)	10-24	1/4-20	5/16-18	3/8-16	1/2-13	5/8-11
Head Height (in.)	7/64	11/64	13/64	15/64	5/16	25/64
Washer O.D., d_w (in.)	1/2	5/8	13/16	1	1-1/4	1-1/2
Wrench Size (in.)	5/16	7/16	1/2	9/16	3/4	15/16
Max. Tightening Torque, T_{max} (ft-lbs)	3-4	10-12	20-25	35-45	80-100	95-120
Bearing Area (in^2)	0.070	0.105	0.145	0.246	0.370	0.515

Carbon Steel Flat Head Power-Bolt (80° – 82° head)

Dimension	Anchor Diameter, *d*		
	3/8"	**1/2"**	**5/8"**
ANSI Drill Bit Size, d_{bit} (in.)	3/8	1/2	5/8
Fixture Clearance Hole, d_h (in.)	7/16	9/16	11/16
Internal Bolt Size (UNC)	5/16-18	3/8-16	1/2-13
Head Height (in.)	15/64	1/4	21/64
Head Diameter, d_{hd} (in.)	3/4	7/8	1-1/8
Allen Wrench Size (in.)	7/32	5/16	3/8
Max. Tightening Torque, T_{max} (ft-lbs)	20-25	35-45	80-100
Bearing Area (in^2)	0.145	0.246	0.370

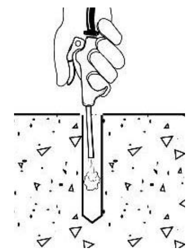
Stainless Steel Hex Head Power-Bolt

Dimension	Anchor Diameter, *d*				
	1/4"	**3/8"**	**1/2"**	**5/8"**	**3/4"**
ANSI Drill Bit Size, d_{bit} (in.)	1/4	3/8	1/2	5/8	3/4
Fixture Clearance Hole, d_h (in.)	5/16	7/16	9/16	11/16	13/16
Internal Bolt Size (UNC)	10-24	5/16-18	3/8-16	1/2-13	5/8-11
Head Height (in.)	7/64	13/64	15/64	5/16	25/64
Washer O.D., d_w (in.)	1/2	13/16	1	1-1/4	1-1/2
Wrench Size (in.)	5/16	1/2	9/16	3/4	15/16
Max. Tightening Torque, T_{max} (ft-lbs)	2-3	10-12	20-25	45-60	70-90
Bearing Area (in^2)	0.070	0.145	0.246	0.370	0.515

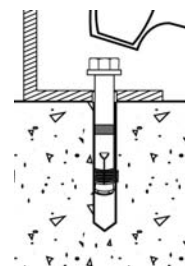
Installation Procedure

Using the proper diameter bit, drill a hole into the base material to a depth of at least 1/2" or one anchor diameter deeper than the embedment required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.

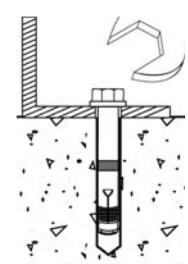
Blow the hole clean of dust and other material. Do not expand the anchor or advance the bolt in the anchor assembly prior to installation.

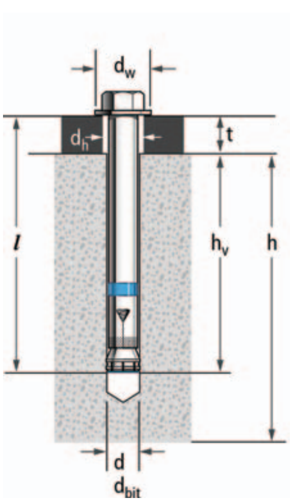


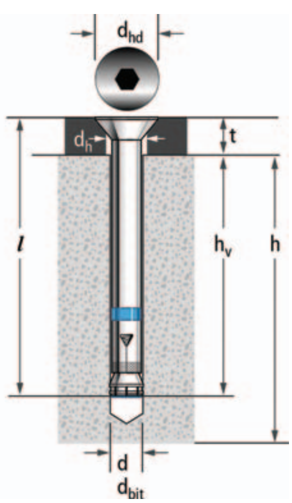
Drive the anchor through the fixture into the anchor hole until the bolt head is firmly seated against the fixture. Be sure the anchor is driven to the required embedment depth.



Tighten the anchor by turning the head 3 to 5 turns past finger tight or by applying the guide installation torque from the finger tight position.







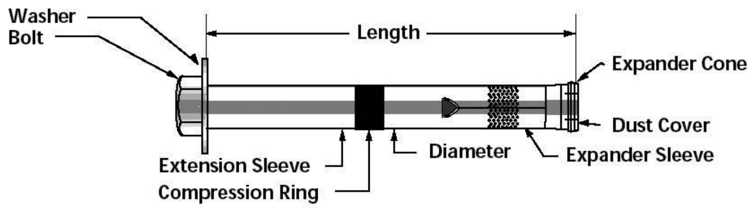
Nomenclature

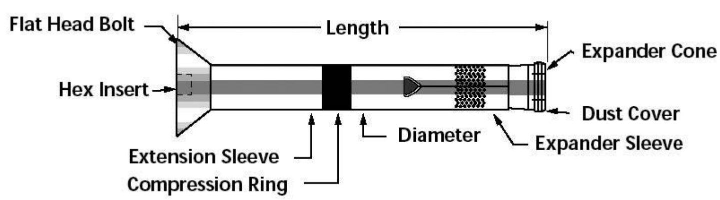
d = Diameter of anchor
d_{bit} = Diameter of drill bit
d_h = Diameter of fixture clearance hole
d_{hd} = Flat head diameter
d_w = Diameter of washer
h = Base material thickness. The minimum value of h should be $1.5h_v$
h_v = Minimum embedment depth
l = Overall length of anchor
t = Fixture thickness
T_{max} = Maximum tightening torque

MATERIAL SPECIFICATIONS

Anchor Component	Carbon Steel Hex Head	Carbon Steel Flat Head	Stainless Steel Hex Head
Internal Bolt	*SAE Grade 5	SAE Grade 5	**Type 304 SS
Washer	AISI 1040	N/A	Type 18-8 SS
Expander Sleeve	AISI 1010	AISI 1010	Type 304 SS
Extension Sleeve	AISI 1010	AISI 1010	Type 304 SS
Expander Cone	AISI 12L14	AISI 12L14	Type 303 SS
Compression Ring	Nylon	Nylon	Nylon
Dust Cap	Nylon	Nylon	Nylon
Plating	ASTM B 633, SC1, Type III (Fe/Zn 5) – Zinc		N/A

* 1/4" and 5/16" Power-Bolts are manufactured with SAE Grade 8 internal bolts.
** Manufactured with a minimum yield strength of 65,000 psi.
Stainless steel anchor components are passivated.





Length Identification

Mark	♦	■	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
From	1/2"	1"	1-1/2"	2"	2-1/2"	3"	3-1/2"	4"	4-1/2"	5"	5-1/2"	6"	6-1/2"	7"	7-1/2"	8"	8-1/2"	9"
Up to but not including	1"	1-1/2"	2"	2-1/2"	3"	3-1/2"	4"	4-1/2"	5"	5-1/2"	6"	6-1/2"	7"	7-1/2"	8"	8-1/2"	9"	9-1/2"

PERFORMANCE DATA

Ultimate Load Capacities for Carbon and Stainless Steel Power-Bolt in Normal-Weight Concrete[1,2]

Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
		2,000 psi (13.8 MPa)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	1,180 (5.3)	2,070 (9.3)	1,380 (6.2)	2,100 (9.5)	1,580 (7.1)	2,130 (9.6)	1,660 (7.5)	2,130 (9.6)
	1 3/4 (44.5)	1,400 (6.3)	2,070 (9.3)	1,550 (7.0)	2,305 (10.4)	1,700 (7.7)	2,540 (11.4)	1,860 (8.4)	2,540 (11.4)
	2 1/2 (63.5)	1,880 (8.5)	2,070 (9.3)	1,940 (8.7)	2,730 (12.3)	2,000 (9.0)	3,385 (15.2)	2,100 (9.5)	3,385 (15.2)
5/16 (7.9)	1 1/2 (38.1)	2,320 (10.4)	2,800 (12.6)	2,430 (10.9)	3,000 (13.5)	2,540 (11.4)	3,200 (14.4)	2,620 (11.8)	3,200 (14.4)
	2 (50.8)	2,640 (11.9)	3,280 (14.8)	2,880 (13.0)	3,755 (16.9)	3,120 (14.0)	4,230 (19.0)	3,270 (14.7)	4,230 (19.0)
	3 (76.2)	2,880 (13.0)	3,440 (15.5)	3,330 (15.0)	4,410 (19.8)	3,780 (17.0)	5,380 (24.2)	4,260 (19.2)	5,380 (24.2)
3/8 (9.5)	2 (50.8)	3,500 (15.8)	3,985 (17.9)	4,045 (18.2)	5,205 (23.4)	4,585 (20.6)	6,425 (28.9)	5,915 (26.6)	7,440 (33.5)
	2 1/2 (63.5)	3,800 (17.1)	4,380 (19.7)	4,330 (19.5)	5,770 (26.0)	4,855 (21.8)	7,160 (32.2)	6,665 (30.0)	7,960 (35.8)
	3 1/2 (88.9)	4,395 (19.8)	4,980 (22.4)	5,195 (23.4)	6,815 (30.7)	5,995 (27.0)	8,650 (38.9)	7,150 (32.2)	8,650 (38.9)
1/2 (12.7)	2 1/2 (63.5)	4,900 (22.1)	6,840 (30.8)	5,710 (25.7)	7,535 (33.9)	6,520 (29.3)	8,225 (37.0)	7,320 (32.9)	8,225 (37.0)
	3 1/2 (88.9)	6,140 (27.6)	8,540 (38.4)	7,590 (34.2)	9,200 (41.4)	9,040 (40.7)	9,860 (44.4)	9,890 (44.5)	10,780 (48.5)
	5 (127.0)	7,260 (32.7)	10,140 (45.6)	8,480 (38.2)	11,230 (50.5)	9,700 (43.7)	12,320 (55.4)	10,935 (49.2)	12,315 (55.4)
5/8 (15.9)	2 3/4 (69.9)	5,360 (24.1)	7,970 (35.9)	6,535 (29.4)	9,970 (44.9)	7,705 (34.7)	11,970 (53.9)	8,490 (38.2)	11,970 (53.9)
	4 (101.6)	6,460 (29.1)	10,860 (48.9)	8,210 (36.9)	12,710 (57.2)	9,960 (44.8)	14,560 (65.5)	13,110 (59.0)	15,900 (71.6)
	6 (152.4)	9,400 (42.3)	13,780 (62.0)	10,570 (47.6)	16,230 (73.0)	11,740 (52.8)	18,680 (84.1)	15,580 (70.1)	18,670 (84.0)
3/4 (19.1)	3 (76.2)	7,660 (34.5)	12,375 (55.7)	8,580 (38.6)	14,245 (64.1)	9,500 (42.8)	16,110 (72.5)	10,780 (48.5)	16,110 (72.5)
	4 1/2 (114.3)	10,060 (45.3)	16,900 (76.1)	11,200 (50.4)	20,250 (91.1)	12,340 (55.5)	23,600 (106.2)	16,240 (73.1)	23,600 (106.2)
	7 (177.8)	11,780 (53.0)	22,640 (101.9)	13,440 (60.5)	25,880 (116.5)	15,100 (68.0)	29,120 (131.0)	21,980 (98.9)	29,120 (131.0)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate loads for intermediate embedments and compressive strengths.

PERFORMANCE DATA

Allowable Load Capacities for Carbon and Stainless Steel Power-Bolt in Normal-Weight Concrete[1,2,3]

Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
		2,000 psi (13.8 MPa)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**Shear** lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	295 (1.3)	515 (2.3)	345 (1.6)	525 (2.4)	395 (1.8)	535 (2.4)	415 (1.9)	530 (2.4)
	1 3/4 (44.5)	350 (1.6)	515 (2.3)	390 (1.8)	575 (2.6)	425 (1.9)	635 (2.9)	465 (2.1)	635 (2.9)
	2 1/2 (63.5)	470 (2.1)	515 (2.3)	485 (2.2)	680 (3.1)	500 (2.3)	845 (3.8)	525 (2.4)	845 (3.8)
5/16 (7.9)	1 1/2 (38.1)	580 (2.6)	700 (3.2)	610 (2.7)	750 (3.4)	635 (2.9)	800 (3.6)	655 (2.9)	800 (3.6)
	2 (50.8)	660 (3.0)	820 (3.7)	720 (3.2)	940 (4.2)	780 (3.5)	1,060 (4.8)	820 (3.7)	1,060 (4.8)
	3 (76.2)	720 (3.2)	860 (3.9)	835 (3.8)	1,105 (5.0)	945 (4.3)	1,345 (6.1)	1,065 (4.8)	1,345 (6.1)
3/8 (9.5)	2 (50.8)	875 (3.9)	995 (4.5)	1,010 (4.5)	1,300 (5.9)	1,145 (5.2)	1,605 (7.2)	1,480 (6.7)	1,860 (8.4)
	2 1/2 (63.5)	950 (4.3)	1,095 (4.9)	1,080 (4.9)	1,445 (6.5)	1,215 (5.5)	1,790 (8.1)	1,665 (7.5)	1,990 (9.0)
	3 1/2 (88.9)	1,100 (5.0)	1,245 (5.6)	1,300 (5.9)	1,705 (7.7)	1,500 (6.8)	2,165 (9.7)	1,790 (8.1)	2,165 (9.7)
1/2 (12.7)	2 1/2 (63.5)	1,225 (5.5)	1,710 (7.7)	1,430 (6.4)	1,885 (8.5)	1,630 (7.3)	2,055 (9.2)	1,830 (8.2)	2,055 (9.2)
	3 1/2 (88.9)	1,535 (6.9)	2,135 (9.6)	1,900 (8.6)	2,300 (10.4)	2,260 (10.2)	2,465 (11.1)	2,470 (11.1)	2,695 (12.1)
	5 (127.0)	1,815 (8.2)	2,535 (11.4)	2,120 (9.5)	2,810 (12.6)	2,425 (10.9)	3,080 (13.9)	2,735 (12.3)	3,080 (13.9)
5/8 (15.9)	2 3/4 (69.9)	1,340 (6.0)	1,995 (9.0)	1,635 (7.4)	2,495 (11.2)	1,925 (8.7)	2,995 (13.5)	2,125 (9.6)	2,995 (13.5)
	4 (101.6)	1,615 (7.3)	2,715 (12.2)	2,055 (9.2)	3,180 (14.3)	2,490 (11.2)	3,640 (16.4)	3,275 (14.7)	3,975 (17.9)
	6 (152.4)	2,350 (10.6)	3,445 (15.5)	2,645 (11.9)	4,060 (18.3)	2,935 (13.2)	4,670 (21.0)	3,895 (17.5)	4,670 (21.0)
3/4 (19.1)	3 (76.2)	1,915 (8.6)	3,095 (13.9)	2,145 (9.7)	3,560 (16.0)	2,375 (10.7)	4,025 (18.1)	2,695 (12.1)	4,025 (18.1)
	4 1/2 (114.3)	2,515 (11.3)	4,225 (19.0)	2,800 (12.6)	5,065 (22.8)	3,085 (13.9)	5,900 (26.6)	4,060 (18.3)	5,900 (26.6)
	7 (177.8)	2,945 (13.3)	5,660 (25.5)	3,360 (15.1)	6,470 (29.1)	3,775 (17.0)	7,280 (32.8)	5,495 (24.7)	7,280 (32.8)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
3. Allowable loads for anchors to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load, where permitted by code.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Carbon and Stainless Steel Power-Bolt in Structural Lightweight Concrete[1,2,3]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
		f'_c = 3,000 psi (20.7 MPa)				$f'_c \geq$ 5,000 psi (34.5 MPa)			
		Ultimate Load		Allowable Load		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	1,000 (4.5)	1,520 (6.8)	250 (1.1)	380 (1.7)	1,320 (5.9)	1,520 (6.8)	330 (1.5)	380 (1.7)
	2 (50.8)	1,510 (6.8)	1,540 (6.9)	380 (1.7)	385 (1.7)	–	–	–	–
3/8 (9.5)	2 (50.8)	2,160 (9.7)	2,780 (12.5)	540 (2.4)	695 (3.1)	3,240 (14.6)	2,780 (12.5)	810 (3.6)	695 (3.1)
	3 1/2 (88.9)	4,200 (18.9)	4,980 (22.4)	1,050 (4.7)	1,245 (5.6)	–	–	–	–
1/2 (12.7)	2 1/2 (63.5)	3,680 (16.6)	4,615 (20.8)	920 (4.1)	1,155 (5.2)	4,920 (22.1)	4,615 (20.8)	1,230 (5.5)	1,155 (5.2)
	5 (127.0)	5,540 (24.9)	8,730 (39.3)	1,385 (6.2)	2,185 (9.8)	–	–	–	–
5/8 (15.9)	2 3/4 (69.9)	3,120 (14.0)	6,840 (30.8)	780 (3.5)	1,710 (7.7)	5,240 (23.6)	6,840 (30.8)	1,310 (5.9)	1,710 (7.7)
	6 (152.4)	6,730 (30.3)	14,340 (64.5)	1,685 (7.6)	3,585 (16.1)	–	–	–	–
3/4 (19.1)	3 (76.2)	5,600 (25.2)	8,765 (39.4)	1,400 (6.3)	2,190 (9.9)	7,880 (35.5)	8,765 (39.4)	1,970 (8.9)	2,190 (9.9)
	7 (177.8)	9,860 (44.4)	19,740 (88.8)	2,465 (11.1)	4,935 (22.2)	–	–	–	–

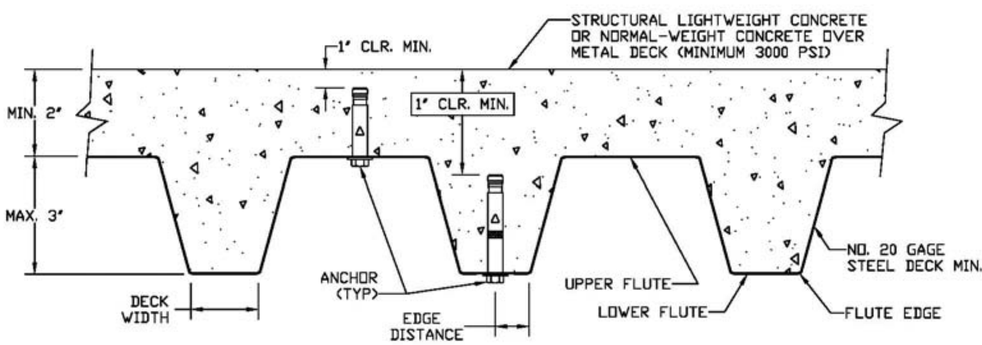
1. The values listed above are ultimate and allowable load capacities for Power-Bolt anchors in sand-lightweight concrete.
2. Allowable load capacities are calculated using an applied safety factor of 4.0.
3. Linear interpolation may be used to determine ultimate and allowable loads for intermediate embedments and compressive strengths.

PERFORMANCE DATA

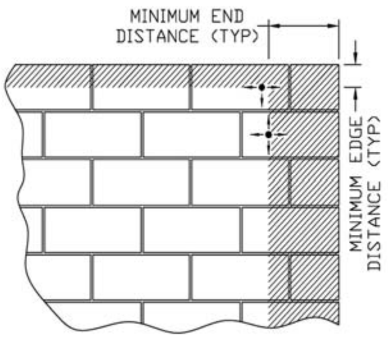
Ultimate and Allowable Load Capacities for Carbon and Stainless Steel Power-Bolt Installed Through Metal Deck into Structural Lightweight Concrete[1,2,3,4]

Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Lightweight Concrete over minimum 20 Gage Metal Deck, $f'_c \geq$ 3,000 (20.7 MPa)							
		Minimum 1-1/2" Wide Deck				Minimum 4-1/2" Wide Deck			
		Ultimate Load		Allowable Load		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	720 (3.2)	2,360 (10.6)	180 (0.8)	590 (2.7)	920 (4.1)	2,360 (10.6)	230 (1.0)	590 (2.7)
3/8 (9.5)	2 (50.8)	720 (3.2)	2,740 (12.3)	180 (0.8)	685 (3.1)	1,840 (8.3)	2,740 (12.3)	460 (2.1)	685 (3.1)
1/2 (12.7)	2 1/2 (63.5)	1,640 (7.4)	2,740 (12.3)	410 (1.8)	685 (3.1)	2,000 (9.0)	4,400 (19.8)	500 (2.3)	1,100 (5.0)
5/8 (15.9)	2 3/4 (88.9)	–	–	–	–	2,000 (9.0)	4,440 (20.0)	500 (2.3)	1,110 (5.0)
3/4 (19.1)	3 (76.2)	–	–	–	–	4,960 (22.3)	4,480 (20.2)	1,240 (5.6)	1,120 (5.0)

1. The values listed above are ultimate and allowable load capacities for Power-Bolt anchor in sand-lightweight concrete over metal deck.
2. Allowable loads capacities are calculated using an applied safety factor of 4.0.
3. Tabulated load values are for anchors installed in the center of the flute. Spacing distances shall be in accordance with the spacing table for lightweight concrete listed in the Design Criteria section for Power-Bolt.
4. Anchors are permitted to be installed in the lower or upper flute of the metal deck provided the proper installation procedures are maintained.



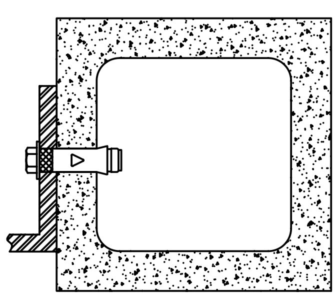
PERFORMANCE DATA



Ultimate and Allowable Load Capacities for Power-Bolt in Grout-Filled Concrete Masonry[1,2,3,4]

Anchor Diameter	Minimum Embed. Depth	Minimum Edge Distance	Minimum End Distance	$f'_m \geq$ 1,500 psi (10.4 MPa)			
				Ultimate Load		Allowable Load	
d in. (mm)	h_v in. (mm)	in. (mm)	in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/8 (28.6)	3 3/4 (95.3)	3 3/4 (95.3)	1,215 (5.5)	1,185 (5.3)	245 (1.1)	235 (1.1)
	2 1/2 (63.5)	5 1/4 (133.4)	3 3/4 (95.3)	1,760 (7.9)	1,185 (5.3)	350 (1.6)	235 (1.1)
3/8 (9.5)	2 (50.8)	5 5/8 (142.9)	5 5/8 (142.9)	1,985 (8.9)	3,065 (13.8)	395 (1.8)	615 (2.8)
	3 1/2 (88.9)	7 7/8 (200.0)	5 5/8 (142.9)	2,120 (9.5)	3,065 (13.8)	425 (1.9)	615 (2.8)
1/2 (12.7)	2 1/2 (63.5)	7 1/2 (190.5)	7 1/2 (190.5)	2,435 (11.0)	5,650 (25.4)	485 (2.2)	1,130 (5.1)
	4 (101.6)	10 1/2 (266.7)	7 1/2 (190.5)	2,690 (12.1)	5,650 (25.4)	540 (2.4)	1,130 (5.1)
5/8 (15.9)	2 3/4 (69.9)	9 3/8 (238.1)	9 3/8 (238.1)	2,560 (11.5)	9,000 (40.5)	510 (2.3)	1,800 (8.1)
	5 (127.0)	13 1/8 (333.4)	9 3/8 (238.1)	2,975 (13.4)	9,000 (40.5)	595 (2.7)	1,800 (8.1)
3/4 (19.1)	3 (76.2)	11 1/4 (285.8)	11 1/4 (285.8)	3,345 (15.0)	9,870 (44.4)	670 (3.0)	1,975 (8.9)
	5 (127.0)	15 3/4 (400.1)	11 1/4 (285.8)	4,250 (19.1)	9,870 (44.4)	850 (3.8)	1,975 (8.9)

1. Tabulated load values are for carbon and stainless steel anchors installed in minimum 6-inch wide, Grade N, Type II, medium and normal weight concrete masonry units. Mortar must be minimum Type N. Masonry prism compressive strength must be 1,500 psi minimum at the time of installation.
2. Allowable loads are for carbon and stainless steel anchors and are based on average ultimate values using a safety factor of 5.0.
3. Linear interpolation may be used to determine ultimate and allowable loads for intermediate embedment depths.
4. The tabulated values are for anchors installed at a minimum of 12 anchor diameters on center for 100 percent capacity. Spacing distances may be reduced to 6 anchor diameters on center provided the capacities are reduced by 50 percent. Linear interpolation may be used for intermediate spacing.



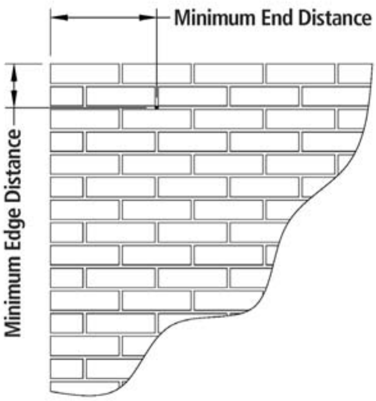
Ultimate and Allowable Load Capacities for Power-Bolt in Hollow Concrete Masonry[1,2,3,4,5]

Anchor Diameter	Minimum Embed. Depth	Minimum Edge Distance	Minimum End Distance	$f'_m \geq$ 1,500 psi (10.4 MPa)			
				Ultimate Load		Allowable Load	
d in. (mm)	h_v in. (mm)	in. (mm)	in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	7/8 (22.2)	3 3/4 (95.3)	3 3/4 (95.3)	600 (2.7)	765 (3.4)	120 (0.5)	155 (0.7)
	1 1/4 (31.8)	3 3/4 (95.3)	8 (203.2)	825 (3.7)	1,055 (4.8)	165 (0.7)	210 (0.9)
	1 1/2 (38.1)	3 3/4 (95.3)	12 (304.8)	1,130 (5.1)	1,230 (5.5)	225 (1.0)	245 (1.1)
3/8 (9.5)	1 1/4 (31.8)	12 (304.8)	8 (203.2)	1,360 (6.1)	2,150 (9.7)	270 (1.2)	430 (1.9)
	1 1/2 (38.1)	12 (304.8)	12 (304.8)	1,470 (6.6)	2,600 (11.7)	295 (1.3)	520 (2.3)
1/2 (12.7)	1 1/4 (31.8)	12 (304.8)	8 (203.2)	2,560 (11.5)	2,150 (9.7)	590 (2.4)	430 (1.9)
	1 1/2 (38.1)	12 (304.8)	12 (304.8)	2,560 (11.5)	3,385 (15.2)	510 (2.3)	675 (3.0)

1. Tabulated load values are for carbon and stainless steel anchors installed in minimum 6-inch wide, Grade N, Type II, medium and normal weight concrete masonry units. Mortar must be minimum Type N. Masonry prism compressive strength must be 1,500 psi minimum at the time of installation.
2. Allowable loads are for carbon and stainless steel anchors and are based on average ultimate values using a safety factor of 5.0.
3. Linear interpolation may be used to determine ultimate and allowable loads for intermediate embedment depths.
4. The tabulated values are for anchors installed at a minimum of 12 anchor diameters on center for 100 percent capacity. Spacing distances may be reduced to 6 anchor diameters on center provided the capacities are reduced by 50 percent. Linear interpolation may be used for intermediate spacing.
5. Anchors with diameters of 1/2" and larger installed in hollow concrete masonry units are limited to one anchor per unit cell.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Power-Bolt in Clay Brick Masonry[1,2,3]



Anchor Dia. d in. (mm)	Min. Embed. Depth h_v in. (mm)	Min. Edge Distance	Min. End Distance	Spacing Distance	Structural Brick Masonry $f'_m \geq$ 1,500 psi (10.4 MPa) Ultimate Load Tension lbs. (kN)	Ultimate Load Shear lbs. (kN)	Allowable Load Tension lbs. (kN)	Allowable Load Shear lbs. (kN)
1/4 (6.4)	7/8 (22.2)	8 (203.2)	4 (101.6)	6 (152.4)	1,090 (4.9)	1,160 (5.2)	220 (1.0)	230 (1.0)
	1 1/2 (38.1)				1,455 (6.6)	1,265 (5.7)	290 (1.3)	255 (1.1)
3/8 (9.5)	2 (50.8)	12 (304.8)	6 (152.4)	8 (203.2)	2,015 (9.1)	3,655 (16.5)	405 (1.8)	730 (3.3)
1/2 (12.7)	2 1/2 (63.5)		8 (203.2)	10 (254.0)	3,110 (14.0)	4,585 (20.6)	620 (2.8)	915 (4.1)
5/8 (15.9)	2 3/4 (69.9)	16 (406.4)	10 (254.0)	12 (304.8)	4,535 (20.4)	5,470 (24.6)	905 (4.1)	1,095 (4.9)
3/4 (19.1)	3 (76.2)		12 (304.8)	16 (406.4)	5,930 (26.7)	6,770 (30.5)	1,185 (5.3)	1,355 (6.1)

1. Tabulated load values are for carbon and stainless steel anchors installed in Grade SW multiple wythe, solid brick masonry conforming to ASTM C62.
2. Allowable loads are calculated using an applied safety factor of 5.0.
3. Spacing between anchors may be reduced to half the listed distances provided the capacities are reduced by 50 percent. Linear interpolation may be used for intermediate spacing.

DESIGN CRITERIA

Combined Loading

For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n}\right)^{\frac{5}{3}} + \left(\frac{V_u}{V_n}\right)^{\frac{5}{3}} \leq 1 \quad \text{OR} \quad \left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

Load Adjustment Factors for Spacing and Edge Distances

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	**Load Type**	**Critical Distance (Full Anchor Capacity)**	**Critical Load Factor**	**Minimum Distance (Reduced Capacity)**	**Minimum Load Factor**
Spacing (s)	Tension and Shear	$s_{cr} = 2.0h_v$	$F_N = F_V = 1.0$	$s_{min} = h_v$	$F_N = F_V = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_N = 1.0$	$c_{min} = 5d$	$F_N = 0.70$
	Shear	$c_{cr} = 12d$	$F_V = 1.0$	$c_{min} = 5d$	$F_V = 0.35$

Anchor Installed in Lightweight Concrete					
Anchor Dimension	**Load Type**	**Critical Distance (Full Anchor Capacity)**	**Critical Load Factor**	**Minimum Distance (Reduced Capacity)**	**Minimum Load Factor**
Spacing (s)	Tension and Shear	$s_{cr} = 2.0h_v$	$F_N = F_V = 1.0$	$s_{min} = h_v$	$F_N = F_V = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_N = 1.0$	$c_{min} = 5d$	$F_N = 0.80$
	Shear	$c_{cr} = 12d$	$F_V = 1.0$	$c_{min} = 5d$	$F_V = 0.40$

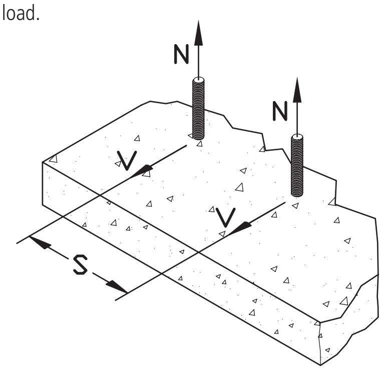
DESIGN CRITERIA

Load Adjustment Factors for Normal-Weight Concrete

Spacing, Tension (F_N) & Shear (F_V)																
Dia. (in.)		1/4			3/8			1/2			5/8			3/4		
h_v (in.)		1 1/4	1 3/4	2 1/2	2	2 1/2	3 1/2	2 1/2	3 1/2	5	2 3/4	4	6	3	4 1/2	7
s_{cr} (in.)		2 1/2	3 1/2	5	4	5	7	5	7	10	5 1/2	8	12	6	9	14
s_{min} (in.)		1 1/4	1 3/4	2 1/2	2	2 1/2	3 1/2	2 1/2	3 1/2	5	2 3/4	4	6	3	4 1/2	7
Spacing, *s* (inches)	1 1/4	0.50														
	1 3/4	0.70	0.50													
	2	0.80	0.57		0.50											
	2 1/2	1.00	0.71	0.50	0.63	0.50		0.50								
	2 3/4		0.79	0.55	0.69	0.55		0.55			0.50					
	3		0.86	0.60	0.75	0.60		0.60			0.55			0.50		
	3 1/2		1.00	0.70	0.88	0.70	0.50	0.70	0.50		0.64			0.58		
	4			0.80	1.00	0.80	0.57	0.80	0.57		0.73	0.50		0.67		
	4 1/2			0.90		0.90	0.64	0.90	0.64		0.82	0.56		0.75	0.50	
	5			1.00		1.00	0.71	1.00	0.71	0.50	0.91	0.63		0.83	0.56	
	5 1/2						0.79		0.79	0.55	1.00	0.69		0.92	0.61	
	6						0.86		0.86	0.60		0.75	0.50	1.00	0.67	
	7						1.00		1.00	0.70		0.88	0.58		0.78	0.50
	8									0.80		1.00	0.67		0.89	0.57
	9									0.90			0.75		1.00	0.64
	10									1.00			0.83			0.71
	12												1.00			0.86
	14															1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 2 embedment depths ($2\,h_v$) at which the anchor achieves 100% of load.

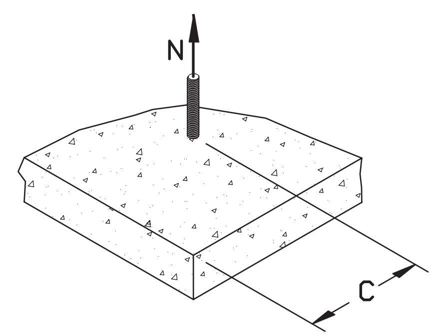
Minimum spacing (s_{min}) is equal to 1 embedment depth (h_v) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_N)						
Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	4 1/2	6	7 1/2	9
c_{min} (in.)		1 1/4	1 7/8	2 1/2	3 1/8	3 3/4
Edge Distance, *c* (inches)	1 1/4	0.70				
	1 5/8	0.76				
	1 7/8	0.81	0.70			
	2	0.83	0.71			
	2 1/2	0.91	0.77	0.70		
	3	1.00	0.83	0.74		
	3 1/8		0.84	0.75	0.70	
	3 3/4		0.91	0.81	0.74	0.70
	4		0.94	0.83	0.76	0.71
	4 1/2		1.00	0.87	0.79	0.74
	5			0.91	0.83	0.77
	6			1.00	0.90	0.83
	6 1/4				0.91	0.84
	7				0.97	0.89
	7 1/2				1.00	0.91
	8					0.94
	9					1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12*d*) at which the anchor achieves 100% of load.

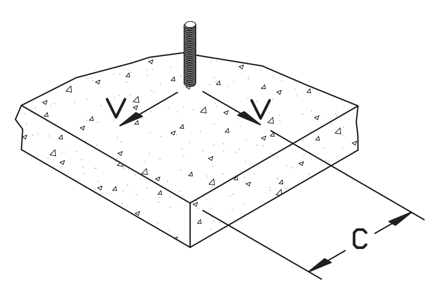
Minimum edge distance (c_{min}) is equal to 5 anchor diameters (5*d*) at which the anchor achieves 70% of load.



Edge Distance, Shear (F_V)						
Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	4 1/2	6	7 1/2	9
c_{min} (in.)		1 1/4	1 7/8	2 1/2	3 1/8	3 3/4
Edge Distance, *c* (inches)	1 1/4	0.35				
	1 5/8	0.49				
	1 7/8	0.58	0.35			
	2	0.63	0.38			
	2 1/2	0.81	0.50	0.35		
	3	1.00	0.63	0.44		
	3 1/8		0.66	0.47	0.35	
	3 3/4		0.81	0.58	0.44	0.35
	4		0.88	0.63	0.48	0.38
	4 1/2		1.00	0.72	0.55	0.44
	5			0.81	0.63	0.50
	6			1.00	0.78	0.63
	6 1/4				0.81	0.66
	7				0.93	0.75
	7 1/2				1.00	0.81
	8					0.88
	9					1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12*d*) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 5 anchor diameters (5*d*) at which the anchor achieves 35% of load.



DESIGN CRITERIA

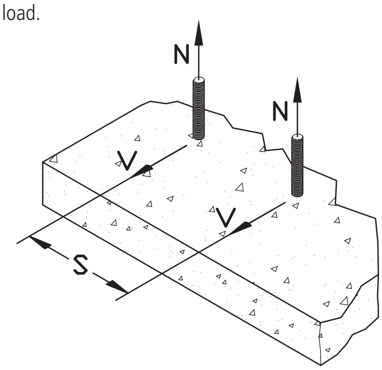
Load Adjustment Factors for Lightweight Concrete

Spacing, Tension (F_N) & Shear (F_V)

	Dia. (in.)	1/4			3/8			1/2			5/8			3/4		
	h_v (in.)	1 1/4	1 3/4	2 1/2	2	2 1/2	3 1/2	2 1/2	3 1/2	5	2 3/4	4	6	3	4 1/2	7
	s_{cr} (in.)	2 1/2	3 1/2	5	4	5	7	5	7	10	5 1/2	8	12	6	9	14
	s_{min} (in.)	1 1/4	1 3/4	2 1/2	2	2 1/2	3 1/2	2 1/2	3 1/2	5	2 3/4	4	6	3	4 1/2	7
Spacing, s (inches)	1 1/4	0.50														
	1 3/4	0.70	0.50													
	2	0.80	0.57		0.50											
	2 1/2	1.00	0.71	0.50	0.63	0.50		0.50								
	2 3/4		0.79	0.55	0.69	0.55		0.55			0.50					
	3		0.86	0.60	0.75	0.60		0.60			0.55			0.50		
	3 1/2		1.00	0.70	0.88	0.70	0.50	0.70	0.50		0.64			0.58		
	4			0.80	1.00	0.80	0.57	0.80	0.57		0.73	0.50		0.67		
	4 1/2			0.90		0.90	0.64	0.90	0.64		0.82	0.56		0.75	0.50	
	5			1.00		1.00	0.71	1.00	0.71	0.50	0.91	0.63		0.83	0.56	
	5 1/2						0.79		0.79	0.55	1.00	0.69		0.92	0.61	
	6						0.86		0.86	0.60		0.75	0.50	1.00	0.67	
	7						1.00		1.00	0.70		0.88	0.58		0.78	0.50
	8									0.80		1.00	0.67		0.89	0.57
	9									0.90			0.75		1.00	0.64
	10									1.00			0.83			0.71
	12												1.00			0.86
	14															1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 2 embedment depths ($2h_V$) at which the anchor achieves 100% of load.

Minimum spacing (s_{min}) is equal to 1 embedment depth (h_v) at which the anchor achieves 50% of load.

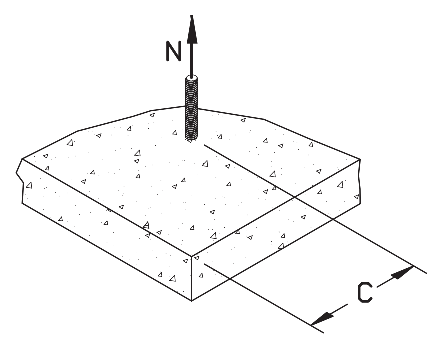


Edge Distance, Tension (F_N)

	Dia. (in.)	1/4	3/8	1/2	5/8	3/4
	c_{cr} (in.)	3	4 1/2	6	7 1/2	9
	c_{min} (in.)	1 1/4	1 7/8	2 1/2	3 1/8	3 3/4
Edge Distance, c (inches)	1 1/4	0.80				
	1 5/8	0.84				
	1 7/8	0.87	0.80			
	2	0.89	0.81			
	2 1/2	0.94	0.85	0.80		
	3	1.00	0.89	0.83		
	3 1/8		0.90	0.84	0.80	
	3 3/4		0.94	0.87	0.83	0.80
	4		0.96	0.89	0.84	0.81
	4 1/2		1.00	0.91	0.86	0.83
	5			0.94	0.89	0.85
	6			1.00	0.93	0.89
	6 1/4				0.94	0.90
	7				0.98	0.92
	7 1/2				1.00	0.94
	8					0.96
	9					1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 12 anchor diameters ($12d$) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 5 anchor diameters ($5d$) at which the anchor achieves 80% of load.

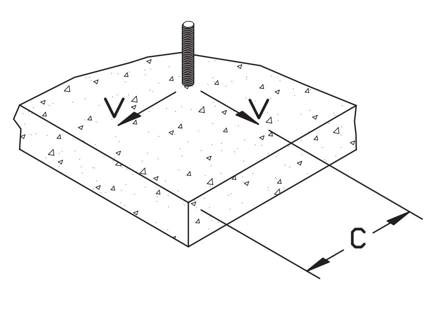


Edge Distance, Shear (F_V)

	Dia. (in.)	1/4	3/8	1/2	5/8	3/4
	c_{cr} (in.)	3	4 1/2	6	7 1/2	9
	c_{min} (in.)	1 1/4	1 7/8	2 1/2	3 1/8	3 3/4
Edge Distance, c (inches)	1 1/4	0.40				
	1 5/8	0.53				
	1 7/8	0.61	0.40			
	2	0.66	0.43			
	2 1/2	0.83	0.54	0.40		
	3	1.00	0.66	0.49		
	3 1/8		0.69	0.51	0.40	
	3 3/4		0.83	0.61	0.49	0.40
	4		0.89	0.66	0.52	0.43
	4 1/2		1.00	0.74	0.59	0.49
	5			0.83	0.66	0.54
	6			1.00	0.79	0.66
	6 1/4				0.83	0.69
	7				0.93	0.77
	7 1/2				1.00	0.83
	8					0.89
	9					1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters ($12d$) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 5 anchor diameters ($5d$) at which the anchor achieves 40% of load.



ORDERING INFORMATION

Carbon Steel Hex Head Power-Bolt

Cat. No.	Anchor Size	Drill Dia.	Min. Embed.	Std. Box	Std. Carton	Wt./100
6900	1/4" x 1"	1/4"	7/8"	100	600	2
6902	1/4" x 1 3/4"	1/4"	1-1/4"	100	600	3
6906	1/4" x 3"	1/4"	1-1/4"	100	600	5
6907	5/16" x 1 3/4"	5/16"	1-1/2"	100	600	5
6908	5/16" x 2 1/2"	5/16"	1-1/2"	50	300	6
6909	5/16" x 3 1/2"	5/16"	1-1/2"	50	300	8
6910	3/8" x 2 1/4"	3/8"	2"	50	300	8
6911*	3/8" x 1 7/8"	3/8"	1-1/4"	100	600	6
6913	3/8" x 3"	3/8"	2"	50	300	11
6914	3/8" x 3 1/2"	3/8"	2"	50	300	12
6916	3/8" x 4"	3/8"	2"	50	300	14
6930	1/2" x 2 3/4"	1/2"	2-1/2"	50	200	16
6932	1/2" x 3 3/4"	1/2"	2-1/2"	25	150	21
6934	1/2" x 4 3/4"	1/2"	2-1/2"	25	150	26
6936	1/2" x 5 3/4"	1/2"	2-1/2"	25	150	32
6940	5/8" x 3"	5/8"	2-3/4"	20	120	28
6942	5/8" x 4"	5/8"	2-3/4"	15	90	40
6944	5/8" x 5"	5/8"	2-3/4"	15	90	47
6945	5/8" x 6"	5/8"	2-3/4"	15	90	57
6947	5/8" x 8 1/2"	5/8"	2-3/4"	10	40	77
6950	3/4" x 3 1/4"	3/4"	3"	15	90	47
6952	3/4" x 4 1/4"	3/4"	3"	10	60	58
6954	3/4" x 5 1/4"	3/4"	3"	10	60	70
6956	3/4" x 7 1/4"	3/4"	3"	10	40	105
6957	3/4" x 8 1/4"	3/4"	3"	10	40	110

The published length is measured from below the washer to the end of the anchor.
*This size does not have a compression ring.

Carbon Steel Flat Head Power-Bolt

Cat. No.	Anchor Size	Drill Dia.	Min. Embed.	Std. Box	Std. Carton	Wt./100
6981	3/8" x 3 3/4"	3/8"	2"	50	300	14
6982	3/8" x 5"	3/8"	2"	50	300	17
6983	3/8" x 6"	3/8"	2"	50	300	20
6984	1/2" x 5"	1/2"	2-1/2"	25	150	26
6987	5/8" x 5 1/2"	5/8"	2-3/4"	15	90	57

The published length is the overall length of the anchor.
The flat head Power-Bolt anchor has a hex key insert formed in the head of the bolt.
Each box contains an Allen wrench which matches the insert size.

Stainless Steel Hex Head Power-Bolt

Cat. No.	Anchor Size	Drill Dia.	Min. Embed.	Std. Box	Std. Carton	Wt./100
5900*	1/4" x 1"	1/4"	7/8"	100	600	2
5902	1/4" x 1 3/4"	1/4"	1-1/4"	100	600	3
5906	1/4" x 3"	1/4"	1-1/4"	100	600	5
5910	3/8" x 2 1/4"	3/8"	2"	50	300	10
5914	3/8" x 3 1/2"	3/8"	2"	50	300	12
5916	3/8" x 4"	3/8"	2"	50	300	14
5930	1/2" x 2 3/4"	1/2"	2-1/2"	50	200	16
5934	1/2" x 4 3/4"	1/2"	2-1/2"	25	150	26
5944	5/8" x 5"	5/8"	2-3/4"	15	90	47
5946	5/8" x 7"	5/8"	2-3/4"	15	60	67
5954	3/4" x 5-1/4"	3/4"	3"	15	60	70
5957	3/4" x 8 1/4"	3/4"	3"	10	40	110

The published length is measured from below the washer to the end of the anchor.
*This size does not have a compression ring.

Power-Stud™ *Wedge Expansion Anchor*

PRODUCT DESCRIPTION

The Power-Stud anchor, formerly known as the *Rawl-Stud,* is a fully threaded, torque-controlled, wedge expansion anchor which is designed for consistent performance. It is available in threaded, rod hanger and tie-wire versions suitable for applications in solid concrete and grout-filled concrete masonry. The threaded version is produced in carbon steel and stainless steel to offer various levels of corrosion resistance depending on use. The drill bit diameter necessary for proper installation is the same as the anchor diameter.

GENERAL APPLICATIONS AND USES

- Water Treatment Plants and Marine Applications
- Lighting Standards
- Sill Plates and Support Ledgers
- Structural Anchorage
- Retrofit Projects and Machinery Anchorage
- Seismic Attachments
- Food and Beverage Facilities

FEATURES AND BENEFITS

- Heavy and medium duty all-purpose anchor
- Tested in accordance with ASTM E488 and AC01 criteria
- Qualified for seismic and wind load applications
- Drill bit diameter is the same as the anchor diameter
- Length ID stamped on each threaded anchor
- Anchors can be installed through the fixture, no need for hole spotting
- Chamfered impact section prevents damage to threads
- Length of holes can be over-drilled or bottomless
- Convenient, fully threaded body – no shims required
- Clip design prevents spinning during installation

APPROVALS AND LISTINGS

International Code Council, Evaluation Service (ICC-ES) ESR-1532
(formerly listed in ICBO ES ER-5225)
Southern Building Code Conference International (SBCCI) #9943A
City of Los Angeles (COLA) Research Report LARR-24960
Florida Building Code Approval – FL2209.6
Miami-Dade County Notice of Acceptance (NOA) 03-0311.08
Factory Mutual Research Corporation (FM Approvals) – File No. J.I. OK3A9.AH
Underwriters Laboratory (UL Listed) – File No. EX1289
Federal GSA Specification – Meets the proof load requirements of FF-S-325C, Group II, Type 4, Class 1 (superseded) and CID A-A-1923A, Type 4
Various North American Departments of Transportation (DOT) – See www.powers.com, including CalTrans listing for "Stud Mechanical Expansion Anchors"

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring, 04081-Masonry Anchorage* and *05090-Metal Fastenings.* Expansion Anchors shall be Power-Stud anchors as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS Page No.

Threaded Power-Stud

Rod Hanger Power-Stud

Tie-Wire Power-Stud

HEAD STYLES

Threaded
Rod Hanger
Tie-Wire

ANCHOR MATERIALS

Zinc Plated Carbon Steel
Mechanically Galvanized Carbon Steel
Type 304 Stainless Steel
Type 316 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

1/4" diameter x 1-3/4" length to
1 1/4" diameter x 12" length

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Structural Lightweight Concrete
Grouted Concrete Masonry

INSTALLATION SPECIFICATIONS

Carbon Steel Power-Stud

Dimension	Anchor Diameter, *d*							
	1/4"	**3/8"**	**1/2"**	**5/8"**	**3/4"**	**7/8"**	**1"**	**1-1/4"**
ANSI Drill Bit Size, d_{bit} (in.)	1/4	3/8	1/2	5/8	3/4	7/8	1	1-1/4
Fixture Clearance Hole, d_h (in.)	5/16	7/16	9/16	11/16	13/16	15/16	1-1/8	1-3/8
Thread Size (UNC)	1/4-20	3/8-16	1/2-13	5/8-11	3/4 -10	7/8-9	1-8	1 1/4-7
Nut Height (in.)	7/32	21/64	7/16	35/64	41/64	3/4	55/64	1 1/16
Washer O.D., d_w (in.)	5/8	13/16	1 1/16	1 3/4	2	2 1/4	2 1/2	3
Wrench Size (in.)	7/16	9/16	3/4	15/16	1 1/8	1 5/16	1 1/2	1 7/8
Max. Tightening Torque, T_{max} (ft-lbs)	8	28	60	90	175	250	300	450

Maximum tightening torque is listed for anchors installed in normal-weight concrete. Consult performance data tables for other base materials.

Stainless Steel Power-Stud

Dimension	Anchor Diameter, *d*						
	1/4"	**3/8"**	**1/2"**	**5/8"**	**3/4"**	**7/8"**	**1"**
ANSI Drill Bit Size, d_{bit} (in.)	1/4	3/8	1/2	5/8	3/4	7/8	1
Fixture Clearance Hole, d_h (in.)	5/16	7/16	9/16	11/16	13/16	15/16	1-1/8
Thread Size (UNC)	1/4-20	3/8-16	1/2-13	5/8-11	3/4-10	7/8-9	1-8
Nut Height (in.)	7/32	21/64	7/16	35/64	41/64	3/4	55/64
Washer O.D (304 SS)., d_w (in.)	5/8	13/16	1 1/16	1 3/4	2	2 1/4	2 1/2
Washer O.D (316 SS)., d_w (in.)	5/8	7/8	1 1/4	1 1/2	1 3/4	2	2
Wrench Size (in.)	7/16	9/16	3/4	15/16	1 1/8	1 5/16	1 1/2
Max. Tightening Torque, T_{max} (ft-lbs)	8	28	60	90	175	250	300

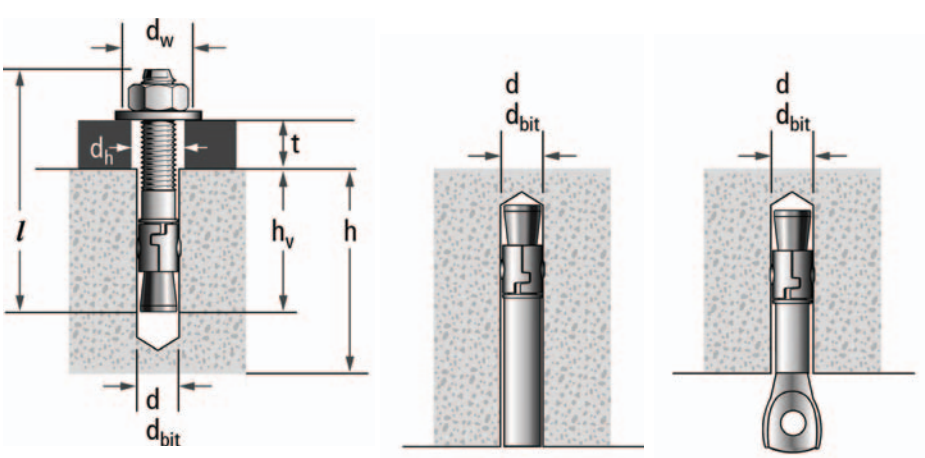
Maximum tightening torque is listed for anchors installed in normal-weight concrete. Consult performance data tables for other base materials.

Rod Hanger Power-Stud

Dimension	Rod Diameter, *d*		
	3/8"	**1/2"**	**5/8"**
Anchor Diameter (in.)	1/2	5/8	7/8
ANSI Drill Bit Size, d_{bit} (in.)	1/2	5/8	7/8
Thread Size (UNC)	3/8 - 16	1/2 - 13	5/8 - 11

Tie-Wire Power-Stud

Dimension	Anchor Diameter, *d*
	1/4"
ANSI Drill Bit Size, d_{bit} (in.)	1/4
Tie-Wire Hole Size (in.)	9/32
Head Height (in.)	3/4



Nomenclature

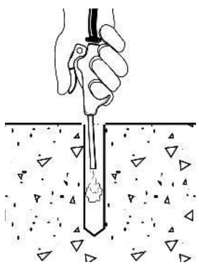
- *d* = Diameter of anchor
- d_{bit} = Diameter of drill bit
- d_h = Diameter of fixture clearance hole
- d_w = Diameter of washer
- *h* = Base material thickness. The minimum value of *h* should be 1.5h_v
- h_v = Minimum embedment depth
- *l* = Overall length of anchor
- *t* = Fixture thickness
- T_{max} = Maximum tightening torque

INSTALLATION PROCEDURES

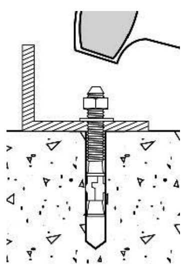
Threaded Stud Version

Using the proper diameter bit, drill a hole into the base material to a depth of at least 1/2" or one anchor diameter deeper than the embedment required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15

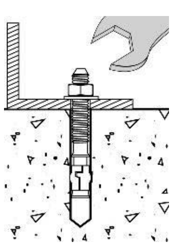
Blow the hole clean of dust and other material. Do not expand the anchor prior to installation



Position the washer on the anchor and thread on the nut. Drive the anchor through the fixture into the anchor hole until the nut and washer are firmly seated against the fixture. Be sure the anchor is driven to the required embedment depth.



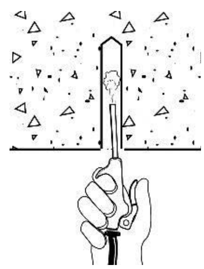
Tighten the anchor by turning the nut 3 to 5 turns past finger tight or by applying the guide installation torque from the finger tight position.



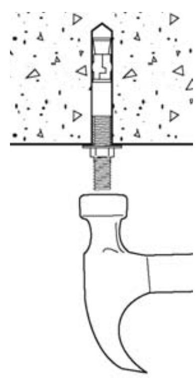
Rod Hanger Version

Using the proper diameter bit, drill a hole into the base material to a depth of at least 1/2" or one anchor diameter deeper than the embedment required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15

Blow the hole clean of dust and other material. Do not expand the anchor prior to installation



Thread the anchor onto the rod to be used along with a nut and washer. Drive the anchor into the hole until the anchor is at the required embedment depth. The anchor body should be recessed in the hole.

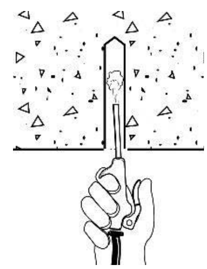


Run the nut and washer up to the concrete surface and tighten the anchor by turning the nut 3 to 5 turns past finger tight or by applying the guide installation torque from the finger tight position.

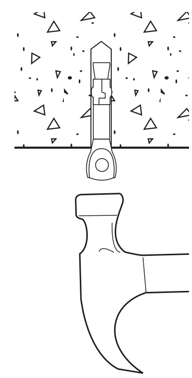
Tie-Wire Version

Using the proper diameter bit, drill a hole into the base material to a depth of at least 1/2" or one anchor diameter deeper than the embedment required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15

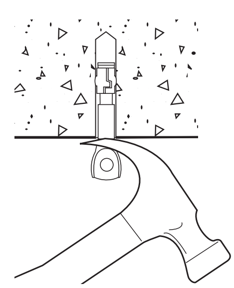
Blow the hole clean of dust and other material. Do not expand the anchor prior to installation



Drive the anchor into the hole until the head is firmly seated against the base material. Be sure the anchor is driven to the required embedment depth.



Set the anchor with a prying action using a claw hammer.



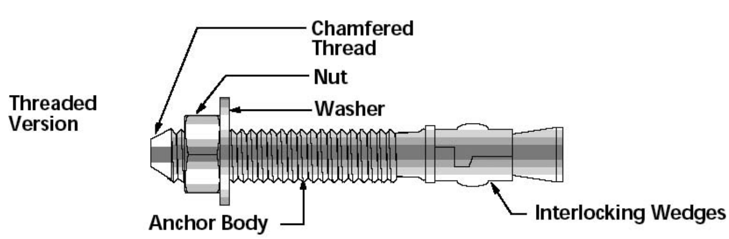
MATERIAL SPECIFICATIONS

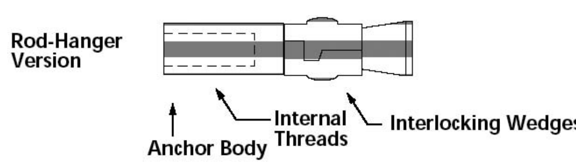
Anchor Component	Carbon Steel Power-Stud	Mechanically Galvanized Power-Stud
Anchor Body	AISI 1018 (1/4"– 3/4", lengths up to 7")	AISI 1018 (1/4"– 3/4", lengths up to 7")
	AISI 12L14 (7/8"–1-1/4" and all lengths over 7")	AISI 12L14 (7/8"– 1-1/4" and all lengths over 7")
Nut	Carbon Steel, ASTM A563, Grade A	Carbon Steel, ASTM A563, Grade A
Washer	AISI 1010 Carbon Steel, Meets Dimensional Requirements of ANSI/ASME 8.22.1, Type A Plain	AISI 1010 Carbon Steel, Meets Dimensional Requirements of ANSI/ASME 8.22.1, Type A Plain
Expansion Wedge	Tempered AISI 1010 Carbon Steel	Type 304 Stainless Steel
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn 5)	ASTM B695, Class 65, Type I

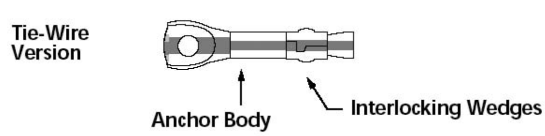
Anchor Component	Type 304 Stainless Steel Power-Stud	Type 316 Stainless Steel Power-Stud
Anchor Body	Type 304Cu (1/4"– 3/4", lengths up to 7")	Type 316L Stainless Steel
	Type 304 (7/8"– 1", lengths over to 7")	
Nut	Type 18-8 (300 Series) Stainless Steel	Type 316L Stainless Steel
Washer	Type 18-8 (300 Series) Stainless Steel	Type 316L Stainless Steel
Expansion Wedge	Type 304 Stainless Steel	Type 316L Stainless Steel

Stainless steel anchor components are passivated.

Anchor Component	Rod Hanger Power-Stud	Tie-Wire Power-Stud
Anchor Body	AISI 12L14 Carbon Steel	AISI 1018 Carbon Steel
Expansion Wedge	Tempered AISI 1010 Carbon Steel	Tempered AISI 1010 Carbon Steel
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn 5)	ASTM B633, SC1, Type III (Fe/Zn 5)







Length Identification

Mark	♦	■	A	B	C	D	E	F	G	H	I
From	1/2"	1"	1-1/2"	2"	2-1/2"	3"	3-1/2"	4"	4-1/2"	5"	5-1/2"
Up to but not including	1"	1-1/2"	2"	2-1/2"	3"	3-1/2"	4"	4-1/2"	5"	5-1/2"	6"

Mark	J	K	L	M	N	O	P	Q	R	S	T
From	6"	6-1/2"	7"	7-1/2"	8"	8-1/2"	9"	9-1/2"	10"	11"	12"
Up to but not including	6-1/2"	7"	7-1/2"	8"	8-1/2"	9"	9-1/2"	10"	11"	12"	13"

PERFORMANCE DATA

Ultimate Load Capacities for Carbon and Stainless Steel Power-Stud in Normal-Weight Concrete[1,2]

Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/8 (28.6)	1,240 (5.6)	1,580 (7.1)	1,440 (6.5)	1,620 (7.3)	1,740 (7.8)	1,620 (7.3)
	1 1/2 (38.1)	1,635 (7.4)	1,580 (7.1)	2,080 (9.4)	1,620 (7.3)	2,100 (9.5)	1,620 (7.3)
	2 (50.8)	1,900 (8.6)	1,580 (7.1)	2,080 (9.4)	1,620 (7.3)	2,100 (9.5)	1,620 (7.3)
	2 3/4 (69.9)	2,340 (10.5)	1,655 (7.4)	2,360 (10.6)	2,070 (9.3)	2,535 (11.4)	2,080 (9.4)
3/8 (9.5)	1 5/8 (41.3)	1,920 (8.6)	3,560 (16.0)	3,040 (13.7)	3,760 (16.9)	3,040 (13.7)	3,760 (16.9)
	2 (50.8)	2,800 (12.6)	3,560 (16.0)	3,850 (17.3)	3,760 (16.9)	4,075 (18.3)	3,760 (16.9)
	3 (76.2)	4,100 (18.5)	3,560 (16.0)	6,020 (27.1)	3,760 (16.9)	6,025 (27.1)	3,760 (16.9)
	4 1/4 (108.0)	5,045 (22.7)	3,840 (17.3)	6,020 (27.1)	5,185 (23.3)	6,025 (27.1)	5,185 (23.3)
1/2 (12.7)	2 1/4 (57.2)	3,440 (15.5)	6,540 (29.4)	5,560 (25.0)	6,800 (30.6)	6,540 (29.4)	6,800 (30.6)
	3 (76.2)	5,100 (23.0)	6,540 (29.4)	8,160 (36.7)	6,800 (30.6)	9,200 (41.4)	6,800 (30.6)
	4 (101.6)	5,700 (25.7)	6,540 (29.4)	8,160 (36.7)	6,800 (30.6)	9,200 (41.4)	6,800 (30.6)
	6 (152.4)	7,910 (35.6)	7,025 (31.6)	9,550 (43.0)	7,190 (32.4)	10,730 (48.3)	7,190 (32.4)
5/8 (15.9)	2 3/4 (69.9)	6,240 (27.8)	9,280 (41.8)	8,300 (37.4)	11,900 (53.6)	9,860 (44.4)	11,900 (53.6)
	4 (101.6)	9,600 (43.2)	9,280 (41.8)	10,825 (48.7)	11,900 (53.6)	13,495 (60.7)	11,900 (53.6)
	5 (127.0)	10,640 (47.3)	9,280 (41.8)	12,510 (56.3)	11,900 (53.6)	16,410 (73.8)	11,900 (53.6)
	7 (177.8)	12,500 (55.6)	9,760 (43.9)	15,880 (71.5)	12,170 (54.8)	16,410 (73.8)	12,170 (54.8)
3/4 (19.1)	3 3/8 (85.7)	7,420 (33.0)	12,380 (55.7)	10,000 (45.0)	15,060 (67.8)	12,540 (56.4)	15,060 (67.8)
	5 (127.0)	10,640 (47.3)	12,380 (55.7)	14,630 (65.8)	15,060 (67.8)	17,265 (77.7)	15,060 (67.8)
	6 (152.4)	10,640 (47.3)	12,380 (55.7)	17,080 (76.9)	15,060 (67.8)	20,180 (90.8)	15,060 (67.8)
	8 (203.2)	14,000 (62.3)	13,600 (61.2)	22,000 (99.0)	17,110 (77.0)	24,905 (112.1)	17,110 (77.0)
7/8 (22.2)	3 7/8 (98.4)	7,600 (34.2)	17,960 (80.8)	12,300 (55.4)	24,160 (108.7)	17,300 (77.9)	24,160 (108.7)
	4 1/2 (114.3)	9,600 (43.2)	17,960 (80.8)	15,620 (70.3)	24,160 (108.7)	20,075 (90.3)	24,160 (108.7)
	5 3/4 (146.1)	10,640 (47.3)	17,960 (80.8)	19,880 (89.5)	24,160 (108.7)	25,625 (115.3)	24,160 (108.7)
	7 (177.8)	12,680 (56.4)	17,960 (80.8)	20,440 (92.0)	24,160 (108.7)	31,180 (140.3)	24,160 (108.7)
	8 (203.2)	15,160 (67.4)	18,630 (83.8)	22,840 (101.6)	25,710 (115.7)	31,180 (140.3)	25,710 (115.7)
1 (25.4)	4 1/2 (114.3)	8,740 (39.3)	26,420 (118.9)	13,820 (62.2)	31,100 (140.0)	21,220 (94.4)	31,100 (140.0)
	5 1/2 (139.7)	12,770 (57.5)	26,420 (118.9)	20,280 (91.3)	31,100 (140.0)	27,800 (123.7)	31,100 (140.0)
	6 1/2 (165.1)	16,605 (74.7)	26,420 (118.9)	25,485 (114.7)	31,100 (140.0)	34,360 (152.8)	31,100 (140.0)
	8 (203.2)	22,360 (100.6)	26,420 (118.9)	27,040 (121.7)	31,100 (140.0)	44,220 (199.0)	31,100 (140.0)
	9 (228.6)	26,195 (117.9)	27,020 (121.6)	34,205 (153.9)	32,370 (145.7)	44,220 (199.0)	32,370 (145.7)
1 1/4 (31.8)	5 1/2 (139.7)	16,800 (75.6)	40,820 (183.7)	26,980 (121.4)	40,820 (183.7)	36,925 (166.2)	40,820 (183.7)
	7 (177.8)	25,360 (114.1)	40,820 (183.7)	35,410 (159.3)	40,820 (183.7)	44,845 (201.8)	40,820 (183.7)
	10 (254.0)	28,800 (129.6)	40,820 (183.7)	52,280 (235.3)	40,820 (183.7)	60,690 (273.1)	40,820 (183.7)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate loads for intermediate embedments and compressive strengths.

PERFORMANCE DATA

Allowable Load Capacities for Carbon and Stainless Steel Power-Stud in Normal-Weight Concrete[1,2,3]

Anchor Diameter	Minimum Embedment Depth	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
d in. (mm)	h_v in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/8 (28.6)	310 (1.4)	395 (1.8)	360 (1.6)	405 (1.8)	435 (2.0)	405 (1.8)
	1 1/2 (38.1)	410 (1.8)	395 (1.8)	520 (2.3)	405 (1.8)	525 (2.4)	405 (1.8)
	2 (50.8)	475 (2.1)	395 (1.8)	520 (2.3)	405 (1.8)	525 (2.4)	405 (1.8)
	2 3/4 (69.9)	585 (2.6)	415 (1.9)	590 (2.7)	520 (2.3)	635 (2.9)	520 (2.3)
3/8 (9.5)	1 5/8 (41.3)	480 (2.2)	890 (4.0)	760 (3.4)	940 (4.2)	760 (3.4)	940 (4.2)
	2 (50.8)	700 (3.2)	890 (4.0)	965 (4.3)	940 (4.2)	1,020 (4.6)	940 (4.2)
	3 (76.2)	1,025 (4.6)	890 (4.0)	1,505 (6.8)	940 (4.2)	1,505 (6.8)	940 (4.2)
	4 1/4 (108.0)	1,260 (5.7)	960 (4.3)	1,505 (6.8)	1,295 (5.8)	1,505 (6.8)	1,295 (5.8)
1/2 (12.7)	2 1/4 (57.2)	860 (3.9)	1,635 (7.4)	1,390 (6.3)	1,700 (7.7)	1,635 (7.4)	1,700 (7.7)
	3 (76.2)	1,275 (5.7)	1,635 (7.4)	2,040 (9.2)	1,700 (7.7)	2,300 (10.4)	1,700 (7.7)
	4 (101.6)	1,425 (6.4)	1,635 (7.4)	2,040 (9.2)	1,700 (7.7)	2,300 (10.4)	1,700 (7.7)
	6 (152.4)	1,980 (8.9)	1,755 (7.9)	2,390 (10.8)	1,800 (8.1)	2,685 (12.1)	1,800 (8.1)
5/8 (15.9)	2 3/4 (69.9)	1,560 (6.9)	2,320 (10.4)	2,075 (9.3)	2,975 (13.4)	2,465 (11.1)	2,975 (13.4)
	4 (101.6)	2,400 (10.8)	2,320 (10.4)	2,705 (12.2)	2,975 (13.4)	3,375 (15.2)	2,975 (13.4)
	5 (127.0)	2,660 (11.8)	2,320 (10.4)	3,130 (14.1)	2,975 (13.4)	4,105 (18.5)	2,975 (13.4)
	7 (177.8)	3,125 (13.9)	2,440 (11.0)	3,970 (17.9)	3,045 (13.7)	4,105 (18.5)	3,045 (13.7)
3/4 (19.1)	3 3/8 (85.7)	1,855 (8.3)	3,095 (13.9)	2,500 (11.3)	3,765 (16.9)	3,135 (14.1)	3,765 (16.9)
	5 (127.0)	2,660 (11.8)	3,095 (13.9)	3,660 (16.5)	3,765 (16.9)	4,315 (19.4)	3,765 (16.9)
	6 (152.4)	2,660 (11.8)	3,095 (13.9)	4,270 (19.2)	3,765 (16.9)	5,045 (22.7)	3,765 (16.9)
	8 (203.2)	3,500 (15.6)	3,400 (15.3)	5,710 (25.4)	4,280 (19.3)	6,225 (28.0)	4,280 (19.3)
7/8 (22.2)	3 7/8 (98.4)	1,900 (8.6)	4,490 (20.2)	3,075 (13.8)	6,040 (27.2)	4,325 (19.5)	6,040 (27.2)
	4 1/2 (114.3)	2,400 (10.8)	4,490 (20.2)	3,905 (17.6)	6,040 (27.2)	5,305 (23.6)	6,040 (27.2)
	5 3/4 (146.1)	2,660 (11.8)	4,490 (20.2)	4,970 (22.4)	6,040 (27.2)	6,950 (30.9)	6,040 (27.2)
	7 (177.8)	3,170 (14.1)	4,490 (20.2)	5,110 (23.0)	6,040 (27.2)	8,590 (38.2)	6,040 (27.2)
	8 (203.2)	3,790 (16.9)	4,660 (21.0)	5,710 (25.4)	6,430 (28.9)	7,795 (35.1)	6,430 (28.9)
1 (25.4)	4 1/2 (114.3)	2,185 (9.8)	6,605 (29.7)	3,455 (15.5)	7,775 (35.0)	5,305 (23.6)	7,775 (35.0)
	5 1/2 (139.7)	3,195 (14.4)	6,605 (29.7)	5,070 (22.8)	7,775 (35.0)	6,950 (30.9)	7,775 (35.0)
	6 1/2 (165.1)	4,150 (18.7)	6,605 (29.7)	6,370 (28.7)	7,775 (35.0)	8,590 (38.2)	7,775 (35.0)
	8 (203.2)	5,590 (25.2)	6,605 (29.7)	6,760 (30.4)	7,775 (35.0)	11,055 (49.7)	7,775 (35.0)
	9 (228.6)	6,550 (29.5)	6,755 (30.4)	8,550 (38.5)	8,095 (36.4)	11,055 (49.7)	8,095 (36.4)
1 1/4 (31.8)	5 1/2 (139.7)	4,200 (18.9)	10,205 (45.9)	6,745 (30.4)	10,205 (45.9)	9,230 (41.5)	10,205 (45.9)
	7 (177.8)	6,340 (28.5)	10,205 (45.9)	8,855 (39.8)	10,205 (45.9)	11,210 (50.4)	10,205 (45.9)
	10 (254.0)	7,200 (32.4)	10,205 (45.9)	13,070 (58.8)	10,205 (45.9)	15,175 (68.3)	10,205 (45.9)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
3. Allowable loads for anchors to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load, where permitted by code.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Carbon and Stainless Steel Power-Stud in Structural Lightweight Concrete[1,2,3]

Anchor Diameter d in. (mm)	Max. Guide Torque T_{max} ft.-lbs.	Min. Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c) — Tension, lbs (kN) — 3,000 psi (20.7 MPa) Ultimate Load	3,000 psi (20.7 MPa) Allowable Load	4,000 psi (27.6 MPa) Ultimate Load	4,000 psi (27.6 MPa) Allowable Load	5,000 psi (34.5 MPa) Ultimate Load	5,000 psi (34.5 MPa) Allowable Load	Shear, lbs (kN) — $f'_c \geq$ 3,000 psi (20.7 MPa) Ultimate Load	Shear, lbs (kN) — $f'_c \geq$ 3,000 psi (20.7 MPa) Allowable Load
1/4 (6.4)	4	1 1/8 (28.6)	720 (3.2)	180 (0.8)	960 (4.3)	240 (1.1)	1,200 (5.4)	300 (1.4)	720 (3.2)	180 (0.8)
3/8 (9.5)	20	1 5/8 (41.3)	1,600 (7.2)	400 (1.8)	1,940 (8.7)	485 (2.2)	2,300 (10.4)	575 (2.6)	1,840 (8.3)	460 (2.1)
		3 (76.2)	–	–	2,860 (12.9)	715 (3.2)	–	–	1,840 (8.3)	460 (2.1)
1/2 (12.7)	30	2 1/4 (57.2)	2,820 (12.7)	705 (3.2)	3,180 (14.3)	795 (3.6)	3,560 (16.0)	890 (4.0)	5,040 (22.7)	1,260 (5.7)
		3 (76.2)	–	–	4,020 (18.1)	1,005 (4.5)	–	–	5,040 (22.7)	1,260 (5.7)
		5 (127.0)	–	–	4,200 (18.9)	1,050 (4.7)	–	–	5,040 (22.7)	1,260 (5.7)
5/8 (15.9)	65	2 3/4 (69.9)	4,380 (19.7)	1,095 (4.9)	4,980 (22.4)	1,245 (5.6)	5,580 (25.1)	1,395 (6.3)	6,940 (31.2)	1,735 (7.8)
		3 1/2 (88.9)	–	–	4,840 (21.8)	1,210 (5.4)	–	–	6,940 (31.2)	1,735 (7.8)
		5 (127.0)	–	–	6,920 (31.1)	1,730 (7.8)	–	–	6,940 (31.2)	1,735 (7.8)
3/4 (19.1)	90	3 3/8 (85.7)	5,060 (22.8)	1,265 (5.7)	5,600 (25.2)	1,400 (6.3)	6,140 (27.6)	1,535 (6.9)	9,880 (44.5)	2,470 (11.1)
		4 (101.6)	–	–	8,240 (37.1)	2,060 (9.3)	–	–	9,880 (44.5)	2,470 (11.1)
		5 (127.0)	–	–	9,300 (41.9)	2,325 (10.5)	–	–	9,880 (44.5)	2,470 (11.1)

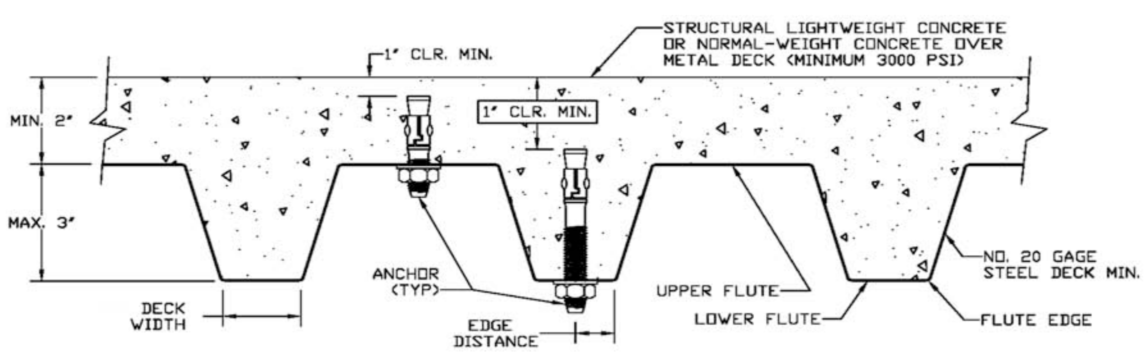
1. The values listed above are ultimate and allowable load capacities for anchors installed in sand-lightweight concrete.
2. Allowable load capacities are calculated using an applied safety factor of 4.0.
3. Linear interpolation may be used to determine loads for intermediate embedments and compressive strengths.

PERFORMANCE DATA

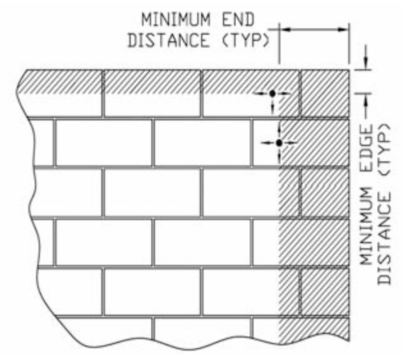
Ultimate and Allowable Load Capacities for Carbon and Stainless Steel Power-Stud Installed Through Metal Deck into Structural Lightweight Concrete[1,2,3,4]

Anchor Diameter d in. (mm)	Max. Guide Torque T_{max} ft.-lbs.	Min. Embed. Depth h_v in. (mm)	Lightweight Concrete over minimum 20 Gage Metal Deck, $f'_c \geq$ 3,000 (20.7 MPa)							
			Minimum 1-1/2" Wide Deck				Minimum 4-1/2" Wide Deck			
			Ultimate Load		Allowable Load		Ultimate Load		Allowable Load	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	4	1 1/8 (28.6)	880 (4.0)	1,840 (8.3)	220 (1.0)	460 (2.1)	880 (4.0)	1,840 (8.3)	220 (1.0)	460 (2.1)
3/8 (9.5)	20	1 5/8 (41.3)	880 (4.0)	2,800 (12.6)	220 (1.0)	700 (3.2)	1,520 (6.8)	2,800 (12.6)	380 (1.7)	700 (3.2)
		3 (76.2)	880 (4.0)	2,800 (12.6)	220 (1.0)	700 (3.2)	4,480 (20.2)	3,840 (17.3)	1,120 (5.0)	960 (4.3)
1/2 (12.7)	30	2 1/4 (57.2)	1,400 (6.3)	2,800 (12.6)	350 (1.6)	700 (3.2)	3,200 (14.4)	4,780 (21.5)	800 (3.6)	1,195 (5.4)
		3 (76.2)	1,400 (6.3)	2,800 (12.6)	350 (1.6)	700 (3.2)	4,560 (20.5)	5,960 (26.8)	1,140 (5.1)	1,490 (6.7)
		4 (101.6)	1,400 (6.3)	2,800 (12.6)	350 (1.6)	700 (3.2)	6,360 (28.6)	7,540 (33.9)	1,590 (7.2)	1,885 (8.5)
5/8 (15.9)	65	2 3/4 (69.9)	–	–	–	–	3,200 (14.4)	4,780 (21.5)	800 (3.6)	1,195 (5.4)
		3 1/2 (88.9)	–	–	–	–	5,540 (24.9)	7,160 (32.2)	1,385 (6.2)	1,790 (8.1)
		5 (127.0)	–	–	–	–	9,200 (41.4)	10,940 (49.2)	2,300 (10.4)	2,735 (12.3)
3/4 (19.1)	90	3 3/8 (85.7)	–	–	–	–	2,740 (12.3)	7,000 (31.5)	685 (3.1)	1,750 (7.9)
		5 (127.0)	–	–	–	–	10,840 (48.8)	12,570 (56.6)	2,710 (12.2)	3,140 (14.1)

1. The values listed above are ultimate and allowable load capacities for anchors installed in sand-lightweight concrete.
2. Allowable loads capacities are calculated using an applied safety factor of 4.0.
3. Tabulated load values are for anchors installed in the center of the flute. Spacing distances shall be in accordance with the spacing table for lightweight concrete listed in the Design Criteria section. Linear interpolation may be used for flute edge distances between those listed. Flute edge distance equals one-half the minimum deck width.
4. Anchors are permitted to be installed in the lower or upper flute of the metal deck provided the proper installation procedures are maintained.



PERFORMANCE DATA



Ultimate and Allowable Load Capacities for Carbon and Stainless Steel Power-Stud in Grout-Filled Concrete Masonry[1,2,3]

Anchor Dia. d in. (mm)	Max. Guide Torque T_{max} ft.-lbs.	Min. Embed. Depth h_v in. (mm)	Min. Edge Distance in. (mm)	Min. End Distance in. (mm)	Grout-Filled Concrete Masonry $f'_m \geq$ 1,500 psi (10.4 MPa) Ultimate Load Tension lbs. (kN)	Ultimate Load Shear lbs. (kN)	Allowable Load Tension lbs. (kN)	Allowable Load Shear lbs. (kN)
1/4 (6.4)	4	1 1/8 (28.6)	3 3/4 (95.3)	3 3/4 (95.3)	1,230 (5.5)	1,230 (5.5)	245 (1.1)	245 (1.1)
		2 (50.8)	5 1/4 (133.4)	3 3/4 (95.3)	1,670 (7.5)	1,230 (5.5)	335 (1.5)	245 (1.1)
3/8 (9.5)	20	1 5/8 (41.3)	5 5/8 (142.9)	5 5/8 (142.9)	1,990 (9.0)	3,240 (14.6)	400 (1.8)	650 (2.9)
		3 (76.2)	7 7/8 (200.0)	5 5/8 (142.9)	2,200 (9.9)	3,240 (14.6)	440 (2.0)	650 (2.9)
1/2 (12.7)	30	2 1/4 (57.2)	7 1/2 (190.5)	7 1/2 (190.5)	2,260 (10.2)	6,230 (28.0)	450 (2.0)	1,245 (5.6)
		4 (101.6)	10 1/2 (266.7)	7 1/2 (190.5)	2,620 (11.8)	6,230 (28.0)	525 (2.4)	1,245 (5.6)
5/8 (15.9)	65	2 3/4 (69.9)	9 3/8 (238.1)	9 3/8 (238.1)	3,170 (14.3)	7,830 (35.2)	635 (2.9)	1,565 (7.0)
		5 (127.0)	13 1/8 (333.4)	9 3/8 (238.1)	3,780 (17.0)	7,830 (35.2)	755 (3.4)	1,565 (7.0)
3/4 (19.1)	90	3 3/8 (85.7)	11 1/4 (285.8)	11 1/4 (285.8)	4,085 (18.4)	9,760 (43.9)	815 (3.7)	1,950 (8.8)
		5 (127.0)	15 3/4 (400.1)	11 1/4 (285.8)	4,420 (19.9)	9,760 (43.9)	885 (4.0)	1,950 (8.8)

1. Tabulated load values are for anchors installed in minimum 6-inch wide, Grade N, Type II, medium and normal-weight concrete masonry units conforming to ASTM C 90 that have reached the minimum designated ultimate compressive strength at the time of installation ($f'm \geq$ 1,500 psi).
2. Allowable load capacities listed are calculated using an applied safety factor of 5.0.
3. The tabulated values are for anchors installed at a minimum of 12 anchor diameters on center for 100 percent capacity. Spacing distances may be reduced to 6 anchor diameters on center provided the capacities are reduced by 50 percent. Linear interpolation may be used for intermediate spacing.

DESIGN CRITERIA

Combined Loading

For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n}\right)^{\frac{5}{3}} + \left(\frac{V_u}{V_n}\right)^{\frac{5}{3}} \leq 1 \quad \text{OR} \quad \left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

Load Adjustment Factors for Spacing and Edge Distances

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	**Load Type**	**Critical Distance (Full Anchor Capacity)**	**Critical Load Factor**	**Minimum Distance (Reduced Capacity)**	**Minimum Load Factor**
Spacing (s)	Tension and Shear	$s_{cr} = 2.0h_v$	$F_N = F_V = 1.0$	$s_{min} = h_v$	$F_N = F_V = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_N = 1.0$	$c_{cr} = 5d$	$F_N = 0.75$
	Shear	$c_{cr} = 12d$	$F_V = 1.0$	$c_{cr} = 5d$	$F_V = 0.35$

Anchor Installed in Lightweight Concrete					
Anchor Dimension	**Load Type**	**Critical Distance (Full Anchor Capacity)**	**Critical Load Factor**	**Minimum Distance (Reduced Capacity)**	**Minimum Load Factor**
Spacing (s)	Tension and Shear	$s_{cr} = 2.0h_v$	$F_N = F_V = 1.0$	$s_{min} = h_v$	$F_N = F_V = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_N = 1.0$	$c_{cr} = 5d$	$F_N = 0.95$
	Shear	$c_{cr} = 12d$	$F_V = 1.0$	$c_{cr} = 5d$	$F_V = 0.30$

DESIGN CRITERIA

Spacing Load Adjustment Factors for Normal-Weight and Lightweight Concrete (Continued Below)

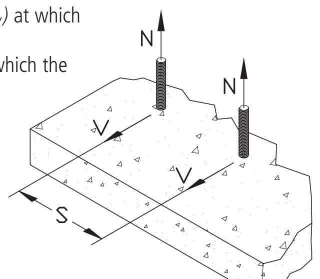
Spacing, Tension (F_N) & Shear (F_V)																			
Dia. (in.)		1/4				3/8				1/2					5/8				
h_v (in.)		1 1/8	1 1/2	2	2 3/4	1 5/8	2	3	4 1/4	2 1/4	3	4	5	6	2 3/4	3 1/2	4	5	7
s_{cr} (in.)		2 1/4	3	4	5 1/2	3 1/4	4	6	8 1/2	4 1/2	6	8	10	12	5 1/2	7	8	10	14
s_{min} (in.)		1 1/8	1 1/2	2	2 3/4	1 5/8	2	3	4 1/4	2 1/4	3	4	5	6	2 3/4	3 1/2	4	5	7
Spacing, *s* (inches)	1 1/8	0.50																	
	1 1/2	0.67	0.50																
	1 5/8	0.72	0.54			0.50													
	2	0.89	0.67	0.50		0.62	0.50												
	2 1/4	1.00	0.75	0.56		0.69	0.56			0.50									
	2 3/4		0.92	0.69	0.50	0.85	0.69			0.61					0.50				
	3		1.00	0.75	0.55	0.92	0.75	0.50		0.67	0.50				0.55				
	3 1/4			0.81	0.59	1.00	0.81	0.54		0.72	0.54				0.59				
	3 1/2			0.88	0.64		0.88	0.58		0.78	0.58				0.64	0.50			
	4			1.00	0.73		1.00	0.67		0.89	0.67	0.50			0.73	0.57	0.50		
	4 1/4				0.77			0.71	0.50	0.94	0.71	0.53			0.77	0.61	0.53		
	4 1/2				0.82			0.75	0.53	1.00	0.75	0.56			0.82	0.64	0.56		
	5				0.91			0.83	0.59		0.83	0.63	0.50		0.91	0.71	0.63	0.50	
	5 1/2				1.00			0.92	0.65		0.92	0.69	0.55		1.00	0.79	0.69	0.55	
	6							1.00	0.71		1.00	0.75	0.60	0.50		0.86	0.75	0.60	
	7								0.82			0.88	0.70	0.58		1.00	0.88	0.70	0.50
	8								0.94			1.00	0.80	0.67			1.00	0.80	0.57
	8 1/2								1.00				0.85	0.71				0.85	0.61
	10												1.00	0.83				1.00	0.71
	11													0.92					0.79
	12													1.00					0.86
	13																		0.93
	14																		1.00

Spacing Load Adjustment Factors for Normal-Weight and Lightweight Concrete (Continued from Above)

Spacing, Tension (F_N) & Shear (F_V)																			
Dia. (in.)		3/4					7/8					1					1 1/4		
h_v (in.)		3 3/8	4	5	6	8	3 7/8	4 1/2	5 3/4	7	8	4 1/2	5 1/2	6 1/2	8	9	5 1/2	7	10
s_{cr} (in.)		6 3/4	8	10	12	16	7 3/4	9	11 1/2	14	16	9	11	13	16	18	11	14	20
s_{min} (in.)		3 3/8	4	5	6	8	3 7/8	4 1/2	5 3/4	7	8	4 1/2	5 1/2	6 1/2	8	9	5 1/2	7	10
Spacing, *s* (inches)	3 3/8	0.50																	
	3 7/8	0.57					0.50												
	4	0.59	0.50				0.52												
	4 1/2	0.67	0.56				0.58	0.50				0.50							
	5	0.74	0.63	0.50			0.65	0.56				0.56							
	5 1/2	0.81	0.69	0.55			0.71	0.61				0.61	0.50				0.50		
	5 3/4	0.85	0.72	0.58			0.74	0.64	0.50			0.64	0.52				0.52		
	6	0.89	0.75	0.60	0.50		0.77	0.67	0.52			0.67	0.55				0.55		
	6 1/2	0.96	0.81	0.65	0.54		0.84	0.72	0.57			0.72	0.59	0.50			0.59		
	6 3/4	1.00	0.84	0.68	0.56		0.87	0.75	0.59			0.75	0.61	0.52			0.61		
	7		0.88	0.70	0.58		0.90	0.78	0.61	0.50		0.78	0.64	0.54			0.64	0.50	
	7 3/4		0.97	0.78	0.65		1.00	0.86	0.67	0.55		0.86	0.70	0.60			0.70	0.55	
	8		1.00	0.80	0.67	0.50		0.89	0.70	0.57	0.50	0.89	0.73	0.62	0.50		0.73	0.57	
	9			0.90	0.75	0.56		1.00	0.78	0.64	0.56	1.00	0.82	0.69	0.56	0.50	0.82	0.64	
	10			1.00	0.83	0.63			0.87	0.71	0.63		0.91	0.77	0.63	0.56	0.91	0.71	0.50
	11				0.92	0.69			0.96	0.79	0.69		1.00	0.85	0.69	0.61	1.00	0.79	0.55
	11 1/2				0.96	0.72			1.00	0.82	0.72			0.88	0.72	0.64		0.82	0.58
	12				1.00	0.75				0.86	0.75			0.92	0.75	0.67		0.86	0.60
	13					0.81				0.93	0.81			1.00	0.81	0.72		0.93	0.65
	14					0.88				1.00	0.88				0.88	0.78		1.00	0.70
	16					1.00					1.00				1.00	0.89			0.80
	18															1.00			0.90
	20																		1.00

Notes: Critical spacing (s_{cr}) is equal to 2 embedment depths ($2h_v$) at which the anchor achieves 100% of load.

Minimum spacing (s_{min}) is equal to 1 embedment depth (h_v) at which the anchor achieves 50% of load.



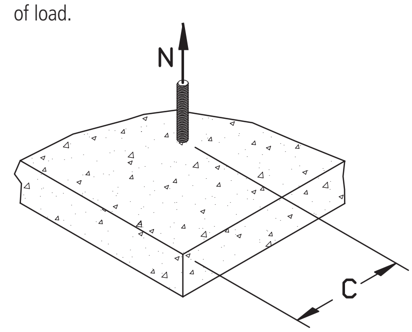
DESIGN CRITERIA

Edge Distance Load Adjustment Factors for Normal-Weight Concrete

Edge Distance, Tension (F_N)									
Diameter (in.)		1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/4
c_{cr} (in.)		3	4 1/2	6	7 1/2	9	10 1/2	12	15
c_{min} (in.)		1 1/4	1 7/8	2 1/2	3 1/8	3 3/4	4 3/8	5	6 1/4
Edge Distance, c (inches)	1 1/4	0.75							
	1 5/8	0.80							
	1 7/8	0.84	0.75						
	2	0.86	0.76						
	2 1/2	0.93	0.81	0.75					
	3	1.00	0.86	0.79					
	3 1/8		0.87	0.79	0.75				
	3 3/4		0.93	0.84	0.79	0.75			
	4		0.95	0.86	0.80	0.76			
	4 3/8		0.99	0.88	0.82	0.78	0.75		
	4 1/2		1.00	0.89	0.83	0.79	0.76		
	5			0.93	0.86	0.81	0.78	0.75	
	6			1.00	0.91	0.86	0.82	0.79	
	6 1/4				0.93	0.87	0.83	0.79	0.75
	7				0.97	0.90	0.86	0.82	0.77
	7 1/2				1.00	0.93	0.88	0.84	0.79
	8					0.95	0.90	0.86	0.80
	9					1.00	0.94	0.89	0.83
	10 1/2						1.00	0.95	0.87
	12							1.00	0.91
	15								1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12*d*) at which the anchor achieves 100% of load.

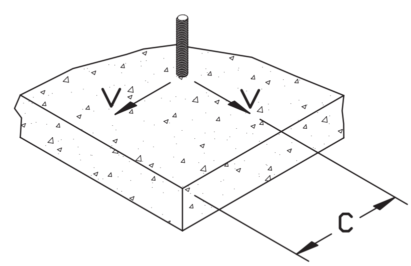
Minimum edge distance (c_{min}) is equal to 5 anchor diameters (5*d*) at which the anchor achieves 75% of load.



Edge Distance, Shear (F_V)									
Diameter (in.)		1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/4
c_{cr} (in.)		3	4 1/2	6	7 1/2	9	10 1/2	12	15
c_{min} (in.)		1 1/4	1 7/8	2 1/2	3 1/8	3 3/4	4 3/8	5	6 1/4
Edge Distance, c (inches)	1 1/4	0.35							
	1 5/8	0.49							
	1 7/8	0.58	0.35						
	2	0.63	0.38						
	2 1/2	0.81	0.50	0.35					
	3	1.00	0.63	0.44					
	3 1/8		0.66	0.47	0.35				
	3 3/4		0.81	0.58	0.44	0.35			
	4		0.88	0.63	0.48	0.38			
	4 3/8		0.97	0.70	0.54	0.43	0.35		
	4 1/2		1.00	0.72	0.55	0.44	0.36		
	5			0.81	0.63	0.50	0.42	0.35	
	6			1.00	0.78	0.63	0.52	0.44	
	6 1/4				0.81	0.66	0.55	0.47	0.35
	7				0.93	0.75	0.63	0.54	0.41
	7 1/2				1.00	0.81	0.68	0.58	0.44
	8					0.88	0.73	0.63	0.48
	9					1.00	0.84	0.72	0.55
	10 1/2						1.00	0.86	0.67
	12							1.00	0.78
	15								1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12*d*) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 5 anchor diameters (5*d*) at which the anchor achieves 35% of load.



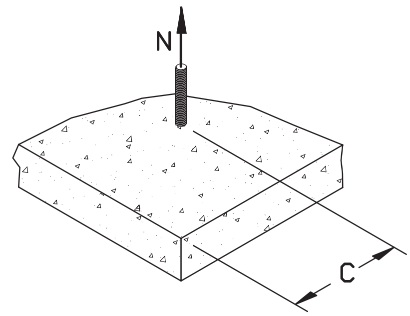
DESIGN CRITERIA

Edge Distance Load Adjustment Factors for Lightweight Concrete

Edge Distance, Tension (F_N)									
Diameter (in.)		1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/4
c_{cr} (in.)		3	4 1/2	6	7 1/2	9	10 1/2	12	15
c_{min} (in.)		1 1/4	1 7/8	2 1/2	3 1/8	3 3/4	4 3/8	5	6 1/4
Edge Distance, c (inches)	1 1/4	0.95							
	1 5/8	0.96							
	1 7/8	0.97	0.95						
	2	0.97	0.95						
	2 1/2	0.99	0.96	0.95					
	3	1.00	0.97	0.96					
	3 1/8		0.97	0.96	0.95				
	3 3/4		0.99	0.97	0.96	0.95			
	4		0.99	0.97	0.96	0.95			
	4 3/8		1.00	0.98	0.96	0.96	0.95		
	4 1/2		1.00	0.98	0.97	0.96	0.95		
	5			0.99	0.97	0.96	0.96	0.95	
	6			1.00	0.98	0.97	0.96	0.96	
	6 1/4				0.99	0.97	0.97	0.96	0.95
	7				0.99	0.98	0.97	0.96	0.95
	7 1/2				1.00	0.99	0.98	0.97	0.96
	8					0.99	0.98	0.97	0.96
	9					1.00	0.99	0.98	0.97
	10 1/2						1.00	0.99	0.97
	12							1.00	0.98
	15								1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12*d*) at which the anchor achieves 100% of load.

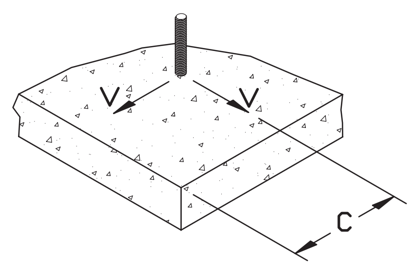
Minimum edge distance (c_{min}) is equal to 5 anchor diameters (5*d*) at which the anchor achieves 95% of load.



Edge Distance, Shear (F_V)									
Diameter (in.)		1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/4
c_{cr} (in.)		3	4 1/2	6	7 1/2	9	10 1/2	12	15
c_{min} (in.)		1 1/4	1 7/8	2 1/2	3 1/8	3 3/4	4 3/8	5	6 1/4
Edge Distance, c (inches)	1 1/4	0.30							
	1 5/8	0.45							
	1 7/8	0.55	0.30						
	2	0.60	0.33						
	2 1/2	0.80	0.47	0.30					
	3	1.00	0.60	0.40					
	3 1/8		0.63	0.43	0.30				
	3 3/4		0.80	0.55	0.40	0.30			
	4		0.87	0.60	0.44	0.33			
	4 3/8		0.97	0.68	0.50	0.38	0.30		
	4 1/2		1.00	0.70	0.52	0.40	0.31		
	5			0.80	0.60	0.47	0.37	0.30	
	6			1.00	0.76	0.60	0.49	0.40	
	6 1/4				0.80	0.63	0.51	0.43	0.30
	7				0.92	0.73	0.60	0.50	0.36
	7 1/2				1.00	0.80	0.66	0.55	0.40
	8					0.87	0.71	0.60	0.44
	9					1.00	0.83	0.70	0.52
	10 1/2						1.00	0.85	0.64
	12							1.00	0.76
	15								1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12*d*) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 5 anchor diameters (5*d*) at which the anchor achieves 30% of load.



ORDERING INFORMATION

Carbon Steel Power-Stud

Cat. No.	Anchor Size	Min. Embed.	Thread Length	Std. Box	Std. Carton	Wt./100
7400	1/4" x 1 3/4"	1 1/8"	3/4"	100	500	3
7402	1/4" x 2 1/4"	1 1/8"	1 1/4"	100	500	3 1/2
7404	1/4" x 3 1/4"	1 1/8"	2 1/4"	100	500	4 3/4
7410	3/8" x 2 1/4"	1 5/8"	1 1/4"	50	250	8 3/4
7412	3/8" x 2 3/4"	1 5/8"	1 5/8"	50	250	9 1/2
7413	3/8" x 3"	1 5/8"	1 7/8"	50	250	10 3/4
7414	3/8" x 3 1/2"	1 5/8"	2 3/8"	50	250	12
7415	3/8" x 3 3/4"	1 5/8"	2 5/8"	50	250	12 3/4
7416	3/8" x 5"	1 5/8"	3 7/8"	50	250	15 1/2
7417	3/8" x 7"	1 5/8"	5 7/8"	50	200	21
7420	1/2" x 2 3/4"	2 1/4"	1 3/8"	50	200	18
7422	1/2" x 3 3/4"	2 1/4"	2 3/8"	50	200	23
7423	1/2" x 4 1/2"	2 1/4"	3 1/8"	50	200	28
7424	1/2" x 5 1/2"	2 1/4"	4 1/8"	50	150	32
7426	1/2" x 7"	2 1/4"	5 5/8"	25	100	44
7427	1/2" x 8 1/2"	2 1/4"	7 1/8"	25	100	46
7430	5/8" x 3 1/2"	2 3/4"	2"	25	100	40
7432	5/8" x 4 1/2"	2 3/4"	3"	25	100	54
7433	5/8" x 5"	2 3/4"	3 1/2"	25	100	57
7434	5/8" x 6"	2 3/4"	4 1/2"	25	75	64
7436	5/8" x 7"	2 3/4"	5 1/2"	25	75	72
7438	5/8" x 8 1/2"	2 3/4"	7"	25	75	84
7439	5/8" x 10"	2 3/4"	8 1/2"	25	75	100
7440	3/4" x 4 1/4"	3 3/8"	2 3/8"	20	60	70
7441	3/4" x 4 3/4"	3 3/8"	2 7/8"	20	60	76
7442	3/4" x 5 1/2"	3 3/8"	3 5/8"	20	60	85
7444	3/4" x 6 1/4"	3 3/8"	4 3/8"	20	60	95
7446	3/4" x 7"	3 3/8"	5 1/8"	20	60	105
7448	3/4" x 8 1/2"	3 3/8"	6 5/8"	10	40	120
7449	3/4" x 10"	3 3/8"	8 1/8"	10	30	135
7451	3/4" x 12"	3 3/8"	10 1/8"	10	30	155
7450	7/8" x 6"	3 7/8"	2 3/4"	10	40	120
7452	7/8" x 8"	3 7/8"	4 3/4"	10	40	160
7454	7/8" x 10"	3 7/8"	6 3/4"	10	30	200
7461	1" x 6"	4 1/2"	2 3/8"	10	30	170
7463	1" x 9"	4 1/2"	5 3/8"	10	30	240
7465	1" x 12"	4 1/2"	8 3/8"	5	15	300
7473	1 1/4" x 9"	5 1/2"	4 3/4"	5	15	360
7475	1 1/4" x 12"	5 1/2"	7 3/4"	5	15	480

The published length is the overall length of the anchor. Allow for fixture thickness plus one anchor diameter for the nut and washer thickness when selecting a length.

Mechanically Galvanized Power-Stud

Cat. No.	Anchor Size	Min. Embed.	Thread Length	Std. Box	Std. Carton	Wt./100
7720	1/2" x 2 3/4"	2 1/4"	1 3/8"	50	200	18
7723	1/2" x 4 1/2"	2 1/4"	3 1/8"	50	200	30
7724	1/2" x 5 1/2"	2 1/4"	4 1/8"	50	150	34
7726	1/2" x 7"	2 1/4"	5 5/8"	25	100	34
7730	5/8" x 3 1/2"	2 3/4"	2"	25	100	40
7734	5/8" x 6"	2 3/4"	4 1/2"	25	75	64
7741	3/4" x 4 3/4"	3 3/8"	2 7/8"	20	60	76
7742	3/4" x 5 1/2"	3 3/8"	3 5/8"	20	60	85
7748	3/4" x 8 1/2"	3 3/8"	6 5/8"	10	40	120
7750	7/8" x 6"	3 7/8"	2 3/4"	10	40	120
7752	7/8" x 8"	3 7/8"	4 3/4"	10	40	160
7763	1" x 9"	4 1/2"	5 3/8"	10	30	240

The published length is the overall length of the anchor. Allow for fixture thickness plus one anchor diameter for the nut and washer thickness when selecting a length.

ORDERING INFORMATION

Rod Hanger Power-Stud

Cat. No.	Rod Size	Anchor Size	Drill Dia.	Min. Embed.	Thread Depth	Std. Box	Std. Ctn.	Wt./100
7806	3/8"	1/2" x 2 3/8"	1/2"	2 1/4"	9/16"	50	250	18
7808*	1/2"	5/8" x 2 1/2"	5/8"	2 3/4"	3/4"	25	125	40
7810*	5/8"	7/8" x 3 1/4"	7/8"	3 7/8"	15/16"	10	50	120

The published length is the overall length of the anchor.
*Discontinued item once current stock is exhausted.

Tie-Wire Power-Stud

Cat. No.	Size	Tie-Wire Hole Size	Min. Embed.	Std. Box	Std. Carton	Wt./100
7409	1/4" x 2"	9/32"	1 1/8"	100	500	3 3/4

The published length is the overall length of the anchor.

Type 304 Stainless Steel Power-Stud

Cat. No.	Anchor Size	Min. Embed.	Thread Length	Std. Box	Std. Carton	Wt./100
7300	1/4" x 1 3/4"	1 1/8"	3/4"	100	500	3
7302	1/4" x 2 1/4"	1 1/8"	1 1/4"	100	500	3 1/2
7304	1/4" x 3 1/4"	1 1/8"	2 1/4"	100	500	4 3/4
7310	3/8" x 2 1/4"	1 5/8"	1 1/4"	50	250	8 3/4
7312	3/8" x 2 3/4"	1 5/8"	1 5/8"	50	250	9 1/2
7313	3/8" x 3"	1 5/8"	1 7/8"	50	250	10 3/4
7314	3/8" x 3 1/2"	1 5/8"	2 3/8"	50	250	12
7315	3/8" x 3 3/4"	1 5/8"	2 5/8"	50	250	12 3/4
7316	3/8" x 5"	1 5/8"	3 1/8"	50	250	15 1/2
7320	1/2" x 2 3/4"	2 1/4"	1 3/8"	50	200	18
7322	1/2" x 3 3/4"	2 1/4"	2 3/8"	50	200	23
7323	1/2" x 4 1/2"	2 1/4"	3 1/8"	50	200	30
7324	1/2" x 5 1/2"	2 1/4"	4 1/8"	50	150	34
7326	1/2" x 7"	2 1/4"	5 5/8"	25	100	44
7330	5/8" x 3 1/2"	2 3/4"	2"	25	100	40
7332	5/8" x 4 1/2"	2 3/4"	3"	25	100	54
7333	5/8" x 5"	2 3/4"	3 1/2"	25	100	57
7334	5/8" x 6"	2 3/4"	4 1/2"	25	75	64
7336	5/8" x 7"	2 3/4"	5 1/2"	25	75	72
7338	5/8" x 8 1/2"	2 3/4"	7"	25	75	84
7340	3/4" x 4 1/4"	3 3/8"	2 3/8"	20	60	70
7341	3/4" x 4 3/4"	3 3/8"	2 7/8"	20	60	76
7342	3/4" x 5 1/2"	3 3/8"	3 5/8"	20	60	85
7344	3/4" x 6 1/4"	3 3/8"	4 3/8"	20	60	95
7346	3/4" x 7"	3 3/8"	5 1/8"	20	60	105
7348	3/4" x 8 1/2"	3 3/8"	6 5/8"	10	40	120
7349	3/4" x 10"	3 3/8"	8 1/8"	10	30	135
7352	7/8" x 8"	3 7/8"	4 3/4"	10	40	160
7361	1" x 6"	4 1/2"	2 3/8"	10	30	170
7363	1" x 9"	4 1/2"	5 3/8"	10	30	240
7365	1" x 12"	4 1/2"	8 3/8"	5	15	300

The published length is the overall length of the anchor. Allow for fixture thickness plus one anchor diameter for the nut and washer thickness when selecting a length.

ORDERING INFORMATION

Type 316 Stainless Steel Power-Stud

Cat. No.	Anchor Size	Min. Embed.	Thread Length	Std. Box	Std. Carton	Wt./100
7600	1/4" x 1 3/4"	1 1/8"	3/4"	100	500	3 1/4
7602	1/4" x 2 1/4"	1 1/8"	1 1/4"	100	500	3 3/4
7604	1/4" x 3 1/4"	1 1/8"	2 1/4"	100	500	5 1/4
7610	3/8" x 2 1/4"	1 5/8"	1 1/4"	50	250	8 3/4
7612	3/8" x 2 3/4"	1 5/8"	1 5/8"	50	250	10 1/2
7613	3/8" x 3"	1 5/8"	1 7/8"	50	250	11
7614	3/8" x 3 1/2"	1 5/8"	2 3/8"	50	250	12
7615	3/8" x 3 3/4"	1 5/8"	2 5/8"	50	250	13
7616	3/8" x 5"	1 5/8"	3 1/8"	50	250	17 1/4
7620	1/2" x 2 3/4"	2 1/4"	1 3/8"	50	200	18
7622	1/2" x 3 3/4"	2 1/4"	2 3/8"	50	200	24
7623	1/2" x 4 1/2"	2 1/4"	3 1/8"	50	200	30
7624	1/2" x 5 1/2"	2 1/4"	4 1/8"	50	150	34
7626	1/2" x 7"	2 1/4"	5 5/8"	25	100	44
7630	5/8" x 3 1/2"	2 3/4"	2"	25	100	40
7632	5/8" x 4 1/2"	2 3/4"	3"	25	100	54
7633	5/8" x 5"	2 3/4"	3 1/2"	25	100	57
7634	5/8" x 6"	2 3/4"	4 1/2"	25	75	64
7636	5/8" x 7"	2 3/4"	5 1/2"	25	75	72
7638	5/8" x 8 1/2"	2 3/4"	7"	25	75	84
7640	3/4" x 4 1/4"	3 3/8"	2 3/8"	20	60	70
7641	3/4" x 4 3/4"	3 3/8"	2 7/8"	20	60	76
7642	3/4" x 5 1/2"	3 3/8"	3 5/8"	20	60	85
7644	3/4" x 6 1/4"	3 3/8"	4 3/8"	20	60	95
7646	3/4" x 7"	3 3/8"	5 1/8"	20	60	105
7648	3/4" x 8 1/2"	3 3/8"	6 5/8"	10	40	120

The published length is the overall length of the anchor. Allow for fixture thickness plus one anchor diameter for the nut and washer thickness when selecting a length.

Lok-Bolt™ *Sleeve Expansion Anchor*

PRODUCT DESCRIPTION

The Lok-Bolt is a pre-assembled single unit sleeve anchor available in carbon steel and stainless steel which can be used in concrete, block, brick, and stone. The Lok-Bolt is designed to draw the fixture into full bearing against the base material through the action of its unique and flexible compression ring. This helps to increase the resistance of the anchor to loosening when subjected to vibratory loads. As the anchor is being tightened, the nylon compression ring will compress if necessary, so that the fixture is tightly secured against the face of the base material. Under load, the specially tapered plow bolt is drawn further into the expansion sleeve to develop increased locking action against the walls of the hole. Extension sleeves are added for longer lengths.

GENERAL APPLICATIONS AND USES

- Door and Window Frame Installations
- Mounting fixtures on walls
- Mounting of Handrails and Fencing
- Shelving and Storage
- Masonry Applications
- Electrical and Mechanical Attachments

FEATURES AND BENEFITS

- Multiple head styles for multiple applications and finished appearance
- Fits standard fixture holes – No need to undersize anchors for proper fit
- Immediate Loading – Minimizes downtime
- Sleeve has 360° contact area and reduces concrete stress
- Versatile and ideal for concrete, brick and block
- Available in carbon steel and Type 304 stainless steel

APPROVALS AND LISTINGS

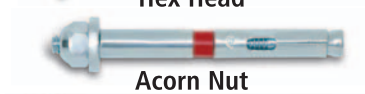
Southern Building Code Conference International (SBCCI) #9944A
Florida Building Code Approval – FL2209.3
Miami-Dade County Notice of Acceptance (NOA) 03-0311.08
Factory Mutual Research Corporation (FM Approvals) Serial No. 26692, J.I. OJ8A1.AH, J.I. OJ9A9.AH
Underwriters Laboratory (UL Listed) File No. EX 1289 (N)
Meets the descriptive requirements of FF-S.235C, Group II, Type 3, Class 3 (superceded)

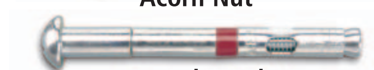
GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring, 04081-Masonry Anchorage* and *05090-Metal Fastenings.* Sleeve Anchors shall be Lok-Bolt anchors as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS Page No.


Hex Head


Acorn Nut


Round Head


Combo Flat Head


Threshold Flat Head


Rod Hanger


Tie-Wire


Extender

HEAD STYLES

Hex Head
Acorn Nut
Round Head
Combo Flat Head
Threshold Flat Head
Rod Hanger
Tie-Wire

ANCHOR MATERIALS

Zinc Plated Carbon Steel
Type 304 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

1/4" diameter x 5/8" length to
3/4" diameter x 7 1/2" length

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Structural Lightweight Concrete
Grouted Concrete Masonry
Hollow Concrete Masonry

INSTALLATION SPECIFICATIONS

Acorn Nut and Hex Head Lok-Bolt

Dimension	Anchor Size, *d*					
	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"
ANSI Drill Bit Size, d_{bit} (in.)	1/4	5/16	3/8	1/2	5/8	3/4
Fixture Clearance Hole, d_h (in.)	5/16	3/8	7/16	9/16	11/16	15/16
Plow Bolt Size (UNC)	10-24	1/4-20	5/16-18	3/8-16	1/2-13	5/8-11
Nut Height (in.)	3/16	7/32	17/64	21/64	7/16	35/64
Washer O.D., d_w (in.)	1/2	5/8	13/16	1	1 3/8	1 3/4
Wrench Size (in.)	3/8	7/16	1/2	9/16	3/4	15/16

Round Head Lok-Bolt

Dimension	Anchor Size, *d*		
	1/4"	5/16"	3/8"
ANSI Drill Bit Size, d_{bit} (in.)	1/4	5/16	3/8
Fixture Clearance Hole, d_h (in.)	5/16	3/8	7/16
Plow Bolt Size (UNC)	10-24	1/4-20	5/16-18
Head Height (in.)	11/64	13/64	15/64
Head Width, d_{hd} (in.)	29/64	9/16	43/64

Combo Flat Head Lok-Bolt

Dimension	Anchor Size, *d*		
	1/4"	5/16"	3/8"
ANSI Drill Bit Size, d_{bit} (in.)	1/4	5/16	3/8
Fixture Clearance Hole, d_h (in.)	5/16	3/8	7/16
Plow Bolt Size (UNC)	10-24	1/4-20	5/16-18
Head Height (in.)	5/32	3/16	15/64
Head Width, d_{hd} (in.)	1/2	5/8	3/4

Rod Hanger Lok-Bolt

Dimension	Anchor Size, *d*		
	1/4"	3/8"	1/2"
ANSI Drill Bit Size, d_{bit} (in.)	1/4	3/8	1/2
Plow Bolt Size (UNC)	1/4-20	5/16-18	3/8-16
Coupling Height (in.)	7/8	1	1 1/4
Washer O.D., d_w (in.)	5/8	13/16	1
Coupling Wrench Size (in.)	7/16	1/2	11/16

Threshold Lok-Bolt

Dimension	Anchor Size, *d*
	1/4"
ANSI Drill Bit Size, d_{bit} (in.)	1/4
Fixture Clearance Hole, d_h (in.)	5/16
Plow Bolt Size (UNC)	10-24
Head Height (in.)	5/64
Head Width, d_{hd} (in.)	23/64

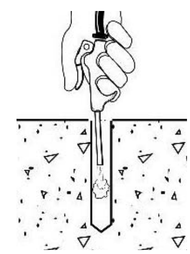
Tire-Wire Lok-Bolt

Dimension	Anchor Size, *d*
	5/16"
ANSI Drill Bit Size, d_{bit} (in.)	5/16
Fixture Clearance Hole, d_h (in.)	1/4
Plow Bolt Size (UNC)	1/4-20
Head Height (in.)	1 9/16
Head Width, d_{hd} (in.)	31/64

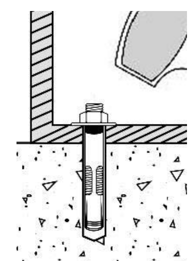
Installation Guidelines

Using the proper diameter bit, drill a hole into the base material to a depth of at least 1/2" or one anchor diameter deeper than the embedment required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.

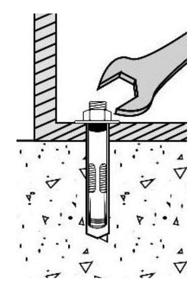
Blow the hole clean of dust and other material. Do not expand the anchor prior to installation.



Drive the anchor through the fixture into the anchor hole until the head is firmly seated against the fixture. Be sure the anchor is driven to the required embedment depth.



Tighten the anchor by turning the nut of head 3 to 5 turns past finger tight or by applying the guide installation torque from the finger tight position.



MATERIAL SPECIFICATIONS

General Lok-Bolt Components

Anchor Component	Component Material	
	Carbon Steel	Stainless Steel
Plow Bolt	AISI 1010 / 1018	Type 18-8 SS
Expansion Sleeve	AISI 1010 / 1020	Type 304 SS
Extension Sleeve	AISI 1010 / 1020	Type 304 SS
Compression Ring	Nylon	Nylon
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn 5)	N/A

Lok-Bolt Head Components

Anchor Component	Component Material	
	Carbon Steel	Stainless Steel
Hex Nut	ASTM A 563, Grade A	Type 304 SS
Acorn Nut	AISI 1010 / 1018	Type 304 SS
Washer	ASTM F 844	Type 18-8 SS
Round Head	AISI 1010 / 1018	Type 304 SS
Flat Head	AISI 1010 / 1018	Type 304 SS
Rod Coupling	AISI 12L14	Type 18-8 SS
Threshold	AISI 1010 / 1018	N/A
Tie-Wire	AISI 1010 / 1018	N/A
Zinc Plating	ASTM B 633, SC1, Type III (Fe/Zn 5)	N/A

PERFORMANCE DATA

Ultimate Load Capacities for Carbon and Stainless Steel Lok-Bolt in Normal-Weight Concrete[1,2]

Anchor Diameter d in. (mm)	Minimum Embed. Depth h_v in. (mm)	Maximum Tightening Torque T_{max} ft.-lbs. Carbon	Maximum Tightening Torque T_{max} ft.-lbs. Stainless	2,000 psi (13.8 MPa) Tension lbs. (kN)	2,000 psi (13.8 MPa) Shear lbs. (kN)	4,000 psi (27.6 MPa) Tension lbs. (kN)	4,000 psi (27.6 MPa) Shear lbs. (kN)	6,000 psi (41.4 MPa) Tension lbs. (kN)	6,000 psi (41.4 MPa) Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	3-4	2-3	540 (2.4)	1,000 (4.5)	620 (2.8)	1,200 (5.4)	680 (3.1)	1,200 (5.4)
	1 1/8 (28.6)			1,190 (5.3)	1,520 (6.8)	1,340 (6.0)	1,520 (6.8)	1,730 (7.8)	1,520 (6.8)
5/16 (7.9)	1 1/2 (38.1)	6-8	–	2,070 (9.4)	1,520 (6.8)	2,080 (9.4)	1,520 (6.8)	2,070 (9.3)	1,520 (6.8)
3/8 (9.5)	1 5/8 (41.3)	12-16	8-11	2,450 (11.1)	2,440 (11.0)	2,680 (12.1)	2,440 (11.0)	2,700 (12.2)	2,440 (11.0)
1/2 (12.7)	2 1/4 (57.2)	20-28	15-20	4,770 (21.5)	4,210 (19.0)	5,015 (22.6)	4,220 (19.0)	5,275 (23.7)	4,210 (19.0)
5/8 (15.9)	2 1/4 (57.2)	45-60	30-40	3,270 (14.7)	7,200 (32.4)	5,860 (26.4)	7,200 (32.4)	6,250 (28.1)	7,200 (32.4)
	2 3/4 (69.9)			6,060 (27.3)	7,820 (35.2)	6,620 (29.8)	7,820 (35.2)	6,800 (30.6)	7,810 (35.2)
3/4 (19.1)	2 1/4 (57.2)	70-90	45-60	4,480 (20.2)	9,840 (44.3)	8,420 (37.9)	11,670 (52.5)	8,940 (40.2)	11,670 (52.5)
	3 3/8 (85.7)			6,790 (30.6)	12,600 (56.7)	8,720 (39.2)	12,600 (56.7)	8,940 (40.2)	12,600 (56.7)

Minimum Concrete Compressive Strength (f'_c)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.

Allowable Load Capacities for Carbon and Stainless Steel Lok-Bolt in Normal-Weight Concrete[1,2]

Anchor Diameter d in. (mm)	Minimum Embed. Depth h_v in. (mm)	Maximum Tightening Torque T_{max} ft.-lbs. Carbon	Maximum Tightening Torque T_{max} ft.-lbs. Stainless	2,000 psi (13.8 MPa) Tension lbs. (kN)	2,000 psi (13.8 MPa) Shear lbs. (kN)	4,000 psi (27.6 MPa) Tension lbs. (kN)	4,000 psi (27.6 MPa) Shear lbs. (kN)	6,000 psi (41.4 MPa) Tension lbs. (kN)	6,000 psi (41.4 MPa) Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	3-4	2-3	135 (0.6)	250 (1.1)	155 (0.7)	300 (1.4)	170 (0.8)	300 (1.4)
	1 1/8 (28.6)			255 (1.1)	380 (1.7)	335 (1.5)	380 (1.7)	435 (1.9)	380 (1.7)
5/16 (7.9)	1 1/2 (38.1)	6-8	–	520 (2.3)	380 (1.7)	520 (2.3)	380 (1.7)	520 (2.3)	380 (1.7)
3/8 (9.5)	1 5/8 (41.3)	12-16	8-11	615 (2.8)	610 (2.7)	670 (3.0)	610 (2.7)	675 (3.0)	610 (2.7)
1/2 (12.7)	2 1/4 (57.2)	20-28	15-20	1,195 (5.4)	1,055 (4.7)	1,255 (5.6)	1,055 (4.7)	1,320 (5.9)	1,055 (4.7)
5/8 (15.9)	2 1/4 (57.2)	45-60	30-40	818 (3.7)	1,800 (8.1)	1,465 (6.6)	1,800 (8.1)	1,565 (7.0)	1,800 (8.1)
	2 3/4 (69.9)			1,515 (6.8)	1,955 (8.8)	1,655 (7.4)	1,955 (8.8)	1,700 (7.7)	1,955 (8.8)
3/4 (19.1)	2 1/4 (57.2)	70-90	40-60	1,120 (5.0)	2,460 (11.1)	2,105 (9.5)	2,918 (13.1)	2,235 (10.1)	2,920 (13.1)
	3 3/8 (85.7)			1,700 (7.7)	3,150 (14.2)	2,180 (9.8)	3,150 (14.2)	2,235 (10.1)	3,150 (14.2)

Minimum Concrete Compressive Strength (f'_c)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Carbon and Stainless Steel Lok-Bolt in Structural Lightweight Concrete[1,2,3]

Anchor Dia. d in. (mm)	Min. Embed. Depth h_v in. (mm)	Maximum Tightening Torque T_{max} ft.-lbs.	Minimum Concrete Compressive Strength							
			f'_c = 3,000 psi (20.7 MPa)				f'_c = 5,000 psi (34.5 MPa)			
			Ultimate Load		Allowable Load		Ultimate Load		Allowable Load	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1/4 (6.4)	2-3	1,040 (4.7)	1,160 (5.2)	260 (1.2)	290 (1.3)	1,240 (5.6)	1,160 (5.2)	310 (1.4)	290 (1.3)
5/16 (7.9)	5/16 (7.9)	5-6	1,140 (5.1)	1,560 (7.0)	285 (1.3)	390 (1.8)	1,720 (7.7)	1,560 (7.0)	430 (1.9)	390 (1.8)
3/8 (9.5)	3/8 (9.5)	8-11	1,180 (5.3)	2,600 (11.7)	295 (1.3)	650 (2.9)	1,720 (7.7)	2,600 (11.7)	430 (1.9)	650 (2.9)
1/2 (12.7)	1/2 (12.7)	15-20	2,400 (10.8)	4,020 (18.1)	600 (2.7)	1,005 (4.5)	3,780 (17.0)	4,020 (18.1)	945 (4.3)	1,005 (4.5)
5/8 (15.9)	5/8 (15.9)	30-40	3,740 (16.8)	6,420 (28.9)	935 (4.2)	1,605 (7.2)	4,640 (20.9)	6,420 (28.9)	1,160 (5.2)	1,605 (7.2)
3/4 (19.1)	3/4 (19.1)	45-60	3,740 (16.8)	10,440 (47.0)	935 (4.2)	2,610 (11.7)	4,640 (20.9)	10,440 (47.0)	1,160 (5.2)	2,610 (11.7)

1. The values listed above are ultimate and allowable load capacities for anchors in sand-lightweight concrete.
2. Allowable load capacities are calculated using an applied safety factor of 4.0.
3. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.

Ultimate and Allowable Load Capacities for Carbon and Stainless Steel Lok-Bolt Installed Through Metal Deck into Structural Lightweight Concrete[1,2,3,4]

Anchor Dia. d in. (mm)	Min. Embed. Depth h_v in. (mm)	Maximum Tightening Torque T_{max} ft.-lbs.	Lightweight Concrete Over Minimum 20 Ga. Metal Deck $f'_c \geq$ 3,000 (20.7 MPa)							
			Minimum 1-1/2" Wide Deck				Minimum 4-1/2" Wide Deck			
			Ultimate Load		Allowable Load		Ultimate Load		Allowable Load	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	2-3	1,080 (4.9)	1,920 (8.6)	270 (1.2)	480 (2.2)	1,080 (4.9)	1,920 (8.6)	270 (1.2)	480 (2.2)
5/16 (7.9)	1 1/2 (38.1)	5-6	1,080 (4.9)	1,920 (8.6)	270 (1.2)	480 (2.2)	1,080 (4.9)	1,920 (8.6)	270 (1.2)	480 (2.2)
3/8 (9.5)	2 (50.8)	8-11	1,080 (4.9)	2,480 (11.2)	270 (1.2)	620 (2.8)	1,080 (4.9)	1,920 (8.6)	270 (1.2)	480 (2.2)
1/2 (12.7)	2 1/2 (63.5)	15-20	1,940 (8.7)	2,480 (11.2)	485 (2.2)	620 (2.8)	2,840 (12.8)	4,640 (20.9)	710 (3.2)	1,160 (5.2)
5/8 (15.9)	2 3/4 (69.9)	30-40	–	–	–	–	2,840 (12.8)	4,640 (20.9)	710 (3.2)	1,160 (5.2)
3/4 (19.1)	3 (76.2)	45-60	–	–	–	–	4,440 (20.0)	9,060 (40.8)	1,110 (5.0)	2,265 (10.2)

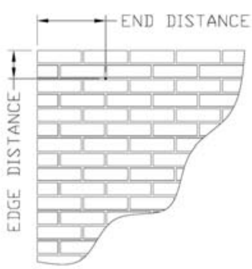
1. The values listed above are ultimate and allowable load capacities for anchors in sand-lightweight concrete over metal deck.
2. Allowable loads capacities are calculated using an applied safety factor of 4.0.
3. Tabulated load values are for anchors installed in the center of the flute. Spacing distances shall be in accordance with the spacing lightweight concrete table listed in the Design Criteria section.
4. Anchors are permitted to be installed in the lower or upper flute of the metal deck provided the proper installed procedures are maintained.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Lok-Bolt in Hollow or Solid Concrete Masonry[1,2,3,4,5]

Anchor Dia. d in. (mm)	Min. Embed. Depth h_v in. (mm)	Maximum Tightening Torque T_{max} ft.-lbs.	Min. Edge Dist. in. (mm)	Min. End Dist. in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
					Ultimate Load		Allowable Load	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	1-3	3 3/4 (95.3)	3 3/4 (95.3)	230 (1.0)	1,000 (4.5)	45 (0.2)	200 (0.9)
	1 1/8 (28.6)	1-3	3 3/4 (95.3)	8 (203.2)	1,200 (5.4)	1,270 (5.7)	240 (1.1)	255 (1.1)
5/16 (7.9)	1 1/2 (38.1)	4-6	3 3/4 (95.3)	8 (203.2)	1,430 (6.4)	1,970 (8.9)	285 (1.3)	395 (1.8)
3/8 (9.5)	1 1/2 (38.1)	8-11	12 (304.8)	12 (304.8)	1,700 (7.7)	2,180 (9.8)	340 (1.5)	435 (2.0)
1/2 (12.7)	1 1/2 (38.1)	16-20	12 (304.8)	12 (304.8)	2,460 (11.1)	2,840 (12.8)	490 (2.2)	570 (2.6)

1. Tabulated load values are for carbon and stainless steel anchors installed in minimum 6-inch wide, Grade N, Type II, medium and normal-weight concrete masonry units. Mortar must be minimum Type N. Masonry prism compressive strength must be 1,500 psi minimum at the time of installation.
2. Allowable loads are for carbon and stainless steel anchors and are based on average ultimate values using a safety factor of 5.0.
3. Linear interpolation may be used for allowable loads for intermediate embedment depths.
4. The tabulated values are for anchors installed at a minimum of 12 anchor diameters on center for 100 percent capacity. Spacing distances may be reduced to 6 anchor diameters on center provided the capacities are reduced by 50 percent. Linear interpolation may be used for intermediate spacings.
5. Anchors with diameters of 1/2" and larger installed in hollow concrete masonry units are limited to one anchor per unit cell.



Ultimate and Allowable Load Capacities for Lok-Bolt in Hollow or Solid Clay Brick Masonry[1,2,3]

Anchor Dia. d in. (mm)	Min. Embed. Depth h_v in. (mm)	Maximum Tightening Torque T_{max} ft.-lbs.	Min. Edge Dist. in. (mm)	Min. End Dist. in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
					Ultimate Load		Allowable Load	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	1-3	4 (101.6)	4 (101.6)	800 (3.6)	1,120 (5.0)	160 (0.7)	225 (1.0)
	1 1/8 (28.6)	1-3			950 (4.3)	1,120 (5.0)	190 (0.9)	225 (1.0)
5/16 (7.9)	1 1/2 (38.1)	4-6			1,230 (5.5)	1,120 (5.0)	245 (1.1)	225 (1.0)
3/8 (9.5)	1 1/2 (38.1)	8-11	8 (203.2)	8 (203.2)	1,860 (8.4)	1,260 (5.7)	370 (1.7)	250 (1.1)
1/2 (12.7)	1 1/2 (38.1)	16-20			3,520 (15.8)	4,010 (18.0)	705 (3.2)	800 (3.6)

1. Tabulated load values are for carbon and stainless steel anchors installed in Grade SW multiple wythe, solid brick masonry conforming to ASTM C62.
2. Allowable loads are calculated using an applied safety factor of 5.0.
3. The tabulated values are for anchors installed at a minimum of 12 anchor diameters on center for 100 percent capacity. Spacing distances may be reduced to 6 anchor diameters on center provided the capacities are reduces by 50 percent. Linear interpolation may be used for intermediate spacings.

DESIGN CRITERIA

Combined Loading

For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n}\right)^{\frac{5}{3}} + \left(\frac{V_u}{V_n}\right)^{\frac{5}{3}} \leq 1 \quad \text{OR} \quad \left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

Load Adjustment Factors for Spacing and Edge Distances

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	**Load Type**	**Critical Distance (Full Anchor Capacity)**	**Critical Load Factor**	**Minimum Distance (Reduced Capacity)**	**Minimum Load Factor**
Spacing (s)	Tension and Shear	$s_{cr} = 3.0h_v$	$F_N = F_V = 1.0$	$s_{min} = 1.5h_v$	$F_N = F_V = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_N = 1.0$	$c_{min} = 5d$	$F_N = 0.70$
	Shear	$c_{cr} = 12d$	$F_V = 1.0$	$c_{min} = 5d$	$F_V = 0.45$

Anchor Installed in Lightweight Concrete					
Anchor Dimension	**Load Type**	**Critical Distance (Full Anchor Capacity)**	**Critical Load Factor**	**Minimum Distance (Reduced Capacity)**	**Minimum Load Factor**
Spacing (s)	Tension and Shear	$s_{cr} = 3.0h_v$	$F_N = F_V = 1.0$	$s_{min} = 1.5h_v$	$F_N = F_V = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_N = 1.0$	$c_{min} = 5d$	$F_N = 0.85$
	Shear	$c_{cr} = 12d$	$F_V = 1.0$	$c_{min} = 5d$	$F_V = 0.40$

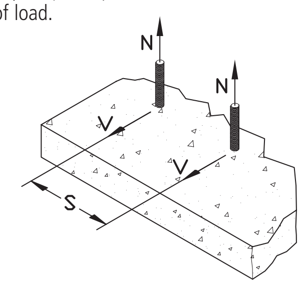
DESIGN CRITERIA

Load Adjustment Factors for Normal-Weight Concrete

Spacing, Tension (F_N) & Shear (F_V)							
Dia. (in.)		1/4	5/16	3/8	1/2	5/8	3/4
h_v (in.))		1 1/4	1 1/2	2	2 1/2	2 3/4	3
s_{cr} (in.)		3 3/4	4 1/2	6	7 1/2	8 1/4	9
s_{min} (in.)		1 7/8	2 1/4	3	3 3/4	4 1/8	4 1/2
Spacing, *s* (inches)	1 7/8	0.50					
	2 1/4	0.56	0.50				
	3	0.80	0.67	0.50			
	3 3/4	1.00	0.83	0.63	0.50		
	4		0.89	0.67	0.53		
	4 1/8		0.92	0.69	0.55	0.50	
	4 1/2		1.00	0.75	0.60	0.55	0.50
	6			1.00	0.80	0.73	0.67
	7 1/2				1.00	0.91	0.83
	8 1/4					1.00	0.92
	9						1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 3 embedment depths ($3h_V$) at which the anchor achieves 100% of load.

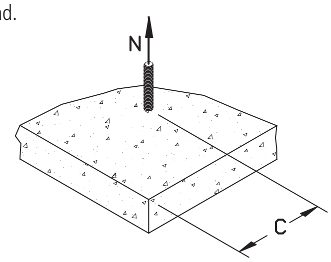
Minimum spacing (s_{min}) is equal to 1.5 embedment depths ($1.5h_v$) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_N)							
Dia. (in.)		1/4	5/16	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	3 3/4	4 1/2	6	7 1/2	9
c_{min} (in.)		1 1/4	1 5/8	1 7/8	2 1/2	3 1/8	3 3/4
Edge Distance, *c* (inches)	1 1/4	0.70					
	1 5/8	0.76	0.70				
	1 7/8	0.81	0.74	0.70			
	2 1/2	0.91	0.83	0.77	0.70		
	3	1.00	0.90	0.83	0.74		
	3 1/8		0.91	0.84	0.75	0.70	
	3 3/4		1.00	0.91	0.81	0.74	0.70
	4 1/2			1.00	0.87	0.79	0.74
	6				1.00	0.90	0.81
	7 1/2					1.00	0.84
	9						1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 12 anchor diameters ($12d$) at which the anchor achieves 100% of load.

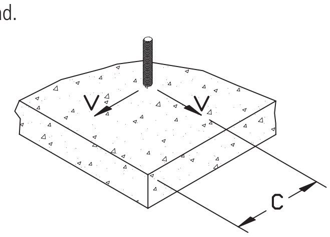
Minimum edge distance (c_{min}) is equal to 5 anchor diameters ($5d$) at which the anchor achieves 70% of load.



Edge Distance, Shear (F_V)							
Dia. (in.)		1/4	5/16	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	3 3/4	4 1/2	6	7 1/2	9
c_{min} (in.)		1 1/4	1 5/8	1 7/8	2 1/2	3 1/8	3 3/4
Edge Distance, *c* (inches)	1 1/4	0.45					
	1 5/8	0.57	0.45				
	1 7/8	0.65	0.53	0.45			
	2 1/2	0.84	0.69	0.58	0.45		
	3	1.00	0.81	0.69	0.53		
	3 1/8		0.84	0.71	0.55	0.45	
	3 3/4		1.00	0.84	0.65	0.53	0.45
	4 1/2			1.00	0.76	0.62	0.53
	6				1.00	0.81	0.69
	7 1/2					1.00	0.84
	9						1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters ($12d$) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 5 anchor diameters ($5d$) at which the anchor achieves 45% of load.



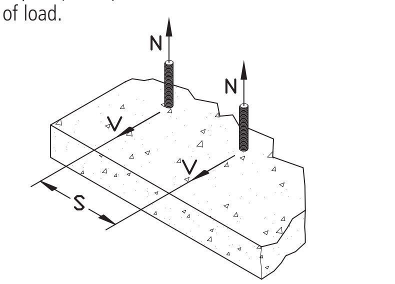
DESIGN CRITERIA

Load Adjustment Factors for Lightweight Concrete

Spacing, Tension (F_N) & Shear (F_V)							
Dia. (in.)		1/4	5/16	3/8	1/2	5/8	3/4
h_v (in.)		1 1/4	1 1/2	2	2 1/2	2 3/4	3
s_{cr} (in.)		3 3/4	4 1/2	6	7 1/2	8 1/4	9
s_{min} (in.)		1 7/8	2 1/4	3	3 3/4	4 1/8	4 1/2
Spacing, *s* (inches)	1 7/8	0.50					
	2 1/4	0.56	0.50				
	3	0.80	0.67	0.50			
	3 3/4	1.00	0.83	0.63	0.50		
	4		0.89	0.67	0.53		
	4 1/8		0.92	0.69	0.55	0.50	
	4 1/2		1.00	0.75	0.60	0.55	0.50
	6			1.00	0.80	0.73	0.67
	7 1/2				1.00	0.91	0.83
	8 1/4					1.00	0.92
	9						1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 3 embedment depths ($3h_V$) at which the anchor achieves 100% of load.

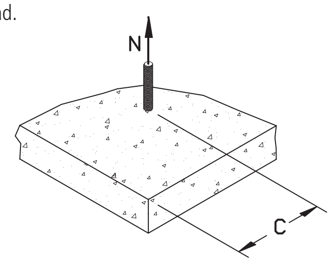
Minimum spacing (s_{min}) is equal to 1.5 embedment depths ($1.5h_V$) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_N)							
Dia. (in.)		1/4	5/16	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	3 3/4	4 1/2	6	7 1/2	9
c_{min} (in.)		1 1/4	1 5/8	1 7/8	2 1/2	3 1/8	3 3/4
Edge Distance, *c* (inches)	1 1/4	0.85					
	1 5/8	0.88	0.85				
	1 7/8	0.90	0.87	0.85			
	2 1/2	0.96	0.91	0.89	0.85		
	3	1.00	0.95	0.91	0.87		
	3 1/8		0.96	0.92	0.88	0.85	
	3 3/4		1.00	0.96	0.90	0.87	0.85
	4 1/2			1.00	0.94	0.90	0.87
	6				1.00	0.95	0.91
	7 1/2					1.00	0.92
	9						1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 12 anchor diameters ($12d$) at which the anchor achieves 100% of load.

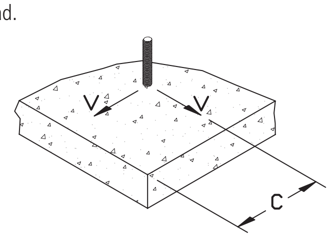
Minimum edge distance (c_{min}) is equal to 5 anchor diameters ($5d$) at which the anchor achieves 85% of load.



Edge Distance, Shear (F_V)							
Dia. (in.)		1/4	5/16	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	3 3/4	4 1/2	6	7 1/2	9
c_{min} (in.)		1 1/4	1 5/8	1 7/8	2 1/2	3 1/8	3 3/4
Edge Distance, *c* (inches)	1 1/4	0.40					
	1 5/8	0.53	0.40				
	1 7/8	0.61	0.49	0.40			
	2 1/2	0.83	0.66	0.54	0.40		
	3	1.00	0.79	0.66	0.49		
	3 1/8		0.83	0.69	0.51	0.40	
	3 3/4		1.00	0.83	0.61	0.49	0.40
	4 1/2			1.00	0.74	0.59	0.49
	6				1.00	0.79	0.66
	7 1/2					1.00	0.83
	9						1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters ($12d$) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 5 anchor diameters ($5d$) at which the anchor achieves 40% of load.



ORDERING INFORMATION

Hex Nut Lok-Bolt

Catalog Number Carbon	Catalog Number Stainless	Size	Bolt Length	Drill Diameter	Minimum Embed.	Standard Box	Standard Carton	Wt./ 100
5005	–	5/16" x 1-1/2"	1 13/16"	5/16"	1 3/8"	100	1,000	4 1/4
5010	–	5/16" x 2 1/2"	2 11/16"	5/16"	1 1/2"	100	500	5 3/4
5015	6152	3/8" x 1 7/8"	2 3/16"	3/8"	1 5/8"	50	500	7
5020	6153	3/8" x 3"	3 5/16"	3/8"	1 5/8"	50	500	10
5022	–	3/8" x 4"	4 5/16"	3/8"	1 5/8"	50	500	16
5025	6156	1/2" x 2 1/4"	2 7/8"	1/2"	2 1/8"	25	250	14
5030	6157	1/2" x 3"	3 3/8"	1/2"	2 1/4"	25	250	17 1/4
5034	6160	1/2" x 4"	4 3/8"	1/2"	2 1/4"	25	125	22
5033	–	1/2" x 5 1/4"	6 1/8"	1/2"	2 1/4"	25	125	27
5032	–	1/2" x 6"	6 3/4"	1/2"	2 1/4"	10	100	35
5035	–	5/8" x 2 1/4"	3 3/16"	5/8"	2 1/8"	25	125	25 1/2
5038	–	5/8" x 3"	3 3/4"	5/8"	2 3/4"	25	125	34
5040	6164	5/8" x 4 1/4"	5"	5/8"	2 3/4"	10	100	41
5045	–	5/8" x 6"	6 1/4"	5/8"	2 3/4"	10	100	49
5050	–	3/4" x 2 1/2"	3 5/8"	3/4"	2 1/8"	10	100	46
5055	6168	3/4" x 4"	5 1/8"	3/4"	3 3/8"	10	40	70
5060	–	3/4" x 5 3/4"	7 1/8"	3/4"	3 3/8"	10	30	90
5065	–	3/4" x 7 1/2"	9"	3/4"	3 3/8"	10	30	115

The published minimum length is measured from below the washer to the end of the anchor. Actual anchor lengths may be slightly longer.

Acorn Nut Lok-Bolt

Catalog Number Carbon	Catalog Number Stainless	Size	Bolt Length	Drill Diameter	Minimum Embed.	Standard Box	Standard Carton	Wt./ 100
*5125	–	1/4" x 5/8"	1 1/32"	1/4"	1/2"	100	1,000	2
5150	6150	1/4" x 1 3/8"	1 21/32"	1/4"	1 1/8"	100	1,000	2 3/4
5175	–	1/4" x 2 1/4"	2 9/16"	1/4"	1 1/8"	100	1,000	3 1/4

The published minimum length is measured from below the washer to the end of the anchor. Actual anchor lengths may be slightly longer.
*This size does not have a compression ring.

Round Head Lok-Bolt, Slotted

Catalog Number Carbon	Catalog Number Stainless	Size	Drill Diameter	Minimum Embed.	Standard Box	Standard Carton	Wt./ 100
*5205	–	1/4" x 1 1/8"	5/16"	1 3/8"	100	1,000	4 1/4
5210	6180	1/4" x 2"	5/16"	1 1/2"	100	500	5 3/4
5215	–	1/4" x 2 3/4"	3/8"	1 5/8"	50	500	7
5225	–	5/16" x 2 3/8"	3/8"	1 5/8"	50	500	16
5230	–	5/16" x 3 3/8"	1/2"	2 1/8"	25	250	14
5235	–	3/8" x 2 1/2"	1/2"	2 1/4"	25	250	17 1/4
5240	–	3/8" x 3 3/4"	1/2"	2 1/4"	25	125	22

The published length is measured from below the head to the end of the anchor.
*This size does not have a compression ring.

ORDERING INFORMATION

Combo Flat Head Lok-Bolt

Catalog Number							
Carbon	Stainless	Size	Drill Diameter	Minimum Embed.	Standard Box	Standard Carton	Wt./ 100
5305	–	1/4" x 1 1/8"	1/4"	1"	100	1,000	2
5310	6170	1/4" x 2"	1/4"	1 1/8"	100	1,000	2 3/4
5315	6172	1/4" x 3"	1/4"	1 1/8"	100	1,000	3 3/4
5320	–	1/4" x 4"	1/4"	1 1/8"	100	500	4 1/2
5325	–	1/4" x 5 1/4"	1/4"	1 1/8"	100	500	6 1/2
5330	–	5/16" x 2 1/2"	5/16"	1 1/2"	100	1,000	4 1/2
5340	–	3/8" x 2 3/4"	3/8"	1 5/8"	50	500	7 1/2
5345	6174	3/8" x 4"	3/8"	1 5/8"	50	250	10 3/4
5350	6175	3/8" x 5"	3/8"	1 5/8"	50	250	14
5360	6176	3/8" x 6"	3/8"	1 5/8"	50	250	16

The published length is the minimum overall length of the anchor. Combo Flat Head Lok-Bolts do not have a compression ring.

Threshold Flat Head Lok-Bolt, Slotted

Catalog Number							
Carbon	Stainless	Size	Drill Diameter	Minimum Embed.	Standard Box	Standard Carton	Wt./ 100
5500	–	1/4" x 2"	1/4"	1 1/8"	100	1,000	2 1/2

The published length is the minimum overall length of the anchor. Threshold Flat Head Lok-Bolts do not have a compression ring.

Rod Hanger Lok-Bolt

Catalog Number							
Carbon	Stainless	Size	Drill Diameter	Minimum Embed.	Standard Box	Standard Carton	Wt./ 100
5810	–	1/4" x 1 1/2"	5/16"	1 1/2"	50	250	5 1/2
5815	–	3/8" x 1 7/8"	3/8"	1 5/8"	50	250	9
5825	–	1/2" x 2 1/4"	1/2"	2 1/4"	25	125	21

The published length is measured from below the washer to the end of the anchor.
Rod Hanger Lok-Bolts do not have a compression ring.

Tie-Wire Lok-Bolt

Catalog Number							
Carbon	Stainless	Size	Drill Diameter	Minimum Embed.	Standard Box	Standard Carton	Wt./ 100
5700	–	5/16" x 1 1/2"	5/16"	1 1/2"	100	1,000	5 1/4

The published length is measured from below the head to the end of the anchor.

Lok-Bolt Multiple Use Kit

Catalog Number							
Carbon	Stainless	Size	Drill Diameter	Minimum Embed.	Standard Box	Standard Carton	Wt./ 100
5660	–	1/2"	1/2"	2 1/4"	25	250	10

Multiple use kits contain expansion sleeves, expansion cones, nuts, and washers for use with 3/8" diameter rod.

Lok-Bolt Extenders

Catalog Number							
Carbon	Stainless	Size	Drill Diameter	Minimum Embed.	Standard Box	Standard Carton	Wt./ 100
5680	5687	1/4" x 1"	1/4"	1 1/8"	100	1,000	3
5681	–	5/16" x 1 1/8"	5/16"	1 1/2"	100	1,000	3
5684	5689	3/8" x 1"	3/8"	1 5/8"	50	500	3
5685	5690	1/2" x 1 3/8"	1/2"	2 1/4"	25	125	3

Extenders are used for added length on all head styles.

Set-Bolt™ *Displacement-Controlled Expansion Anchor*

PRODUCT DESCRIPTION

The Set-Bolt is a one piece, stud style anchor with an external bottom-bearing expansion plug. It is available in carbon steel for use in concrete, stone and solid masonry units.

The design of the Set-Bolt provides an anchor which is ideal for applications in which it is desirable to minimize the clamping force on a fixture. The nut may be placed on finger tight if required to prevent damage to light duty fixtures such as aluminum extrusions or stone facades. Jacking or leveling equipment can easily be accomplished with the Set-Bolt.

GENERAL APPLICATIONS AND USES

- Structural Anchorage
- Column Base Plates
- Cable Trays and Strut
- Mechanical Equipment
- Fire Sprinkler
- Suspended Lighting

FEATURES AND BENEFITS

- Fast installation with force-controlled setting mechanism
- No torque wrench required

APPROVALS AND LISTINGS

Factory Mutual Research Corporation (FM Approvals) – J.I OK4A9.AH

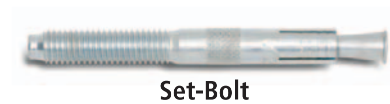
Federal GSA Specification – Meets the proof load requirements of FF-S-325C, Group VIII, Type 2, (superseded) and CID A-A-55614, Type 2.

Various North American Departments of Transportation (DOT) – See www.powers.com, including CalTrans listing for "Stud Mechanical Expansion Anchors"

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring* and *05090-Metal Fastenings.*
Expansion Anchors shall be Set-Bolt as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS Page No.



Set-Bolt

ANCHOR MATERIALS

Carbon Steel

ANCHOR SIZE RANGE (TYP.)

1/4" diameter x 1-3/4" length to
1/2" diameter x 5-1/4" length

SUITABLE BASE MATERIALS

Normal-Weight Concrete

INSTALLATION AND MATERIAL SPECIFICATIONS

Installation Specification

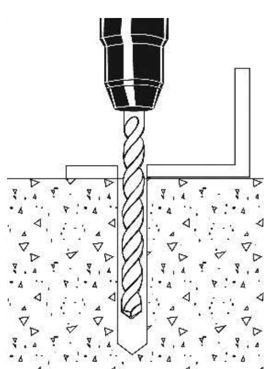
Dimension	Anchor Size, *d* 1/4"	3/8"	1/2"
ANSI Drill Bit Size, d_{bit} (in.)	1/4	3/8	1/2
Max. Tightening Torque, T_{max} (ft.-lbs)	5-7	15-20	22-30
Fixture Clearance Hole, d_h (in.)	5/16	7/16	9/16
Thread Size (UNC)	1/4-20	3/8-16	1/2-13

Material Specification

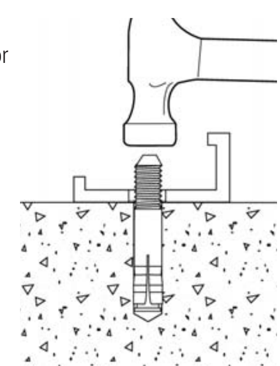
Anchor Component	Component Material
Anchor Body	AISI 12L14
Cone	AISI 12L14
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn 5)

Installation Guidelines

Drill a hole into the base material to a depth that equals the embedment required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15. Do not over drill the hole. Blow the hole clean of dust and other material.



Insert the anchor through the fixture into the hole. Set the anchor by driving the anchor body over the plug. Be sure the anchor is driven to the required embedment depth. A nut and washer (supplied separately) is applied to secure the fixture.



PERFORMANCE DATA

Ultimate Load Capacities for Set-Bolt Installed in Normal-Weight Concrete[1,2]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 3/8 (34.9)	1,150 (5.2)	1,780 (8.0)	1,935 (8.7)	2,070 (9.3)	2,320 (10.4)	2,070 (9.3)
3/8 (9.5)	1 5/8 (41.3)	2,605 (11.7)	3,705 (16.7)	3,600 (16.2)	4,185 (18.8)	3,850 (17.3)	4,185 (18.8)
1/2 (12.7)	1 7/8 (47.6)	3,595 (16.2)	5,140 (23.1)	5,000 (22.5)	6,000 (27.0)	5,265 (23.7)	6,000 (27.0)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.

Allowable Load Capacities for Set-Bolt Installed in Normal-Weight Concrete[1,2]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 3/8 (34.9)	290 (1.3)	445 (2.0)	485 (2.2)	520 (2.3)	580 (2.6)	520 (2.3)
3/8 (9.5)	1 5/8 (41.3)	650 (2.9)	925 (4.2)	900 (4.0)	1,045 (4.7)	965 (4.3)	1,045 (4.7)
1/2 (12.7)	1 7/8 (47.6)	900 (4.0)	1,285 (5.8)	1,250 (5.6)	1,500 (6.8)	1,315 (5.9)	1,500 (6.8)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.

DESIGN CRITERIA

Combined Loading

For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

Load Adjustment Factors for Spacing and Edge Distances

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	**Load Type**	**Critical Distance (Full Anchor Capacity)**	**Critical Load Factor**	**Minimum Distance (Reduced Capacity)**	**Minimum Load Factor**
Spacing (s)	Tension and Shear	$s_{cr} = 10d$	$F_N = F_V = 1.0$	$s_{min} = 5d$	$F_N = F_V = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_N = 1.0$	$c_{min} = 5d$	$F_N = 0.80$
	Shear	$c_{cr} = 12d$	$F_V = 1.0$	$c_{min} = 5d$	$F_V = 0.50$

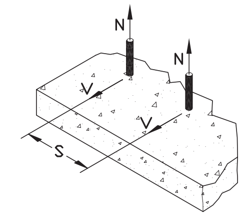
DESIGN CRITERIA

Load Adjustment Factors for Normal-Weight and Lightweight Concrete

Spacing, Tension (F_N) & Shear (F_V)				
Dia. (in.)		1/4	3/8	1/2
s_{cr} (in.)		2 1/2	3 3/4	5
s_{min} (in.)		1 1/4	1 7/8	2 1/2
Spacing, *s* (inches)	1 1/4	0.50		
	1 1/2	0.60		
	1 7/8	0.75	0.50	
	2	0.80	0.53	
	2 1/2	1.00	0.67	0.50
	3		0.80	0.60
	3 1/2		0.93	0.70
	3 3/4		1.00	0.75
	4			0.80
	5			1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 10 anchor diameters (10*d*) at which the anchor achieves 100% of load.

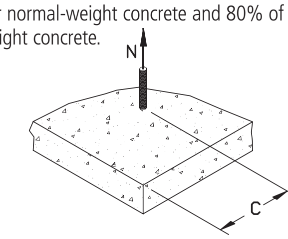
Minimum spacing (s_{min}) is equal to 5 anchor diameters (5*d*) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_N)				
Dia. (in.)		1/4	3/8	1/2
c_{cr} (in.)		3	4 1/2	6
c_{min} (in.)		1 1/4	1 7/8	2 1/2
Edge Distance, *c* (inches)	1 1/4	0.80		
	1 7/8	0.87	0.80	
	2	0.89	0.81	
	2 1/2	0.94	0.85	0.80
	3	1.00	0.89	0.83
	3 3/4		0.94	0.87
	4		0.96	0.89
	4 1/2		1.00	0.91
	5			0.94
	6			1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12*d*) at which the anchor achieves 100% of load.

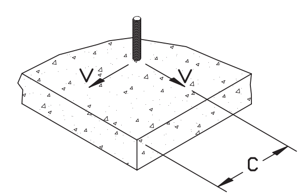
Minimum edge distance (c_{min}) is equal to 5 anchor diameters (5*d*) at which the anchor achieves 80% of load for normal-weight concrete and 80% of load for lightweight concrete.



Edge Distance, Shear (F_V)				
Dia. (in.)		1/4	3/8	1/2
c_{cr} (in.)		3	4 1/2	6
c_{min} (in.)		1 1/4	1 7/8	2 1/2
Edge Distance, *c* (inches)	1 1/4	0.50		
	1 7/8	0.68	0.50	
	2	0.71	0.52	
	2 1/2	0.86	0.62	0.50
	3	1.00	0.71	0.57
	3 3/4		0.86	0.68
	4		0.90	0.71
	4 1/2		1.00	0.79
	5			0.86
	6			1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12*d*) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 5 anchor diameters (5*d*) at which the anchor achieves 50% of load.



ORDERING INFORMATION

Set-Bolt

Cat. No.	Size	Min. Embed.	Thread Length	Std. Box	Std. Carton	Wt./100
7101	1/4" x 1 3/4"	1 3/8"	5/8"	100	1,000	2 1/4
7103	1/4" x 2 1/4"	1 3/8"	7/8"	100	500	2 3/4
7107	1/4" x 3 1/4"	1 3/8"	1"	100	500	4 1/4
7123	3/8" x 2 1/4"	1 5/8"	5/8"	50	250	6 1/2
7126	3/8" x 3"	1 5/8"	1 3/8"	50	250	8 1/2
7129	3/8" x 3 3/4"	1 5/8"	1 3/8"	50	250	11
7134*	3/8" x 6"	1 5/8"	2 1/2"	50	50	16 1/2
7145	1/2" x 2 3/4"	1 7/8"	7/8"	50	250	14
7151	1/2" x 4 1/4"	1 7/8"	1 7/8"	25	125	24
7153	1/2" x 5 1/4"	1 7/8"	2"	25	25	28

*Discontinued item once current stock is depleted.

MECHANICAL ANCHORS

Wedge-Bolt® *Screw Anchor*

PRODUCT DESCRIPTION

The Wedge-Bolt anchor is a one piece, heavy duty screw anchor with a finished hex head. It is easy to identify, fully removable and vibration resistant. The Wedge-Bolt has many unique features and benefits that make it well suited for many applications in a variety of base materials. Optimum performance is obtained using a combination of patented design concepts. The steel threads along the anchor body self tap into the hole during installation and provide positive keyed engagement.

The benefit to the designer is higher load capacities, while the benefit to the user is ease of installation. The Wedge-Bolt can be easily installed with either a powered impact wrench or conventional hand socket.

Wedge-Bolt – Wedge-Bolt screw anchors are designed to be used with a matched tolerance Wedge-Bit™ for optimum performance. The Wedge-Bolt works in fixture clearance holes that are 1/16" over nominal, which is typical of standard fixture holes used in steel fabrication.

Wedge-Bolt OT – The Wedge-Bolt OT is specifically engineered for use in fixture clearance holes sized a minimum of 1/8" over nominal. The Wedge-Bolt OT must be installed with an ANSI rotary drill bit.

GENERAL APPLICATIONS AND USES

- Racking and Shelving
- Support Ledgers
- Fencing
- Maintenance
- Repairs
- Material Handling
- Structural Anchorage
- Masonry Applications
- Food and Beverage Facilities
- Retrofits

FEATURES AND BENEFITS

- One-piece design eliminates possibility of lost anchor parts or improper assembly
- Tested in accordance with ASTM E488 and AC106 criteria
- Qualified for seismic and wind loads
- Wedge-Bolt anchor will fit standard fixture hole dimensions in fabricated steel
- Can be installed with an impact wrench or conventional hand socket
- Fast installation and immediate loading minimizes downtime
- High load capacities and full grip along thread length
- Diameter and length ID stamped on head of each hex head anchor for easy inspection
- Finished hex head provides attractive appearance and eliminates tripping hazard
- No expansion forces transferred to the base material
- Can be installed closer to the edge than traditional expansion anchors
- Versatile installation in concrete, block and brick masonry
- Ratchet teeth on underside of hex washer head lock against the fixture
- Removable and will not leave components in the hole

APPROVALS AND LISTINGS

International Code Council, Evaluation Service (ICC-ES) ESR-1678
(formerly listed in ER-5788)
Southern Building Code Conference International (SBCCI) #2124
City of Los Angeles (COLA) Research Report LARR-25415
Florida Building Code Approval – FL2209.10
Miami-Dade County Notice of Acceptance (NOA) 00-0229.04
Federal GSA Specification – Meets the proof load requirements of FF-S-325C, Group II, Type 4, Class 1 (superseded) and CID A-A1923A, Type 4
Various North American Departments of Transportation (DOT) – See www.powers.com

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring, 04081-Masonry Anchorage* and *05090-Metal Fastenings.* Screw Anchors shall be Wedge-Bolt or Wedge-Bolt OT anchors as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS Page No.

Carbon Steel Wedge-Bolt

410 Stainless Steel Wedge-Bolt

Carbon Steel
Wedge-Bolt OT (ANSI)

HEAD STYLES

Hex Head

ANCHOR MATERIALS

Zinc Plated Carbon Steel
Mechanically Galvanized Carbon Steel
Type 410 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

1/4" diameter x 1 1/4" length to
5/8" x 14" and
3/4" diameter x 8" lengths

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Structural Lightweight Concrete
Grouted Concrete Masonry
Brick Masonry

INSTALLATION SPECIFICATIONS

Carbon Steel Wedge-Bolt

Dimension	Nominal Anchor Diameter, *d*				
	1/4"	**3/8"**	**1/2"**	**5/8"**	**3/4"**
Wedge-Bit Size, d_{bit} (in.)	1/4	3/8	1/2	5/8	3/4
Wedge-Bit Size Range (in.)	0.255-0.259	0.385-0.389	0.490-0.495	0.600-0.605	0.720-0.725
Fixture Clearance Hole, d_h (in.)	5/16	7/16	9/16	11/16	13/16
Head Washer Height (in.)	7/32	21/64	7/16	1/2	19/32
Washer O.D., d_w (in.)	9/16	47/64	1	1 3/16	1 13/32
Wrench Size (in.)	7/16	9/16	3/4	15/16	1 1/8

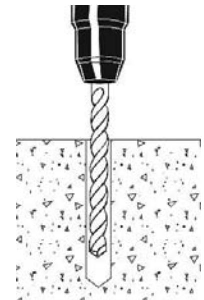
410 Stainless Steel Wedge-Bolt

Dimension	Nominal Anchor Diameter, *d*				
	1/4"	**3/8"**	**1/2"**	**5/8"**	**3/4"**
Wedge-Bit Size, d_{bit} (in.)	1/4	3/8	1/2	5/8	3/4
Wedge-Bit Size Range (in.)	0.255-0.259	0.385-0.389	0.490-0.495	0.600-0.605	0.720-0.725
Fixture Clearance Hole, d_h (in.)	5/16	7/16	9/16	11/16	13/16
Head Washer Height (in.)	7/32	21/64	7/16	1/2	19/32
Washer O.D., d_w (in.)	9/16	47/64	1	1 3/16	1 13/32
Wrench Size (in.)	7/16	9/16	3/4	15/16	1 1/8

Carbon Steel Wedge-Bolt OT (Orange Tip)

Dimension	Nominal Anchor Diameter, *d*			
	1/4"	**3/8"**	**1/2"**	**5/8"**
ANSI Drill Bit Size, d_{bit} (in.)	1/4	3/8	1/2	5/8
ANSI Drill Bit Size Range (in.)	0.260-0.268	0.390-0.398	0.520-0.530	0.650-0.660
Fixture Clearance Hole, d_h (in.)	3/8	1/2	5/8	3/4
Head Washer Height (in.)	7/32	21/64	7/16	1/2
Washer O.D., d_w (in.)	9/16	47/64	1	1 3/16
Wrench Size (in.)	7/16	9/16	3/4	15/16

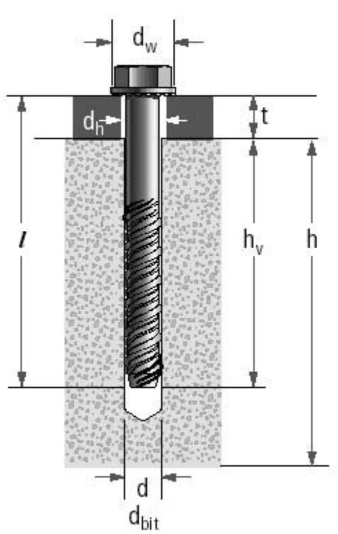
Installation Procedure



Select the proper diameter Wedge-Bit for Wedge-Bolt and 410 Stainless Steel Wedge-Bolt installations ***or*** proper diameter ANSI drill bit for Wedge-Bolt OT installations. ANSI drill bits should meet the requirements of ANSI Standard B212.15. Using the proper drill bit, drill a hole into the base material to a depth of at least 1/2" or one anchor diameter deeper than the embedment required.

Insert the anchor through the fixture into the anchor hole. Begin tightening the anchor by rotating clockwise and applying pressure in toward the base material. A powered impact wrench may also be used. This will engage the first few threads as the anchor begins to advance.

Continue tightening the anchor until the head is firmly seated against the fixture while achieving the required embedment depth.



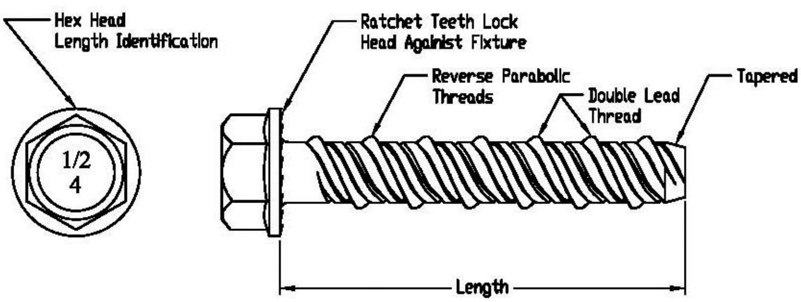
Nomenclature

d = Diameter of anchor
d_{bit} = Diameter of drill bit
d_h = Diameter of fixture clearance hole
d_w = Diameter of washer
h = Base material thickness. The minimum value of *h* should be 1.5h_v
h_v = Minimum embedment depth
l = Overall length of anchor
t = Fixture thickness

INSTALLATION SPECIFICATIONS

Maximum Clamping Torque (ft.-lbs.)

Base Material	Anchor Diameter				
	1/4"	3/8"	1/2"	5/8"	3/4"
2,000 psi Concrete	5	30	45	75	150
4,000 psi Concrete	10	40	60	95	200
6,000 psi Concrete	10	40	60	95	200
3,000 psi Lightweight Concrete	10	15	40	60	70
Grout Filled Block	10	15	40	60	70
Solid Red Brick	10	30	45	75	100



WEDGE-BOLT AND WEDGE-BOLT OT

MATERIAL SPECIFICATIONS

Carbon Steel Wedge-Bolt and Wedge-Bolt OT

Anchor Component	Component Material
Anchor Body	Case Hardened AISI 1020 / 1040 or 10B21 Carbon Steel
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn 5) ASTM B695, Class 65, Type I (Mechanically galvanized Wedge-Bolts are available on request)

410 Stainless Steel Wedge-Bolt

Anchor Component	Component Material
Anchor Body	Type 410 Stainless Steel
Coating	Class 4 Sealcoat (Passivated)

PERFORMANCE DATA

Ultimate Load Capacities for Wedge-Bolt and Wedge-Bolt OT installed in Normal-Weight Concrete at Critical Spacing and Edge Distances[1,2,3,4]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		4,000 psi (27.6 MPa)		6,000 psi (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 (25.4)	720 (3.2)	1,040 (4.7)	1,340 (6.0)	2,080 (9.4)	1,660 (7.5)	2,400 (10.8)
	1 1/2 (38.1)	1,440 (6.5)	2,200 (9.9)	2,140 (9.6)	2,200 (9.9)	2,480 (11.2)	2,500 (11.3)
	2 (50.8)	2,400 (10.8)	2,200 (9.9)	3,940 (17.7)	2,200 (9.9)	4,980 (22.4)	2,920 (13.1)
	2 1/2 (63.5)	3,520 (15.8)	2,200 (9.9)	4,660 (21.0)	2,200 (9.9)	5,260 (23.7)	2,920 (13.1)
3/8 (9.5)	1 1/2 (38.1)	1,900 (8.6)	3,380 (15.2)	2,520 (11.3)	4,680 (21.1)	3,040 (13.7)	6,840 (30.8)
	2 (50.8)	3,000 (13.5)	4,440 (20.0)	3,920 (17.6)	5,080 (22.9)	5,200 (23.4)	6,840 (30.8)
	2 1/2 (63.5)	4,100 (18.5)	5,480 (24.7)	5,320 (23.9)	5,480 (24.7)	7,340 (33.0)	6,840 (30.8)
	3 (76.2)	5,800 (26.1)	5,700 (25.7)	7,740 (34.8)	5,920 (26.6)	9,900 (44.6)	6,840 (30.8)
	3 1/2 (88.9)	7,500 (33.8)	5,900 (26.6)	10,140 (45.6)	6,360 (28.6)	12,440 (56.0)	6,840 (30.8)
1/2 (12.7)	2 (50.8)	2,860 (12.9)	5,720 (25.7)	3,940 (17.7)	6,820 (30.7)	4,780 (21.5)	8,740 (39.3)
	2 1/2 (63.5)	4,100 (18.5)	6,680 (30.1)	5,200 (23.4)	7,500 (33.8)	6,480 (29.2)	9,080 (40.9)
	3 (76.2)	5,920 (26.6)	7,160 (32.2)	7,800 (35.1)	8,380 (37.7)	9,380 (42.2)	9,080 (40.9)
	3 1/2 (88.9)	6,060 (27.3)	8,660 (39.0)	8,480 (38.2)	9,080 (40.9)	11,900 (53.6)	9,600 (43.2)
	4 (101.6)	7,560 (34.0)	8,660 (39.0)	12,620 (56.8)	9,080 (40.9)	12,620 (56.8)	9,600 (43.2)
5/8 (15.9)	2 1/2 (63.5)	3,420 (15.4)	7,200 (32.4)	4,720 (21.2)	10,820 (48.7)	6,900 (31.1)	13,400 (60.3)
	3 (76.2)	4,560 (20.5)	9,300 (41.9)	7,380 (33.2)	12,220 (55.0)	8,960 (40.3)	14,200 (63.9)
	3 1/2 (88.9)	5,720 (25.7)	11,380 (51.2)	10,040 (45.2)	13,600 (61.2)	11,040 (49.7)	15,000 (67.5)
	4 (101.6)	8,240 (37.1)	12,580 (56.6)	12,760 (57.4)	14,760 (66.4)	14,320 (64.4)	15,920 (71.6)
	4 1/2 (114.3)	10,780 (48.5)	13,800 (62.1)	15,500 (69.8)	15,920 (71.6)	17,600 (79.2)	16,840 (75.8)
	5 (127.0)	13,300 (59.9)	15,000 (67.5)	18,220 (82.0)	17,080 (76.9)	20,860 (93.9)	17,760 (79.9)
3/4 (19.1)	3 (76.2)	4,320 (19.4)	12,020 (54.1)	6,480 (29.2)	15,340 (69.0)	8,700 (39.2)	18,780 (84.5)
	3 1/2 (88.9)	5,720 (25.7)	13,280 (59.8)	9,320 (41.9)	18,780 (84.5)	11,360 (51.1)	20,800 (93.6)
	4 (101.6)	7,120 (32.0)	14,520 (65.3)	12,140 (54.6)	22,200 (99.9)	14,020 (63.1)	22,820 (102.7)
	4 1/2 (114.3)	9,240 (41.6)	16,640 (74.9)	13,580 (61.1)	23,320 (104.9)	16,720 (75.2)	23,800 (107.1)
	5 (127.0)	11,340 (51.0)	18,760 (84.4)	15,020 (67.6)	24,440 (110.0)	19,400 (87.3)	24,760 (111.4)
	5 1/2 (139.7)	13,440 (60.5)	20,880 (94.0)	16,460 (74.1)	25,560 (115.0)	22,080 (99.4)	25,720 (115.7)
	6 (152.4)	15,540 (69.9)	22,980 (103.4)	17,900 (80.6)	26,680 (120.1)	24,760 (111.4)	26,680 (120.1)

1. Tabulated load values are applicable for carbon steel and stainless steel anchors.
2. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
3. Critical and minimum spacing and edge distances as well as reduction factors for intermediate spacing and edge distances are listed in the Design Criteria section.
4. Linear interpolation may be used to determine ultimate loads for intermediate embedments and compressive strengths.

PERFORMANCE DATA

Allowable Load Capacities for Wedge-Bolt and Wedge-Bolt OT installed in Normal-Weight Concrete at Critical Spacing and Edge Distances[1,2,3,4,5]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c) 2,000 psi (13.8 MPa) Tension lbs. (kN)	2,000 psi (13.8 MPa) Shear lbs. (kN)	4,000 psi (27.6 MPa) Tension lbs. (kN)	4,000 psi (27.6 MPa) Shear lbs. (kN)	6,000 psi (41.4 MPa) Tension lbs. (kN)	6,000 psi (41.4 MPa) Shear lbs. (kN)
1/4 (6.4)	1 (25.4)	180 (0.8)	260 (1.2)	335 (1.5)	520 (2.3)	415 (1.9)	600 (2.7)
	1 1/2 (38.1)	360 (1.6)	550 (2.5)	535 (2.4)	550 (2.5)	620 (2.8)	625 (2.8)
	2 (50.8)	600 (2.7)	550 (2.5)	985 (4.4)	550 (2.5)	1,245 (5.6)	730 (3.3)
	2 1/2 (63.5)	880 (4.0)	550 (2.5)	1,165 (5.2)	550 (2.5)	1,315 (5.9)	730 (3.3)
3/8 (9.5)	1 1/2 (38.1)	475 (2.1)	845 (3.8)	630 (2.8)	1,170 (5.3)	760 (3.4)	1,710 (7.7)
	2 (50.8)	750 (3.4)	1,110 (5.0)	980 (4.4)	1,270 (5.7)	1,300 (5.9)	1,710 (7.7)
	2 1/2 (63.5)	1,025 (4.6)	1,370 (6.2)	1,330 (6.0)	1,370 (6.2)	1,835 (8.3)	1,710 (7.7)
	3 (76.2)	1,450 (6.5)	1,425 (6.4)	1,935 (8.7)	1,480 (6.7)	2,475 (11.1)	1,710 (7.7)
	3 1/2 (88.9)	1,875 (8.4)	1,475 (6.6)	2,535 (11.4)	1,590 (7.2)	3,110 (14.0)	1,710 (7.7)
1/2 (12.7)	2 (50.8)	715 (3.2)	1,430 (6.4)	985 (4.4)	1,705 (7.7)	1,195 (5.4)	2,185 (9.8)
	2 1/2 (63.5)	1,025 (4.6)	1,670 (7.5)	1,300 (5.9)	1,875 (8.4)	1,620 (7.3)	2,270 (10.2)
	3 (76.2)	1,480 (6.7)	1,790 (8.1)	1,950 (8.8)	2,095 (9.4)	2,345 (10.6)	2,270 (10.2)
	3 1/2 (88.9)	1,515 (6.8)	2,165 (9.7)	2,120 (9.5)	2,270 (10.2)	2,975 (13.4)	2,400 (10.8)
	4 (101.6)	1,890 (8.5)	2,165 (9.7)	3,155 (14.2)	2,270 (10.2)	3,155 (14.2)	2,400 (10.8)
5/8 (15.9)	2 1/2 (63.5)	855 (3.8)	1,800 (8.1)	1,180 (5.3)	2,705 (12.2)	1,725 (7.8)	3,350 (15.1)
	3 (76.2)	1,140 (5.1)	2,325 (10.5)	1,845 (8.3)	3,055 (13.7)	2,240 (10.1)	3,550 (16.0)
	3 1/2 (88.9)	1,430 (6.4)	2,845 (12.8)	2,510 (11.3)	3,400 (15.3)	2,760 (12.4)	3,750 (16.9)
	4 (101.6)	2,060 (9.3)	3,145 (14.2)	3,190 (14.4)	3,690 (16.6)	3,580 (16.1)	3,980 (17.9)
	4 1/2 (114.3)	2,695 (12.1)	3,450 (15.5)	3,875 (17.4)	3,980 (17.9)	4,400 (19.8)	4,210 (18.9)
	5 (127.0)	3,325 (15.0)	3,750 (16.9)	4,555 (20.5)	4,270 (19.2)	5,215 (23.5)	4,440 (20.0)
3/4 (19.1)	3 (76.2)	1,080 (4.9)	3,005 (13.5)	1,620 (7.3)	3,835 (17.3)	2,175 (9.8)	4,695 (21.1)
	3 1/2 (88.9)	1,430 (6.4)	3,320 (14.9)	2,330 (10.5)	4,695 (21.1)	2,840 (12.8)	5,200 (23.4)
	4 (101.6)	1,780 (8.0)	3,630 (16.3)	3,035 (13.7)	5,550 (25.0)	3,505 (15.8)	5,705 (25.7)
	4 1/2 (114.3)	2,310 (10.4)	4,160 (18.7)	3,395 (15.3)	5,830 (26.2)	4,180 (18.8)	5,950 (26.8)
	5 (127.0)	2,835 (12.8)	4,690 (21.1)	3,755 (16.9)	6,110 (27.5)	4,850 (21.8)	6,190 (27.9)
	5 1/2 (139.7)	3,360 (15.1)	5,220 (23.5)	4,115 (18.5)	6,390 (28.8)	5,520 (24.8)	6,430 (28.9)
	6 (152.4)	3,885 (17.5)	5,745 (25.9)	4,475 (20.1)	6,670 (30.0)	6,190 (27.9)	6,670 (30.0)

1. Tabulated load values are applicable for carbon steel and stainless steel anchors.
2. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
3. Critical and minimum spacing and edge distances as well as reduction factors for intermediate spacing and edge distances are listed in the Design Criteria section.
4. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
5. Allowable loads for anchors to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load where permitted by code.

PERFORMANCE DATA

Ultimate Load Capacities for Wedge-Bolt and Wedge-Bolt OT installed in Normal-Weight Concrete at 16 Diameters Spacing and Edge Distances[1,2,3,4]

Anchor Diameter *d* in. (mm)	Minimum Embed. Depth h_v in. (mm)	Spacing and Edge Distance at 16 *d* in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
			2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 (25.4)	4 (101.6)	920 (4.1)	1,030 (4.6)	1,520 (6.8)	2,090 (9.4)	1,650 (7.4)	2,440 (11.0)
	1 1/2 (38.1)		1,760 (7.9)	2,580 (11.6)	2,360 (10.6)	2,780 (12.5)	2,480 (11.2)	2,690 (12.1)
	2 (50.8)		2,800 (12.6)	2,780 (12.5)	4,230 (19.0)	2,780 (12.5)	4,980 (22.4)	3,360 (15.1)
	2 1/2 (63.5)		4,220 (19.0)	3,080 (13.9)	4,900 (22.1)	3,080 (13.9)	5,260 (23.7)	3,660 (16.5)
3/8 (9.5)	1 1/2 (38.1)	6 (152.4)	2,140 (9.6)	3,600 (16.2)	2,660 (12.0)	4,870 (21.9)	3,030 (13.6)	7,340 (33.0)
	2 (50.8)		3,300 (14.9)	4,540 (20.4)	4,120 (18.5)	5,180 (23.3)	5,185 (23.3)	7,340 (33.0)
	2 1/2 (63.5)		4,460 (20.1)	5,480 (24.7)	5,550 (25.0)	5,480 (24.7)	7,340 (33.0)	7,340 (33.0)
	3 (76.2)		6,180 (27.8)	6,400 (28.8)	7,970 (35.9)	6,460 (29.1)	9,890 (44.5)	7,475 (33.6)
	3 1/2 (88.9)		7,900 (35.6)	7,290 (32.8)	10,390 (46.8)	7,440 (33.5)	12,440 (56.0)	7,610 (34.2)
1/2 (12.7)	2 (50.8)	8 (203.2)	2,960 (13.3)	6,570 (29.6)	3,930 (17.7)	7,420 (33.4)	4,780 (21.5)	9,000 (40.5)
	2 1/2 (63.5)		4,100 (18.5)	7,420 (33.4)	5,200 (23.4)	7,980 (35.9)	6,480 (29.2)	9,260 (41.7)
	3 (76.2)		5,910 (26.6)	7,700 (34.7)	7,800 (35.1)	8,730 (39.3)	9,380 (42.2)	9,260 (41.7)
	3 1/2 (88.9)		6,060 (27.3)	8,650 (38.9)	8,480 (38.2)	9,080 (40.9)	11,890 (53.5)	9,430 (42.4)
	4 (101.6)		7,620 (34.3)	8,650 (38.9)	13,260 (59.7)	9,080 (40.9)	13,260 (59.7)	9,600 (43.2)
5/8 (15.9)	2 1/2 (63.5)	10 (254.0)	3,420 (15.4)	7,790 (35.1)	4,720 (21.2)	11,320 (50.9)	6,900 (31.1)	13,400 (60.3)
	3 (76.2)		4,560 (20.5)	10,075 (45.3)	7,380 (33.2)	12,740 (57.3)	8,960 (40.3)	13,620 (61.3)
	3 1/2 (88.9)		5,720 (25.7)	12,360 (55.6)	10,040 (45.2)	14,160 (63.7)	11,040 (49.7)	15,100 (68.0)
	4 (101.6)		8,280 (37.3)	13,700 (61.7)	12,760 (57.4)	15,400 (69.3)	14,320 (64.4)	15,920 (71.6)
	4 1/2 (114.3)		10,860 (48.9)	15,100 (68.0)	15,500 (69.8)	16,580 (74.6)	17,600 (79.2)	16,840 (75.8)
	5 (127.0)		13,440 (60.5)	16,480 (74.2)	18,220 (82.0)	17,750 (79.9)	20,860 (93.9)	17,750 (79.9)
3/4 (19.1)	3 (76.2)	12 (304.8)	4,320 (19.4)	12,270 (55.2)	6,480 (29.2)	15,500 (69.8)	10,260 (46.2)	18,770 (84.5)
	3 1/2 (88.9)		5,760 (25.9)	13,945 (62.8)	9,320 (41.9)	19,160 (86.2)	12,140 (54.6)	20,795 (93.6)
	4 (101.6)		7,200 (32.4)	15,620 (70.3)	12,140 (54.6)	22,820 (102.7)	14,020 (63.1)	22,820 (102.7)
	4 1/2 (114.3)		9,800 (44.1)	18,740 (84.3)	13,640 (61.4)	24,760 (111.4)	16,720 (75.2)	25,160 (113.2)
	5 (127.0)		12,400 (55.8)	21,840 (98.3)	15,120 (68.0)	26,700 (120.2)	19,400 (87.3)	27,500 (123.8)
	5 1/2 (139.7)		15,000 (67.5)	24,940 (112.2)	16,600 (74.7)	28,640 (128.9)	22,080 (99.4)	29,840 (134.3)
	6 (152.4)		17,570 (79.1)	28,030 (126.1)	18,080 (81.4)	30,550 (137.5)	24,760 (111.4)	32,180 (144.8)

1. Tabulated load values are applicable for carbon and stainless steel anchors.
2. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
3. Linear interpolation may be used to determine ultimate loads for intermediate embedments and compressive strengths.
4. Tabular loads are for anchors installed at a minimum spacing distance between anchors and an edge distance of 16 times the anchor diameter.

MECHANICAL ANCHORS

PERFORMANCE DATA

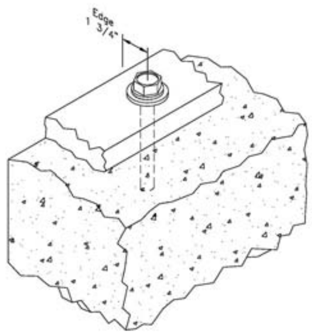
Allowable Load Capacities for Wedge-Bolt and Wedge-Bolt OT installed in Normal-Weight Concrete at 16 Diameters Spacing and Edge Distances[1,2,3,4,5]

Anchor Diameter *d* in. (mm)	Minimum Embed. Depth h_v in. (mm)	Spacing and Edge Distance at 16 *d* in. (mm)	Minimum Concrete Compressive Strength (f'_c) 2,000 psi (13.8 MPa) Tension lbs. (kN)	2,000 psi (13.8 MPa) Shear lbs. (kN)	4,000 psi (27.6 MPa) Tension lbs. (kN)	4,000 psi (27.6 MPa) Shear lbs. (kN)	6,000 psi (41.4 MPa) Tension lbs. (kN)	6,000 psi (41.4 MPa) Shear lbs. (kN)
1/4 (6.4)	1 (25.4)	4 (101.6)	230 (1.0)	260 (1.2)	380 (1.7)	525 (2.4)	415 (1.9)	610 (2.7)
	1 1/2 (38.1)		440 (2.0)	645 (2.9)	590 (2.7)	695 (3.1)	620 (2.8)	675 (3.0)
	2 (50.8)		700 (3.2)	695 (3.1)	1,060 (4.8)	695 (3.1)	1,245 (5.6)	840 (3.8)
	2 1/2 (63.5)		1,055 (4.7)	770 (3.5)	1,225 (5.5)	770 (3.5)	1,315 (5.9)	915 (4.1)
3/8 (9.5)	1 1/2 (38.1)	6 (152.4)	535 (2.4)	900 (4.1)	665 (3.0)	1,220 (5.5)	760 (3.4)	1,835 (8.3)
	2 (50.8)		825 (3.7)	1,135 (5.1)	1,030 (4.6)	1,295 (5.8)	1,300 (5.9)	1,835 (8.3)
	2 1/2 (63.5)		1,115 (5.0)	1,370 (6.2)	1,390 (6.3)	1,370 (6.2)	1,835 (8.3)	1,835 (8.3)
	3 (76.2)		1,545 (7.0)	1,600 (7.2)	1,995 (9.0)	1,615 (7.3)	2,475 (11.1)	1,870 (8.4)
	3 1/2 (88.9)		1,975 (8.9)	1,825 (8.2)	2,600 (11.7)	1,860 (8.4)	3,110 (14.0)	1,905 (8.6)
1/2 (12.7)	2 (50.8)	8 (203.2)	740 (3.3)	1,645 (7.4)	985 (4.4)	1,855 (8.3)	1,195 (5.4)	2,250 (10.1)
	2 1/2 (63.5)		1,025 (4.6)	1,855 (8.3)	1,300 (5.9)	1,995 (9.0)	1,620 (7.3)	2,315 (10.4)
	3 (76.2)		1,480 (6.7)	1,925 (8.7)	1,950 (8.8)	2,185 (9.8)	2,345 (10.6)	2,315 (10.4)
	3 1/2 (88.9)		1,515 (6.8)	2,165 (9.7)	2,120 (9.5)	2,270 (10.2)	2,975 (13.4)	2,360 (10.6)
	4 (101.6)		1,905 (8.6)	2,165 (9.7)	3,315 (14.9)	2,270 (10.2)	3,315 (14.9)	2,400 (10.8)
5/8 (15.9)	2 1/2 (63.5)	10 (254.0)	855 (3.8)	1,950 (8.8)	1,180 (5.3)	2,830 (12.7)	1,725 (7.8)	3,350 (15.1)
	3 (76.2)		1,140 (5.1)	2,520 (11.3)	1,845 (8.3)	3,185 (14.3)	2,240 (10.1)	3,405 (15.3)
	3 1/2 (88.9)		1,430 (6.4)	3,090 (13.9)	2,510 (11.3)	3,540 (15.9)	2,760 (12.4)	3,775 (17.0)
	4 (101.6)		2,070 (9.3)	3,425 (15.4)	3,190 (14.4)	3,850 (17.3)	3,580 (16.1)	3,980 (17.9)
	4 1/2 (114.3)		2,715 (12.2)	3,775 (17.0)	3,875 (17.4)	4,145 (18.7)	4,400 (19.8)	4,210 (18.9)
	5 (127.0)		3,360 (15.1)	4,120 (18.5)	4,555 (20.5)	4,440 (20.0)	5,215 (23.5)	4,440 (20.0)
3/4 (19.1)	3 (76.2)	12 (304.8)	1,080 (4.9)	3,070 (13.8)	1,620 (7.3)	3,875 (17.4)	2,565 (11.5)	4,695 (21.1)
	3 1/2 (88.9)		1,440 (6.5)	3,490 (15.7)	2,330 (10.5)	4,790 (21.6)	3,035 (13.7)	5,200 (23.4)
	4 (101.6)		1,800 (8.1)	3,905 (17.6)	3,035 (13.7)	5,705 (25.7)	3,505 (15.8)	5,705 (25.7)
	4 1/2 (114.3)		2,450 (11.0)	4,685 (21.1)	3,410 (15.3)	6,190 (27.9)	4,180 (18.8)	6,290 (28.3)
	5 (127.0)		3,100 (14.0)	5,460 (24.5)	3,780 (17.0)	6,675 (30.0)	4,850 (21.8)	6,875 (30.9)
	5 1/2 (139.7)		3,750 (16.9)	6,235 (28.1)	4,150 (18.7)	7,160 (32.2)	5,520 (24.8)	7,460 (33.6)
	6 (152.4)		4,395 (19.8)	7,010 (31.5)	4,520 (20.3)	7,640 (34.4)	6,190 (27.9)	8,045 (36.2)

1. Tabulated load values are applicable for carbon and stainless steel anchors.
2. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
3. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
4. Allowable loads for anchors to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load where permitted by code.
5. Tabular loads are for anchors installed at a minimum spacing distance between anchors and an edge distance of 16 times the anchor diameter.

PERFORMANCE DATA

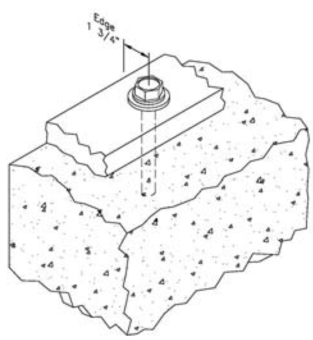
Ultimate and Allowable Shear Load Capacities for Wedge-Bolt and Wedge-Bolt OT at the Edge of Normal-Weight Concrete[1,2,3]



Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	*f´c* ≥ 2,000 psi (13.8 MPa) Parallel to the Free Edge: Ultimate Shear lbs. (kN)	*f´c* ≥ 2,000 psi (13.8 MPa) Parallel to the Free Edge: Allowable Shear lbs. (kN)
1/2 (12.7)	3 3/8 (85.7)	1 3/4 (44.5)	5,020 (22.6)	1,255 (5.6)
5/8 (15.9)	3 3/8 (85.7)	1 3/4 (44.5)	5,420 (24.4)	1,355 (6.1)
3/4 (19.1)	3 3/8 (85.7)	1 3/4 (44.5)	5,660 (25.5)	1,415 (6.4)

1. Tabulated load values are applicable to carbon steel and stainless steel anchors.
2. Allowable load capacities are calculated using an applied safety factor of 4.0.
3. Allowable loads for anchors to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load where permitted by code.

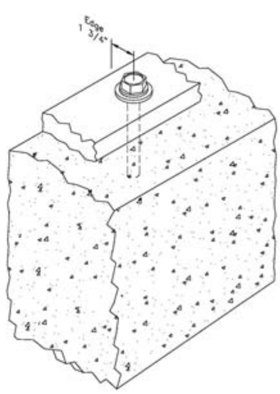
Ultimate and Allowable Tension Load Capacities for Wedge-Bolt and Wedge-Bolt OT Installed at the Edge of Normal-Weight Concrete[1,2]



Anchor Dia. *d* in. (mm)	Min. Embed. Depth h_v in. (mm)	Min. Edge Distance in. (mm)	2,500 psi (17.2 MPa) Ultimate lbs. (kN)	2,500 psi (17.2 MPa) Allow. lbs. (kN)	3,000 psi (20.7 MPa) Ultimate lbs. (kN)	3,000 psi (20.7 MPa) Allow. lbs. (kN)	4,000 psi (27.6 MPa) Ultimate lbs. (kN)	4,000 psi (27.6 MPa) Allow. lbs. (kN)
			Minimum Concrete Compressive Strength (*f´c*)					
5/8 (15.9)	8 (203.2)	1 3/4 (44.5)	15,630 (70.3)	3,910 (17.6)	16,630 (74.8)	4,160 (18.7)	18,150 (81.7)	4,540 (20.4)
	9 (228.6)		16,995 (76.5)	4,250 (19.1)	18,185 (81.8)	4,545 (20.5)	19,820 (89.2)	4,955 (22.3)
	10 (254.0)		18,360 (82.6)	4,590 (20.7)	19,740 (88.8)	4,935 (22.2)	21,490 (96.7)	5,375 (24.2)
	11 (279.4)		19,065 (85.8)	4,765 (21.4)	20,425 (91.9)	5,105 (23.0)	22,605 (101.7)	5,650 (25.4)
	12 (304.8)		19,775 (89.0)	4,945 (22.3)	21,105 (95.0)	5,275 (23.7)	23,715 (106.7)	5,930 (26.7)
	13 (330.2)		20,480 (92.2)	5,120 (23.0)	21,790 (98.1)	5,450 (24.5)	24,830 (111.7)	6,210 (27.9)

1. Allowable load capacities are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strength.

Allowable Load Capacities for Wedge-Bolt and Wedge-Bolt OT installed in Normal-Weight Concrete Stem Walls[1,2,3,4]



Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	*f´c* ≥ 2,500 psi (17.2 MPa): Tension lbs. (kN)	*f´c* ≥ 2,500 psi (17.2 MPa) Parallel to the Free Edge: Shear lbs. (kN)	*f´c* ≥ 2,500 psi (17.2 MPa) Towards the Free Edge: Shear lbs. (kN)
1/2 (12.7)	4 (101.6)	1 3/4 (44.5)	1,270 (5.7)	1,425 (6.4)	470 (2.1)
5/8 (15.9)	2 1/2 (63.5)	1 3/4 (44.5)	610 (2.7)	1,155 (5.2)	380 (1.7)
	3 3/4 (95.3)		1,310 (5.9)	1,330 (6.0)	490 (2.2)
	5 (127.0)		2,015 (9.1)	1,505 (6.8)	600 (2.7)

1. Tabulated load values are applicable to carbon steel and stainless steel anchors.
2. Allowable load capacities are calculated using an applied safety factor of 4.0.
3. Allowable loads for anchors to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load where permitted by code.
4. Allowable load capacities may also be applied to conditions at the edge of normal-weight concrete slabs.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Wedge-Bolt and Wedge-Bolt OT installed in Structural Lightweight Concrete[1,2,3,4,5]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength $f'_c \geq$ 3,000 psi (20.7 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	2 (50.8)	3,320 (14.9)	3,000 (13.5)	830 (3.7)	750 (3.4)
3/8 (9.5)	1 1/2 (38.1)	2,220 (10.0)	2,200 (9.9)	555 (2.5)	550 (2.5)
	2 1/4 (57.2)	3,760 (16.9)	3,960 (17.8)	940 (4.2)	990 (4.5)
	3 (76.2)	5,280 (23.8)	5,700 (25.7)	1,320 (5.9)	1,425 (6.4)
1/2 (12.7)	2 (50.8)	2,920 (13.1)	6,180 (27.8)	730 (3.3)	1,545 (7.0)
	3 (76.2)	5,320 (23.9)	8,420 (37.9)	1,330 (6.0)	2,105 (9.5)
	4 (101.6)	7,720 (34.7)	10,660 (48.0)	1,930 (8.7)	2,665 (12.0)
5/8 (15.9)	2 1/2 (63.5)	3,720 (16.7)	9,240 (41.6)	930 (4.2)	2,310 (10.4)
	3 3/4 (95.3)	7,940 (35.7)	14,440 (65.0)	1,985 (8.9)	3,610 (16.2)
	5 (127.0)	12,160 (54.7)	19,640 (88.4)	3,040 (13.7)	4,910 (22.1)
3/4 (19.1)	5 1/4 (133.4)	13,320 (59.9)	22,520 (101.3)	3,330 (15.0)	5,630 (25.3)

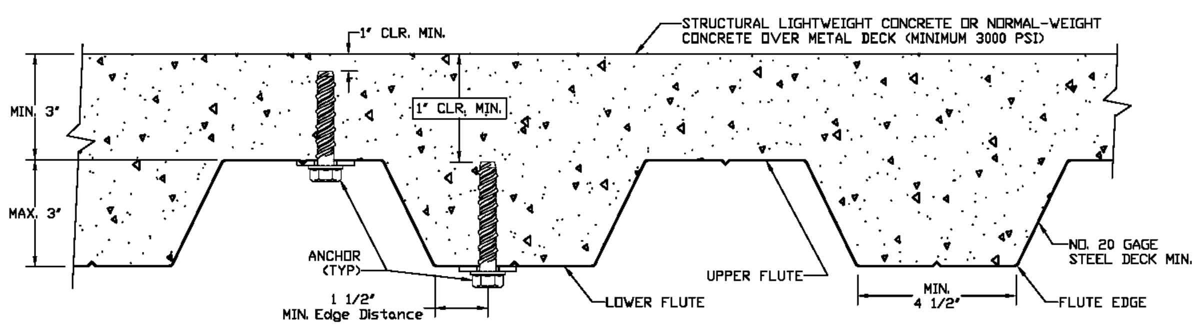
1. The values listed above are ultimate and allowable load capacities for anchors installed in sand-lightweight concrete.
2. Allowable load capacities are calculated using an applied safety factor of 4.0.
3. Critical and minimum spacing and edge distances as well as reduction factors for intermediate spacing and edge distances are listed in the Design Criteria section.
4. Linear interpolation for allowable loads for anchors at intermediate embedment depths may also be used.
5. Allowable loads for anchors to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load where permitted by code.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Wedge-Bolt and Wedge-Bolt OT Installed Through Metal Deck into Structural Lightweight Concrete[1,2,3,4,5]

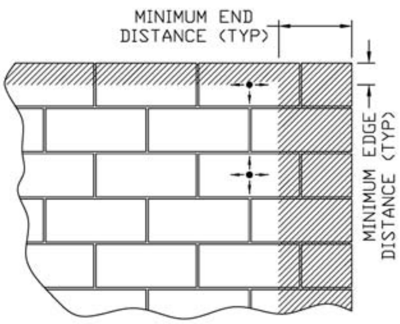
Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Lightweight Concrete Over Minimum 20 Gage Metal Deck $f'_c \geq$ 3,000 psi (20.7 MPa) — Minimum 4 1/2" Wide Deck — Ultimate Load: Tension lbs. (kN)	Ultimate Load: Shear lbs. (kN)	Allowable Load: Tension lbs. (kN)	Allowable Load: Shear lbs. (kN)
1/4 (6.4)	2 (50.8)	2,660 (12.0)	3,600 (16.2)	665 (3.0)	900 (4.1)
3/8 (9.5)	1 1/2 (38.1)	1,780 (8.0)	3,380 (15.2)	445 (2.0)	845 (3.8)
	2 1/4 (57.2)	3,160 (14.2)	4,320 (19.4)	790 (3.6)	1,080 (4.9)
	3 (76.2)	4,520 (20.3)	5,240 (23.6)	1,130 (5.1)	1,310 (5.9)
1/2 (12.7)	2 (50.8)	2,940 (13.2)	4,380 (19.7)	735 (3.3)	1,095 (4.9)
	3 (76.2)	4,380 (19.7)	6,300 (28.4)	1,095 (4.9)	1,575 (7.1)
	4 (101.6)	5,820 (26.2)	8,220 (37.0)	1,455 (6.5)	2,055 (9.2)
5/8 (15.9)	2 1/2 (63.5)	3,100 (14.0)	5,020 (22.6)	775 (3.5)	1,255 (5.6)
	3 3/4 (95.3)	5,420 (24.4)	7,640 (34.4)	1,355 (6.1)	1,910 (8.6)
	5 (127.0)	7,740 (34.8)	10,260 (46.2)	1,935 (8.7)	2,565 (11.5)
3/4 (19.1)	5 1/4 (133.4)	9,700 (43.7)	11,540 (51.9)	2,425 (10.9)	2,885 (13.0)

1. The values listed above are ultimate and allowable load capacities for anchors installed in sand-lightweight concrete.
2. Allowable loads capacities are calculated using an applied safety factor of 4.0.
3. Spacing distances shall be in accordance with the spacing table for lightweight concrete listed in the Design Criteria.
4. Anchors are permitted to be installed in the lower or upper flute of the metal deck provided the proper installed procedures are maintained.
5. Allowable loads for anchors to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load where permitted by code.



PERFORMANCE DATA

Allowable Load Capacities for Wedge-Bolt and Wedge-Bolt OT Anchors Installed in Grout-Filled Concrete Masonry[1,2,3,4,5,6]



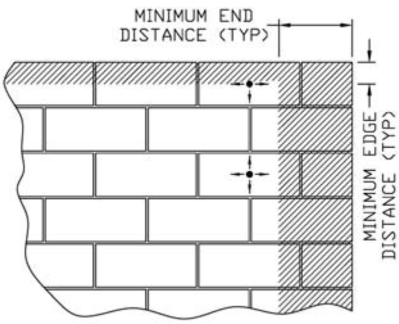
Face Shell
(Grouted Cell)
Permissible Anchor Locations
(Unshaded Area)

Anchor Installed Through Face Shell Into Grouted Cell					
Rod Diameter *d* in. (mm)	Minimum Embed. Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 (25.4)	3 3/4 (95.3)	3 3/4 (95.3)	80 (0.4)	150 (0.7)
	2 (50.8)			340 (1.5)	340 (1.5)
3/8 (9.5)	1 1/2 (38.1)	2 (50.8)	–	210 (0.9)	340 (1.5)
	1 1/2 (38.1)	3 3/4 (95.3)	12 (304.8)	210 (0.9)	400 (1.8)
	2 1/2 (63.5)	2 (50.8)	–	670 (3.0)	340 (1.5)
	2 1/2 (63.5)	7 7/8 (200.0)	12 (304.8)	750 (3.4)	755 (3.4)
	3 1/2 (88.9)	12 (304.8)		1,290 (5.8)	1,110 (5.0)
1/2 (12.7)	2 (50.8)	3 3/4 (95.3)	12 (304.8)	335 (1.5)	720 (3.2)
	3 (76.2)	7 7/8 (200.0)		930 (4.2)	985 (4.4)
	4 (101.6)	12 (304.8)		1,525 (6.9)	1,245 (5.6)
5/8 (15.9)	2 1/2 (63.5)	3 3/4 (95.3)	12 (304.8)	455 (2.0)	1,320 (5.9)
	3 1/4 (82.6)	7 7/8 (200.0)		885 (4.0)	1,500 (6.8)
	4 (101.6)	12 (304.8)		1,310 (5.9)	1,500 (6.8)
	5 (127.0)			1,940 (8.7)	1,680 (7.6)
3/4 (19.1)	3 (76.2)	3 3/4 (95.3)	12 (304.8)	615 (2.8)	750 (3.4)
		12 (304.8)		615 (2.8)	1,320 (5.9)
	3 1/2 (88.9)	7 7/8 (200.0)		1,035 (4.7)	1,265 (5.7)
	4 (101.6)	12 (304.8)		1,455 (6.5)	1,780 (8.0)
	5 (127.0)			1,680 (7.6)	2,240 (10.1)

1. Tabulated load values are for carbon and stainless steel anchors installed in minimum 6" wide, Grade N, Type II, lightweight, medium-weight and normal-weight concrete masonry units conforming to ASTM C 90 that have reached the minimum designated ultimate compressive strength at the time of installation ($f'_m \geq$ 1,500 psi).
2. Allowable load capacities listed are calculated using an applied safety factor of 5.0.
3. Tabulated load values are applicable for screw anchors installed at a critical spacing between screw anchors of 16 times the screw anchor diameter. Reduce the tabulated load capacities by 50 percent when anchors are installed at minimum spacing between anchors of 8 times the screw anchor diameter. Linear interpolation may be used for intermediate spacing distances.
4. Linear interpolation for allowable loads for anchors at intermediate embedment depths may be used.
5. Allowable shear loads for 1/4" and 3/8" diameter anchor installations into the face shell of a masonry wall may be applied in any direction. Allowable shear loads for anchor diameters 1/2" and greater installed into the face shell may be applied in any direction provided the location is a minimum of 12" from the edge and end of the wall. For anchors diameters 1/2" and greater installed with an edge distance less than 12" the allowable shear loads may be applied in any direction except upward vertically.
6. Allowable loads for anchors to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load where permitted by code.

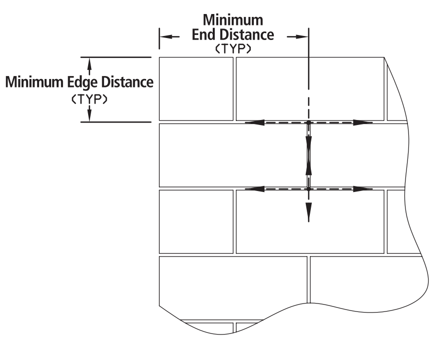
PERFORMANCE DATA

Allowable Load Capacities for Wedge-Bolt and Wedge-Bolt OT Anchors Installed in Grout-Filled Concrete Masonry[1,2,3,4,5,6,7,8]



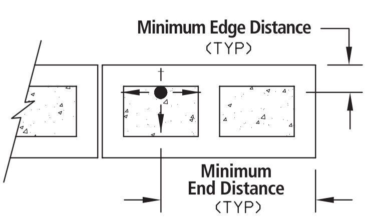
Face Shell
(Cell Web)
Permissible Anchor Locations
(Unshaded Area)

Anchor Installed Through Face Shell Into Cell Web				
Rod Diameter *d* in. (mm)	Minimum Embed. Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Tension lbs. (kN)
3/8 (9.5)	3 1/2 (25.4)	16 (406.4)	16 (406.4)	870 (3.9)
1/2 (12.7)	4 (101.6)			1,110 (5.0)
5/8 (15.9)	4 (101.6)			1,205 (5.4)
3/4 (19.1)	4 (101.6)			1,310 (5.9)



T-Joints
Permissible Anchor Locations

Anchor Installed In Joint					
Rod Diameter *d* in. (mm)	Minimum Embed. Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)
3/8 (9.5)	1 1/2 (38.1)	16 (406.4)	16 (406.4)	–	510 (2.3)
	3 1/2 (88.9)			830 (3.7)	
1/2 (12.7)	4 (101.6)			1,090 (4.9)	
5/8 (15.9)	4 (101.6)			840 (3.8)	1,225 (5.5)
3/4 (19.1)	2 1/2 (63.5)			–	
	4 (101.6)			890 (4.0)	



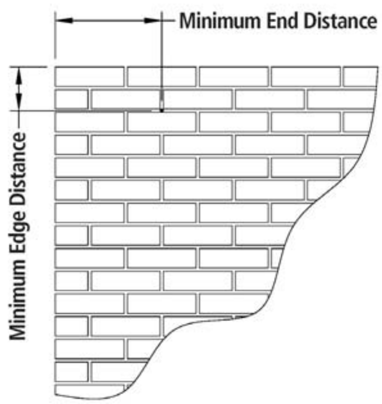
Top of Wall

Anchor Installed in Cell Opening (Top of Wall)				
Rod Diameter *d* in. (mm)	Minimum Embed. Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)
3/8 (9.5)	1 1/2 (38.1)	2 (50.8)	–	350 (1.6)
	2 1/2 (63.5)		570 (2.5)	380 (1.7)

1. Tabulated load values are for carbon and stainless steel anchors installed in minimum 6" wide, Grade N, Type II, lightweight, medium-weight and normal-weight concrete masonry units conforming to ASTM C 90 that have reached the minimum designated ultimate compressive strength at the time of installation ($f'm \geq$ 1,500 psi).
2. Allowable load capacities listed are calculated using an applied safety factor of 5.0.
3. Tabulated load values are applicable for screw anchors installed at a critical spacing between screw anchors of 16 times the screw anchor diameter. Reduce the tabulated load capacities by 50 percent when anchors are installed at minimum spacing between anchors of 8 times the screw anchor diameter. Linear interpolation may be used for intermediate spacing distances.
4. Linear interpolation for allowable loads for anchors at intermediate embedment depths may be used.
5. Allowable shear loads for anchor installations into the cell web may be applied in any direction.
6. Allowable shear loads for anchor installation into the horizontal and vertical mortar joints may be applied in any direction provided the anchor location is a minimum of 16" from the edge and end of the wall. For anchor installations with an edge distance less than 16" the allowable shear loads may be applied in any direction except upward vertically.
7. Allowable tension load values for anchors installed into horizontal mortar (bed) joint locations may be increased by 35 percent.
8. Allowable loads for anchors to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load where permitted by code.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Wedge-Bolt and Wedge-Bolt OT Anchors Installed in Multiple Wythe Brick Masonry[1,2,3]



Anchor Diameter d in. (mm)	Minimum Embed. Depth h_v in. (mm)	Minimum Edge and End Distance in. (mm)	Minimum Spacing Distance	Structural Brick Masonry $f'_m \geq$ 1,500 psi (10.4 MPa)			
				Ultimate Load		Allowable Load	
				Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	2 1/2 (63.5)	4 (101.6)	4" Any Direction	2,280 (10.3)	1,480 (6.7)	455 (2.0)	295 (1.3)
3/8 (9.5)	3 1/2 (88.9)	6 (152.4)	6" Any Direction	3,390 (15.3)	3,830 (17.2)	680 (3.1)	765 (3.4)
1/2 (12.7)	4 (101.6)	8 (101.6)	8" Any Direction	4,800 (21.6)	7,060 (31.8)	960 (4.3)	1,410 (6.3)
5/8 (15.9)	4 (101.6)	10 (254.0)	12" Any Direction	6,120 (27.5)	11,250 (50.6)	1,225 (5.5)	2,250 (10.1)
3/4 (19.1)	4 (101.6)	12 (304.8)	2 Bricks or 16" Any Direction (whichever is less)	6,580 (29.6)	12,340 (55.5)	1,315 (5.9)	2,470 (11.1)

1. Tabulated load values are applicable to carbon steel and stainless steel anchors.
2. Tabulated load values are for anchors installed in minimum Grade SW multiple wythe, solid brick masonry conforming to ASTM C62.
3. Allowable loads are calculated using an applied safety factor of 5.0.

DESIGN CRITERIA

Combined Loading

For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n}\right)^{\frac{5}{3}} + \left(\frac{V_u}{V_n}\right)^{\frac{5}{3}} \leq 1 \quad \text{OR} \quad \left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

Load Adjustment Factors for Spacing and Edge Distances

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	**Load Type**	**Critical Distance (Full Anchor Capacity)**	**Critical Load Factor**	**Minimum Distance (Reduced Capacity)**	**Minimum Load Factor**
Spacing (s)	Tension	$s_{cr} = 12d$	$F_N = 1.0$	$s_{min} = 4d$	$F_N = 0.50$
	Shear	$s_{cr} = 12d$	$F_V = 1.0$	$s_{min} = 4d$	$F_V = 0.75$
Edge Distance (c)	Tension	$c_{cr} = 8d$	$F_N = 1.0$	$c_{min} = 3d$	$F_N = 0.70$
	Shear	$c_{cr} = 12d$	$F_V = 1.0$	$c_{min} = 3d$	$F_V = 0.15$

Anchor Installed in Lightweight Concrete					
Anchor Dimension	**Load Type**	**Critical Distance (Full Anchor Capacity)**	**Critical Load Factor**	**Minimum Distance (Reduced Capacity)**	**Minimum Load Factor**
Spacing (s)	Tension	$s_{cr} = 14.1d$	$F_N = 1.0$	$s_{min} = 4.7d$	$F_N = 0.50$
	Shear	$s_{cr} = 14.1d$	$F_V = 1.0$	$s_{min} = 4.7d$	$F_V = 0.75$
Edge Distance (c)	Tension	$c_{cr} = 9.4d$	$F_N = 1.0$	$c_{min} = 3.5d$	$F_N = 0.70$
	Shear	$c_{cr} = 14.1d$	$F_V = 1.0$	$c_{min} = 3.5d$	$F_V = 0.15$

DESIGN CRITERIA

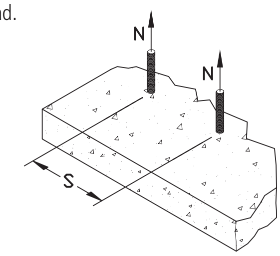
Load Adjustment Factors for Normal-Weight Concrete

Spacing, Tension (F_N)

	Dia. (in.)	1/4	3/8	1/2	5/8	3/4
	s_{cr} (in.)	3	4 1/2	6	7 1/2	9
	s_{min} (in.)	1	1 1/2	2	2 1/2	3
Spacing, *s* (inches)	1	0.50				
	1 1/2	0.63	0.50			
	2	0.75	0.58	0.50		
	2 1/2	0.88	0.67	0.56	0.50	
	3	1.00	0.75	0.63	0.55	0.50
	4 1/2		1.00	0.81	0.70	0.63
	6			1.00	0.85	0.75
	7 1/2				1.00	0.88
	9					1.00

Notes: For anchors loaded in tension, the critical spacing (s_{cr}) is equal to 12 anchor diameters (12*d*) at which the anchor achieves 100% of load.

Minimum spacing (s_{min}) is equal to 4 anchor diameters (4*d*) at which the anchor achieves 50% of load.

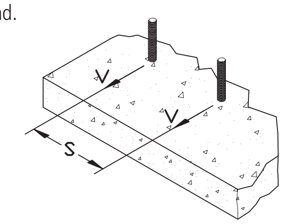


Spacing, Shear (F_V)

	Dia. (in.)	1/4	3/8	1/2	5/8	3/4
	s_{cr} (in.)	3	4 1/2	6	7 1/2	9
	s_{min} (in.)	1	1 1/2	2	2 1/2	3
Spacing, *s* (inches)	1	0.75				
	1 1/2	0.81	0.75			
	2	0.88	0.79	0.75		
	2 1/2	0.94	0.83	0.78	0.75	
	3	1.00	0.88	0.81	0.78	0.75
	4 1/2		1.00	0.91	0.85	0.81
	6			1.00	0.93	0.88
	7 1/2				1.00	0.94
	9					1.00

Notes: For anchors loaded in shear, the critical spacing (s_{cr}) is equal to 12 anchor diameters (12*d*) at which the anchor achieves 100% of load.

Minimum spacing (s_{min}) is equal to 4 anchor diameters (4*d*) at which the anchor achieves 75% of load.

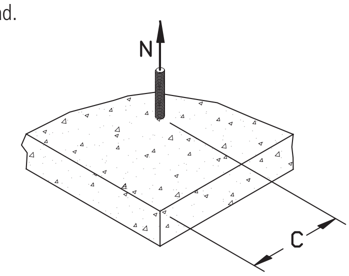


Edge Distance, Tension (F_N)

	Dia. (in.)	1/4	3/8	1/2	5/8	3/4
	c_{cr} (in.)	2	3	4	5	6
	c_{min} (in.)	3/4	1 1/8	1 1/2	1 7/8	2 1/4
Edge Distance, *c* (in.)	3/4	0.70				
	1 1/8	0.79	0.70			
	1 1/2	0.88	0.76	0.70		
	1 7/8	0.97	0.82	0.75	0.70	
	2	1.00	0.84	0.76	0.71	
	2 1/4		0.88	0.79	0.74	0.70
	3		1.00	0.88	0.81	0.76
	4			1.00	0.90	0.84
	5				1.00	0.92
	6					1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 8 anchor diameters (8*d*) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 3 anchor diameters (3*d*) at which the anchor achieves 70% of load.

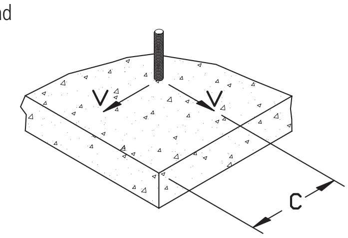


Edge Distance, Shear (F_V)

	Dia. (in.)	1/4	3/8	1/2	5/8	3/4
	c_{cr} (in.)	3	4 1/2	6	7 1/2	9
	c_{min} (in.)	3/4	1 1/8	1 1/2	1 7/8	2 1/4
Edge Distance, *c* (in.)	3/4	0.15				
	1 1/8	0.29	0.15			
	1 1/2	0.43	0.24	0.15		
	1 7/8	0.58	0.34	0.22	0.15	
	2 1/4	0.72	0.43	0.29	0.21	0.15
	3	1.00	0.62	0.43	0.32	0.24
	4 1/2		1.00	0.72	0.55	0.43
	6			1.00	0.77	0.62
	7 1/2				1.00	0.81
	9					1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12*d*) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 3 anchor diameters (3*d*) at which the anchor achieves 15% of load



DESIGN CRITERIA

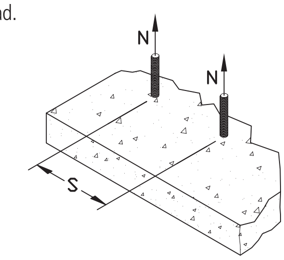
Load Adjustment Factors for Lightweight Concrete

Spacing, Tension (F_N)

	Dia. (in.)	1/4	3/8	1/2	5/8	3/4
	s_{cr} (in.)	3 1/2	5 1/4	7	8 7/8	10 1/2
	s_{min} (in.)	1 1/4	1 3/4	2 3/8	3	3 1/2
Spacing, *s* (inches)	1 1/4	0.50				
	1 3/4	0.61	0.50			
	2 3/8	0.75	0.59	0.50		
	3	0.89	0.67	0.57	0.50	
	3 1/2	1.00	0.74	0.62	0.54	0.50
	5 1/4		1.00	0.82	0.70	0.63
	7			1.00	0.84	0.75
	8 7/8				1.00	0.88
	10 1/2					1.00

Notes: For anchors loaded in tension, the critical spacing (s_{cr}) is equal to 14.1 anchor diameters (14.1*d*) at which the anchor achieves 100% of load.

Minimum spacing (s_{min}) is equal to 4.7 anchor diameters (4.7*d*) at which the anchor achieves 50% of load.

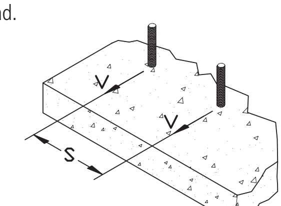


Spacing, Shear (F_V)

	Dia. (in.)	1/4	3/8	1/2	5/8	3/4
	s_{cr} (in.)	3 1/2	5 1/4	7	8 7/8	10 1/2
	s_{min} (in.)	1 1/4	1 3/4	2 3/8	3	3 1/2
Spacing, *s* (inches)	1 1/4	0.75				
	1 3/4	0.81	0.75			
	2 3/8	0.88	0.79	0.75		
	3	0.94	0.84	0.78	0.75	
	3 1/2	1.00	0.87	0.81	0.77	0.75
	5 1/4		1.00	0.91	0.85	0.82
	7			1.00	0.92	0.88
	8 7/8				1.00	0.94
	10 1/2					1.00

Notes: For anchors loaded in shear, the critical spacing (s_{cr}) is equal to 14.1 anchor diameters (14.1*d*) at which the anchor achieves 100% of load.

Minimum spacing (s_{min}) is equal to 4.7 anchor diameters (4.7*d*) at which the anchor achieves 75% of load.

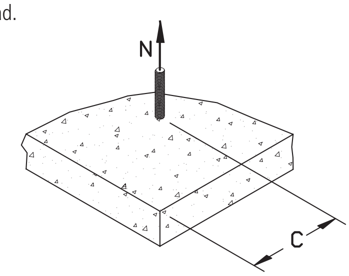


Edge Distance, Tension (F_N)

	Dia. (in.)	1/4	3/8	1/2	5/8	3/4
	c_{cr} (in.)	2 3/8	3 1/2	4 3/4	5 7/8	7
	c_{min} (in.)	7/8	1 3/8	1 3/4	2 1/4	2 5/8
Edge Distance, *c* (in.)	7/8	0.70				
	1 3/8	0.80	0.70			
	1 3/4	0.88	0.76	0.70		
	2 1/4	0.98	0.83	0.75	0.70	
	2 3/8	1.00	0.84	0.76	0.72	
	2 5/8		0.88	0.79	0.74	0.70
	3 1/2		1.00	0.88	0.81	0.76
	4 3/4			1.00	0.91	0.84
	5 7/8				1.00	0.92
	7					1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 9.4 anchor diameters (9.4*d*) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 3.5 anchor diameters (3.5*d*) at which the anchor achieves 70% of load.

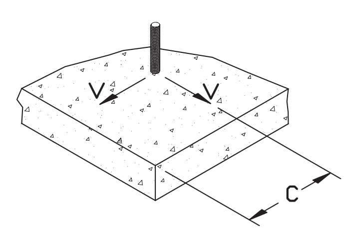


Edge Distance, Shear (F_V)

	Dia. (in.)	1/4	3/8	1/2	5/8	3/4
	c_{cr} (in.)	3 1/2	5 1/4	7	8 7/8	10 1/2
	c_{min} (in.)	7/8	1 3/8	1 3/4	2 1/4	2 5/8
Edge Distance, *c* (in.)	7/8	0.15				
	1 3/8	0.31	0.15			
	1 3/4	0.43	0.24	0.15		
	2 1/4	0.59	0.35	0.23	0.15	
	2 5/8	1.00	0.43	0.29	0.21	
	3 1/2		0.62	0.43	0.32	0.15
	5 1/4		1.00	0.71	0.54	0.43
	7			1.00	0.77	0.62
	8 7/8				1.00	0.82
	10 1/2					1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 14.1 anchor diameters (14.1*d*) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 3.5 anchor diameters (3.5*d*) at which the anchor achieves 15% of load



ORDERING INFORMATION

Carbon Steel Wedge-Bolt

Catalog Number	Size	Wedge Bit Diameter	Clearance Hole Diameter	Minimum Embedment	Thread Length	Standard Box	Standard Carton
7204	1/4" x 1 1/4"	1/4"	5/16"	1"	1 1/8"	100	500
7206	1/4" x 1 3/4"	1/4"	5/16"	1"	1 5/8"	100	500
7208	1/4" x 2 1/4"	1/4"	5/16"	1"	2"	100	500
7210	1/4" x 3"	1/4"	5/16"	1"	2 3/4"	100	500
7220	3/8" x 1 3/4"	3/8"	7/16"	1 1/2"	1 1/2"	50	250
7222	3/8" x 2 1/2"	3/8"	7/16"	1 1/2"	2 1/4"	50	250
7224	3/8" x 3"	3/8"	7/16"	1 1/2"	2 3/4"	50	250
7226	3/8" x 4"	3/8"	7/16"	1 1/2"	3 3/4"	50	250
7228	3/8" x 5"	3/8"	7/16"	1 1/2"	3 3/4"	50	250
7240	1/2" x 2"	1/2"	9/16"	1 3/4"	2 1/4"	50	200
7242	1/2" x 2 1/2"	1/2"	9/16"	1 3/4"	2 3/4"	50	200
7244	1/2" x 3"	1/2"	9/16"	1 3/4"	2 3/4"	50	150
7246	1/2" x 4"	1/2"	9/16"	1 3/4"	3 3/4"	50	150
NEW! 7248	1/2" x 5"	1/2"	9/16"	1 3/4"	3 3/4"	25	100
7250	1/2" x 6"	1/2"	9/16"	1 3/4"	3 3/4"	25	75
7260	5/8" x 3"	5/8"	11/16"	2 1/2"	2 3/4"	25	100
7262	5/8" x 4"	5/8"	11/16"	2 1/2"	3 3/4"	25	100
7264	5/8" x 5"	5/8"	11/16"	2 1/2"	3 3/4"	25	75
7266	5/8" x 6"	5/8"	11/16"	2 1/2"	3 3/4"	25	75
NEW! 7270	5/8" x 10"	5/8"	1 1/16"	2 1/2"	6"	25	75
NEW! 7272	5/8" x 12"	5/8"	1 1/16"	2 1/2"	6"	25	75
NEW! 7274	5/8" x 14"	5/8"	1 1/16"	2 1/2"	6"	25	–
7280	3/4" x 3"	3/4"	13/16"	2 1/2"	2 3/4"	20	60
7282	3/4" x 4"	3/4"	13/16"	3"	3 3/4"	20	60
7284	3/4" x 5"	3/4"	13/16"	3"	3 3/4"	20	60
7286	3/4" x 6"	3/4"	13/16"	3"	3 3/4"	20	60
7288	3/4" x 8"	3/4"	13/16"	3"	3 3/4"	10	40

Installation is recommended with the use of a Wedge-Bit.

410 Stainless Steel Wedge-Bolt

Catalog Number	Size	Wedge Bit Diameter	Clearance Hole Diameter	Minimum Embedment	Thread Length	Standard Box	Standard Carton
7701	1/4" x 1 3/4"	1/4"	5/16"	1"	1 5/8"	100	500
7705	3/8" x 2 1/2"	3/8"	7/16"	1 1/2"	2 1/4"	50	250
7706	3/8" x 3"	3/8"	7/16"	1 1/2"	2 3/4"	50	250
7710	1/2" x 3"	1/2"	9/16"	1 3/4"	2 3/4"	50	150
7711	1/2" x 4"	1/2"	9/16"	1 3/4"	3 3/4"	50	150
7715	5/8" x 4"	5/8"	11/16"	2 1/2"	3 3/4"	25	100
7722	3/4" x 6"	3/4"	13/16"	3"	3 3/4"	20	60

Installation is recommended with the use of a Wedge-Bit.

Carbon Steel Wedge-Bolt OT

Catalog Number	Size	Drill Bit Diameter	Clearance Hole Diameter	Minimum Embedment	Thread Length	Standard Box	Standard Carton
7215	1/4" x 3"	1/4"	3/8"	1"	2 3/4"	100	500
7216	3/8" x 4"	3/8"	1/2"	1 1/2"	3 3/4"	50	250
7217	1/2" x 4"	1/2"	5/8"	1 3/4"	3 3/4"	50	150
7218	1/2" x 5"	1/2"	5/8"	1 3/4"	3 3/4"	25	100
NEW! 7214	1/2" x 6"	1/2"	5/8"	1 3/4"	3 3/4"	25	75
7219	5/8" x 4"	5/8"	3/4"	2 1/2"	3 3/4"	25	100
7221	5/8" x 5"	5/8"	3/4"	2 1/2"	3 3/4"	25	75
NEW! 7227	5/8" x 6"	5/8"	3/4"	2 1/2"	3 3/4"	25	75
NEW! 7229	5/8" x 7"	5/8"	3/4"	2 1/2"	3 3/4"	25	40

Installation is recommended with the use of an ANSI bit.

ORDERING INFORMATION

SDS-Plus Wedge-Bit

Catalog Number	Size	Usable Length Inches	Overall Length Inches	Standard Pouch
1312	1/4" SDS-Plus Wedge-Bit	2	4	1
1314	1/4" SDS-Plus Wedge-Bit	4	6	1
1316	3/8" SDS-Plus Wedge-Bit	4	6	1
1318	3/8" SDS-Plus Wedge-Bit	6	8	1
1332	3/8" SDS-Plus Wedge-Bit	10	12	1
1320	1/2" SDS-Plus Wedge-Bit	4	6	1
1322	1/2" SDS-Plus Wedge-Bit	8	10	1
1334	1/2" SDS-Plus Wedge-Bit	10	12	1
1324	5/8" SDS-Plus Wedge-Bit	6	8	1
1326	5/8" SDS-Plus Wedge-Bit	10	12	1
1336	5/8" SDS-Plus Wedge-Bit	16	18	1
1328	3/4" SDS-Plus Wedge-Bit	6	8	1
1330	3/4" SDS-Plus Wedge-Bit	10	12	1

Heavy Duty Straight Shank Wedge-Bit

Catalog Number	Size	Usable Length Inches	Overall Length Inches	Standard Pouch
1370	1/4" Heavy Duty Straight Shank	2 3/4	4	1
1372	1/4" Heavy Duty Straight Shank	4	6	1
1380	3/8" Heavy Duty Straight Shank	4	6	1
1384	3/8" Heavy Duty Straight Shank	11	13	1
1390	1/2" Heavy Duty Straight Shank	4	6	1
1394	1/2" Heavy Duty Straight Shank	11	13	1
1396	5/8" Heavy Duty Straight Shank	11	13	1
1397	3/4" Heavy Duty Straight Shank	11	13	1

Spline Wedge-Bit

Catalog Number	Size	Usable Length Inches	Overall Length Inches	Standard Pouch
1340	1/2" Spline Wedge-Bit	8	13	1
1342	1/2" Spline Wedge-Bit	11	16	1
1344	5/8" Spline Wedge-Bit	8	13	1
1348	3/4" Spline Wedge-Bit	8	13	1

SDS-Max Wedge-Bit

Catalog Number	Size	Usable Length Inches	Overall Length Inches	Standard Pouch
1354	1/2" SDS-Max Wedge-Bit	8	13	1
1356	5/8" SDS-Max Wedge-Bit	8	13	1
101293	5/8" SDS-Max Wedge-Bit	16	21	1
1358	3/4" SDS-Max Wedge-Bit	8	13	1

Tilt Wall Wedge-Bolt® *Screw Anchor*

PRODUCT DESCRIPTION

The Tilt Wall Wedge-Bolt anchors are specifically engineered for high load tilt-up applications. Ideal for lift plates and brace shoes used to support tilt-up wall panels. Tilt Wall Wedge-Bolt anchors can be used in systems such as those manufactured by Meadow Burke.

GENERAL APPLICATIONS AND USES

- Anchorage for Tilt-up Brace Shoes, Clips and Lift Plates

FEATURES AND BENEFITS

- One-piece design eliminates possibility of lost anchor parts or improper assembly
- Safe and controlled installation guidelines
- Diameter and length ID stamped on head of each hex head anchor for easy inspection
- Fast and easy installation with a powered impact wrench
- Immediate high strength loading
- No expansion forces transferred to the base material
- Specific manufacturing and heat treatment processes facilitate hard cutting threads and a ductile anchor body

APPROVALS AND LISTINGS

Meadow Burke approval for tilt-up brace shoe and lift plate anchorage

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring* and *05090-Metal Fastenings.*
Anchors shall be Tilt Wall Wedge-Bolt anchors as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS Page No.

Black Tilt Wall Wedge-Bolt (ANSI)

HEAD STYLES

Hex Head

ANCHOR MATERIALS

Black Oxide Coated Carbon Steel

ANCHOR SIZE RANGE (TYP.)

3/4" diameter x 6" length and
3/4" diameter x 8" length

SUITABLE BASE MATERIALS

Normal-Weight Concrete

INSTALLATION AND MATERIAL SPECIFICATIONS

Installation Specification

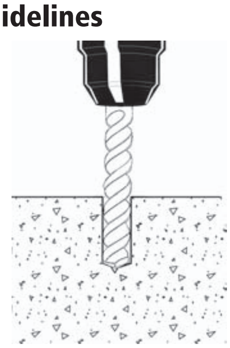
Dimension	Nominal Anchor Dia., d 3/4"
ANSI Drill Bit Size, d_{bit} (in.)	3/4
Fixture Clearance Hole, d_h (in.)	7/8
Head Washer Height (in.)	19/32
Washer O.D., d_w (in.)	1-13/32
Wrench Size (in.)	1 1/8
Max. Clamping Torque, T_{max} (ft-lbs)	250

Material Specification

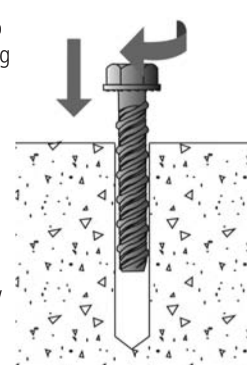
Anchor Component	Component Material
Anchor Body	Case Hardened 10B21 Carbon Steel
Finish	E-Coated Carbon Steel

Installation Guidelines

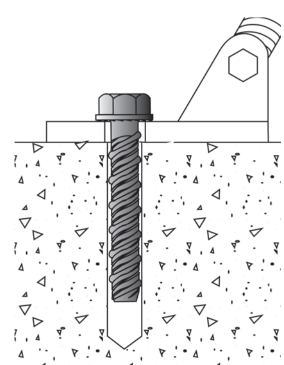
Using a 3/4" diameter ANSI Drill bit, drill a hole into the concrete base material to a depth at least 3/4" deeper than the embedment depth required. Blow the anchor hole clean of dust and other material. Typical minimum concrete base material thickness is 5". It is acceptable to drill through the concrete base material. Choose the correct length Tilt Wall Wedge-Bolt that will maximize thread engagement with the walls of the anchor hole.



Insert the anchor into the anchor hole. Using an electric impact wrench fitted with a 1 1/8" hex socket, advance the anchor by rotating clockwise while applying pressure in towards the concrete base material. The first few threads will engage the walls of the anchor hole and the anchor will continue to advance. The Tilt Wall Wedge-Bolt is installed without the brace shoe, advancing the anchor until the hex head is 1 1/2" above the surface of the concrete base material.



Slide the brace shoe onto the exposed portion of the anchor body and finish advancing the anchor until the integral hex head is firmly seated against the brace shoe.



PERFORMANCE DATA

Ultimate Load Capacities for Tilt Wall Wedge-Bolt Installed in Normal-Weight Concrete[1,2]

Anchor Diameter d in. (mm)	Min. Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)								
		2,000 psi (13.8 MPa)			**3,000 psi** (20.7 MPa)			**4,000 psi** (27.6 MPa)		
		Tension lbs. (kN)	Shear lbs. (kN)	60° Load lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	60° Load lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	60° Load lbs. (kN)
3/4 (19.1)	5 (127.0)	13,500 (60.8)	21,825 (98.2)	14,780 (66.5)	16,103 (66.5)	24,303 (66.5)	15,465 (66.5)	18,705 (84.2)	26,780 (120.5)	16,150 (72.7)
	7 (177.8)	17,570 (79.1)	28,030 (126.1)	22,750 (102.4)	20,090 (102.4)	29,290 (102.4)	23,803 (102.4)	22,610 (101.7)	30,550 (137.5)	24,855 (111.8)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 2.0 or greater to determine the allowable working load for tilt-up bracing applications. For other applications, the ultimate load capacities should be reduced by a minimum applied safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate loads for intermediate embedments and compressive strengths.

Allowable Load Capacities for Tilt Wall Wedge-Bolt Installed in Normal-Weight Concrete[1,2]

Anchor Diameter d in. (mm)	Min. Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)								
		2,000 psi (13.8 MPa)			**3,000 psi** (20.7 MPa)			**4,000 psi** (27.6 MPa)		
		Tension lbs. (kN)	Shear lbs. (kN)	60° Load lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	60° Load lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	60° Load lbs. (kN)
3/4 (19.1)	5 (127.0)	6,750 (30.4)	10,915 (49.1)	7,390 (33.3)	8,050 (36.2)	12,150 (54.7)	7,735 (34.8)	9,355 (42.1)	13,390 (60.3)	8,075 (36.3)
	7 (177.8)	8,785 (39.5)	14,015 (63.1)	11,375 (51.2)	10,045 (45.2)	14,645 (65.9)	11,900 (53.6)	11,305 (50.9)	15,275 (68.7)	12,430 (55.9)

1. Allowable load capacities listed are calculated using an applied safety factor of 2.0 for Tilt-up Bracing applications.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.

DESIGN CRITERIA

Load Adjustment Factors for Spacing and Edge Distances

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	**Load Type**	**Critical Distance (Full Anchor Capacity)**	**Critical Load Factor**	**Minimum Distance (Reduced Capacity)**	**Minimum Load Factor**
Spacing (s)	Tension	$s_{cr} = 12d$	$F_N = 1.0$	$s_{min} = 4d$	$F_N = 0.50$
	Shear	$s_{cr} = 12d$	$F_V = 1.0$	$s_{min} = 4d$	$F_V = 0.75$
Edge Distance (c)	Tension	$c_{cr} = 8d$	$F_N = 1.0$	$c_{min} = 3d$	$F_N = 0.70$
	Shear	$c_{cr} = 12d$	$F_V = 1.0$	$c_{min} = 3d$	$F_V = 0.15$

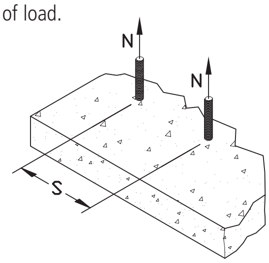
DESIGN CRITERIA

Load Adjustment Factors for Tilt Wall Wedge-Bolt in Normal-Weight Concrete

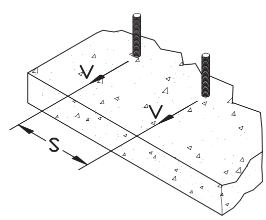
		Spacing, Tension (F_N)	Spacing, Shear (F_V)	Edge Distance, Tension (F_N)	Edge Distance, Shear (F_V)
Diameter (in.)		3/4	3/4	3/4	3/4
s_{cr} or c_{cr} (in.)		9	9	6	9
s_{min} or c_{min} (in.)		3	3	2 1/4	2 1/4
Spacing, *s* and Edge Distance, *c* (inches)	2 1/4			0.70	0.15
	3	0.50	0.75	0.76	0.24
	4	0.58	0.79	0.84	0.37
	5	0.67	0.83	0.92	0.50
	6	0.75	0.88	1.00	0.62
	7	0.83	0.92		0.75
	8	0.92	0.96		0.87
	9	1.00	1.00		1.00

Notes:

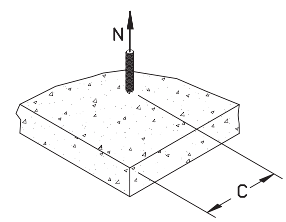
For anchors loaded in tension, the critical spacing (s_{cr}) is equal to 12 anchor diameters (12*d*) at which the anchor achieves 100% of load.
Minimum spacing (s_{min}) is equal to 4 anchor diameters (4*d*) at which the anchor achieves 50% of load.



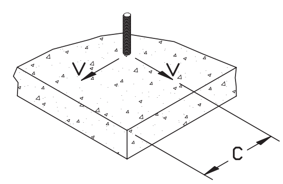
For anchors loaded in shear, the critical spacing (s_{cr}) is equal to 12 anchor diameters (12*d*) at which the anchor achieves 100% of load.
Minimum spacing (s_{min}) is equal to 4 anchor diameters (4*d*) at which the anchor achieves 75% of load.



For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 8 anchor diameters (8*d*) at which the anchor achieves 100% of load.
Minimum edge distance (c_{min}) is equal to 3 anchor diameters (3*d*) at which the anchor achieves 70% of load.



For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12*d*) at which the anchor achieves 100% of load.
Minimum edge distance (c_{min}) is equal to 3 anchor diameters (3*d*) at which the anchor achieves 15% of load.



ORDERING INFORMATION

Tilt-Wall Wedge-Bolt

Catalog Number	Size	ANSI Bit Diameter	Thread Length	Clearance Hole Dia.	Minimum Embedment	Standard Box	Standard Carton
7295	3/4" x 6"	3/4"	4 1/2"	7/8"	5"	10	40
7297	3/4" x 8"	3/4"	6"	7/8"	6"	10	40

Tapper® *Concrete Screw Anchor*

PRODUCT DESCRIPTION

The Tapper fastening system is a complete family of screw anchors for light to medium duty applications in concrete, masonry block and brick base materials. The Tapper is fast and easy to install and provides a neat, finished appearance. The Tapper screw anchor is engineered with matched tolerance drill bits and installation tools designed to meet the needs of the user and also provide optimum performance.

For every project, it is important to consider several things before making a selection: The proper head style, the color or finish that is desired, and the required level of corrosion resistance. The Tapper screw anchor is available in carbon steel with a zinc plated finish, carbon steel with a Perma-Seal climate coating in several colors, and also in 410 and 304 stainless steels. Head styles include a slotted hex washer head, Phillips flat head, trim head and flange head.

GENERAL APPLICATIONS AND USES

Zinc Plated Tappers
- Metal Door Frames
- Interior Electrical Applications
- Thresholds
- Joint Flashings

Perma-Seal Tappers
- Window Installations
- Interior Hand Rails
- Storm Shutters
- Interior Lighting Fixtures

410 Stainless Steel Tappers
- Screen Enclosures
- Exterior Metal Lighting or Fixtures
- Storm Shutters
- Light Duty Industrial Applications

304 Stainless Steel Tappers
- Exterior Applications
- Marine Applications
- Food and Beverage Facilities
- Waste and Water Treatment Plants

FEATURES AND BENEFITS

- Tested in accordance with ASTM E488 and AC106 criteria
- Available in several head styles
- Several colors and finishes to match application
- Removable and reusable
- High-low thread design for greater stability and grip
- Does not exert expansion forces
- No hole spotting required
- Good corrosion protection with Perma-Seal coating
- Available in 410 and 304 stainless steel

APPROVALS AND LISTINGS

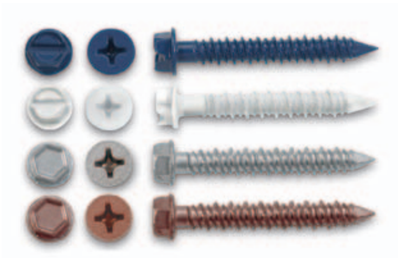
International Code Council, Evaluation Service (ICC-ES) ER-5878
Southern Building Code Conference International (SBCCI) #9944A
City of Los Angeles (COLA) Research Report LARR – 25548
Florida Building Code Approval – FL2209.9
Miami-Dade County Notice of Acceptance (NOA) 03-0303.14
Various North American Departments of Transportation (DOT) – See www.powers.com

GUIDE SPECIFICATIONS

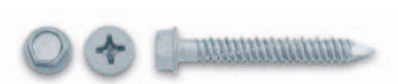
CSI Divisions: *03151-Concrete Anchoring, 04081-Masonry Anchorage* and *05090-Metal Fastenings.* Concrete Screw Anchors shall be Tapper anchors as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS Page No.

Zinc Plated Carbon Steel Tapper



Perma-Seal Coated Carbon Steel Tapper



410 Stainless Steel Tapper

304 Stainless Steel Tapper

ANCHOR MATERIALS

Zinc Plated Carbon Steel
Perma-Seal Carbon Steel
Type 410 Stainless Steel
Type 304 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

3/16" diameter x 1 1/4" length to
3/8" diameter x 6" length

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Structural Lightweight Concrete
Grouted Concrete Masonry
Hollow Concrete Masonry
Solid Brick Masonry

INSTALLATION SPECIFICATIONS

Perma-Seal Carbon Steel Hex Head Tapper

	Anchor Diameter, *d*	
Dimension	**3/16"**	**1/4"**
Tapper Drill Bit Size, d_{bit} (in.)	5/32	3/16
Fixture Clearance Hole, d_h (in.)	1/4	5/16
Thread Size (UNC)	11-16	1/4-15
Head Height (in.)	7/64	9/64
Head Width (in.)	1/4	5/16
Washer O.D., d_w (in.)	11/32	13/32
Washer Thickness, (in.)	1/32	1/32
Hex Driver (in.)	1/4	5/16

1/4" flange hex head parts have a washer O.D. of 39/64".

Perma-Seal Carbon Steel Flat Head Tapper

	Anchor Diameter, *d*	
Dimension	**3/16"**	**1/4"**
Tapper Drill Bit Size, d_{bit} (in.)	5/32	3/16
Fixture Clearance Hole, d_h (in.)	1/4	5/16
Thread Size (UNC)	11-16	1/4-15
Phillips Head O.D., (in.)	3/8	1/2
Phillips Head Height, (in.)	9/64	3/16
Phillips Bit Size	2	3
Phillips Driver	#2	#3

1/4" trim flat head parts have a head height of 5/32" and a head width of 13/32".

1/4" Zinc Plated Carbon Steel Tapper

	Anchor Diameter, *d*	
Dimension	**1/4" HEX**	**1/4" PFH**
Tapper Drill Bit Size, d_{bit} (in.)	3/16	3/16
Fixture Clearance Hole, d_h (in.)	5/16	5/16
Thread Size (UNC)	5/16-18	1/4-15
Head Height (in.)	1/4	3/16
Head Width (in.)	3/8	31/64 O.D.
Washer O.D., d_w (in.)	39/64	N/A
Hex Driver (in.) / Phillips Driver	3/8	#3

3/8" Zinc Plated Carbon Steel Tapper

	Anchor Diameter, *d*	
Dimension	**3/8" HEX**	**3/8" PFH**
Tapper Drill Bit Size, d_{bit} (in.)	1/4	1/4
Fixture Clearance Hole, d_h (in.)	5/16	5/16
Thread Size (UNC)	5/16-18	5/16-18
Head Height (in.)	1/4	19/64
Head Width (in.)	3/8	3/4 O.D.
Washer O.D., d_w (in.)	39/64	N/A
Hex Driver (in.) / Phillips Driver	3/8	#3

304 Stainless Steel Tapper

	Anchor Diameter, *d*	
Dimension	**1/4" HEX**	**1/4" PFH**
Tapper Drill Bit Size, d_{bit} (in.)	3/16	3/16
Fixture Clearance Hole, d_h (in.)	5/16	5/16
Thread Size (UNC)	1/4-14	1/4-14
Head Height (in.)	9/64	3/16
Head Width (in.)	5/16	1/2 O.D.
Washer O.D., d_w (in.)	13/32	N/A
Washer Thickness, (in.)	1/32	N/A
Hex Driver (in.) / Phillips Driver	3/8	#3

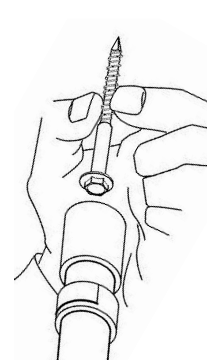
410 Stainless Steel Tapper

	Anchor Diameter, *d*	
Dimension	**1/4" HEX**	**1/4" PFH**
Tapper Drill Bit Size, d_{bit} (in.)	3/16	3/16
Fixture Clearance Hole, d_h (in.)	5/16	5/16
Thread Size (UNC)	1/4-14	1/4-14
Head Height (in.)	9/64	3/16
Head Width (in.)	5/16	1/2 O.D.
Washer O.D., d_w (in.)	13/32	N/A
Washer Thickness, (in.)	1/32	N/A
Hex Driver (in.) / Phillips Driver	3/8	#3

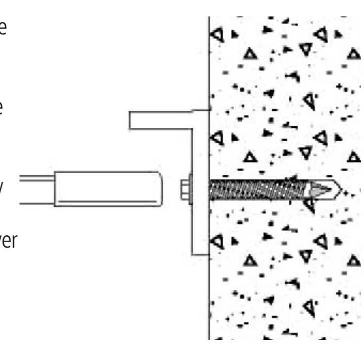
Installation Procedure

Using the proper diameter bit, drill a hole into the base material to a depth of at least 1/4" deeper than the embedment required. A Tapper drill bit must be used. Blow the hole clean of dust and other material.

Select the Tapper installation tool and drive socket to be used. Insert the head of the Tapper into the hex head socket or Phillips head driver. For softer concrete or masonry, set the drill motor to the "rotation only" mode.



Place the point of the Tapper through the fixture into the pre-drilled hole and drive the anchor in one steady continuous motion until it is fully seated at the proper embedment. The driver will automatically disengage from the head of the Tapper.



MATERIAL SPECIFICATIONS

Anchor Component	Perma-Seal Tapper	Zinc Plated*	410 Stainless Steel	304 Stainless Steel
Anchor Body	Case Hardened AISI 1022	Case Hardened AISI 1022	Type 410 Stainless Steel	Type 304 Stainless Steel
Coating/Plating/Finish	Perma-Seal Fluoropolymer	ASTM B 633, SC1, Type III (Fe/Zn5)	Class 4 Sealcoat (Passivated)	Passivated

*These hardened zinc plated carbon steel fasteners meet or exceed industry standards. They are not recommended for use in direct contact with aluminum when moisture may be present. Efforts to prevent corrosion due to dissimilar metal contact should be made.

PERFORMANCE DATA

Ultimate Load Capacities for Carbon Steel Tapper Screw Anchors in Normal-Weight Concrete[1,2]

Anchor Diameter *d* in. (mm)	Anchor Material and Plating/ Coating	Min. Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
			2,000 psi (13.8 MPa)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	Carbon Steel, Perma-Seal	1 (25.4)	160 (0.7)	700 (3.2)	260 (1.2)	700 (3.2)	360 (1.6)	700 (3.2)	510 (2.3)	980 (4.4)
		1 1/4 (31.8)	520 (2.3)	840 (3.8)	610 (2.7)	880 (4.0)	695 (3.1)	920 (4.1)	840 (3.8)	1,090 (4.9)
		1 3/8 (34.9)	700 (3.2)	910 (4.1)	780 (3.5)	900 (4.1)	855 (3.8)	920 (4.1)	1,060 (4.8)	1,135 (5.1)
		1 1/2 (38.1)	720 (3.2)	920 (4.1)	860 (3.9)	920 (4.1)	1,020 (4.6)	920 (4.1)	1,275 (5.7)	1,180 (5.3)
		1 3/4 (31.8)	1,180 (2.3)	940 (4.2)	1,340 (6.0)	940 (4.2)	1,500 (6.8)	940 (4.2)	1,570 (7.1)	1,290 (5.8)
1/4 (6.4)	Carbon Steel, Perma-Seal and Zinc Plated	1 (25.4)	620 (2.8)	820 (3.7)	840 (3.8)	820 (3.7)	1,060 (4.8)	820 (3.7)	1,140 (7.1)	1,320 (5.9)
		1 1/4 (31.8)	810 (3.6)	1,130 (5.1)	1,080 (4.9)	1,275 (5.7)	1,345 (6.1)	1,420 (6.4)	1,445 (6.5)	1,630 (7.3)
		1 3/8 (34.9)	905 (4.1)	1,280 (5.8)	1,195 (5.4)	1,350 (6.1)	1,485 (6.7)	1,420 (6.4)	1,615 (7.3)	1,805 (8.1)
		1 1/2 (38.1)	1,000 (4.5)	1,420 (6.4)	1,300 (5.9)	1,420 (6.4)	1,620 (7.3)	1,420 (6.4)	1,770 (8.0)	1,980 (8.9)
		1 3/4 (44.5)	1,620 (7.3)	1,480 (6.7)	1,680 (7.6)	1,480 (6.7)	1,740 (7.8)	1,480 (6.7)	2,195 (9.9)	2,260 (10.2)
	Carbon Steel, Zinc Plated	1 1/2 (38.1)	–	–	2,080 (9.4)	1,940 (8.7)	2,080 (9.4)	1,940 (8.7)	2,080 (9.4)	1,940 (8.7)
3/8 (9.5)	Carbon Steel, Zinc Plated	1 (25.4)	700 (3.2)	960 (4.3)	720 (3.2)	960 (4.3)	760 (3.4)	960 (4.3)	1,055 (4.7)	1,200 (5.4)
		1 1/4 (31.8)	905 (4.1)	1,475 (6.6)	1030 (4.6)	1,715 (7.7)	1,150 (5.2)	1,950 (8.8)	1,570 (7.1)	2,000 (9.0)
		1 1/2 (38.1)	1,110 (5.0)	1,980 (8.9)	1,320 (5.9)	1,980 (8.9)	1,540 (6.9)	1,980 (8.9)	2,120 (9.5)	2,700 (12.2)
		1 3/4 (44.5)	1,360 (6.1)	2,320 (10.4)	1,660 (7.5)	2,320 (10.4)	1,960 (8.8)	2,320 (10.4)	2,590 (11.7)	2,950 (13.3)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.

PERFORMANCE DATA

Allowable Load Capacities for Carbon Steel Tapper Screw Anchors in Normal-Weight Concrete[1,2,3]

Anchor Diameter d in. (mm)	Anchor Material and Plating/ Coating	Min. Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
			2,000 psi (13.8 MPa)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	Carbon Steel, Perma-Seal	1 (25.4)	40 (0.2)	175 (0.8)	65 (0.3)	175 (0.8)	90 (0.4)	175 (0.8)	130 (0.6)	245 (1.1)
		1 1/4 (31.8)	130 (0.6)	210 (0.9)	155 (0.7)	220 (1.0)	175 (0.8)	230 (1.0)	210 (0.9)	275 (1.2)
		1 3/8 (34.9)	175 (0.8)	230 (1.0)	195 (0.9)	225 (1.0)	215 (1.0)	230 (1.0)	265 (1.2)	285 (1.3)
		1 1/2 (38.1)	180 (0.8)	230 (1.0)	215 (1.0)	230 (1.0)	255 (1.1)	230 (1.0)	320 (1.4)	295 (1.3)
		1 3/4 (31.8)	295 (1.3)	235 (1.1)	335 (1.5)	235 (1.1)	375 (1.7)	235 (1.1)	395 (1.8)	325 (1.5)
1/4 (6.4)	Carbon Steel, Perma-Seal and Zinc Plated	1 (25.4)	155 (0.7)	205 (0.9)	210 (0.9)	205 (0.9)	265 (1.2)	205 (0.9)	285 (1.3)	330 (1.5)
		1 1/4 (31.8)	205 (0.9)	285 (1.3)	270 (1.2)	320 (1.4)	335 (1.5)	355 (1.6)	360 (1.6)	410 (1.8)
		1 3/8 (34.9)	225 (1.0)	320 (1.4)	300 (1.4)	340 (1.5)	370 (1.7)	355 (1.6)	405 (1.8)	450 (2.0)
		1 1/2 (38.1)	250 (1.1)	355 (1.6)	325 (1.5)	355 (1.6)	405 (1.8)	355 (1.6)	445 (2.0)	495 (2.2)
		1 3/4 (44.5)	405 (1.8)	370 (1.7)	420 (1.9)	370 (1.7)	435 (2.0)	370 (1.7)	550 (2.5)	565 (2.5)
	Carbon Steel, Zinc Plated	1 1/2 (38.1)	–	–	520 (2.3)	485 (2.2)	520 (2.3)	485 (2.2)	520 (2.3)	485 (2.2)
3/8 (9.5)	Carbon Steel, Zinc Plated	1 (25.4)	175 (0.8)	240 (1.1)	180 (0.8)	240 (1.1)	190 (0.9)	240 (1.1)	265 (1.2)	300 (1.4)
		1 1/4 (31.8)	225 (1.0)	370 (1.7)	260 (1.2)	430 (1.9)	290 (1.3)	490 (2.2)	395 (1.8)	500 (2.3)
		1 1/2 (38.1)	275 (1.2)	495 (2.2)	330 (1.5)	495 (2.2)	385 (1.7)	495 (2.2)	530 (2.4)	675 (3.0)
		1 3/4 (44.5)	340 (1.5)	580 (2.6)	415 (1.9)	580 (2.6)	490 (2.2)	580 (2.6)	650 (2.9)	740 (3.3)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
3. Critical and minimum spacing and edge distances as well as reduction factors for intermediate spacing and edge distances are listed in the Design Criteria section.

PERFORMANCE DATA

Ultimate Load Capacities for Stainless Steel Tapper Screw Anchors in Normal-Weight Concrete[1,2]

Anchor Diameter *d* in. (mm)	Anchor Material and Plating/ Coating	Min. Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
			2,000 psi (13.8 MPa)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
			Tension lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**Shear** lbs. (kN)
1/4 (6.4)	Type 304 Stainless Steel	1 (25.4)	500 (2.3)	1,180 (5.3)	600 (2.7)	1,180 (5.3)	700 (3.2)	1,180 (5.3)	700 (3.2)	1,180 (5.3)
		1 1/4 (31.8)	855 (3.8)	1,265 (5.7)	855 (3.8)	1,265 (5.7)	1,015 (4.6)	1,340 (6.0)	1,215 (5.5)	1,340 (6.0)
		1 1/2 (38.1)	1,140 (5.1)	1,340 (6.0)	1,220 (5.5)	1,340 (6.0)	1,320 (5.9)	1,340 (6.0)	1,320 (5.9)	1,340 (6.0)
		1 3/4 (44.5)	1,440 (6.5)	1,640 (7.4)	1,520 (6.8)	1,640 (7.4)	1,580 (7.1)	1,640 (7.4)	1,580 (7.1)	1,640 (7.4)
1/4 (6.4)	Type 410 Stainless Steel	1 1/2 (38.1)	–	–	2,160 (9.7)	2,420 (10.9)	2,160 (9.7)	2,420 (10.9)	2,160 (9.7)	2,420 (10.9)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate loads for intermediate embedments and compressive strengths.

Allowable Load Capacities for Stainless Steel Tapper Screw Anchors in Normal-Weight Concrete[1,2,3]

Anchor Diameter *d* in. (mm)	Anchor Material and Plating/ Coating	Min. Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
			2,000 psi (13.8 MPa)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
			Tension lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**Shear** lbs. (kN)
1/4 (6.4)	Type 304 Stainless Steel	1 (25.4)	125 (0.6)	295 (1.3)	150 (0.7)	295 (1.3)	175 (0.8)	295 (1.3)	175 (0.8)	295 (1.3)
		1 1/4 (31.8)	215 (1.0)	315 (1.4)	215 (1.0)	315 (1.4)	255 (1.1)	335 (1.5)	305 (1.4)	335 (1.5)
		1 1/2 (38.1)	285 (1.3)	335 (1.5)	305 (1.4)	335 (1.5)	330 (1.5)	335 (1.5)	330 (1.5)	335 (1.5)
		1 3/4 (44.5)	360 (1.6)	410 (1.8)	380 (1.7)	410 (1.8)	395 (1.8)	410 (1.8)	395 (1.8)	410 (1.8)
1/4 (6.4)	Type 410 Stainless Steel	1 1/2 (38.1)	–	–	540 (2.4)	605 (2.7)	540 (2.4)	605 (2.7)	540 (2.4)	605 (2.7)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
3. Critical and minimum spacing and edge distances as well as reduction factors for intermediate spacing and edge distances are listed in the Design Criteria section.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Tapper Screw Anchors in Structural Lightweight Concrete[1,2,3]

Anchor Diameter *d* in. (mm)	Anchor Material and Plating/ Coating	Minimum Embed. Depth h_v in. (mm)	Tension, lbs (kN)						Shear, lbs (kN)	
			Minimum Concrete Compressive Strength (f'_c)							
			3,000 psi (20.7 MPa)		4,000 psi (27.6 MPa)		5,000 psi (34.5 MPa)		$f'_c \geq$ 3,000 psi (20.7 MPa)	
			Ultimate Load	Allowable Load	Ultimate Load	Allowable Load	Ultimate Load	Allowable Load	Ultimate Load	Allowable Load
3/16 (4.8)	Carbon Steel, Perma-Seal	1 1/4 (31.8)	230 (1.0)	60 (0.3)	270 (1.2)	70 (0.3)	305 (1.4)	75 (0.3)	340 (1.5)	85 (0.4)
1/4 (6.4)	Carbon Steel, Perma-Seal and Zinc Plated	1 1/4 (31.8)	270 (1.2)	70 (0.3)	300 (1.4)	75 (0.3)	325 (1.5)	80 (0.4)	450 (2.0)	115 (0.5)
1/4 (6.4)	Type 304 Stainless Steel	1 1/2 (38.1)	270 (1.2)	70 (0.3)	300 (1.4)	75 (0.3)	325 (1.5)	80 (0.4)	520 (2.3)	130 (0.6)
3/8 (9.5)	Carbon Steel, Zinc-Plated	1 1/2 (38.1)	325 (1.5)	80 (0.4)	345 (1.6)	85 (0.4)	380 (1.7)	95 (0.4)	580 (2.6)	145 (0.7)

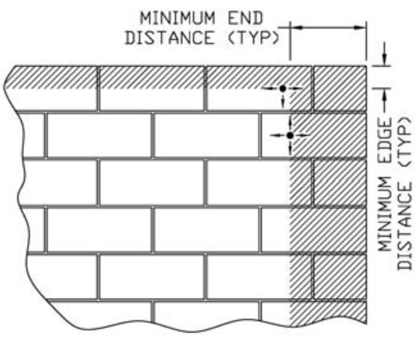
1. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.
3. Critical and minimum spacing and edge distances as well as reduction factors for intermediate spacing and edge distances are listed in the Design Criteria section.

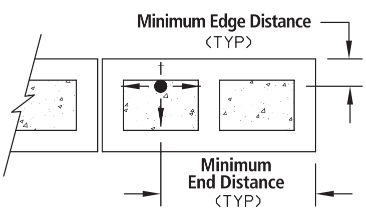
Ultimate and Allowable Load Capacities for Tapper Screw Anchors Installed Through Metal Deck into Structural Lightweight Concrete[1,2,3,4]

Anchor Diameter *d* in. (mm)	Anchor Material and Plating/Coating	Minimum Embedment Depth h_v in. (mm)	Lightweight Concrete over Minimum 20 Ga. Metal Deck $f'_c \geq$ 3,000 psi (20.7 MPa)			
			Minimum 1 3/4" Wide Deck			
			Ultimate Load		Allowable Load	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	Carbon Steel, Perma-Seal	1 1/4 (31.8)	230 (1.0)	270 (1.2)	60 (0.3)	70 (0.3)
1/4 (6.4)	Carbon Steel, Perma-Seal and Zinc Plated	1 1/4 (31.8)	270 (1.2)	300 (1.4)	70 (0.3)	75 (0.3)
3/8 (9.5)	Carbon Steel, Zinc-Plated	1 1/2 (38.1)	270 (1.2)	300 (1.4)	70 (0.3)	75 (0.3)

1. The tabulated values are for screw anchors installed in structural lightweight concrete having the designated compressive strength at the time of anchor installation.
2. The embedment depth is the distance from the concrete surface to the embedded end of the screw anchor. The minimum concrete thickness is 11/2 times the screw anchor embedment depth.
3. The tabulated values are applicable for screw anchors installed at a minimum spacing between screw anchors of 8 times the screw anchor diameter.
4. The tabulated values are applicable for screw anchors installed at a critical edge distance of 12 times the screw anchor diameter. The screw anchors may be reduced to a minimum edge distance of 5 times the screw diameter provided the allowable tension loads are reduced by 65 percent and the allowable shear loads are reduced by 40 percent. Linear interpolation for allowable loads may be used for intermediate edge distances

PERFORMANCE DATA





1. Tabulated load values are for anchors installed in minimum Grade N, Type II, lightweight, medium-weight and normal-weight concrete masonry units conforming to ASTM C 90 that have reached the minimum designated ultimate compressive strength at the time of installation ($f'm \geq$ 1,500 psi).
2. Allowable load capacities listed are calculated using an applied safety factor of 5.0.
3. The tabulated values are applicable for screw anchors installed at a critical spacing between screw anchors of 16 times the screw anchor diameter. The screw anchors may be reduced to a minimum spacing distance of 8 times the screw diameter provided the allowable loads are reduced by 70 percent. Linear interpolation for allowable loads may be used for intermediate spacing distances.
4. The tabulated values are applicable for screw anchors installed at a minimum edge distance of 12 times the screw anchor diameter unless otherwise noted.

Allowable Load Capacities for Tapper Screw Anchors in Grout-Filled Concrete Masonry[1,2,3]

Anchor Installed Through Face Shell or Cell Web[4]				
Anchor Diameter *d* in. (mm)	Anchor Material and Plating/ Coating	Minimum Embedment Depth h_v in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	Carbon Steel, Perma-Seal	1 1/2 (38.1)	370 (1.7)	320 (1.4)

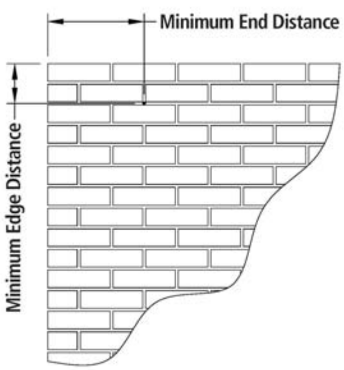
Anchor Installed in Cell Opening (Top of Wall) for Sill Plates and Other Attachments					
Anchor Diameter *d* in. (mm)	Anchor Material and Plating/ Coating	Minimum Embed. Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	Carbon Steel, Perma-Seal	2 (50.8)	1 3/4 (44.5)	280 (1.3)	225 (1.0)

Allowable Load Capacities for Tapper Screw Anchors in C-90 Hollow Block[1,2,3,4]

Anchor Diameter *d* in. (mm)	Anchor Material and Plating/ Coating	Minimum Embedment Depth h_v in. (mm)	Lightweight, Medium & Normal Weight CMU $f'_m \geq$ **2,000 psi** (13.8 MPa) Tension lbs. (kN)	 Shear lbs. (kN)
3/16 (4.8)	Carbon Steel, Perma-Seal	1 (25.4)	90 (0.4)	185 (0.8)
		1 1/4 (31.8)	105 (0.5)	205 (0.9)
		1 3/8 (34.9)	120 (0.5)	245 (1.1)
		1 1/2 (38.1)	120 (0.5)	245 (1.1)
		1 3/4 (31.8)	120 (0.5)	245 (1.1)
1/4 (6.4)	Carbon Steel, Perma-Seal	1 (25.4)	115 (0.5)	205 (0.9)
	Carbon Steel, Perma-Seal and Zinc-Plated	1 1/4 (31.8)	175 (0.8)	255 (1.1)
		1 3/8 (34.9)	240 (1.1)	365 (1.6)
		1 1/2 (38.1)	240 (1.1)	365 (1.6)
		1 3/4 (44.5)	240 (1.1)	365 (1.6)
1/4 (6.4)	Type 410 Stainless Steel	1 (25.4)	140 (0.6)	210 (0.9)
	Type 304 and Type 410 Stainless Steel	1 1/4 (31.8)	120 (0.5)	205 (0.9)
		1 1/2 (38.1)	145 (0.7)	245 (1.1)
		1 3/4 (44.5)	145 (0.7)	245 (1.1)
3/8 (9.5)	Carbon Steel, Zinc Plated	1 (25.4)	170 (0.8)	230 (1.0)
		1 1/4 (31.8)	205 (0.9)	255 (1.1)
		1 1/2 (38.1)	250 (1.1)	335 (1.5)
		1 3/4 (44.5)	295 (1.3)	365 (1.6)

PERFORMANCE DATA

Allowable Load Capacities for Tapper Screw Anchors in Brick Masonry[1,2,3,4,5]



Anchor Diameter *d* in. (mm)	Anchor Material and Plating/ Coating	Minimum Embedment Depth h_v in. (mm)	Brick Masonry $f'_m \geq$ 1,300 psi (9.0 MPa) Tension lbs. (kN)	Brick Masonry $f'_m \geq$ 1,300 psi (9.0 MPa) Shear lbs. (kN)
3/16 (4.8)	Carbon Steel, Perma-Seal	1 (25.4)	125 (0.6)	195 (0.9)
		1 1/4 (31.8)	215 (1.0)	220 (1.0)
		1 3/8 (34.9)	230 (1.0)	230 (1.0)
		1 1/2 (38.1)	245 (1.1)	245 (1.1)
		1 3/4 (31.8)	265 (1.2)	270 (1.2)
1/4 (6.4)	Carbon Steel, Perma-Seal and Zinc-Plated	1 (25.4)	190 (0.9)	345 (1.6)
		1 1/4 (31.8)	230 (1.0)	370 (1.7)
		1 3/8 (34.9)	250 (1.1)	375 (1.7)
		1 1/2 (38.1)	265 (1.2)	385 (1.7)
		1 3/4 (44.5)	285 (1.3)	425 (1.9)
1/4 (6.4)	Type 304 and Type 410 Stainless Steel	1 (25.4)	145 (0.7)	288 (1.3)
		1 1/4 (31.8)	160 (0.7)	330 (1.5)
		1 1/2 (38.1)	190 (0.9)	345 (1.6)
		1 3/4 (44.5)	190 (0.9)	345 (1.6)
3/8 (9.5)	Carbon Steel, Zinc Plated	1 (25.4)	205 (0.9)	365 (1.6)
		1 1/4 (31.8)	275 (1.2)	470 (2.1)
		1 1/2 (38.1)	310 (1.4)	525 (2.4)
		1 3/4 (44.5)	330 (1.5)	550 (2.5)

1. Tabulated load values are for anchors installed in Grade SW multiple wythe, solid brick masonry conforming to ASTM C62.
2. Allowable load capacities are calculated using an applied safety factor of 5.0.
3. Linear interpolation may be used to determine allowable load capacities for intermediate embedments.
4. The tabulated values are for anchors installed at a minimum edge and end distance of 4 inches.
5. The tabulated values are for anchors installed at a minimum of 12 anchor diameters on center for 100 percent capacity. Spacing distances may be reduced to 6 anchor diameters on center provided the capacities are reduced by 50 percent. Linear interpolation may be used for intermediate spacing.

DESIGN CRITERIA

Combined Loading

For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n}\right)^{\frac{5}{3}} + \left(\frac{V_u}{V_n}\right)^{\frac{5}{3}} \leq 1$$

OR

$$\left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

Load Adjustment Factors for Spacing and Edge Distances in Normal-Weight Concrete[1]

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	**Load Type**	**Critical Distance (Full Anchor Capacity)**	**Critical Load Factor**	**Minimum Distance (Reduced Capacity)**	**Minimum Load Factor**
Spacing (s)	Tension and Shear	$s_{cr} = 12d$	$F_N = F_V = 1.0$	$s_{min} = 6d$	$F_N = F_V = 0.50$
Edge Distance (c)	Tension and Shear	$c_{cr} = 12d$	$F_N = F_V = 1.0$	$c_{min} = 6d$	$F_N = F_V = 0.50$

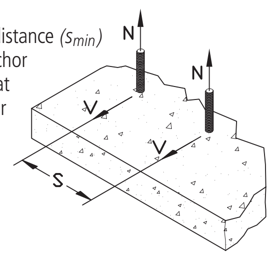
1. Load values, found in the Performance Tables, are multiplied by the reduction factors when spacing edge distances are less than critical distances. Linear interpolation is allowed for spacing and edge distances that fall between critical and minimum distances. When a group of anchors is affected by both reduced spacing and edge distance, the spacing and edge distance reduction factors must be combined (multiplied).

Load Adjustment Factors for Normal-Weight Concrete

Spacing, Tension (F_N) & Shear (F_V)				
Dia. (in.)		3/16	1/4	3/8
s_{cr} (in.)		2 1/4	3	4 1/2
s_{min} (in.)		1 1/8	1 1/2	2 1/4
Spacing, s (in.)	1 1/8	0.50		
	1 1/2	0.67	0.50	
	2	0.89	0.67	
	2 1/4	1.00	0.75	0.50
	2 1/2		0.83	0.56
	3		1.00	0.67
	3 1/2			0.78
	4			0.89
	4 1/2			1.00

Notes: For anchors loaded in tension and shear, the critical edge distance (s_{cr}) is equal to 12 anchor diameters (12d) at which the anchor achieves 100% of load.

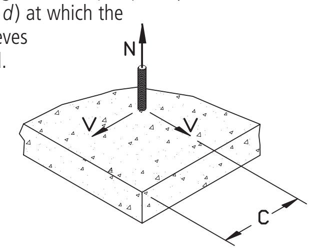
Minimum edge distance (s_{min}) is equal to 6 anchor diameters (6d) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_N) & Shear (F_V)				
Dia. (in.)		3/16	1/4	3/8
c_{cr} (in.)		2 1/4	3	4 1/2
c_{min} (in.)		1 1/8	1 1/2	2 1/4
Spacing, s (in.)	1 1/8	0.50		
	1 1/2	0.67	0.50	
	2	0.89	0.67	
	2 1/4	1.00	0.75	0.50
	2 1/2		0.83	0.56
	3		1.00	0.67
	3 1/2			0.78
	4			0.89
	4 1/2			1.00

Notes: For anchors loaded in tension and shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12d) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 6 anchor diameters (6d) at which the anchor achieves 50% of load.



ORDERING INFORMATION

Hex head Tapper anchors are measured from below the washer while flat head Tapper anchors are measured end to end. To select the proper minimum anchor length, determine the embedment depth required to obtain the desired load capacity. Then add the thickness of the fixture, including any spacers or shims, to the embedment depth.

Do not select a length that will result in an embedment into the base material which is greater than 1 3/4" to 2". Most concrete screw anchors cannot be properly driven to a depth of more than 2", especially in denser base materials.

Blue Perma-Seal Tapper, Slotted Hex Head & Flat Head

Catalog Number		Size	Standard Box	Standard Carton	Wt./ 100	Drill Bit Reference	
HEX	PFH					Straight	SDS HEX
2700	2740	3/16" x 1 1/4"	100	500	3/4	2781	2793
2702	2742	3/16" x 1 3/4"	100	500	1	2781	2793
2704	2744	3/16" x 2 1/4"	100	500	1 1/4	2782	2793
2706	2746	3/16" x 2 3/4"	100	500	1 1/2	2782	2793
2708	2748	3/16" x 3 1/4"	100	500	1 3/4	2783	2794
2710	2750	3/16" x 3 3/4"	100	500	2 1/4	2783	2794
2712	2752	3/16" x 4"	100	500	2 1/2	2783	2794
2720	2760	1/4" x 1 1/4"	100	500	1 1/2	2785	2796
2722	2762	1/4" x 1 3/4"	100	500	1 3/4	2785	2796
2724	2764	1/4" x 2 1/4"	100	500	2	2786	2796
2726	2766	1/4" x 2 3/4"	100	500	2 3/4	2786	2796
2728	2768	1/4" x 3 1/4"	100	500	3 1/4	2787	2797
2730	2770	1/4" x 3 3/4"	100	500	3 3/4	2787	2797
2732	2772	1/4" x 4"	100	100	4 1/2	2787	2797
–	2774	1/4" x 5"	100	100	4 1/2	2788	–
–	2776	1/4" x 6"	100	100	5 1/2	2789	–

One drill bit is packaged in each box of tappers.

Blue Perma-Seal Tapper (Master Packaging)

Catalog Number		Size	Standard Carton	Wt./ 100	Drill Bit Reference	
HEX	PFH				Straight	SDS HEX
9462	9476	3/16" x 1 1/4"	2,000	3/4	2781	2793
9463	9477	3/16" x 1 3/4"	2,000	1	2781	2793
9464	9478	3/16" x 2 1/4"	2,000	1 1/4	2782	2793
9465	9479	3/16" x 2 3/4"	2,000	1 1/2	2782	2793
9466	9480	3/16" x 3 1/4"	1,000	1 3/4	2783	2794
9467	9481	3/16" x 3 3/4"	1,000	2 1/4	2783	2794
9468	9482	3/16" x 4"	1,000	2 1/2	2783	2794
9469	9483	1/4" x 1 1/4"	2,000	1 1/2	2785	2796
9470	9484	1/4" x 1 3/4"	2,000	1 3/4	2785	2796
9471	9485	1/4" x 2 1/4"	1,000	2	2786	2796
9472	9486	1/4" x 2 3/4"	1,000	2 3/4	2786	2796
9473	9487	1/4" x 3 1/4"	1,000	3 1/4	2787	2797
9474	9488	1/4" x 3 3/4"	1,000	3 3/4	2787	2797
9475	9489	1/4" x 4"	1,000	4 1/2	2787	2797
–	9490	1/4" x 5"	1,000	4 1/2	2788	–
–	9491	1/4" x 6"	500	5 1/2	2789	–

Type 304 Stainless Steel Tapper, Hex Head & Flat Head

Catalog Number		Size	Standard Box	Standard Carton	Wt./ 100	Drill Bit Reference	
HEX	PFH					Straight	SDS HEX
2880	2887	1/4" x 1 1/4"	100	500	1 1/2	2894	2790
2881	2888	1/4" x 1 3/4"	100	500	1 3/4	2894	2790
2882	2889	1/4" x 2 1/4"	100	500	2	2895	2790
2883	2890	1/4" x 2 3/4"	100	500	2 3/4	2895	2790

One drill bit is packaged in each box of tappers.

Type 410 Stainless Steel Tapper, Hex Head & Flat Head

Catalog Number		Size	Standard Box	Standard Carton	Wt./ 100	Drill Bit Reference	
HEX	PFH					Straight	SDS HEX
4110	4118	1/4" x 1 1/4"	100	500	1 1/2	2785	2796
4112	4120	1/4" x 1 3/4"	100	500	1 3/4	2785	2796
4114	4123	1/4" x 2 1/4"	100	500	2	2786	2796
4116	4125	1/4" x 2 3/4"	100	500	2 3/4	2786	2796

One drill bit is packaged in each box of tappers.

ORDERING INFORMATION

White Perma-Seal Tapper, Slotted Hex Head & Flat Head

Catalog Number						Drill Bit Reference	
HEX	PFH	Size	Standard Box	Standard Carton	Wt./ 100	Straight	SDS HEX
2400	2440	3/16" x 1 1/4"	100	500	3/4	2781	2793
2402	2442	3/16" x 1 3/4"	100	500	1	2781	2793
2404	2444	3/16" x 2 1/4"	100	500	1 1/4	2782	2793
2406	2446	3/16" x 2 3/4"	100	500	1 1/2	2782	2793
2408	2448	3/16" x 3 1/4"	100	500	1 3/4	2783	2794
2410	2450	3/16" x 3 3/4"	100	500	2 1/4	2783	2794
2412	2449	3/16" x 4"	100	500	2 1/2	2783	2794
2420	2460	1/4" x 1 1/4"	100	500	1 1/2	2785	2796
2422	2462	1/4" x 1 3/4"	100	500	1 3/4	2785	2796
2424	2464	1/4" x 2 1/4"	100	500	2	2786	2796
2426	2466	1/4" x 2 3/4"	100	500	2 3/4	2786	2796
2428	2468	1/4" x 3 1/4"	100	500	3 1/4	2787	2797
2430	2470	1/4" x 3 3/4"	100	500	3 3/4	2787	2797
2435	2472	1/4" x 4"	100	500	4 1/2	2787	2797

One drill bit is packaged in each box of tappers.

White Perma-Seal Tapper (Master Packaging)

Catalog Number					Drill Bit Reference	
HEX	PFH	Size	Standard Carton	Wt./ 100	Straight	SDS HEX
–	9191	3/16" x 1 1/4"	2,000	3/4	2781	2793
–	9192	3/16" x 1 3/4"	2,000	1	2781	2793
–	9193	3/16" x 2 1/4"	2,000	1 1/4	2782	2793
–	9194	3/16" x 2 3/4"	2,000	1 1/2	2782	2793
–	9195	3/16" x 3 1/4"	1,000	1 3/4	2783	2794
–	9196	3/16" x 3 3/4"	1,000	2 1/4	2783	2794
–	9197	3/16" x 4"	1,000	2 1/2	2783	2794
9923	9951	1/4" x 1 1/4"	2,000	1 1/2	2785	2796
9924	9952	1/4" x 1 3/4"	2,000	1 3/4	2785	2796
9925	9953	1/4" x 2 1/4"	1,000	2	2786	2796
9926	9954	1/4" x 2 3/4"	1,000	2 3/4	2786	2796
9927	9955	1/4" x 3 1/4"	1,000	3 1/4	2787	2797
9928	9956	1/4" x 3 3/4"	1,000	3 3/4	2787	2797
9929	9957	1/4" x 4"	1,000	4 1/2	2787	2797
–	9958	1/4" x 5"	1,000	4 1/2	2788	–
–	9959	1/4" x 6"	500	5 1/2	2789	–

White Perma-Seal Tapper, Flange Hex Head & Trim Flat Head

Catalog Number						Drill Bit Reference	
HEX	PFH	Size	Standard Box	Standard Carton	Wt./ 100	Straight	SDS HEX
8706	8710	1/4" x 1 3/4"	100	500	1 3/4	2785	2796
8707	8711	1/4" x 2 1/4"	100	500	2	2786	2796
8708	8712	1/4" x 2 3/4"	100	500	2 3/4	2786	2796
8709	8713	1/4" x 3 1/4"	100	500	3 1/4	2787	2797
–	8714	1/4" x 3 3/4"	100	500	3 3/4	2787	2797

One drill bit is packaged in each box of tappers.

Zinc Plated Carbon Steel Tapper, Hex Head & Flat Head

Catalog Number						Drill Bit Reference	
HEX	PFH	Size	Standard Box	Standard Carton	Wt./ 100	Straight	SDS HEX
5826*	5830	1/4" x 1 1/4"	100	500	1 3/4	2785	2796
5827*	5831	1/4" x 1 3/4"	100	500	2 1/4	2785	2796
5828*	5832	1/4" x 2 1/4"	100	500	2 1/2	2786	2796
5829*	5833	1/4" x 2 3/4"	100	500	3	2786	2796
5804	–	3/8" x 2"	100	500	5 1/4	5860	5866
5806	5852	3/8" x 3"	100	500	8 1/4	5860	5866
5808	5854	3/8" x 4"	100	500	11 1/2	5861	5868
–	5856	3/8" x 5"	100	500	13	5862	5868
–	5858	3/8" x 6"	100	500	15 1/2	5863	5868

* 3/8" Hex Head
One drill bit is packaged in each box of tappers.

ORDERING INFORMATION

Silver Perma-Seal Tapper, Hex Head & Flat Head

Catalog Number		Size	Standard Box	Standard Carton	Wt./ 100	Drill Bit Reference	
HEX	PFH					Straight	SDS HEX
2400	2498	3/16" x 1 1/4"	100	500	3/4	2781	2793
2402	2500	3/16" x 1 3/4"	100	500	1	2781	2793
2404	2501	3/16" x 2 1/4"	100	500	1 1/4	2782	2793
2406	2502	3/16" x 2 3/4"	100	500	1 1/2	2782	2793
2408	2503	3/16" x 3 1/4"	100	500	1 3/4	2783	2794
2410	2504	3/16" x 3 3/4"	100	500	2 1/4	2783	2794
2412	2505	3/16" x 4"	100	500	2 1/2	2783	2794
2486	2506	1/4" x 1 1/4"	100	500	1 1/2	2785	2796
2488	2507	1/4" x 1 3/4"	100	500	1 3/4	2785	2796
2490	2508	1/4" x 2 1/4"	100	500	2	2786	2796
2492	2509	1/4" x 2 3/4"	100	500	2 3/4	2786	2796
2494	2510	1/4" x 3 1/4"	100	500	3 1/4	2787	2797
2495	2511	1/4" x 3 3/4"	100	500	3 3/4	2787	2797
2496	2512	1/4" x 4"	100	500	4 1/2	2787	2797

One drill bit is packaged in each box of tappers.

Silver Perma-Seal Tapper (Master Packaging)

Catalog Number		Size	Standard Carton	Wt./ 100	Drill Bit Reference	
HEX	PFH				Straight	SDS HEX
–	8757	3/16" x 1 1/4"	2,000	3/4	2781	2793
–	8758	3/16" x 1 3/4"	2,000	1	2781	2793
–	8759	3/16" x 2 1/4"	2,000	1 1/4	2782	2793
–	8760	3/16" x 2 3/4"	2,000	1 1/2	2782	2793
–	8761	3/16" x 3 1/4"	1,000	1 3/4	2783	2794
–	8762	3/16" x 3 3/4"	1,000	2 1/4	2783	2794
–	8763	3/16" x 4"	1,000	2 1/2	2783	2794
8750	8764	1/4" x 1 1/4"	2,000	1 1/2	2785	2796
8751	8765	1/4" x 1 3/4"	2,000	1 3/4	2785	2796
8752	8766	1/4" x 2 1/4"	1,000	2	2786	2796
8753	8767	1/4" x 2 3/4"	1,000	2 3/4	2786	2796
8754	8768	1/4" x 3 1/4"	1,000	3 1/4	2787	2797
8755	8769	1/4" x 3 3/4"	1,000	3 3/4	2787	2797
8756	8770	1/4" x 4"	1,000	4 1/2	2787	2797

Silver Perma-Seal Tapper, Flange Hex Head & Trim Flat Head

Catalog Number		Size	Standard Box	Standard Carton	Wt./ 100	Drill Bit Reference	
HEX	PFH					Straight	SDS HEX
8715	8719	1/4" x 1 3/4"	100	500	1 3/4	2785	2796
8716	8720	1/4" x 2 1/4"	100	500	2	2786	2796
8717	8721	1/4" x 2 3/4"	100	500	2 3/4	2786	2796
8718	8722	1/4" x 3 1/4"	100	500	3 1/4	2787	2797
–	8723	1/4" x 3 3/4"	100	500	3 3/4	2787	2797

One drill bit is packaged in each box of tappers.

Bronze Perma-Seal Tapper, Flange Hex Head & Trim Flat Head

Catalog Number		Size	Standard Box	Standard Carton	Wt./ 100	Drill Bit Reference	
HEX	PFH					Straight	SDS HEX
9977	9975	1/4" x 1 3/4"	100	500	1 3/4	2785	2796
9978	9976	1/4" x 2 1/4"	100	500	2	2786	2796

One drill bit is packaged in each box of tappers.

ORDERING INFORMATION

Carbide Drill Bits for Perma-Seal, 1/4" Zinc Plated & 410 Stainless Steel Tapper

(Do not use with Type 304 Stainless Steel or 3/8" Zinc Plated Tapper)

Straight Shank

Catalog Number	Size	Drill Bit Range	Usable Length	Standard Tube	Wt./ 10
2781	5/32" x 3 1/2"		2"	10	1/4
2782	5/32" x 4 1/2"	0.168"– 0.175"	3"	10	1/4
2783	5/32" x 5 1/2"		4"	10	1/4
2785	3/16" x 3 1/2"		2"	10	1/4
2786	3/16" x 4 1/2"		3"	10	1/4
2787	3/16" x 5 1/2"	0.202"– 0.204"	4"	10	1/2
2788	3/16" x 6 1/2"		5"	10	1/2
2789	3/16" x 7 1/2"		6"	10	1/2

Hex Shank SDS-Plus

Catalog Number	Size	Drill Bit Range	Usable Length	Standard Tube	Wt./ 10
2793	5/32" x 5"	0.168"– 0.175"	3"	1	1
2794	5/32" x 7"		5"	1	1
2796	3/16" x 5"	0.202"– 0.204"	3"	1	1
2797	3/16" x 7"		5"	1	1

Carbide Drill Bits for Type 304 Stainless Steel Tapper

Straight Shank

Catalog Number	Size	Drill Bit Range	Usable Length	Standard Tube	Wt./ 10
2894	3/16" x 3 1/2"	0.215"– 0.216"	2"	10	1/4
2895	3/16" x 4 1/2"		3"	10	1/4

Hex Shank SDS-Plus

Catalog Number	Size	Drill Bit Range	Usable Length	Standard Tube	Wt./ 10
2790	3/16" x 5"	0.215"– 0.216"	3"	1	1

Carbide Drill Bits for 3/8" Tapper

Straight Shank

Catalog Number	Size	Drill Bit Range	Usable Length	Standard Tube	Wt./ 10
5860	1/4" x 4 1/2"		3"	5	1/2
5861	1/4" x 5 1/2"	0.260"– 0.268"	4"	5	1/2
5862	1/4" x 6 1/2"		5"	5	3/4
5863	1/4" x 7 1/2"		6"	5	3/4

Hex Shank SDS-Plus

Catalog Number	Size	Drill Bit Range	Usable Length	Standard Tube	Wt./ 10
5866	1/4" x 6"	0.260"– 0.268"	4"	1	1 1/2
5868	1/4" x 8"		6"	1	1 3/4

ORDERING INFORMATION

Installation Tools for 3/16" and 1/4" Tapper

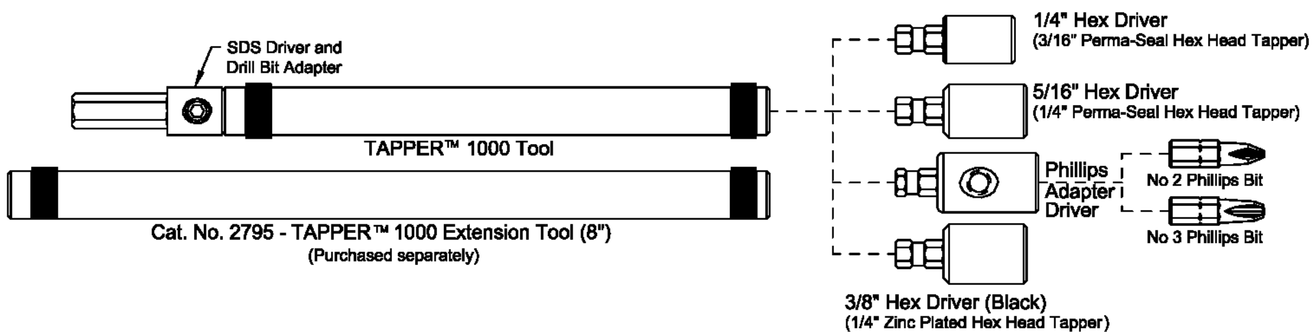
Catalog Number	Description	Max. Screw Length	Max. Bit Length	Standard Box	Wt./ Each
2791	Tapper 1000 Tool Kit	4"	5 1/2"	1	3/4
2792	*CONDRIVE® 2000	2 3/4"	4 1/2"	1	3/4
2795	1000 SDS Extension (8")	6"	7 1/2"	1	1/2

*CONDRIVE® is a Registered Trademark of Illinois Tool Works. This tool cannot be used with SDS Drill bits or PFH screws.

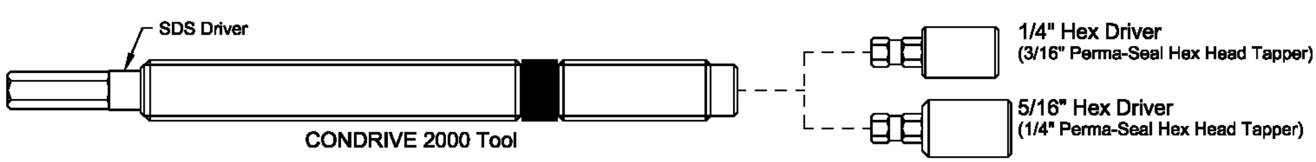
Installation Tools for 3/8" Tapper

Catalog Number	Description	Max. Screw Length	Max. Bit Length	Standard Box	Wt./ Each
5865	Tapper 3000 Tool Kit	4"	5 1/2"	1	3/4
5867	3000 Extension (8")	6"	7 1/2"	1	1/2

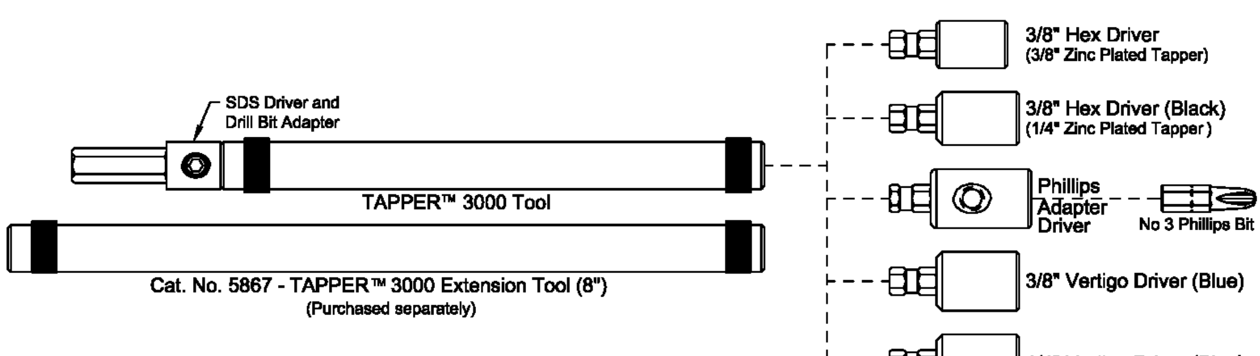
T1000 Installation Tool (3/16" and 1/4" Hex Head and PFH Tappers)



Condrive 2000® (3/16" and 1/4" Hex Head Tappers)



T3000 Installation Tool (3/8" Hex Head and PFH Tappers and 1/4" and 3/8" Vertigo Rod Hangers)



NEW! Snake™ *Internally Threaded Self-Tapping Anchor*

PRODUCT DESCRIPTION

The Snake anchor is an all-steel, self-tapping, machine bolt anchor designed for use in concrete and is suitable for overhead applications. The anchor is installed with a power tool and mechanically interlocks with the base material. A hammer is not required for installation.

GENERAL APPLICATIONS AND USES

- Suspending Conduit
- Cable Trays and Strut
- Pipe Supports
- Fire Sprinklers
- Concrete Formwork
- Suspended Lighting

FEATURES AND BENEFITS

- Anchor design allows for shallow embedment
- Internally threaded anchor for easy removability and service work
- Fast Installation with a powered impact tool
- Factory Mutual Research Corporation (FM Approvals) – File No. 3024502 for 3/8" diameter Snake

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring* and *05090-Metal Fastening.*
Internally threaded anchors shall be Snake anchors as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS Page No.

Snake

THREAD VERSION

UNC Thread

ANCHOR MATERIALS

Zinc Plated Carbon Steel

ROD/ANCHOR SIZE RANGE (TYP.)

1/4" to 3/8" diameter

SUITABLE BASE MATERIALS

Normal-Weight Concrete

INSTALLATION AND MATERIAL SPECIFICATIONS

Installation Specifications

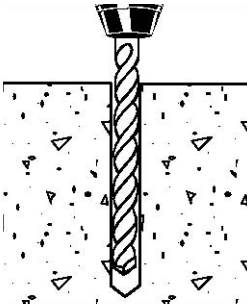
Dimension	Rod/Anchor Diameter, *d*	
	1/4"	3/8"
ANSI Drill Bit Size, d_{bit} (in.)	5/16	1/2
Max.Tightening Torque, T_{max} (ft.-lbs)	4	8
Internal Thread Size (UNC)	1/4-20	3/8-16
Overall Anchor Length (in.)	1 3/16	1 1/4

Material Specifications

Anchor Component	Component Material
Anchor Body	Case Hardened 10B21 Carbon Steel
Plating	ASTM B 633, SC1, Type III (Fe/Zn 5)

Installation Guidelines

Drill a hole into the base material to the depth of embedment required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



Insert the tip of the anchor into the hole. With the appropriate hex driver attached to a powered impact wrench, drive the anchor until the setting tool spins off the anchor. The anchor should be slightly subset following installation.

If using a fixture, position it, insert bolt and tighten. Many overhead applications utilize threaded rod. Minimum thread engagement should be at least one anchor diameter.

PERFORMANCE DATA

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

Rod/Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		4,000 psi (27.6 MPa)		6,000 psi (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	980 (4.4)	1,250 (5.6)	1,250 (5.6)	1,450 (6.5)	1,410 (6.3)	1,650 (7.4)
3/8 (9.5)	1 1/2 (38.1)	1,565 (7.0)	2,850 (12.8)	2,150 (9.6)	3,290 (14.8)	2,230 (10.0)	4,220 (19.0)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.

Allowable Load Capacities for Snake in Normal-Weight Concrete[1,2]

Rod/Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		4,000 psi (27.6 MPa)		6,000 psi (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	245 (1.1)	313 (1.4)	313 (1.4)	365 (1.6)	355 (1.6)	413 (1.9)
3/8 (9.5)	1 1/2 (38.1)	391 (1.8)	713 (3.2)	540 (2.4)	825 (3.7)	558 (2.5)	1,055 (4.7)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.

DESIGN CRITERIA

Combined Loading

For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

Load Adjustment Factors for Spacing and Edge Distances

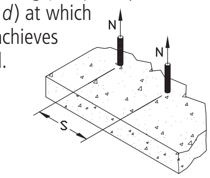
Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (s)	Tension	$s_{cr} = 12d$	$F_N = 1.0$	$s_{min} = 4d$	$F_N = 0.50$
	Shear	$s_{cr} = 12d$	$F_V = 1.0$	$s_{min} = 4d$	$F_V = 0.75$
Edge Distance (c)	Tension	$c_{cr} = 8d$	$F_N = 1.0$	$c_{min} = 3d$	$F_N = 0.70$
	Shear	$c_{cr} = 12d$	$F_V = 1.0$	$c_{min} = 3d$	$F_V = 0.15$

DESIGN CRITERIA

Load Adjustment Factors for Normal-Weight Concrete

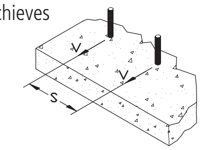
Spacing, Tension (F_N)			
Dia. (in.)		1/4	3/8
s_{cr} (in.)		3	4 1/2
s_{min} (in.)		1	1 1/2
Spacing, s (in.)	1	0.50	
	1 1/2	0.63	0.50
	2	0.75	0.58
	2 1/2	0.88	0.67
	3	1.00	0.75
	4 1/2		1.00

Notes: For anchors loaded in tension, the critical spacing (s_{cr}) is equal to 12 anchor diameters (12d) at which the anchor achieves 100% of load.
Minimum spacing (s_{min}) is equal to 4 anchor diameters (4d) at which the anchor achieves 50% of load.



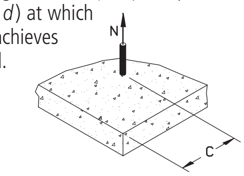
Spacing, Shear (F_V)			
Dia. (in.)		1/4	3/8
s_{cr} (in.)		3	4 1/2
s_{min} (in.)		1	1 1/2
Spacing, s (in.)	1	0.75	
	1 1/2	0.81	0.75
	2	0.88	0.79
	2 1/2	0.94	0.83
	3	1.00	0.88
	4 1/2		1.00

Notes: For anchors loaded in tension, the critical spacing (s_{cr}) is equal to 12 anchor diameters (12d) at which the anchor achieves 100% of load.
Minimum spacing (s_{min}) is equal to 4 anchor diameters (4d) at which the anchor achieves 75% of load.



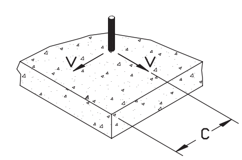
Edge Distance, Tension (F_N)			
Dia. (in.)		1/4	3/8
c_{cr} (in.)		2	3
c_{min} (in.)		3/4	1 1/8
Edge Dist., c (in.)	3/4	0.70	
	1 1/8	0.79	0.70
	1 1/2	0.88	0.76
	2	1.00	0.84
	2 1/2		0.92
	3		1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 8 anchor diameters (8d) at which the anchor achieves 100% of load.
Minimum edge distance (c_{min}) is equal to 3 anchor diameters (3d) at which the anchor achieves 70% of load.



Edge Distance, Shear (F_V)			
Dia. (in.)		1/4	3/8
c_{cr} (in.)		3	4 1/2
c_{min} (in.)		3/4	1 1/8
Edge Dist., c (in.)	3/4	0.15	
	1 1/8	0.29	0.15
	1 1/2	0.43	0.24
	2	0.62	0.37
	2 1/2	0.81	0.50
	3	1.00	0.62
	4 1/2		1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12d) at which the anchor achieves 100% of load.
Minimum edge distance (c_{min}) is equal to 3 anchor diameters (3d) at which the anchor achieves 15% of load.



ORDERING INFORMATION

Carbon Steel Snake Anchor

Cat. No.	Rod/Anchor Size	Min. Hole Depth	Thread Depth	Standard Box	Standard Carton
6400	1/4"	1 1/8"	9/16"	100	1,000
6401	3/8"	1 1/4"	11/16"	50	500

One setting tool is included in each box.

Setting Tool for Snake Anchor

Cat. No.	Rod/Anchor Size	Standard Box	Standard Carton
6402	1/4"	1	100
6403	3/8"	1	100

Hollow-Set™ Dropin™ *Internally Threaded Expansion Anchor*

PRODUCT DESCRIPTION

The Hollow-Set Dropin anchor is designed for anchoring in hollow base materials such as hollow concrete block, brick with weep holes, and precast hollow core plank. It can also be used in solid base materials.

Precast plank or concrete masonry blocks often have a maximum outer wall thickness of 1 1/2". During the drilling process, spalling on the back side of the wall often decreases the wall thickness, leaving only 1" or less for anchoring. The Hollow-Set Dropin is designed to perform in this environment, although most conventional style anchors will not function properly. The Hollow-Set Dropin is also appropriate for overhead applications.

GENERAL APPLICATIONS AND USES

- Anchoring to Concrete Block
- Suspending Conduit
- Cable Trays and Strut
- Pipe Supports
- Anchoring to Precast Hollow Core Plank
- Fire Sprinkler
- Suspended Lighting
- Removable Anchorage

FEATURES AND BENEFITS

- Internally threaded anchor for easy removability and service work
- Unique expansion design allows for anchoring in thin-walled base materials such as hollow concrete block and precast hollow core plank
- Smooth wall dropin can be installed flush mounted or below the base material surface
- Versatile setting options allows for torque-controlled or forced-controlled expansion
- Tested in accordance with ASTM E488 and AC01 criteria
- Qualified for seismic and wind loads

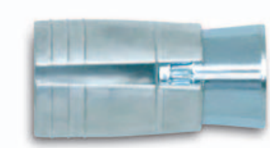
APPROVALS AND LISTINGS

International Code Council, Evaluation Service (ICC-ES) ESR-1532
(formerly listed in ICBO ES ER-5225)
City of Los Angeles (COLA) LARR-24960
Factory Mutual Research Corporation (FM Approvals) – Serial No. 15219/1952
Underwriters Laboratories (UL Listed) – File EX 1289 (N)
Federal GSA Specification – Meets the proof load requirements of FF-S-325C, Group II, Type 3, Class I (superseded)

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring, 04081-Masonry Anchorage* and *05090-Metal Fastenings.* Dropin Anchors shall be Hollow-Set Dropin anchors as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS Page No.



Hollow-Set Dropin

ANCHOR MATERIALS

Zamac Alloy Anchor Body
Carbon Steel Cone
Type 304 Stainless Steel Cone

ROD/ANCHOR SIZE RANGE (TYP.)

1/4" to 5/8" diameter

SUITABLE BASE MATERIALS

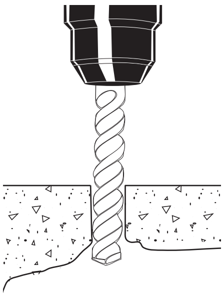
Normal-Weight Concrete
Precast Hollow Core Plank
Hollow Concrete Masonry
Brick Masonry

INSTALLATION SPECIFICATIONS

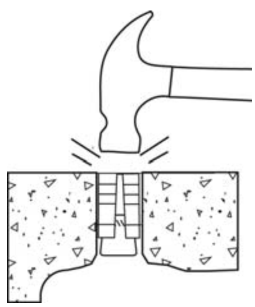
Dimension	Rod/Anchor Diameter, *d*				
	1/4"	5/16"	3/8"	1/2"	5/8"
ANSI Drill Bit Size, d_{bit} (in.)	3/8	5/8	5/8	3/4	1
Maximum Tightening Torque, T_{max} (ft.-lbs)	5	7	10	20	40
Thread Size (UNC)	1/4-20	5/16-18	3/8-16	1/2-13	5/8-11
Overall Anchor Length (in.)	7/8	1 5/16	1 5/16	1 3/4	2
Sleeve Length (in.)	5/8	15/16	15/16	1 1/4	1 1/2
Thread Length In Cone (in.)	3/8	5/8	5/8	3/4	1

Installation Guidelines for Hollow Base Materials

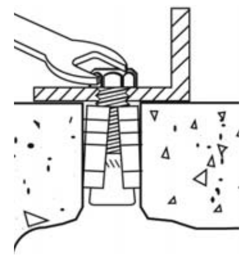
Drill a hole into the base material to the required depth. In hollow base materials, drill through into the cell or void. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



Blow the hole clean of dust and other materials. Do not expand the anchor prior to installation. Insert cone end and tap flush to surface.



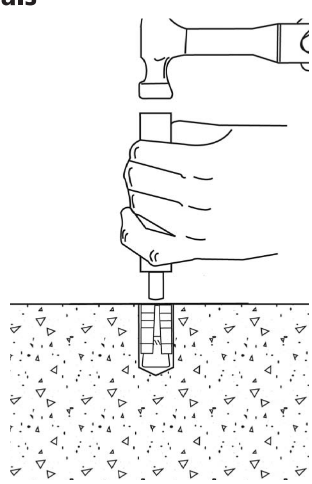
Position fixture, insert bolt and tighten. The bolt should engage a minimum of 2/3 of the anchor threads. The anchor can also be expanded using a Hollow-Set Tool. (If Hollow-Set Tool is used, thread anchor onto tool prior to tapping into anchor hole. When flush with surface, turn tool clockwise to tighten. Release tool from set anchor by turning counterclockwise. Fixture can then be attached).



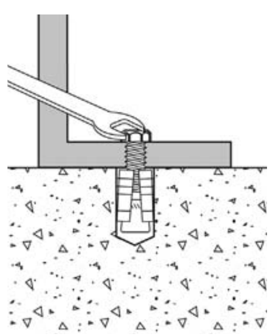
Installation Guidelines for Solid Base Materials

Drill a hole into the base material to the required depth. In hollow base materials, drill through into the cell or void. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.

Blow the hole clean of dust and other materials. Insert the anchor into the hole. Position the setting tool in the anchor.



Using the Solid Tool, set the anchor by driving the Zamac sleeve over the cone using several sharp hammer blows. Be sure the anchor is at the required embedment depth, so that anchor threads do not protrude above the surface of the base material. Position the fixture, insert bolt or threaded rod and tighten.



MATERIAL SPECIFICATIONS

Anchor Component	Carbon Steel	Stainless Steel
Anchor Body	Zamac Alloy	Zamac Alloy
Cone	AISI 12L14	Type 304 Stainless Steel
Plating (Cone)	ASTM B633, SC1, Type III (Fe/Zn 5)	N/A

PERFORMANCE DATA

Ultimate Load Capacities for Hollow-Set Dropin in Normal-Weight Concrete[1,2,3]

Rod/ Anchor Diameter *d* in. (mm)	Min. Embed. Depth h_v in. (mm)	Drill Bit Diameter d_{bit} in.	2,000 psi (13.8 MPa) Tension lbs. (kN)	2,000 psi (13.8 MPa) Shear lbs. (kN)	4,000 psi (27.6 MPa) Tension lbs. (kN)	4,000 psi (27.6 MPa) Shear lbs. (kN)	6,000 psi (41.4 MPa) Tension lbs. (kN)	6,000 psi (41.4 MPa) Shear lbs. (kN)
1/4 (6.4)	3/4 (19.1)	3/8	760 (3.4)	1,200 (5.4)	1,140 (5.1)	1,200 (5.4)	1,440 (6.5)	1,200 (5.4)
	7/8 (22.2)		880 (4.0)	1,440 (6.5)	1,145 (5.2)	1,440 (6.5)	2,045 (9.2)	1,440 (6.5)
5/16 (7.9)	1 (25.4)	5/8	1,120 (5.0)	1,980 (8.9)	1,680 (7.6)	1,980 (8.9)	2,200 (9.9)	1,980 (8.9)
	1 1/2 (38.1)		2,205 (9.9)	2,740 (12.3)	2,775 (12.5)	2,740 (12.3)	4,825 (21.7)	2,740 (12.3)
3/8 (9.5)	1 (25.4)	5/8	1,370 (6.2)	2,550 (11.5)	2,070 (9.3)	2,550 (11.5)	2,290 (10.3)	2,550 (11.5)
	1 1/2 (38.1)		2,445 (11.0)	3,145 (14.2)	3,510 (15.8)	3,145 (14.2)	5,085 (22.9)	3,145 (14.2)
1/2 (12.7)	1 1/2 (38.1)	3/4	2,140 (9.6)	4,020 (18.1)	4,025 (18.1)	4,020 (18.1)	7,285 (32.8)	4,020 (18.1)
	2 (50.8)		2,780 (12.5)	4,020 (18.1)	4,375 (19.7)	4,020 (18.1)	9,455 (42.5)	4,020 (18.1)
5/8 (15.9)	2 1/4 (57.2)	1	5,725 (25.8)	6,400 (28.8)	9,410 (42.3)	6,400 (28.8)	12,745 (57.4)	6,400 (28.8)

Minimum Concrete Compressive Strength (f'_c)

1. Tabulated load values are applicable to anchors with carbon and stainless steel cones.
2. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
3. Linear interpolation may be used to determine ultimate loads for intermediate embedments and compressive strengths.

Allowable Load Capacities for Hollow-Set Dropin in Normal-Weight Concrete[1,2,3,4,5]

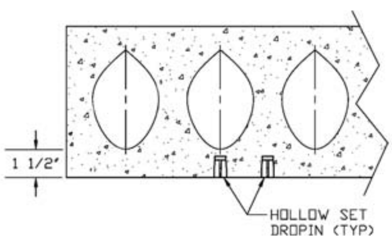
Rod/ Anchor Diameter *d* in. (mm)	Min. Embed. Depth h_v in. (mm)	Drill Bit Diameter d_{bit} in.	2,000 psi (13.8 MPa) Tension lbs. (kN)	2,000 psi (13.8 MPa) Shear lbs. (kN)	4,000 psi (27.6 MPa) Tension lbs. (kN)	4,000 psi (27.6 MPa) Shear lbs. (kN)	6,000 psi (41.4 MPa) Tension lbs. (kN)	6,000 psi (41.4 MPa) Shear lbs. (kN)
1/4 (6.4)	3/4 (19.1)	3/8	190 (0.9)	300 (1.4)	285 (1.3)	300 (1.4)	360 (1.6)	300 (1.4)
	7/8 (22.2)		220 (1.0)	360 (1.6)	285 (1.3)	360 (1.6)	510 (2.3)	360 (1.6)
5/16 (7.9)	1 (25.4)	5/8	280 (1.3)	495 (2.2)	420 (1.9)	495 (2.2)	550 (2.5)	495 (2.2)
	1 1/2 (38.1)		550 (2.5)	685 (3.1)	695 (3.1)	685 (3.1)	1,205 (5.4)	685 (3.1)
3/8 (9.5)	1 (25.4)	5/8	345 (1.6)	640 (2.9)	520 (2.3)	640 (2.9)	575 (2.6)	640 (2.9)
	1 1/2 (38.1)		610 (2.7)	785 (3.5)	880 (4.0)	785 (3.5)	1,270 (5.7)	785 (3.5)
1/2 (12.7)	1 1/2 (38.1)	3/4	535 (2.4)	1,005 (4.5)	1,005 (4.5)	1,005 (4.5)	1,820 (8.2)	1,005 (4.5)
	2 (50.8)		695 (3.1)	1,005 (4.5)	1,095 (4.9)	1,005 (4.5)	2,365 (10.6)	1,005 (4.5)
5/8 (15.9)	2 1/4 (57.2)	1	1,430 (6.4)	1,600 (7.2)	2,355 (10.6)	1,600 (7.2)	3,185 (14.3)	1,600 (7.2)

Minimum Concrete Compressive Strength (f'_c)

1. Tabulated load values are applicable to anchors with carbon and stainless steel cones.
2. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
3. Linear interpolation may be used to determine ultimate loads for intermediate embedments and compressive strengths.
4. Allowable loads for anchors to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load, where permitted by code.
5. Critical and minimum spacing and edge distances as well as reduction factors for intermediate spacing and edge distances are listed in the Design Criteria section.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Hollow-Set Dropin in Hollow Core Plank[1,2]

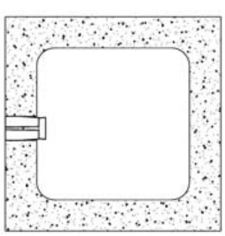


Rod/ Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Drill Bit Diameter d_{bit} in.	Minimum Concrete Compressive Strength $f'_c \geq$ 5,000 psi (34.5 MPa)			
			Ultimate Load		Allowable Load	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	7/8 (22.2)	3/8	1,190 (5.4)	1,440 (6.5)	300 (1.4)	360 (1.6)
5/16 (7.9)	1* (25.4)	5/8	2,280 (10.3)	2,740 (12.3)	570 (2.6)	685 (3.1)
3/8 (9.5)	1* (25.4)	5/8	2,525 (11.4)	2,740 (12.3)	630 (2.8)	685 (3.1)
	1 1/2 (38.1)	5/8	3,620 (16.3)	3,145 (14.2)	905 (4.1)	785 (3.5)
1/2 (12.7)	1 1/4* (31.8)	3/4	5,420 (24.4)	5,580 (25.1)	1,355 (6.1)	1,395 (6.3)
5/8 (15.9)	1 1/2* (38.1)	1	9,660 (43.5)	8,320 (37.4)	2,415 (10.9)	2,080 (9.4)

1. Tabulated load values are applicable to anchors with carbon and stainless steel cones.
2. Allowable loads are calculated using an applied safety factor of 4.0.

*Anchors were installed with sleeve flush to surface of the plank.

Ultimate and Allowable Load Capacities for Hollow-Set Dropin in Hollow Concrete Masonry[1,2]

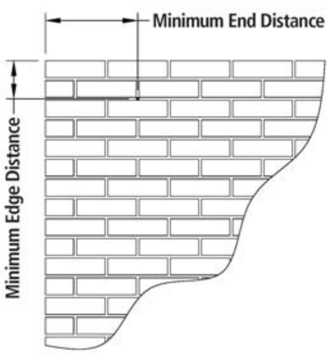


Rod/ Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Drill Bit Diameter d_{bit} in.	$f'_m \geq$ 1,500 psi (10.4 MPa)			
			Ultimate Load		Allowable Load	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	7/8 (22.2)	3/8	1,325 (6.0)	1,575 (7.1)	265 (1.2)	315 (1.4)
5/16 (7.9)	1* (25.4)	5/8	2,070 (9.3)	1,815 (8.2)	415 (1.9)	365 (1.6)
3/8 (9.5)	1* (25.4)	5/8	2,450 (11.0)	2,485 (11.2)	490 (2.2)	495 (2.2)
1/2 (12.7)	1 1/4* (31.8)	3/4	3,580 (16.1)	3,655 (16.4)	715 (3.2)	730 (3.3)
5/8 (15.9)	1 1/2* (38.1)	1	3,580 (16.1)	3,740 (16.8)	715 (3.2)	750 (3.4)

1. Tabulated load values are for anchors installed in minimum 6-inch wide, Grade N, Type II, medium and normal-weight concrete masonry units. Mortar must be minimum Type N. Masonry prism compressive strength must be 1,500 psi minimum at the time of installation.
2. Tabulated load values are applicable to anchors with carbon and stainless steel cones. Allowable loads are calculated using an applied safety factor of 5.0.

*Anchors were installed with sleeve flush to face shell surface.

PERFORMANCE DATA



Ultimate and Allowable Load Capacities for Hollow-Set Dropin in Brick with Weepholes and Clay Brick Masonry[1,2,3,4]

Rod/ Anchor Diameter *d* in. (mm)	Minimum Embed. Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Structural Brick Masonry $f'_m \geq$ 1,500 psi (10.4 MPa)			
				Ultimate Load		Allowable Load	
				Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	7/8 (22.2)	6 (152.4)		880 (4.0)	1,640 (7.4)	175 (0.8)	330 (1.5)
5/16 (9.5)	1 1/4 (31.8)	8 (203.2)		1,460 (6.6)	2,230 (10.0)	290 (1.3)	445 (2.0)
3/8 (12.7)	1 1/4 (31.8)	8 (203.2)	8 (203.2)	1,860 (8.4)	2,980 (13.4)	370 (1.7)	595 (2.7)
1/2 (15.9)	1 1/2 (38.1)	10 (254.0)		3,240 (14.6)	4,230 (19.0)	650 (2.9)	845 (3.8)
5/8 (19.1)	2 1/4 (57.2)	12 (304.8)		4,680 (21.1)	6,420 (28.9)	935 (4.2)	1,605 (7.2)

1. Tabulated load values are for anchors with carbon or stainless steel cones installed in Grade SW multiple wythe, brick masonry conforming to ASTM C62.
2. Tabulated load values are applicable to anchors with carbon and stainless steel cones. Allowable loads are calculated using an applied safety factor of 5.0.
3. Anchors were installed with sleeve flush to face shell surface.
4. The tabulated values are for anchors installed at a minimum of 16 anchor diameters on center for 100 percent capacity. Spacing distances may be reduced to 8 anchor diameters on center provided the capacities are reduced by 50 percent. Linear interpolation may be used for intermediate spacing.

DESIGN CRITERIA

Combined Loading

For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

Load Adjustment Factors for Spacing and Edge Distances[1]

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (*s*)	Tension and Shear	$s_{cr} = 3.0h_V$	$F_N = F_V = 1.0$	$s_{min} = 1.5h_V$	$F_N = F_V = 0.50$
Edge Distance (*c*)	Tension	$c_{cr} = 14d$	$F_N = 1.0$	$c_{cr} = 8d$	$F_N = 0.80$
	Shear	$c_{cr} = 14d$	$F_V = 1.0$	$c_{cr} = 8d$	$F_V = 0.50$

1. Load values, found in the Performance Tables, are multiplied by the reduction factors when spacing edge distances are less than critical distances. Linear interpolation is allowed for spacing and edge distances that fall between critical and minimum distances. When a group of anchors is affected by both reduced spacing and edge distance, the spacing and edge distance reduction factors must be combined (multiplied).

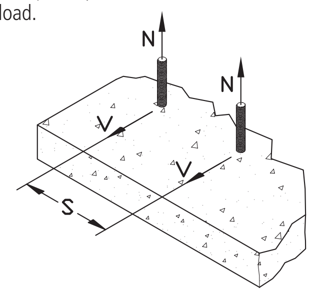
DESIGN CRITERIA

Load Adjustment Factors for Normal-Weight Concrete

Spacing, Tension (F_N) & Shear (F_V)						
Dia. (in.)		1/4	5/16	3/8	1/2	5/8
h_v (in.)		7/8	1 1/2	1 1/2	2	2 1/4
s_{cr} (in.)		2 5/8	4 1/2	4 1/2	6	6 3/4
s_{min} (in.)		1 3/8	2 1/4	2 1/4	3	3 3/8
Spacing, s (inches)	1 3/8	0.50				
	2 1/4	0.86	0.50	0.50		
	2 5/8	1.00	0.58	0.58		
	3		0.67	0.67	0.50	
	3 3/8		0.75	0.75	0.56	0.50
	4		0.89	0.89	0.67	0.59
	4 1/2		1.00	1.00	0.75	0.67
	5				0.83	0.74
	6				1.00	0.89
	6 3/4					1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 3 embedment depths ($3h_v$) at which the anchor achieves 100% of load.

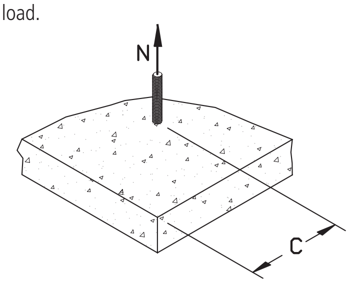
Minimum spacing (s_{min}) is equal to 1.5 embedment depths ($1.5h_v$) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_N)						
Dia. (in.)		1/4	5/16	3/8	1/2	5/8
c_{cr} (in.)		3 1/2	4 3/8	5 1/4	7	8 3/4
c_{min} (in.)		2	2 1/2	3	4	5
Edge Distance, c (inches)	2	0.80				
	2 1/2	0.87	0.80			
	3	0.93	0.85	0.80		
	3 1/2	1.00	0.91	0.84		
	4		0.96	0.89	0.80	
	4 3/8		1.00	0.92	0.83	
	5			0.98	0.87	0.80
	5 1/4			1.00	0.88	0.81
	6				0.93	0.85
	7				1.00	0.91
	8					0.96
	8 3/4					1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 14 anchor diameters ($14d$) at which the anchor achieves 100% of load.

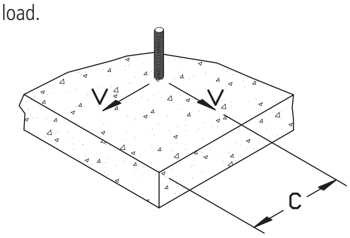
Minimum edge distance (c_{min}) is equal to 8 anchor diameters ($8d$) at which the anchor achieves 80% of load.



Edge Distance, Shear (F_V)						
Dia. (in.)		1/4	5/16	3/8	1/2	5/8
c_{cr} (in.)		3 1/2	4 3/8	5 1/4	7	8 3/4
c_{min} (in.)		2	2 1/2	3	4	5
Edge Distance, c (inches)	2	0.50				
	2 1/2	0.67	0.50			
	3	0.83	0.63	0.50		
	3 1/2	1.00	0.77	0.61		
	4		0.90	0.72	0.50	
	4 3/8		1.00	0.81	0.56	
	5			0.94	0.67	0.50
	5 1/4			1.00	0.71	0.53
	6				0.83	0.63
	7				1.00	0.77
	8					0.90
	8 3/4					1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 14 anchor diameters ($14d$) at which the anchor achieves 100% of load.

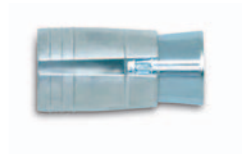
Minimum edge distance (c_{min}) is equal to 8 anchor diameters ($8d$) at which the anchor achieves 50% of load.



ORDERING INFORMATION

Hollow-Set Dropin with Carbon Steel Cone

Catalog Number	Rod/Anchor Diameter	Drill Diameter	Overall Length	Sleeve Length	Std. Box	Std. Ctn.	Wt./ 100
9320	1/4"	3/8"	7/8"	5/8"	100	1,000	1 3/4
9330	5/16"	5/8"	1-5/16"	15/16"	50	500	5 1/2
9340	3/8"	5/8"	1-5/16"	15/16"	50	500	5 1/2
9350	1/2"	3/4"	1-3/4"	1 1/4"	50	250	9 1/2
9360	5/8"	1"	2"	1 1/2"	25	125	21



Hollow-Set Dropin with Stainless Steel Cone

Catalog Number	Rod/Anchor Diameter	Drill Diameter	Overall Length	Sleeve Length	Std. Box	Std. Ctn.	Wt./ 100
9420	1/4"	3/8"	7/8"	5/8"	100	1,000	1-3/4
9440	3/8"	5/8"	1-5/16"	15/16"	100	500	5-1/2

Setting Tool for Solid Base Materials

Catalog Number	Size	Standard Box	Standard Carton
9322	1/4"	1	1
9342	5/16" and 3/8"	1	1
9352	1/2"	1	1
9362	5/8"	1	1

Setting Tool for Hollow Base Materials

Catalog Number	Size	Standard Box	Standard Carton
9323	1/4"	1	1
9333	5/6"	1	1
9343	3/8"	1	1
9353	1/2"	1	1
9363	5/8"	1	1

Steel Dropin™ *Internally Threaded Expansion Anchor*

PRODUCT DESCRIPTION

The Steel Dropin is an all-steel, machine bolt anchor available in carbon steel and two types of stainless steel. It can be used in solid concrete, hard stone, and solid block base materials. A coil thread version for forming applications is also available. FM and UL listings make this anchor appropriate for overhead applications.

GENERAL APPLICATIONS AND USES

- Suspending Conduit
- Cable Trays and Strut
- Pipe Supports
- Fire Sprinkler
- Concrete Formwork
- Suspended Lighting

FEATURES AND BENEFITS

- Internally threaded anchor for easy removability and service work
- Flanged (lipped) version installs flush for easy inspection and standardizes rod heights
- Smooth wall dropin can be installed flush mounted or below the base material surface
- Optionally available with a knurled body
- Coil thread version accepts coil rod and typically used for concrete formwork applications
- Tested in accordance with ASTM 488 and AC01 criteria
- Qualified for seismic and wind loads

APPROVALS AND LISTINGS

International Code Council, Evaluation Service (ICC-ES) ESR-1532
(formerly listed in ICBO ES ER-5225)
Southern Building Code Conference International (SBCCI) #9943A
City of Los Angeles (COLA) Research Report LARR – 24960
Florida Building Code Approval – FL2209.8
Miami-Dade County Notice of Acceptance (NOA) 03-0311.08
Factory Mutual Research Corporation (FM Approvals) – File No. J.I. OK4A9.AH
Underwriters Laboratory (UL Listed) – File No. EX1289 (N)
Federal GSA Specification – Meets the proof load requirements of FF-S-325C,
Group VIII, Type 1 (superseded)
Various North American Departments of Transportation (DOT) – See www.powers.com,
including CalTrans listing for "Shell Mechanical Expansion Anchors"

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring* and *05090-Metal Fastenings.* Dropin Anchors shall be Steel Dropin anchors as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS Page No.

Smooth Wall Dropin

Flange (Lipped) Dropin

THREAD VERSION

UNC Coarse Thread
Coil Thread

ANCHOR MATERIALS

Zinc Plated Carbon Steel
Type 303 Stainless Steel
Type 316 Stainless Steel

ROD/ANCHOR SIZE RANGE (TYP.)

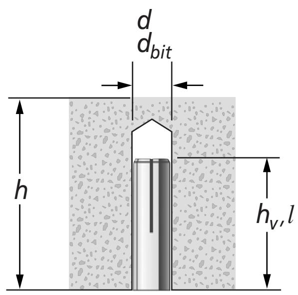
1/4" to 3/4" diameter UNC Coarse Thread
1/2" and 3/4" diameter Coil Thread

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Structural Lightweight Concrete

INSTALLATION SPECIFICATIONS

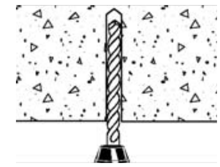
Anchor (Rod) Size	Rod/Anchor Diameter, *d*						
	1/4"	3/8"	1/2"	1/2" Coil Thread	5/8"	3/4"	3/4" Coil Thread
ANSI Drill Bit Size, d_{bit} (in.)	3/8	1/2	5/8	5/8	7/8	1	1
Maximum Tightening Torque, T_{max} (ft.-lbs.)	5	10	20	20	40	80	80
Thread Size (UNC)	1/4-20	3/8-16	1/2-13	1/2-6	5/8-11	3/4-10	3/4-4 1/2
Thread Depth (in.)	7/16	5/8	13/16	13/16	1 3/16	1 3/8	1 3/8
Flange Size (in.)	7/16	9/16	45/64	–	–	–	–
Anchor Length *l*, h_v (in.)	1	1 9/16	2	2	2 1/2	3 3/16	3 3/16



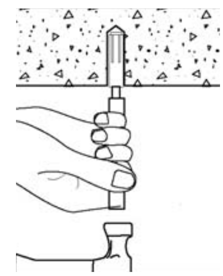
Nomenclature

d = Diameter of anchor
d_{bit} = Diameter of drill bit
h = Base material thickness. The minimum value of h should be $1.5h_v$
h_v = Minimum embedment depth
l = Overall length of anchor
T_{max} = Maximum tightening torque

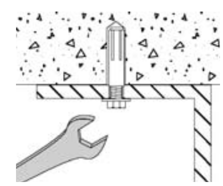
Installation Procedure



Drill a hole into the base material to the depth of embedment required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15. Do not over drill the hole unless the application calls for a subset anchor.



Blow the hole clean of dust and other materials. Insert the anchor into the hole and tap flush with surface. *Using a Powers setting tool specifically, set the anchor by driving the tool with a sufficient number of hammer blows until the shoulder of the tool is seated against the anchor.* Anchor will not hold allowable loads required if shoulder of *Powers* setting tool does not seat against anchor.

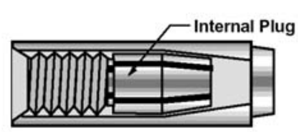


If using a fixture, position it, insert bolt and tighten. Most overhead applications utilize threaded rod. Minimum thread engagement should be at least one anchor diameter.

MATERIAL SPECIFICATIONS

Anchor Component	Carbon Steel	Type 303 Stainless Steel	Type 316 Stainless Steel
Anchor Body	AISI 12L14	Type 303 Stainless Steel	Type 316 Stainless Steel
Plug	AISI 1018	Type 303 Stainless Steel	Type 316 Stainless Steel
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn 5)	N/A	N/A

Stainless steel anchor components are passivated.



PERFORMANCE DATA

Ultimate Load Capacities for Steel Dropin in Normal-Weight Concrete[1,2,3]

Rod/Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 (25.4)	1,140 (5.1)	2,120 (9.5)	1,985 (8.9)	2,120 (9.5)	2,080 (9.4)	2,120 (9.5)
3/8 (9.5)	1 9/16 (39.7)	2,180 (9.8)	4,585 (20.6)	4,180 (18.8)	4,585 (20.6)	4,950 (22.3)	4,585 (20.6)
1/2 (12.7)	2 (50.8)	4,105 (18.5)	6,400 (28.8)	5,760 (25.9)	6,400 (28.8)	6,585 (29.6)	6,400 (28.8)
5/8 (15.9)	2 1/2 (63.5)	4,665 (21.0)	12,380 (55.7)	7,440 (33.5)	12,380 (55.7)	10,920 (49.1)	12,380 (55.7)
3/4 (19.1)	3 3/16 (81.0)	8,580 (38.6)	15,680 (70.6)	14,405 (64.8)	15,680 (70.6)	17,300 (77.9)	15,680 (70.6)

1. Tabulated load values are applicable to carbon and stainless steel anchors.
2. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
3. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.

Allowable Load Capacities for Steel Dropin in Normal-Weight Concrete[1,2,3,4]

Rod/Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 (25.4)	285 (1.3)	530 (2.4)	495 (2.2)	530 (2.4)	520 (2.3)	530 (2.4)
3/8 (9.5)	1 9/16 (39.7)	545 (2.5)	1,145 (5.2)	1,045 (4.7)	1,145 (5.2)	1,240 (5.6)	1,145 (5.2)
1/2 (12.7)	2 (50.8)	1,025 (4.6)	1,600 (7.2)	1,440 (6.5)	1,600 (7.2)	1,645 (7.4)	1,600 (7.2)
5/8 (15.9)	2 1/2 (63.5)	1,165 (5.2)	3,095 (13.9)	1,860 (8.4)	3,095 (13.9)	2,730 (12.3)	3,095 (13.9)
3/4 (19.1)	3 3/16 (81.0)	2,145 (9.7)	3,920 (17.6)	3,600 (16.2)	3,920 (17.6)	4,325 (19.5)	3,920 (17.6)

1. Tabulated load values are applicable to carbon and stainless steel anchors.
2. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
3. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.
4. Allowable loads for anchors to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load, where permitted by code.

Ultimate Load Capacities for Steel Dropin in Structural Lightweight Concrete[1,2,3]

Rod/Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 (25.4)	1,060 (4.8)	1,920 (8.6)	1,360 (6.1)	1,920 (8.6)	1,660 (7.5)	1,920 (8.6)
3/8 (9.5)	1 9/16 (39.7)	3,040 (13.7)	4,120 (18.5)	3,780 (17.0)	4,120 (18.5)	4,520 (20.3)	4,120 (18.5)
1/2 (12.7)	2 (50.8)	4,240 (19.1)	5,680 (25.6)	4,840 (21.8)	5,680 (25.6)	5,460 (24.6)	5,680 (25.6)
5/8 (15.9)	2 1/2 (63.5)	6,860 (30.9)	9,640 (43.4)	7,840 (35.3)	9,640 (43.4)	8,840 (39.8)	9,640 (43.4)
3/4 (19.1)	3 3/16 (81.0)	10,280 (46.3)	16,460 (74.1)	11,700 (52.7)	16,460 (74.1)	13,120 (59.0)	16,460 (74.1)

1. Tabulated load values are applicable to carbon and stainless steel anchors.
2. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
3. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.

PERFORMANCE DATA

Allowable Load Capacities for Steel Dropin in Structural Lightweight Concrete[1,2,3]

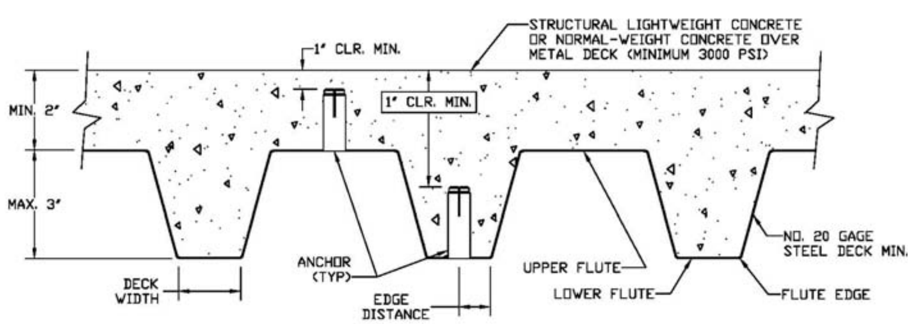
Rod/Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		4,000 psi (27.6 MPa)		6,000 psi (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 (25.4)	265 (1.2)	480 (2.2)	340 (1.5)	480 (2.2)	415 (1.9)	480 (2.2)
3/8 (9.5)	1 9/16 (39.7)	760 (3.4)	1,030 (4.6)	945 (4.3)	1,030 (4.6)	1,130 (5.1)	1,030 (4.6)
1/2 (12.7)	2 (50.8)	1,060 (4.8)	1,420 (6.4)	1,210 (5.4)	1,420 (6.4)	1,365 (6.1)	1,420 (6.4)
5/8 (15.9)	2 1/2 (63.5)	1,715 (7.7)	2,410 (10.8)	1,960 (8.8)	2,410 (10.8)	2,210 (9.9)	2,410 (10.8)
3/4 (19.1)	3 3/16 (81.0)	2,570 (11.6)	4,115 (18.5)	2,925 (13.2)	4,115 (18.5)	3,280 (14.8)	4,115 (18.5)

1. Tabulated load values are applicable to carbon and stainless steel anchors.
2. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
3. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.

Ultimate and Allowable Load Capacities for Steel Dropin Installed Through Metal Deck into Structural Lightweight Concrete[1,2,3,4,5]

Rod/Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Lightweight Concrete over minimum 20 Gage Metal Deck, $f'_c \geq$ 3,000 (20.7 MPa)							
		Minimum 1-1/2" Wide Deck				Minimum 4-1/2" Wide Deck			
		Ultimate Load		Allowable Load		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 (25.4)	600 (2.7)	2,040 (9.2)	150 (0.7)	510 (2.3)	960 (4.3)	2,040 (9.2)	240 (1.1)	510 (2.3)
3/8 (9.5)	1 9/16 (39.7)	600 (2.7)	2,040 (9.2)	150 (0.7)	510 (2.3)	960 (4.3)	2,040 (9.2)	240 (1.1)	510 (2.3)
1/2 (12.7)	2 (50.8)	1,820 (8.2)	2,780 (12.5)	455 (2.0)	695 (3.1)	2,740 (12.3)	5,560 (25.0)	685 (3.1)	1,390 (6.3)

1. The values listed above are ultimate and allowable load capacities for carbon and stainless steel anchors installed in sand-lightweight concrete.
2. Allowable load capacities are calculated using a safety factor of 4.0.
3. Tabulated load values are for anchors installed in the center of the flute. Spacing distances shall be in accordance with the spacing table for lightweight concrete listed in the Design Criteria.
4. Flute edge distance equals one-half the minimum deck width.
5. Anchors are permitted to be installed in the lower or upper flute of the metal deck provided the proper installation procedures are maintained.



DESIGN CRITERIA

Combined Loading

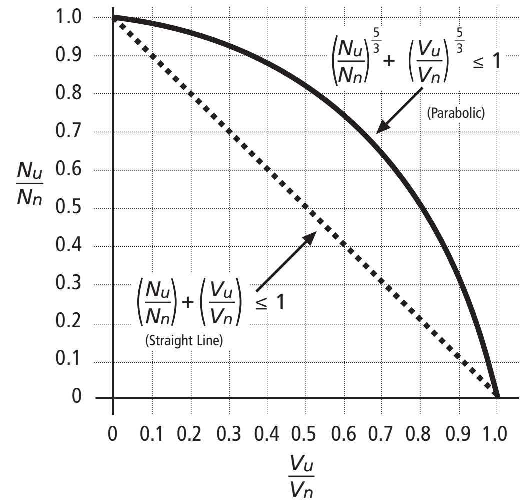
For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n}\right)^{\frac{5}{3}} + \left(\frac{V_u}{V_n}\right)^{\frac{5}{3}} \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

Load combinations may be analyzed more conservatively with the following proportion:

$$\left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$



Load Adjustment Factors for Spacing and Edge Distances

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	**Load Type**	**Critical Distance (Full Anchor Capacity)**	**Critical Load Factor**	**Minimum Distance (Reduced Capacity)**	**Minimum Load Factor**
Spacing (s)	Tension and Shear	$s_{cr} = 3.0h_v$	$F_N = F_V = 1.0$	$s_{min} = 1.5h_v$	$F_N = F_V = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 14d$	$F_N = 1.0$	$c_{min} = 7d$	$F_N = 0.90$
	Shear	$c_{cr} = 14d$	$F_V = 1.0$	$c_{min} = 7d$	$F_V = 0.50$

Anchor Installed in Lightweight Concrete					
Anchor Dimension	**Load Type**	**Critical Distance (Full Anchor Capacity)**	**Critical Load Factor**	**Minimum Distance (Reduced Capacity)**	**Minimum Load Factor**
Spacing (s)	Tension and Shear	$s_{cr} = 3.0h_v$	$F_N = F_V = 1.0$	$s_{min} = 1.5h_v$	$F_N = F_V = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 14d$	$F_N = 1.0$	$c_{min} = 7d$	$F_N = 0.80$
	Shear	$c_{cr} = 14d$	$F_V = 1.0$	$c_{min} = 7d$	$F_V = 0.50$

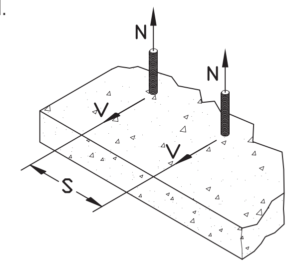
DESIGN CRITERIA

Load Adjustment Factors for Normal-Weight and Lightweight Concrete

Spacing, Tension (F_N) & Shear (F_V)						
Dia. (in.)		1/4	3/8	1/2	5/8	3/4
h_v (in.)		1	1 1/2	2	2 1/2	3
s_{cr} (in.)		3	4 1/2	6	7 1/2	9
s_{min} (in.)		1 1/2	2 1/4	3	3 3/4	4 1/2
Spacing, *s* (inches)	1 1/2	0.50				
	2 1/4	0.75	0.50			
	3	1.00	0.67	0.50		
	3 3/4		0.83	0.63	0.50	
	4		0.89	0.67	0.53	
	4 1/2		1.000	0.75	0.60	0.50
	5			0.83	0.67	0.56
	6			1.00	0.80	0.67
	7 1/2				1.00	0.83
	9					1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 3 embedment depths ($3h_v$) at which the anchor achieves 100% of load.

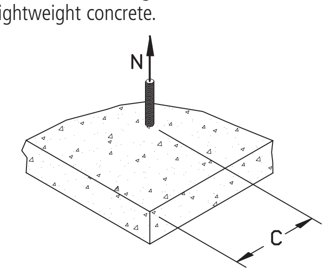
Minimum spacing (s_{min}) is equal to 1.5 embedment depths ($1.5h_v$) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_N) (Normal-Weight concrete only)						
Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		3 1/2	5 1/4	7	8 3/4	10 1/2
c_{min} (in.)		1 3/4	2 5/8	3 1/2	4 3/8	5 1/4
Edge Distance, *c* (inches)	1 3/4	0.90				
	2	0.91				
	2 5/8	0.95	0.90			
	3	0.97	0.91			
	3 1/2	1.00	0.93	0.90		
	4 3/8		0.97	0.93	0.90	
	5 1/4		1.00	0.95	0.92	0.90
	6			0.97	0.94	0.91
	7			1.00	0.96	0.93
	8				0.98	0.95
	8 3/4				1.00	0.97
	10 1/2					1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 14 anchor diameters ($14d$) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 7 anchor diameters ($7d$) at which the anchor achieves 90% of load for normal-weight concrete and 80% of load for lightweight concrete.

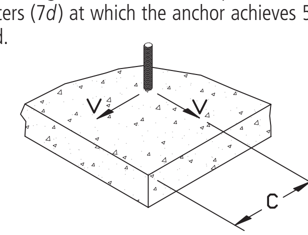


Edge Distance, Tension (F_N) (Lightweight concrete only)						
Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		3 1/2	5 1/4	7	8 3/4	10 1/2
c_{min} (in.)		1 3/4	2 5/8	3 1/2	4 3/8	5 1/4
Edge Distance, *c* (inches)	1 3/4	0.80				
	2	0.83				
	2 5/8	0.90	0.80			
	3	0.94	0.83			
	3 1/2	1.00	0.87	0.80		
	4 3/8		0.93	0.85	0.80	
	5 1/4		1.00	0.90	0.84	0.80
	6			0.94	0.87	0.83
	7			1.00	0.92	0.87
	8				0.97	0.90
	8 3/4				1.00	0.93
	10 1/2					1.00

Edge Distance, Shear (F_V)						
Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		3 1/2	5 1/4	7	8 3/4	10 1/2
c_{min} (in.)		1 3/4	2 5/8	3 1/2	4 3/8	5 1/4
Edge Distance, *c* (inches)	1 3/4	0.50				
	2	0.57				
	2 5/8	0.75	0.50			
	3	0.86	0.57			
	3 1/2	1.00	0.67	0.50		
	4 3/8		0.83	0.63	0.50	
	5		0.95	0.71	0.57	
	5 1/4		1.00	0.75	0.60	0.50
	6			0.86	0.69	0.57
	7			1.00	0.80	0.67
	8				0.91	0.76
	8 3/4				1.00	0.83
	10					0.95
	10 1/2					1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 14 anchor diameters ($14d$) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 7 anchor diameters ($7d$) at which the anchor achieves 50% of load.



ORDERING INFORMATION

Carbon Steel Smooth Wall Dropin

Cat. No.	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Carton	Wt./100
6304	1/4"	1"	7/16"	100	1,000	2
6306	3/8"	1 9/16"	5/8"	50	500	6
6308	1/2"	2"	13/16"	50	250	12
6320	5/8"	2 1/2"	1 3/16"	25	125	32
6312	3/4"	3 3/16"	1 3/8"	10	50	48

Carbon Steel Flanged Dropin (Lipped)

Cat. No.	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Carton	Wt./100
6324	1/4"	1"	7/16"	100	1,000	2
6326	3/8"	1 9/16"	5/8"	50	500	6
6328	1/2"	2"	13/16"	50	250	12

NEW! Carbon Steel Knurled Wall Dropin

Cat. No.	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Carton	Wt./100
6340	1/4"	1"	7/16"	100	1,000	2
6342	3/8"	1 9/16"	5/8"	50	500	6
6344	1/2"	2"	13/16"	50	250	12

Type 303 Stainless Steel Dropin

Cat. No.	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Carton	Wt./100
6204	1/4"	1"	7/16"	100	1,000	2
6206	3/8"	1 9/16"	5/8"	50	500	6
6208	1/2"	2"	13/16"	50	250	12
6210	5/8"	2 1/2"	1 3/16"	25	125	32
6212	3/4"	3 3/16"	1 3/8"	10	50	48

Type 316 Stainless Steel Dropin

Cat. No.	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Carton	Wt./100
6224	1/4"	1"	7/16"	100	1,000	2
6226	3/8"	1 9/16"	5/8"	50	500	6
6228	1/2"	2"	13/16"	50	250	12
6230	5/8"	2 1/2"	1 3/16"	25	125	32
6232	3/4"	3 3/16"	1 3/8"	10	50	48

Carbon Steel Coil Thread Dropin

Cat. No.	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Carton	Wt./100
6330	1/2"	2"	13/16"	50	250	12
6332	3/4"	3 3/16"	1 3/8"	10	50	48

Setting Tools for Steel Dropin

Cat. No.	6305	6307	6309	6311	6313
Rod/Anchor Size	1/4"	3/8"	1/2"	5/8"	3/4"
Pin Length	39/64"	61/64"	1 3/16"	1 5/16"	1 61/64"

Mini Dropin™ *Internally Threaded Expansion Anchor*

PRODUCT DESCRIPTION

The Mini Dropin is a carbon steel machine bolt anchor for use in shallow embedment applications. In addition to solid concrete and precast hollow core plank, it can be used in post-tensioned concrete slabs and concrete pours over metal deck. It is suitable for overhead applications.

GENERAL APPLICATIONS AND USES

- Suspending Conduit
- Cable Trays and Strut
- Pipe Supports
- Fire Sprinkler
- Concrete Formwork
- Suspended Lighting

FEATURES AND BENEFITS

- Anchor design allows for shallow embedment
- Internally threaded anchor for easy removability and service work
- Ideal for precast hollow core plank and post-tension concrete slabs
- Lip provides flush installation and consistent embedment
- Setting tool scores flange when set to verify proper expansion

APPROVALS AND LISTINGS

Factory Mutual Research Corporation (FM Approvals) – File No. J.I. 3002071
Federal GSA Specification – Meets the proof load requirements of FF-S-325C, Group VIII, Type 1 (superseded)

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring* and *05090-Metal Fastenings.* Dropin Anchors shall be Mini Dropin anchors as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS Page No.

Mini Dropin

THREAD VERSION

UNC Thread

ANCHOR MATERIALS

Zinc Plated Carbon Steel

ROD/ANCHOR SIZE RANGE (TYP.)

1/4" to 1/2" diameter

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Structural Lightweight Concrete
Precast Hollow Core Plank

MATERIAL AND INSTALLATION SPECIFICATIONS

Material Specification

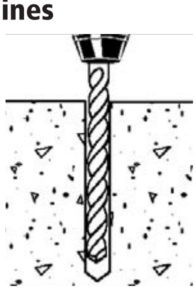
Anchor Component	Carbon Steel
Anchor Body	AISI 12L14
Plug	AISI 1018
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn 5)

Installation Specification

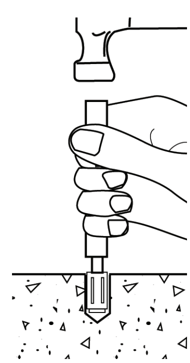
	Rod/Anchor Diameter, d		
Dimension	**1/4"**	**3/8"**	**1/2"**
ANSI Drill Bit Size, d_{bit} (in.)	3/8	1/2	5/8
Maximum Tightening Torque, T_{max}, (ft-lbs)	3	5	10
Thread Size (UNC)	1/4-20	3/8-16	1/2-13
Thread Depth (in.)	3/8	13/32	5/8
Overall Anchor Length (in.)	5/8	3/4	1

Installation Guidelines

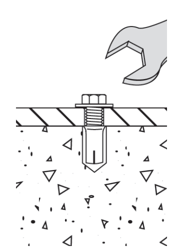
Drill a hole into the base material to the depth of embedment required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15. *In post-tensioned concrete slabs, take care to avoid drilling into the post-tensioned cables.*



Blow the hole clean of dust and other materials. Insert the anchor into the hole and tap flush with surface. Using a *Powers* setting tool specifically, set the anchor by driving the tool with a sufficient number of hammer blows until the shoulder of the tool is seated against the anchor. Anchor will not hold allowable loads required if shoulder of *Powers* setting tool does not seat against anchor.



If using a fixture, position it, insert bolt and tighten. Most overhead applications utilize threaded rod. Minimum thread engagement should be at least one anchor diameter.



PERFORMANCE DATA

Ultimate Load Capacities for Mini Dropin in Normal-Weight Concrete[1,2]

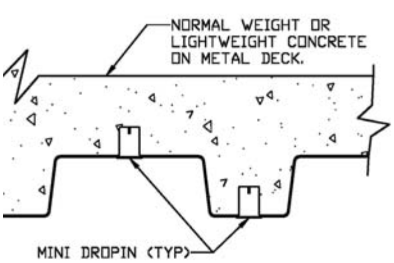
Rod/Anchor Size d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		3,000 psi (20.7 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	1,400 (6.3)	1,260 (5.7)	1,400 (6.3)	1,650 (7.4)	1,400 (6.3)	1,650 (7.4)
3/8 (9.5)	3/4 (19.1)	1,980 (8.9)	2,700 (12.2)	2,120 (9.5)	4,220 (19.0)	2,270 (10.2)	4,220 (19.0)
1/2 (12.7)	1 (25.4)	3,360 (15.1)	4,400 (19.8)	3,360 (15.1)	4,875 (21.9)	3,750 (16.9)	4,875 (21.9)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.

Allowable Load Capacities for Mini Dropin in Normal-Weight Concrete[1,2,3]

Rod/Anchor Size d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		3,000 psi (20.7 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	350 (1.6)	315 (1.4)	350 (1.6)	415 (1.9)	350 (1.6)	415 (1.9)
3/8 (9.5)	3/4 (19.1)	495 (2.2)	675 (3.0)	530 (2.4)	1,055 (4.7)	570 (2.6)	1,055 (4.7)
1/2 (12.7)	1 (25.4)	840 (3.8)	1,100 (5.0)	840 (3.8)	1,220 (5.5)	940 (4.2)	1,220 (5.5)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.
3. Spacing and edge distances shall be in accordance with the Load Adjustment Factors table for Normal-Weight concrete listed in the Design Criteria Section.

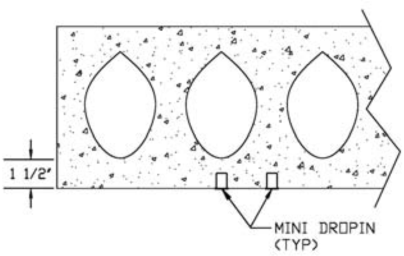


Ultimate and Allowable Load Capacities for Mini Dropin Installed Through Metal Deck into Structural Lightweight Concrete[1,2,3,4]

Rod/Anchor Size d in. (mm)	Minimum Embed. Depth h_v in. (mm)	Lightweight Concrete Over Min. 20 Ga. Metal Deck. $f'_c \geq$ **3,000 psi** (20.7 MPa)			
		Minimum 1 3/4" Wide Deck			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	740 (3.3)	1,880 (8.5)	185 (0.8)	470 (2.1)
3/8 (9.5)	3/4 (19.1)	880 (4.0)	2,040 (9.2)	220 (1.0)	510 (2.3)
1/2 (12.7)	1 (25.4)	1,380 (6.2)	2,120 (9.5)	345 (1.6)	530 (2.4)

1. The metal deck shall be No. 22 gage to No. 18 gage thick steel [0.030-inch to 0.047-inch base metal thickness (0.75mm to 1.20mm)].
2. Allowable load capacities are calculated using a safety factor of 4.0.
3. Tabulated load values are for anchors installed with a minimum edge distance of 7/8" when installed through the lower flute. Anchors installed through the upper flute may be in any location provided the proper installation procedures are maintained.
4. Spacing shall be in accordance with the Load Adjustment Factors table for lightweight concrete listed in the Design Criteria section.

PERFORMANCE DATA



Ultimate and Allowable Load Capacities for Mini Dropin in Precast Hollow Core Concrete Plank[1,2]

Rod/ Anchor Size d in. (mm)	Minimum Embed. Depth h_v in. (mm)	Minimum Spacing in. (mm)	Edge Distance in. (mm)	Min. Concrete Compressive Strength $f'_c \geq$ 5,000 psi (34.5 MPa)			
				Ultimate Load		Allowable Load	
				Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	3 (76.2)	3 (76.2)	2,360 (10.6)	1,840 (8.3)	590 (2.7)	460 (2.1)
3/8 (9.5)	3/4 (19.1)	4 1/2 (114.3)	4 1/2 (114.3)	2,600 (11.7)	3,400 (15.3)	650 (2.9)	850 (3.8)
1/2 (12.7)	1 (25.4)	6 (152.4)	6 (152.4)	2,600 (11.7)	3,540 (15.9)	650 (2.9)	885 (4.0)

1. Allowable loads are calculated using an applied safety factor of 4.0.
2. Edge distances shall be in accordance with the Load Adjustment Factors table for Normal-Weight concrete listed in the Design Criteria section.

DESIGN CRITERIA

Combined Loading

For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n}\right)^{\frac{5}{3}} + \left(\frac{V_u}{V_n}\right)^{\frac{5}{3}} \leq 1 \quad \text{OR} \quad \left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

Load Adjustment Factors for Spacing and Edge Distances

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	**Load Type**	**Critical Distance (Full Anchor Capacity)**	**Critical Load Factor**	**Minimum Distance (Reduced Capacity)**	**Minimum Load Factor**
Spacing (s)	Tension and Shear	$s_{cr} = 3.0h_v$	$F_N = F_V = 1.0$	$s_{min} = 1.5h_v$	$F_N = F_V = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_N = F_V = 1.0$	$c_{min} = 6d$	$F_N = 0.90$
	Shear[1]	$c_{cr} = 12d$	$F_N = F_V = 1.0$	$c_{min} = 6d$	$F_V = 0.75$

1. Allowable loads for anchors loaded in shear parallel to the edge have no reduction when installed at minimum edge distances.

Anchor Installed in Lightweight Concrete					
Anchor Dimension	**Load Type**	**Critical Distance (Full Anchor Capacity)**	**Critical Load Factor**	**Minimum Distance (Reduced Capacity)**	**Minimum Load Factor**
Spacing (s)	Tension and Shear	$s_{cr} = 3.0h_v$	$F_N = F_V = 1.0$	$s_{min} = 1.5h_v$	$F_N = F_V = 0.50$

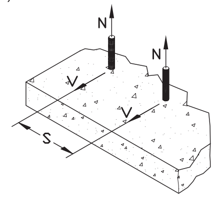
DESIGN CRITERIA

Load Adjustment Factors for Normal-Weight and Lightweight Concrete

Spacing, Tension (F_N) & Shear (F_V) (Normal-Weight and Lightweight Concrete)				
Dia. (in.)		1/4	3/8	1/2
h_v (in.)		5/8	3/4	1
s_{cr} (in.)		1 7/8	2 1/4	3
s_{min} (in.)		1	1 1/8	1 1/2
Spacing, *s* (in.)	1	0.50		
	1 1/8	0.60	0.50	
	1 1/2	0.80	0.67	0.50
	1 7/8	1.00	0.83	0.63
	2		0.89	0.67
	2 1/4		1.00	0.75
	2 1/2			0.83
	3			1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 3 embedment depths ($3h_v$) at which the anchor achieves 100% of load.

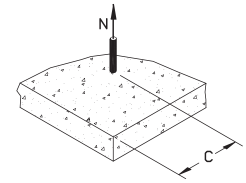
Minimum spacing (s_{min}) is equal to 1.5 embedment depths ($1.5h_v$) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_N) (Normal-Weight concrete only)				
Dia. (in.)		1/4	3/8	1/2
c_{cr} (in.)		3	4 1/2	6
c_{min} (in.)		1 1/2	2 1/4	3
Edge Distance, *c* (in)	1 1/2	0.90		
	2	0.93		
	2 1/4	0.95	0.90	
	2 1/2	0.97	0.91	
	3	1.00	0.93	0.90
	4		0.98	0.93
	4 1/2		1.00	0.95
	5			0.97
	6			1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 12 anchor diameters ($12d$) at which the anchor achieves 100% of load.

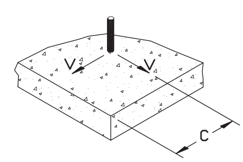
Minimum edge distance (c_{min}) is equal to 6 anchor diameters ($6d$) at which the anchor achieves 90% of load.



Edge Distance, Shear (F_V) (Normal-Weight concrete only)				
Dia. (in.)		1/4	3/8	1/2
c_{cr} (in.)		3	4 1/2	6
c_{min} (in.)		1 1/2	2 1/4	3
Edge Distance, *c* (in)	1 1/2	0.75		
	2	0.83		
	2 1/4	0.88	0.75	
	2 1/2	0.92	0.78	
	3	1.00	0.83	0.75
	4		0.94	0.83
	4 1/2		1.00	0.88
	5			0.92
	6			1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters ($12d$) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 6 anchor diameters ($6d$) at which the anchor achieves 75% of load.



ORDERING INFORMATION

Carbon Steel Mini Dropin

Cat No.	Rod/Anchor Dia.	Drill Diameter	Overall Length	Standard Box	Standard Ctn.
6335	1/4"	5/8"	5/8"	100	1,000
6322	3/8"	3/4"	3/4"	100	1,000
6337	1/2"	1"	1"	50	500

Setting Tool for Mini Dropin

Cat No.	Rod/Anchor Size	Standard Box	Standard Carton
6336	1/4"	1	50
6323	3/8"	1	50
6338	1/2"	1	50

Double™ *Shell Expansion Anchor*

PRODUCT DESCRIPTION

The Double is a dual expansion machine bolt anchor particularly suited for materials of questionable strength. It can be used in solid concrete, block, brick, and stone. Job site tests are recommended when used in base materials of questionable strength.

GENERAL APPLICATIONS AND USES

- Suspending Conduit
- Cable Trays and Strut
- Support Anchoring
- Suspended Lighting

FEATURES AND BENEFITS

- Performs in base material of questionable strength
- Internally threaded anchor for easy removability and service work

APPROVALS AND LISTINGS

Federal GSA Specification – Meets the proof load requirements of FF-S-325C, Group II, Type 2, Class 2, style 2 (superseded) and CID A-A 1923A, Type 3

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring, 04081-Masonry Anchorage* and *05090-Metal Fastenings.* Expansion Anchors shall be Double anchors as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS Page No.

Double

THREAD VERSION

UNC Thread

ANCHOR MATERIALS

Zamac Alloy

ROD/ANCHOR SIZE RANGE (TYP.)

1/4" to 3/4" diameter

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Hollow Concrete Masonry
Brick Masonry

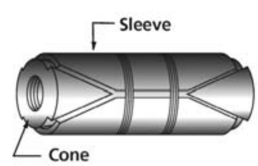
INSTALLATION AND MATERIAL SPECIFICATIONS

Installation Specifications

Dimension	Rod/Anchor Diameter, *d*					
	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"
ANSI Drill Bit Size, d_{bit} (in.)	1/2	5/8	3/4	7/8	1	1 1/4
Max. Tightening Torque, T_{max} (ft.-lbs.)	5	7	10	20	30	60
Sleeve Length (in.)	1	1 3/16	1 9/16	2	2 1/4	3 1/4
Thread Size (UNC)	1/4-20	5/16-18	3/8-16	1/2-13	5/8-11	3/4-10
Thread Length In Cone (in.)	1/2	1/2	5/8	3/4	7/8	1 1/8
Overall Anchor Length (in.)	1 3/8	1 5/8	2	2 1/2	2 3/4	3 15/16

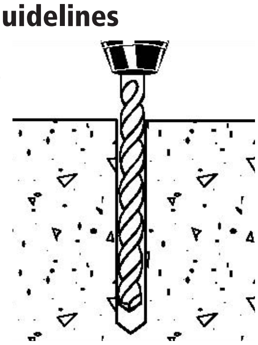
Material Specifications

Anchor Component	Component Material
Anchor Shield	Zamac Alloy
Cone	Zamac Alloy

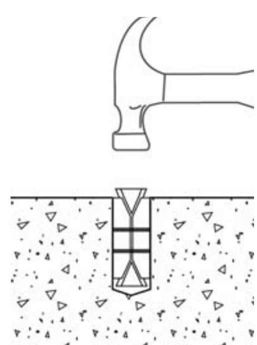


Installation Guidelines

Drill a hole into the base material to the minimum depth required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15. Do not expand the anchor prior to installation. Do not over drill the hole unless the application calls for a subset anchor.



Insert anchor into the hole, threaded cone end first until the sleeve is flush with the surface of the base material.



Position fixture, then insert screw or bolt and tighten. For maximum expansion, the upper cone should protrude slightly before setting. The bolt must engage a minimum of 2/3 of the anchor threads.

PERFORMANCE DATA

Ultimate Load Capacities for Double Expansion Anchor in Normal-Weight Concrete[1,2]

Rod/Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	1,290 (5.8)	1,585 (7.1)	1,650 (7.4)	1,620 (7.3)	2,220 (10.0)	1,910 (8.6)
5/16 (7.9)	1 1/2 (38.1)	1,610 (7.2)	2,040 (9.2)	2,200 (9.9)	2,375 (10.7)	2,540 (11.4)	2,535 (11.4)
3/8 (9.5)	1 3/4 (44.5)	2,275 (10.2)	3,590 (16.2)	3,500 (15.8)	4,000 (18.0)	4,115 (18.5)	5,370 (24.2)
1/2 (12.7)	2 1/4 (57.2)	4,710 (21.2)	5,345 (24.1)	6,500 (29.3)	6,155 (27.7)	6,635 (29.9)	9,900 (44.6)
5/8 (15.9)	2 1/2 (63.5)	5,045 (22.7)	10,710 (48.2)	7,000 (31.5)	11,410 (51.3)	7,660 (34.5)	12,870 (57.9)
3/4 (19.1)	3 1/2 (88.9)	10,005 (45.0)	14,565 (65.5)	14,000 (63.0)	17,775 (80.0)	15,350 (69.1)	19,310 (86.9)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.

Allowable Load Capacities for Double Expansion Anchor in Normal-Weight Concrete[1,2,3]

Rod/Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	325 (1.5)	395 (1.8)	415 (1.9)	405 (1.8)	555 (2.5)	480 (2.2)
5/16 (7.9)	1 1/2 (38.1)	405 (1.8)	510 (2.3)	550 (2.5)	595 (2.7)	635 (2.9)	635 (2.9)
3/8 (9.5)	1 3/4 (44.5)	570 (2.6)	900 (4.1)	875 (3.9)	1,000 (4.5)	1,030 (4.6)	1,345 (6.1)
1/2 (12.7)	2 1/4 (57.2)	1,180 (5.3)	1,335 (6.0)	1,625 (7.3)	1,540 (6.9)	1,660 (7.5)	2,475 (11.1)
5/8 (15.9)	2 1/2 (63.5)	1,260 (5.7)	2,680 (12.1)	1,750 (7.9)	2,855 (12.8)	1,915 (8.6)	3,220 (14.5)
3/4 (19.1)	3 1/2 (88.9)	2,500 (11.3)	3,640 (16.4)	3,500 (15.8)	4,445 (20.0)	3,840 (17.3)	4,830 (21.7)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.
3. Critical and minimum spacing and edge distances as well as reduction factors for intermediate spacing and edge distances are listed in the Design Criteria section.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Double Shell Expansion Anchor in Hollow Concrete Masonry[1,2,3]

Rod/Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	885 (4.0)	1,350 (6.1)	175 (0.8)	270 (1.2)
5/16 (7.9)	1 1/2 (38.1)	1,295 (5.8)	1,635 (7.4)	260 (1.2)	325 (1.5)
3/8 (9.5)	1 1/2 (38.1)	1,575 (7.1)	2,160 (9.7)	315 (1.4)	430 (1.9)
1/2 (12.7)	1 1/2 (38.1)	2,710 (12.2)	3,130 (14.1)	540 (2.4)	625 (2.8)

1. Tabulated load values are for anchors installed in minimum 8-inch wide, Grade N, Type II, medium and normal-weight concrete masonry units. Mortar must be minimum Type N. Masonry compressive strength must be 1,500 psi minimum at the time of installation.
2. Allowable loads are for carbon and stainless steel anchors and are based on average ultimate values using a safety factor of 5.0.
3. Anchors with diameters of 1/2" and larger installed in hollow concrete masonry units are limited to one anchor per unit cell.

Ultimate and Allowable Load Capacities for Double Shell Expansion Anchor in Clay Brick Masonry[1,2]

Rod/Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Structural Brick Masonry $f'_m \geq$ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	1,175 (5.3)	1,585 (7.1)	235 (1.1)	315 (1.4)
5/16 (7.9)	1 1/2 (38.1)	1,585 (7.1)	2,040 (9.2)	315 (1.4)	410 (1.8)
3/8 (9.5)	1 3/4 (44.5)	1,830 (8.2)	3,590 (16.2)	365 (1.6)	720 (3.2)
1/2 (12.7)	2 1/4 (57.2)	3,420 (15.4)	5,185 (23.3)	685 (3.1)	1,035 (4.7)
5/8 (15.9)	2 1/2 (63.5)	5,245 (23.6)	6,055 (27.2)	1,050 (4.7)	1,210 (5.4)
5/8 (15.9)	3 1/2 (88.9)	7,055 (31.7)	7,935 (35.7)	1,410 (6.3)	1,585 (7.1)

1. Tabulated load values are for anchors installed in Grade SW multiple wythe, solid brick masonry conforming to ASTM C62.
2. Tabulated load values are applicable to anchors with carbon and stainless steel cones. Allowable loads are calculated using an applied safety factor of 5.0.

DESIGN CRITERIA

Combined Loading

For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

Load Adjustment Factors for Spacing and Edge Distances

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (s)	Tension and Shear	$s_{cr} = 10d$	$F_N = F_V = 1.0$	$s_{min} = 5d$	$F_N = F_V = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_N = 1.0$	$c_{min} = 8d$	$F_N = 0.80$
	Shear	$c_{cr} = 12d$	$F_V = 1.0$	$c_{min} = 8d$	$F_V = 0.50$

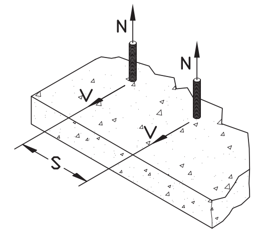
DESIGN CRITERIA

Load Adjustment Factors for Normal-Weight Concrete

Spacing, Tension (F_N) & Shear (F_V)							
Dia. (in.)		1/4	5/16	3/8	1/2	5/8	3/4
s_{cr} (in.)		2 1/2	3 1/8	3 3/4	5	6 1/4	7 1/2
s_{min} (in.)		1 1/4	1 9/16	1 7/8	2 1/2	3 1/8	3 3/4
Spacing, s (inches)	1 1/4	0.50					
	1 9/16	0.63	0.50				
	1 7/8	0.75	0.60	0.50			
	2 1/2	1.00	0.80	0.67	0.50		
	3 1/8		1.00	0.83	0.63	0.50	
	3 3/4			1.00	0.75	0.60	0.50
	5				1.00	0.80	0.67
	6 1/4					1.00	0.83
	7 1/2						1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 10 anchor diameters (10d) at which the anchor achieves 100% of load.

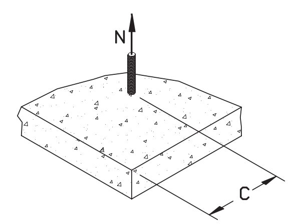
Minimum spacing (s_{min}) is equal to 5 anchor diameters (5d) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_N)							
Dia. (in.)		1/4	5/16	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	3 3/4	4 1/2	6	7 1/2	9
c_{min} (in.)		2	2 1/2	3	4	5	6
Edge Distance, c (inches)	2	0.80					
	2 1/2	0.90	0.80				
	3	1.00	0.88	0.80			
	3 3/4		1.00	0.90			
	4			0.93	0.80		
	4 1/2			1.00	0.85		
	5				0.90	0.80	
	6				1.00	0.88	0.80
	7 1/2					1.00	0.90
	9						1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12d) at which the anchor achieves 100% of load.

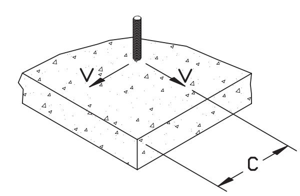
Minimum edge distance (c_{min}) is equal to 8 anchor diameters (8d) at which the anchor achieves 80% of load.



Edge Distance, Shear (F_V)							
Dia. (in.)		1/4	5/16	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	3 3/4	4 1/2	6	7 1/2	9
c_{min} (in.)		2	2 1/2	3	4	5	6
Edge Distance, c (inches)	2	0.50					
	2 1/2	0.75	0.50				
	3	1.00	0.70	0.50			
	3 3/4		1.00	0.75			
	4			0.83	0.50		
	4 1/2			1.00	0.63		
	5				0.75	0.50	
	6				1.00	0.70	0.50
	7 1/2					1.00	0.75
	9						1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12d) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 8 anchor diameters (8d) at which the anchor achieves 50% of load.



ORDERING INFORMATION

Double Shell Expansion Anchor

Catalog Number	Rod/Anchor Diameter	Drill Diameter	Overall Length	Minimum Hole Depth	Standard Box	Standard Carton	Wt./ 100
9510	1/4"	1/2"	1 3/8"	1 1/4"	50	500	4
9515	5/16"	5/8"	1 5/8"	1 1/2"	50	500	7 1/2
9520	3/8"	3/4"	2"	1 3/4"	50	250	12 1/2
9525	1/2"	7/8"	2 1/2"	2 1/4"	25	250	18
9530	5/8"	1"	2 3/4"	2 1/2"	25	100	25 1/2
9535	3/4"	1 1/4"	3 15/16"	3 1/2"	10	50	54 1/2

Single™ *Shell Expansion Anchor*

PRODUCT DESCRIPTION

The Single is a machine bolt anchor designed for use in concrete, block, brick, and stone. The Single consists of a pre-assembled set of expansion shields and an expander cone formed from zamac alloy. As the anchor is tightened, the wedge-shaped cone is drawn into the shields, compressing them against the base material. The Single is not recommended for use in overhead applications. Overhead applications are better served typically by an FM Global or UL listed anchor.

GENERAL APPLICATIONS AND USES

- Floor and Wall Attachments
- General Purpose Anchoring

FEATURES AND BENEFITS

- Readily accepts machine bolts
- Internally threaded anchor for easy removability and service work

APPROVALS AND LISTINGS

Federal GSA Specification – Meets the proof load requirements of FF-S-325C, Group II, Type 2, Class 2, style 1 (superseded) and CID A-A 1923A, Type 2

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring* and *05090-Metal Fastening.*
Expansion Anchors shall be Single anchors as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS Page No.

Single

THREAD VERSION

UNC Thread

ANCHOR MATERIALS

Zamac Alloy

ROD/ANCHOR SIZE RANGE (TYP.)

1/4" to 3/4" diameter

SUITABLE BASE MATERIALS

Normal-Weight Concrete

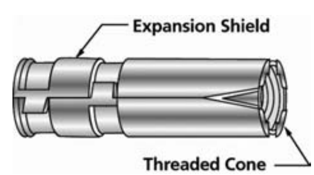
INSTALLATION AND MATERIAL SPECIFICATIONS

Installation Specifications

Dimension	Rod/Anchor Diameter, *d* 1/4"	5/16"	3/8"	1/2"	5/8"	3/4"
ANSI Drill Bit Size, d_{bit} (in.)	1/2	5/8	5/8	7/8	1	1 1/4
Max. Tightening Torque, T_{max} (ft.-lbs.)	5	7	10	20	30	40
Thread Size (UNC)	1/4-20	5/16-18	3/8-16	1/2-13	5/8-11	3/4-10
Thread Length In Cone (in.)	5/16	5/16	5/16	7/16	5/8	11/16
Overall Anchor Length (in.)	1 5/16	1 1/2	1 1/2	2 1/16	2 5/8	2 3/4

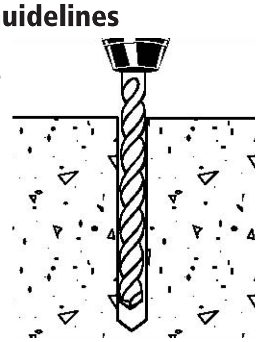
Material Specifications

Anchor Component	Component Material
Anchor Shield	Zamac Alloy
Cone	Zamac Alloy

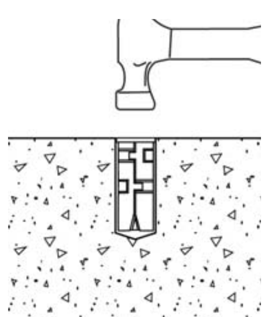


Installation Guidelines

Drill a hole into the base material to the minimum depth required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15. Blow the hole clean of dust and other material.



Do not expand the anchor prior to installation. Insert anchor into the hole, threaded cone end first and tap it flush to the surface.



Position fixture, then insert bolt and tighten. The bolt must engage a minimum of 2/3 of the anchor threads.

PERFORMANCE DATA

Ultimate Load Capacities for Single Shell Expansion Anchor in Normal-Weight Concrete[1,2]

Rod/Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 3/8 (34.9)	885 (4.0)	1,585 (7.1)	2,000 (9.0)	1,620 (7.3)	2,310 (10.4)	1,910 (8.6)
5/16 (7.9)	1 5/8 (41.3)	1,380 (6.2)	2,045 (9.2)	2,100 (9.5)	2,375 (10.7)	2,460 (11.1)	2,535 (11.4)
3/8 (9.5)	1 5/8 (41.3)	1,660 (7.5)	3,590 (16.2)	2,900 (13.1)	3,795 (17.1)	3,370 (15.2)	5,375 (24.2)
1/2 (12.7)	2 1/2 (63.5)	2,990 (13.5)	5,345 (24.1)	4,900 (22.1)	6,155 (27.7)	5,100 (23.0)	9,900 (44.6)
5/8 (15.9)	2 3/4 (69.9)	4,950 (22.3)	10,710 (48.2)	8,200 (36.9)	11,410 (51.3)	8,830 (39.7)	12,870 (57.9)
3/4 (19.1)	2 7/8 (73.0)	6,415 (28.9)	14,560 (65.5)	10,600 (47.7)	17,775 (80.0)	11,040 (49.7)	19,310 (86.9)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.

Allowable Load Capacities for Single Shell Expansion Anchor in Normal-Weight Concrete[1,2,3]

Rod/Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 3/8 (34.9)	220 (1.0)	395 (1.8)	500 (2.3)	405 (1.8)	580 (2.6)	480 (2.2)
5/16 (7.9)	1 5/8 (41.3)	345 (1.6)	510 (2.3)	525 (2.4)	595 (2.7)	615 (2.8)	635 (2.9)
3/8 (9.5)	1 5/8 (41.3)	415 (1.9)	900 (4.1)	725 (3.3)	950 (4.3)	845 (3.8)	1,345 (6.1)
1/2 (12.7)	2 1/2 (63.5)	750 (3.4)	1,335 (6.0)	1,225 (5.5)	1,540 (6.9)	1,275 (5.7)	2,475 (11.1)
5/8 (15.9)	2 3/4 (69.9)	1,240 (5.6)	2,680 (12.1)	2,050 (9.2)	2,855 (12.8)	2,210 (9.9)	3,220 (14.5)
3/4 (19.1)	2 7/8 (73.0)	1,605 (7.2)	3,640 (16.4)	2,650 (11.9)	4,445 (20.0)	2,760 (12.4)	4,830 (21.7)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.
3. Critical and minimum spacing and edge distances as well as reduction factors for intermediate spacing and edge distances are listed in the Design Criteria section.

DESIGN CRITERIA

Combined Loading

For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

Load Adjustment Factors for Spacing and Edge Distances

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (*s*)	Tension and Shear	$s_{cr} = 10d$	$F_N = F_V = 1.0$	$s_{min} = 5d$	$F_N = F_V = 0.50$
Edge Distance (*c*)	Tension	$c_{cr} = 12d$	$F_N = 1.0$	$c_{min} = 8d$	$F_N = 0.80$
	Shear	$c_{cr} = 12d$	$F_V = 1.0$	$c_{min} = 8d$	$F_V = 0.50$

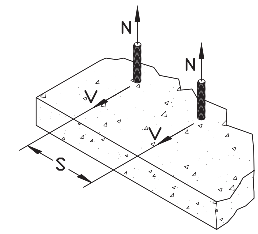
DESIGN CRITERIA

Load Adjustment Factors for Normal-Weight Concrete

Spacing, Tension (F_N) & Shear (F_V)							
	Dia. (in.)	1/4	5/16	3/8	1/2	5/8	3/4
	s_{cr} (in.)	2	3 1/8	3 3/4	5	6 1/4	7 1/2
	s_{min} (in.)	1 1/4	1 9/16	1 7/8	2 1/2	3 1/8	3 3/4
Spacing, s (inches)	1 1/4	0.50					
	1 9/16	0.63	0.50				
	1 7/8	0.75	0.60	0.50			
	2 1/2	1.00	0.80	0.67	0.50		
	3 1/8		1.00	0.83	0.63	0.50	
	3 3/4			1.00	0.75	0.60	0.50
	5				1.00	0.80	0.67
	6 1/4					1.00	0.83
	7 1/2						1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 10 anchor diameters (10*d*) at which the anchor achieves 100% of load.

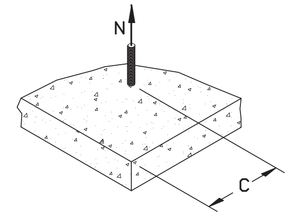
Minimum spacing (s_{min}) is equal to 5 anchor diameters (5*d*) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_N)							
	Dia. (in.)	1/4	5/16	3/8	1/2	5/8	3/4
	c_{cr} (in.)	3	3 3/4	4 1/2	6	7 1/2	9
	c_{min} (in.)	2	2 1/2	3	4	5	6
Edge Distance, c (inches)	2	0.80					
	2 1/2	0.90	0.80				
	3	1.00	0.88	0.80			
	3 3/4		1.00	0.90			
	4			0.93	0.80		
	4 1/2			1.00	0.85		
	5				0.90	0.80	
	6				1.00	0.88	0.80
	7 1/2					1.00	0.90
	9						1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12*d*) at which the anchor achieves 100% of load.

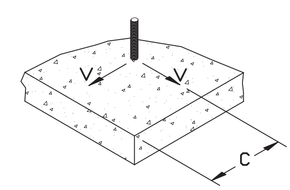
Minimum edge distance (c_{min}) is equal to 8 anchor diameters (8*d*) at which the anchor achieves 80% of load.



Edge Distance, Shear (F_V)							
	Dia. (in.)	1/4	5/16	3/8	1/2	5/8	3/4
	c_{cr} (in.)	3	3 3/4	4 1/2	6	7 1/2	9
	c_{min} (in.)	2	2 1/2	3	4	5	6
Edge Distance, c (inches)	2	0.50					
	2 1/2	0.75	0.50				
	3	1.00	0.70	0.50			
	3 3/4		1.00	0.75			
	4			0.83	0.50		
	4 1/2			1.00	0.63		
	5				0.75	0.50	
	6				1.00	0.70	0.50
	7 1/2					1.00	0.75
	9						1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12*d*) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 8 anchor diameters (8*d*) at which the anchor achieves 50% of load.



ORDERING INFORMATION

Single Shell Expansion Anchor

Cat. No.	Rod/Anchor Dia.	Drill Diameter	Min. Hole Depth	Std. Box	Std. Carton	Wt./100
9650	1/4"	1/2"	1 3/8"	50	250	3 3/4
9655	5/16"	5/8"	1 5/8"	50	250	5 1/2
9665	3/8"	5/8"	1 5/8"	50	250	5 1/4
9675	1/2"	7/8"	2 1/2"	25	125	15 1/4
9685	5/8"	1"	2 3/4"	25	125	24
9695	3/4"	1 1/4"	2 7/8"	10	100	43

Calk-In™ *Machine Bolt Anchor*

PRODUCT DESCRIPTION

The Calk-In is a pre-assembled precision cast calking type machine bolt anchor which can be used in concrete, block, brick or stone. The Calk-In consists of an antimonial lead alloy calking sleeve and a Zamac alloy internally threaded expanded cone. This anchor is not recommended for use in overhead applications. Overhead applications are better served typically by an FMRC or UL listed anchor.

GENERAL APPLICATIONS AND USES

- Windows
- Sliding Doors
- Screens
- Shutters

FEATURES AND BENEFITS

- Readily accepts machine bolts
- Internally threaded anchor for easy removability and service work
- Shallow Embedment

APPROVALS AND LISTINGS

Southern Building Code Conference International (SBCCI) #9944A

Federal GSA Specification – Meets the proof load requirements of FF-S-325C, Group I, Type 1, Class 1 (superseded) and CID A-A 1922A, Type 1

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring, 04081-Masonry Anchorage* and *05090-Metal Fastening.* Machine Bolt Anchors shall be Calk-In as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS Page No.

Calk-In

THREAD VERSION

UNC Thread

ANCHOR MATERIALS

Antimonial Lead Alloy body and Zamac Alloy cone

ROD/ANCHOR SIZE RANGE (TYP.)

#8 Screw to 1/2" diameter

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Hollow Concrete Masonry
Brick Masonry

INSTALLATION AND MATERIAL SPECIFICATIONS

Installation Specifications

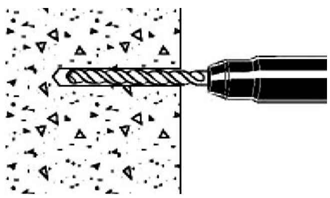
Dimension	Rod/Anchor Size, d					
	#8-32	#10-24	1/4"	5/16"	3/8"	1/2"
ANSI Drill Bit Size, d_{bit} (in.)	5/16	3/8	1/2	5/8	3/4	7/8
Max. Tightening Torque, T_{max} (ft.-lbs.)	15	20	60	7	10	15
Thread Size (UNC)	13/32	15/32	19/32	3/4	1	1 1/8

Material Specifications

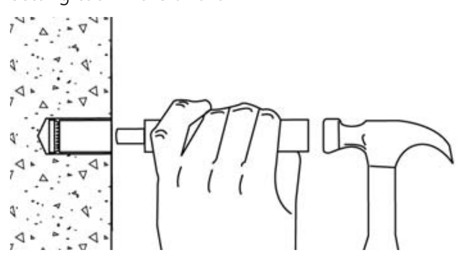
Anchor Component	Component Material
Anchor Sleeve	Antimonial Lead
Cone	Zamac Alloy

Installation Guidelines

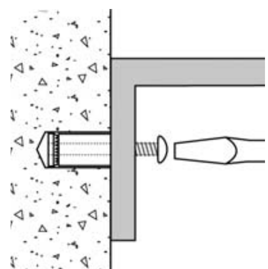
Drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15. Do not over drill the hole.



Blow the hole clean of dust and other material. Insert the anchor into the hole. Position the setting tool in the anchor.



Using the tool, set the anchor by driving the lead sleeve over the cone using several sharp hammer blows. Be sure the anchor is at the required embedment depth so that anchor threads do not protrude above the surface of the base material. Positions the fixture, insert screw or bolt and tighten.



PERFORMANCE DATA

Ultimate Load Capacities for Calk-In in Normal-Weight Concrete[1,2]

Rod/Anchor Size d in. (UNC)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
#8-32	1/2 (12.7)	840 (3.8)	565 (2.5)	915 (4.1)	655 (2.9)	950 (4.3)	655 (2.9)
#10-24	5/8 (15.9)	960 (4.3)	885 (4.0)	1,215 (5.5)	940 (4.2)	1,380 (6.2)	940 (4.2)
1/4-20	7/8 (22.2)	1,870 (8.4)	1,355 (6.1)	2,340 (10.5)	1,410 (6.3)	2,440 (11.0)	1,410 (6.3)
5/16-18	1 (25.4)	2,250 (10.1)	1,880 (8.5)	2,445 (11.0)	2,070 (9.3)	3,030 (13.6)	2,070 (9.3)
3/8-16	1 1/4 (31.8)	2,625 (11.8)	2,700 (12.2)	3,105 (14.0)	3,305 (14.9)	3,600 (16.2)	3,305 (14.9)
1/2-13	1 1/2 (38.1)	4,260 (19.2)	3,995 (18.0)	4,370 (19.7)	4,545 (20.5)	4,895 (22.0)	4,545 (20.5)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.

Allowable Load Capacities for Calk-In in Normal-Weight Concrete[1,2,3]

Rod/Anchor Size d in. (UNC)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
#8-32	1/2 (12.7)	210 (0.9)	140 (0.6)	230 (1.0)	165 (0.7)	240 (1.1)	165 (0.7)
#10-24	5/8 (15.9)	240 (1.1)	220 (1.0)	305 (1.4)	235 (1.1)	345 (1.6)	235 (1.1)
1/4-20	7/8 (22.2)	470 (2.1)	340 (1.5)	585 (2.6)	355 (1.6)	610 (2.7)	355 (1.6)
5/16-18	1 (25.4)	565 (2.5)	470 (2.1)	610 (2.7)	520 (2.3)	760 (3.4)	520 (2.3)
3/8-16	1 1/4 (31.8)	655 (2.9)	675 (3.0)	775 (3.5)	825 (3.7)	900 (4.1)	825 (3.7)
1/2-13	1 1/2 (38.1)	1,065 (4.8)	1,000 (4.5)	1,095 (4.9)	1,135 (5.1)	1,225 (5.5)	1,135 (5.1)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.
3. Critical and minimum spacing and edge distances as well as reduction factors for intermediate spacing and edge distances are listed in the Design Criteria section.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Calk-In in Hollow Concrete Masonry[1,2,3]

Rod/Anchor Size d in. (UNC)	Minimum Embedment Depth h_v in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
#8-32	1/2 (12.7)	680 (3.1)	565 (2.5)	135 (0.6)	115 (0.5)
#10-24	5/8 (15.9)	740 (3.3)	885 (4.0)	150 (0.7)	175 (0.8)
1/4-20	7/8 (22.2)	880 (4.0)	1,250 (5.6)	175 (0.8)	250 (1.1)
5/16-18	1 (25.4)	1,470 (6.6)	1,585 (7.1)	295 (1.3)	315 (1.4)
3/8-16	1 1/4 (31.8)	1,700 (7.7)	2,265 (10.2)	340 (1.5)	455 (2.0)
1/2-13	1 1/2 (38.1)	2,360 (10.6)	3,210 (14.4)	470 (2.1)	640 (2.9)

1. Tabulated load values are for anchors installed in minimum 6-inch wide, Grade N, Type II, medium and normal-weight concrete masonry units. Mortar must be minimum Type N. Masonry compressive strength must be 1,500 psi minimum at the time of installation.
2. Allowable loads are based on average ultimate values using a safety factor of 5.0.
3. Anchors installed flush with face shell surface.

Ultimate and Allowable Load Capacities for Calk-In in Clay Brick Masonry[1,2]

Rod/Anchor Size d in. (UNC)	Minimum Embedment Depth h_v in. (mm)	Structural Brick Masonry $f'_m \geq$ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
#8-32	1/2 (12.7)	740 (3.3)	655 (2.9)	150 (0.7)	130 (0.6)
#10-24	5/8 (15.9)	960 (4.3)	890 (4.0)	190 (0.9)	180 (0.8)
1/4-20	7/8 (22.2)	1,460 (6.6)	1,480 (6.7)	290 (1.3)	295 (1.3)
5/16-18	1 (25.4)	1,730 (7.8)	1,995 (9.0)	345 (1.6)	400 (1.8)
3/8-16	1 1/4 (31.8)	2,200 (9.9)	3,600 (16.2)	440 (2.0)	720 (3.2)
1/2-13	1 1/2 (38.1)	3,200 (14.4)	4,535 (20.4)	640 (2.9)	905 (4.1)

1. Tabulated load values are for anchors installed in Grade SW multiple wythe, solid brick masonry conforming to ASTM C62.
2. Allowable loads are calculated using an applied safety factor of 5.0.

DESIGN CRITERIA

Combined Loading

For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n}\right)^{\frac{5}{3}} + \left(\frac{V_u}{V_n}\right)^{\frac{5}{3}} \leq 1 \quad \text{OR} \quad \left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

Load Adjustment Factors for Spacing and Edge Distances

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (s)	Tension and Shear	$s_{cr} = 10d$	$F_N = F_V = 1.0$	$s_{min} = 5d$	$F_N = F_V = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_N = 1.0$	$c_{min} = 8d$	$F_N = 0.80$
	Shear	$c_{cr} = 12d$	$F_V = 1.0$	$c_{min} = 8d$	$F_V = 0.50$

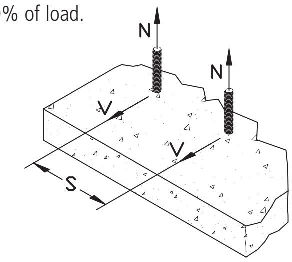
DESIGN CRITERIA

Load Adjustment Factors for Normal-Weight Concrete

Spacing, Tension (F_N) & Shear (F_V)							
Dia. (in.)		#8	#10	1/4	5/16	3/8	1/2
s_{cr} (in.)		1 5/8	1 7/8	2 1/2	3 1/8	3 3/4	5
s_{min} (in.)		7/8	1	1 1/4	1 9/16	1 7/8	2 1/2
Spacing, s (inches)	7/8	0.50					
	1	0.61	0.50				
	1 1/4	0.76	0.66	0.50			
	1 3/8	0.84	0.72	0.55			
	1 9/16	0.95	0.82	0.63	0.50		
	1 5/8	1.00	0.86	0.65	0.52		
	1 7/8		1.00	0.75	0.60	0.50	
	2 1/8			0.85	0.68	0.57	
	2 1/2			1.00	0.80	0.67	0.50
	3 1/8				1.00	0.83	0.63
	3 3/4					1.00	0.75
	5						1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 10 anchor diameters (10d) at which the anchor achieves 100% of load.

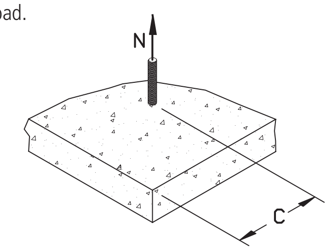
Minimum spacing (s_{min}) is equal to 5 anchor diameters (5d) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_N)							
Dia. (in.)		#8	#10	1/4	5/16	3/8	1/2
c_{cr} (in.)		2	2 1/4	3	3 3/4	4 1/2	6
c_{min} (in.)		1 1/4	1 1/2	2	2 1/2	3	4
Edge Distance, c (inches)	1 1/4	0.80					
	1 1/2	0.86	0.80				
	1 5/8	0.90	0.83				
	2	1.00	0.93	0.80			
	2 1/4		1.00	0.85			
	2 1/2			0.90	0.80		
	3			1.00	0.88	0.80	
	3 3/4				1.00	0.90	
	4					0.93	0.80
	4 1/2					1.00	0.85
	5						0.90
	6						1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12d) at which the anchor achieves 100% of load.

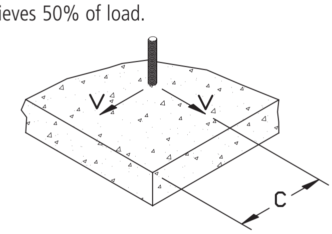
Minimum edge distance (c_{min}) is equal to 8 anchor diameters (8d) at which the anchor achieves 80% of load.



Edge Distance, Shear (F_V)							
Dia. (in.)		#8	#10	1/4	5/16	3/8	1/2
c_{cr} (in.)		2	2 1/4	3	3 3/4	4 1/2	6
c_{min} (in.)		1 1/4	1 1/2	2	2 1/2	3	4
Edge Distance, c (inches)	1 1/4	0.50					
	1 1/2	0.64	0.50				
	1 5/8	0.74	0.57				
	2	1.00	0.82	0.50			
	2 1/4		1.00	0.63			
	2 1/2			0.75	0.50		
	3			1.00	0.70	0.50	
	3 3/4				1.00	0.75	
	4					0.83	0.50
	4 1/2					1.00	0.63
	5						0.75
	6						1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12d) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 8 anchor diameters (8d) at which the anchor achieves 50% of load.



ORDERING INFORMATION

Calk-In

Cat. No.	Size	Drill Diameter	Min. Hole Depth	Std. Box	Std. Carton	Wt./100
9205	#8-32	5/16"	1/2"	100	1,000	1
9210	#10-24	3/8"	5/8"	100	1,000	1 3/4
9220	1/4"-20	1/2"	7/8"	100	1,000	4 1/2
9225	5/16"-18	5/8"	1"	50	250	7 3/4
9230	3/8"-16	3/4"	1 1/4"	50	250	14
9240	1/2"-13	7/8"	1 1/2	50	250	19

Setting Tools

Cat. No.	9201	9211	9221	9226	9231	9241
Size	#8	#10	1/4"	5/16"	3/8"	1/2"

Lag Shield™ *Shell Expansion Anchor*

PRODUCT DESCRIPTION

The Lag Shield is a screw style anchor designed for use with lag bolts. It is suitable for use in concrete and the mortar joints of block or brick walls. In harder masonry materials, short style Lag Shields are used to reduce drilling time. The long style version is used in soft or weak masonry to better develop strength.

GENERAL APPLICATIONS AND USES

- Hard and Soft Base Materials
- Mortar Joints
- Shallow Attachments
- Masonry Anchorage

FEATURES AND BENEFITS

- Ideal for use in masonry materials
- Internally threaded anchor for easy removability and service work

APPROVALS AND LISTINGS

Federal GSA Specification – Meets the proof load requirements of FF-S-325C-Group 2, Type 1, Class 1 (Long) or Class 2C (Short) (superseded) and CID A-A 1923A, Type 1

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring, 04081-Masonry Anchorage* and *05090-Metal Fastenings.* Shell Expansion Anchors shall be Lag Shield anchors as supplied by Powers Fasteners, Inc., Brewster, NY.

Lag Shield

THREAD VERSION

UNC Thread

ANCHOR MATERIALS

Zamac Alloy

ROD/ANCHOR SIZE RANGE (TYP.)

1/4" to 3/4" diameter

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Hollow Concrete Masonry
Brick Masonry

INSTALLATION AND MATERIAL SPECIFICATIONS

Installation Specifications

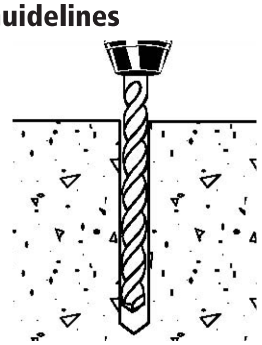
Dimension	Rod/Anchor Diameter, *d*					
	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"
ANSI Drill Bit Size, d_{bit} (in.)	1/2	1/2	5/8	3/4	7/8	1
Max. Tightening Torque, T_{max} (ft.-lbs.)	5	7	10	20	30	60
Thread Size (UNC)	1/4-10	5/16-9	3/8-7	1/2-6	5/8-5	3/4-4 1/2

Material Specifications

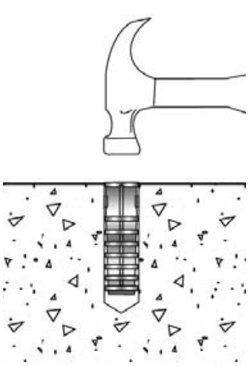
Anchor Component	Component Material
Anchor Body	Zamac Alloy

Installation Guidelines

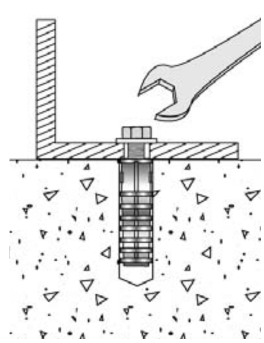
Drill a hole into the base material to the depth of at least 1/2" or one anchor diameter deeper than the embedment required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15. Do not over dill the hole unless the application calls for a subset anchor.



Blow the hole clean of dust and other material. Insert the anchor into the hole until it is flush with the surface. If installing in a mortar joint, position the anchor to expand against the block or brick.



Position fixture, insert the lag bolt, and tighten. The lag bolt length selected should fully engage the entire anchor body.



PERFORMANCE DATA

Ultimate Load Capacities for Lag Shield in Normal-Weight Concrete[1,2]

Rod/Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		4,000 psi (27.6 MPa)		6,000 psi (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 Short (6.4)	1 (25.4)	220 (1.0)	880 (4.0)	315 (1.4)	1,025 (4.6)	415 (1.9)	1,025 (4.6)
1/4 Long (6.4)	1 1/2 (38.1)	435 (2.0)	880 (4.0)	635 (2.9)	1,025 (4.6)	750 (3.4)	1,025 (4.6)
5/16 Short (7.9)	1 1/4 (31.8)	370 (1.7)	1,105 (5.0)	600 (2.7)	1,485 (6.7)	780 (3.5)	1,485 (6.7)
5/16 Long (7.9)	1 3/4 (44.5)	535 (2.4)	1,105 (5.0)	785 (3.5)	1,485 (6.7)	820 (3.7)	1,485 (6.7)
3/8 Short (9.5)	1 3/4 (44.5)	845 (3.8)	1,305 (5.9)	1,225 (5.5)	1,620 (7.3)	1,345 (6.1)	1,620 (7.3)
3/8 Long (9.5)	2 1/2 (63.5)	1,060 (4.8)	1,305 (5.9)	1,545 (7.0)	1,620 (7.3)	1,840 (8.3)	1,620 (7.3)
1/2 Short (12.7)	2 (50.8)	1,145 (5.2)	1,780 (8.0)	1,700 (7.7)	2,140 (9.6)	1,810 (8.1)	2,140 (9.6)
1/2 Long (12.7)	3 (76.2)	2,085 (9.4)	1,780 (8.0)	3,015 (13.6)	2,140 (9.6)	3,390 (15.3)	2,140 (9.6)
5/8 Short (15.9)	2 (50.8)	1,220 (5.5)	2,220 (10.0)	1,760 (7.9)	2,520 (11.3)	1,935 (8.7)	2,520 (11.3)
5/8 Long (15.9)	3 1/2 (88.9)	2,470 (11.1)	2,220 (10.0)	3,800 (17.1)	2,520 (11.3)	4,265 (19.2)	2,520 (11.3)
3/4 Short (19.1)	2 (50.8)	1,325 (6.0)	2,355 (10.6)	2,200 (9.9)	2,680 (12.1)	2,345 (10.6)	2,680 (12.1)
3/4 Long (19.1)	3 1/2 (88.9)	2,925 (13.2)	2,355 (10.6)	4,000 (18.0)	2,680 (12.1)	4,195 (18.9)	2,680 (12.1)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.

Allowable Load Capacities for Lag Shield in Normal-Weight Concrete[1,2,3]

Rod/Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		4,000 psi (27.6 MPa)		6,000 psi (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 Short (6.4)	1 (25.4)	55 (0.2)	220 (1.0)	80 (0.4)	255 (1.1)	105 (0.5)	255 (1.1)
1/4 Long (6.4)	1 1/2 (38.1)	110 (0.5)	220 (1.0)	160 (0.7)	255 (1.1)	190 (0.9)	255 (1.1)
5/16 Short (7.9)	1 1/4 (31.8)	95 (0.4)	275 (1.2)	150 (0.7)	370 (1.7)	195 (0.9)	370 (1.7)
5/16 Long (7.9)	1 3/4 (44.5)	135 (0.6)	275 (1.2)	195 (0.9)	370 (1.7)	205 (0.9)	370 (1.7)
3/8 Short (9.5)	1 3/4 (44.5)	210 (0.9)	325 (1.5)	305 (1.4)	405 (1.8)	335 (1.5)	405 (1.8)
3/8 Long (9.5)	2 1/2 (63.5)	265 (1.2)	325 (1.5)	385 (1.7)	405 (1.8)	460 (2.1)	405 (1.8)
1/2 Short (12.7)	2 (50.8)	285 (1.3)	445 (2.0)	425 (1.9)	535 (2.4)	455 (2.0)	535 (2.4)
1/2 Long (12.7)	3 (76.2)	520 (2.3)	445 (2.0)	755 (3.4)	535 (2.4)	850 (3.8)	535 (2.4)
5/8 Short (15.9)	2 (50.8)	305 (1.4)	555 (2.5)	440 (2.0)	630 (2.8)	485 (2.2)	630 (2.8)
5/8 Long (15.9)	3 1/2 (88.9)	620 (2.8)	555 (2.5)	950 (4.3)	630 (2.8)	1,065 (4.8)	630 (2.8)
3/4 Short (19.1)	2 (50.8)	330 (1.5)	590 (2.7)	550 (2.5)	670 (3.0)	585 (2.6)	670 (3.0)
3/4 Long (19.1)	3 1/2 (88.9)	730 (3.3)	590 (2.7)	1,000 (4.5)	670 (3.0)	1,050 (4.7)	670 (3.0)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.
3. Critical and minimum spacing and edge distances as well as reduction factors for intermediate spacing and edge distances are listed in the Design Criteria section.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Lag Shield in Hollow Concrete Masonry[1,2,3,4]

Rod/Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 Short (6.4)	1 (25.4)	230 (1.0)	720 (3.2)	45 (0.2)	145 (0.7)
5/16 Short (7.9)	1 1/4 (31.8)	360 (1.6)	1,025 (4.6)	70 (0.3)	205 (0.9)
3/8 Short (9.5)	1 1/2 (38.1)	795 (3.6)	1,125 (5.1)	160 (0.7)	225 (1.0)
1/2 Short (12.7)	1 1/2 (38.1)	1,025 (4.6)	1,600 (7.2)	205 (0.9)	320 (1.4)

1. Tabulated load values are for anchors installed in minimum 6-inch wide, Grade N, Type II, medium and normal-weight concrete masonry units. Mortar must be minimum Type N. Masonry compressive strength must be 1,500 psi minimum at the time of installation.
2. Allowable loads are based on average ultimate values using a safety factor of 5.0.
3. Anchors with diameters of 1/2" and larger installed in hollow concrete masonry units are limited to one anchor per unit cell.
4. Anchors installed flush with face shell surface.

Ultimate and Allowable Load Capacities for Lag Shield in Clay Brick Masonry[1,2]

Rod/Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 Short (6.4)	1 (25.4)	240 (1.1)	1,025 (4.6)	50 (0.2)	205 (0.9)
5/16 Short (7.9)	1 1/4 (31.8)	425 (1.9)	1,485 (6.7)	85 (0.4)	295 (1.3)
3/8 Short (9.5)	1 3/4 (44.5)	1,190 (5.4)	1,620 (7.3)	240 (1.1)	325 (1.5)
1/2 Short (12.7)	2 (50.8)	1,230 (5.5)	2,140 (9.6)	245 (1.1)	430 (1.9)

1. Tabulated load values are for anchors installed in Grade SW multiple wythe, solid brick masonry conforming to ASTM C62.
2. Allowable loads are calculated using an applied safety factor of 5.0.

DESIGN CRITERIA

Combined Loading

For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n}\right)^{\frac{5}{3}} + \left(\frac{V_u}{V_n}\right)^{\frac{5}{3}} \leq 1 \quad \text{OR} \quad \left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

Load Adjustment Factors for Spacing and Edge Distances

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	**Load Type**	**Critical Distance (Full Anchor Capacity)**	**Critical Load Factor**	**Minimum Distance (Reduced Capacity)**	**Minimum Load Factor**
Spacing (*s*)	Tension and Shear	$s_{cr} = 10d$	$F_N = F_V = 1.0$	$s_{min} = 5d$	$F_N = F_V = 0.50$
Edge Distance (*c*)	Tension	$c_{cr} = 12d$	$F_N = 1.0$	$c_{min} = 8d$	$F_N = 0.80$
	Shear	$c_{cr} = 12d$	$F_V = 1.0$	$c_{min} = 8d$	$F_V = 0.50$

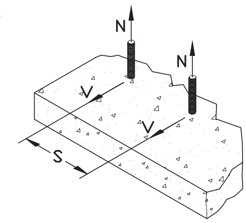
DESIGN CRITERIA

Load Adjustment Factors for Normal-Weight Concrete

Spacing, Tension (F_N) & Shear (F_V)							
Dia. (in.)		1/4	5/16	3/8	1/2	5/8	3/4
s_{cr} (in.)		2 1/2	3 1/8	3 3/4	5	6 1/4	7 1/2
s_{min} (in.)		1 1/4	1 9/16	1 7/8	2 1/2	3 1/8	3 3/4
Spacing, *s* (inches)	1 1/4	0.50					
	1 9/16	0.63	0.50				
	1 7/8	0.75	0.60	0.50			
	2 1/2	1.00	0.80	0.67	0.50		
	3 1/8		1.00	0.83	0.63	0.50	
	3 3/4			1.00	0.75	0.60	0.50
	5				1.00	0.80	0.67
	6 1/4					1.00	0.83
	7 1/2						1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 10 anchor diameters (10*d*) at which the anchor achieves 100% of load.

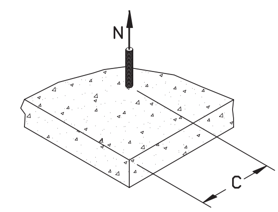
Minimum spacing (s_{min}) is equal to 5 anchor diameters (5*d*) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_N)							
Dia. (in.)		1/4	5/16	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	3 3/4	4 1/2	6	7 1/2	9
c_{min} (in.)		2	2 1/2	3	4	5	6
Edge Distance, *c* (inches)	2	0.80					
	2 1/2	0.90	0.80				
	3	1.00	0.88	0.80			
	3 3/4		1.00	0.90			
	4			0.93	0.80		
	4 1/2			1.00	0.85		
	5				0.90	0.80	
	6				1.00	0.88	0.80
	7 1/2					1.00	0.90
	9						1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12*d*) at which the anchor achieves 100% of load.

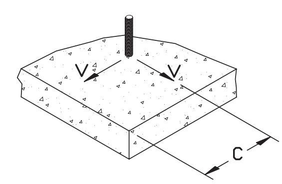
Minimum edge distance (c_{min}) is equal to 8 anchor diameters (8*d*) at which the anchor achieves 80% of load.



Edge Distance, Shear (F_V)							
Dia. (in.)		1/4	5/16	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	3 3/4	4 1/2	6	7 1/2	9
c_{min} (in.)		2	2 1/2	3	4	5	6
Edge Distance, *c* (inches)	2	0.50					
	2 1/2	0.75	0.50				
	3	1.00	0.70	0.50			
	3 3/4		1.00	0.75			
	4			0.83	0.50		
	4 1/2			1.00	0.63		
	5				0.75	0.50	
	6				1.00	0.70	0.50
	7 1/2					1.00	0.75
	9						1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12*d*) at which the anchor achieves 100% of load.

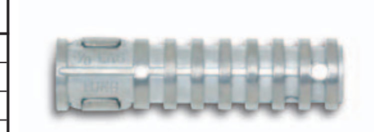
Minimum edge distance (c_{min}) is equal to 8 anchor diameters (8*d*) at which the anchor achieves 50% of load.



ORDERING INFORMATION

Lag Shield Anchor

Catalog Number	Size	Drill Diameter	Length	Thread Length	Standard Box	Standard Carton	Wt./ 100
1051	1/4" Short	1/2"	1/2"	1"	50	500	3
1055	1/4" Long	1/2"	1"	1 1/2"	50	500	4
1101	5/16" Short	1/2"	3/4"	1 1/4"	50	500	3
1105	5/16" Long	1/2"	1"	1 3/4"	50	500	4 1/4
1151	3/8" Short	5/8"	1"	1 3/4"	50	500	6 3/4
1155	3/8" Long	5/8"	1 1/2"	2 1/2"	50	250	9 1/2
1201	1/2" Short	3/4"	1 1/8"	2"	50	500	9 1/4
1205	1/2" Long	3/4"	1 7/8"	3"	50	200	14 1/4
1251	5/8" Short	7/8"	1"	2"	25	125	13
1255	5/8" Long	7/8"	2 1/4"	3 1/2"	25	125	22
1301	3/4" Short	1"	1 1/8"	2"	25	125	16
1305	3/4" Long	1"	2 1/4"	3 1/2"	25	100	24 1/2



Vertigo™ *Rod Hanging System*

PRODUCT DESCRIPTION

Vertigo is a one-piece, all steel threaded fastening system for suspending steel threaded rod vertically overhead in pipe hanging, fire protection, electrical conduit and cable-tray applications. Vertigo can be installed in a variety of base materials including steel purlins, bar joists and beams, wood frame columns and beams, as well as concrete ceilings, beams and columns.

Steel threaded rods in 1/4", 3/8" and 1/2" diameters can be vertically suspended with Vertigo. In wood and steel base materials, Vertigo is also offered in a side mount style for lateral installation of 1/4" and 3/8" diameter steel threaded rods onto joists, columns and overhead members. For all steel and wood Vertigo fasteners, a universal Vertigo Socket Driver is recommended to provide proper installation with a screw gun or hammer drill. Concrete Vertigo fasteners should be installed with the appropriate size standard drive sockets and adjustable torque, battery powered screw gun or hammer drill.

GENERAL APPLICATIONS AND USES

- Hanging Pipe and Sprinkler Systems
- Lighting Systems and Overhead Utilities
- Suspended Ceilings
- Suspending Conduit and Cable Trays
- HVAC Ductwork and Strut Channels
- Mounting Security Equipment

FEATURES AND BENEFITS

- One system for all rod hanging applications in steel, wood and concrete
- Ease and speed of overhead installation
- Lower in-place cost, when compared to beam clamps, lag bolts and dropins
- Steel and wood Vertigo can be installed with an screw gun or hammer drill
- Concrete Vertigo can be installed with an adjustable torque, battery powered screw gun or hammer drill
- Side mount versions available for steel and wood Vertigo
- The universal socket can be used for the steel and wood Vertigo

APPROVALS AND LISTINGS

International Code Council, Evaluation Service (ICC-ES) ESR-1678
(for concrete Vertigo only)
Factory Mutual Research Corporation (FM Approvals) File No. J.I 3015153
Underwriters Laboratory (UL) File No. EX 1289 (N)

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring, 05090-Metal Fastenings and 06060-Wood Connections and Fasteners.* Rod Hangers shall be Vertigo anchors as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS Page No.

Steel Vertigo

Wood Vertigo

Concrete Vertigo (Wedge-Bolt OT)

ANCHOR MATERIALS

Zinc Plated Carbon Steel

ROD/ANCHOR SIZE RANGE (TYP.)

1/4" to 1/2" threaded rod for Steel
1/4" to 1/2" threaded rod for Wood
1/4" to 1/2" threaded rod for Concrete

SUITABLE BASE MATERIALS

Steel Purlins and Beams
Wood and Timber
Normal-Weight Concrete
Structural Lightweight Concrete
Hollow Core Concrete Plank

INSTALLATION SPECIFICATIONS

Steel Vertigo

Point Style	#3	#5
Self Drilling Range	0.036" (20 gage) – 0.188" (3/16")	0.188" (3/16") – 0.500" (1/2")
Screw Size (UNC)	1/4-20 thread	1/4-20 thread
Root Diameter (in.)	13/64	13/64
Thread Length (in.)	1-3/16" (1 1/2"screw)	31/32" (1 1/2"screw)
Flange Thickness (in.)	1/16	1/16
Drill Speed (RPM)	500-1,500	500-1,500

Install with universal steel and wood socket.

Wood Vertigo

Screw Size	1/4" Thread Forming	3/8" Thread Forming
Pre-drill Diameter (in.) (if required)	1/8	1/8
Point Style	Type 17	Type 17
Root Diameter (in.)	3/16	5/16
Thread Length (in.)	Screw length less 5/16	Screw length less 5/16
Flange Thickness (in.)	1/16	1/16

Install with universal steel and wood socket.

Vertigo Couplings (Steel & Wood)

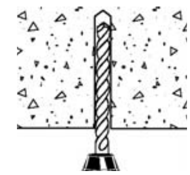
Coupling Size and Type	1/4" Vertical	3/8" Vertical	1/2" Vertical	1/4" Side	3/8" Side
Thread Size (UNC)	1/4-20	3/8-16	1/2-13	1/4-20	3/8-16
Thread Depth (in.)	3/8	3/8	3/8	5/8 (through)	5/8 (through)
Width (flat to flat) (in.)	5/8	5/8	5/8	5/8	5/8
Height (in.)	13/16	13/16	13/16	13/16	13/16

Concrete Vertigo (Wedge-Bolt OT)

Rod Diameter/Anchor Size	1/4"	3/8"	1/2"
ANSI Drill Bit (in.)	1/4	1/4	3/8
Overall Screw Shank Length	1-1/4	1-1/2	2-3/4
Anchor Thread Length (in.)	1-1/8	1-3/8	2-1/2
Root Diameter (in.)	15/64	15/64	23/64
Coupling / Washer Height (in.)	27/64	9/16	53/64
Integral Washer O.D. (in.)	31/64	39/64	31/32
Coupling Thread Size (UNC)	1/4-20	3/8-16	1/2-13
Coupling Thread Depth (in.)	3/8	1/2	3/4
Socket Driver Size (in.)	3/8	1/2	11/16

Install with appropriate sized concrete socket.

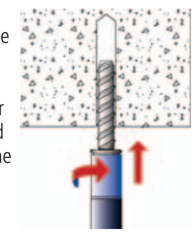
Installation Guidelines



When installing Vertigo fasteners, eye protection should be worn as a safety precaution.

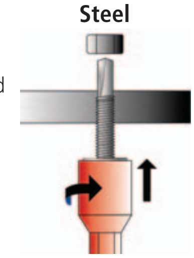
If pre-drilling is required (certain types of wood truss/wood joist and all concrete base materials), select the recommended drill bit type and diameter. For Concrete Vertigo only, drill to the appropriate embedment depth, adding at least one diameter (1/4" to 1/2") to the drilling depth to prevent the tip of the fastener from running into a dead end at the rear of the anchor hole.

Concrete



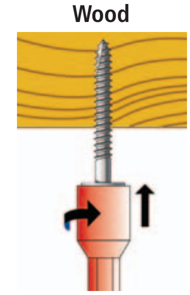
Select the appropriate socket driver for the anchor size and type to be installed and mount into chuck of installation tool. Insert the Vertigo fastener into the socket driver, and install perpendicular to the base material surface. Drive the fastener with a smooth steady motion until the coupling is firmly seated against the surface of the base material.

Steel



Thread the appropriate diameter steel threaded rod or threaded bolt into the coupling. The threaded rod or bolt should fully engage the thread length of the coupling on a vertical mount fastener. The threaded rod or threaded portion of the bolt can pass through coupling of a side mount fastener.

Wood



For UL and FM listings, Steel Vertigo should be installed with a retaining nut.

MATERIAL SPECIFICATIONS

Steel and Wood Vertigo

Component	Component Material
Screw Body	AISI 1022 (Case Hardened)
Coupling	AISI 1018-1022 (Case Hardened)
Zinc Plating	ASTM B633, SC1, Type III

Concrete Vertigo (Wedge-Bolt OT)

Component	Component Material
Anchor Body	Case Hardened 10B21 Carbon Steel
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn 5)

PERFORMANCE DATA

Steel Vertigo – Ultimate Tension Load Capacities when Installed in Minimum ASTM A 36 Steel (Beams) and ASTM A 572 Steel (Purlins)[1,2]

Anchor Size/ Rod Diameter in. (mm)	Mount Direction	Screw Shank Size and Length	Minimum Steel Gage (Thickness)						
			20 0.036"	18 0.048"	16 0.060"	14 0.075"	12 0.105"	3/16" 0.187"	1/4" 0.250"
			lbs. (kN)	lbs. (kN)	lbs. (kN)	lbs. (kN)	lbs. (kN)	lbs. (kN)	lbs. (kN)
1/4 (6.4)	Vertical	1/4-20 x 1" (w/nut)	1,550 (7.0)	1,550 (7.0)	1,775 (8.0)	1,775 (8.0)	2,050 (9.2)	3,850 (17.3)	5,040 (22.7)
	Vertical	1/4-20 x 1"	405 (1.8)	620 (2.8)	985 (4.4)	1,160 (5.2)	1,560 (7.0)	3,205 (14.4)	5,040 (22.7)
	Side	1/4-20 x 1" (w/nut)	1,550 (7.0)	1,550 (7.0)	1,775 (8.0)	1,775 (8.0)	2,050 (9.2)	3,850 (17.3)	2,050 (9.2)
3/8 (9.5)	Vertical	1/4-20 x 1" (w/nut)	1,550 (7.0)	1,550 (7.0)	1,775 (8.0)	1,775 (8.0)	2,050 (9.2)	3,850 (17.3)	5,040 (22.7)
	Side	1/4-20 x 1-1/2" (w/nut)	1,550 (7.0)	1,550 (7.0)	1,775 (8.0)	1,775 (8.0)	2,050 (9.2)	3,850 (17.3)	2,050 (9.2)
	Vertical	1/4-20 x 1-1/2"	405 (1.8)	620 (2.8)	985 (4.4)	1,160 (5.2)	1,560 (7.0)	3,205 (14.4)	5,040 (22.7)
	Side	1/4-20 x 1-1/2"	405 (1.8)	620 (2.8)	985 (4.4)	1,160 (5.2)	1,560 (7.0)	1,965 (8.8)	1,965 (8.8)
	Vertical	1/4-20 x 2" (w/nut)	1,550 (7.0)	1,550 (7.0)	1,775 (8.0)	1,775 (8.0)	2,050 (9.2)	3,850 (17.3)	5,040 (22.7)
1/2 (12.7)	Vertical	12-24 x 1-1/2"	495 (2.2)	710 (3.2)	920 (4.1)	1,560 (7.0)	2,050 (9.2)	3,280 (14.8)	5,040 (22.7)

1. For Steel Vertigo loaded perpendicular to threaded rod (shear) the ultimate load capacity for the anchor is 1,965 lbs in nominal 20 gage steel (0.036").
2. Steel Vertigo are recommended to be installed with the Universal Steel & Wood Nut Driver.

Wood Vertigo – Ultimate Tension Load Capacities when Installed in Wood Base Materials (Structural Wood and Timber)[1,2]

Anchor Size/ Rod Diameter in. (mm)	Mount Direction	Screw Shank Size and Length	Embedment Depth in. (mm)	Wood Member (Type)		
				Fir	Pine	Spruce
				lbs. (kN)	lbs. (kN)	lbs. (kN)
1/4 (6.4)	Vertical	1/4 x 1"	1 (25.4)	685 (3.1)	650 (2.9)	650 (2.9)
	Side	1/4 x 1"	1 (25.4)	685 (3.1)	650 (2.9)	650 (2.9)
3/8 (9.5)	Vertical	1/4 x 2"	2 (50.8)	1,510 (6.8)	1,510 (6.8)	1,510 (6.8)
	Side	1/4 x 2"	2 (50.8)	1,800 (8.1)	1,800 (8.1)	1,800 (8.1)
	Vertical	1/4 x 3"	3 (76.2)	2,075 (9.3)	1,510 (6.8)	1,510 (6.8)
	Vertical	1/4 x 4"	4 (101.6)	2,075 (9.3)	1,510 (6.8)	1,510 (6.8)
	Vertical	3/8" x 2 1/2"	2 1/2 (63.5)	2,670 (12.0)	3,110 (14.0)	3,110 (14.0)
	Side	3/8" x 2 1/2"	2 1/2 (63.5)	1,450 (6.5)	1,530 (6.9)	1,380 (6.2)
1/2 (12.7)	Vertical	3/8" x 2 1/2"	2 1/2 (63.5)	2,670 (12.0)	3,110 (14.0)	3,110 (14.0)

1. Timber/joist manufacturers may require pre-drilled holes with wood depending on the location of the anchor installation. Consult with the trust/joist manufacturer for details.
2. Wood Vertigo are recommended to be installed with the Universal Steel & Wood Nut Driver.

PERFORMANCE DATA

Concrete Vertigo – Ultimate Load Capacities when Installed in Normal-Weight Concrete[1,2,3]

Anchor Size/ Rod Dia. in. (mm)	Mount Direction	Screw Shank Size and Length	ANSI Drill Bit Diameter d_{bit} in.	Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
					2,000 psi (13.8 MPa)		**4,000 psi** (20.7 MPa)		**6,000 psi** (41.4 MPa)	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	Vertical	1/4" x 1 1/4"	1/4"	1 1/4 (31.8)	1,390 (6.3)	1,810 (8.1)	1,950 (8.8)	2,440 (11.0)	2,070 (9.3)	2,570 (11.6)
3/8 (9.5)	Vertical	1/4" x 1 1/2"	1/4"	1 1/2 (38.1)	1,760 (7.9)	2,580 (11.6)	2,595 (11.7)	2,640 (11.9)	2,770 (12.5)	2,700 (12.2)
1/2 (12.7)	Vertical	3/8" x 2 3/4"	3/8"	2 3/4 (69.9)	5,320 (23.9)	5,250 (23.6)	6,050 (27.2)	6,330 (28.5)	8,620 (38.8)	3,110 (14.0)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.
3. Concrete Vertigo anchors are recommended to be installed with the appropriate Concrete Nut Driver.

Concrete Vertigo – Ultimate Load Capacities when Installed Through Metal Deck into Structural Lightweight Concrete[1,2,3,4,5,6]

Anchor Size Rod Diameter d in. (mm)	Embedment Depth h_v in. (mm)	Lightweight Concrete Over Minimum 20 Ga. Metal Deck $f'_c \geq$ 3,000 psi (20.7 MPa)	
		Minimum 4 1/2" Wide Deck	
		Tension lbs. (kN)	Load at 45° lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	800 (3.6)	1,140 (5.1)
3/8 (9.5)	1 1/2 (38.1)	1,780 (8.0)	1,500 (6.8)
1/2 (12.7)	2 3/4 (69.9)	3,880 (17.5)	2,920 (13.1)

1. The values listed above are ultimate and allowable load capacities for Vertigo rod hangers installed in sand-lightweight concrete.
2. The metal deck shall be minimum No. 20 gage thick steel [(0.035-inch base metal thickness (0.89 mm)] conforming to ASTM A 653/ A 653M.
3. Allowable loads capacities are calculated using an applied safety factor of 4.0.
4. The tabulated load values are for anchors installed with a minimum flute edge distance of 1 1/2-inch.
5. Allowable loads for anchors to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load where permitted by code.
6. Concrete Vertigo anchors are recommended to be installed with the appropriate Concrete Nut Driver.

Concrete Vertigo – Ultimate Tension Load Capacities when Installed in Hollow Core Concrete Plank[1,2,3]

Anchor Size/ Rod Dia. in. (mm)	Mount Direction	Screw Shank Size and Length	ANSI Drill Bit Diameter d_{bit} in.	Embed. Depth h_v in. (mm)	Center of Web	Center of Core
					lbs. (kN)	lbs. (kN)
1/4 (6.4)	Vertical	1/4" x 1 1/4"	1/4"	1 1/4 (31.8)	1,390 (6.3)	1,810 (8.1)
3/8 (9.5)	Vertical	1/4" x 1 1/2"	1/4"	1 1/2 (38.1)	1,760 (7.9)	2,580 (11.6)
1/2 (12.7)	Vertical	3/8" x 2 3/4"	3/8"	2 3/4 (69.9)	5,320 (23.9)	5,250 (23.6)

1. Tabulated load values are for anchors installed in 8-inch-thick hollow core plank with minimum compressive strength of 5,000 psi at the time of installation. The 4' x 6' normal-weight concrete members features include 1-1/2" cover above and below cores and a minimum web thickness of 1-1/2".
2. Depending on fastener application and governing building code, ultimate load capacities should be reduced by a minimum safety factor to determine the allowable working load. NFPA 13 Fire Protection requirements are 5 times the weight of the liquid (water) filled pipe plus 250 lbs. Consult the engineer of record.
3. Concrete Vertigo anchors are recommended to be installed with the appropriate Concrete Nut Driver.

PERFORMANCE DATA

Steel Vertigo – Ultimate Load Capacities for Factory Mutual (FM Global) and Underwriter's Laboratories (UL) Listings[1]

Catalog Number	Anchor Size/ Rod Dia. in. (mm)	Mount Direction	Screw Shank Size and Length	Point Style	Maximum Pipe Size in. (mm)	UL Minimum Steel Thickness in. (mm)	UL Test Load lbs. (kN)	FM Minimum Steel Thickness in. (mm)	FM Test Load lbs. (kN)
7158	3/8 (9.5)	Vertical	1/4-20 x 1"	#3	4 (101.6)	0.060 (1.5)	1,500 (6.8)	0.096 (2.4)	1,475 (6.6)
7184		Side	1/4-20 x 1"	#3	4 (101.6)	0.060 (1.5)	1,500 (6.8)	0.096 (2.4)	1,475 (6.6)
7160		Vertical	1/4-20 x 1 1/2"	#3	4 (101.6)	0.060 (1.5)	1,500 (6.8)	0.096 (2.4)	1,475 (6.6)
7186		Side	1/4-20 x 1 1/2"	#3	4 (101.6)	0.060 (1.5)	1,500 (6.8)	0.096 (2.4)	1,475 (6.6)
7154		Vertical	12-24 x 1 1/2"	#5	4 (101.6)	0.060 (1.5)	1,500 (6.8)	0.096 (2.4)	1,475 (6.6)
7188		Side	1/4-20 x 2"	#3	4 (101.6)	0.060 (1.5)	1,500 (6.8)	0.096 (2.4)	1,475 (6.6)
7201		Side	12-24 x 1 1/2"	#5	4 (101.6)	0.060 (1.5)	1,500 (6.8)	0.096 (2.4)	1,475 (6.6)
7164	1/2 (12.7)	Vertical	12-24 x 1 1/2"	#5	8 (203.2)	0.250 (6.4)	4,050 (18.2)	0.250 (6.4)	3,800 (17.1)

1. Steel Vertigo anchors are recommended to be installed with the Universal Steel & Wood Nut Driver. For UL and FM listings, Steel Vertigo must be installed with a retaining nut.

Wood Vertigo – Ultimate Load Capacities for Factory Mutual (FM Global) and Underwriter's Laboratories (UL) Listings[1]

Catalog Number	Anchor Size/ Rod Dia. in. (mm)	Mount Direction	Screw Shank Size and Length	Embedment Depth in. (mm)	UL Maximum Pipe Size in. (mm)	UL Test Load lbs. (kN)	FM Maximum Pipe Size in. (mm)	FM Test Load lbs. (kN)
7165	3/8 (9.5)	Vertical	1/4 x 2"	2 (50.8)	3 (76.2)	1,050 (4.7)	†	†
7170		Side	1/4 x 2"	2 (50.8)	3 (76.2)	1,050 (4.7)	†	†
7167		Vertical	1/4 x 3"	3 (76.2)	3 (76.2)	1,050 (4.7)	†	†
7169		Vertical	1/4 x 4"	4 (101.6)	3 (76.2)	1,050 (4.7)	†	†
7162		Vertical	3/8" x 2 1/2"	2 1/2 (63.5)	4 (101.6)	1,500 (6.8)	4 (101.6)	1,475 (6.6)
7156		Side	3/8" x 2 1/2"	2 1/2 (63.5)	4 (101.6)	1,500 (6.8)	†	†

1. Wood Vertigo anchors are recommended to be installed with the Universal Steel & Wood Nut Driver. No pre-drilling was done in the wood base materials.
† Factory Mutual standard requires a screw diameter of 3/8" and minimum length of 2 1/2" for pipe hanging approval in wood base materials.

Concrete Vertigo – Ultimate Load Capacities for Factory Mutual (FM Global) Listings[1,2]

Catalog Number	Anchor Size/ Rod Dia. in. (mm)	Mount Direction	Screw Shank Size and Length	ANSI Drill Bit Diameter d_{bit} in.	Embedment Depth in. (mm)	FM Maximum Pipe Size in. (mm)	FM Test Load lbs. (kN)
7173	3/8 (9.5)	Vertical	1/4" x 1 1/2"	1/4"	1 1/2 (38.1)	4 (101.6)	1,475 (6.6)
7175	1/2 (12.7)	Vertical	3/8" x 2 3/4"	3/8"	2 3/4 (69.9)	8 (203.2)	3,800 (17.1)

1. Tabulated load values are for anchors installed in 8 inch thick hollow core plank with minimum compressive strength of 4,000 psi at the time of installation. The 4' x 6' normal-weight concrete members features include 1 1/2" cover above and below cores and a minimum web thickness of 1 1/2".
2. Concrete Vertigo are recommended to be installed with the appropriate Concrete Nut Driver.

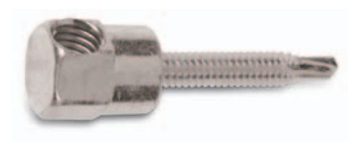
ORDERING INFORMATION

Steel Vertical Hanger (#3 for Purlins, #5 for Beams)

Cat. No.	Rod Dia.	Screw Shank Size and Length	Point Style	Self Drilling Range	Std. Box	Std. Ctn.
7155	1/4"	1/4-20 x 1"	#3	0.036" (20 gage) to 0.188" (3/16")	100	500
7157	3/8"	1/4-20 x 2"	#3		100	500
7158	3/8"	1/4-20 x 1" (w/nut)	#3		100	500
7159	3/8"	1/4-20 x 1 1/2"	#3		100	500
7160	3/8"	1/4-20 x 1 1/2" (w/nut)	#3		100	500
7152	1/4"	12-24 x 1 1/2"	#5	0.188" (3/16") to 0.500" (1/2")	100	500
7154	3/8"	12-24 x 1 1/2" (w/nut)	#5		100	500
7161	1/2"	12-24 x 1 1/2" (w/nut)	#5		100	500

Steel Side Hanger (#3 for Purlins, #5 for Beams)

Cat. No.	Rod Dia.	Screw Shank Size and Length	Point Style	Self Drilling Range	Std. Box	Std. Ctn.
7183	1/4"	1/4-20 x 1"	#3	0.036" (20 gage) to 0.188" (3/16")	100	500
7184	3/8"	1/4-20 x 1" (w/nut)	#3		100	500
7186	3/8"	1/4-20 x 1 1/2"	#3		100	500
7188	3/8"	1/4-20 x 1 1/2" (w/nut)	#3		100	500
7200	1/4"	12-24 x 1 1/2"	#5	0.188" (3/16") to 0.500" (1/2")	100	500
7201	3/8"	12-24 x 1 1/2" (w/nut)	#5		100	100



Wood Vertical Hanger

Cat. No.	Rod Dia.	Screw Shank Size and Length	Point Style	Pre-Drill Diameter (If Required)	Std. Box	Std. Ctn.
7163	1/4"	1/4" x 2"	Type 17	1/8"	100	500
7203	3/8"	1/4" x 1"	Type 17		100	500
7165	3/8"	1/4" x 2"	Type 17		100	500
7167	3/8"	1/4" x 3"	Type 17		100	500
7169	3/8"	1/4" x 4"	Type 17		100	500
7162	3/8"	3/8" x 2 1/2"	Type 17		100	500
7164	1/2"	3/8" x 2 1/2"	Type 17		100	500

Wood Side Hanger

Cat. No.	Rod Dia.	Screw Shank Size and Length	Point Style	Pre-Drill Diameter (If Required)	Std. Box	Std. Ctn.
7185	1/4"	1/4" x 1"	Type 17	1/8"	100	500
7205	3/8"	1/4" x 1"	Type 17		100	500
7170	3/8"	1/4" x 2"	Type 17		100	500
7156	3/8"	3/8" x 2 1/2"	Type 17		100	500

Concrete Vertical Hanger

Cat. No.	Rod Dia.	Screw Shank Size and Length	Thread Style	Pre-Drill Diameter	Std. Box	Std. Ctn.
7171	1/4"	1/4" x 1 1/4"	Wedge-Bolt OT	1/4" ANSI	100	500
7173	3/8"	1/4" x 1 1/2"	Wedge-Bolt OT	1/4" ANSI	100	500
7175	1/2"	3/8" x 2 3/4"	Wedge-Bolt OT	3/8" ANSI	50	250

For side mount concrete applications use Catalog Number 7185 and 7170 with a 1/4" ANSI drill bit.

Drive Sockets and Pole Tool

Cat. No.	Description	RPM	Std. Box	Std. Ctn.
7166	6'-12' Pole Tool (includes three Jaw Chuck)	N/A	1	1
7187	Universal Steel & Wood Socket (Red)	500 to 1500 RPM	5	25
7195	1/4" Concrete Socket (Blue)	–	5	25
7197	3/8" Concrete Socket (Blue)	–	5	25
7198	1/2" Concrete Socket (Blue)	–	5	25

Concrete Vertigo Installation Accessories

Cat. No.	Description	Maximum Bit Length	Std. Box	Wt./ Each
5865	Tapper 3000 Tool Kit — Hex Driver (used with Cat#5860) Sleeve Assembly (same as Cat# 5874) 1/4" and 3/8" Concrete Drive Sockets (Blue)	6"	1	3/4
5874	Sleeve Assembly	6"	1	–
Cat. No.	**Description**	**Usable Length**	**Std.Tube**	**Wt./10**
5860	1/4" x 4 1/2" Straight Shank Drill Bit	3"	5	1/2
5866	1/4" x 6" Hex Shank SDS Drill Bit	4"	1	1/2

Bang-It™ and Wood-Knocker™ *Concrete Inserts*

PRODUCT DESCRIPTION

Bang-It concrete inserts are designed for installation in and through metal composite deck (i.e. "pan-deck") used to support newly poured concrete floors or roof slabs. After pre-drilling the deck and installation, the protective sleeve of the insert protrudes below the surface of the deck allowing overhead attachment of steel threaded rod in sizes ranging from 1/4" to 7/8" in diameter. The sleeve prevents sprayed fireproofing material and acoustical dampening products from clogging the internal threads of the insert. It also prevents burying, masking or losing the insert location. The unique, six sided impact plate offers resistance to rotation within the concrete as a steel threaded rod is being installed.

Wood-Knocker concrete inserts are installed onto wooden forms used to support newly poured concrete floor slabs, roof slabs or walls. When the forms are stripped, the color-coded flange is visibly embedded in the concrete surface. The inserts allow the attachment of steel threaded rod or threaded bolts in sizes ranging from 1/4" to 3/4" in diameter. The unique six sided impact plate offers resistance to rotation within the concrete as a steel threaded rod or threaded bolt is being installed.

A coil thread design is available for Wood-Knocker upon request in 1/2" and 3/4" sizes for forming applications.

GENERAL APPLICATIONS AND USES

- Hanging Pipe and Sprinkler Systems
- Lighting Systems and Overhead Utilities
- Suspended Ceilings
- Suspending Conduit and Cable Trays
- HVAC Ductwork and Strut Channels
- Concrete Formwork

FEATURES AND BENEFITS

- Patented hex head does not rotate when set
- UL and FM listings
- Higher load values due to full thread engagement
- Color coded by size for all trades
- Low overall installed cost

APPROVALS AND LISTINGS

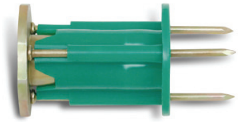
Factory Mutual Research Corporation (FM Approvals) File No. J.I 3015153
Underwriters Laboratory (UL) File No. EX 1289. Recognized for use in air handling spaces.

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring* **and** *05090-Metal Fastenings.* Rod Hangers shall be Bang-It and/or Wood-Knocker concrete inserts as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS Page No.

Bang-It Metal Deck Insert



Wood-Knocker
Wood Form Insert

ANCHOR MATERIALS

Carbon Steel and Engineered Plastic

ROD/ANCHOR SIZE RANGE (TYP.)

1/4" to 7/8" threaded rod for Bang-It Concrete Inserts

1/4" to 3/4" threaded rod for Wood-Knocker Concrete Inserts

1/2" and 3/4" coil thread for Wood-Knocker Concrete Inserts

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Structural Lightweight Concrete

MATERIAL SPECIFICATIONS

Bang-It

Anchor Component	Component Material
Insert Body	AISI 1008 Carbon Steel
Flange	AISI 1008 Carbon Steel
Spring	Steel Music Wire
Zinc Plating	ASTM B 633 (Yellow Dichromate)
Protective Sleeve	Engineered Plastic

Wood-Knocker

Anchor Component	Component Material
Insert Body	AISI 1008 Carbon Steel
Flange	Engineered Plastic
Zinc Plating	ASTM B 633 (Yellow Dichromate)

STEEL SPECIFICATIONS

Material Properties for Threaded Rod

Steel Description	Steel Specification (ASTM)	Rod Diameter (inch)	Minimum Yield Strength, f_y (ksi)	Minimum Ultimate Strength, f_u (ksi)
Standard carbon rod	A 36	All	36.0	58.0
	A 307, Grade C	3/8 thru 4	36.0	58.0
High strength carbon rod	A 193, Grade B7	3/8 thru 2 1/2	105.0	120.0
Stainless Rod (Type 304 / 316 SS)	F 593, Condition CW	3/8 thru 5/8	65.0	100.0
		3/4 thru 1 1/2	45.0	85.0

Allowable Steel Strength for Threaded Rod

Anchor Diameter *d* in. (mm)	Nominal Area of Rod in. (mm)	Allowable Tension: ASTM A36 lbs. (kN)	Allowable Tension: ASTM A307 Grade C lbs. (kN)	Allowable Tension: ASTM A193 Grade B7 lbs. (kN)	Allowable Tension: ASTM F593 304/316 SS lbs. (kN)	Allowable Shear: ASTM A36 lbs. (kN)	Allowable Shear: ASTM A307 Grade C lbs. (kN)	Allowable Shear: ASTM A193 Grade B7 lbs. (kN)	Allowable Shear: ASTM F593 304/316 SS lbs. (kN)
1/4 (6.4)	0.0491 (1.2)	940 (4.2)	940 (4.2)	2,160 (9.7)	1,210 (5.4)	485 (2.2)	485 (2.2)	1,030 (4.6)	625 (2.8)
3/8 (9.5)	0.1104 (2.8)	2,115 (9.5)	2,115 (9.5)	4,375 (19.7)	3,630 (16.3)	1,090 (4.9)	1,090 (4.9)	2,255 (10.1)	1,870 (8.4)
1/2 (12.7)	0.1963 (5.0)	3,755 (16.9)	3,755 (16.9)	7,775 (35.0)	6,470 (29.1)	1,940 (8.7)	1,940 (8.7)	4,055 (18.2)	3,330 (15.0)
5/8 (15.9)	0.3068 (7.8)	5,870 (26.4)	5,870 (26.4)	12,150 (54.7)	10,130 (45.6)	3,025 (13.6)	3,025 (13.6)	6,260 (28.2)	5,210 (23.4)
3/4 (19.1)	0.4418 (11.2)	8,455 (38.0)	8,455 (38.0)	17,495 (78.7)	12,400 (55.8)	4,355 (19.6)	4,355 (19.6)	9,010 (40.5)	6,390 (28.8)
7/8 (22.2)	0.6010 (15.3)	11,510 (51.8)	11,510 (51.8)	23,810 (107.1)	16,860 (75.9)	5,930 (26.7)	5,930 (26.7)	12,265 (55.2)	8,680 (39.1)

INSTALLATION SPECIFICATIONS

Bang-It

Dimension	Rod/Anchor Size 1/4"	3/8"	1/2"	5/8"	3/4"	7/8"
Metal Hole Saw Diameter (in.)	13/16	13/16	13/16	1 3/16	1 3/16	1 3/16
Drilling Speed (rpm)	700-900	700-900	700-900	500-700	500-700	500-700
Height of Spring (in.)	2	2	2	2	2	2
Insert Thread Length (in.)	3/8	5/8	11/16	15/16	1 1/8	1 5/16
Length of Sleeve (in.)	3 3/8	3 3/8	3 3/8	3 3/8	3 3/8	3 3/8
Thread Size, UNC	1/4-20	3/8-16	1/2-13	5/8-11	3/4-10	7/8-8
Overall Length (in.)	5 5/16	5 5/16	5 5/16	5 5/16	5 5/16	5 5/16
Steel Flange Thickness (in.)	5/64	5/64	5/64	5/64	5/64	5/64

Wood-Knocker

Dimension	Rod/Anchor Size 1/4"	3/8"	1/2"	5/8"	3/4"
Insert Thread Length (in.)	3/8	5/8	11/16	15/16	1 1/8
Plastic Flange Dia. (in.)	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8
Plastic Flange Thickness (in.)	7/64	7/64	7/64	7/64	7/64
Thread Size, UNC	1/4-20	3/8-16	1/2-13	5/8-11	3/4-10
Overall Length (in.)	1 7/8	1 7/8	1 7/8	1 7/8	1 7/8
Break-Off Nail Length (in.)	3/4	3/4	3/4	3/4	3/4

INSTALLATION GUIDELINES

Bang-It

Prior to pouring concrete, use the recommended diameter metal hole saw to drill a hole through the metal deck at the location the insert is needed. Typically, inserts are installed in the upper flute (crest) of the metal deck for easier access during installation. However, it is also acceptable to install the insert in the lower flute of the metal deck.

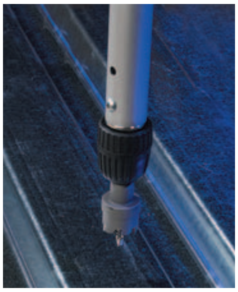
From the topside of the metal deck, place the Bang-It Concrete Insert's color-coded, plastic protective sleeve through the pre-drilled hole. The oversized steel flange will balance the spring-loaded impact plate and cause it to stand upright. Either step on the Bang-It with your foot or using a hand held hammer, strike the head of the Bang-It with enough force to cause the tapered portion of the protective plastic sleeve to push through the metal deck, clamping the deck surface between the sleeve and the flange. When all inserts are installed, concrete pouring may commence. The clamping pressure generated by the spring keeps the sleeve perpendicular to the deck surface during the pour.

Either before or after the concrete has been placed, tap the appropriate diameter steel threaded rod or threaded bolt through the opening at the end of the plastic sleeve and screw into the internally threaded insert. Minimum thread engagement should be one anchor diameter. Concrete should be allowed to properly cure and achieve its design compressive strength before loading the threaded rod with the intended assembly.

For safety purposes, it is best to wait until the insert is ready to be put in service before screwing the steel threaded rod into place.

Note: UL listing for 1/2" Bang-It is for the crest of the metal deck only.

Chuck Carbide Hole Saw



Drill Deck Holes

Push Bang-It into Place

Set by Stepping on Bang-It

Pour Concrete.
Then Install Rod

Wood-Knocker

Prior to pouring concrete over the wood form, place the Wood-Knocker Concrete Insert (break-off nails down) on the surface of the wood form at the desired location. Strike the impact plate of the insert with a hand held hammer, until the plastic color-coded flange is flush with the wood surface. When all inserts are installed, concrete pouring may commence.

After the wood forms are removed, the three break-off nails and color-coded flange are left exposed. Carefully remove any unbroken nails by swiping with a hammer. Eye protection should be worn when removing the break-off nails. The appropriate diameter steel rod or threaded bolt can be inserted into the opening of the flange and screwed into the internally threaded insert.

Minimum thread engagement should be one anchor diameter. Concrete should be allowed to properly cure and achieve its design compressive strength before loading the rod or threaded bolt with the intended assembly.

For safety purposes, it is best to wait until the insert is ready to be put in service before screwing the steel threaded rod into place.

Note: UL listing for 5/8" Wood-Knocker is for 8" pipe maximum.

Set Wood-Knocker into Place

Hammer in Insert

Pour Concrete

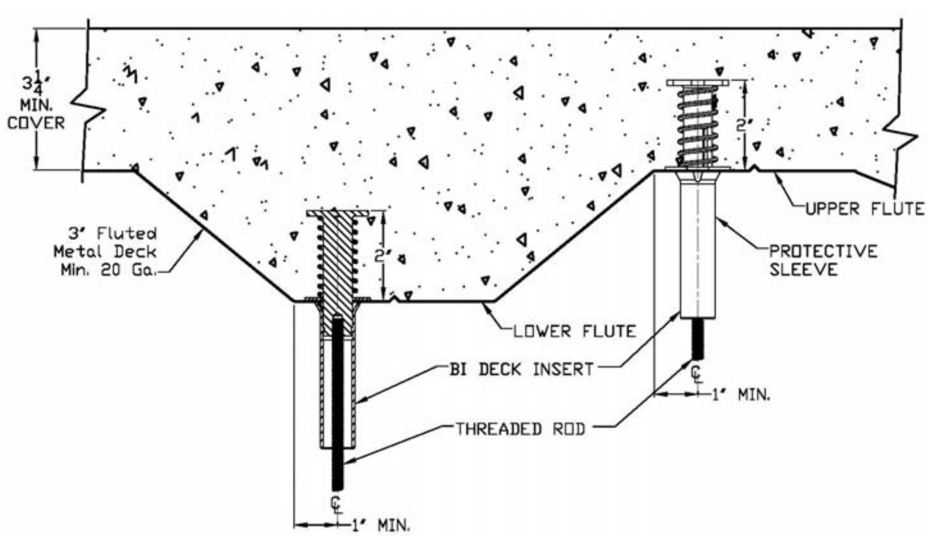
Install Rod

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Bang-It Inserts Installed in Structural Lightweight Concrete over Metal Deck[1,2,3,4]

Rod/Insert Diameter *d* in. (mm)	Embedment Depth h_v in. (mm)	Flute Location in Deck	Minimum Insert Spacing in. (mm)	Minimum End Distance in. (mm)	$f'_c \geq$ 3,000 psi (20.7 MPa) Ultimate Load Tension lbs. (kN)	Ultimate Load Shear lbs. (kN)	Allowable Load Tension lbs. (kN)	Allowable Load Shear lbs. (kN)
1/4 (6.4)	2 (50.8)	Upper	9 (228.6)	12 (304.8)	4,450 (20.0)	2,500 (11.3)	1,115 (5.0)	835 (3.8)
		Lower			3,320 (14.9)	2,500 (11.3)	830 (3.7)	625 (2.8)
3/8 (9.5)	2 (50.8)	Upper	9 (228.6)	12 (304.8)	5,750 (25.9)	3,350 (15.1)	1,915 (8.6)	1,115 (5.0)
		Lower			3,320 (14.9)	3,350 (15.1)	830 (3.7)	840 (3.8)
1/2 (12.7)	2 (50.8)	Upper	9 (228.6)	12 (304.8)	7,110 (32.0)	3,350 (15.1)	2,370 (10.7)	1,115 (5.0)
		Lower			3,320 (14.9)	3,350 (15.1)	830 (3.7)	840 (3.8)
5/8 (15.9)	2 (50.8)	Upper	9 (228.6)	12 (304.8)	8,810 (39.6)	3,350 (15.1)	2,935 (13.2)	1,115 (5.0)
		Lower	9 (228.6)		3,960 (17.8)	–	990 (4.5)	–
			12 (304.8)		3,960 (17.8)	3,350 (15.1)	990 (4.5)	840 (3.8)
3/4 (19.1)	2 (50.8)	Upper	9 (228.6)	12 (304.8)	8,810 (39.6)	3,350 (15.1)	2,935 (13.2)	1,115 (5.0)
		Lower	9 (228.6)		3,960 (17.8)	–	990 (4.5)	–
			12 (304.8)		3,960 (17.8)	3,350 (15.1)	990 (4.5)	840 (3.8)
7/8 (22.2)	2 (50.8)	Upper	9 (228.6)	12 (304.8)	8,810 (39.6)	3,350 (15.1)	2,935 (13.2)	1,115 (5.0)
		Lower	9 (228.6)		3,960 (17.8)	–	990 (4.5)	–
			12 (304.8)		3,960 (17.8)	3,350 (15.1)	990 (4.5)	840 (3.8)

1. Allowable load capacities listed are calculated using an applied safety factor of 3.0 for installations in the upper flute and 4.0 for installations in the lower flute.
2. The allowable working load must be the lesser of the insert capacity or the steel strength of the threaded rod.
3. NFPA 13 design requirements are five times the weight of the water filled pipe plus 250 pounds.
4. Allowable loads for anchors to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load where permitted by code.



PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Wood-Knocker Inserts Installed in Normal-Weight Concrete[1,2,3,4,5]

Rod/ Insert Diameter *d* in. (mm)	Embed. Depth h_v in. (mm)	Minimum Insert Spacing in. (mm)	Minimum End Distance in. (mm)	3,000 psi (20.7 MPa) Ultimate Load Tension lbs. (kN)	3,000 psi Ultimate Load Shear lbs. (kN)	3,000 psi Allowable Load Tension lbs. (kN)	3,000 psi Allowable Load Shear lbs. (kN)	4,500 psi (31.1 MPa) Ultimate Load Tension lbs. (kN)	4,500 psi Ultimate Load Shear lbs. (kN)	4,500 psi Allowable Load Tension lbs. (kN)	4,500 psi Allowable Load Shear lbs. (kN)
1/4 (6.4)	2 (50.8)	9 (228.6)	6 (152.4)	3,720 (16.7)	1,490 (6.7)	1,240 (5.6)	495 (2.2)	4,250 (19.1)	1,610 (7.2)	1,415 (6.4)	535 (2.4)
3/8 (9.5)	2 (50.8)	9 (228.6)	6 (152.4)	4,820 (21.7)	5,330 (24.0)	1,605 (7.2)	1,775 (8.0)	7,190 (32.4)	5,620 (25.3)	2,395 (10.8)	1,875 (8.4)
1/2 (12.7)	2 (50.8)	9 (228.6)	6 (152.4)	4,820 (21.7)	7,400 (33.3)	1,605 (7.2)	2,465 (11.1)	7,190 (32.4)	8,590 (38.7)	2,395 (10.8)	2,865 (12.9)
5/8 (15.9)	2 (50.8)	9 (228.6)	6 (152.4)	4,650 (20.9)	–	1,550 (7.0)	–	8,440 (38.0)	–	2,815 (12.7)	–
		12 (304.8)	9 (228.6)	4,650 (20.9)	11,360 (51.1)	1,550 (7.0)	3,785 (17.0)	8,440 (38.0)	13,010 (58.5)	2,815 (12.7)	4,335 (19.5)
3/4 (19.1)	2 (50.8)	9 (228.6)	6 (152.4)	4,650 (20.9)	–	1,550 (7.0)	–	7,350 (33.1)	–	2,450 (11.0)	–
		12 (304.8)	9 (228.6)	4,650 (20.9)	11,360 (51.1)	1,550 (7.0)	3,785 (17.0)	7,350 (33.1)	14,590 (65.7)	2,450 (11.0)	4,865 (21.9)

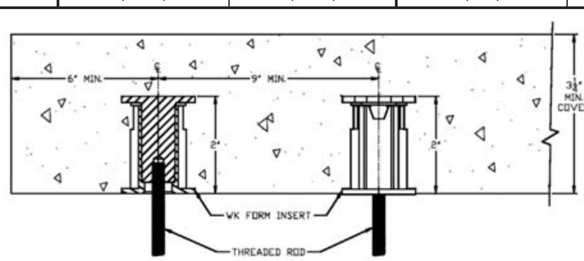
Minimum Concrete Compressive Strength (f'_c)

1. Allowable load capacities listed are calculated using an applied safety factor of 3.0.
2. The allowable working load must be the lesser of the insert capacity or the steel strength of the threaded rod.
3. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.
4. NFPA 13 design requirements are five times the weight of the water filled pipe plus 250 pounds.
5. Allowable loads for anchors to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load where permitted by code.

Ultimate and Allowable Load Capacities for Wood-Knocker Inserts Installed in Structural Lightweight Concrete[1,2,3,4]

Rod/Insert Diameter *d* in. (mm)	Embedment Depth h_v in. (mm)	Minimum Insert Spacing in. (mm)	Minimum End Distance in. (mm)	$f'_c \geq$ 3,000 psi (20.7 MPa) Ultimate Load Tension lbs. (kN)	Ultimate Load Shear lbs. (kN)	Allowable Load Tension lbs. (kN)	Allowable Load Shear lbs. (kN)
1/4 (6.4)	2 (50.8)	9 (228.6)	6 (152.4)	4,270 (19.2)	1,680 (7.6)	1,425 (6.4)	560 (2.5)
3/8 (9.5)	2 (50.8)	9 (228.6)	6 (152.4)	4,270 (19.2)	5,280 (23.8)	1,425 (6.4)	1,760 (7.9)
1/2 (12.7)	2 (50.8)	9 (228.6)	6 (152.4)	4,270 (19.2)	7,180 (32.3)	1,425 (6.4)	2,395 (10.8)
5/8 (15.9)	2 (50.8)	9 (228.6)	6 (152.4)	4,600 (20.7)	–	1,535 (6.9)	–
		12 (304.8)	9 (228.6)	4,600 (20.7)	7,590 (34.2)	1,535 (6.9)	2,530 (11.4)
3/4 (19.1)	2 (50.8)	9 (228.6)	6 (152.4)	4,600 (20.7)	–	1,535 (6.9)	–
		12 (304.8)	9 (228.6)	4,600 (20.7)	7,590 (34.2)	1,535 (6.9)	2,530 (11.4)

1. Allowable load capacities listed are calculated using an applied safety factor of 3.0.
2. The allowable working load must be the lesser of the insert capacity or the steel strength of the threaded rod.
3. NFPA 13 design requirements are five times the weight of the water filled pipe plus 250 pounds.
4. Allowable loads for anchors to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load where permitted by code.



PERFORMANCE DATA

Underwriter's Laboratories (UL) and Factory Mutual (FM Global) Ultimate Load Capacities for Bang-It Inserts Installed in Lightweight Concrete over Metal Deck[1,2]

Rod/Insert Diameter d in. (mm)	Embedment Depth h_v in. (mm)	Maximum Pipe Diameter in. (mm)	Flute Location in Deck	$f'_c \geq$ 3,000 psi (20.7 MPa)	
				UL Test[3] lbs. (kN)	FM Test[4] lbs. (kN)
3/8 (9.5)	2 (50.8)	4 (101.6)	Upper	1,500 (6.8)	1,450 (6.5)
			Lower	1,500 (6.8)	1,450 (6.5)
1/2 (12.7)	2 (50.8)	8 (203.2)	Upper	4,050 (18.2)	3,800 (17.1)
5/8 (15.9)	2 (50.8)	12 (304.8)	Upper	–	7,900 (35.6)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 3.0 or greater to determine the allowable working load.
2. NFPA 13 Fire protection fastening requirements are five times the weight of the liquid (water) filled pipe plus 250 lbs. Consult the Engineer of Record.
3. Underwriters Laboratories (UL) – File No. EX1289. Recognized and suitable for use in air handling spaces.
4. Factory Mutual (FM Approvals) – File No. J.I. 3015153.

Underwriter's Laboratories (UL) and Factory Mutual (FM Global) Ultimate Load Capacities for Wood-Knocker Inserts Installed in Normal-Weight Concrete[1,2]

Rod/Insert Diameter d in. (mm)	Embedment Depth h_v in. (mm)	Maximum Pipe Diameter in. (mm)	$f'_c \geq$ 3,000 psi (20.7 MPa)	
			UL Test[3] lbs. (kN)	FM Test[4] lbs. (kN)
3/8 (9.5)	2 (50.8)	4 (101.6)	1,500 (6.8)	1,450 (6.5)
1/2 (12.7)	2 (50.8)	8 (203.2)	4,050 (18.2)	3,800 (17.1)
5/8 (15.9)	2 (50.8)	8 (203.2)	4,050 (18.2)	–

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 3.0 or greater to determine the allowable working load.
2. NFPA 13 Fire protection fastening requirements are five times the weight of the liquid (water) filled pipe plus 250 lbs. Consult the Engineer of Record.
3. Underwriters Laboratories (UL) – File No. EX1289. Recognized and suitable for use in air handling spaces.
4. Factory Mutual (FM Approvals) – File No. J.I. 3015153.

DESIGN CRITERIA

Combined Loading

For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

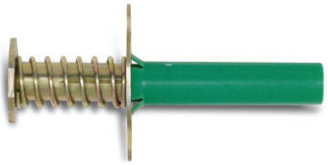
$$\left(\frac{N_u}{N_n}\right)^{\frac{5}{3}} + \left(\frac{V_u}{V_n}\right)^{\frac{5}{3}} \leq 1 \quad \textbf{OR} \quad \left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

ORDERING INFORMATION

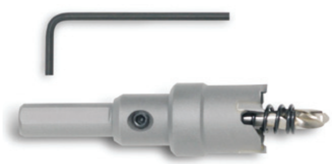
Bang-It

Cat. No.	Description	Color Code	Pre-Drilled Hole	Standard Box	Std. Pallet
7540	1/4" Bang-It	Brown	13/16"	100	4,000
7542	3/8" Bang-It	Green	13/16"	100	4,000
7544	1/2" Bang-It	Yellow	13/16"	100	4,000
7546	5/8" Bang-It	Red	1 3/16"	50	2,400
7548	3/4" Bang-It	Purple	1 3/16"	50	2,400
7549	7/8" Bang-It	Black	1 3/16"	50	2,400



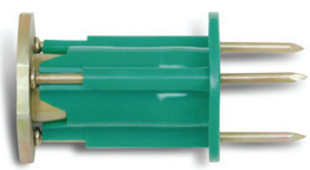
Bang-It Installation Accessories

Cat. No.	Description	Standard Box
7560	Bang-It Stand Up Pole Tool	1
7562	13/16" Carbide Hole Saw for 1/4", 3/8" and 1/2" sizes	1
7564	1 3/16" Carbide Hole Saw for 5/8", 3/4" and 7/8" sizes	1
7566	Extra Carbide Hole Saw Center Bit	1



Wood-Knocker

Cat. No.	Description	Color Code	Standard Box	Std. Pallet
7550	1/4" Wood-Knocker	Brown	200	9,600
7552	3/8" Wood-Knocker	Green	200	9,600
7554	1/2" Wood-Knocker	Yellow	200	9,600
7556	5/8" Wood-Knocker	Red	150	6,000
7558	3/4" Wood-Knocker	Purple	150	6,000
7567	1/2" Coil Thread Wood-Knocker	Yellow	200	9,600
7568	3/4" Coil Thread Wood-Knocker	Purple	150	6,000



MECHANICAL ANCHORS

Spike® *Pre-Expanded Anchor*

PRODUCT DESCRIPTION

The Spike anchor, also known as the *Rawl Spike,* is a patented, one-piece, tamper-proof vibration resistant anchor for use in concrete, block or stone. Several head styles and anchor materials are available. The Spike anchor is formed with an "s" shaped configuration at the working end of the anchor to create an expansion mechanism. Since the anchor is pre-expanded, there is no secondary tightening operation required which greatly reduces the overall cost of an anchor installation.

Once seated at the required embedment, residual spring forces developed in the expansion mechanism provides three compression forces at the bottom of the anchor hole. When subjected to vibratory loads, the Spike will expand due to the residual spring action of the expansion mechanism.

GENERAL APPLICATIONS AND USES

- Tamper-proof Applications
- Exterior Applications
- Cable Trays and Strut
- Pipe Supports
- Wood Sill Plate and Metal Track Attachments
- Fire Sprinkler
- Concrete Formwork
- Suspended Ceilings

FEATURES AND BENEFITS

- Pre-expanded anchor design allows for easy installation.
- Mushroom and flat head Spike anchors are tamper-proof.
- Forming Spike, which is removable, can be used for temporary installations.
- Pipe and Tie-wire Spike is an easy to install alternative to overhead anchoring.
- Tested in accordance with ASTM E488 and AC01 criteria.
- Qualified for seismic and wind loads.

APPROVALS AND LISTINGS

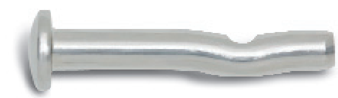
International Code Council, Evaluation Service (ICC-ES) ESR-1532
Southern Building Code Conference International (SBCCI) #9943A
City of Los Angeles (COLA) Research Report LARR – 24960
Florida Building Code Approval – FL2209.7
Miami-Dade County Notice of Acceptance (NOA) 03-0303.14
Factory Mutual Research Corporation (FM Approvals) – J.I. ON5A1.AH
Federal GSA Specification – Meets the proof load requirements of FF-S-325C, Group VI, (Carbon and stainless steel, mushroom head versions) – superseded

GUIDE SPECIFICATIONS

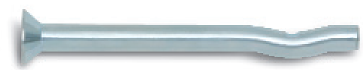
CSI Divisions: *03151-Concrete Anchoring, 04081-Masonry Anchorage* and *05090-Metal Fastenings.* Pre-expanded Anchors shall be Spike anchors as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS

Page No.

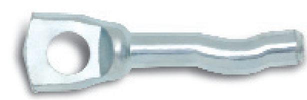


Mushroom Head Spike



Flat Head Spike

Pipe Spike



Tie-Wire Spike

Forming Spike

HEAD STYLES

Mushroom Head
Flat Head
Pipe
Tie-Wire
Forming

ANCHOR MATERIALS

Zinc Plated Carbon Steel
Type 316 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

3/16" diameter x 1" length to
1/2" diameter x 6-1/2" length

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Structural Lightweight Concrete
Hollow and Grouted CMU

INSTALLATION SPECIFICATIONS

Mushroom Head Carbon Steel Spike

Dimension	Anchor Size, *d*			
	3/16"	1/4"	3/8"	1/2"
ANSI Drill Bit Size, d_{bit} (in.)	3/16	1/4	3/8	1/2
Fixture Clearance Hole, d_h (in.)	1/4	5/16	7/16	9/16
Head Height (in.)	7/64	7/64	7/32	1/4
Head Size, O.D. (in.)	7/16	1/2	3/4	1

Flat Head Spike (80°– 82° Head)

Dimension	Anchor Size, *d*	
	3/16"	1/4"
ANSI Drill Bit Size, d_{bit} (in.)	3/16	1/4
Fixture Clearance Hole, d_h (in.)	1/4	5/16
Head Height (in.)	7/64	9/64
Head Size, O.D. (in.)	3/8	1/2

Mushroom Head Stainless Steel Spike

Dimension	Anchor Size, *d*			
	3/16"	1/4"	3/8"	1/2"
ANSI Drill Bit Size, d_{bit} (in.)	3/16	1/4	3/8	1/2
Fixture Clearance Hole, d_h (in.)	1/4	5/16	7/16	9/16
Head Height (in.)	7/64	7/64	7/32	1/4
Head Size, O.D. (in.)	7/16	1/2	3/4	1

Pipe Spike

Dimension	Anchor Size	
	1/4"	3/8"
ANSI Drill Bit Size, *d*, d_{bit} (in.)	3/16	1/4
UNC Thread Size	1/4-20	3/8-16
Head Height (in.)	1/2	5/8
Head Size, O.D. (in.)	13/32	35/64

Tie-Wire Spike

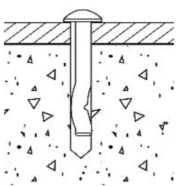
Dimension	Anchor Size, *d*	
	3/16"	1/4"
ANSI Drill Bit Size, d_{bit} (in.)	3/16	1/4
Tie-Wire Hole (in.)	3/16	9/32
Head Height (in.)	37/64	41/64
Head Width (in.)	9/64 x 7/16	3/16 x 9/16

Forming Spike

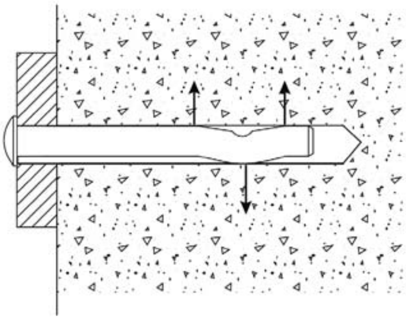
Dimension	Anchor Size, *d*	
	3/16"	1/4"
ANSI Drill Bit Size, d_{bit} (in.)	3/16	1/4
Fixture Clearance Hole, d_h (in.)	1/4	5/16
Head Height (in.)	9/16	9/16
Head Size, O.D. (in.)	13/32	1/2

Installation Procedure

Drill a hole into the base material to a depth of at least 1/2" deeper than the embedment required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15. Blow the hole clean of dust and other material.



Where a fixture is used, drive the anchor through the fixture into the anchor hole until the head is firmly seated against the fixture. Be sure the anchor is driven to the required embedment depth. The Tie-Wire and Pipe Spike versions should be driven in until the head is seated against the surface of the base material.



MATERIAL SPECIFICATIONS

Carbon Steel (Mushroom Head, Flat Head, Pipe, Tie-Wire and Forming Spike)

Anchor Component	Component Material
Anchor Body	Grade 8.2 Carbon Steel
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn 5)

Stainless Steel (Mushroom Head)

Anchor Component	Component Material
Anchor Body	Type 316L Stainless Steel

PERFORMANCE DATA

Ultimate Load Capacities for Carbon Steel Spike in Normal-Weight Concrete[1,2]

Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
		2,000 psi (13.8 MPa)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 MPa)	
		Tension lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**Shear** lbs. (kN)
3/16 (4.8)	7/8 (22.2)	520 (2.3)	1,080 (4.9)	760 (3.4)	1,270 (5.7)	860 (3.9)	1,310 (5.9)	890 (4.0)	1,350 (6.1)
	1 (25.4)	540 (2.4)	1,230 (5.5)	820 (3.7)	1,725 (7.8)	980 (4.4)	1,860 (8.4)	995 (4.5)	1,860 (8.4)
	1 1/4 (31.8)	780 (3.5)	1,800 (8.1)	1,000 (4.5)	2,000 (9.0)	1,260 (5.7)	2,155 (9.7)	1,520 (6.8)	2,310 (10.4)
1/4 (6.4)	7/8 (22.2)	680 (3.1)	1,405 (6.3)	820 (3.7)	1,630 (7.3)	945 (4.3)	1,870 (8.4)	1,010 (4.5)	2,110 (9.5)
	1 (25.4)	720 (3.2)	1,585 (7.1)	975 (4.4)	1,965 (8.8)	1,135 (5.1)	2,160 (9.7)	1,185 (5.3)	2,360 (10.6)
	1 1/4 (31.8)	830 (3.7)	1,815 (8.2)	1,200 (5.4)	2,020 (9.1)	1,410 (6.3)	2,220 (10.0)	1,620 (7.3)	2,585 (11.6)
3/8 (9.5)	1 3/4 (44.5)	1,785 (8.0)	3,645 (16.4)	2,120 (9.5)	4,480 (20.2)	2,630 (11.8)	5,025 (22.6)	2,875 (12.9)	5,075 (22.8)
1/2 (12.7)	2 1/2 (63.5)	3,215 (14.5)	5,345 (24.1)	3,620 (16.3)	8,460 (38.1)	4,015 (18.1)	10,320 (46.4)	4,410 (19.8)	10,860 (48.9)

1. Ultimate load capacities should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate loads for intermediate embedments and compressive strengths.

Allowable Load Capacities for Carbon Steel Spike in Normal-Weight Concrete[1,2,3]

Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
		2,000 psi (13.8 MPa)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 MPa)	
		Tension lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**Shear** lbs. (kN)
3/16 (4.8)	7/8 (22.2)	130 (0.6)	270 (1.2)	190 (0.9)	320 (1.4)	215 (1.0)	330 (1.5)	225 (1.0)	340 (1.5)
	1 (25.4)	135 (0.6)	310 (1.4)	205 (0.9)	430 (1.9)	245 (1.1)	465 (2.1)	250 (1.1)	465 (2.1)
	1 1/4 (31.8)	195 (0.9)	450 (2.0)	250 (1.1)	500 (2.3)	315 (1.4)	540 (2.4)	380 (1.7)	580 (2.6)
1/4 (6.4)	7/8 (22.2)	170 (0.8)	350 (1.6)	205 (0.9)	410 (1.8)	235 (1.1)	470 (2.1)	255 (1.1)	530 (2.4)
	1 (25.4)	180 (0.8)	395 (1.8)	245 (1.1)	490 (2.2)	285 (1.3)	540 (2.4)	295 (1.3)	590 (2.7)
	1 1/4 (31.8)	210 (0.9)	455 (2.0)	300 (1.4)	505 (2.3)	355 (1.6)	555 (2.5)	405 (1.8)	645 (2.9)
3/8 (9.5)	1 3/4 (44.5)	445 (2.0)	910 (4.1)	530 (2.4)	1,120 (5.0)	660 (3.0)	1,255 (5.6)	720 (3.2)	1,270 (5.7)
1/2 (12.7)	2 1/2 (63.5)	805 (3.6)	1,335 (6.0)	905 (4.1)	2,115 (9.5)	1,005 (4.5)	2,580 (11.6)	1,105 (5.0)	2,715 (12.2)

1. Allowable load capacities are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
3. Allowable loads for anchors to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration for the load, where permitted by code.

PERFORMANCE DATA

Ultimate Load Capacities for Stainless Steel Spike in Normal-Weight Concrete[1,2]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
		2,000 psi (13.8 MPa)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	7/8 (22.2)	490 (2.2)	920 (4.1)	715 (3.2)	1,155 (5.2)	850 (3.8)	1,220 (5.5)	875 (3.9)	1,290 (5.8)
	1 (25.4)	500 (2.3)	1,175 (5.3)	810 (3.6)	1,650 (7.4)	975 (4.4)	1,740 (7.8)	985 (4.4)	1,830 (8.2)
	1 1/4 (31.8)	740 (3.3)	1,735 (7.8)	970 (4.4)	1,930 (8.7)	1,160 (5.2)	2,040 (9.2)	1,420 (6.4)	2,150 (9.7)
1/4 (6.4)	7/8 (22.2)	635 (2.9)	1,350 (6.1)	790 (3.6)	1,570 (7.1)	880 (4.0)	1,785 (8.0)	980 (4.4)	2,000 (9.0)
	1 (25.4)	670 (3.0)	1,565 (7.0)	970 (4.4)	1,845 (8.3)	1,045 (4.7)	2,095 (9.4)	1,120 (5.0)	2,250 (10.1)
	1 1/4 (31.8)	795 (3.6)	1,765 (7.9)	1,080 (4.9)	1,965 (8.8)	1,375 (6.2)	2,145 (9.7)	1,580 (7.1)	2,325 (10.5)
3/8 (9.5)	1 3/4 (44.5)	1,575 (7.1)	3,155 (14.2)	1,990 (9.0)	3,880 (17.5)	2,420 (10.9)	4,150 (18.7)	2,570 (11.6)	4,425 (19.9)

1. Ultimate load capacities should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate loads for intermediate embedments and compressive strengths.

Allowable Load Capacities for Stainless Steel Spike in Normal-Weight Concrete[1,2,3]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
		2,000 psi (13.8 MPa)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	7/8 (22.2)	125 (0.6)	230 (1.0)	180 (0.8)	290 (1.3)	215 (1.0)	305 (1.4)	220 (1.0)	325 (1.5)
	1 (25.4)	125 (0.6)	295 (1.3)	205 (0.9)	415 (1.9)	245 (1.1)	435 (2.0)	245 (1.1)	460 (2.1)
	1 1/4 (31.8)	185 (0.8)	435 (2.0)	245 (1.1)	485 (2.2)	290 (1.3)	510 (2.3)	355 (1.6)	540 (2.4)
1/4 (6.4)	7/8 (22.2)	160 (0.7)	340 (1.5)	200 (0.9)	395 (1.8)	220 (1.0)	445 (2.0)	245 (1.1)	500 (2.3)
	1 (25.4)	170 (0.8)	390 (1.8)	245 (1.1)	460 (2.1)	260 (1.2)	525 (2.4)	280 (1.3)	565 (2.5)
	1 1/4 (31.8)	200 (0.9)	440 (2.0)	270 (1.2)	490 (2.2)	345 (1.6)	535 (2.4)	395 (1.8)	580 (2.6)
3/8 (9.5)	1 3/4 (44.5)	395 (1.8)	790 (3.6)	500 (2.3)	970 (4.4)	605 (2.7)	1,040 (4.7)	645 (2.9)	1,105 (5.0)

1. Allowable load capacities are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
3. Allowable loads for anchors to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration for the load, where permitted by code.

PERFORMANCE DATA

Ultimate Load Capacities for Carbon Steel Pipe Spike in Normal-Weight Concrete[1,2,3]

Anchor Dia. d in. (mm)	Drill Bit Dia. d_{bit} in.	Minimum Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
			2,000 psi (13.8 MPa)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 MPa)	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	3/16	1 1/4 (31.8)	780 (3.5)	975 (4.4)	1,260 (5.7)	975 (4.4)	1,260 (5.7)	975 (4.4)	1,260 (5.7)	975 (4.4)
3/8 (9.5)	1/4	1 3/4 (44.5)	1,100 (5.0)	1,815 (8.2)	1,660 (7.5)	2,020 (9.1)	2,000 (9.0)	2,100 (9.5)	2,320 (10.4)	2,180 (9.8)

1. Ultimate load capacities should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.
3. For installations of the 3/8" Pipe Spike in hard aggregate concrete, a 7mm SDS drill bit (Cat. No. 0390) may be used as listed in the section on SDS Plus Drill Bits. Jobsite tests are required when using this bit.

Allowable Load Capacities for Carbon Steel Pipe Spike in Normal-Weight Concrete[1,2,3,4]

Anchor Dia. d in. (mm)	Drill Bit Dia. d_{bit} in.	Minimum Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
			2,000 psi (13.8 MPa)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 MPa)	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	3/16	1 1/4 (31.8)	195 (0.9)	245 (1.1)	315 (1.4)	245 (1.1)	315 (1.4)	245 (1.1)	315 (1.4)	245 (1.1)
3/8 (9.5)	1/4	1 3/4 (44.5)	275 (1.2)	455 (2.0)	415 (1.9)	505 (2.3)	500 (2.3)	525 (2.4)	580 (2.6)	545 (2.5)

1. Allowable load capacities are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.
3. For installations of the 3/8" Pipe Spike in hard aggregate concrete, a 7mm SDS drill bit (Cat. No. 0390) may be used as listed in the section on SDS Plus Drill Bits. Jobsite tests are required when using this bit.
4. Allowable loads for anchors to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration for the load, where permitted by code.

Ultimate Load Capacities for Carbon Steel Tie-Wire Spike in Normal-Weight Concrete[1,2]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		3,000 psi (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/8 (28.6)	975 (4.4)	950 (4.3)	1,050 (4.7)	950 (4.3)	1,120 (5.0)	950 (4.3)
3/8 (9.5)	1 1/8 (28.6)	1,075 (4.8)	1,310 (5.9)	1,150 (5.2)	1,310 (5.9)	1,230 (5.5)	1,310 (5.9)

1. Ultimate load capacities should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.

Allowable Load Capacities for Carbon Steel Tie-Wire Spike in Normal-Weight Concrete[1,2,3]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		3,000 psi (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/8 (28.6)	245 (1.1)	240 (1.1)	265 (1.2)	240 (1.1)	280 (1.3)	240 (1.1)
3/8 (9.5)	1 1/8 (28.6)	270 (1.2)	330 (1.5)	290 (1.3)	330 (1.5)	310 (1.4)	330 (1.5)

1. Allowable load capacities are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.
3. Allowable loads for anchors to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration for the load, where permitted by code.

PERFORMANCE DATA

Ultimate Load Capacities for Carbon Steel Forming Spike in Normal-Weight Concrete[1,2]

Anchor Diameter d in. (mm)	Minimum Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
		2,000 psi (13.8 MPa)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	1 1/4 (31.8)	780 (3.5)	1,800 (8.1)	1,000 (4.5)	2,000 (9.0)	1,260 (5.7)	2,155 (9.7)	1,520 (6.8)	2,310 (10.4)
1/4 (6.4)	1 1/4 (31.8)	830 (3.7)	1,815 (8.2)	1,200 (5.4)	2,020 (9.1)	1,410 (6.3)	2,220 (10.0)	1,620 (7.3)	2,585 (11.6)

1. Ultimate load capacities should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.

Allowable Load Capacities for Carbon Steel Forming Spike in Normal-Weight Concrete[1,2]

Anchor Diameter d in. (mm)	Minimum Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
		2,000 psi (13.8 MPa)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	1 1/4 (31.8)	195 (0.9)	450 (2.0)	250 (1.1)	500 (2.3)	315 (1.4)	540 (2.4)	380 (1.7)	580 (2.6)
1/4 (6.4)	1 1/4 (31.8)	210 (0.9)	455 (2.0)	300 (1.4)	505 (2.3)	355 (1.6)	555 (2.5)	405 (1.8)	645 (2.9)

1. Allowable load capacities are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.

Ultimate Load Capacities for Spike in Structural Lightweight Concrete[1,2,3]

Anchor Diameter d in. (mm)	Minimum Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		3,000 psi (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	1 1/4 (31.8)	440 (2.0)	1,280 (5.8)	400 (1.8)	1,280 (5.8)	380 (1.7)	1,280 (5.8)
1/4 (6.4)	1 1/4 (31.8)	480 (2.2)	1,720 (7.7)	440 (2.0)	1,720 (7.7)	400 (1.8)	1,720 (7.7)
3/8 (9.5)	1 3/4 (44.5)	1,140 (5.1)	3,000 (13.5)	960 (4.3)	3,000 (13.5)	800 (3.6)	3,000 (13.5)
1/2 (12.7)	2 1/2 (63.5)	1,860 (8.4)	6,440 (29.0)	1,860 (8.4)	6,440 (29.0)	1,860 (8.4)	6,440 (29.0)

1. Tabulated load values are applicable to carbon and stainless steel anchors.
2. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
3. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.

Allowable Load Capacities for Spike in Structural Lightweight Concrete[1,2,3]

Anchor Diameter d in. (mm)	Minimum Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		3,000 psi (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	1 1/4 (31.8)	110 (0.5)	320 (1.4)	100 (0.5)	320 (1.4)	95 (0.4)	320 (1.4)
1/4 (6.4)	1 1/4 (31.8)	120 (0.5)	430 (1.9)	110 (0.5)	430 (1.9)	100 (0.5)	430 (1.9)
3/8 (9.5)	1 3/4 (44.5)	285 (1.3)	750 (3.4)	240 (1.1)	750 (3.4)	200 (0.9)	750 (3.4)
1/2 (12.7)	2 1/2 (63.5)	465 (2.1)	1,610 (7.2)	465 (2.1)	1,610 (7.2)	465 (2.1)	1,610 (7.2)

1. Tabulated load values are applicable to carbon and stainless steel anchors.
2. Allowable load capacities are calculated using an applied safety factor of 4.0.
3. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Carbon and Stainless Steel Spike Anchors Installed Through Metal Deck into Structural Lightweight Concrete[1,2,3,4,5]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Lightweight Concrete Over Minimum 20 Ga. Metal Deck $f'_c \geq$ 3,000 psi (20.7 MPa)			
		Minimum 1 1/2" Wide Deck			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	1 1/4 (31.8)	560 (2.5)	2,000 (9.0)	140 (0.6)	500 (2.3)
1/4 (6.4)	1 1/4 (31.8)	560 (2.5)	2,000 (9.0)	140 (0.6)	500 (2.3)
3/8 (9.5)	1 3/4 (44.5)	600 (2.7)	2,620 (11.8)	150 (0.7)	655 (2.9)
1/2 (12.7)	2 1/2 (63.5)	1,120 (5.0)	3,020 (13.6)	280 (1.3)	755 (3.4)

1. The values listed above are ultimate and allowable load capacities for anchors installed in sand-lightweight concrete.
2. Allowable load capacities are calculated using a safety factor of 4.0.
3. Spacing distances shall be in accordance with the spacing table for lightweight concrete listed in the Design Criteria.
4. Flute edge distance equals one-half the minimum deck width. Linear interpolation may be used for flute edge distance between those listed.
5. Anchors are permitted to be installed in the lower or upper flute of the metal deck provided the proper installation procedures are maintained.

Ultimate and Allowable Load Capacities for Carbon Steel and Stainless Steel Spike in Hollow and Grouted Concrete Masonry[1,2,3,4]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Normal-Weight CMU – $f'_m \geq$ 1,500 psi (10.4 MPa)							
		Ultimate Load				Allowable Load			
		Carbon Steel Spike		Stainless Steel Spike		Carbon Steel Spike		Stainless Steel Spike	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	7/8 (22.2)	280 (1.3)	540 (2.4)	280 (1.3)	540 (2.4)	55 (0.2)	110 (0.5)	55 (0.2)	110 (0.5)
	1 (25.4)	410 (1.8)	590 (2.7)	310 (1.4)	590 (2.7)	80 (0.4)	120 (0.5)	60 (0.3)	120 (0.5)
	1 1/4 (31.8)	740 (3.3)	1,090 (4.9)	730 (3.3)	1,980 (8.9)	150 (0.7)	420 (1.9)	145 (0.7)	395 (1.8)
1/4 (6.4)	7/8 (22.2)	440 (2.0)	1,650 (7.4)	435 (2.0)	1,350 (6.1)	90 (0.4)	330 (1.5)	85 (0.4)	270 (1.2)
	1 (25.4)	670 (3.0)	1,840 (8.3)	645 (2.9)	1,620 (7.3)	135 (0.6)	370 (1.7)	130 (0.6)	325 (1.5)
	1 1/4 (31.8)	800 (3.6)	2,100 (9.5)	770 (3.5)	1,890 (8.5)	160 (0.7)	420 (1.9)	155 (0.7)	380 (1.7)

1. Tabulated load values are for anchors installed in minimum 6-inch wide, Grade N, normal-weight concrete masonry units conforming to ASTM C 90.
2. Allowable load capacities are calculated using a safety factor of 5.0.
3. Linear interpolation may be used to determine load capacities for intermediate embedments.
4. The tabulated values are for anchors installed at a minimum of 16 anchor diameters on center for 100 percent capacity. Spacing distances may be reduced to 8 anchor diameters on center provided the capacities are reduced by 50 percent. Linear interpolation may be used for intermediate spacing.

DESIGN CRITERIA

Combined Loading

For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

Load Adjustment Factors for Spacing and Edge Distances

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	**Load Type**	**Critical Distance (Full Anchor Capacity)**	**Critical Load Factor**	**Minimum Distance (Reduced Capacity)**	**Minimum Load Factor**
Spacing (s)	Tension and Shear	$s_{cr} = 2.0h_v$	$F_N = F_V = 1.0$	$s_{min} = h_v$	$F_N = F_V = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 14d$	$F_N = 1.0$	$c_{min} = 5d$	$F_N = 0.50$
	Shear	$c_{cr} = 14d$	$F_V = 1.0$	$c_{min} = 5d$	$F_V = 0.25$

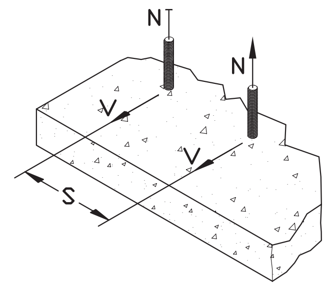
Anchor Installed in Lightweight Concrete					
Anchor Dimension	**Load Type**	**Critical Distance (Full Anchor Capacity)**	**Critical Load Factor**	**Minimum Distance (Reduced Capacity)**	**Minimum Load Factor**
Spacing (s)	Tension and Shear	$s_{cr} = 3.0h_v$	$F_N = F_V = 1.0$	$s_{min} = 1.5h_v$	$F_N = F_V = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 14d$	$F_N = 1.0$	$c_{min} = 7d$	$F_N = 0.50$
	Shear	$c_{cr} = 14d$	$F_V = 1.0$	$c_{min} = 7d$	$F_V = 0.40$

DESIGN CRITERIA

Load Adjustment Factors for Normal-Weight Concrete

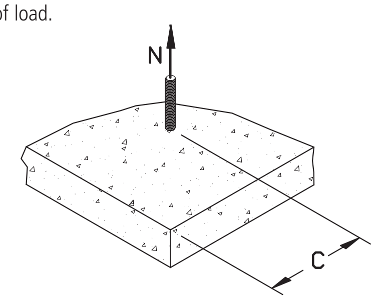
Spacing, Tension (F_N) & Shear (F_V)								
Dia. (in.)	3/16			1/4			3/8	1/2
h_v (in.)	7/8	1	1 1/4	7/8	1	1 1/4	2 1/2	2 3/4
s_{cr} (in.)	1 3/4	2	2 1/2	1 3/4	2	2 1/2	5	5 1/2
s_{min} (in.)	7/8	1	1 1/4	7/8	1	1 1/4	2 1/2	2 3/4
Spacing, *s* (inches) 7/8	0.50			0.50				
1	0.57	0.50		0.57	0.50			
1 1/4	0.71	0.63	0.50	0.71	0.63	0.50		
1 1/2	0.86	0.75	0.60	0.86	0.75	0.60		
1 3/4	1.00	0.88	0.70	1.00	0.88	0.70		
2		1.00	0.80		1.00	0.80		
2 1/2			1.00			1.00	0.50	
2 3/4							0.55	0.50
3							0.60	0.55
4							0.80	0.73
5							1.00	0.91
5 1/2								1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 2 embedment depths ($2 h_V$) at which the anchor achieves 100% of load. Minimum spacing (s_{min}) is equal to 1 embedment depth (h_V) at which the anchor achieves 50% of load.



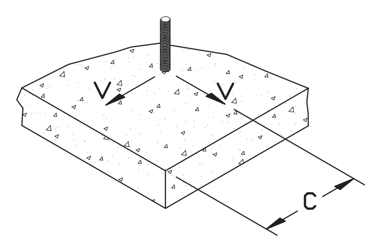
Edge Distance, Tension (F_N)				
Dia. (in.)	3/16	1/4	3/8	1/2
c_{cr} (in.)	2 5/8	3 1/2	5 1/4	7
c_{min} (in.)	1	1 1/4	1 7/8	2 1/2
Edge Distance, *c* (inches) 1	0.50			
1 1/4	0.59	0.50		
1 7/8	0.78	0.64	0.50	
2	0.81	0.67	0.52	
2 1/2	0.96	0.78	0.59	0.50
2 5/8	1.00	0.81	0.61	0.51
3		0.89	0.67	0.56
3 1/2		1.00	0.74	0.61
4			0.81	0.67
5			0.96	0.78
5 1/4			1.00	0.81
6				0.89
7				1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 14 anchor diameters ($14d$) at which the anchor achieves 100% of load. Minimum edge distance (c_{min}) is equal to 5 anchor diameters ($5d$) at which the anchor achieves 50% of load.



Edge Distance, Shear (F_V)				
Dia. (in.)	3/16	1/4	3/8	1/2
c_{cr} (in.)	2 5/8	3 1/2	5 1/4	7
c_{min} (in.)	1	1 1/4	1 7/8	2 1/2
Edge Distance, *c* (inches) 1	0.25			
1 1/4	0.39	0.25		
1 7/8	0.67	0.46	0.25	
2	0.72	0.50	0.28	
2 1/2	0.94	0.67	0.39	0.25
2 5/8	1.00	0.71	0.42	0.27
3		0.83	0.50	0.33
3 1/2		1.00	0.61	0.42
4			0.72	0.50
5			0.94	0.67
5 1/4			1.00	0.71
6				0.83
7				1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 14 anchor diameters ($14d$) at which the anchor achieves 100% of load. Minimum edge distance (c_{min}) is equal to 5 anchor diameters ($5d$) at which the anchor achieves 25% of load.



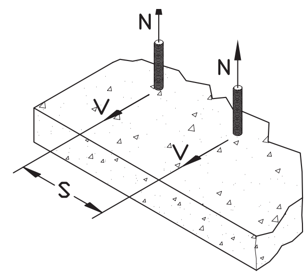
DESIGN CRITERIA

Load Adjustment Factors for Lightweight Concrete

Spacing, Tension (F_N) & Shear (F_V)									
Dia. (in.)		3/16			1/4			3/8	1/2
h_v (in.)		7/8	1	1 1/4	7/8	1	1 1/4	2 1/2	2 3/4
s_{cr} (in.)		2 5/8	3	3 3/4	2 5/8	3	3 3/4	7 1/2	8 1/4
s_{min} (in.)		1 3/8	1 1/2	1 7/8	1 3/8	1 1/2	1 7/8	3 3/4	4 1/8
Spacing, *s* (inches)	1 3/8	0.50			0.50				
	1 1/2	0.57	0.50		0.57	0.50			
	1 7/8	0.71	0.63	0.50	0.71	0.63	0.50		
	1 1/2	0.57	0.50	0.40	0.57	0.50	0.40		
	2 5/8	1.00	0.88	0.70	1.00	0.88	0.70		
	3		1.00	0.80		1.00	0.80		
	3 3/4			1.00			1.00	0.50	
	4							0.53	
	4 1/8							0.55	0.50
	5							0.67	0.61
	6							0.80	0.73
	7							0.93	0.85
	7 1/2							1.00	0.91
	8 1/4								1.00

Notes: For anchors loaded in tension and shear, the critical spacing *(s_{cr})* is equal to 3 embedment depths ($3h_V$) at which the anchor achieves 100% of load.

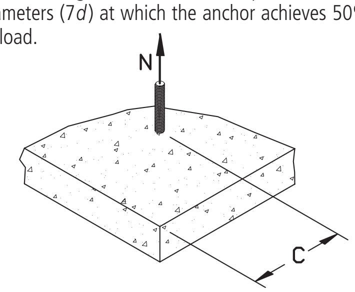
Minimum spacing *(s_{min})* is equal to 1.5 embedment depth *($1.5h_V$)* at which the anchor achieves 50% of load.



Edge Distance, Tension (F_N)					
Dia. (in.)		3/16	1/4	3/8	1/2
c_{cr} (in.)		2 5/8	3 1/2	5 1/4	7
c_{min} (in.)		1 3/8	1 3/4	2 5/8	3 1/2
Edge Distance, *c* (inches)	1 3/8	0.50			
	1 3/4	0.67	0.50		
	2	0.76	0.57		
	2 5/8	1.00	0.75	0.50	
	3		0.86	0.57	
	3 1/2		1.00	0.67	0.50
	4			0.76	0.57
	5			0.95	0.71
	5 1/4			1.00	0.75
	6				0.86
	7				1.00

Notes: For anchors loaded in tension, the critical edge distance *(c_{cr})* is equal to 14 anchor diameters ($14d$) at which the anchor achieves 100% of load.

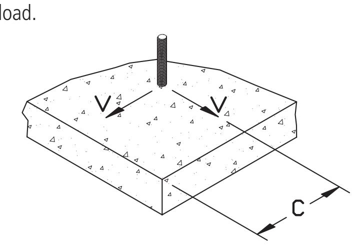
Minimum edge distance *(c_{min})* is equal to 7 anchor diameters ($7d$) at which the anchor achieves 50% of load.



Edge Distance, Shear (F_V)					
Dia. (in.)		3/16	1/4	3/8	1/2
c_{cr} (in.)		2 5/8	3 1/2	5 1/4	7
c_{min} (in.)		1 3/8	1 3/4	2 5/8	3 1/2
Edge Distance, *c* (inches)	1 3/8	0.40			
	1 3/4	0.60	0.40		
	2	0.71	0.49		
	2 5/8	1.00	0.70	0.40	
	3		0.83	0.49	
	3 1/2		1.00	0.60	0.40
	4			0.71	0.49
	5			0.94	0.66
	5 1/4			1.00	0.70
	6				0.83
	7				1.00

Notes: For anchors loaded in shear, the critical edge distance *(c_{cr})* is equal to 14 anchor diameters ($14d$) at which the anchor achieves 100% of load.

Minimum edge distance *(c_{min})* is equal to 7 anchor diameters ($7d$) at which the anchor achieves 40% of load.



ORDERING INFORMATION

Mushroom Head Carbon Steel Spike (Tamperproof)

Cat. No.	Anchor Size	Drill Diameter	Min. Embed.	Std. Box	Std. Carton	Wt./100
5502	3/16" x 1"	3/16"	7/8"	100	1,000	1 1/4
5503	3/16" x 1 1/4"	3/16"	7/8"	100	1,000	1 1/2
5504	3/16" x 1 1/2"	3/16"	1 1/4"	100	1,000	1 3/4
5506	3/16" x 2"	3/16"	1 1/4"	100	1,000	2
5508	3/16" x 2 1/2"	3/16"	1 1/4"	100	1,000	2
5510	3/16" x 3"	3/16"	1 1/4"	100	1,000	2 1/2
5511	3/16" x 3 1/2"	3/16"	1 1/4"	100	1,000	3 1/2
5512	3/16" x 4"	3/16"	1 1/4"	100	500	4
5522	1/4" x 1"	1/4"	7/8"	100	1,000	1 1/2
5523	1/4" x 1 1/4"	1/4"	1"	100	1,000	2 1/4
5524	1/4" x 1 1/2"	1/4"	1 1/4"	100	1,000	2 1/2
5526	1/4" x 2"	1/4"	1 1/4"	100	1,000	3
5528	1/4" x 2 1/2"	1/4"	1 1/4"	100	1,000	4
5530	1/4" x 3"	1/4"	1 1/4"	100	1,000	4 1/2
5546	3/8" x 2"	3/8"	1 3/4"	25	250	7 1/2
5548	3/8" x 2 1/2"	3/8"	1 3/4"	25	250	9
5550	3/8" x 3"	3/8"	1 3/4"	25	250	10
5551	3/8" x 3 1/2"	3/8"	1 3/4"	25	250	11

The published length is measured from below the head to the end of the anchor.

Flat Head Carbon Steel Spike (Tamperproof)

Cat. No.	Anchor Size	Drill Diameter	Min. Embed.	Std. Box	Std. Carton	Wt./100
5608	3/16" x 2 1/2"	3/16"	1 1/4"	100	1,000	2
5610	3/16" x 3"	3/16"	1 1/4"	100	1,000	2 1/2
5612	3/16" x 4"	3/16"	1 1/4"	100	500	4
5624	1/4" x 1 1/2"	1/4"	1 1/4"	100	1,000	2 1/2
5626	1/4" x 2"	1/4"	1 1/4"	100	1,000	3
5628	1/4" x 2 1/2"	1/4"	1 1/4"	100	1,000	3 3/4
5630	1/4" x 3"	1/4"	1 1/4"	100	1,000	4 1/2
5631	1/4" x 3 1/2"	1/4"	1 1/4"	100	1,000	5
5632	1/4" x 4"	1/4"	1 1/4"	100	500	5 3/4

The published length is the overall length of the anchor.

ORDERING INFORMATION

Mushroom Head Type 316 Stainless Spike (Tamperproof)

Cat. No.	Anchor Size	Drill Diameter	Min. Embed.	Std. Box	Std. Carton	Wt./100
6602	3/16" x 1"	3/16"	7/8"	100	1,000	1 1/4
6603	3/16" x 1 1/4"	3/16"	7/8"	100	1,000	1 1/2
6693*	3/16" x 1 1/4"	3/16"	7/8"	100	1,000	1 1/2
6604	3/16" x 1 1/2"	3/16"	1 1/4"	100	1,000	1 3/4
6606	3/16" x 2"	3/16"	1 1/4"	100	1,000	2
6608	3/16" x 2 1/2"	3/16"	1 1/4"	100	1,000	2 1/4
6622	1/4" x 1"	1/4"	7/8"	100	1,000	1 1/2
6623	1/4" x 1 1/4"	1/4"	1"	100	1,000	2 1/4
6624	1/4" x 1 1/2"	1/4"	1 1/4"	100	1,000	2 1/2
6626	1/4" x 2"	1/4"	1 1/4"	100	1,000	3
6628	1/4" x 2 1/2"	1/4"	1 1/4"	100	1,000	4
6630	1/4" x 3"	1/4"	1 1/4"	100	1,000	4 1/2
6646	3/8" x 2"	3/8"	1 3/4"	25	250	7 1/2
6648	3/8" x 2 1/2"	3/8"	1 3/4"	25	250	9
6650	3/8" x 3"	3/8"	1 3/4"	25	250	10

The published length is measured from below the head to the end of the anchor.
*Supplied with EPDM Sealing Washer.

Pipe Spike

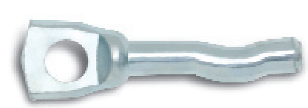
Cat. No.	Anchor Size	Drill Diameter	Min. Embed.	Std. Box	Std. Carton	Wt./100
3755	1/4"	3/16"	1 1/4"	100	1,000	4
3758	3/8"	1/4"	1 3/4"	50	500	6

Designed for rod hanging.

Tie-Wire Spike

Catalog Number	Anchor Size	Drill Diameter	Minimum Embed.	Tie Wire Hole Size	Standard Box	Standard Carton	Wt./100
3756	3/16"	3/16"	1 1/8"	3/16"	100	500	2
3759	1/4"	1/4"	1 1/8"	9/32"	100	500	2 1/2

Designed for suspended ceilings.



Forming Spike

Cat. No.	Anchor Size	Drill Diameter	Min. Embed.	Std. Box	Std. Carton	Wt./100
3795	3/16" x 1 1/2"	3/16"	1 1/4"	100	1,000	2 1/2
3796	3/16" x 2"	3/16"	1 1/4"	100	1,000	3
3797	3/16" x 2 3/4"	3/16"	1 1/4"	100	1,000	4
3794	1/4" x 2 3/4"	1/4"	1 1/4"	100	1,000	5

Designed for concrete forming. The published length is measured from below the head to the end of the anchor.

ORDERING INFORMATION

Spike Drivers

While the SPIKE anchor can easily be installed using a hammer, a specially designed series of drivers and manual tools provide a fast, easy to use method for installing SPIKE anchors into concrete and masonry materials. The tools allow the SPIKE anchor to be installed in confined areas and prevent damage to the fixture from stray hammer blows.

Catalog Number	Tool Description	Guide I.D.	Standard Box	Wt./100
3790	Spike Driver 1000	1/2"	1	1/4
3791	Spike Driver 2000	1/2"	1	1/4
3894*	Spike Driver 6000	1"	1	1/4

*Discontinued item once current stock is exhausted.

The SPIKE Driver 1000 is a one piece tool with an SDS shank formed on one end and a retractable guide on the other. The driver is designed to fit directly into the chuck of an SDS rotary hammer drill to provide maximum impact energy for faster driving. Once the anchor hole is drilled, insert the SPIKE Driver 1000 into the chuck of the rotary hammer drill. Insert the tip of the SPIKE through the fixture into the anchor hole, then place the guide over the head of the SPIKE. Turn the rotary hammer on and drive the SPIKE until it is at the required embedment in the base material and seated flush against the fixture. As the SPIKE is driven into the base material, the guide retracts until the anchor is fully seated. This driver is normally used with a two person installation team where one installer is drilling the anchor holes while the other positions the fixture and sets the anchor.

The SPIKE Driver 2000 is a variation of the 1000 tool which is designed to be used in conjunction with a 3/16" x 4" or 1/4" x 4" SDS carbide tipped bit. The Driver has a recessed end which is slipped over the SDS bit on one end and a retractable guide on the other. Once the anchor hole is drilled, slip the SPIKE Driver 2000 over the 3/16" or 1/4" SDS bit. Drive the SPIKE anchor with the rotary hammer until it is seated flush against the fixture and at the required embedment in the base material. As the SPIKE is driven into the base material, the guide retracts until the anchor is fully seated. Once the SPIKE is installed,remove the driver from the SDS bit and drill the next anchor hole.

The SPIKE Driver 6000 is a one piece tool which is designed to drive 3/8" or 1/2" diameter SPIKE anchors when using a spline shank rotary hammer drill. The Driver has a Spline shank formed on one end and a large, tapered retractable guide on the other to allow the Driver to be easily positioned over the head of the SPIKE. Once the anchor hole is drilled, insert the SPIKE Driver 6000 into the chuck of the drill to drive the SPIKE.

Pipe Spike Setting Tool

When installing the 3/8" Pipe SPIKE, this tool is designed to make driving easier. The tool has a guide tip on which the 3/8" Pipe SPIKE is mounted which helps to protect the internal threads during the driving operation. A large handle provides a convenient gripping area and a large bearing surface to accept the hammer blows. Simply position the 3/8" Pipe SPIKE on the tool and insert the tip of the anchor into the hole. Give the end of the handle several sharp hammer blows to drive the 3/8" Pipe SPIKE into the base material until it is at the required embedment.

Catalog Number	Tool Description	Tip O.D.	Standard Box	Wt./100
3760	Pipe Spike Setting Tool	5/16"	1	1

Spike Driver Selection Guide

Style	Size	1000	2000	6000	Pipe
Mushroom	3/16"	X	X		
Mushroom	1/4"	X	X		
Mushroom	3/8"			X	
Mushroom	1/2"			X	
Flat Head	3/16"	X	X		
Flat Head	1/4"	X	X		
Pipe	1/4"	X	X		
Pipe	3/8"			X	X
Tie-Wire	3/16"	X	X		
Forming	3/16"	X	X		
Forming	1/4"	X	X		

Drive® *Pre-Expanded Anchor*

PRODUCT DESCRIPTION

The Drive is a one-piece, tamperproof, pre-expanded anchor available in carbon steel for use in concrete and stone. Tie-Wire Drive anchors are used for suspended ceiling applications. The flat head (counter-sunk) style is particularly suited for wood-to-concrete anchoring. The round head style can be used for all other applications requiring fast, permanent installations.

GENERAL APPLICATIONS AND USES

- Tamper Proof Applications
- Cable Trays and Strut
- Suspended Ceilings
- Fire Sprinkler and Pipe Supports

FEATURES AND BENEFITS

- Pre-expanded anchor design allows for easy installation.
- Round and flat head Drive anchors are tamper proof.

APPROVALS AND LISTINGS

Underwriters Laboratory (UL Listed) – File No. EX1289

Factory Mutual Research Corporation (FM Approvals) – J.I. OK4A9.AH

Federal GSA Specification – Meets the descriptive requirements of FF-S-325C, Group VI (superseded)

GUIDE SPECIFICATIONS

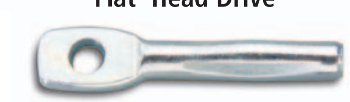
CSI Divisions: *03151-Concrete Anchoring* and *05090-Metal Fastenings.*
Pre-expanded Anchors shall be Drive anchors as supplied by Powers Fasteners, Inc., Brewster, NY.

MATERIAL SPECIFICATIONS

Anchor Component	Component Material
Anchor Body	Heat Treated AISI 1038
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn 5)

Round Head Drive

Flat Head Drive



Tie-Wire Drive

HEAD STYLES

Round Head
Flat Head
Tie-Wire

ANCHOR MATERIALS

Zinc Plated Carbon Steel

ANCHOR SIZE RANGE (TYP.)

3/16" diameter x 1" length to
1/2" diameter x 3" length

SUITABLE BASE MATERIALS

Normal-Weight Concrete

INSTALLATION SPECIFICATIONS

Round Head Drive

Dimension	Anchor Size, *d*			
	3/16"	1/4"	3/8"	1/2"
ANSI Drill Bit Size, d_{bit} (in.)	3/16	1/4	3/8	1/2
Fixture Clearance Hole, d_h (in.)	1/4	5/16	7/16	9/16
Head Height (in.)	3/32	1/8	3/16	1/4
Head Width (in.)	3/8	1/2	3/4	1

Flat Head Drive

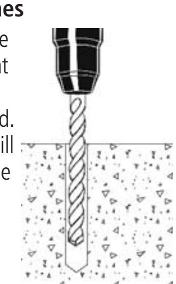
Dimension	Anchor Size, *d*	
	3/16"	1/4"
ANSI Drill Bit Size, d_{bit} (in.)	3/16	1/4
Fixture Clearance Hole, d_h (in.)	1/4	5/16
Head Height (in.)	7/64	9/64
Head Width (in.)	3/8	1/2

Tie-Wire Drive

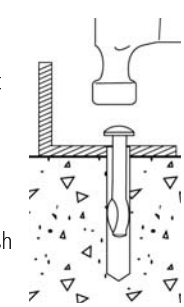
Dimension	Anchor Size, *d*
	1/4"
ANSI Drill Bit Size, d_{bit} (in.)	1/4
Head Height (in.)	5/8
Tie-Wire Hole (in.)	13/64

Installation Guidelines

Drill a hole into the base material to a depth of at least 1/2" deeper than the embedment required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15. Blow the hole clean of dust and other material.



Drive the anchor into the hole until the head is firmly seated against the fixture. Be sure the anchor is driven to the required embedment depth. The tie-wire Drive should be driven in until the head is flush against the surface of the base material.



PERFORMANCE DATA

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

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	7/8 (22.2)	700 (3.2)	1,100 (5.0)	1,080 (4.9)	1,365 (6.1)	1,080 (4.9)	1,370 (6.2)
1/4 (6.4)	1 1/8 (28.6)	1,320 (5.9)	1,665 (7.5)	1,760 (7.9)	2,090 (9.4)	1,760 (7.9)	2,090 (9.4)
3/8 (9.5)	1 7/8 (47.6)	2,275 (10.2)	5,580 (25.1)	4,240 (19.1)	7,030 (31.6)	4,240 (19.1)	7,030 (31.6)
1/2 (12.7)	2 5/8 (66.7)	2,560 (11.5)	7,945 (35.8)	4,960 (22.3)	10,205 (45.9)	4,960 (22.3)	10,205 (45.9)

1. Ultimate load capacities should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.

Allowable Load Capacities for Drive in Normal-Weight Concrete[1,2]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	7/8 (22.2)	175 (0.8)	275 (1.2)	270 (1.2)	340 (1.5)	270 (1.2)	345 (1.6)
1/4 (6.4)	1 1/8 (28.6)	330 (1.5)	415 (1.9)	440 (2.0)	525 (2.4)	440 (2.0)	525 (2.4)
3/8 (9.5)	1 7/8 (47.6)	570 (2.6)	1,395 (6.3)	1,060 (4.8)	1,760 (7.9)	1,060 (4.8)	1,760 (7.9)
1/2 (12.7)	2 5/8 (66.7)	640 (2.9)	1,985 (8.9)	1,240 (5.6)	2,550 (11.5)	1,240 (5.6)	2,550 (11.5)

1. Allowable load capacities are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.

DESIGN CRITERIA

Combined Loading

For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

Load Adjustment Factors for Spacing and Edge Distances

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (s)	Tension and Shear	$s_{cr} = 10d$	$F_N = F_V = 1.0$	$s_{min} = 5d$	$F_N = F_V = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_N = 1.0$	$c_{min} = 5d$	$F_N = 0.80$
	Shear	$c_{cr} = 12d$	$F_V = 1.0$	$c_{min} = 5d$	$F_V = 0.50$

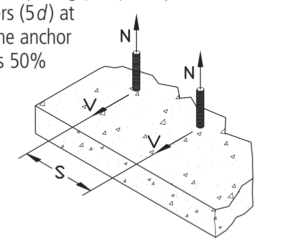
DESIGN CRITERIA

Load Adjustment Factors for Normal-Weight Concrete

Spacing, Tension (F_N) & Shear (F_V)					
	Dia. (in.)	3/16	1/4	3/8	1/2
	s_{cr} (in.)	1 7/8	2 1/2	3 3/4	5
	s_{min} (in.)	1	1 1/4	1 7/8	2 1/2
Spacing, s (inches)	1	0.50			
	1 1/4	0.67	0.50		
	1 7/8	1.00	0.75	0.50	
	2		0.80	0.53	
	2 1/2		1.00	0.67	0.50
	3			0.80	0.60
	3 3/4			1.00	0.75
	4				0.80
	5				1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 10 anchor diameters (10d) at which the anchor achieves 100% of load.

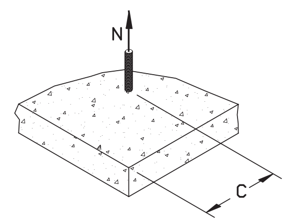
Minimum spacing (s_{min}) is equal to 5 anchor diameters (5d) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_N)					
	Dia. (in.)	3/16	1/4	3/8	1/2
	c_{cr} (in.)	2 1/4	3	4 1/2	6
	c_{min} (in.)	1	1 1/4	1 7/8	2 1/2
Edge Distance, c (inches)	1	0.80			
	1 1/4	0.85	0.80		
	1 7/8	0.94	0.87	0.80	
	2	0.96	0.89	0.81	
	2 1/4	1.00	0.91	0.83	
	2 1/2		0.94	0.85	0.80
	2 3/4		0.97	0.87	0.81
	3		1.00	0.89	0.83
	3 1/2			0.92	0.86
	4			0.96	0.89
	4 1/2			1.00	0.91
	5				0.94
	6				1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12d) at which the anchor achieves 100% of load.

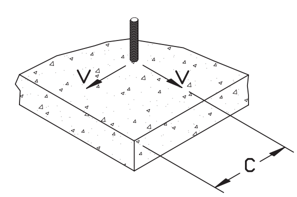
Minimum edge distance (c_{min}) is equal to 5 anchor diameters (5d) at which the anchor achieves 80% of load.



Edge Distance, Shear (F_V)					
	Dia. (in.)	3/16	1/4	3/8	1/2
	c_{cr} (in.)	2 1/4	3	4 1/2	6
	c_{min} (in.)	1	1 1/4	1 7/8	2 1/2
Edge Distance, c (inches)	1	0.50			
	1 1/4	0.62	0.50		
	1 7/8	0.86	0.68	0.50	
	2	0.90	0.71	0.52	
	2 1/4	1.00	0.79	0.57	
	2 1/2		0.86	0.62	0.50
	2 3/4		0.93	0.67	0.54
	3		1.00	0.71	0.57
	3 1/2			0.81	0.64
	4			0.90	0.71
	4 1/2			1.00	0.79
	5				0.86
	6				1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12d) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 5 anchor diameters (5d) at which the anchor achieves 50% of load.



ORDERING INFORMATION

Round Head Drive

Cat. No.	Size	Drill Dia.	Min. Embed.	Std. Box	Std. Carton	Wt./100
3031	3/16" x 1"	3/16"	7/8"	100	1,000	1
3091	3/16" x 1 1/2"	3/16"	7/8"	100	1,000	1 1/4
3211	1/4" x 1 1/4"	1/4"	1 1/8"	100	1,000	1 3/4
3241	1/4" x 1 1/2"	1/4"	1 1/8"	100	1,000	2 1/2
3271	1/4" x 2"	1/4"	1 1/8"	100	1,000	3
3301	1/4" x 2 1/2"	1/4"	1 1/8"	100	1,000	3 3/4
3601	3/8" x 2"	3/8"	1 7/8"	25	250	7 1/2
3631	3/8" x 2 1/2"	3/8"	1 7/8"	25	250	8 1/2
3691	3/8" x 3 1/2"	3/8"	1 7/8"	25	250	11 3/4
3781	1/2" x 3"	1/2"	2 5/8"	25	125	25

Flat Head Drive

Cat. No.	Size	Drill Dia.	Min. Embed.	Std. Box	Std. Carton	Wt./100
3092	3/16" x 1 1/2"	3/16"	7/8"	100	1,000	1 1/4
3122	3/16" x 2"	3/16"	7/8"	100	1,000	1 3/4
3152	3/16" x 2 1/2"	3/16"	7/8"	100	1,000	2
3162	3/16" x 3"	3/16"	7/8"	100	1,000	2 1/2
3242	1/4" x 1 1/2"	1/4"	1 1/8"	100	1,000	2 1/2
3272	1/4" x 2"	1/4"	1 1/8"	100	1,000	3
3302	1/4" x 2 1/2"	1/4"	1 1/8"	100	1,000	3 3/4
3332	1/4" x 3"	1/4"	1 1/8"	100	1,000	4 1/2
3362	1/4" x 3 1/2"	1/4"	1 1/8"	100	1,000	5
3392	1/4" x 4"	1/4"	1 1/8"	100	500	5 3/4

Tie-Wire Drive (13/64" Tie-Wire Hole)

Cat. No.	Size	Drill Dia.	Min. Embed.	Std. Box	Std. Carton	Wt./100
3244	1/4" x 1 3/4" Master Pack	1/4"	1 1/8"	500	500	2 1/2
3245	1/4" x 1 3/4"	1/4"	1 1/8"	100	500	2 1/2
3250	Tie-Wire Setting Tool	–	–	1	1	1/4

Zamac Hammer-Screw™ *Nail Anchor*

PRODUCT DESCRIPTION

The Zamac Hammer-Screw is a unique, one-step nail drive anchor featuring a Phillips type head and a screw thread for use in concrete, block, brick or stone. It is available in 1/4" diameter and lengths ranging from 3/4" to 3". With a body formed from corrosion resistant Zamac alloy and a carbon or stainless steel drive screw, this anchor has been developed as an improvement over standard nailin anchors.

Traditionally, Zamac Nailin anchors have been used for light duty, non-engineered applications and have not been recommended for use overhead. In order to overcome these problems, the Zamac Hammer-Screw has been designed to provide a removable anchor with up to 40% higher tension load capacities when installed in concrete.

While the standard Zamac Nailin has not been recommended for use overhead, the Zamac Hammer-Screw can be used overhead provided it is designed by an engineer who will take the proper design considerations and safety factors into account.

GENERAL APPLICATIONS AND USES

- Roof Flashings
- Brick Ties and Masonry Anchorage
- Electrical Fixtures
- HVAC and Mechanical Attachments
- Drywall track
- Maintenance

FEATURES AND BENEFITS

- General purpose anchoring
- Installs in a variety of base materials
- Removable anchor when screw is backed out with a Phillips head driver

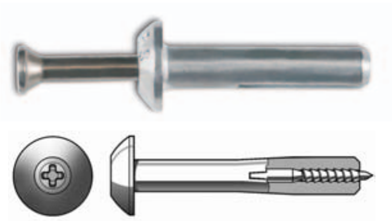
APPROVALS AND LISTINGS

Southern Building Code Conference International (SBCCI) #9944A
Federal GSA Specification Meets the proof load requirements of FF-S-325C, Group V, Type 2, Class 3, (superseded) and CID A-A 1925A, Type 1

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring, 04081-Masonry Anchorage* and *05090-Metal Fastenings.* Pin Anchors shall be Zamac Hammer-Screw anchors as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS Page No.



Zamac Hammer-Screw

ANCHOR MATERIALS

Zamac Alloy with Carbon or Stainless Steel Drive Screw

ANCHOR SIZE RANGE (TYP.)

1/4" x 3/4" to 1/4" x 3" diameter

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Hollow Concrete Masonry
Brick Masonry

INSTALLATION AND MATERIAL SPECIFICATIONS

Installation Specifications

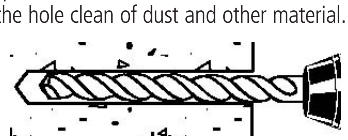
Dimension	Anchor Diameter, *d* 1/4"
ANSI Drill Bit Size, d_{bit} (in.)	1/4
Fixture Clearance Hole (in.)	5/16
Head Height (in.)	9/64
Head Width d_{hd} (in.)	35/64

Material Specifications

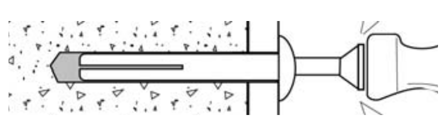
Anchor Component	Component Material: Mushroom Head Carbon Steel Screw	Component Material: Mushroom Head Stainless Screw
Drive Screw	AISI 1018	Type 304 SS
Anchor Body	Zamac Alloy	Zamac Alloy
Screw Plating	ASTM B 633, SC1, Type III (Fe/Zn 5)	N/A
Screw Coating	Perma-Seal Fluoropolymer	N/A

Installation Guidelines

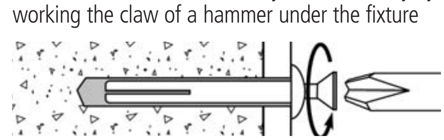
Drill a hole into the base material to a depth of at least 1/4" deeper than the required embedment. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15. Blow the hole clean of dust and other material.



Insert the anchor through the fixture. Drive the screw into the anchor body to expand it. Be sure the head is seated firmly against the fixture and that the anchor is at the proper embedment.



To remove – Press a Phillips screw driver firmly into the screw head and turn counterclockwise. Remove the screw from the anchor body, then pry out the fixture and anchor body simultaneously by working the claw of a hammer under the fixture



PERFORMANCE DATA

Ultimate Load Capacities for Zamac Hammer-Screw in Normal-Weight Concrete[1,2]

Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (*f´c*)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	675 (3.0)	650 (2.9)	850 (3.8)	880 (4.0)	890 (4.0)	880 (4.0)
	3/4 (19.1)	790 (3.6)	805 (3.6)	1,135 (5.1)	1,115 (5.0)	1,190 (5.4)	1,115 (5.0)
	7/8 (22.2)	930 (4.2)	990 (4.5)	1,205 (5.4)	1,230 (5.5)	1,250 (5.6)	1,230 (5.5)
	1 1/8 (28.6)	1,220 (5.5)	1,365 (6.1)	1,350 (6.1)	1,470 (6.6)	1,450 (6.5)	1,470 (6.6)
	1 3/8 (34.9)	1,325 (6.0)	1,555 (7.0)	1,450 (6.5)	1,645 (7.4)	1,530 (6.9)	1,645 (7.4)
	1 3/4 (44.5)	1,480 (6.7)	1,840 (8.3)	1,600 (7.2)	1,910 (8.6)	1,660 (7.5)	1,910 (8.6)
	1 7/8 (47.6)	1,480 (6.7)	1,840 (8.3)	1,600 (7.2)	1,910 (8.6)	1,660 (7.5)	1,910 (8.6)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate loads for intermediate embedments and compressive strengths.

Allowable Load Capacities for Zamac Hammer-Screw in Normal-Weight Concrete[1,2,3]

Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (*f´c*)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	170 (0.8)	165 (0.7)	215 (1.0)	220 (1.0)	225 (1.0)	220 (1.0)
	3/4 (19.1)	200 (0.9)	200 (0.9)	285 (1.3)	280 (1.3)	300 (1.4)	280 (1.3)
	7/8 (22.2)	235 (1.1)	250 (1.1)	300 (1.4)	310 (1.4)	315 (1.4)	310 (1.4)
	1 1/8 (28.6)	305 (1.4)	340 (1.5)	340 (1.5)	370 (1.7)	365 (1.6)	370 (1.7)
	1 3/8 (34.9)	330 (1.5)	390 (1.8)	365 (1.6)	410 (1.8)	385 (1.7)	410 (1.8)
	1 3/4 (44.5)	370 (1.7)	460 (2.1)	400 (1.8)	480 (2.2)	415 (1.9)	480 (2.2)
	1 7/8 (47.6)	370 (1.7)	460 (2.1)	400 (1.8)	480 (2.2)	415 (1.9)	480 (2.2)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
3. Critical and minimum spacing and edge distances as well as reduction factors for intermediate spacing and edge distances are listed in the Design Criteria section.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Zamac Nailin in Hollow Concrete Masonry[1,2]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	420 (1.9)	1,160 (5.2)	85 (0.4)	230 (1.0)
	3/4 (19.1)	825 (3.7)	1,215 (5.5)	165 (0.7)	245 (1.1)
	1 (25.4)	1,000 (4.5)	1,265 (5.7)	200 (0.9)	255 (1.1)
	1 1/8 (28.6)	1,090 (4.9)	1,290 (5.8)	220 (1.0)	260 (1.2)
	1 3/8 (34.9)	1,145 (5.2)	1,345 (6.1)	230 (1.0)	270 (1.2)
	1 1/2 (38.1)	1,145 (5.2)	1,345 (6.1)	230 (1.0)	270 (1.2)

1. Tabulated load values are for anchors installed in minimum 6-inch wide, Grade N, Type II, medium and normal-weight and lightweight concrete masonry units. Mortar must be minimum Type N. Masonry compressive strength must be 1,500 psi minimum at the time of installation.
2. Tabulated load values are applicable to anchors with carbon and stainless steel drive screws. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 5.0 or greater to determine the allowable working load.

Ultimate and Allowable Load Capacities for Zamac-Hammer Screw in Solid or Hollow Clay Brick Masonry[1,2]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	680 (3.1)	1,400 (6.3)	135 (0.6)	280 (1.3)
	3/4 (19.1)	930 (4.2)	1,600 (7.2)	185 (0.8)	320 (1.4)
	1 (25.4)	990 (4.5)	1,600 (7.2)	200 (0.9)	320 (1.4)
	1 1/8 (28.6)	1,040 (4.7)	1,600 (7.2)	210 (0.9)	320 (1.4)
	1 3/8 (34.9)	1,150 (5.2)	1,600 (7.2)	230 (1.0)	320 (1.4)
	1 1/2 (38.1)	1,260 (5.7)	1,600 (7.2)	250 (1.1)	320 (1.4)

1. Tabulated load values are for anchors installed in Grade SW multiple wythe, brick masonry conforming to ASTM C62.
2. Tabulated load values are applicable to anchors with carbon and stainless steel drive screws. Allowable loads are calculated using an applied safety factor of 5.0.

DESIGN CRITERIA

Combined Loading

For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

Load Adjustment Factors for Spacing and Edge Distances

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (s)	Tension and Shear	$s_{cr} = 10d$	$F_N = F_V = 1.0$	$s_{min} = 5d$	$F_N = F_V = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_N = 1.0$	$c_{min} = 5d$	$F_N = 0.80$
	Shear	$c_{cr} = 12d$	$F_V = 1.0$	$c_{min} = 5d$	$F_V = 0.50$

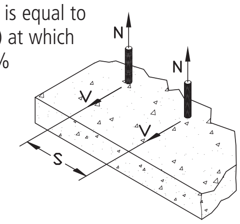
DESIGN CRITERIA

Load Adjustment Factors for Normal-Weight Concrete

Spacing, Tension (F_N) & Shear (F_V)		
Dia. (in.)		1/4
s_{cr} (in.)		2 1/2
s_{min} (in.)		1 1/4
Spacing, *s* (in.)	1 1/4	0.50
	1 3/8	0.55
	1 9/16	0.63
	1 5/8	0.65
	1 7/8	0.75
	2 1/8	0.85
	2 1/2	1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 10 anchor diameters (10*d*) at which the anchor achieves 100% of load.

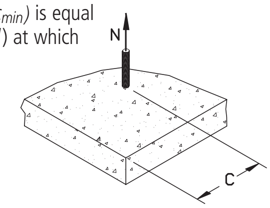
Minimum spacing (s_{min}) is equal to 5 anchor diameters (5*d*) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_N)		
Dia. (in.)		1/4
c_{cr} (in.)		3
c_{min} (in.)		1 1/4
Edge Dist., *c* (in.)	1 1/4	0.80
	2	0.89
	2 1/4	0.91
	2 1/2	0.94
	3	1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12*d*) at which the anchor achieves 100% of load.

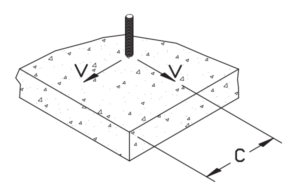
Minimum edge distance (c_{min}) is equal to 5 anchor diameters (5*d*) at which the anchor achieves 80% of load.



Edge Distance, Shear (F_V)		
Dia. (in.)		1/4
c_{cr} (in.)		3
c_{min} (in.)		1 1/4
Edge Dist., *c* (in.)	1 1/4	0.50
	2	0.71
	2 1/4	0.79
	2 1/2	0.86
	3	1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12*d*) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 5 anchor diameters (5*d*) at which the anchor achieves 50% of load.



ORDERING INFORMATION

Mushroom Head with No. 2 Phillips Head Screw

Catalog Number		Anchor Size	Drill Diameter	Standard Box	Standard Carton	Wt./ 100
CS	SS					
2848	–	1/4" x 2 1/4"	1/4"	100	500	3 1/2
2850	–	1/4" x 3"	1/4"	100	500	4 1/4

*Discontinued item once current stock is exhausted.

Master Pack

Catalog Number	Anchor Size	Drill Diameter	Standard Box	Standard Carton	Wt./ 100
2939	1/4" x 3/4"	1/4"	1,000	1,000	1 1/2
2940	1/4" x 1"	1/4"	1,000	1,000	1 3/4
2942	1/4' x 1 1/4"	1/4"	1,000	1,000	2 1/4
2944	1/4" x 1 1/2"	1/4"	1,000	1,000	2 1/2
2946	1/4" x 2"	1/4"	1,000	1,000	3
2948	1/4" x 2 1/4"	1/4"	1,000	1,000	3 1/2
2949	1/4" x 3"	1/4"	1,000	1,000	4 1/4

Mushroom Head with No. 2 Phillips Head Perma-Seal Screw

Catalog Number	Anchor Size	Drill Diameter	Standard Box	Standard Carton	Wt./ 100
2817	1/4" x 1 1/4"	1/4"	100	500	2 1/4
2818 Master Pack	1/4" x 1 1/4"	1/4"	1,000	1,000	2 1/4

Zamac Nailin™ *Nail Anchor*

PRODUCT DESCRIPTION

The Zamac Nailin is a nail drive anchor which has a body formed from Zamac alloy. Drive nails are available in carbon or stainless steel. The anchor can be used in concrete, block, brick or stone.

A corrosion resistant Zamac alloy is used to form the anchor body with either a mushroom or flat head. The anchor can be used for light duty, tamperproof applications. This anchor is not recommended for applications overhead. For overhead applications, please refer to the Zamac Hammer-Screw.

GENERAL APPLICATIONS AND USES

- Roof Flashing
- Brick Ties and Masonry Anchorage
- Electrical Fixtures
- Mechanical Attachments
- Furring Strips
- Maintenance

FEATURES AND BENEFITS

- General purpose anchoring
- Installs in a variety of base materials

APPROVALS AND LISTINGS

Southern Building Code Conference International (SBCCI) #9944A
Florida Building Code Approval – FL2209.11
Miami-Dade County Notice of Acceptance (NOA) 03-0311.08
Federal GSA Specification – Meets the proof load requirements of FF-S-325C, Group V, Type 2, Class 3, (superseded) and CID A-A 1925A, Type 1 (mushroom head) & Type 2 (flat head)

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring, 04081-Masonry Anchorage* and *05090-Metal Fastenings.* Pin Anchors shall be Zamac Nailin anchors as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS Page No.

Zamac Nailin

ANCHOR MATERIALS

Zamac Alloy with Carbon or Stainless Steel Drive Nail

ANCHOR SIZE RANGE (TYP.)

3/16" diameter x 7/8" length to 1/4" diameter x 2" length

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Hollow Concrete Masonry
Brick Masonry
Stone

INSTALLATION AND MATERIAL SPECIFICATIONS

Installation Specifications

Dimension	Anchor Diameter, d 3/16" MH	1/4" MH	1/4" FH
ANSI Drill Bit Size, d_{bit} (in.)	3/16	1/4	1/4
Fixture Clearance Hole (in.)	1/4	5/16	5/16
Head Height (in.)	7/64	9/64	3/16
Head Width d_{hd} (in.)	13/32	35/64	35/64

MH = Mushroom Head FH = Flat Head

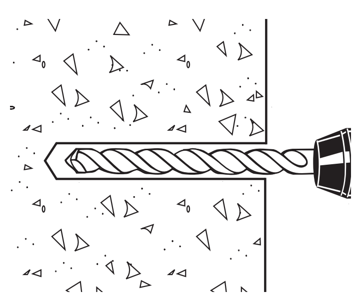
Material Specifications

Anchor Component	Component Material		
	Mushroom Head	Flat Head	Mushroom Head
	CS Nail	CS Nail	SS Nail
Drive Nail	AISI 1018	AISI 1018	Type 304 SS
Anchor Body	Zamac Alloy	Zamac Alloy	Zamac Alloy
Nail Plating	ASTM B 633, SC1, Type III (Fe/Zn 5)		N/A

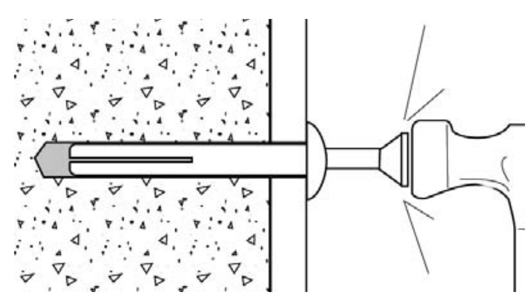
CS = Carbon Steel SS = Stainless Steel

Installation Guidelines

Using the proper diameter bit, drill a hole into the base material to a depth of at least 1/4" deeper than the required embedment. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15. Blow the hole clean of dust and other material.



Insert the anchor through the fixture. Drive the nail into the anchor body to expand it. Be sure the head is seated firmly against the fixture and that the anchor is at the proper embedment. Take care not to overdrive. This anchor is not recommended for use overhead.



PERFORMANCE DATA

Ultimate Load Capacities for Zamac Nailin in Normal-Weight Concrete[1,2]

Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**Shear** lbs. (kN)
3/16 (4.8)	3/4 (19.1)	460 (2.1)	520 (2.3)	500 (2.3)	700 (3.2)	580 (2.6)	700 (3.2)
1/4 (6.4)	5/8 (15.9)	480 (2.2)	550 (2.5)	600 (2.7)	820 (3.7)	640 (2.9)	820 (3.7)
	3/4 (19.1)	655 (2.9)	755 (3.4)	1,045 (4.7)	1,065 (4.8)	1,045 (4.7)	1,065 (4.8)
	7/8 (22.2)	780 (3.5)	800 (3.6)	1,070 (4.8)	1,115 (5.0)	1,070 (4.8)	1,115 (5.0)
	1 1/8 (28.6)	1,030 (4.6)	900 (4.1)	1,120 (5.0)	1,215 (5.5)	1,120 (5.0)	1,215 (5.5)
	1 3/8 (34.9)	1,085 (4.9)	1,105 (5.0)	1,150 (5.2)	1,460 (6.6)	1,230 (5.5)	1,460 (6.6)
	1 3/4 (44.5)	1,165 (5.2)	1,420 (6.4)	1,200 (5.4)	1,825 (8.2)	1,260 (5.7)	1,825 (8.2)
	1 7/8 (47.6)	1,165 (5.2)	1,420 (6.4)	1,300 (5.9)	1,825 (8.2)	1,365 (6.1)	1,825 (8.2)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate loads for intermediate embedments and compressive strengths.

Allowable Load Capacities for Zamac Nailin in Normal-Weight Concrete[1,2,3]

Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**Shear** lbs. (kN)
3/16 (4.8)	3/4 (19.1)	115 (0.5)	130 (0.6)	125 (0.6)	175 (0.8)	145 (0.7)	175 (0.8)
1/4 (6.4)	5/8 (15.9)	120 (0.5)	140 (0.6)	150 (0.7)	205 (0.9)	160 (0.7)	205 (0.9)
	3/4 (19.1)	165 (0.7)	190 (0.9)	260 (1.2)	265 (1.2)	260 (1.2)	265 (1.2)
	7/8 (22.2)	195 (0.9)	200 (0.9)	270 (1.2)	280 (1.3)	270 (1.2)	280 (1.3)
	1 1/8 (28.6)	260 (1.2)	225 (1.0)	280 (1.3)	305 (1.4)	280 (1.3)	305 (1.4)
	1 3/8 (34.9)	270 (1.2)	275 (1.2)	290 (1.3)	365 (1.6)	310 (1.4)	365 (1.6)
	1 3/4 (44.5)	290 (1.3)	355 (1.6)	300 (1.4)	455 (2.0)	315 (1.4)	455 (2.0)
	1 7/8 (47.6)	290 (1.3)	355 (1.6)	325 (1.5)	455 (2.0)	340 (1.5)	455 (2.0)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
3. Critical and minimum spacing and edge distances as well as reduction factors for intermediate spacing and edge distances are listed in the Design Criteria section.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Zamac Nailin in Hollow Concrete Masonry[1,2,3]

Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	3/4 (19.1)	270 (1.2)	860 (3.9)	55 (0.2)	170 (0.8)
1/4 (6.4)	5/8 (15.9)	360 (1.6)	1,040 (4.7)	70 (0.3)	210 (0.9)
	3/4 (19.1)	735 (3.3)	1,075 (4.8)	145 (0.7)	215 (1.0)
	1 (25.4)	835 (3.8)	1,130 (5.1)	165 (0.7)	225 (1.0)
	1 1/8 (28.6)	1,040 (4.7)	1,250 (5.6)	210 (0.9)	250 (1.1)
	1 3/8 (34.9)	1,090 (4.9)	1,275 (5.7)	220 (1.0)	255 (1.1)
	1 1/2 (38.1)	1,090 (4.9)	1,275 (5.7)	220 (1.0)	255 (1.1)

1. Tabulated load values are for anchors installed in minimum 6-inch wide, Grade N, Type II, medium and normal-weight and lightweight concrete masonry units. Mortar must be minimum Type N. Masonry compressive strength must be 1,500 psi minimum at the time of installation.
2. Allowable loads are based on average ultimate values using a safety factor of 5.0.
3. Anchors installed flush with face shell surface.

Ultimate and Allowable Load Capacities for Zamac Nailin in Solid or Hollow Clay Brick Masonry[1,2]

Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	3/4 (19.1)	460 (2.1)	920 (4.1)	90 (0.4)	185 (0.8)
1/4 (6.4)	5/8 (15.9)	570 (2.6)	1,250 (5.6)	115 (0.5)	250 (1.1)
	3/4 (19.1)	790 (3.6)	1,400 (6.3)	160 (0.7)	280 (1.3)
	1 (25.4)	820 (3.7)	1,400 (6.3)	165 (0.7)	280 (1.3)
	1 1/8 (28.6)	865 (3.9)	1,400 (6.3)	175 (0.8)	280 (1.3)
	1 3/8 (34.9)	950 (4.3)	1,400 (6.3)	190 (0.9)	280 (1.3)
	1 1/2 (38.1)	1,015 (4.6)	1,400 (6.3)	205 (0.9)	280 (1.3)

1. Tabulated load values are for anchors installed in Grade SW multiple wythe, brick masonry conforming to ASTM C62.
2. Allowable loads are calculated using an applied safety factor of 5.0.

DESIGN CRITERIA

Combined Loading

For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

Load Adjustment Factors for Spacing and Edge Distances

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (*s*)	Tension and Shear	$s_{cr} = 10d$	$F_N = F_V = 1.0$	$s_{min} = 5d$	$F_N = F_V = 0.50$
Edge Distance (*c*)	Tension	$c_{cr} = 12d$	$F_N = 1.0$	$c_{min} = 5d$	$F_N = 0.80$
	Shear	$c_{cr} = 12d$	$F_V = 1.0$	$c_{min} = 5d$	$F_V = 0.50$

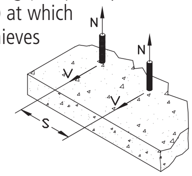
DESIGN CRITERIA

Load Adjustment Factors for Normal-Weight Concrete

Spacing, Tension (F_N) & Shear (F_V)			
Dia. (in.)		3/16	1/4
s_{cr} (in.)		1 7/8	2 1/2
s_{min} (in.)		1	1 1/4
Spacing, s (in.)	1	0.50	
	1 1/4	0.67	0.50
	1 1/2	0.80	0.60
	1 7/8	1.00	0.75
	2		0.80
	2 1/2		1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 10 anchor diameters (10d) at which the anchor achieves 100% of load.

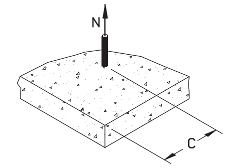
Minimum spacing (s_{min}) is equal to 5 anchor diameters (5d) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_N)			
Dia. (in.)		3/16	1/4
c_{cr} (in.)		2 1/4	3
c_{min} (in.)		1	1 1/4
Edge Dist., c (in.)	1	0.80	
	1 1/4	0.85	0.80
	1 1/2	0.89	0.83
	2	0.96	0.89
	2 1/4	1.00	0.91
	2 1/2		0.94
	3		1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12d) at which the anchor achieves 100% of load.

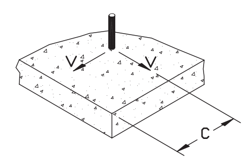
Minimum edge distance (c_{min}) is equal to 5 anchor diameters (5d) at which the anchor achieves 80% of load.



Edge Distance, Shear (F_V)			
Dia. (in.)		3/16	1/4
c_{cr} (in.)		2 1/4	3
c_{min} (in.)		1	1 1/4
Edge Dist., c (in.)	1	0.50	
	1 1/4	0.62	0.50
	1 1/2	0.71	0.57
	2	0.90	0.71
	2 1/4	1.00	0.79
	2 1/2		0.86
	3		1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12d) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 5 anchor diameters (5d) at which the anchor achieves 50% of load.



ORDERING INFORMATION

Mushroom Head Zamac Nailin with Carbon Steel Nail

Cat. No.	Anchor Size	Drill Diameter	Std. Box	Std. Carton	Wt./100
2802	3/16" x 7/8"	3/16"	100	500	3/4
2806	1/4" x 3/4"	1/4"	100	500	1 1/2
2808	1/4" x 1"	1/4"	100	500	1 3/4
2814	1/4" x 1 1/4"	1/4"	100	500	2 1/4
2820	1/4" x 1 1/2"	1/4"	100	500	2 1/2
2826	1/4" x 2"	1/4"	100	500	3
2804	1/4" x 3"	1/4"	100	500	4

Master Pack Mushroom Head Zamac Nailin with Carbon Steel Nail

Cat. No.	Anchor Size	Drill Diameter	Std. Box	Std. Carton	Wt./100
2803	3/16" x 7/8"	3/16"	–	1,000	3/4
2807	1/4" x 3/4"	1/4"	–	1,000	1 1/2
2809	1/4" x 1"	1/4"	–	1,000	1 3/4
2815	1/4" x 1 1/4"	1/4"	–	1,000	2 1/4
2821	1/4" x 1 1/2"	1/4"	–	1,000	2 1/2
2827	1/4" x 2"	1/4"	–	1,000	3
2805	1/4" x 3"	1/4"	–	1,000	4

Flat Head Zamac Nailin with Carbon Steel Nail

Cat. No.	Anchor Size	Drill Diameter	Std. Box	Std. Carton	Wt./100
2836	1/4" x 1 1/2"	1/4"	100	500	2 1/2
2838	1/4" x 2"	1/4"	100	500	3

Mushroom Head Zamac Nailin with Stainless Steel Nail

Cat. No.	Anchor Size	Drill Diameter	Std. Box	Std. Carton	Wt./100
2858	1/4" x 1"	1/4"	100	500	1 3/4
2864	1/4" x 1 1/4"	1/4"	100	500	2 1/4
2870	1/4' x 1 1/2"	1/4"	100	500	2 1/2
2876	1/4" x 2"	1/4"	100	500	3

Nylon Nailin™ *Nail Anchor*

PRODUCT DESCRIPTION

The Nylon Nailin is a nail drive anchor with a body formed from engineered plastic and drive nails available in carbon and stainless steel. The anchor can be used in concrete, block, brick or stone. The anchor is pre-assembled with either a carbon steel or stainless steel nail. This anchor is not recommended for applications overhead. For overhead applications, please refer to the Zamac Hammer-Screw.

GENERAL APPLICATIONS AND USES

- Brick Ties and Masonry Anchorage
- Electrical Fixtures
- Copper Flashing
- Furring Strips
- Maintenance
- Aluminum Frames

FEATURES AND BENEFITS

- General purpose anchoring
- Installs in a variety of base materials

APPROVALS AND LISTINGS

Federal GSA Specification – Meets the proof load requirements of FF-S-325C, Group V, Type 2, Class 4, (superseded) and CID A-A 1925A, Type 3 (mushroom head), Type 4 (flat head) and Type 5 (round head)

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring, 04081-Masonry Anchorage* and *05090-Metal Fastenings.* Pin Anchors shall be Nylon Nailin anchors as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS Page No.

Round Head Nylon Nailin

Flat Head Nylon Nailin

Mushroom Head Nylon Nailin

ANCHOR MATERIALS

Engineered Nylon with Carbon or Stainless Steel Drive Nail

ANCHOR SIZE RANGE (TYP.)

3/16" diameter x 1" length to 1/4" diameter x 6" length

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Hollow Concrete Masonry
Brick Masonry
Stone

INSTALLATION AND MATERIAL SPECIFICATIONS

Installation Specifications

Dimension	Anchor Diameter, *d*					
	3/16"			1/4"		
	RH	FH	MH	RH	FH	MH
ANSI Drill Bit Size, d_{bit} (in.)	3/16	3/16	3/16	1/4	1/4	1/4
Fixture Clearance Hole (in.)	1/4	1/4	1/4	5/16	5/16	5/16
Head Height (in.)	1/8	1/8	1/8	1/8	1/8	1/8
Head Width d_{hd} (in.)	3/8	3/8	9/16	7/16	7/16	9/16

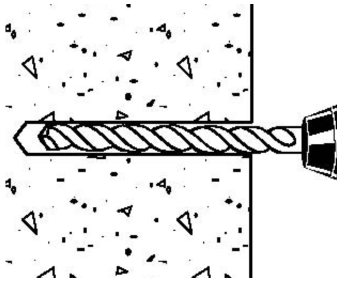
RH = Round Head FH = Flat Head MH = Mushroom Head

Material Specifications

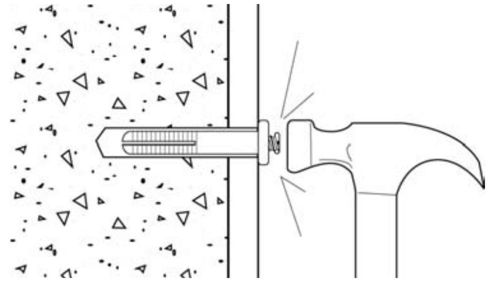
Anchor Component	Component Material			
	Round Head	Flat Head	Mushroom Head	
			Carbon	Stainless
Drive Nail	AISI 1018	AISI 1018	AISI 1018	Type 304 SS
Anchor Body	Nylon	Nylon	Nylon	Nylon
Nail Plating	ASTM B 633, SC1, Type III (Fe/Zn 5)			N/A

Installation Guidelines

Using the proper diameter bit, drill a hole into the base material to a depth of at least 1/4" deeper than the required embedment. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15. Blow the hole clean of dust and other material.



Insert the anchor through the fixture. Drive the nail into the anchor body to expand it. Be sure the head is seated firmly against the fixture and that the anchor is at the proper embedment. This anchor is not recommended for use overhead.



PERFORMANCE DATA

Ultimate Load Capacities for Nylon Nailin in Normal-Weight Concrete[1,2]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		4,000 psi (27.6 MPa)		6,000 psi (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	3/4 (19.1)	180 (0.8)	280 (1.3)	195 (0.9)	320 (1.4)	200 (0.9)	320 (1.4)
	1 (25.4)	200 (0.9)	280 (1.3)	220 (1.0)	320 (1.4)	230 (1.0)	320 (1.4)
1/4 (6.4)	5/8 (15.9)	120 (0.5)	320 (1.4)	140 (0.6)	500 (2.3)	180 (0.8)	500 (2.3)
	3/4 (19.1)	220 (1.0)	320 (1.4)	240 (1.1)	500 (2.3)	245 (1.1)	500 (2.3)
	1 (25.4)	230 (1.0)	320 (1.4)	250 (1.1)	500 (2.3)	260 (1.2)	500 (2.3)
	1 1/2 (38.1)	240 (1.1)	320 (1.4)	270 (1.2)	500 (2.3)	280 (1.3)	500 (2.3)
	2 (50.8)	255 (1.1)	320 (1.4)	285 (1.3)	500 (2.3)	300 (1.4)	500 (2.3)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate loads for intermediate embedments and compressive strengths.

Allowable Load Capacities for Nylon Nailin in Normal-Weight Concrete[1,2,3]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		4,000 psi (27.6 MPa)		6,000 psi (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	3/4 (19.1)	45 (0.2)	70 (0.3)	50 (0.2)	80 (0.4)	50 (0.2)	80 (0.4)
	1 (25.4)	50 (0.2)	70 (0.3)	55 (0.2)	80 (0.4)	60 (0.3)	80 (0.4)
1/4 (6.4)	5/8 (15.9)	30 (0.1)	80 (0.4)	35 (0.2)	125 (0.6)	45 (0.2)	125 (0.6)
	3/4 (19.1)	55 (0.2)	80 (0.4)	60 (0.3)	125 (0.6)	60 (0.3)	125 (0.6)
	1 (25.4)	60 (0.3)	80 (0.4)	65 (0.3)	125 (0.6)	65 (0.3)	125 (0.6)
	1 1/2 (38.1)	60 (0.3)	80 (0.4)	70 (0.3)	125 (0.6)	70 (0.3)	125 (0.6)
	2 (50.8)	65 (0.3)	80 (0.4)	70 (0.3)	125 (0.6)	75 (0.3)	125 (0.6)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
3. Critical and minimum spacing and edge distances as well as reduction factors for intermediate spacing and edge distances are listed in the Design Criteria section.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Nylon Nailin in Hollow Concrete Masonry[1,2]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	3/4 (19.1)	170 (0.8)	280 (1.3)	35 (0.2)	55 (0.2)
	1 (25.4)	180 (0.8)	280 (1.3)	35 (0.2)	55 (0.2)
1/4 (6.4)	5/8 (15.9)	110 (0.5)	320 (1.4)	20 (0.1)	65 (0.3)
	3/4 (19.1)	160 (0.7)	320 (1.4)	30 (0.1)	65 (0.3)
	1 (25.4)	170 (0.8)	320 (1.4)	35 (0.2)	65 (0.3)
	1 1/4 (31.8)	180 (0.8)	320 (1.4)	35 (0.2)	65 (0.3)
	1 1/2 (38.1)	200 (0.9)	320 (1.4)	40 (0.2)	65 (0.3)

1. Tabulated load values are for anchors installed in minimum 6-inch wide, Grade N, Type II, medium and normal-weight concrete masonry units. Mortar must be minimum Type N. Masonry compressive strength must be 1,500 psi minimum at the time of installation.
2. Allowable loads are based on average ultimate values using a safety factor of 5.0.

Ultimate and Allowable Load Capacities for Nylon Nailin in Solid or Hollow Clay Brick Masonry[1,2]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	3/4 (19.1)	155 (0.7)	320 (1.4)	30 (0.1)	65 (0.3)
	1 (25.4)	170 (0.8)	320 (1.4)	35 (0.2)	65 (0.3)
1/4 (6.4)	5/8 (15.9)	150 (0.7)	500 (2.3)	30 (0.1)	100 (0.5)
	3/4 (19.1)	200 (0.9)	500 (2.3)	40 (0.2)	100 (0.5)
	1 (25.4)	220 (1.0)	500 (2.3)	45 (0.2)	100 (0.5)
	1 1/4 (31.8)	240 (1.1)	500 (2.3)	50 (0.2)	100 (0.5)
	1 1/2 (38.1)	250 (1.1)	500 (2.3)	50 (0.2)	100 (0.5)

1. Tabulated load values are for anchors installed in Grade SW multiple wythe, solid brick masonry conforming to ASTM C62.
2. Allowable loads are calculated using an applied safety factor of 5.0.

DESIGN CRITERIA

Combined Loading

For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

Load Adjustment Factors for Spacing and Edge Distances

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (s)	Tension and Shear	$s_{cr} = 10d$	$F_N = F_V = 1.0$	$s_{min} = 5d$	$F_N = F_V = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_N = 1.0$	$c_{min} = 5d$	$F_N = 0.80$
	Shear	$c_{cr} = 12d$	$F_V = 1.0$	$c_{min} = 5d$	$F_V = 0.50$

TABLE OF CONTENTS

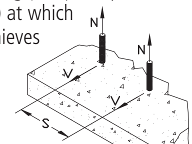
DESIGN CRITERIA

Load Adjustment Factors for Normal-Weight Concrete

Spacing, Tension (F_N) & Shear (F_V)			
Dia. (in.)		3/16	1/4
s_{cr} (in.)		1 7/8	2 1/2
s_{min} (in.)		1	1 1/4
Spacing, s (in.)	1	0.50	
	1 1/4	0.67	0.50
	1 1/2	0.80	0.60
	1 7/8	1.00	0.75
	2		0.80
	2 1/2		1.00

Notes: For anchors loaded in tension, the critical spacing (s_{cr}) is equal to 10 anchor diameters (10d) at which the anchor achieves 100% of load.

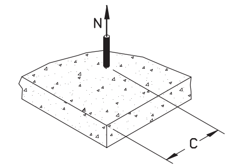
Minimum spacing (s_{min}) is equal to 5 anchor diameters (5d) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_N)			
Dia. (in.)		3/16	1/4
c_{cr} (in.)		2 1/4	3
c_{min} (in.)		1	1 1/4
Edge Dist., c (in.)	1	0.80	
	1 1/4	0.85	0.80
	1 1/2	0.89	0.83
	2	0.96	0.89
	2 1/4	1.00	0.91
	2 1/2		0.94
	3		1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12d) at which the anchor achieves 100% of load.

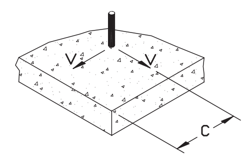
Minimum edge distance (c_{min}) is equal to 5 anchor diameters (5d) at which the anchor achieves 80% of load.



Edge Distance, Shear (F_V)			
Dia. (in.)		3/16	1/4
c_{cr} (in.)		2 1/4	3
c_{min} (in.)		1	1 1/4
Edge Dist., c (in.)	1	0.50	
	1 1/4	0.62	0.50
	1 1/2	0.71	0.57
	2	0.90	0.71
	2 1/4	1.00	0.79
	2 1/2		0.86
	3		1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12d) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 5 anchor diameters (5d) at which the anchor achieves 50% of load.



ORDERING INFORMATION

Round Head Nylon Nailin with Carbon Steel Nail

Catalog Number	Anchor Size	Drill Dia.	Std. Box	Std. Carton	Wt./100
2431	3/16" x 1	3/16"	100	1,000	1/2
2451	3/16" x 1 1/2"	3/16"	100	1,000	3/4
2521	1/4" x 1"	1/4"	100	1,000	3/4
2541	1/4" x 1 1/2"	1/4"	100	1,000	1
2561	1/4" x 2"	1/4"	100	1,000	1

Flat Head Nylon Nailin with Carbon Steel Nail

Catalog Number	Anchor Size	Drill Dia.	Std. Box	Std. Carton	Wt./100
2432	3/16" x 1"	3/16"	100	1,000	1/2
2452	3/16" x 1 1/2"	3/16"	100	1,000	3/4
2522	1/4" x 1"	1/4"	100	1,000	3/4
2542	1/4" x 1 1/2"	1/4"	100	1,000	1
2562	1/4" x 2"	1/4"	100	1,000	1

Mushroom Head Nylon Nailin

Catalog Number		Anchor Size	Drill Diameter	Standard Box	Standard Carton	Wt./ 100
Carbon	Stainless					
2433	–	3/16" x 1"	3/16"	100	1,000	1/2
2513	–	1/4" x 3/4"	1/4"	100	1,000	1/2
2523	2528	1/4" x 1"	1/4"	100	1,000	3/4
2543	2548	1/4" x 1 1/2"	1/4"	100	1,000	1
2563	–	1/4" x 2"	1/4"	100	1,000	1
2573	–	1/4" x 3"	1/4"	100	1,000	2 1/4
2583	–	1/4" x 4"	1/4"	100	1,000	2 3/4
2593	–	1/4" x 6"	1/4"	100	400	4

Mushroom Head Bodies Only

Catalog Number	Anchor Size	Drill Dia.	Std. Box	Std. Carton	Wt./100
2574	1/4" x 3"	1/4"	2500	2500	1/2

Notes:

ADHESIVES

SECTION CONTENTS

ADHESIVE ANCHORING SELECTION GUIDE

Anchor Category		Injection Adhesive Anchors		Glass Capsule Adhesive Anchors		Anchor Hardware			Expansion Foam		Bonding Sealant
Product		AC100 Plus	Power-Fast+	Chem-Stud	Hammer-Capsule	Straight Cut Anchor Rod	Chisel Pointed Anchor Rod	Internally Threaded Inserts	Powerfoam	TriggerFoam	PowerStick
Page		186	209	227	239	248	248	248	262	264	266
Base Material	Concrete	■	■	■	■	■	■	■	■	■	■
	Lightweight Concrete	■	■	□	□	■	□	□	■	■	■
	Grout-filled Concrete Masonry	■	■	□	□	■	□	□	■	■	■
	Hollow Concrete Masonry	■	■			■			■	■	■
	Solid Brick	■	■	□	□	■	□	□	■	■	■
	Hollow Brick	□	■			■			■	■	■
	Stone	□	□	□	□	■	□	□	■	■	■
	Structural Clay Tile	□	□			■			■	■	■
Anchor Diameter	1/4"	□	■			■					
	3/8"	■	■	■	■	■	■	■			
	1/2"	■	■	■	■	■	■	■			
	5/8"	■	■	■	■	■	■	■			
	3/4"	■	■	■	■	■	■	■			
	7/8"	■	■	■	■	■	■				
	1"	■	■	■	■	■	■				
	1 1/4"	■	■	■	□	■	■				
	1 3/8"	□	■								
	1 1/2"	□	■								
	1 3/4"	□	□								
	2"	□	□								
Working Load	Under 400 lbs.	■	■	■	■	■	■	■			
	400 lbs. to 4,000 lbs.	■	■	■	■	■	■	■			
	Over 4,000 lbs.	■	■	■	■	■	■	■			
Anchor Element	Coated / Plated Carbon Steel					■	■	■			
	Type 304 Stainless Steel					■	■				
Chemistry	Epoxy		■								
	Ester Based Resin	■		■	■						
	Polyurethane								■	■	
	MS Polymer										■

Adhesive Anchoring

INTRODUCTION

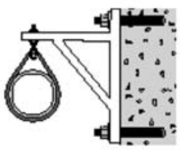
Adhesive anchoring systems offer many advantages for applications requiring high load capacities. Capsule type systems first appeared in the market in the late 1970's followed by the early co-axial type injection systems. Originally, these products were used in highway and bridge construction as a substitute for grouted anchors because of speed of installation. As industry realized the benefits of adhesive systems, their use in other building applications have gained general acceptance. Major features applicable to adhesive systems include:

SECTION CONTENTS Page No.

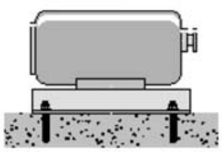
- High Strength
- Ability to be used with a Variety of Rod Materials
- Stress Free (No mechanical forces exerted on base material)
- Sealed Anchor Hole for Weather Resistance
- Good Dynamic and Shock Load Performance
- Small Hole Diameter Compared to Grout

Typical applications for which adhesive systems may be used are shown below:

Threaded Anchor Rods

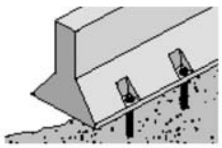


Pipe Supports



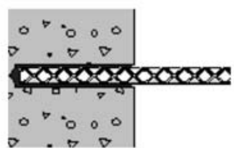
Machine Bases

Light Poles

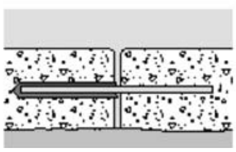


Median Barriers

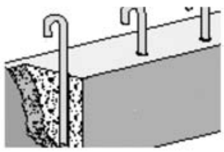
Reinforcing and Smooth Dowel Rods



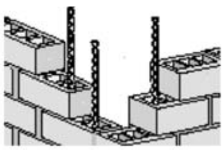
Deformed Bars



Smooth Bars



Hooked Bars



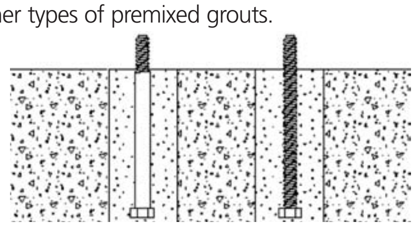
Block Reinforcing

ADHESIVE ANCHOR FUNCTIONING

This type of anchor bonds threaded rods, bolts, and reinforcing bars to the base material using cementitious materials or chemical adhesives. Loads are transferred to the base material by the bond formed between both the anchor rod and the walls of the drilled hole. Anchors of this type normally have the highest load capacities because the base material does not have to withstand the high point load stresses often associated with mechanical expansion anchors. Performance when subjected to dynamic or shock loads is typically superior.

Grouted Anchors

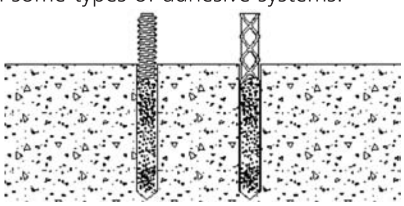
Grouted anchors require the drilling of a large diameter anchor hole to accommodate the placement of the grout around the anchor. Headed bolts or threaded rods with pre-mounted nuts are inserted into the holes which are filled with a portland cement grout, sand grout, or other types of premixed grouts.



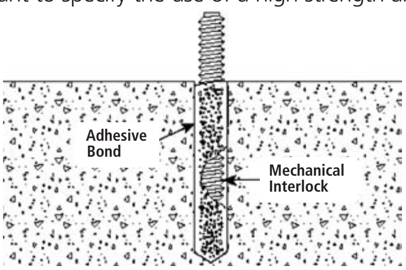
Chemical Anchors

Chemical or adhesive anchors typically use an ester based resin or an epoxy to bond threaded bolts or reinforcing bars into the anchor hole. Normally, the hole size is only slightly greater than the rod bolt or bar diameter. Typical two-part systems include an encapsulated glass design such as the *Chem-Stud* or *Hammer-Capsule* and plastic cartridge injection systems in various configurations such as the *Power-Fast+* or *AC100 Plus* systems.

Adhesive anchors achieve their load capacities based on the ability of the adhesive used to bond to the base material. This ability to bond, often referred to as "wetting action", will vary depending upon the adhesive type and formulation. While the adhesive bonds to the base material, it also forms a mechanical interlock around the threaded rod. In order to form this interlock, it is important to use anchor rods which have some type of deformation. Examples would be threaded rod or deformed reinforcing bars. Smooth dowel bars coated with epoxy can be used with some types of adhesive systems.



In addition to the ability to bond to the base material, the strength of the anchor rod used can be a critical factor. Many adhesive types can achieve the load capacity of a standard Grade 2, A 36 or A 307 threaded rod. In order to achieve the strength of the adhesive, it is often important to specify the use of a high strength anchor rod.



PERFORMANCE DATA

The load capacities for adhesives published in this manual are based on extensive testing conducted according to the requirements of ASTM Standards E 488 and E 1512. To determine the bond strength of an adhesive, a high strength anchor rod was used. From the initial testing conducted, the adhesive bond strength for an anchor rod installed in several concrete compressive strengths was developed allowing for the calculation of various combinations of anchor rod and embedment.

When designing with an adhesive anchoring system, both the strength of the adhesive resin and the steel anchor rod must be considered. The adhesive may often have an allowable or working load capacity that is higher than that for the anchor rod. In order to account for this, the capacities listed in this manual are published in two ways.

The ultimate or failure load for the adhesive resin is published first. Then the allowable bond strength for the adhesive based on a safety factor is tabulated along with the allowable load capacities for various threaded steel anchor rod or reinforcing bars. The designer may wish to use higher safety factors than the minimum safety factor of 4 for concrete or 5 for masonry base materials depending upon application and governing building code. Steel strength capacities for threaded rod are based on the design criteria listed in the AISC Manual of Steel Construction. For reinforcing and dowel bars, the capacities are based on the requirements of ASTM A 615. The designer should select the lesser of the published allowable loads, either the bond strength or the steel strength to determine the capacity of the anchorage.

The spacing and edge distance factors as listed in the following sections should also be considered. As in all applications, the actual safety factors and allowable load capacities used should be reviewed and verified by a design professional familiar with the actual product installation.

INSTALLATION GUIDELINES

As with any building component, proper installation is the key to a successful application once the anchor has been properly selected. While each individual adhesive product section provides specific installation instructions, the following summary highlights general areas of importance.

Anchor Holes

A properly drilled hole is a critical factor both for ease of installation and optimum anchor performance. The anchors selected and the drill bits to be used should be specified as part of the total anchoring system. Powers adhesive anchors are designed to be installed in holes drilled with carbide tipped bits meeting the requirements of the American National Standards Institute (ANSI) Standard B212.15 unless other-wise specified. If alternate bit types such as diamond tipped core bits are used, the tip tolerance should be within the specified ANSI range. Smooth walls should generally be roughened and cleaned with a wire brush. A diamond tipped bit drills a hole which has very smooth walls. Although adhesive anchors tend to work acceptably in diamond cored holes, testing should be conducted to verify performance.

When using adhesives, anchor holes should be thoroughly cleaned prior to installation of the adhesive. During the drilling process, dust is often pressed into the walls of the hole. Blowing the hole with compressed air or vacuuming alone will not properly clean the hole. In order to ensure that the proper bond is developed with the base material, the holes should also be brushed using a nylon brush to remove dust and other debris which may have been pressed into the walls of the hole.

Maximum Torque Ranges

A maximum torque range is listed for applications in which an adhesive anchor will be used to install a threaded rod. Although the application of torque is not necessary to achieve the published loads, in some cases it may be desirable to apply a clamping force to a fixture. The purpose of a maximum torque range is to prevent over stressing of the adhesive bond. These values are based on testing in normal-weight concrete. Suggested allowable torque ranges are also provided for specific applications, job site tests are recommended. As with mechanical anchors, preload relaxation should be expected due to creep within the concrete and/or within the adhesive.

Use of Adhesives in Cold Weather

One of the differences between epoxy and ester based resins is the type of chemical reaction. When the individual components of an epoxy are combined or mixed, the reaction which occurs is called an addition reaction. The reaction is described in this manner because it involves the addition of an epoxy molecule with an amine molecule which are then cross linked three dimensionally to form a polymer. When the temperature is warmer, the molecules are free and can cross link faster. As the temperature lowers, the cross linking becomes more difficult and will stop at a certain point.

Ester based resins react differently. In an ester based resin, the hardening catalyst causes the ester molecules or monomers to link together forming long chain polymers. In this type of reaction, the mix ratio is not as critical. While colder temperatures do not affect the reaction of these resins as severely, proper conditioning is still required for some systems.

As the temperature of the unmixed components of an adhesive material decreases, they thicken which can make dispensing or installation difficult in cold weather. To prevent difficulty during installation, Powers recommends that adhesives be conditioned to a minimum temperature of 60°F. prior to installation unless otherwise recommended in the individual product sections. When an adhesive is conditioned, it should be maintained at the required minimum temperature for a sufficient amount of time to ensure that the entire cross section of the container is brought to temperature.

Some products, especially epoxies, are not recommended for use in base materials having a temperature of less than 40° F unless job site performance tests are conducted. Although these materials may gel and cure at lower temperatures, 40° F was selected as a safe minimum temperature because experience has shown that no special installation procedures are required beyond our published instructions.

When adhesive anchors are installed in concrete which is in the freezing range, frost or ice can form on the walls of the anchor hole. If this occurs, injection type adhesives may not properly bond to the walls of the anchor hole. Spin-in type capsule systems which scrape the walls of the anchor hole during installation are less

INSTALLATION GUIDELINES (Continued)

sensitive to this. Since concrete is porous and acts like a sponge, even the pour water can freeze and prevent the adhesive from properly wetting the surface of the hole. This can be prevented by heating the anchor hole with a heat gun prior to installation of the adhesive. A torch should normally not be used because it carbonates the concrete on the walls of the anchor hole creating a residual dust. Job site tests are recommended where a torch is used to dry the anchor hole.

Since variations in the concrete mix design may affect the formation of frost or ice on the walls of an anchor hole, job site performance tests are required for installations of epoxies in base materials having a temperature of less than 40° F to verify gel and cure times. In house tests have shown that the Fast Set version of *Power-Fast+* can gel and set in materials as cold as 25ºF, however the specified installation procedures described above need to be followed and gel and cure times for the adhesive in base material temperatures between 25° to 40ºF can be unpredictable and inconsistent.

ADHESIVES

AC100 Plus™ *Epoxy Acrylate Adhesive Anchoring System*

PRODUCT DESCRIPTION

The AC100 Plus epoxy acrylate adhesive system is a two-component, 10 to1 ratio, structural adhesive which is packaged in engineered plastic cartridges. It is used with either a manual, pneumatic or power-operated injection tool and proportionally mixed through a static-element mixing nozzle. AC100 Plus has been vigorously tested to meet or exceed required standards as an anchoring adhesive. This all-weather adhesive can be used effectively in temperatures as low as -4°F (-20°C).

AC100 Plus is designed for use in anchoring threaded rods, bolts, reinforcing bars, and smooth dowels into concrete and masonry base materials. The system can also be used to anchor into hollow masonry materials using rod and rebar with screen tubes. The AC100 Plus adhesive is a 100% solids, low odor, moisture insensitive formulation which does not contain volatile organic compounds (VOC's) and is free of styrene and solvents.

GENERAL APPLICATIONS AND USES

- Heavy duty anchoring such as rebar, threaded anchor rods, and threaded bolts in solid concrete, grout filled block, stone, etc.
- Used in wet environments, a wide range of temperatures and whenever solvent or styrene fumes are not acceptable
- Anchoring with screen tubes in hollow block or brick
- Repair and retrofit projects
- For details on additional uses, refer to the "Special Applications" section located on page 249

FEATURES AND BENEFITS

- Listed and approved to resist dead loads, live loads, and short-term loads such as those resulting from wind or earthquake
- Superior dispensing speed and fast cure even in low temperatures
- All-weather material is ideal for cold and moderate environment applications
- 100% solids, styrene-free, anchoring mortar with no VOC's
- Available in five cartridge sizes to match project and application
- Non-flammable, does not contain hazardous methyl-methacrylate like other "acrylic" formulas
- Virtually odorless for indoor and outdoor applications
- Meets the requirements of ASTM C881, Types I and IV, Grade 3, Class A, B and C
- Optimal for use in diamond cored holes
- Suitable for dry, damp or water-filled holes
- Meets current building code and DOT requirements
- High load capacities in concrete and masonry
- Excellent chemical resistance
- Independently tested and qualified to ASTM E1512 and AC58 Criteria, including creep resistance, freeze-thaw cycling and simulated seismic/wind conditions

APPROVALS AND LISTINGS

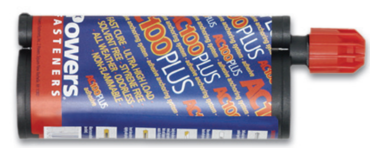
International Code Council, Evaluation Service (ICC-ES) ESR-1686
City of Los Angeles (COLA) Research Report LARR-25579
Miami-Dade County Notice of Acceptance (NOA) 04-0820.02
Meets ASTM C881 and AASHTO M235
Various North American Departments of Transportation (DOT) – See www.powers.com

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring, 04081-Masonry Anchorage* and *05090-Metal Fastenings.* Adhesive anchoring system shall be AC100 Plus as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS Page No.

AC100 Plus Coaxial Cartridge



AC100 Plus Dual Cartridge

PACKAGING

Coaxial Cartridge
5.5 fl. oz. (160 ml or 9.9 in³)
10 fl. oz. (295 ml or 18.0 in³)

Dual (Side-by-Side) Cartridge
8 fl. oz. (235 ml or 14.4 in³)
12 fl. oz. (355 ml or 21.6 in³)
30 fl. oz. (890 ml or 54.0 in³)

ANCHOR SIZE RANGE (TYP.)

3/8" to 1-1/4" diameter rod
No.3 to No.11 reinforcing bar
3/8" to 1-1/4" smooth dowel bar
1/2" to 3/4" internally threaded inserts

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Structural Lightweight Concrete
Grouted Concrete Masonry
Hollow CMU
Brick Masonry
Stone

MATERIAL AND INSTALLATION SPECIFICATIONS

Physical Properties of Adhesive

Shelf Life	18 months from date of manufacture
Storage Conditions	14°F (-10°C) to 86°F (30°C)
Injection Temperature	-4°F (-20°C) or greater
Color	Component A (Resin) – White Component B (Hardener) – Black
Mixing Ratio	10:1 by volume
Mixed Consistency	Uniform, non-sag gray mortar
Shore Hardness (ASTM D2240)	90
Compressive Strength (ASTM D 695)	10,100 psi, 7 days
Tensile Strength (ASTM D 638)	2,100 psi
Flexural Strength (ASTM D 790)	3,670 psi
Slant Shear Strength (ASTM D732)	4,590 psi
Water Absorption (ASTM D 570)	Less than 1% (0.11%)
Bond Strength (ASTM C 882)	1,380 psi, 2 Day Cure 1,760 psi, 2 Day Cure
Shrinkage (ASTM D 2566)	0.004 in/in
Heat Deflection (ASTM D 648)	176°F (80°C)

Setting Times

Base Material Temperature	Maximum Gel Time[1]	Minimum Curing Time[2]
-4°F (-20°C)	12 hours	72 hours
5°F (-15°C)	8 hours	24 hours
14°F (-10°C)	4 hours	12 hours
23°F (-5°C)	2 hours	6 hours
32°F (0°C)	40 minutes	4 hours
41°F (5°C)	20 minutes	2 hours
50°F (10°C)	15 minutes	60 minutes
59°F (15°C)	10 minutes	45 minutes
68°F (20°C)	7 minutes	30 minutes
86°F (30°C)	4 minutes	25 minutes
104°F (40°C)	2 minutes	20 minutes

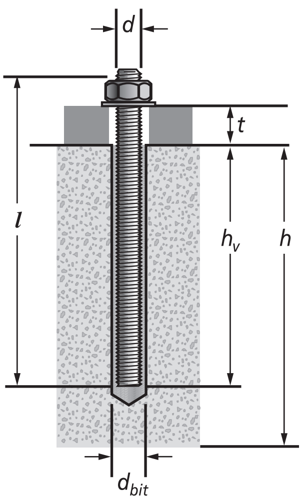
1. The gel time is the maximum time during which the adhesive can be dispensed before it begins to harden. Do not disturb the anchors between the maximum gel time and the minimum cure time.
2. The minimum cure time is the time for the adhesive to completely harden. Anchors may not be tightened or loaded until the full curing time has elapsed.

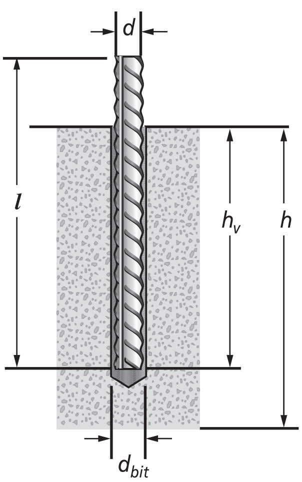
ADHESIVES

Installation Specifications

Property		Rod Diameter, *d* (in.)						
		3/8	1/2	5/8	3/4	7/8	1	1 1/4
A_{nom} = Nominal area of threaded rod (inch^2)		0.1105	0.1963	0.3068	0.4418	0.6013	0.7854	1.2272
A_{se} = Tensile stress area of rod (inch^2)		0.0775	0.1419	0.2260	0.3345	0.4617	0.6057	0.9691
d_{bit} = Nominal bit diameter (inch)		7/16	9/16	11/16	13/16 or 7/8	15/16 or 1	1 1/16	1 3/8
T_{max} = Max. tightening torque range (ft.-lbs.)	$4d \leq h_v < 8d$	5-6	10-12	20-22	35-40	55-60	75-85	135-150
	$h_v \geq 8d$	15-17	30-35	50-60	100-110	140-155	210-230	400-450

Property	Reinforcing Bar Sizes, *d*								
	No.3	No.4	No.5	No.6	No.7	No.8	No.9	No.10	No.11
d = Nominal bar diameter (inch)	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8
d_{ef} = Effective anchor diameter (inch)	0.375	0.500	0.625	0.750	0.875	1.000	1.128	1.270	1.410
A_{br} = Nominal area of reinforcing bar (inch^2)	0.110	0.200	0.310	0.440	0.600	0.790	1.000	1.270	1.560
d_{bit} = Nominal bit diameter (inch)	7/16	9/16	11/16	7/8	1	1 1/8	1 1/4	1 1/2	1 5/8





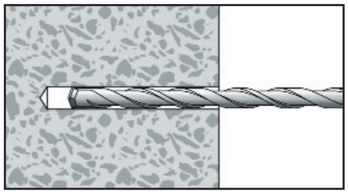
Nomenclature

d = Diameter of rod or rebar
d_{bit} = Diameter of drill bit
h = Base material thickness. The minimum value of h should be $1.5h_v$
h_v = Minimum embedment depth
l = Overall length of rod or rebar
t = Fixture thickness
T_{max} = Maximum tightening torque (Only possible after full cure)

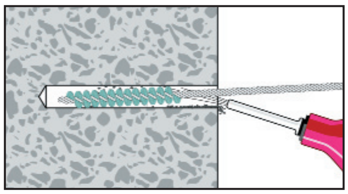
INSTALLATION GUIDELINES

Solid Base Materials

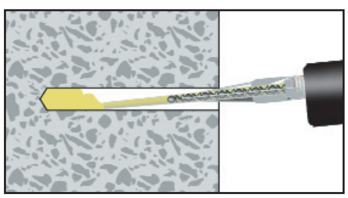
Drill a hole to the size and embedment required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



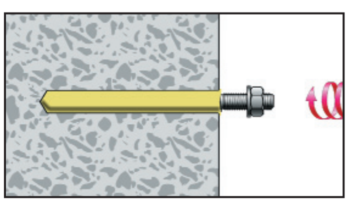
Starting from the bottom or back of the anchor hole, blow clean with compressed air, brush the hole with a nylon brush, and blow it clean again. Vacuuming only is not sufficient. Blow out bulbs generally do not provide enough dust removal for most drilled anchor holes. Holes should be clean and sound. Holes may be dry, damp, or water filled but should be free of frost. If using reinforcing bar, be sure the bar will fit into the drilled hole. If a larger hole is required, the diameter should be as close as possible to the diameter of the reinforcing bar.



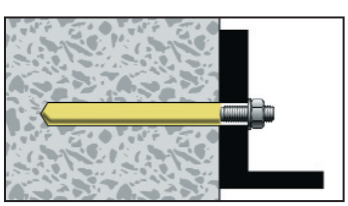
Prior to dispensing into anchor hole, balance the cartridge and visually inspect that adhesive components are uniformly mixed. Fill the hole approximately half way with adhesive starting from the bottom or back of the anchor hole. Slowly withdraw the static mixing nozzle as the hole fills to avoid creating air pockets.



Push the threaded rod or reinforcing bar into the anchor hole while turning slightly to ensure positive distribution of the adhesive. Be sure the rod is fully seated at the bottom of the hole and that some adhesive has flowed from the top of the hole. The threaded rod or reinforcing bar used should be free of dirt, grease, oil or other foreign material.

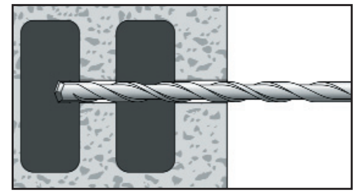


Allow the adhesive to cure for the specified time prior to applying any load. Do not disturb or load the anchor until it is fully cured.



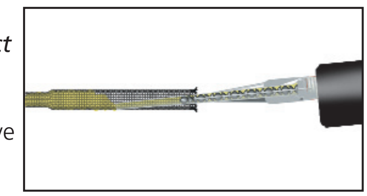
Hollow Base Materials

Drill a hole to the size and embedment for the required screen size. The tolerances of the drill bit used should meet the requirements of ANSI B212.15.

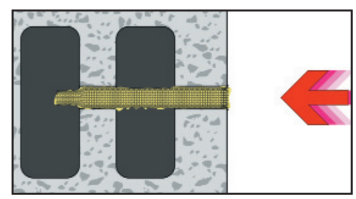


Starting from the bottom or back of the anchor hole, blow the hole clean with compressed air, brush the hole with a nylon brush and blow it clean again. Vacuuming only is not sufficient. Blow out bulbs generally do not provide enough dust removal for most drilled anchor holes.

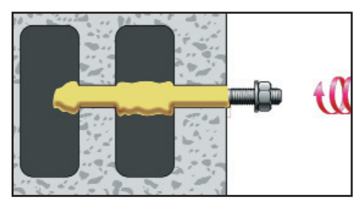
Prior to dispensing into screen tube, visually inspect that adhesive components are uniformly mixed. Fill the screen tube with adhesive starting from the bottom of the screen. The screen tube should be completely filled prior to inserting it in the anchor hole.



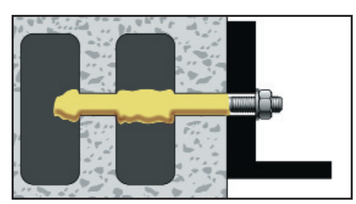
Insert the filled screen tube into the anchor hole until it is fully seated at the required embedment.



Push the threaded rod into the screen while turning slightly to ensure positive dispensing of the adhesive. Be sure the rod is fully inserted down to the end of the screen tube. The threaded rod or reinforcing bar used should be free of dirt, grease, oil, or other foreign material.



Allow the adhesive to cure for the specified time prior to applying any load. Do not disturb or load the anchor until it is fully cured.



Prior to use, read product label, Material Safety Data Sheet and injection tool instructions.

ADHESIVES

STEEL SPECIFICATIONS

Material Properties for Threaded Rod and Reinforcing Bar

Anchor Type	Steel Description	Steel Specification (ASTM)	Rod Dia. or Rebar Size (inch or No.)	Minimum Yield Strength, f_y (ksi)	Minimum Ultimate Strength, f_u (ksi)
Threaded Rod	Standard carbon rod	A36	All	36.0	58.0
		A 307, Grade C	3/8 thru 4	36.0	58.0
	High strength carbon rod	A 193, Grade B7	3/8 thru 2 1/2	105.0	120.0
	Stainless Rod (Type 304 / 316 SS)	F 593, Condition CW	3/8 thru 5/8	65.0	100.0
			3/4 thru 1 1/2	45.0	85.0
Reinforcing Bar	Grade 40 Rebar	A 615, A 616, A 617, A 706 or A 767	All	40.0	70.0
	Grade 60 Rebar			60.0	90.0

Allowable Steel Strength Capacities for Threaded Rod

Anchor Diameter *d* in. (mm)	Allowable Tension				Allowable Shear			
	ASTM A36 lbs. (kN)	ASTM A307 Grade C lbs. (kN)	ASTM A193 Grade B7 lbs. (kN)	ASTM F593 304/316 SS lbs. (kN)	ASTM A36 lbs. (kN)	ASTM A307 Grade C lbs. (kN)	ASTM A193 Grade B7 lbs. (kN)	ASTM F593 304/316 SS lbs. (kN)
3/8 (9.5)	2,115 (9.5)	2,115 (9.5)	4,375 (19.7)	3,630 (16.3)	1,090 (4.9)	1,090 (4.9)	2,255 (10.1)	1,870 (8.4)
1/2 (12.7)	3,755 (16.9)	3,755 (16.9)	7,775 (35.0)	6,470 (29.1)	1,940 (8.7)	1,940 (8.7)	4,055 (18.2)	3,330 (15.0)
5/8 (15.9)	5,870 (26.4)	5,870 (26.4)	12,150 (54.7)	10,130 (45.6)	3,025 (13.6)	3,025 (13.6)	6,260 (28.2)	5,210 (23.4)
3/4 (19.1)	8,455 (38.0)	8,455 (38.0)	17,495 (78.7)	12,400 (55.8)	4,355 (19.6)	4,355 (19.6)	9,010 (40.5)	6,390 (28.8)
7/8 (22.2)	11,510 (51.8)	11,510 (51.8)	23,810 (107.1)	16,860 (75.9)	5,930 (26.7)	5,930 (26.7)	12,265 (55.2)	8,680 (39.1)
1 (25.4)	15,035 (67.7)	15,035 (67.7)	31,100 (140.0)	22,020 (99.1)	7,745 (34.9)	7,745 (34.9)	16,020 (72.1)	11,340 (51.0)
1 1/4 (31.8)	23,485 (105.7)	23,485 (105.7)	48,560 (218.5)	34,420 (154.9)	12,100 (54.5)	12,100 (54.5)	25,035 (112.7)	17,730 (79.8)

Steel strength capacities are based on the design criteria listed in the *AISC Manual of Steel Construction*.

Allowable Steel Strength Capacities for Reinforcing Bar

Bar Size	Tension lbs. (kN)		Shear lbs. (kN)	
	Grade 40	Grade 60	Grade 40	Grade 60
No. 3 (3/8")	2,200 (9.9)	2,640 (11.9)	1,310 (5.9)	1,680 (7.6)
No. 4 (1/2")	4,000 (18.0)	4,800 (21.6)	2,380 (10.7)	3,060 (13.8)
No. 5 (5/8")	6,200 (27.9)	7,440 (33.5)	3,690 (16.6)	4,740 (21.3)
No. 6 (3/4")	8,800 (39.6)	10,560 (47.5)	5,235 (23.6)	6,730 (30.3)
No. 7 (7/8")	12,000 (54.0)	14,400 (64.8)	7,140 (32.1)	9,180 (41.3)
No. 8 (1")	15,800 (71.1)	18,960 (85.3)	9,400 (42.3)	12,085 (54.4)
No. 9 (1 1/8")	20,000 (90.0)	24,000 (108.0)	11,900 (53.6)	15,300 (68.9)
No. 10 (1 1/4")	25,400 (114.3)	30,480 (137.2)	15,115 (68.0)	19,430 (87.4)
No. 11 (1 3/8")	31,200 (140.4)	37,440 (168.5)	16,920 (76.1)	20,305 (91.4)

Steel strength capacities are based on the requirements of ASTM A 615.

Note:
Allowable design load must be the lesser of allowable steel strength (as shown on this page) and the allowable bond capacities.

Allowable steel strength values for threaded rod are based on the following equations:

$T = 0.33 * f_u * A_{nom}$
$V = 0.17 * f_u * A_{nom}$

And, the allowable steel strength values for reinforcing bar are based on the following equations:

$T = f_s * A_{br}$
$V = 0.17 * f_s * A_{br}$

Where:
- T = Allowable tension load (pounds).
- V = Allowable shear load (pounds).
- f_u = Minimum specified ultimate stress (psi)
- f_s = Allowable tensile stress of reinforcement bar (psi)
- A_{nom} = Nominal cross-sectional area of threaded rod (in^2).
- A_{br} = Nominal cross-sectional area of reinforcing bar (in^2).

PERFORMANCE DATA

Ultimate Bond Strength Capacities for Threaded Rod Installed with AC100 Plus in Normal-Weight Concrete[1,2]

Rod Diameter d in. (mm)	Drill Bit Diameter d_{bit} in.	Minimum Embedment Depth h_v in. (mm)	2,000 psi (13.8 MPa) Tension lbs. (kN)	2,000 psi (13.8 MPa) Shear lbs. (kN)	3,000 psi (20.7 MPa) Tension lbs. (kN)	3,000 psi (20.7 MPa) Shear lbs. (kN)	4,000 psi (27.6 MPa) Tension lbs. (kN)	4,000 psi (27.6 MPa) Shear lbs. (kN)
3/8 (9.5)	7/16	1 3/4 (44.5)	3,280 (14.8)	3,020 (13.6)	3,695 (16.6)	3,740 (16.8)	4,105 (18.5)	4,455 (20.1)
		3 1/2 (88.9)	10,115 (45.5)	3,635 (16.4)	10,370 (46.7)	3,995 (18.0)	10,625 (47.8)	4,460 (20.1)
		5 1/4 (133.4)	10,115 (45.5)	4,410 (19.8)	10,385 (46.7)	4,570 (20.6)	10,650 (47.9)	4,735 (21.3)
1/2 (12.7)	9/16	2 1/8 (54.0)	5,395 (24.3)	3,765 (16.9)	6,080 (27.4)	5,365 (24.2)	6,760 (30.4)	6,965 (31.4)
		4 1/4 (108.0)	15,305 (68.9)	9,985 (44.9)	16,425 (73.9)	10,280 (46.3)	17,540 (78.9)	10,575 (47.6)
		6 3/8 (161.9)	20,330 (91.5)	9,455 (42.6)	20,835 (93.8)	10,155 (45.7)	21,340 (96.0)	10,855 (48.9)
5/8 (15.9)	11/16	2 1/2 (63.5)	7,570 (34.1)	5,350 (24.1)	8,740 (39.3)	6,520 (29.3)	9,910 (44.6)	7,695 (34.6)
		5 (127.0)	18,265 (82.2)	15,765 (70.9)	21,820 (98.2)	16,535 (74.4)	25,375 (114.2)	17,300 (77.9)
		7 1/2 (190.5)	27,955 (125.8)	15,765 (70.9)	30,310 (136.4)	17,105 (77.0)	32,660 (147.0)	18,460 (83.1)
3/4 (19.1)	13/16 or 7/8	3 3/8 (85.7)	9,500 (42.8)	8,830 (39.7)	11,985 (53.9)	12,050 (54.2)	14,465 (65.1)	15,265 (68.7)
		6 5/8 (168.3)	28,050 (126.2)	24,395 (109.8)	32,785 (147.5)	24,395 (109.8)	37,515 (168.8)	24,395 (109.8)
		10 (254.0)	43,340 (195.0)	24,395 (109.8)	44,270 (199.2)	24,395 (109.8)	45,195 (203.4)	24,395 (109.8)
7/8 (22.2)	15/16 or 1	3 3/4 (95.3)	12,670 (57.0)	11,325 (51.0)	15,565 (70.0)	15,450 (69.5)	18,460 (83.1)	19,575 (88.1)
		7 1/2 (190.5)	31,765 (142.9)	29,925 (134.7)	35,010 (157.5)	32,340 (145.5)	38,250 (172.1)	34,755 (156.4)
		11 1/4 (285.8)	39,590 (178.2)	34,415 (154.9)	46,585 (209.6)	35,155 (158.2)	53,575 (241.1)	35,890 (161.5)
1 (25.4)	1 1/16	4 1/8 (104.8)	15,335 (69.0)	12,355 (55.6)	18,620 (83.8)	15,975 (71.9)	21,900 (98.6)	19,590 (88.2)
		8 1/4 (209.6)	38,480 (173.2)	35,070 (157.8)	46,410 (208.9)	40,360 (181.6)	54,340 (244.5)	45,680 (205.6)
		12 3/8 (314.3)	48,650 (218.9)	45,680 (205.6)	58,425 (262.9)	45,680 (205.6)	68,200 (306.9)	45,675 (205.5)
1 1/4 (31.8)	1 3/8	6 (152.4)	21,340 (96.0)	25,625 (115.3)	24,035 (108.2)	30,560 (137.5)	26,725 (120.3)	35,500 (159.7)
		12 (304.8)	52,940 (238.2)	66,250 (298.1)	65,400 (294.3)	67,720 (304.7)	77,860 (350.4)	69,190 (311.4)
		15 (381.0)	66,420 (298.9)	69,210 (311.4)	76,705 (345.2)	71,735 (322.8)	93,040 (418.7)	74,265 (334.2)

Minimum Concrete Compressive Strength (f'_c)

1. Ultimate load capacities should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate load capacities for intermediate embedments and compressive strengths.

PERFORMANCE DATA

Allowable Bond Strength Capacities for Threaded Rod Installed with AC100 Plus in Normal-Weight Concrete[1,2,3,4,5]

Rod Diameter *d* in. (mm)	Drill Bit Diameter d_{bit} in.	Minimum Embedment Depth h_v in. (mm)	2,000 psi (13.8 MPa) Tension lbs. (kN)	2,000 psi (13.8 MPa) Shear lbs. (kN)	3,000 psi (20.7 MPa) Tension lbs. (kN)	3,000 psi (20.7 MPa) Shear lbs. (kN)	4,000 psi (27.6 MPa) Tension lbs. (kN)	4,000 psi (27.6 MPa) Shear lbs. (kN)
3/8 (9.5)	7/16	1 3/4* (44.5)	820 (3.7)	755 (3.4)	925 (4.2)	935 (4.2)	1,025 (4.6)	1,115 (5.0)
		3 1/2* (88.9)	2,530 (11.4)	910 (4.1)	2,595 (11.7)	1,010 (4.5)	2,655 (11.9)	1,115 (5.0)
		5 1/4 (133.4)	2,530 (11.4)	1,100 (5.0)	2,595 (11.7)	1,140 (5.1)	2,665 (12.0)	1,185 (5.3)
1/2 (12.7)	9/16	2 1/8* (54.0)	1,345 (6.1)	940 (4.2)	1,520 (6.8)	1,340 (6.0)	1,690 (7.6)	1,740 (7.8)
		4 1/4* (108.0)	3,825 (17.2)	2,495 (11.2)	4,105 (18.5)	2,570 (11.6)	4,385 (19.7)	2,645 (11.9)
		6 3/8 (161.9)	5,080 (22.9)	2,495 (11.2)	5,210 (23.4)	2,605 (11.4)	5,335 (24.0)	2,715 (12.2)
5/8 (15.9)	11/16	2 1/2* (63.5)	1,890 (8.5)	1,335 (6.0)	2,185 (9.8)	1,630 (7.3)	2,475 (11.1)	1,925 (8.7)
		5* (127.0)	4,565 (20.5)	3,940 (17.7)	5,455 (24.5)	4,130 (18.6)	6,340 (28.5)	4,325 (19.5)
		7 1/2 (190.5)	6,990 (31.5)	3,940 (17.7)	7,580 (34.1)	4,280 (19.3)	8,165 (36.7)	4,615 (20.8)
3/4 (19.1)	13/16 or 7/8	3 3/8* (85.7)	2,375 (10.7)	2,205 (9.9)	2,995 (13.5)	3,010 (13.5)	3,615 (16.3)	3,815 (17.2)
		6 5/8* (168.3)	7,010 (31.5)	6,100 (27.5)	8,200 (36.9)	6,100 (27.5)	9,385 (42.2)	6,100 (27.5)
		10 (254.0)	10,835 (48.8)	6,100 (27.5)	11,070 (49.8)	6,100 (27.5)	11,300 (50.9)	6,100 (27.5)
7/8 (22.2)	15/16 or 1	3 3/4* (95.3)	3,165 (14.2)	2,830 (12.7)	3,890 (17.5)	3,860 (17.4)	4,615 (20.8)	4,890 (22.0)
		7 1/2* (190.5)	7,940 (35.7)	7,480 (33.7)	8,755 (39.4)	8,085 (36.4)	9,565 (43.0)	8,690 (39.1)
		11 1/4 (285.8)	9,900 (44.6)	8,605 (38.7)	11,650 (52.4)	8,790 (39.6)	13,395 (60.3)	8,970 (40.4)
1 (25.4)	1 1/16	4 1/8* (104.8)	3,835 (17.3)	3,090 (13.9)	4,655 (20.9)	3,990 (18.0)	5,475 (24.6)	4,890 (22.0)
		8 1/4* (209.6)	9,620 (43.3)	8,765 (39.4)	11,605 (52.2)	10,090 (45.4)	13,585 (61.1)	11,420 (51.4)
		12 3/8 (314.3)	12,160 (54.7)	11,420 (51.4)	14,605 (65.7)	11,420 (51.4)	17,050 (76.7)	11,420 (51.4)
1 1/4 (31.8)	1 3/8	6* (152.4)	5,335 (24.0)	6,405 (28.8)	6,010 (27.0)	7,640 (34.4)	6,680 (30.1)	8,875 (39.9)
		12* (304.8)	13,235 (59.6)	16,560 (74.5)	16,350 (73.6)	16,930 (76.2)	19,465 (87.6)	17,295 (77.8)
		15 (381.0)	16,605 (74.7)	17,300 (77.9)	19,935 (86.3)	17,935 (80.7)	23,260 (104.7)	18,565 (83.5)

Minimum Concrete Compressive Strength (f'_c)

1. Allowable bond capacities are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable bond capacities for intermediate embedments and compressive strengths.
3. Allowable design load should be the lesser of the bond or allowable steel strength.
4. Allowable loads for threaded rods to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load, with the exception of embedments designated with an asterisk (*) loaded in tension which may be increased by 20 percent for the duration of the load, where permitted by code.
5. Critical and minimum spacing and edge distances as well as reduction factors for intermediate spacing and edge distances are listed in the Design Criteria section.

ADHESIVES

PERFORMANCE DATA

Ultimate and Allowable Shear Bond Capacity Strength Based on Concrete Capacity for Threaded Rod Installed with AC100 Plus in Normal-Weight Concrete[1,2,3,4]

Rod Diameter d in. (mm)	Drill Bit Diameter d_{bit} in.	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
			2,000 psi (13.8 MPa)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)	
			Ultimate Shear lbs. (kN)	Allowable Shear lbs. (kN)	Ultimate Shear lbs. (kN)	Allowable Shear lbs. (kN)	Ultimate Shear lbs. (kN)	Allowable Shear lbs. (kN)
3/8 (9.5)	7/16	1 3/4 (44.5)	2,060 (9.3)	515 (2.3)	2,525 (11.4)	630 (2.8)	2,915 (13.1)	730 (3.3)
		3 1/2 (88.9)	6,490 (29.2)	1,625 (7.3)	7,950 (35.8)	1,990 (9.0)	9,180 (41.3)	2,295 (10.3)
		5 1/4 (133.4)	11,925 (53.7)	2,980 (13.4)	14,605 (65.7)	3,650 (16.4)	16,865 (75.9)	4,215 (19.0)
1/2 (12.7)	9/16	2 1/8 (54.0)	3,125 (14.1)	780 (3.5)	3,825 (17.2)	955 (4.3)	4,420 (19.9)	1,105 (5.0)
		4 1/4 (108.0)	10,030 (45.1)	2,510 (11.3)	12,285 (55.3)	3,070 (13.8)	14,185 (63.8)	3,545 (16.0)
		6 3/8 (161.9)	18,425 (82.9)	4,605 (20.7)	22,565 (101.5)	5,640 (25.4)	26,060 (117.3)	6,515 (29.3)
5/8 (15.9)	11/16	2 1/2 (63.5)	4,405 (19.8)	1,100 (5.0)	5,395 (24.3)	1,350 (6.1)	6,230 (28.0)	1,560 (7.0)
		5 (127.0)	14,310 (64.4)	3,580 (16.1)	17,525 (78.9)	4,380 (19.7)	20,235 (91.1)	5,060 (22.8)
		7 1/2 (190.5)	26,285 (118.3)	6,570 (29.6)	32,195 (144.9)	8,050 (36.2)	37,175 (167.3)	9,295 (41.8)
3/4 (19.1)	13/16 or 7/8	3 3/8 (85.7)	7,750 (34.9)	1,940 (8.7)	9,490 (42.7)	2,375 (10.7)	10,955 (49.3)	2,740 (12.3)
		6 5/8 (168.3)	23,905 (107.6)	5,975 (26.9)	29,280 (131.8)	7,320 (32.9)	33,810 (152.1)	8,455 (38.0)
		10 (254.0)	44,335 (199.5)	11,085 (49.9)	54,300 (244.4)	13,575 (61.1)	62,700 (282.2)	15,675 (70.5)
7/8 (22.2)	15/16 or 1	3 3/4 (95.3)	9,705 (43.7)	2,425 (10.9)	11,890 (53.5)	2,975 (13.4)	13,725 (61.8)	3,430 (15.4)
		7 1/2 (190.5)	31,105 (140.0)	7,775 (35.0)	38,095 (171.4)	9,525 (42.9)	43,985 (197.9)	10,995 (49.5)
		11 1/4 (285.8)	57,140 (257.1)	14,285 (64.3)	69,985 (314.9)	17,495 (78.7)	80,810 (363.6)	20,205 (90.9)
1 (25.4)	1 1/16	4 1/8 (104.8)	11,880 (53.5)	2,970 (13.4)	14,550 (65.5)	3,640 (16.4)	16,800 (75.6)	4,200 (18.9)
		8 1/4 (209.6)	38,360 (172.6)	9,590 (43.2)	46,985 (211.4)	11,745 (52.9)	54,250 (244.1)	13,565 (61.0)
		12 3/8 (314.3)	70,475 (317.1)	17,620 (79.3)	86,315 (388.4)	21,580 (97.1)	99,665 (448.5)	24,915 (112.1)
1 1/4 (31.8)	1 3/8	6 (152.4)	24,015 (108.1)	6,005 (27.0)	29,415 (132.4)	7,355 (33.1)	33,965 (152.8)	8,490 (38.2)
		12 (304.8)	75,240 (338.6)	18,810 (84.6)	92,150 (414.7)	23,040 (103.7)	106,405 (478.8)	26,600 (119.7)
		15 (381.0)	105,150 (473.2)	26,290 (118.3)	128,780 (579.5)	32,195 (144.9)	148,705 (669.2)	37,175 (167.3)

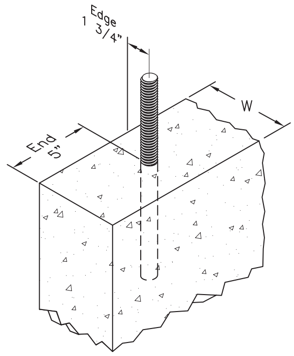
1. Linear interpolation may be used to determine ultimate load capacities for intermediate embedments and compressive strength.
2. Tabulated allowable concrete capacity loads have been calculated using the following equation (assumes Ø=0.75, c = $1.5h_v$, $l \leq 8d$ and an uncracked concrete condition in accordance with section D.6 of Appendix D of ACI 318-99): $V=[13\,(h_v/d)^{0.2}\,(d)^{0.5}\,(c)^{1.5}]/4$
   Where: V=Allowable shear load based on concrete capacity (pounds).
3. Allowable design load should be the lesser of the concrete capacity and allowable steel strength.
4. Allowable loads for reinforcing bars to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load.

PERFORMANCE DATA

Allowable Bond Strength Capacities for Threaded Rod Installed with AC100 Plus at 1-3/4" from Edge of Normal-Weight Concrete[1,2,3,4]

Rod Diameter d in. (mm)	Drill Bit Diameter d_{bit} in.	Minimum Embedment Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	Tension lbs. (kN)		Shear lbs.(kN)			
						Parallel to the Free Edge		Towards the Free Edge	
				2,000 psi (13.8 Mpa)	4,000 psi (27.6 Mpa)	2,000 psi (13.8 Mpa)	4,000 psi (27.6 Mpa)	2,000 psi (13.8 Mpa)	4,000 psi (27.6 Mpa)
3/8 (9.5)	7/16	3 1/2* (88.9)	1 3/4 (44.5)	1,520 (6.8)	1,975 (8.9)	960 (4.3)	960 (4.3)	–	–
1/2 (12.7)	9/16	4 1/4* (108.0)	1 3/4 (44.5)	2,025 (9.1)	2,740 (12.3)	1,300 (5.9)	1,690 (7.6)	495 (2.2)	520 (2.3)
		6 3/8 (161.9)		3,030 (13.6)	3,810 (17.1)				
		8 1/2 (215.9)		4,030 (18.1)	4,880 (22.0)				
5/8 (15.9)	11/16	5* (76.2)	1 3/4 (44.5)	2,285 (10.3)	3,545 (16.0)	1,700 (7.7)	2,780 (12.5)	495 (2.2)	685 (3.1)
		7 1/2 (190.5)		3,640 (16.4)	4,870 (21.9)				
		10 (254.0)		4,990 (22.5)	6,190 (27.9)				
7/8 (22.2)	15/16 or 1	7 1/2* (190.5)	1 3/4 (44.5)	4,030 (18.1)	5,120 (23.0)	1,915 (8.6)	3,625 (16.3)	815 (3.7)	910 (4.1)
		11 1/4 (285.8)		6,005 (27.0)	6,550 (29.5)				
		15 (381.0)		7,975 (35.9)	7,975 (35.9)				

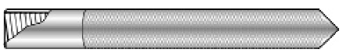
1. Allowable bond capacities are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable bond capacities for intermediate embedments and compressive strengths.
3. Allowable design load should be the lesser of the bond or allowable steel strength.
4. Allowable loads for threaded rods to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load with the exception of embedments designated with an asterisk (*) loaded in tension which may be increased by 20 percent for the duration of the load, where permitted by code.



Allowable Bond Strength Capacities for Threaded Rod Installed with AC100 Plus in Normal-Weight Concrete Stem Walls[1,2,3]

Rod Diameter d in. (mm)	Drill Bit Diameter d_{bit} in.	Min. Embed. Depth h_v in. (mm)	Min. Wall Width w in. (mm)	Min. Edge Dist. in. (mm)	Min. End Dist. in. (mm)	$f'_c \geq$ 2,500 psi (17.2 MPa) Tension lbs. (kN)
1/2 (12.7)	9/16	8 (203.2)	6 (152.4)	1 3/4 (44.5)	5 (127.0)	2,715 (12.2)
5/8 (15.9)	11/16	10 (254.0)	6 (152.4)	1 3/4 (44.5)	5 (127.0)	2,845 (12.8)
3/4 (19.1)	13/16 or 7/8	13 1/4 (336.6)	8 (203.2)	1 3/4 (44.5)	5 (127.0)	3,155 (14.2)
7/8 (22.2)	15/16 or 1	15 (381.0)	8 (203.2)	1 3/4 (44.5)	5 (127.0)	3,520 (15.8)

Ultimate and Allowable Bond Strength Capacities for Internally Threaded Steel Inserts Installed with AC100 Plus in Normal-Weight Concrete[1,2,3]



Internally Threaded Insert

Steel Insert Size d in. (mm)	Thread Depth in. (mm)	Outside Diameter in. (mm)	Drill Bit Dia. d_{bit} in.	Min. Embed. Depth h_v in. (mm)	$f'_c \geq$ 4,000 psi (27.6 MPa)			
					Ultimate		Allowable	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/2 (12.7)	1 5/8 (41.3)	21/32 (16.7)	3/4	4 1/4 (108.0)	10,692 (48.1)	8,480 (29.2)	2,673 (12.0)	2,209 (9.9)
5/8 (15.9)	2 3/8 (60.3)	29/32 (23.0)	1	5 (127.0)	13,054 (58.7)	17,120 (50.0)	3,264 (14.7)	4,497 (20.2)
3/4 (19.1)	2 3/4 (69.9)	1 (25.4)	1 1/8	6 5/8 (168.3)	37,550 (169.0)	28,650 (79.4)	9,388 (42.2)	7,072 (31.8)

1. Allowable bond capacities are calculated using an applied safety factor of 4.0.
2. Allowable design load should be the lesser of the bond or allowable steel strength.
3. Allowable loads for threaded rods to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load, where permitted by code.

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PERFORMANCE DATA

Ultimate and Allowable Tension Bond Strength Capacities for Reinforcing Bar Installed with AC100 Plus in Normal-Weight Concrete[1,2,3,4,5]

Bar Size No.	Drill Bit Diameter d_{bit} in.	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c): 2,000 psi (13.8 MPa) Ultimate Tension lbs. (kN)	2,000 psi (13.8 MPa) Allowable Tension lbs. (kN)	3,000 psi (20.7 MPa) Ultimate Tension lbs. (kN)	3,000 psi (20.7 MPa) Allowable Tension lbs. (kN)	4,000 psi (27.6 MPa) Ultimate Tension lbs. (kN)	4,000 psi (27.6 MPa) Allowable Tension lbs. (kN)
No. 3 (3/8")	7/16	1 5/8 (41.3)	2,900 (13.1)	725 (3.3)	3,740 (16.8)	935 (4.2)	4,560 (20.5)	1,140 (5.1)
		3 3/8 (85.7)	6,720 (30.2)	1,680 (7.6)	7,060 (31.8)	1,765 (7.9)	7,400 (33.3)	1,850 (8.3)
		5 5/8 (142.9)	7,400 (33.3)	1,850 (8.3)	7,400 (33.3)	1,850 (8.3)	7,400 (33.3)	1,850 (8.3)
No. 4 (1/2")	9/16	2 1/4 (57.2)	5,280 (23.8)	1,320 (5.9)	6,200 (27.9)	1,550 (7.0)	7,100 (32.0)	1,775 (8.0)
		4 1/2 (114.3)	15,120 (68.0)	3,780 (17.0)	16,260 (73.2)	4,065 (18.3)	17,420 (78.4)	4,355 (19.6)
		7 1/2 (190.5)	18,020 (81.1)	4,505 (20.3)	18,020 (81.1)	4,505 (20.3)	18,020 (81.1)	4,505 (20.3)
No. 5 (5/8")	11/16	2 3/4 (69.9)	7,740 (34.8)	1,935 (8.7)	9,540 (42.9)	2,385 (10.7)	11,340 (51.0)	2,835 (12.8)
		5 5/8 (142.9)	19,980 (89.9)	4,995 (22.5)	24,260 (109.2)	6,065 (27.3)	28,560 (128.5)	7,140 (32.1)
		9 3/8 (238.1)	28,260 (127.2)	7,065 (31.8)	29,560 (133.0)	7,390 (33.3)	30,880 (139.0)	7,720 (34.7)
No. 6 (3/4")	7/8	3 3/8 (85.7)	11,520 (51.8)	2,880 (13.0)	14,800 (66.6)	3,700 (16.7)	18,060 (81.3)	4,515 (20.3)
		6 3/4 (171.5)	28,440 (128.0)	7,110 (32.0)	34,520 (155.3)	8,630 (38.8)	40,600 (182.7)	10,150 (45.7)
		11 1/4 (285.8)	39,880 (179.5)	9,970 (44.9)	42,340 (190.5)	10,585 (47.6)	44,780 (201.5)	11,195 (50.4)
No. 7 (7/8")	1	3 7/8 (98.4)	11,840 (53.3)	2,960 (13.3)	15,940 (71.7)	3,985 (17.9)	20,040 (90.2)	5,010 (22.5)
		7 7/8 (200.0)	26,940 (121.2)	6,735 (30.3)	36,580 (164.6)	9,145 (41.2)	46,200 (207.9)	11,550 (52.0)
		13 1/8 (333.4)	53,080 (238.9)	13,270 (59.7)	57,820 (260.2)	14,455 (65.0)	62,560 (281.5)	15,640 (70.4)
No. 8 (1")	1 1/8	4 1/2 (114.3)	18,240 (82.1)	4,560 (20.5)	21,980 (98.9)	5,495 (24.7)	25,720 (115.7)	6,430 (28.9)
		9 (228.6)	35,240 (158.6)	8,810 (39.6)	42,040 (189.2)	10,510 (47.3)	48,860 (219.9)	12,215 (55.0)
		15 (381.0)	54,620 (245.8)	13,655 (61.4)	59,980 (269.9)	14,995 (67.5)	65,320 (293.9)	16,330 (73.5)
No. 9 (1 1/8")	1 1/4	5 (127.0)	14,660 (66.0)	3,665 (16.5)	18,960 (85.3)	4,740 (21.3)	23,260 (104.7)	5,815 (26.2)
		10 1/8 (257.2)	38,600 (173.7)	9,650 (43.4)	51,920 (233.6)	12,980 (58.4)	65,260 (293.7)	16,315 (73.4)
		16 7/8 (428.6)	84,500 (380.3)	21,125 (95.1)	87,040 (391.7)	21,760 (97.9)	89,580 (403.1)	22,395 (100.8)
No. 10 (1 1/4")	1 1/2	5 5/8 (142.9)	22,160 (99.7)	5,540 (24.9)	27,600 (124.2)	6,900 (31.1)	33,040 (148.7)	8,260 (37.2)
		11 1/4 (285.8)	47,600 (214.2)	11,900 (53.6)	59,940 (269.7)	14,985 (67.4)	72,300 (325.4)	18,075 (81.3)
		18 1/2 (469.9)	76,900 (346.1)	19,225 (86.5)	82,140 (369.6)	20,535 (92.4)	87,400 (393.3)	21,850 (98.3)
No. 11 (1 3/8")	1 5/8	6 1/8 (155.6)	25,960 (116.8)	6,490 (29.2)	35,060 (157.8)	8,765 (39.4)	44,180 (198.8)	11,045 (49.7)
		12 3/8 (314.3)	60,120 (270.5)	15,030 (67.6)	76,640 (344.9)	19,160 (86.2)	93,180 (419.3)	23,295 (104.8)
		19 1/4 (489.0)	104,600 (470.7)	26,150 (117.7)	115,500 (519.8)	28,875 (129.9)	126,420 (568.9)	31,605 (142.2)

1. Allowable tension capacities were calculated using a safety factor of 4.0.
2. Linear interpolation may be used to determine bond capacities for intermediate embedments and compressive strengths.
3. Allowable design load should be the lesser of the bond or allowable steel strength.
4. Allowable loads for reinforcing bars to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load, where permitted by code.
5. Critical and minimum spacing and edge distances as well as reduction factors for intermediate spacing and edge distances are listed in the Design Criteria section.

PERFORMANCE DATA

Ultimate and Allowable Shear Load Capacities Based on Bond Strength for Reinforcing Bar Installed with AC100 Plus in Normal-Weight Concrete[1,2,3,4,5]

Bar Size No.	Drill Bit Diameter d_{bit} in.	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c) — Shear Loads Based on Bond Strength, lbs. (kN) — **2,000 psi** (13.8 MPa) Ultimate Shear lbs. (kN)	2,000 psi Allowable Shear lbs. (kN)	**3,000 psi** (20.7 MPa) Ultimate Shear lbs. (kN)	3,000 psi Allowable Shear lbs. (kN)	**4,000 psi** (27.6 MPa) Ultimate Shear lbs. (kN)	4,000 psi Allowable Shear lbs. (kN)
No. 3 (3/8")	7/16	3 3/8 (85.7)	5,360 (24.1)	1,340 (6.0)	5,360 (24.1)	1,340 (6.0)	5,360 (24.1)	1,340 (6.0)
No. 4 (1/2")	9/16	4 1/2 (114.3)	7,020 (31.6)	1,755 (7.9)	8,860 (39.9)	2,215 (10.0)	10,700 (48.2)	2,675 (12.0)
No. 5 (5/8")	11/16	5 5/8 (142.9)	14,000 (63.0)	3,500 (15.8)	16,220 (73.0)	4,055 (18.2)	18,440 (83.0)	4,610 (20.7)
No. 6 (3/4")	7/8	6 3/4 (171.5)	23,040 (103.7)	5,760 (25.9)	25,600 (115.2)	6,400 (28.8)	28,160 (126.7)	7,040 (31.7)
No. 7 (7/8")	1	7 7/8 (200.0)	32,920 (148.1)	8,230 (37.0)	32,920 (148.1)	8,230 (37.0)	32,920 (148.1)	8,230 (37.0)
No. 8 (1")	1 1/8	9 (228.6)	35,040 (157.7)	8,760 (39.4)	37,380 (168.2)	9,345 (42.1)	39,700 (178.7)	9,925 (44.7)
No. 9 (1 1/8")	1 1/4	10 1/8 (257.2)	37,180 (167.3)	9,295 (41.8)	49,180 (221.3)	12,295 (55.3)	61,180 (275.3)	15,295 (68.8)
No. 10 (1 1/4")	1 1/2	11 1/4 (285.8)	64,060 (288.3)	16,015 (72.1)	65,880 (296.5)	16,470 (74.1)	67,680 (304.6)	16,920 (76.1)

1. Allowable shear capacities were calculated using a safety factor of 4.0.
2. Linear interpolation may be used to determine bond capacities for intermediate compressive strengths.
3. Allowable design load should be the lesser of the bond and allowable steel strength.
4. Allowable loads for reinforcing bars to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load, where permitted by code.
5. Critical and minimum spacing and edge distances as well as reduction factors for intermediate spacing and edge distances are listed in the Design Criteria section.

Ultimate and Allowable Shear Load Capacities Based on Concrete Capacity for Reinforcing Bar Installed with AC100 Plus in Normal-Weight Concrete[1,2,3]

Bar Size No.	Drill Bit Diameter d_{bit} in.	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c) — Shear Loads Based on Concrete Capacity, lbs. (kN) — **2,000 psi** (13.8 MPa) Ultimate Shear lbs. (kN)	2,000 psi Allowable Shear lbs. (kN)	**3,000 psi** (20.7 MPa) Ultimate Shear lbs. (kN)	3,000 psi Allowable Shear lbs. (kN)	**4,000 psi** (27.6 MPa) Ultimate Shear lbs. (kN)	4,000 psi Allowable Shear lbs. (kN)
No. 3 (3/8")	7/16	3 3/8 (85.7)	6,145 (27.7)	1,535 (6.9)	7,530 (33.9)	1,885 (8.5)	8,695 (39.1)	2,175 (9.8)
No. 4 (1/2")	9/16	4 1/2 (114.3)	10,925 (49.2)	2,730 (12.3)	13,385 (60.2)	3,345 (15.1)	15,455 (69.5)	3,865 (17.4)
No. 5 (5/8")	11/16	5 5/8 (142.9)	17,075 (76.8)	4,270 (19.2)	20,910 (94.1)	5,230 (23.5)	24,145 (108.7)	6,035 (27.2)
No. 6 (3/4")	7/8	6 3/4 (171.5)	24,585 (110.6)	6,145 (27.7)	30,110 (135.5)	7,530 (33.9)	34,770 (156.5)	8,695 (39.1)
No. 7 (7/8")	1	7 7/8 (200.0)	33,465 (150.6)	8,365 (37.6)	40,985 (184.4)	10,245 (46.1)	47,325 (213.0)	11,830 (53.2)
No. 8 (1")	1 1/8	9 (228.6)	43,710 (196.7)	10,930 (49.2)	53,535 (240.9)	13,385 (60.2)	61,815 (278.2)	15,455 (69.5)
No. 9 (1 1/8")	1 1/4	10 1/8 (257.2)	55,320 (248.9)	13,830 (62.2)	67,755 (304.9)	16,940 (76.2)	78,235 (352.1)	19,560 (88.0)
No. 10 (1 1/4")	1 1/2	11 1/4 (285.8)	68,295 (307.3)	17,075 (76.8)	83,645 (376.4)	20,910 (94.1)	96,585 (434.6)	24,145 (108.7)

1. Linear interpolation may be used to determine ultimate capacities for intermediate embedments and compressive strengths.
2. Tabulated ultimate concrete capacity loads have been calculated using the following equation (assumes $0=0.75$, $c = 1.5h_V$, $l \leq 8d$ and an uncracked concrete condition in accordance with section D.6 of Appendix D of ACI 318-99): $V=13\,(h_V/d)^{0.2}\,(d)^{0.5}\,(c)^{1.5}$
   Where: V=Allowable shear load based on concrete capacity (pounds).
3. Allowable design load should be the lesser of the concrete capacity and allowable steel strength.
4. Allowable loads for reinforcing bars to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load.

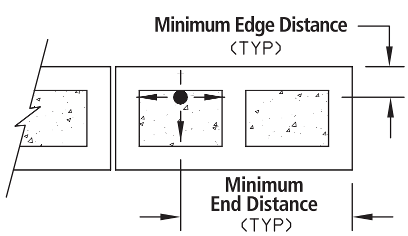
ADHESIVES

PERFORMANCE DATA

Ultimate and Allowable Bond Strength Capacities for Threaded Rod Installed with AC100 Plus in Structural Lightweight Concrete[1,2,3,4,5]

Rod Diameter d in. (mm)	Drill Bit Diameter d_{bit} in.	Minimum Embed. Depth h_v in. (mm)	Critical Spacing Distance s_{cr} in. (mm)	Minimum Spacing Distance s_{min} in. (mm)	Critical Edge Distance c_{cr} in. (mm)	Minimum Edge Distance c_{min} in. (mm)	$f'_c \geq$ 3,000 psi (20.7 MPa) Ultimate Load Tension lbs. (kN)	Ultimate Load Shear lbs. (kN)	Allowable Load Tension lbs. (kN)	Allowable Load Shear lbs. (kN)
3/8 (9.5)	7/16	1 3/4 (44.5)	4 1/8 (104.8)	1 (25.4)	2 5/8 (66.7)	1 (25.4)	2,640 (11.9)	2,400 (10.8)	660 (3.0)	600 (2.7)
		3 1/2 (88.9)	8 1/4 (209.6)	2 (50.8)	5 1/4 (133.4)	2 (50.8)	4,360 (19.6)	5,470 (24.6)	1,090 (4.9)	1,370 (6.2)
1/2 (12.7)	5/8	2 1/8 (54.0)	5 (127.0)	1 1/4 (31.8)	3 1/8 (79.4)	1 1/4 (31.8)	2,790 (12.6)	3,260 (14.7)	700 (3.2)	815 (3.7)
		4 1/4 (108.0)	10 (254.0)	2 1/2 (63.5)	6 3/8 (161.9)	2 1/2 (63.5)	5,330 (24.0)	9,780 (44.0)	1,330 (6.0)	2,445 (11.0)
5/8 (15.9)	3/4	2 1/2 (63.5)	5 7/8 (149.2)	1 1/2 (38.1)	3 3/4 (95.3)	1 1/2 (38.1)	3,000 (13.5)	3,890 (17.5)	750 (3.4)	975 (4.4)
		5 (127.0)	11 3/4 (298.5)	3 (76.2)	7 1/2 (190.5)	3 (76.2)	5,830 (26.2)	13,070 (58.8)	1,460 (6.6)	3,270 (14.7)

1. The values listed above are ultimate and allowable bond capacities for the anchors installed in sand-lightweight Concrete.
2. Allowable bond capacities are calculated using an applied safety factor of 4.0.
3. Linear interpolation may be used to determine allowable bond capacities for intermediate embedments.
4. Allowable tension and shear loads for anchors installed at minimum anchor spacing, s_{min}, and minimum edge distance, c_{min}, shall be derived using the load reduction factors shown in the Design Criteria section. Linear interpolation for allowable loads for anchors loaded in tension and shear are permitted to be used for spacing between s_{cr} and s_{min} and edge distances between c_{cr} and c_{min}.
5. Allowable design load should be the lesser of the bond or allowable steel strength.



Top of Wall

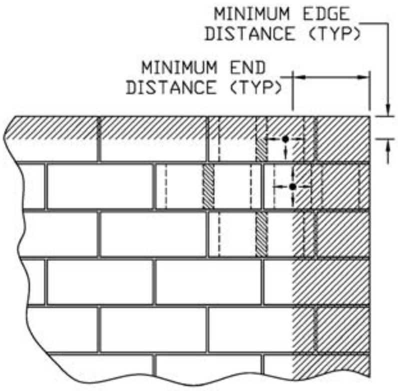
Allowable Bond Strength Capacities for Threaded Rod Installed with AC100 Plus in Grout-Filled Concrete Masonry[1,2,3,4,5]

Anchor Installed In Cell Opening (Top of Wall) For Sill Plates And Other Attachments							
Anchor Dia. d in. (mm)	Drill Bit Diameter d_{bit} in.	Min. Embed. Depth h_v in. (mm)	Min. Edge Distance in. (mm)	Min. End Distance in. (mm)	Tension lbs. (kN)	Shear lbs. (kN) Towards the Edge	Shear lbs. (kN) Parallel to the Edge
5/8 (15.9)	3/4	5 (127.0)	1 3/4 (44.5)	10 3/4 (273.1)	1,055 (4.7)	310 (1.4)	800 (3.6)

1. Tabulated load values are for anchors installed in minimum Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90 that have reached the minimum designated ultimate compressive strength at the time of installation ($f'm \geq$ 1,500 psi).
2. Allowable bond capacities are calculated using an applied safety factor of 5.0.
3. Allowable design load should be the lesser of the bond or allowable steel strength.
4. Allowable loads for threaded rods to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load, where permitted by code.
5. The critical spacing distance shall be 16 anchor diameters and the minimum spacing distance shall be 8 anchor diameters at which a reduction factor of 50 percent should be applied. Linear interpolation may be used to determine allowable load capacities for intermediate spacing distances.

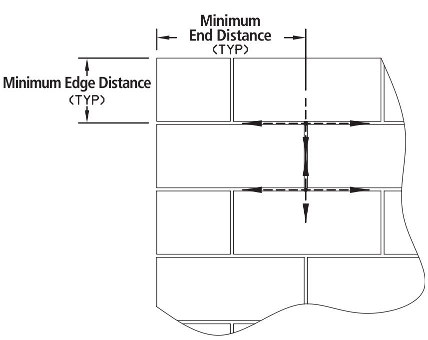
PERFORMANCE DATA

Allowable Bond Strength Capacities for Threaded Rod Installed with AC100 Plus in Grout-Filled Concrete Masonry[1,2,3,4,5,6]



Face Shell
(Grouted Cell & Web)
Permissible Anchor Locations
(Unshaded Area)

Anchor Installed Through Face Shell						
Rod Diameter d in. (mm)	Drill Bit Diameter d_{bit} in.	Minimum Embed. Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)
3/8 (9.5)	7/16	3 1/2 (88.9)	3 3/4 (95.3)	8 (203.2)	590 (2.7)	–
			12 (304.8)	8 (203.2)	705 (3.2)	–
			3 3/4 (95.3)	12 (304.8)	590 (2.7)	895 (4.0)
			12 (304.8)	12 (304.8)	705 (3.2)	945 (4.3)
1/2 (12.7)	9/16	4 1/4 (108.0)	3 3/4 (95.3)	8 (203.2)	785 (3.5)	–
			12 (304.8)	8 (203.2)	880 (4.0)	–
			3 3/4 (95.3)	12 (304.8)	785 (3.5)	1,255 (5.6)
			12 (304.8)	12 (304.8)	880 (4.0)	1,380 (6.2)
5/8 (15.9)	11/16 or 3/4	5 (127.0)	3 3/4 (95.3)	8 (203.2)	675 (3.0)	–
			12 (304.8)	8 (203.2)	1,040 (4.7)	–
			3 3/4 (95.3)	12 (304.8)	675 (3.0)	1,415 (6.4)
			12 (304.8)	12 (304.8)	1,040 (4.7)	2,015 (9.1)



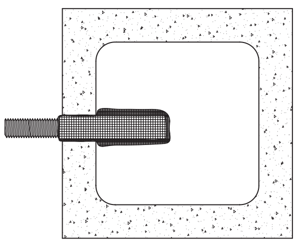
T-Joints
Permissible Anchor Locations

Anchor Installed In Joint						
Anchor Diameter d in. (mm)	Drill Bit Diameter d_{bit} in.	Minimum Embed. Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)
3/8 (9.5)	7/16	3 1/2 (88.9)	8 (203.2)	8 (203.2)	890 (4.0)	–
			16 (406.4)	8 (203.2)	890 (4.0)	1,020 (4.6)
1/2 (12.7)	9/16	4 1/4 (108.0)	8 (203.2)	8 (203.2)	730 (3.3)	–
			16 (406.4)	8 (203.2)	730 (3.3)	1,465 (6.6)
5/8 (15.9)	11/16 or 3/4	5 (127.0)	8 (203.2)	8 (203.2)	1,310 (5.9)	–
			16 (406.4)	8 (203.2)	1,310 (5.9)	1,940 (8.7)

1. Tabulated load values are for anchors installed in minimum Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90 that have reached the minimum designated ultimate compressive strength at the time of installation ($f'm \geq 1{,}500$ psi).
2. Allowable bond capacities are calculated using an applied safety factor of 5.0.
3. Allowable design load should be the lesser of the bond or allowable steel strength.
4. Allowable loads for threaded rods to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load, where permitted by code.
5. The critical spacing distance shall be 16 anchor diameters and the minimum spacing distance shall be 8 anchor diameters at which a reduction factor of 50 percent should be applied. Linear interpolation may be used to determine allowable load capacities for intermediate spacing distances.
6. Allowable tension load values for 5/8-inch diameter anchors installed into the face shell or joint may be increased by 20 percent if an 11/16-inch diameter drill bit is used for installation.

PERFORMANCE DATA

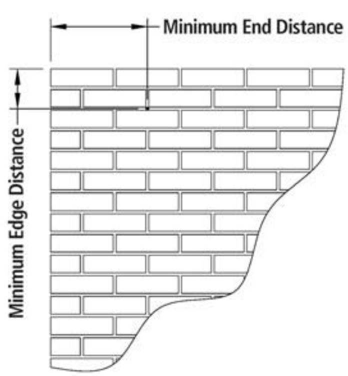
Allowable Bond Strength Capacities for Threaded Rod Installed with AC100 Plus in Hollow Concrete Masonry[1,2,3,4]



Rod Dia. d in. (mm)	Drill Bit Dia. d_{bit} in.	Min. Embed. Depth h_v in. (mm)	Min. Edge Distance in. (mm)	Min. End Distance in. (mm)	Lightweight & medium-weight CMU		Normal-Weight CMU	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/8 (9.5)	1/2	3 1/2 (88.9)	3 3/4 (95.3)	3 3/4 (95.3)	–	–	470 (2.1)	685 (3.1)
1/2 (12.7)	5/8	3 1/2 (88.9)	3 3/4 (95.3)	3 3/4 (95.3)	145 (0.7)	315 (1.4)	570 (2.6)	835 (3.8)
5/8 (15.9)	3/4	3 1/2 (88.9)	3 3/4 (95.3)	3 3/4 (95.3)	130 (0.6)	385 (1.7)	–	–
		4 1/2 (114.3)	3 3/4 (95.3)	3 3/4 (95.3)	–	–	665 (3.0)	1,035 (4.7)
3/4 (19.1)	7/8	6 (152.4)	4 (101.6)	4 (101.6)	–	–	810 (3.6)	1,295 (5.8)

1. Tabulated load values are for anchors installed in minimum Type II, Grade N, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90.
2. Allowable bond capacities are calculated using an applied safety factor of 5.0.
3. Allowable design load should be the lesser of the bond or allowable steel strength.
4. Minimum anchor spacing is limited to 1 anchor per cell.

Allowable Bond Strength Capacities for Threaded Rod Installed with AC100 Plus in Brick Masonry[1,2,3]



Rod Dia. d in. (mm)	Drill Bit Dia. d_{bit} in.	Min. Embed. Depth h_v in. (mm)	Minimum Edge and End Distance h_v in.	Min. Spacing Distance h_v in.	Brick Masonry $f'_m \geq$ 1,300 psi (9.0 MPa)	
					Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	3/8	3 (76.2)	1 Brick or 8 inches	4" Any Direction	825 (3.7)	375 (1.7)
		6 (152.4)			825 (3.7)	480 (2.2)
3/8 (9.5)	1/2	3 1/2 (88.9)	1 Brick or 8 inches	6" Any Direction	1,420 (6.4)	1,080 (4.9)
		6 (152.4)			2,155 (9.7)	1,080 (4.9)
		8 (203.2)			2,355 (10.6)	1,080 (4.9)
1/2 (12.7)	5/8	3 1/2 (88.9)	2 Bricks or 16 inches	8" Any Direction	1,750 (7.9)	1,370 (6.2)
		6 (152.4)			2,270 (10.2)	1,370 (6.2)
		8 (203.2)			3,635 (16.4)	1,800 (8.1)
5/8 (15.9)	3/4	4 1/2 (114.3)	2 Bricks or 16 inches	10" Any Direction	1,870 (8.4)	1,970 (8.9)
		6 (152.4)			2,675 (12.0)	1,970 (8.9)
3/4 (19.1)	7/8	4 1/2 (114.3)	2 Bricks or 16 inches	12" Any Direction	3,410 (15.3)	3,590 (16.2)
		6 (152.4)			4,040 (18.2)	3,590 (16.2)

1. Tabulated load values are for anchors installed in Grade SW multiple wythe, solid brick masonry conforming to ASTM C62.
2. Allowable bond capacities are calculated using an applied safety factor of 5.0.
3. Linear interpolation may be used to determine allowable bond capacities for intermediate embedments.

DESIGN CRITERIA

Combined Loading

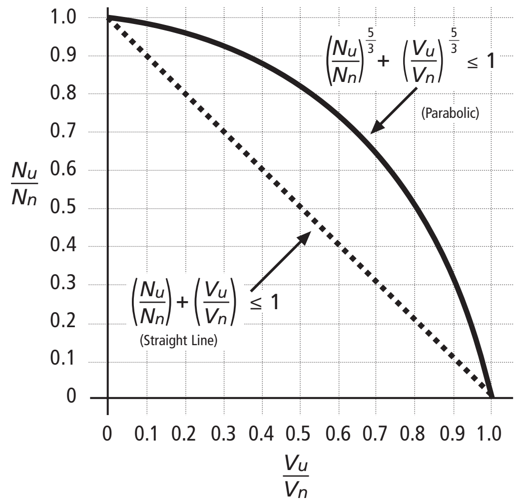
For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n}\right)^{\frac{5}{3}} + \left(\frac{V_u}{V_n}\right)^{\frac{5}{3}} \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

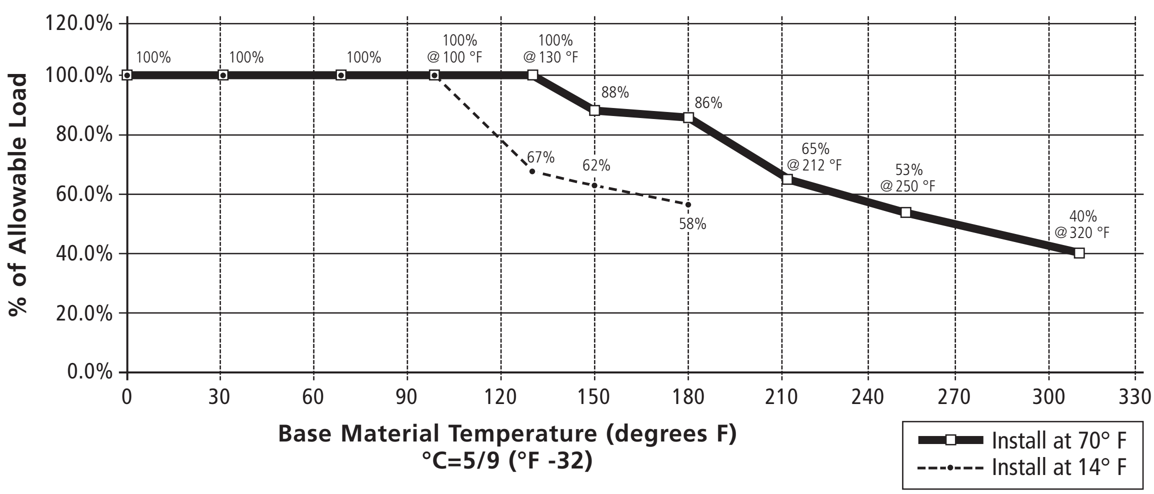
Load combinations may be analyzed more conservatively with the following proportion:

$$\left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$



In-Service Temperature

Allowable tension and shear load bond strength reduction based on in-service temperature for the AC100 Plus anchoring adhesive.



Load Adjustment Factors for Spacing and Edge Distance Using AC100 Plus Adhesive with Threaded Rod and Reinforcing Bar[1,2,3]

Anchor Installed in Normal-weight concrete					
Anchor Dimension	**Load Type**	**Critical Distance (Full Anchor Capacity)**	**Critical Load Factor**	**Minimum Distance (Reduced Capacity)**	**Minimum Load Factor**
Spacing (s)	Tension and Shear	$s_{cr} = 2.0 \times h_v$	$F_N = F_V = 1.0$	s_{min} $(0.25 \times s_{cr}) = 0.50 \times h_v$	$F_N = F_V = 0.70$
Edge Distance (c)	Tension	$c_{cr} = 1.5 \times h_v$	$F_N = 1.0$	c_{min} $(0.33 \times c_{cr}) = 0.50 \times h_v$	$F_N = 0.60$
	Shear Towards Edge	$c_{cr} = 1.5 \times h_v$	$F_V = 1.0$	c_{min} $(0.33 \times c_{cr}) = 0.50 \times h_v$	$F_V = 0.20$
	Shear Parallel Edge[1]	$c_{cr} = 1.5 \times h_v$	$F_V = 1.0$	c_{min} $(0.33 \times c_{cr}) = 0.50 \times h_v$	$F_V = 0.75$
	Shear Parallel Edge[2]	$c_{cr} = 1.5 \times h_v$	$F_V = 1.0$	c_{min} $(0.33 \times c_{cr}) = 0.50 \times h_v$	$F_V = 0.55$

1. Applicable to diameters less than or equal to 3/4" (d ≤ 3/4").
2. Applicable to diameters greater than 3/4" (d > 3/4").
3. Minimum load factors are also applicable to structural lightweight concrete.

ADHESIVES

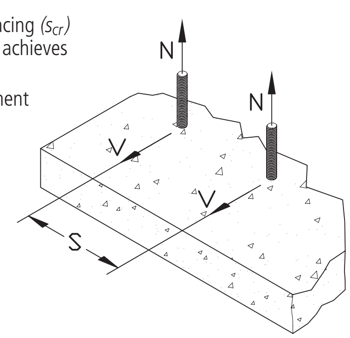
DESIGN CRITERIA

Load Adjustment Factors for Threaded Rod in Normal-Weight Concrete

Spacing, Tension (F_N) & Shear (F_V)																					
Dia. (in.)	3/8			1/2			5/8			3/4			7/8			1			1 1/4		
h_v (in.)	1 3/4	3 1/2	5 1/4	2 1/8	4 1/4	7 1/2	2 1/2	5	6 5/8	3 3/8	6 5/8	10	3 3/4	7 1/2	11 1/4	4 1/8	8 1/4	12 3/8	6	12	15
s_{cr} (in.)	3 1/2	7	10 1/2	4 1/4	8 1/2	15	5	10	13 1/4	6 3/4	13 1/4	20	7 1/2	15	22 1/2	8 1/4	16 1/2	24 3/4	12	24	30
s_{min} (in.)	7/8	1 3/4	2 5/8	1	2 1/8	3 3/4	1 1/4	2 1/2	3 3/8	1 3/4	3 3/8	5	1 7/8	3 3/4	5 5/8	2 1/8	4 1/8	6 1/4	3	6	7 1/2
Spacing, s (inches) 7/8	0.70																				
1	0.71			0.70																	
1 1/4	0.74			0.72			0.70														
1 3/4	0.80	0.70		0.77			0.74			0.70											
1 7/8	0.81	0.71		0.78			0.75			0.71			0.70								
2	0.83	0.71		0.79			0.76			0.72			0.71								
2 1/8	0.84	0.72		0.80	0.70		0.77			0.73			0.71			0.70					
2 1/2	0.89	0.74		0.84	0.72		0.80	0.70		0.75			0.73			0.72					
2 5/8	0.90	0.75	0.70	0.85	0.72		0.81	0.71		0.76			0.74			0.73					
3	0.94	0.77	0.71	0.88	0.74		0.84	0.72		0.78			0.76			0.75			0.70		
3 3/8	0.99	0.79	0.73	0.92	0.76		0.87	0.74	0.70	0.80	0.70		0.78			0.76			0.71		
3 1/2	1.00	0.80	0.73	0.93	0.76		0.88	0.74	0.71	0.81	0.71		0.79			0.77			0.72		
3 3/4		0.81	0.74	0.95	0.78	0.70	0.90	0.75	0.71	0.82	0.71		0.80	0.70		0.78			0.73		
4 1/8		0.84	0.76	0.99	0.79	0.71	0.93	0.77	0.72	0.84	0.72		0.82	0.71		0.80	0.70		0.74		
4 1/4		0.84	0.76	1.00	0.80	0.71	0.94	0.77	0.73	0.85	0.73		0.83	0.71		0.81	0.70		0.74		
5		0.89	0.79		0.84	0.73	1.00	0.80	0.75	0.90	0.75	0.70	0.87	0.73		0.84	0.72		0.77		
5 5/8		0.92	0.81		0.86	0.75		0.83	0.77	0.93	0.77	0.71	0.90	0.75	0.70	0.87	0.74		0.79		
6		0.94	0.83		0.88	0.76		0.84	0.78	0.96	0.78	0.72	0.92	0.76	0.71	0.89	0.75		0.80	0.70	
6 1/4		0.96	0.84		0.89	0.77		0.85	0.79	0.97	0.79	0.73	0.93	0.77	0.71	0.90	0.75	0.70	0.81	0.70	
6 3/4		0.99	0.86		0.92	0.78		0.87	0.80	1.00	0.80	0.74	0.96	0.78	0.72	0.93	0.76	0.71	0.83	0.71	
7		1.00	0.87		0.93	0.79		0.88	0.81		0.81	0.74	0.97	0.79	0.72	0.94	0.77	0.71	0.83	0.72	
7 1/2			0.89		0.95	0.80		0.90	0.83		0.83	0.75	1.00	0.80	0.73	0.96	0.78	0.72	0.85	0.73	0.70
8 1/4			0.91		0.99	0.82		0.93	0.85		0.85	0.77		0.82	0.75	1.00	0.80	0.73	0.88	0.74	0.71
8 1/2			0.92		1.00	0.83		0.94	0.86		0.86	0.77		0.83	0.75		0.81	0.74	0.88	0.74	0.71
10			0.98			0.87		1.00	0.90		0.90	0.80		0.87	0.78		0.84	0.76	0.93	0.77	0.73
10 1/2			1.00			0.88			0.92		0.92	0.81		0.88	0.79		0.85	0.77	0.95	0.78	0.74
12						0.92			0.96		0.96	0.84		0.92	0.81		0.89	0.79	1.00	0.80	0.76
13 1/4						0.95			1.00		1.00	0.87		0.95	0.84		0.92	0.81		0.82	0.78
15						1.00						0.90		1.00	0.87		0.96	0.84		0.85	0.80
16 1/2												0.93			0.89		1.00	0.87		0.88	0.82
20												1.00			0.96			0.92		0.93	0.87
22 1/2															1.00			0.96		0.98	0.90
24																		0.99		1.00	0.92
24 3/4																		1.00			0.93
30																					1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 2 times the embedment ($2h_v$) at which the anchor achieves 100% of load.

Minimum spacing (s_{min}) is equal to one-half times the embedment ($0.5h_v$) at which the anchor achieves 70% of load.



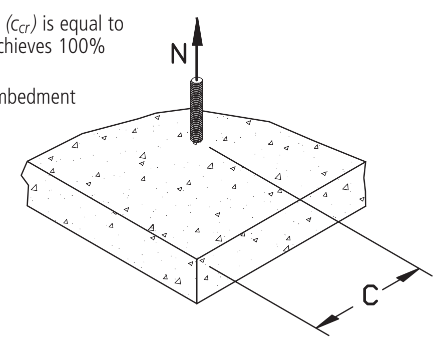
DESIGN CRITERIA

Load Adjustment Factors for Threaded Rod in Normal-Weight Concrete

Edge Distance, Tension (F_N)																					
Dia. (in.)	3/8			1/2			5/8			3/4			7/8			1			1 1/4		
h_v (in.)	1 3/4	3 1/2	5 1/4	2 1/8	4 1/4	6 3/8	2 1/2	5	7 1/2	3 3/8	6 5/8	10	3 3/4	7 1/2	11 1/4	4 1/8	8 1/4	12 3/8	6	12	15
c_{cr} (in.)	2 5/8	5 1/4	7 7/8	3 1/4	6 3/8	9 1/2	3 3/4	7 1/2	11	5	10	15	5 5/8	11 1/4	16 7/8	6 1/4	12 3/8	18 5/8	9	18	22 1/2
c_{min} (in.)	7/8	1 3/4	2 5/8	1	2 1/8	3 1/4	1 1/4	2 1/2	3 3/4	1 3/4	3 1/4	5	1 7/8	3 3/4	5 5/8	2	4	6 1/4	3	6	7 1/2
Edge, c (inches): 7/8	0.60																				
1	0.63			0.60																	
1 1/4	0.69			0.64			0.60														
1 3/4	0.80	0.60		0.73			0.68			0.60											
1 7/8	0.83	0.61		0.75			0.70			0.62			0.60								
2	0.86	0.63		0.78			0.72			0.64			0.61			0.60					
2 1/8	0.89	0.64		0.80	0.60		0.74			0.65			0.63			0.61					
2 1/2	0.97	0.69		0.87	0.64		0.80	0.60		0.70			0.67			0.64					
2 5/8	1.00	0.70	0.60	0.89	0.65		0.82	0.61		0.71			0.68			0.65					
3		0.74	0.63	0.96	0.68		0.88	0.64		0.76			0.72			0.69			0.60		
3 1/4		0.77	0.65	1.00	0.71	0.60	0.92	0.66		0.79	0.60		0.75			0.72			0.62		
3 3/4		0.83	0.69		0.75	0.64	1.00	0.70	0.60	0.84	0.63		0.80	0.60		0.76			0.65		
4		0.86	0.70		0.78	0.65		0.72	0.61	0.87	0.64		0.83	0.61		0.79	0.60		0.67		
5		0.97	0.78		0.87	0.71		0.80	0.67	1.00	0.70	0.60	0.93	0.67		0.88	0.64		0.73		
5 1/4		1.00	0.80		0.89	0.73		0.82	0.68		0.72	0.61	0.96	0.68		0.91	0.65		0.75		
5 5/8			0.83		0.93	0.75		0.85	0.70		0.74	0.63	1.00	0.70	0.60	0.95	0.67		0.78		
6			0.86		0.96	0.78		0.88	0.72		0.76	0.64		0.72	0.61	0.98	0.69		0.80	0.60	
6 1/4			0.88		0.99	0.79		0.90	0.73		0.78	0.65		0.73	0.62	1.00	0.70	0.60	0.82	0.61	
6 3/8			0.89		1.00	0.80		0.91	0.74		0.78	0.66		0.74	0.63		0.71	0.61	0.83	0.61	
7 1/2			0.97			0.87		1.00	0.80		0.85	0.70		0.80	0.67		0.76	0.64	0.90	0.65	0.60
7 7/8			1.00			0.89			0.82		0.88	0.72		0.82	0.68		0.78	0.65	0.93	0.66	0.61
9						0.96			0.88		0.94	0.76		0.88	0.72		0.84	0.69	1.00	0.70	0.64
9 1/2						1.00			0.91		0.97	0.78		0.91	0.74		0.86	0.71		0.72	0.65
10									0.93		1.00	0.80		0.93	0.76		0.88	0.72		0.73	0.67
11									1.00			0.84		0.99	0.79		0.93	0.76		0.77	0.69
11 1/4												0.85		1.00	0.80		0.95	0.76		0.78	0.70
12 3/8												0.90			0.84		1.00	0.80		0.81	0.73
15												1.00			0.93			0.88		0.90	0.80
16 7/8															1.00			0.95		0.96	0.85
18																		0.98		1.00	0.88
18 5/8																		1.00			0.90
22 1/2																					1.00

Notes: For anchors loaded in tension, the critical spacing (c_{cr}) is equal to 1.5 times the embedment ($1.5h_v$) at which the anchor achieves 100% of load.

Minimum spacing (c_{min}) is equal to one-half times the embedment ($0.5h_v$) at which the anchor achieves 60% of load.



ADHESIVES

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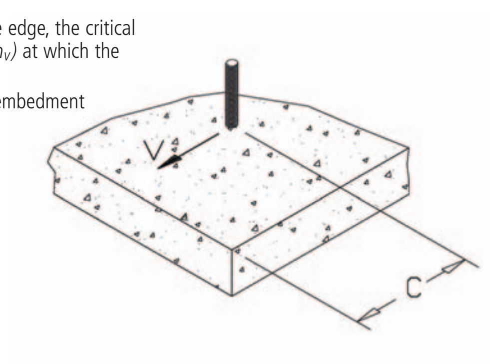
DESIGN CRITERIA

Load Adjustment Factors for Threaded Rod in Normal-Weight Concrete

Edge Distance, Shear Perpendicular to Edge (F_V)																						
Dia. (in.)		3/8			1/2			5/8			3/4			7/8			1			1 1/4		
h_v (in.)		1 3/4	3 1/2	5 1/4	2 1/8	4 1/4	6 3/8	2 1/2	5	7 1/2	3 3/8	6 5/8	10	3 3/4	7 1/2	11 1/4	4 1/8	8 1/4	12 3/8	6	12	15
c_{cr} (in.)		2 5/8	5 1/4	7 7/8	3 1/4	6 3/8	9 1/2	3 3/4	7 1/2	11	5	10	15	5 5/8	11 1/4	16 7/8	6 1/4	12 3/8	18 5/8	9	18	22 1/2
c_{min} (in.)		7/8	1 3/4	2 5/8	1	2 1/8	3 1/4	1 1/4	2 1/2	3 3/4	1 3/4	3 1/4	5	1 7/8	3 3/4	5 5/8	2	4	6 1/4	3	6	7 1/2
Edge, c (inches)	7/8	0.20																				
	1	0.26			0.20																	
	1 1/4	0.37			0.29			0.20														
	1 3/4	0.60	0.20		0.47			0.36			0.20											
	1 7/8	0.66	0.23		0.52			0.40			0.23			0.20								
	2	0.71	0.26		0.57			0.44			0.26			0.23			0.20					
	2 1/8	0.77	0.29		0.61	0.20		0.48			0.29			0.25			0.22					
	2 1/2	0.94	0.37		0.75	0.27		0.60	0.20		0.38			0.33			0.30					
	2 5/8	1.00	0.40	0.20	0.79	0.29		0.64	0.22		0.41			0.36			0.32					
	3		0.49	0.26	0.93	0.36		0.76	0.28		0.50			0.44			0.39			0.20		
	3 1/4		0.54	0.30	1.00	0.41	0.20	0.84	0.32	0.20	0.56	0.20		0.49			0.44			0.23		
	3 3/4		0.66	0.37		0.51	0.27	1.00	0.40	0.25	0.68	0.26		0.60	0.20		0.53			0.30		
	4 1/8		0.74	0.43		0.58	0.32		0.46	0.29	0.77	0.30		0.68	0.24		0.61	0.20		0.35		
	5		0.94	0.56		0.74	0.43		0.60	0.38	1.00	0.41	0.20	0.87	0.33		0.77	0.28		0.47		
	5 1/4		1.00	0.60		0.79	0.46		0.64	0.40		0.44	0.22	0.92	0.36		0.82	0.31		0.50		
	5 5/8			0.66		0.86	0.51		0.70	0.44		0.48	0.25	1.00	0.40	0.20	0.89	0.35		0.55		
	6			0.71		0.93	0.55		0.76	0.48		0.53	0.28		0.44	0.23	0.96	0.38		0.60	0.20	
	6 1/4			0.75		0.98	0.58		0.80	0.50		0.56	0.30		0.47	0.24	1.00	0.41	0.20	0.63	0.22	
	6 3/8			0.77		1.00	0.60		0.82	0.51		0.57	0.31		0.48	0.25		0.42	0.21	0.65	0.23	
	7 1/2			0.94			0.74		1.00	0.63		0.71	0.40		0.60	0.33		0.53	0.28	0.80	0.30	0.20
	7 7/8			1.00			0.79			0.66		0.75	0.43		0.64	0.36		0.56	0.31	0.85	0.33	0.22
	9						0.93			0.78		0.89	0.52		0.76	0.44		0.67	0.38	1.00	0.40	0.28
	9 1/2						1.00			0.83		0.95	0.56		0.81	0.48		0.72	0.41		0.43	0.31
	10									0.88		1.00	0.60		0.87	0.51		0.77	0.44		0.47	0.33
	11									1.00			0.68		0.97	0.58		0.87	0.51		0.53	0.39
	11 1/4												0.70		1.00	0.60		0.89	0.52		0.55	0.40
	12 3/8												0.79			0.68		1.00	0.60		0.63	0.46
	15												1.00			0.87			0.77		0.80	0.60
	16 7/8															1.00			0.89		0.93	0.70
	18																		0.96		1.00	0.76
	18 5/8																		1.00			0.79
	22 1/2																					1.00

Notes: For anchors loaded in shear perpendicular to the edge, the critical spacing *(c_{cr})* is equal to 1.5 times the embedment *(1.5h_v)* at which the anchor achieves 100% of load.

Minimum spacing *(c_{min})* is equal to one-half times the embedment *(0.5h_v)* at which the anchor achieves 20% of load.



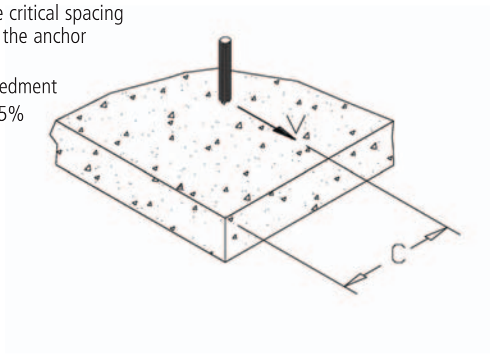
DESIGN CRITERIA

Load Adjustment Factors for Threaded Rod in Normal-Weight Concrete

Edge Distance, Shear Parallel to Edge (F_V)																						
Dia. (in.)		3/8			1/2			5/8			3/4			7/8			1			1 1/4		
h_v (in.)		1 3/4	3 1/2	5 1/4	2 1/8	4 1/4	6 3/8	2 1/2	5	7 1/2	3 3/8	6 5/8	10	3 3/4	7 1/2	11 1/4	4 1/8	8 1/4	12 3/8	6	12	15
c_{cr} (in.)		2 5/8	5 1/4	7 7/8	3 1/4	6 3/8	9 1/2	3 3/4	7 1/2	11	5	10	15	5 5/8	11 1/4	16 7/8	6 1/4	12 3/8	18 5/8	9	18	22 1/2
c_{min} (in.)		7/8	1 3/4	2 5/8	1	2 1/8	3 1/4	1 1/4	2 1/2	3 3/4	1 3/4	3 1/4	5	1 7/8	3 3/4	5 5/8	2	4	6 1/4	3	6	7 1/2
Edge, c (inches)	7/8	0.75																				
	1	0.77			0.75																	
	1 1/4	0.80			0.77			0.75														
	1 3/4	0.88	0.75		0.83			0.80			0.75											
	1 7/8	0.89	0.76		0.85			0.81			0.76			0.55								
	2	0.91	0.77		0.86			0.83			0.77			0.57			0.55					
	2 1/8	0.93	0.78		0.88	0.75		0.84			0.78			0.58			0.56					
	2 1/2	0.98	0.80		0.92	0.77		0.88	0.75		0.81			0.63			0.60					
	2 5/8	1.00	0.81	0.75	0.93	0.78		0.89	0.76		0.82			0.64			0.61					
	3		0.84	0.77	0.98	0.80		0.93	0.78		0.85			0.69			0.65			0.55		
	3 1/4		0.86	0.78	1.00	0.82	0.75	0.95	0.79		0.87	0.75		0.72			0.68			0.57		
	3 3/4		0.89	0.80		0.85	0.77	1.00	0.81	0.75	0.90	0.77		0.78	0.55		0.73			0.61		
	4		0.91	0.82		0.86	0.78		0.83	0.76	0.92	0.78		0.81	0.57		0.76	0.55		0.63		
	5		0.98	0.86		0.92	0.82		0.88	0.79	1.00	0.81	0.75	0.93	0.63		0.87	0.60		0.70		
	5 1/4		1.00	0.88		0.93	0.83		0.89	0.80		0.82	0.76	0.96	0.64		0.90	0.61		0.72		
	5 5/8			0.89		0.96	0.85		0.91	0.81		0.84	0.77	1.00	0.66	0.55	0.94	0.63		0.75		
	6			0.91		0.98	0.86		0.93	0.83		0.85	0.78		0.69	0.57	0.98	0.65		0.78	0.55	
	6 1/4			0.92		0.99	0.87		0.94	0.83		0.86	0.78		0.70	0.58	1.00	0.67	0.55	0.79	0.56	
	6 3/8			0.93		1.00	0.88		0.94	0.84		0.87	0.78		0.71	0.58		0.67	0.56	0.80	0.56	
	7 1/2			0.98			0.92		1.00	0.88		0.91	0.81		0.78	0.63		0.73	0.60	0.89	0.61	0.55
	7 7/8			1.00			0.94			0.89		0.92	0.82		0.80	0.64		0.75	0.61	0.92	0.62	0.56
	9						0.98			0.93		0.96	0.85		0.87	0.69		0.82	0.65	1.00	0.66	0.60
	9 1/2						1.00			0.94		0.98	0.86		0.90	0.71		0.84	0.67		0.68	0.61
	10									0.96		1.00	0.88		0.93	0.73		0.87	0.69		0.70	0.63
	11									1.00			0.90		0.99	0.77		0.93	0.73		0.74	0.66
	11 1/4												0.91		1.00	0.78		0.94	0.73		0.75	0.66
	12 3/8												0.93			0.82		1.00	0.78		0.79	0.70
	15												1.00			0.93			0.87		0.89	0.78
	16 7/8															1.00			0.94		0.96	0.83
	18																		0.98		1.00	0.87
	18 5/8																		1.00			0.88
	22 1/2																					1.00

Notes: For anchors loaded in shear parallel to the edge, the critical spacing (c_{cr}) is equal to 1.5 times the embedment ($1.5h_v$) at which the anchor achieves 100% of load.

Minimum spacing (c_{min}) is equal to one-half times the embedment ($0.5h_v$) at which anchors 3/4" diameter and less achieve 75% of load and anchors above 3/4" diameter achieve 55% of load.



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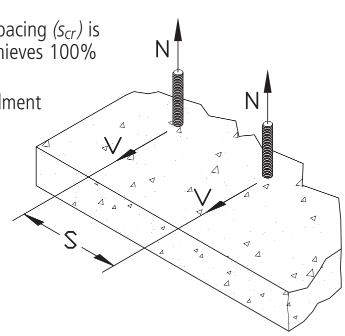
DESIGN CRITERIA

Load Adjustment Factors for Reinforcing Bar in Normal-Weight Concrete

Spacing, Tension (F_N) and Shear (F_V)																											
Dia. (in.)	No. 3			No. 4			No. 5			No. 6			No. 7			No. 8			No. 9			No. 10			No. 11		
h_v (in.)	1 5/8	3 3/8	5 5/8	2 1/4	4 1/2	7 1/2	2 3/4	5 5/8	9 3/8	3 3/8	6 3/4	11 1/4	3 7/8	7 7/8	13 1/8	4 1/2	9	15	5	10 1/8	16 7/8	5 5/8	11 1/4	18 1/2	6 1/8	12 3/8	19 1/4
s_{cr} (in.)	3 1/4	6 3/4	11 1/4	4 1/2	9	15	5 1/2	11 1/4	18 3/4	6 3/4	13 1/2	22 1/2	7 3/4	15 3/4	26 1/4	9	18	30	10	20 1/4	33 3/4	11 1/4	22 1/2	37	12 1/4	24 3/4	38 1/2
s_{min} (in.)	7/8	1 3/4	2 7/8	1 1/4	2 1/4	3 3/4	1 3/8	2 7/8	4 3/4	1 3/4	3 3/8	5 5/8	2	4	6 5/8	2 1/4	4 1/2	7 1/2	2 1/2	5 1/8	8 1/2	2 7/8	5 5/8	9 1/4	3 1/8	6 1/4	9 3/4
Spacing, s (inches)																											
7/8	0.70																										
1 1/4	0.75			0.70																							
1 3/8	0.77			0.72			0.70																				
1 3/4	0.82	0.70		0.76			0.73			0.70																	
2	0.85	0.72		0.78			0.75			0.72			0.70														
2 1/4	0.88	0.73		0.80	0.70		0.76			0.73			0.72			0.70											
2 1/2	0.91	0.75		0.82	0.71		0.78			0.75			0.73			0.71			0.70								
2 7/8	0.95	0.77	0.70	0.86	0.73		0.81	0.70		0.77			0.75			0.73			0.72			0.70					
3 1/8	0.98	0.79	0.71	0.88	0.74		0.83	0.71		0.79			0.76			0.74			0.73			0.71			0.70		
3 1/4	1.00	0.79	0.72	0.89	0.74		0.84	0.72		0.79			0.77			0.74			0.73			0.72			0.71		
3 3/8		0.80	0.72	0.90	0.75		0.85	0.72		0.80	0.70		0.77			0.75			0.74			0.72			0.71		
3 3/4		0.82	0.73	0.93	0.77	0.70	0.87	0.73		0.82	0.71		0.79			0.77			0.75			0.73			0.72		
4		0.84	0.74	0.96	0.78	0.71	0.89	0.74		0.84	0.72		0.81	0.70		0.78			0.76			0.74			0.73		
4 1/2		0.87	0.76	1.00	0.80	0.72	0.93	0.76		0.87	0.73		0.83	0.71		0.80	0.70		0.78			0.76			0.75		
4 3/4		0.88	0.77		0.81	0.73	0.95	0.77	0.70	0.88	0.74		0.85	0.72		0.81	0.71		0.79			0.77			0.76		
5 1/8		0.90	0.78		0.83	0.74	0.97	0.78	0.71	0.90	0.75		0.86	0.73		0.83	0.71		0.81	0.70		0.78			0.77		
5 1/2		0.93	0.80		0.84	0.75	1.00	0.80	0.72	0.93	0.76		0.88	0.74		0.84	0.72		0.82	0.71		0.80			0.78		
5 5/8		0.93	0.80		0.85	0.75		0.80	0.72	0.93	0.77	0.70	0.89	0.74		0.85	0.73		0.83	0.71		0.80	0.70		0.78		
6 1/4		0.97	0.82		0.88	0.77		0.82	0.73	0.97	0.79	0.71	0.92	0.76		0.88	0.74		0.85	0.72		0.82	0.71		0.80	0.70	
6 5/8		0.99	0.84		0.89	0.78		0.84	0.74	0.99	0.80	0.72	0.94	0.77	0.70	0.89	0.75		0.87	0.73		0.84	0.72		0.82	0.71	
6 3/4		1.00	0.84		0.90	0.78		0.84	0.74	1.00	0.80	0.72	0.95	0.77	0.70	0.90	0.75		0.87	0.73		0.84	0.72		0.82	0.71	
7 1/2			0.87		0.93	0.80		0.87	0.76		0.82	0.73	0.99	0.79	0.71	0.93	0.77	0.70	0.90	0.75		0.87	0.73		0.84	0.72	
7 3/4			0.88		0.94	0.81		0.88	0.77		0.83	0.74	1.00	0.80	0.72	0.94	0.77	0.70	0.91	0.75		0.88	0.74		0.85	0.73	
8 1/2			0.90		0.98	0.83		0.90	0.78		0.85	0.75		0.82	0.73	0.98	0.79	0.71	0.94	0.77	0.70	0.90	0.75		0.88	0.74	
9			0.92		1.00	0.84		0.92	0.79		0.87	0.76		0.83	0.74	1.00	0.80	0.72	0.96	0.78	0.71	0.92	0.76		0.89	0.75	
9 1/4			0.93			0.85		0.93	0.80		0.87	0.76		0.83	0.74		0.81	0.72	0.97	0.78	0.71	0.93	0.76	0.70	0.90	0.75	
9 5/8			0.94			0.86		0.94	0.81		0.89	0.77		0.84	0.75		0.81	0.73	0.99	0.79	0.71	0.94	0.77	0.70	0.91	0.76	0.70
10			0.96			0.87		0.96	0.81		0.90	0.78		0.85	0.75		0.82	0.73	1.00	0.80	0.72	0.96	0.78	0.71	0.93	0.76	0.70
11 1/4			1.00			0.90		1.00	0.84		0.93	0.80		0.89	0.77		0.85	0.75		0.82	0.73	1.00	0.80	0.72	0.97	0.78	0.72
12 1/4						0.93			0.86		0.96	0.82		0.91	0.79		0.87	0.76		0.84	0.75		0.82	0.73	1.00	0.80	0.73
13 1/2						0.96			0.89		1.00	0.84		0.94	0.81		0.90	0.78		0.87	0.76		0.84	0.75		0.82	0.74
15						1.00			0.92			0.87		0.98	0.83		0.93	0.80		0.90	0.78		0.87	0.76		0.84	0.76
15 3/4									0.94			0.88		1.00	0.84		0.95	0.81		0.91	0.79		0.88	0.77		0.85	0.76
18									0.98			0.92			0.87		1.00	0.84		0.96	0.81		0.92	0.79		0.89	0.79
18 3/4									1.00			0.93			0.89			0.85		0.97	0.82		0.93	0.80		0.90	0.79
20 1/4												0.96			0.91			0.87		1.00	0.84		0.96	0.82		0.93	0.81
22 1/2												1.00			0.94			0.90			0.87		1.00	0.84		0.96	0.83
24 3/4															0.98			0.93			0.89			0.87		1.00	0.86
26 1/4															1.00			0.95			0.91			0.88			0.87
30																		1.00			0.96			0.92			0.91
33 3/4																					1.00			0.96			0.95
37																								1.00			0.98
38 1/2																											1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 2 times the embedment ($2h_v$) at which the rebar achieves 100% of load.

Minimum spacing (s_{min}) is equal to one-half times the embedment ($0.5h_v$) at which the rebar achieves 70% of load.



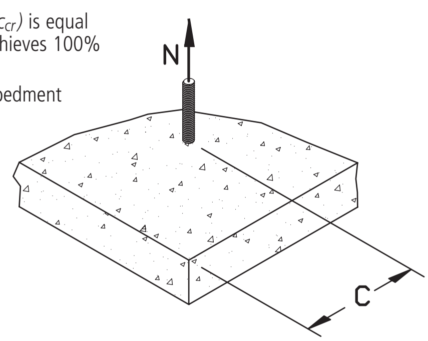
DESIGN CRITERIA

Load Adjustment Factors for Reinforcing Bar in Normal-Weight Concrete

Edge Distance, Tension (F_N)																											
Dia. (in.)	No. 3			No. 4			No. 5			No. 6			No. 7			No. 8			No. 9			No. 10			No. 11		
h_v (in.)	1 5/8	3 3/8	5 5/8	2 1/4	4 1/2	7 1/2	2 3/4	5 5/8	9 3/8	3 3/8	6 3/4	11 1/4	3 7/8	7 7/8	13 1/8	4 1/2	9	15	5	10 1/8	16 7/8	5 5/8	11 1/4	18 1/2	6 1/8	12 3/8	19 1/4
c_{cr} (in.)	2 1/2	5 1/8	8 1/2	3 3/8	6 3/4	11 1/4	4 1/8	8 1/2	14 1/8	5 1/8	10 1/8	16 7/8	5 7/8	11 7/8	19 3/4	6 3/4	13 1/2	22 1/2	7 1/2	15 1/4	25 3/8	8 1/2	16 7/8	27 3/4	9 1/4	18 5/8	28 7/8
c_{min} (in.)	7/8	1 3/4	2 7/8	1 1/8	2 1/4	3 3/4	1 3/8	2 7/8	4 3/4	1 3/4	3 3/8	5 5/8	2	4	6 5/8	2 1/4	4 1/2	7 1/2	2 1/2	5 1/8	8 1/2	2 7/8	5 5/8	9 1/4	3 1/8	6 1/4	9 5/8
Edge Distance, c (inches): 7/8	0.60																										
1 1/8	0.68			0.60																							
1 3/8	0.74			0.64			0.60																				
1 3/4	0.83	0.60		0.71			0.65			0.60																	
2	0.89	0.64		0.76			0.69			0.64			0.60														
2 1/4	0.95	0.67		0.80	0.60		0.73			0.67			0.63			0.60											
2 1/2	1.00	0.70		0.84	0.62		0.76			0.70			0.66			0.62			0.60								
2 7/8		0.74	0.60	0.91	0.66		0.82	0.60		0.74			0.70			0.66			0.63			0.60					
3 1/8		0.77	0.62	0.96	0.68		0.85	0.62		0.77			0.72			0.68			0.65			0.62			0.60		
3 3/8		0.80	0.64	1.00	0.70		0.89	0.64		0.80	0.60		0.75			0.70			0.67			0.64			0.62		
3 3/4		0.84	0.67		0.73	0.60	0.95	0.67		0.84	0.62		0.79			0.73			0.70			0.67			0.64		
4		0.87	0.68		0.76	0.61	0.98	0.68		0.87	0.64		0.81	0.60		0.76			0.72			0.68			0.66		
4 1/8		0.89	0.69		0.77	0.62	1.00	0.69		0.89	0.64		0.83	0.61		0.77			0.73			0.69			0.67		
4 1/2		0.93	0.72		0.80	0.64		0.72		0.93	0.67		0.86	0.63		0.80	0.60		0.76			0.72			0.69		
4 3/4		0.96	0.74		0.82	0.65		0.74	0.60	0.96	0.68		0.89	0.64		0.82	0.61		0.78			0.74			0.71		
5 1/8		1.00	0.76		0.86	0.67		0.76	0.62	1.00	0.70		0.93	0.66		0.86	0.63		0.81	0.60		0.76			0.73		
5 5/8			0.80		0.90	0.70		0.80	0.64		0.73	0.60	0.98	0.69		0.90	0.65		0.85	0.62		0.80	0.60		0.77		
5 7/8			0.82		0.92	0.71		0.82	0.65		0.75	0.61	1.00	0.70		0.92	0.66		0.87	0.63		0.82	0.61		0.78		
6 1/4			0.84		0.96	0.73		0.84	0.67		0.77	0.62		0.72		0.96	0.68		0.90	0.65		0.84	0.62		0.81	0.60	
6 5/8			0.87		0.99	0.75		0.87	0.68		0.79	0.64		0.74	0.60	0.99	0.69		0.93	0.66		0.87	0.64		0.83	0.61	
6 3/4			0.88		1.00	0.76		0.88	0.69		0.80	0.64		0.74	0.61	1.00	0.70		0.94	0.67		0.88	0.64		0.84	0.62	
7 1/2			0.93			0.80		0.93	0.72		0.84	0.67		0.78	0.63		0.73	0.60	1.00	0.70		0.93	0.67		0.89	0.64	
8 1/2			1.00			0.85		1.00	0.76		0.90	0.70		0.83	0.66		0.78	0.63		0.74	0.60	1.00	0.70		0.96	0.67	
9 1/4						0.89			0.79		0.95	0.73		0.87	0.68		0.81	0.65		0.77	0.62		0.73	0.60	1.00	0.70	
9 5/8						0.91			0.81		0.97	0.74		0.89	0.69		0.83	0.66		0.78	0.63		0.74	0.61		0.71	0.60
10 1/8						0.94			0.83		1.00	0.76		0.91	0.71		0.85	0.67		0.80	0.64		0.76	0.62		0.73	0.61
11 1/4						1.00			0.88			0.80		0.97	0.74		0.90	0.70		0.84	0.67		0.80	0.64		0.76	0.63
11 7/8									0.91			0.82		1.00	0.76		0.93	0.72		0.87	0.68		0.82	0.66		0.78	0.65
13 1/2									0.98			0.88			0.81		1.00	0.76		0.93	0.72		0.88	0.69		0.84	0.68
14 1/8									1.00			0.90			0.83			0.78		0.96	0.73		0.90	0.71		0.86	0.69
15 1/4												0.94			0.86			0.81		1.00	0.76		0.94	0.73		0.89	0.72
16 7/8												1.00			0.91			0.85			0.80		1.00	0.76		0.95	0.75
18 5/8															0.97			0.90			0.84			0.80		1.00	0.79
19 3/4															1.00			0.93			0.87			0.83			0.81
22 1/2																		1.00			0.93			0.89			0.87
25 3/8																					1.00			0.95			0.93
27 3/4																								1.00			0.98
28 7/8																											1.00

Notes: For anchors loaded in tension, the critical spacing (c_{cr}) is equal to 1.5 times the embedment ($1.5h_v$) at which the rebar achieves 100% of load.

Minimum spacing (c_{min}) is equal to one-half times the embedment ($0.5h_v$) at which the rebar achieves 60% of load.



ADHESIVES

DESIGN CRITERIA

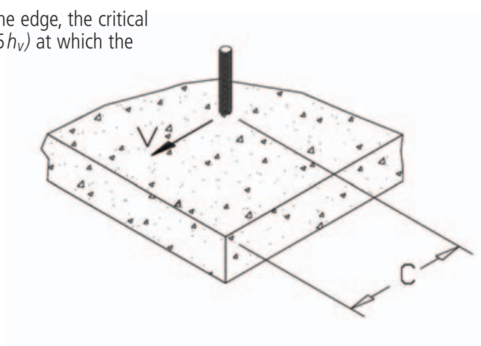
Load Adjustment Factors for Reinforcing Bar in Normal-Weight Concrete

Edge Distance, Shear Perpendicular to Edge (F_V)

Dia. (in.)	No. 3			No. 4			No. 5			No. 6			No. 7			No. 8			No. 9			No. 10			No. 11		
h_v (in.)	1 5/8	3 3/8	5 5/8	2 1/4	4 1/2	7 1/2	2 3/4	5 5/8	9 3/8	3 3/8	6 3/4	11 1/4	3 7/8	7 7/8	13 1/8	4 1/2	9	15	5	10 1/8	16 7/8	5 5/8	11 1/4	18 1/2	6 1/8	12 3/8	19 1/4
c_{cr} (in.)	2 1/2	5 1/8	8 1/2	3 3/8	6 3/4	11 1/4	4 1/8	8 1/2	14 1/8	5 1/8	10 1/8	16 7/8	5 7/8	11 7/8	19 3/4	6 3/4	13 1/2	22 1/2	7 1/2	15 1/4	25 3/8	8 1/2	16 7/8	27 3/4	9 1/4	18 5/8	28 7/8
c_{min} (in.)	7/8	1 3/4	2 7/8	1 1/8	2 1/4	3 3/4	1 3/8	2 7/8	4 3/4	1 3/4	3 3/8	5 5/8	2	4	6 5/8	2 1/4	4 1/2	7 1/2	2 1/2	5 1/8	8 1/2	2 7/8	5 5/8	9 1/4	3 1/8	6 1/4	9 5/8
Edge Distance, c (inches)																											
7/8	0.20																										
1 1/8	0.35			0.20																							
1 3/8	0.48			0.29			0.20																				
1 3/4	0.66	0.20		0.42			0.31			0.20																	
2	0.78	0.27		0.51			0.38			0.27			0.20														
2 1/4	0.91	0.33		0.60	0.20		0.45			0.33			0.26			0.20											
2 1/2	1.00	0.39		0.69	0.24		0.53			0.39			0.32			0.24			0.20								
2 7/8		0.48	0.20	0.82	0.31		0.64	0.20		0.48			0.39			0.31			0.26			0.20					
3 1/8		0.54	0.24	0.91	0.36		0.71	0.24		0.54			0.45			0.36			0.30			0.24			0.20		
3 3/8		0.60	0.28	1.00	0.40		0.78	0.28		0.60	0.20		0.50			0.40			0.34			0.28			0.24		
3 3/4		0.69	0.33		0.47	0.20	0.89	0.33		0.69	0.24		0.57			0.47			0.40			0.33			0.29		
4		0.75	0.37		0.51	0.23	0.96	0.37		0.75	0.27		0.63	0.20		0.51			0.44			0.37			0.32		
4 1/8		0.78	0.39		0.53	0.24	1.00	0.39		0.78	0.29		0.65	0.22		0.53			0.46			0.39			0.34		
4 1/2		0.87	0.44		0.60	0.28		0.44		0.87	0.33		0.73	0.26		0.60	0.20		0.52			0.44			0.39		
4 3/4		0.93	0.48		0.64	0.31		0.48	0.20	0.93	0.36		0.78	0.28		0.64	0.22		0.56			0.48			0.42		
5 1/8		1.00	0.53		0.71	0.35		0.53	0.24	1.00	0.41		0.86	0.32		0.71	0.26		0.62	0.20		0.53			0.47		
5 5/8			0.60		0.80	0.40		0.60	0.28		0.47	0.20	0.96	0.37		0.80	0.30		0.70	0.24		0.60	0.20		0.53		
5 7/8			0.64		0.84	0.43		0.64	0.30		0.50	0.22	1.00	0.40		0.84	0.32		0.74	0.26		0.64	0.22		0.57		
6 1/4			0.69		0.91	0.47		0.69	0.33		0.54	0.24		0.43		0.91	0.36		0.80	0.29		0.69	0.24		0.62	0.20	
6 5/8			0.74		0.98	0.51		0.74	0.37		0.59	0.27		0.47	0.20	0.98	0.39		0.86	0.32		0.74	0.27		0.67	0.23	
6 3/4			0.76		1.00	0.52		0.76	0.38		0.60	0.28		0.49	0.21	1.00	0.40		0.88	0.33		0.76	0.28		0.68	0.24	
7 1/2			0.87			0.60		0.87	0.44		0.69	0.33		0.56	0.26		0.47	0.20	1.00	0.39		0.87	0.33		0.78	0.28	
8 1/2			1.00			0.71		1.00	0.53		0.81	0.40		0.66	0.32		0.56	0.25		0.47	0.20	1.00	0.40		0.91	0.35	
9 1/4						0.79			0.59		0.90	0.46		0.74	0.36		0.62	0.29		0.53	0.24		0.46	0.20	1.00	0.40	
9 5/8						0.83			0.62		0.94	0.48		0.78	0.39		0.66	0.31		0.56	0.26		0.48	0.22		0.42	0.20
10 1/8						0.88			0.66		1.00	0.52		0.83	0.42		0.70	0.34		0.60	0.28		0.52	0.24		0.45	0.22
11 1/4						1.00			0.76			0.60		0.94	0.49		0.80	0.40		0.69	0.33		0.60	0.29		0.53	0.27
11 7/8									0.81			0.64		1.00	0.52		0.86	0.43		0.74	0.36		0.64	0.31		0.57	0.29
13 1/2									0.95			0.76			0.62		1.00	0.52		0.87	0.44		0.76	0.38		0.67	0.36
14 1/8									1.00			0.80			0.66			0.55		0.92	0.47		0.80	0.41		0.71	0.39
15 1/4												0.88			0.73			0.61		1.00	0.52		0.88	0.46		0.79	0.43
16 7/8												1.00			0.83			0.70			0.60		1.00	0.53		0.89	0.50
18 5/8															0.94			0.79			0.68			0.61		1.00	0.57
19 3/4															1.00			0.85			0.74			0.65			0.62
22 1/2																		1.00			0.87			0.77			0.74
25 3/8																					1.00			0.90			0.85
27 3/4																								1.00			0.95
28 7/8																											1.00

Notes: For anchors loaded in shear perpendicular to the edge, the critical spacing (c_{cr}) is equal to 1.5 times the embedment ($1.5h_v$) at which the rebar achieves 100% of load.

Minimum spacing (c_{min}) is equal to one-half times the embedment ($0.5h_v$) at which the rebar achieves 20% of load.



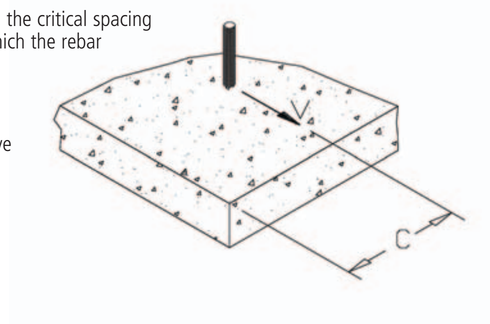
DESIGN CRITERIA

Load Adjustment Factors for Reinforcing Bar in Normal-Weight Concrete

Edge Distance, Shear Parallel to Edge (F_V)																											
Dia. (in.)	No. 3			No. 4			No. 5			No. 6			No. 7			No. 8			No. 9			No. 10			No. 11		
h_v (in.)	1 5/8	3 3/8	5 5/8	2 1/4	4 1/2	7 1/2	2 3/4	5 5/8	9 3/8	3 3/8	6 3/4	11 1/4	3 7/8	7 7/8	13 1/8	4 1/2	9	15	5	10 1/8	16 7/8	5 5/8	11 1/4	18 1/2	6 1/8	12 3/8	19 1/4
c_{cr} (in.)	2 1/2	5 1/8	8 1/2	3 3/8	6 3/4	11 1/4	4 1/8	8 1/2	14 1/8	5 1/8	10 1/8	16 7/8	5 7/8	11 7/8	19 3/4	6 3/4	13 1/2	22 1/2	7 1/2	15 1/4	25 3/8	8 1/2	16 7/8	27 3/4	9 1/4	18 5/8	28 7/8
c_{min} (in.)	7/8	1 3/4	2 7/8	1 1/8	2 1/4	3 3/4	1 3/8	2 7/8	4 3/4	1 3/4	3 3/8	5 5/8	2	4	6 5/8	2 1/4	4 1/2	7 1/2	2 1/2	5 1/8	8 1/2	2 7/8	5 5/8	9 1/4	3 1/8	6 1/4	9 5/8
Edge Distance, c (inches): 7/8	0.75																										
1 1/8	0.80			0.75																							
1 3/8	0.84			0.78			0.75																				
1 3/4	0.89	0.75		0.82			0.78			0.75																	
2	0.93	0.77		0.85			0.81			0.77			0.55														
2 1/4	0.97	0.79		0.88	0.75		0.83			0.79			0.59			0.55											
2 1/2	1.00	0.81		0.90	0.76		0.85			0.81			0.62			0.58			0.55								
2 7/8		0.84	0.75	0.94	0.78		0.89	0.75		0.84			0.66			0.61			0.58			0.55					
3 1/8		0.86	0.76	0.97	0.80		0.91	0.76		0.86			0.69			0.64			0.61			0.58			0.55		
3 3/8		0.88	0.78	1.00	0.81		0.93	0.78		0.88	0.75		0.72			0.66			0.63			0.60			0.57		
3 3/4		0.90	0.79		0.83	0.75	0.97	0.79		0.90	0.76		0.76			0.70			0.66			0.63			0.60		
4		0.92	0.80		0.85	0.76	0.99	0.80		0.92	0.77		0.79	0.55		0.73			0.69			0.65			0.62		
4 1/8		0.93	0.81		0.85	0.76	1.00	0.81		0.93	0.78		0.80	0.56		0.74			0.70			0.66			0.63		
4 1/2		0.96	0.83		0.88	0.78		0.83		0.96	0.79		0.85	0.58		0.78	0.55		0.73			0.69			0.66		
4 3/4		0.98	0.84		0.89	0.78		0.84	0.75	0.98	0.80		0.88	0.60		0.80	0.56		0.75			0.71			0.67		
5 1/8		1.00	0.85		0.91	0.80		0.85	0.76	1.00	0.81		0.92	0.62		0.84	0.58		0.79	0.55		0.74			0.70		
5 5/8			0.88		0.94	0.81		0.88	0.78		0.83	0.75	0.98	0.65		0.89	0.61		0.83	0.58		0.78	0.55		0.74		
5 7/8			0.89		0.95	0.82		0.89	0.78		0.84	0.76	1.00	0.66		0.91	0.62		0.85	0.59		0.80	0.56		0.76		
6 1/4			0.90		0.97	0.83		0.90	0.79		0.86	0.76		0.68		0.95	0.64		0.89	0.60		0.83	0.58		0.78	0.55	
6 5/8			0.92		0.99	0.85		0.92	0.80		0.87	0.77		0.70	0.55	0.99	0.66		0.92	0.62		0.86	0.59		0.81	0.57	
6 3/4			0.93		1.00	0.85		0.93	0.81		0.88	0.78		0.71	0.56	1.00	0.66		0.93	0.63		0.87	0.60		0.82	0.57	
7 1/2			0.96			0.88		0.96	0.83		0.90	0.79		0.75	0.58		0.70	0.55	1.00	0.66		0.93	0.63		0.88	0.60	
8 1/2			1.00			0.91		1.00	0.85		0.94	0.81		0.81	0.62		0.75	0.58		0.70	0.55	1.00	0.67		0.95	0.63	
9 1/4						0.93			0.87		0.97	0.83		0.85	0.64		0.79	0.60		0.74	0.57		0.70	0.55	1.00	0.66	
9 5/8						0.95			0.88		0.98	0.84		0.88	0.66		0.81	0.61		0.75	0.58		0.71	0.56		0.68	0.55
10 1/8						0.96			0.90		1.00	0.85		0.90	0.67		0.83	0.63		0.78	0.60		0.73	0.57		0.69	0.56
11 1/4						1.00			0.93			0.88		0.97	0.71		0.89	0.66		0.83	0.63		0.78	0.60		0.73	0.59
11 7/8									0.94			0.89		1.00	0.73		0.92	0.68		0.85	0.64		0.80	0.61		0.76	0.60
13 1/2									0.99			0.93			0.79		1.00	0.73		0.93	0.69		0.87	0.65		0.82	0.64
14 1/8									1.00			0.94			0.81			0.75		0.95	0.70		0.89	0.67		0.84	0.66
15 1/4												0.96			0.85			0.78		1.00	0.73		0.94	0.70		0.88	0.68
16 7/8												1.00			0.90			0.83			0.78		1.00	0.74		0.94	0.72
18 5/8															0.96			0.88			0.82			0.78		1.00	0.76
19 3/4															1.00			0.92			0.85			0.81			0.79
22 1/2																		1.00			0.93			0.87			0.85
25 3/8																					1.00			0.94			0.92
27 3/4																								1.00			0.97
28 7/8																											1.00

Notes: For anchors loaded in shear parallel to the edge, the critical spacing (c_{cr}) is equal to 1.5 times the embedment ($1.5h_v$) at which the rebar achieves 100% of load.

Minimum spacing (c_{min}) is equal to one-half times the embedment ($0.5h_v$) at which No. 6 and smaller rebar achieve 75% of load and rebar larger than No. 6 achieve 55% of load.



ADHESIVES

ORDERING INFORMATION

AC100 Plus Cartridges

Cat. No.	Description	Standard Box	Std. Carton	Pallet
8462	5.5 oz. Pusher Cartridge	12	36	–
8478	10 oz. Quik-Shot Cartridge	12	36	972
8480	8 oz. Cartridge	–	12	576
8486	12 oz. Cartridge	–	12	864
8490	30 oz. Jumbo Cartridge	–	8	400

AC100 Plus mixing nozzles should be used to ensure complete and proper mixing of the chemical components.

Cartridge System Mixing Nozzles

Cat. No.	Description	Standard Box	Standard Carton
8482	Extra Nozzle for 5.5, 8, 10 & 12 oz. AC100 Plus (8462, 8464, 8478, 8480, 8486)	12	144
8498	Extra Nozzle for 30 oz. Jumbo AC100 Plus (8490)	2	24

Manual Injection Dispensing Tools

Cat. No.	Description	Standard Box	Standard Carton
8437	10 oz. Heavy Duty Caulking Gun (8462, 8478)	1	12
8463	10 oz. High Performance Caulking Gun (8478)	1	6
8484	8 oz. Std. All Metal Manual Tool (8480)	1	6
8485	8 & 12 oz. High Performance Manual Tool (8480, 8486)	1	20
8494	30 oz. Std. All Metal Manual Tool (8490)	1	1
8495	30 oz. High Performance Manual Tool (8490)	1	1

Pneumatic Injection Dispensing Tools

Cat. No.	Description	Standard Box	Standard Carton
8496	30 oz. High Performance Pneumatic Tool	1	1

Maximum operating pressure – 125 psi.
Normal operating pressure – 80 to 100 psi.
Maximum free air required – 1 cfm based on average use.

Battery Injection Dispensing Tools

Cat. No.	Description	Standard Box	Standard Carton
8444	30 oz. High Performance Battery Tool	1	1

Battery and charger are included. Additional batteries are available for purchase upon request.

Note: Reference the Adhesive Anchoring Accessories section for information on installation accessories, screen tubes and miscellaneous anchor hardware.

Note: Reference the "Estimating Guides" section for information on number of installations per various cartridge sizes, base materials and hardware.

Power-Fast®+ *Epoxy Adhesive Anchoring System*

PRODUCT DESCRIPTION

The Power-Fast+ Epoxy adhesive system is a two-component structural epoxy which is packaged in engineered plastic cartridges. It is used with either a manual, pneumatic or power-operated injection tool and proportionally mixed through a static-element mixing nozzle. Power-Fast+ is a premium, non-sag, high strength epoxy which has been vigorously tested to meet or exceed required standards as an anchoring and bonding adhesive. Power-Fast+ is available in Fast Set and Standard Set formulas.

Power-Fast+ Epoxy, formerly known as *Rawl Foil-Fast*, is designed for use in anchoring threaded rods, bolts, reinforcing bars, and smooth dowels into concrete and masonry base materials. The system can also be used to anchor into hollow masonry materials using rod and rebar with screen tubes. In addition to anchoring applications, Power-Fast+ is used for bonding steel and cured concrete to cured concrete, for pick proofing applications, for surface sealing cracks and for placing injection ports.

GENERAL APPLICATIONS AND USES

- Heavy duty anchoring such as rebar, threaded anchor rod, and threaded bolts in solid concrete, grout filled block, stone, masonry, etc.
- Used in damp environments, moderate to high temperatures and whenever solvent or styrene fumes are not acceptable
- Anchoring with screen tubes in hollow block or brick
- High strength bonding to concrete, steel, wood, etc.
- Optimal for unreinforced masonry (URM) retrofit projects
- Ideal for crack sealing and port placement prior to epoxy resin crack injection
- Commonly used for pick-proof applications in security and correctional projects

FEATURES AND BENEFITS

- Non-shrink, non-sag, moisture tolerant, high strength, structural epoxy gel
- 100% solids, styrene and solvent-free, low odor, smooth paste formulation
- The plus symbol "+" in Power-Fast+ designates a nozzle is packaged with each cartridge (except for Jumbo cartridge packaging)
- Available in five cartridge sizes to match project and application
- Excellent resistance to chemicals
- Meets the requirements of ASTM C881, Types I, II, IV and V, Grade 3, Class C
- Meets building code compliance and DOT requirements
- Independently tested and qualified to ASTM E1512 and ICC-ES AC58 criteria. See ESR-1531 listing. Both formulas evaluated and permitted to resist short-term loads such as those resulting from wind or earthquake. Standard Set formula is also evaluated and listed to resist dead and live loads
- May be suitable for oversized and dry diamond cored holes. Jobsite testing is required.
- For special applications reference information beginning on page 249

APPROVALS AND LISTINGS

International Code Council, Evaluation Service (ICC-ES) ESR-1531
(formerly listed in ICBO ES ER-4514)
Southern Building Code Conference International (SBCCI) #9943A
City of Los Angeles (COLA) Research Report LARR-25230
City of Los Angeles (COLA) Research Report LARR-24979 for Unreinforced Masonry (URM)
Florida Building Code Approval – FL2209.05
Miami-Dade County Notice of Acceptance (NOA) 04-0823.06
ANSI/NSF 61 – Drinking Water System Components Compliant
Conforms to ASTM C881 and AASHTO M235 requirements
Various North American Departments of Transportation (DOT) – See www.powers.com

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring, 04081-Masonry Anchorage* and *05090-Metal Fastening.* Epoxy adhesive system shall be Standard Set or Fast Set Power-Fast+ as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS Page No.

ADHESIVES

Power-Fast+ Coaxial Cartridge

Power-Fast+ Dual Cartridge

PACKAGING

Coaxial Cartridge
10 fl. oz. (295 ml or 18.0 in^3)

Dual (Side-by-Side) Cartridge
15 fl. oz. (440 ml or 27.1 in^3)
22 fl. oz. (650 ml or 39.7 in^3)
44 fl. oz. (1300 ml or 79.4 in^3)
56 fl. oz. (1650 ml or 101.0 in^3)

ANCHOR SIZE RANGE (TYP.)

1/4" to 1-1/2" diameter rod
No.3 to No.11 reinforcing bar
3/4" to 1-1/2" smooth dowel bar
3/8" to 3/4" internally threaded inserts

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Structural Lightweight Concrete
Grouted Concrete Masonry
Hollow CMU
Brick Masonry
Stone

ADHESIVES

MATERIAL AND INSTALLATION SPECIFICATIONS

Physical Properties for Adhesive

Shelf Life	2 years for components
Storage Conditions	Store dry at 40° to 90°F
Injection Temperature	For best results, condition material to 60°F - 85°F
Color	Component A – White Component B – Dark Gray
Mixing Ratio	1:1 by volume
Mixed Consistency	Smooth, non-sag, uniform gray paste
Shore Hardness (ASTM D2240)	D 86 – 90
Compressive Strength (ASTM D 695)	11,125 psi, 1 day 14,740 psi, 7 days
Tensile Strength (ASTM D 638)	7,250 psi, Fast Set 7,400 psi, Standard Set
Flexural Strength (ASTM D 790)	6,200 psi, Fast Set 6,700 psi, Standard Set
Slant Shear Strength (ASTM D732)	4,900 psi, Fast Set – 1 day 6,700 psi, Standard Set – 14 day
Water Absorption (ASTM D 570)	Less than 1% (0.59%)
Bond Strength (Dry cure)	3,000 psi, concrete to concrete 3,000 psi, steel to concrete
Shrinkage (ASTM D 2566)	Not measurable
Heat Deflection (ASTM D 648)	140°F (60°C)

Setting Times

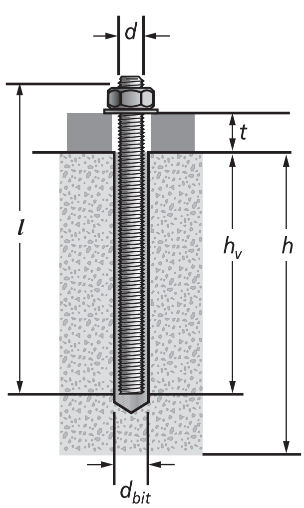
Base Material Temp. (°F)	Maximum Gel Time[1,2] (Minutes)		Minimum Curing Time[2,3] (Hours)		Full Curing Time[4] (Hours)	
	Fast Set	Std. Set	Fast Set	Std. Set	Fast Set	Std. Set
40	30	60	8	16	36	48
60	20	45	3	7	24	36
75	15	35	2	6	24	24
90	10	20	1 1/2	4	16	24
°C = 5/9 (°F-32)						

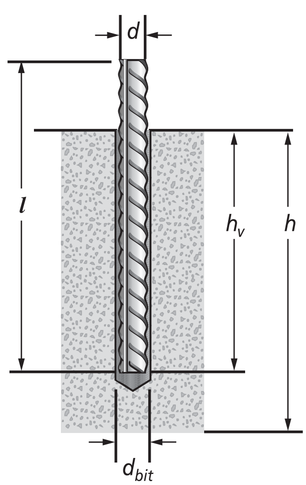
1. The gel time is the maximum time during which the epoxy can be worked before it begins to harden.
2. Anchors must not be disturbed between the maximum gel time and the minimum curing time.
3. The Power-Fast+ adhesive can support the weight of the anchor element (not including any fixture) at half of the minimum cure time.
4. The full curing time is the time required for the epoxy to harden and achieve published load capacities. Anchors may not be tightened until the full curing time has elapsed.

Installation Specifications

Property		Rod Diameter, *d* (in.)									
		1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/4	1 3/8	1 1/2
A_{nom} = Nominal area of threaded rod (inch^2)		0.0491	0.1105	0.1963	0.3068	0.4418	0.6013	0.7854	1.2272	1.4840	1.7660
A_{se} = Tensile stress area of rod (inch^2)		0.0318	0.0775	0.1419	0.2260	0.3345	0.4617	0.6057	0.9691	1.1549	1.4053
d_{bit} = Nominal bit diameter (inch)		5/16	7/16	9/16	3/4	7/8	1	1 1/8	1 3/8	1 1/2	1 5/8
T_{max} = Max. tightening torque range (ft.-lbs.)	$4d \leq h_v < 9d$	2-3	7-8	17-20	25-30	40-45	65-75	100-110	160-175	210-235	275-300
	$h_v \geq 9d$	4-5	15-17	35-40	70-80	120-130	185-200	275-300	375-425	500-550	650-725

Property	Reinforcing Bar Sizes, *d*								
	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	No. 11
d = Nominal bar diameter (inch)	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8
d_{ef} = Effective anchor diameter (inch)	0.375	0.500	0.625	0.750	0.875	1.000	1.128	1.270	1.410
A_{br} = Nominal area of reinforcing bar (inch^2)	0.110	0.200	0.310	0.440	0.600	0.790	1.000	1.270	1.560
d_{bit} = Nominal bit diameter (inch)	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 1/2	1 5/8



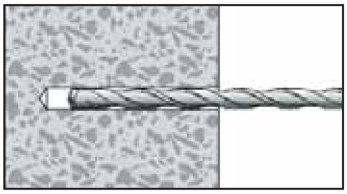


Nomenclature

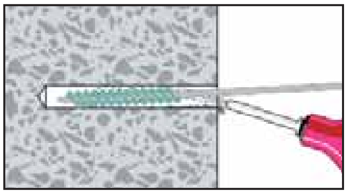
d = Diameter of rod or rebar
d_{bit} = Diameter of drill bit
h = Base material thickness. The minimum value of h should be $1.5h_v$
h_v = Minimum embedment depth
l = Overall length of rod or rebar
t = Fixture thickness
T_{max} = Maximum tightening torque (Only possible after full curing time)

INSTALLATION GUIDELINES

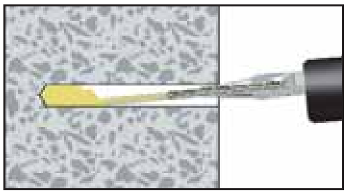
Solid Base Materials



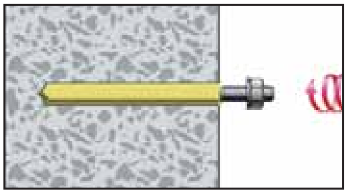
Drill a hole to the size and embedment required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



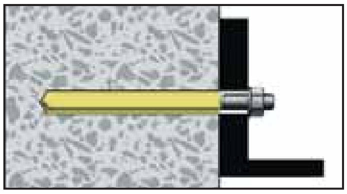
Starting from the bottom or back of the anchor hole, blow clean with compressed air for a minimum of four seconds, brush the hole with a nylon brush a minimum of four times, and blow it clean again. Vacuuming only is not sufficient. Blow out bulbs generally do not provide enough dust removal for most drilled anchor holes. Holes should be clean and sound. They may be dry or damp, but should be free of standing water or frost. If using reinforcing bar, be sure the bar will fit into the drilled hole. If a larger hole is required, the diameter should be as close as possible to the diameter of the reinforcing bar.



Prior to dispensing into anchor hole, balance the cartridge and visually inspect that adhesive components are uniformly mixed. Fill the hole approximately half to two-thirds full with adhesive starting from the bottom or back of the anchor hole. Slowly withdraw the static mixing nozzle as the hole fills to avoid creating air pockets.

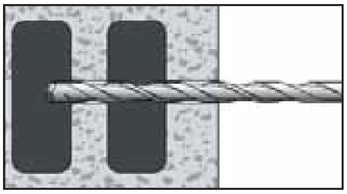


Push the threaded rod or reinforcing bar into the anchor hole while turning slightly to ensure positive distribution of the adhesive. Be sure the rod is fully seated at the bottom of the hole and that some adhesive has flowed from the top of the hole. The threaded rod or reinforcing bar used should be free of dirt, grease, oil or other foreign material.



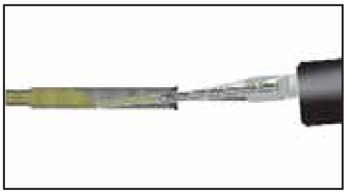
Allow the adhesive to cure for the specified time prior to applying any load. Do not disturb, torque, or load the anchor until it is fully cured.

Hollow Base Materials

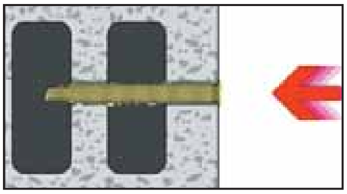


Drill a hole to the size and embedment for the required screen size. The tolerances of the drill bit used should meet the requirements of ANSI B212.15.

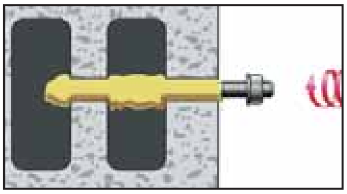
Starting from the bottom or back of the anchor hole, blow the hole clean with compressed air for a minimum of four seconds, brush the hole with a nylon brush a minimum of four times, and blow it clean again. Vacuuming only is not sufficient. Blow out bulbs generally do not provide enough dust removal for drilled anchor holes in hollow base materials.



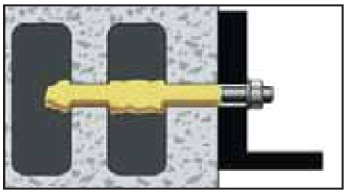
Prior to dispensing into screen tube, balance the cartridge and visually inspect that adhesive components are uniformly mixed. Fill the screen tube with adhesive starting from the bottom of the screen. The screen tube should be completely filled prior to inserting it in the anchor hole.



Insert the filled screen tube into the anchor hole until it is fully seated at the required embedment.



Push the threaded rod into the screen while turning slightly to ensure positive dispensing of the adhesive. Be sure the rod is fully inserted down to the end of the screen tube. The threaded rod or reinforcing bar used should be free of dirt, grease, oil, or other foreign material.



Allow the adhesive to cure for the specified time prior to applying any load. Do not disturb, torque, or load the anchor until it is fully cured.

Prior to use, read product label, Material Safety Data Sheet and injection tool instructions.
Hole cleaning is essential for the proper performance of adhesive anchors.

For special applications including overhead installation, reference information on page 249.

STEEL SPECIFICATIONS

Material Properties for Threaded Rod and Reinforcing Bar

Anchor Type	Steel Description	Steel Specification (ASTM)	Rod Dia. or Rebar Size (inch or No.)	Minimum Yield Strength, f_y (ksi)	Minimum Ultimate Strength, f_u (ksi)
Threaded Rod	Standard carbon rod	A36	All	36.0	58.0
		A 307, Grade C	3/8 thru 4	36.0	58.0
	High strength carbon rod	A 193, Grade B7	3/8 thru 2 1/2	105.0	120.0
	Stainless Rod (Type 304 / 316 SS)	F 593, Condition CW	3/8 thru 5/8	65.0	100.0
			3/4 thru 1 1/2	45.0	85.0
Reinforcing Bar	Grade 40 Rebar	A 615, A 616, A 617, A 706 or A 767	All	40.0	70.0
	Grade 60 Rebar			60.0	90.0

Allowable Steel Strength Capacities for Threaded Rod

Anchor Diameter *d* in. (mm)	Allowable Tension				Allowable Shear			
	ASTM A36 lbs. (kN)	ASTM A307 Grade C lbs. (kN)	ASTM A193 Grade B7 lbs. (kN)	ASTM F593 304/316 SS lbs. (kN)	ASTM A36 lbs. (kN)	ASTM A307 Grade C lbs. (kN)	ASTM A193 Grade B7 lbs. (kN)	ASTM F593 304/316 SS lbs. (kN)
1/4 (6.4)	940 (4.2)	940 (4.2)	2,160 (9.7)	1,210 (5.4)	485 (2.2)	485 (2.2)	1,030 (4.6)	625 (2.8)
3/8 (9.5)	2,115 (9.5)	2,115 (9.5)	4,375 (19.7)	3,630 (16.3)	1,090 (4.9)	1,090 (4.9)	2,255 (10.1)	1,870 (8.4)
1/2 (12.7)	3,755 (16.9)	3,755 (16.9)	7,775 (35.0)	6,470 (29.1)	1,940 (8.7)	1,940 (8.7)	4,055 (18.2)	3,330 (15.0)
5/8 (15.9)	5,870 (26.4)	5,870 (26.4)	12,150 (54.7)	10,130 (45.6)	3,025 (13.6)	3,025 (13.6)	6,260 (28.2)	5,210 (23.4)
3/4 (19.1)	8,455 (38.0)	8,455 (38.0)	17,495 (78.7)	12,400 (55.8)	4,355 (19.6)	4,355 (19.6)	9,010 (40.5)	6,390 (28.8)
7/8 (22.2)	11,510 (51.8)	11,510 (51.8)	23,810 (107.1)	16,860 (75.9)	5,930 (26.7)	5,930 (26.7)	12,265 (55.2)	8,680 (39.1)
1 (25.4)	15,035 (67.7)	15,035 (67.7)	31,100 (140.0)	22,020 (99.1)	7,745 (34.9)	7,745 (34.9)	16,020 (72.1)	11,340 (51.0)
1 1/4 (31.8)	23,485 (105.7)	23,485 (105.7)	48,560 (218.5)	34,420 (154.9)	12,100 (54.5)	12,100 (54.5)	25,035 (112.7)	17,730 (79.8)
1 3/8 (34.9)	28,400 (127.8)	28,400 (127.8)	58,760 (264.4)	41,625 (187.3)	14,630 (65.8)	14,630 (65.8)	30,270 (136.2)	21,440 (96.5)
1 1/2 (38.1)	33,800 (152.1)	33,800 (152.1)	69,930 (314.7)	49,535 (222.9)	17,410 (78.3)	17,410 (78.3)	36,025 (162.1)	25,515 (114.8)

Steel strength capacities are based on the design criteria listed in the *AISC Manual of Steel Construction*.

Allowable Steel Strength Capacities for Reinforcing Bar

Bar Size	Tension lbs. (kN)		Shear lbs. (kN)	
	Grade 40	Grade 60	Grade 40	Grade 60
No. 3 (3/8")	2,200 (9.9)	2,640 (11.9)	1,310 (5.9)	1,680 (7.6)
No. 4 (1/2")	4,000 (18.0)	4,800 (21.6)	2,380 (10.7)	3,060 (13.8)
No. 5 (5/8")	6,200 (27.9)	7,440 (33.5)	3,690 (16.6)	4,740 (21.3)
No. 6 (3/4")	8,800 (39.6)	10,560 (47.5)	5,235 (23.6)	6,730 (30.3)
No. 7 (7/8")	12,000 (54.0)	14,400 (64.8)	7,140 (32.1)	9,180 (41.3)
No. 8 (1")	15,800 (71.1)	18,960 (85.3)	9,400 (42.3)	12,085 (54.4)
No. 9 (1 1/8")	20,000 (90.0)	24,000 (108.0)	11,900 (53.6)	15,300 (68.9)
No. 10 (1 1/4")	25,400 (114.3)	30,480 (137.2)	15,115 (68.0)	19,430 (87.4)
No. 11 (1 3/8")	31,200 (140.4)	37,440 (168.5)	16,920 (76.1)	20,305 (91.4)

Steel strength capacities are based on the requirements of ASTM A 615.

Note:
Allowable design load must be the lesser of allowable steel strength (as shown on this page) and the allowable bond capacities.

Allowable steel strength values for threaded rod are based on the following equations:

$T = 0.33 * f_u * A_{nom}$
$V = 0.17 * f_u * A_{nom}$

And, the allowable steel strength values for reinforcing bar are based on the following equations:

$T = f_s * A_{br}$
$V = 0.17 * f_s * A_{br}$

Where:
T = Allowable tension load (pounds).
V = Allowable shear load (pounds).
f_u = Minimum specified ultimate stress (psi)
f_s = Allowable tensile stress of reinforcement bar (psi)
A_{nom} = Nominal cross-sectional area of threaded rod (in^2).
A_{br} = Nominal cross-sectional area of reinforcing bar (in^2).

PERFORMANCE DATA

Ultimate Bond Strength Capacities for Threaded Rod Installed with Standard Set Power-Fast+ in Normal-Weight Concrete[1,2,3]

Rod Diameter	Drill Bit Dia.	Min. Embed. Depth	Minimum Concrete Compressive Strength (f'_c)							
			2,000 psi (13.8 MPa)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 MPa)	
d in. (mm)	d_{bit} in.	h_v in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	5/16	1 (25.4)	1,400 (6.3)	2,465 (11.1)	1,500 (6.8)	2,465 (11.1)	1,600 (7.2)	2,465 (11.1)	1,905 (8.6)	2,465 (11.1)
		2 (50.8)	2,370 (10.7)	2,465 (11.1)	2,660 (12.0)	2,465 (11.1)	2,950 (13.3)	2,465 (11.1)	3,685 (16.6)	2,465 (11.1)
		3 (76.2)	3,860 (17.4)	2,465 (11.1)	4,165 (18.7)	2,465 (11.1)	4,470 (20.1)	2,465 (11.1)	5,355 (24.1)	2,465 (11.1)
3/8 (9.5)	7/16	1 1/2 (38.1)	3,460 (15.6)	4,600 (20.7)	3,920 (17.6)	4,600 (20.7)	4,400 (19.8)	4,600 (20.7)	5,200 (23.4)	4,600 (20.7)
		3 3/8 (85.7)	9,560 (43.0)	6,000 (27.0)	11,040 (49.7)	6,000 (27.0)	11,780 (53.0)	6,000 (27.0)	12,520 (56.3)	6,000 (27.0)
		5 1/4 (133.4)	14,000 (63.0)	6,480 (29.2)	15,380 (69.2)	6,480 (29.2)	15,560 (70.0)	6,480 (29.2)	15,640 (70.4)	6,480 (29.2)
1/2 (12.7)	9/16	2 (50.8)	4,800 (21.6)	6,800 (30.6)	7,240 (32.6)	6,800 (30.6)	10,820 (48.7)	6,800 (30.6)	14,460 (65.1)	6,800 (30.6)
		4 1/2 (114.3)	12,980 (58.4)	12,800 (57.6)	13,600 (61.2)	12,800 (57.6)	18,860 (84.9)	12,800 (57.6)	21,760 (97.9)	12,800 (57.6)
		7 (177.8)	20,880 (94.0)	12,800 (57.6)	24,380 (109.7)	12,800 (57.6)	26,440 (119.0)	12,800 (57.6)	28,500 (128.3)	12,800 (57.6)
5/8 (15.9)	3/4	2 1/2 (63.5)	6,900 (31.1)	9,600 (43.2)	8,280 (37.3)	9,600 (43.2)	9,400 (42.3)	9,600 (43.2)	10,500 (47.3)	9,600 (43.2)
		5 5/8 (142.9)	19,340 (87.0)	22,800 (102.6)	22,240 (100.1)	22,800 (102.6)	23,400 (105.3)	22,800 (102.6)	24,580 (110.6)	22,800 (102.6)
		8 3/4 (222.3)	30,820 (138.7)	22,800 (102.6)	32,040 (144.2)	22,800 (102.6)	36,760 (165.4)	22,800 (102.6)	38,280 (172.3)	22,800 (102.6)
3/4 (19.1)	7/8	3 (76.2)	9,600 (43.2)	14,400 (64.8)	12,200 (54.9)	14,400 (64.8)	14,840 (66.8)	14,400 (64.8)	17,440 (78.5)	14,400 (64.8)
		6 3/4 (171.5)	28,160 (126.7)	25,600 (115.2)	33,480 (150.7)	25,600 (115.2)	37,520 (168.8)	25,600 (115.2)	43,080 (193.9)	25,600 (115.2)
		10 1/2 (266.7)	39,760 (178.9)	29,250 (131.6)	45,520 (204.8)	29,250 (131.6)	47,680 (214.6)	29,250 (131.6)	49,800 (224.1)	29,250 (131.6)
7/8 (22.2)	1	3 1/2 (88.9)	10,920 (49.1)	14,000 (63.0)	13,320 (59.9)	14,000 (63.0)	15,580 (70.1)	14,000 (63.0)	17,820 (80.2)	14,000 (63.0)
		7 7/8 (200.0)	32,680 (147.1)	36,800 (165.6)	38,400 (172.8)	36,800 (165.6)	42,160 (189.7)	36,800 (165.6)	45,900 (206.6)	36,800 (165.6)
		12 1/4 (311.2)	52,360 (235.6)	36,800 (165.6)	61,440 (276.5)	36,800 (165.6)	67,240 (302.6)	36,800 (165.6)	73,000 (328.5)	36,800 (165.6)
1 (25.4)	1 1/8	4 (101.6)	13,540 (60.9)	18,400 (82.8)	16,340 (73.5)	18,400 (82.8)	18,780 (84.5)	18,400 (82.8)	21,200 (95.4)	18,400 (82.8)
		9 (228.6)	39,760 (178.9)	50,000 (225.0)	48,520 (218.3)	50,000 (225.0)	56,740 (255.3)	50,000 (225.0)	64,920 (292.1)	50,000 (225.0)
		14 (355.6)	58,900 (265.1)	53,135 (239.1)	68,760 (309.4)	53,135 (239.1)	74,600 (335.7)	53,135 (239.1)	80,420 (361.9)	53,135 (239.1)
1 1/4 (31.8)	1 3/8	5 (127.0)	18,000 (81.0)	22,000 (99.0)	24,080 (108.4)	22,000 (99.0)	30,760 (138.4)	22,000 (99.0)	38,780 (174.5)	22,000 (99.0)
		11 1/4 (285.8)	52,920 (238.1)	72,000 (324.0)	66,800 (300.6)	72,000 (324.0)	83,920 (377.6)	72,000 (324.0)	100,900 (454.1)	72,000 (324.0)
		17 1/2 (444.5)	91,480 (411.7)	83,450 (375.5)	109,240 (491.6)	83,450 (375.5)	123,280 (554.8)	83,450 (375.5)	137,240 (617.6)	83,450 (375.5)
1 3/8 (34.9)	1 1/2	5 1/2 (139.7)	30,330 (136.5)	47,980 (215.9)	36,610 (164.7)	47,980 (215.9)	42,890 (193.0)	47,980 (215.9)	49,550 (223.0)	47,980 (215.9)
		12 3/8 (314.3)	68,250 (307.1)	78,905 (355.1)	82,375 (370.7)	78,905 (355.1)	96,500 (434.3)	78,905 (355.1)	111,490 (501.7)	78,905 (355.1)
		16 1/2 (419.1)	90,995 (409.5)	97,460 (438.6)	109,825 (494.2)	97,460 (438.6)	128,660 (579.0)	97,460 (438.6)	148,650 (668.9)	97,460 (438.6)
1 1/2 (38.1)	1 5/8	6 (152.4)	35,760 (160.9)	55,520 (249.8)	43,160 (194.2)	55,520 (249.8)	50,560 (227.5)	55,520 (249.8)	58,415 (262.9)	55,520 (249.8)
		13 1/2 (342.9)	80,455 (362.0)	91,305 (410.9)	97,105 (437.0)	91,305 (410.9)	113,760 (511.9)	91,305 (410.9)	131,430 (591.4)	91,305 (410.9)
		18 (457.2)	107,275 (482.7)	112,780 (507.5)	129,475 (582.6)	112,780 (507.5)	151,680 (682.6)	112,780 (507.5)	167,245 (752.6)	112,780 (507.5)

1. Ultimate load capacities are listed for the Standard Set formula and should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Reduce the above ultimate load values by 25 percent when calculating ultimate load capacities for the Fast Set formula. For allowable working loads see page 214.
3. Linear interpolation may be used to determine ultimate load capacities for intermediate embedments and compressive strengths.

ADHESIVES

PERFORMANCE DATA

Allowable Bond Strength Capacities for Threaded Rod Installed with Standard Set Power-Fast+ in Normal-Weight Concrete[1,2,3,4,5]

Rod Diameter	Drill Bit Dia.	Min. Embed. Depth	Minimum Concrete Compressive Strength (f'_c)							
			2,000 psi (13.8 MPa)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 MPa)	
d in. (mm)	d_{bit} in.	h_v in. (mm)	**Tension** lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**Shear** lbs. (kN)
1/4 (6.4)	5/16	1 (25.4)	350 (1.6)	615 (2.8)	375 (1.7)	615 (2.8)	400 (1.8)	615 (2.8)	475 (2.1)	615 (2.8)
		2 (50.8)	595 (2.7)	615 (2.8)	665 (3.0)	615 (2.8)	740 (3.3)	615 (2.8)	920 (4.1)	615 (2.8)
		3 (76.2)	965 (4.3)	615 (2.8)	1,040 (4.7)	615 (2.8)	1,120 (5.0)	615 (2.8)	1,340 (6.0)	615 (2.8)
3/8 (9.5)	7/16	1 1/2 (38.1)	865 (3.9)	1,150 (5.2)	980 (4.4)	1,150 (5.2)	1,100 (5.0)	1,150 (5.2)	1,300 (5.9)	1,150 (5.2)
		3 3/8 (85.7)	2,390 (10.8)	1,500 (6.8)	2,760 (12.4)	1,500 (6.8)	2,945 (13.3)	1,500 (6.8)	3,130 (14.1)	1,500 (6.8)
		5 1/4 (133.4)	3,500 (15.8)	1,620 (7.3)	3,845 (17.3)	1,620 (7.3)	3,890 (17.5)	1,620 (7.3)	3,910 (17.6)	1,620 (7.3)
1/2 (12.7)	9/16	2 (50.8)	1,200 (5.4)	1,700 (7.7)	1,810 (8.1)	1,700 (7.7)	2,705 (12.2)	1,700 (7.7)	3,615 (16.3)	1,700 (7.7)
		4 1/2 (114.3)	3,245 (14.6)	3,200 (14.4)	3,400 (15.3)	3,200 (14.4)	4,715 (21.2)	3,200 (14.4)	5,440 (24.5)	3,200 (14.4)
		7 (177.8)	5,220 (23.5)	3,200 (14.4)	6,095 (27.4)	3,200 (14.4)	6,610 (29.7)	3,200 (14.4)	7,125 (32.1)	3,200 (14.4)
5/8 (15.9)	3/4	2 1/2 (63.5)	1,725 (7.8)	2,400 (10.8)	2,070 (9.3)	2,400 (10.8)	2,350 (10.6)	2,400 (10.8)	2,625 (11.8)	2,400 (10.8)
		5 5/8 (142.9)	4,835 (21.8)	5,700 (25.7)	5,560 (25.0)	5,700 (25.7)	5,850 (26.3)	5,700 (25.7)	6,145 (27.7)	5,700 (25.7)
		8 3/4 (222.3)	7,705 (34.7)	5,700 (25.7)	8,010 (36.0)	5,700 (25.7)	9,190 (41.4)	5,700 (25.7)	9,570 (43.1)	5,700 (25.7)
3/4 (19.1)	7/8	3 (76.2)	2,400 (10.8)	3,600 (16.2)	3,050 (13.7)	3,600 (16.2)	3,710 (16.7)	3,600 (16.2)	4,360 (19.6)	3,600 (16.2)
		6 3/4 (171.5)	7,040 (31.7)	6,400 (28.8)	8,370 (37.7)	6,400 (28.8)	9,380 (42.2)	6,400 (28.8)	10,770 (48.5)	6,400 (28.8)
		10 1/2 (266.7)	9,940 (44.7)	7,315 (32.9)	11,380 (51.2)	7,315 (32.9)	11,920 (53.6)	7,315 (32.9)	12,450 (56.0)	7,315 (32.9)
7/8 (22.2)	1	3 1/2 (88.9)	2,730 (12.3)	3,500 (15.8)	3,330 (15.0)	3,500 (15.8)	3,895 (17.5)	3,500 (15.8)	4,455 (20.0)	3,500 (15.8)
		7 7/8 (200.0)	8,170 (36.8)	9,200 (41.4)	9,600 (43.2)	9,200 (41.4)	10,540 (47.4)	9,200 (41.4)	11,475 (51.6)	9,200 (41.4)
		12 1/4 (311.2)	13,090 (58.9)	9,200 (41.4)	15,360 (69.1)	9,200 (41.4)	16,810 (75.6)	9,200 (41.4)	18,250 (82.1)	9,200 (41.4)
1 (25.4)	1 1/8	4 (101.6)	3,385 (15.2)	4,600 (20.7)	4,085 (18.4)	4,600 (20.7)	4,695 (21.1)	4,600 (20.7)	5,300 (23.9)	4,600 (20.7)
		9 (228.6)	9,940 (44.7)	12,500 (56.3)	12,130 (54.6)	12,500 (56.3)	14,185 (63.8)	12,500 (56.3)	16,230 (73.0)	12,500 (56.3)
		14 (355.6)	14,725 (66.3)	13,285 (59.8)	17,190 (77.4)	13,285 (59.8)	18,650 (83.9)	13,285 (59.8)	20,105 (90.5)	13,285 (59.8)
1 1/4 (31.8)	1 3/8	5 (127.0)	4,500 (20.3)	5,500 (24.8)	6,020 (27.1)	5,500 (24.8)	7,690 (34.6)	5,500 (24.8)	9,695 (43.6)	5,500 (24.8)
		11 1/4 (285.8)	13,230 (59.5)	18,000 (81.0)	16,700 (75.2)	18,000 (81.0)	20,980 (94.4)	18,000 (81.0)	25,225 (113.5)	18,000 (81.0)
		17 1/2 (444.5)	22,870 (102.9)	20,865 (93.9)	27,310 (122.9)	20,865 (93.9)	30,820 (138.7)	20,865 (93.9)	34,310 (154.4)	20,865 (93.9)
1 3/8 (34.9)	1 1/2	5 1/2 (139.7)	7,585 (34.1)	11,995 (54.0)	9,155 (41.2)	11,995 (54.0)	10,725 (48.3)	11,995 (54.0)	12,390 (55.8)	11,995 (54.0)
		12 3/8 (314.3)	17,065 (76.8)	19,725 (88.8)	20,595 (92.7)	19,725 (88.8)	24,125 (108.6)	19,725 (88.8)	27,875 (125.4)	19,725 (88.8)
		16 1/2 (419.1)	22,750 (102.4)	24,365 (109.6)	27,455 (123.5)	24,365 (109.6)	32,165 (144.7)	24,365 (109.6)	37,165 (167.2)	24,365 (109.6)
1 1/2 (38.1)	1 5/8	6 (152.4)	8,940 (40.2)	13,880 (62.5)	10,790 (48.6)	13,880 (62.5)	12,640 (56.9)	13,880 (62.5)	14,605 (65.7)	13,880 (62.5)
		13 1/2 (342.9)	20,115 (90.5)	22,825 (102.7)	24,275 (109.2)	22,825 (102.7)	28,440 (128.0)	22,825 (102.7)	32,860 (147.9)	22,825 (102.7)
		18 (457.2)	26,820 (120.7)	28,195 (126.9)	32,370 (145.7)	28,195 (126.9)	37,920 (170.6)	28,195 (126.9)	41,810 (188.1)	28,195 (126.9)

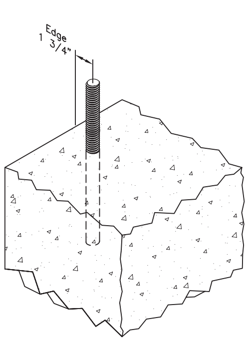
1. Allowable bond capacities listed are for the Standard Set formula and are calculated using an applied safety factor of 4.0.
2. **Reduce the above allowable bond capacities by 25 percent when calculating allowable bond capacities for the Fast Set formula. Allowable working load values for Fast Set formula are permitted for short-term loads only; where applicable to code and ICC-ES ESR-1531.**
3. Linear interpolation may be used to determine allowable bond capacities for intermediate embedments and compressive strengths.
4. Allowable design load should be the lesser of the bond or allowable steel strength.
5. Allowable loads for threaded rods to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load, where permitted by code.

PERFORMANCE DATA

Allowable Bond Strength Capacities for Threaded Rod Installed with Standard Set Power-Fast+ at 1-3/4" from Edge of Normal-Weight Concrete[1,2,3,4,5]

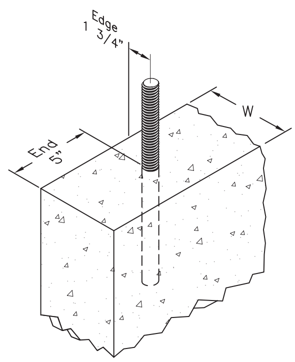
Rod Dia. d in. (mm)	Drill Bit Dia. d_{bit} in.	Min. Embed. Depth h_v in. (mm)	Min. Edge Dist. in. (mm)	Min. End Dist. in. (mm)	Tension, lbs. (kN) — Minimum Concrete Compressive Strength (f'_c)				Shear, lbs. (kN) — f'_c = 2,000 psi (13.8 MPa)		Shear, lbs. (kN) — $f'_c \geq$ 2,500 psi (17.2 MPa)	
					2,000 psi (13.8 MPa)	**3,000 psi** (20.7 MPa)	**4,000 psi** (27.6 MPa)	**5,000 psi** (34.5 MPa)	Towards the Free Edge	Parallel to the Free Edge	Towards the Free Edge	Parallel to the Free Edge
1/2 (12.7)	9/16	4 1/2 (114.3)	1 3/4 (44.5)	7 (177.8)	2,150 (9.7)	2,530 (11.4)	2,915 (13.1)	3,295 (14.8)	565 (2.5)	1,455 (6.5)	620 (2.8)	1,600 (7.2)
		5 (127.0)			2,405 (10.8)	2,790 (12.6)	3,170 (14.3)	3,555 (16.0)				
		5 1/2 (139.7)			2,660 (12.0)	3,045 (13.7)	3,430 (15.4)	3,815 (17.2)				
		6 (139.7)			2,915 (12.0)	3,305 (13.7)	3,690 (15.4)	4,080 (17.2)				
		6 1/2 (165.1)			3,175 (14.3)	3,565 (16.0)	3,950 (17.8)	4,340 (19.5)				
		7 (177.8)			3,430 (15.4)	3,820 (17.2)	4,210 (18.9)	4,600 (20.7)				
5/8 (15.9)	3/4	5 5/8 (142.9)	1 3/4 (44.5)	8 3/4 (222.3)	2,615 (11.8)	3,260 (14.7)	3,905 (17.6)	4,550 (20.5)	620 (2.8)	2,060 (9.3)	680 (3.1)	2,260 (10.2)
		6 1/4 (158.8)			3,010 (13.5)	3,690 (16.6)	4,375 (19.7)	5,055 (22.7)				
		6 7/8 (174.6)			3,405 (15.3)	4,125 (18.6)	4,840 (21.8)	5,560 (25.0)				
		7 1/2 (190.5)			3,805 (17.1)	4,560 (20.5)	5,310 (23.9)	6,065 (27.3)				
		8 1/8 (206.4)			4,200 (18.9)	4,990 (22.5)	5,780 (26.0)	6,570 (29.6)				
		8 3/4 (222.3)			4,595 (20.7)	5,420 (24.4)	6,250 (28.1)	7,075 (31.8)				
7/8 (22.2)	1	7 7/8 (200.0)	1 3/4 (44.5)	12 1/4 (311.2)	5,055 (22.7)	5,415 (24.4)	5,775 (26.0)	6,135 (27.6)	930 (4.2)	2,650 (11.9)	1,020 (4.6)	2,910 (13.1)
		8 3/4 (222.3)			5,585 (25.1)	6,045 (27.2)	6,500 (29.3)	6,960 (31.3)				
		9 5/8 (244.5)			6,120 (27.5)	6,675 (30.0)	7,230 (32.5)	7,785 (35.0)				
		10 1/2 (266.7)			6,650 (29.9)	7,300 (32.9)	7,955 (35.8)	8,605 (38.7)				
		11 3/8 (288.9)			7,185 (32.3)	7,935 (35.7)	8,680 (39.1)	9,430 (42.4)				
		12 1/4 (311.2)			7,715 (34.7)	8,560 (38.5)	9,410 (42.3)	10,255 (46.1)				

1. Allowable bond capacities listed are for the Standard Set formula and are calculated using an applied safety factor of 4.0.
2. **Reduce the above allowable bond capacities by 25 percent when calculating allowable bond capacities for the Fast Set formula. Allowable working load values for Fast Set formula are permitted for short-term loads only; where applicable to code and ICC-ES ESR-1531.**
3. Linear interpolation may be used to determine allowable bond capacities for intermediate embedments and compressive strengths.
4. Allowable design load should be the lesser of the bond or allowable steel strength.
5. Allowable loads for threaded rods to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load, where permitted by code.



ADHESIVES

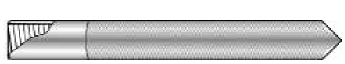
PERFORMANCE DATA



Allowable Bond Strength Capacities for Threaded Rod Installed with Standard Set Power-Fast+ in Normal-Weight Concrete Stem Walls[1,2,3,4,5]

Rod Diameter d in. (mm)	Drill Bit Diameter d_{bit} in.	Min. Embed. Depth h_v in. (mm)	Min. Wall Width w in. (mm)	Min. Edge Dist. in. (mm)	Min. End Dist. in. (mm)	$f'_c \geq$ 2,500 psi (17.2 MPa) Tension lbs. (kN)
1/2 (12.7)	9/16	7 (177.8)	6 (152.4)	1 3/4 (44.5)	5 (127.0)	2,830 (12.7)
5/8 (15.9)	3/4	8 3/4 (222.3)	6 (152.4)	1 3/4 (44.5)	5 (127.0)	3,675 (16.5)
		10 (254.0)			5 (127.0)	3,730 (16.8)
		10 (254.0)			10 (254.0)	3,915 (17.6)
		12 1/2 (317.5)			5 (127.0)	3,835 (17.3)
3/4 (19.1)	7/8	12 1/2 (317.5)	6 (152.4)	1 3/4 (44.5)	5 (127.0)	4,055 (18.2)
7/8 (22.2)	1	12 1/4 (311.2)	8 (203.2)	1 3/4 (44.5)	5 (127.0)	4,890 (22.0)
		15 (381.0)			5 (127.0)	5,530 (24.6)
		15 (381.0)			10 (254.0)	6,565 (29.5)
		17 1/2 (444.5)			5 (127.0)	6,110 (27.5)

1. Allowable bond capacities listed are for the Standard Set formula and are calculated using an applied safety factor of 4.0.
2. **Reduce the above allowable bond capacities by 25 percent when calculating allowable bond capacities for the Fast Set formula. Allowable working load values for Fast Set formula are permitted for short-term loads only; where applicable to code and ICC-ES ESR-1531.**
3. Linear interpolation may be used to determine allowable bond capacities for intermediate embedments.
4. Allowable design load should be the lesser of the bond or allowable steel strength.
5. Allowable loads for threaded rods to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load, where permitted by code.



Internally Threaded Insert

Ultimate and Allowable Bond Strength Capacities for Internally Threaded Inserts Installed with Standard Set Power-Fast+ in Normal-Weight Concrete[1,2,3,4]

Steel Insert Size d in. (mm)	Thread Depth in. (mm)	Outside Diameter in. (mm)	Drill Bit Dia. d_{bit} in.	Min. Embed. Depth h_v in. (mm)	$f'_c \geq$ 4,000 psi (27.6 MPa) Ultimate Tension lbs. (kN)	Ultimate Shear lbs. (kN)	Allowable Tension lbs. (kN)	Allowable Shear lbs. (kN)
3/8 (9.5)	1 1/2 (38.1)	17/32 (13.5)	9/16	3 1/2 (88.9)	7,880 (35.5)	6,480 (29.2)	1,970 (8.9)	1,620 (7.3)
1/2 (12.7)	1 5/8 (41.3)	21/32 (16.7)	3/4	4 1/4 (108.0)	10,960 (49.3)	11,120 (50.0)	2,740 (12.3)	2,780 (12.5)
5/8 (15.9)	2 3/8 (60.3)	29/32 (23.0)	1	5 (127.0)	15,600 (70.2)	17,650 (79.4)	3,900 (17.6)	4,415 (19.9)
3/4 (19.1)	2 3/4 (69.9)	1 (25.4)	1 1/8	6 5/8 (168.3)	22,440 (101.0)	29,250 (131.6)	5,610 (25.2)	7,315 (32.9)

1. Allowable bond capacities listed are for the Standard Set formula and are calculated using an applied safety factor of 4.0.
2. **Reduce the above allowable bond capacities by 25 percent when calculating allowable bond capacities for the Fast Set formula. Allowable working load values for Fast Set formula are permitted for short-term loads only; where applicable to code and ICC-ES ESR-1531.**
3. Allowable design load should be the lesser of the bond or allowable steel strength.
4. Allowable loads for threaded rods to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load, where permitted by code.

ADHESIVES

PERFORMANCE DATA

Ultimate and Allowable Bond Strength Capacities for Reinforcing Bar Installed with Standard Set Power-Fast+ in Normal-Weight Concrete[1,2,3,4,5]

Bar Size No. (in.)	Drill Bit Diameter d_{bit} in.	Min. Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c) — Tension, lbs (kN) — 2,000 psi (13.8 MPa) Ultimate Tension lbs. (kN)	2,000 psi (13.8 MPa) Allowable Tension lbs. (kN)	4,000 psi (27.6 MPa) Ultimate Tension lbs. (kN)	4,000 psi (27.6 MPa) Allowable Tension lbs. (kN)	6,000 psi (41.4 MPa) Ultimate Tension lbs. (kN)	6,000 psi (41.4 MPa) Allowable Tension lbs. (kN)	Shear, lbs (kN) — $f'_c \geq$ 2,000 psi (13.8 MPa) Ultimate Shear lbs. (kN)	Shear, lbs (kN) — $f'_c \geq$ 2,000 psi (13.8 MPa) Allowable Shear lbs. (kN)
No. 3 (3/8")	1/2	2 1/4 (57.2)	7,425 (33.4)	1,855 (8.3)	11,085 (49.9)	2,770 (12.5)	12,130 (54.6)	3,035 (13.7)	6,480 (29.2)	1,620 (7.3)
		3 3/8 (85.7)	11,140 (50.1)	2,785 (12.5)	16,630 (74.8)	4,160 (18.7)	18,200 (81.9)	4,550 (20.5)	8,300 (37.4)	2,075 (9.3)
		4 1/2 (114.3)	14,855 (66.8)	3,715 (16.7)	22,180 (99.8)	5,545 (25.0)	24,270 (109.2)	6,070 (27.3)	8,300 (37.4)	2,075 (9.3)
No. 4 (1/2")	5/8	3 (76.2)	9,625 (43.3)	2,405 (10.8)	14,370 (64.7)	3,595 (16.2)	15,725 (70.8)	3,930 (17.7)	11,120 (50.0)	2,780 (12.5)
		4 1/2 (114.3)	14,440 (65.0)	3,610 (16.2)	21,560 (97.0)	5,390 (24.3)	23,590 (106.2)	5,900 (26.6)	14,820 (66.7)	3,705 (16.7)
		6 (152.4)	19,255 (86.6)	4,815 (21.7)	28,745 (129.4)	7,185 (32.3)	31,460 (141.6)	7,865 (35.4)	14,820 (66.7)	3,705 (16.7)
No. 5 (5/8")	3/4	3 3/4 (95.3)	13,415 (60.4)	3,355 (15.1)	20,030 (90.1)	5,010 (22.5)	21,915 (98.6)	5,480 (24.7)	17,660 (79.5)	4,415 (19.9)
		5 5/8 (142.9)	20,120 (90.5)	5,030 (22.6)	30,040 (135.2)	7,510 (33.8)	32,870 (147.9)	8,220 (37.0)	26,240 (118.1)	6,560 (29.5)
		7 1/2 (190.5)	26,825 (120.7)	6,705 (30.2)	40,050 (180.2)	10,015 (45.1)	43,825 (197.2)	10,955 (49.3)	26,240 (118.1)	6,560 (29.5)
No. 6 (3/4")	7/8	4 1/2 (114.3)	17,545 (79.0)	4,385 (19.7)	26,195 (117.9)	6,550 (29.5)	28,665 (129.0)	7,165 (32.2)	21,900 (98.6)	5,475 (24.6)
		6 3/4 (171.5)	26,320 (118.4)	6,580 (29.6)	39,295 (176.8)	9,825 (44.2)	43,000 (193.5)	10,750 (48.4)	28,060 (126.3)	7,015 (31.6)
		9 (228.6)	35,095 (157.9)	8,775 (39.5)	52,395 (235.8)	13,100 (59.0)	57,340 (258.0)	14,335 (64.5)	28,060 (126.3)	7,015 (31.6)
No. 7 (7/8")	1	5 1/4 (133.4)	22,215 (100.0)	5,555 (25.0)	33,165 (149.2)	8,290 (37.3)	36,295 (163.3)	9,075 (40.8)	36,060 (162.3)	9,015 (40.6)
		7 7/8 (200.0)	33,320 (149.9)	8,330 (37.5)	49,745 (223.9)	12,435 (56.0)	54,435 (245.0)	13,610 (61.2)	49,220 (221.5)	12,305 (55.4)
		10 1/2 (266.7)	44,425 (199.9)	11,105 (50.0)	66,325 (298.5)	16,580 (74.6)	72,580 (326.6)	18,145 (81.7)	49,220 (221.5)	12,305 (55.4)
No. 8 (1")	1 1/8	6 (152.4)	32,225 (145.0)	8,055 (36.2)	48,110 (216.5)	12,030 (54.1)	52,650 (236.9)	13,165 (59.2)	53,140 (239.1)	13,285 (59.8)
		9 (228.6)	48,340 (217.5)	12,085 (54.4)	72,170 (324.8)	18,045 (81.2)	78,975 (355.4)	19,745 (88.9)	59,140 (266.1)	14,785 (66.5)
		12 (304.8)	64,455 (290.0)	16,115 (72.5)	96,230 (433.0)	24,060 (108.3)	105,305 (473.9)	26,325 (118.5)	59,140 (266.1)	14,785 (66.5)
No. 9 (1 1/8")	1 3/8	6 3/4 (171.5)	37,145 (167.2)	9,285 (41.8)	55,455 (249.5)	13,865 (62.4)	60,685 (273.1)	15,170 (68.3)	68,300 (307.4)	17,075 (76.8)
		10 1/8 (257.2)	55,720 (250.7)	13,930 (62.7)	83,190 (374.4)	20,800 (93.6)	91,035 (409.7)	22,760 (102.4)	80,460 (362.1)	20,115 (90.5)
		13 1/2 (342.9)	74,295 (334.3)	18,575 (83.6)	110,920 (499.1)	27,730 (124.8)	121,380 (546.2)	30,345 (136.6)	80,460 (362.1)	20,115 (90.5)
No. 10 (1 1/4")	1 1/2	7 1/2 (190.5)	49,375 (222.2)	12,345 (55.6)	73,715 (331.7)	18,430 (82.9)	80,665 (363.0)	20,165 (90.7)	83,460 (375.6)	20,865 (93.9)
		11 1/4 (285.8)	74,060 (333.3)	18,515 (83.3)	110,570 (497.6)	27,645 (124.4)	120,995 (544.5)	30,250 (136.1)	84,300 (379.4)	21,075 (94.8)
		15 (381.0)	98,745 (444.4)	24,685 (111.1)	147,425 (663.4)	36,855 (165.8)	161,325 (726.0)	40,330 (181.5)	84,300 (379.4)	21,075 (94.8)
No. 11 (1 3/8")	1 5/8	8 1/4 (209.6)	58,695 (264.1)	14,675 (66.0)	87,630 (394.3)	21,910 (98.6)	95,895 (431.5)	23,975 (107.9)	97,460 (438.6)	24,365 (109.6)
		12 3/8 (314.3)	88,040 (396.2)	22,010 (99.0)	131,440 (591.5)	32,860 (147.9)	143,835 (647.3)	35,960 (161.8)	97,460 (438.6)	24,365 (109.6)
		16 1/2 (419.1)	117,385 (528.2)	29,345 (132.1)	175,250 (788.6)	43,815 (197.2)	191,780 (863.0)	47,945 (215.8)	97,460 (438.6)	24,365 (109.6)

1. Allowable bond capacities listed are for the Standard Set formula and are calculated using an applied safety factor of 4.0.
2. **Reduce the above allowable bond capacities by 25 percent when calculating allowable bond capacities for the Fast Set formula. Allowable working load values for Fast Set formula are permitted for short-term loads only; where applicable to code and ICC-ES ESR-1531.**
3. Linear interpolation may be used to determine allowable bond capacities for intermediate embedments and compressive strengths.
4. Allowable design load should be the lesser of the bond or allowable steel strength.
5. Allowable loads for reinforcing bars to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load, where permitted by code.

ADHESIVES

PERFORMANCE DATA

Minimum Development Lengths for Reinforcing Bar Installed with Standard Set Power-Fast+ in Normal-Weight Concrete[1,2,3]

Bar Size No. (in.)	Drill Bit Dia. d_{bit} in.	Min. Embed. Depth h_v in. (mm)	Tension, f'_c = 2,000 psi (13.8 MPa): Ultimate Bond Strength lbs. (kN)	2,000 psi: Embed. at Yield Strength in. (mm)	2,000 psi: Embed. at Tensile Strength in. (mm)	Tension, f'_c = 4,000 psi (27.6 MPa): Ultimate Bond Strength lbs. (kN)	4,000 psi: Embed. at Yield Strength in. (mm)	4,000 psi: Embed. at Tensile Strength in. (mm)	Tension, f'_c = 6,000 psi (41.4 MPa): Ultimate Bond Strength lbs. (kN)	6,000 psi: Embed. at Yield Strength in. (mm)	6,000 psi: Embed. at Tensile Strength in. (mm)	Grade 60 Rebar (f_y=60 ksi, f_u=90 ksi): Yield Strength lbs. (kN)	Grade 60 Rebar: Ultimate Tensile Strength lbs. (kN)
No. 3 (3/8")	1/2	2 1/4 (57.2)	7,425 (33.4)	2 (50.8)	3 (76.2)	11,085 (49.9)	1 3/8 (34.0)	2 (51.0)	12,130 (54.6)	1 1/4 (31.1)	1 7/8 (46.7)	6,600 (29.7)	9,900 (44.6)
		3 3/8 (85.7)	11,140 (50.1)			16,630 (74.8)			18,200 (81.9)				
		4 1/2 (114.3)	14,855 (66.8)			22,180 (99.8)			24,270 (109.2)				
No. 4 (1/2")	5/8	3 (76.2)	9,625 (43.3)	3 3/4 (95.0)	5 5/8 (142.5)	14,370 (64.7)	2 1/2 (63.6)	3 3/4 (95.4)	15,725 (70.8)	2 1/2 (58.2)	3 3/8 (87.2)	12,000 (54.0)	18,000 (81.0)
		4 1/2 (114.3)	14,440 (65.0)			21,560 (97.0)			23,590 (106.2)				
		6 (152.4)	19,255 (86.6)			28,745 (129.4)			31,460 (141.6)				
No. 5 (5/8")	3/4	3 3/4 (95.3)	13,415 (60.4)	5 1/4 (132.1)	7 3/4 (198.1)	20,030 (90.1)	3 1/2 (88.4)	5 1/4 (132.7)	21,915 (98.6)	3 (80.8)	4 3/4 (121.3)	18,600 (83.7)	27,900 (125.6)
		5 5/8 (142.9)	20,120 (90.5)			30,040 (135.2)			32,870 (147.9)				
		7 1/2 (190.5)	26,825 (120.7)			40,050 (180.2)			43,825 (197.2)				
No. 6 (3/4")	7/8	4 1/2 (114.3)	17,545 (79.0)	6 3/4 (172.0)	10 1/4 (257.9)	26,195 (117.9)	4 1/2 (115.2)	6 3/4 (172.8)	28,665 (129.0)	4 (105.3)	6 1/4 (157.9)	26,400 (118.8)	39,600 (178.2)
		6 3/4 (171.5)	26,320 (118.4)			39,295 (176.8)			43,000 (193.5)				
		9 (228.6)	35,095 (157.9)			52,395 (235.8)			57,340 (258.0)				
No. 7 (7/8")	1	5 1/4 (133.4)	22,215 (100.0)	8 1/2 (216.1)	12 3/4 (324.2)	33,165 (149.2)	5 3/4 (144.8)	8 1/2 (217.1)	36,295 (163.3)	5 (132.3)	7 3/4 (198.4)	36,000 (162.0)	54,000 (243.0)
		7 7/8 (200.0)	33,320 (149.9)			49,745 (223.9)			54,435 (245.0)				
		10 1/2 (266.7)	44,425 (199.9)			66,325 (298.5)			72,580 (326.6)				
No. 8 (1")	1 1/8	6 (152.4)	32,225 (145.0)	8 3/4 (224.4)	13 1/4 (336.2)	48,110 (216.5)	6 (150.3)	8 3/4 (225.2)	52,650 (236.9)	5 1/2 (137.3)	8 1/8 (205.8)	47,450 (213.5)	71,100 (320.0)
		9 (228.6)	48,340 (217.5)			72,170 (324.8)			78,975 (355.4)				
		12 (304.8)	64,455 (290.0)			96,230 (433.0)			105,305 (473.9)				
No. 9 (1 1/8")	1 3/8	6 3/4 (171.5)	37,145 (167.2)	11 (276.9)	16 1/4 (415.4)	55,455 (249.5)	7 1/4 (185.5)	11 (278.2)	60,685 (273.1)	6 1/2 (169.5)	10 (254.3)	60,000 (270.0)	90,000 (405.0)
		10 1/8 (257.2)	55,720 (250.7)			83,190 (374.4)			91,035 (409.7)				
		13 1/2 (342.9)	74,295 (334.3)			110,920 (499.1)			121,380 (546.2)				
No. 10 (1 1/4")	1 1/2	7 1/2 (190.5)	49,375 (222.2)	11 5/8 (294.0)	17 1/4 (441.0)	73,715 (331.7)	8 (196.9)	11 5/8 (295.4)	80,665 (363.0)	7 (180.0)	10 5/8 (269.9)	76,200 (342.9)	114,300 (514.4)
		11 1/4 (285.8)	74,060 (333.3)			110,570 (497.6)			120,995 (544.5)				
		15 (381.0)	98,745 (444.4)			147,425 (663.4)			161,325 (726.0)				
No. 11 (1 3/8")	1 5/8	8 1/4 (209.6)	58,695 (264.1)	13 (334.2)	19 3/4 (501.3)	87,630 (394.3)	9 (223.8)	13 (335.8)	95,895 (431.5)	8 (204.5)	12 1/8 (306.8)	93,600 (421.2)	140,400 (631.8)
		12 3/8 (314.3)	88,040 (396.2)			131,440 (591.5)			143,835 (647.3)				
		16 1/2 (419.1)	117,385 (528.2)			175,250 (788.6)			191,780 (863.0)				

1. Ultimate bond strength capacities listed are for the Standard Set formula.
2. Reduce the tabulated ultimate bond strength capacities by 25 percent for the Fast Set formula. Increase development lengths accordingly.
3. Linear interpolation may be used to determine rebar development lengths for intermediate compressive strengths.

ADHESIVES

PERFORMANCE DATA

Ultimate and Allowable Bond Strength Capacities for Smooth Dowel Bars Installed with Standard Set Power-Fast+ in Normal-Weight Concrete[1,2,3,4,5]

Dowel Size d	Drill Bit Diameter d_{bit} in.	Min. Embed. Depth h_v in. (mm)	Bond Strength, Minimum Concrete Compressive Strength (f'_c): 2,000 psi (13.8 MPa) Ultimate Tension lbs. (kN)	2,000 psi Allowable Tension lbs. (kN)	4,000 psi (27.6 MPa) Ultimate Tension lbs. (kN)	4,000 psi Allowable Tension lbs. (kN)	6,000 psi (41.4 MPa) Ultimate Tension lbs. (kN)	6,000 psi Allowable Tension lbs. (kN)	Steel Strength, Grade 60 Dowel: Yield Tension lbs. (kN)	Steel Strength, Grade 60 Dowel: Ultimate Tension lbs. (kN)
3/4 (19.1)	7/8	7 (177.8)	28,600 (128.7)	7,150 (32.2)	38,100 (171.5)	9,525 (42.9)	42,320 (190.4)	10,580 (47.6)	26,400 (118.8)	39,600 (178.2)
		9 (228.6)	36,800 (165.6)	9,200 (41.4)	48,980 (220.4)	12,245 (55.1)	54,420 (244.9)	13,605 (61.2)	26,400 (118.8)	39,600 (178.2)
1 (25.4)	1 1/8	7 (177.8)	36,670 (165.0)	9,170 (41.3)	48,800 (219.6)	12,200 (54.9)	54,230 (244.0)	13,560 (61.0)	47,400 (213.3)	71,100 (320.0)
		9 (228.6)	47,150 (212.2)	11,790 (53.1)	62,750 (282.4)	15,690 (70.6)	69,730 (313.8)	17,435 (78.5)	47,400 (213.3)	71,100 (320.0)
1 1/4 (31.8)	1 3/8	7 (177.8)	44,480 (200.2)	11,120 (50.0)	59,200 (266.4)	14,800 (66.6)	65,775 (296.0)	16,445 (74.0)	73,590 (331.2)	110,390 (496.8)
		9 (228.6)	57,180 (257.3)	14,295 (64.3)	76,100 (342.5)	19,025 (85.6)	84,560 (380.5)	21,140 (95.1)	73,590 (331.2)	110,390 (496.8)
1 1/2 (38.1)	1 5/8	7 (177.8)	52,280 (235.3)	13,070 (58.8)	69,580 (313.1)	17,395 (78.3)	77,315 (347.9)	19,330 (87.0)	105,975 (476.9)	158,960 (715.3)
		9 (228.6)	67,200 (302.4)	16,800 (75.6)	89,460 (402.6)	22,365 (100.6)	99,400 (447.3)	24,850 (111.8)	105,975 (476.9)	158,960 (715.3)

1. Allowable bond capacities listed are for the Standard Set formula and are calculated using an applied safety factor of 4.0.
2. Reduce the above allowable bond capacities by 25 percent when calculating allowable bond capacities for the Fast Set formula.
Allowable working load values for Fast Set formula are permitted for short-term loads only; where applicable to code and ICC-ES ESR-1531.
3. Linear interpolation may be used to determine allowable bond capacities for intermediate embedments and compressive strengths.
4. Allowable design load should be the lesser of the bond or allowable steel strength.
5. Allowable loads for reinforcing bars to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load, where permitted by code.

Ultimate and Allowable Bond Strength Capacities for Threaded Rod Installed with Standard Set Power-Fast+ in Structural Sand-Lightweight Concrete[1,2,3,4]

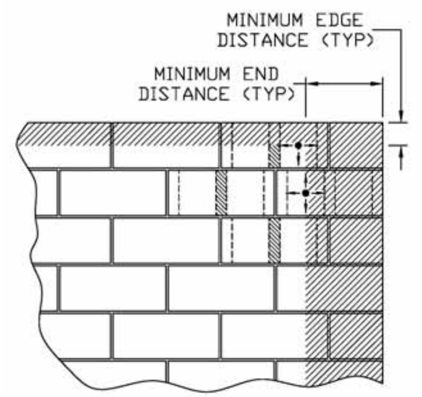
Rod Diameter d in. (mm)	Drill Bit Diameter d_{bit} in.	Min. Embed. Depth h_v in. (mm)	$f'_c \geq$ 3,000 psi (20.7 MPa): Ultimate Load Tension lbs. (kN)	Ultimate Load Shear lbs. (kN)	Allowable Load Tension lbs. (kN)	Allowable Load Shear lbs. (kN)
3/8 (9.5)	7/16	1 1/2 (38.1)	3,280 (14.8)	5,160 (23.2)	820 (3.7)	1,290 (5.8)
		1 7/8 (47.6)	4,300 (19.4)	5,220 (23.5)	1,075 (4.8)	1,305 (5.9)
		2 1/4 (57.2)	5,300 (23.9)	5,300 (23.9)	1,325 (6.0)	1,325 (6.0)
		2 5/8 (66.7)	6,320 (28.4)	5,360 (24.1)	1,580 (7.1)	1,340 (6.0)
		3 (76.2)	7,320 (32.9)	5,440 (24.5)	1,830 (8.2)	1,360 (6.1)
		3 3/8 (85.7)	8,340 (37.5)	5,500 (24.8)	2,085 (9.4)	1,375 (6.2)
1/2 (12.7)	9/16	2 (50.8)	5,100 (23.0)	8,020 (36.1)	1,275 (5.7)	2,005 (9.0)
		2 1/2 (63.5)	6,740 (30.3)	8,320 (37.4)	1,685 (7.6)	2,080 (9.4)
		3 (76.2)	8,380 (37.7)	8,620 (38.8)	2,095 (9.4)	2,155 (9.7)
		3 1/2 (88.9)	10,040 (45.2)	8,940 (40.2)	2,510 (11.3)	2,235 (10.1)
		4 (101.6)	11,680 (52.6)	9,240 (41.6)	2,920 (13.1)	2,310 (10.4)
		4 1/2 (114.3)	13,320 (59.9)	9,540 (42.9)	3,330 (15.0)	2,385 (10.7)
5/8 (15.9)	3/4	2 1/2 (63.5)	6,880 (31.0)	11,440 (51.5)	1,720 (7.7)	2,860 (12.9)
		3 1/8 (79.4)	8,580 (38.6)	12,040 (54.2)	2,145 (9.7)	3,010 (13.5)
		3 3/4 (95.3)	10,280 (46.3)	12,640 (56.9)	2,570 (11.6)	3,160 (14.2)
		4 3/8 (111.1)	12,000 (54.0)	13,240 (59.6)	3,000 (13.5)	3,310 (14.9)
		5 (127.0)	13,700 (61.7)	13,840 (62.3)	3,425 (15.4)	3,460 (15.6)
		5 5/8 (142.9)	15,400 (69.3)	14,440 (65.0)	3,850 (17.3)	3,610 (16.2)

1. The values listed above are ultimate and allowable bond capacities for Power-Fast+ in sand-lightweight concrete.
2. Reduce the above allowable bond capacities by 25 percent when calculating allowable bond capacities for the Fast Set formula.
Allowable working load values for Fast Set formula are permitted for short-term loads only; where applicable to code and ICC-ES ESR-1531.
3. Reduce the above allowable bond capacities by 25 percent when calculating allowable bond capacities for the Fast Set formula.
4. Linear interpolation may be used to determine allowable bond capacities for intermediate embedments. Allowable loads for intermediate spacing and edge distances may be calculated using spacing and edge distance reduction factors in the Design Criteria section.
5. Allowable design load should be the lesser of the bond or allowable steel strength.

ADHESIVES

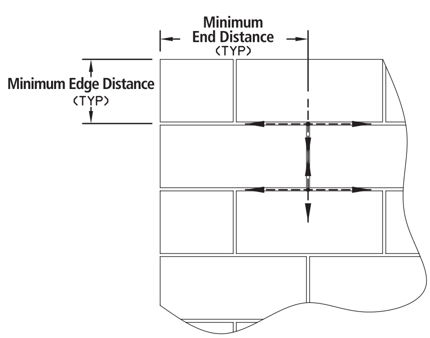
PERFORMANCE DATA

Allowable Bond Strength Capacities for Threaded Rod Installed with Standard Set Power-Fast+ in Grout-Filled Concrete Masonry[1,2,3,4,5,6]



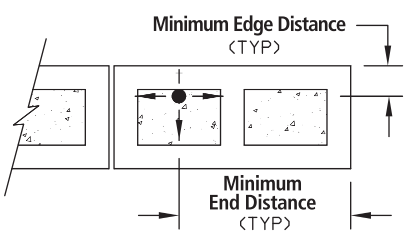
Face Shell
(Grouted Cell & Web)
Permissible Anchor Locations
(Unshaded Area)

Anchor Installed Through Face Shell						
Rod Diameter *d* in. (mm)	Drill Bit Diameter d_{bit} in.	Minimum Embed. Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)
3/8 (9.5)	7/16	3 1/2 (88.9)	3 3/4 (95.3)	12 (304.8)	875 (3.9)	970 (4.4)
			12 (304.8)	12 (304.8)	930 (4.2)	1,005 (4.5)
1/2 (12.7)	9/16	4 1/4 (108.0)	3 3/4 (95.3)	12 (304.8)	1,305 (5.9)	1,370 (6.2)
			12 (304.8)	12 (304.8)	1,585 (7.1)	1,615 (7.3)
5/8 (15.9)	3/4	5 (127.0)	3 3/4 (95.3)	12 (304.8)	1,505 (6.8)	1,370 (6.2)
			12 (304.8)	12 (304.8)	1,780 (8.0)	1,940 (8.7)



T-Joints
Permissible Anchor Locations

Anchor Installed In Joint						
Rod Diameter *d* in. (mm)	Drill Bit Diameter d_{bit} in.	Minimum Embed. Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)
3/8 (9.5)	7/16	3 1/2 (88.9)	8 (203.2)	16 (406.4)	1,025 (4.6)	1,030 (4.6)
1/2 (12.7)	9/16	4 1/4 (108.0)	8 (203.2)	16 (406.4)	1,325 (6.0)	1,830 (8.2)
5/8 (15.9)	3/4	5 (127.0)	8 (203.2)	16 (406.4)	1,730 (7.8)	2,290 (10.3)



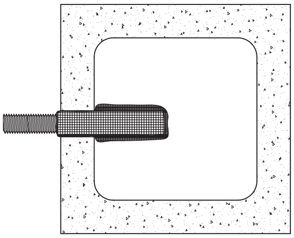
Top of Wall

Anchor Installed In Cell Opening (Top of Wall) For Sill Plates And Other Attachments							
Rod Dia. *d* in. (mm)	Drill Bit Diameter d_{bit} in.	Min. Embed. Depth h_v in. (mm)	Min. Edge Distance in. (mm)	Min. End Distance in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)	
						Perpen. to Edge	Parallel to Edge
1/2 (12.7)	9/16	4 1/4 (108.0)	1 3/4 (44.5)	10 3/4 (273.1)	960 (4.3)	255 (1.1)	650 (2.9)
5/8 (15.9)	3/4	5 (127.0)	1 3/4 (44.5)	10 3/4 (273.1)	1,115 (5.0)	320 (1.4)	650 (2.9)

1. Tabulated load values are for anchors installed in minimum Grade N, Type II, lightweight, medium-weight and normal-weight concrete masonry units conforming to ASTM C 90 that have reached the minimum designated ultimate compressive strength at the time of installation ($f'm \geq$ 1,500 psi).
2. Allowable bond capacities listed are for the Standard Set formula and are calculated using an applied safety factor of 5.0.
3. **Reduce the above allowable bond capacities by 25 percent when calculating allowable bond capacities for the Fast Set formula. Allowable working load values for Fast Set formula are permitted for short-term loads only; where applicable to code and ICC-ES ESR-1531.**
4. Allowable design load should be the lesser of the bond or allowable steel strength.
5. Allowable loads for threaded rods to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load, where permitted by code.
6. The critical spacing is 16 anchor diameters for full capacity. The minimum spacing is 8 anchor diameters for 50 percent reduction in load. Linear interpolation may be used to determine reduction factors for intermediate spacing distances.

PERFORMANCE DATA

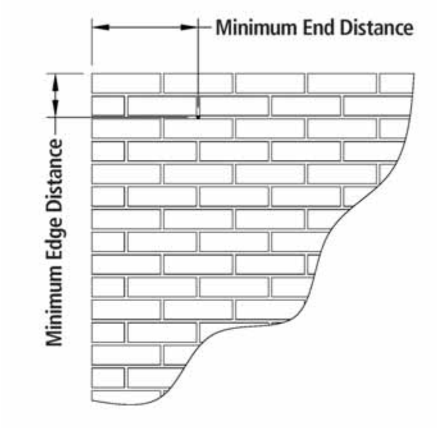
Allowable Bond Strength Capacities for Threaded Rod Installed with Standard Set Power-Fast+ in Hollow Concrete Masonry[1,2,3,4,5,6]



Rod Dia. d in. (mm)	Drill Bit Dia. d_{bit} in.	Min. Embed. Depth h_v in. (mm)	Min. Edge Distance in. (mm)	Min. End Distance in. (mm)	Lightweight & medium-weight CMU Tension lbs. (kN)	Lightweight & medium-weight CMU Shear lbs. (kN)	Normal-Weight CMU Tension lbs. (kN)	Normal-Weight CMU Shear lbs. (kN)
1/4 (6.4)	3/8	2 (50.8)	3 3/4 (95.3)	3 3/4 (95.3)	–	–	270 (1.2)	435 (2.0)
3/8 (9.5)	1/2	3 1/2 (88.9)	3 3/4 (95.3)	3 3/4 (95.3)	–	–	455 (2.0)	870 (3.9)
1/2 (12.7)	5/8	3 1/2 (88.9)	3 3/4 (95.3)	3 3/4 (95.3)	135 (0.6)	315 (1.4)	655 (2.9)	1,115 (5.0)
5/8 (15.9)	3/4	3 1/2 (88.9)	3 3/4 (95.3)	3 3/4 (95.3)	135 (0.6)	375 (1.7)	–	–
		4 1/2 (114.3)	3 3/4 (95.3)	3 3/4 (95.3)	–	–	755 (3.4)	1,330 (6.0)
3/4 (19.1)	7/8	6 (152.4)	4 (101.6)	4 (101.6)	–	–	1,015 (4.6)	1,510 (6.8)

1. Tabulated load values are for anchors installed in minimum Type II,Grade N, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90.
2. Allowable bond capacities listed are for the Standard Set formula and are calculated using an applied safety factor of 5.0.
3. **Reduce the above allowable bond capacities by 25 percent when calculating allowable bond capacities for the Fast Set formula. Allowable working load values for Fast Set formula are permitted for short-term loads only; where applicable to code and ICC-ES ESR-1531.**
4. Allowable design load should be the lesser of the bond or allowable steel strength.
5. Allowable loads for threaded rods to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load, where permitted by code.
6. The critical spacing is 16*d* for full capacity. The minimum spacing is 8*d* for 50 percent reduction in load. Linear interpolation may be used to determine reduction factors for intermediate spacing distances.

Allowable Bond Strength Capacities for Threaded Rod Installed with Standard Set Power-Fast+ in Brick Masonry[1,2,3,4]



Rod Dia. d in. (mm)	Drill Bit Dia. d_{bit} in.	Min. Embed. Depth h_v in. (mm)	Minimum Edge and End Distance	Min. Spacing Distance	Brick Masonry $f'_m \geq$ 1,300 psi (9.0 MPa) Tension lbs. (kN)	Brick Masonry $f'_m \geq$ 1,300 psi (9.0 MPa) Shear lbs. (kN)
1/4 (6.4)	3/8	2 (50.8)	2 Bricks or 16 inches (which ever is less)	4" Any Direction	545 (2.5)	365 (1.6)
		3 1/2 (88.9)			605 (2.7)	365 (1.6)
3/8 (9.5)	1/2	3 1/2 (88.9)	2 Bricks or 16 inches (which ever is less)	6" Any Direction	880 (4.0)	900 (4.1)
		6 (152.4)			1,485 (6.7)	900 (4.1)
		10 (254.0)			2,130 (9.6)	900 (4.1)
1/2 (12.7)	5/8	3 1/2 (88.9)	2 Bricks or 16 inches (which ever is less)	8" Any Direction	1,780 (8.0)	1,290 (5.8)
		6 (152.4)			2,250 (10.1)	1,290 (5.8)
		10 (254.0)			2,860 (12.9)	1,290 (5.8)
5/8 (15.9)	3/4	3 1/2 (88.9)	2 Bricks or 16 inches (which ever is less)	12" Any Direction	1,765 (7.9)	1,690 (7.6)
		4 1/2 (114.3)			1,890 (8.5)	1,690 (7.6)
		6 (152.4)			2,515 (11.3)	1,690 (7.6)
		10 (254.0)			2,920 (13.1)	1,690 (7.6)
3/4 (19.1)	7/8	3 1/2 (88.9)	2 Bricks or 16 inches (which ever is less)	2 Bricks or 16" Any Direction (which ever is less)	1,885 (8.5)	2,170 (9.8)
		6 (152.4)			2,170 (9.8)	2,170 (9.8)
		8 (203.2)			2,920 (13.1)	2,170 (9.8)
		13 (330.2)			4,740 (21.3)	2,170 (9.8)

1. Tabulated load values are for anchors installed in minimum Grade SW multiple wythe, solid brick masonry conforming to ASTM C62.
2. Allowable bond capacities listed are for the Standard Set formula and are calculated using an applied safety factor of 5.0.
3. Linear interpolation may be used to determine allowable bond capacities for intermediate embedments.
4. **Reduce the above allowable bond capacities by 25 percent when calculating allowable bond capacities for the Fast Set formula. Allowable working load values for Fast Set formula are permitted for short-term loads only; where applicable to code and ICC-ES ESR-1531.**

ADHESIVES

PERFORMANCE DATA

Allowable Bond Strength Capacities for Threaded Rods and Reinforcing Bars for Standard Set Power-Fast+ Epoxy Installed in Unreinforced Masonry[1,2]

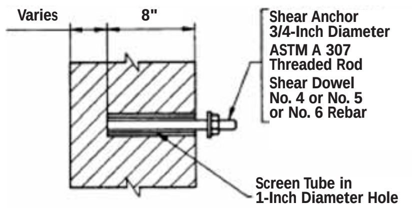


Figure 1

Shear Anchor – Configuration A (See Figure 1)					
Rod Dia. or Rebar Size *d* in. (mm)	Minimum Embed. h_v in. (mm)	Minimum Wall Thickness in. (mm)	Allowable Tension lbs. (kN)	Allowable Shear lbs. (kN)	Maximum Torque ft.-lbs. (Nm)
3/4 (19.1)	8 (203.2)	13 (330.2)	–	1,000 (4.5)	60 (81.3)
No. 4	8 (203.2)	13 (330.2)	–	500 (2.3)	40 (54.2)
No. 5	8 (203.2)	13 (330.2)	–	750 (3.4)	50 (67.8)
No. 6	8 (203.2)	13 (330.2)	–	1,000 (4.5)	60 (81.3)

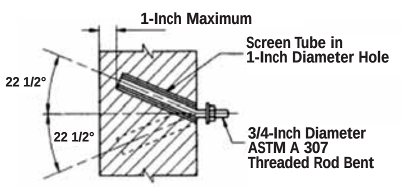


Figure 2

22-1/2° Combination Anchor – Configuration B (See Figure 2)					
Rod Dia. or Rebar Size *d* in. (mm)	Minimum Embed. h_v in. (mm)	Minimum Wall Thickness in. (mm)	Allowable Tension lbs. (kN)	Allowable Shear lbs. (kN)	Maximum Torque ft.-lbs. (Nm)
3/4 (19.1)	Within 1 inch of opposite wall surface	13 (330.2)	1,200 (5.4)	1,000 (4.5)	60 (81.3)

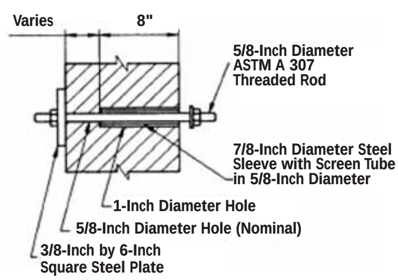


Figure 3

Through Anchor – Configuration C (See Figure 3)					
Rod Dia. or Rebar Size *d* in. (mm)	Minimum Embed. h_v in. (mm)	Minimum Wall Thickness in. (mm)	Allowable Tension lbs. (kN)	Allowable Shear lbs. (kN)	Maximum Torque ft.-lbs. (Nm)
5/8 (15.9)	8 inches from interior wall surface	13 (330.2)	1,200 (5.4)	750 (3.4)	50 (67.8)

1. Allowable shear values are applicable only to anchors where in-place shear tests indicate minimum mortar strength of 50 psi net.
2. No increase for lateral loading is permitted, such as loading induced by wind or earthquake.

Spacing and Edge Distance Requirements for Standard Set Power-Fast Epoxy Adhesive Installed in Unreinforced Masonry

Anchor Description	Minimum Vertical Spacing in.	Minimum Horizontal Spacing in.	Minimum Edge Distance in.
Shear Anchor Configuration A – (See Figure 1)	16	16	24
22-1/2° Combination Anchor Configuration B – (See Figure 2)	16	16	24
Through-bolt Anchor Configuration C – (See Figure 3)	16	24	16

DESIGN CRITERIA

Combined Loading

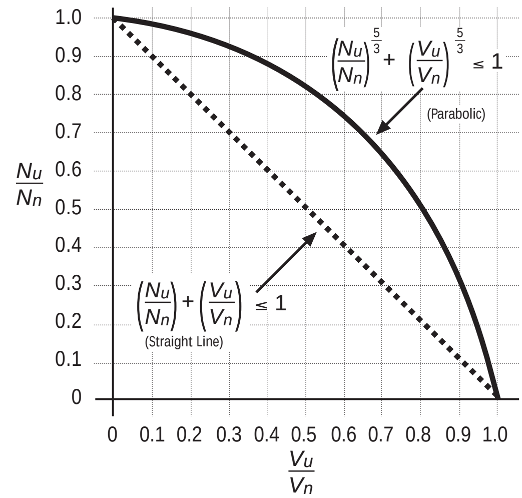
For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n}\right)^{\frac{5}{3}} + \left(\frac{V_u}{V_n}\right)^{\frac{5}{3}} \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

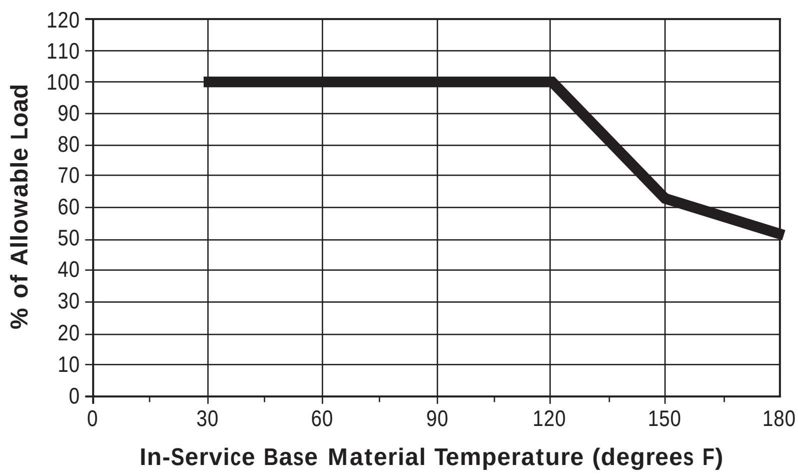
Load combinations may be analyzed more conservatively with the following proportion:

$$\left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$



In-Service Temperature

Allowable tension and shear load bond strength reduction based on in-service temperature for the Power-Fast+ Epoxy adhesive.



Temperature Conversion

Degree Fahrenheit (°F)	Degree Celsius (°C)	Percent Allowable Load (%)
32	0	100
70	21	100
90	32	100
120	49	100
150	65	63
180	82	52

Load Adjustment Factors for Spacing and Edge Distances for Normal-Weight and Structural Lightweight Concrete[1,2]

Threaded Rods[1]					
Anchor Dimension	**Load Type**	**Critical Distance (Full Anchor Capacity)**	**Critical Load Factor**	**Minimum Distance (Reduced Capacity)**	**Minimum Load Factor**
Spacing (s)	Tension and Shear	$s_{cr} = 16d$	$F_N = F_V = 1.0$	s_{min} (0.5 x s_{cr}) = $8d$	$F_N = F_V = 0.70$
Edge Distance (c)	Tension	$c_{cr} = 10d$	$F_N = 1.0$	c_{min} (0.4 x c_{cr}) = $4d$	$F_N = 0.55$
	Shear Towards Edge	$c_{cr} = 12d$	$F_V = 1.0$	c_{min} (0.33 x c_{cr}) = $4d$	$F_V = 0.20$
	Shear Parallel to Edge	$c_{cr} = 12d$	$F_V = 1.0$	c_{min} (0.33 x c_{cr}) = $4d$	$F_V = 0.60$
Reinforcing Bar[2]					
Anchor Dimension	**Load Type**	**Critical Distance (Full Anchor Capacity)**	**Critical Load Factor**	**Minimum Distance (Reduced Capacity)**	**Minimum Load Factor**
Spacing (s)	Tension and Shear	$s_{cr} = 18d$	$F_N = F_V = 1.0$	s_{min} (0.5 x s_{cr}) = $9d$	$F_N = F_V = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_N = 1.0$	c_{min} (0.5 x c_{cr}) = $6d$	$F_N = 0.55$
	Shear Towards Edge	$c_{cr} = 16d$	$F_V = 1.0$	c_{min} (0.25 x c_{cr}) = $4d$	$F_V = 0.15$
	Shear Parallel to Edge	$c_{cr} = 16d$	$F_V = 1.0$	c_{min} (0.25 x c_{cr}) = $4d$	$F_V = 0.55$

1. Minimum anchor spacing distance, (s_{min}) for normal-weight concrete may be further reduced from 8 diameters ($8d$) to 4 diameters ($4d$) provided that the allowable load values in the tables are reduced by an additional 5 percent. Linear interpolation is allowed for spacing distances between 8 diameters and 4 diameters.
2. Minimum anchor spacing distance, (s_{min}) for normal-weight concrete may be further reduced from 9 diameters ($9d$) to 4.5 diameters ($4.5d$) provided that the allowable load values in the tables are reduced by an additional 5 percent. Linear interpolation is allowed for spacing distances between 9 diameters and 4.5 diameters.

ADHESIVES

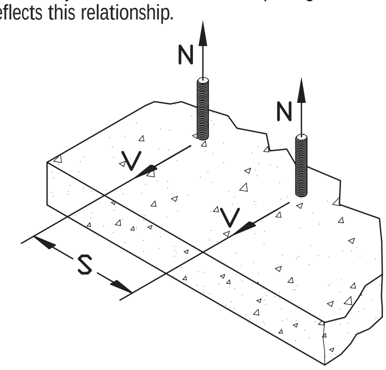
DESIGN CRITERIA

Load Adjustment Factors for Threaded Rod in Normal-Weight and Lightweight Concrete

Spacing, Tension (F_N) & Shear (F_V)										
Dia. (in.)	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/4	1 3/8	1 1/2
s_{cr} (in.)	4	6	8	10	12	14	16	20	22	24
s_{min} (in.)	1	1 1/2	2	2 1/2	3	3 1/2	4	5	5 1/2	6
Spacing, *s* (inches)										
1	0.65									
1 1/2	0.68	0.65								
2	0.70	0.67	0.65							
2 1/2	0.78	0.68	0.66	0.65						
3	0.85	0.70	0.68	0.66	0.65					
3 1/2	0.93	0.75	0.69	0.67	0.66	0.65				
4	1.00	0.80	0.70	0.68	0.67	0.66	0.65			
5		0.90	0.78	0.70	0.68	0.67	0.66	0.65		
5 1/2		0.95	0.81	0.73	0.69	0.68	0.67	0.66	0.65	
6		1.00	0.85	0.76	0.70	0.69	0.68	0.66	0.66	0.65
7			0.93	0.82	0.75	0.70	0.69	0.67	0.67	0.66
8			1.00	0.88	0.80	0.74	0.70	0.68	0.68	0.67
10				1.00	0.90	0.83	0.78	0.70	0.69	0.68
11					0.95	0.87	0.81	0.73	0.70	0.69
12					1.00	0.91	0.85	0.76	0.73	0.70
14						1.00	0.93	0.86	0.78	0.75
16							1.00	0.91	0.84	0.80
20								1.00	0.95	0.90
22									1.00	0.95
24										1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 16 anchor diameters (16*d*) at which the anchor achieves 100% of load.

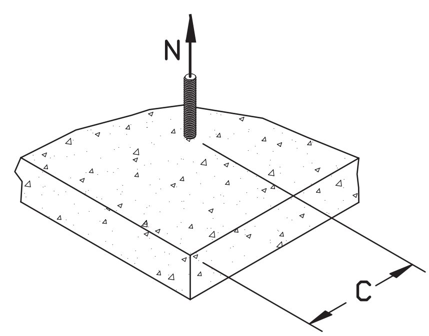
Minimum spacing (s_{min}) is equal to 8 anchor diameters (8*d*) at which the anchor achieves 70% of load. Minimum anchor spacing distance, s_{min} may be further reduced to 4 anchor diameters (4*d*) provided that the load values in the tables are reduced by an additional 5%. The spacing table reflects this relationship.



Edge Distance, (F_N) Tension										
Dia. (in.)	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/4	1 3/8	1 1/2
c_{cr} (in.)	2 1/2	3 3/4	5	6 1/4	7 1/2	8 3/4	10	12 1/2	13 3/4	15
c_{min} (in.)	1	1 1/2	2	2 1/2	3	3 1/2	4	5	5 1/2	6
Edge Distance, *c* (inches)										
1	0.55									
1 1/2	0.70	0.55								
2	0.85	0.65	0.55							
2 1/2	1.00	0.75	0.63	0.55						
3		0.85	0.70	0.61	0.55					
3 1/2		0.95	0.78	0.67	0.60	0.55				
3 3/4		1.00	0.81	0.70	0.63	0.57				
4			0.85	0.73	0.65	0.59	0.55			
5			1.00	0.85	0.75	0.68	0.63	0.55		
5 1/2				0.91	0.80	0.72	0.66	0.58	0.55	
6				0.97	0.85	0.76	0.70	0.61	0.58	0.55
6 1/4				1.00	0.88	0.79	0.72	0.63	0.59	0.56
7 1/2					1.00	0.89	0.81	0.70	0.66	0.63
8 3/4						1.00	0.91	0.78	0.73	0.69
10							1.00	0.85	0.80	0.75
12 1/2								1.00	0.93	0.88
13 3/4									1.00	0.94
15										1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 10 anchor diameters (10*d*) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 4 anchor diameters (4*d*) at which the anchor achieves 55% of load.

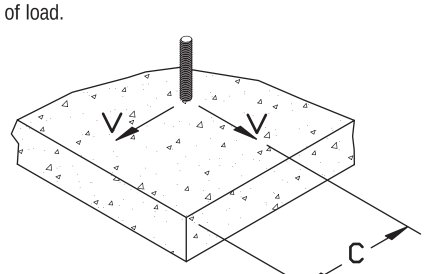


Edge Distance, Shear (F_V)										
Dia. (in.)	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/4	1 3/8	1 1/2
c_{cr} (in.)	3	4 1/2	6	7 1/2	9	10 1/2	12	15	16 1/2	18
c_{min} (in.)	1	1 1/2	2	2 1/2	3	3 1/2	4	5	5 1/2	6
Edge Distance, *c* (inches)										
1	0.20									
1 1/2	0.40	0.20								
2	0.60	0.33	0.20							
2 1/2	0.80	0.47	0.30	0.20						
3	1.00	0.60	0.40	0.28	0.20					
3 1/2		0.73	0.50	0.36	0.27	0.20				
4		0.87	0.60	0.44	0.33	0.26	0.20			
4 1/2		1.00	0.70	0.52	0.40	0.31	0.25			
5			0.80	0.60	0.47	0.37	0.30	0.20		
5 1/2			0.90	0.68	0.53	0.43	0.35	0.24	0.20	
6			1.00	0.76	0.60	0.49	0.40	0.28	0.24	0.20
7 1/2				1.00	0.80	0.66	0.55	0.40	0.35	0.30
9					1.00	0.83	0.70	0.52	0.45	0.40
10 1/2						1.00	0.85	0.64	0.56	0.50
12							1.00	0.76	0.67	0.60
15								1.00	0.89	0.80
16 1/2									1.00	0.90
18										1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12*d*) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 4 anchor diameters (4*d*) at which the anchor achieves 20% of load.

Minimum edge distance (c_{min}) for anchors loaded in shear parallel to the edge is equal to 4 anchor diameters (4*d*) at which the anchor achieves 60% of load.



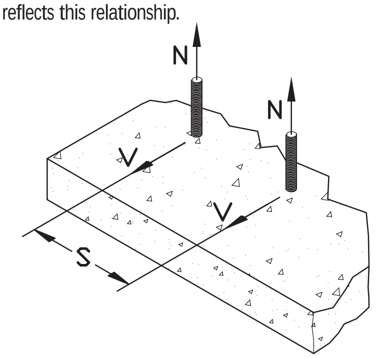
DESIGN CRITERIA

Load Adjustment Factors for Reinforcing Bar in Normal-Weight Concrete

Spacing (F_S) Tension & Shear									
Rebar Size	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	No. 11
s_{cr} (in.)	6 3/4	9	11 1/4	13 1/2	15 3/4	18	20 1/4	22 1/2	24 3/4
s_{min} (in.)	1 3/4	2 1/4	2 7/8	3 3/8	4	4 1/2	5	5 5/8	6 1/4
Spacing, *s* (inches)									
1 3/4	0.45								
2 1/4	0.47	0.45							
2 7/8	0.48	0.46	0.45						
3 3/8	0.50	0.48	0.46	0.45					
4	0.59	0.49	0.47	0.46	0.45				
4 1/2	0.67	0.50	0.48	0.47	0.46	0.45			
5	0.74	0.56	0.49	0.47	0.46	0.46	0.45		
5 5/8	0.83	0.63	0.50	0.48	0.47	0.46	0.46	0.45	
6 1/4	0.93	0.69	0.56	0.49	0.48	0.47	0.46	0.46	0.45
6 3/4	1.00	0.75	0.60	0.50	0.49	0.48	0.47	0.46	0.45
7 7/8		0.88	0.70	0.58	0.50	0.49	0.48	0.47	0.46
9		1.00	0.80	0.67	0.57	0.50	0.49	0.48	0.47
10 1/8			0.90	0.75	0.64	0.56	0.50	0.49	0.48
11 1/4			1.00	0.83	0.71	0.63	0.56	0.50	0.49
12 3/8				0.92	0.79	0.69	0.61	0.55	0.50
13 1/2				1.00	0.86	0.75	0.67	0.60	0.58
15 3/4					1.00	0.88	0.78	0.70	0.67
18						1.00	0.89	0.80	0.75
20 1/4							1.00	0.90	0.83
22 1/2								1.00	0.92
24 3/4									1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 18 anchor diameters (18*d*) at which the anchor achieves 100% of load.

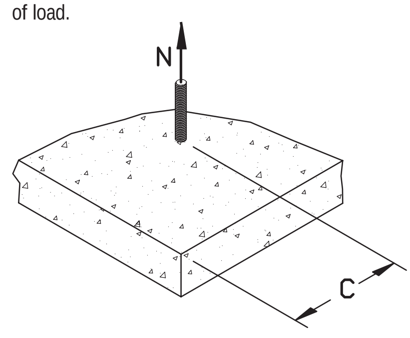
Minimum spacing (s_{min}) is equal to 9 anchor diameters (9*d*) at which the anchor achieves 50% of load. Minimum anchor spacing distance, smin may be further reduced to 4.5 anchor diameters (4.5*d*) provided that the load values in the tables are reduced by an additional 5%.The spacing table reflects this relationship.



Edge Distance, (F_N) Tension									
Rebar Size	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	No. 11
c_{cr} (in.)	4 1/2	6	7 1/2	9	10 1/2	12	13 1/2	15	16 1/2
c_{min} (in.)	2 1/4	3	3 3/4	4 1/2	5 1/4	6	6 3/4	7 1/2	8 1/4
Edge Distance, *c* (inches)									
2 1/4	0.55								
3	0.70	0.55							
3 3/4	0.85	0.66	0.55						
4 1/2	1.00	0.78	0.64	0.55					
5 1/4		0.89	0.73	0.63	0.55				
6		1.00	0.82	0.70	0.61	0.55			
6 3/4			0.91	0.78	0.68	0.61	0.55		
7 1/2			1.00	0.85	0.74	0.66	0.60	0.55	
8 1/4				0.93	0.81	0.72	0.65	0.60	0.55
9				1.00	0.87	0.78	0.70	0.64	0.59
10 1/2					1.00	0.89	0.80	0.73	0.67
12						1.00	0.90	0.82	0.75
13 1/2							1.00	0.91	0.84
15								1.00	0.92
16 1/2									1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12*d*) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 6 anchor diameters (6*d*) at which the anchor achieves 55% of load.

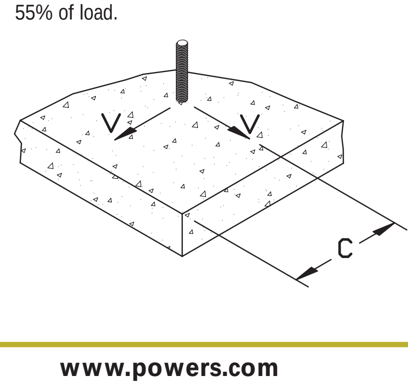


Edge Distance, Shear (F_V)									
Rebar Size	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	No. 11
c_{cr} (in.)	6	8	10	12	14	16	18	20	22
c_{min} (in.)	1 1/2	2	2 1/2	3	3 1/2	4	4 1/2	5	5 1/2
Edge Distance, *c* (inches)									
1 1/2	0.15								
2	0.24	0.15							
2 1/2	0.34	0.22	0.15						
3	0.43	0.29	0.21	0.15					
3 1/2	0.53	0.36	0.26	0.20	0.15				
4	0.62	0.43	0.32	0.24	0.19	0.15			
4 1/2	0.72	0.50	0.38	0.29	0.23	0.19	0.15		
5	0.81	0.58	0.43	0.34	0.27	0.22	0.18	0.15	
5 1/2	0.91	0.65	0.49	0.39	0.31	0.26	0.21	0.18	0.15
6	1.00	0.72	0.55	0.43	0.35	0.29	0.24	0.21	0.18
8		1.00	0.77	0.62	0.51	0.43	0.37	0.32	0.28
10			1.00	0.81	0.68	0.58	0.50	0.43	0.38
12				1.00	0.84	0.72	0.62	0.55	0.48
14					1.00	0.86	0.75	0.66	0.59
16						1.00	0.87	0.77	0.69
18							1.00	0.89	0.79
20								1.00	0.90
22									1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 16 anchor diameters (16*d*) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 4 anchor diameters (4*d*) at which the anchor achieves 15% of load.

Minimum edge distance (c_{min}) for anchors loaded in shear parallel to the edge is equal to 4 anchor diameters (4*d*) at which the anchor achieves 55% of load.



ORDERING INFORMATION

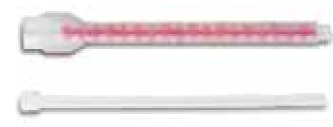
Power-Fast+ Cartridges

Cat. No.	Description	Standard Box	Standard Ctn.	Pallet
8424	10 oz. Quik-Shot Cartridge – Fast Set	12	36	648
8402	15 oz. Cartridge – Fast Set	–	12	960
8403	15 oz. Cartridge – Standard Set	–	12	960
8422	22 oz. Cartridge – Fast Set	–	12	432
8423	22 oz. Cartridge – Standard Set	–	12	432
8443	44 oz. Jumbo Cartridge – Standard Set	–	6	288
8436	56 oz. Jumbo Cartridge – Standard Set	–	6	288

Power-Fast mixing nozzles should be used to ensure complete and proper mixing of the epoxy components.
Jumbo Cartridges are not packaged with a mixing nozzle.

Cartridge System Mixing Nozzles

Cat. No.	Description	Standard Box	Standard Carton
7908	Extra Nozzles for Power-Fast+ (with 9" Extension)	2	24
7919	Extra Nozzles for Power-Fast+ (bulk quantity)	–	400
7921	Turbo Nozzles for Jumbo Power-Fast+ (8443 & 8436)	2	24



Manual Injection Dispensing Tools

Cat. No.	Description	Standard Box	Standard Carton
8437	10 oz. Heavy Duty Caulking Gun	1	12
8463	10 oz. High Performance Caulking Gun	1	10
8415	15 oz. High Performance Manual Tool	1	10
8416	15 oz. Standard All Metal Manual Tool	1	8
8421	22 oz. High Performance Manual Tool	1	10
8409	22 oz. Standard All Metal Manual Tool	1	8

Pneumatic Injection Dispensing Tools

Cat. No.	Description	Standard Box	Standard Carton
8407	15 oz. High Performance Pneumatic Tool	1	1
8413	22 oz. High Performance Pneumatic Tool	1	1
8445	44 oz. High Performance Pneumatic Tool	1	1
8438	56 oz. High Performance Pneumatic Tool	1	1

Maximum operating pressure –125 psi.
Normal operating pressure – 80 to 100 psi.
Maximum free air required – 1 cfm based on average use.

Battery Injection Dispensing Tools

Cat. No.	Description	Standard Box	Standard Carton
8442	22 oz. High Performance Battery Tool	1	1

Battery and charger are included. Additional batteries are available for purchase upon request.

Chem-Stud® *Spin-Type Capsule Adhesive*

PRODUCT DESCRIPTION

The Chem-Stud anchor systems consists of self contained two-part glass capsules and matching chisel pointed anchor rods which are installed using a rotary hammer and rod adapters. The Chem-Stud adhesive, formerly known as *Rawl Chem-Stud* is an ester based resin material packaged in single use glass capsules designed for installation of 3/8" through 1-1/2" threaded rods in solid concrete and masonry materials. It can also be used with reinforcing bars.

Chem-Stud Capsule – The outer capsule contains epoxy acrylate resin (vinyl ester) in which quartz aggregate is suspended. The inner capsule contains a benzoyl peroxide hardening agent. When the components are combined, they form an adhesive mortar which mechanically bonds the anchor rod to solid base materials. This type of system must be used with a chisel pointed anchor rod and must be spun into the anchor hole using a rotary hammer drill.

Chem-Stud Chisel Pointed Hardware – The threaded anchor rods have a 45° chisel point cut on one end to properly mix the components contained in the capsule during installation. A 90° point is formed on the internally threaded inserts. The threaded rod or reinforcing bar used must have a chisel point to mix the components contained in the capsule during installation.

GENERAL APPLICATIONS AND USES

- Heavy duty anchoring such as threaded anchor rods and rebars in solid concrete.
- Steel erection including anchoring of equipment and column base plates.
- Resists vibratory loads introduced from machinery, moving vehicles, etc.
- Internally threaded inserts available for removable anchorage.
- Ideal for normal-weight or heavy-weight concrete.

FEATURES AND BENEFITS

- High strength adhesive anchoring system
- Pre-measured chemical component volumes – no waste
- Fast cure minimizes downtime
- Over 30 years of successful product installations
- Glass capsule scrapes and cleans hole during installation
- Components are mixed during installation of rod or rebar
- Listed and approved to resist dead loads, live loads, and short-term loads such as those resulting from wind or earthquake
- Meets many building code and DOT requirements
- Independently tested and qualified to ASTM E1512 and AC58 Criteria, including creep resistance, freeze-thaw cycling and simulated seismic/wind conditions
- Suitable for wet and diamond cored holes
- Excellent chemical resistance
- Consistent and reliable performance

APPROVALS AND LISTINGS

International Conference of Building Officials, Evaluation Service (ICBO ES) ER-4514
Southern Building Code Conference International (SBCCI) #9943A
Miami-Dade County Notice of Acceptance (NOA) 03-0311.07
Florida Building Code Approval FL 2209.02
Various North American Departments of Transportation (DOT) – See www.powers.com

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring* and *05090-Metal Fastenings.*
Capsule adhesive system shall be Chem-Stud as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS Page No.

Chem-Stud Capsule

Chisel Pointed Threaded Rod

Internally Threaded Insert
(Optional for Removability)

ANCHOR SIZE RANGE (TYP.)

3/8" to 1-1/2" diameter rod
No. 3 to No. 11 reinforcing bar

SUITABLE BASE MATERIALS

Normal-weight Concrete
Heavy-weight Concrete

MATERIAL AND INSTALLATION SPECIFICATIONS

Physical Properties

Shelf Life	2 Years
Storage Conditions	Store dry at 40° to 90°F and keep out of direct sunlight
Installation Temperature	Condition material to 60°F minimum for best results
Color	Mixed adhesive mortar – amber
Consistency	Paste mortar

Setting Times[1]

Minimum Base Material Temperature	Minimum Curing Time
68°F (20°C)	20 minutes
50°F (10°C)	30 minutes
32°F (0°C)	1 hour
23°F (-5°C)	5 hours
14°F (-10°C)	10 hours
5°F (-15°C)	18 hours
0°F (-18°C)	24 hours

1. Cure time should be doubled for wet concrete.

Chem-Stud Capsule[1,2]

Dimension	Chem-Stud Capsule, Nominal Size						
	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/4"
Capsule Diameter (in.)	0.43	0.51	0.67	0.87	0.87	0.95	1.30
Capsule Length (in.)	3.15	3.75	3.75	6.63	6.89	8.25	10.50
Mortar Volume (in^3)	0.35	0.55	0.95	2.55	3.25	4.65	11.70
Mortar Volume (fl. oz.)	0.19	0.30	0.52	1.40	1.79	2.56	6.44

1. The mortar volume listed is for the mixed material.
2. The diameter and length may be different than products offered by other manufacturer's capsules because of variations in air content. When comparing capsules, use the installed mortar volume.

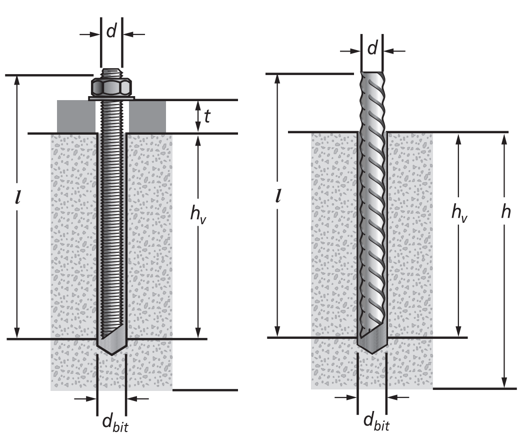
Chisel Pointed Threaded Rod in Normal-Weight Concrete

Dimension	Chisel Pointed Threaded Rod Diameter, *d*								
	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/4"	1 3/8"	1 1/2"
A_{nom} = Nominal area of threaded rod (in^2)	0.111	0.196	0.307	0.442	0.601	0.785	1.227	1.484	1.766
A_{se} = Tensile stress area of rod (in^2)	0.078	0.142	0.226	0.335	0.462	0.606	0.969	1.155	1.405
d_{bit} = Nominal bit diameter (in.)	7/16	9/16	11/16	7/8	1	1 1/8	1 1/2	1 5/8	1 3/4
h_v = Minimum Embedment Depth (in.)	3 1/2	4 1/4	5	6 5/8	7	8 1/4	10 1/4	10 1/4	10 1/4
T_{max} = Max. tightening torque range (ft.-lbs.)	15-20	30-40	68-90	120-160	150-200	225-300	375-500	375-500	375-500
Mortar per inch (in^3)	0.094	0.133	0.184	0.326	0.390	0.478	0.917	1.042	1.133

Reinforcing Bar in Normal-Weight Concrete[1]

Dimension	Reinforcing Bar Size								
	No.3	No.4	No.5	No.6	No.7	No.8	No.9	No.10	No.11
A_{nom} = Nominal area of threaded rod (in^2)	0.110	0.200	0.310	0.440	0.600	0.790	1.000	1.270	1.560
d_{bit} = Nominal bit diameter (in.)	1/2	5/8	3/4	7/8	1	1 1/4	1 3/8	1 5/8	1 3/4
h_v = Minimum Embedment Depth (in.)	3 1/2	4 1/2	5	7	7	8 1/2	9	10	10
Mortar per inch (in^3)	0.111	0.142	0.176	0.220	0.252	0.537	0.594	0.932	0.961

1. All reinforcing bar must have a 45° chisel point to mix the components contained in the capsule during installation. Adhesive mortar volume required for installation of reinforcing bar is based on smooth bars. Actual mortar volume required will be less due to raised deformations on bars.

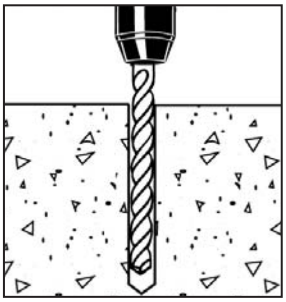


Nomenclature

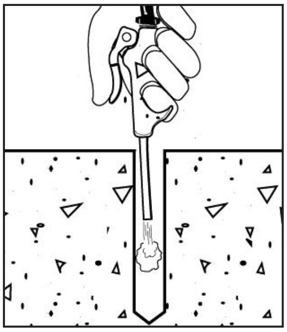
- d = Diameter of rod or rebar
- d_{bit} = Diameter of drill bit
- d_h = Diameter of fixture clearance hole
- d_w = Diameter of washer
- h = Base material thickness. The minimum value of h should be $1.5h_v$
- h_v = Minimum embedment depth
- l = Overall length of rod or rebar
- t = Fixture thickness
- T_{max} = Maximum tightening torque

INSTALLATION GUIDELINES

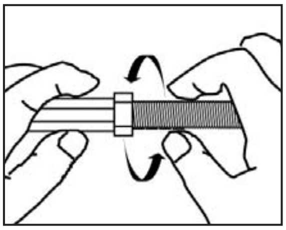
Drill a hole to the size and embedment required. The tolerances of the drill bit used should meet the requirements of ANSI B212.15.



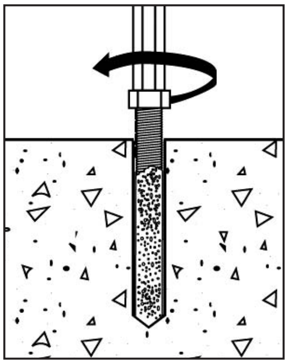
Starting from the bottom or back of the anchor hole, blow clean with compressed air, brush the hole with a nylon brush, and blow it clean again. Vacuuming only is not sufficient. Blow out bulbs generally do not provide enough dust removal for most drilled anchor holes. Holes should be clean and sound. Anchor holes may be dry or damp, but should be free of standing water or frost. If using reinforcing bar, be sure the bar will fit into the drilled hole. If a larger hole is required, the diameter should be as close as possible to the diameter of the reinforcing bar. Prior to installing check the capsule to be sure it is not damaged and invert several times at 60°F or above to confirm all of the resin is in a liquid state. Insert the capsule into the hole. Either end of the capsule may be inserted first.



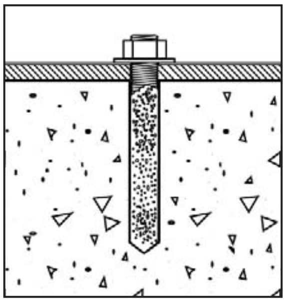
Thread the nut onto the anchor rod leaving 3 to 4 threads exposed. Then thread the rod coupler onto the threaded rod until it is tight against the nut. If using reinforcing bar, insert the bar into the proper size coupler. The threaded rod or reinforcing bar used should be free of dirt, grease, oil, or other foreign material.



Select the drive unit, insert it into a rotary hammer drill and engage the coupling to be used. Insert the chisel point of the rod or rebar into the hole to break the glass capsule. Spin it into the capsule at a speed of 250 to 500 RPM until it is fully embedded.



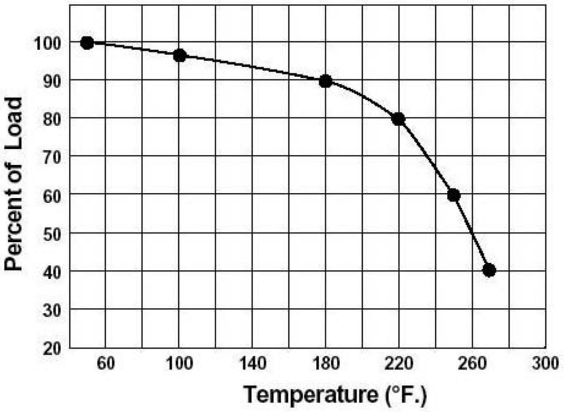
Once the rod or bar is fully embedded, turn the rotary hammer drill off immediately. If installing threaded rod, pull the driver out of the coupling while holding the rod. Hold the hex nut with a wrench to unthread the coupler. If using reinforcing bar, release the set lever and slide the coupler off the bar.



Allow the adhesive to cure for the specified time prior to applying any load. Do not disturb or load the anchor until it is fully cured.

In-Service Temperature

Allowable tension and shear load bond strength reduction based on in-service temperature for the Chem-Stud capsule adhesive.



Temperature Conversion		
Degree Fahrenheit (°F)	Degree Celsius (°C)	Percent Allowable Load (%)
50	10	100
100	38	97
180	82	90
220	104	80
250	121	60
270	132	40

ADHESIVES

STEEL SPECIFICATIONS

Material Properties for Threaded Rod and Reinforcing Bar

Anchor Type	Steel Description	Steel Specification (ASTM)	Rod Dia. or Rebar Size (inch or No.)	Minimum Yield Strength, f_y (ksi)	Minimum Ultimate Strength, f_u (ksi)
Threaded Rod	Standard carbon rod	A36	All	36.0	58.0
		A 307, Grade C	3/8 thru 4	36.0	58.0
	High strength carbon rod	A 193, Grade B7	3/8 thru 2 1/2	105.0	120.0
	Stainless Rod (Type 304 / 316 SS)	F 593, Condition CW	3/8 thru 5/8	65.0	100.0
			3/4 thru 1 1/2	45.0	85.0
Reinforcing Bar	Grade 40 Rebar	A 615, A 616, A 617, A 706 or A 767	All	40.0	70.0
	Grade 60 Rebar			60.0	90.0

Allowable Steel Strength Capacities for Threaded Rod

Anchor Diameter *d* in. (mm)	Allowable Tension: ASTM A36 lbs. (kN)	ASTM A307 Grade C lbs. (kN)	ASTM A193 Grade B7 lbs. (kN)	ASTM F593 304/316 SS lbs. (kN)	Allowable Shear: ASTM A36 lbs. (kN)	ASTM A307 Grade C lbs. (kN)	ASTM A193 Grade B7 lbs. (kN)	ASTM F593 304/316 SS lbs. (kN)
3/8 (9.5)	2,115 (9.5)	2,115 (9.5)	4,375 (19.7)	3,630 (16.3)	1,090 (4.9)	1,090 (4.9)	2,255 (10.1)	1,870 (8.4)
1/2 (12.7)	3,755 (16.9)	3,755 (16.9)	7,775 (35.0)	6,470 (29.1)	1,940 (8.7)	1,940 (8.7)	4,055 (18.2)	3,330 (15.0)
5/8 (15.9)	5,870 (26.4)	5,870 (26.4)	12,150 (54.7)	10,130 (45.6)	3,025 (13.6)	3,025 (13.6)	6,260 (28.2)	5,210 (23.4)
3/4 (19.1)	8,455 (38.0)	8,455 (38.0)	17,495 (78.7)	12,400 (55.8)	4,355 (19.6)	4,355 (19.6)	9,010 (40.5)	6,390 (28.8)
7/8 (22.2)	11,510 (51.8)	11,510 (51.8)	23,810 (107.1)	16,860 (75.9)	5,930 (26.7)	5,930 (26.7)	12,265 (55.2)	8,680 (39.1)
1 (25.4)	15,035 (67.7)	15,035 (67.7)	31,100 (140.0)	22,020 (99.1)	7,745 (34.9)	7,745 (34.9)	16,020 (72.1)	11,340 (51.0)
1 1/4 (31.8)	23,485 (105.7)	23,485 (105.7)	48,560 (218.5)	34,420 (154.9)	12,100 (54.5)	12,100 (54.5)	25,035 (112.7)	17,730 (79.8)
1 3/8 (34.9)	28,400 (127.8)	28,400 (127.8)	58,760 (264.4)	41,625 (187.3)	14,630 (65.8)	14,630 (65.8)	30,270 (136.2)	21,440 (96.5)
1 1/2 (38.1)	33,800 (152.1)	33,800 (152.1)	69,930 (314.7)	49,535 (222.9)	17,410 (78.3)	17,410 (78.3)	36,025 (162.1)	25,515 (114.8)

Steel strength capacities are based on the design criteria listed in the *AISC Manual of Steel Construction*.

Allowable Steel Strength Capacities for Reinforcing Bar

Bar Size	Tension lbs. (kN) Grade 40	Tension Grade 60	Shear lbs. (kN) Grade 40	Shear Grade 60
No. 3 (3/8")	2,200 (9.9)	2,640 (11.9)	1,310 (5.9)	1,680 (7.6)
No. 4 (1/2")	4,000 (18.0)	4,800 (21.6)	2,380 (10.7)	3,060 (13.8)
No. 5 (5/8")	6,200 (27.9)	7,440 (33.5)	3,690 (16.6)	4,740 (21.3)
No. 6 (3/4")	8,800 (39.6)	10,560 (47.5)	5,235 (23.6)	6,730 (30.3)
No. 7 (7/8")	12,000 (54.0)	14,400 (64.8)	7,140 (32.1)	9,180 (41.3)
No. 8 (1")	15,800 (71.1)	18,960 (85.3)	9,400 (42.3)	12,085 (54.4)
No. 9 (1 1/8")	20,000 (90.0)	24,000 (108.0)	11,900 (53.6)	15,300 (68.9)
No. 10 (1 1/4")	25,400 (114.3)	30,480 (137.2)	15,115 (68.0)	19,430 (87.4)
No. 11 (1 3/8")	31,200 (140.4)	37,440 (168.5)	16,920 (76.1)	20,305 (91.4)

Steel strength capacities are based on the requirements of ASTM A 615.

Note:
Allowable design load must be the lesser of allowable steel strength (as shown on this page) and the allowable bond capacities.

Allowable steel strength values for threaded rod are based on the following equations:

$T = 0.33 * f_u * A_{nom}$
$V = 0.17 * f_u * A_{nom}$

And, the allowable steel strength values for reinforcing bar are based on the following equations:

$T = f_s * A_{br}$
$V = 0.17 * f_s * A_{br}$

Where:
- T = Allowable tension load (pounds).
- V = Allowable shear load (pounds).
- f_u = Minimum specified ultimate strength (psi)
- f_s = Tensile stress area in reinforcement (psi)
- A_{nom} = Nominal cross-sectional area of threaded rod (in^2).
- A_{br} = Nominal cross-sectional area of reinforcing bar (in^2).

PERFORMANCE DATA

Ultimate Load Capacities for Threaded Rod Installed with Chem-Stud Capsules in Normal-Weight and Heavy-weight Concrete[1,2]

Anchor Dia. d in. (mm)	Min. Embed. Depth h_v in. (mm)	Capsules Required	Minimum Concrete Compressive Strength (f'_c)									
			2,000 psi (13.8 MPa)		3,000 psi (20.7 MPa)		4,000 psi (27.6 MPa)		5,000 psi (34.5 MPa)		6,000 psi (41.4 MPa)	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/8 (9.5)	3 1/2 (88.9)	One 3/8"	6,300 (28.4)	6,660 (30.0)	7,540 (33.9)	6,660 (30.0)	8,760 (39.4)	6,660 (30.0)	10,880 (49.0)	6,660 (30.0)	11,220 (50.5)	6,660 (30.0)
	5 1/4 (133.4)	Two 3/8"	9,450 (42.5)	6,660 (30.0)	11,295 (50.8)	6,660 (30.0)	13,140 (59.1)	6,660 (30.0)	14,985 (67.4)	6,660 (30.0)	16,830 (75.7)	6,660 (30.0)
	7 (177.8)	Two 3/8"	12,600 (56.7)	6,660 (30.0)	15,060 (67.8)	6,660 (30.0)	17,520 (78.8)	6,660 (30.0)	19,980 (89.9)	6,660 (30.0)	22,440 (101.0)	6,660 (30.0)
1/2 (12.7)	4 1/4 (108.0)	One 1/2"	10,040 (45.2)	11,655 (52.4)	11,880 (53.5)	11,655 (52.4)	13,560 (61.0)	11,655 (52.4)	17,080 (76.9)	11,655 (52.4)	18,380 (82.7)	11,655 (52.4)
	6 3/8 (161.9)	One 1/2" & One 3/8"	15,060 (67.8)	11,655 (52.4)	17,700 (79.7)	11,655 (52.4)	20,340 (91.5)	11,655 (52.4)	23,955 (107.8)	11,655 (52.4)	27,570 (124.1)	11,655 (52.4)
	8 1/2 (215.9)	Two 1/2"	20,080 (90.4)	11,655 (52.4)	23,600 (106.2)	11,655 (52.4)	27,120 (122.0)	11,655 (52.4)	31,940 (143.7)	11,655 (52.4)	36,760 (165.4)	11,655 (52.4)
5/8 (15.9)	5 (127.0)	One 5/8"	13,840 (62.3)	18,745 (84.4)	16,240 (73.1)	18,745 (84.4)	18,620 (83.8)	18,745 (84.4)	23,400 (105.3)	18,745 (84.4)	25,160 (113.2)	18,745 (84.4)
	7 1/2 (190.5)	One 5/8" & One 1/2"	20,760 (93.4)	18,745 (84.4)	24,345 (109.6)	18,745 (84.4)	27,930 (125.7)	18,745 (84.4)	32,350 (145.6)	18,745 (84.4)	36,770 (165.5)	18,745 (84.4)
	10 (254.0)	Two 5/8"	27,680 (124.6)	18,745 (84.4)	32,460 (146.1)	18,745 (84.4)	37,240 (167.6)	18,745 (84.4)	43,130 (194.1)	18,745 (84.4)	49,025 (220.6)	18,745 (84.4)
3/4 (19.1)	6 5/8 (168.3)	One 3/4"	22,300 (100.4)	30,060 (135.3)	26,100 (117.5)	30,060 (135.3)	28,540 (128.4)	30,060 (135.3)	34,780 (156.5)	30,060 (135.3)	37,020 (166.6)	30,060 (135.3)
	10 (254.0)	One 3/4" & One 5/8"	33,660 (151.5)	30,060 (135.3)	38,235 (172.1)	30,060 (135.3)	42,810 (192.6)	30,060 (135.3)	49,345 (222.1)	30,060 (135.3)	55,880 (251.5)	30,060 (135.3)
	13 1/4 (336.6)	Two 3/4"	44,600 (200.7)	30,060 (135.3)	50,840 (228.8)	30,060 (135.3)	57,080 (256.9)	30,060 (135.3)	65,560 (295.0)	30,060 (135.3)	74,040 (333.2)	30,060 (135.3)
7/8 (22.2)	7 (177.8)	One 7/8"	23,480 (105.7)	36,065 (162.3)	28,020 (126.1)	36,065 (162.3)	32,560 (146.5)	36,065 (162.3)	41,640 (187.4)	36,065 (162.3)	44,780 (201.5)	36,065 (162.3)
	10 1/4 (260.4)	Two 3/4"	35,220 (158.5)	36,065 (162.3)	42,030 (189.1)	36,065 (162.3)	48,840 (219.8)	36,065 (162.3)	58,005 (261.0)	36,065 (162.3)	67,170 (302.3)	36,065 (162.3)
	14 (355.6)	Two 7/8"	46,960 (211.3)	36,065 (162.3)	56,040 (252.2)	36,065 (162.3)	65,120 (293.0)	36,065 (162.3)	77,340 (348.0)	36,065 (162.3)	89,560 (403.0)	36,065 (162.3)
1 (25.4)	8 1/4 (209.6)	One 1"	32,360 (145.6)	53,135 (239.1)	39,540 (177.9)	53,135 (239.1)	46,700 (210.2)	53,135 (239.1)	61,040 (274.7)	53,135 (239.1)	65,620 (295.3)	53,135 (239.1)
	12 3/8 (314.3)	One 1" & One 7/8"	48,530 (218.4)	53,135 (239.1)	59,290 (266.8)	53,135 (239.1)	70,050 (315.2)	53,135 (239.1)	84,240 (379.1)	53,135 (239.1)	98,430 (442.9)	53,135 (239.1)
	16 1/2 (419.1)	Two 1"	64,700 (291.2)	53,135 (239.1)	79,050 (355.7)	53,135 (239.1)	93,400 (420.3)	53,135 (239.1)	112,320 (505.4)	53,135 (239.1)	131,240 (590.6)	53,135 (239.1)
1 1/4 (31.8)	10 1/4 (260.4)	One 1 1/4"	58,380 (262.7)	68,000 (306.0)	64,900 (292.1)	68,000 (306.0)	71,400 (321.3)	68,000 (306.0)	82,240 (370.1)	68,000 (306.0)	88,420 (397.9)	68,000 (306.0)
	15 (381.0)	One 1 1/4" & One 1"	85,435 (384.5)	68,000 (306.0)	94,355 (424.6)	68,000 (306.0)	103,280 (464.8)	68,000 (306.0)	111,240 (500.6)	68,000 (306.0)	119,200 (536.4)	68,000 (306.0)
	20 1/2 (520.7)	Two 1 1/4"	116,760 (525.4)	68,000 (306.0)	129,780 (584.0)	68,000 (306.0)	140,200 (630.9)	68,000 (306.0)	141,390 (636.3)	68,000 (306.0)	142,580 (641.6)	68,000 (306.0)
1 3/8 (34.9)	10 1/4 (260.4)	One 1 14"	63,000 (283.5)	82,000 (369.0)	68,500 (308.3)	82,000 (369.0)	74,000 (333.0)	82,000 (369.0)	84,500 (380.3)	82,000 (369.0)	95,000 (427.5)	82,000 (369.0)
	15 (381.0)	One 1 1/4" & One 1"	92,225 (415.0)	82,000 (369.0)	100,155 (450.7)	82,000 (369.0)	108,085 (486.4)	82,000 (369.0)	116,540 (524.4)	82,000 (369.0)	125,000 (562.5)	82,000 (369.0)
	20 1/2 (520.7)	Two 1 1/4"	126,040 (567.2)	82,000 (369.0)	134,270 (604.2)	82,000 (369.0)	142,500 (641.3)	82,000 (369.0)	145,750 (655.9)	82,000 (369.0)	149,000 (670.5)	82,000 (369.0)
1 1/2 (38.1)	10 1/4 (260.4)	One 1 1/4"	67,000 (301.5)	94,500 (425.3)	72,500 (326.3)	94,500 (425.3)	78,000 (351.0)	94,500 (425.3)	88,000 (396.0)	94,500 (425.3)	98,000 (441.0)	94,500 (425.3)
	15 (381.0)	One 1 1/4" & One 1"	100,460 (452.1)	94,500 (425.3)	108,725 (489.3)	94,500 (425.3)	116,995 (526.5)	94,500 (425.3)	127,195 (572.4)	94,500 (425.3)	137,400 (618.3)	94,500 (425.3)
	20 1/2 (520.7)	Two 1 1/4"	134,000 (603.0)	94,500 (425.3)	139,500 (627.8)	94,500 (425.3)	145,000 (652.5)	94,500 (425.3)	147,000 (661.5)	94,500 (425.3)	149,000 (670.5)	94,500 (425.3)

1. Ultimate load capacities should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate load capacities for intermediate embedments and compressive strengths.

PERFORMANCE DATA

Allowable Load Capacities for Threaded Rod Installed with Chem-Stud Capsules in Normal-Weight and Heavy-weight Concrete[1,2,3,4,5]

Anchor Dia. *d* in. (mm)	Min. Embed. Depth h_v in. (mm)	Capsules Required	Minimum Concrete Compressive Strength (f'_c) 2,000 psi (13.8 MPa) Tension lbs. (kN)	2,000 psi (13.8 MPa) Shear lbs. (kN)	3,000 psi (20.7 MPa) Tension lbs. (kN)	3,000 psi (20.7 MPa) Shear lbs. (kN)	4,000 psi (27.6 MPa) Tension lbs. (kN)	4,000 psi (27.6 MPa) Shear lbs. (kN)	5,000 psi (34.5 MPa) Tension lbs. (kN)	5,000 psi (34.5 MPa) Shear lbs. (kN)	6,000 psi (41.4 MPa) Tension lbs. (kN)	6,000 psi (41.4 MPa) Shear lbs. (kN)
3/8 (9.5)	3 1/2 (88.9)	One 3/8"	1,575 (7.1)	1,665 (7.5)	1,885 (8.5)	1,665 (7.5)	2,190 (9.9)	1,665 (7.5)	2,720 (12.2)	1,665 (7.5)	2,805 (12.6)	1,665 (7.5)
	5 1/4 (133.4)	Two 3/8"	2,365 (10.6)	1,665 (7.5)	2,825 (12.7)	1,665 (7.5)	3,285 (14.8)	1,665 (7.5)	3,745 (16.9)	1,665 (7.5)	4,210 (18.9)	1,665 (7.5)
	7 (177.8)	Two 3/8"	3,150 (14.2)	1,665 (7.5)	3,765 (16.9)	1,665 (7.5)	4,380 (19.7)	1,665 (7.5)	4,995 (22.5)	1,665 (7.5)	5,610 (25.2)	1,665 (7.5)
1/2 (12.7)	4 1/4 (108.0)	One 1/2"	2,510 (11.3)	2,915 (13.1)	2,970 (13.4)	2,915 (13.1)	3,390 (15.3)	2,915 (13.1)	4,270 (19.2)	2,915 (13.1)	4,595 (20.7)	2,915 (13.1)
	6 3/8 (161.9)	One 1/2" & One 3/8"	3,765 (16.9)	2,915 (13.1)	4,425 (19.9)	2,915 (13.1)	5,085 (22.9)	2,915 (13.1)	5,990 (27.0)	2,915 (13.1)	6,895 (31.0)	2,915 (13.1)
	8 1/2 (215.9)	Two 1/2"	5,020 (22.6)	2,915 (13.1)	5,900 (26.6)	2,915 (13.1)	6,780 (30.5)	2,915 (13.1)	7,985 (35.9)	2,915 (13.1)	9,190 (41.4)	2,915 (13.1)
5/8 (15.9)	5 (127.0)	One 5/8"	3,460 (15.6)	4,685 (21.1)	4,060 (18.3)	4,685 (21.1)	4,655 (20.9)	4,685 (21.1)	5,850 (26.3)	4,685 (21.1)	6,290 (28.3)	4,685 (21.1)
	7 1/2 (190.5)	One 5/8" & One 1/2"	5,190 (23.4)	4,685 (21.1)	6,085 (27.4)	4,685 (21.1)	6,985 (31.4)	4,685 (21.1)	8,090 (36.4)	4,685 (21.1)	9,195 (41.4)	4,685 (21.1)
	10 (254.0)	Two 5/8"	6,920 (31.1)	4,685 (21.1)	8,115 (36.5)	4,685 (21.1)	9,310 (41.9)	4,685 (21.1)	10,785 (48.5)	4,685 (21.1)	12,255 (55.1)	4,685 (21.1)
3/4 (19.1)	6 5/8 (168.3)	One 3/4"	5,575 (25.1)	7,515 (33.8)	6,525 (29.4)	7,515 (33.8)	7,135 (32.1)	7,515 (33.8)	8,695 (39.1)	7,515 (33.8)	9,255 (41.6)	7,515 (33.8)
	10 (254.0)	One 3/4" & One 5/8"	8,415 (37.9)	7,515 (33.8)	9,560 (43.0)	7,515 (33.8)	10,705 (48.2)	7,515 (33.8)	12,335 (55.5)	7,515 (33.8)	13,970 (62.9)	7,515 (33.8)
	13 1/4 (336.6)	Two 3/4"	11,150 (50.2)	7,515 (33.8)	12,710 (57.2)	7,515 (33.8)	14,270 (64.2)	7,515 (33.8)	16,390 (73.8)	7,515 (33.8)	18,510 (83.3)	7,515 (33.8)
7/8 (22.2)	7 (177.8)	One 7/8"	5,870 (26.4)	9,015 (40.6)	7,005 (31.5)	9,015 (40.6)	8,140 (36.6)	9,015 (40.6)	10,410 (46.8)	9,015 (40.6)	11,195 (50.4)	9,015 (40.6)
	10 1/4 (260.4)	Two 3/4"	8,805 (39.6)	9,015 (40.6)	10,510 (47.3)	9,015 (40.6)	12,210 (54.9)	9,015 (40.6)	14,500 (65.3)	9,015 (40.6)	16,795 (75.6)	9,015 (40.6)
	14 (355.6)	Two 7/8"	11,740 (52.8)	9,015 (40.6)	14,010 (63.0)	9,015 (40.6)	16,280 (73.3)	9,015 (40.6)	19,335 (87.0)	9,015 (40.6)	22,390 (100.8)	9,015 (40.6)
1 (25.4)	8 1/4 (209.6)	One 1"	8,090 (36.4)	13,285 (59.8)	9,885 (44.5)	13,285 (59.8)	11,675 (52.5)	13,285 (59.8)	15,260 (68.7)	13,285 (59.8)	16,405 (73.8)	13,285 (59.8)
	12 3/8 (314.3)	One 1" & One 7/8"	12,135 (54.6)	13,285 (59.8)	14,825 (66.7)	13,285 (59.8)	17,515 (78.8)	13,285 (59.8)	21,060 (94.8)	13,285 (59.8)	24,610 (110.7)	13,285 (59.8)
	16 1/2 (419.1)	Two 1"	16,175 (72.8)	13,285 (59.8)	19,765 (88.9)	13,285 (59.8)	23,350 (105.1)	13,285 (59.8)	28,080 (126.4)	13,285 (59.8)	32,810 (147.6)	13,285 (59.8)
1 1/4 (31.8)	10 1/4 (260.4)	One 1 1/4"	14,595 (65.7)	17,000 (76.5)	16,225 (73.0)	17,000 (76.5)	17,850 (80.3)	17,000 (76.5)	20,560 (92.5)	17,000 (76.5)	22,105 (99.5)	17,000 (76.5)
	15 (381.0)	One 1 1/4" & One 1"	21,360 (96.1)	17,000 (76.5)	23,590 (106.2)	17,000 (76.5)	25,820 (116.2)	17,000 (76.5)	27,810 (125.1)	17,000 (76.5)	29,800 (134.1)	17,000 (76.5)
	20 1/2 (520.7)	Two 1 1/4"	29,190 (131.4)	17,000 (76.5)	32,445 (146.0)	17,000 (76.5)	35,050 (157.7)	17,000 (76.5)	35,350 (159.1)	17,000 (76.5)	35,645 (160.4)	17,000 (76.5)
1 3/8 (34.9)	10 1/4 (260.4)	One 1 14"	15,750 (70.9)	20,500 (92.3)	17,125 (77.1)	20,500 (92.3)	18,500 (83.3)	20,500 (92.3)	21,125 (95.1)	20,500 (92.3)	23,750 (106.9)	20,500 (92.3)
	15 (381.0)	One 1 1/4" & One 1"	23,055 (103.7)	20,500 (92.3)	25,040 (112.7)	20,500 (92.3)	27,020 (121.6)	20,500 (92.3)	29,135 (131.1)	20,500 (92.3)	31,250 (140.6)	20,500 (92.3)
	20 1/2 (520.7)	Two 1 1/4"	31,510 (141.8)	20,500 (92.3)	33,570 (151.1)	20,500 (92.3)	35,625 (160.3)	20,500 (92.3)	36,440 (164.0)	20,500 (92.3)	37,250 (167.6)	20,500 (92.3)
1 1/2 (38.1)	10 1/4 (260.4)	One 1 1/4"	16,750 (75.4)	23,625 (106.3)	18,125 (81.6)	23,625 (106.3)	19,500 (87.8)	23,625 (106.3)	22,000 (99.0)	23,625 (106.3)	24,500 (110.3)	23,625 (106.3)
	15 (381.0)	One 1 1/4" & One 1"	25,115 (113.0)	23,625 (106.3)	27,180 (122.3)	23,625 (106.3)	29,250 (131.6)	23,625 (106.3)	31,800 (143.1)	23,625 (106.3)	34,350 (154.6)	23,625 (106.3)
	20 1/2 (520.7)	Two 1 1/4"	33,500 (150.8)	23,625 (106.3)	34,875 (156.9)	23,625 (106.3)	36,250 (163.1)	23,625 (106.3)	36,750 (165.4)	23,625 (106.3)	37,250 (167.6)	23,625 (106.3)

1. Allowable bond capacities are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable bond capacities for intermediate embedments and compressive strengths.
3. Allowable design load should be the lesser of the bond or allowable steel strength.
4. Allowable loads for threaded rods to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load where permitted by code.
5. Critical and minimum spacing and edge distances as well as reduction factors for intermediate spacing and edge distances are listed in the Design Criteria section.

PERFORMANCE DATA

Ultimate Load Capacities for Reinforcing Bar Installed with Chem-Stud Capsules in Normal-Weight and Heavy-weight Concrete[1,2]

Rebar Size No. (in.)	Min. Embed. Depth h_v in. (mm)	Capsules Required	Minimum Concrete Compressive Strength (f'_c)									
			2,000 psi (13.8 MPa)		3,000 psi (20.7 MPa)		4,000 psi (27.6 MPa)		5,000 psi (34.5 MPa)		6,000 psi (41.4 MPa)	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
No.3 (3/8)	3 1/2 (88.9)	One 3/8"	7,400 (33.3)	6,480 (29.2)	10,350 (46.6)	6,480 (29.2)	13,300 (59.9)	6,480 (29.2)	13,300 (59.9)	6,480 (29.2)	13,300 (59.9)	6,480 (29.2)
	5 1/4 (133.4)	Two 3/8"	11,100 (50.0)	6,480 (29.2)	15,525 (69.9)	6,480 (29.2)	19,950 (89.8)	6,480 (29.2)	19,950 (89.8)	6,480 (29.2)	19,950 (89.8)	6,480 (29.2)
	7 (177.8)	Two 3/8"	14,800 (66.6)	6,480 (29.2)	20,700 (93.2)	6,480 (29.2)	26,600 (119.7)	6,480 (29.2)	26,600 (119.7)	6,480 (29.2)	26,600 (119.7)	6,480 (29.2)
No.4 (1/2)	4 1/2 (114.3)	One 1/2"	10,450 (47.0)	11,120 (50.0)	13,550 (61.0)	11,120 (50.0)	16,650 (74.9)	11,120 (50.0)	17,050 (76.7)	11,120 (50.0)	17,450 (78.5)	11,120 (50.0)
	6 3/4 (171.5)	One 1/2" & One 3/8"	15,675 (70.5)	11,120 (50.0)	17,700 (79.7)	11,120 (50.0)	24,975 (112.4)	11,120 (50.0)	25,575 (115.1)	11,120 (50.0)	26,175 (117.8)	11,120 (50.0)
	9 (228.6)	Two 1/2"	20,900 (94.1)	11,120 (50.0)	23,600 (106.2)	11,120 (50.0)	33,300 (149.9)	11,120 (50.0)	34,100 (153.5)	11,120 (50.0)	34,900 (157.1)	11,120 (50.0)
No.5 (5/8)	5 (127.0)	One 5/8"	15,460 (69.6)	17,660 (79.5)	20,830 (93.7)	17,660 (79.5)	26,200 (117.9)	17,660 (79.5)	26,200 (117.9)	26,200 (117.9)	26,200 (117.9)	17,660 (79.5)
	7 1/2 (190.5)	One 5/8" & One 1/2"	23,190 (104.4)	17,660 (79.5)	31,245 (140.6)	17,660 (79.5)	39,300 (176.9)	17,660 (79.5)	39,300 (176.9)	39,300 (176.9)	39,300 (176.9)	17,660 (79.5)
	10 (254.0)	Two 5/8"	30,920 (139.1)	17,660 (79.5)	41,660 (187.5)	17,660 (79.5)	52,400 (235.8)	17,660 (79.5)	52,400 (235.8)	52,400 (235.8)	52,400 (235.8)	17,660 (79.5)
No.6 (3/4)	7 (177.8)	One 3/4"	22,760 (102.4)	21,900 (98.6)	27,890 (125.5)	21,900 (98.6)	33,020 (148.6)	21,900 (98.6)	34,900 (157.1)	21,900 (98.6)	36,780 (165.5)	21,900 (98.6)
	10 1/2 (266.7)	One 3/4" & One 5/8"	34,140 (153.6)	21,900 (98.6)	41,835 (188.3)	21,900 (98.6)	49,530 (222.9)	21,900 (98.6)	52,350 (235.6)	21,900 (98.6)	55,170 (248.3)	21,900 (98.6)
	14 (355.6)	Two 3/4"	45,520 (204.8)	21,900 (98.6)	55,780 (251.0)	21,900 (98.6)	66,040 (297.2)	21,900 (98.6)	69,800 (314.1)	21,900 (98.6)	73,560 (331.0)	21,900 (98.6)
No.7 (7/8)	7 (177.8)	One 7/8"	26,500 (119.3)	36,060 (162.3)	31,750 (142.9)	36,060 (162.3)	37,000 (166.5)	36,060 (162.3)	39,665 (178.5)	36,060 (162.3)	42,330 (190.5)	36,060 (162.3)
	10 1/2 (266.7)	Two 3/4"	39,750 (178.9)	36,060 (162.3)	47,625 (214.3)	36,060 (162.3)	55,500 (249.8)	36,060 (162.3)	59,498 (267.7)	36,060 (162.3)	63,495 (285.7)	36,060 (162.3)
	14 (355.6)	Two 7/8"	53,000 (238.5)	36,060 (162.3)	63,500 (285.8)	36,060 (162.3)	74,000 (333.0)	36,060 (162.3)	79,330 (357.0)	36,060 (162.3)	84,660 (381.0)	36,060 (162.3)
No.8 (1)	8 1/2 (215.9)	One 1"	36,650 (164.9)	53,140 (239.1)	45,075 (202.8)	53,140 (239.1)	53,500 (240.8)	53,140 (239.1)	55,170 (248.3)	53,140 (239.1)	56,840 (255.8)	53,140 (239.1)
	12 3/4 (323.9)	One 1" & One 3/4"	54,975 (247.4)	53,140 (239.1)	67,613 (304.3)	53,140 (239.1)	80,250 (361.1)	53,140 (239.1)	82,755 (372.4)	53,140 (239.1)	85,260 (383.7)	53,140 (239.1)
	17 (431.8)	Two 1"	73,300 (329.9)	53,140 (239.1)	90,150 (405.7)	53,140 (239.1)	107,000 (481.5)	53,140 (239.1)	110,340 (496.5)	53,140 (239.1)	113,680 (511.6)	53,140 (239.1)
No.9 (1 1/8)	9 (228.6)	One 1"	49,440 (222.5)	68,300 (307.4)	56,645 (254.9)	68,300 (307.4)	63,850 (287.3)	68,300 (307.4)	69,775 (314.0)	68,300 (307.4)	75,700 (340.7)	68,300 (307.4)
	13 1/2 (342.9)	One 1" & One 7/8"	74,160 (333.7)	68,300 (307.4)	84,968 (382.4)	68,300 (307.4)	95,775 (431.0)	68,300 (307.4)	104,663 (471.0)	68,300 (307.4)	113,550 (511.0)	68,300 (307.4)
	18 (457.2)	Two 1"	98,880 (445.0)	68,300 (307.4)	113,290 (509.8)	68,300 (307.4)	127,700 (574.7)	68,300 (307.4)	139,550 (628.0)	68,300 (307.4)	151,400 (681.3)	68,300 (307.4)
No.10 (1 1/4)	10 (254.0)	One 1 14"	57,000 (256.5)	83,460 (375.6)	64,735 (291.3)	83,460 (375.6)	72,470 (326.1)	83,460 (375.6)	82,435 (371.0)	83,460 (375.6)	92,400 (415.8)	83,460 (375.6)
	15 (381.0)	One 1 1/4" & One 7/8"	85,500 (384.8)	83,460 (375.6)	97,103 (437.0)	83,460 (375.6)	108,705 (489.2)	83,460 (375.6)	117,353 (528.1)	83,460 (375.6)	126,000 (567.0)	83,460 (375.6)
	20 (508.0)	Two 1 1/4"	114,000 (513.0)	83,460 (375.6)	129,470 (582.6)	83,460 (375.6)	144,940 (652.2)	83,460 (375.6)	148,470 (668.1)	83,460 (375.6)	152,000 (684.0)	83,460 (375.6)
No.11 (1 3/8)	10 (254.0)	One 1 1/4"	65,000 (292.5)	97,460 (438.6)	70,500 (317.3)	97,460 (438.6)	76,000 (342.0)	97,460 (438.6)	85,000 (382.5)	97,460 (438.6)	94,000 (423.0)	97,460 (438.6)
	15 (381.0)	One 1 1/4" & One 7/8"	92,000 (414.0)	97,460 (438.6)	103,000 (463.5)	97,460 (438.6)	114,000 (513.0)	97,460 (438.6)	119,000 (535.5)	97,460 (438.6)	124,000 (558.0)	97,460 (438.6)
	20 (508.0)	Two 1 1/4"	126,000 (567.0)	97,460 (438.6)	137,000 (616.5)	97,460 (438.6)	148,000 (666.0)	97,460 (438.6)	151,000 (679.5)	97,460 (438.6)	154,000 (693.0)	97,460 (438.6)

1. Ultimate load capacities should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate load capacities for intermediate embedments and compressive strengths.

ADHESIVES

ADHESIVES

PERFORMANCE DATA

Allowable Load Capacities for Reinforcing Bar Installed with Chem-Stud Capsules in Normal-Weight and Heavy-weight Concrete[1,2,3,4,5]

Rebar Size No. (in.)	Min. Embed. Depth h_v in. (mm)	Capsules Required	2,000 psi (13.8 MPa) Tension lbs. (kN)	2,000 psi (13.8 MPa) Shear lbs. (kN)	3,000 psi (20.7 MPa) Tension lbs. (kN)	3,000 psi (20.7 MPa) Shear lbs. (kN)	4,000 psi (27.6 MPa) Tension lbs. (kN)	4,000 psi (27.6 MPa) Shear lbs. (kN)	5,000 psi (34.5 MPa) Tension lbs. (kN)	5,000 psi (34.5 MPa) Shear lbs. (kN)	6,000 psi (41.4 MPa) Tension lbs. (kN)	6,000 psi (41.4 MPa) Shear lbs. (kN)
No.3 (3/8)	3 1/2 (88.9)	One 3/8"	1,850 (8.3)	1,620 (7.3)	2,590 (11.7)	1,620 (7.3)	3,325 (15.0)	1,620 (7.3)	3,325 (15.0)	1,620 (7.3)	3,325 (15.0)	1,620 (7.3)
	5 1/4 (133.4)	Two 3/8"	2,775 (12.5)	1,620 (7.3)	3,880 (17.5)	1,620 (7.3)	4,990 (22.5)	1,620 (7.3)	4,990 (22.5)	1,620 (7.3)	4,990 (22.5)	1,620 (7.3)
	7 (177.8)	Two 3/8"	3,700 (16.7)	1,620 (7.3)	5,175 (23.3)	1,620 (7.3)	6,650 (29.9)	1,620 (7.3)	6,650 (29.9)	1,620 (7.3)	6,650 (29.9)	1,620 (7.3)
No.4 (1/2)	4 1/2 (114.3)	One 1/2"	2,615 (11.8)	2,780 (12.5)	3,390 (15.3)	2,780 (12.5)	4,165 (18.7)	2,780 (12.5)	4,265 (19.2)	2,780 (12.5)	4,365 (19.6)	2,780 (12.5)
	6 3/4 (171.5)	One 1/2" & One 3/8"	3,920 (17.6)	2,780 (12.5)	4,425 (19.9)	2,780 (12.5)	6,245 (28.1)	2,780 (12.5)	6,395 (28.8)	2,780 (12.5)	6,545 (29.5)	2,780 (12.5)
	9 (228.6)	Two 1/2"	5,225 (23.5)	2,780 (12.5)	5,900 (26.6)	2,780 (12.5)	8,325 (37.5)	2,780 (12.5)	8,525 (38.4)	2,780 (12.5)	8,725 (39.3)	2,780 (12.5)
No.5 (5/8)	5 (127.0)	One 5/8"	3,865 (17.4)	4,415 (19.9)	5,210 (23.4)	4,415 (19.9)	6,550 (29.5)	4,415 (19.9)	6,550 (29.5)	6,550 (29.5)	6,550 (29.5)	4,415 (19.9)
	7 1/2 (190.5)	One 5/8" & One 1/2"	5,800 (26.1)	4,415 (19.9)	7,810 (35.1)	4,415 (19.9)	9,825 (44.2)	4,415 (19.9)	9,825 (44.2)	9,825 (44.2)	9,825 (44.2)	4,415 (19.9)
	10 (254.0)	Two 5/8"	7,730 (34.8)	4,415 (19.9)	10,415 (46.9)	4,415 (19.9)	13,100 (59.0)	4,415 (19.9)	13,100 (59.0)	13,100 (59.0)	13,100 (59.0)	4,415 (19.9)
No.6 (3/4)	7 (177.8)	One 3/4"	5,690 (25.6)	5,475 (24.6)	6,975 (31.4)	5,475 (24.6)	8,255 (37.1)	5,475 (24.6)	8,725 (39.3)	5,475 (24.6)	9,195 (41.4)	5,475 (24.6)
	10 1/2 (266.7)	One 3/4" & One 5/8"	8,535 (38.4)	5,475 (24.6)	10,460 (47.1)	5,475 (24.6)	12,385 (55.7)	5,475 (24.6)	13,090 (58.9)	5,475 (24.6)	13,795 (62.1)	5,475 (24.6)
	14 (355.6)	Two 3/4"	11,380 (51.2)	5,475 (24.6)	13,945 (62.8)	5,475 (24.6)	16,510 (74.3)	5,475 (24.6)	17,450 (78.5)	5,475 (24.6)	18,390 (82.8)	5,475 (24.6)
No.7 (7/8)	7 (177.8)	One 7/8"	6,625 (29.8)	9,015 (40.6)	7,940 (35.7)	9,015 (40.6)	9,250 (41.6)	9,015 (40.6)	9,915 (44.6)	9,015 (40.6)	10,585 (47.6)	9,015 (40.6)
	10 1/2 (266.7)	Two 3/4"	9,940 (44.7)	9,015 (40.6)	11,905 (53.6)	9,015 (40.6)	13,875 (62.4)	9,015 (40.6)	14,875 (66.9)	9,015 (40.6)	15,875 (71.4)	9,015 (40.6)
	14 (355.6)	Two 7/8"	13,250 (59.6)	9,015 (40.6)	15,875 (71.4)	9,015 (40.6)	18,500 (83.3)	9,015 (40.6)	19,835 (89.3)	9,015 (40.6)	21,165 (95.2)	9,015 (40.6)
No.8 (1)	8 1/2 (215.9)	One 1"	9,165 (41.2)	13,285 (59.8)	11,270 (50.7)	13,285 (59.8)	13,375 (60.2)	13,285 (59.8)	13,795 (62.1)	13,285 (59.8)	14,210 (63.9)	13,285 (59.8)
	12 3/4 (323.9)	One 1" & One 3/4"	13,745 (61.9)	13,285 (59.8)	16,905 (76.1)	13,285 (59.8)	20,065 (90.3)	13,285 (59.8)	20,690 (93.1)	13,285 (59.8)	21,315 (95.9)	13,285 (59.8)
	17 (431.8)	Two 1"	18,325 (82.5)	13,285 (59.8)	22,540 (101.4)	13,285 (59.8)	26,750 (120.4)	13,285 (59.8)	27,585 (124.1)	13,285 (59.8)	28,420 (127.9)	13,285 (59.8)
No.9 (1 1/8)	9 (228.6)	One 1"	12,360 (55.6)	17,075 (76.8)	14,160 (63.7)	17,075 (76.8)	15,965 (71.8)	17,075 (76.8)	17,445 (78.5)	17,075 (76.8)	18,925 (85.2)	17,075 (76.8)
	13 1/2 (342.9)	One 1" & One 7/8"	18,540 (83.4)	17,075 (76.8)	21,240 (95.6)	17,075 (76.8)	23,945 (107.8)	17,075 (76.8)	26,165 (117.7)	17,075 (76.8)	28,390 (127.8)	17,075 (76.8)
	18 (457.2)	Two 1"	24,720 (111.2)	17,075 (76.8)	28,325 (127.5)	17,075 (76.8)	31,925 (143.7)	17,075 (76.8)	34,890 (157.0)	17,075 (76.8)	37,850 (170.3)	17,075 (76.8)
No.10 (1 1/4)	10 (254.0)	One 1 14"	14,250 (64.1)	20,865 (93.9)	16,185 (72.8)	20,865 (93.9)	18,120 (81.5)	20,865 (93.9)	20,610 (92.7)	20,865 (93.9)	23,100 (104.0)	20,865 (93.9)
	15 (381.0)	One 1 1/4" & One 7/8"	21,375 (96.2)	20,865 (93.9)	24,275 (109.2)	20,865 (93.9)	27,175 (122.3)	20,865 (93.9)	29,340 (132.0)	20,865 (93.9)	31,500 (141.8)	20,865 (93.9)
	20 (508.0)	Two 1 1/4"	28,500 (128.3)	20,865 (93.9)	32,370 (145.7)	20,865 (93.9)	36,235 (163.1)	20,865 (93.9)	37,120 (167.0)	20,865 (93.9)	38,000 (171.0)	20,865 (93.9)
No.11 (1 3/8)	10 (254.0)	One 1 1/4"	16,250 (73.1)	24,365 (109.6)	17,625 (79.3)	24,365 (109.6)	19,000 (85.5)	24,365 (109.6)	21,250 (95.6)	24,365 (109.6)	23,500 (105.8)	24,365 (109.6)
	15 (381.0)	One 1 1/4" & One 7/8"	23,000 (103.5)	24,365 (109.6)	25,750 (115.9)	24,365 (109.6)	28,500 (128.3)	24,365 (109.6)	29,750 (133.9)	24,365 (109.6)	31,000 (139.5)	24,365 (109.6)
	20 (508.0)	Two 1 1/4"	31,500 (141.8)	24,365 (109.6)	34,250 (154.1)	24,365 (109.6)	37,000 (166.5)	24,365 (109.6)	37,750 (169.9)	24,365 (109.6)	38,500 (173.3)	24,365 (109.6)

Minimum Concrete Compressive Strength (f'_c)

1. Allowable bond capacities are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable bond capacities for intermediate embedments and compressive strengths.
3. Allowable design load should be the lesser of the bond or allowable steel strength.
4. Allowable loads for threaded rods to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load where permitted by code.
5. Critical and minimum spacing and edge distances as well as reduction factors for intermediate spacing and edge distances are listed in the Design Criteria section.

PERFORMANCE DATA

Ultimate Load Capacities for Internally Threaded Inserts Installed with Chem-Stud Capsules in Normal-Weight and Heavy-weight Concrete[1,2]

Anchor Dia. d in. (mm)	Drill Bit Dia. d_{bit} in.	Min. Embed. Depth h_v in. (mm)	Capsules Required	2,000 psi (13.8 MPa) Tension lbs. (kN)	2,000 psi (13.8 MPa) Shear lbs. (kN)	3,000 psi (20.7 MPa) Tension lbs. (kN)	3,000 psi (20.7 MPa) Shear lbs. (kN)	4,000 psi (27.6 MPa) Tension lbs. (kN)	4,000 psi (27.6 MPa) Shear lbs. (kN)	5,000 psi (34.5 MPa) Tension lbs. (kN)	5,000 psi (34.5 MPa) Shear lbs. (kN)	6,000 psi (41.4 MPa) Tension lbs. (kN)	6,000 psi (41.4 MPa) Shear lbs. (kN)
3/8 (9.5)	5/8	3 1/2 (88.9)	One 3/8"	7,630 (34.3)	6,480 (29.2)	7,935 (35.7)	6,480 (29.2)	8,240 (37.1)	6,480 (29.2)	9,050 (40.7)	6,480 (29.2)	9,860 (44.4)	6,480 (29.2)
1/2 (12.7)	11/16	4 1/4 (108.0)	One 1/2"	9,670 (43.5)	11,120 (50.0)	10,985 (49.4)	11,120 (50.0)	12,300 (55.4)	11,120 (50.0)	13,585 (61.1)	11,120 (50.0)	14,870 (66.9)	11,120 (50.0)
5/8 (15.9)	1	5 (127.0)	One 5/8"	15,230 (68.5)	17,650 (79.4)	18,340 (82.5)	17,650 (79.4)	21,450 (96.5)	17,650 (79.4)	22,445 (101.0)	17,650 (79.4)	23,440 (105.5)	17,650 (79.4)
3/4 (19.1)	1 1/8	6 5/8 (168.3)	One 3/4"	23,420 (105.4)	27,385 (123.2)	25,920 (116.6)	27,385 (123.2)	28,420 (127.9)	27,385 (123.2)	32,130 (144.6)	27,385 (123.2)	35,840 (161.3)	27,385 (123.2)

Minimum Concrete Compressive Strength (f'_c)

1. Ultimate load capacities should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate load capacities for intermediate compressive strengths.

Allowable Load Capacities for Internally Threaded Inserts Installed with Chem-Stud Capsules in Normal-Weight and Heavy-weight Concrete[1,2,3]

Anchor Dia. d in. (mm)	Drill Bit Dia. d_{bit} in.	Min. Embed. Depth h_v in. (mm)	Capsules Required	2,000 psi (13.8 MPa) Tension lbs. (kN)	2,000 psi (13.8 MPa) Shear lbs. (kN)	3,000 psi (20.7 MPa) Tension lbs. (kN)	3,000 psi (20.7 MPa) Shear lbs. (kN)	4,000 psi (27.6 MPa) Tension lbs. (kN)	4,000 psi (27.6 MPa) Shear lbs. (kN)	5,000 psi (34.5 MPa) Tension lbs. (kN)	5,000 psi (34.5 MPa) Shear lbs. (kN)	6,000 psi (41.4 MPa) Tension lbs. (kN)	6,000 psi (41.4 MPa) Shear lbs. (kN)
3/8 (9.5)	5/8	3 1/2 (88.9)	One 3/8"	1,910 (8.6)	1,620 (7.3)	1,985 (8.9)	1,620 (7.3)	2,060 (9.3)	1,620 (7.3)	2,265 (10.2)	1,620 (7.3)	2,465 (11.1)	1,620 (7.3)
1/2 (12.7)	11/16	4 1/4 (108.0)	One 1/2"	2,420 (10.9)	2,780 (12.5)	2,745 (12.4)	2,780 (12.5)	3,075 (13.8)	2,780 (12.5)	3,395 (15.3)	2,780 (12.5)	3,720 (16.7)	2,780 (12.5)
5/8 (15.9)	1	5 (127.0)	One 5/8"	3,810 (17.1)	4,415 (19.9)	4,585 (20.6)	4,415 (19.9)	5,365 (24.1)	4,415 (19.9)	5,610 (25.2)	4,415 (19.9)	5,860 (26.4)	4,415 (19.9)
3/4 (19.1)	1 1/8	6 5/8 (168.3)	One 3/4"	5,855 (26.3)	6,845 (30.8)	6,480 (29.2)	6,845 (30.8)	7,105 (32.0)	6,845 (30.8)	8,035 (36.2)	6,845 (30.8)	8,960 (40.3)	6,845 (30.8)

Minimum Concrete Compressive Strength (f'_c)

1. Allowable bond capacities are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable bond capacities for intermediate compressive strengths.
3. Allowable design load should be the lesser of the bond or allowable steel strength.

DESIGN CRITERIA

Combined Loading

For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n}\right)^{\frac{5}{3}} + \left(\frac{V_u}{V_n}\right)^{\frac{5}{3}} \leq 1 \quad \textbf{OR} \quad \left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

Load Adjustment Factors for Spacing and Edge Distances

Anchor Installed in Normal-Weight Concrete[1]

Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (s)	Tension and Shear	$s_{cr} = 16d$	$F_N = F_V = 1.0$	$s_{min} = 8d$	$F_N = F_V = 0.65$
Edge Distance (c)	Tension	$c_{cr} = 10d$	$F_N = 1.0$	$c_{min} = 4d$	$F_N = 0.65$
	Shear[2]	$c_{cr} = 12d$	$F_V = 1.0$	$c_{min} = 4d$	$F_V = 0.20$

1. Minimum anchor spacing distance (s_{min}) for normal-weight concrete may be further reduced from 8 diameters ($8d$) to 4 diameters ($4d$) provided that the allowable load values in the table are reduced by an additional 5 percent. Linear interpolation is allowed for spacing distances between 8 diameters and 4 diameters.
2. Minimum edge distance (c_{min}) for anchors loaded in shear parallel to the edge is equal to 4 anchor diameters ($4d$) at which the anchor achieves 60% of load.

ADHESIVES

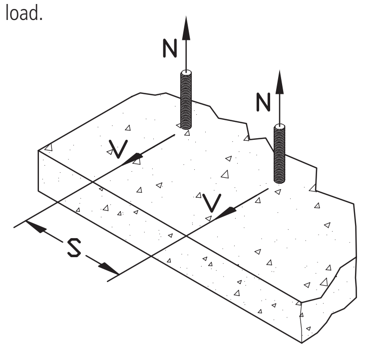
DESIGN CRITERIA

Load Adjustment Factors for Threaded Rod in Normal-Weight Concrete

Spacing, Tension (F_N) & Shear (F_V)										
Dia. (in.)	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/4	1 3/8	1 1/2
s_{cr} (in.)	4	6	8	10	12	14	16	20	22	24
s_{min} (in.)	2	3	4	5	6	7	8	10	11	12
Spacing, *s* (inches)										
2	0.65									
3	0.83	0.65								
4	1.00	0.77	0.65							
5		0.88	0.74	0.65						
6		1.00	0.83	0.72	0.65					
7			0.91	0.79	0.71	0.65				
8			1.00	0.86	0.77	0.70	0.65			
10				1.00	0.88	0.80	0.74	0.65		
11					0.94	0.85	0.78	0.69	0.65	
12					1.00	0.90	0.83	0.72	0.68	0.65
14						1.00	0.91	0.79	0.75	0.71
16							1.00	0.86	0.81	0.77
20								1.00	0.94	0.88
22									1.00	0.94
24										1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 16 anchor diameters (16*d*) at which the anchor achieves 100% of load.

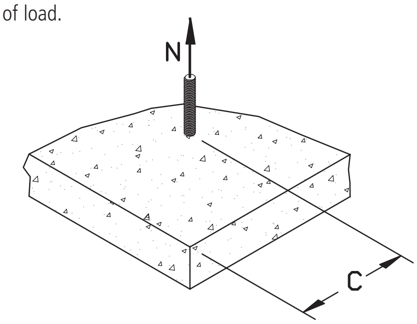
Minimum spacing (s_{min}) is equal to 8 anchor diameters (8*d*) at which the anchor achieves 65% of load.



Edge Distance, (F_N) Tension										
Dia. (in.)	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/4	1 3/8	1 1/2
c_{cr} (in.)	2 1/2	3 3/4	5	6 1/4	7 1/2	8 3/4	10	12 1/2	13 3/4	15
c_{min} (in.)	1	1 1/2	2	2 1/2	3	3 1/2	4	5	5 1/2	6
Edge Distance, *c* (inches)										
1	0.65									
1 1/2	0.77	0.65								
2	0.88	0.73	0.65							
2 1/2	1.00	0.81	0.71	0.65						
3		0.88	0.77	0.70	0.65					
3 1/2		0.96	0.83	0.74	0.69	0.65				
3 3/4		1.00	0.85	0.77	0.71	0.67				
4			0.88	0.79	0.73	0.68	0.65			
5			1.00	0.88	0.81	0.75	0.71	0.65		
5 1/2				0.93	0.84	0.78	0.74	0.67	0.65	
6				0.98	0.88	0.82	0.77	0.70	0.67	0.65
6 1/4				1.00	0.90	0.83	0.78	0.71	0.68	0.66
7 1/2					1.00	0.92	0.85	0.77	0.73	0.71
8 3/4						1.00	0.93	0.83	0.79	0.76
10							1.00	0.88	0.84	0.81
12 1/2								1.00	0.95	0.90
13 3/4									1.00	0.95
15										1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 10 anchor diameters (10*d*) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 4 anchor diameters (4*d*) at which the anchor achieves 65% of load.

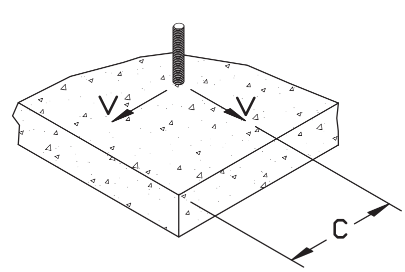


Edge Distance, Shear (F_V)										
Dia. (in.)	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/4	1 3/8	1 1/2
c_{cr} (in.)	3	4 1/2	6	7 1/2	9	10 1/2	12	15	16 1/2	18
c_{min} (in.)	1	1 1/2	2	2 1/2	3	3 1/2	4	5	5 1/2	6
Edge Distance, *c* (inches)										
1	0.20									
1 1/2	0.40	0.20								
2	0.60	0.33	0.20							
2 1/2	0.80	0.47	0.30	0.20						
3	1.00	0.60	0.40	0.28	0.20					
3 1/2		0.73	0.50	0.36	0.27	0.20				
4		0.87	0.60	0.44	0.33	0.26	0.20			
4 1/2		1.00	0.70	0.52	0.40	0.31	0.25			
5			0.80	0.60	0.47	0.37	0.30	0.20		
5 1/2			0.90	0.68	0.53	0.43	0.35	0.24	0.20	
6			1.00	0.76	0.60	0.49	0.40	0.28	0.24	0.20
7 1/2				1.00	0.80	0.66	0.55	0.40	0.35	0.30
9					1.00	0.83	0.70	0.52	0.45	0.40
10 1/2						1.00	0.85	0.64	0.56	0.50
12							1.00	0.76	0.67	0.60
15								1.00	0.89	0.80
16 1/2									1.00	0.90
18										1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12*d*) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 4 anchor diameters (4*d*) at which the anchor achieves 20% of load.

Minimum edge distance (c_{min}) for anchors loaded in shear parallel to the edge is equal to 4 anchor diameters (4*d*) at which the anchor achieves 60% of load.



ORDERING INFORMATION

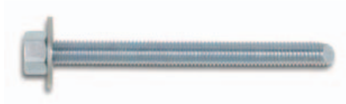
Chem-Stud Capsules

Cat. No.	Description	Standard Box	Standard Carton	Wt./100
6502	3/8" Chem-Stud Capsule	10	500	4
6503	1/2" Chem-Stud Capsule	10	200	5
6504	5/8" Chem-Stud Capsule	10	200	9
6505	3/4" Chem-Stud Capsule	5	50	19
6506	7/8" Chem-Stud Capsule	5	50	20
6507	1" Chem-Stud Capsule	5	50	32
6508	1-1/4" Chem-Stud Capsule	5	25	84

ASTM A307 Standard Carbon Steel, Zinc Plated Chisel Pointed Rod (ASTM B633)

Cat. No.	Description	Standard Box	Standard Carton	Wt./100
6513	1/2" x 6-1/2"	10	50	28
6514	5/8" x 7-1/2"	10	40	51
6515	3/4" x 9-5/8"	10	40	96
6516*	7/8" x 10-1/4"	–	10	140
6517	1" x 12"	–	10	213
6518	1-1/4" x 15"	–	5	433

*Mechanically Galvanized to ASTM B695, Class 65



ASTM A193 Grade B7 High Strength Carbon Steel, Zinc Plated Chisel Pointed Rod (ASTM B633)

Cat. No.	Description	Standard Box	Standard Carton	Wt./100
6522	3/8" x 5-1/8"	10	50	12
6523	1/2" x 6-1/2"	10	50	28
6524	5/8" x 7-1/2"	10	40	51
6525	3/4" x 9-5/8"	10	40	96
6526	7/8" x 10-1/4"	–	10	140
6527	1" x 12"	–	10	213
6528	1-1/4" x 15"	–	5	433

Internally Threaded Inserts, Carbon Steel Zinc Plated (ASTM B633)

Cat. No.	Description	O.D.	Min. Depth	Thread Depth	Std. Box	Std. Carton	Wt./100
6592	3/8" x 3-1/2"	0.55"	3 1/2"	1 1/2"	10	40	20
6593	1/2" x 4-1/4"	0.65"	4 1/4"	1 5/8"	10	40	44
6594	5/8" x 5"	0.90"	5"	2 3/8"	10	40	68
6595	3/4" x 6-5/8"	1.00"	6 5/8"	2 3/4"	10	40	125

ORDERING INFORMATION

Chisel Pointed Anchor Rod Installation Tools

Rod Couplers

Cat. No.	Description	Standard Box	Standard Carton
6562	3/8" Coupler	1	10
6563	1/2" Coupler	1	10
6564	5/8" Coupler	1	10
6565	3/4" Coupler	1	5
6566	7/8" Coupler	1	5
6567	1" Coupler	1	5
6568	1-1/4" Coupler	1	5

Drivers for Threaded Rod Couplers – Hex

Cat. No.	Hex Size	Fits Coupler Size	Standard Box	Standard Carton
6570	1/4"	3/8" to 5/8"	1	10
6572	3/8"	3/4" to 1-1/4"	1	10

Drivers for Threaded Rod Couplers – SDS Plus

Cat. No.	Hex Size	Fits Coupler Size	Standard Box	Standard Carton
6574	1/4"	3/8" to 5/8"	1	10
6576	3/8"	3/4" to 1-1/4"	1	10

Drivers for Threaded Rod Couplers – Spline

Cat. No.	Hex Size	Fits Coupler Size	Standard Box	Standard Carton
6580	1/4"	3/8" to 5/8"	1	10
6582	3/8"	3/4" to 1-1/4"	1	10

Drivers for Threaded Rod Couplers – SDS Max

Cat. No.	Hex Size	Fits Coupler Size	Standard Box	Standard Carton
6559	1/4"	3/8" to 5/8"	1	10
6561	3/8"	3/4" to 1-1/4"	1	10

Reinforcing Bar Installation Tools

Cat. No.	Description	Standard Box	Standard Carton
6533	#3 Coupler	1	10
6534	#4 Coupler	1	10
6536	#6 Coupler	1	10
6537	#7 Coupler	1	10
6538	#8 Coupler	1	10
6539	#9 Coupler	1	10
6540	#10 Coupler	1	10
6589	Skil 726 Driver	1	1
6590	Spline Driver Extension	1	1
6596	SDS-Max Driver Extension	1	1

Internally Threaded Insert Tools*

Cat. No.	Description	Standard Box	Standard Carton
6862	3/8"	1	1
6863	1/2"	1	1
6864	5/8"	1	1
6865	3/4"	1	1

*Use with drivers for threaded rod.

Hammer-Capsule® *Drive-In Capsule Adhesive*

PRODUCT DESCRIPTION

The Hammer-Capsule system consists of a self contained, single use, two-part glass capsule into which threaded anchor rod or reinforcing bars can be directly driven without the need for a chisel point or spinning action. It is designed for use in the installation of 3/8" through 1" diameter threaded rod in solid concrete and masonry materials. It can also be used to install reinforcing bars.

A mixture of hardener and quartz aggregate is contained in the upper portion of the capsule while the lower portion contains an epoxy acrylate resin. Unlike traditional capsule anchors which required the use of chisel-pointed anchor rod and special installation tools, the Hammer-Capsule is designed for use with straight cut anchor rod.

GENERAL APPLICATIONS AND USES

- Anchoring rebar (doweling), and threaded anchor rods in solid concrete and grouted concrete masonry
- Steel erection including anchoring of equipment and column base plates
- Resists vibratory loads introduced from machinery, moving vehicles, etc
- Barriers, fencing and railing attachments

FEATURES AND BENEFITS

- Fast, easy installation - no special tools required for setting
- Suitable for diamond cored holes
- Excellent chemical resistance
- Components are mixed during installation of rod or rebar
- Pre-measured chemical component volumes – no waste
- Ideal for small projects
- Independently tested to ASTM E1512 and AC58 Criteria

APPROVALS AND LISTINGS

Various North American Departments of Transportation (DOT) – See www.powers.com

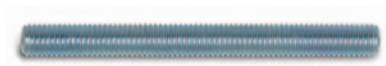
GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring, 04081-Masonry Anchorage* and *05090-Metal Fastenings.* Capsule adhesive system shall be Hammer-Capsule as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS Page No.

ADHESIVES

Hammer-Capsule



Straight Cut Threaded Rod
(Supplied by Powers Fasteners or equivalent by installer)

ANCHOR SIZE RANGE (TYP.)

3/8" to 1" diameter rod
No. 3 to No. 8 reinforcing bar

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Grouted Concrete Masonry

MATERIAL SPECIFICATIONS

Physical Properties

Shelf Life	2 Years
Storage Conditions	Store dry at 40° to 90°F and out of direct sunlight
Installation Temperature	Condition capsules to 60°F minimum for best results
Color	Mixed adhesive mortar – amber
Consistency	Paste mortar

Setting Times

Minimum Base Material Temperature	Minimum Curing Time
68°F (20°C)	1 hour
50°F (10°C)	2 hours
32°F (0°C)	5 hours
23°F (-5°C)	10 hours
14°F (-10°C)	24 hours

Cure time should be doubled for wet concrete.

INSTALLATION SPECIFICATIONS

Hammer-Capsule[1,2]

Dimension	Hammer-Capsule, Nominal Size					
	3/8"	1/2"	5/8"	3/4"	7/8"	1"
Capsule Diameter (in.)	0.43	0.51	0.67	0.78	0.87	0.95
Capsule Length (in.)	3.50	4.30	5.00	5.50	6.89	8.25
Mortar Volume (in^3)	0.40	0.70	1.40	2.05	3.25	4.50
Mortar Volume (fl. oz.)	0.22	0.39	0.77	1.13	1.79	2.48

1. The mortar volume listed is for the mixed material.
2. The diameter and length may be different than products offered by other manufacturer's capsules because of variations in air content. When comparing capsules, use the installed mortar volume.

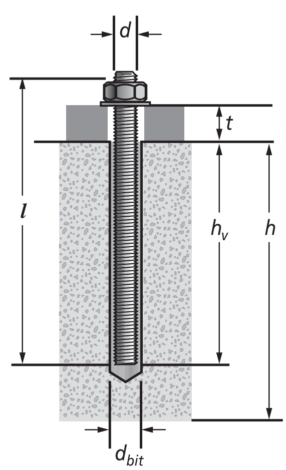
Threaded Rod in Normal-Weight Concrete

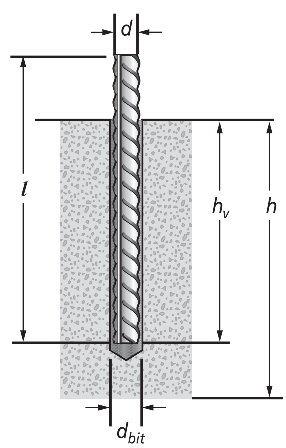
Dimension	Hammer-Capsule, Nominal Size					
	3/8"	1/2"	5/8"	3/4"	7/8"	1"
A_{nom} = Nominal area of threaded rod (in^2)	0.111	0.196	0.307	0.442	0.601	0.785
A_{se} = Tensile stress area of rod (in^2)	0.078	0.142	0.226	0.335	0.462	0.606
d_{bit} = Nominal bit diameter (in.)	7/16	9/16	11/16	7/8	1	1 1/8
h_v = Minimum Embedment Depth (in.)	3 1/2	4 1/4	5	6 5/8	7	8 1/4
T_{max} = Max. tightening torque range (ft.-lbs.)	7.5-10	11-15	26-35	56-75	75-100	112-150
Mortar per inch (in^3)	0.094	0.133	0.184	0.326	0.390	0.478

Reinforcing Bar in Normal-Weight Concrete[1]

Dimension	Reinforcing Bar Size					
	No.3	No.4	No.5	No.6	No.7	No.8
A_{nom} = Nominal area of threaded rod (in^2)	0.110	0.200	0.310	0.440	0.600	0.790
d_{bit} = Nominal bit diameter (in.)	1/2	5/8	3/4	7/8	1	1 1/8
h_v = Minimum Embedment Depth (in.)	3 1/2	4 1/4	5	6	7	8 1/4
Mortar per inch (in^3)	0.111	0.142	0.176	0.220	0.252	0.537

1. Adhesive mortar volumes for reinforcing bar are based on smooth bars. Actual mortar volume required will be less due to raised deformations on bars.

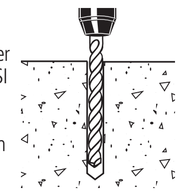




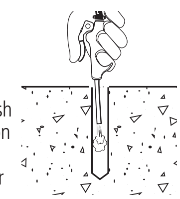
Nomenclature

- d = Diameter of anchor
- d_{bit} = Diameter of drill bit
- d_h = Diameter of fixture clearance hole
- d_w = Diameter of washer
- h = Base material thickness. The minimum value of h should be $1.5h_v$
- h_v = Minimum embedment depth
- l = Overall length of anchor
- t = Fixture thickness
- T_{max} = Maximum tightening torque

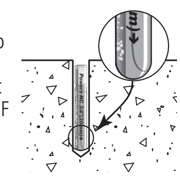
Installation Guidelines



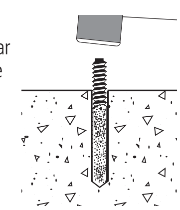
Drill a hole using a carbide tipped bit meeting the diameter requirements of ANSI B212.15 to the minimum depth required as shown in the chart.



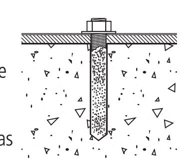
Starting from the bottom or back of the anchor hole, blow clean with compressed air, brush the hole with a nylon brush, and blow it clean again. Anchor holes may be dry or damp, but should be free of standing water or frost. Vacuuming only is not sufficient. Blow out bulbs generally do not provide enough dust removal for most drilled anchor holes. Holes should be clean and sound.



Prior to installation check the capsule to be sure it is not damaged and invert several times at 60°F or above to confirm all of the resin is in a liquid state. Insert the capsule into the hole. Be careful to observe the direction of insertion. The arrow on the capsule should point toward the bottom of the hole.



Drive the threaded rod or reinforcing bar into the anchor hole through the capsule until it is fully embedded. A 2-pound hammer and eye protection are recommended.
A rotary hammer set in the hammering only mode and Chem-Stud drive adapters can also be used. Stop driving immediately upon reaching the bottom of the anchor hole.



Allow the Hammer-Capsule to cure for specified time before loading anchor. Do not disturb the rod once the material has begun to set.

STEEL SPECIFICATIONS

Material Properties for Threaded Rod and Reinforcing Bar

Anchor Type	Steel Description	Steel Specification (ASTM)	Rod Dia. or Rebar Size (inch or No.)	Minimum Yield Strength, f_y (ksi)	Minimum Ultimate Strength, f_u (ksi)
Threaded Rod	Standard carbon rod	A36	All	36.0	58.0
		A 307, Grade C	3/8 thru 4	36.0	58.0
	High strength carbon rod	A 193, Grade B7	3/8 thru 2 1/2	105.0	120.0
	Stainless Rod (Type 304 / 316 SS)	F 593, Condition CW	3/8 thru 5/8	65.0	100.0
			3/4 thru 1 1/2	45.0	85.0
Reinforcing Bar	Grade 40 Rebar	A 615, A 616, A 617, A 706 or A 767	All	40.0	70.0
	Grade 60 Rebar			60.0	90.0

Allowable Steel Strength Capacities for Threaded Rod

Anchor Diameter *d* in. (mm)	Allowable Tension				Allowable Shear			
	ASTM A36 lbs. (kN)	ASTM A307 Grade C lbs. (kN)	ASTM A193 Grade B7 lbs. (kN)	ASTM F593 304/316 SS lbs. (kN)	ASTM A36 lbs. (kN)	ASTM A307 Grade C lbs. (kN)	ASTM A193 Grade B7 lbs. (kN)	ASTM F593 304/316 SS lbs. (kN)
3/8 (9.5)	2,115 (9.5)	2,115 (9.5)	4,375 (19.7)	3,630 (16.3)	1,090 (4.9)	1,090 (4.9)	2,255 (10.1)	1,870 (8.4)
1/2 (12.7)	3,755 (16.9)	3,755 (16.9)	7,775 (35.0)	6,470 (29.1)	1,940 (8.7)	1,940 (8.7)	4,055 (18.2)	3,330 (15.0)
5/8 (15.9)	5,870 (26.4)	5,870 (26.4)	12,150 (54.7)	10,130 (45.6)	3,025 (13.6)	3,025 (13.6)	6,260 (28.2)	5,210 (23.4)
3/4 (19.1)	8,455 (38.0)	8,455 (38.0)	17,495 (78.7)	12,400 (55.8)	4,355 (19.6)	4,355 (19.6)	9,010 (40.5)	6,390 (28.8)
7/8 (22.2)	11,510 (51.8)	11,510 (51.8)	23,810 (107.1)	16,860 (75.9)	5,930 (26.7)	5,930 (26.7)	12,265 (55.2)	8,680 (39.1)
1 (25.4)	15,035 (67.7)	15,035 (67.7)	31,100 (140.0)	22,020 (99.1)	7,745 (34.9)	7,745 (34.9)	16,020 (72.1)	11,340 (51.0)

Steel strength capacities are based on the design criteria listed in the *AISC Manual of Steel Construction*.

Allowable Steel Strength Capacities for Reinforcing Bar

Bar Size	Tension lbs. (kN)		Shear lbs. (kN)	
	Grade 40	Grade 60	Grade 40	Grade 60
No. 3 (3/8")	2,200 (9.9)	2,640 (11.9)	1,310 (5.9)	1,680 (7.6)
No. 4 (1/2")	4,000 (18.0)	4,800 (21.6)	2,380 (10.7)	3,060 (13.8)
No. 5 (5/8")	6,200 (27.9)	7,440 (33.5)	3,690 (16.6)	4,740 (21.3)
No. 6 (3/4")	8,800 (39.6)	10,560 (47.5)	5,235 (23.6)	6,730 (30.3)
No. 7 (7/8")	12,000 (54.0)	14,400 (64.8)	7,140 (32.1)	9,180 (41.3)
No. 8 (1")	15,800 (71.1)	18,960 (85.3)	9,400 (42.3)	12,085 (54.4)

Steel strength capacities are based on the requirements of ASTM A 615.

Note:
Allowable design load must be the lesser of allowable steel strength (as shown on this page) and the allowable bond capacities.

Allowable steel strength values for threaded rod are based on the following equations:

$T = 0.33 * f_u * A_{nom}$

$V = 0.17 * f_u * A_{nom}$

And, the allowable steel strength values for reinforcing bar are based on the following equations:

$T = f_s * A_{br}$

$V = 0.17 * f_s * A_{br}$

Where:

T = Allowable tension load (pounds).
V = Allowable shear load (pounds).
f_u = Minimum specified ultimate strength (psi).
f_s = Tensile stress area in reinforcement (psi).
A_{nom} = Nominal cross-sectional area of threaded rod (in^2).
A_{br} = Nominal cross-sectional area of reinforcing bar (in^2).

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PERFORMANCE DATA

Ultimate Load Capacities for Threaded Rod Installed with Hammer-Capsule in Normal-Weight Concrete[1,2]

Anchor Dia. *d* in. (mm)	Min. Embed. Depth h_v in. (mm)	Capsules Required	Minimum Concrete Compressive Strength (f'_c)									
			2,000 psi (13.8 MPa)		3,000 psi (20.7 MPa)		4,000 psi (27.6 MPa)		5,000 psi (34.5 MPa)		6,000 psi (41.4 MPa)	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/8 (9.5)	3 1/2 (88.9)	One 3/8"	4,920 (22.1)	4,440 (20.0)	5,880 (26.5)	4,440 (20.0)	6,120 (27.5)	4,440 (20.0)	7,175 (32.3)	4,440 (20.0)	8,210 (36.9)	4,440 (20.0)
	7 (177.8)	Two 3/8"	9,840 (44.3)	4,440 (20.0)	11,760 (52.9)	4,440 (20.0)	12,240 (55.1)	4,440 (20.0)	14,350 (64.6)	4,440 (20.0)	16,420 (73.9)	4,440 (20.0)
1/2 (12.7)	4 1/4 (108.0)	One 1/2"	8,235 (37.1)	10,720 (48.2)	10,355 (46.6)	10,720 (48.2)	11,480 (51.7)	10,720 (48.2)	12,840 (57.8)	10,720 (48.2)	14,200 (63.9)	10,720 (48.2)
	8 1/2 (215.9)	Two 1/2"	16,470 (74.1)	10,720 (48.2)	20,670 (93.0)	10,720 (48.2)	22,960 (103.3)	10,720 (48.2)	25,680 (115.6)	10,720 (48.2)	28,400 (127.8)	10,720 (48.2)
5/8 (15.9)	5 (127.0)	One 5/8"	10,160 (45.7)	17,160 (77.2)	13,080 (58.9)	17,160 (77.2)	15,160 (68.2)	17,160 (77.2)	17,410 (78.3)	17,160 (77.2)	19,660 (88.5)	17,160 (77.2)
	10 (254.0)	Two 5/8"	20,320 (91.4)	17,160 (77.2)	26,160 (117.7)	17,160 (77.2)	30,320 (136.4)	17,160 (77.2)	34,820 (156.7)	17,160 (77.2)	39,320 (176.9)	17,160 (77.2)
3/4 (19.1)	6 (152.4)	One 3/4"	13,080 (58.9)	24,990 (112.5)	17,125 (77.1)	24,990 (112.5)	17,990 (81.0)	24,990 (112.5)	19,190 (86.4)	24,990 (112.5)	20,390 (91.8)	24,990 (112.5)
	12 (304.8)	Two 3/4"	26,160 (117.7)	24,990 (112.5)	34,250 (154.1)	24,990 (112.5)	35,980 (161.9)	24,990 (112.5)	38,380 (172.7)	24,990 (112.5)	40,780 (183.5)	24,990 (112.5)
7/8 (22.2)	7 (177.8)	One 7/8"	16,265 (73.2)	35,600 (160.2)	21,065 (94.8)	35,600 (160.2)	24,640 (110.9)	35,600 (160.2)	28,425 (127.9)	35,600 (160.2)	32,210 (144.9)	35,600 (160.2)
	14 (355.6)	Two 7/8"	32,530 (146.4)	35,600 (160.2)	42,130 (189.6)	35,600 (160.2)	49,280 (221.8)	35,600 (160.2)	56,850 (255.8)	35,600 (160.2)	64,420 (289.9)	35,600 (160.2)
1 (25.4)	8 1/4 (209.6)	One 1"	28,720 (129.2)	46,840 (210.8)	32,265 (145.2)	46,840 (210.8)	32,495 (146.2)	46,840 (210.8)	35,205 (158.4)	46,840 (210.8)	37,920 (170.6)	46,840 (210.8)
	16 1/2 (419.1)	Two 1"	57,440 (258.5)	46,840 (210.8)	64,530 (290.4)	46,840 (210.8)	64,990 (292.5)	46,840 (210.8)	70,410 (316.8)	46,840 (210.8)	75,840 (341.3)	46,840 (210.8)

1. Ultimate load capacities should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate load capacities for intermediate embedments and compressive strengths.

Allowable Load Capacities for Threaded Rod Installed with Hammer-Capsule in Normal-Weight Concrete[1,2,3,4]

Anchor Dia. *d* in. (mm)	Min. Embed. Depth h_v in. (mm)	Capsules Required	Minimum Concrete Compressive Strength (f'_c)									
			2,000 psi (13.8 MPa)		3,000 psi (20.7 MPa)		4,000 psi (27.6 MPa)		5,000 psi (34.5 MPa)		6,000 psi (41.4 MPa)	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/8 (9.5)	3 1/2 (88.9)	One 3/8"	1,230 (5.5)	1,110 (5.0)	1,470 (6.6)	1,110 (5.0)	1,530 (6.9)	1,110 (5.0)	1,795 (8.1)	1,110 (5.0)	2,055 (9.2)	1,110 (5.0)
	7 (177.8)	Two 3/8"	2,460 (11.1)	1,110 (5.0)	2,940 (13.2)	1,110 (5.0)	3,060 (13.8)	1,110 (5.0)	3,590 (16.2)	1,110 (5.0)	4,105 (18.5)	1,110 (5.0)
1/2 (12.7)	4 1/4 (108.0)	One 1/2"	2,060 (9.3)	2,680 (12.1)	2,590 (11.7)	2,680 (12.1)	2,870 (12.9)	2,680 (12.1)	3,210 (14.4)	2,680 (12.1)	3,550 (16.0)	2,680 (12.1)
	8 1/2 (215.9)	Two 1/2"	4,120 (18.5)	2,680 (12.1)	5,170 (23.3)	2,680 (12.1)	5,740 (25.8)	2,680 (12.1)	6,420 (28.9)	2,680 (12.1)	7,100 (32.0)	2,680 (12.1)
5/8 (15.9)	5 (127.0)	One 5/8"	2,540 (11.4)	4,290 (19.3)	3,270 (14.7)	4,290 (19.3)	3,790 (17.1)	4,290 (19.3)	4,355 (19.6)	4,290 (19.3)	4,915 (22.1)	4,290 (19.3)
	10 (254.0)	Two 5/8"	5,080 (22.9)	4,290 (19.3)	6,540 (29.4)	4,290 (19.3)	7,580 (34.1)	4,290 (19.3)	8,705 (39.2)	4,290 (19.3)	9,830 (44.2)	4,290 (19.3)
3/4 (19.1)	6 (152.4)	One 3/4"	3,270 (14.7)	6,250 (28.1)	4,280 (19.3)	6,250 (28.1)	4,500 (20.3)	6,250 (28.1)	4,800 (21.6)	6,250 (28.1)	5,100 (23.0)	6,250 (28.1)
	12 (304.8)	Two 3/4"	6,540 (29.4)	6,250 (28.1)	8,565 (38.5)	6,250 (28.1)	8,995 (40.5)	6,250 (28.1)	9,595 (43.2)	6,250 (28.1)	10,195 (45.9)	6,250 (28.1)
7/8 (22.2)	7 (177.8)	One 7/8"	4,065 (18.3)	8,900 (40.1)	5,265 (23.7)	8,900 (40.1)	6,160 (27.7)	8,900 (40.1)	7,105 (32.0)	8,900 (40.1)	8,055 (36.2)	8,900 (40.1)
	14 (355.6)	Two 7/8"	8,135 (36.6)	8,900 (40.1)	10,535 (47.4)	8,900 (40.1)	12,320 (55.4)	8,900 (40.1)	14,215 (64.0)	8,900 (40.1)	16,105 (72.5)	8,900 (40.1)
1 (25.4)	8 1/4 (209.6)	One 1"	7,180 (32.3)	11,710 (52.7)	8,065 (36.3)	11,710 (52.7)	8,125 (36.6)	11,710 (52.7)	8,800 (39.6)	11,710 (52.7)	9,480 (42.7)	11,710 (52.7)
	16 1/2 (419.1)	Two 1"	14,360 (64.6)	11,710 (52.7)	16,135 (72.6)	11,710 (52.7)	16,250 (73.1)	11,710 (52.7)	17,605 (79.2)	11,710 (52.7)	18,960 (85.3)	11,710 (52.7)

1. Allowable bond capacities are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable bond capacities for intermediate embedments and compressive strengths.
3. Allowable design load should be the lesser of the bond or allowable steel strength.
4. Critical and minimum spacing and edge distances as well as reduction factors for intermediate spacing and edge distances are listed in the Design Criteria section.

PERFORMANCE DATA

Ultimate Load Capacities for Reinforcing Bar Installed with Hammer-Capsule in Normal-Weight Concrete[1,2]

Rebar Size No. (in)	Min. Embed. Depth h_v in. (mm)	Capsules Required	Minimum Concrete Compressive Strength (f'_c) 2,000 psi (13.8 MPa) Tension lbs. (kN)	2,000 psi Shear lbs. (kN)	3,000 psi (20.7 MPa) Tension lbs. (kN)	3,000 psi Shear lbs. (kN)	4,000 psi (27.6 MPa) Tension lbs. (kN)	4,000 psi Shear lbs. (kN)	5,000 psi (34.5 MPa) Tension lbs. (kN)	5,000 psi Shear lbs. (kN)	6,000 psi (41.4 MPa) Tension lbs. (kN)	6,000 psi Shear lbs. (kN)
No.3 (3/8)	3 1/2 (88.9)	One 3/8"	7,840 (35.3)	6,600 (29.7)	10,520 (47.3)	6,600 (29.7)	13,200 (59.4)	6,600 (29.7)	13,200 (59.4)	6,600 (29.7)	13,200 (59.4)	6,600 (29.7)
	7 (177.8)	Two 3/8"	15,680 (70.6)	6,600 (29.7)	21,040 (94.7)	6,600 (29.7)	26,400 (118.8)	6,600 (29.7)	26,400 (118.8)	6,600 (29.7)	26,400 (118.8)	6,600 (29.7)
No.4 (1/2)	4 1/2 (114.3)	One 1/2"	12,720 (57.2)	12,000 (54.0)	14,125 (63.6)	12,000 (54.0)	15,190 (68.4)	12,000 (54.0)	15,190 (68.4)	12,000 (54.0)	15,190 (68.4)	12,000 (54.0)
	9 (228.6)	Two 1/2"	25,440 (114.5)	12,000 (54.0)	28,250 (127.1)	12,000 (54.0)	30,380 (136.7)	12,000 (54.0)	30,380 (136.7)	12,000 (54.0)	30,380 (136.7)	12,000 (54.0)
No.5 (5/8)	5 (127.0)	One 5/8"	16,160 (72.7)	18,600 (83.7)	18,280 (82.3)	18,600 (83.7)	20,280 (91.3)	18,600 (83.7)	21,840 (98.3)	18,600 (83.7)	23,400 (105.3)	18,600 (83.7)
	10 (254.0)	Two 5/8"	32,320 (145.4)	18,600 (83.7)	36,560 (164.5)	18,600 (83.7)	40,560 (182.5)	18,600 (83.7)	43,680 (196.6)	18,600 (83.7)	46,800 (210.6)	18,600 (83.7)
No.6 (3/4)	7 (177.8)	One 3/4"	18,840 (84.8)	26,400 (118.8)	20,480 (92.2)	26,400 (118.8)	21,220 (95.5)	26,400 (118.8)	28,600 (128.7)	26,400 (118.8)	34,330 (154.5)	26,400 (118.8)
	14 (355.6)	Two 3/4"	37,680 (169.6)	26,400 (118.8)	40,960 (184.3)	26,400 (118.8)	42,440 (191.0)	26,400 (118.8)	57,200 (257.4)	26,400 (118.8)	68,660 (309.0)	26,400 (118.8)
No.7 (7/8)	7 (177.8)	One 7/8"	21,200 (95.4)	36,000 (162.0)	22,660 (102.0)	36,000 (162.0)	25,730 (115.8)	36,000 (162.0)	34,920 (157.1)	36,000 (162.0)	38,400 (172.8)	36,000 (162.0)
	14 (355.6)	Two 7/8"	42,400 (190.8)	36,000 (162.0)	45,320 (203.9)	36,000 (162.0)	51,460 (231.6)	36,000 (162.0)	69,840 (314.3)	36,000 (162.0)	76,800 (345.6)	36,000 (162.0)
No.8 (1)	8 1/2 (215.9)	One 1"	22,520 (101.3)	47,400 (213.3)	26,290 (118.3)	47,400 (213.3)	35,070 (157.8)	47,400 (213.3)	38,905 (175.1)	47,400 (213.3)	47,600 (214.2)	47,400 (213.3)
	17 (431.8)	Two 1"	45,040 (202.7)	47,400 (213.3)	52,580 (236.6)	47,400 (213.3)	70,140 (315.6)	47,400 (213.3)	77,810 (350.1)	47,400 (213.3)	95,200 (428.4)	47,400 (213.3)

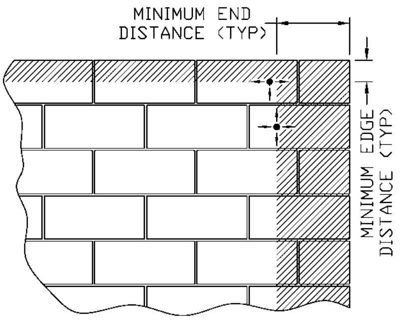
1. Ultimate load capacities should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate load capacities for intermediate embedments and compressive strengths.

Allowable Load Capacities for Reinforcing Bar Installed with Hammer-Capsule in Normal-Weight Concrete[1,2,3,4]

Rebar Size No. (in)	Min. Embed. Depth h_v in. (mm)	Capsules Required	Minimum Concrete Compressive Strength (f'_c) 2,000 psi (13.8 MPa) Tension lbs. (kN)	2,000 psi Shear lbs. (kN)	3,000 psi (20.7 MPa) Tension lbs. (kN)	3,000 psi Shear lbs. (kN)	4,000 psi (27.6 MPa) Tension lbs. (kN)	4,000 psi Shear lbs. (kN)	5,000 psi (34.5 MPa) Tension lbs. (kN)	5,000 psi Shear lbs. (kN)	6,000 psi (41.4 MPa) Tension lbs. (kN)	6,000 psi Shear lbs. (kN)
No.3 (3/8)	3 1/2 (88.9)	One 3/8"	1,960 (8.8)	1,650 (7.4)	2,630 (11.8)	1,650 (7.4)	3,300 (14.9)	1,650 (7.4)	3,300 (14.9)	1,650 (7.4)	3,300 (14.9)	1,650 (7.4)
	7 (177.8)	Two 3/8"	3,920 (17.6)	1,650 (7.4)	5,260 (23.7)	1,650 (7.4)	6,600 (29.7)	1,650 (7.4)	6,600 (29.7)	1,650 (7.4)	6,600 (29.7)	1,650 (7.4)
No.4 (1/2)	4 1/2 (114.3)	One 1/2"	3,180 (14.3)	3,000 (13.5)	3,530 (15.9)	3,000 (13.5)	3,800 (17.1)	3,000 (13.5)	3,800 (17.1)	3,000 (13.5)	3,800 (17.1)	3,000 (13.5)
	9 (228.6)	Two 1/2"	6,360 (28.6)	3,000 (13.5)	7,065 (31.8)	3,000 (13.5)	7,595 (34.2)	3,000 (13.5)	7,595 (34.2)	3,000 (13.5)	7,595 (34.2)	3,000 (13.5)
No.5 (5/8)	5 (127.0)	One 5/8"	4,040 (18.2)	4,650 (20.9)	4,570 (20.6)	4,650 (20.9)	5,070 (22.8)	4,650 (20.9)	5,460 (24.6)	4,650 (20.9)	5,850 (26.3)	4,650 (20.9)
	10 (254.0)	Two 5/8"	8,080 (36.4)	4,650 (20.9)	9,140 (41.1)	4,650 (20.9)	10,140 (45.6)	4,650 (20.9)	10,920 (49.1)	4,650 (20.9)	11,700 (52.7)	4,650 (20.9)
No.6 (3/4)	7 (177.8)	One 3/4"	4,710 (21.2)	6,600 (29.7)	5,120 (23.0)	6,600 (29.7)	5,305 (23.9)	6,600 (29.7)	7,150 (32.2)	6,600 (29.7)	8,585 (38.6)	6,600 (29.7)
	14 (355.6)	Two 3/4"	9,420 (42.4)	6,600 (29.7)	10,240 (46.1)	6,600 (29.7)	10,610 (47.7)	6,600 (29.7)	14,300 (64.4)	6,600 (29.7)	17,165 (77.2)	6,600 (29.7)
No.7 (7/8)	7 (177.8)	One 7/8"	5,300 (23.9)	9,000 (40.5)	5,665 (25.5)	9,000 (40.5)	6,435 (29.0)	9,000 (40.5)	8,730 (39.3)	9,000 (40.5)	9,600 (43.2)	9,000 (40.5)
	14 (355.6)	Two 7/8"	10,600 (47.7)	9,000 (40.5)	11,330 (51.0)	9,000 (40.5)	12,865 (57.9)	9,000 (40.5)	17,460 (78.6)	9,000 (40.5)	19,200 (86.4)	9,000 (40.5)
No.8 (1)	8 1/2 (215.9)	One 1"	5,630 (25.3)	11,850 (53.3)	6,575 (29.6)	11,850 (53.3)	8,770 (39.5)	11,850 (53.3)	9,725 (43.8)	11,850 (53.3)	11,900 (53.6)	11,850 (53.3)
	17 (431.8)	Two 1"	11,260 (50.7)	11,850 (53.3)	13,145 (59.2)	11,850 (53.3)	17,535 (78.9)	11,850 (53.3)	19,455 (87.5)	11,850 (53.3)	23,800 (107.1)	11,850 (53.3)

1. Allowable bond capacities are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable bond capacities for intermediate embedments and compressive strengths.
3. Allowable design load should be the lesser of the bond or allowable steel strength.
4. Critical and minimum spacing and edge distances as well as reduction factors for intermediate spacing and edge distances are listed in the Design Criteria section.

PERFORMANCE DATA



Allowable Load Capacities for Threaded Rod Installed with Hammer-Capsule in Grout-Filled Concrete Masonry[1,2,3,4]

Anchor Installed Through Face Shell						
Anchor Diameter d in. (mm)	Drill Bit Diameter d_{bit} in.	Minimum Embed. Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)
3/8 (9.5)	7/16	3 1/2 (88.9)	4 (101.6)	12 (304.8)	1,063 (4.8)	1,125 (5.1)
1/2 (12.7)	9/16	4 1/4 (108.0)	6 (152.4)	12 (304.8)	1,988 (8.9)	1,614 (7.3)
5/8 (15.9)	11/16	5 (127.0)	8 (203.2)	12 (304.8)	2,655 (11.9)	2,365 (10.6)
3/4 (19.1)	7/8	6 (152.4)	12 (304.8)	12 (304.8)	2,865 (12.9)	2,960 (13.3)

1. Tabulated load values are for anchors installed in minimum Grade N, Type II, lightweight, medium-weight and normal-weight concrete masonry units conforming to ASTM C 90 that have reached the minimum designated ultimate compressive strength at the time of installation ($f'm \geq 1{,}500$ psi).
2. Allowable design load should be the lesser of the bond or allowable steel strength.
3. The critical spacing is 16 diameters for full capacity. The minimum spacing is 8 diameters for 50 percent reduction in load. Linear interpolation may be used to determine reduction factors for intermediate spacing distances.
4. Allowable bond capacities are calculated using an applied safety factor of 5.0.

DESIGN CRITERIA

Combined Loading

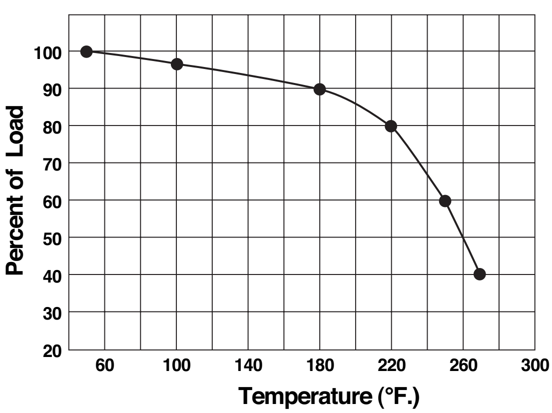
For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n}\right)^{\frac{5}{3}} + \left(\frac{V_u}{V_n}\right)^{\frac{5}{3}} \leq 1 \quad \text{OR} \quad \left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

In-Service Temperature

Allowable tension and shear load bond strength reduction based on in-service temperature for the Hammer-Capsule adhesive.



Temperature Conversion		
Degree Fahrenheit (°F)	Degree Celsius (°C)	Percent Allowable Load (%)
50	10	100
100	38	97
180	82	90
220	104	80
250	121	60
270	132	40

Load Adjustment Factors for Spacing and Edge Distances

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (s)	Tension and Shear	$s_{cr} = 8d$	$F_N = F_V = 1.0$	$s_{min} = 4d$	$F_N = F_V = 0.70$
Edge Distance (c)	Tension	$c_{cr} = 8d$	$F_N = 1.0$	$c_{min} = 4d$	$F_N = 0.60$
	Shear	$c_{cr} = 12d$	$F_V = 1.0$	$c_{min} = 4d$	$F_V = 0.50$

DESIGN CRITERIA

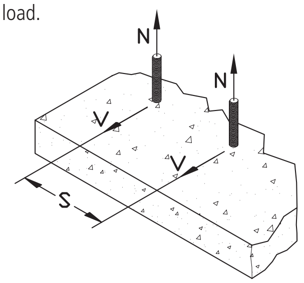
Load Adjustment Factors for Threaded Rod in Normal-Weight Concrete

Spacing, Tension (F_N) & Shear (F_V)

Dia. (in.)	1/4	3/8	1/2	5/8	3/4	7/8	1
s_{cr} (in.)	2	3	4	5	6	7	8
s_{min} (in.)	1	1 1/2	2	2 1/2	3	3 1/2	4
Spacing, s (inches)							
1	0.70						
1 1/2	0.85	0.70					
2	1.00	0.80	0.70				
2 1/2		0.90	0.78	0.70			
3		1.00	0.85	0.76	0.70		
3 1/2			0.93	0.82	0.75	0.70	
4			1.00	0.88	0.80	0.74	0.70
5				1.00	0.90	0.83	0.78
5 1/2					0.95	0.87	0.81
6					1.00	0.91	0.85
7						1.00	0.93
8							1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 8 anchor diameters (8d) at which the anchor achieves 100% of load.

Minimum spacing (s_{min}) is equal to 4 anchor diameters (4d) at which the anchor achieves 70% of load.

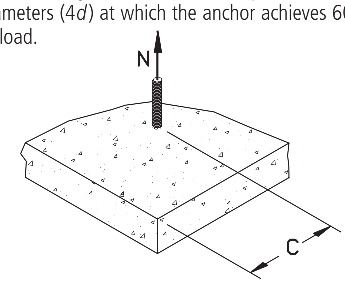


Edge Distance, Tension (F_N)

Dia. (in.)	1/4	3/8	1/2	5/8	3/4	7/8	1
c_{cr} (in.)	2	3	4	5	6	7	8
c_{min} (in.)	1	1 1/2	2	2 1/2	3	3 1/2	4
Edge Distance, c (inches)							
1	0.60						
1 1/2	0.80	0.60					
2	1.00	0.73	0.60				
2 1/2		0.87	0.70	0.60			
3		1.00	0.80	0.68	0.60		
3 1/2			0.90	0.76	0.67	0.60	
4			1.00	0.84	0.73	0.66	0.60
5				1.00	0.87	0.77	0.70
6					1.00	0.89	0.80
7						1.00	0.90
8							1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 8 anchor diameters (8d) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 4 anchor diameters (4d) at which the anchor achieves 60% of load.

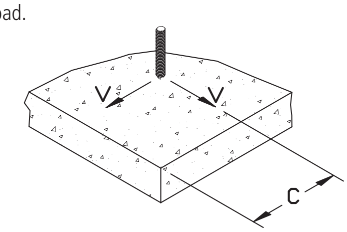


Edge Distance, Shear (F_V)

Dia. (in.)	1/4	3/8	1/2	5/8	3/4	7/8	1
c_{cr} (in.)	3	4 1/2	6	7 1/2	9	10 1/2	12
c_{min} (in.)	1	1 1/2	2	2 1/2	3	3 1/2	4
Edge Distance, c (inches)							
1 1/2	0.63	0.50					
2	0.75	0.58	0.50				
2 1/2	0.88	0.67	0.56	0.50			
3	1.00	0.75	0.63	0.55	0.50		
3 1/2		0.83	0.69	0.60	0.54	0.50	
4		0.92	0.75	0.65	0.58	0.54	0.50
4 1/2		1.00	0.81	0.70	0.63	0.57	0.53
5			0.88	0.75	0.67	0.61	0.56
5 1/2			0.94	0.80	0.71	0.64	0.59
6			1.00	0.85	0.75	0.68	0.63
7 1/2				1.00	0.88	0.79	0.72
9					1.00	0.89	0.81
10 1/2						1.00	0.91
12							1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12d) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 4 anchor diameters (4d) at which the anchor achieves 50% of load.



ADHESIVES

ORDERING INFORMATION

Hammer-Capsule

Cat. No.	Description	Standard Box	Std. Carton	Wt./100
6702	3/8" Hammer-Capsule	10	500	4
6703	1/2" Hammer-Capsule	10	200	5
6704	5/8" Hammer-Capsule	10	200	9
6705	3/4" Hammer-Capsule	5	50	19
6706	7/8" Hammer-Capsule	5	50	20
6707	1" Hammer-Capsule	5	50	32

For installation and hardware accessories, including straight cut threaded rod, please reference the Adhesive Anchoring Accessories product section.

Adhesive Anchoring Accessories

PRODUCT DESCRIPTION

Adhesive Accessories should be used with Powers Fasteners adhesives including AC100 Plus, Power-Fast+, Chem-Stud and Hammer-Capsule. Accessories are used in conjunction with various anchoring applications and for supporting proper anchor installation. The accessories are divided into three sections:

Installation Accessories – Extension tubing to mixing nozzles for delivering adhesive to bottom of deep holes, tools used to aid in the preparation of the anchor hole, and seal plugs for sealing holes, centering hardware in holes and for overhead anchoring applications.

Screen Tubes – Used with base materials with voids and cavities which require keying action for load transfer. The screen tubes hold the adhesive in place and readily accept threaded rod and reinforcing bar.

Hardware – Threaded rods and internally threaded inserts (for removability) used with Powers Fasteners adhesives.

SECTION CONTENTS Page No.

INSTALLATION ACCESSORIES

Installation accessories are designed to provide a dispenser or mixing nozzle extension when required and to aid in the preparation of the anchor hole.

Extension Tubing

Cat. No.	Description	Standard Bag
7914	Extension Tubing (25 feet)	1

Blow Out Bulb

Cat. No.	Description	Standard Bag
7930	Blow Out Bulb	1

Blow out bulbs typically do not create enough air pressure to properly clean most larger diameter and deeper embedment depth anchor holes. They are only appropriate for smaller diameter anchors with shallow embedment depths. Compressed air should be used when the Blow Out Bulb is uneffective when cleaning the holes.

Brushes

Cat. No.	Description	Standard Bag
7931	1/2" x 8 1/2" brush	1
7932	3/4" x 8 1/2" brush	1
7933	1" x 12" brush	1
7934	1 1/4" x 13" brush	1
7935	1 1/2" x 16" brush	1

Anchor Seal Plugs

Cat. No.	Description	Plug Depth	Hole Size	Standard Bag
7936	3/8" Anchor Seal Plug	3/8"	7/16"	25
7937	1/2" Anchor Seal Plug	1/2"	9/16"	25

Anchor seal plugs are designed for use as an aid with anchor installation in ceilings and wall applications. The plugs help retain the adhesive in the anchor hole and hold the anchor rod centered in the hole until the adhesive sets. The plugs are described by the anchor rod diameter they are used with.

SCREEN TUBES

Screen tubes should be used with masonry construction when voids are present.

Stainless Steel Screen Tubes

Cat. No.	Description	Drill Diameter	Standard Carton
7960	1/4" x 2" Screen Tube*	3/8"	25
7862	1/4" x 6" Screen Tube*	3/8"	25
7864	1/4" x 8" Screen Tube*	3/8"	25
7866	1/4" x 10" Screen Tube*	3/8"	25
7961	3/8" x 3 1/2" Screen Tube*	1/2"	25
7962	3/8" x 6" Screen Tube*	1/2"	25
7963	3/8" x 8" Screen Tube*	1/2"	25
7965	1/2" x 3 1/2" Screen Tube	5/8"	25
7966	1/2" x 6" Screen Tube	5/8"	25
7967	1/2" x 8" Screen Tube*	5/8"	25
7968	1/2" x 10" Screen Tube*	5/8"	25
7969	5/8" x 4 1/2" Screen Tube*	3/4"	20
7970	5/8" x 6" Screen Tube	3/4"	20
7971	5/8" x 8" Screen Tube	3/4"	20
7973	3/4" x 6" Screen Tube	7/8"	10
7977	3/4" x 8" Screen Tube	7/8"	10
7974	3/4" x 10" Screen Tube	7/8"	10
7865	15/16" x 8" Screen Tube	1"	10
7867	15/16" x 13" Screen Tube	1"	10
7869	15/16" x 17" Screen Tube	1"	10
7955	13/16" Adhesive Shear Tube (steel sleeve)	Special Order	

Screen tubes are made from a 300 series stainless steel. The nominal diameter of the screen listed indicates the matching rod diameter.
*Includes extension tubing.

Plastic Screen Tubes

Cat. No.	Description	Drill Diameter	Standard Carton
8470	1/4" x 1 3/4" Screen Tube	1/2"	25
8473	3/8" x 2 3/4" Screen Tube	9/16"	25
8474	3/8" x 3 1/2" Screen Tube	9/16"	25
8475	1/2" x 3 1/4" Screen Tube	5/8"	25
8476	1/2" x 4" Screen Tube	5/8"	25

The nominal diameter of the screen listed indicates the matching rod diameter. Note that the hole size required for plastic screen tubes are different than that for the stainless steel tubes.

ADHESIVES

HARDWARE

A limited offering of hardware is available through Powers Fasteners. Other hardware, as outlined in each product section, is also acceptable for use as anchor elements.

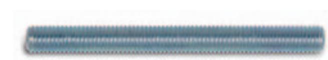
ASTM A307 Straight Cut Threaded Anchor Rod

Cat. No.	Description	Standard Carton
7980	1/4" x 3" Anchor Rod	25
7985	1/2" x 5 1/2" Anchor Rod	25
7986	1/2" x 8" Anchor Rod	25
7989	5/8" x 6 1/2" Anchor Rod	20
7990	5/8" x 8" Anchor Rod	20
7946	5/8" x 19" Anchor Rod	20
7947	5/8" x 21" Anchor Rod	20
7993	3/4" x 9" Anchor Rod	10
7994	3/4" x 12" Anchor Rod	10

Straight cut rod is provided in the materials listed above and includes nuts and washers.

ASTM A193, Grade B7 Straight Cut Threaded Anchor Rod

Cat. No.	Description	Standard Box	Standard Carton
6022*	3/8" x 5 1/8" Anchor Rod	10	50
6023*	1/2" x 6 1/2" Anchor Rod	10	50
6024*	5/8" x 7 1/2" Anchor Rod	10	40
6026*	7/8" x 10 1/4" Anchor Rod	10	40
6027	1" x 12" Anchor Rod	10	40
6028*	1 1/4" x 15" Anchor Rod	15	5



Grade B7 (AISI 4140) anchor rod (ASTM A 193) is supplied with nuts meeting the requirements of ASTM A 194, Grade 2H (ASTM A 563, Grade DH) and hardened washers meeting the requirements of ASTM F 436.

*Discontinued item once current stock is exhausted.

Type 304 Stainless Steel Straight Cut Threaded Anchor Rod

Cat. No.	Description	Standard Box	Standard Carton
6046*	7/8" x 10 1/4" Anchor Rod	10	40
6048*	1 1/4" x 15" Anchor Rod	5	5

Type 304 stainless steel rod is supplied with nuts and washers.

*Discontinued item once current stock is exhausted.

ASTM A307 Bent Threaded Anchor Rod (22-1/2°) for URM Retrofits

Cat. No.	Description	Standard Carton
7957*	3/4" x 21" 22 1/2° Bent Rod	10

Rod is pre-bent at a 22-1/2 degree angle and includes nuts and washers. The bend is approximately two inches from the end of the rod.

*Discontinued item once current stock is exhausted.

Internally Threaded Steel Inserts, Zinc Plated (ASTM B633)

Cat. No.	Size	O.D	Drill Dia.	Min. Depth	Thread Depth	Std. Box	Std. Ctn.
6592	3/8" x 3 1/2"	0.55"	5/8"	3-1/2"	1 1/2"	10	40
6593	1/2" x 4 1/4"	0.65"	11/16"	4 1/4"	1 5/8"	10	40
6594	5/8" x 5"	0.90"	1"	5"	2 3/8"	10	40
6595	3/4" x 6 5/8"	1.00"	1 1/8"	6 5/8"	2 3/4"	10	40

Underwater Installation of Adhesive Anchors

APPLICATION DESCRIPTION

AC100 Plus, Power-Fast+, and Chem-Stud can be used for the installation of threaded anchor rod or reinforcing bars in submerged applications provided special installation and design criteria are followed. The anchor holes should be prepared following the standard installation guidelines with the following exceptions.

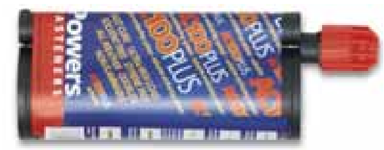
AC100 Plus and Power-Fast+ – Special care should be taken to clean the anchor hole as a slurry of concrete paste tends to form on the walls of the anchor hole when drilling under water. To inject the epoxy, insert the mixing nozzle to the bottom or rear of the anchor hole. Slowly withdraw the nozzle as the anchor hole is filled to ensure that the water is displaced from the hole and that no air pockets are formed. The anchor hole should be filled completely with epoxy prior to inserting the anchor rod. The curing time of Power-Fast+ and AC100 Plus in submerged applications depends upon the base material temperature as listed in the corresponding material properties section. Laboratory tests and field experience have shown that a decrease of 15 to 20% for Power-Fast+ and 10 to 15% for AC100 Plus in ultimate tension load capacity can be expected for an anchor which is installed under water partially due to reduced porosity of the base material. The design professional should include this reduction in his calculations. If the load capacities are critical, a job site test is recommended.

Chem-Stud – Special care should be taken to clean the anchor hole as a slurry of concrete paste tends to form on the walls of the anchor hole when drilling under water. Insert the proper size capsule into the anchor hole. Be sure the capsule is fully inserted to the bottom of the hole. Follow the standard installation instructions for spinning the anchor rod used into the capsule with an appropriate tool for submerged use.

The setting time of the Chem-Stud adhesive in submerged applications depends upon the base material temperature as shown previously. Laboratory tests and field experience have shown that a decrease of 15 to 20% in the ultimate tension load capacity can be expected. The design professional should include this reduction in his calculations. If the load capacities are critical, a job site test is recommended.

PRODUCTS

AC100 Plus
Power-Fast+
Chem-Stud



ADHESIVES

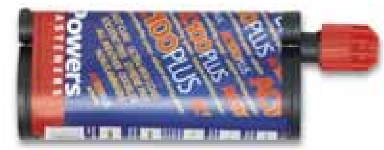
Removable Adhesive Anchors

APPLICATION DESCRIPTION

Many temporary anchoring applications that require high load capacities, also require a removable anchor. Adhesive systems often provide the highest load capacity, but are not removable. Powers has developed a method that has several advantages over those offered by competitive systems. Typically, a removable installation requires the use of a steel insert sleeve. A large hole size is required to accommodate the sleeve. The sleeve is expensive, and it must be left in the concrete which can cause corrosion problems. These problems are easily eliminated when using AC100 Plus or Power-Fast+ by wrapping Teflon pipe tape around the bond area of the threaded anchor rod or bolt prior to inserting it in the anchor hole filled with adhesive. The threaded rod or bolt can easily be removed after the Power-Fast+ has set, by rotating counterclockwise leaving threads formed from epoxy completely intact in the anchor hole. The rod or bolt can later be re-threaded back into the anchor hole and still achieve the allowable working load.

PRODUCTS

AC100 Plus
Power-Fast+



Overhead Installation of Adhesive Anchors

APPLICATION DESCRIPTION

Prior to installing adhesive anchors overhead or in walls, consult with the governing building authority to determine the requirements for fire safety guidelines. The effect of elevated temperature on the adhesive anchoring systems is shown in the material properties section.

AC100 Plus, Power-Fast+, and Chem-Stud can be used for the installation of threaded anchor rod overhead provided consideration for such critical applications may require safety factors of 10 or higher. Local building codes should be consulted to determine the required safety factors. The anchor holes should be prepared following the standard installation guidelines with the following exceptions.

AC100 Plus and Power-Fast+ – After the anchor hole is drilled and cleaned, insert the proper size anchor seal plug into the hole until the rim of the plug is fully seated against the base material. Insert the Power-Fast+ mixing nozzle through the cross cut opening of the anchor seal plug. Hold the plug in place and begin filling the anchor hole half way with Power-Fast+ Epoxy starting from the bottom or rear of the anchor hole. Insert the threaded rod through the cross cut opening of the anchor seal plug. Turn the rod slightly to ensure proper distribution of the epoxy. Be sure that the anchor rod is fully seated at the bottom of the anchor hole and that some epoxy has flowed from the cross cut opening in the anchor seal plug.

Chem-Stud – After the anchor hole is drilled and cleaned, insert the proper size capsule into the hole. Select the proper size anchor seal plug and insert it into the hole until the rim of the plug is fully seated against the base material. Be sure the hole is deep enough to accept both the capsule and the plug. Following the standard procedures, insert the chisel-pointed anchor rod through the cross cut opening of the anchor seal plug and spin the rod into the capsule. An alternate method is to use a piece of duct tape or similar material to hold the capsule in place prior to spinning the anchor rod into the hole. If duct tape is used, it will be necessary to secure the chisel - pointed anchor rod in place until the adhesive gels.

PRODUCTS

AC100 Plus
Power-Fast+
Chem-Stud

Note: Life safety applications may also require safety factors of 10 or higher. Local building codes or authority having jurisdiction should be consulted to determine the required safety factors.

Pick-Proof Applications

APPLICATION DESCRIPTION

Power-Fast+ is commonly used for pick proof applications in prison and security projects. The approximate number of linear feet that can be dispensed from each cartridge size is listed below:

Cartridge Size	Bead Size	Linear Feet
10 Fluid Ounce Cartridge	1/8"	192
10 Fluid Ounce Cartridge	1/4"	48
15 Fluid Ounce Cartridge	1/8"	288
15 Fluid Ounce Cartridge	1/4"	71
22 Fluid Ounce Cartridge	1/8"	461
22 Fluid Ounce Cartridge	1/4"	115

The actual amount of material will vary depending upon job site installation procedures and waste. Power-Fast+ Epoxy is a rigid material when cured and does not flex with normal building movement.

PRODUCTS

Power-Fast+

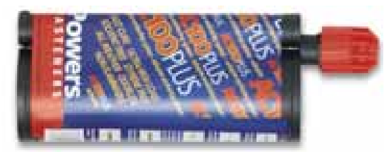
Applications in Unreinforced Masonry Walls

APPLICATION DESCRIPTION

PRODUCTS

AC100 Plus

Power-Fast+



An earthquake can have a devastating effect on unreinforced masonry (URM) buildings. Floor and roof decks which are not properly anchored can collapse resulting in injury or death. To reduce this risk, Division 88 of the Los Angeles City Building Code requires unreinforced masonry buildings built before 1934 to be upgraded to better withstand seismic loading. The upgrades include the installation of anchors to ensure that floor and roof decks are properly attached to the load bearing masonry walls. Standard anchoring methods specified in the ordinance include the use of threaded rod or bolts extended through the wall to an outer bearing plate to resist shear and tension. This type of anchor is commonly referred to as a combination anchor. To resist shear only, threaded rod or bolts installed 8" deep were specified. In both cases, the diameter of the drilled hole is 2-1/2" to allow installation of the grout. Impact type tools, such as rotary hammer drills, cannot be used to drill the anchor holes because the hammering action may damage the masonry walls. These methods can be very time consuming because of the large hole diameter required and the hand mixing / insertion of the grout materials.

There are three types of anchor assemblies designed for use with the AC100 Plus and Power-Fast+ Injection Adhesive Systems. Each anchor assembly is installed in a 7/8" or 1" diameter hole which reduces drilling time. The hole size used depends upon the code jurisdiction. Since the masonry walls are generally low strength, drilling is done in the "rotation only" mode to prevent damage to the wall. Once the anchor holes are drilled, the epoxy is then injected into stainless steel screen tubes which are then inserted into the drilled holes. As the anchor rods or sleeves are inserted into the tubes, the epoxy bonds to the solid areas and forms a key lock in any hollow portion.

Two different combination style anchors are used to resist shear and tension. The first style is a 5/8" through bolt combination anchor which is used in conjunction with an 8" steel sleeve, a bearing plate, and a screen tube. The bearing plate (supplied by the contractor) enables the anchor to resist tension by spreading the force applied to the 5/8" rod over the wall, similar to a toggle. Resistance to applied shear loads is achieved by the action of the 5/8" threaded rod bearing against the steel sleeve which is held into the wall by the adhesive. For various combinations of wall/fixture thickness, the 5/8" threaded rods are supplied in a variety of lengths.

In many buildings, the presence of bearing plates on the outer facade is unsightly, while on other buildings the outer surface of the wall may not be accessible. For applications such as these, a second type of anchor is used. The anchor consists of a 3/4" diameter threaded rod which is bent at a 22-1/2º angle and a screen tube. To install this type of anchor, a hole is drilled (rotation only) at an angle of 22-1/2º into the masonry wall.

To resist shear only, a 3/4" diameter threaded rod is used in conjunction with an 8" screen tube. For information on the threaded rods and screens used for these applications, refer to the Adhesive Installation Accessories section.

Fire Resistance

APPLICATION DESCRIPTION

PRODUCTS

Power-Fast+

As with all adhesive anchors, the bond strength of Power-Fast+ is affected by elevated temperatures in the base material. As the temperature of the base material increases, the bond strength of the anchor will decrease. Typical performance of the Power-Fast+ Epoxy at elevated base material temperatures is shown in the In-Service Temperature curve found in the Power-Fast+ product section. The values are based on maintaining the concrete test samples at a given temperature for a minimum of 24 hours before applying a test load according to ASTM Standard E 1512.

The testing is based on heating the entire concrete test element. During a fire, the actual behavior of Power-Fast depends upon heat dissipation inside the concrete. The rate of heat dissipation will vary depending upon the concrete mix design along with the shape and thickness of the structural member. Normally, at depths beyond 3", the concrete heats up relatively slowly since typically only one face of a slab is actually exposed to the fire.

In addition to the heat dissipation within the base material, the transfer of heat into the adhesive by the anchor rod should be considered. One method of reducing the transfer of heat energy is to protect the fixture and the head of the anchor with a suitable coating. Where fire resistance is a concern, Powers recommends job-specific heat testing be conducted. Contact Powers for additional test program information.

NUMBER OF ANCHORS PER CARTRIDGE

5.5 Fluid Ounce Cartridge

Rod Size (in.)	Drill Dia. (in.)	Number of Installations of Threaded Rod in Solid Base Materials — Hole Depth (inches)																		
		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3/8	7/16	64.5	43.0	32.3	25.8	21.5	18.4	16.1	14.3	12.9	11.7	10.8	9.9	9.2	8.6	8.1	7.6	7.2	6.8	6.5
1/2	9/16	47.0	31.3	23.5	18.8	15.7	13.4	11.8	10.4	9.4	8.5	7.8	7.2	6.7	6.3	5.9	5.5	5.2	4.9	4.7
5/8	11/16	34.4	22.9	17.2	13.7	11.5	9.8	8.6	7.6	6.9	6.2	5.7	5.3	4.9	4.6	4.3	4.0	3.8	3.6	3.4
3/4	13/16	27.9	18.6	14.0	11.2	9.3	8.0	7.0	6.2	5.6	5.1	4.7	4.3	4.0	3.7	3.5	3.3	3.1	2.9	2.8
3/4	7/8	18.3	12.2	9.1	7.3	6.1	5.2	4.6	4.1	3.7	3.3	3.0	2.8	2.6	2.4	2.3	2.2	2.0	1.9	1.8
7/8	15/16	22.2	14.8	11.1	8.9	7.4	6.3	5.6	4.9	4.4	4.0	3.7	3.4	3.2	3.0	2.8	2.6	2.5	2.3	2.2
7/8	1	15.4	10.3	7.7	6.2	5.1	4.4	3.9	3.4	3.1	2.8	2.6	2.4	2.2	2.1	1.9	1.8	1.7	1.6	1.5
1	1 1/16	18.4	12.3	9.2	7.4	6.1	5.3	4.6	4.1	3.7	3.3	3.1	2.8	2.6	2.5	2.3	2.2	2.0	1.9	1.8
1 1/4	1 3/8	10.0	6.6	5.0	4.0	3.3	2.8	2.5	2.2	2.0	1.8	1.7	1.5	1.4	1.3	1.2	1.2	1.1	1.0	1.0

Bar Size	Drill Dia. (in.)	Number of Installations of Deformed Reinforcing Bar in Solid Base Materials — Hole Depth (inches)																		
		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
No. 3	7/16	80.1	53.4	40.1	32.1	26.7	22.9	20.0	17.8	16.0	14.6	13.4	12.3	11.4	10.7	10.0	9.4	8.9	8.4	8.0
No. 4	9/16	66.1	44.0	33.0	26.4	22.0	18.9	16.5	14.7	13.2	12.0	11.0	10.2	9.4	8.8	8.3	7.8	7.3	7.0	6.6
No. 5	11/16	49.5	33.0	24.7	19.8	16.5	14.1	12.4	11.0	9.9	9.0	8.2	7.6	7.1	6.6	6.2	5.8	5.5	5.2	4.9
No. 6	7/8	22.5	15.0	11.3	9.0	7.5	6.4	5.6	5.0	4.5	4.1	3.8	3.5	3.2	3.0	2.8	2.7	2.5	2.4	2.3
No. 7	1	19.7	13.1	9.8	7.9	6.6	5.6	4.9	4.4	3.9	3.6	3.3	3.0	2.8	2.6	2.5	2.3	2.2	2.1	2.0
No. 8	1 1/8	16.9	11.3	8.4	6.8	5.6	4.8	4.2	3.8	3.4	3.1	2.8	2.6	2.4	2.3	2.1	2.0	1.9	1.8	1.7
No. 9	1 1/4	15.2	10.1	7.6	6.1	5.1	4.3	3.8	3.4	3.0	2.8	2.5	2.3	2.2	2.0	1.9	1.8	1.7	1.6	1.5
No.10	1 1/2	8.1	5.4	4.0	3.2	2.7	2.3	2.0	1.8	1.6	1.5	1.3	1.2	1.2	1.1	1.0	0.9	0.9	0.8	0.8
No.11	1 5/8	7.7	5.2	3.9	3.1	2.6	2.2	1.9	1.7	1.5	1.4	1.3	1.2	1.1	1.0	1.0	0.9	0.9	0.8	0.8

Bar Size (in.)	Drill Dia. (in.)	Number of Installations of Smooth Coated Reinforcing Bar in Solid Base Materials — Hole Depth (inches)																		
		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3/4	7/8	23.6	15.8	11.8	9.5	7.9	6.8	5.9	5.3	4.7	4.3	3.9	3.6	3.4	3.2	3.0	2.8	2.6	2.5	2.4
7/8	1	20.5	13.7	10.3	8.2	6.8	5.9	5.1	4.6	4.1	3.7	3.4	3.2	2.9	2.7	2.6	2.4	2.3	2.2	2.1
1	1 1/8	17.4	11.6	8.7	7.0	5.8	5.0	4.4	3.9	3.5	3.2	2.9	2.7	2.5	2.3	2.2	2.0	1.9	1.8	1.7
1 1/4	1 3/8	14.1	9.4	7.1	5.7	4.7	4.0	3.5	3.1	2.8	2.6	2.4	2.2	2.0	1.9	1.8	1.7	1.6	1.5	1.4

Rod Size (in.)	Drill Dia. (in.)	Number of Installations of Threaded Rod Using Screen Tubes in Hollow Base Materials — Hole Depth (inches)																		
		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1/4	3/8	47.9	32.0	24.0	19.2	16.0	13.7	12.0	10.7	9.6	8.7	8.0	7.4	6.8	6.4	6.0	5.6	5.3	5.0	4.8
3/8	1/2	31.8	21.2	15.9	12.7	10.6	9.1	7.9	7.1	6.4	5.8	5.3	4.9	4.5	4.2	4.0	3.7	3.5	3.3	3.2
1/2	5/8	23.1	15.4	11.6	9.2	7.7	6.6	5.8	5.1	4.6	4.2	3.9	3.6	3.3	3.1	2.9	2.7	2.6	2.4	2.3
5/8	3/4	18.2	12.1	9.1	7.3	6.1	5.2	4.5	4.0	3.6	3.3	3.0	2.8	2.6	2.4	2.3	2.1	2.0	1.9	1.8
3/4	7/8	14.6	9.8	7.3	5.9	4.9	4.2	3.7	3.3	2.9	2.7	2.4	2.3	2.1	2.0	1.8	1.7	1.6	1.5	1.5
3/4	1	4.7	3.1	2.4	1.9	1.6	1.3	1.2	1.0	0.9	0.9	0.8	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.5

Tabulated values for hollow base materials are based on 25% waste. Actual usage may vary.

NUMBER OF ANCHORS PER CARTRIDGE

8 Fluid Ounce Cartridge

Rod Size (in.)	Drill Dia. (in.)	Number of Installations of Threaded Rod in Solid Base Materials — Hole Depth (inches)																		
		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3/8	7/16	93.8	62.6	46.9	37.5	31.3	26.8	23.5	20.9	18.8	17.1	15.6	14.4	13.4	12.5	11.7	11.0	10.4	9.9	9.4
1/2	9/16	68.4	45.6	34.2	27.4	22.8	19.5	17.1	15.2	13.7	12.4	11.4	10.5	9.8	9.1	8.5	8.0	7.6	7.2	6.8
5/8	11/16	50.0	33.3	25.0	20.0	16.7	14.3	12.5	11.1	10.0	9.1	8.3	7.7	7.1	6.7	6.2	5.9	5.6	5.3	5.0
3/4	13/16	40.6	27.1	20.3	16.2	13.5	11.6	10.2	9.0	8.1	7.4	6.8	6.2	5.8	5.4	5.1	4.8	4.5	4.3	4.1
3/4	7/8	26.6	17.7	13.3	10.6	8.9	7.6	6.6	5.9	5.3	4.8	4.4	4.1	3.8	3.5	3.3	3.1	3.0	2.8	2.7
7/8	15/16	32.3	21.5	16.2	12.9	10.8	9.2	8.1	7.2	6.5	5.9	5.4	5.0	4.6	4.3	4.0	3.8	3.6	3.4	3.2
7/8	1	22.5	15.0	11.2	9.0	7.5	6.4	5.6	5.0	4.5	4.1	3.7	3.5	3.2	3.0	2.8	2.6	2.5	2.4	2.2
1	1 1/16	26.7	17.8	13.4	10.7	8.9	7.6	6.7	5.9	5.3	4.9	4.5	4.1	3.8	3.6	3.3	3.1	3.0	2.8	2.7
1 1/4	1 3/8	14.5	9.7	7.3	5.8	4.8	4.1	3.6	3.2	2.9	2.6	2.4	2.2	2.1	1.9	1.8	1.7	1.6	1.5	1.5

Bar Size	Drill Dia. (in.)	Number of Installations of Deformed Reinforcing Bar in Solid Base Materials — Hole Depth (inches)																		
		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
No. 3	7/16	116.6	77.7	58.3	46.6	38.9	33.3	29.1	25.9	23.3	21.2	19.4	17.9	16.7	15.5	14.6	13.7	13.0	12.3	11.7
No. 4	9/16	96.1	64.1	48.1	38.4	32.0	27.5	24.0	21.4	19.2	17.5	16.0	14.8	13.7	12.8	12.0	11.3	10.7	10.1	9.6
No. 5	11/16	71.9	48.0	36.0	28.8	24.0	20.6	18.0	16.0	14.4	13.1	12.0	11.1	10.3	9.6	9.0	8.5	8.0	7.6	7.2
No. 6	7/8	32.8	21.9	16.4	13.1	10.9	9.4	8.2	7.3	6.6	6.0	5.5	5.0	4.7	4.4	4.1	3.9	3.6	3.5	3.3
No. 7	1	28.6	19.1	14.3	11.4	9.5	8.2	7.2	6.4	5.7	5.2	4.8	4.4	4.1	3.8	3.6	3.4	3.2	3.0	2.9
No. 8	1 1/8	24.6	16.4	12.3	9.8	8.2	7.0	6.1	5.5	4.9	4.5	4.1	3.8	3.5	3.3	3.1	2.9	2.7	2.6	2.5
No. 9	1 1/4	22.1	14.7	11.0	8.8	7.4	6.3	5.5	4.9	4.4	4.0	3.7	3.4	3.2	2.9	2.8	2.6	2.5	2.3	2.2
No.10	1 1/2	11.7	7.8	5.9	4.7	3.9	3.3	2.9	2.6	2.3	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2
No.11	1 5/8	11.2	7.5	5.6	4.5	3.7	3.2	2.8	2.5	2.2	2.0	1.9	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1

Bar Size (in.)	Drill Dia. (in.)	Number of Installations of Smooth Coated Reinforcing Bar in Solid Base Materials — Hole Depth (inches)																		
		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3/4	7/8	34.4	22.9	17.2	13.8	11.5	9.8	8.6	7.6	6.9	6.3	5.7	5.3	4.9	4.6	4.3	4.0	3.8	3.6	3.4
7/8	1	29.9	19.9	14.9	12.0	10.0	8.5	7.5	6.6	6.0	5.4	5.0	4.6	4.3	4.0	3.7	3.5	3.3	3.1	3.0
1	1 1/8	25.3	16.9	12.7	10.1	8.4	7.2	6.3	5.6	5.1	4.6	4.2	3.9	3.6	3.4	3.2	3.0	2.8	2.7	2.5
1 1/4	1 3/8	20.6	13.7	10.3	8.2	6.9	5.9	5.1	4.6	4.1	3.7	3.4	3.2	2.9	2.7	2.6	2.4	2.3	2.2	2.1

Rod Size (in.)	Drill Dia. (in.)	Number of Installations of Threaded Rod Using Screen Tubes in Hollow Base Materials — Hole Depth (inches)																		
		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1/4	3/8	69.7	46.5	34.9	27.9	23.2	19.9	17.4	15.5	13.9	12.7	11.6	10.7	10.0	9.3	8.7	8.2	7.7	7.3	7.0
3/8	1/2	46.2	30.8	23.1	18.5	15.4	13.2	11.5	10.3	9.2	8.4	7.7	7.1	6.6	6.2	5.8	5.4	5.1	4.9	4.6
1/2	5/8	33.6	22.4	16.8	13.4	11.2	9.6	8.4	7.5	6.7	6.1	5.6	5.2	4.8	4.5	4.2	4.0	3.7	3.5	3.4
5/8	3/4	26.4	17.6	13.2	10.6	8.8	7.5	6.6	5.9	5.3	4.8	4.4	4.1	3.8	3.5	3.3	3.1	2.9	2.8	2.6
3/4	7/8	21.3	14.2	10.6	8.5	7.1	6.1	5.3	4.7	4.3	3.9	3.5	3.3	3.0	2.8	2.7	2.5	2.4	2.2	2.1
3/4	1	6.9	4.6	3.4	2.7	2.3	2.0	1.7	1.5	1.4	1.2	1.1	1.1	1.0	0.9	0.9	0.8	0.8	0.7	0.7

Tabulated values for hollow base materials are based on 25% waste. Actual usage may vary.

ADHESIVES

NUMBER OF ANCHORS PER CARTRIDGE

10 Fluid Ounce Cartridge (Quik Shot)

Rod Size	Drill Dia.	Number of Installations of Threaded Rod in Solid Base Materials																		
		Hole Depth (inches)																		
(in.)	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3/8	7/16	117.3	78.2	58.7	46.9	39.1	33.5	29.3	26.1	23.5	21.3	19.6	18.0	16.8	15.6	14.7	13.8	13.0	12.3	11.7
1/2	9/16	85.5	57.0	42.7	34.2	28.5	24.4	21.4	19.0	17.1	15.5	14.2	13.1	12.2	11.4	10.7	10.1	9.5	9.0	8.5
5/8	11/16	62.5	41.7	31.2	25.0	20.8	17.9	15.6	13.9	12.5	11.4	10.4	9.6	8.9	8.3	7.8	7.4	6.9	6.6	6.2
3/4	13/16	50.8	33.8	25.4	20.3	16.9	14.5	12.7	11.3	10.2	9.2	8.5	7.8	7.3	6.8	6.3	6.0	5.6	5.3	5.1
3/4	7/8	33.2	22.2	16.6	13.3	11.1	9.5	8.3	7.4	6.6	6.0	5.5	5.1	4.7	4.4	4.2	3.9	3.7	3.5	3.3
7/8	15/16	40.4	26.9	20.2	16.2	13.5	11.5	10.1	9.0	8.1	7.3	6.7	6.2	5.8	5.4	5.0	4.8	4.5	4.3	4.0
7/8	1	28.1	18.7	14.0	11.2	9.4	8.0	7.0	6.2	5.6	5.1	4.7	4.3	4.0	3.7	3.5	3.3	3.1	3.0	2.8
1	1 1/16	33.4	22.3	16.7	13.4	11.1	9.5	8.4	7.4	6.7	6.1	5.6	5.1	4.8	4.5	4.2	3.9	3.7	3.5	3.3
1 1/4	1 3/8	18.1	12.1	9.1	7.3	6.0	5.2	4.5	4.0	3.6	3.3	3.0	2.8	2.6	2.4	2.3	2.1	2.0	1.9	1.8

Bar Size	Drill Dia.	Number of Installations of Deformed Reinforcing Bar in Solid Base Materials																		
		Hole Depth (inches)																		
	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
No. 3	7/16	145.7	97.1	72.8	58.3	48.6	41.6	36.4	32.4	29.1	26.5	24.3	22.4	20.8	19.4	18.2	17.1	16.2	15.3	14.6
No. 4	9/16	120.1	80.1	60.1	48.1	40.0	34.3	30.0	26.7	24.0	21.8	20.0	18.5	17.2	16.0	15.0	14.1	13.3	12.6	12.0
No. 5	11/16	89.9	60.0	45.0	36.0	30.0	25.7	22.5	20.0	18.0	16.4	15.0	13.8	12.8	12.0	11.2	10.6	10.0	9.5	9.0
No. 6	7/8	41.0	27.3	20.5	16.4	13.7	11.7	10.2	9.1	8.2	7.5	6.8	6.3	5.9	5.5	5.1	4.8	4.6	4.3	4.1
No. 7	1	35.8	23.8	17.9	14.3	11.9	10.2	8.9	7.9	7.2	6.5	6.0	5.5	5.1	4.8	4.5	4.2	4.0	3.8	3.6
No. 8	1 1/8	30.7	20.5	15.4	12.3	10.2	8.8	7.7	6.8	6.1	5.6	5.1	4.7	4.4	4.1	3.8	3.6	3.4	3.2	3.1
No. 9	1 1/4	27.6	18.4	13.8	11.0	9.2	7.9	6.9	6.1	5.5	5.0	4.6	4.2	3.9	3.7	3.5	3.2	3.1	2.9	2.8
No.10	1 1/2	14.6	9.8	7.3	5.9	4.9	4.2	3.7	3.3	2.9	2.7	2.4	2.3	2.1	2.0	1.8	1.7	1.6	1.5	1.5
No.11	1 5/8	14.0	9.4	7.0	5.6	4.7	4.0	3.5	3.1	2.8	2.6	2.3	2.2	2.0	1.9	1.8	1.7	1.6	1.5	1.4

Bar Size	Drill Dia.	Number of Installations of Smooth Coated Reinforcing Bar in Solid Base Materials																		
		Hole Depth (inches)																		
(in.)	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3/4	7/8	43.0	28.7	21.5	17.2	14.3	12.3	10.7	9.6	8.6	7.8	7.2	6.6	6.1	5.7	5.4	5.1	4.8	4.5	4.3
7/8	1	37.4	24.9	18.7	14.9	12.5	10.7	9.3	8.3	7.5	6.8	6.2	5.7	5.3	5.0	4.7	4.4	4.2	3.9	3.7
1	1 1/8	31.7	21.1	15.8	12.7	10.6	9.0	7.9	7.0	6.3	5.8	5.3	4.9	4.5	4.2	4.0	3.7	3.5	3.3	3.2
1 1/4	1 3/8	25.7	17.2	12.9	10.3	8.6	7.4	6.4	5.7	5.1	4.7	4.3	4.0	3.7	3.4	3.2	3.0	2.9	2.7	2.6

Rod Size	Drill Dia.	Number of Installations of Threaded Rod Using Screen Tubes in Hollow Base Materials																		
		Hole Depth (inches)																		
(in.)	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1/4	3/8	87.1	58.1	43.6	34.9	29.0	24.9	21.8	19.4	17.4	15.8	14.5	13.4	12.4	11.6	10.9	10.3	9.7	9.2	8.7
3/8	1/2	57.7	38.5	28.9	23.1	19.2	16.5	14.4	12.8	11.5	10.5	9.6	8.9	8.2	7.7	7.2	6.8	6.4	6.1	5.8
1/2	5/8	42.0	28.0	21.0	16.8	14.0	12.0	10.5	9.3	8.4	7.6	7.0	6.5	6.0	5.6	5.3	4.9	4.7	4.4	4.2
5/8	3/4	33.0	22.0	16.5	13.2	11.0	9.4	8.3	7.3	6.6	6.0	5.5	5.1	4.7	4.4	4.1	3.9	3.7	3.5	3.3
3/4	7/8	26.6	17.7	13.3	10.6	8.9	7.6	6.6	5.9	5.3	4.8	4.4	4.1	3.8	3.5	3.3	3.1	3.0	2.8	2.7
3/4	1	8.6	5.7	4.3	3.4	2.9	2.4	2.1	1.9	1.7	1.6	1.4	1.3	1.2	1.1	1.1	1.0	1.0	0.9	0.9

Tabulated values for hollow base materials are based on 25% waste. Actual usage may vary.

NUMBER OF ANCHORS PER CARTRIDGE

12 Fluid Ounce Cartridge

Rod Size	Drill Dia.	Number of Installations of Threaded Rod in Solid Base Materials																		
		Hole Depth (inches)																		
(in.)	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3/8	7/16	140.8	93.8	70.4	56.3	46.9	40.2	35.2	31.3	28.2	25.6	23.5	21.7	20.1	18.8	17.6	16.6	15.6	14.8	14.1
1/2	9/16	102.6	68.4	51.3	41.0	34.2	29.3	25.6	22.8	20.5	18.6	17.1	15.8	14.7	13.7	12.8	12.1	11.4	10.8	10.3
5/8	11/16	75.0	50.0	37.5	30.0	25.0	21.4	18.7	16.7	15.0	13.6	12.5	11.5	10.7	10.0	9.4	8.8	8.3	7.9	7.5
3/4	13/16	60.9	40.6	30.5	24.4	20.3	17.4	15.2	13.5	12.2	11.1	10.2	9.4	8.7	8.1	7.6	7.2	6.8	6.4	6.1
3/4	7/8	39.9	26.6	19.9	16.0	13.3	11.4	10.0	8.9	8.0	7.3	6.6	6.1	5.7	5.3	5.0	4.7	4.4	4.2	4.0
7/8	15/16	48.5	32.3	24.2	19.4	16.2	13.8	12.1	10.8	9.7	8.8	8.1	7.5	6.9	6.5	6.1	5.7	5.4	5.1	4.8
7/8	1	33.7	22.5	16.8	13.5	11.2	9.6	8.4	7.5	6.7	6.1	5.6	5.2	4.8	4.5	4.2	4.0	3.7	3.5	3.4
1	1 1/16	40.1	26.7	20.0	16.0	13.4	11.5	10.0	8.9	8.0	7.3	6.7	6.2	5.7	5.3	5.0	4.7	4.5	4.2	4.0
1 1/4	1 3/8	21.8	14.5	10.9	8.7	7.3	6.2	5.4	4.8	4.4	4.0	3.6	3.3	3.1	2.9	2.7	2.6	2.4	2.3	2.2

Bar Size	Drill Dia.	Number of Installations of Deformed Reinforcing Bar in Solid Base Materials																		
		Hole Depth (inches)																		
	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
No. 3	7/16	174.8	116.6	87.4	69.9	58.3	50.0	43.7	38.9	35.0	31.8	29.1	26.9	25.0	23.3	21.9	20.6	19.4	18.4	17.5
No. 4	9/16	144.2	96.1	72.1	57.7	48.1	41.2	36.0	32.0	28.8	26.2	24.0	22.2	20.6	19.2	18.0	17.0	16.0	15.2	14.4
No. 5	11/16	107.9	71.9	54.0	43.2	36.0	30.8	27.0	24.0	21.6	19.6	18.0	16.6	15.4	14.4	13.5	12.7	12.0	11.4	10.8
No. 6	7/8	49.2	32.8	24.6	19.7	16.4	14.1	12.3	10.9	9.8	8.9	8.2	7.6	7.0	6.6	6.1	5.8	5.5	5.2	4.9
No. 7	1	42.9	28.6	21.5	17.2	14.3	12.3	10.7	9.5	8.6	7.8	7.2	6.6	6.1	5.7	5.4	5.0	4.8	4.5	4.3
No. 8	1 1/8	36.9	24.6	18.4	14.7	12.3	10.5	9.2	8.2	7.4	6.7	6.1	5.7	5.3	4.9	4.6	4.3	4.1	3.9	3.7
No. 9	1 1/4	33.1	22.1	16.6	13.3	11.0	9.5	8.3	7.4	6.6	6.0	5.5	5.1	4.7	4.4	4.1	3.9	3.7	3.5	3.3
No. 10	1 1/2	17.6	11.7	8.8	7.0	5.9	5.0	4.4	3.9	3.5	3.2	2.9	2.7	2.5	2.3	2.2	2.1	2.0	1.9	1.8
No. 11	1 5/8	16.9	11.2	8.4	6.7	5.6	4.8	4.2	3.7	3.4	3.1	2.8	2.6	2.4	2.2	2.1	2.0	1.9	1.8	1.7

Bar Size	Drill Dia.	Number of Installations of Smooth Coated Reinforcing Bar in Solid Base Materials																		
		Hole Depth (inches)																		
(in.)	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3/4	7/8	51.6	34.4	25.8	20.6	17.2	14.7	12.9	11.5	10.3	9.4	8.6	7.9	7.4	6.9	6.4	6.1	5.7	5.4	5.2
7/8	1	44.8	29.9	22.4	17.9	14.9	12.8	11.2	10.0	9.0	8.2	7.5	6.9	6.4	6.0	5.6	5.3	5.0	4.7	4.5
1	1 1/8	38.0	25.3	19.0	15.2	12.7	10.9	9.5	8.4	7.6	6.9	6.3	5.8	5.4	5.1	4.7	4.5	4.2	4.0	3.8
1 1/4	1 3/8	30.9	20.6	15.4	12.3	10.3	8.8	7.7	6.9	6.2	5.6	5.1	4.7	4.4	4.1	3.9	3.6	3.4	3.2	3.1

Rod Size	Drill Dia.	Number of Installations of Threaded Rod Using Screen Tubes in Hollow Base Materials																		
		Hole Depth (inches)																		
(in.)	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1/4	3/8	104.6	69.7	52.3	41.8	34.9	29.9	26.1	23.2	20.9	19.0	17.4	16.1	14.9	13.9	13.1	12.3	11.6	11.0	10.5
3/8	1/2	69.3	46.2	34.6	27.7	23.1	19.8	17.3	15.4	13.9	12.6	11.5	10.7	9.9	9.2	8.7	8.2	7.7	7.3	6.9
1/2	5/8	50.4	33.6	25.2	20.2	16.8	14.4	12.6	11.2	10.1	9.2	8.4	7.8	7.2	6.7	6.3	5.9	5.6	5.3	5.0
5/8	3/4	39.6	26.4	19.8	15.9	13.2	11.3	9.9	8.8	7.9	7.2	6.6	6.1	5.7	5.3	5.0	4.7	4.4	4.2	4.0
3/4	7/8	31.9	21.3	16.0	12.8	10.6	9.1	8.0	7.1	6.4	5.8	5.3	4.9	4.6	4.3	4.0	3.8	3.5	3.4	3.2
3/4	1	10.3	6.9	5.1	4.1	3.4	2.9	2.6	2.3	2.1	1.9	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1	1.0

Tabulated values for hollow base materials are based on 25% waste. Actual usage may vary.

ADHESIVES

NUMBER OF ANCHORS PER CARTRIDGE

30 Fluid Ounce Cartridge

Rod Size	Drill Dia.	Number of Installations of Threaded Rod in Solid Base Materials																		
		Hole Depth (inches)																		
(in.)	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3/8	7/16	351.9	234.6	176.0	140.8	117.3	100.6	88.0	78.2	70.4	64.0	58.7	54.1	50.3	46.9	44.0	41.4	39.1	37.0	35.2
1/2	9/16	256.4	170.9	128.2	102.6	85.5	73.3	64.1	57.0	51.3	46.6	42.7	39.4	36.6	34.2	32.1	30.2	28.5	27.0	25.6
5/8	11/16	187.4	125.0	93.7	75.0	62.5	53.6	46.9	41.7	37.5	34.1	31.2	28.8	26.8	25.0	23.4	22.1	20.8	19.7	18.7
3/4	13/16	152.3	101.5	76.1	60.9	50.8	43.5	38.1	33.8	30.5	27.7	25.4	23.4	21.8	20.3	19.0	17.9	16.9	16.0	15.2
3/4	7/8	99.7	66.5	49.9	39.9	33.2	28.5	24.9	22.2	19.9	18.1	16.6	15.3	14.2	13.3	12.5	11.7	11.1	10.5	10.0
7/8	15/16	121.1	80.8	60.6	48.5	40.4	34.6	30.3	26.9	24.2	22.0	20.2	18.6	17.3	16.2	15.1	14.3	13.5	12.8	12.1
7/8	1	84.2	56.2	42.1	33.7	28.1	24.1	21.1	18.7	16.8	15.3	14.0	13.0	12.0	11.2	10.5	9.9	9.4	8.9	8.4
1	1 1/16	100.2	66.8	50.1	40.1	33.4	28.6	25.1	22.3	20.0	18.2	16.7	15.4	14.3	13.4	12.5	11.8	11.1	10.6	10.0
1 1/4	1 3/8	54.4	36.3	27.2	21.8	18.1	15.5	13.6	12.1	10.9	9.9	9.1	8.4	7.8	7.3	6.8	6.4	6.0	5.7	5.4

Bar Size	Drill Dia.	Number of Installations of Deformed Reinforcing Bar in Solid Base Materials																		
		Hole Depth (inches)																		
	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
No. 3	7/16	437.1	291.4	218.5	174.8	145.7	124.9	109.3	97.1	87.4	79.5	72.8	67.2	62.4	58.3	54.6	51.4	48.6	46.0	43.7
No. 4	9/16	360.4	240.3	180.2	144.2	120.1	103.0	90.1	80.1	72.1	65.5	60.1	55.4	51.5	48.1	45.0	42.4	40.0	37.9	36.0
No. 5	11/16	269.8	179.9	134.9	107.9	89.9	77.1	67.4	60.0	54.0	49.1	45.0	41.5	38.5	36.0	33.7	31.7	30.0	28.4	27.0
No. 6	7/8	123.0	82.0	61.5	49.2	41.0	35.1	30.7	27.3	24.6	22.4	20.5	18.9	17.6	16.4	15.4	14.5	13.7	12.9	12.3
No. 7	1	107.3	71.5	53.6	42.9	35.8	30.7	26.8	23.8	21.5	19.5	17.9	16.5	15.3	14.3	13.4	12.6	11.9	11.3	10.7
No. 8	1 1/8	92.1	61.4	46.1	36.9	30.7	26.3	23.0	20.5	18.4	16.8	15.4	14.2	13.2	12.3	11.5	10.8	10.2	9.7	9.2
No. 9	1 1/4	82.9	55.2	41.4	33.1	27.6	23.7	20.7	18.4	16.6	15.1	13.8	12.7	11.8	11.0	10.4	9.7	9.2	8.7	8.3
No. 10	1 1/2	43.9	29.3	22.0	17.6	14.6	12.6	11.0	9.8	8.8	8.0	7.3	6.8	6.3	5.9	5.5	5.2	4.9	4.6	4.4
No. 11	1 5/8	42.1	28.1	21.1	16.9	14.0	12.0	10.5	9.4	8.4	7.7	7.0	6.5	6.0	5.6	5.3	5.0	4.7	4.4	4.2

Bar Size	Drill Dia.	Number of Installations of Smooth Coated Reinforcing Bar in Solid Base Materials																		
		Hole Depth (inches)																		
(in.)	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3/4	7/8	129.0	86.0	64.5	51.6	43.0	36.8	32.2	28.7	25.8	23.4	21.5	19.8	18.4	17.2	16.1	15.2	14.3	13.6	12.9
7/8	1	112.1	74.7	56.0	44.8	37.4	32.0	28.0	24.9	22.4	20.4	18.7	17.2	16.0	14.9	14.0	13.2	12.5	11.8	11.2
1	1 1/8	95.0	63.3	47.5	38.0	31.7	27.1	23.7	21.1	19.0	17.3	15.8	14.6	13.6	12.7	11.9	11.2	10.6	10.0	9.5
1 1/4	1 3/8	77.2	51.5	38.6	30.9	25.7	22.1	19.3	17.2	15.4	14.0	12.9	11.9	11.0	10.3	9.6	9.1	8.6	8.1	7.7

Rod Size	Drill Dia.	Number of Installations of Threaded Rod Using Screen Tubes in Hollow Base Materials																		
		Hole Depth (inches)																		
(in.)	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1/4	3/8	261.4	174.3	130.7	104.6	87.1	74.7	65.4	58.1	52.3	47.5	43.6	40.2	37.3	34.9	32.7	30.8	29.0	27.5	26.1
3/8	1/2	173.2	115.5	86.6	69.3	57.7	49.5	43.3	38.5	34.6	31.5	28.9	26.7	24.7	23.1	21.7	20.4	19.2	18.2	17.3
1/2	5/8	126.0	84.0	63.0	50.4	42.0	36.0	31.5	28.0	25.2	22.9	21.0	19.4	18.0	16.8	15.8	14.8	14.0	13.3	12.6
5/8	3/4	99.1	66.1	49.5	39.6	33.0	28.3	24.8	22.0	19.8	18.0	16.5	15.2	14.2	13.2	12.4	11.7	11.0	10.4	9.9
3/4	7/8	79.8	53.2	39.9	31.9	26.6	22.8	19.9	17.7	16.0	14.5	13.3	12.3	11.4	10.6	10.0	9.4	8.9	8.4	8.0
3/4	1	25.7	17.1	12.9	10.3	8.6	7.3	6.4	5.7	5.1	4.7	4.3	4.0	3.7	3.4	3.2	3.0	2.9	2.7	2.6

Tabulated values for hollow base materials are based on 25% waste. Actual usage may vary.

NUMBER OF ANCHORS PER CARTRIDGE

10 Fluid Ounce Cartridge (Quik Shot)

Rod Size	Drill Dia.	Number of Installations of Threaded Rod in Solid Base Materials																		
		Hole Depth (inches)																		
(in.)	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1/4	5/16	192.0	128.0	96.0	76.8	64.0	54.9	48.0	42.7	38.4	34.9	32.0	29.5	27.4	25.6	24.0	22.6	21.3	20.2	19.2
3/8	7/16	117.3	78.2	58.7	46.9	39.1	33.5	29.3	26.1	23.5	21.3	19.6	18.0	16.8	15.6	14.7	13.8	13.0	12.3	11.7
1/2	9/16	85.5	57.0	42.7	34.2	28.5	24.4	21.4	19.0	17.1	15.5	14.2	13.1	12.2	11.4	10.7	10.1	9.5	9.0	8.5
5/8	3/4	41.3	27.5	20.6	16.5	13.8	11.8	10.3	9.2	8.3	7.5	6.9	6.4	5.9	5.5	5.2	4.9	4.6	4.3	4.1
3/4	7/8	33.2	22.2	16.6	13.3	11.1	9.5	8.3	7.4	6.6	6.0	5.5	5.1	4.7	4.4	4.2	3.9	3.7	3.5	3.3
7/8	1	28.1	18.7	14.0	11.2	9.4	8.0	7.0	6.2	5.6	5.1	4.7	4.3	4.0	3.7	3.5	3.3	3.1	3.0	2.8
1	1 1/8	23.3	15.5	11.6	9.3	7.8	6.7	5.8	5.2	4.7	4.2	3.9	3.6	3.3	3.1	2.9	2.7	2.6	2.5	2.3
1 1/4	1 3/8	18.1	12.1	9.1	7.3	6.0	5.2	4.5	4.0	3.6	3.3	3.0	2.8	2.6	2.4	2.3	2.1	2.0	1.9	1.8
1 3/8	1 1/2	15.8	10.5	7.9	6.3	5.3	4.5	3.9	3.5	3.2	2.9	2.6	2.4	2.3	2.1	2.0	1.9	1.8	1.7	1.6
1 1/2	1 5/8	14.6	9.8	7.3	5.9	4.9	4.2	3.7	3.3	2.9	2.7	2.4	2.3	2.1	2.0	1.8	1.7	1.6	1.5	1.5

Bar Size	Drill Dia.	Number of Installations of Deformed Reinforcing Bar in Solid Base Materials																		
		Hole Depth (inches)																		
	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
No. 3	1/2	81.7	54.4	40.8	32.7	27.2	23.3	20.4	18.1	16.3	14.8	13.6	12.6	11.7	10.9	10.2	9.6	9.1	8.6	8.2
No. 4	5/8	63.6	42.4	31.8	25.4	21.2	18.2	15.9	14.1	12.7	11.6	10.6	9.8	9.1	8.5	7.9	7.5	7.1	6.7	6.4
No. 5	3/4	51.2	34.1	25.6	20.5	17.1	14.6	12.8	11.4	10.2	9.3	8.5	7.9	7.3	6.8	6.4	6.0	5.7	5.4	5.1
No. 6	7/8	41.0	27.3	20.5	16.4	13.7	11.7	10.2	9.1	8.2	7.5	6.8	6.3	5.9	5.5	5.1	4.8	4.6	4.3	4.1
No. 7	1	35.8	23.8	17.9	14.3	11.9	10.2	8.9	7.9	7.2	6.5	6.0	5.5	5.1	4.8	4.5	4.2	4.0	3.8	3.6
No. 8	1 1/8	30.7	20.5	15.4	12.3	10.2	8.8	7.7	6.8	6.1	5.6	5.1	4.7	4.4	4.1	3.8	3.6	3.4	3.2	3.1
No. 9	1 1/4	27.6	18.4	13.8	11.0	9.2	7.9	6.9	6.1	5.5	5.0	4.6	4.2	3.9	3.7	3.5	3.2	3.1	2.9	2.8
No.10	1 1/2	14.6	9.8	7.3	5.9	4.9	4.2	3.7	3.3	2.9	2.7	2.4	2.3	2.1	2.0	1.8	1.7	1.6	1.5	1.5
No.11	1 5/8	14.0	9.4	7.0	5.6	4.7	4.0	3.5	3.1	2.8	2.6	2.3	2.2	2.0	1.9	1.8	1.7	1.6	1.5	1.4

Bar Size	Drill Dia.	Number of Installations of Smooth Coated Reinforcing Bar in Solid Base Materials																		
		Hole Depth (inches)																		
(in.)	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3/4	7/8	43.0	28.7	21.5	17.2	14.3	12.3	10.7	9.6	8.6	7.8	7.2	6.6	6.1	5.7	5.4	5.1	4.8	4.5	4.3
7/8	1	37.4	24.9	18.7	14.9	12.5	10.7	9.3	8.3	7.5	6.8	6.2	5.7	5.3	5.0	4.7	4.4	4.2	3.9	3.7
1	1 1/8	31.7	21.1	15.8	12.7	10.6	9.0	7.9	7.0	6.3	5.8	5.3	4.9	4.5	4.2	4.0	3.7	3.5	3.3	3.2
1 1/4	1 3/8	25.7	17.2	12.9	10.3	8.6	7.4	6.4	5.7	5.1	4.7	4.3	4.0	3.7	3.4	3.2	3.0	2.9	2.7	2.6
1 1/2	1 5/8	22.0	14.7	11.0	8.8	7.3	6.3	5.5	4.9	4.4	4.0	3.7	3.4	3.1	2.9	2.8	2.6	2.4	2.3	2.2

Rod Size	Drill Dia.	Number of Installations of Threaded Rod Using Screen Tubes in Hollow Base Materials																		
		Hole Depth (inches)																		
(in.)	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1/4	3/8	87.1	58.1	43.6	34.9	29.0	24.9	21.8	19.4	17.4	15.8	14.5	13.4	12.4	11.6	10.9	10.3	9.7	9.2	8.7
3/8	1/2	57.7	38.5	28.9	23.1	19.2	16.5	14.4	12.8	11.5	10.5	9.6	8.9	8.2	7.7	7.2	6.8	6.4	6.1	5.8
1/2	5/8	42.0	28.0	21.0	16.8	14.0	12.0	10.5	9.3	8.4	7.6	7.0	6.5	6.0	5.6	5.3	4.9	4.7	4.4	4.2
5/8	3/4	33.0	22.0	16.5	13.2	11.0	9.4	8.3	7.3	6.6	6.0	5.5	5.1	4.7	4.4	4.1	3.9	3.7	3.5	3.3
3/4	7/8	26.6	17.7	13.3	10.6	8.9	7.6	6.6	5.9	5.3	4.8	4.4	4.1	3.8	3.5	3.3	3.1	3.0	2.8	2.7
3/4	1	8.6	15.0	11.2	9.0	7.5	6.4	5.6	5.0	4.5	4.1	3.7	3.5	3.2	3.0	2.8	2.6	2.5	2.4	2.2

Tabulated values for hollow base materials are based on 25% waste. Actual usage may vary.

NUMBER OF ANCHORS PER CARTRIDGE

15 Fluid Ounce Cartridge

Rod Size	Drill Dia.	Number of Installations of Threaded Rod in Solid Base Materials																		
		Hole Depth (inches)																		
(in.)	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1/4	5/16	288.1	192.0	144.0	115.2	96.0	82.3	72.0	64.0	57.6	52.4	48.0	44.3	41.2	38.4	36.0	33.9	32.0	30.3	28.8
3/8	7/16	176.0	117.3	88.0	70.4	58.7	50.3	44.0	39.1	35.2	32.0	29.3	27.1	25.1	23.5	22.0	20.7	19.6	18.5	17.6
1/2	9/16	128.2	85.5	64.1	51.3	42.7	36.6	32.1	28.5	25.6	23.3	21.4	19.7	18.3	17.1	16.0	15.1	14.2	13.5	12.8
5/8	3/4	61.9	41.3	31.0	24.8	20.6	17.7	15.5	13.8	12.4	11.3	10.3	9.5	8.8	8.3	7.7	7.3	6.9	6.5	6.2
3/4	7/8	49.9	33.2	24.9	19.9	16.6	14.2	12.5	11.1	10.0	9.1	8.3	7.7	7.1	6.6	6.2	5.9	5.5	5.2	5.0
7/8	1	42.1	28.1	21.1	16.8	14.0	12.0	10.5	9.4	8.4	7.7	7.0	6.5	6.0	5.6	5.3	5.0	4.7	4.4	4.2
1	1 1/8	34.9	23.3	17.5	14.0	11.6	10.0	8.7	7.8	7.0	6.3	5.8	5.4	5.0	4.7	4.4	4.1	3.9	3.7	3.5
1 1/4	1 3/8	27.2	18.1	13.6	10.9	9.1	7.8	6.8	6.0	5.4	4.9	4.5	4.2	3.9	3.6	3.4	3.2	3.0	2.9	2.7
1 3/8	1 1/2	23.7	15.8	11.8	9.5	7.9	6.8	5.9	5.3	4.7	4.3	3.9	3.6	3.4	3.2	3.0	2.8	2.6	2.5	2.4
1 1/2	1 5/8	22.0	14.6	11.0	8.8	7.3	6.3	5.5	4.9	4.4	4.0	3.7	3.4	3.1	2.9	2.7	2.6	2.4	2.3	2.2

Bar Size	Drill Dia.	Number of Installations of Deformed Reinforcing Bar in Solid Base Materials																		
		Hole Depth (inches)																		
	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
No. 3	1/2	122.5	81.7	61.2	49.0	40.8	35.0	30.6	27.2	24.5	22.3	20.4	18.8	17.5	16.3	15.3	14.4	13.6	12.9	12.2
No. 4	5/8	95.4	63.6	47.7	38.1	31.8	27.2	23.8	21.2	19.1	17.3	15.9	14.7	13.6	12.7	11.9	11.2	10.6	10.0	9.5
No. 5	3/4	76.8	51.2	38.4	30.7	25.6	21.9	19.2	17.1	15.4	14.0	12.8	11.8	11.0	10.2	9.6	9.0	8.5	8.1	7.7
No. 6	7/8	61.5	41.0	30.7	24.6	20.5	17.6	15.4	13.7	12.3	11.2	10.2	9.5	8.8	8.2	7.7	7.2	6.8	6.5	6.1
No. 7	1	53.6	35.8	26.8	21.5	17.9	15.3	13.4	11.9	10.7	9.8	8.9	8.3	7.7	7.2	6.7	6.3	6.0	5.6	5.4
No. 8	1 1/8	46.1	30.7	23.0	18.4	15.4	13.2	11.5	10.2	9.2	8.4	7.7	7.1	6.6	6.1	5.8	5.4	5.1	4.8	4.6
No. 9	1 1/4	41.4	27.6	20.7	16.6	13.8	11.8	10.4	9.2	8.3	7.5	6.9	6.4	5.9	5.5	5.2	4.9	4.6	4.4	4.1
No.10	1 1/2	22.0	14.6	11.0	8.8	7.3	6.3	5.5	4.9	4.4	4.0	3.7	3.4	3.1	2.9	2.7	2.6	2.4	2.3	2.2
No.11	1 5/8	21.1	14.0	10.5	8.4	7.0	6.0	5.3	4.7	4.2	3.8	3.5	3.2	3.0	2.8	2.6	2.5	2.3	2.2	2.1

Bar Size	Drill Dia.	Number of Installations of Smooth Coated Reinforcing Bar in Solid Base Materials																		
		Hole Depth (inches)																		
(in.)	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3/4	7/8	64.5	43.0	32.2	25.8	21.5	18.4	16.1	14.3	12.9	11.7	10.7	9.9	9.2	8.6	8.1	7.6	7.2	6.8	6.4
7/8	1	56.0	37.4	28.0	22.4	18.7	16.0	14.0	12.5	11.2	10.2	9.3	8.6	8.0	7.5	7.0	6.6	6.2	5.9	5.6
1	1 1/8	47.5	31.7	23.7	19.0	15.8	13.6	11.9	10.6	9.5	8.6	7.9	7.3	6.8	6.3	5.9	5.6	5.3	5.0	4.7
1 1/4	1 3/8	38.6	25.7	19.3	15.4	12.9	11.0	9.6	8.6	7.7	7.0	6.4	5.9	5.5	5.1	4.8	4.5	4.3	4.1	3.9
1 1/2	1 5/8	33.0	22.0	16.5	13.2	11.0	9.4	8.3	7.3	6.6	6.0	5.5	5.1	4.7	4.4	4.1	3.9	3.7	3.5	3.3

Rod Size	Drill Dia.	Number of Installations of Threaded Rod Using Screen Tubes in Hollow Base Materials																		
		Hole Depth (inches)																		
(in.)	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1/4	3/8	130.7	87.1	65.4	52.3	43.6	37.3	32.7	29.0	26.1	23.8	21.8	20.1	18.7	17.4	16.3	15.4	14.5	13.8	13.1
3/8	1/2	86.6	57.7	43.3	34.6	28.9	24.7	21.7	19.2	17.3	15.7	14.4	13.3	12.4	11.5	10.8	10.2	9.6	9.1	8.7
1/2	5/8	63.0	42.0	31.5	25.2	21.0	18.0	15.8	14.0	12.6	11.5	10.5	9.7	9.0	8.4	7.9	7.4	7.0	6.6	6.3
5/8	3/4	49.5	33.0	24.8	19.8	16.5	14.2	12.4	11.0	9.9	9.0	8.3	7.6	7.1	6.6	6.2	5.8	5.5	5.2	5.0
3/4	7/8	39.9	26.6	19.9	16.0	13.3	11.4	10.0	8.9	8.0	7.3	6.6	6.1	5.7	5.3	5.0	4.7	4.4	4.2	4.0
3/4	1	12.9	22.5	16.8	13.5	11.2	9.6	8.4	7.5	6.7	6.1	5.6	5.2	4.8	4.5	4.2	4.0	3.7	3.5	3.4

Tabulated values for hollow base materials are based on 25% waste. Actual usage may vary.

NUMBER OF ANCHORS PER CARTRIDGE

22 Fluid Ounce Cartridge

Rod Size	Drill Dia.	Number of Installations of Threaded Rod in Solid Base Materials																		
		Hole Depth (inches)																		
(in.)	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1/4	5/16	422.5	281.7	211.3	169.0	140.8	120.7	105.6	93.9	84.5	76.8	70.4	65.0	60.4	56.3	52.8	49.7	46.9	44.5	42.3
3/8	7/16	258.1	172.1	129.0	103.2	86.0	73.7	64.5	57.4	51.6	46.9	43.0	39.7	36.9	34.4	32.3	30.4	28.7	27.2	25.8
1/2	9/16	188.0	125.4	94.0	75.2	62.7	53.7	47.0	41.8	37.6	34.2	31.3	28.9	26.9	25.1	23.5	22.1	20.9	19.8	18.8
5/8	3/4	90.8	60.6	45.4	36.3	30.3	26.0	22.7	20.2	18.2	16.5	15.1	14.0	13.0	12.1	11.4	10.7	10.1	9.6	9.1
3/4	7/8	73.1	48.8	36.6	29.3	24.4	20.9	18.3	16.3	14.6	13.3	12.2	11.3	10.4	9.8	9.1	8.6	8.1	7.7	7.3
7/8	1	61.8	41.2	30.9	24.7	20.6	17.7	15.4	13.7	12.4	11.2	10.3	9.5	8.8	8.2	7.7	7.3	6.9	6.5	6.2
1	1 1/8	51.2	34.1	25.6	20.5	17.1	14.6	12.8	11.4	10.2	9.3	8.5	7.9	7.3	6.8	6.4	6.0	5.7	5.4	5.1
1 1/4	1 3/8	39.9	26.6	19.9	16.0	13.3	11.4	10.0	8.9	8.0	7.3	6.6	6.1	5.7	5.3	5.0	4.7	4.4	4.2	4.0
1 3/8	1 1/2	34.7	23.1	17.4	13.9	11.6	9.9	8.7	7.7	6.9	6.3	5.8	5.3	5.0	4.6	4.3	4.1	3.9	3.7	3.5
1 1/2	1 5/8	32.2	21.5	16.1	12.9	10.7	9.2	8.1	7.2	6.4	5.9	5.4	5.0	4.6	4.3	4.0	3.8	3.6	3.4	3.2

Bar Size	Drill Dia.	Number of Installations of Deformed Reinforcing Bar in Solid Base Materials																		
		Hole Depth (inches)																		
	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
No. 3	1/2	179.6	119.8	89.8	71.9	59.9	51.3	44.9	39.9	35.9	32.7	29.9	27.6	25.7	24.0	22.5	21.1	20.0	18.9	18.0
No. 4	5/8	139.9	93.2	69.9	55.9	46.6	40.0	35.0	31.1	28.0	25.4	23.3	21.5	20.0	18.6	17.5	16.5	15.5	14.7	14.0
No. 5	3/4	112.7	75.1	56.3	45.1	37.6	32.2	28.2	25.0	22.5	20.5	18.8	17.3	16.1	15.0	14.1	13.3	12.5	11.9	11.3
No. 6	7/8	90.2	60.1	45.1	36.1	30.1	25.8	22.5	20.0	18.0	16.4	15.0	13.9	12.9	12.0	11.3	10.6	10.0	9.5	9.0
No. 7	1	78.7	52.4	39.3	31.5	26.2	22.5	19.7	17.5	15.7	14.3	13.1	12.1	11.2	10.5	9.8	9.3	8.7	8.3	7.9
No. 8	1 1/8	67.6	45.0	33.8	27.0	22.5	19.3	16.9	15.0	13.5	12.3	11.3	10.4	9.7	9.0	8.4	7.9	7.5	7.1	6.8
No. 9	1 1/4	60.8	40.5	30.4	24.3	20.3	17.4	15.2	13.5	12.2	11.0	10.1	9.3	8.7	8.1	7.6	7.1	6.8	6.4	6.1
No.10	1 1/2	32.2	21.5	16.1	12.9	10.7	9.2	8.1	7.2	6.4	5.9	5.4	5.0	4.6	4.3	4.0	3.8	3.6	3.4	3.2
No.11	1 5/8	30.9	20.6	15.5	12.4	10.3	8.8	7.7	6.9	6.2	5.6	5.2	4.8	4.4	4.1	3.9	3.6	3.4	3.3	3.1

Bar Size	Drill Dia.	Number of Installations of Smooth Coated Reinforcing Bar in Solid Base Materials																		
		Hole Depth (inches)																		
(in.)	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3/4	7/8	94.6	63.0	47.3	37.8	31.5	27.0	23.6	21.0	18.9	17.2	15.8	14.5	13.5	12.6	11.8	11.1	10.5	10.0	9.5
7/8	1	82.2	54.8	41.1	32.9	27.4	23.5	20.5	18.3	16.4	14.9	13.7	12.6	11.7	11.0	10.3	9.7	9.1	8.7	8.2
1	1 1/8	69.7	46.4	34.8	27.9	23.2	19.9	17.4	15.5	13.9	12.7	11.6	10.7	10.0	9.3	8.7	8.2	7.7	7.3	7.0
1 1/4	1 3/8	56.6	37.7	28.3	22.6	18.9	16.2	14.1	12.6	11.3	10.3	9.4	8.7	8.1	7.5	7.1	6.7	6.3	6.0	5.7
1 1/2	1 5/8	48.4	32.3	24.2	19.4	16.1	13.8	12.1	10.8	9.7	8.8	8.1	7.4	6.9	6.5	6.1	5.7	5.4	5.1	4.8

Rod Size	Drill Dia.	Number of Installations of Threaded Rod Using Screen Tubes in Hollow Base Materials																		
		Hole Depth (inches)																		
(in.)	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1/4	3/8	191.7	127.8	95.9	76.7	63.9	54.8	47.9	42.6	38.3	34.9	32.0	29.5	27.4	25.6	24.0	22.6	21.3	20.2	19.2
3/8	1/2	127.0	84.7	63.5	50.8	42.3	36.3	31.8	28.2	25.4	23.1	21.2	19.5	18.1	16.9	15.9	14.9	14.1	13.4	12.7
1/2	5/8	92.4	61.6	46.2	37.0	30.8	26.4	23.1	20.5	18.5	16.8	15.4	14.2	13.2	12.3	11.6	10.9	10.3	9.7	9.2
5/8	3/4	72.7	48.4	36.3	29.1	24.2	20.8	18.2	16.1	14.5	13.2	12.1	11.2	10.4	9.7	9.1	8.5	8.1	7.6	7.3
3/4	7/8	58.5	39.0	29.3	23.4	19.5	16.7	14.6	13.0	11.7	10.6	9.8	9.0	8.4	7.8	7.3	6.9	6.5	6.2	5.9
3/4	1	18.8	33.0	24.7	19.8	16.5	14.1	12.4	11.0	9.9	9.0	8.2	7.6	7.1	6.6	6.2	5.8	5.5	5.2	4.9

Tabulated values for hollow base materials are based on 25% waste. Actual usage may vary.

NUMBER OF ANCHORS PER CARTRIDGE

44 Fluid Ounce Cartridge

Rod Size (in.)	Drill Dia. (in.)	Number of Installations of Threaded Rod in Solid Base Materials — Hole Depth (inches)																		
		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1/4	5/16	845.0	563.3	422.5	338.0	281.7	241.4	211.3	187.8	169.0	153.6	140.8	130.0	120.7	112.7	105.6	99.4	93.9	88.9	84.5
3/8	7/16	516.2	344.1	258.1	206.5	172.1	147.5	129.0	114.7	103.2	93.8	86.0	79.4	73.7	68.8	64.5	60.7	57.4	54.3	51.6
1/2	9/16	376.1	250.7	188.0	150.4	125.4	107.5	94.0	83.6	75.2	68.4	62.7	57.9	53.7	50.1	47.0	44.2	41.8	39.6	37.6
5/8	3/4	181.7	121.1	90.8	72.7	60.6	51.9	45.4	40.4	36.3	33.0	30.3	27.9	26.0	24.2	22.7	21.4	20.2	19.1	18.2
3/4	7/8	146.3	97.5	73.1	58.5	48.8	41.8	36.6	32.5	29.3	26.6	24.4	22.5	20.9	19.5	18.3	17.2	16.3	15.4	14.6
7/8	1	123.6	82.4	61.8	49.4	41.2	35.3	30.9	27.5	24.7	22.5	20.6	19.0	17.7	16.5	15.4	14.5	13.7	13.0	12.4
1	1 1/8	102.4	68.3	51.2	41.0	34.1	29.3	25.6	22.8	20.5	18.6	17.1	15.8	14.6	13.7	12.8	12.1	11.4	10.8	10.2
1 1/4	1 3/8	79.8	53.2	39.9	31.9	26.6	22.8	19.9	17.7	16.0	14.5	13.3	12.3	11.4	10.6	10.0	9.4	8.9	8.4	8.0
1 3/8	1 1/2	69.4	46.3	34.7	27.8	23.1	19.8	17.4	15.4	13.9	12.6	11.6	10.7	9.9	9.3	8.7	8.2	7.7	7.3	6.9
1 1/2	1 5/8	64.5	43.0	32.2	25.8	21.5	18.4	16.1	14.3	12.9	11.7	10.7	9.9	9.2	8.6	8.1	7.6	7.2	6.8	6.4

Bar Size	Drill Dia. (in.)	Number of Installations of Deformed Reinforcing Bar in Solid Base Materials — Hole Depth (inches)																		
		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
No. 3	1/2	359.3	239.5	179.6	143.7	119.8	102.7	89.8	79.8	71.9	65.3	59.9	55.3	51.3	47.9	44.9	42.3	39.9	37.8	35.9
No. 4	5/8	279.7	186.5	139.9	111.9	93.2	79.9	69.9	62.2	55.9	50.9	46.6	43.0	40.0	37.3	35.0	32.9	31.1	29.4	28.0
No. 5	3/4	225.3	150.2	112.7	90.1	75.1	64.4	56.3	50.1	45.1	41.0	37.6	34.7	32.2	30.0	28.2	26.5	25.0	23.7	22.5
No. 6	7/8	180.4	120.3	90.2	72.2	60.1	51.5	45.1	40.1	36.1	32.8	30.1	27.8	25.8	24.1	22.5	21.2	20.0	19.0	18.0
No. 7	1	157.3	104.9	78.7	62.9	52.4	45.0	39.3	35.0	31.5	28.6	26.2	24.2	22.5	21.0	19.7	18.5	17.5	16.6	15.7
No. 8	1 1/8	135.1	90.1	67.6	54.1	45.0	38.6	33.8	30.0	27.0	24.6	22.5	20.8	19.3	18.0	16.9	15.9	15.0	14.2	13.5
No. 9	1 1/4	121.5	81.0	60.8	48.6	40.5	34.7	30.4	27.0	24.3	22.1	20.3	18.7	17.4	16.2	15.2	14.3	13.5	12.8	12.2
No.10	1 1/2	64.5	43.0	32.2	25.8	21.5	18.4	16.1	14.3	12.9	11.7	10.7	9.9	9.2	8.6	8.1	7.6	7.2	6.8	6.4
No.11	1 5/8	61.8	41.2	30.9	24.7	20.6	17.7	15.5	13.7	12.4	11.2	10.3	9.5	8.8	8.2	7.7	7.3	6.9	6.5	6.2

Bar Size (in.)	Drill Dia. (in.)	Number of Installations of Smooth Coated Reinforcing Bar in Solid Base Materials — Hole Depth (inches)																		
		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3/4	7/8	189.1	126.1	94.6	75.7	63.0	54.0	47.3	42.0	37.8	34.4	31.5	29.1	27.0	25.2	23.6	22.3	21.0	19.9	18.9
7/8	1	164.4	109.6	82.2	65.8	54.8	47.0	41.1	36.5	32.9	29.9	27.4	25.3	23.5	21.9	20.5	19.3	18.3	17.3	16.4
1	1 1/8	139.3	92.9	69.7	55.7	46.4	39.8	34.8	31.0	27.9	25.3	23.2	21.4	19.9	18.6	17.4	16.4	15.5	14.7	13.9
1 1/4	1 3/8	113.2	75.5	56.6	45.3	37.7	32.3	28.3	25.2	22.6	20.6	18.9	17.4	16.2	15.1	14.1	13.3	12.6	11.9	11.3
1 1/2	1 5/8	96.8	64.6	48.4	38.7	32.3	27.7	24.2	21.5	19.4	17.6	16.1	14.9	13.8	12.9	12.1	11.4	10.8	10.2	9.7

Rod Size (in.)	Drill Dia. (in.)	Number of Installations of Threaded Rod Using Screen Tubes in Hollow Base Materials — Hole Depth (inches)																		
		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1/4	3/8	383.4	255.6	191.7	153.4	127.8	109.5	95.9	85.2	76.7	69.7	63.9	59.0	54.8	51.1	47.9	45.1	42.6	40.4	38.3
3/8	1/2	254.1	169.4	127.0	101.6	84.7	72.6	63.5	56.5	50.8	46.2	42.3	39.1	36.3	33.9	31.8	29.9	28.2	26.7	25.4
1/2	5/8	184.8	123.2	92.4	73.9	61.6	52.8	46.2	41.1	37.0	33.6	30.8	28.4	26.4	24.6	23.1	21.7	20.5	19.5	18.5
5/8	3/4	145.3	96.9	72.7	58.1	48.4	41.5	36.3	32.3	29.1	26.4	24.2	22.4	20.8	19.4	18.2	17.1	16.1	15.3	14.5
3/4	7/8	117.0	78.0	58.5	46.8	39.0	33.4	29.3	26.0	23.4	21.3	19.5	18.0	16.7	15.6	14.6	13.8	13.0	12.3	11.7
3/4	1	37.7	65.9	49.4	39.5	33.0	28.2	24.7	22.0	19.8	18.0	16.5	15.2	14.1	13.2	12.4	11.6	11.0	10.4	9.9

Tabulated values for hollow base materials are based on 25% waste. Actual usage may vary.

NUMBER OF ANCHORS PER CARTRIDGE

56 Fluid Ounce Cartridge

Rod Size	Drill Dia.	Number of Installations of Threaded Rod in Solid Base Materials																		
		Hole Depth (inches)																		
(in.)	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1/4	5/16	1075.5	717.0	537.7	430.2	358.5	307.3	268.9	239.0	215.1	195.5	179.2	165.5	153.6	143.4	134.4	126.5	119.5	113.2	107.5
3/8	7/16	656.9	438.0	328.5	262.8	219.0	187.7	164.2	146.0	131.4	119.4	109.5	101.1	93.8	87.6	82.1	77.3	73.0	69.2	65.7
1/2	9/16	478.7	319.1	239.3	191.5	159.6	136.8	119.7	106.4	95.7	87.0	79.8	73.6	68.4	63.8	59.8	56.3	53.2	50.4	47.9
5/8	3/4	231.2	154.1	115.6	92.5	77.1	66.1	57.8	51.4	46.2	42.0	38.5	35.6	33.0	30.8	28.9	27.2	25.7	24.3	23.1
3/4	7/8	186.2	124.1	93.1	74.5	62.1	53.2	46.5	41.4	37.2	33.9	31.0	28.6	26.6	24.8	23.3	21.9	20.7	19.6	18.6
7/8	1	157.3	104.8	78.6	62.9	52.4	44.9	39.3	34.9	31.5	28.6	26.2	24.2	22.5	21.0	19.7	18.5	17.5	16.6	15.7
1	1 1/8	130.4	86.9	65.2	52.1	43.5	37.2	32.6	29.0	26.1	23.7	21.7	20.1	18.6	17.4	16.3	15.3	14.5	13.7	13.0
1 1/4	1 3/8	101.5	67.7	50.8	40.6	33.8	29.0	25.4	22.6	20.3	18.5	16.9	15.6	14.5	13.5	12.7	11.9	11.3	10.7	10.2
1 3/8	1 1/2	88.3	58.9	44.2	35.3	29.4	25.2	22.1	19.6	17.7	16.1	14.7	13.6	12.6	11.8	11.0	10.4	9.8	9.3	8.8
1 1/2	1 5/8	82.0	54.7	41.0	32.8	27.3	23.4	20.5	18.2	16.4	14.9	13.7	12.6	11.7	10.9	10.3	9.7	9.1	8.6	8.2

Bar Size	Drill Dia.	Number of Installations of Deformed Reinforcing Bar in Solid Base Materials																		
		Hole Depth (inches)																		
	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
No. 3	1/2	457.3	304.8	228.6	182.9	152.4	130.6	114.3	101.6	91.5	83.1	76.2	70.3	65.3	61.0	57.2	53.8	50.8	48.1	45.7
No. 4	5/8	356.0	237.3	178.0	142.4	118.7	101.7	89.0	79.1	71.2	64.7	59.3	54.8	50.9	47.5	44.5	41.9	39.6	37.5	35.6
No. 5	3/4	286.8	191.2	143.4	114.7	95.6	81.9	71.7	63.7	57.4	52.1	47.8	44.1	41.0	38.2	35.8	33.7	31.9	30.2	28.7
No. 6	7/8	229.6	153.1	114.8	91.8	76.5	65.6	57.4	51.0	45.9	41.7	38.3	35.3	32.8	30.6	28.7	27.0	25.5	24.2	23.0
No. 7	1	200.3	133.5	100.1	80.1	66.8	57.2	50.1	44.5	40.1	36.4	33.4	30.8	28.6	26.7	25.0	23.6	22.3	21.1	20.0
No. 8	1 1/8	172.0	114.7	86.0	68.8	57.3	49.1	43.0	38.2	34.4	31.3	28.7	26.5	24.6	22.9	21.5	20.2	19.1	18.1	17.2
No. 9	1 1/4	154.7	103.1	77.3	61.9	51.6	44.2	38.7	34.4	30.9	28.1	25.8	23.8	22.1	20.6	19.3	18.2	17.2	16.3	15.5
No.10	1 1/2	82.0	54.7	41.0	32.8	27.3	23.4	20.5	18.2	16.4	14.9	13.7	12.6	11.7	10.9	10.3	9.7	9.1	8.6	8.2
No.11	1 5/8	78.7	52.4	39.3	31.5	26.2	22.5	19.7	17.5	15.7	14.3	13.1	12.1	11.2	10.5	9.8	9.3	8.7	8.3	7.9

Bar Size	Drill Dia.	Number of Installations of Smooth Coated Reinforcing Bar in Solid Base Materials																		
		Hole Depth (inches)																		
(in.)	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3/4	7/8	240.7	160.5	120.4	96.3	80.2	68.8	60.2	53.5	48.1	43.8	40.1	37.0	34.4	32.1	30.1	28.3	26.7	25.3	24.1
7/8	1	209.2	139.5	104.6	83.7	69.7	59.8	52.3	46.5	41.8	38.0	34.9	32.2	29.9	27.9	26.2	24.6	23.2	22.0	20.9
1	1 1/8	177.3	118.2	88.7	70.9	59.1	50.7	44.3	39.4	35.5	32.2	29.6	27.3	25.3	23.6	22.2	20.9	19.7	18.7	17.7
1 1/4	1 3/8	144.1	96.0	72.0	57.6	48.0	41.2	36.0	32.0	28.8	26.2	24.0	22.2	20.6	19.2	18.0	16.9	16.0	15.2	14.4
1 1/2	1 5/8	123.3	82.2	61.6	49.3	41.1	35.2	30.8	27.4	24.7	22.4	20.5	19.0	17.6	16.4	15.4	14.5	13.7	13.0	12.3

Rod Size	Drill Dia.	Number of Installations of Threaded Rod Using Screen Tubes in Hollow Base Materials																		
		Hole Depth (inches)																		
(in.)	(in.)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1/4	3/8	488.0	325.3	244.0	195.2	162.7	139.4	122.0	108.4	97.6	88.7	81.3	75.1	69.7	65.1	61.0	57.4	54.2	51.4	48.8
3/8	1/2	323.4	215.6	161.7	129.4	107.8	92.4	80.8	71.9	64.7	58.8	53.9	49.8	46.2	43.1	40.4	38.0	35.9	34.0	32.3
1/2	5/8	235.2	156.8	117.6	94.1	78.4	67.2	58.8	52.3	47.0	42.8	39.2	36.2	33.6	31.4	29.4	27.7	26.1	24.8	23.5
5/8	3/4	185.0	123.3	92.5	74.0	61.7	52.8	46.2	41.1	37.0	33.6	30.8	28.5	26.4	24.7	23.1	21.8	20.6	19.5	18.5
3/4	7/8	149.0	99.3	74.5	59.6	49.7	42.6	37.2	33.1	29.8	27.1	24.8	22.9	21.3	19.9	18.6	17.5	16.6	15.7	14.9
3/4	1	48.0	83.9	62.9	50.3	41.9	35.9	31.5	28.0	25.2	22.9	21.0	19.4	18.0	16.8	15.7	14.8	14.0	13.2	12.6

Tabulated values for hollow base materials are based on 25% waste. Actual usage may vary.

ADHESIVES

PowerFoam™ *Expanding Polyurethane Foam*

PRODUCT DESCRIPTION

PowerFoam is a single component, moisture curing expanding polyurethane foam. The adhesive strength of PowerFoam allows it to be set on various types of building elements including concrete, brick, wood, metal, aluminum and steel. When installing the foam, consideration should be given to the two fold expansion of the foam after it leaves the plastic tube. The surface of the foam initially dries within 1-4 hours and becomes fully cured in 12-15 hours. The foam works best at room temperature. It is dispensed through a straw-like plastic tube that is packaged with the can. The structure of the hardened foam provides excellent insulation against heat and noise. The foam has a R-5 value when used in place of traditional installation methods.

GENERAL APPLICATIONS AND USES

PowerFoam is used in applications where it is not necessary to control the size of the bead or the rate of flow. PowerFoam can be used in a wide variety of applications. Use it to fill, seal or insulate. It blocks drafts, stops leaks, saves energy, adheres to all types of construction material, deadens sound, acts as a buoyancy material once cured, controls radon, confines asbestos fibers, and can be used in HVAC applications. PowerFoam also seals and keeps out insects and rodents. After installation, it is recommended that a full 24 hours elapse prior to scraping, sanding staining or painting.

Insulating

- Around window frames, sills, door frames floor/wall joints
- Refrigeration units and pipes
- Electrical junction boxes
- Attics
- Air conditioning systems

Filling

- Breaches in walls
- Sound Dampening
- Voids in concrete forms
- Pipe penetrations in non-fire rated walls
- Underground ductwork

FEATURES AND BENEFITS

- CFC free propellant
- Class B3 Flame retardant
- Physiologically harmless when fully cured
- Contains no urea formaldehyde or PCB's
- Does not rot or deteriorate with age
- Water Resistant
- Neutral odor
- High foam yield – up to 1.6ft^3 per 29 oz. can
- Precision plastic valve helps prevent pressure loss and prolongs shelf life
- Stop and Go application product remains liquid in applicator until dispensed
- Minimal subsequent expansion (± 10%)
- Compatible with PVC

APPROVALS AND LISTINGS

Underwriters Laboratory (UL Listing) – File No. R16754, Caulkings and Sealants

- Tested in accordance with UL 723 "Test for Surface Burning Characteristics of Building Materials"
- Applied to Inorganic Reinforced Cement Board tested as applied in two 1" diameter beads, 8" OC covering 11.1 percent of the exposed test area:
  Flame spread 15
  Smoke developed 15

Tested in accordance with ASTM E 90 (Sound Transmission Classification 60), ASTM C 518 and ASTM C 423

DIN Standard 4102 Part 1, Section 6.2.5.2 – Test Certificates PZ IV/00-063 & PZ IC/00-068

SECTION CONTENTS Page No.

PowerFoam

CAN SIZES

12 oz.
29 oz.

SUITABLE BASE MATERIALS

Concrete
Masonry
Wood
Metal
Aluminum
Steel

ADHESIVES

TECHNICAL DATA

Volume yield	12 oz.: 1,035 - 1,125 in^3 or 0.60 - 0.65 ft^3 (16-18 liters) 29 oz.: 2,420 - 2,765 in^3 or 1.4 - 1.6 ft^3 (40-45 liters)
Density (of foamed product)	1.25 lb/ft^3
Application temperature	32°F (0°C) minimum for application surfaces
Tack free time	5 - 10 minutes (depending on temperature and humidity)
Cutting time	15 - 20 minutes (depending on temperature and humidity)
Initial drying time	1 - 4 hours (depending on temperature and humidity)
Full curing time	12 - 15 hours (depending on temperature and humidity)
Water absorption	Max. 1% by volume
Temperature resistance on cured product	-8°F to +212°F
Compressive strength	1.0 psf
Elongation at breakage	20 - 25%
Contents	12 oz. (375g) or 29 oz. (900g) Net Weight
Shelf life	24 months (50°F to 70°F) higher temperature = shorter shelf life (must be stored in vertical position)

INSTALLATION PROCEDURES

- Remove any dirt, dust, grease and any other loose debris from the building elements surface prior to applying PowerFoam. It is helpful to dampen the surface to enhance PowerFoam's ability to bond prior to dispensing.
- Attached to the aerosol can's cap is a straw-like plastic tube and valve trigger adapter. Remove the cap, plastic tube and valve trigger adapter to reveal the valve stem protruding from the top of the aerosol can. Connect the plastic tube to the valve trigger adapter and the valve trigger adapter to the valve stem. Shake can well and follow the arrows on the label indicating the direction of use. Turn the can over as suggested by the arrows shown on the label. The connected valve trigger adapter and plastic tube are now effectively at the “bottom” of the can.
- Dispense the contents of the can by pressing the valve trigger adapter inward toward the body of the can. If the entire foam contents of the can are not exhausted and the installer wishes to use at a later time, then the valve stem, valve trigger adapter and plastic tube should be immediately cleaned with Powers' Triggerfoam Cleaner while the foam remains in a wet, uncured state. TriggerFoam Cleaner should be shaken well before use. Dried foam can only be removed mechanically. Completely emptied cans of PowerFoam can be discarded with common construction waste.

ORDERING INFORMATION

PowerFoam

Cat. No.	Description	Standard Box	Standard Carton
8130	PowerFoam 12 oz.	12	12
8132	PowerFoam 29 oz.	12	12

TriggerFoam™ *Polyurethane Expanding Foam*

PRODUCT DESCRIPTION

TriggerFoam is a one part polyurethane expanding foam which sets into its final form by using moisture present in the air. When installing the foam, consideration should be given to the two fold expansion of the foam after it leaves the nozzle. The surface of the foam initially dries within 1-4 hours and becomes fully cured in 12-15 hours. TriggerFoam sets well on ordinary surfaces such as concrete, brick, metal, etc. Surfaces do not require preparation and can also be damp. After installation, it is recommended that a full 24 hours elapse prior to scraping, sanding, staining or painting. The foam has a R-5 value when used in place of traditional installation methods.

GENERAL APPLICATIONS AND USES

TriggerFoam is dispensed through a special gun that allows the user to control the rate of flow as well as the size of the bead for more precise placement of the product, allowing it to be used in a wide variety of applications. Use it to fill, seal or insulate. It blocks drafts, stops leaks, saves energy, adheres to all types of construction materials, deadens sound, acts as a buoyancy material once cured, controls radon, confines asbestos fibers, and can be used in HVAC applications.

Insulating

- Around window frames, sills, door frames floor/wall joints
- Refrigeration units and pipes
- Electrical junction boxes
- Attics
- Air conditioning systems

Filling

- Breaches in walls
- Sound Dampening
- Voids in concrete forms
- Pipe penetrations in non-fire rated walls
- Underground ductwork

FEATURES AND BENEFITS

- CFC free propellant
- Class B3 Flame retardant
- Physiologically harmless when fully cured
- Contains no urea formaldehyde or PCB's
- Does not rot or deteriorate with age
- Neutral odor
- High foam yield – up to 1.6ft^3 per 29 oz. can
- Easily adjustable applicator can dispense foam beads as small as 1/8”
- Hardened steel dispenser tip for longer life on metal tool
- Precision plastic valve helps prevent pressure loss and prolongs shelf life
- Stop and go application product remains liquid in applicator until dispensed
- Minimal subsequent expansion (± 10%)
- Compatible with PVC
- VOC

APPROVALS AND LISTINGS

Underwriters Laboratory (UL Listing) – File No. R16754, Caulkings and Sealants
- Tested in accordance with UL 723 “Test for Surface Burning Characteristics of Building Materials”
- Applied to Inorganic Reinforced Cement Board tested as applied in two 1" diameter beads, 8" OC covering 11.1 percent of the exposed test area:
  Flame spread 15
  Smoke developed 15

Tested in accordance with ASTM E 90 (Sound Transmission Classification 60), ASTM C 518 and ASTM C 423

DIN Standard 4102 Part 1, Section 6.2.5.2 – Test Certificates PZ IV/00-063 & PZ IC/00-068

SECTION CONTENTS Page No.

TriggerFoam

CAN SIZES

29 oz.

SUITABLE BASE MATERIALS

Concrete
Masonry
Wood
Metal
Aluminum
Steel

TECHNICAL DATA

Volume yield	29 oz.: 2,420 - 2,765 in³ or 1.4 - 1.6 ft³ (40-45 liters)
Density (of foamed product)	1.44 lb/ft³
Application temperature	32°F (0°C) minimum for application surfaces
Tack free time	5 - 10 minutes (depending on temperature and humidity)
Cutting time	15 - 20 minutes (depending on temperature and humidity)
Initial drying time	1 - 4 hours (depending on temperature and humidity)
Full curing time	12 - 15 hours (depending on temperature and humidity)
Water absorption	Maximum 1% by volume
Temperature resistance on cured product	-8°F to +212°F
Compressive strength	1.0 psf
Elongation at breakage	20 - 25%
Contents	29 oz. (900g) Net Weight
Shelf life	24 months (50°F to 70°F) Higher temperature = shorter shelf life (must be stored in vertical position)

INSTALLATION PROCEDURES

- Remove any dirt, dust, grease and any other loose debris from the building elements surface prior to applying TriggerFoam. It is helpful to dampen the surface to enhance TriggerFoam's ability to bond prior to dispensing.
- Remove the cap of the aerosol can to reveal the plastic threaded connection and valve stem. Select a TriggerFoam Gun and attach to the can by engaging the gun's matching threads and turning clockwise until tightened. Be careful not to overtighten.
- Shake can well and follow the arrows on the label indicating the direction of use. Turn the can over as suggested by the arrows. The TriggerFoam Gun is now effectively at the "bottom" of the can.
- Prior to dispensing TriggerFoam, open the screw located at the rear of the gun by turning counterclockwise (initially about 1/4 turn), and then pull the trigger. Adjusting the screw will control the size of the dispensed bead of foam. Varying pressure on the trigger will control the rate of flow. Caution: do not completely remove the screw at the rear of the gun while connected to a "live" can of TriggerFoam.
- It is not necessary to exhaust the entire contents of the can. When finished applying TriggerFoam, the screw at the rear of the gun can be tightened to halt further flow. Do not remove the TriggerFoam gun from the can. Peeling cured foam off the end of the gun's nozzle and reopening the screw allows for use of the remaining contents at a later time.
- While the application is ongoing, remove the exhausted can and immediately mount a new can of TriggerFoam onto the gun while it still contains wet, uncured foam. When the job is done and the last can of TriggerFoam is exhausted, immediately unscrew the gun from the can and attach a well-shaken can of TriggerFoam Cleaner. Two or three quick squirts of TriggerFoam Cleaner through the gun while the foam is sill wet and uncured is recommended to keep the gun clean and ready for the next application. Completely emptied cans of TriggerFoam can be discarded with common construction waste. Cured foam can only be removed mechanically.

ORDERING INFORMATION

TriggerFoam

Cat. No.	Description	Standard Box	Standard Carton
8136	TriggerFoam 29 oz.	12	12

TriggerFoam Tools and Accessories

Cat. No.	Description	Standard Box	Standard Carton
8137	TriggerFoam Subfloor Gun 22"	1	1
8139	TriggerFoam Plastic Gun	1	1
8140	TriggerFoam Gun	1	1

Cleaner

Cat. No.	Description	Standard Box	Standard Carton
8142	TriggerFoam Cleaner 20 oz.	12	12

PowerStick™ *Adhesive Sealant*

PRODUCT DESCRIPTION

PowerStick is a one-component universal adhesive/sealant based on proprietary MS Polymer chemistry. PowerStick is the first professional grade product on the market that delivers high bond strength and superior flexibility.

PowerStick does not shrink, can be applied on wet surfaces, is virtually odorless and has excellent UV resistance. PowerStick also features high aggressive initial tack, is non-reactive with the substrate and can be painted after curing.
In short, PowerStick can be used on virtually any substrate, indoors of outdoors and removes the guesswork by having one universal product solution for all applications.

PowerStick is non-hazardous, safe for the environment and does not require special shipping procedures. It does not contain solvents, isocyanates and is VOC compliant. Cleaning up is easy with just soap and warm water or mineral spirits.

SECTION CONTENTS Page No.

PowerStick

CARTRIDGE SIZES

7 oz.
10 oz.

COLORS

White
Gray

GENERAL APPLICATIONS AND USES

Caulks

- Tubs
- Showers
- Tiles
- Floor Seams
- Sinks
- Mouldings
- Foundations
- Thresholds
- Sills
- Pipe
- Trim

Bonds

- Masonry
- Brass
- Tile
- Steel
- Canvas
- Drywall
- Porcelain
- Wood
- Aluminum
- Ceramic
- Plywood
- Foam Board
- Concrete
- Copper
- Glass
- Marble
- Fiberglass

Seals

- Gutters
- Doors
- Windows
- Small cracks
- Ductwork
- Joints

GENERAL APPLICATIONS AND USES

- Elastic properties — can be used as a sealant for filling cracks and joints
- No harmful components, solvent free and is VOC compliant
- Can be shipped without restriction and is environmentally friendly
- Inert formula will not interact with substrates such as metal trim, silver lining on mirrors or foam insulation board
- Works on virtually every base material
- Latex-base formula is not affected by water, moisture of mildew during service
- UV resistant formula is suitable for outdoor use
- Superior initial tack (grab)
- Accepts primer and paint unlike silicone based sealants

TECHNICAL DATA

Base	Proprietary MS Polymer
Shelf life	14 months in unopened package (when stored in a cool dry place, 41°F to 86°F). Short term storage temperature should not exceed 110°F (43°C).
Curing system	One-component moisture cure
Full cure/Bonding	Less than 24 hours (full cure of bonding later of 0.0788-inch)
Tack free time	Approximately 15 minutes (depending on temperature and humidity)
Skin formation	5 to 7 minutes (depending on temperature and humidity)

Base	Proprietary MS Polymer
Freeze/Thaw stability	No impact on sealant by frost
Application temperature	34°F to 95°F (1°C to 35°C)
In-Service temperature	-40°F to 194°F (-40°C to 90°C)
Ideal storage temperature	41°F to 86°F (5°C to 30°C)
Density	0.94 oz./in^3 (1.62 g/ml)
Hardness	50 + 5 Shore A
Elasticity modulus (100%)	109 psi (0.75 MPa) per DIN 53504
Tear strength	290 psi (2.0 MPa) per DIN 53504
Maximum elongation	20%

INSTALLATION GUIDELINES AND SUGGESTED USE

Application

- Method: Finger tip control or caulking gun.
- Cleaning: Warm water and soap or mineral spirits immediately after application and before curing
- Tooling: Clean with soapy solution before skin formation

Installation Preparation

- PowerStick should be applied to surfaces that are clean and free of dust, dirt and grease.

Health and Safety

- Hand and eye protection is highly recommended. As with all adhesives, consult the MSDS.

Chemical Resistance

- Good resistance to aquatic solutions with a pH range between 5 and 9. Preliminary compatibility tests should be conducted for aquatic solutions with higher pH.
- Good resistance to water, aliphatic solvents, mineral oils, grease, diluted inorganic acids and alkalis.
- Good resistance to mineral oils and grease.
- Some resistance to aromatic solvents, concentrated acids, chlorinated hydrogens.

Curing Process

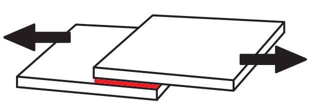
- PowerStick is a moisture cure system. In bonding applications, one of the surfaces should be porous to allow for air and/or moisture to transfer to the adhesive for normal curing speed. If two non-porous surfaces are bonded together with PowerStick, full curing time may require several days depending on the application and the project conditions.

Special Applications

- PowerStick should not be installed in submerged conditions for load bearing applications.
- PowerStick may be painted, however, due to the large number of paints and varnishes available a compatibility test before application is strongly suggested. The drying time of alkyd resin based paints may increase.
- PowerStick can be applied to a wide variety of substrates. Performance with specific substrates, such as plastics, polycarbonates, etc, may differ according to manufacturer, therefore it is suggested that preliminary compatibility tests be conducted.

PERFORMANCE DATA

Lap Shear Bond Strength



The bond strength capacities listed below are for the lap shear strength traction of the PowerStick used with different substrates.

Metals

Building Material	Bond Strength psi (MPa)
Steel	127 (0.88)
Aluminum	109 (0.75)
Copper	144 (0.99)
Brass	81 (0.56)
Galvanized Steel	116 (0.80)

Masonry

Building Material	Bond Strength psi (MPa)
Brick	112 (0.77)
Hollow Block	112 (0.77)
Block	112 (0.77)

Concrete

Building Material	Bond Strength psi (MPa)
Concrete	128 (0.88)

Wood

Building Material	Bond Strength psi (MPa)
Oak	131 (0.90)
Beech	134 (0.92)
Pine	125 (0.86)
Douglas Fir	125 (0.86)
Cedar	125 (0.86)

Plastics

Building Material	Bond Strength psi (MPa)
Epoxy (Typ.)	118 (0.81)
Polystyrene	112 (0.77)
Makrolon (PC)	128 (0.88)
PVC	76 (0.52)
PA6	123 (0.85)
PMMA	95 (0.66)
ABS	119 (0.82)

Yield: 7 fl. oz. = 12.6 in.^{3} (21.5 Lineal Feet with 1/4" bead)
10 fl. oz. = 18 in.^{3} (30.5 Lineal Feet with 1/4" bead)

ORDERING INFORMATION

PowerStick Cartridges

Cat. No.	Size	Color	Dispenser	Standard Box
8166	10 oz.	White	Caulk Gun	12
8168	10 oz.	Gray	Caulk Gun	12
8170	7 oz.	White	Press Pack	12
8172	7 oz.	Gray	Press Pack	12

Caulking Guns for PowerStick

Cat. No.	Description	Standard Box	Standard Carton
8437	Manual Caulking Gun	1	1
8463	High Performance Manual Tool	1	1

WALL ANCHORS

SECTION CONTENTS

WALL ANCHOR SELECTION GUIDE

	Anchor Category	Metal					Plastics						
	Product	Wall-Dog	Scru-Lead	Toggle-Bolt	Polly	Legs	Strap-Toggle	Zip-It (Also Available in Zinc)	Zip-Toggle	Poly-Toggle	Pop Toggle	Bantam Plug	Fluted Plastic
	Page	271	274	276	279	282	283	285	287	288	290	291	293
Base Material	Concrete	■	■							■	□	■	■
	Lightweight Concrete	□	□							□	□	□	□
	Hollow Core Plank	■	□	■	□		■			□	□	□	□
	Grout-filled Concrete Masonry	■	□							□	□	□	□
	Hollow Concrete Masonry	■	□	■	■		■			■	□	□	□
	Solid Brick	■	■							□	□	■	□
	Hollow Brick	□	□	□			□			□	□	□	□
	Stone		□							□	□		
	Structural Clay Tile			□	□		□			□	□		
	Plywood	■		■	■		□	□		□	■		
	Wallboard /Plaster	■		■	■	■	■	■	■	■	■	■	□
Anchor Diameter	No. 4 Screw												■
	No. 5 Screw												■
	No. 6 Screw		■			■		■	■	■	■	■	■
	No. 7 Screw		■			■		■		■	■	■	■
	No. 8 Screw		■			■		■		■	■	■	■
	No. 9 Screw									■	■	■	■
	No. 10 Screw		■				■				■	■	■
	No. 12 Screw		■				■				■	■	■
	No. 14 Screw		■				■					■	■
	No. 16 Screw		■									■	
	No. 18 Screw		■										
	1/8"			■	■								
	3/16"			■	■		■						
	1/4"	■		■	■		■						
	5/16"			■									
	3/8"			■			■						
	1/2"			■			■						
Head Style	Finished (Hex) Head			■	■								
	Round Head			■					■				
	Flat Head (Countersunk)			■	■								
	Mushroom Head	■		■	■							■	
	Removable	■						■					
Working Load	Under 400 lbs.	■	■	■	■	■	■	■	■	■	■	■	■
	400 lbs. to 4,000 lbs.			■			■						
	Over 4,000 lbs.												
Coating/ Material	Coated / Plated Carbon Steel	■		■	■	■	■						
	Zamac Alloy							■					
	Nylon / Plastic						■	■	■	■	■	■	■
	Lead		■										

WALL ANCHORS

Wall-Dog™ *Universal Light Duty Anchor*

PRODUCT DESCRIPTION

The Wall-Dog is an all steel, one-piece screw anchor, which features high-profile threads for easy fastening into wallboard and other masonry base materials. The deep cutting, corkscrew-like threads provide for smooth entry and a powerful hold. When removed, the Wall-Dog leaves a much smaller hole than toggles or other systems. For aesthetic appearances, the Wall-Dog is available in two color finishes: white and chrome; and in two head styles: pan and oval. For fastening into wallboard or wood, no pre-drilling is required – the anchor is inserted through the fixture and screwed in with an ordinary Phillips screwdriver. Fastening into concrete, hollow or grout-filled concrete masonry, brick and plaster requires a pre-drilled hole using a 3/16" ANSI bit. Wall-Dog anchors are ideal for light to medium duty anchoring. Typical applications include lightweight fixtures, drapery supports, as well as electrical, telephone and cable accessories.

FEATURES AND BENEFITS

- Installs in a variety of base materials.
- Installs directly through fixtures into wallboard – no second step is required
- When removed the Wall-Dog leaves a much smaller hole than toggles or other systems
- Thread design prevents spinning and stripping
- Heat treated point penetrates metal and wood studs
- Two finished heads, oval and pan
- Two colors, chrome & white head
- No pilot hole required for wallboard
- Can be easily backed out of hole
- No hole spotting required

MATERIAL SPECIFICATIONS

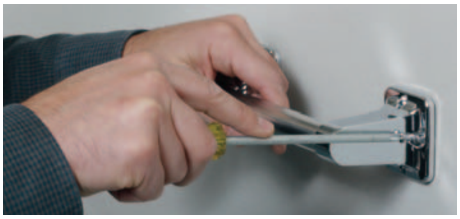
Anchor Component	Component Material	
	Chrome Wall-Dog	White Head Wall-Dog
Anchor Body	Carbon Steel – AISI 1018	Carbon Steel – AISI 1018
Plating	Decorative Chrome	Screw Head – White Screw Body – Zinc

INSTALLATION SPECIFICATIONS

ANSI Drill Bit Size, d_{bit} (in.)	3/16 (Required for concrete, masonry and plaster)
Head Size	No. 8
Driver	No. 2 Phillips

Installation Guidelines

For fastening into wallboard or wood, no pre-drilling is required. The anchor is inserted through the fixture and screwed in with an ordinary Phillips screwdriver.



Fastening into concrete, grout-filled or hollow block, brick or plaster requires a 3/16" pre-drilled hole using a carbide tipped drill bit.

SECTION CONTENTS Page No.

Wall-Dog Chrome, Pan Head

Wall-Dog Chrome, Oval Head

Wall-Dog White, Pan Head

Wall-Dog White, Oval Head

ANCHOR MATERIALS

Carbon Steel

ANCHOR SIZE RANGE (TYP.)

1/4" Diameter with No. 8 Head

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Grout-Filled Concrete Masonry
Hollow Concrete Masonry
Brick Masonry
Wallboard
Plywood
Plaster

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Wall-Dog in Normal-Weight Concrete[1]

Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength $f'_c \geq$ 4,000 psi (27.6 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	3/4 (19.1)	350 (1.6)	1,030 (4.6)	90 (0.4)	260 (1.2)
	1 (25.4)	700 (3.2)	1,070 (4.8)	175 (0.8)	270 (1.2)

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

Ultimate Load Capacities for Wall-Dog in Wallboard and Plywood[1]

Anchor Diameter *d* in. (mm)	1/2" Wallboard		5/8" Wallboard		3/4" Plywood	
	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	85 (0.4)	245 (1.1)	135 (0.6)	360 (1.6)	255 (1.1)	600 (2.7)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.

WALL ANCHORS

Allowable Load Capacities for Wall-Dog in Wallboard and Plywood[1]

Anchor Diameter *d* in. (mm)	1/2" Wallboard		5/8" Wallboard		3/4" Plywood	
	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	20 (0.1)	60 (0.3)	35 (0.2)	90 (0.4)	65 (0.3)	150 (0.7)

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

Ultimate Load Capacities for Wall-Dog in Grout-Filled, Hollow Concrete Masonry and Structural Brick Masonry[1]

Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Anchor Location	Grout-Filled Concrete Masonry ASTM C 90		Hollow Concrete Masonry ASTM C 90		Brick Masonry	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	3/4 (19.1)	Center of Masonry Unit	–	–	–	–	400 (1.8)	650 (2.9)
	3/4 (19.1)	T-Joint	–	–	–	–	350 (1.6)	600 (2.7)
	1 (25.4)	Center of Masonry Unit	285 (1.3)	825 (3.7)	305 (1.4)	825 (3.7)	600 (2.7)	900 (4.1)
	1 (25.4)	T-Joint	290 (1.3)	915 (4.1)	290 (1.3)	915 (4.1)	380 (1.7)	825 (3.7)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 5.0 or greater to determine the allowable working load.

PERFORMANCE DATA

Allowable Load Capacities for Wall-Dog in Grout-Filled, Hollow Concrete Masonry and Structural Brick Masonry[1]

Anchor Diameter	Minimum Embedment Depth	Anchor Location	Grout-Filled Concrete Masonry ASTM C 90		Hollow Concrete Masonry ASTM C 90		Brick Masonry	
d in. (mm)	h_v in. (mm)		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	3/4 (19.1)	Center of Masonry Unit	–	–	–	–	80 (0.4)	130 (0.6)
	3/4 (19.1)	T-Joint	–	–	–	–	70 (0.3)	120 (0.5)
	1 (25.4)	Center of Masonry Unit	55 (0.2)	165 (0.7)	60 (0.3)	165 (0.7)	120 (0.5)	180 (0.8)
	1 (25.4)	T-Joint	60 (0.3)	185 (0.8)	60 (0.3)	185 (0.8)	75 (0.3)	165 (0.7)

1. Allowable load capacities listed are calculated using an applied safety factor of 5.0.

ORDERING INFORMATION

Wall-Dog Light Duty Anchor

Catalog Number		Description	Standard Box	Standard Carton
Oval Head	Pan Head			
2314	2316	Wall-Dog Chrome	100	1,000
2328	2330	Wall-Dog White Head	100	1,000

Wall-Dog Master Pack

Catalog Number		Description	Standard Box
Oval Head	Pan Head		
2317	2315	Wall-Dog Chrome Master Pack	5,000
2329	2331	Wall-Dog White Head Master Pack	5,000

Wall-Dog Kit (Screwdriver)

Catalog Number	Description	Standard Box	Standard Carton
2289	Wall-Dog Kit with Screwdriver	1	10

Screwdriver packaged with 50 Chrome Pan Head anchors and one No. 2 Phillips Screwdriver

Wall-Dog Kit (Bit)

Catalog Number	Description	Standard Box	Standard Carton
2332	Wall-Dog Kit with Drill Bit	1	10

Bit packaged with 50 Chrome Pan Head anchors and 3/16" Straight Shank Bit

Scru-Lead™ *Wall Anchor*

PRODUCT DESCRIPTION

The Scru-Lead anchor is designed for use with sheet metal or wood screws in concrete, block or brick. The anchor is made entirely of lead alloy which is soft enough for easy installation, yet hard enough to give sure, secure holding power. The performance of this product depends on the integrity of the base material. The anchor is recommended for light duty applications where holding power is not a critical factor. It should not be used overhead.

SECTION CONTENTS Page No.

Scru-Lead

FEATURES AND BENEFITS

- Can be used in a variety of base materials
- Anchor body is corrosion resistant

MATERIAL SPECIFICATIONS

Anchor Component	Component Material
Anchor Body	Antimonial Lead

ANCHOR MATERIAL

Lead Alloy

ANCHOR SIZE RANGE (TYP.)

No. 6-8 screw x 3/4" length to
No. 16-18 screw x 1 1/2" length

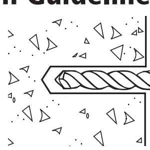
SUITABLE BASE MATERIALS

Normal-Weight Concrete
Concrete Masonry
Solid or Hollow Brick Masonry

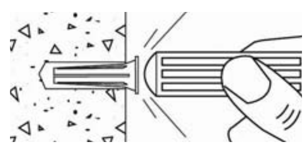
INSTALLATION SPECIFICATIONS

Dimension	Screw Size #6-#8	#10-#14	#16-#18
ANSI Drill Bit Size, d_{bit} (in.)	1/4	5/16	3/8
Flange Size (in.)	25/64	1/2	37/64
Screw Size Range	#6-#8	#10-#14	#16-#18

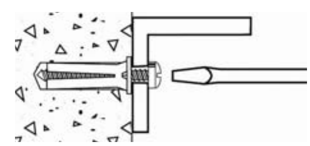
Installation Guidelines



Drill a hole into the base material to the depth of embedment required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



Blow the hole clean of dust and other material. Insert the anchor into the hole until the flange is seated flush with the surface of the base material.



Position the fixture. Insert the screw tip through the fixture into the anchor and tighten.

PERFORMANCE DATA

Ultimate Load Capacities for Scru-Lead in Normal-Weight Concrete[1,2]

Screw Size Range d	Minimum Embedment Depth h_v in. (mm)	2,000 psi (13.8 MPa) Tension lbs. (kN)	2,000 psi (13.8 MPa) Shear lbs. (kN)	4,000 psi (27.6 MPa) Tension lbs. (kN)	4,000 psi (27.6 MPa) Shear lbs. (kN)	6,000 psi (41.4 MPa) Tension lbs. (kN)	6,000 psi (41.4 MPa) Shear lbs. (kN)
		Minimum Concrete Compressive Strength (f'_c)					
#6-#8	3/4 (19.1)	160 (0.7)	215 (1.0)	280 (1.3)	215 (1.0)	280 (1.3)	215 (1.0)
#6-#8	1 (25.4)	220 (1.0)	215 (1.0)	345 (1.6)	215 (1.0)	345 (1.6)	215 (1.0)
#6-#8	1 1/2 (38.1)	350 (1.6)	215 (1.0)	460 (2.1)	215 (1.0)	460 (2.1)	215 (1.0)
#10-#14	1 (25.4)	580 (2.6)	575 (2.6)	810 (3.6)	575 (2.6)	810 (3.6)	575 (2.6)
#10-#14	1 1/2 (38.1)	800 (3.6)	575 (2.6)	1,000 (4.5)	575 (2.6)	1,000 (4.5)	575 (2.6)
#16-#18	1 1/2 (38.1)	920 (4.1)	1,200 (5.4)	1,260 (5.7)	1,200 (5.4)	1,260 (5.7)	1,200 (5.4)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.

PERFORMANCE DATA

Allowable Load Capacities for Scru-Lead in Normal-Weight Concrete[1,2]

Screw Size Range *d*	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
#6 - #8	3/4 (19.1)	40 (0.2)	55 (0.2)	70 (0.3)	55 (0.2)	70 (0.3)	55 (0.2)
#6 - #8	1 (25.4)	55 (0.2)	55 (0.2)	85 (0.4)	55 (0.2)	85 (0.4)	55 (0.2)
#6 - #8	1 1/2 (38.1)	90 (0.4)	55 (0.2)	115 (0.5)	55 (0.2)	115 (0.5)	55 (0.2)
#10 - #14	1 (25.4)	145 (0.7)	145 (0.7)	205 (0.9)	145 (0.7)	205 (0.9)	145 (0.7)
#10 - #14	1 1/2 (38.1)	200 (0.9)	145 (0.7)	250 (1.1)	145 (0.7)	250 (1.1)	145 (0.7)
#16 - #18	1 1/2 (38.1)	230 (1.0)	300 (1.4)	315 (1.4)	300 (1.4)	315 (1.4)	300 (1.4)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.

Ultimate and Allowable Load Capacities for Scru-Lead in Hollow Concrete Masonry[1,2]

Screw Size Range *d*	Minimum Embedment Depth h_v in. (mm)	$f'_m \geq$ **1,500 psi** (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
#6 - #8	3/4 (19.1)	70 (0.3)	200 (0.9)	15 (0.1)	40 (0.2)
#10 - #14	1 (25.4)	410 (1.8)	520 (2.3)	80 (0.4)	105 (0.5)
#16 - #18	1 1/2 (38.1)	740 (3.3)	1,000 (4.5)	150 (0.7)	200 (0.9)

1. Tabulated load values are for anchors installed in minimum 6-inch wide, Grade N, Type II, medium and normal-weight concrete masonry units. Mortar must be minimum Type N.
2. Allowable loads are for carbon and stainless steel anchors and are based on average ultimate values using a safety factor of 5.0.

Ultimate and Allowable Load Capacities for Scru-Lead in Solid and Hollow Clay Brick Masonry[1,2]

Screw Size Range *d*	Minimum Embedment Depth h_v in. (mm)	$f'_m \geq$ **1,500 psi** (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
#6 - #8	3/4 (19.1)	95 (0.4)	200 (0.9)	20 (0.1)	40 (0.2)
#10 - #14	1 (25.4)	340 (1.5)	520 (2.3)	70 (0.3)	105 (0.5)
#16 - #18	1 1/2 (38.1)	890 (4.0)	1,000 (4.5)	180 (0.8)	200 (0.9)

1. Tabulated load values are for anchors installed in Grade SW, solid brick masonry conforming to ASTM C62.
2. Allowable loads are calculated using an applied safety factor of 5.0.

ORDERING INFORMATION

Scru-Lead

Cat. No.	Anchor Size	Drill Diameter	Std. Box	Std. Carton	Wt./100
9409	#6 - #8 x 3/4"	1/4"	100	1,000	1 1/4
9414	#6 - #8 x 1"	1/4"	100	1,000	1 1/2
9419	#6 - #8 x 1 1/2"	1/4"	100	1,000	2
9429	#10 - #14 x 1"	5/16"	100	1,000	2
9439	#10 - #14 x 1 1/2"	5/16"	100	1,000	3
9460	#16 - #18 x 1 1/2"	3/8"	25	250	4 1/2

Master Carton

Cat. No.	Anchor Size	Drill Diameter	Std. Carton	Wt./100
9430	#10 - #14 x 1"	5/16"	1,000	2

WALL ANCHORS

Toggle Bolt *Hollow Wall Anchor*

PRODUCT DESCRIPTION

The Toggle Bolt is a spring wing type hollow wall anchor designed for use in block, wallboard and other hollow base materials. The Toggle Bolt is a two-part assembly consisting of a machine screw and a spring wing toggle. Sizes range from 1/8" diameter x 2" length to 1/2" diameter x 6" length with combo round, flat mushroom, tie-wire or slotted hex head styles.

FEATURES AND BENEFITS

- Adjustable to accommodate various wall thickness up to 2 1/2"
- Easy to use and works in a variety of base materials

MATERIAL SPECIFICATIONS

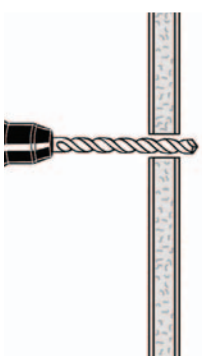
Anchor Component	Component Material
Wing	AISI 1010
1/8"-3/8" Trunion Nut	AISI 1010
1/2" Trunion Nut	Zamac Alloy
Bolt	Carbon Steel – ANSI B18.6.3
Zinc Plating	ASTM B633, SC1, Type III, (Fe/Zn 5)

INSTALLATION SPECIFICATIONS

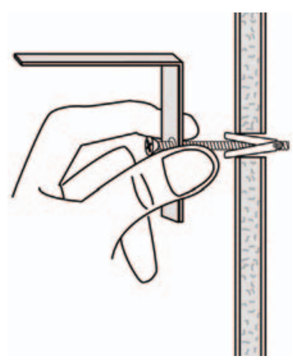
Dimension	Anchor Diameter, *d*					
	1/8"	3/16"	1/4"	5/16"	3/8"	1/2"
ANSI Drill Bit Size, d_{bit} (in.)	3/8	1/2	5/8	7/8	7/8	1 1/4
Wing Clearance (in.)	1 1/16	1 3/8	1 1/2	2 1/8	2 1/8	3
Thread Size (UNC)	6-32	10-24	1/4-20	5/16-18	3/8-16	1/2-13

Installation Guidelines

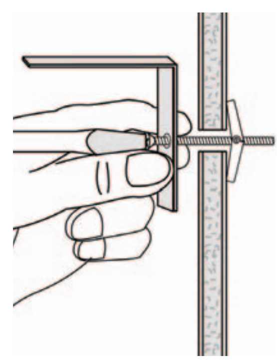
Drill the required hole through the base material. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.14. In denser materials such as high strength concrete, drill the hole 1/16" larger.



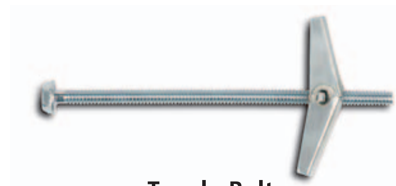
Insert the bolt through the fixture to be fastened, thread on wings, then fold the wings completely back and insert through the hole until wings spring open.



Pull back on assembly to hold the wings inside the wall to prevent the wings from spinning while tightening bolt. Turn the bolt with the screwdriver until firmly tightened.



SECTION CONTENTS Page No.



Toggle Bolt

ANCHOR MATERIALS

Carbon Steel

ANCHOR SIZE RANGE (TYP.)

1/8" diameter x 2" length to
1/2" diameter x 6" length

SUITABLE BASE MATERIALS

Wallboard
Plaster
Hollow Concrete Masonry

WALL ANCHORS

PERFORMANCE DATA

Ultimate Load Capacities for Toggle Bolt in Wallboard[1]

Anchor Diameter *d* in. (mm)	3/8" Wallboard		1/2" Wallboard		5/8" Wallboard		3/4" Wallboard	
	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/8 (3.2)	115 (0.5)	120 (0.5)	150 (0.7)	135 (0.6)	190 (0.9)	180 (0.8)	220 (1.0)	210 (0.9)
3/16 (4.8)	130 (0.6)	140 (0.6)	185 (0.8)	190 (0.9)	235 (1.1)	235 (1.1)	290 (1.3)	280 (1.3)
1/4[2] (6.4)	215 (1.0)	210 (0.9)	235 (1.1)	235 (1.1)	265 (1.2)	260 (1.2)	315 (1.4)	300 (1.4)
5/16 (7.9)	240 (1.1)	240 (1.1)	250 (1.1)	280 (1.3)	275 (1.2)	300 (1.4)	320 (1.4)	340 (1.5)
3/8 (9.5)	245 (1.1)	250 (1.1)	255 (1.1)	295 (1.3)	290 (1.3)	315 (1.4)	340 (1.5)	355 (1.6)
1/2 (12.7)	255 (1.1)	275 (1.2)	325 (1.5)	315 (1.4)	390 (1.8)	375 (1.7)	415 (1.9)	400 (1.8)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Also applies to the 1/4" Tie-Wire Acoustical Toggle.

Allowable Load Capacities for Toggle Bolt in Wallboard[1]

Anchor Diameter *d* in. (mm)	3/8" Wallboard		1/2" Wallboard		5/8" Wallboard		3/4" Wallboard	
	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/8 (3.2)	30 (0.1)	30 (0.1)	40 (0.2)	35 (0.2)	50 (0.2)	45 (0.2)	55 (0.2)	55 (0.2)
3/16 (4.8)	35 (0.2)	35 (0.2)	45 (0.2)	50 (0.2)	60 (0.3)	60 (0.3)	75 (0.3)	70 (0.3)
1/4[2] (6.4)	55 (0.2)	55 (0.2)	60 (0.3)	60 (0.3)	65 (0.3)	65 (0.3)	80 (0.4)	75 (0.3)
5/16 (7.9)	60 (0.3)	60 (0.3)	65 (0.3)	70 (0.3)	70 (0.3)	75 (0.3)	80 (0.4)	85 (0.4)
3/8 (9.5)	60 (0.3)	65 (0.3)	65 (0.3)	75 (0.3)	75 (0.3)	80 (0.4)	85 (0.4)	90 (0.4)
1/2 (12.7)	65 (0.3)	70 (0.3)	80 (0.4)	80 (0.4)	100 (0.5)	95 (0.4)	105 (0.5)	100 (0.5)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
2. Also applies to the 1/4" Tie-Wire Acoustical Toggle.

Ultimate and Allowable Load Capacities for Toggle Bolt in Hollow Concrete Masonry[1,2]

Anchor Diameter *d* in. (mm)	Drill Bit Diameter d_{bit} in. (mm)	$f'_m \geq$ **1,500 psi** (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/8 (3.2)	3/8 (9.5)	195 (0.9)	180 (0.8)	40 (0.2)	35 (0.2)
3/16 (4.8)	1/2 (12.7)	340 (1.5)	355 (1.6)	70 (0.3)	70 (0.3)
1/4[3] (6.4)	5/8 (15.9)	350 (1.6)	595 (2.7)	70 (0.3)	120 (0.5)
5/16 (7.9)	7/8 (22.2)	430 (1.9)	680 (3.1)	85 (0.4)	135 (0.6)
3/8 (9.5)	7/8 (22.2)	970 (4.4)	705 (3.2)	195 (0.9)	140 (0.6)
1/2 (12.7)	1 1/4 (31.8)	1,160 (5.2)	800 (3.6)	230 (1.0)	160 (0.7)

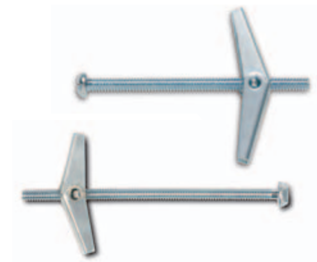
1. Tabulated load values are for anchors installed in minimum 6-inch wide, Grade N, Type II, medium and normal-weight concrete masonry units. Mortar must be minimum Type N.
2. Allowable loads are based on average ultimate values using a safety factor of 5.0.
3. Also applies to the 1/4" Tie-Wire Acoustical Toggle.

ORDERING INFORMATION

Mushroom and Slotted Hex Head Toggle Bolt

Catalog Number		Anchor Size	Drill Diameter	Standard Box	Standard Carton	Wt./100
MH	SHH					
4023	4028	1/8" x 2"	3/8"	50	500	1 1/4
4033	4038	1/8" x 3"	3/8"	50	500	1 1/2
4043	–	1/8" x 4"	3/8"	50	500	2
4133	–	3/16" x 3"	1/2"	50	500	4
4143	–	3/16" x 4"	1/2"	50	500	5
4233	–	1/4" x 3"	5/8"	50	500	6 1/2
4243	–	1/4" x 4"	5/8"	50	500	7 1/2

MH = Mushroom Head
SHH = Slotted Hex Head



Round and Flat Hex Head Toggle Bolt

Catalog Number		Anchor Size	Drill Diameter	Standard Box	Standard Carton	Wt./100
Round	Flat					
4021	–	1/8" x 2"	3/8"	50	500	1 1/4
4031	4033	1/8" x 3"	3/8"	50	500	1 1/2
4041	4042	1/8" x 4"	3/8"	50	500	2
4121	–	3/16" x 2"	1/2"	50	500	3 1/4
4131	4132	3/16" x 3"	1/2"	50	500	4
4141	4142	3/16" x 4"	1/2"	50	500	5
4151	–	3/16" x 5"	1/2"	50	500	5 1/2
4161	–	3/16" x 6"	1/2"	50	500	6 1/4
4231	4232	1/4" x 3"	5/8"	50	500	6 1/2
4241	4242	1/4" x 4"	5/8"	50	500	7 1/2
4251	–	1/4" x 5"	5/8"	50	500	8 1/2
4261	–	1/4" x 6"	5/8"	50	500	9 1/2
4331	–	5/16" x 3"	7/8"	25	250	13
4341	–	5/16" x 4"	7/8"	25	250	14
4351	–	5/16" x 5"	7/8"	25	250	16
4361	–	5/16" x 6"	7/8"	25	250	18
4431	–	3/8" x 3"	7/8"	25	250	16
4441	–	3/8" x 4"	7/8"	25	250	18
4451	–	3/8" x 5"	7/8"	25	125	20
4461	–	3/8" x 6"	7/8"	25	125	23
4541	–	1/2" x 4"	1 1/4"	25	25	42
4561	–	1/2" x 6"	1 1/4"	25	25	50

Toggle Wings Only

Catalog Number	Anchor Size	Drill Dia.	Std. Box	Std. Carton	Wt./100
4000	1/8"	3/8"	100	500	1
4020	3/16"	1/2"	100	1,000	2
4220	1/4"	5/8"	100	1,000	3
4330	5/16"	7/8"	50	500	7
4430	3/8"	7/8"	50	500	7
4540	1/2"	1 1/4"	25	25	19

Tie Wire Acoustical Toggle

Catalog Number	Anchor Size	Tie Wire Hole Size	Drill Dia.	Std. Box	Std. Carton	Wt./100
4247	1/4" x 4"	7/32"	5/8"	100	100	9
4257	1/4" x 5"	7/32"	5/8"	100	100	12

Polly™ *Hollow Wall Anchor*

PRODUCT DESCRIPTION

The Polly is a sleeve type hollow wall anchor designed for use in base materials such as plaster, wallboard, concrete block or hollow tile. Once the anchor has been set, the screw may be removed as often as necessary without affecting the anchor.

FEATURES AND BENEFITS

- Allows for fixture and screw removal and re-anchoring
- Federal GSA Specification – The Polly meets the descriptive requirements of FF-B-588D, Type III, Class A (Standard Polly) and Class B (Drive Polly)

MATERIAL SPECIFICATIONS

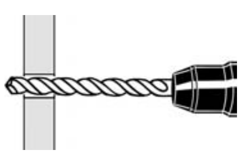
Anchor Component	Component Material
Anchor Body	AISI 1010
Machine Screw	Carbon Steel – ANSI B18.6.3
Plating	ASTM B633, SC1, Type III, (Fe/Zn 5)

INSTALLATION SPECIFICATIONS

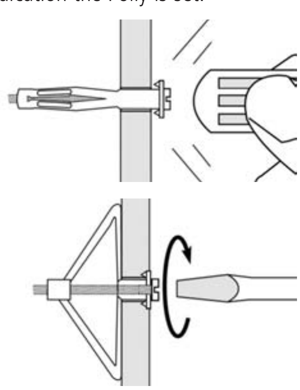
Dimension	Anchor Diameter, *d*		
	1/8"	3/16"	1/4"
ANSI Drill Bit Size, d_{bit} (in.)	5/16	3/8	7/16
Collar Diameter (in.)	1/2	5/8	11/16
Body Diameter (in.)	17/64	3/8	7/16
Thread Size (UNC)	6-32	10-24	1/4-20

Installation Guidelines

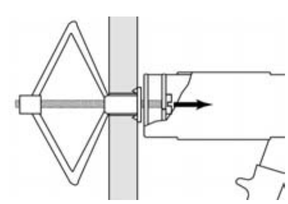
Drill a hole through the base material into the hollow area. The drive version of the Polly can be driven directly into the wallboard.



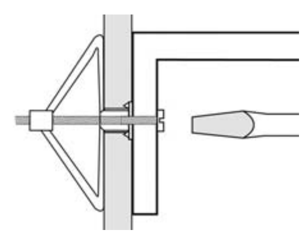
Inset the Polly and tap the head until the gripper prongs are embedded in the base material. Maintain pressure with the screwdriver while turning the screw until a definite resistance is felt, indication the Polly is set.



For faster setting, use the Polly setting tool. Back screw head out 2-3 turns, slide the tool behind the screw head, then squeeze the tool to expand the Polly. This tool fits all sizes.



To complete the installation, remove the screw, line up mounting hole of item to be fastened, re-insert screw and tighten.



SECTION CONTENTS Page No.

Polly

ANCHOR MATERIAL

Carbon Steel

ANCHOR SIZE RANGE (TYP.)

1/8" Extra Short to 1/4" Extra Long

SUITABLE BASE MATERIALS

Wallboard
Plywood
Hollow Concrete Masonry

PERFORMANCE DATA

Ultimate Load Capacities for Polly in Wallboard[1]

Anchor Diameter d in. (mm)	3/8" Wallboard		1/2" Wallboard		5/8" Wallboard		3/4" Wallboard	
	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/8 (3.2)	80 (0.4)	110 (0.5)	150 (0.7)	170 (0.8)	160 (0.7)	195 (0.9)	170 (0.8)	210 (0.9)
3/16 (4.8)	90 (0.4)	130 (0.6)	175 (0.8)	180 (0.8)	190 (0.9)	210 (0.9)	210 (0.9)	220 (1.0)
1/4 (6.4)	95 (0.4)	150 (0.7)	200 (0.9)	200 (0.9)	220 (1.0)	220 (1.0)	245 (1.1)	250 (1.1)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.

Allowable Load Capacities for Polly in Wallboard[1]

Anchor Diameter d in. (mm)	3/8" Wallboard		1/2" Wallboard		5/8" Wallboard		3/4" Wallboard	
	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/8 (3.2)	20 (0.1)	30 (0.1)	40 (0.2)	45 (0.2)	40 (0.2)	50 (0.2)	45 (0.2)	55 (0.2)
3/16 (4.8)	25 (0.1)	35 (0.2)	45 (0.2)	45 (0.2)	50 (0.2)	55 (0.2)	55 (0.2)	55 (0.2)
1/4[2] (6.4)	25 (0.1)	40 (0.2)	50 (0.2)	50 (0.2)	55 (0.2)	55 (0.2)	60 (0.3)	65 (0.3)

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

Ultimate Load Capacities for Polly in Plywood[1]

Anchor Diameter d in. (mm)	1/8" Plywood		1/4" Plywood		3/8" Plywood		1/2" Plywood		5/8" Plywood	
	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/8 (3.2)	110 (0.5)	100 (0.5)	125 (0.6)	450 (2.0)	200 (0.9)	450 (2.0)	300 (1.4)	450 (2.0)	420 (1.9)	450 (2.0)
3/16 (4.8)	–	–	–	–	320 (1.4)	580 (2.6)	420 (1.9)	610 (2.7)	500 (2.3)	640 (2.9)
1/4 (6.4)	–	–	–	–	400 (1.8)	720 (3.2)	480 (2.2)	830 (3.7)	560 (2.5)	900 (4.1)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.

Allowable Load Capacities for Polly in Plywood[1]

Anchor Diameter d in. (mm)	1/8" Plywood		1/4" Plywood		3/8" Plywood		1/2" Plywood		5/8" Plywood	
	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/8 (3.2)	30 (0.1)	25 (0.1)	30 (0.1)	115 (0.5)	50 (0.2)	115 (0.5)	75 (0.3)	115 (0.5)	105 (0.5)	115 (0.5)
3/16 (4.8)	–	–	–	–	80 (0.4)	145 (0.7)	105 (0.5)	155 (0.7)	125 (0.6)	160 (0.7)
1/4[2] (6.4)	–	–	–	–	100 (0.5)	180 (0.8)	120 (0.5)	210 (0.9)	140 (0.6)	225 (1.0)

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

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Polly in Hollow Concrete Masonry[1,2]

Anchor Size in. (mm)	Drill Bit Diameter d_{bit} in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/8" XL (3.2)	5/16 (7.9)	160 (0.7)	170 (0.8)	30 (0.1)	35 (0.2)
3/16" XL (4.8)	3/8 (9.5)	190 (0.9)	210 (0.9)	40 (0.2)	40 (0.2)
1/4" XL (6.4)	7/16 (11.1)	220 (1.0)	245 (1.1)	45 (0.2)	50 (0.2)

1. Tabulated load values are for anchors installed in minimum 6-inch wide, Grade N, Type II, medium and normal-weight concrete masonry units. Mortar must be minimum Type N.
2. Allowable loads are based on average ultimate values using a safety factor of 5.0.

ORDERING INFORMATION

Standard Polly with Combination Slotted Phillips Head

Cat. No.	Anchor Size	Screw Length	Drill Diameter	Wall Thickness	Standard Box	Standard Carton	Wt./100
2100	1/8" Ex. Short	1 1/16"	5/16"	1/8" to 1/4"	100	500	1
2101	1/8" Short	1 3/4"	5/16"	3/8" to 1/2"	100	500	1 1/2
2102	1/8" Long	2 1/4"	5/16"	5/8" to 1"	100	500	2
2103	1/8" Ex. Long	2 11/16"	5/16"	1 1/4" to 1 1/2"	50	250	2 1/2
2111	3/16" Short	2"	3/8"	3/8" to 5/8"	50	250	3 1/2
2112	3/16" Long	2 1/2"	3/8"	3/4" to 1 1/8"	50	250	4
2113	3/16" Ex. Long	3"	3/8"	1 1/4" to 1 3/4"	25	125	5 1/4
2121	1/4" Short	2 1/4"	7/16"	3/8" to 1/2"	50	250	5
2122	1/4" Long	2 3/4"	7/16"	5/8" to 1 1/8"	50	250	6 1/4
2123	1/4" Ex. Long	3 3/8"	7/16"	1 1/4" to 1 3/4"	25	125	7 1/2

WALL ANCHORS

Standard Polly with Slotted Hex Head

Cat. No.	Anchor Size	Screw Length	Drill Diameter	Wall Thickness	Standard Box	Standard Carton	Wt./100
2105	1/8" Short	1 3/4"	5/16"	3/8" to 1/2"	100	500	1 1/2

Drive Polly

Cat. No.	Anchor Size	Screw Length	Drill Diameter	Wall Thickness	Standard Box	Standard Carton	Wt./100
2180	1/8" Ex. Short	1 3/8"	–	1/8" to 1/4"	100	500	1
2182	1/8" Short	2"	–	3/8" to 1/2"	100	500	1 1/2
2184	1/8" Long	2 3/8"	–	1/2" to 3/4"	100	500	2

Polly Setting Tool (Fits All Sizes)

Cat. No.	Standard Box	Standard Carton	Wt./Each
2150	1	1	2

Legs® *Wallboard Anchor*

PRODUCT DESCRIPTION

The Legs anchor is a one piece drive type anchor designed for use in hollow gypsum wallboard for light to medium duty loads. It is made from heat treated carbon steel which is zinc coated using a special plating process and can be used with No. 6 or No. 8 screws.

The Legs anchor is a fast, easy to use expansion anchor designed for use in wallboard. As the screw enters the anchor, it engages the pre-formed tabs in each leg causing them to expand outwards into the base material. Removal of the anchor, if required, is easy. Once removed, the anchor leaves a small slit in the wallboard versus the gaping holes left with other types of hollow wall anchors.

SECTION CONTENTS Page No.

Legs

ANCHOR MATERIAL

Carbon Steel

ANCHOR SIZE RANGE (TYP.)

Use with No. 6 or No. 8 screws

SUITABLE BASE MATERIALS

Wallboard

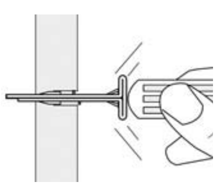
FEATURES AND BENEFITS

- Fast and easy to use
- Leaves small "slit" in wallboard, versus larger holes left with other wall anchors

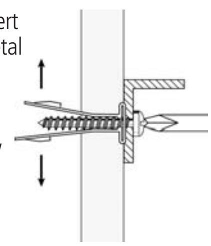
MATERIAL AND INSTALLATION SPECIFICATIONS

Anchor Component	Component Material
Anchor Body	Heat Treated Spring Steel

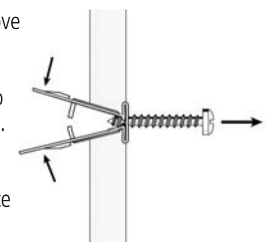
Place the tip of the anchor against the face of the wallboard and tap in with a hammer of back of a screwdriver until the flange is seated flush against the wallboard



Locate the fixture and insert a No. 6 or No. 8 sheet metal screw through the fixture hole into the installed anchor. Tighten the screw until the fixture is securely seated against the base material and the anchor is fully expanded.



To Remove – Remove the screw and the fixture, then insert the screw into the anchor one turn. Pull on the screw to slide the anchor out of the slit in the face of the wallboard.



WALL ANCHORS

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Legs in Wallboard[1]

Load	3/8" Wallboard		1/2" Wallboard		5/8" Wallboard		3/4" Wallboard	
	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
Ultimate Loads	60 (0.3)	85 (0.4)	70 (0.3)	115 (0.5)	95 (0.4)	165 (0.7)	100 (0.5)	170 (0.8)
Allowable Loads	15 (0.1)	20 (0.1)	20 (0.1)	30 (0.1)	25 (0.1)	40 (0.2)	25 (0.1)	45 (0.2)

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

ORDERING INFORMATION

Legs Drywall Anchor

Cat. No.	Description	Standard Box	Standard Carton	Wt./100
2336	Legs Wallboard Anchor	100	1,000	3/4
2335	Legs Anchor, No. 8 x 1" Screw	100	1,000	1 3/4

Master Pack

Cat. No.	Description	Standard Box	Standard Carton	Wt./100
2338	Legs Wallboard Anchor	–	5,000	3/4
2337	Legs Wallboard Anchor	–	5,000	3/4

Legs Anchor Kit

Cat. No.	Description	Standard Box	Standard Carton	Wt./100
2360	Legs Wallboard Anchor Kit 50 Anchors and No. 8 x 1" Screws	1	10	9

Strap-Toggle™ *Hollow Wall Anchor*

PRODUCT DESCRIPTION

The Strap-Toggle is a heavy duty hollow wall anchor designed for use in base materials such as plaster, wallboard, concrete block or hollow tile. The Strap-Toggle is a pre-assembled anchor consisting of a carbon steel wing and a locking cap/ratchet leg assembly molded from engineered plastic. It is available in 3/16", 1/4", 3/8" and 1/2" sizes. When compared to traditional toggles, this unique anchor can be installed in a smaller hole and does not require a fixture or screw to set it. The anchor can be easily adjusted to accommodate a wall thickness of up to 2 1/2" while using a shorter bolt. The bolt and fixture may be installed and removed as often as necessary.

SECTION CONTENTS — Page No.

Strap-Toggle

FEATURES AND BENEFITS

- Adjustable to accommodate various wall thickness up to 2 1/2"
- Allows for fixture and bolt/screw removal and re-anchoring
- Federal GSA Specification – Meets the descriptive requirements of FF-B-588D, Type V for a captive toggle (superseded)

MATERIAL SPECIFICATIONS

Anchor Component	Component Material
Wing	AISI 1010
Plating	ASTM B633, SC1, Type III, (Fe/Zn 5)
Anchor Body	Engineered Plastic

ANCHOR MATERIALS

Engineered Plastic
Carbon Steel (Wing)

ANCHOR SIZE RANGE (TYP.)

3/16" to 1/2" diameter

SUITABLE BASE MATERIALS

Wallboard
Hollow Concrete Masonry

INSTALLATION SPECIFICATIONS

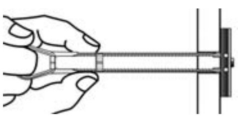
Dimension	Anchor Diameter, *d*			
	3/16"	1/4"	3/8"	1/2"
ANSI Drill Bit Size, d_{bit} (in.)	*1/2	*1/2	**3/4	**3/4
Cap Size (in.)	5/8	5/8	1	1
Grip Range (in.)	2 1/2	2 1/2	2 1/2	2 1/2
Thread Size (UNC)	3/16-24	1/4-20	3/8-16	1/2-13
Max. Tightening Torque, T_{max}, (ft-lbs)	5	5	5	5
Minimum Clearance (in.)	1 7/8	1 7/8	1 7/8	1 7/8

*9/16" diameter bit may be required for very dense materials.
**13/16" diameter bit may be required for very dense materials.

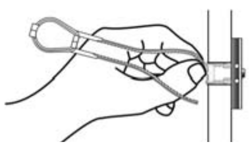
Installation Guidelines

Drill the proper size hole into the cavity of the hollow base material.

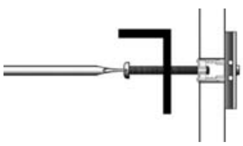
Position the wing parallel to the plastic legs and slide the anchor through the drilled hole into the hollow cavity.



Pull the wing firmly against the inside wall of the hollow material using the ring, then slide the plastic cap forward until the flange is seated flush against the work surface.



Place your thumb between the plastic straps and snap the straps off.



Position the fixture. Insert the bolt through the fixture and tighten. The minimum bolt length should be at least 1/2" longer than the combined wall and fixture.

PERFORMANCE DATA

Ultimate Load Capacities for Strap-Toggle in Wallboard[1]

Anchor Diameter *d* in. (mm)	3/8" Wallboard		1/2" Wallboard		5/8" Wallboard		3/4" Wallboard	
	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	120 (0.5)	240 (1.1)	130 (0.6)	285 (1.3)	195 (0.9)	380 (1.7)	205 (0.9)	440 (2.0)
1/4 (6.4)	130 (0.6)	270 (1.2)	145 (0.7)	295 (1.3)	210 (0.9)	420 (1.9)	215 (1.0)	470 (2.1)
3/8 (9.5)	135 (0.6)	275 (1.2)	150 (0.7)	300 (1.4)	220 (1.0)	420 (1.9)	230 (1.0)	475 (2.1)
1/2 (12.7)	140 (0.6)	290 (1.3)	150 (0.7)	355 (1.6)	220 (1.0)	430 (1.9)	230 (1.0)	485 (2.2)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.

Allowable Load Capacities for Strap-Toggle in Wallboard[1]

Anchor Diameter *d* in. (mm)	3/8" Wallboard		1/2" Wallboard		5/8" Wallboard		3/4" Wallboard	
	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	30 (0.1)	60 (0.3)	35 (0.2)	70 (0.3)	50 (0.2)	95 (0.4)	50 (0.2)	110 (0.5)
1/4 (6.4)	35 (0.2)	70 (0.3)	35 (0.2)	75 (0.3)	55 (0.2)	105 (0.5)	55 (0.2)	120 (0.5)
3/8 (9.5)	35 (0.2)	70 (0.3)	40 (0.2)	75 (0.3)	55 (0.2)	105 (0.5)	60 (0.3)	120 (0.5)
1/2 (12.7)	35 (0.2)	75 (0.3)	40 (0.2)	90 (0.4)	55 (0.2)	110 (0.5)	60 (0.3)	120 (0.5)

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

Ultimate and Allowable Load Capacities for Strap-Toggle in Hollow Concrete Masonry[1,2]

Anchor Diameter *d* in. (mm)	Drill Bit Diameter d_{bit} in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	1/2 (12.7)	1,080 (4.9)	740 (3.3)	215 (1.0)	150 (0.7)
1/4 (6.4)	1/2 (12.7)	1,355 (6.1)	1,420 (6.4)	270 (1.2)	285 (1.3)
3/8 (9.5)	3/4 (19.1)	1,435 (6.5)	2,330 (10.5)	285 (1.3)	465 (2.1)
1/2 (12.7)	3/4 (19.1)	1,720 (7.7)	2,980 (13.4)	345 (1.6)	595 (2.7)

1. Tabulated load values are for anchors installed in minimum 6-inch wide, Grade N, Type II, medium and normal-weight concrete masonry units. Mortar must be minimum Type N.
2. Allowable loads are based on average ultimate values using a safety factor of 5.0.

ORDERING INFORMATION

Strap-Toggle (Not packaged with screws)

Cat. No.	Anchor Size	Drill Diameter	Wall Thickness	Std. Box	Std. Carton	Wt./100
4052	3/16" x 4"	1/2"	3/8"-2 1/2"	50	300	3 1/2
4054	1/4" x 4"	1/2"	3/8"-2 1/2"	50	300	3 1/2
4056	3/8" x 4"	3/4"	3/8"-2 1/2"	25	150	5
4058	1/2" x 4"	3/4"	3/8"-2 1/2"	25	150	5

Zip-It® *Wallboard Anchor*

PRODUCT DESCRIPTION

The Zip-It anchor is a one-piece self drilling anchor designed for use in hollow gypsum wallboard for light to medium duty loads. It is available in both engineered nylon and Zamac alloy for use with No. 8 screws in 3/8" to 1" thick wallboard. The Zip-It Jr. is also available in engineered nylon and Zamac alloy for use with No. 6 screws in 3/8" to 5/8" wallboard.

FEATURES AND BENEFITS

- Ideal for mounting electrical fixtures, fastening drapery supports, installing phone systems, miscellaneous hardware, etc.
- Packaged with and without screws

MATERIAL SPECIFICATIONS

Anchor Component	Component Material	
	Nylon Zip-It/Zip-It Jr.	Zinc Zip-It/Zip-It Jr.
Anchor Body	Nylon	Zamac Alloy

INSTALLATION SPECIFICATIONS

Dimension	Nylon Zip-It/Zinc Zip-It	Nylon Zip-It Jr./Zinc Zip-It Jr.
Collar Size (in.)	9/16	15/32
Screw Size Range (No.)	6-8*	6-8*
Thread Length (in.)	15/16	47/64
Point Length (in.)	3/4	37/64
Anchor Length (in.)	1 11/16	1 5/16
Min. Screw Engagement (in.)	3/4	3/4

* Recommended Size

SECTION CONTENTS Page No.

Nylon Zip-It

Zinc Zip-It

ANCHOR MATERIALS

Engineered Nylon or Zamac Alloy

ANCHOR SIZE RANGE (TYP.)

Use with No. 6 or No. 8 screws

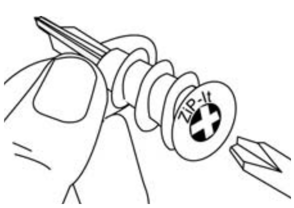
SUITABLE BASE MATERIALS

Wallboard

WALL ANCHORS

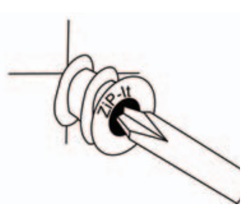
Installation Guidelines

Inset either No.2 or No.3 Phillips driver bit into the recess of the Zip-It anchor head. Use a manual screwdriver or a low rpm battery powered electric screw gun.

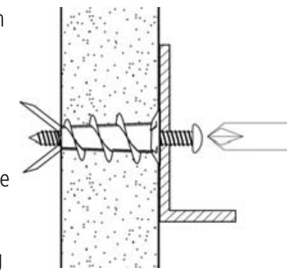


Note: Pre-drill hole if difficulty is encountered during installation of the Zip-It. In very hard wallboard or double-board construction, use 1/4" diameter drill bit. In solid plaster wall use 7/16" diameter drill bit (HSS or Carbide). Job site tests are recommended when pre-drilling holes.

Push the Zip-It anchor into the surface of the wallboard until the two cutting blades penetrate the surface. Using gentle forward pressure, rotate the Zip-It until the collar sets flush to the surface of the wall.



Put the fixture in place, insert the screw and tighten until it feels secure. As the screw is threaded into the nylon versions, the point will expand resulting in increased load capacity in thicker wallboard.



Note: When using an electric screw gun for application, set clutch and use slow speed (do not exceed approximately 300-400 rpm).

PERFORMANCE DATA

Ultimate Load Capacities for Zip-It in Wallboard[1]

Anchor	3/8" Wallboard		1/2" Wallboard		5/8" Wallboard		3/4" Wallboard	
	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
Zip-It	50 (0.2)	60 (0.3)	65 (0.3)	70 (0.3)	80 (0.4)	100 (0.5)	85 (0.4)	100 (0.5)
Zip-It Jr.	45 (0.2)	50 (0.2)	55 (0.2)	55 (0.2)	70 (0.3)	70 (0.3)	75 (0.3)	80 (0.4)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.

PERFORMANCE DATA

Allowable Load Capacities for Zip-It in Wallboard[1]

Anchor	3/8" Wallboard		1/2" Wallboard		5/8" Wallboard		3/4" Wallboard	
	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
Zip-It	15 (0.1)	15 (0.1)	15 (0.1)	20 (0.1)	20 (0.1)	25 (0.1)	20 (0.1)	25 (0.1)
Zip-It Jr.	10 (0.0)	15 (0.1)	15 (0.1)	15 (0.1)	20 (0.1)	20 (0.1)	20 (0.1)	20 (0.1)

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

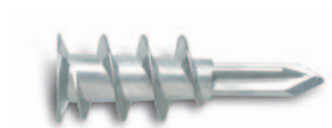
ORDERING INFORMATION

Nylon Zip-It

Cat. No.	Wall Thickness	Description	Std. Box	Std. Carton	Wt./100
2345	3/8" to 1"	Std. Box (No screws)	100	1,000	1/2
2348	3/8" to 1"	Std. Box, No. 8 x 1" screws	100	1,000	1 1/4
2355	3/8" to 1"	Master Carton (No screws)	–	5,000	1/2

Zinc Zip-It

Cat. No.	Wall Thickness	Description	Std. Box	Std. Carton	Wt./100
2346	3/8" to 1"	Std. Box (No screws)	100	1,000	2
2349	3/8" to 1"	Std. Box, No. 8 x 1" screws	100	1,000	2 1/2
2356	3/8" to 1"	Master Carton (No screws)	–	5,000	1 3/4



Core Zip-It

Cat. No.	Wall Thickness	Description	Std. Box	Std. Carton	Wt./100
2370	3/8" to 1"	Nylon Core Zip-It	100	1,000	1/2
2371	3/8" to 1"	Zinc Core Zip-It	100	1,000	1 1/4
2390	3/8" to 5/8"	Nylon Core Jr. Zip-It	100	1,000	1/4

Core Zip-It available only in Canada.

Zip-It Kits

Cat. No.	Material	Description	Std. Box	Std. Carton	Wt./100
2368	Nylon	50 Anchors, No. 8 x 1" Screws, & No. 2 Phillips Driver Bit	1	10	7
2369	Zinc	50 Anchors, No. 8 x 1" Screws, & No. 2 Phillips Driver Bit	1	10	13 1/4

Nylon Zip-It Jr.

Cat. No.	Wall Thickness	Description	Std. Box	Std. Carton	Wt./100
2350	3/8" to 5/8"	Std. Box (No screws)	100	1,000	1/4
2351	3/8" to 5/8"	Std. Box, No.6 x 1" screws	100	1,000	3/4

Zinc Zip-It Jr.

Cat. No.	Wall Thickness	Description	Std. Box	Std. Carton	Wt./100
2362	3/8" to 5/8"	Std. Box (No screws)	100	1,000	1
2364	3/8" to 5/8"	Std. Box, No.6 x 1" screws	100	1,000	3
2363	3/8" to 5/8"	Master Carton (No screws)	–	5,000	1

Zip-It Jr. Kits

Cat. No.	Material	Description	Std. Box	Std. Carton	Wt./100
2367	Nylon	50 Anchors, No. 6 x 1" Screws, & No. 2 Phillips Driver Bit	1	10	7
2361	Zinc	50 Anchors, No. 6 x 1" Screws, & No. 2 Phillips Driver Bit	1	10	13 1/4

Note: To select the proper screw length required, determine the thickness of the fixture, including any spacers or shims and add 3/4".

Zip-Toggle® *Plastic Hollow Wall Anchor*

PRODUCT DESCRIPTION

The Zip-Toggle is a self drilling hollow gypsum wallboard anchor designed to provide superior performance without the need to pre-drill larger diameter holes. The Zip-Toggle is packaged with its own No. 6 x 2" lubricated screw.

FEATURES AND BENEFITS

- Self drills and uses a smaller hole versus toggles
- Fast and easy installation – approximatley 5 times faster than toggles
- Heavy duty toggle design works in 3/8" to 5/8" wallboard
- Fastens fixtures up to 3/4"

MATERIAL SPECIFICATIONS

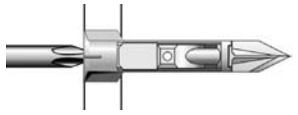
Anchor Component	Component Material
Fastener Body	Nylon
Screw	Carbon Steel – ANSI 18.6.4
Screw Plating	ASTM B633, SC1, Type III (Zn/Fe 5)

INSTALLATION SPECIFICATIONS

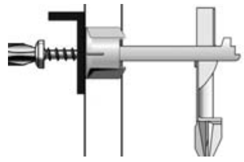
Recommended Screw Size	No. 6 x 2" (lubricated)
Threaded Length (in.)	21/64
Point Length (in.)	5/8
Anchor Length (in.)	2 1/8

Installation Guidelines

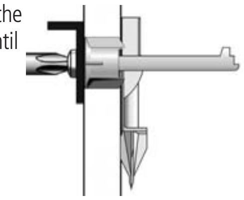
Using a manual or low RPM battery powered electric screwdriver, insert a No.2 Phillips driver bit into the recess of the anchor and press the tip of the anchor into the wallboard until the cutting blades penetrate the surface.



Using gentle forward pressure, press the anchor further into the wall board until the collar is set flush with the surface of the wallboard.



Position the fixture and insert a No. 6 x 2" screw (packaged with the anchor). Press the screw into the anchor until the toggle portion is opened.



Tighten the screw until it feels secure with the toggle portion seated against the back of the wallboard. Do not over tighten. Note: Use only a No. 6 x 2" lubricated screw as packaged with the anchor.

SECTION CONTENTS Page No.

Zip-Toggle

ANCHOR MATERIALS

Engineered Plastic

ANCHOR SIZE RANGE (TYP.)

No. 6 x 2" Screw
Wall Thickness from 3/8" to 5/8"

SUITABLE BASE MATERIALS

Wallboard

PERFORMANCE DATA

Ultimate Load Capacities for Zip-Toggle in Wallboard[1]

Anchor Size	Ultimate Load						Allowable Load					
	3/8" Wallboard		1/2" Wallboard		5/8" Wallboard		3/8" Wallboard		1/2" Wallboard		5/8" Wallboard	
	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
No. 6 x 2" Screw	75 (0.3)	180 (0.8)	140 (0.6)	265 (1.2)	180 (0.8)	300 (1.4)	20 (0.1)	45 (0.2)	35 (0.2)	65 (0.3)	45 (0.2)	75 (0.3)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.

ORDERING INFORMATION

Zip-Toggle

Cat. No.	Description	Standard Box	Standard Carton	Wt./100
2290	Zip-Toggle w/ No.6 x 2" Screws	50	250	1 1/2

Poly-Toggle® *Plastic Hollow Wall Anchor*

PRODUCT DESCRIPTION

The Poly-Toggle is a screw actuated hollow wall anchor for use in paneling, wallboard, and solid masonry. The Poly-Toggle anchor is available in 6 sizes to match the most common wall thicknesses of hollow base materials. In solid base materials, the anchor can be used by removing the outer wings.

FEATURES AND BENEFITS

- Allows for fixture and screw removal and re-anchoring
- Federal GSA Specification – Meets the descriptive requirements of FF-B-588D, Type IV (superseded)

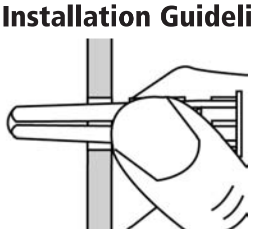
MATERIAL SPECIFICATIONS

Anchor Component	Component Material
Anchor Body	Engineered Plastic
Screw	Carbon Steel – ANSI 18.6.4
Screw Plating	ASTM B633, SC1, Type III, (Zn/Fe 5)

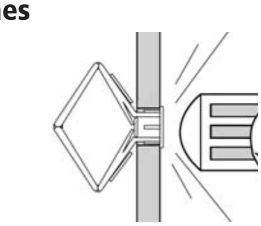
INSTALLATION SPECIFICATIONS

Dimension	Anchor Size					
	Mini	Short	Medium	Long	Extra Long	Super Long
ANSI Drill Bit Size, d_{bit} (in.)	5/16	5/16	5/16	5/16	5/16	5/16
Minimum Screw Length (in.)	1	1 1/4	1 1/4	1 1/2	1 3/4	2
Screw Size Range	No. 6-12	No. 6-12	No. 6-12	No. 6-12	No. 6-12	No. 6-12
Flange Size (in.)	29/64	1/2	1/2	1/2	1/2	1/2
Embed. (Solid Materials) (in.)	5/8	1 1/8	1 1/4	1 3/8	1 1/2	1 3/4

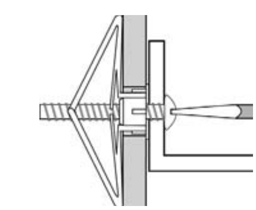
Installation Guidelines



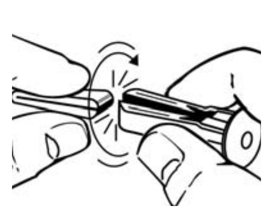
Drill 5/16" diameter hole through base material. Select the proper size Poly-Toggle based on the wall thickness. Squeeze the Poly-Toggle flat and push into the hole.



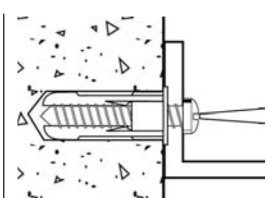
Tap the Poly-Toggle through the wall until the flange is seated flush against the outer wall.



Position the fixture, insert the screw through the fixture into the Poly-Toggle, and tighten until it feels secure.



Solid Base Materials – For installations in solid base materials, break off the outer wings.



Squeeze the inner wings flat, and insert the Poly-Toggle into the anchor hole. Insert the screw through the fixture and tighten.

SECTION CONTENTS Page No.

Poly-Toggle

ANCHOR MATERIALS

Engineered Plastic

ANCHOR SIZE RANGE (TYP.)

No. 6 to No.12
Wall Thickness from 1/8" to 1"

SUITABLE BASE MATERIALS

Solid Base Materials
Wallboard
Hollow Concrete Masonry

PERFORMANCE DATA

Ultimate Load Capacities for Poly-Toggle in Wallboard and Concrete Block[1,2]

Anchor Size	Drill Bit Diameter d_{bit} in. (mm)	Wall Thickness in. (mm)	Wallboard				Concrete Block			
			Ultimate Load		Allowable Load		Ultimate Load		Allowable Load	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
Mini	5/16 (7.9)	1/8 (3.2)	120 (0.5)	100 (0.5)	30 (0.1)	25 (0.1)	–	–	–	–
Short	5/16 (7.9)	3/8 (9.5)	135 (0.6)	165 (0.7)	35 (0.2)	40 (0.2)	240 (1.1)	220 (1.0)	60 (0.3)	55 (0.2)
Medium	5/16 (7.9)	1/2 (12.7)	150 (0.7)	220 (1.0)	40 (0.2)	55 (0.2)	280 (1.3)	230 (1.0)	70 (0.3)	60 (0.3)
Long	5/16 (7.9)	5/8 (15.9)	170 (0.8)	250 (1.1)	45 (0.2)	65 (0.3)	350 (1.6)	230 (1.0)	90 (0.4)	60 (0.3)
Extra Long	5/16 (7.9)	3/4 (19.1)	180 (0.8)	250 (1.1)	45 (0.2)	65 (0.3)	400 (1.8)	240 (1.1)	100 (0.5)	60 (0.3)
Super Long	5/16 (7.9)	1 (25.4)	220 (1.0)	250 (1.1)	55 (0.2)	65 (0.3)	450 (2.0)	250 (1.1)	115 (0.5)	65 (0.3)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. The load capacities for this product depend on the integrity of the base material in which it is installed. The anchor is recommended for light duty static applications where holding power is not a critical factor. This anchor is not recommended for use in overhead applications.

WALL ANCHORS

ORDERING INFORMATION

Poly-Toggle

Cat. No.	Anchor Size	Wall Thickness	Screws	Standard Box	Standard Carton	Wt./ 1,000
2302	Mini	1/8"	–	100	1,000	3
2303	Short	3/8"	–	100	1,000	5
2304	Medium	1/2"	–	100	1,000	5
2305	Long	5/8"	–	100	1,000	6
2306	Extra Long	3/4"	–	100	1,000	7
2307	Super Long	1"	–	100	1,000	8

Pop-Toggle™ *Hollow Wall Anchor*

PRODUCT DESCRIPTION

Pop-Toggle fasteners are hollow wall anchors ideal for static applications requiring light to medium load performance. Installation is very fast, needing a pre-drilled 5/16" diameter hole. The fastener pre-installs without a screw, allowing for easy placement and removal of the fixture. Pop-Toggle fasteners are not recommended for use overhead or applications where holding values are critical.

SECTION CONTENTS Page No.

Pop-Toggle

FEATURES AND BENEFITS

- Allows for fixture and screw removal and re-anchoring
- Fast and easy installation

MATERIAL SPECIFICATIONS

Anchor Component	Component Material
Anchor Body	Engineered Plastic

ANCHOR MATERIAL

Engineered Plastic

ANCHOR SIZE RANGE (TYP.)

No. 6 to No.14 screw x 2 1/8" length
Wall Thickness from 1/8" to 3/4"

SUITABLE BASE MATERIALS

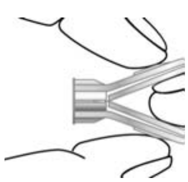
Wallboard
Plaster
Plywood
Hollow Concrete Masonry

INSTALLATION SPECIFICATIONS

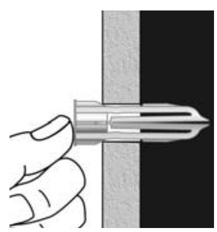
Dimension	Anchor Size: Small	Medium	Large
ANSI Drill Bit Size, d_{bit} (in.)	5/16	5/16	5/16
Grip Range (in.)	1/8 to 1/4	3/8 to 1/2	5/8 to 3/4
Recommended Screw Size (UNC)	No.6 to No. 14	No.6 to No. 14	No.6 to No. 14
Anchor Length (in.)	2 1/8	2 1/8	2 1/8

Installation Guidelines

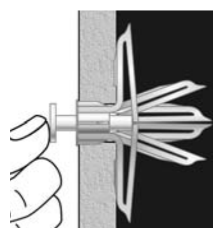
Drill 5/16" diameter hole through base material. Fold anchor in the middle.



Insert the anchor through the wall until Pop-Toggle is flush with the wall.



Insert the Popper to open the anchor behind the hollow wall (not necessary for thicker base materials). Do not force or strike the Popper with a hammer.



Remove the Popper, insert the screw through the fixture and tighten until the fixture is clamped securely to the surface of the base material. Be sure not to overtighten.

PERFORMANCE DATA

Ultimate Load Capacities for Pop-Toggle in Plywood and Wallboard[1]

Anchor Size	Drill Bit Diameter d_{bit} in. (mm)	1/4" Plywood Tension lbs. (kN)	1/4" Plywood Shear lbs. (kN)	1/2" Plywood Tension lbs. (kN)	1/2" Plywood Shear lbs. (kN)	3/8" Wallboard Tension lbs. (kN)	3/8" Wallboard Shear lbs. (kN)	1/2" Wallboard Tension lbs. (kN)	1/2" Wallboard Shear lbs. (kN)	5/8" Wallboard Tension lbs. (kN)	5/8" Wallboard Shear lbs. (kN)
Small	5/16 (7.9)	125 (0.6)	265 (1.2)	–	–	–	–	–	–	–	–
Medium	5/16 (7.9)	–	–	175 (0.8)	125 (0.6)	95 (0.4)	125 (0.6)	145 (0.7)	165 (0.7)	100 (0.5)	215 (1.0)
Large	5/16 (7.9)	–	–	–	–	–	–	–	–	160 (0.7)	235 (1.1)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.

ORDERING INFORMATION

Pop-Toggle

Cat. No.	Description	Standard Box	Standard Carton
4060	Pop-Toggle Small	100	1,000
4062	Pop-Toggle Medium	100	1,000
4064	Pop-Toggle Large	100	1,000

Bantam Plug™ *Plastic Wall Anchor*

PRODUCT DESCRIPTION

The Bantam Plug is a plastic anchor designed for use with lightweight fixtures. It can be used in concrete, block and brick. It is suggested quite often for use in wallboard. Holding values in wallboard tend to be inconsistent, whereas, other Powers products may be more appropriate. The Bantam Plug anchor is injection molded from an engineered plastic and is designed to be used in conjunction with a sheet metal or wood screw. The Bantam Plug is recommended for light duty static applications where holding power is not a critical factor. It should not be used overhead.

SECTION CONTENTS Page No.

FEATURES AND BENEFITS

- Performs well in most base material
- Anchor body is resistant to corrosion from moisture

Bantam Plug

MATERIAL SPECIFICATIONS

Anchor Component	Component Material
Anchor Shield	Engineered Plastic

ANCHOR MATERIAL

Engineered Plastic

ANCHOR SIZE RANGE (TYP.)

No. 6-8 screw x 3/4" length to
No. 14-16 screw x 1 1/2" length

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Hollow Concrete Masonry
Solid or Hollow Brick Masonry
Wallboard

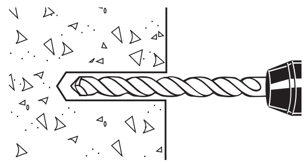
WALL ANCHORS

INSTALLATION SPECIFICATIONS

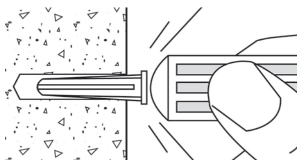
Installation Specifications

Dimension	Screw Size #6-#8	#8-#10	#10-#12	#14-#16
ANSI Drill Bit Size, d_{bit} (in.)	3/16	3/16	1/4	5/16
Flange Size (in.)	19/64	19/64	3/8	7/16
Screw Size Range (UNC)	#6-#8	#8-#10	#10-#12	#14-#16
Overall Length (in.)	3/4	7/8	1	1 1/2

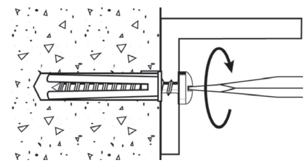
Installation Guidelines



Drill a hole into the base material to the depth of embedment required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



Blow the hole clean of dust and other material. Tap the anchor into the hole until it is flush with the surface of the base material.



Position the fixture, then insert the proper size screw through the fixture into the top of the anchor and tighten. Be sure screw thread fully engages the anchor body.

PERFORMANCE DATA

Ultimate Load Capacities for Bantam Plug in Normal-Weight Concrete[1,2]

Screw Size Range	Minimum Embedment Depth	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		4,000 psi (27.6 MPa)		6,000 psi (41.4 MPa)	
d	h_v in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
#6-#8	3/4 (19.1)	185 (0.8)	215 (1.0)	210 (0.9)	240 (1.1)	225 (1.0)	240 (1.1)
#8-#10	7/8 (22.2)	300 (1.4)	235 (1.1)	440 (2.0)	280 (1.3)	520 (2.3)	280 (1.3)
#10-#12	1 (25.4)	350 (1.6)	280 (1.3)	550 (2.5)	350 (1.6)	640 (2.9)	350 (1.6)
#14-#16	1 1/2 (38.1)	840 (3.8)	530 (2.4)	840 (3.8)	575 (2.6)	900 (4.1)	575 (2.6)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.

PERFORMANCE DATA

Allowable Load Capacities for Bantam Plug in Normal-Weight Concrete[1,2]

Screw Size Range *d*	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
#6-#8	3/4 (19.1)	45 (0.2)	55 (0.2)	55 (0.2)	60 (0.3)	55 (0.2)	60 (0.3)
#8-#10	7/8 (22.2)	75 (0.3)	60 (0.3)	110 (0.5)	70 (0.3)	130 (0.6)	70 (0.3)
#10-#12	1 (25.4)	90 (0.4)	70 (0.3)	140 (0.6)	90 (0.4)	160 (0.7)	90 (0.4)
#14-#16	1 1/2 (38.1)	210 (0.9)	135 (0.6)	210 (0.9)	145 (0.7)	225 (1.0)	145 (0.7)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.

Ultimate and Allowable Load Capacities for Bantam Plug in Hollow Concrete Masonry[1,2,3]

Screw Size Range *d*	Minimum Embedment Depth h_v in. (mm)	$f'_m \geq$ **1,500 psi** (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
#6-#8	3/4 (19.1)	180 (0.8)	215 (1.0)	35 (0.2)	45 (0.2)
#8-#10	7/8 (22.2)	290 (1.3)	235 (1.1)	60 (0.3)	45 (0.2)
#10-#12	1 (25.4)	350 (1.6)	280 (1.3)	70 (0.3)	55 (0.2)
#14-#16	1 1/2 (38.1)	840 (3.8)	530 (2.4)	170 (0.8)	105 (0.5)

1. Tabulated load values are for anchors installed in minimum 6-inch wide, Grade N, Type II, medium and normal-weight concrete masonry units.
2. Allowable loads are for anchors and are based on average ultimate values using a safety factor of 5.0.
3. Anchors installed flush with face shell surface.

Ultimate and Allowable Load Capacities for Bantam Plug in Solid and Hollow Clay Brick Masonry[1,2]

Screw Size Range *d*	Minimum Embedment Depth h_v in. (mm)	$f'_m \geq$ **1,500 psi** (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
#6-#8	3/4 (19.1)	100 (0.5)	230 (1.0)	20 (0.1)	45 (0.2)
#8-#10	7/8 (22.2)	160 (0.7)	260 (1.2)	30 (0.1)	50 (0.2)
#10-#12	1 (25.4)	280 (1.3)	320 (1.4)	55 (0.2)	65 (0.3)
#14-#16	1 1/2 (38.1)	880 (4.0)	500 (2.3)	175 (0.8)	100 (0.5)

1. Tabulated load values are for anchors installed in Grade SW multiple wythe, solid and hollow brick masonry conforming to ASTM C62.
2. Allowable loads are calculated using an applied safety factor of 5.0.

ORDERING INFORMATION

Bantam Plug (Not packaged with screws)

Cat. No.	Anchor Size	Drill Diameter	Std. Box	Std. Carton	Wt./100
7559	#6-#8 x 3/4"	3/16"	100	1,000	1
7569	#8-#10 x 7/8"	3/16"	100	1,000	1 1/2
7579	#10-#12 x 1"	1/4"	100	1,000	3
7589	#14-#16 x 1 1/2"	5/16"	50	500	6

Master Pack

Cat. No.	Kit No.	Anchor Size	Screw Size	Anchors & Screws	Std. Box	Std. Carton	Wt./100
8934	B-8	#8-#10	#8 x 1"	100	1	10	9 1/2
8936	B-10	#10-#12	#10 x 1"	100	1	10	12
8938	B-12	#10-#12	#12 x 1"	100	1	10	14

Fluted Plastic Anchor™ *Plastic Wall Anchor*

PRODUCT DESCRIPTION

The Fluted Plastic Anchor is designed for light duty fastening applications in concrete, block, brick or stone. The body of the Fluted Plastic anchor is injection molded from a ductile plastic and is designed to be used with sheet metal or wood screws.

The load capacities for this product depend on the integrity of the base material in which it is installed. The anchor is recommended for light duty static applications where holding power is not a critical factor. It should not be used overhead.

SECTION CONTENTS Page No.

Fluted Plastic Anchor

FEATURES AND BENEFITS

- Works in a variety of base materials
- Anchor body is resistant to corrosion

MATERIAL SPECIFICATIONS

Anchor Component	Component Material
Anchor Shield	Engineered Plastic

ANCHOR MATERIAL

Engineered Plastic

ANCHOR SIZE RANGE (TYP.)

No. 4-6 screw x 1" length to
No. 14 screw x 1 1/2" length

SUITABLE BASE MATERIALS

Normal-Weight Concrete

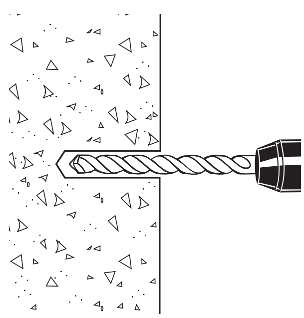
WALL ANCHORS

INSTALLATION SPECIFICATIONS

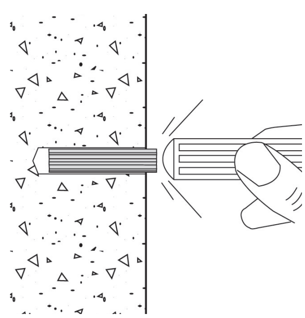
Dimension	Screw Size			
	#4-#6	#7-#9	#10-#12	#14
ANSI Drill Bit Size, d_{bit} (in.)	3/16	7/32	1/4	5/16
Screw Size Range (UNC)	#4-#6	#7-#9	#10-#12	#14

Installation Guidelines

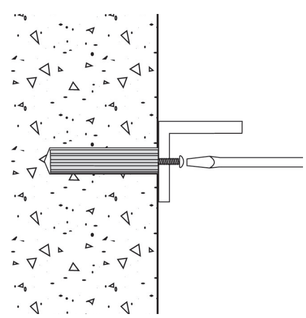
Drill a hole into the base material to the depth of embedment required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



Blow the hole clean of dust and other material. Insert the anchor into the hole until it is flush with the surface of the base material.



Position the fixture. Insert the proper size screw through the fixture into the top of the anchor and tighten. Be sure screw thread fully engages the anchor body.



PERFORMANCE DATA

Ultimate Load Capacities for Fluted Plastic Anchor in Normal-Weight Concrete[1,2]

Screw Size Range *d*	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
#4-#6	3/4 (19.1)	120 (0.5)	200 (0.9)	140 (0.6)	215 (1.0)	160 (0.7)	215 (1.0)
#7-#9	7/8 (22.2)	220 (1.0)	230 (1.0)	235 (1.1)	240 (1.1)	250 (1.1)	240 (1.1)
#10-#12	1 (25.4)	440 (2.0)	280 (1.3)	490 (2.2)	350 (1.6)	540 (2.4)	350 (1.6)
#10-#12	1 1/4 (31.8)	490 (2.2)	280 (1.3)	540 (2.4)	350 (1.6)	590 (2.7)	350 (1.6)
#10-#12	1 1/2 (38.1)	520 (2.3)	280 (1.3)	610 (2.7)	350 (1.6)	680 (3.1)	350 (1.6)
#14	1 (25.4)	520 (2.3)	530 (2.4)	570 (2.6)	575 (2.6)	620 (2.8)	575 (2.6)
#14	1 1/2 (38.1)	540 (2.4)	530 (2.4)	615 (2.8)	575 (2.6)	690 (3.1)	575 (2.6)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.

Allowable Load Capacities for Fluted Plastic Anchor in Normal-Weight Concrete[1,2]

Screw Size Range *d*	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
#4-#6	3/4 (19.1)	30 (0.1)	60 (0.3)	35 (0.2)	55 (0.2)	40 (0.2)	55 (0.2)
#7-#9	7/8 (22.2)	55 (0.2)	60 (0.3)	60 (0.3)	60 (0.3)	65 (0.3)	60 (0.3)
#10-#12	1 (25.4)	110 (0.5)	70 (0.3)	125 (0.6)	90 (0.4)	135 (0.6)	90 (0.4)
#10-#12	1 1/4 (31.8)	125 (0.6)	70 (0.3)	135 (0.6)	90 (0.4)	150 (0.7)	90 (0.4)
#10-#12	1 1/2 (38.1)	130 (0.6)	70 (0.3)	155 (0.7)	90 (0.4)	170 (0.8)	90 (0.4)
#14	1 (25.4)	130 (0.6)	135 (0.6)	145 (0.7)	145 (0.7)	155 (0.7)	145 (0.7)
#14	1 1/2 (38.1)	135 (0.6)	135 (0.6)	155 (0.7)	145 (0.7)	175 (0.8)	145 (0.7)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.

ORDERING INFORMATION

Fluted Plastic Anchor (Not packaged with screws)

Cat. No.	Anchor Size	Color	Drill Diameter	Std. Box	Std. Carton	Wt./100
7500	#4-#6 x 1"	White	3/16"	100	1,000	1
7505	#7-#9 x 1"	Red	7/32"	100	1,000	2
7510	#10-#12 x 1"	Green	1/4"	100	1,000	2
7515	#10-#12 x 1 1/4"	Green	1/4"	100	1,000	2
7520	#10-#12 x 1 1/2"	Green	1/4"	100	1,000	3
7525	#14 x 1"	Blue	5/16"	100	1,000	2
7530	#14 x 1 1/2"	Blue	5/16"	100	1,000	4

Notes:

POWDER ACTUATED

SECTION CONTENTS

POWDER ACTUATED FASTENING SELECTION GUIDES

	Pin Category	0.300" Head Drive Pin						8mm Head Drive Pin					Threaded Studs		Heavy Duty Pins	
	Product	.300" Head Drive Pin		.300" Head Drive Pin with Top Hat	.300" Head Drive Pin with Washers		.300" Head Step Shank Drive Pins	8mm Head Drive Pin		8mm Head Drive Pin with Top Hat	8mm Head Drive Pin with 1" Washers		1/4" – 20 Threaded Stud	3/8" – 16 Threaded Stud	3/8" Head Drive Pin	10mm Head Drive Pin
	Page	311	311	312	312	312	311	314	314	314	314	314	316	316	317	315
Pin Dimensions	Shank Length	1/2" to 1 1/2"	1 3/4" to 3"	1/2" to 1"	3/4" to 1 1/2"	2" to 3"	3/4" to 1"	5/8" to 1 1/2"	1 5/8" to 2 7/8"	5/8" to 1"	1" to 1 1/2"	2" to 2 7/8"	1/2" to 1 1/4"	3/4" to 1 1/4"	1" to 3 1/8"	3/4" to 3 1/4"
	Shank Diameter	0.145"					.145/.130"	0.145"					0.145"	0.205"	.172", .216/.188"	0.177"
Base Material	Concrete	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Lightweight Concrete	■	■	■	■	■		■	■	■	■	■	■	■	■	■
	Grout-filled Concrete Masonry	■	□	□	■	□		■	□	□	□	□	□	□	□	□
	Steel	■		■	■		■	■		■	■		■	■	■	■
Load Power Level	Gray – Power Level 1															
	Brown – Power Level 2															
	Green – Power Level 3															
	Yellow – Power Level 4															
	Red – Power Level 5															
	Purple/Black – Power Level 6															
Powers Tools	P3600													■		■
	PA351	□		□	□		□	■		□	□					
	P3801												□	■	■	■
	P3500 / PA3500	■	■	■	■	■	■	■	■	■	■	■	■			
	P35s	■		■	■		■	■		■	■					
	P7201	■		■	■		■	■		■	■		■			
	P2201	■	■	■	■	■	■	■	■	■	■	■	■			
	P1000	■	■	■	■	■	■	■	■	■	■	■	■			
	Hammer Drive Tool															
Other Tools	721	■		■	■		■	■		■	■		■			
	M70	■	■	■	■	■	■	■	■	■	■	■	■			
	LADD (L1600)															
	D45	■	■	■	■	■	■	■	■	■	■	■	■			
	D60 / D60L	■	■	■	■	■	■	■	■	■	■	■	■			
	MD380													■	■	
	SA270	■	■	■	■	■	■	■	■	■	■	■	■			
	Cobra	■	■	■	■	■	■	■	■	■	■	■	■			
	Viper	■		■	■			■		■	■		■			
	DX E37	■		■	■		■	■		■	■		■			
	DX E72	■	■	■	■	■	■	■	■	■	■	■	■			
	DX400	■	■	■	■	■	■	■	■	■	■	■	■			
	DX600N													■	■	□
	DX35	■		■	■		■	■		■	■		■			
	DX350 / DX351	■	■	■	■	■	■	■	■	■	■	■	■			
	DX36M	■	■	■	■	■	■	■	■	■	■	■	■			
	DX 450															
	DX451	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
	DXA40	■		■	■		■	■		■	■		■			■
	DXA41	□	□	□	□	□	□	□	□	□	□	□	□	■	■	■
	DX100	■	■	■	■	■	■	■	■	■	■		■			
	DX200	■	■	■	■	■	■	■	■	■	■		■			
	DX460	□		□	□		□	■		□	□					

POWDER ACTUATED

POWDER ACTUATED FASTENING SELECTION GUIDES (Continued)

	Pin Category	Ballistic Point Pin			Specialty Fasteners		Clips and Accessories				Powder Actuated Loads									
	Product	Ballistic Point Pin	Ballistic Point Step Shank Pin		Forming Pin	Hammer Drive Pin	Ceiling Clip Assemblies (.300", 8mm & Ballistic Point)	Ceiling Clip Assemblies Ladd Tool (L1600)	BX – EMT Conduit Clip Assemblies (.300" & 8mm)	Rebar Basket Clip Assemblies (8mm)	.22 Caliber "A" Single Load	.22 Caliber Single Loads Ladd Tool (L1600)	.25 Caliber Disk Load	.25 Caliber Disk Loads (Red)	.25 Caliber Single Load	.27 Caliber Single Loads	.27 Caliber Single Long Loads	.25 Caliber 10 Load Strip	.27 Caliber 10 Load Strip (Purple/Black)	.27 Caliber Safety Strip
	Page	316	316	316	319	317	318	318	318	319	329	329	329	329	329	329	330	330	330	330
Pin Dimensions	Shank Length	1/2" to 7/8"	1 1/4"	1 7/8"	1 3/4" to 2 1/2"	3/4" to 3"	1" to 1 1/4"	1 1/2"	1" to 1 1/4"	1 1/4" to 2 7/8"										
	Shank Diameter	0.150"	0.181"/0.150"		0.145"	0.140"	0.145"	0.155"	0.145"	0.145"										
Base Material	Concrete	■	■	■	■	■	■	■	■	■										
	Lightweight Concrete	■	■	■	■	■		■	■	■										
	Grout-filled Concrete Masonry	□	□		□	□	□		□	□										
	Steel	■	■	□			■	■	■	□										
Load Power Level	Gray – Power Level 1										■		■							
	Brown – Power Level 2										■		■			■				■
	Green – Power Level 3										■	■	■		■	■	■	■		■
	Yellow – Power Level 4										■	■	■		■	■	■	■		■
	Red – Power Level 5											■		■	■	■	■	■		■
	Purple/Black – Power Level 6											■			■	■	■		■	
Powers Tools	P3600																		■	■
	PA351																			■
	P3801															■	■			
	P3500 / PA3500	■	■	■	■		■		■	■										■
	P35s	■	■				■		■									■		
	P7201	■	■				■		■		■									
	P2201	■	■	■	■		■		■	■	■									
	P1000	■	■	■	■		■		■	■	■									
	Hammer Drive Tool					■														
Other Tools	721	■	■				■		■		■									
	M70	■	■	■	■		■		■	■	■									
	LADD (L1600)							■				■								
	D45	■	■	■	■		■		■	■			■	■						
	D60 / D60L	■	■	■	■		■		■	■			■							
	MD380																■			
	SA270	■	■	■	■		■		■	■										■
	Cobra	■	■	■	■		■		■	■										■
	Viper		■				■		■											■
	DX E37	■	■				■		■		■									
	DX E72	■	■	■	■		■		■	■	■									
	DX400		■	■	■		■		■	■						■				
	DX600N	■															■			
	DX35	■	■				■		■									■		
	DX350 / DX351	■	■	■	■		■		■	■										■
	DX36M	■	■	■	■		■		■	■										■
	DX 450																		■	■
	DX451	■	■	■															■	■
	DXA40	■	■	■			■		■											■
	DXA41	■	■	■	■		■		■	■										■
	DX100	■	■	■	■		■		■	■					■					
	DX200	■	■	■	■		■		■	■					■					
	DX460																			■

POWDER ACTUATED

Powder Actuated Fastening

INTRODUCTION

Powder actuated fastening systems provide a cost effective method of attaching fixtures for light duty, static load conditions. Powers' systems consist of specially designed fasteners, installation tools, and powder loads which are designed to function in combination to provide optimum performance. Historically, this method of fastening was developed commercially during the second World War for repairing damage to ships. The original application was the fastening of steel plates together using a direct acting tool system. After WWII, use of powder actuated fastening systems in the construction industry developed rapidly because of the significant speed of installation which resulted in considerable cost savings.

These systems provide the contractor with the ability to fasten into concrete, masonry, and structural steel without pre-drilling holes. For most applications, this eliminates time consuming layout or hole spotting resulting in faster installation and reduced costs. In addition, powder actuated fastening systems are completely portable and are ideal for locations that are difficult to access. Today, powder actuated fastening technology has become the standard method of attachment for many applications in the construction industry. Powers offers a complete line of high quality, low velocity powder actuated tools, fasteners, assemblies, and accessories.

SECTION CONTENTS Page No.

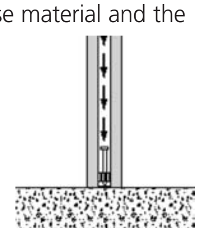
GENERAL FUNCTIONING PRINCIPLES

Operating Principle

Powder actuated systems, often described as forced entry systems, require special installation tools which are critical components of a successful fastening. Two types of tools have been used in the market which operate on different driving principles, direct acting and indirect acting. The basic design of the tools are similar in that each has a breech which holds the powder load and a barrel or guide mechanism to hold the fastener. However, the installation and safety characteristics of the tools are very different.

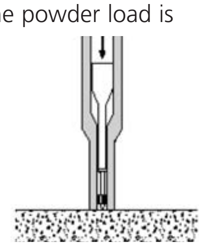
Direct Acting Principle

As the powder load is ignited in a direct acting tool, the expanding gases of the load act directly on the fastener to drive it down the barrel of the tool and into the base material. In a tool of this type, 100% of the energy developed by the powder load is transferred to the fastener. Penetration of the fastener into the base material is controlled primarily by the density of the base material and the load level selected. While the direct acting principle may allow fastenings to be made in very dense concrete and thick steel base materials, safety concerns have made the indirect principle the technology of choice. Powder actuated tools using this principle are no longer commercially available.



Indirect Acting Principle

In a tool which operates using the indirect acting principle, the expanding gases of the ignited powder load act directly on a captive piston which is housed within the barrel of the tool. The piston drives the fastener into the base material providing better control over the penetration of the fastener. In a tool of this type, most of the energy developed by the powder load is retained by the piston. Penetration of the fastener into the base material is controlled by the design of the piston, the load level selected, and the density of the base material. All Powers' powder actuated tools operate using the indirect acting principle and are classified as low velocity tools.



Tool Classification

Powder actuated tools can be classified as low, medium, or high velocity. This classification system can apply to either direct or indirect acting tools and is based on a ballistic test. Using the strongest powder load and the lightest fastener commercially available from the manufacturer for a specific tool, the velocity of the tool is determined by measuring the average velocity of the fastener for ten individual tests. The velocity classifications based on ANSI A10.3 are as follows:

1. **Low Velocity Tool**
   A tool in which the average test velocity does not exceed 328 feet per second (100 meters per second).
2. **Medium Velocity Tool**
   A tool in which the average test velocity exceeds 328 feet per second (100 meters per second) but is less than 492 feet per second (150 meters per second). Medium velocity tools are no longer commercially available.
3. **High Velocity Tool**
   A tool in which the average test velocity exceeds 492 feet per second (150 meters per second). High velocity tools are no longer commercially available.

Tool Safety

Powder actuated fasteners should be installed by properly trained and licensed operators as described in ANSI Standard A 10.3. Authorized Powers distributors offer complete training programs for end users. Contact your local Powers branch office or distributor for complete details. While the powder actuated tools are summarized in this section of the manual, only trained and licensed operators are allowed to use the tools. These summaries are for general information only.

POWDER LOADS

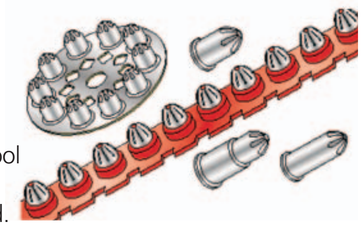
The energy source used to drive a powder actuated fastener into the base material is a self contained unit called a powder load. Specific load types are designed for each unique powder actuated tool. Powers tools use cased powder loads in which the propellant is housed in a crimped metal case.

Powder Load Identification

In the commercial market, cased powder loads are available in sizes ranging from .22 to .27 calibers. The power level or strength of a cased powder load is identified using a 12 level system in which a combination of six color codes and two case types are used. Power level 1/gray is the lowest with power level 12/purple being the highest. Only six color codes are used because there are not twelve easily distinguished colors available. The following table shows this identification system.

Power Level	Color Identification	
	Case Color	Load Color
1	Brass	Gray
2	Brass	Brown
3	Brass	Green
4	Brass	Yellow
5	Brass	Red
6	Brass	Purple
7	Nickel	Gray
8	Nickel	Brown
9	Nickel	Green
10	Nickel	Yellow
11	Nickel	Red
12	Nickel	Purple

Powder loads are available as single units for single shot tools and collated in groups of 10 into plastic strips or metal discs for semi-automatic tools. Powers tools use .22 caliber A, .25 caliber, and .27 caliber crimped, rim fire powder loads having power levels ranging from 1-6. Powder loads for other commercially available tools are also available such as .22 caliber Ladd and .27 caliber long. Consult the individual tool instructions for details on the caliber, range, and type of load.



The crimped tip on the load retains the powder in the casing. Wadded loads which have a plug in the front of the casing should never be used in tools designed for use with crimped loads such as low velocity, piston tools. The wadding material can cause the tool to clog or jam. Rim fire refers to the method of actuation. In a rim fire powder load, the primer is contained in the rim of the casing. When the tool is fired, the firing pin strikes the rim causing the primer to ignite which in turn ignites the powder contained in the main portion of the load. The power level of Powers powder loads is marked on each box. As the number increases, the power level also increases. Power level is also indicated by the color of the box, label, and the color on each individual powder load.

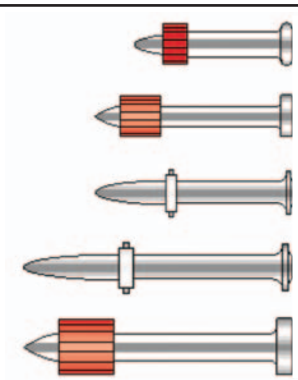
Powder Load Selection

Use of the proper power level is critical to the success of a powder actuated fastening. Prior to selecting the proper power level, conduct a center punch test as described in the upcoming section on base material suitability. To select the proper power level to be used with a specific fastener, always make a test firing using the lowest power level recommended for the tool being used. On tools which have a variable power control, use the lowest possible setting. If the lowest power level does not fully drive the fastener, try a powder load having the next higher power level. Continue this procedure until the proper fastener penetration is obtained.

FASTENER TYPES

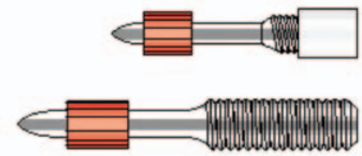
Several fastener types are available including drive pins and threaded studs along with application-specific assemblies. According to ANSI A 10.3, only those types of fasteners and powder loads as recommended by the tool manufacturer for a particular tool, or those providing the same level of safety and performance, shall be used.

Typical Drive Pins



Drive pins are one of the most commonly specified type of powder actuated fastener. They are used to fasten a fixture directly to the base material in one operation for permanent applications. Pins are available in several head configurations. Each of the head configurations has a corresponding shank diameter and a variety of lengths. Some drive pins designed for use in steel have a knurled shank to provide increase load capacities. Other drive pins have a narrow shank diameter close to its point and a wider shank diameter comprising the upper portion. This design is known as “step shank” and is used to penetrate denser base materials more consistently.

Threaded Studs

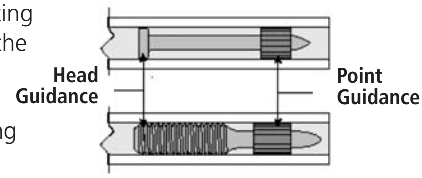


For applications where adjustment or removability may be required, threaded studs are available with both a 1/4" or 3/8" thread diameter. Each thread size has a corresponding shank diameter and is available in a variety of shank and thread lengths.

FASTENER GUIDANCE AND MATERIAL SPECIFICATIONS

Fastener Guidance

Both types of fastener have pre-mounted plastic fluting or washers which hold the fastener centered in the tool guide prior to driving. During the driving process, the fluting or washers provide point guidance for the fastener. Generally, head guidance is provided by the diameter of the fastener head or threads. 1/4"-20 threaded studs also have a plastic cap to protect the threads of the fastener during the driving process providing head guidance.



Fastener Material Specifications

Mechanical Properties

Powder actuated fasteners are subjected to extremely high stresses as they are driven into the base material. A key aspect of their design is to manufacture them from a material that is tough enough to prevent deformation of the fastener during the driving process with ductility to prevent shattering. Powers fasteners are specially manufactured using a proprietary process to meet these requirements. The fasteners are manufactured from modified AISI 1062 steel and austempered to a core hardness of RC 53 to 55. To ensure ductility, samples of all fasteners are bend tested during Quality Control inspections to 60 degrees. Powder actuated fasteners have the following minimum mechanical properties:

Typical Tensile Strength – 282,000 psi
Typical Shear Strength – 162,000 psi

Corrosion Resistance

Powder actuated fasteners are designed to be used in a non-corrosive atmosphere unless application specific corrosion testing has been performed. To reduce the possibility of the embrittlement of a heat treated part, the standard finish for all Powers fasteners is mechanically applied zinc meeting the requirements of ASTM B 695, Class 5, Type 1 providing an average minimum thickness of 5 microns (0.0002") with no supplementary coating.

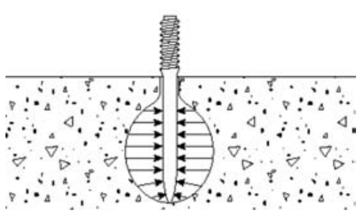
FUNCTIONING OF POWDER ACTUATED FASTENERS

Functioning in Concrete

The load capacity of a powder actuated fastener when installed into concrete or masonry base materials is based on the following factors:

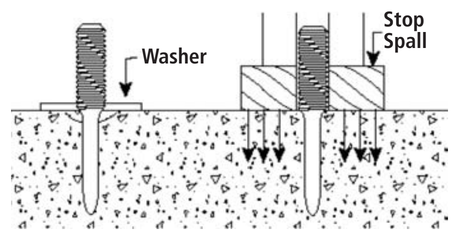
1. Strength of the base material
2. Hardness and concentration of the aggregate
3. Shank diameter of the fastener
4. Depth of embedment into the base material
5. Fastener spacing and edge distance

In addition to these factors, installation tool accessories such as a stop spall which reduces the tendency of the concrete surface to spall during the driving action can increase the performance of the fastener.



When a powder actuated fastener is driven into concrete, it displaces the volume of concrete around the embedded area of the fastener shank. As this occurs, the concrete directly surrounding the fastener is compressed and in turn presses back against the shank of the fastener. Additionally, the driving action generates heat which causes particles within the concrete to fuse to the shank of the fastener. This combination of compression and fusion holds the fastener in the concrete base material. A similar action occurs when fastening into block masonry.

Generally, the performance of the fastener in a given concrete strength will increase with greater embedment depths in a certain range. Depending on the fastener style and base material strength, embedment depths range from 5/8" to 1-1/2". For depths greater than this range, there is the possibility of fastener bending or "fishhooking" which may decrease expected load capacities. For typical embedment depths achieved, refer to the upcoming section on load capacities.

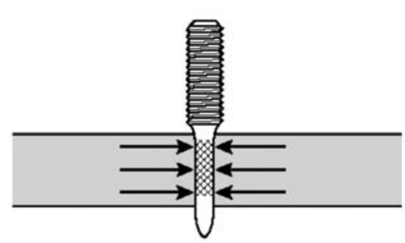


During the driving action, some localized surface spalling of the concrete may occur. Normally, this is a surface effect which does not affect the performance of the fastener. However, it may pose an aesthetic problem for exposed applications where a fixture is not used. In cases such as this, two methods can be used to improve the appearance of the fastening. A stop spall adapter mounted on the powder actuated tool can help to reduce surface spalling. Another method used is to drive the fastener through a steel washer to improve the appearance of the application.

Functioning in Steel

The load capacity of a powder actuated fastener when installed into steel base materials is based on the following factors:

1. Thickness of the steel
2. Tensile strength of the steel
3. Shank diameter of the fastener
4. Depth of point penetration through the steel
5. Fastener spacing and edge distance.



POWDER ACTUATED

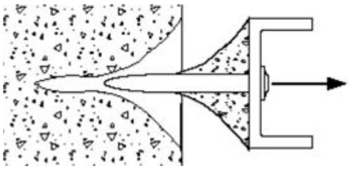
Functioning in Steel (Continued)

When a powder actuated fastener is driven into steel, it displaces the steel laterally 360 degrees around the shank of the fastener. Since steel is an elastic material, it presses back against the shank of the fastener to hold it in place. As the diameter of the fastener shank is increased, the load capacity obtained will generally increase provided the steel thickness is sufficient to accept the fastener. To further increase fastener performance in steel, some fasteners have a knurled shank which allows the steel to form a key lock into the grooves to provide higher capacities than those obtained with a smooth shank. For typical performance, the fastener point should completely penetrate the steel. Normally, a minimum of 1/4" is allowed for the point length. An increase in performance can be expected until the fastener no longer completely penetrates through the steel. At this point, the elastic properties of the steel can cause a compression force to be developed at an angle against the fastener point which reduces load capacity. In thicker steel base materials, adequate load capacities may be obtained for applications in which the point of the fastener does not fully penetrate the steel. Job site performance tests are recommended.

Fasteners should not be used in areas that have been welded or cut with a torch as these procedures may have caused local hardening of the steel. Over driving of the fastener should be avoided as the rebound created may reduce the load capacity or cause damage to both the fastener and the tool. When fastening into unsupported long steel members, it may be necessary to provide support in the area of the fastening to prevent spring action which can cause inconsistent penetration and a reduction in load capacity.

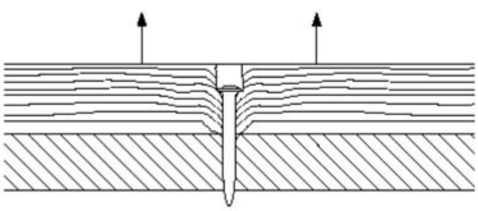
FASTENER BEHAVIOR

An understanding of the performance characteristics of a powder actuated fastener is an important aspect of the selection process. At ultimate failure, the following modes of failure can be expected.



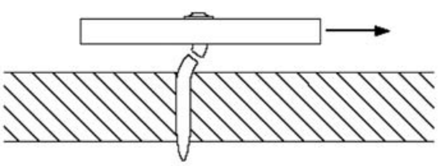
Base Material Failure Fastener Pullout

The fastener pulls out of the base material when subjected to a tension load. In concrete, a typical cone type failure can be expected while in steel the fastener pulls out cleanly.



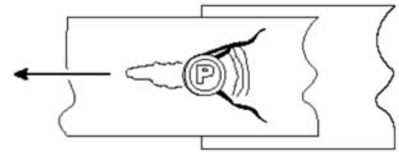
Pullover Failure

The fixture or material fastened pulls over the head of the fastener. This is a common occurrence when fastening lumber or thin metal materials. To help improve pullover resistance for applications such as this, Powers powder actuated fasteners are available with pre-mounted steel washers.



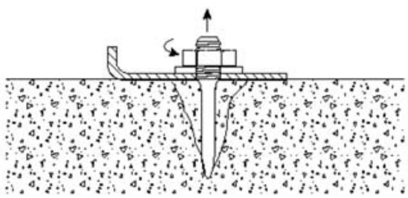
Shank Failure

The shank of the fastener is broken due to an applied lateral load such as shear. This can also happen when a bending load is created.



Bearing Failure

The fixture or material fastened tears as a lateral load is applied and is pulled over the head of the fastener.



Tightening Failure

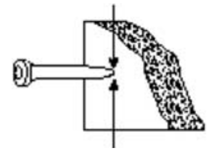
On threaded studs, the tightening torque applied must be limited to prevent over tightening of the connection. This will prevent the development of a clamping force greater than the tension or pullout load resistance of the fastener.

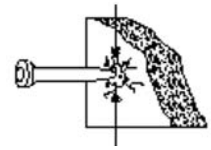
BASE MATERIAL SUITABILITY

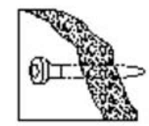
While powder actuated fasteners can be used successfully in concrete, certain masonry materials, A 36 and A572 steel, some materials are completely unsuitable. Fasteners should never be fired into hard or brittle materials such as cast iron, tile, glass, or rock. These materials can shatter easily resulting in a potential safety hazard. In addition, soft base materials such as wallboard, plaster, or wood are not appropriate as the fastener could pass completely through these materials. The user should never guess when fastening into any base material.

A Center Punch Test should always be performed to determine the suitability of the base material for a powder actuated fastening. This test is relatively simple and can help to ensure a safe, successful fastening. Be sure to wear the appropriate eye protection when performing this test. To begin, select the fastener to be used for the job. Then place the point of the fastener against the proposed base material. Strike the fastener with a single hammer blow and then examine the point. If the point of the fastener is not blunted and the base material has a clear point indentation, it is acceptable to proceed with the first test installation.

Use of a powder actuated system is not recommended if the following occurs during the Center Punch Test:





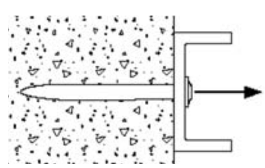


1. The fastener point has been blunted. This indicates that the base material is too hard.
2. The base material cracks or shatters. This indicates that the base material is too brittle.
3. When using an average hammer blow, the fastener penetrates the base material easily. This indicates that the base material is too soft.

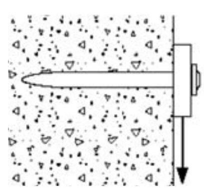
APPLIED LOADS

The type of load and the manner in which it is applied by the fixture or other attachment is a primary consideration in the selection of a powder actuated fastener. Powder actuated fastening systems provide a cost effective method of attaching fixtures for light duty, static load conditions. The load capacities for powder actuated fasteners published in this manual represent the results of laboratory testing conducted according to ASTM Standards E 488 and E 1190. As always, the suitability of a fastener for a specific application should be determined by a qualified design professional responsible for the product installation.

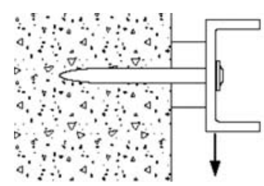
Tension Load
A tension load is applied directly in line with the axis of the fastener.



Shear Load
A shear load is applied perpendicular to the fastener directly along the surface of the base material.



Bending Loads
For fixtures 5/8" or greater, the effect of bending resulting from the application of static shear load should be considered. This can occur in softer material such as lumber used for sill plates or when shims or spacers are placed between the fixture and the base material. In situations such as this, the load is applied at a distance from the surface of the base material creating a lever type action on the fastener. When a bending load is applied to a fastener, it is often the physical strength of the fastener material, not the tension or shear load capacities, that limit the strength of the connection. For sill plate applications, Powers publishes test data based on the use of 2x lumber to develop the capacities. The allowable bending load should be calculated by a design professional based on the material from which the fastener is manufactured. For threaded powder actuated fasteners and step shank pins, it is important to remember that the point of maximum stress is at the interface of the shank and the base material. For example, when calculating the bending load for a fastener such as a 1/4"-20 threaded stud, it is important to use the shank diameter of 0.145" in calculations, not the 0.211" root diameter of the threads.



DESIGN RECOMMENDATIONS FOR CONCRETE

Allowable Load Capacities

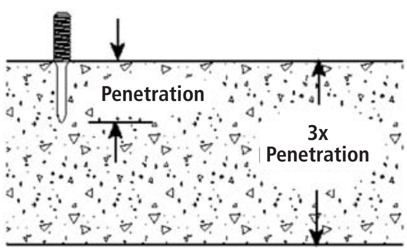
The allowable load capacity which may be applied to a powder actuated fastener is based on applying a safety factor to the average ultimate load capacity obtained from testing according to ASTM Standards E 488 and E 1190. One purpose of the safety factor is to allow for field variations which may differ from the testing conditions in the laboratory. An example is the type and strength of the base material. For proper performance, powder actuated fasteners must be installed by properly trained and licensed operators. In concrete and masonry materials, the values for allowable loads are based on applying a safety factor of 5:1 or greater to the ultimate loads. Loads are based on testing fasteners installed in base materials having the designated strength at the time of installation. Values are for the fastener only, connected parts must be investigated separately. Due to the variability of powder actuated fasteners installed in concrete or masonry materials, use of multiple fasteners is recommended to increase reliability. The design data listed in the tables are suggested allowable load capacities based on the safety factors noted below each table. These safety factors are based on industry experience and may need to be increased based on the application requirements or local codes as determined by the design professional responsible for the product installation. Proper spacing and edge distance guidelines must be followed.

DESIGN RECOMMENDATIONS FOR CONCRETE (Continued)

Base Material Strength

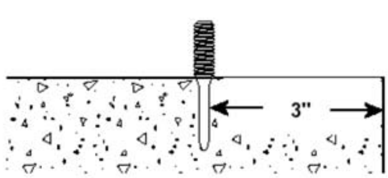
As discussed earlier in this manual, the strength of concrete and masonry base materials can vary widely. For installations in concrete, load capacities are published for powder actuated fasteners in normal-weight concrete in various compressive strength ranges. Linear interpolation of the data to calculate load capacities for fasteners installed in intermediate concrete strengths is permitted. Normally, the load capacities can be expected to increase as the compressive strength of the concrete base material increases. However, some types of high compressive strength concrete or concrete with a very hard aggregate may not be suitable for powder actuated fastenings. Job site installation tests are recommended to determine fastener suitability. For structural lightweight concrete, values are published for minimum 3000 psi concrete with and without steel deck. For masonry base materials, the published load capacities are based on testing in a wall constructed from ASTM C 90, Grade N, lightweight block. Since the consistency of masonry block can vary widely, especially within the mortar used, these values should be used solely as a guide. Job site tests are recommended to determine actual load capacities when used in masonry walls.

Base Material Thickness



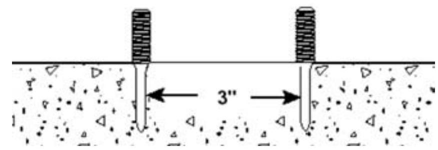
Concrete base material should be at least three (3) times as thick as the fastener embedment penetration. If the concrete is too thin, the compressive forces forming at the fasteners point can cause the free face of the concrete to break away. This can create a dangerous condition from flying concrete and/or the fastener and also results in a reduction of fastener holding power. For applications in the face shell of concrete masonry block, select a fastener length which will not exceed the thickness of the face shell.

Edge Distance



Do not fasten closer than 3" from the edge of concrete. If the concrete cracks, the fastener may not hold. Closer edge distances for applications such as sill plates may be permitted if specific fastener testing has been conducted.

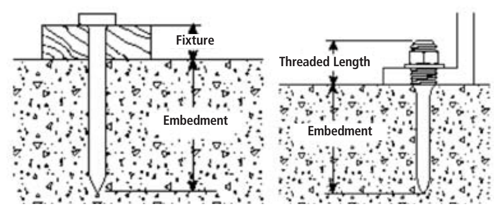
Spacing



Setting fasteners too close together in concrete or masonry can cause cracking. The recommended minimum distance between fasteners is 3" center to center.

Length Selection

For permanent applications using pins in concrete, first determine the thickness of the fixture to be fastened. To this, add the required embedment or penetration into the base material. This will be the fastener shank length required. For applications in the face shell of masonry block, select a fastener length which will not exceed the thickness of the face shell.



For removable applications with threaded studs, the shank length required is equal to the embedment depth required. To determine the minimum threaded length, add the thickness of the fixture and the nut / washer thickness. The nut and washer thickness is equal to the nominal thread diameter. For applications where 3/8" threaded studs are used at an embedment depth of 1-3/8", the fasteners were driven up to the threaded portion of the part. Do not over tighten threaded parts. Maximum tightening torque values are listed in the table below. Use of a nut setter is recommended to reduce the possibility of over tightening the fasteners. For critical applications, perform a job site test.

Maximum Torque for 1/4" Stud (ft.-lbs.)	Maximum Torque for 3/8" Stud (ft.-lbs.)
2	4

DESIGN RECOMMENDATIONS FOR STEEL

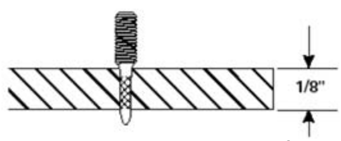
Allowable Load Capacities

The allowable load capacity which may be applied to a powder actuated fastener is based on applying a safety factor to the average ultimate load capacity obtained from testing according to ASTM Standards E 488 and E 1190. One purpose of the safety factor is to allow for field variations which may differ from the testing conditions in the laboratory. An example is the type and strength of the base material. For proper performance, powder actuated fasteners must be installed by properly trained and licensed operators. In steel materials, the values listed are based on a safety factor of 5:1 or greater to the ultimate loads. Values are for the fastener only, connected parts must be investigated separately. Use of multiple fasteners is recommended to increase reliability. The design data listed in the tables are suggested allowable load capacities based on the safety factors noted below each table. This safety factor is based on industry experience and may need to be increased based on the application or local code requirements as determined by the design professional responsible for the product installation. Proper spacing and edge distance guidelines must be followed.

Base Material Strength

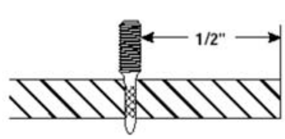
The published allowable load capacities are based on testing conducted in ASTM A 36 structural steel with the fastener point fully penetrating the steel member. For use in higher strength steel, applications where the point of the fastener will not penetrate a thickness of steel greater than those listed in the tables, job site tests are recommended to determine the suitability of the application and the actual load capacities.

Base Material Thickness



Steel base materials should be a minimum of 1/8" in thickness.

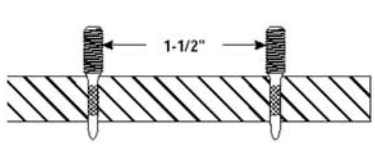
Edge Distance



For installations in steel, 1/2" is the recommended minimum edge distance.

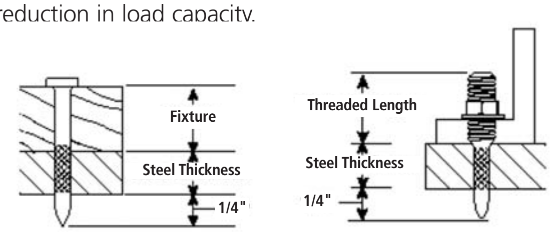
Spacing

The recommended minimum distance between fastenings is 1-1/2" center to center for installations in steel.



Length Selection

For permanent applications when using pins in steel, first determine the thickness of the fixture to be fastened. To this, add the thickness of the steel base material plus a minimum of 1/4" to allow for proper point penetration. This will be the minimum fastener shank length required. Do not select a fastener length longer than that required for the application. An excessively long shank can burnish or polish the hole created in the steel resulting in a reduction in load capacity.



For removable applications with threaded studs, the shank length required is equal to the thickness of the steel base material plus a minimum of 1/4" to allow for point penetration. This will be the minimum fastener shank length required. Do not select a shank length longer than that required for the application. An excessively long shank can burnish or polish the hole created in the steel resulting in a reduction in load capacity. To determine the minimum threaded length, add the thickness of the fixture and the nut / washer thickness. The nut and washer thickness is equal to the nominal thread diameter.

Do not over tighten threaded studs, the maximum tightening torque is listed in the table below. Use of a nut setter is recommended to reduce the possibility of over tightening the fasteners. For critical applications, perform a job site test.

Base Material Thickness (in.)	Maximum Torque for 1/4" Stud (ft.-lbs.)	Maximum Torque for 3/8" Stud (ft.-lbs.)
1/8"	2	4
3/16"	4	6
1/4"	6	10
3/8"	8	12

PERFORMANCE DATA

Ultimate Load Capacities for Powder Actuated Fasteners in Normal-Weight Concrete[1]

Pin Description	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
		2,000 psi (13.8 MPa)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
Ballistic Point Pin (0.150" Shank)	5/8 (15.9)	370 (1.7)	590 (2.7)	610 (2.7)	810 (3.6)	610 (2.7)	800 (3.6)	590 (2.7)	780 (3.5)
	3/4 (19.1)	480 (2.2)	770 (3.5)	660 (3.0)	940 (4.2)	680 (3.1)	980 (4.4)	700 (3.2)	1,020 (4.6)
Ballistic Point Pin (0.181"/0.150" Shank)	1 (25.4)	690 (3.1)	1,130 (5.1)	770 (3.5)	1,200 (5.4)	820 (3.7)	1,350 (6.1)	870 (3.9)	1,500 (6.8)
	1 1/4 (31.8)	810 (3.6)	1,460 (6.6)	1,130 (5.1)	1,490 (6.7)	1,380 (6.2)	1,680 (7.6)	1,620 (7.3)	1,890 (8.5)
	1 1/2 (38.1)	920 (4.1)	1,780 (8.0)	1,490 (6.7)	1,780 (8.0)	1,930 (8.7)	2,020 (9.1)	2,370 (10.7)	2,250 (10.1)
.300" Head Drive Pin 8mm Head Drive Pin 1/4"-20 Threaded Stud (0.145" Shank)	5/8 (15.9)	370 (1.7)	590 (2.7)	610 (2.7)	810 (3.6)	610 (2.7)	800 (3.6)	590 (2.7)	780 (3.5)
	3/4 (19.1)	480 (2.2)	770 (3.5)	660 (3.0)	940 (4.2)	680 (3.1)	980 (4.4)	700 (3.2)	1,020 (4.6)
	1 (25.4)	690 (3.1)	1,130 (5.1)	770 (3.5)	1,200 (5.4)	820 (3.7)	1,350 (6.1)	870 (3.9)	1,500 (6.8)
	1 1/4 (31.8)	810 (3.6)	1,460 (6.6)	1,130 (5.1)	1,490 (6.7)	1,380 (6.2)	1,680 (7.6)	1,620 (7.3)	1,890 (8.5)
	1 1/2 (38.1)	920 (4.1)	1,780 (8.0)	1,490 (6.7)	1,780 (8.0)	1,930 (8.7)	2,020 (9.1)	2,370 (10.7)	2,250 (10.1)
3/8" Head Drive Pin (0.172" Shank)	1 1/4 (31.8)	930 (4.2)	1,780 (8.0)	1,160 (5.2)	2,120 (9.5)	1,310 (5.9)	2,120 (9.5)	1,600 (7.2)	2,120 (9.5)
	1 1/2 (38.1)	1,470 (6.6)	2,540 (11.4)	2,040 (9.2)	2,540 (11.4)	2,040 (9.2)	2,540 (11.4)	2,040 (9.2)	2,540 (11.4)
10mm Head Drive Pin (0.177" Shank)	3/4 (19.1)	–	–	525 (2.4)	725 (3.3)	540 (2.4)	740 (3.3)	550 (2.5)	750 (3.4)
	1 (25.4)	–	–	875 (3.9)	925 (4.2)	890 (4.0)	940 (4.2)	900 (4.1)	950 (4.3)
	1 1/4 (31.8)	–	–	1,225 (5.5)	1,125 (5.1)	1,225 (5.5)	1,125 (5.1)	1,225 (5.5)	1,125 (5.1)
3/8"-16 Threaded Stud (0.205" Shank)	1 (25.4)	770 (3.5)	1,250 (5.6)	990 (4.5)	1,320 (5.9)	1,300 (5.9)	1,700 (7.7)	1,300 (5.9)	1,700 (7.7)
	1 1/4 (31.8)	1,340 (6.0)	2,090 (9.4)	1,340 (6.0)	2,170 (9.8)	1,690 (7.6)	2,560 (11.5)	1,690 (7.6)	2,560 (11.5)
	1 3/8 (34.9)	1,840 (8.3)	2,210 (9.9)	2,190 (9.9)	2,590 (11.7)	2,340 (10.5)	3,150 (14.2)	2,340 (10.5)	3,150 (14.2)
Ceiling Clips – Standard (0.145" Shank)	3/4 (19.1)	320 (1.4)	600 (2.7)	500 (2.3)	600 (2.7)	525 (2.4)	975 (4.4)	540 (2.4)	1,170 (5.3)
	1 (25.4)	410 (1.8)	960 (4.3)	670 (3.0)	990 (4.5)	700 (3.2)	1,180 (5.3)	720 (3.2)	1,280 (5.8)
Ceiling Clips – Economy (0.145" Shank)	3/4 (19.1)	250 (1.1)	610 (2.7)	330 (1.5)	760 (3.4)	520 (2.3)	1,030 (4.6)	570 (2.6)	1,170 (5.3)
	1 (25.4)	440 (2.0)	960 (4.3)	440 (2.0)	1,190 (5.4)	690 (3.1)	1,195 (5.4)	820 (3.7)	1,200 (5.4)
Ballistic Point Ceiling Clip – (0.181"/0.150" Shank)	–	–	–	500 (2.3)	200 (0.9)	–	–	–	–
Ceiling Clips – LADD Pin (0.152" Shank)	1 1/8 (28.6)	630 (2.8)	810 (3.6)	750 (3.4)	1,100 (5.0)	955 (4.3)	1,225 (5.5)	1,060 (4.8)	1,290 (5.8)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 5.0 or greater to determine the allowable working load.

PERFORMANCE DATA

Ultimate Load Capacities for Powder Actuated Fasteners in Lightweight Concrete[1,2,3]

Pin Description	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
		3,000 psi (20.7 MPa)				**3,500 psi** (24.2 MPa)			
		Lightweight Concrete		Over 20 Gage Deck		Lightweight Concrete		Over 20 Gage Deck	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
Ballistic Point Pin (0.150" Shank)	3/4 (19.1)	560 (2.5)	600 (2.7)	350 (1.6)	1,310 (5.9)	600 (2.7)	650 (2.9)	380 (1.7)	1,410 (6.3)
Ballistic Point Pin (0.181"/0.150" Shank)	1 (25.4)	570 (2.6)	1,000 (4.5)	550 (2.5)	1,350 (6.1)	610 (2.7)	1,080 (4.9)	590 (2.7)	1,460 (6.6)
	1 1/4 (31.8)	810 (3.6)	1,220 (5.5)	700 (3.2)	1,380 (6.2)	870 (3.9)	1,320 (5.9)	760 (3.4)	1,490 (6.7)
	1 1/2 (38.1)	1,040 (4.7)	1,440 (6.5)	840 (3.8)	1,400 (6.3)	1,120 (5.0)	1,560 (7.0)	920 (4.1)	1,510 (6.8)
.300" Head Drive Pin	3/4 (19.1)	560 (2.5)	600 (2.7)	350 (1.6)	1,310 (5.9)	600 (2.7)	650 (2.9)	380 (1.7)	1,410 (6.3)
8mm Head Drive Pin	1 (25.4)	570 (2.6)	1,000 (4.5)	550 (2.5)	1,350 (6.1)	610 (2.7)	1,080 (4.9)	590 (2.7)	1,460 (6.6)
1/4"-20 Threaded Stud	1 1/4 (31.8)	810 (3.6)	1,220 (5.5)	700 (3.2)	1,380 (6.2)	870 (3.9)	1,320 (5.9)	760 (3.4)	1,490 (6.7)
(0.145" Shank)	1 1/2 (38.1)	1,040 (4.7)	1,440 (6.5)	840 (3.8)	1,400 (6.3)	1,120 (5.0)	1,560 (7.0)	920 (4.1)	1,510 (6.8)
3/8" Head Drive Pin (0.172" Shank)	1 1/4 (31.8)	650 (2.9)	1,540 (6.9)	620 (2.8)	1,830 (8.2)	700 (3.2)	1,660 (7.5)	670 (3.0)	1,980 (8.9)
	1 1/2 (38.1)	1,210 (5.4)	1,620 (7.3)	860 (3.9)	1,930 (8.7)	1,310 (5.9)	1,750 (7.9)	930 (4.2)	2,090 (9.4)
10mm Head Drive Pin (0.177" Shank)	1 1/4 (31.8)	1,150 (5.2)	1,200 (5.4)	875 (3.9)	1,475 (6.6)	–	–	–	–
	1 3/8 (34.9)	1,575 (7.1)	1,575 (7.1)	1,025 (4.6)	1,575 (7.1)	–	–	–	–
	1 1/2 (38.1)	1,850 (8.3)	1,850 (8.3)	1,175 (5.3)	1,700 (7.7)	–	–	–	–
	1 5/8 (41.3)	2,400 (10.8)	2,325 (10.5)	1,325 (6.0)	1,800 (8.1)	–	–	–	–
3/8"-16 Threaded Stud (0.205" Shank)	1 (25.4)	910 (4.1)	1,250 (5.6)	530 (2.4)	1,310 (5.9)	980 (4.4)	1,350 (6.1)	570 (2.6)	1,420 (6.4)
	1 1/4 (31.8)	1,350 (6.1)	2,110 (9.5)	670 (3.0)	1,810 (8.1)	1,460 (6.6)	2,280 (10.3)	720 (3.2)	1,960 (8.8)
Ceiling Clips – Standard (0.145" Shank)	3/4 (19.1)	410 (1.8)	440 (2.0)	270 (1.2)	980 (4.4)	440 (2.0)	480 (2.2)	300 (1.4)	1,060 (4.8)
	1 (25.4)	480 (2.2)	790 (3.6)	360 (1.6)	980 (4.4)	520 (2.3)	850 (3.8)	390 (1.8)	1,060 (4.8)
Ceiling Clips – Economy (0.145" Shank)	3/4 (19.1)	280 (1.3)	440 (2.0)	270 (1.2)	1,060 (4.8)	300 (1.4)	480 (2.2)	300 (1.4)	1,140 (5.1)
	1 (25.4)	420 (1.9)	940 (4.2)	460 (2.1)	1,060 (4.8)	460 (2.1)	1,020 (4.6)	500 (2.3)	1,140 (5.1)
Ballistic Point Ceiling Clip – (0.181"/0.150" Shank)	–	–	–	625 (2.8)	1,050 (4.7)	–	–	–	–
Ceiling Clips – LADD Pin (0.152" Shank)	1 1/8 (28.6)	730 (3.3)	1,130 (5.1)	440 (2.0)	1,000 (4.5)	790 (3.6)	1,220 (5.5)	480 (2.2)	1,080 (4.9)

1. For the 10mm Head drive pin, the shear load listed is perpendicular to the flute. The shear value parallel to the flute is 2,025 lbs. (9.1 kN).
2. For the Ballistic Point ceiling clip the shear listed is perpendicular to the flute. The shear value parallel to the flute is 1,125 lbs. (5.1 kN).
3. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 5.0 or greater to determine the allowable working load.

POWDER ACTUATED

Ultimate Load Capacities for Powder Actuated Fasteners used to Install Sill Plates onto Normal-Weight Concrete[1]

Pin Description	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength		
		$f'_c \geq$ **2,000 psi** (13.8 MPa)		
		Tension	Shear	
		lbs. (kN)	Perpen. to Concrete lbs. (kN)	Parallel to Concrete lbs. (kN)
Ballistic Point Pin (0.181"/0.150" Shank)	1 1/2 (38.1)	1,010 (4.5)	1,060 (4.8)	1,200 (5.4)
.300"/8mm Head Drive Pin or 1/4"-20 Threaded Stud (0.145" Shank)	1 1/2 (38.1)	1,010 (4.5)	1,060 (4.8)	1,200 (5.4)
3/8" Head Drive Pin (0.172" Shank)	1 1/2 (38.1)	940 (4.2)	960 (4.3)	1,150 (5.2)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 5.0 or greater to determine the allowable working load.

PERFORMANCE DATA

Ultimate Load Capacities for Powder Actuated Fasteners in Masonry[1,2]

Pin Description	Minimum Embed. Depth h_v in. (mm)	Hollow CMU				Grout-filled Concrete Masonry			
		Cell		Mortar Joint		Cell		Mortar Joint	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
Ballistic Point Pin (0.181"/0.150" Shank)	1 (25.4)	320 (1.4)	740 (3.3)	–	–	570 (2.6)	900 (4.1)	510 (2.3)	960 (4.3)
.300"/8mm Head Drive Pin or 1/4"-20 Threaded Stud (0.145" Shank)	1 (25.4)	320 (1.4)	740 (3.3)	–	–	570 (2.6)	900 (4.1)	510 (2.3)	960 (4.3)
3/8" Head Drive Pin (0.172" Shank)	1 (25.4)	–	–	–	–	740 (3.3)	850 (3.8)	–	–
3/8"-16 Threaded Stud (0.205" Shank)	1 (25.4)	160 (0.7)	670 (3.0)	–	–	860 (3.9)	1,460 (6.6)	1,060 (4.8)	1,030 (4.6)

1. Successful fastening to the face shell of Hollow CMU is typically done with the lightest powder load level.
2. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 5.0 or greater to determine the allowable working load.

Ultimate Load Capacities for Powder Actuated Fasteners in ASTM A 36 Steel[1]

Pin Description	Shank Type	Nominal Steel Thickness									
		1/8"		3/16"		1/4"		3/8"		1/2"	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
Ballistic Point Pin (0.150" Shank)	Smooth	590 (2.7)	2,090 (9.4)	910 (4.1)	3,030 (13.6)	1,310 (5.9)	3,030 (13.6)	2,410 (10.8)	2,620 (11.8)	–	–
.300" Head Drive Pin 8mm Head Drive Pin (0.145" Shank)	Knurled	1,100 (5.0)	990 (4.5)	1,630 (7.3)	1,370 (6.2)	2,160 (9.7)	1,750 (7.9)	2,160 (9.7)	1,750 (7.9)	–	–
	Smooth	590 (2.7)	2,090 (9.4)	910 (4.1)	3,030 (13.6)	1,310 (5.9)	3,030 (13.6)	2,410 (10.8)	2,620 (11.8)	–	–
1/4"-20 Threaded Stud (0.145" Shank)	Knurled	1,100 (5.0)	2,230 (10.0)	1,630 (7.3)	2,770 (12.5)	2,160 (9.7)	3,300 (14.9)	2,560 (11.5)	3,760 (16.9)	–	–
3/8" Head Drive Pin (0.172" Shank)	Smooth	950 (4.3)	2,700 (12.2)	1,490 (6.7)	3,700 (16.7)	1,820 (8.2)	3,890 (17.5)	3,020 (13.6)	4,230 (19.0)	–	–
10mm Head Drive Pin (0.177" Shank)	Smooth	–	–	850 (3.8)	4,150 (18.7)	1,300 (5.9)	4,150 (18.7)	1,900 (8.6)	4,400 (19.8)	3,675 (16.5)	4,075 (18.3)
3/8"-16 Threaded Stud (0.205" Shank)	Knurled	1,120 (5.0)	2,770 (12.5)	2,700 (12.2)	5,460 (24.6)	3,730 (16.8)	8,090 (36.4)	–	–	–	–
Ceiling Clips – Standard (0.145" Shank)	Smooth	1,030 (4.6)	1,190 (5.4)	1,090 (4.9)	1,190 (5.4)	1,090 (4.9)	1,190 (5.4)	1,090 (4.9)	1,190 (5.4)	–	–
Ceiling Clips – Economy (0.145" Shank)	Smooth	950 (4.3)	1,290 (5.8)	1,090 (4.9)	1,290 (5.8)	1,090 (4.9)	1,290 (5.8)	1,090 (4.9)	1,290 (5.8)	–	–
Ceiling Clips – LADD Pin (0.152" Shank)	Smooth	1,180 (5.3)	1,200 (5.4)	1,180 (5.3)	1,200 (5.4)	1,180 (5.3)	1,200 (5.4)	1,180 (5.3)	1,200 (5.4)	–	–

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 5.0 or greater to determine the allowable working load.

Ultimate Load Capacities for Powder Actuated Fasteners in ASTM A 572 Steel[1]

Pin Description	Shank Type	Nominal Steel Thickness									
		1/8"		3/16"		1/4"		3/8"		1/2"	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
10mm Head Drive Pin (0.177" Shank)	Smooth	1,275 (5.7)	3,850 (17.3)	–	–	1,800 (8.3)	3,900 (17.6)	2,275 (10.2)	4,250 (19.1)	–	–

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 5.0 or greater to determine the allowable working load.

PERFORMANCE DATA

Ultimate Tension and Shear Load Capacities for 10mm Powder-Actuated Fasteners Installed in ASTM A 36 Steel Through Wood Members[1,2]

Fastener Description	Shank Diameter in.	1/2-Inch Thick Steel, Structural Plywood, Tension lbs. (kN)	1/2-Inch Thick Steel, Structural Plywood, Shear lbs. (kN)	3/4-Inch Thick Steel, Structural Plywood, Tension lbs. (kN)	3/4-Inch Thick Steel, Structural Plywood, Shear lbs. (kN)	3/8-Inch Thick Steel, Nominal 2"x4" Douglas Fire Element, Tension lbs. (kN)	3/8-Inch Thick Steel, Nominal 2"x4" Douglas Fire Element, Shear lbs. (kN)
10mm Head Drive pin	0.177"	1,600 (7.2)	3,220 (14.5)	3,800 (17.1)	2,640 (11.9)	3,340 (15.0)	2,700 (12.2)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 5.0 or greater to determine the allowable working load.
2. Allowable capacities for wood members connected to the substrate must be investigated in accordance with accepted design criteria.

Ultimate and Allowable Tensile Pullover Capacities for Light Steel Framing with Powder-Actuated Fasteners[1,2,3]

Pin Description	Head/Shank Diameter	Minimum Thickness of Sheet Steel or Framing Member									
		16 Gage		18 Gage		20 Gage		22 Gage		25 Gage	
		Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)
8mm Top Hat Pin	0.315"/0.145"	2,650 (11.9)	530 (2.4)	2,470 (11.1)	495 (2.2)	1,210 (5.4)	240 (1.1)	895 (4.0)	180 (0.8)	580 (2.6)	115 (0.5)
8mm Pin without Washer	0.315"/0.145"	–	–	1,470 (6.6)	295 (1.3)	1,050 (4.7)	210 (0.9)	730 (3.3)	145 (0.7)	415 (1.9)	85 (0.4)
8mm Pin with 1" Washer	0.315"/0.145"	–	–	1,575 (7.1)	310 (1.4)	1,185 (5.3)	235 (1.1)	990 (4.5)	200 (0.9)	795 (3.6)	160 (0.7)
.300" Pin with 7/8" washer	0.300"/0.145"	–	–	–	–	790 (3.6)	160 (0.7)	645 (2.9)	130 (0.6)	500 (2.3)	100 (0.5)
10mm Pin without Washer	0.390"/0.177"	2,330 (10.5)	465 (2.1)	1,750 (7.9)	350 (1.6)	1,185 (5.3)	235 (1.1)	890 (4.0)	180 (0.8)	590 (2.7)	120 (0.5)

1. Tabulated allowable pullover load values were tested in accordance with ICC-ES AC70 and are based on an applied safety factor of 5.0.
2. Allowable pullover capacities of sheet steel or framing member should be compared to the fastener tensile load capacities in concrete, steel and masonry to determine the controlling resistance load.
3. For pins with washer assemblies, the washer thickness is 14 gage minimum.

Approvals and Listings

International Code Council, Evaluation Service (ICC-ES) ER-5330
City of Los Angeles (COLA) Research Report LARR-25304
Factory Mutual Research Corporation (FM Approvals) – File No. J.I. 3002070 for 3/8" Threaded Studs

.300" Head Drive Pins

PRODUCT DESCRIPTION

Drive pins with a .300" head are designed for permanently fastening a fixture to concrete, some types of concrete block, and A36 or A572 structural steel. The pins are formed with a 0.145" diameter shank in various lengths, and a specially designed point to allow proper penetration into typical base materials. Knurled shank designs are available to increase performance in steel base materials. A plastic flute is mounted over the point to retain the drive pin in the fastener guide of the tool providing guidance during the driving operation.

Blue Magic™ pins offer a hard plastic flute for improved centering in the tool and tip protection.

FASTENERS SIZES

.300" Head Drive Pins

Cat. No.	Shank Length	Shank Diameter	Standard Box	Standard Carton	Wt./100
50012	1/2" (K)	0.145"	100	5,000	0.5
50016	5/8" (K)	0.145"	100	5,000	0.5
50022	3/4"	0.145"	100	5,000	0.6
50026	1"	0.145"	100	5,000	0.7
50030	1 1/8"	0.145"	100	1,000	0.8
50032	1 1/4"	0.145"	100	1,000	0.9
50034	1 1/2"	0.145"	100	1,000	1.0
50038	2"	0.145"	100	1,000	1.2
50040	2 1/4"	0.145"	100	1,000	1.3
50042	2 3/8"	0.145"	100	1,000	1.5
50044	2 1/2"	0.145"	100	1,000	1.5
50046	2 3/4"	0.145"	100	1,000	1.6
50048	3"	0.145"	100	1,000	1.8

(K) = knurled

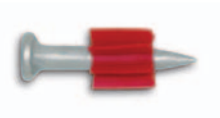
.300" Head Drive Pins – Master Pack

Cat. No.	Shank Length	Shank Diameter	Standard Box	Standard Carton	Wt./100
50980	1/2" (K)	0.145"	1,000	5,000	0.4
53300	5/8" (K)	0.145"	1,000	5,000	0.5
51040	3/4"	0.145"	1,000	5,000	0.5
51100	1"	0.145"	1,000	5,000	0.7
51160	1 1/4"	0.145"	1,000	5,000	0.8
51340	1/2" (K) Top Hat	0.145"	1,000	5,000	0.6
53400	5/8" (K) Top Hat	0.145"	1,000	5,000	0.6
51400	3/4" Top Hat	0.145"	1,000	5,000	0.7
51520	1" Top Hat	0.145"	1,000	5,000	0.8

(K) = knurled

.300" Head Step Shank Drive Pins

Cat. No.	Shank Length	Shank Diameter	Standard Box	Standard Carton	Wt./100
50158	3/4" Step Shank	0.145/0.130"	100	5,000	0.5
50159	1" Step Shank	0.145/0.130"	100	5,000	0.6



NEW! .300" Head Blue Magic™ Drive Pins

Cat. No.	Shank Length	Shank Diameter	Standard Box	Standard Carton	Wt./100
56000	1/2"	0.145"	100	5,000	0.9
56004	3/4"	0.145"	100	5,000	0.9
56006	1"	0.145"	100	5,000	0.9
56012	1 1/2"	0.145"	100	5,000	0.9

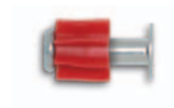
.300" Head Drive Pins with Top Hat

PRODUCT DESCRIPTION

These pins are used primarily for applications fastening drywall track to concrete or steel. Pins are assembled with a metal top hat to provide faster insertion into the driving tool with reduced possibility of pricking a finger during load and to provide extra bearing surface against the drywall track.

FASTENERS SIZES

Cat. No.	Shank Length	Shank Diameter	Standard Box	Standard Carton	Wt./100
50136	1/2" (K)	0.145"	100	5,000	0.6
50138	5/8" (K)	0.145"	100	5,000	0.7
50140	3/4"	0.145"	100	5,000	0.7
50144	1"	0.145"	100	5,000	0.8



(K) = knurled

.300" Head Drive Pins with Washers

PRODUCT DESCRIPTION

To provide resistance to pullover, these pins are available with preassembled 14 gage (0.075") metal washers in various diameters. Resistance to pullover is increased by the additional bearing surface provided by the washer. The insulation washer has a thickness of 0.035".

FASTENERS SIZES

.300" Head Drive Pins with 3/4" Washer

Cat. No.	Shank Length	Shank Diameter	Standard Box	Standard Carton	Wt./100
50070	3/4"	0.145"	100	1,000	1.5
50080	2 1/2"	0.145"	100	1,000	2.5

.300" Head Drive Pins with 7/8" Washer

Cat. No.	Shank Length	Shank Diameter	Standard Box	Standard Carton	Wt./100
50090	1"	0.145"	100	1,000	2.0
50092	1 1/4"	0.145"	100	1,000	2.1
50094	1 1/2"	0.145"	100	1,000	2.2
50096	2"	0.145"	100	1,000	2.5
50098	2 1/2"	0.145"	100	1,000	2.7
50100	3"	0.145"	100	1,000	3.3

.300" Head Drive Pins with 1" Washer

Cat. No.	Shank Length	Shank Diameter	Standard Box	Standard Carton	Wt./100
50108	1 1/4"	0.145"	100	1,000	2.5
50110	1 1/2"	0.145"	100	1,000	2.6
50112	2"	0.145"	100	1,000	2.9
50114	2 1/2"	0.145"	100	1,000	3.3
50116	3"	0.145"	100	1,000	3.6

.300" Head Drive Pins with 1 7/16" Insulation Washer

Cat. No.	Shank Length	Shank Diameter	Standard Box	Standard Carton	Wt./100
50122	1 1/2"	0.145"	100	1,000	2.5
50126	2 1/2"	0.145"	50	500	3.2

NEW! PTZ Drive Pins for Pressure Treated Lumber

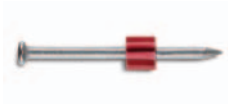
PRODUCT DESCRIPTION

The Powers PTZ powder actuated fasteners are designed for fastening through pressure treated lumber into concrete and grout-filled concrete masonry. The fasteners are manufactured and plated to ASTM B 695, class 65 to provide a minimum level of corrosion resistance equivalent to hot dipped galvanized fasteners available for pressure treated lumber applications. A plastic diaphragm protects the PTZ pin coating from being scraped off as it travels down and through the washer. The fasteners are available with either a round or square washer for increased pullover resistance.

FASTENERS SIZES

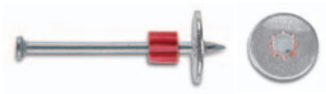
.300" Head PTZ Pin (No Washer)

Cat. No.	Shank Length	Shank Diameter	Standard Box	Standard Carton	Wt./100
50045	2 1/2"	0.145"	100	1,000	1.5
50047	3"	0.145"	100	1,000	1.6



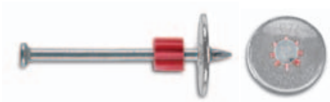
.300" Head PTZ Pin with 7/8" Washer

Cat. No.	Shank Length	Shank Diameter	Standard Box	Standard Carton	Wt./100
50097	2 1/2"	0.145"	100	1,000	2.7
50101	3"	0.145"	100	1,000	3.2



.300" Head PTZ Pin with 1" Washer

Cat. No.	Shank Length	Shank Diameter	Standard Box	Standard Carton	Wt./100
50113	2 1/2"	0.145"	100	1,000	2.7
50115	3"	0.145"	100	1,000	2.7



.300" Head PTZ Pin with 1" Square Washer

Cat. No.	Shank Length	Shank Diameter	Standard Box	Standard Carton	Wt./100
50119	3"	0.145"	100	1,000	2.5

8mm Head PTZ Pin with 1" Washer

Cat. No.	Shank Length	Shank Diameter	Standard Box	Standard Carton	Wt./100
50229	72mm - 2 7/8"	0.145"	100	1,000	3.2

8mm Head PTZ Pin with 1" Square Washer

Cat. No.	Shank Length	Shank Diameter	Standard Box	Standard Carton	Wt./100
50231	72mm - 2 7/8"	0.145"	100	1,000	3.2

8mm Head Drive Pins

PRODUCT DESCRIPTION

Drive Pins with a 8mm head are designed for permanently fastening a fixture to concrete, some types of masonry, and A36 or A572 structural steel. The pins are manufactured with a 0.145" diameter shank in various lengths. Knurled shank designs are available to increase performance in steel base materials. A 8mm plastic washer is mounted over the point to retain the drive pin in the fastener guide of the tool providing centered guidance during the driving operation.

FASTENERS SIZES

8mm Head Drive Pins

Cat. No.	Shank Length	Shank Diameter	Standard Box	Standard Carton	Wt./100
50180	16mm (K)- 5/8"	0.145"	100	5,000	0.4
50182	19mm (K)- 3/4"	0.145"	100	5,000	0.5
50184	22mm - 7/8"	0.145"	100	5,000	0.6
50186	27mm - 1"	0.145"	100	5,000	0.7
50188	32mm - 1 1/4"	0.145"	100	1,000	0.8
50190	37mm - 1 1/2"	0.145"	100	1,000	0.9
50192	42mm - 1 5/8"	0.145"	100	1,000	1.0
50194	47mm - 1 7/8	0.145"	100	1,000	1.1
50196	52mm - 2"	0.145"	100	1,000	1.3
50198	57mm - 2 1/4"	0.145"	100	1,000	1.4
50200	62mm - 2 1/2"	0.145"	100	1,000	1.5
50202	72mm - 2 7/8"	0.145"	100	1,000	1.6

(K) = knurled

POWDER ACTUATED

8mm Head Drive Pins with Top Hat

These pins are used primarily for applications fastening drywall track to concrete or steel. They are assembled with a metal top hat to provide faster insertion into the driving tool with reduced possibility of pricking a finger during loading and to provide extra bearing surface against the drywall track.

Cat. No.	Shank Length	Shank Diameter	Standard Box	Standard Carton	Wt./100
50210	16mm (K) -5/8"	0.145"	100	5,000	0.6
50214	22mm - 7/8"	0.145"	100	5,000	0.7
50216	27mm - 1"	0.145"	100	5,000	0.8

(K) = knurled

8mm Head Diameter Drive Pins with Top Hat – Master Pack

Cat. No.	Shank Length	Shank Diameter	Standard Box	Std. Carton	Wt./100
51700	16mm K Top Hat	0.145"	1,000	5,000	0.6
51750	22mm Top Hat	0.145"	1,000	5,000	0.7

8mm Head Drive Pins with Washers

FASTENERS SIZES

8mm Head Drive Pins with 1" Washer

To provide resistance to pullover, these pins are available with preassembled 14 gage (0.075") metal washers in various diameters. Resistance to pullover is increased by the additional bearing surface provided by the washer.

Cat. No.	Shank Length	Shank Diameter	Standard Box	Standard Carton	Wt./100
50220	27mm - 1"	0.145"	100	1,000	2.5
50222	32mm - 1 1/4"	0.145"	100	1,000	2.5
50224	37mm - 1 1/2"	0.145"	100	1,000	2.6
50226	52mm - 2"	0.145"	100	1,000	2.9
50228	62mm - 2 1/2"	0.145"	100	1,000	3.1
50230	72mm - 2 7/8"	0.145"	100	1,000	3.3

8mm Head Collated Drive Pins

PRODUCT DESCRIPTION

8mm head collated drive pins are designed for production fastening into concrete and steel. The pins are collated into plastic strips of ten fasteners each which provide a semi-automatic feed and centering guidance during the driving operation. Each pin has a 0.145" diameter shank available in various lengths. A knurled shank design is standard on shorter lengths to increase performance in steel base materials.

FASTENERS SIZES

8mm Head Collated Drive Pins

Cat. No.	Shank Length	Shank Diameter	Standard Box	Standard Carton
50240	16mm-5/8" (K)	0.145"	500	2,500
50242	19mm-3/4" (K)	0.145"	500	2,500
50244	19mm-3/4"	0.145"	500	2,500
50246	22mm-7/8"	0.145"	500	2,500
50248	27mm-1"	0.145"	500	2,500
50250	32mm-1 1/4"	0.145"	500	2,500
50252	37mm-1 1/2"	0.145"	500	2,500
50254	42mm-1 5/8"	0.145"	500	2,500
50256	47mm-1 7/8"	0.145"	500	2,500
50258	52mm-2"	0.145"	500	2,500
50260	57mm-2 1/4"	0.145"	500	2,500
50262	62mm-2 1/2"	0.145"	500	2,500
50264	72mm-2 7/8"	0.145"	500	2,500

(K) = knurled

Use with PA351, DX350, DX460. The PA351 and DX350 have a maximum pin length capacity of 42mm (1 5/8). Longer length pins are suitable for the DX460.

NEW! 10mm Head Drive Pins

PRODUCT DESCRIPTION

Drive Pins with a 10mm head are designed for permanently fastening a fixture to concrete, some types of masonry, and A36 or A572 structural steel. The pins are manufactured with a 0.177” diameter shank in various lengths. A 10mm plastic washer is mounted over the point to retain the drive pin in the fastener guide of the tool providing centered guidance during the driving operation.

FASTENERS SIZES

10mm Head Drive Pins

Cat. No.	Shank Length	Shank Diameter	Standard Box	Standard Carton
50846	19mm-3/4"	0.177"	100	1,000
50848	22mm-7/8"	0.177"	100	1,000
50850	27mm-1"	0.177"	100	1,000
50852	32mm-1 1/4"	0.177"	100	1,000
50854	42mm-1 5/8"	0.177"	100	1,000
50856	52mm-2"	0.177"	100	1,000
50858	62mm-2 1/2"	0.177"	100	1,000
50860	72mm-2 7/8"	0.177"	100	1,000
50862	82mm-3 1/4"	0.177"	100	1,000

Ballistic Point™ Drive Pins

PRODUCT DESCRIPTION

Premium drive pins with a 0.300" head have a specially designed point to allow more consistent penetration into harder base materials and will reduce failures in dense concrete and steel. Drive Pins are manufactured with 0.150" diameter shank and a 0.181" step shank in various lengths. A plastic flute is mounted over the point to retain the drive pin in the fastener guide of the tool providing guidance during the driving operation.

Ballistic Point Drive Pins are ideal for fastening to steel and hard concrete. Standard powder actuated pins fasten inconsistently in steel and harder concrete base materials. Ballistic Point Drive Pins have a unique pointed tip for more consistent performance. Pin penetration into difficult base materials is improved due to a rolled manufacturing process and a black coating applied to the pin.

FASTENERS SIZES

Ballistic Point™ Drive Pins (Black)

Cat. No.	Shank Length	Shank Diameter	Standard Box	Standard Carton	Wt./100
50052	1/2"	0.150"	100	1,000	0.5
50054	3/4"	0.150"	100	1,000	0.6

Ballistic Point™ Step Shank Drive Pins (Black)

Cat. No.	Shank Length	Shank Diameter	Standard Box	Standard Carton	Wt./100
50056	1 1/4"	0.181/0.150"	100	5,000	0.6
50057	1 7/8"	0.181/0.150"	100	1,000	1.5

POWDER ACTUATED

Threaded Studs

PRODUCT DESCRIPTION

Threaded studs are available in 1/4"-20 and 3/8"-16 thread diameters with a variety of thread and shank lengths for use in concrete, some types of concrete block, and A36 or A572 structural steel. They are used for applications where it may be desirable to remove the fixture, where shimming may be required or for suspending sprinkler systems. The 3/8"-16 threaded studs have FM approval.

The shank diameter for the threaded studs is 0.145" for the 1/4"-20 diameter and 0.205" for the 3/8"-16 diameter. Both sizes have a specially designed point to allow proper penetration into the base material. Knurled shank designs are available to increase performance in steel base materials. A plastic flute is mounted over the point to retain the drive pin in the fasteners guide of the tool providing guidance during the driving operation. On the 1/4"-20 threaded studs a plaster cap is also provided to protect the threads of the fastener during the driving process as well as providing guidance during installation.

FASTENERS SIZES

1/4"-20 Threaded Studs

Cat. No.	Thread Length	Shank Length	Shank Dia.	Standard Box	Std. Carton	Wt./100
50320	1/2"	1/2" (K)	0.145"	100	1,000	0.8
50322	3/4"	1/2" (K)	0.145"	100	1,000	1.1
50326	3/4"	3/4"	0.145"	100	1,000	1.2
50328	1/2"	1"	0.145"	100	1,000	1.2
50330	3/4"	1"	0.145"	100	1,000	1.4
50334	1/2"	1 1/4"	0.145"	100	1,000	1.3
50336	3/4"	1 1/4"	0.145"	100	1,000	1.5

(K) = knurled

3/8"-16 Threaded Studs

Cat. No.	Thread Length	Shank Length	Shank Dia.	Standard Box	Std. Carton	Wt./100
50340	1 1/4"	3/4" (K)	0.205"	100	1,000	3.6
50342	1 1/4"	1"	0.205"	100	1,000	3.8
50344	1 1/4"	1 1/4"	0.205"	100	1,000	3.8

(K) = knurled

3/8" Head Drive Pins

PRODUCT DESCRIPTION

Drive pins with a 3/8" head are designed for permanently fastening a fixture to concrete, some types of concrete block, and A36 or A572 structural steel. The pins are formed with a 0.172" diameter shank in various lengths and a specially designed point to allow proper penetration into the base material. A plastic flute is mounted over the point to retain the drive pin in the fasteners guide of the tool providing guidance during the driving operation.

FASTENERS SIZES

3/8" Head Drive Pins

Cat. No.	Shank Length	Shank Diameter	Standard Box	Standard Carton	Wt./100
50162	1"	0.172"	100	1,000	1.1
50164	1 1/4"	0.172"	100	1,000	1.3
50166	1 1/2"	0.172"	100	1,000	1.4
50172	2 1/2"	0.172"	100	1,000	2.1
50174	3"	0.172"	100	1,000	2.5
50176	3 1/8" (w/ step shank)	0.216/0.188"	100	1,000	3.4

Hammer Drive® Pins

PRODUCT DESCRIPTION

Hammer Drive pins are designed for permanently fastening a fixture to concrete and some types of concrete block. This fastener is designed for use in a standard hand tool and should not be used in a powder actuated tool. The pins are formed with 1/4" diameter head on one end, a 0.140" diameter shank in various lengths, and a specially designed point to allow proper penetration into the base material. A 3/8" diameter steel washer is mounted over the point to retain the drive pin in the fastener guide of the tool and to provide guidance during the driving operation. This fastener is recommended for light duty static load applications where holding power is not a critical factor. It should not be used overhead.

FASTENERS SIZES

1/4" Head Hammer Drive Pins

Cat. No.	Shank Length	Shank Dia.	Standard Box	Std. Carton	Wt./100
50294	3/4"	0.140	100	1,000	0.6
50296	1"	0.140	100	1,000	0.7
50298	1 1/4"	0.140	100	1,000	0.8
50302	2"	0.140	100	1,000	1.2
50304	2 1/2"	0.140	100	1,000	1.5
50306	3"	0.140	100	1,000	1.7

Hammer Drive Setting Tool

Cat. No.	Description	Standard Box	Std. Carton
50310	Hammer Drive Tool – Standard	1	1

Ceiling Clip Assemblies

PRODUCT DESCRIPTION

For acoustical applications and suspended ceiling systems or light fixtures. Several styles of angled clips are pre-mounted onto pins.

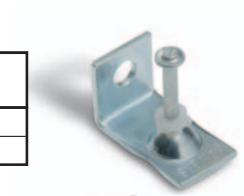
.300" Head Drive Pins with Ceiling Clips

Catalog Number	Shank Length	Shank Diameter	Wire Hole	Standard Box	Standard Carton	Wt./100
50363**	1"	0.145"	0.278"	100	1,000	3.5
50364	1"	0.145"	0.278"	100	1,000	3.5
50368	1 1/8"	0.145"	0.278"	100	1,000	3.0
50370	1 1/4"	0.145"	0.278"	100	1,000	3.7
50374*	1 1/4"	0.145"	0.278"	100	1,000	3.2

* Economy Clip ** No Dome

8mm Head Drive Pins with Ceiling Clips

Catalog Number	Shank Length	Shank Diameter	Wire Hole	Standard Box	Standard Carton	Wt./100
50272	27mm (1")	0.145"	0.278"	100	1,000	3.5
50274	32mm (1-1/4")	0.145"	0.278"	100	1,000	3.7



NEW! Ballistic Point Drive Pin with Ceiling Clip

Cat. No.	Description	Head Dia.	Shank Dia.	Wire Hole	Std. Box	Std. Ctn.
50058	1 1/4" with Ceiling Clip	0.300"	0.181"/0.150"	0.278"	100	1,000

Pre-Assembled Pin and Clip for LADD Tool

Catalog Number	Shank Length	Shank Diameter	Head Diameter	Wire Hole	Standard Box	Standard Carton	Wt./100
50438	Pre-assembled Pin & Clip (LADD)	0.155"	0.310"	0.278"	100	1,000	4.5

The assembly is designed for use in a LADD type tool.

BX and Conduit Clip Assemblies

PRODUCT DESCRIPTION

For the electrical trade, BX and conduit clips are provided in various sizes for attaching conduit to base materials where easy removal is not a requirement.

.300" Head Drive Pins with BX Cable Straps

Cat. No.	Shank Length	Shank Dia.	Standard Box	Std. Carton	Wt./100
50150	1"	0.145"	100	1,000	3.5
50152	1 1/4"	0.145"	100	1,000	3.7

.300" Head Pins with Conduit Clips

Cat. No.	Shank Length	Shank Dia.	Standard Box	Std. Carton	Wt./100
50380	1/2" EMT 1 1/4"	0.145"	100	1,000	3.4
50381*	1/2" EMT 1" Pin	0.145"	100	1,000	3.3
50382	1/2" EMT 1" Pin	0.145"	100	1,000	3.3
50384	3/4" EMT 1 1/4"	0.145"	100	1,000	3.5
50386	3/4" EMT 1" Pin	0.145"	100	1,000	3.3
50388	1" EMT 1" Pin	0.145"	25	250	3.2

* With Top Hat

8mm Head Drive Pins with Conduit Clips

Cat. No.	Shank Length	Shank Dia.	Std. Box	Std. Carton	Wt./100
50276	27mm w/ 1/2" EMT	0.145"	100	1,000	3.2
50278	27mm w/ 3/4" EMT	0.145"	100	500	3.3
50280	27mm w/ 1" EMT	0.145"	25	250	6.2

NEW! Rod Hanging

PRODUCT DESCRIPTION

8mm Head Drive Pins with Rod Hanger Clip

Catalog Number	Description	Shank Diameter	Standard Box	Standard Carton
50219	32mm (1 1/4") Pin with 1/4"-20 Rod Hanger	0.145"	100	1,000
50221	32mm (1 1/4") Pin with 3/8"-16 Rod Hanger	0.145"	100	1,000

Rebar Basket Assemblies

PRODUCT DESCRIPTION

Rebar basket clips are typically used in highway construction and paving applications to hold the support baskets for the reinforcing bars in place while the concrete is being poured.

8mm Head Drive Pins with Rebar Basket Clip

Catalog Number	Shank Length	Shank Diameter	Standard Box	Standard Carton	Wt./100
50702	32mm w/ basket clip	0.145"	100	100	4
50704	37mm w/ basket clip	0.145"	100	100	4.1
50710	47mm w/ basket clip	0.145"	100	100	4.3
50712	52mm w/ basket clip	0.145"	100	100	4.4
50716	62mm w/ basket clip	0.145"	100	100	4.6
50718	72mm w/ basket clip	0.145"	100	100	4.8

Forming Pins

PRODUCT DESCRIPTION

For concrete forming applications, the 1 3/4" (44mm) is designed for fastening wood members up to 3/4" in thickness while the 2 1/2" (62mm) forming pin is designed for fastening wood members up to 1 1/2" in thickness. Each pin has a break off groove 1" from the point to allow the wood forming members to be easily removed.

POWDER ACTUATED

Fastener Accessories

Catalog Number	Shank Length	Shank Diameter	Head Diameter	Standard Box	Standard Carton	Wt./100
50789	44mm - 1 3/4"	0.145"	0.205"	100	1,000	1.4
50790	62mm - 2 1/2"	0.145"	0.205"	100	1,000	1.4

Fastener Accessories

PRODUCT DESCRIPTION

In addition to the assemblies, the following accessories are available for use with drive pins or threaded studs as indicated below.

Fastener Accessories

Catalog Number	Description	Standard Box	Standard Carton
50365	Domed Ceiling Clip – No Pin	100	1,000
50375	Economy Ceiling Clip – No Pin	100	1,000
50400	Ceiling Clip (no pin) 9/32" and 5/16" holes	100	1,000
50404	1/4"-20 Threaded Coupling	100	1,000
50408	3/8"-16 Threaded Coupling	100	1,000
50414	1/4"-20 Eye Coupling (1/4" Wire Hole)	100	1,000
50416	3/4" Metal Washer – 14 gage	100	1,000
50421	1 7/8" Insulation Washer	100	1,000
50439	LADD Clip – No Pin	100	1,000

P1000™ *Powder-actuated Single Shot Tool*

TOOL DESCRIPTION

The P1000 is a Hammer actuated, do-it-yourself (DIY) powder actuated tool. Engineered for high reliability, low maintenance and speed. This tool uses four levels of power: gray through yellow load (levels 1-4) and .300" Head Drive Pins, 8mm Head Fasteners with lengths of 1/2" through 3" and 1/4"-20 studs.

P1000

TECHNICAL DATA

Tool Body	Precision Moulded Rubber and Precision Cast Aluminum
Tool Length	13"
Tool Weight	3 lbs
Pin Length	1/2" to 3" Total Length
Load Type	.22 Caliber "A" Load
Power Level	Gray (1), Brown (2), Green (3), Yellow (4)

PINS

Ballistic Point Drive Pin
.300" Head Drive
8mm Head Drive Pin
1/4"-20 Threaded Stud

PIN SIZE RANGE (TYP.)

1/2" to 3"

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Concrete Masonry
Steel

GENERAL APPLICATIONS AND USES

- Remodeling
- Maintenance Applications
- Electrical Fixtures
- Telecommunications

ORDERING INFORMATION

Catalog Number	Description	Standard Box
52013	P1000 Tool (Blister Pack)	1

POWDER ACTUATED

P2201™ *Powder-actuated Single Shot Tool*

TOOL DESCRIPTION

The P2201 is a low velocity, single shot, .22 caliber tool which can be used to install .300" head drive pins, 8mm head drive pins and 1/4"-20 threaded studs, up to 3" in total length. The P2201 is designed for maintenance or residential contractors.

P2201

TECHNICAL DATA

Tool Body	Engineered Plastic and Precision Cast Aluminum
Tool Length	12 1/2"
Tool Weight	4.3 lbs
Pin Length	1/2" to 3" Total Length
Load Type	.22 Caliber "A" Load
Power Level	Gray (1), Brown (2), Green (3), Yellow (4)

PINS

Ballistic Point Drive Pin
.300" Head Drive Pin
8mm Head Drive Pin
1/4"-20 Threaded Stud

PIN SIZE RANGE (TYP.)

1/2" to 3"

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Concrete Masonry
Steel

GENERAL APPLICATIONS AND USES

- Conduit Clip to Concrete
- Track to Floor
- Residential Construction
- Electrical Fixture to Steel and Concrete
- Wood to Concrete
- Wood to Steel

ORDERING INFORMATION

Catalog Number	Description	Standard Box
52006	P2201 Tool (Deluxe Kit): • Safety Glasses, Disposable Ear Plugs • Allen Wrenches, Wire Brushes, Tool Lubricant • Spall Guard • Pin & Load Starter Kit: .300" Headed Pins: (50) 1/2", (50) 3/4", (15) 3" with 7/8" washer .22 Caliber Loads: (100) Brown, (100) Green, (100) Yellow	1
52007	P2201 (Blister Pack)	1
52522	Piston for the P2201	1
52510	Nose Piece for the P2201	1
52512	Piston Reset Pin for the P2201	1

POWDER ACTUATED

P35s™ *Powder-actuated Load Strip Tool*

TOOL DESCRIPTION

The P35s™ is specially designed for acoustical and drywall contractors. It is a low velocity, semi-automatic, tool which can be used to install .300" head drive pins, 8mm head drive pins and 1/4"-20 threaded studs up to 1 1/2" in total length. The P35s™ is designed for high speed and repetitive volume applications. The standard version of the tool is supplied with a flat end piston and a full size baseplate/guide. A limited access baseplate/guide assembly is also available.

TECHNICAL DATA

Tool Body	Precision Cast Aluminum
Tool Length	11 1/4"
Tool Weight	4.25 lbs.
Pin Length	1/2" to 1 1/2" Total Length
Load Type	.25 Caliber 10 Load Strip
Power Level	Green (3), Yellow (4), Red (5)

PINS

Ballistic Point Drive Pin
.300" Head Drive Pin
8mm Head Drive Pin
1/4"-20 Threaded Stud

PIN SIZE RANGE (TYP.)

1/2" to 1 1/2" Total Length

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Concrete Masonry
Steel

GENERAL APPLICATIONS AND USES

- Conduit Clip to Concrete
- Track to Floor
- Electrical Fixture to Concrete
- Commercial Construction
- Electrical Fixture to Steel
- Wood to Concrete
- Wood to Steel
- Reliable and Compact for Short Pin Applications

ORDERING INFORMATION

Catalog Number	Description	Standard Box
52002	P35s Tool (Deluxe Kit): • Safety Glasses, Disposable Ear Plugs • Allen Wrenches, Wire Brushes, Tool Lubricant • Spall Guard • Pin & Load Starter Kit: .300 Headed Pins: (50) 1/2", (50) 3/4", (15) 1 1/2" .22 Caliber Loads: (90) Green (90) Yellow	1
52023	P35s Tool (Blister pack)	1
52200	Piston Standard 21/SDF for the P35s	1
52204	Guide 21/F3-1 for the P35s	1
52206	Baseplate 21/S1 for the P35s	1

Pole Tools for Overhead Attachments

Catalog Number	Description	Standard Box
50065	6' Di-electric Pole Tool	1
50066	8' Di-electric Pole Tool	1
52041	6' Smacker Pole Tool (Extension Available)	1

P7201™ *Powder-actuated Single Shot Tool*

TOOL DESCRIPTION

The P7201 is a low velocity, single shot .22 caliber tool which can be used to install .300" head drive pins, 8mm head drive pins and 1/4"-20 threaded studs up to 1 1/2" in total length. The P7201 is commonly used in the drywall trade.

P7201

TECHNICAL DATA

Tool Body	Precision Cast Aluminum
Tool Length	13 1/2"
Tool Weight	4.3 lbs.
Pin Length	1/2" to 1 1/2" Total Length
Load Type	.22 Caliber "A" Load
Power Level	Gray (1), Brown (2), Green (3), Yellow (4)

PINS

Ballistic Point Drive Pin
.300" Head Drive Pin
8mm Head Drive Pin
1/4"-20 Threaded Stud

PIN SIZE RANGE (TYP.)

1/2" to 1 1/2" Total Length

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Concrete Masonry
Steel

GENERAL APPLICATIONS AND USES

- Conduit Clip to Concrete
- Track to Floor
- Electrical Fixture to Concrete
- Electrical Fixture to Steel
- Wood to Concrete
- Wood to Steel

ORDERING INFORMATION

Catalog Number	Description	Standard Box
52004	P7201 Tool (Deluxe Kit): • Safety Glasses, Disposable Ear Plugs • Allen Wrenches, Wire Brushes, Tool Lubricant • Spall Guard • Pin & Load Starter Kit: .300 Headed Pins: (50) 1/2", (50) 3/4", (15) 3" with 7/8" washer .22 Caliber Loads: (100) Brown, (100) Green, (100) Yellow	1
52005	P7201 Tool (Blister pack)	1
52300	Piston with Ring for the P7201	1
52306	Nose Piece for the P7201	1
52308	Piston Reset Pin for the P7201	1

Pole Tools for Overhead Attachments

Catalog Number	Description	Standard Box
50060	6' Di-electric Pole Tool	1
50063	8' Di-electric Pole Tool	1

POWDER ACTUATED

P3500™ *Powder-actuated Semi-automatic Tool*

TOOL DESCRIPTION

The P3500 is a low velocity, semi-automatic .27 caliber tool which can be used to install .300" head drive pins, 8mm head drive pins and 1/4"-20 threaded studs, up to 3" in total length. The P3500 is designed for high speed, durability and repetitive volume applications.

P3500

TECHNICAL DATA

Tool Body	Precision Cast Aluminum
Tool Length	13 5/8"
Tool Weight	5 lbs.
Pin Length	1/2" to 3" Total Length
Load Type	.27 Caliber 10 Load Strip and .27 Caliber Safety Strip
Power Level	Brown (2), Green (3), Yellow (4), Red (5)

PINS

Ballistic Point Drive Pin
.300" Head Drive Pin
8mm Head Drive Pin
1/4"-20 Threaded Stud

PIN SIZE RANGE (TYP.)

1/2" to 3" Total Length

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Concrete Masonry
Steel

GENERAL APPLICATIONS AND USES

- Conduit Clip to Concrete
- Wood to Concrete
- Wood to Steel
- Electrical Fixture to Concrete
- Electrical Fixture to Steel
- Concrete Forming
- Commercial and Residential Construction

ORDERING INFORMATION

Catalog Number	Description	Standard Box
52000	P3500 Tool (Deluxe Kit): • Safety Glasses, Disposable Ear Plugs • Allen Wrenches, Wire Brushes, Tool Lubricant • Spall Guard, Spare Parts • Pin & Load Starter Kit: .300 Headed Pins: (50) 1/2", (50) 3/4", (15) 3" with 7/8" washer .27 Caliber Loads: (60) Green, (60) Yellow, (60) Red	1
52001	P3500 Tool (Blister pack)	1
52106	Piston Ring for the P3500	1
52108	Guide 2/F-3 for the P3500	1
52110	Base Plate 2/S-13 for the P3500/PA3500	1
52120	Shear Clip for the P35s/P3500/PA3500	1
52112	Piston Stop for the P3500/PA3500	1
52122	Steel Annular Ball for the P35s/P3500/PA3500	1

Piston for Installing 8mm Head Drive Pins

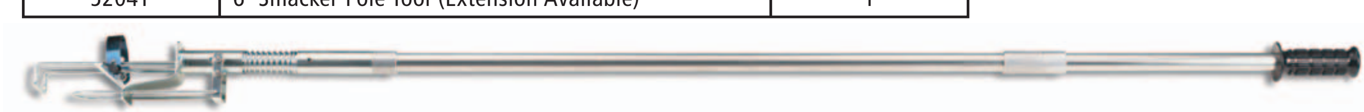
Catalog Number	Description	Standard Box
52100	Piston 2/DN-1 (for 8mm Head Drive Pins) for the P3500	1

Limited Access Baseplates

Catalog Number	Description	Standard Box
52114	Guide 2/F-4 Limited Access for the P3500	1
52116	Baseplate 2/F-14-1 Limited Access for the P3500	1

Pole Tools for Overhead Attachments

Catalog Number	Description	Standard Box
50065	6' Di-electric Pole Tool	1
50066	8' Di-electric Pole Tool	1
52041	6' Smacker Pole Tool (Extension Available)	1



PA3500™ *Powder-actuated Semi-automatic Tool*

TOOL DESCRIPTION

The PA3500 is a modified version of the P3500 that includes a power adjuster, allowing the operator to effectively decrease the power level of the load being used by up to two (2) levels. For example, a red load can be adjusted down to the level of a green load.

PA3500

PINS

Ballistic Point Drive Pin
.300" Head Drive Pin
8mm Head Drive Pin
1/4"-20 Threaded Stud

PIN SIZE RANGE (TYP.)

1/2" to 2" Total Length

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Concrete Masonry
Steel

TECHNICAL DATA

Tool Body	Precision Cast Aluminum
Tool Length	13 5/8"
Tool Weight	5 lbs.
Pin Length	1/2" to 3" Total Length
Load Type	.27 Caliber 10 Load Strip and .27 Caliber Safety Strip
Power Level	Brown (2), Green (3), Yellow (4), Red (5)

GENERAL APPLICATIONS AND USES

- Conduit Clip to Concrete
- Wood to Concrete
- Wood to Steel
- Electrical Fixture to Concrete
- Electrical Fixture to Steel
- Concrete Forming
- Commercial and Residential Construction

ORDERING INFORMATION

Catalog Number	Description	Standard Box
52019	PA3500 Tool (Deluxe Kit): • Safety Glasses, Disposable Ear Plugs • Allen Wrenches, Wire Brushes, Tool Lubricant • Spall Guard, Spare Parts • Pin & Load Starter Kit: .300 Headed Pins: (50) 1/2", (50) 3/4", (15) 3" with 7/8" washer .27 Caliber Loads: (60) Green, (60) Yellow, (60) Red	1
52025	PA3500 Tool (Blister pack)	1
52103	PA Piston Flat End with Ring for the PA3500	1
52108	Guide 2/F-3 for the P3500/PA3500	1
52110	Base Plate 2/S-13 for the P3500/PA3500	1
52112	Piston Stop for the P3500/PA3500	1
52120	Shear Clip for the P35s/P3500/PA3500	1
52122	Steel Annular Ball for the P35s/P3500/PA3500	1

Piston for Installing 8mm Head Drive Pins

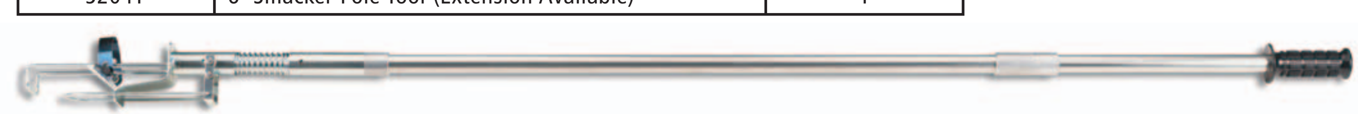
Catalog Number	Description	Standard Box
52100	Piston 2/DN-1 (for 8mm Head Drive Pins)	1

Limited Access Baseplates

Catalog Number	Description	Standard Box
52114	Guide 2/F-4 Limited Access for the P3500/PA3500	1
52116	Baseplate 2/F-14-1 Limited Access for the P3500/PA3500	1

Pole Tools for Overhead Attachments

Catalog Number	Description	Standard Box
50065	6' Di-electric Pole Tool	1
50066	8' Di-electric Pole Tool	1
52041	6' Smacker Pole Tool (Extension Available)	1



POWDER ACTUATED

P3801™ *Powder-actuated Single Shot Tool*

TOOL DESCRIPTION

Powerful and reliable heavy-duty powder actuated tool, for installing 3/8" threaded studs into concrete and steel. This tool features an easy load ejector and has a low re-coil for greater operator comfort. The P3801 is independent of any external power source saving you time and money.

P3801

TECHNICAL DATA

Tool Body	Precision Cast Aluminum
Tool Length	14"
Tool Weight	7 lbs.
Pin Length	1/2" to 3" Total Length
Load Type	.27 Caliber Single Short and Long
Power Level	Red (5), Purple (6)

PINS

1/4" and 3/8" Threaded Studs
3/8" Head Drive Pins

PIN SIZE RANGE (TYP.)

1/2" to 3" Total Length

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Concrete Masonry
Steel

GENERAL APPLICATIONS AND USES

- Hanging Sprinkler Pipe
- Hard Concrete
- Electrical Fixtures
- Heavy-duty Applications for Steel and Concrete

ORDERING INFORMATION

Catalog Number	Description	Standard Box
52008	P3801 Tool (Deluxe Kit): • Safety Glasses, Disposable Ear Plugs • Allen Wrenches, Wire Brushes, Tool Lubricant • Spall Guard, Spare Parts • Pin & Load Starter Kit: Threaded studs: (100) 1/4", (50) 3/8" .27 Caliber Long Loads: (100) Yellow, (100) Red, (100) Purple	1

For additional spare parts please reference the Buyers Guide

POWDER ACTUATED

P3600™ *Powder-actuated Semi-automatic Tool*

TOOL DESCRIPTION

The P3600 is a powerful, heavy-duty, low velocity, semi-automatic .27 caliber tool, which can be used to install 10mm head .177 diameter shank drive pins, 3/8"-16 threaded studs, and 3/8" headed drive pins, The P3600 is designed for applications where more power is needed, such as attaching 2x4 to hard aggregate or steel. The tool utilizes a red (5) or purple (6) .27 caliber strip.

P3600

TECHNICAL DATA

Tool Body	Precision Cast Aluminum
Tool Length	13 5/8"
Tool Weight	5 lbs
Pin Length	Up to 3" Total Length
Load Type	.27 Caliber 10 Load Strip and .27 Caliber Safety Strip
Power Level	Red (5), Purple (6)

PINS

10mm Head Pins
3/8” Threaded Studs
3/8” Headed Drive Pins

PIN SIZE RANGE (TYP.)

1/2" to 3" Total Length

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Concrete Masonry
Steel

GENERAL APPLICATIONS AND USES

- Ceiling Clip assemblies
- Track to Floor, Door Frames
- Wood to Concrete
- Electrical Fixtures
- Duct Straps
- Concrete Forms, Basket Clips, Forming Pins

POWDER ACTUATED

ORDERING INFORMATION

Catalog Number	Description	Standard Box
52010	P3600 Tool (Deluxe Kit): • Safety Glasses, Disposable Ear Plugs • Allen Wrenches, Wire Brushes, Tool Lubricant • Spall Guard • Pin & Load Starter Kit: 10mm Headed Pins: (15) 1", (15) 1 5/8", (15) 2" .27 Caliber Loads: (120) Red	1
52510	Nose Piece for the P2201/P3600	1
52512	Piston Reset Pin for the P2201/P3600	1
52522	Piston for the P2201/P3600	1
52578	Piston Ring for the P3600	1

Pole Tools for Overhead Attachments

Catalog Number	Description	Standard Box
50065	6' Di-electric Pole Tool	1
50066	8' Di-electric Pole Tool	1
52041	6' Smacker Pole Tool (Extension Available)	1

PA351™ *Fully Automatic Powder-actuated Tool*

TOOL DESCRIPTION

The PA351 is a lightweight, fully automatic, powder-actuated tool with a 10 fastener magazine for high volume applications. This tool fastens up to 700 nails per hour for increased productivity. The easy drop in magazine allows for one handed operation. A power adjuster provides variable load level choices and the tool automatically cycles the load.

PA351

TECHNICAL DATA

Tool Body	Precision Cast Aluminum
Tool Length	17"
Tool Weight	8 lbs.
Pin Length	5/8" to 1 5/8" Total Length
Load Type	.27 Caliber 10 Load Strip and .27 Caliber Safety Strip
Power Level	Brown (2), Green (3), Yellow (4), Red (5)

PINS

8mm Head Drive Pin

PIN SIZE RANGE (TYP.)

5/8" to 1 5/8" Total Length

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Lightweight Concrete
Grouted Concrete Masonry

GENERAL APPLICATIONS AND USES

- Electrical Fixtures
- Conduit Clip Assemblies
- Duct Straps
- Sill Plates/Wood to Concrete
- Metal Track, Door Frames
- Concrete Forming
- Commercial and Residential Construction
- Wood to Steel

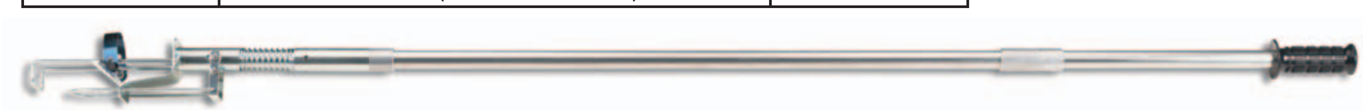
POWDER ACTUATED

ORDERING INFORMATION

Catalog Number	Description	Standard Box
52066	PA351 Tool (Deluxe Kit): • Safety Glasses, Disposable Ear Plugs • Allen Wrenches, Wire Brushes, Tool Lubricant • Spall Guard, Spare Parts • Pin & Load Starter Kit: 8mm Headed Pin 10 Fastener Magazine: (50) 3/4", (50) 1", (15) 1 1/2" .27 Caliber Loads: (60) Green, (60) Yellow, (60) Red	1
52133	PA351 Piston with Ring	1
52135	Guide 2/F-3 for the PA351	1
52137	Base Plate 2/S-13 for the PA351	1
52141	Magazine	1

Pole Tools for Overhead Attachments

Catalog Number	Description	Standard Box
52041	6' Smacker Pole Tool (Extension Available)	1



Powder Loads

GENERAL DESCRIPTION

Powers offers high quality powder loads, produced by the largest manufacturer in the United States, with unsurpassed quality and reliability. Specific load types are designed for each unique powder actuated tool. They are offered as single cartridge units for single shot tools and also collated in groups of 10 into plastic strips or metal discs for semi-automatic tools.

SELECTION GUIDE

.22 Caliber "A" Single Loads

Cat. No.	Description	Standard Box	Std. Carton	Master Carton	Wt./100
50500	Gray, .22A	100	5,000	20,000	0.2
50502	Brown, .22A	100	5,000	20,000	0.2
50504	Green, .22A	100	5,000	20,000	0.2
50506	Yellow, .22A	100	5,000	20,000	0.2

SUGGESTED TOOLS

Powers: P1000, P2201, P7201
Ramset®: 721, M70, RS22
Hilti®: DXE37, DXE72

.22 Caliber for LADD

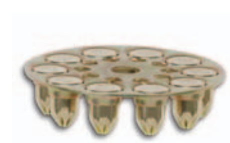
Cat. No.	Description	Standard Box	Std. Carton	Master Carton	Wt./100
50514	Green – LADD	100	5,000	20,000	0.2
50516	Yellow – LADD	100	5,000	20,000	0.2
50518	Red – LADD	100	5,000	20,000	0.2
50520	Purple – LADD	100	5,000	20,000	0.2

SUGGESTED TOOLS

Ramset®: L1600

.25 Caliber Disk Loads

Cat. No.	Description	Standard Box	Std. Carton	Master Carton	Wt./100
50530	Gray, .25 Disk	100	1,000	10,000	0.4
50532	Brown, .25 Disk	100	1,000	10,000	0.4
50534	Green, .25 Disk	100	1,000	10,000	0.4
50536	Yellow, .25 Disk	100	1,000	10,000	0.4



SUGGESTED TOOLS

Ramset®: D45, D45A, D60, D60L

Cat. No.	Description	Standard Box	Std. Carton	Master Carton	Wt./100
50538	Gray, .25 Disk	100	1,000	10,000	0.4

Ramset®: D45, D45A Only

.25 Caliber Single Loads

Cat. No.	Description	Standard Box	Std. Carton	Master Carton	Wt./100
50560	Green, .25 single	100	5,000	20,000	0.2
50562	Yellow, .25 single	100	5,000	20,000	0.2
50564	Red, .25 single	100	5,000	20,000	0.2
50566	Purple, .25 single	100	5,000	20,000	0.2

SUGGESTED TOOLS

Hilti®: DX100, DX200

.27 Caliber Single Loads

Cat. No.	Description	Standard Box	Std. Carton	Master Carton	Wt./100
50582	Brown, .27 single	100	5,000	20,000	0.3
50584	Green, .27 single	100	5,000	20,000	0.3
50586	Yellow, .27 single	100	5,000	20,000	0.3
50588	Red, .27 single	100	5,000	20,000	0.3
50590	Purple, .27 single	100	5,000	20,000	0.3

SUGGESTED TOOLS

Powers: P3801
Hilti®: DX400

SELECTION GUIDE

.27 Caliber Long Loads

Cat. No.	Description	Standard Box	Std. Carton	Master Carton	Wt./100
50608	Green, .27 Long	100	2,500	10,000	0.35
50612	Red, .27 Long	100	2,500	10,000	0.35
50614	Purple, .27 Long	100	2,500	10,000	0.35

SUGGESTED TOOLS

Powers: P3801
Ramset®: MD380
Hilti®: DX600N

.25 Caliber 10 Load Strips

Cat. No.	Description	Standard Box	Std. Carton	Master Carton	Wt./100
50570	Green, .25 Strip	100	1,000	20,000	0.3
50574	Yellow, .25 Strip	100	1,000	20,000	0.3
50578	Red, .25 Strip	100	1,000	20,000	0.3

SUGGESTED TOOLS

Powers: P35s
Hilti®: DX35

.25 Caliber 10 Load Strips – Master Pack

Cat. No.	Description	Standard Box	Standard Carton	Wt./100
50572	Green, .25 Strip	1,000	20,000	2.7
50576	Yellow, .25 Strip	1,000	20,000	2.7
50580	Red, .25 Strip	1,000	20,000	2.7

.27 Caliber 10 Load Strips

Cat. No.	Description	Standard Box	Std. Carton	Master Carton	Wt./100
50606	Purple, .27 Strip	100	1,000	20,000	0.4

SUGGESTED TOOLS

Powers: P3600
Hilti®: DX451

Safety Strip®

.27 Caliber 10 Load Safety Strip

Cat. No.	Description	Standard Box	Std. Carton	Master Carton	Wt./100
50620	Brown, .27 safety strip	100	1,000	10,000	0.3
50622	Green, .27 safety strip	100	1,000	10,000	0.3
50626	Yellow, .27 safety strip	100	1,000	10,000	0.3
50630	Red, .27 safety strip	100	1,000	10,000	0.3

SUGGESTED TOOLS

Powers: P3500, PA3500, PA351, P3600, Sniper
Ramset®: SA270, Viper, Cobra
Hilti®: DX350, DX351, DX36M and DX451, DX460

.27 Caliber 10 Load Safety Strip – Master Pack

Cat. No.	Description	Std. Carton	Master Carton	Wt./100
50624	Green, .27 safety strip	10,000	20,000	0.3
50628	Yellow, .27 safety strip	10,000	20,000	0.3
50632	Red, .27 safety strip	10,000	20,000	0.3

Notes:

GAS FASTENING

SECTION CONTENTS

Tools and Fasteners

GAS FASTENING SELECTION GUIDE

Pin Category		Trak-It C3 Pins[1]							Trak-It C4	Trak-It W3 Framing Nails[2]				
Product		1/2" Steel Pin (Step Shank with Rolled Point)	Standard Pins (Smooth Shank with Rolled Point)	Standard Pins with Break-free Collation (Smooth Shank with Rolled Point)	Perma-Seal Coated Standard Pins	Plywood to Steel (Spiral Knurl Shank with Rolled Point)	Bullseye Pins (Step Shank with Rolled Point)	Stick-E Pin (Step Shank)	C4 Pins	22° Plastic Collated Full Round Head Nails	34° (30-34) Paper Tape Round or Clipped Head Nails	Positive Placement 34° Paper Tape Nails	15° Coil Nails	Mini Coil Nails
Page		336	336	336	336	336	336	340	336	347	348	349	349	349
Pin Dimensions	Diameter (inches)	0.102"/ 0.120"	0.102"	0.102"	0.102"	0.102"	0.102"/ 0.120"	0.088" 0.102"	0.136" 0.145"	0.113" 0.120" 0.131"	0.113" 0.120" 0.131"	0.131" 0.148" 0.162"	0.099" 0.113" 0.120" 0.131"	0.092"
	Length (Inches)	1/2"	3/4" 1" 1 1/4" 1 1/2"	3/4" 1 1/4" 1 1/2"	3/4" 1"	1 3/8"	11/16" 3/4" 1"	0.780" 1"	3/4" 1" 1 1/4" 2 9/16"	2 3/8" 2 1/2" 3" 3 1/4"	2 3/8" 2 1/2" 3" 3 1/4"	1 1/2" 2 1/2"	2" 2 3/8" 3" 31/4"	1 3/4" 2" 2 3/16"
Base Material	Concrete		■	■	■			■	■					
	High Strength Concrete/ Precast Concrete						■	□	□					
	Lightweight Concrete		■	■	■			■	■					
	Lightweight Concrete on Metal Deck		■	■	■			■	■					
	Wood Sill Plate to Concrete								■					
	Grouted Concrete Masonry		■	■	■			■	□					
	Hollow Concrete Masonry		■	■	■			■						
	Brick Masonry		□	□	□			□						
	Plywood to Lt. Gage Steel					■								
	Stick-E Accessories							■	■					
	A36 / A572 Steel	■												
	Wood									■	■	■	■	■

1. Trak-It C3 pins and fuel are compatible with TrakFast® fastening tools.
2. Trak-It W3 paper tape nails and fuel are compatible with Paslode® framing nailers. All Trak-It W3 nails are compatible with pneumatic nailers.
(K) = knurled

Trak-It® *Gas Fastening System*

PRODUCT DESCRIPTION

Trak-It is a gas-powered fastening system used for light-duty static applications, including drywall track to concrete, block or steel, lath to concrete or block, furring strips to concrete or block, and plywood to concrete or block base materials. The high performance system is designed for speed, efficiency and consistency. A fuel cell contains enough gas to install up to 800 to 1,200 fasteners. Operation of a gas powered fastening system does not require special safety training or licensing.

GENERAL APPLICATIONS AND USES

- Shoot metal track, lath or furring strips to concrete, block, brick and steel
- Lightweight design is great for overhead use
- Shoot sill plate to concrete foundation (C4 tool)

FEATURES AND BENEFITS

- Fast, safe and easy to use
- No licensing required
- Nose of tool fits in narrow channel
- 30,000 to 50,000 shots before cleaning is necessary
- No extra accessories required for shooting lath

APPROVALS AND LISTINGS

International Code Council Evaluation Service (ICC-ES) ER-6157
City of Los Angeles (COLA) Research Report LARR-25523

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring, 04081-Masonry Anchorage, 05090-Metal Fastenings, 06090-Wood and Plastic Fastenings and 09051-Fastenings.* Power-actuated system shall be Trak-It as supplied by Powers Fasteners, Inc., Brewster, NY.

TOOL SPECIFICATIONS

Trak-It C3 Tool

Tool Body	Precision Moulded Aluminum and Plastic
Tool Length	13"
Tool Weight	8 lbs
Pin Length	1/2" to 1 1/2" Total Length
Pin Capacity	42
Approximate Shots per Fuel Cell	1,200 pins
Approximate Shots per Battery Charge	5,700

Trak-It C4 Tool

Tool Body	Precision Moulded Aluminum and Plastic
Tool Length	13"
Tool Weight	7 lbs
Pin Length	2 1/2" Total Length
Pin Capacity	42 pins
Approximate Shots per Fuel Cell	800 pins
Approximate Shots per Battery Charge	5,700 pins

SECTION CONTENTS Page No.

Trak-It C3 Tool

Trak-It C3-ST Tool
(Short Track)

Trak-It C4 Tool

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Structural Lightweight Concrete
Hollow and Grouted CMU
Brick Masonry
Steel

GAS FASTENING

PIN SPECIFICATIONS

Fasteners for Trak-It C3 Tool

Pin	Available Lengths	Shank Diameter	Material	Hardness	Finish
1/2" Steel Pin (Step Shank with Rolled Point)	1/2"	0.120/0.102"	AISI 1060 to 1065	Rockwell Hardness 51 to 55	ASTM B633, SC1, Type III (Zn/Fe 5)
Standard Pins (Smooth Shank with Rolled Point)	3/4" 1" 1 1/4" 1 1/2"	0.102"	AISI 1060 to 1065	Rockwell Hardness 51 to 55	ASTM B695, Class 5, Type I
Standard Pins with Break-free Collation (Smooth Shank with Rolled Point)	3/4" 1 1/4" 1 1/2"	0.102"	AISI 1060 to 1065	Rockwell Hardness 51 to 55	ASTM B695, Class 5, Type I (3/4" pin has a Black Oxide Finish)
Perma-Seal Coated Standard Pins (Smooth Shank with Rolled Point)	3/4" 1"	0.102"	AISI 1060 to 1065	Rockwell Hardness 51 to 55	Perma-Seal Coating
Plywood to Steel (Spiral Knurl Shank with Rolled Point)	1 3/8" (k)	0.102"	AISI 1060 to 1065	Rockwell Hardness 51 to 55	ASTM B695, Class 5, Type I
Bullseye Pins (Step Shank with Rolled Point)	11/16" 3/4"	0.120/0.102"	AISI 1060 to 1065	Rockwell Hardness 51 to 55	ASTM B633, SC1, Type III (Zn/Fe 5)

All Trak-It pins have a 0.250" head diameters
(k) = knurled

Fasteners for Trak-It C4 Tool

Pin	Available Lengths	Shank Diameter	Material	Hardness	Finish
Sill Plate Pin	2 1/2"	0.137"	AISI 1060 to 1065	Rockwell Hardness 51 to 55	ASTM B695, Class 65, Type I

PERFORMANCE DATA

Allowable Load Capacities for Fasteners Installed in Normal-Weight Concrete[1]

Shank Diameter *d* in. (mm)	Min. Embed. h_v in. (mm)	Min. Spacing in. (mm)	Min. Edge Distance in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
				2,000 psi (13.8 MPa)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 MPa)	
				Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
0.102 (2.59)	5/8 (15.9)	4 (101.6)	3 (76.2)	70 (0.31)	80 (0.36)	75 (0.33)	90 (0.40)	80 (0.36)	100 (0.44)	85 (0.38)	110 (0.49)
	3/4 (19.1)	4 (101.6)	3 (76.2)	80 (0.36)	130 (0.58)	105 (0.47)	170 (0.76)	130 (0.58)	210 (0.93)	155 (0.69)	250 (1.11)
	7/8 (22.2)	4 (101.6)	3 (76.2)	80 (0.36)	160 (0.71)	105 (0.47)	190 (0.85)	130 (0.58)	220 (0.98)	155 (0.69)	250 (1.11)
	1 (25.4)	4 (101.6)	3 (76.2)	80 (0.36)	190 (0.85)	105 (0.47)	210 (0.93)	130 (0.58)	230 (1.02)	155 (0.69)	250 (1.11)

1. Allowable load capacities listed are calculated using a safety factor of 5.0 or greater.

Allowable Load Capacities for Fasteners Installed in Structural Lightweight Concrete[1]

Shank Diameter *d* in. (mm)	Minimum Embedment h_v in. (mm)	Minimum Spacing in. (mm)	Minimum Edge Distance in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
				3,000 psi (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 MPa)	
				Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
0.102 (2.59)	3/4 (19.1)	4 (101.6)	6 (152.4)	100 (0.44)	120 (0.53)	110 (0.49)	190 (0.85)	110 (0.49)	255 (1.13)
	7/8 (22.2)	4 (101.6)	6 (152.4)	110 (0.49)	125 (0.56)	120 (0.53)	190 (0.85)	120 (0.53)	260 (1.16)
	1 (25.4)	4 (101.6)	6 (152.4)	110 (0.49)	130 (0.58)	120 (0.53)	190 (0.85)	120 (0.53)	265 (1.18)

1. Allowable load capacities listed are calculated using a safety factor of 5.0 or greater.

PERFORMANCE DATA

Allowable Load Capacities for Fasteners Installed Through Metal Deck into Structural Lightweight Concrete[1,2,3,4,5]

Shank Diameter d in. (mm)	Minimum Embedment h_v in. (mm)	Minimum Spacing in. (mm)	Minimum Edge Distance in. (mm)	Minimum Concrete Compressive Strength (f'_c)			
				3,000 psi (20.7 MPa)		4,000 psi (27.6 MPa)	
				Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
0.102 (2.59)	3/4 (19.1)	4 (101.6)	1 (25.4)	80 (0.36)	105 (0.47)	85 (0.38)	115 (0.51)
	7/8 (22.2)	4 (101.6)	1 (25.4)	85 (0.38)	120 (0.53)	90 (0.40)	130 (0.58)

1. Allowable load capacities listed are calculated using a safety factor of 5.0 or greater.
2. For fasteners installed through metal deck, the minimum edge distance is 1 inch from the edge of the deck rib and 6 inches from the end of the deck. Allowable shear loads may be applied in any direction.
3. Fasteners are permitted to be installed in the lower or upper flute of the metal deck provided that proper installation procedures are maintained.
4. The allowable values are applicable to fasteners installed through the underside of a steel deck at the ribs and into minimum 3,000 psi structural lightweight concrete. The steel deck must have a minimum base-metal thickness of 0.034 inch (20 gage) with a minimum yield point, Fy, of 33,000 psi and conform to the Steel Deck institute requirements for Standard Wide Rib Deck.
5. Load capacities are also applicable to the Perma-Seal coated pins.

Allowable Load Capacities for Fasteners Installed in Concrete Masonry Units[1,2,3]

Shank Diameter d in. (mm)	Minimum Embedment h_v in. (mm)	Minimum Spacing in. (mm)	Minimum Edge Distance in. (mm)	Hollow or Grouted (Any Location)	
				$f'_m \geq$ 1,500 psi (10.4 MPa)	
				Tension lbs. (kN)	Shear lbs. (kN)
0.102 (2.59)	7/8 (22.2)	4 (101.6)	3 3/4 (95.3)	65 (0.29)	80 (0.36)
	1 (25.4)	4 (101.6)	3 3/4 (95.3)	65 (0.29)	120 (0.53)

1. Allowable load capacities listed are calculated using a safety factor of 5.0 or greater.
2. Tabulated load values are for fasteners installed in minimum 6-inch wide, Grade N, Type II lightweight, medium and normal-weight concrete masonry units conforming to ASTM C 90. The face shell thickness of the concrete masonry units shall be a minimum of 1 1/4 inch.
3. Load capacities are also applicable to the Perma-Seal coated pins.

Allowable Load Capacities for Fasteners Installed in ASTM A 36 Steel[1,2,3]

Fastener Type (Style)	Minimum Spacing in. (mm)	Minimum Edge Distance in. (mm)	Nominal Steel Thickness							
			3/16"		1/4"		3/8"		1/2"	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/2 inch Steel Pin	1 (25.4)	1/2 (12.7)	115 (0.51)	260 (1.16)	165 (0.73)	260 (1.16)	175 (0.78)	255 (1.13)	175 (0.78)	205 (0.91)

1. Allowable load capacities listed are calculated using a safety factor of 5.0 or greater.
2. Steel members must have a minimum yield strength, Fy, of 36,000 psi
3. Fasteners installed in 1/2 inch thick steel must have a minimum embedment depth of 3/8 inch.

Allowable Load Capacities for Fasteners Installed in ASTM A 572 Steel[1,2,3]

Fastener Type (Style)	Minimum Spacing in. (mm)	Minimum Edge Distance in. (mm)	Nominal Steel Thickness							
			3/16"		1/4"		3/8"		1/2"	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/2 inch Steel Pin	1 (25.4)	1/2 (12.7)	145 (0.64)	290 (1.29)	175 (0.78)	290 (1.29)	215 (0.96)	270 (1.20)	165 (0.73)	250 (1.11)

1. Allowable load capacities listed are calculated using a safety factor of 5.0 or greater.
2. Steel members must have a minimum yield strength, Fy, of 50,000 psi
3. Fasteners installed in 1/2 inch thick steel must have a minimum embedment depth of 3/8 inch.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Fasteners Installed through 2x Sill Plate into Normal-Weight Concrete[1]

Shank Diameter *d* in. (mm)	Minimum Embedment h_v in. (mm)	Minimum Spacing in. (mm)	Minimum Edge Distance in. (mm)	$f'_c \geq$ 2,000 psi (13.8 MPa)			
				Ultimate load		Allowable Load	
				Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
0.137 (3.48)	1 3/16 (30.2)	4 (101.6)	3 (76.2)	525 (2.4)	530 (2.4)	105 (0.47)	105 (0.47)

1. Tabulated values are applicable to the wood sill plate pins installed with the Trak-It C4 Tool.

ORDERING INFORMATION

Tools and Accessories

Trak-It C3 Tools

Cat. No.	Description	Standard Box	Standard Carton
55011	C3 Trak-It	1	1
55002	C3-ST Trak-It	1	1

Tool comes with case, charger and two batteries.

Trak-It C4 Tool

Cat. No.	Description	Standard Box	Standard Carton
55019	C4 Trak-It	1	1

Tool comes with case, charger and two batteries.

Trak-It Fuel Cells

Cat. No.	Description	Standard Box	Standard Carton
55010	Trak-It C3 Fuel Cell	20	80
55115	Trak-It C4 Fuel Cell	20	80

Both fuel cells work in temperatures down to 10°F.

Trak-It Pole Tools

Cat. No.	Description	Standard Box	Standard Carton
55048	6' Pole Tool and one Trak-It C3-ST (Short Trak) Tool	1	1
55051	8' Pole Tool and one Trak-It C3-ST (Short Trak) Tool	1	1
55053	6' Pole Tool	1	1
55055	8' Pole Tool	1	1

ORDERING INFORMATION

Fasteners

1/2" Steel Pin (Step Shank with Rolled Point)

Cat. No.	Description	Shank Diameter	Standard Box	Standard Carton
55020	1/2" Steel Pin	0.120/0.102"	1,000	5,000

Designed for use in A36 and A572 steel beams, purlins, and bar joist.
Each box of pins come packaged with one fuel cell.

Standard Pins (Smooth Shank with Rolled Point)

Cat. No.	Description	Shank Diameter	Standard Box	Standard Carton
55022	3/4" Zinc	0.102"	1,000	5,000
55024	1" Zinc	0.102"	1,000	5,000
55026	1 1/4" Zinc	0.102"	1,000	5,000
55028	1 1/2" Zinc	0.102"	1,000	5,000

Designed for use in concrete and masonry. All pins are zinc plated for a minimum level of corrosion resistance.
Each box of pins come packaged with one fuel cell.

Standard Pins with Break-free Collation (Smooth Shank with Rolled Point)

Cat. No.	Description	Shank Diameter	Standard Box	Standard Carton
55032	3/4" Black	0.102"	1,000	5,000
55033	1" Zinc	0.102"	1,000	5,000
55034	1 1/4" Zinc	0.102"	1,000	5,000
55035	1 1/2" Zinc	0.102"	1,000	5,000

Designed for use in concrete and masonry. All pins are zinc plated or coated with black oxide for a minimum level of corrosion resistance.
Plastic collation breaks completely free of pin during installation.
Each box of pins come packaged with one fuel cell.

Perma-Seal Coated Standard Pins

Cat. No.	Description	Shank Diameter	Standard Box	Standard Carton
55038	3/4" Perma-Seal	0.102"	1,000	5,000
55039	1" Perma-Seal	0.102"	1,000	5,000

Perma-Seal coated pins are designed for use in areas where a greater level of corrosion resistance is required.
Each box of pins come packaged with one fuel cell.

Plywood to Steel Pins (Spiral Knurl Shank with Rolled Point)

Cat. No.	Description	Shank Diameter	Standard Box	Standard Carton
55036	1 3/8" Zinc	0.102"	1,000	5,000

Designed for use to attach plywood to light gage steel framing.
Each box of pins come packaged with one fuel cell.

Bullseye Pins (Step Shank with Rolled Point)

Cat. No.	Description	Shank Diameter	Standard Box	Standard Carton
55085	680 Step Shank Pin	0.120/0.102"	1,000	5,000
55087	730 Step Shank Pin	0.120/0.102"	1,000	5,000

Designed for use in hard aggregate and precast concrete.
Each box of pins come packaged with one fuel cell.

Wood Sill Plate C4 Pin and Stick-E Washer

Cat. No.	Description	Shank Diameter	Standard Box	Standard Carton
55130	3/4" Pin	0.145"	800	4,000
55132	1" Pin	0.145"	800	4,000
55145	2 1/2" Pin	0.137"	800	4,000
55150	1" Square Stick-E Washer	–	100	1,000

Each box of pins come packaged with one fuel cell

Stick-E Lathing Washer

Cat. No.	Description	Standard Box	Standard Carton
55040	Zinc Plated 1" Diameter Washer with holes	100	1,000

An easy-to-use washer for securing wire lath to concrete and masonry. Washers fit snug onto the nose of the tool and do not require additional hardware.

Note: Powers Trak-It pins, fuel cells and tools are fully interchangeable with ITW Trakfast® products.

GAS FASTENING

Stick-E™ *Electrical and Mechanical Fastening System*

PRODUCT DESCRIPTION

The Stick-E fastening system uses Trak-It gas technology with specially designed accessories for fastening applications encountered by electricians and mechanical contractors. The Stick-E fastening system eliminates drilling and anchoring by offering the ability to fasten directly through the fixture with the magazine pins and accessories. Operation of a gas powered fastening system does not require special safety training or licensing.

GENERAL APPLICATIONS AND USES

- Fastening electrical boxes to concrete walls
- Hanging duct work straps
- Suspending threaded rod
- Suspending Conduit, BX Cables and electrical wiring
- Securing rebar
- Installing insulation and lathing material

FEATURES AND BENEFITS

- Fast, safe and easy to use
- No licensing required
- Nose of tool fits in narrow channel
- 30,000 to 50,000 shots before cleaning is necessary

APPROVALS AND LISTINGS

International Code Council, Evaluation Service (ICC-ES) ER-6157
City of Los Angeles (COLA) Research Report LARR-25523

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring, 04081-Masonry Anchorage* and *05090-Metal Fastenings and 09051-Fastenings.* Power-actuated fastening system shall be Stick-E as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS Page No.

Trak-It C3-ST Tool
(Short Track)

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Structural Lightweight Concrete
Hollow and Grouted CMU
Brick Masonry
Steel

TOOL SPECIFICATIONS

Trak-It C3-ST Tool

Tool Length	13"
Tool Weight	7 lbs
Pin Length Range	1/2" to 1 1/2"
Pin Capacity	22
Approximate Shots per Fuel Cell	1,000
Approximate Shots per Battery Charge	5,700

PIN SPECIFICATIONS

Fasteners for Trak-It C3-ST Tool

Fastener	Available Lengths	Shank Diameter	Material	Hardness	Finish
Standard Pins with Break-free Collation (Smooth Shank with Rolled Point)	3/4" 1" 1 1/4" 1 1/2"	0.102"	AISI 1060 to 1065	Rockwell Hardness 51 to 55	ASTM B695, Class 5, Type I (Except 3/4" pin which is Black Oxide Finish)
Perma-Seal Coated Standard Pins (Smooth Shank with Rolled Point)	3/4" 1"	0.102"	AISI 1060 to 1065	Rockwell Hardness 51 to 55	Perma-Seal coated
Stick-E Pin (Step Shank)	3/4" 1"	0.102"/0.088"	AISI 1060 to 1065	Rockwell Hardness 51 to 55	ASTM B695, Class 5, Type I

Tool is compatible with all Trak-It C3 pins.

APPLICATIONS GUIDE

Cable Tie Donut

Application	For attaching small and large diameter cable ties to all types of walls and ceilings including wood, steel beams, concrete and block. Ideal for strapping wires and cable for hanging temporary lighting fixtures from all base materials. (fits ties up to 1/4" wide.)
Contractor(s)	Electricians
Suggested Pin Size(s)	780 Trak-It Step Shank Pins

Mini Conduit Clip

Application	For attaching conduit and piping to steel beams, wood and concrete ceilings.
Contractor(s)	Electricians
Suggested Pin Size(s)	780 Trak-It Step Shank Pins

Conduit Clip (One Hole Strap)

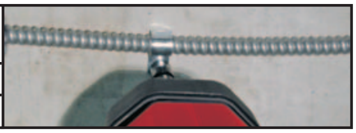
Application	For attaching conduit and light duty pipe to walls and ceilings of any base material including wood, steel beams, concrete and steel purlins.
Contractor(s)	Electricians
Suggested Pin Size(s)	780 Trak-It Step Shank Pins

Bridal Ring

Application	For suspending single or multiple wires and cable in runs from overhead ceilings of all base materials including wood, steel beams, concrete and steel purlins.
Contractor(s)	Electricians
Suggested Pin Size(s)	780 Trak-It Step Shank Pins 1" Trak-It Step Shank Pins

BX Clip

Application	For attaching BX cable to walls and ceilings of any base material including wood, steel beams, concrete and steel purlins.
Contractor(s)	Cable Installers, Telecommunication Installers, Electricians
Suggested Pin Size(s)	780 Trak-It Step Shank Pins

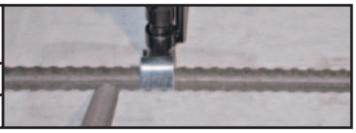


Strap Washer

Application	For attaching duct straps to suspend HVAC ductwork onto ceiling of various base materials.
Contractor(s)	Sheet Metal Contractors
Suggested Pin Size(s)	780 Trak-It Step Shank Pins

Rebar Basket Clip

Application	For attaching rebar to existing concrete or wood forms prior to a pour. Most popular in road and bridge construction and repair.
Contractor(s)	Concrete Contractors
Suggested Pin Size(s)	780 Trak-It Step Shank Pins



Rod Hanger

Application	Attaching rod overhead to steel beams, wood or concrete ceilings for the purpose of suspending utilities, cable trays, conduit and pipe.
Contractor(s)	Electricians, Plumbers, Mechanical Contractors
Suggested Pin Size(s)	780 Trak-It Step Shank Pins 1" Trak-It Step Shank Pins

APPLICATIONS GUIDE

Right Angle Clip

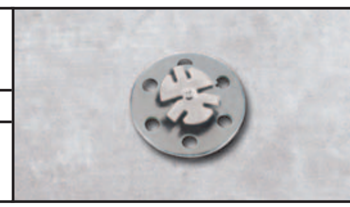
Application	For suspending acoustical ceiling systems or light fixtures.
Contractor(s)	Acoustical and Ceiling Contractors
Suggested Pin Size(s)	780 Trak-It Step Shank Pins 1" Trak-It Step Shank Pins

Insulation Washer

Application	For attaching exterior foam insulation to all base materials including wood, steel and concrete.
Contractor(s)	Insulation Contractors, Waterproofers
Suggested Pin Size(s)	780 Trak-It Step Shank Pins 1" Trak-It Step Shank Pins 1 1/4" Break Free Rolled Point Trak-It Pins (most base materials) 1 1/2" Break Free Rolled Point Trak-It Pins (most base materials)

Lathing Washer

Application	For attaching wire lathe to wood, steel, concrete or block for the purpose of troweling stucco in exterior applications or plaster in interior applications. Can also be used as a general purpose washer.
Contractor(s)	Drywall, Plaster, Exterior Siding Contractors
Suggested Pin Size(s)	780 Trak-It Step Shank Pins 1" Break Free Rolled Point Trak-It Pins (most base materials) 1 1/4" Break Free Rolled Point Trak-It Pins (most base materials)



Stainless Steel Sealing Washer

Application	For attaching waterproofing membrane to foundations and roofing applications.
Contractor(s)	Insulation Contractors, Waterproofers, Roofers
Suggested Pin Size(s)	3/4" Perma-Seal Coated Rolled Point Trak-It Pins (most base materials) 1" Perma-Seal Coated Rolled Point Trak-It Pins (most base materials)

PERFORMANCE DATA

Ultimate Load Capacities for Stick-E Accessories Installed with 780 Pin into Concrete, Concrete Block, or Lightweight Concrete over Metal Deck[1]

Stick-E	Minimum Embed. Depth h_v in. (mm)	Ultimate Load	
		Tension lbs. (kN)	Shear lbs. (kN)
Conduit Clip	3/4 (19.1)	550 (2.45)	400 (1.78)
BX Clip	3/4 (19.1)	550 (2.45)	400 (1.78)
Bridal Ring	3/4 (19.1)	550 (2.45)	400 (1.78)
Cable Tie	3/4 (19.1)	550 (2.45)	400 (1.78)
Insulation Washer	3/4 (19.1)	550 (2.45)	400 (1.78)
Rebar Clip	3/4 (19.1)	550 (2.45)	400 (1.78)
Strap Washer	3/4 (19.1)	640 (2.85)	400 (1.78)
Rod Hanger	3/4 (19.1)	640 (2.85)	N/A

1. Minimum 2,000 psi Concrete or Concrete Block at time of installation.

Ultimate Load Capacities for Stick-E Accessories Installed with 780 Pin into A36 and A572 Steel

Stick-E	Minimum Embedment Depth h_v in. (mm)	Ultimate Load					
		A36 Steel (3/16" Thick)		A572 Steel (1/8" Thick)		A572 Steel (12 Gage)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
Conduit BX Clip	3/4 (19.1)	650 (2.89)	600 (2.67)	450 (2.00)	550 (2.45)	300 (1.33)	500 (2.22)
Bridal Ring	3/4 (19.1)	650 (2.89)	600 (2.67)	450 (2.00)	550 (2.45)	300 (1.33)	500 (2.22)
Cable Tie	3/4 (19.1)	650 (2.89)	600 (2.67)	450 (2.00)	550 (2.45)	300 (1.33)	500 (2.22)
Strap Washer	3/4 (19.1)	650 (2.89)	600 (2.67)	450 (2.00)	550 (2.45)	300 (1.33)	500 (2.22)
Rod Hanger	3/4 (19.1)	650 (2.89)	N/A	450 (2.00)	N/A	300 (1.33)	N/A

Ultimate Load Capacities for Channel/Strut Mounted Installed with Stick-E 780 Pin into Concrete or Concrete Block[1,2,3]

Trak-It Pin	Minimum Embed. Depth h_v in. (mm)	Minimum Number of Pins (Per Foot Length)	Maximum Spacing in. (mm)	Ultimate Load (lbs/ft)		
				Tension lbs. (kN)	Shear Vertical Axis lbs. (kN)	Shear Horizontal Axis lbs. (kN)
780	9/16 (19.1)	3	4* (101.9)	625 (9.12)	570 (8.32)	1,170 (17.07)
		5	2.5** (63.70)	1,025 (14.96)	1,190 (17.37)	2,110 (30.79)

1. Installations for Nominal 1-5/8" Channel (12 Gage), All Finishes.
2. Minimum 2,000 psi Concrete of Concrete Block at time of installation.
3. Maximum spacing is center to center
* Fits all channel configurations
** Fits all channel configurations except slotted

GAS FASTENING

PERFORMANCE DATA

Electrical Boxes Mounted Installed with Stick-E 780 Pin into Concrete or Concrete Block[1,2]

Trak-It Pin	Minimum Embed. Depth h_v in. (mm)	Number of Pins (Per Box)	Maximum Spacing in. (mm)	Fastening Pattern	Ultimate Load		
					Tension lbs. (kN)	Shear Vert. Axis lbs. (kN)	Shear Horiz. Axis lbs. (kN)
780	5/8 (15.9)	2	1 (25.5)	Line	640 (2.85)	975 (4.34)	850 (3.78)
		3	2 (50.9)	Triangle	720 (3.20)	1,115 (4.96)	1,055 (4.69)
		4	2 (50.9)	Square/Diamond	900 (4.00)	1,840 (8.18)	1,840 (8.18)

1. Installations for Nominal 16 Gage Electrical Boxes, All Finishes.
2. Minimum 2,000 psi Concrete of Concrete Block at time of installation.

ORDERING INFORMATION

Stick-E Mini Conduit Clip

Cat. No.	Description	Standard Box	Standard Carton
55064	Mini Conduit Clip 1/2"	100	1,000
55066	Mini Conduit Clip 3/4"	100	1,000
55068	Mini Conduit Clip 1"	100	1,000

Stick-E Cable Tie Donut

Cat. No.	Description	Standard Box	Standard Carton
55076	Cable Tie Donut	100	1,000

Stick-E Conduit Clip (One Hole Strap)

Cat. No.	Description	Standard Box	Standard Carton
55059	Conduit Clip 1/2"	100	1,000
55061	Conduit Clip 3/4"	100	1,000

Stick-E BX Clip

Cat. No.	Description	Standard Box	Standard Carton
55054	Stick-E 3/8" BX Clips	100	1,000

Stick-E Bridal Ring

Cat. No.	Description	Standard Box	Standard Carton
55094	Bridal Ring 1 1/4"	100	1,000
55095	Bridal Ring 1 1/2"	100	1,000
55096	Bridal Ring 2"	100	1,000

Stick-E Strap Washer

Cat. No.	Description	Standard Box	Standard Carton
55062	Strap Washer 1/2" Diameter	100	1,000

Stick-E Rod Hanger

Cat. No.	Description	Standard Box	Standard Carton
55050	Rod Hanger 1/4"	100	1,000
55052	Rod Hanger 3/8"	100	1,000

Stick-E Rebar Basket Clip

Cat. No.	Description	Standard Box	Standard Carton
55070	#3 and #4 Bar	100	1,000

ORDERING INFORMATION

Stick-E Right Angle Clip

Cat. No.	Description	Standard Box	Standard Carton
55092	Right Angle Clip (Wirehole 0.278")	100	1,000

Stick-E Insulation Washer

Cat. No.	Description	Standard Box	Standard Carton
55042	Insulation Washer 1 7/16"	100	1,000

Stick-E Lathing Washer

Cat. No.	Description	Standard Box	Standard Carton
55040	Lathing Washer 1" with holes	100	1,000

Stick-E Stainless Steel Sealing Washer

Cat. No.	Description	Standard Box	Standard Carton
55043	SS Sealing Washer 3/4"	100	1,000

Stick-E Pin (Step Shank)

Cat. No.	Description	Shank Diameter	Standard Box	Standard Carton
55080	780 (3/4") Step Shank Pins (K)	0.102"/0.088"	1,000	5,000
55081	1" Step Shank Pin	0.102"/0.088"	1,000	5,000

(K) = Knurled

Standard Pins with Break-free Collation (Smooth Shank with Rolled Point)

Cat. No.	Description	Shank Diameter	Standard Box	Standard Carton
55032	3/4" Black	0.102"	1,000	5,000
55033	1" Zinc	0.102"	1,000	5,000
55034	1 1/4" Zinc	0.102"	1,000	5,000
55035	1 1/2" Zinc	0.102"	1,000	5,000

Designed for use in concrete and masonry. All pins are zinc plated or coated with black oxide for a minimum level of corrosion resistance.
Plastic collation breaks completely free of pin during installation.
Each box of pins come packaged with one fuel cell.

Perma-Seal Coated Standard Pins

Cat. No.	Description	Shank Diameter	Standard Box	Standard Carton
55038	3/4" Perma-Seal	0.102"	1,000	5,000
55039	1" Perma-Seal	0.102"	1,000	5,000

Perma-Seal coated pins are designed for use in areas where a greater level of corrosion resistance is required.
Each box of pins come packaged with one fuel cell.

Trak-It Tools

Cat. No.	Description	Standard Box	Standard Carton
55002	C3-ST Trak-It	1	1

Tool comes with case, charger and two batteries.
Stick-E accessories are compatible with Trak-It C3 tools.

Trak-It Fuel Cell

Cat. No.	Description	Standard Box	Standard Carton
55010	Trak-It Fuel Cell	20	80

Trak-It Pole Tools

Cat. No.	Description	Standard Box	Standard Carton
55048	6' Pole Tool	1	1
55051	8' Pole Tool	1	1

Pole tools come complete with Trak-It C3-ST tool (Short Trak tool).

Trak-It® W3 *Gas Wood Nailing System*

PRODUCT DESCRIPTION

Powers wood-to-wood gas powered nailers cover a broad range of tasks on a construction site. The lightweight design allows virtually unlimited access both high and low, with no air hoses or compressors to hold you back or slow down progress. Powers Gas Fastening technology features a linear combustion motor that produces tremendous energy in an incredibly lightweight compact body size, especially when compared to competitive battery tools with only a battery powered motor.

GENERAL APPLICATIONS AND USES

- Rafters
- Sheathing
- Headers
- Cripple Studs
- Interior Wall Framing
- Stairs
- Fascia
- Soffits
- Blocking between studs
- Roof Decking
- Ridge Beams
- Floor Decking and Underlayment

FEATURES AND BENEFITS

- Cordless fastening is fully portable and eliminates the need for air hoses or compressors
- Heavy-duty tool construction for durability on any jobsite
- An adjustable depth control can be easily used to set nail depth
- 3 1/4" nail capacity covers most framing applications
- Full round head nails meet all building codes
- Full round head nails have 0.280" diameter head vs. 0.250" diameter head of competitor
- Pullover value of full round head is higher than competitive nails
- Plastic collated nails create smaller hole in wood for higher pullout capacities

GUIDE SPECIFICATIONS

CSI Divisions: *06060-Wood Connections and Fasteners.* Power-actuated framing nail system shall be Trak-It W3 as supplied by Powers Fasteners, Inc., Brewster, NY.

Trak-It W3-21FRH Tool

Trak-It W3-34CDH Tool

SUITABLE BASE MATERIALS

Wood Framing Members
Decking and Sheathing

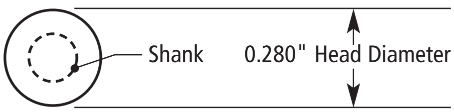
GAS FASTENING

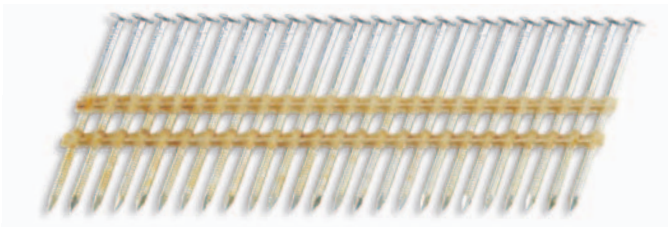
TOOL SPECIFICATIONS

Tool	**W3-21FRH** (Cat. No. 55019)	**W3-34CDH** (Cat. No. 55021)
Magazine Type	20° to 22°	30° to 34°
Tool Height	15"	15 3/8"
Tool Width	4 3/8"	4 3/8"
Tool Weight	7.8 lbs	7.8 lbs
Pin Length Range	Up to 3 1/4" Total Length	Up to 3 1/4" Total Length
Pin Shank Diameter Range	0.113" to 0.131"	0.113" to 0.131"
Pin Capacity	32 Nails	40 Nails
Fuel Cell	Use Powers Red Nailing Gas Fuel Cell (Cat. No. 55015)	Use Powers Red Nailing Gas Fuel Cell (Cat. No. 55015)
Approximate Shots per Battery Charge	5,700	5,700
Minimum/Maximum Temperature	10° F/120°F	10° F/120°F

FASTENER SPECIFICATIONS, APPLICATIONS AND ORDERING INFORMATION

20°- 22° Full Round Head Nails





22° Plastic Collated Full Round Head Nails

Catalog Number	Length	Shank Diameter	Head Diameter	Finish	Shank	Nails/Strip	Pieces/Carton	Pallet
57000	2 3/8"	0.113"	0.280"	Brite	Smooth	30	5,000	48
57002	2 3/8"	0.113"	0.280"	Brite	Ring	30	5,000	48
57004	2 3/8"	0.113"	0.280"	HDG	Ring	30	5,000	48
57006	2 3/8"	0.113"	0.280"	SS304	Ring	30	1,000	48
57008	2 3/8"	0.113"	0.280"	SS316	Ring	30	1,000	48
57010	3"	0.120"	0.280"	Brite	Smooth	30	4,000	48
57012	3"	0.120"	0.280"	HDG	Ring	30	4,000	48
57014	3"	0.120"	0.280"	SS304	Ring	30	1,000	48
57016	2 1/2"	0.131"	0.280"	Brite	Smooth	30	5,000	48
57018	2 1/2"	0.131"	0.280"	Brite	Ring	30	5,000	48
57020	3"	0.131"	0.280"	Brite	Smooth	30	4,000	48
57022	3"	0.131"	0.280"	HDG	Ring	30	4,000	48
57024	3"	0.131"	0.280"	HDG	Smooth	30	4,000	48
57026	3"	0.131"	0.280"	SS304	Ring	30	1,000	48
57028	3"	0.131"	0.280"	SS316	Ring	30	1,000	48
57030	3 1/4"	0.131"	0.280"	Brite	Smooth	30	4,000	48

Fasteners to be used with Trak-It tool W3-21FRH

Cordless Gas Nailing Tool for Plastic Collated 20-22° Framing Nails

Catalog Number	Description	Standard Box	Standard Carton
55031	W3-21FRH Full Round Head Gas Nailer	1	1

Red Fuel Cell for Powers or Paslode® Framing Tools

Catalog Number	Description	Standard Box	Standard Carton
55015	Red Nailing Gas Fuel Cell	12	144

One fuel cell will shoot approximately 1,000 nails.

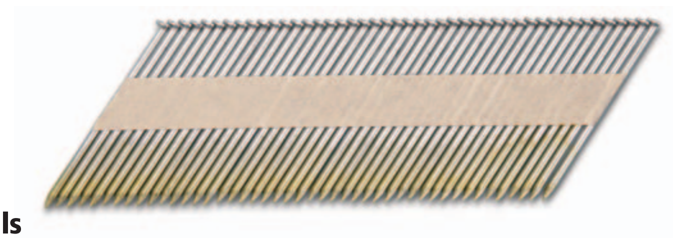
GAS FASTENING

22° Plastic Collated Full Round Head Nail Applications

Application	Catalog Number	Length	Shank Diameter	Head Diameter	Finish	Shank
Sheathing, Decking & 1xFraming	57000	2 3/8"	0.113"	0.280"	Brite	Smooth
Soffit, Fascia, Stair Treads and 1xExterior Trim	57004	2 3/8"	0.113"	0.280"	HDG	Ring
Soffit, Fascia, Stair Treads and 1xExterior Trim	57006	2 3/8"	0.113"	0.280"	SS304	Ring
Exterior 2x Applications Ridge Beams and Trim	57016	2 1/2"	0.131"	0.280"	Brite	Smooth
Exterior 2x Applications & Decks & Stairs	57018	2 1/2"	0.131"	0.280"	Brite	Ring
2x Framing	57020	3"	0.131"	0.280"	Brite	Smooth
Exterior 2x Applications & Decks & Stairs	57022	3"	0.131"	0.280"	HDG	Ring
Exterior 2x Applications Ridge Beams and Trim	57024	3"	0.131"	0.280"	HDG	Smooth
2x Framing	57026	3"	0.131"	0.280"	SS304	Ring

FASTENER SPECIFICATIONS, APPLICATIONS AND ORDERING INFORMATION

34° Clipped Head Nails



34° (30-34) Paper Tape Round Head Drive Nails

Catalog Number	Length	Shank Diameter	Head Diameter	Finish	Shank	Nails/Strip	Pieces/Carton	Pallet
57050	2 3/8"	0.113"	0.250"	Brite	Smooth	34	5,000	48
57052	2 3/8"	0.113"	0.250"	HDG	Ring	34	2,000	48
57054	2 3/8"	0.113"	0.250"	SS304	Ring	34	1,000	48
57056	3"	0.120"	0.250"	Brite	Smooth	34	2,500	48
57058	3"	0.120"	0.250"	HDG	Ring	34	2,000	48
57060	3"	0.120"	0.250"	SS304	Ring	34	1,000	48
57062	2 1/2"	0.131"	0.250"	Brite	Smooth	34	3,000	48
57064	3"	0.131"	0.250"	Brite	Smooth	34	2,500	48
57066	3"	0.131"	0.250"	HDG	Ring	34	2,000	48
57068	3"	0.131"	0.250"	HDG	Smooth	34	2,000	48
57070	3"	0.131"	0.250"	SS304	Ring	34	1,000	48
57072	3 1/4"	0.131"	0.250"	Brite	Smooth	34	2,500	48

Fasteners to be used with Trak-It tool W3-34CDH

Cordless Gas Nailing Tool for Paper Tape 34° Clipped or Offset Round Head Nails

Catalog Number	Description	Standard Box	Standard Carton
55029	W3-34CDH Clipped Head Gas Nailer	1	1

Red Fuel Cell for Powers or Paslode® Framing Tools

Catalog Number	Description	Standard Box	Standard Carton
55015	Red Nailing Gas Fuel Cell	12	144

One fuel cell will shoot approximately 1,000 nails.

34° Paper Tape Offset Round Head Nail Applications

Application	Catalog Number	Length	Shank Diameter	Head Diameter	Finish	Shank
Sheathing, Decking & 1xFraming	57050	2 3/8"	0.113"	0.250"	Brite	Smooth
Soffit, Fascia, Stair Treads and 1xExterior Trim	57052	2 3/8"	0.113"	0.250"	HDG	Ring
Soffit, Fascia, Stair Treads and 1xExterior Trim	57054	2 3/8"	0.113"	0.250"	SS304	Ring
2x Framing	57064	3"	0.131"	0.250"	Brite	Smooth
Exterior 2x Applications & Decks & Stairs	57066	3"	0.131"	0.250"	HDG	Ring
Exterior 2x Applications Ridge Beams and Trim	57068	3"	0.131"	0.250"	HDG	Smooth
2x Framing	57070	3"	0.131"	0.250"	SS304	Ring

FASTENER SPECIFICATIONS AND ORDERING INFORMATION

Positive Placement® and Coil Nails

Positive Placement 34° (30-34) Paper Tape Nails

Catalog Number	Length	Shank Diameter	Head Diameter	Finish	Shank	Nails/Strip	Pieces/Carton	Pallet
57080	1 1/2"	0.131"	0.250"	Brite	Sm HT	34	4,000	48
57082	1 1/2"	0.131"	0.250"	MG	Sm HT	34	4,000	48
57084	1 1/2"	0.148"	0.250"	Brite	Sm HT	34	3,000	48
57086	1 1/2"	0.148"	0.250"	MG	Sm HT	34	3,000	48
57088	2 1/2"	0.148"	0.250"	Brite	Sm HT	34	2,500	48
57090	2 1/2"	0.148"	0.250"	MG	Sm HT	34	2,500	48
57092	2 1/2"	0.162"	0.250"	Brite	Sm HT	34	2,000	48
57094	2 1/2"	0.162"	0.250"	MG	Sm HT	34	2,000	48

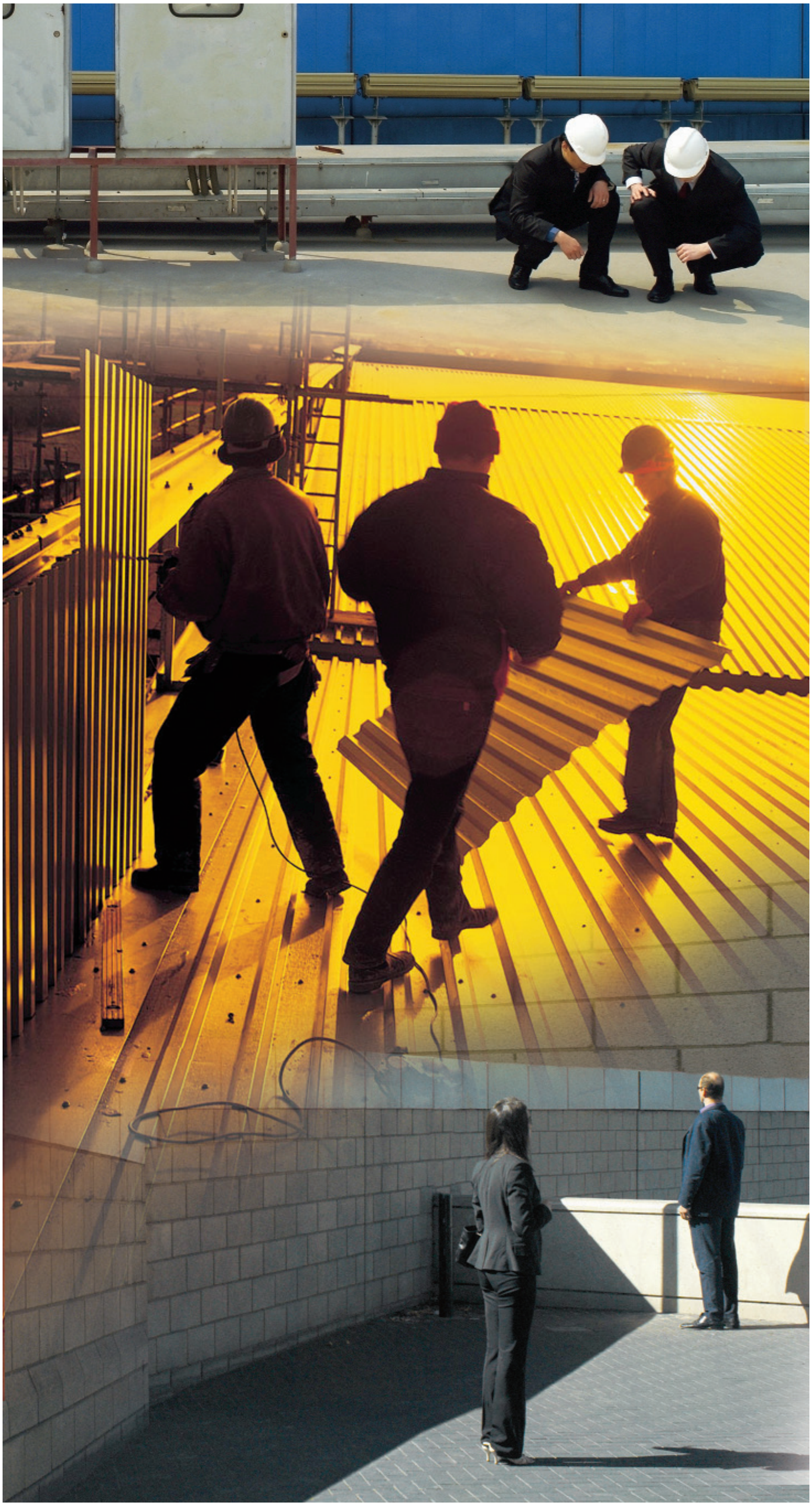
15° Coil Nails

Catalog Number	Length	Shank Diameter	Head Diameter	Finish	Shank	Nails/Strip	Pieces/Carton	Pallet
57100	2"	0.099"	0.250"	Brite	Ring	34	9,000	27
57102	2"	0.099"	0.250"	Brite	Screw	34	9,000	27
57104	2"	0.113"	0.250"	Brite	Smooth	34	6,000	40
57106	2"	0.113"	0.250"	Brite	Ring	34	6,000	40
57108	2"	0.099"	0.250"	Brite	Screw	34	9,000	27
57110	2 3/8"	0.113"	0.250"	Brite	Smooth	34	6,000	40
57112	2 3/8"	0.113"	0.250"	Brite	Ring	34	6,000	40
57114	3"	0.120"	0.250"	Brite	Smooth	34	4,500	40
57116	3"	0.131"	0.250"	Brite	Smooth	34	4,500	40
57118	3 1/4"	0.120"	0.250"	Brite	Smooth	34	4,500	40
57120	3 1/4"	0.131"	0.250"	Brite	Smooth	34	4,500	40
57122	2 3/8"	0.113"	0.250"	HDG	Ring	34	5,400	40
57124	3"	0.131"	0.250"	HDG	Smooth	34	4,000	40
57126	3"	0.120"	0.250"	HDG	Ring	34	4,000	40
57128	3 1/4"	0.120"	0.250"	HDG	Smooth	34	4,000	40
57130	3 1/4"	0.131"	0.250"	HDG	Smooth	34	4,000	40

Mini Coil Nails

Catalog Number	Length	Shank Diameter	Head Diameter	Finish	Shank	Nails/Strip	Pieces/Carton	Pallet
57150	1 3/4"	0.092"	0.250"	HDG	Ring	34	3,600	48
57152	2"	0.092"	0.250"	HDG	Ring	34	3,600	48
57154	2 3/16"	0.092"	0.250"	HDG	Ring	34	3,600	48
57156	1 3/4"	0.092"	0.250"	SS	Ring	34	3,600	48
57158	2"	0.092"	0.250"	SS	Ring	34	3,600	48
57160	2 3/16"	0.092"	0.250"	SS	Ring	34	3,600	48

ROOFING FASTENERS



SECTION CONTENTS

ROOFING FASTENERS SELECTION GUIDE

	Product	Perma-Seal Roofing Spike	Powerlite	Deck Screws	Stress Plates
	Page	357	359	361	364
Base Material	Steel Deck			■	
	Wood Deck			■	
	Concrete Deck	■			
	Lightweight Concrete Deck		■		
	Insulating Cover		□		
	Cement Wood Fiber		■		
	Gypsum		■		
Insulation Thickness	1"	■	■	■	
	2"	■	■	■	
	3"	■	■	■	
	4"	■	■	■	
	5"	■	■	■	
	6"	■	■	■	
	7"	■	■	■	
	8"	■	■		
	9"	■	■		
	10"	■	■		
	11"	■	■		
	12"	■	■		
	13"	■			
Coating/Material	Perma-Seal Coated Carbon Steel	■		■	
	Stainless Steel				■
	Galvalume				■
	Engineered Plastic		■		■

ROOFING FASTENERS

Roofing Fasteners

INTRODUCTION

SECTION CONTENTS Page No.

No other area of building construction and renovation poses more problems to a building owner, architect, engineer or consultant than roofing. In fact a great majority of liability suits in commercial construction pertain to roof damage. For many years, insulation boards were fastened to the structural roof deck primarily with adhesive. According to FM Global, uneven spreading of adhesives under extreme weather conditions fails to provide assured protection against windstorm losses. Mechanical fasteners have become an approved solution depending upon the particular roofing system employed. In 1983, FM Global stated that the only recommended means of attaching rigid insulation board to roof decks was the use of mechanical fasteners. Factory Mutual Research Corporation established categories of windstorm protection such as, I-60 (60 psf uplift), and I-90 (90 psf uplift). Today, the roofing industry commonly specifies mechanical fastening as a solution to the problem of windstorm uplift damage to insulation, coverings and perimeter fastenings. In an effort to provide problem solving solutions for both the systems manufacturer and roofer, Powers has designed many fasteners and accessories to reduce costs, installation time, and above all, provide a better means of attachment.

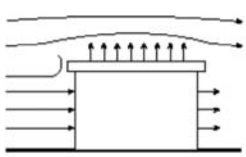
This section of the manual is designed to help you select the best combination of fastener, plate, and carbide-tipped drill, for the roofing project you are planning. Each application is unique and this section will help you choose the product which best suits your specific needs.

DESIGN GUIDELINES

Commonly used design approaches are published by several organizations including FM Global, The Single Ply Roofing Institute (SPRI), and local building code organizations. Consult the appropriate organization and the roofing manufacturer for detailed requirements. General considerations include the wind speed, type of building structure, height, exposure, type of roofing system, and structural base material.

Wind Speed

One of the first requirements in selecting an appropriate roofing fastener is to determine the amount of wind uplift to be resisted. The uplift is based on the location of the building, height, ground roughness, and area of the roof. As a wind force strikes a building structure, pressure differentials are created as fast moving air flows over and around a building. These differentials are referred to as suction or uplift and are often greatest at areas such as the roof perimeter, roof corners, wall corners, and ridges. Basic wind speed maps are normally used in conjunction with tables based on the ground roughness factor to determine the amount of uplift in the field of the roof. In some areas, local experience based on terrain or other factors may require the use of higher wind speeds. Additional factors are then applied for fasteners to be installed in the perimeter, ridges, and corners.



Wind force striking a building structure

To determine wind speed, consult an appropriate wind design map. Basic wind speed is measured at various locations around the country using anemometers usually at an elevation of 30-35 feet above the ground. Data has been collected from records to provide maps which show the fastest winds which have occurred over periods of time. The most commonly used maps are based on intervals of 50 and 100 years. These intervals or frequencies are described as the Mean Recurrence Interval (MRI) and are usually noted on the maps. Gust factors and other increases may need to be applied based on local code requirements.

Ground Roughness Exposure

Most recordings of wind speed are not influenced by the ground roughness since the anemometers are usually located in relatively open Exposure C or D areas. The wind speed may be reduced significantly depending upon the ground obstructions such as buildings and local terrain. Care should be taken when selecting a ground roughness factor. For example, a building may have obstructions in the area of local prevailing winds, but be open in the leeward area. It is normally considered good design practice to assume that maximum winds can blow from any direction. ASCE 7 establishes four categories for ground roughness or exposure based on the terrain and the location of adjacent structures.

Exposure A

This exposure is defined as large city centers with at least 50% of the buildings having a height in excess of 70 feet. Use of this exposure category should be limited to those areas for which terrain representative of Exposure A prevails in the upwind direction for a distance of at least one half mile and terrain representative of Exposure B prevails for an additional distance of one mile. Use of Exposure B is recommended unless wind tunnel testing proves otherwise.

Exposure B

Urban and suburban areas, well wooded areas, or other terrain with numerous closely spaced obstructions having the size of single family dwellings or greater. Use of this category of exposure should be limited to those areas in which terrain representative of Exposure B prevails in any direction for a distance of at least 1500 feet or ten times the height of the building or structure, whichever is greater. If Exposure B prevails in the vicinity of the proposed structure, but the distance to terrain less rough than Exposure B is less than 1500 feet or ten times the height of the structure, whichever is greater, then Exposure C should be used.

Exposure C

Open terrain with scattered obstructions having heights generally less than 30 feet. This exposure category includes flat, open country and grasslands.

Exposure D

Flat, unobstructed areas directly exposed to wind blowing over large bodies of water. This exposure category should be used for areas extending inland from the shore to a distance of 1500 feet or ten times the height of the building or structure, whichever is greater.

DESIGN GUIDELINES (Continued)

Velocity Pressure

After the appropriate ground roughness has been selected based on the type of exposure and the height of the roof, the velocity or uplift pressure can be calculated using formulas or taken from a design table. As an example, the tables published by FM Global are provided here for reference purposes. These values are for the field of the roof.

Velocity Pressure for Ground Roughness / Exposure B

Height Above Ground	Velocity Pressure (psf)					
	Wind Speed (mph)					
(ft.)	70	80	90	100	110	120
0-15	10	11	14	17	20	–
30	10	13	17	21	25	–
50	12	15	19	24	29	–
75	14	18	22	27	33	–
100	15	20	25	31	37	–
200	19	24	31	38	46	–
300	22	28	36	44	53	–
400	24	31	39	48	58	–
500	26	33	42	52	63	–

Velocity Pressure for Ground Roughness / Exposure C

Height Above Ground	Velocity Pressure (psf)					
	Wind Speed (mph)					
(ft.)	70	80	90	100	110	120
0-15	14	18	23	29	35	41
30	16	21	27	33	40	48
50	18	24	30	37	44	53
75	20	26	33	40	49	58
100	21	28	35	43	52	62
200	25	32	41	50	61	72
300	27	35	44	55	66	79
400	29	37	47	58	71	84
500	30	39	50	62	74	89

Velocity Pressure for Ground Roughness / Exposure D

Height Above Ground	Velocity Pressure (psf)					
	Wind Speed (mph)					
(ft.)	70	80	90	100	110	120
0-15	17	23	29	35	43	60
30	19	25	32	39	48	66
50	21	27	34	42	51	71
75	23	29	37	46	55	77
100	24	31	39	48	58	81
200	26	34	43	54	65	91
300	28	37	46	57	69	96
400	29	38	49	60	72	101
500	30	40	50	62	75	104

Other factors which may affect the velocity or uplift pressure to be used include the percentage of wall openings, projections or overhangs, air permeability of the roof deck, and the effect of positive pressure within the building. Consult the appropriate code or design guide for details.

Perimeter, Ridge and Corner Factors

Since the perimeter, ridges, and corners are typically exposed to higher uplift forces than the field of the roof, the design uplift pressure to be used in these areas is increased using factors or coefficients established by the various codes and design guides. The dimensional definition of the perimeter, ridge, and corner areas varies depending upon the code or guide used. As an example, the following coefficients are recommended by SPRI for mechanically fastened single ply roofing systems. Refer to the current SPRI guide for details.

Roof Area	Coefficent
Field	1
Perimeter and Ridges	2
Corners	3

Once the uplift pressure for the field of the roof has been determined, the design pressure for the perimeter, ridge, and corner areas is determined by multiplying the field pressure by the appropriate coefficient. For example, if the field pressure is determined to be 40 psf, the design pressure used in the perimeter area would be 80 psf and 120 psf in the corners.

Perimeter, Ridge and Corner Factors

Base materials used for roof decks are described in detail earlier in this manual. The type of base material is a primary factor in the selection of the proper fastener. Some codes or organizations establish requirements for each type of roof deck. For example, the FMRC deck requirements are as follows:

Steel	Minimum 22 gage
Concrete	Minimum 2,500 psi
Wood	Minimum 3/4" treated plywood or 2" lumber
Lightweight Concrete	Minimum 2" thickness over minimum 28 gage corrugated steel
Gypsum decks	Only pre-approved by FM Global
Cement Wood Fiber	Minimum 2" thickness

Roof decks should be inspected to verify that they are capable of sustaining the fastener loading requirements. For re-roof or recover applications, job site tests are usually recommended. Typical minimum average fastener pullout values recommended by SPRI for intermediate substrates used with fully adhered single ply systems and mechanically fastened single ply roofing systems are shown in the following table. Refer to the current SPRI guide for details.

Average Deck Type	Fastener Type	Average Pullout	Min. Embed. Depth
Structural	Pre-drilled screw/nail	800	1"
Concrete	Direct drive nail	800	1"
Cement	Non-penetrating screw	250	1 1/2"
Wood Fiber	Penetrating wing toggle	450	Through penetration
Gypsum	Non-penetrating screw	300	1 1/2"
Concrete	Penetrating wing toggle	450	Through penetration
Steel 22 Gage	Screw	375	3/4" through
Steel 24 Gage		325	3/4" through
Steel 26 Gage		225	3/4" through
Wood 3/4"	Screw	375	3/4" through
Wood 5/8"	Screw	325	3/4" through
Wood 1/2"	Screw	275	3/4" through

Tests should be conducted on a minimum of 10 fasteners at various locations in the roof. Contact the roofing manufacturer for recommendations.

Attachment of Insulation

When mechanical fasteners are used to attach insulation or intermediate substrate to the roof deck, they are normally used in conjunction with a stress distribution plate which will prevent the insulation from pulling over the head of the fastener. Powers provides 3" diameter round diaphragm action stress plates for use in attaching insulation. Spacing requirements for the attachment of insulation board are established by the

DESIGN GUIDELINES (Continued)

manufacturer of the insulation or an approval organization. FM Global provides recommended spacing and fastening patterns based upon specific construction assemblies. Requirements are typically based on an I-60 (60 psf) or I-90 (90 psf) rating. Consult the current FM Global Approval Guide for details.

Attachment of Membranes

For mechanically attaching roof membranes, fasteners are used in conjunction with a stress distribution plate, disc, bar or strip which as been approved for use with the specific roofing material. Spacing requirements are determined by the membrane manufacturer or an approval organization. FM Global provides recommended spacing and fastening patterns based upon specific construction assemblies. Requirements are typically based on I-60 (60 psf) or I-90 (90 psf) ratings. Consult the current FM Global Approval Guide for details.

Perimeter/Termination Attachment

The requirements for anchors or fasteners used for the attachment of systems used to terminate a roofing membrane are normally established by the membrane manufacturer. As an example, SPRI recommends a minimum design load of 90 pounds per linear foot. Refer to the current SPRI guide for details.

FIELD TEST GUIDELINES

Purpose of Test

Performance of roofing fasteners is a critical part of any successful roofing system. With the following exceptions, all deck types should be tested to determine the suitability of any fastener.

A. Metal deck – 22 gage or thicker in new construction
B. 3/4" Plywood in new construction
C. 2" Thick wood plank in new construction

Job site tests are always recommended whenever there may be a concern regarding the suitability of the deck. It is good practice to perform tests on all re-roof applications to verify the integrity of the base material. Decks such as cement wood fiber or gypsum should always be tested.

Equipment

Test equipment should consist of a hydraulic pulling unit with a gauge that reads in pounds. The gauge used should allow the lead values to fall within the working range of the unit which is generally 10 to 90% of the full scale of the gauge. If the tester has a gauge which reads in pounds per square inch (psi) and the values are converted to pounds, this should be noted on the test report. The conversion chart should be included with the test unit. For testing roofing fasteners, Powers offers a COMTEN hydraulic test unit with a load range of 0 to 2,000 pounds.

Catalog No.	Description	Std. Ctn.
2673	2K Dynanometer (0-2,000 lbs)	1

Equipment Calibration

Hydraulic equipment used for testing should be calibrated every 12 months by an independent laboratory. It should also be calibrated if it is suspected that the equipment is out of tolerance. Procedures are based on the document entitles ANSI/SPRI FX-1, *Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners.*

Procedures

A. Remove any roofing material in the area directly around the fastener to prevent any influence on the results of the tests. If the existing roof cover is to be left in place, 2 test series should be performed with and without the roof covering in place. The lowest values obtained from either test series should be used for design purposes.
B. The fasteners should be installed using procedures and methods which are identical to those to be used during actual construction. The details of the installation including drill diameter, embedment depth into the deck, fastener size, and installation tools should be recorded.
C. The fasteners should be installed perpendicular to the roof deck. The load should be applied evenly and slowly to the fastener in a direct line perpendicular to the deck.
D. A minimum of 10 tests should be performed for roof decks up to 50,000 square feet. For larger roof decks, an additional 5 tests for each additional 50,000 square feet or portion thereof shall be performed. Tests shall be performed in various areas of the roof including the comers, perimeter, and field to provide a representative sample of overall performance so that at least 50% of the samples are performed in the corner and perimeter areas. Additional testing shall be conducted in any areas of the deck which are damaged or where damage is suspected.
E. A plan of the roof shall be included to identify the location of each test. This plan need not be to scale.
F. The results of all roofing tests must be summarized on a Powers test form.

Personnel

A representative of the building owner shall be present to witness the tests performed and verify the load capacities. The suitability of the fastener and the spacing requirements shall be determined by the roof system manufacturer or a design professional in charge. A qualified roof technician shall be present to repair the roof in the areas where the testing has been performed to ensure that it has been returned to a watertight condition. An authorized representative of Powers Fasteners or their authorized distributor who is skilled in the use of test equipment shall perform fastener testing.

Cautions

A. Tests are indicative of fastener performance at the time of testing and should be conducted as close to job startup time as possible. Data that is greater than 1 year old should not be used and the roof deck should be tested again.
B. Prior to commencing job site tests, a survey of the roof and building interior should be conducted to prevent installation of fasteners into sensitive areas such as electrical wiring, etc.
C. Roof decks such as gypsum, cement wood fiber, light weight concrete, and insulating concrete can be affected by free water. Tests on these decks should not be conducted when the temperature of the deck is below 32°F or when it is suspected that the deck may be frozen.

INSTALLATION GUIDELINES

General

A. Fasteners should be driven perpendicular (90°) to the work surface.
B. The stress plate and fastener head should recess slightly to avoid abrasion with the roof cover.
C. Fasteners that have snapped due to improper driving should be removed.
D. Fasteners should be placed at least 6 inches from the edges of insulation board.
E. Fastening patterns vary according to systems manufacturer, and size positioning of insulation boards. Consult the systems manufacturer, board, manufacturer, FM Global, or local code office for information.

Steel Deck Applications

Deck Screws should be driven with the proper power bit and variable speed screw gun with a recommended 2500 rpm's.

Deck screws should be sized to penetrate the deck 3/4" minimum. Deck screws should penetrate the top flange of the deck to provide a secure fastening joint.

Concrete Deck Applications

Spike: Be sure all holes are drilled with carbide drills conforming to ANSI specifications. Improper bit diameters will affect fastener performance. Use of an electropneumatic rotary hammer with SDS-Plus drill bits are recommended.

Lightweight Deck Applications

(Tectum, Gypsum, Lightweight Insulating Concrete)

Powerlite: Job site tests must be performed. When installing into gypsum a 3/8", 7/16" or 1/2" drill bit should be used. Use a 1/4" drill when fastening into insulating concrete.

BACKOUT RESISTANCE

Flutter induced by wind loading and dynamic movements caused by roof mounted equipment can cause fasteners to back out of the deck material over time. Fasteners used in the attachment of membrane and insulation have been designed to provide resistance to back out.

Steel Deck Applications

Deck Screw: Specially designed drill points pierce the smallest possible hole in the steel deck. The points used are varied by the thread design to provide optimum performance. Unique thread configurations are used to bind the screw into the deck by providing the largest possible contact area between the minor diameter of the screw and the deck to provide resistance to unthreading.

Concrete Deck Applications

Spike: Fasteners which create point loading in concrete can cause the deck to deteriorate. Screws having no expansion mechanism lose their friction grip on the deck and fail. The Spike anchor overcomes these problems with a positive expansion design which provides even distribution of the load at three levels in the anchor hole. When subjected to vibratory loads, the design prevents pulverization of the concrete to provide resistance to back out.

Lightweight Deck Applications

Powerlite: A specially designed thread having a tapered root design compacts the base material during installation making the deck denser. Compared to a non-tapered fastener, the threads engage 70% more contact area to provide resistance to unthreading. To further resist back out, tabs on the screw head engage ratchet teeth on a barbed plate that grips the insulation or membrane.

Roofing Spike® *Anchor*

PRODUCT DESCRIPTION

For roofing applications, the Spike is a one-piece, vibration resistant anchor available for use in fastening insulation, single-ply membrane, wood, and metal to structural concrete roof decks. This version of the Spike has a Perma-Seal™ coating, and is designed for use in conjunction with Powers insulation or membrane plates.

GENERAL APPLICATIONS AND USES

- Fastening insulation, single-ply membrane, wood and metal to structural concrete decks.

APPROVALS AND LISTINGS

Factory Mutual Research Corporation – Now known as FM Global (FM Approvals)

Structural Concrete Deck – J.I. 1K6A7.AM, J.I. 0N9A2.AM, J.I. 1M4A5.AM

Fully Adhered Single-Ply and Modified Bitumen Coverings (All Decks) – J.I. 1T9A4.AM

MATERIAL SPECIFICATIONS

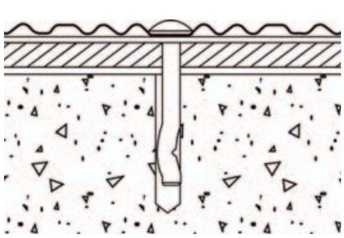
Anchor Component	Component Material
Anchor Body	Grade 8.2 Carbon Steel
Coating	Perma-Seal Fluoropolymer

INSTALLATION SPECIFICATIONS

	Component Material
Diameter	1/4"
ANSI Drill Bit Size, d_{bit} (in.)	1/4
Fixture Clearance Hole (in.)	5/16
Head Size, O.D. (in.)	1/2
Head Height (in.)	7/64

Installation Guidelines

Drill a hole into the base material to the depth of at least 1/2" deeper than the embedment required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15. Blow the hole clean of dust and other material.



Drive the anchor through the plate into the anchor hole until the head is firmly seated. Be sure the anchor is driven to the required embedment depth.

SECTION CONTENTS Page No.

Roofing Spike

ANCHOR MATERIALS

Perma-Seal Coated Carbon Steel

ANCHOR SIZE RANGE (TYP.)

1/4" x 1" to 1/4" x 14"

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Concrete Masonry

PERFORMANCE DATA

Ultimate Load Capacities for Roofing Spike in Normal-Weight Concrete[1,2]

Anchor Diameter	Minimum Embedment Depth	Minimum Concrete Compressive Strength (f'_c)					
		3,000 psi (20.7 MPa)		4,000 psi (27.6 MPa)		5,000 psi (34.5 MPa)	
d in. (mm)	h_v in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	1,100 (5.0)	2,500 (11.3)	1,550 (7.0)	2,750 (12.4)	1,700 (7.7)	2,100 (9.5)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.

ROOFING FASTENERS

PERFORMANCE DATA

Allowable Load Capacities for Roofing Spike in Normal-Weight Concrete[1,2]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		3,000 psi (20.7 MPa)		4,000 psi (27.6 MPa)		5,000 psi (34.5 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	275 (1.2)	625 (2.8)	390 (1.8)	690 (3.1)	425 (1.9)	525 (2.4)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.

Ultimate and Allowable Load Capacities for Roofing Spike in Hollow Concrete Masonry[1,2]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	$f'_m \geq$ 3,000 psi (20.7 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	800 (3.6)	2,100 (9.5)	160 (0.7)	420 (1.9)

1. Tabulated load values are for anchors installed in minimum 6-inch wide, Grade N, Type II, medium and normal-weight concrete masonry units. Mortar must be minimum Type N. Masonry prism compressive strength must be 1,500 psi minimum at the time of installation.
2. Allowable loads are based on average ultimate values using a safety factor of 5.0.

ORDERING INFORMATION

Roofing Spike

Cat. No.	Anchor Size	Drill Diameter	Min. Embedment	Std. Box	Std. Carton	Wt./100
3811	1/4" x 1 1/4"	1/4"	7/8"	500	500	2 1/2
3723	1/4" x 1 1/2"	1/4"	1 1/4"	500	500	2 1/2
3725	1/4" x 2"	1/4"	1 1/4"	500	500	3
3727	1/4" x 2 1/2"	1/4"	1 1/4"	500	500	4
3729	1/4" x 3"	1/4"	1 1/4"	500	500	4 1/2
3731	1/4" x 3 1/2"	1/4"	1 1/4"	500	500	5
3733	1/4" x 4"	1/4"	1 1/4"	500	500	6
3735	1/4" x 4 1/2"	1/4"	1 1/4"	500	500	6 1/2
3737	1/4" x 5"	1/4"	1 1/4"	500	500	7
3739	1/4" x 5 1/2"	1/4"	1 1/4"	500	500	7 1/2
3741	1/4" x 6"	1/4"	1 1/4"	250	250	8
3743	1/4" x 6 1/2"	1/4"	1 1/4"	250	250	8 1/2
3745	1/4" x 7"	1/4"	1 1/4"	250	250	9 1/2
3747	1/4" x 7 1/2"	1/4"	1 1/4"	250	250	10 1/2
3749	1/4" x 8"	1/4"	1 1/4"	250	250	11
3753	1/4" x 9"	1/4"	1 1/4"	250	250	12
3757	1/4" x 10"	1/4"	1 1/4"	250	250	13
3765	1/4" x 11"	1/4"	1 1/4"	100	100	14
3769	1/4" x 12"	1/4"	1 1/4"	100	100	15
3773	1/4" x 13"	1/4"	1 1/4"	100	100	16
3777	1/4" x 14"	1/4"	1 1/4"	100	100	17

ROOFING FASTENERS

Roofing Spike Installation Tools

Cat. No.	Description	Guide I.D.	Std. Box	Wt./Each
3790	Spike Driver 1000	1/2"	1	1/4
3791	Spike Driver 2000	1/2"	1	1/4

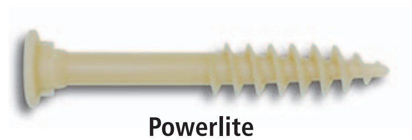
Powerlite™ *Roofing Anchor*

PRODUCT DESCRIPTION

The Powerlite is a fastener used to mechanically attach rigid insulation board and single-ply membrane to structural cement wood fiber, gypsum, and lightweight insulating concrete roof decks. The fastener is used in conjunction with insulation and membrane plates. Both types of stress plates are formed from Galvalume, an alloy material which meets Factory Mutual Research Corporation Standard 4470 for corrosion protection. The plates are manufactured with four barbs on the underside that grip the insulation board or single-ply membrane preventing rotation.

The Powerlite is designed with a high thread profile along with a tapered root diameter and sharp point. This unique design allows the Powerlite to penetrate the roof deck and progressively compact the base material creating a stronger hold in weak material. Normally, the Powerlite can be installed into cement wood fiber decks such as Tectum® without pre-drilling. Decks such as Insulrock may require a 5/16" pre-drilled hole. Gypsum and lightweight insulating concrete decks should be pre-drilled using a 3/8" or 7/16" carbide tipped bit. Larger carbide tipped bits up to 1/2" in diameter can be used in denser material. The drill bit size to be used should be determined during the job site test.

SECTION CONTENTS Page No.



Powerlite

ANCHOR MATERIALS

Reinforced Engineered Nylon

ANCHOR SIZE RANGE (TYP.)

2” to 14” Lengths

SUITABLE BASE MATERIALS

Structural Cement Wood Fiber
Gypsum
Lightweight Concrete

APPROVALS AND LISTINGS

Factory Mutual Research Corporation – Now known as FM Global (FM Approvals)
Gypsum and Tectum Decks – J.I. 1Q2A2.AM, J.I.1T9A4.AM
Recover Construction – J.I. 1T9A4.AM
All Deck Types
Fully Adhered Single-Ply and Modified Bitumen Roof Coverings – J.I. 1T9A4.AM
Single Ply Roof Covers in Cementitious Wood Fiber Deck – J.I. 3X2A7.AM

MATERIAL SPECIFICATIONS

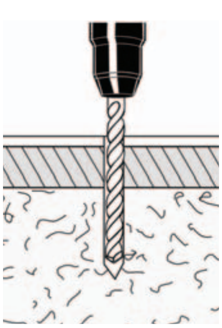
Anchor Component	Component Material
Fastener Body	Nylon
Plate	Galvalume Coated Steel

INSTALLATION SPECIFICATIONS

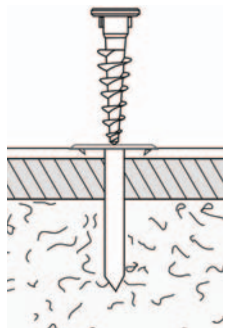
Head Size, O.D. (in.)	1
Head Height (in.)	1/8
Insert Size (in.)	1/4
Fixture Clearance Hole* (in.)	5/8

* Fixture Clearance holes are needed only when plywood or other rigid materials are fastened to a roof deck

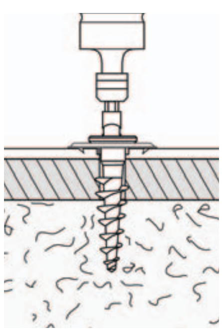
Installation Guidelines



If predrilling is required, drill a hole into the base material to a depth 1/2" greater than the embedment required. The tolerances of the drill bit should meet the requirements of ANSI Standard B94.12



Place the Powerlite plate on the insulation (3" round) or membrane (2" round)



Using an impact wrench, drive the Powerlite through the plate into the base material until the head of the fastener is properly seated in the plate. The plate should be seated securely against the insulation or membrane. Do not overdrive.

PERFORMANCE DATA

Ultimate Load Capacities for Powerlite in various Base Materials[1]

Base Material	Pre-Drill in.	Minimum Embedment Depth h_v in. (mm)	Tension lbs. (kN)
Tectum	–	1 1/2 (38.1)	280 (1.3)
Tectum	–	2 (50.8)	440 (2.0)
Tectum	–	2 1/2 (63.5)	595 (2.7)
3" Insulrock	5/16	2 1/2 (63.5)	365 (1.6)
Poured Gypsum	3/8	2 (50.8)	540 (2.4)

1. The test data above represents average ultimate loads and should be used as guideline only. Apply an appropriate safety factor. Jobsite tests are recommended. Tectum® is registered trademark of Tectum, Inc.

ORDERING INFORMATION

Powerlite

Catalog Number	Length	Minimum Embedment	Standard Carton	Wt./100
4670	2"	1 1/2"	500	3
4671	2 1/2"	1 1/2"	500	3
4672	3"	1 1/2"	500	3
4673	3 1/2"	1 1/2"	500	4
4674	4"	1 1/2"	500	4
4675	4 1/2"	1 1/2"	500	4
4676	5"	1 1/2"	500	4
4677	5 1/2"	1 1/2"	500	5
4678	6"	1 1/2"	500	5
4679	6 1/2"	1 1/2"	500	5
4680	7"	1 1/2"	500	5
4681	7 1/2"	1 1/2"	500	6
4683	8"	1 1/2"	250	6
4684	8 1/2"	1 1/2"	250	6
4685	9"	1 1/2"	250	6
4686	9 1/2"	1 1/2"	250	7
4687	10	1 1/2"	250	7
4688	11"	1 1/2"	250	7
4689	12"	1 1/2"	250	8
4691	13"	1 1/2"	250	8
4692	14"	1 1/2"	250	9
3876	2" Powerlite Plate	–	500	3 1/2
3896	3' Powerlite Plate	–	500	3 1/2

ROOFING FASTENERS

Deck Screws™

PRODUCT DESCRIPTION

Deck Screws are designed for attaching rigid insulation board, single-ply membrane, and wood blocking to carbon steel and wood decks. Some sizes can also be used in concrete decks. Available in carbon steel with a Perma-Seal™ coating. The deck screws are used in conjunction with insulation or membrane plates and can also be used with batten bar.

For corrosion protection the screws are coated with Perma-Seal, a proprietary fluoropolymer, which meets the requirements of Factory Mutual Research Corporation Standard 4470.

SECTION CONTENTS Page No.

Deck Screws

ANCHOR MATERIALS

Perma-Seal™ Coated Carbon Steel

ANCHOR SIZE RANGE (TYP.)

No. 12 x 1 5/8" to No. 12 x 18"

SUITABLE BASE MATERIALS

Steel
Wood
Concrete Roof Decks

APPROVALS AND LISTINGS

Factory Mutual Research Corporation – Now known as FM Global (FM Approvals)
- Steel and Wood
  - No. 12 Perma-Seal Deck Screw – J.I. 0K4A2.AM, J.I. 1M4A5.AM, J.I. 1M2A4.AM
- Recover Construction
  - Power-Deck Screw – J.I. 1N2A4.AM
- All Deck Types
  - Fully Adhered single-ply and modified bitumen roof coverings - J.I. 1T9A4.AM

MATERIAL SPECIFICATIONS

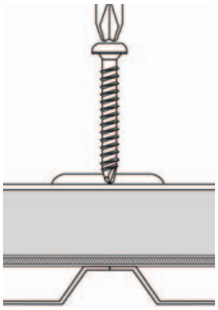
Anchor Component	Screw Size
	No. 12
Screw Body	Case Hardened AISI 1018 – 1022 Carbon Steel
Coating	Perma-Seal Fluoropolymer

INSTALLATION SPECIFICATIONS

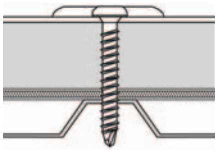
Anchor Size	No. 12
Driver Bit Size	3
Head Style	PH
Head Height (in.)	1/8
Head Width (in.)	7/16
Washer O.D.	–
Thread Size	12-13
Point Style	R

Head Style: PH = Phillips Head
Point Style: R = Ricoh "S" Point

Installation Guidelines



Insert the Phillips driver into Deck Screw head, then position screw in the plate.



Insert Deck Screw through hole in plate, and drive until flush.

Note: Screw must penetrate base material a minimum of 3/4".

Note: In steel and wood deck, the screw should penetrate through the base material at least 3/4". To select the proper length, determine the thickness of insulation to be fastened and add the thickness of the base material to this. Then add 3/4". This will be the minimum screw length required.

PERFORMANCE DATA

Ultimate Load Capacities for Deck Screws installed in Steel Deck[1]

Fastener Size	Tension lbs. (kN)						
	Nominal Gage						
	16	18	20	22	24	26	28
No. 12	930 (4.2)	725 (3.3)	655 (2.9)	550 (2.5)	335 (1.5)	190 (0.9)	185 (0.8)

1. Typical steel deck used in the tests was manufactured according to ASTM A 446, Grade C having a minimum yield strength of 40,000 psi and a minimum ultimate tension strength of 55,000 psi. The deck was galvanized according to ASTM A 525, G 60. Variations in coating and deck type will affect performance. In some cases, especially with thick steel deck materials, pre-drilled holes may be required.

Ultimate Load Capacities for Deck Screws installed in Plywood[1]

Fastener Size	Tension lbs. (kN)			
	Plywood Thickness			
	3/8"	1/2"	5/8"	3/4"
No. 12	285 (1.3)	415 (1.9)	605 (2.7)	710 (3.2)

1. Apply appropriate safety factors.

Ultimate Load Capacities for Deck Screws fasteners[1]

Screw Size	Torsion lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
No. 12	75 (0.3)	2,410 (10.8)	1,815 (8.2)

1. Ultimate load capacities do not consider base material.

Lateral Loads based on Bending

Deck screws are normally used to fasten insulation to a roof deck. In most applications, the lateral load applied to the screw will produce a bending load, not a shear load. The allowable load in bending is based on several factors including the insulation thickness and the material strength of the screw used. These loads should be calculated by a design professional. A typical calculation is shown for references purposes.

Property

Ultimate Tensile Stress of the Steel	F_u = 170,000 psi (based on testing)
Yield Stress of the steel	F_y = 130,000 psi (estimated)
Allowable Bending Stress	$F_b = 0.66*F_y$ = 85,800 psi

Deck Screw Diameters

Dimension	No. 12
Root	285 (1.3)

ROOFING FASTENERS

PERFORMANCE DATA

Calculated Allowable Lateral Loads

Moment Arm in. (mm)	Maximum Allowable Lateral Load No. 12 lbs. (kN)
0.10 (2.5)	160.52 (0.7)
0.25 (6.4)	64.21 (0.3)
0.50 (12.7)	32.10 (0.1)
1.00 (25.4)	16.05 (0.1)
1.50 (38.1)	10.70 (0.0)
2.00 (50.8)	8.03 (0.0)
2.50 (63.5)	6.42 (0.0)
3.00 (76.2)	5.35 (0.0)
3.50 (88.9)	4.59 (0.0)
4.00 (101.6)	4.01 (0.0)
4.50 (114.3)	3.57 (0.0)
5.00 (127.0)	3.21 (0.0)

Moment Arm in. (mm)	Maximum Allowable Lateral Load No. 12 lbs. (kN)
5.50 (139.7)	2.92 (0.0)
6.00 (152.4)	2.68 (0.0)
7.00 (177.8)	2.29 (0.0)
8.00 (203.2)	2.01 (0.0)
9.00 (228.6)	1.78 (0.0)
10.00 (254.0)	1.61 (0.0)
11.00 (279.4)	1.46 (0.0)
12.00 (304.8)	1.34 (0.0)
13.00 (330.2)	1.23 (0.0)
14.00 (355.6)	1.15 (0.0)

$$\textit{Allowable Load} = \frac{\textit{Allowable Load * Section Modulus}}{\textit{Moment Arm}}$$

ORDERING INFORMATION

Perma-Seal™ Coated No. 12 Phillips Head Deck Screw

Catalog Number	Size	Thread Length	Insulation Thickness	Standard Box	Standard Carton	Wt./100
2613	No. 12 x 1 5/8"	1 1/2"	1/8" to 7/8"	1,000	1,000	11
2618	No. 12 x 2 1/4"	2"	1/4" to 1 1/2"	1,000	1,000	14
2624	No. 12 x 2 7/8"	2 5/8"	1/4" to 2 1/8"	1,000	1,000	19
2530	No. 12 x 3 1/4"	3"	3/4" to 2 1/2"	1,000	1,000	22
2632	No. 12 x 3 3/4"	3"	3/4" to 3"	1,000	1,000	25
2636	No. 12 x 4 1/2"	3"	1 1/2" to 3 3/4"	1,000	1,000	27
2640	No. 12 x 5"	3"	2" to 4 1/4"	1,000	1,000	29
2648	No. 12 x 6"	4"	2" to 5 1/4"	500	500	40
2656	No. 12 x 7"	4"	2" to 6 1/4"	500	500	44
2664	No. 12 x 8"	4"	4" to 7 1/4"	500	500	48

Stress Plates

PRODUCT DESCRIPTION

Stress Plates are designed for use with Deck Screws and Spike anchors. For Powerlite specially designed stress plates are listed in the applicable product sections. Stress plates are used when attaching insulation and single ply materials to distribute load and prevent the material being fastened from pulling over the head of the fastener. In addition to the stress plates, a sealing washer and a plastic bearing washer are available for use with flashing and termination systems.

Insulation plates, are used when mechanically attaching rigid form insulation to roof decks. They are manufactured in 3" diameter for use with truss head No.12 Deck Screws, and 3/16" and 1/4" Spike anchors. Two carbon steel plates, Type 304 stainless steel plate and a plastic plate are available. A recessed plate, a Type 304 stainless steel plate and a plastic plate are available for use with the No.12 hex washer head Deck Screws.

The design of the insulation plate allows it to flex during installation if a fastener is overdriven preventing fracturing of the insulation board and facer. Sharp edges which could protrude above the insulation surface are eliminated by the round design. For corrosion resistance, a Galvalume coating is applied to the carbon steel plates. This coating, comprised primarily of aluminum and zinc, provides a degree of corrosion resistance which allows the material to meet the corrosion resistance required by Factory Mutual Research Corporation Standard 4470. Membrane plates, sometimes called lap plates, are used when mechanically attaching single ply material in the area of the lap or seam. They are manufactured in a 2" diameter for use with No.12 Deck Screws and 3/16" and 1/4" Spike anchors. The 2" membrane plate is formed with four barbs to provide positive engagement with the membrane to reduce the possibility of tearing the single ply material under load. For corrosion resistance, a Galvalume coating as described above is applied to the plates.

APPROVALS AND LISTINGS

Factory Mutual Research Corporation – Now known as FM Global (FM Approvals)
Steel, Wood and Structural Concrete Decks
Powers Stress Plates – J.I. 1RA3A1.AM
Recover Construction
Powers Stress Plates – J.I. 1P3A9.AM

SECTION CONTENTS Page No.

Stress Plates

ANCHOR MATERIALS

Stainless Steel
Galvalume
Engineered Plastic

SIZE RANGE (TYP.)

2" and 3" Round

SUITABLE BASE MATERIALS

Insulation
Single-Ply Roofing Materials

PERFORMANCE DATA

Plate Pullover Capacities

Fastener Size	Tension lbs. (kN)		
	3/16" Spike	1/4" Spike	#12 Deck Screw
3" Round Galvalume	635 (2.9)	720 (3.2)	720 (3.2)
3" Round Plastic	530 (2.4)	570 (2.6)	540 (2.4)
3" Round Stainless	1,140 (5.1)	1,150 (5.2)	1,190 (5.4)
2" Round Galvalume	1,350 (6.1)	1,450 (6.5)	1,380 (6.2)

ORDERING INFORMATION

Insulation Plates for Phillips Head Deck Screws

Cat. No.	Size	Plate Thickness	Material	Standard Carton	Wt/100
3880	3" Round	0.019"	Galvalume	500	4
3881	3" Round	0.019"	Stainless Steel	500	4

Membrane Plates

Cat. No.	Size	Plate Thickness	Material	Standard Carton	Wt/100
3878	2" Round barbed	0.034"	Galvalume	1,000	3

EPDM Sealing Washer for use with 1/4" Anchors

Cat. No.	Size	Standard Box	Standard Carton	Wt/100
2896	1/4" (I.D.) x 1 1/8" (O.D.)	100	1,000	1 1/4

Plastic Washer for use with 1/4" Anchors

Cat. No.	Size	Standard Box	Standard Carton	Wt/100
3994	1/4" (I.D.) x 1 1/2" (O.D.) Poly	1,000	5,000	3 1/2

CARBIDE DRILL BITS

SECTION CONTENTS

CARBIDE DRILL BIT SELECTION GUIDE

	Product	S-4 Plus SDS	Quattro Head SDS	Tri-Cutter SDS-Max® Shank	Tri-Cutter Spline Shank	Single Tip Spline Shank	HD Straight Shank	IG Straight Shank	"A" Taper Shank	Rotary Carbide Bits	Rebar Cutters	Heavy Duty Chisels	One and Two Piece Core Bits
	Page	372	373	373	374	374	375	376	377	377	378	378	379
Diameter	1/8"						■	■		■			
	5/32"	■					■			■			
	3/16"	■					■	■	■	■			
	7/32"	■						■		■			
	1/4"	■					■	■	■	■			
	9/32"	■								■			
	5/16"	■					■	■	■	■			
	3/8"	■				■	■	■	■	■			
	7/16"	■				■	■	■		■			
	1/2"	■		■		■	■	■	■	■	■		
	9/16"	■		■		■	■	■		■	■		
	5/8"	■	■	■	■	■	■	■	■	■	■		
	11/16"	■		■	■	■				■	■		
	3/4"	■	■	■	■	■	■	■	■	■	■		
	27/32"	■											
	7/8"	■	■	■	■	■	■	■		■	■		
	1"	■		■	■	■	■	■		■	■	■	
	1 1/8"		■	■	■	■					■	■	■
	1 1/4"		■	■	■	■					■	■	
	1 3/8"			■	■	■						■	
	1 1/2"			■	■	■						■	■
	1 5/8"					■							■
	1 3/4"					■							■
	2"					■						■	■
	2 1/2"												■
	3"												■
	3 1/2"												■

Drill Bits

INTRODUCTION

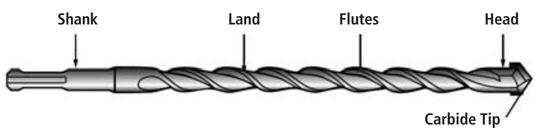
Powers carbide tipped drill bits and accessories are quality professional grade tools manufactured in several grades to meet the demanding requirements of all drilling and demolition applications in concrete and masonry.

Drill bits are specifically designed and manufactured under state-of-the-art controlled certified conditions. This includes strict tolerance limits for the cutting diameter, the symmetry of the carbide tip to drill axis, the symmetry of the tip pint and the out-of-true variation. The resulting products produce geometrically exact drilled holes and give a firm support to post-installed anchoring systems with maximum safety to the user.

SECTION CONTENTS Page No.

PRODUCT DESCRIPTION

The most modern production facilities combined with on-going research and experience form the foundation for the performance, quality and long life of Powers carbide tipped drill bits. Continuous quality control at all intermediate stages of the manufacturing process ensures consistent high quality.



Raw Materials

It all begins with the testing and inspection of the raw materials. Samples from each lot of high grade tool steel are individually tested to ensure compliance with Powers specifications. Each drill blank is formed completely from a piece of steel stock to ensure a uniform quality and grain structure. Welding of components which results in a weaker product is not permitted.

Flute Forming

The flutes are formed to provide maximum energy transfer to the drill tip for faster drilling. A unique design provides high shaft strength for durability while the small lands reduce resistance for faster drilling. On smaller diameter bits, double flutes ensure quick, efficient dust removal to reduce heat and abrasion for maximum bit life. Larger diameter bits normally have a single undercut helical flute.

Head Shaping

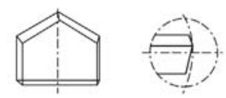
The head is shaped with straight exit flutes to provide maximum support for the carbide insert on both sides. Each slot is precisely cut for a matched tolerance fit with the carbide insert including a relief radius to prevent tip breakage. Different head shapes reduce vibration to provide faster drilling.

Shank Forming

The shank portion of the SDS-Plus, Spline, SDS-Max, hex, and straight shank drill bits and accessories meet the criteria established by major power tool manufacturers.

Carbide Insert

Powers drill bits use a special carbide insert which is formed isostatically under extreme heat and pressure to ensure consistent density. This process provides the best quality available. The grade of the carbide is designed for the type of electric tool in which the drill bit will be used. Each carbide insert has a specially designed relief angle which provides maximum support along the carbide cutting edge to decrease wear resulting in longer bit life. An automatic feed system positions the carbide insert in the slot which ensures precise alignment. Heat treating and brazing is performed simultaneously using a proprietary process. All Powers drill bits have a shot peened surface treatment to provide uniform hardness which prevents fatigue cracks.



Powers Drill Bits

Typical Drill Bits

Final Inspection

Each drill bit is 100% optically inspected upon completion. The combination of these processes produces a bit which has the stability and rigidity required for maximum durability. For corrosion protection, the drill bits have a special finish.

ANSI Standard B212.15

Powers carbide tipped drill bits are manufactured to conform with the American National Standards Institute, Standard B212.15 as listed in the following table. Powers anchors, unless otherwise noted, are designed to be installed in holes drilled in the base material using carbide tipped bits meeting this specification.

Nominal Drill O.D.	ANSI Standard	Nominal Drill O.D.	ANSI Standard
1/8"	0.134 - 0.140"	11/16"	0.713 - 0.723"
5/32"	0.165 - 0.171"	3/4"	0.775 - 0.787"
11/64"	0.181 - 0.187"	27/32"	0.865 - 0.881"
3/16"	0.198 - 0.206"	7/8"	0.905 - 0.917"
7/32"	0.229 - 0.237"	15/16"	0.968 - 0.980"
1/4"	0.260 - 0.268"	1"	1.030 - 1.042"
9/32"	0.296 - 0.304"	1 1/8"	1.160 - 1.175"
5/16"	0.327 - 0.335"	1 1/4"	1.285 - 1.300"
3/8"	0.390 - 0.398"	1 3/8"	1.410 - 1.425"
7/16"	0.458 - 0.468"	1 1/2"	1.535 - 1.550"
1/2"	0.520 - 0.530"	1 5/8"	1.655 - 1.675"
9/16"	0.582 - 0.592"	1 3/4"	1.772 - 1.792"
5/8"	0.650 - 0.660"	2"	2.008 - 2.028"

APPLICATION GUIDELINES

Powers carbide tipped drill bits are quality tools which are designed to provide the user optimum performance and drill bit life. To ensure proper performance and extended drill bit life, the following guidelines should be followed:

1. Carbide tipped drill bits are designed for use in concrete, masonry, and soft stone. Do not use the bits to drill plastic, wood, metal, or other materials. Do not use worn or dull drill bits. Use of a worn drill bit may result in anchor holes which are out of tolerance.
2. The chuck of the installation tool used should be properly maintained to prevent excessive run out which will result in shank and tip wear.
3. The shank end of the drill bit should be properly lubricated if required. Always be sure that the shank end of the drill bit is properly seated in the chuck.
4. While drilling, especially in soft or damp materials, do not allow the flutes of the drill bit to become clogged with cuttings. Occasionally withdraw the bit to clear the flutes to prevent overheating of the drill tip.
5. Do not attempt to cool the drill bit by submersing it in water or by pouring water into the hole. This will cause the carbide insert to crack and will destroy the bit.
6. Drilling in reinforced concrete and masonry materials can be hazardous. Avoid hitting reinforcing bars or other embedments as this will cause bit breakage and jamming.
7. Do not drill deeper than the recommended usable length or the length of the flutes on the drill bit.
8. Never try to realign an off center hole after beginning the drilling operation. Do not attempt to change directions in the hole.
9. Carbide tipped drills and the materials in which they are used may break or shatter during use. Always wear safety glasses and other appropriate protection in the area of their use. Follow all required safety guidelines.

PRODUCT PERFORMANCE

Drilling speed is largely dependent on the type of electric drill used and the base material to be drilled. The Powers design helps to maximize drilling speed through several features.

The solid, reinforced core of the drill bit provides maximum energy transfer from the electric drill to the base material. Powers drill bits have double flutes and a symmetrical head which reduces vibration. This allows the impact energy from the electric drill to be fully transferred to the base material. Drill bits with a single flute will vibrate excessively which results in slower speed. The slim lands on the Powers flutes reduce the friction between the drill bit and the wall of the hole for faster drilling.

The following guide lists typical drilling speeds based on the use of both SDS-Plus and Spline rotary hammer drill bits in 4,000 psi concrete. Results will vary depending on the density of the base material and the electric drill used. To develop this guide, an SDS-Plus rotary hammer which had a hammering action of 4,200 blows per minute and an impact energy of 2.2 joules was used. The Spline rotary hammer had a hammering action of 3,500 blows per minute with an impact energy of 4.2 joules. The speeds listed in the table are in minutes per inch of embedment. To determine the approximate drilling time, multiply the figure from the table by the drilling depth. For example, if using a Spline tool to drill bit a 3/4" hole, 6" deep, the drilling time would be 6 x 0.17 or approximately 1 minute. For calculating multiple holes, a 60% efficiency rate is normally used. In this case, divide the calculated figure by 0.60 to determine typical production.

Drilling Speed – Based on 4,000 psi concrete

Nominal Hole Diameter (Inch)	Drilling Time per Inch (Minutes)	
	SDS Plus Tool	Spline Tool
3/16	0.04	–
1/4	0.05	–
5/16	0.07	–
3/8	0.08	0.06
7/16	0.09	0.07
1/2	0.10	0.08
9/16	0.11	0.10
5/8	0.14	0.11
3/4	0.19	0.17
7/8	0.28	0.22
1	0.33	0.28

Drilling Speed – Based on 4,000 psi concrete (Continued)

Nominal Hole Diameter (Inch)	Drilling Time per Inch (Minutes)	
	SDS Plus Tool	Spline Tool
1 1/8	–	0.36
1 1/4	–	0.50
1 3/8	–	0.57
1 1/2	–	0.75
1 5/8	–	0.81
1 3/4	–	0.92
2	–	1.00

Drilling Bit Life

Drill bits produced to Powers specifications are the best quality available. The following guide lists the expected life when drilling in 6,000 psi concrete. Variables such as hard aggregate and contact with reinforcing bars will reduce drill bit life.

Bit Diameter (Inch)	Typical Drill Life (Feet)		
	SDS-Plus	Quatro Head Spline	Quatro Head Spline
3/16	35	–	–
1/4	45	–	–
5/16	55	–	–
3/8	60	–	–
1/2	75	–	–
5/8	80	110	160
3/4	100	220	300
7/8	110	270	350
1	–	310	400

During the drilling operation, bit wear should be monitored to ensure that the carbide tip does not wear below the following limits. This will maintain proper anchor functioning. This is especially important when using mechanical anchors. Generally, mechanical anchors can be installed in holes drilled with bits which have worn to the lower limit and proper functioning can be expected. However, this may vary depending upon the base material so these values should be used as a guide.

Nominal Drill	Lower Wear	Nominal Drill	Lower Wear
3/16"	0.190"	5/8"	0.639"
1/4"	0.252"	3/4"	0.764"
5/16"	0.319"	7/8"	0.897"
3/8"	0.381"	1"	1.022"
1/2"	0.510"	1 1/4"	1.270"

WARRANTY

Powers carbide tipped drill bits are warranted against failure due to manufacturing defects. This warranty does not apply to failure due to normal wear or where there is evidence of improper application or misuse.

Evaluation Procedure

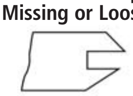
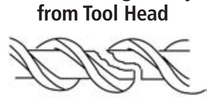
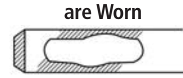
The following criteria is used to evaluate drill bits submitted for warranty. Warranty claims for carbide tipped drill bits should be submitted by the distributor to the local Powers branch from which the merchandise was purchased. Full or partial replacement of a drill bit is based on the amount of wear differential as measured between front and rear portion of the flute as shown below. To determine the wear differential, measure the diameter of flute at d_1 and d_2. The variation between d_1 and d_2 is the differential.

The allowable wear differential is listed in the table below. Bits which are worn beyond the differential have reached the maximum expected bit life and do not qualify for warranty.

Drill Bit Diameter (Inch)	Wear Differential (Inch)
3/16	0.008
1/4	0.008
5/16	0.012
3/8	0.016
7/16	0.020
1/2	0.020
9/16	0.024
5/8	0.024
11/16	0.024
3/4	0.024
7/8	0.028
1	0.032
1 1/8	0.036
1 1/4	0.039
1 3/8	0.043
1 1/2	0.048
1 3/4	0.048
2	0.048

Evaluation Criteria

The following chart shows typical drill bit damage associated with warranty claims, the probable cause, and the warranty policy. Warranty replacement credit will be adjusted based on the amount of drill bit wear. No replacement will be made for bits where the shank transition is polished or where flutes are full of foreign material such as tar.

Damage	Cause
Carbide Insert lip is Missing or Loose 	This is generally caused by poor brazing indicated by a lack of brazing material at the base of the tip or voids. Failure usually occurs within the first 10 to 20 holes. *Full/Partial Replacement based on wear.*
Carbide Tip Fractures 	Tip fractures will occur if reinforcing bars or other embedments are struck when drilling into concrete or masonry. These failures are easily identified because both the carbide insert and the tool steel will be damaged. *No Warranty Replacement.* Tip fractures may also occur if the carbide insert is out of tolerance, usually too hard. If this type of failure occurs, only the carbide tip will be fractured. *Full/Partial Replacement based on wear.*
Carbide Tip/Tool Body Breakage 	A failure such as this indicates that the brazing may not have been strong enough to resist the differences in thermal expansion between the carbide tip and the tool steel. *Full/Partial Replacement based on wear.*
Carbide Cutting Edge is Worn/Rounded  1/3 2/3	If the cutting edge of the carbide tip is worn more than 2/3 of its width, the bit has reached the end of its useful life. *No Warranty Replacement.*
Loss of Carbide/Tool Tip 	A failure such as this indicates that the brazing may not have been strong enough to resist the differences in thermal expansion between the carbide tip and the tool steel. *Full/Partial Replacement based on wear.*
Shaft Breakage behind Head 	Shaft breakage may occur if there is a defect in the tool steel. This will be indicated by a notch which is evident in the fracture area. *Full/Partial Replacement based on wear.* Breakage may occur if the bit has been over torqued by jamming it in the hole. This is indicated by the lack of a notch and an irregular / jagged fracture area. *No Warranty Replacement.*
Shaft Breakage away from Tool Head 	Shaft breakage away from the tool head may occur if there is a defect in the tool steel. This will be indicated by a notch which is evident in the fracture area. *Full/Partial Replacement based on wear.* Breakage in the shaft away from the head or tip area may also occur if the bit has been over torqued by jamming it in the hole. This is indicated by an irregular or jagged fracture area. No notch is apparent. *No Warranty Replacement.*
Shaft Breakage–Clogged Flutes 	The bit has been used to drill through plastic, tar, adhesive, etc., and the flutes have been clogged. This is an indication that the bit could not clear dust and chips and broke from overload. *No Warranty Replacement.*
Shank Transition is Polished 	If the drill bit has been used to produce holes deeper than the length of the flute, the area between the flutes and the upper shank will become polished. Dust may also be packed into the flutes. *No Warranty Replacement.*
Tool Holder Slots are Worn 	Wear in the tool holder area indicates that the drill motor used should be repaired or replaced. *No Warranty Replacement.*

S-4 Plus™ SDS *Carbide Drill Bits*

PRODUCT DESCRIPTION

S-4 Plus carbide drill bits are designed for use in a rotary hammer equipped with an SDS (slotted drive shaft) type chuck. The single tip bits are manufactured to conform with ANSI Standard B212.15 and can be used to drill in concrete, block, brick and soft stone. S-4 Plus SDS carbide drill bits are manufactured within a strict tolerance limits for the cutting diameter, the symmetry of the carbide tip to the drill axis, the symmetry of the tip point and the out-of-true variation. The optimal carbide and flute design provides up to 27% faster drilling and extended bit life.

FOR USE WITH

Rotary Hammer with SDS Chuck or SDS Adapter

SIZE RANGE

5/32" x 6" to 1" x 18"

DRILL BIT SPECIFICATIONS AND ORDERING INFORMATION

S-4 Plus™ SDS

Catalog Number	Size	Usable Length	Standard Pouch	Wt./ Dozen
0302	5/32" x 6"	4"	1	1
0304	3/16" x 4"	2"	1	1
0305	3/16" x 5"	3"	1	1
0306	3/16" x 6"	4"	1	1
0308	3/16" x 8"	6"	1	1 1/4
0310	3/16" x 10"	8"	1	1 1/2
0312	3/16" x 12"	10"	1	1 3/4
0314	3/16" x 14"	12"	1	2
0315	7/32" x 6"	4"	1	1 1/4
0316	7/32" x 8"	6"	1	1 1/2
0317	7/32" x 10"	8"	1	1 3/4
0318	7/32" x 12	10"	1	1 3/4
0319	7/32" x 16"	14"	1	2
0320	1/4" x 4"	2"	1	1
0321	1/4" x 6"	4"	1	1 1/4
0322	1/4" x 8"	6"	1	1 1/2
0323	1/4" x 11"	9"	1	1 3/4
0324	1/4" x 14"	12"	1	2
0325	1/4" x 16"	14"	1	2
0327	1/4" x 20"	18"	1	2 1/4
0329	5/16" x 6"	4"	1	1 1/2
0331	5/16" x 12"	10"	1	2 1/2
0333	3/8" x 6"	4"	1	2
0334	3/8" x 10 1/2"	7 1/2"	1	2 1/2
0336	3/8" x 12"	10"	1	3 1/2
0338	3/8" x 18"	16"	1	4 3/4
0339	3/8" x 24"	22"	1	6

Catalog Number	Size	Usable Length	Standard Pouch	Wt./ Dozen
0341	7/16" x 6"	4"	1	2 1/2
0343	7/16" x 12"	10"	1	3 1/2
0346	1/2" x 6"	4"	1	2 3/4
0348	1/2" x 10"	8"	1	4 1/4
0349	1/2" x 12"	10"	1	5 1/2
0351	1/2" x 18"	16"	1	6 1/2
0352	1/2" x 24"	22"	1	9 1/4
0354	9/16" x 6"	4"	1	3 1/4
0355	9/16" x 10"	8"	1	5 1/2
0359	5/8" x 8"	6"	1	4 1/2
0361	5/8" x 12"	10"	1	6 1/4
0362	5/8" x 18"	16"	1	10
0364	11/16" x 8"	6"	1	4 3/4
0365	11/16" x 12"	10"	1	7
0368	3/4" x 8"	6"	1	5
0370	3/4" x 12"	10"	1	6 3/4
0371	3/4" x 18"	16"	1	12
0373	27/32" x 8"	6"	1	8
0375	7/8" x 8"	6"	1	8 1/4
0376	7/8" x 12"	10"	1	9
0377	7/8" x 16"	16"	1	15
0379	1" x 8"	6"	1	9 1/2
0380	1" x 10"	8"	1	10
0381	1" x 12"	10"	1	13
0382	1" x 18"	16"	1	18
0394	*Spline to SDS Adapter		–	–
0396	*SDS Max Adapter		–	–

* Use of S4-Plus SDS drill bit in larger rotary hammers with an adapter will reduce bit life.

S-4 Plus SDS Bulk Packs

Catalog Number	Size	Usable Length	Drills Per Pack	Wt./ Dozen
0664	3/16" x 4"	2"	25	1
0666	3/16" x 6"	4"	25	1
0668	3/16" x 8"	6"	25	1 1/4
0670	3/16" x 10"	8"	25	1 1/2
0675	7/32" x 6"	4"	25	1 1/4
0676	7/32" x 8"	6"	25	1 1/2
0677	7/32"x 10"	8"	25	1 3/4
0680	1/4" x 4"	2"	25	1

Catalog Number	Size	Usable Length	Drills Per Pack	Wt./ Dozen
0681	1/4" x 6"	4"	25	1 1/4
0682	1/4" x 8"	6"	25	1 1/2
0683	1/4" x 11"	9"	25	1 3/4
0689	5/16" x 6"	4"	25	1 1/2
0693	3/8" x 6"	4"	25	2
0696	1/2" x 6"	4"	15	2 3/4
0697	5/8" x 8"	6"	15	4 1/2

Quatro™ Head SDS Plus *Carbide Drill Bits*

PRODUCT DESCRIPTION

Quatro Head SDS-Plus bits have four cutting faces which reduces vibration up to 60% and noise up to 30%. This carbide design spots accurately and produces rounder holes.

FOR USE WITH

Rotary Hammer with SDS Chuck

SIZE RANGE

5/8" x 10" to 1-1/4" x 18"

DRILL BIT SPECIFICATIONS AND ORDERING INFORMATION

Quatro™ Head SDS Plus Drill Bits

Catalog Number	Drill Size	Usable Length	Standard Pouch	Wt./ Dozen
7081	5/8" x 12"	10"	1	6 1/2
7086	3/4" x 18"	16"	1	12 1/2
7090	7/8" x 18"	16"	1	12
7094	1 1/8" x 18"	16"	1	29
7095	1 1/4" x 18"	16"	1	31

NEW! Tri-Cutter™ SDS-Max® *Carbide Drill Bits*

PRODUCT DESCRIPTION

SDS-Max carbide drill bits are designed for use in a rotary hammer equipped with a SDS-Max type chuck. The bits are manufactured to conform with ANSI Standard B212.14 and can be used to drill in concrete, block, brick and soft stone. The Tri-Cutter head design has three main cutters in a "Y" configuration which make up to 32% less noise and vibration compared to the "X"-cutting heads.

FOR USE WITH

Rotary Hammer with SDS-Max Chuck

SIZE RANGE

1/2" x 12" to 1-1/2" x 22-1/2"

DRILL BIT SPECIFICATIONS AND ORDERING INFORMATION

Tri-Cutter™ SDS-Max® Drill Bits

Catalog Number	Size	Usable Length	Standard Tube	Wt./ Dozen
8801*	1/2" x 12"	8 1/2"	1	12
8802*	1/2" x 21 1/2"	16 1/2"	1	13
8805*	9/16 x 13 1/2"	8 1/2"	1	12
8806*	9/16" x 21 1/2"	16 1/2"	1	17
8809	5/8" x 13 1/2"	8 1/2"	1	13
8810	5/8" x 21 1/2	16 1/2"	1	16
8812	5/8" x 36 1/2"	31 1/2"	1	24
8815	11/16" x 21 1/2"	16 1/2"	1	24
8817	3/4" x 13 1/2"	8 1/2"	1	15
8818	3/4" x 21 1/2"	16 1/2"	1	19
8820	3/4" x 36 1/4"	31 1/4"	1	3
8829	7/8" x 13 1/2"	8 1/2"	1	17
8830	7/8" x 21 1/4"	16 1/2"	1	22
8833	1" x 13 1/4"	8 1/2"	1	20
8834	1" x 21 1/4"	16 1/2"	1	26
8836	1" x 36 1/4"	31 1/4"	1	48
8843	1 1/8" x 15"	10"	1	22
8844	1 1/8" x 22 1/2"	17 1/2"	1	28
8846	1 1/4" x 15"	10"	1	26
8847	1 1/4" x 22 1/2"	17 1/2"	1	28
8848	1 1/4" x 36 1/4"	31 1/4"	1	72
8853	1 3/8" x 22 1/2"	17 1/2"	1	42
8859	1 1/2" x 22 1/2"	17 1/2"	1	44

* 1/2" and 9/16" sizes have a standard single cutter tip and standard helical fluting.

CARBIDE DRILL BITS

Spline *Carbide Drill Bits*

PRODUCT DESCRIPTION

Spline carbide drill bits are designed for use in a rotary hammer equipped with a spline type chuck. The bits are manufactured to conform with ANSI Standard B212.15 and can be used to drill in concrete, block, brick and soft stone.

Tri-Cutter and single tip head styles are available. The Tri-Cutter head design has three main cutters in a "Y" configuration which make up to 32% less noise and vibration and drills up to 25% faster compared to the "X"-cutting heads.

FOR USE WITH

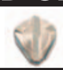
Rotary Hammer with Spline Chuck

SIZE RANGE

3/8" x 10" to 2" x 22"

DRILL BIT SPECIFICATIONS AND ORDERING INFORMATION

NEW! Tri-Cutter™ Spline Drill Bits



Catalog Number	Size	Usable Length	Standard Tube	Wt./ Dozen
7017	5/8" x 10"	5"	1	12
7020	5/8" x 16"	11"	1	15
7021	5/8" x 22"	17"	1	17
7023	5/8" x 27"	22"	1	20
7024	5/8" x 36"	31"	1	25
7028	11/16" x 16"	11"	1	16
7031	3/4" x 10"	5"	1	15
7033	3/4" x 16"	11"	1	18
7035	3/4" x 22"	17"	1	22
7036	3/4" x 27"	22"	1	24
7037	3/4" x 36"	31"	1	29
7043	7/8" x 16"	11"	1	20

Catalog Number	Size	Usable Length	Standard Tube	Wt./ Dozen
7045	7/8" x 22"	17"	1	25
7049	1" x 16"	11"	1	25
7051	1" x 22"	17"	1	31
7053	1" x 36"	31"	1	48
7057	1 1/8" x 16"	11"	1	26
7059	1 1/8" x 22"	17"	1	42
7064	1 1/4" x 16"	11"	1	34
7066	1 1/4" x 22"	17"	1	44
7069	1 1/4" x 36"	31"	1	68
7072	1 3/8" x 22"	17"	1	60
7077	1 1/2" x 22"	17"	1	73

Single Tip Spline Drill Bits

Catalog Number	Size	Usable Length	Standard Tube	Wt./ Dozen
1402	3/8" x 10"	5"	1	9
1403	3/8" x 16"	11"	1	12
1405	7/16" x 13"	8"	1	10
1407	1/2" x 10"	5"	1	10
1408	1/2" x 13"	8"	1	11
1409	1/2" x 16"	11"	1	12-1/2
1410	1/2" x 22"	17"	1	14
1412	1/2" x 27"	22"	1	16-1/2
1413	1/2" x 36"	31"	1	19
1415	9/16" x 13"	8"	1	12
1418	5/8" x 10"	5"	1	11
1419	5/8" x 13"	8"	1	12-1/2
1420	5/8" x 16"	11"	1	14
1421	5/8" x 22"	17"	1	16
1423	5/8" x 27"	22"	1	20
1424	5/8" x 36"	31"	1	24
1427	11/16" x 13"	8"	1	14
1431	3/4" x 10"	5"	1	14
1433	3/4" x 16"	11"	1	17

Catalog Number	Size	Usable Length	Standard Tube	Wt./ Dozen
1434	3/4" x 22"	17"	1	21
1436	3/4" x 27"	22"	1	24
1437	3/4" x 36"	31"	1	28
1443	7/8" x 16"	11"	1	19
1444	7/8" x 22"	17	1	23
1446	7/8" x 36"	31"	1	34
1449	1" x 16"	11"	1	24
1450	1" x 22"	17"	1	29
1453	1" x 36"	31"	1	48
1457	1 1/8" x 16"	11"	1	25
1458	1 1/8" x 22"	17"	1	39
1464	1 1/4" x 16"	11"	1	33
1465	1 1/4" x 22"	17"	1	42
1470	1 3/8" x 16"	11"	1	41
1471	1 3/8" X 22"	17"	1	58
1477	1 1/2" x 22"	17"	1	70
1482	1 5/8" x 22"	17"	1	74
1486	1 3/4" x 22"	17"	1	80
1490	2" x 22"	17"	1	86

HD Straight Shank *Carbide Drill Bits*

PRODUCT DESCRIPTION

Heavy Duty (HD) straight shank carbide drills bits are designed for use in a hammer drill equipped with a 3 jaw Jacobs type chuck. The bits are specifically engineered for high durability and meet ANSI standards and can be used to drill in concrete, block, brick and soft stone.

Heavy Duty straight shank carbide drill bits are designed for use in hammer drills. The drill bits are manufactured from high grade alloy tool steel with a carbide tip to provide long life in most concrete and masonry materials. The specially designed flute provides rapid removal of dust which prevents excessive wear resulting in longer bit life. Each drill bit is precision ground to ensure straightness for faster drilling.

FOR USE WITH

Hammer Drill

SIZE RANGE

1/8" x 3" to 1" x 24"

DRILL BIT SPECIFICATIONS AND ORDERING INFORMATION

HD Straight Shank Bits[1]

Catalog Number	Drill Size	Usable Length	Shank Size	Standard Tube	Wt./ Dozen
0501	1/8" x 3"	2 1/4"	1/8"	1	1/4
0503	5/32" x 6"	4"	5/32"	1	1/2
0504	3/16" x 4"	2 3/4"	3/16"	1	1/4
0505	3/16" x 6"	4"	3/16"	1	1/2
0507	3/16" x 13"	11"	3/16"	1	1 1/4
0512	1/4" x 4"	2 3/4"	1/4"	1	3/4
0513	1/4" x 6"	4"	1/4"	1	1
0514	1/4" x 12"	10"	1/4"	1	1 1/4
0516	1/4" x 24"	22"	1/4"	1	3 1/4
0519	5/16" x 6"	4"	5/16"	1	1
0522	3/8" x 6"	4"	3/8"	1	1 1/2
0523	3/8" x 12"	10"	3/8"	1	2 1/4
0525	3/8" x 24"	22"	3/8"	1	5 3/4
0526	7/16" x 6"	4"	3/8"	1	2 3/4

Catalog Number	Drill Size	Usable Length	Shank Size	Standard Tube	Wt./ Dozen
7017	5/8" x 10"	5"	1	12	12
0531	1/2" x 6"	4"	3/8"	1	3
0532	1/2" x 13"	11"	3/8"	1	5
0534	1/2" x 24"	22"	3/8"	1	8 3/4
0535	9/16" x 6"	4"	3/8"	1	4
0538	5/8" x 6	4"	1/2"	1	3 1/2
0540	5/8" x 13"	11"	1/2"	1	7
0541	5/8" x 24"	22"	1/2"	1	14 1/2
0545	3/4" x 6"	4"	1/2"	1	8
0547	3/4" x 13"	11"	1/2"	1	17
0548	3/4" x 24"	22"	1/2"	1	21 1/2
0550	7/8" x 13"	11"	1/2"	1	18
0554	1" x 13"	11"	1/2"	1	19
0555	1" x 24"	22"	1/2"	1	29 3/4

1. The shank is hex shaped for drill bits 5/8" diameter and larger.

HD Straight Shank Bit Bulk Packs

Catalog Number	Drill Size	Bits Per Pack	Wt./ Dozen
0591	3/16" x 4"	50	1/4
0592	3/16" x 6"	50	1/2
0593	1/4" x 4"	25	3/4

Catalog Number	Drill Size	Bits Per Pack	Wt./ Dozen
0594	1/4" x 6"	25	1
0595	3/8" x 6"	10	1 1/2
0596	1/2" x 6"	10	3

IG Straight Shank *Carbide Drill Bits*

PRODUCT DESCRIPTION

Industrial Grade (IG) straight shank bits are designed for use in a hammer drill equipped with a 3 jaw Jacobs type chuck. The bits meet ANSI standards and can be used to drill in concrete, block, brick and soft stone. Industrial Grade straight shank drill bits are designed for general purpose rotary percussion drilling. The bits can be used for drilling in most masonry materials. This economical drill bit has a rolled slow spiral flute design and a positive angle carbide tip for use in hammer drills.

FOR USE WITH

Hammer Drill

SIZE RANGE

1/8" x 3" to 1" x 12"

DRILL BIT SPECIFICATIONS AND ORDERING INFORMATION

IG Straight Shank Drill Bits

Catalog Number	Drill Size	Usable Length	Shank Size	Standard Pouch	Wt./ Dozen
0601	1/8" x 3"	2 1/4"	1/8"	1	1/4
0604	3/16" x 4"	2 3/4"	3/16"	1	1/4
0605	3/16" x 6"	4"	3/16"	1	1/2
0609	7/32" x 4"	2 1/4"	7/32"	1	3/4
0612	1/4" x 4"	2 3/4"	1/4"	1	3/4
0613	1/4" x 6"	4"	1/4"	1	1
0614	1/4" x 12"	10"	1/4"	1	1 1/4
0615	1/4" x 18"	16"	1/4"	1	1 1/2
0618	5/16" x 4"	2 3/4"	1/4"	1	3/4
0619	5/16" x 6"	4"	1/4"	1	1
0620	5/16" x 12"	10"	1/4"	1	2 1/4
0621	3/8" x 4"	2"	1/4"	1	1

Catalog Number	Drill Size	Usable Length	Shank Size	Standard Pouch	Wt./ Dozen
0622	3/8" x 6"	4"	1/4"	1	1 1/4
0623	3/8" x 12"	10"	5/16"	1	2 1/4
0625	3/8" x 24"	22"	5/16"	1	3
0626	7/16" x 6"	4"	3/8"	1	2 3/4
0631	1/2" x 6"	4"	3/8"	1	3
0632	1/2" x 12"	10"	3/8"	1	5
0635	9/16" x 6"	4"	3/8"	1	4
0638	5/8" x6"	4"	3/8"	1	5
0640	5/8" x 12"	10"	3/8"	1	7
0641	5/8" x 24"	22"	3/8"	1	10
0645	3/4" x 6"	4"	1/2"	1	8
0650	7/8" x 12"	10"	1/2"	1	12
0654	1" x 12"	10"	1/2"	1	14

IG Straight Shank Drill Bit Adapters

Catalog Number	Drill Size	Bits Per Pack	Wt./ Dozen
0561	3/16" x 4"	50	1/4
0562	3/16" x 6"	50	1/2
0563	1/4" x 4"	25	3/4
0564	1/4" x 6"	25	1
0565	3/8" x 6"	10	1 1/4
0566	1/2" x 6"	10	3

"A" Taper *Carbide Drill Bits*

PRODUCT DESCRIPTION

"A" Taper drill bits are designed for use in a rotary hammer equipped with an "A" Taper type chuck. The bits meet ANSI standards and can be used to drill in concrete, block, brick and soft stone. "A" Taper drill bits are manufactured from high grade tool steel. The bit is formed with a Turbo flute which quickly removes dust to provide faster drilling into a variety of masonry materials. The carbide insert is copper brazed to provide longer bit life. "A" Taper drill bits can be used in most models of rotary hammer drills with an "A" Taper shank adapter.

FOR USE WITH

Rotary Hammer with "A" Taper Chuck or Adapter

SIZE RANGE

1/4" x 6" to 3/4" x 12"

DRILL BIT SPECIFICATIONS AND ORDERING INFORMATION

"A" Taper Drill Bits

Catalog Number	Size	Usable Length	Standard Tube	Wt./ Dozen
0712	1/4" x 6"	4"	1	1 1/2
0752	5/8" x 9"	7"	1	6
0754	5/8" x 12"	10"	1	7

Catalog Number	Size	Usable Length	Standard Tube	Wt./ Dozen
0760	3/4" x 9"	7"	1	12
0762	3/4" x 12"	10"	1	16

"A" Taper Drill Bit Adapters

Catalog Number	Size	Standard Pouch	Wt./ Adapter
0791	SDS-Plus to "A" Tapper	1	13
0790	SDS-Max to "A" Tapper	1	13

Catalog Number	Size	Standard Pouch	Wt./ Adapter
0798	Ejector Pin "A" Tapper	1	1 1/4

Rotary *Carbide Drill Bits*

PRODUCT DESCRIPTION

Rotary carbide bits are designed for use in a rotation only drill equipped with a 3 jaw Jacobs type chuck. The bits meet ANSI standards and can be used to drill in soft or brittle masonry materials using rotation only. Fast spiral flutes are for fast drilling in soft to medium masonry materials such as block or brick. Deep fluted drills perform best in concrete where the wide fluting helps clean concrete chips and dust from the hole.

FOR USE WITH

Rotary Only Drill

SIZE RANGE

1/8" x 2-1/2" to 3/4" x 6"

DRILL BIT SPECIFICATIONS AND ORDERING INFORMATION

Fast Spiral Rotary Bits

Catalog Number	Drill Size	Shank Size	Usable Length	Overall Length	Std. Tube	Wt./ Dozen
8500	1/8"	1/8"	1 3/4"	2 1/2"	1	1/4
8506	3/16"	3/16"	1 3/4"	3"	1	1/2
8508	1/4"	1/4"	1 3/4"	4"	1	3/4
8512	5/16"	1/4"	2 1/2"	4"	1	3/4
8514	3/8"	1/4"	2 1/2"	4"	1	1
8560	3/8"	1/4"	4 1/2"	6"	1	1 1/2
8520	1/2"	3/8"	4"	6"	1	3
8566	1/2"	3/8"	10"	12"	1	3
8526	5/8"	1/2"	4"	6"	1	5
8570	5/8"	1/2"	10 1/2"	12"	1	8
8530	3/4"	1/2"	4"	6"	1	6

Deep Flute Rotary Bits

Catalog Number	Drill Size	Shank Size	Usable Length	Overall Length	Std. Tube	Wt./ Dozen
8606	3/16"	3/16"	1 3/4"	3"	1	1/2
8608	1/4"	1/4"	1 3/4"	4"	1	3/4
8610	9/32"	1/4"	2 1/2"	4"	1	3/4

Rebar Cutter *Carbide Drill Bits*

PRODUCT DESCRIPTION

Rebar cutter bits provide a quick, easy method for drilling through mesh or reinforcing bars embedded in concrete when the drilled hole cannot be relocated. The bits are used in the rotation only mode and are designed to fit in a standard rotary drill motor with a 1/2" Jacobs style chuck.

FOR USE WITH

Rotation-only Drill with Standard 1/2" Jacobs style Chuck

SIZE RANGE

1/2” to 1-1/4” diameter

When drilling with a hammer drill or rotary hammer, it is important to stop drilling immediately when a standard carbide bit contacts steel reinforcing bar or wire mesh. If the drilled hole cannot be relocated, a rebar cutter bit is used to drill through the embedded steel. Insert the rebar cutter bit into the chuck of a standard 1/2" rotary drill. Place the bit into the partially drilled hole until it contacts the mesh or reinforcing bar. Drill through the embedded steel with the rebar cutter bit. Once the bit has drilled through the steel, remove the debris from the hole, then continue drilling with the standard carbide tipped bit using a hammer drill or rotary hammer.

DRILL BIT SPECIFICATIONS AND ORDERING INFORMATION

Rebar Cutter Bits

Cat. No.	Drill Size	Usable Length	Wt./Dozen
0845	1/2" x 12"	11"	6
0844	9/16" x 12"	11"	7
0846	5/8" x 12"	11"	7 1/4
0847	11/16" x 12"	11"	10
0849	3/4" x 12"	11"	12
0851	7/8" x 12"	11"	12
0853	1" x 12"	11"	15
0855	1 1/4" x 12"	11"	24

Heavy Duty Chisels

PRODUCT DESCRIPTION

Heavy Duty Chisels and accessories are designed for use in a combination rotary hammer/ chipping tool equipped with a Spline, SDS-Max®, or 3/4" hex chuck. The chisels can be used for chipping applications in concrete, block, brick and soft stone.

FOR USE WITH

Combination Rotary Hammer/Chipping Tool with a Spline, SDS-Max or 3/4" Hex Chuck

HEAVY DUTY CHISEL SPECIFICATIONS AND ORDERING INFORMATION

Heavy Duty Chisels

Cat. No.	Shank Type	Chisel Type	Size or Width	Overall Length	Wt./Dozen
0950	Spline	Bull Point	–	12"	17
0951	Spline	Bull Point	–	18"	27
0952	Spline	Flat	1"	12"	17
0953	Spline	Flat	1"	18"	27
0954	Spline	Scaling	1 1/2"	12"	17
0955	Spline	Scaling	2"	12"	18
0959	Spline	Ground Rod	5/8" & 3/4" Rod	10 1/2"	31
0960	Spline	One Piece Bushing (16 Point)	1 3/4" x 1 3/4"	10"	16
0965	SDS-Max	Bull Point	–	12"	16
0966	SDS-Max	Bull Point	–	18"	22
0967	SDS-Max	Flat	1"	12"	16
0968	SDS-Max	Flat	1"	18"	22
0969	SDS-Max	Scaling	1 1/2"	12"	16
0970	SDS-Max	Scaling	2”	12"	17
0974	SDS-Max	Ground Rod	5/8" & 3/4" Rod	10"	31
0975	SDS-Max	One Piece Bushing (16 Point)	1 3/4" x 1 3/4"	10"	16
0982	3/4" Hex	Flat	1"	12"	17
0983	3/4" Hex	Flat	1"	18"	31

Heavy Duty One and Two Piece Core Bits

PRODUCT DESCRIPTION

Core bits are designed to produce holes which provide clearance for pipe of conduit runs through floors and walls. The bits enable a hammer drill or rotary hammer to produce holes which are larger than the tool rating by cutting the circumference of the hole while leaving the center solid. Heavy duty core bits are offered for drilling through concrete, block, brick and soft stone.

Heavy wall core bits are machined from a single piece of forged steel for long life and are designed for use with Spline or SDS-Max rotary hammers. The top or head of the bit is crowned to direct the hammering energy through the outside wall and into the cutting teeth. The carbide cutting tips are made with a slightly negative cutting angle on the face to allow them to be used in the rotary hammering mode. To provide optimum drilling, the carbide tips or teeth are inserted at irregular intervals in the core to minimize vibration and one piece and two piece core bits are offered. One piece bits have a shank which is friction welded to the forged core body provide the most efficient drilling. Two piece bits have rope threads machined to tight tolerances to minimize energy loss at the connection. As with all adapters, there is normally a 10 to 15% loss of hammering energy with a two piece system.

FOR USE WITH

Rotary Hammer with Spline or SDS-Max® Chuck

SIZE RANGE

1-3/4" to 5" diameter

DRILL BIT SPECIFICATIONS AND ORDERING INFORMATION

One Piece Spline Core Bits – Heavy Wall

Cat. No.	Drill Size	No. of Teeth	Core Tolerance	Usable Length	Overall Length	Wt./ Dozen
0260	2 1/2"	10	2.58"-2.63"	17"	22"	49
0263	3 1/2"	13	3.52"-3.58"	7"	12"	48

One Piece SDS-Max Core Bits – Heavy Wall

Cat. No.	Drill Size	No. of Teeth	Core Tolerance	Usable Length	Overall Length	Wt./ Dozen
0284	2-1/2"	10	2.58"-2.63"	17"	22"	49

One piece core bits are packaged with a centering bit and ejector key.

Two Piece Core Bit Body – Heavy Wall

Cat. No.	Drill Size	No. of Teeth	Core Tolerance	Usable Length	Overall Length	Wt./ Dozen
0570	1 3/4"	6	1.78-1.81	5"	1	12
0571	2"	8	2.03-2.08	5"	1	18
0572	2 5/8"	10	2.64-2.69	5"	1	28
0573	3"	12	3.13-3.18	5"	1	38
0575	4"	15	4.07-4.13	5"	1	60
0576	5"	18	5.06-5.11	5"	1	84

Two Piece Core Bit Drive Shank

Cat. No.	Shank Type	Overall Length	Std. Tube	Wt./ Dozen
0578	Spline	8"	1	21
0579	Spline	18"	1	35
0580	SDS-Max	8"	1	21
0581	SDS-Max	18"	1	35
0590	Centering Bit – 3/8"	5 5/16"	1	1 1/2

Standards and Specifications

The following listings are provided for reference purposes and contain some of the standards and specifications commonly referenced in this manual and in the industry.

American Association of State Highway and Transportation Officials (AASHTO)
www.transportation.org
M 200 Epoxy Protective Coatings
M 234 Epoxy Adhesives for Highway Construction
M 235 Epoxy Resin Adhesives
M 237 Epoxy Resin Adhesive for Bonding Traffic Markers to Hardened Concrete
Other AASHTO specifications can be cross referenced to an ASTM specification.
M 31 ASTM A 615
M 114 ASTM C 62
M 164 ASTM A 325
M 183 ASTM A 36 with some differences
M 232 ASTM A 153
M 291 ASTM A 563
M 292 ASTM A 194
M 293 ASTM F 436

American Concrete Institute (ACI)
www.concrete.org
Manual of Concrete Practice
ACI 318 Building Code Requirements for Reinforced Concrete
ACI 355.2 Evaluating the Performance of Post Installed Mechanical Anchors

American Institute of Steel Construction (AISC)
www.aisc.org
Manual of Steel Construction

American Iron and Steel Institute (AISI)
www.steel.org
Specification for the Design of Cold-Formed Steel Structural Members

American National Standards Institute (ANSI)
www.ansi.org
A10.3 Operations – Safety Requirements for Powder Actuated Fastening Systems
NSF 61 – Drinking Water System Components – Health Effects

American Society Of Mechanical Engineers (ASME) United Engineering Center
www.asme.org
These standards are published jointly by ANSI and ASME.
B18.2.2 Square and Hex Nuts
B18.6.3 Machine Screws and Machine Screw Nuts
B18.6.4 Thread Forming and Thread Cutting Taping Screws and Metallic Drive Screws (inch series)
B18.22.1 Plain Washers
B212.15 Carbide-Tipped Masonry Drills and Blanks for Carbide-Tipped Masonry Drills

American Society of Testing and Materials (ASTM)
www.astm.org
A 36 Structural Steel
A 153 Zinc Coating (Hot Dip) on Iron and Steel Hardware
A 193 Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
A 194 Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
A 276 Stainless Steel Bars and Shapes
A 307 Carbon Steel Bolts and Studs, 60,000 psi Tensile
A 325 Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
A 446 Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality
A 449 Quenched and Tempered Steel Bolts and Studs
A 493 Stainless and Heat-Resisting Steel for Cold Heading and Cold Forging Bar and Wire
A 525 General Requirements for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process
A 563 Carbon and Alloy Steel Nuts
A 611 Steel, Sheet, Carbon, Cold-Rolled, Structural Quality
A 615 Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
B 86 Zinc-Alloy Die Castings
B 117 Method Of Salt Spray (Fog) Testing
B 633 Electrodeposited Coatings of Zinc on Iron and Steel
B 695 Coatings of Zinc Mechanically Deposited on Iron and Steel
C 31 Making and Curing Concrete Test Specimens in the Field
C 33 Concrete Aggregates
C 34 Structural Clay Load-Bearing Wall Tile
C 36 Gypsum Wallboard
C 39 Compressive Strength of Cylindrical Concrete Specimens
C 56 Structural Clay Non-Load-Bearing Tile
C 62 Building Brick (Solid Masonry Units Made from Clay or Shale)
C 90 Load-Bearing Concrete Masonry Units
C 150 Portland Cement
C 119 Terminology Relating to Dimensional Stone
C 170 Compressive Strength of Dimensional Stone
C 212 Structural Clay Facing Tile
C 216 Facing Brick (Solid Masonry Units Made from Clay or Shale)
C 270 Specification for Mortar for Unit Masonry
C 317 Gypsum Concrete
C 330 Lightweight Aggregates for Structural Concrete
C 332 Lightweight Aggregates for Insulating Concrete
C 476 Grout for Masonry
C 503 Marble Dimension Stone (Exterior)
C 568 Limestone Dimension Stone
C 581 Determine Chemical Resistance of Thermosetting Resins
C 615 Granite Dimension Stone
C 616 Quartz-Based Dimension Stone
C 652 Hollow Brick (Hollow Masonry Units Made from Clay or Shale)
C 881 Epoxy-Resin-Base Bonding Systems for Concrete
C 882 Standard Test Method for Bond Strength of Epoxy Resin Systems Used with Concrete by Slant Shear
C 1386 Specification for PAAC Wall Construction Units
E 380 Use of The International System of Units (SI)
E 488 Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
E 1190 Standard Test Methods for Strength of Powder Actuated Fasteners Installed in Structural Members

Standards and Specifications (Continued)

E 1512 Methods of Testing Bond Performance of Adhesive-Bonded Anchors
F 436 Hardened Steel Washers
F 593 Stainless Steel Bolts, Hex Cap Screws, and Studs
F 594 Stainless Steel Nuts
F 844 Washers, Steel, Plain (Flat), Unhardened for General Use

Autoclaved Aerated Concrete Products Association (AACPA)
www.aacpa.org

FM Global (FM Approvals)
Formerly the Factory Mutual Research Corporation
www.fmglobal.com
FM Approval Standard 4450, Class I Insulated Steel Deck Roofs
FM Approval Standard 4470, Class I Roof Covers
FM Approval Standard for Pipe Hanger Components for Automatic Sprinkler Systems.

Federal Specifications – General Services Administration (GSA)
www.gsa.gov
The following superseded specifications are commonly used by the General Services Administration (GSA) for the procurement of anchoring products.
FF-S-325C, Interim Amendment 3, 7-16-65, Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)
FF-B-588D, Bolt, Toggle; and Expansion Sleeve, Screw
FF-P-395C, Pin Drive Guided and Pin Drive, Power Actuated (Fasteners for Power Actuated and Hand Actuated Fastening Tools)

The following Commercial Item Descriptions (CID's) are also used by the GSA for the procurement of anchoring products.
A-A-1922A, Shield Expansion (Caulking Anchors, Singlehead)
A-A-1923A, Shield Expansion (Lag, Machine and Externally Threaded Wedge Bolt Anchors)
A-A-1924A, Shield Expansion (Self Drilling Tubular Expansion Shell Bolt Anchors)
A-A-1925A, Shield Expansion Nail Anchors (Non-drilling Expansion Anchors)
A-A-55614, Shield Expansion (Non-drilling Expansion Anchors)
A-A-55615, Shield Expansion (Wood Screw and Lag Bolt Self Threading Anchors)

International Code Council, Evaluation Services, Inc.(ICC-ES)
Formerly the International Conference of Building Officials (ICBO) Evaluation Services, Inc.
www.icc-es.org
AC 01 Acceptance Criteria for Expansion Anchors in Concrete and Masonry Elements
AC 58 Acceptance Criteria for Adhesive Anchors in Concrete and Masonry Elements
AC 60 Acceptance Criteria for Unreinforced Masonry Anchors
AC 70 Acceptance Criteria for Power-Driven Fasteners in Concrete, Steel and Masonry Elements.
AC 106 Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Concrete or Masonry
AC 193 Acceptance Criteria for Mechanical Anchors in Concrete Elements
AC 308 Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements

National Fire Protection Association (NFPA)
www.nfpa.org
NFPA 13, Standard for the Installation of Sprinkler Systems.

Light Gage Steel Engineers Association (LGSEA)
www.steelframing.org

Single Ply Roofing Institute (SPRI)
www.spri.org
ANSI/SPRI FX-1 Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners

Southern Building Code Congress International (SBCCI)
Now known as ICC-ES www.icc-es.org
SBCCI Standard for Hurricane Resistant Residential Construction SSTD10 and the Standard Building Code

Society of Automotive Engineers (SAE) International
www.sae.org
J 429 Mechanical and Material Requirements for Externally Threaded Fasteners

Steel Deck Institute (SDI)
www.sdi.org
Publication No. 28
Design Manual For Composite Decks, Form Decks, Roof Decks, and Cellular Metal Floor deck with Electrical Distribution.

Underwriters Laboratories Inc. (UL)
www.ul.org
UL 203 Pipe Hanger Equipment for Fire Protection Service
UL 723 Surface Burning Characteristics

Approvals, Listings and Evaluations

Approvals, listings, and applicable GSA Specifications for Powers Products are listed below for reference purposes. Current approvals should be reviewed by the design professional responsible for the product installation to determine the approved sizes, installation methods, and compliance with local codes.

City of Los Angeles

For use with Los Angeles County and related jurisdictions

Research Report No. 24960
Power-Bolt, Power-Stud, Steel Dropin, Hollow-Set Dropin and *Spike*.

Research Report No. 24979
Power-Fast Epoxy Anchoring System For Use In Unreinforced Masonry Walls.

Research Report No. 25230
Power-Fast Epoxy

Research Report No. 25304
Powder Actuated Fasteners

Research Report No. 25415
Wedge-Bolt Anchors

Research Report No. 25523
Trak-It Fasteners

Research Report No. 25548
Tapper Concrete Screws

Research Report No. 25579
AC100 Plus Adhesive Anchoring System

FM Global (Factory Mutual)

The following products have been approved based on FM Global Standards 4450 and 4470 for insulation and roof membrane attachment as listed in the current FM Global Approval Guide. Consult this guide for specific construction assemblies.

Steel and Wood

No. 12 *Perma Seal Deck Screw*	J.I. OK4A2.AM, J.I. 1M4A5.AM
Stress Plate	J.I. 1R3A1.AM

Structural Concrete Deck

Spike	J.I. 1K6A7.AM, J.I. ON9A2.AM, J.I. 1K4A5.AM
Zamac Nailin	J.I. 1K6A7.AM
Steel Stress Plates	J.I. 1R3A1.AM

Gypsum, Tectum Decks

Powerlite	J.I. 1Q2A2.AM, J.I. 1T9A4.AM

Recover Construction

Deck Screw	J.I. 1N2A4.AM
Stainless Steel Deck Screw	J.I. 1N2A5.AM
Spike	J.I. 1M4A5.AM, J.I.ON9A2.AM
Drive	J.I. 1M4A5.AM
Steel Stress Plates	J.I. 1P3A9.AM
Powerlite	J.I. 1Q2A2.AM

All Deck Types

Fully Adhered Single-Ply and Modified Bitumen Roof Coverings	J.I. IT9A4.AM

Federal Specifications – General Services Administration (GSA)

The following table lists the expansion anchors which meet the descriptive requirements of superseded GSA Specification FF-S-325C by Group, Type, Class, and Style to aid in identifying the specific product. In some cases, due to the age of the specification, the product listed may be similar meeting the proof load requirements only.

Group	Type	Class	Style	Product
I	1	1	–	*Calk-In*
II	1	1	–	*Lag Shield (Long)*
II	1	2	–	*Lag Shield (Short)*
II	2	2	1	*Single*
II	2	2	2	*Double*
II	3	1	–	*Hollow-Set Dropin*
II	3	3	–	*Lok-Bolt*
II	3	3	–	*Power-Bolt**
II	4	1	–	*Power-Stud*
II	4	1	–	*Wedge-Bolt**
IV	1	–	–	*Scru-Lead*
V	2	3	–	*Zamac Nailin*
V	2	4	–	*Nylon Nailin*
VI	–	–	–	*Drive*
VI	–	–	–	*Carbon Steel Spike**
VI	–	–	–	*Stainless Steel Spike**
VIII	2	–	–	*Set-Bolt*
VIII	1	–	–	*Steel Dropin*

**Meets proof load requirements*

The following table lists the hollow wall anchors which meet the descriptive requirements of superseded GSA Specification FF-B-588D by Type, Class, and Style to aid in identifying the specific product.

Type	Class	Style	Product
I	A	1	*Toggle-Bolt*
I	A	3	*Tie-Wire Toggle*
III	A	–	*Polly*
III	B	–	*Drive Polly*
IV	–	–	*Poly-Toggle*

The following table lists the powder actuated and hand driven fasteners which meet the descriptive requirements of superseded GSA Specification FF-P-395C by Type, Class and Style to aid in identifying the specific product.

Type	Class	Style	Product
II	2	PC / PS	*Ballistic Point Drive Pins*
II	2	PC / PS	*.300" Head Drive Pins*
II	2	PC / PS	*8mm Head Drive Pins*
II	2	SC / SS	*1/4"-20 Threaded Studs*
II	4	PC / PS	*3/8" Head Drive Pins*
II	4	PC / PS	*3/8-16 Threaded Studs*
III	4	PC	*Hammer Drive Pins*

Approvals, Listings and Evaluations (Continued)

Commercial Item Description (CID)
The GSA has authorized the use of the following commercial item descriptions in preference to Federal Specification FF-S-325C.

CID Number	Style	Product
A-A-1922A	1	*Calk-In*
A-A-1923A	1	*Lag Shield*
A-A-1923A	2	*Single*
A-A-1923A	3	*Double*
A-A-1923A	4	*Power-Stud*
A-A-1923A	4	*Wedge-Bolt**
A-A-1925A	1	*Zamac Hammer-Screw*
A-A-1925A	1	*Zamac Nailin (Mushroom Head)*
A-A-1925A	2	*Zamac Nailin (Flat Head)*
A-A-1925A	3	*Nylon Nailin (Mushroom Head)*
A-A-1925A	4	*Nylon Nailin (Flat Head)*
A-A-1925A	5	*Nylon Nailin (Round Head)*
A-A-55614	2	*Set-Bolt*

**Meets proof load requirements*

Florida Building Code

For use with the Statewide Florida Building Code (FBC)

FL2209.1	*Calk-In Machine Screw Anchor*
FL2209.2	*Chem-Stud Adhesive Anchor*
FL2209.3	*Lok-Bolt Sleeve Anchor*
FL2209.4	*Power-Bolt Heavy Duty Expansion Anchor*
FL2209.5	*Power-Fast Epoxy Adhesive*
FL2209.6	*Power-Stud Wedge Anchor*
FL2209.7	*Spike Expansion Anchor*
FL2209.8	*Steel Dropin*
FL2209.9	*Tapper Concrete Screw*
FL2209.10	*Wedge-Bolt Screw Anchor*
FL2209.11	*Zamac-Nailin*

International Code Council, Evaluation Service (ICC-ES)

ICC-ES ESR-1531 (Formerly In ER-4514)
Power-Fast Epoxy Adhesive Anchoring System

ICC-ES ESR-1532 (Formerly In ER-5225)
Power-Bolt, Power-Stud, Steel Dropin, Hollow-Set Dropin and *Spike* Expansion Anchors

ICC-ES ESR-1686
AC100 Plus Adhesive Anchoring System

ICC-ES ESR-1678 (Formerly In ER-5788)
Wedge-Bolt, Wedge-Bolt OT, and *Vertigo Wedge-Bolt OT*

International Conference of Building Officials, Evaluation Service (ICBO ES)

ICBO-ES ER 5330
Powder Actuated Fastenings, Ceiling Clip Assemblies, and Sill Plate Anchorage

ICBO-ES ER 5878
Tapper Concrete Screw Anchor

ICBO-ES ER 6157
Trak-It Fasteners for Concrete, Masonry and Steel

Miami-Dade Building Code Compliance

For use with Miami-Dade County and the Southern Florida Building Code (SFBC). Includes recognition for the High Velocity Hurricane Zone (HVHZ) of the Statewide Florida Building Code (FBC).

NOA 00-0229.04	*Wedge-Bolt Screw Anchor*
NOA 03-0303.14	*Calk-In, Power-Bolt and Spike Expansion Anchors, Tapper Screw Anchor*
NOA 03-0311.08	*Power-Stud, Lok-Bolt, Zamac Nailin and Steel Dropin Expansion Anchor*
NOA 04-0820.02	*AC100 Plus Adhesive Anchoring System*
NOA 04-0823.06	*Power-Fast Epoxy and Chem-Stud Adhesive Anchors*

Underwriters Laboratory (UL)

File No. EX 1289 (N)
The following products have been tested according to UL Standard 203 for Pipe Hanger Equipment for Fire Protection Service and are listed in the UL Fire Protection Equipment Directory:

Hollow-Set Dropin, Steel Dropin Anchor, Drive, Lok-Bolt, Power-Stud, Power-Bolt, Vertigo, Bang-It and *Wood-Knocker*

File No.'s 9KX2, 39P2, R18615 & R13919
The following products have been tested according to UL 723 for Surface Burning Characteristics:

Powerfoam / TriggerFoam

Other Approvals

Many other local approvals are available such as those from individual State Departments Of Transportation (DOT), Ministry of Transportation and local counties. Contact your local Powers branch for details.

Conversion Factors

The International System of Units known as the modernized metric system was developed by the General Conference on Weights and Measures. The international abbreviation used for this system is SI (System International) based on the original French name. Use of SI units is described in ASTM Standard E 380.

Conversion from imperial to metric sizes may be done using a "hard" or "soft" method depending upon the accuracy required. In many instances, anchoring and fastening products are converted using the "soft" method. Examples of both methods are shown in the following table.

Imperial Size	Hard Metric	Soft Metric
1/4"	6.35 mm	6 mm or 6.5 mm
5/16"	7.94 mm	8 mm
3/8"	9.52 mm	10 mm
1/2"	12.70 mm	12 mm
5/8"	15.88 mm	16 mm
3/4"	19.05 mm	19 mm or 20 mm
7/8"	22.23 mm	22 mm
1"	25.40 mm	24 mm
1-1/4"	31.75 mm	32 mm

The following tables list factors for conversion from both metric to imperial and imperial to metric units. For quick reference, they are grouped by commonly used terms in anchor and fastener design technology.

Metric Units to Imperial Units

To Convert From	To	Multiply by
Length		
Millimeter (mm)	Inch (in)	0.0394
Meter (m)	Foot (ft)	3.2808
Meter (m)	Yard (yd)	1.0936
Kilometer (km)	Mile [statute] (mi)	0.6214
Area		
Square centimeter (cm^2)	Square inch (in^2)	0.1550
Square meter (m^2)	Square foot (ft^2)	10.7639
Square meter (m^2)	Square yard (yd^2)	1.1960
Volume		
Milliliter (ml)	US fluid ounce	0.0338
Cubic centimeter (cm^3)	US fluid ounce	0.0338
Cubic centimeter (cm^3)	Cubic inch (in^3)	0.0610
Cubic meter (m^3)	US gallon	264.1721
Cubic meter (m^3)	Cubic foot (ft^3)	35.3144
Cubic meter (m^3)	Cubic yard (yd^3)	1.3080
Force		
Newton (N)	Pound force (lbs)	0.2248
Kilonewton (kN)	Kilo-pound (kip)	0.2248
Kilonewton (kN)	Pound force (lbs)	224.8
Pressure		
MegaPascal (MPa)	Kilo-pound/square inch (ksi)	0.1450
MegaPascal (MPa)	Pound/square inch (psi)	145.0
Pascal (Pa)	Newton/square meter (N/m^2)	1.0
Pascal (Pa)	Pound/square foot (psf)	0.0208
KiloPascal (KPa)	Pound/square inch (psi)	0.1450
Newton/Square millimeter (N/mm^2)	Pound/square inch (psi)	145.0
Bending Moment or Torque		
Newton meter (N-m)	Foot-pound (ft-lb)	0.7375
Newton meter (N-m)	Inch-pound (in-lb)	8.8500
Mass		
Gram (g)	Ounce (oz)	0.035274
Kilogram (kg)	Pound (lbs)	2.204622
Kilogram (kg)	Ton (t)	0.000984
Tonne (tn)	Ton (t)	0.984206
Temperature		
Degrees Celsius (Centigrade)	Degrees Fahrenheit	(9/5ºC)+32

Imperial Units to Metric Units

To Convert From	To	Multiply by
Length		
Inch (in)	Millimeter (mm)	25.4
Foot (ft)	Meter (m)	0.3048
Yard (yd)	Meter (m)	0.9144
Mile [statute](mi)	Kilometer (km)	1.6093
Area		
Square inch (in^2)	Square centimeter (cm^2)	6.4516
Square foot (ft^2)	Square meter (m^2)	0.0929
Square yard (yd^2)	Square meter (m^2)	0.8361
Volume		
US fluid ounce	Cubic centimeter (cm^3)	29.5729
Cubic inch (in^3)	Cubic centimeter (cm^3)	16.3871
US gallon	Cubic meter (m^3)	0.0037
Cubic foot (ft^3)	Cubic meter (m^3)	0.0283
Cubic yard (yd^3)	Cubic meter (m^3)	0.7646
Force		
Pound force (lbs)	Newton (N)	4.4482
Kilo-pound (kip)	Kilonewton (kN)	4.4482
Pound force (lbs)	Kilonewton (kN)	0.0045
Pressure		
Kilo-pound/square inch (ksi)	MegaPascal (MPa)	6.8947
Pound/square foot (psf)	Pascal (Pa)	47.8803
Pound/square inch (psi)	MegaPascal (MPa)	0.0069
Pound/square inch (psi)	KiloPascal (KPa)	6.8947
Pound/square inch (psi)	Newton/Square millimeter (N/mm^2)	0.0069
Bending Moment or Torque		
Foot-pound (ft-lb)	Newton meter (N-m)	1.3558
Inch-pound (in-lb)	Newton meter (N-m)	0.1130
Mass		
Ounce (oz)	Gram (g)	28.34952
Pound (lbs)	Kilogram (kg)	0.453592
Ton (t)	Kilogram (kg)	1016.047
Ton (t)	Tonne (tn)	1.016047
Temperature		
Degrees Fahrenheit	Degrees Celsius (Centigrade)	5/9 (ºF-32)

Anchor Material Properties

Carbon Steel Materials

AISI/ASTM Designation	Nominal Product Size (inches)	Yield Strength 0.2% Offset (psi)	Ultimate Tensile Strength (psi)
ASTM A 36	1/4 to 4	36,000	58,000
ASTM A 307 Grade C	1/4 to 4	36,000	58,000
ASTM A 307	1/4 to 4	–	60,000
SAE Grade 1	1/4 to 1-1/2	36,000	60,000
SAE Grade 2	1/4 to 3/4	57,000	74,000
	Over 3/4 to 1-1/2	36,000	60,000
AISI 1010	1/4 to 3/4	50,000	65,000
AISI 1018	1/4 to 3/4	60,000	70,000
AISI 1020	1/4 to 3/4	60,000	70,000
AISI 1022	1/4 to 3/4	60,000	70,000
AISI 1035	1/4 to 3/4	75,000	85,000
AISI 1038	1/4 to 3/4	70,000	80,000
AISI 1040	1/4 to 3/4	80,000	90,000
AISI 12L14	1/4 to 1-1/4	60,000	70,000
SAE Grade 5	1/4 to 1	92,000	120,000
	Over 1 to 1-1/2	81,000	105,000
ASTM A 449	1/4 to 1	92,000	120,000
	Over 1 to 1-1/2	81,000	105,000
ASTM A 325	1/2 to 1	92,000	120,000
	Over 1 to 1-1/2	81,000	105,000
ASTM A 193, B7 AISI 4140	1/4 to 2-1/2	105,000	125,000
SAE Grade 8	1/4 to 1-1/2	130,000	150,000
SAE Grade 8.2	1/4 to 1	130,000	150,000

Stainless Steel Materials

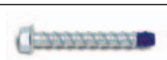
AISI/ASTM Designation	Nominal Product Size (inches)	Yield Strength 0.2% Offset (psi)	Ultimate Tensile Strength (psi)
Type 303	All Diameters	35,000	90,000
Type 304/A 276	All Diameters	30,000	75,000
Type 304 Cu/A 493	All Diameters	30,000	80,000
Type 316L/A 276	Over 1/2"	25,000	70,000
Type 316L/A 580	All Diameters	45,000	90,000
Type 410/A 276	Up to 4"	40,000	70,000

Standard Notations

c	=	Edge Distance – Perpendicular distance from center of anchor to edge of structural member
c_{min}	=	Minimum Edge Distance – Smallest edge distance allowed
c_{cr}	=	Critical Edge Distance – Minimum edge distance for full anchor capacity
d	=	Diameter of anchor
d_{bit}	=	Diameter of drill bit
d_h	=	Fixture Hole Clearance – Diameter of fixture hole
d_{hd}	=	Diameter of Head Width (Flat Head/Countersunk Anchors)
d_w	=	Diameter of washer
F_v	=	Load Adjustment Factor for Edge Distance due to $c \leq c_c$
F_N	=	Load Adjustment Factor for Spacing due to $s \leq s_{cr}$
f'_c	=	Compressive strength of concrete
h	=	Base material thickness
h_v	=	Embedment Depth – Distance measured from concrete surface to the farthest point of the anchor, measured prior to setting
l	=	Published length
N	=	Tension Load – Load parallel to anchor axis
N_N	=	Allowable Tension Load (from Performance Tables) – Nominal anchor resistance in tension
N_u	=	Tension Design Load – Applied Service Tension Load
s	=	Anchor Spacing – Distance from center of anchor to center of anchor
s_{min}	=	Minimum Spacing – Smallest anchor spacing allowed
s_{cr}	=	Critical Spacing – Minimum anchor spacing for full anchor capacity without influence for adjacent anchors
t	=	Fixture thickness
t_{max}	=	Maximum Tightening Torque for installation, usually given in a range or torque values
V	=	Shear Load – Load perpendicular to anchor axis
V_N	=	Allowable Shear Load (from Performance Tables) Nominal anchor resistance in Shear
V_u	=	Shear Design Load – Applied Service Shear Load

Autoclaved Aerated Concrete

Ultimate Load Capacities for Anchors installed in Autoclaved Aerated Concrete (AAC) Building Components[1,2,3,4,5]

Powers Fasteners Product		Anchor Diameter d in. (mm)	Drill Bit Diameter d_{bit} in.	Minimum Embedment h_v in. (mm)	Minimum AAC Compressive Strength ($f'_{aac} \geq 580$ psi) Tension Ultimate lbs. (kN)
Adhesive Anchoring Systems					
Power-Fast+		1/2 (12.7)	9/16 (14.3)	4 (101.6)	1,985 (8.9)
AC100 Plus		1/2 (12.7)	9/16 (14.3)	4 (101.6)	1,735 (7.8)
Mechanical Anchoring					
Zamac Hammer-Screw		1/4 (6.4)	1/4 (6.4)	1 3/8 (34.9)	145 (0.7)
Wedge-Bolt		1/2 (12.7)	1/2[6] (12.7)	3 (76.2)	445 (2.0)
Set-Bolt		1/2 (12.7)	1/2 (12.7)	3 (76.2)	335 (1.5)
Lag Shield (Long)		1/2 (12.7)	3/4 (19.1)	3 (76.2)	470 (2.1)
Wall Anchors					
Wall-Dog		1/4 (6.4)	3/16 (4.8)	1 1/8 (28.6)	35 (0.2)
		1/4 (6.4)	No Pre-Drill Required	1 1/8 (28.6)	125 (0.6)
Bantam Plug		10-12	1/4 (6.4)	1 (25.4)	85 (0.4)

1. Test program was performed in 8" x 8" x 24" masonry blocks of strength category AAC4 (f'_{AAC} = 580 psi)
2. Tabulated load values are valid for masonry and precast panel building components of AAC4 or greater.
3. Tabulated load values are not valid for anchor installations in masonry joints between building components.
4. Use of the listed post-installed anchors to resist earthquake loads is outside the scope of the published data.
5. Allowable loads should be determined by the local building code and the engineer of record.
6. Must use the 1/2" diameter Wedge-Bit, as supplied by Powers Fasteners, when installing the 1/2" Wedge-Bolt.

Notes:

Branch Locations

USA Locations

CITY	ADDRESS	CONTACT	PHONE	FAX
Atlanta	5405 Buford Hwy Suite 220 Norcross, GA 30071-3984	Robert Brito	678-966-0000	678-966-9242
Boston	177 North Falmouth Hwy, North Falmouth, MA 02556	Jack Armour	800-524-3244	914-576-6483
Charlotte	349 L West Tremont Avenue, Charlotte, NC 28203	Jim Karoly	704-375-5012	704-376-5517
Chicago	2474 Wisconsin Avenue, Downers Grove, IL 60515	Dan Gilligan	630-960-3156	630-960-3912
Dallas	see Houston	Joe Jackson	214-638-5043	713-228-1528
Denver	221 Wyandot Street Denver, CO 80223	Aaron Minnis	303-922-9202	303-922-9228
Detroit	21600 Wyoming Avenue, Oak Park, MI 48237	Glen Gaskill	248-543-8600	248-543-8601
Florida	9208 Palm River Road, Bldg. 3, Suite 305, Tampa, FL 33619	Michael Gaffigan	954-981-6955	954-965-0513
Houston	102 Sampson Houston, TX 77003	Jimmy Thompson	713-228-1524	713-228-1528
Indianapolis	15290 Stony Creek Way, Noblesville, IN 46060	Bill Trainor	317-773-1668	317-773-1690
Kansas City / St Louis	716 East 16th Avenue, North Kansas City, MO 64116	Don James, Jr.	816-472-5038	816-472-5040
Los Angeles	2761 Dow Avenue, Tustin, CA 92780	Jack Stewart	714-731-2500	714-731-2566
Maryland	6626 Virginia Manor Road, Beltsville, MD 20705	Gary Engleman	301-210-1430	301-210-1435
Milwaukee	12020 W. Feerick Street, Milwaukee, WI 53222	Donn Raduenz	414-466-2400	414-466-3993
Minneapolis	351 Wilson Street, NE Minneapolis, MN 55413	Rick Gruye	612-331-3756	612-331-3549
Nashville/Memphis	221 Blanton Avenue, Nashville, TN 37210	Ira Liss	615-248-2667	615-248-2676
New Orleans	317 West 24th Avenue, New Orleans, LA 70815	Cal Zenor	888-779-3667	225-928-5809
New York	2 Powers Lane, Brewster, NY 10509	John Partridge	914-235-6300	914-576-6483
Philadelphia	2 Powers Lane, Brewster, NY 10509	Jeff Walker	215-778-5143	914-576-6483
Phoenix	3602 E. Southern Ave, Suite 5 Phoenix, AZ 85040	Craig Hering	602-431-8024	602-431-8027
Pittsburgh	1360 Island Avenue, Mckees Rocks, PA 15136	Bill Dugan	412-771-3010	412-771-9858
Rochester	410 Atlantic Avenue, Rochester, NY 14609	Mike Kolstad	585-288-2080	585-288-8732
Salt Lake City	2212 SW Temple #4, Salt Lake City, UT 84115	Bruce Burnett	801-466-3406	801-484-0731
San Francisco	28970 Hopkins Street, Suite D, Hayward, CA 94545	Sara Hicks	510-293-1500	510-293-1505
Seattle	129 South Kenyon, Seattle, WA 98108	Darin Arnold/Jim Swink	206-762-5812	206-762-5817

International Locations

CITY	ADDRESS	CONTACT	PHONE	FAX
Canada	7407 Bren Road Mississauga Ontario L4T 1H3	Dick Hamer	905-673-7295	905-673-6490
British Columbia	63 Fawcett Road Coquitlam, V3K 6V2	Distributor	604-540-0200	604-540-0212
Manitoba	1810 Dublin Avenue Man. Winnipeg, R3H 0H3	Distributor	204-633-0064	204-694-1261
Quebec	For name of nearest distributor call Powers Industries Ltd at	Dick Hamer	514-631-4216	514-631-2583
Europe	J. Van Stolbergstraat 11 1723LB Noord-Scharwoude Netherlands	Paul Geuvers	+31 226 357 670	+31 226 358 817
Australia	Factory 3, 205 Abbotts Road, Dandenong, South Victoria 3175	Phil Rose	+61 3 8787 5888	+61 3 8787 5899
New Zealand	PO Box 302 076 North Harbour Auckland	Claye Sesto	+64 9415 2425	+64 9415 2627
Venezuela	Calle Sucre/Qta. Maudora, #1721 Entre Cec Acosta Y San Ignacio Chacao, Caracas	Distributor	58 212 264 1313	58 212 263 0219

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Cat. No. 00017

Note: The information and data contained within this documentation was current as of May 2006. The information is subject to change and is updated as needed. Powers Fasteners, Inc. reserves the right to change designs and specifications without notice or liability for such changes. Please contact Powers Fasteners for the most current and up to date available information or refer to our website at www.powers.com