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ANCHORING AND FASTENING SYSTEMS

TECHNICAL GUIDE

FOR THE DESIGN PROFESSIONAL

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TECHNICAL GUIDE
FOR THE DESIGN PROFESSIONAL

2ND EDITION

ANCHORING AND FASTENING SYSTEMS

DEWALT®

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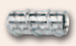
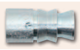
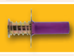
STRUCTURAL ANCHOR SELECTION GUIDE

	Description	Anchor Diameter	ICC-ES Approvals: Concrete	Cracked Concrete	Seismic Loading	Post-Installed Rebar Connections	Concrete-filled Metal Deck	Grouted Masonry	Ungrouted Masonry	Unreinforced Masonry	UL Listing	FM Approval	Relative Capacity	Relative Cost	Similar Product
ADHESIVE ANCHORS															
Pure110+® 	1-to-1 and 3-to-1 Cartridge - Epoxy Anchor	3/8" - 1-1/4" #3 - #11 Rebar	ICC ES ESR-3298	ICC ES ESR-3298	ICC ES ESR-3298	ICC ES ESR-3298							lbs. lbs. lbs. lbs.	$$$	RE 500 V3
Pure50+™ 	1-to-1 Cartridge - Epoxy Anchor	3/8" - 1-1/4" #3 - #10 Rebar	ICC ES ESR-3576	ICC ES ESR-3576	ICC ES ESR-3576								lbs. lbs. lbs.	$$	RE 500 SD RE 100
AC200+ 	10-to-1 Cartridge Hybrid Anchor	3/8" - 1-1/4" #3 - #10 Rebar	ICC ES ESR-4027	ICC ES ESR-4027	ICC ES ESR-4027	ICC ES ESR-4027							lbs. lbs. lbs. lbs.	$$$	HY 200
AC100+ Gold® 	10-to-1 Cartridge - Vinylester Anchor	3/8" - 1-1/4" #3 - #10 Rebar	ICC ES ESR-2582	ICC ES ESR-2582	ICC ES ESR-2582			ICC ES ESR-3200	ICC ES ESR-3200	ICC ES ESR-4105			lbs. lbs. lbs.	$$	HY 100 HY 70
EXPANSION ANCHORS															
Power-Stud®+ SD1 	Carbon Steel Wedge-Anchor	1/4" - 1-1/4"	ICC ES ESR-2818	ICC ES ESR-2818	ICC ES ESR-2818		ICC ES ESR-2818	ICC ES ESR-2966			UL File No. EX1289	FM APPROVED File No. 3059197	lbs. lbs.	$	Kwik Bolt 3 (KB3) KBV-TZ
Power-Stud®+ SD2 	High Performance Carbon Steel Wedge-Anchor	3/8" - 3/4"	ICC ES ESR-2502	ICC ES ESR-2502	ICC ES ESR-2502		ICC ES ESR-2502				UL File No. EX1289	FM APPROVED File No. 3059197	lbs. lbs. lbs.	$$	Kwik Bolt TZ
Power-Stud®+ SD4 	304 Stainless Steel Wedge-Anchor	1/4" - 3/4"	ICC ES ESR-2502	ICC ES ESR-2502	ICC ES ESR-2502								lbs. lbs. lbs.	$$$	Kwik Bolt 3 (KB3) / KB TZ SS
Power-Stud®+ SD6 	316 Stainless Steel Wedge-Anchor	1/4" - 3/4"	ICC ES ESR-2502	ICC ES ESR-2502	ICC ES ESR-2502								lbs. lbs. lbs.	$$$$	Kwik Bolt 3 (KB3) / KB TZ SS
SCREW ANCHORS															
Screw-Bolt+™ 	High Performance Screw Anchor	1/4" - 3/4" (CS and MG)	ICC ES ESR-3889	ICC ES ESR-3889	ICC ES ESR-3889		ICC ES ESR-3889	ICC ES ESR-4042					lbs. lbs. lbs.	$$	KH-EZ / KWIK
SPECIALITY ANCHORS															
Atomic+ Undercut® 	Undercut Anchor	5/8" - 1-1/8" (Rod size 3/8" - 3/4")	ICC ES ESR-3067	ICC ES ESR-3067	ICC ES ESR-3067								lbs. lbs. lbs. lbs.	$$$$	HDA Undercut
Power-Bolt®+ 	Heavy Duty Sleeve Anchor	1/4" - 3/4" (CS) 1/4" - 1/2" (SS)	ICC ES ESR-3260	ICC ES ESR-3260	ICC ES ESR-3260								lbs. lbs. lbs.	$$$	HSL-3
MEP HANGER ANCHORS															
Snake+® 	Rod Hanger / Screw Anchor	1/4" - 1/2"	ICC ES ESR-2272	ICC ES ESR-2272	ICC ES ESR-2272		ICC ES ESR-2272					FM APPROVED File No. 3059197	lbs. lbs.	$$	No Similar Product
Hangermate®+ (Concrete) 	Rod Hanging Anchor	1/4" - 3/8"	ICC ES ESR-3889	ICC ES ESR-3889	ICC ES ESR-3889		ICC ES ESR-3889					FM APPROVED File No. 3059197	lbs. lbs.	$$	KH-EZI
Mini-Undercut+™ 	Rod Hanger for PT and Hollow Plank	3/8"	ICC ES ESR-3912	ICC ES ESR-3912	ICC ES ESR-3912							FM APPROVED File No. 3059197	lbs.	$$	No Similar Product
Bang-It+® 	Speciality Cast-In-Place	1/4" - 3/4"			ICC ES ESR-3657		ICC ES ESR-3657				UL File No. EX1289	FM APPROVED File No. 3059197	lbs. lbs.	$$	HCI-MD KCS-MD
Wood-Knocker+® II 	Speciality Cast-In-Place	1/4" - 3/4"	ICC ES ESR-3657	ICC ES ESR-3657	ICC ES ESR-3657						UL File No. EX1289	FM APPROVED File No. 3059197	lbs. lbs.	$$	HCI-WF KCS-WF
DDI+™ (Deck Insert) 	Thread Insert for Composite Steel Deck	3/8" - 3/4"			ICC ES ESR-3958		ICC ES ESR-3958				UL File No. EX1289	FM APPROVED File No. 3059197	lbs. lbs.	$$	No Similar Product

ICC ES Indicates a Code Listed Product Hilti is a registered trademark of Hilti Corp.

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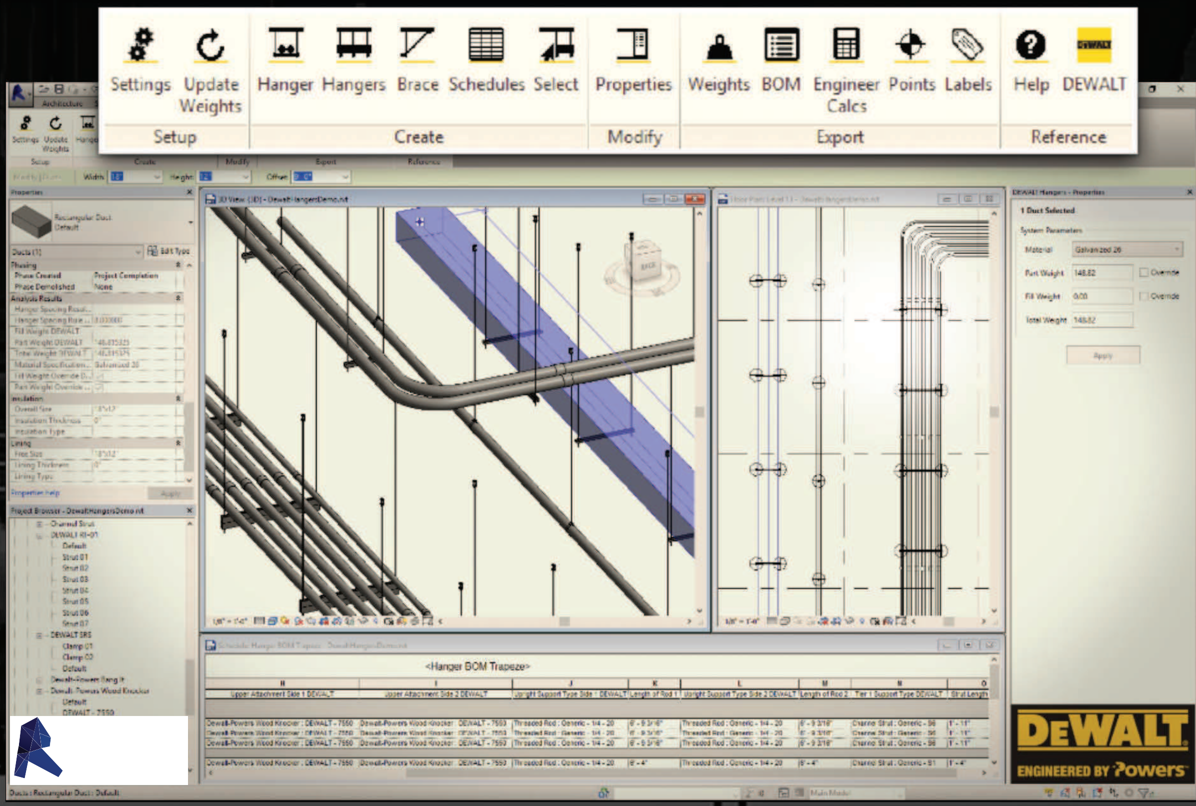
DEWALT® HANGERWORKS™

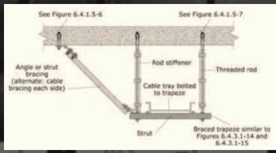
Plug-In for Revit

Automated Placement and Design of MEP Hangers

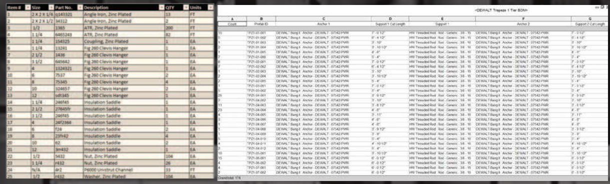


DEWALT® HangerWorks™ plug-in for Autodesk Revit is a tool that automates the placement and engineering design of hangers and seismic bracing for MEP systems such as duct, pipe, conduit and cable tray. Prefabrication sheets, bill of materials, total station layout points and engineering reports such as point load calculations are included.

Point Loads and Seismic

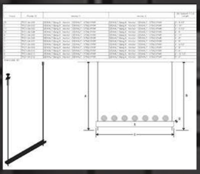


Scheduling and BOMs



Layout

Prefabrication



For additional information or to get started using HangerWorks contact: DWGTP@gogtp.com

701 E. Joppa Road • Towson, MD 21286 • (800) 524-3244 • engineering@powers.com

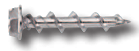
FOR MORE INFORMATION VISIT WWW.DEWALT.COM OR REFER TO DEWALT BUYERS GUIDE

MECHANICAL ANCHORS

Hangermate® Rod Hangers for Concrete, Steel, and Wood

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. Base materials: steel bar joists/beams, wood frame columns/beams, as well as concrete ceilings, beams/columns.

LIGHT DUTY ANCHORS

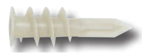


Wall Dog®

All steel, one piece, threaded fastener used to fasten fixtures directly into drywall. Variety of head styles.

Scru-Lead™

For sheet metal or wood screws in concrete, block or brick. Lead alloy. For light duty applications where holding power is not a critical factor. Not to be used overhead.



Zip-It®

A one piece self-drilling anchor for hollow gypsum wallboard and light duty loads. Engineered nylon or Zamac alloy. Use No. 6 or No. 8 screw in 3/8" to 1" wallboard. Zip-It® Jr. is engineered nylon used with a No. 6 screw in 3/8" to 5/8" wallboard.

Strap-Toggle™

A pre-assembled anchor consisting of a carbon steel wing and a locking cap/ratchet leg assembly of molded engineered plastic. Installs through a smaller hole than traditional toggles. Does not require a fixture or screw to set.

Bantam Plug

A plastic anchor for use with lightweight fixtures and a sheet metal or wood screw. For light duty static applications. Not to be used overhead.

Pop-Toggle™

Hollow wall anchors for static applications requiring light to medium load performance. Pre-drill 5/16" diameter hole. Not for use overhead or applications where holding values are critical.

LIGHT DUTY ANCHORS

Polly

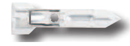
A sleeve type hollow wall anchor designed for use in base materials such as plaster, wallboard, concrete block, hollow tile or plywood.

Poly-Toggle®

A screw actuated hollow wall anchor for paneling, wallboard and solid masonry available in 6 sizes to match the most common wall thicknesses. For light duty static applications where holding power is not a critical factor.

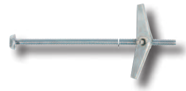
Sharkie™

The screw extrudes the anchor polymer into the wall under pressure, molding the anchor exactly to the surface of the hole. The forces supported by the screw are transmitted outwardly 360° for greater holding power.



Zinc Zip Toggle®

A self drilling hollow gypsum wallboard anchor for superior performance without the need to pre-drill holes. Comes with No. 6 x 2" screws.



Toggle-Bolt

A spring wing type hollow wall anchor for block & wallboard. Machine screw and spring wing toggle assembly. 1/8"x 2" to 1/2" x 6". Combo round, flat, mushroom, tie-wire or slotted hex head styles.

FOR MORE INFORMATION VISIT WWW.DEWALT.COM OR REFER TO DEWALT BUYERS GUIDE

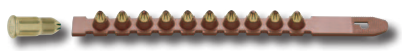
POWDER ACTUATED FASTENING

Tools

0.27 Caliber Strip Tools - P3600, P3500, PA3500, Sniper Pole Tool

0.25 Caliber Strip Tool - P35s

0.22 Caliber Single Shot Tools - P2201, P1000, T1000



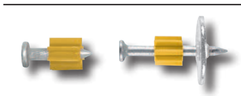
Loads

Single Shot Loads - 0.22 Caliber, 0.25 Caliber, 0.27 Caliber

Strip Shot Loads - 0.25 Caliber, 0.27 Caliber

Threaded Studs

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. For applications where it may be desirable to remove the fixture or where shimming may be required.

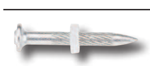


.300 Head Drive Pins

Permanently fastens fixtures to concrete, some types of concrete block, and A36 or A572 structural steel. 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.

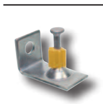
.300 Head Drive Pins With Washers

To provide resistance to pullover, these pins are available with pre-assembled 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".



CSI Pins

Provide premium performance in concrete and steel base materials. Manufactured with a 0.157" diameter shank in various lengths and with a spiral knurling for consistent optimized performance in concrete and steel (including I-Beams).



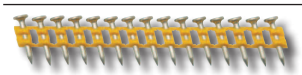
Ceiling Clip Assemblies

For acoustical applications and suspended ceiling systems or light fixtures. Several styles of angled clips are pre-mounted onto pins.

CORDLESS CONCRETE NAILER (CCN)

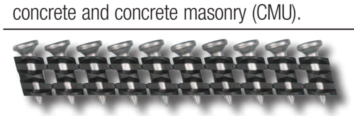
20V MAX* Cordless Concrete Nailer

The 20V MAX* Cordless Concrete Nailer is an operationally gas-free nailer designed for use in concrete and steel applications. Running on only a DEWALT 20V MAX* battery, this tool eliminates the need for fuel cells and powder loads. It provides a consistent, powerful fastening solution with no licensing requirements, that operates on the user's existing battery platform. This nailer is ideal for commercial framing and track installation, mechanical and electrical installations, and insulation, lathing and other surface prep applications.



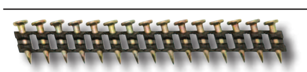
CCN Fasteners for Concrete and Masonry

For fastening metal track and light gage fixtures to concrete and concrete masonry (CMU).



CCN Fasteners for Steel

For fastening metal track to steel.



CCN Specialty Fasteners

For fastening plywood to steel or hard concrete, metal track to precast concrete, lathing to concrete masonry (CMU).

For 20V MAX Maximum initial battery voltage measured without a workload is 20 volts. Nominal voltage is 18.

GAS ACTUATED FASTENING

Trak-It® C5 System

Fuel injected cordless concrete pin nailer; the lightest and smallest tool in its class. Power output at 105 Joules, shoots into even the hardest concrete. Pin styles: 0.102 & 0.145 diameter, short tapered, concrete, steel and spiral knurled, up to 1-1/2" length.

ANCHORING AND FASTENING SYSTEMS

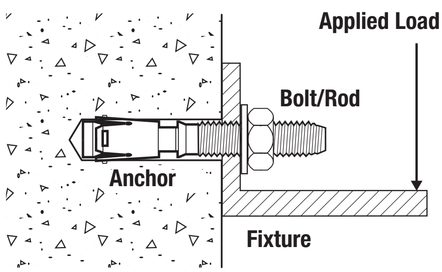
SECTION CONTENTS

INTRODUCTION

A wide variety of post-installed anchors, cast-in place anchors and fastening systems are available. In construction, these products are normally installed into concrete, masonry and steel base materials. This includes but is not limited to mechanical expansion and screw anchors, adhesive anchoring systems, self-drilling screws, direct fastening technologies (e.g. powder actuated, cordless battery actuated, gas actuated). 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 (e.g. material, finish) 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. The following is intended to guide the user of this information toward an anchor or fastening system that is best suited for the application.

FASTENED ASSEMBLY

Before selection can take place, several factors should be considered and reviewed to determine their effect on the application including the key components of the fastened assembly. The following diagram shows a typical fastened assembly using an post-installed anchor:



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

1. Base material (e.g. type and strength) in which the anchor or fastener will be installed.
2. Load level and type of loads applied to the fixture or material to be fastened.
3. Anchor or fastener material and the bolt / threaded rod in the assembly (e.g. internally threaded anchors) as applicable
4. Installation procedures including the method of drilling, hole preparation, and installation tool used.
5. Dimensions of the base material including the material thickness, anchor or fastener spacing, and edge distance.
6. Effects of corrosion and service environment.

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 dense concrete and stone can withstand far greater stress than those installed in softer materials such as lightweight concrete, block, or brick. 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, national/local codes and the authority having jurisdiction should also be considered.

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 characteristics of concrete are workability and strength. Fresh concrete 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 (ACI) in document ACI 318, Building Code Requirements for Structural Concrete.

Steel reinforcement such as deformed reinforcing bars or welded wire fabric are placed in the forms prior to the pouring of concrete to resist tensile forces in the base material. 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. Steel reinforcement should not be drilled/cored through without authorization from the design professional responsible for the project. Dimensions, deformation requirements and strengths of standard deformed reinforcing bars (e.g. Grade 60) are most common according to ASTM A 615 and A 706.

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 and standards specifications 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-inch in diameter while the coarse aggregate is crushed stone or gravel greater than 3/16-inch 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 lightweight concrete, the 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 lightweight concrete ranges from 100 to 115 pcf. 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. Precast autoclaved aerated concrete (AAC) describes another lightweight concrete building material which is mainly available in block form.

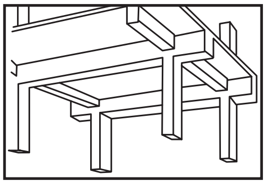
Admixtures are specified in a mix design to modify the concrete, either for placement characteristics or hardened properties. Air entraining admixtures which disperse tiny air bubbles throughout the concrete mix help to improve the freeze thaw resistance and increase workability. Examples of other admixtures 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 according to ASTM C 31. The cylinders are broken according to ASTM C 39 at specified time intervals, and the resulting strength is calculated and reported in psi.

The age of concrete as well as strength and hardness of the aggregate will affect drilling speed, drill bit wear, and drill bit life. Anchors or fasteners installed in lightweight concrete have load capacities which are approximately 40% less than those installed in normal-weight concrete. Job site tests are recommended if specific data is not available for this base material for a given product.

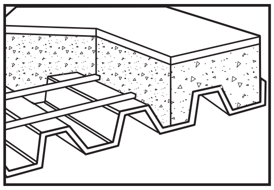
The load capacities listed in this guide were conducted in unreinforced test members to provide baseline data which is usable regardless of the possible benefit of reinforcement unless otherwise noted.

The load capacities for installations in normal-weight and lightweight concrete listed in this guide are for concrete which has achieved its designated 28 day compressive strength. Concrete is considered at early strength or 'green' if less than 21 days old which can have an effect on performance of anchors and fasteners. It is recommended that anchors and fasteners not be made in concrete which has cured for less than 7 days. For concrete that has not cured at least 21 days, expected load capacities for metal anchors and fasteners would correlate to the actual compressive strength of the base material at the time of installation. For use of adhesive anchors in concrete that has not cured at least 21 days, site testing should be considered if product specific testing is not available from the supplier to evaluate any possible effects. Job site tests are recommended for installations in concrete where the material strength or condition is unknown or questionable.

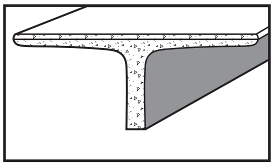
Examples of common construction methods in which concrete is used are shown in the following figures:



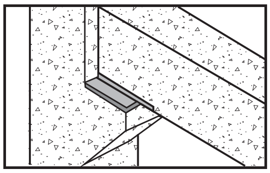
POURED IN PLACE CONCRETE USING A FORM SYSTEM



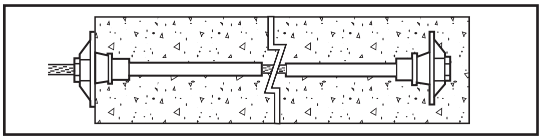
COMPOSITE SLABS POURED OVER STEEL DECK



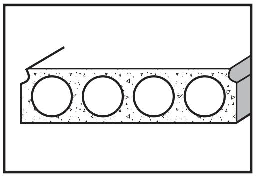
PRECAST TEES



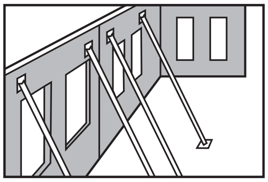
PRECAST BEAMS AND COLUMNS



POST-TENSIONED SLABS AND BEAMS



PRECAST PLANK



TILT-UP WALL PANELS

MASONRY MATERIALS

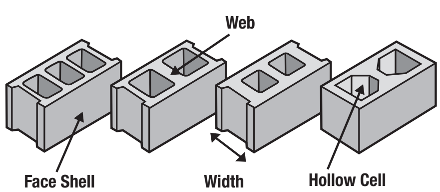
The strength of masonry walls is typically less than that of concrete and the consistency of masonry materials can vary on a regional basis. To form a wall, individual masonry units are bonded together with a cement mortar. A vertical row is called a course and a horizontal row is called a wythe. The strength of the mortar is often the critical factor in this type of base material assembly and typically limits anchor product performance. Generally, anchors or fasteners may be installed in the horizontal mortar joint or directly into most types of masonry units. The vertical mortar joint should be avoided since this joint location is typically not fully mortared.

Note: 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 (e.g. toggle and sleeve type anchors). When using anchors in these materials, spalling can occur during the drilling process prior to installation, 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 or where specific data is not available for this base material or base material location for a given product. 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.

Concrete Block (CMU)

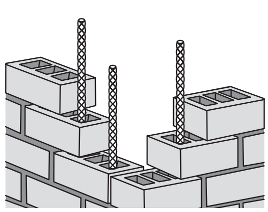
Masonry block is found in a variety of sizes and shapes depending upon the age and location of a building. Both hollow and solid styles which can be classified as load-bearing or non-load bearing are used. Load-bearing block, known as a concrete masonry unit (CMU) is generally suitable for anchoring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

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

Typical minimum dimensions for the face shell and web thickness are given in ASTM C 90. The minimum compressive strength from the ASTM specification is 1,900 psi. Typical dimensions are nominally 8" x 8" x 16" with a minimum face shell thickness of 1-1/4" to 1-1/2". 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. 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.

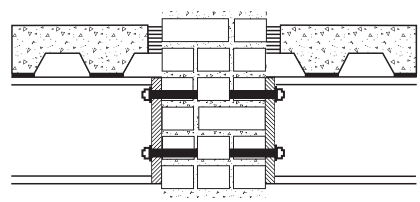


GROUT-FILLED CONCRETE MASONRY

Experience has shown that the consistency of grout-filled block can vary and voided areas are often present a problem. Therefore, job site job site tests are recommended to determine actual load capacities for critical applications or where specific data is not available for this base material or base material location for a given product. In this, 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. The load capacities listed in this guide were conducted in unreinforced test members to provide baseline data which is usable regardless of the possible benefit of reinforcement unless otherwise noted.

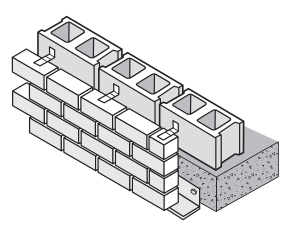
Brick

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. Brick can be used to form a load bearing wall or used as a veneer or facade.



TYPICAL BRICK BEARING WALL

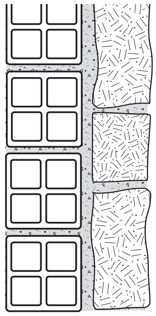
Brick is produced as a solid masonry unit or with cores during extrusion. The cores (also known as weep holes) reduce the weight of the brick and help it to lay better. ASTM C 652 describes hollow brick masonry units. Hollow brick is defined as having a cross sectional bearing area which is less than 75% of the gross area of the brick measured in the same plane. 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 rod and wire reinforcing. When brick is used as a building facade, it is important to properly tie it to the backup wall and structure which is often done using anchors manufactured from a corrosion-resistant material such as stainless steel.



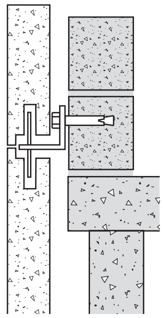
Note: Brick cores can often create a problem when attempting to install traditional anchors because of the cavities. In this case, an alternative anchor, such as an adhesive anchor could be considered. Also, brick is generally not suitable for power-actuated fasteners.

Stone

Natural stone is available in a variety of types, colors, and textures for use in many building applications. The strength and the quality of stone can vary dramatically from each stone quarry and for different geological locations. Naturally occurring rock which has been fabricated to a specific size and shape is referred to as dimension stone. Dimension stone units can be used to form a load bearing wall and as a veneer or façade.



STONE WITH TILE BACKUP



STONE FACADE

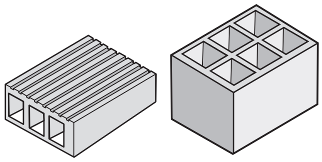
Generally, anchors installed in softer material such as limestone or sandstone will have capacities similar to those obtained in 2,000 psi concrete. In harder stone such as granite or marble, the capacities will be similar to 4,000 or 6,000 psi concrete. Job site tests are recommended because of the wide variation in the strengths of natural stone. 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.

When stone is used as a building facade, it is important that the stone be properly tied to the backup wall using anchors manufactured from a corrosion-resistant 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.

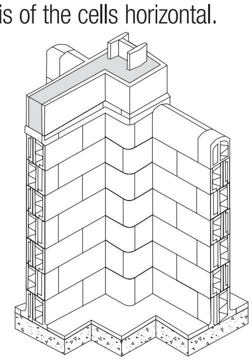
Note: Stone is not generally considered a suitable base material for power-actuated fasteners.

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. 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



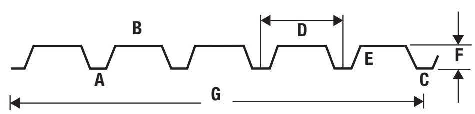
STRUCTURAL CLAY PARTITION

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. Structural clay facing tile is described in ASTM C 212. 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.

Note: These materials present a problem when attempting to install anchors and fasteners because the relatively thin walls cannot sustain the high stresses applied by typical anchors. For light duty loads, a hollow wall anchor which opens behind the face shell may be used (e.g. toggle bolts). For heavier loading, an adhesive anchor installed using a screen tube inserted through the face shell and interior web is suggested. Since the strength and condition of these materials can vary, job site tests are recommended. Structural clay tile is not a suitable base material for power-actuated fasteners.

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. 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). Material requirements are also listed in ASTM A 611 and A 446. The yield strength of the steel deck typically varies from 25,000 to 80,000 psi, depending on the grade. Steel deck is commonly specified by a decimal thickness but often also correlated to a gage number.

Steel floor deck used for composite construction with concrete fill has typical rib depths of 1-1/2", 2", and 3" with deeper depths available. This type of deck is normally manufactured to 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.

TESTING AND DATA FUNDAMENTALS

The fundamentals of anchor and fastener design include the determination calculation of design load capacities based on laboratory test data conducted to simulate typical field conditions. This guide provides published design load capacities for anchors and fasteners installed in concrete and masonry units along with other appropriate base materials.

TEST PROCEDURES AND CRITERIA

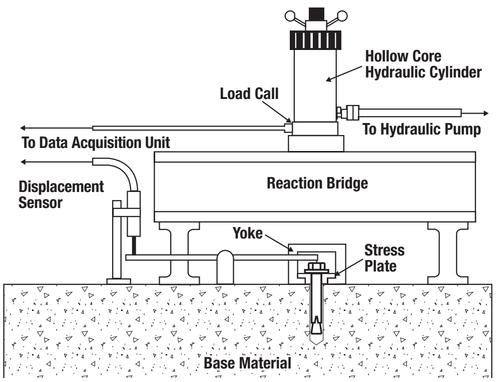
The general test data for anchors and fasteners published in this guide was developed according to the following standards (as applicable): *ASTM E 488, Standard Test Methods for Strength of Anchors in Concrete; ASTM E 1190, Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members; ACI 355.2, Qualification of Post-Installed Mechanical Anchors in Concrete; ACI 355.4, Qualification of Post-Installed Adhesive Anchors in Concrete; ICC-ES AC01, Expansion Anchors in Masonry Elements; ICC-ES AC58, Adhesive Anchors in Masonry Elements; ICC-ES AC70, Power-actuated Fasteners Driven into Concrete, Steel and Masonry Elements; ICC-ES AC193, Mechanical Anchors in Concrete Elements; ICC-ES AC308, Post-installed Adhesive Anchors in Concrete Elements; ICC-ES AC446, Headed Cast-in Specialty Inserts in Concrete.*

TENSION AND SHEAR TEST DATA

Tension test data is sometimes referred to as pullout or tensile test data. A typical hydraulic test assembly used to perform an unconfined tension test on an anchor is illustrated. A similar assembly is used for testing other fasteners (e.g. power-actuated), however, deflection may not be measured unless specified by the prevailing criteria.

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. However, in some cases a confined testing setup is more desirable depending on the product and test purpose (e.g. isolating bond strength of adhesive anchors, proof loading).

In a shear test, the test load is applied perpendicular to the anchor across the cross-section of the product body. This type of loading is also applied typically using a hydraulic equipment test setup. When a shear load is applied to an anchor, the anchor body resists the applied load by placing a bearing stress against the base material. In addition, the anchor will tend to bend as a shear load is applied.



TYPICAL STATIC TENSION TEST ASSEMBLY

and 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.

During testing, load is gradually applied to the anchor 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 is recorded and normally associated with a typical failure mode.

EVALUATION OF TEST DATA (ASD)

Two primary methods of evaluating test data to determine the suitable working loads for anchors in concrete and masonry are currently used. The first and still most common, because of its long history and relative ease of use, is the application of a global safety factor which is used in conjunction with allowable stress design (ASD). Using this method, an appropriate safety factor is applied to the average ultimate load obtained from testing to establish an allowable load:

Allowable load = Ultimate load / Safety Factor

Safety factors are used and assumed to account for field variations which may differ from the testing conditions in the laboratory. Typical minimum safety factors established by industry are 4:1 for concrete and 5:1 for masonry materials. Actual safety factors to be used should be determined by the design professional responsible for the product application and installation, based on the governing building code and after examining all influencing factors.

A second method which is used less frequently, but sometimes used as an alternative to applying straight safety factors 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 unless COV values are very high (e.g greater than 20%).

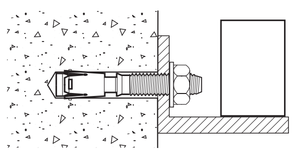
EVALUATION OF TEST DATA (SD)

Strength Design for anchors in concrete for structural and non-structural connections are becoming more the norm as the International Building Code (IBC) has been adopted and accepted in most jurisdictions within the United States. This method incorporates reduction factors to characteristic values determined from comprehensive qualification testing requirements. Specific details of the procedure to properly evaluate such data can be found in ACI 355.2 and ACI 355.4. These requirements provide consideration for anchor behavior and different types of failure modes. Strength Design as it applies to anchorage to concrete is detailed in ACI 318 Appendix D (Chapter 17 for ACI 318-14 and later editions). This method is referenced directly by the IBC and is recommended where applicable.

APPLIED LOADS

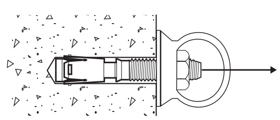
The type of load and the manner in which it is applied by the fixture or other attachment is a principle consideration in the selection of an anchor. Applied loads can be generically described as static, dynamic, or shock. Some anchor types are suitable for use with static loads only, while others can 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



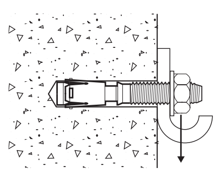
These are non-moving, constant loads such as those produced by an interior sign, cabinet, equipment, or other. A typical static load could be a combination of the dead load (weight of fixture) and the live load a fixture must support. Basic static load conditions are tension, shear, or a combination 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



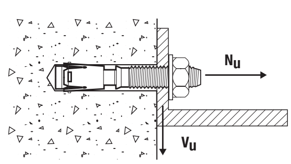
A tension load is applied directly in line with the axis of the anchor.

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.

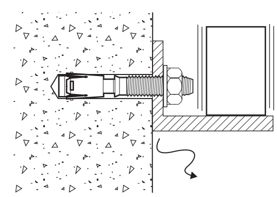
BENDING LOAD

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, approximated by 1/2 to 1 anchor diameter.

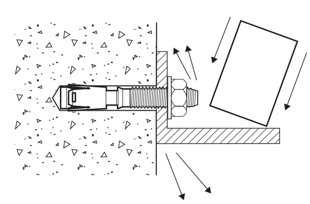
DYNAMIC AND SHOCK LOADS

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.

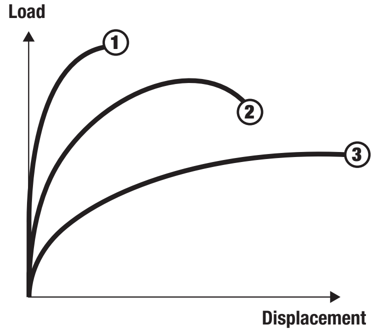
Standard industry practice with regard to safety factors varies depending upon the frequency and intensity of the load. However, safety factors for dynamic or shock load conditions may require 10:1 or higher. Determination of the appropriate safety factor should be made by the design professional in charge of the project and application.

ANCHOR BEHAVIOR AND MATERIAL

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 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 dropin is usually very high when compared to a torque controlled anchor resulting in low displacement characteristics.

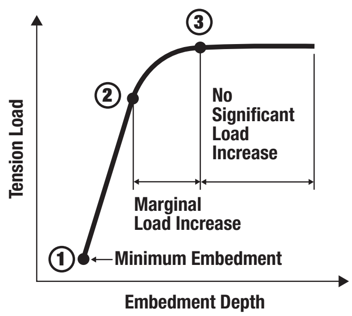
Typical performance of a torque controlled anchor is shown in Curve (2). Displacement begins to occur after the initial preload in the anchor has been exceeded until the ultimate load capacity is achieved.

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.

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 nominal 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. In some masonry materials, the minimum depth may be decreased depending upon the anchor style as noted in the load tables.

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. For applications requiring installation at embedment depths between those published, linear interpolation is permitted. The following diagram shows the typical performance of a mechanical anchor installed in concrete.

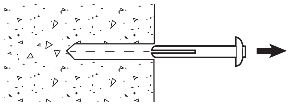


MODES OF FAILURE

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

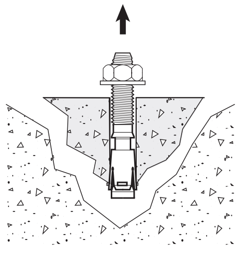
Anchor Pullout

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.



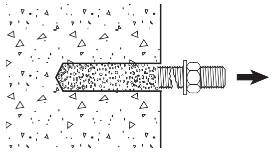
Base Material Failure

When the applied load is greater than the strength of the base material, the material pulls out or fails. In concrete, a shear prism/cone will be pulled, usually for anchors installed at a shallow depth. The angle of the shear prism/cone has been assumed to be 35-45°, however, this can vary slightly depending upon the anchor style and embedment depth.



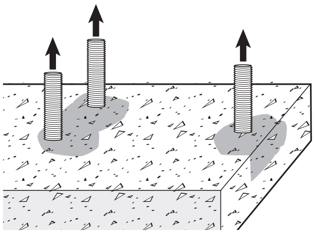
As the embedment of some anchor styles is increased to six diameters or beyond, the concrete can sustain the applied compression force and the load capacity of the anchor will increase up to a point at which either the capacity of the expansion mechanism or the bond is reached. In masonry, part of the individual unit may be pulled from the wall, especially in cases where the strength of the mortar may be low.

Anchor Material Failure



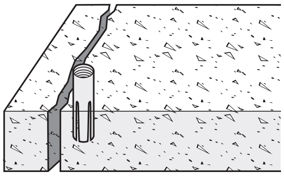
A failure of the anchor body or rod will occur when the applied load exceeds the strength of the material from which the anchor is manufactured. For mechanical anchors, this usually occurs for anchors which are embedded deep enough to develop the full strength of the expansion mechanism and the base 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 (for both unreinforced and reinforced base materials). The critical dimensions include the thickness and the width of the base material.

ANCHOR PRELOAD AND TORQUE

Anchor preload is developed by the setting action in a displacement 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 (but should not be counted on where cracking of the concrete may occur, e.g. seismic event). 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.

LONG TERM BEHAVIOR

Various additional influences may need consideration for the proper long term behavior of an anchoring or fastening system. These important considerations include but are not limited to effects of concrete state (uncracked, cracked), earthquake loading, fatigue, freezing/thawing effects, sustained loading (i.e. creep), elevated temperature, fire, corrosion and/or chemical resistance.

DEWALT current offering of adhesive anchoring systems have been independently tested and qualified to meet or exceed the creep requirements of ACI 355.4, ICC-ES AC308 and AC58. Product specific information can be found in individual product sections.

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, threaded rods or other materials (e.g. steel inserts, rod couplers) 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 various standards. The typical standards used are for externally threaded parts as assigned by the Society of Automotive Engineers (SAE), Industrial Fasteners Institute (IFI), 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.

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 considerations unless specific fire rating tests have been performed. Special materials may be required for corrosive environments and connections involving dissimilar metals which have potential for galvanic reaction.

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(e.g. water), 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.

+ 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)

Galvanic Series

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. In all cases, it is important to evaluate the application, materials and the service environment to make a proper selection.

COATINGS AND PLATINGS

A variety of coatings and platings are offered by industry 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.

Zinc Plating and Coatings

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 are provided for reference and 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
Note: Reproduced from ASTM; the mean corrosion rate given pertains to zinc only and does not include a corrosion rate when zinc is passivated or in contact with other materials.	

The standard zinc plating used on carbon steel anchors is applied using electroplating (often called 'commercial' zinc). 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. DEWALT carbon steel anchors 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 and/or acid-free cleaning processes are used to ensure hydrogen is not introduced during production and manufacture.

Note: Hardened fasteners such as carbon steel concrete screws and 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, a mechanically applied zinc meeting the requirements of ASTM B 695, Class 5 is used. Class 5 signifies an average minimum coating thickness of 5 microns (0.0002").

Zinc platings or coatings are often described using the term “galvanized”. Another zinc coating which is available on some carbon steel anchors is mechanically applied (e.g. mechanical galvanized). 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. ASTM A 153, Type C describes the requirements for applying a zinc coating using a hot dip method. According to this specification, the anchor components are placed in a bath of molten zinc for a specified time to allow a metallurgical reaction which bonds the zinc to the steel surface.

Barrier Coatings (e.g. Perma-Seal)

To provide increased protection from the effects of corrosion on smaller diameter anchors and fasteners used in some industrial applications, proprietary coatings have been developed. Some of these coatings have shown to provide 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.

One of these barrier coatings is called Perma-Seal™. When a component is coated with Perma-Seal, a zinc enriched base is first applied to the surface followed by a proprietary process during which a polymer based paint is bonded over the base coat. This creates a finish which is resistant to the environments such as those created by the high saline (salt) content of most insulation boards, and the acids which are produced by ponded water in many 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 with undamaged coating surface 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 with undamaged coating surface can withstand over 1,000 hours of exposure with less than 5% surface corrosion. The coating has also been tested to ICC-ES AC257, *Acceptance Criteria for Corrosion-resistant Fasteners and Evaluation of Corrosion Effect of Wood Treatment Chemicals*.

In all cases, it is important to evaluate the application and the service environment to make a proper selection. The suitability of an anchor for a specific application should be determined by a qualified design professional responsible for the product installation.

Note: Environmental, application and other factors can affect the service life of anchors and fasteners. Current test standards for corrosion resistance do not enable test results to be directly correlated into expected service life; as such, it is impossible to accurately predict the service life of a specific installation.

CORROSION RESISTANT MATERIALS

In addition to coatings and platings, a variety of other anchor and fastener materials are available which provide varying degrees of corrosion resistance.

Stainless Steel

Stainless steels were originally named according to their chromium and nickel content. Chromium-nickel alloys are known as 300 series stainless steels while chromium alloys are 400 series. Stainless steels develop their resistance to corrosion by forming a thin, self healing, passive film of chromium oxide on their surface.

The most common for fastener applications are produced from 300 series stainless steels. These 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. Type 303 is used where machinability is required for products. 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 cold form anchor components. 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.

Note: The use of Type 316 stainless steel in environments where pitting and stress corrosion is likely (e.g. chloride/chlorine environments) should be avoided due to the possibility of sudden failure without visual warning.

INSTALLATION GUIDELINES

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

DRILLED HOLE (POST-INSTALLED ANCHORS)

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 DEWALT 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"	0.869- 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 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. Smooth walls should generally be roughened and cleaned.

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 (including screw 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. Anchor holes should be thoroughly cleaned prior to installation of the anchor unless otherwise noted. This procedure is easily accomplished using compressed air, pump or a vacuum with an extension. 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, engagement and/or bond can be properly actuated. Extra care must be taken when using adhesives. The drilled hole should be thoughly cleaned, including brushing and blowing of the anchor hole with suitable equipment to ensure that a proper bond is developed. See specific product information concerning suitability of installations in wet or submerged environments.

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

Post-installed anchors of fractional sizes 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 (e.g. through-bolting), 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. For example, through-bolting with mechanical wedge 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.

OVERSIZED HOLES (ADHESIVE ANCHORS)

Unless otherwise noted, the performance values for DEWALT adhesive anchor systems are based upon testing of anchors installed in holes drilled with carbide-tipped bits typically with either 1/16-inch or 1/8-inch greater than the nominal diameter of the steel anchor element (see specific information contained in product sections). Some cases may warrant the consideration of oversizing the drilled holes (e.g. due to placement issues, construction adjustments). Depending upon the application/conditions and product, oversizing the drilled hole can have an effect on performance. Site testing should be considered if product specific testing is not available from the supplier to evaluate any possible effects.

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.

Note: It is not recommended to install mechanical anchors in oversized holes.

CORE DRILLED HOLES (ADHESIVE ANCHORS)

Unless otherwise noted, the performance values for DEWALT adhesive anchor systems are generally based upon testing of anchors installed in holes drilled with carbide-tipped bits. However, some products have undergone specific qualification testing for use in core drilled holes (see specific information contained in product sections).

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.

Note: Unless otherwise noted, it is not recommended to install mechanical anchors in core drilled holes.

TEMPERATURE (ADHESIVE ANCHORS)

The product installation temperature and base material temperature can have an effect on performance of adhesive anchors. The selected product must be suitable for the application and installation conditions. It is recommended that the product be conditioned and installed in accordance with published instructions for best results. For in-service temperature and freeze-thaw effects, reference the information contained in the specific product information sections.

Note: 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 sensitive to this. 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.

INSTALLATION TORQUE

Certain anchor styles, sometimes referred to as torque controlled anchors, are actuated by tightening a bolt or nut. For typical field installations, especially where it is not practical to measure the torque, the commonly suggested tightening procedure for such anchors 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 or a maximum torque as in the case for adhesive anchors.

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. DEWALT 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 with the exception of torque-controlled expansion anchors which have a specified value based on testing, 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.

Note: These values may have to be reduced for installations in hollow and/or 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. Care should be taken by the design professional responsible for the installation to consider the material strength and composition of the anchor so that the tests do not damage the anchor or cause undue damage to the test location.

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 in the range of 2 to 2.5) subject to the design professional and/or building official as applicable.

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. The torque value measured after installation is typically 50% of that initially applied to set the anchor.

DESIGN CRITERIA

ALLOWABLE STRESS DESIGN (ASD)

The historical standards established by industry for anchoring and fastening is to reduce the ultimate load (i.e. mean average) capacity by a minimum safety factor depending upon the type of base material and governing construction code to calculate the allowable working load.

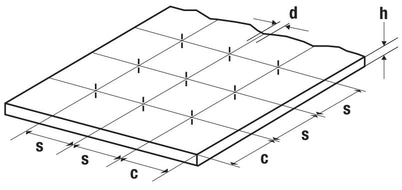
Allowable load = Ultimate load / Safety Factor

For example, a post-installed mechanical anchor which has an average ultimate tension load capacity in solid normal-weight concrete of 12,000 pounds for a given set of conditions would have a maximum allowable working load anchor of 3,000 pounds when utilizing a safety factor of 4 to 1. Connections such as overhead applications and/or involving dynamic loading, shock loads, fatigue loading, corrosion and fire considerations may require higher safety factors depending on product, base material and conditions. The allowable loads are recommendations, however, and local construction codes should be consulted to determine the required safety factors and design methodology. For adhesive anchors, both the strength of the adhesive at in-service temperature and the steel anchor element must also be considered (the lower of the strengths must govern). As in all applications, the actual safety factors and design load capacities used should be reviewed and verified by a design professional responsible for the actual product installation.

In allowable stress design (ASD), the design professional must design the anchorage so that the service loads do not exceed the allowable loads for a given anchor or anchor group (where T = tension and V = shear):

$$T_{service} \leq T_{allowable} \qquad V_{service} \leq V_{allowable}$$

The design professional must take the allowable load from the relevant published data and adjust the allowable load for all applicable design parameters for the anchor. This includes but is not limited to center-to-center spacing distance, edge distance and base material in-service temperature, as applicable.



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

Applicable load-adjustment factors for the anchors for the design conditions must be applied cumulatively. See the applicable product information for the product specific load adjustment factors and guidance for the use of linear interpolation for geometric conditions, where applicable.

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

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

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

[Straight Line and Parabolic Interaction Equations]

The straight line equation is typically given as default; the parabolic equation is applicable where testing has been performed to qualify the use of this parabolic interaction relationship.

STRENGTH DESIGN (SD)

For Strength Design, also known as LRFD, the design professional must design the anchorage so that the required strength (i.e. factored load) does not exceed the lowest design strength of the anchor or anchor group in concrete (considering all possible failure modes):

$$N_{ua} \leq \phi N_n \qquad V_{ua} \leq \phi V_n$$

Calculations are performed in accordance with the design provisions of ACI 318 Appendix D (Chapter 17 for ACI 318-14 and later editions) for cast-in-place, mechanical and adhesive anchors. The characteristic strengths and design data for post-installed anchors are derived from comprehensive independent testing and assessment in accordance with ACI 355.2 (ICC-ES AC193) and ACI 355.4 (ICC-ES AC308). Characteristic strengths are 5% fractile strengths calculated from the average ultimate load and associated coefficient of variation from test results. The 5% fractile strength is defined as the characteristic strength for which there is a 90% confidence that there is a 95% probability of the actual strength exceeding the characteristic strength.

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

$$\left(\frac{N_{ua}}{\phi N_n}\right)+\left(\frac{V_{ua}}{\phi V_n}\right)\leq 1.2$$

N_{ua} = Factored Tensile Applied to an Anchor or Group of Anchors
N_n = Nominal Strength in Tension
V_{ua} = Factored Shear Load Applied to an Anchor or Group of Anchors
V_n = Nominal Strength in Shear
ϕ = Strength Reduction Factor

For anchors that are designed using ACI 318 Appendix D (Chapter 17 for ACI 318-14 and later editions) it is possible to convert design strengths (i.e. Nn or Vn) to allowable loads using the following approach from ICC-ES AC193 and AC308:

$$T_{allowable,\,ASD} \text{ and } V_{allowable,\,ASD} = \frac{\phi N_n}{\alpha} \text{ and } \frac{\phi V_n}{\alpha}$$

Where:

$T_{allowable,\,ASD}$ = Allowable Tension Load
$V_{allowable,\,ASD}$ = Allowable Shear Load

α = Conversion factor calculated as a weighted average of the load factors for the controlling load combination. In addition, the conversion factor, α, shall include all applicable factors to account for non-ductile failure modes and required over-strength. For consideration of complete details, consult the individual product sections and approvals or contact DEWALT.

LIMIT STATE DESIGN

Much like Strength Design, the philosophy of Limit State Design method is to see that the structure remains fit for use throughout its designed life by remaining within the acceptable limit of safety and serviceability requirements based on the risks involved. The limit state design method for anchor design is given in CSA A23.3 Annex D. In principle, the limit state design method for anchorage to concrete follows strength design provisions but utilizes different strength reduction factors. Post-installed anchors qualfied for use with this design method are subject to comprehensive independent testing and assessment in accordance with ACI 355.2 (ICC-ES AC193) and ACI 355.4 (ICC-ES AC308) to determine characteristic strengths and design data.

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 design category/ 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.

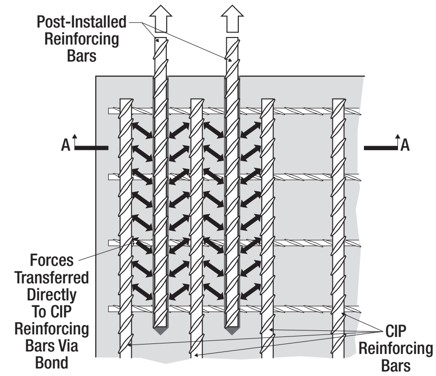
Anchors to be used for seismic loads will not be fully loaded in place until an earthquake occurs. Standard test methods have been developed to provide a methodology to simulate seismic load cycles in order to obtain statistical data for the performance of anchors in such conditions. In shear, anchors are tested and are subjected to alternating load applications. Internationally recognized assessment criteria is utilized for evaluating the performance of post-installed anchors when subjected to such simulated seismic loading.

The criteria used as conditions of acceptance for seismic performance of anchors is based on independent testing according to ACI qualification and ICC-ES acceptance criteria. Anchors qualified for seismic applications must have evidence of performance in cracked concrete in accordance with these standards. For seismic design, anchors in concrete must be designed following Strength Design provisions of ACI 318 Appendix D (or Chapter 17 for ACI 318-14 and later editions) or CSA A23.3, as applicable.

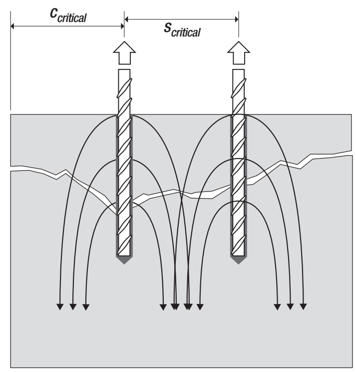
POST-INSTALLED REBAR CONNECTIONS

Post-installed rebar connections can also be designed according to the principles of reinforced concrete design (e.g. ACI 318) to provide development of non-contact bar splices. These connections utilize rebars installed and bonded into drilled holes in hardened concrete with a tested and qualified structural injection adhesive. Testing and qualification of the structural injection adhesive is conducted and evaluated specifically for this application (e.g. in accordance with ICC-ES AC308). The post-installed rebars are assessed and shown to provide equivalent bond strength and basic tensile behavior to cast-in reinforcement for the purposes of design and construction.

Although post-installed rebars behave like cast-in reinforcement, other influences of reinforced concrete design should also be considered such as fire, as applicable. Utilizing proper design and installation practices, the post-installed rebar connections in the structure can be assumed to be monolithic (i.e. uniform structural member).



Post-installed Reinforcing Bar Designed As A Lap Splice



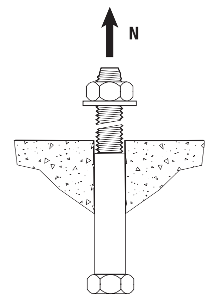
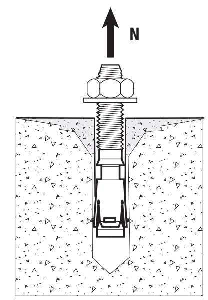
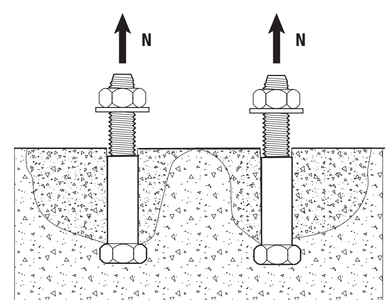
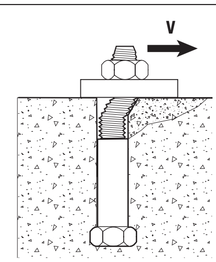
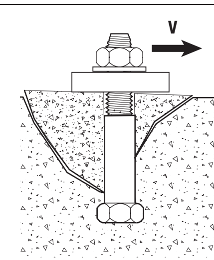
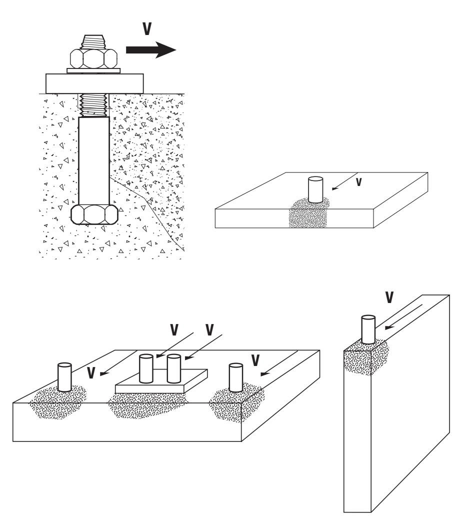
Reinforcing Dowels Designed Using Anchor Theory

Situations where the concrete needs to take up tensile loads from the anchorage or in cases where rebars are designed to carry shear loads, the design should be according to anchor design principles as given in Appendix D (or Chapter 17 for ACI 318-14 and later editions) or CSA A23.3, as applicable. Unlike in anchor applications, reinforcement design is normally done to achieve yielding of the steel, often in nested groups, in order to obtain ductile behavior of the structure with good serviceability.

SD REFERENCE GUIDE - STRENGTH DESIGN OF ANCHORAGE TO CONCRETE ACI 318-11 APPENDIX D AND ACI 318-14 (CHAPTER 17)

The following is a reference tool for the design of anchors into concrete using ACI 318-11 and ACI 318-14.

In general, the following steps should be considered when determining the controlling design strength (i.e. factored resistance, factored nominal strength) of the anchor system:

In all cases, the anchor system must be designed as follows:	Failure modes:
ØNn ≥ Nua where ØNn is the lowest design strength in tension from all appropriate failure modes; • For mechanical expansion and screw anchors, ØN_n is the lowest design strength in tension of an anchor or group of anchors as determined from consideration of ØN_{sa}, ØN_{cb}, ØN_{cbg}, (or ØN_{pn}). • For adhesive anchors, ØN_n is the lowest design strength in tension of an anchor or group of anchors as determined from consideration of ØN_{sa}, ØN_{cb}, ØN_{cbg}, ØN_a (or ØN_{ag}). *(bond strength failure mode not pictured)* A supplemental design check and an additional strength reduction is required for adhesive anchors subjected to sustained tensile loads or load combinations with a sustained load component. • For cast-in anchors, ØNn is the lowest design strength in tension of an anchor or group of anchors as determined from consideration of ØNsa, ØNcb, ØNcbg, ØNsb, ØNsbg,(or ØNpn). *(side-face blowout strength failure mode not pictured)*	 STEEL FAILURE  PULLOUT  CONCRETE BREAKOUT
ØVn ≥ Vua where ØVn is the lowest design strength in shear from all appropriate failure modes; • For mechanical expansion and screw anchors, ØV_n is the lowest design strength in shear of an anchor or group of anchors as determined from consideration of ØV_{sa}, ØV_{cb}, ØV_{cbg}, ØV_{cp}, (or ØV_{cpg}). • For adhesive anchors, ØV_n is the lowest design strength in shear of an anchor or group of anchors as determined from consideration of ØV_{sa}, ØV_{cb}, ØV_{cbg}, ØV_{cp} (or ØV_{cpg}). • For cast-in anchors, ØVn is the lowest design strength in shear of an anchor or group of anchors as determined from consideration of ØVsa, ØVcb, ØVcbg, ØVcp, (or ØVcpg).	 STEEL FAILURE PROCEEDED BY CONCRETE SPALL  CONCRETE PRYOUT FOR ANCHORS FAR FROM A FREE EDGE  CONCRETE BREAKOUT

DUST CONTROL DRILLING SYSTEMS

Table 1 of 29 CFR 1926.1153, part of the OSHA Silica Dust Rule published in March, 2016 details requirements for handheld drills used during the installation process of post-installed anchors. The requirements for each part of this system are:

Tool

1. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions

Accessories and Shrouds

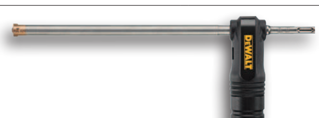
1. Use drill equipped with commercially available shroud or cowling with dust collection system

Dust Extractor

1. Dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency
2. Cleaning holes requires a vacuum with a HEPA filter
3. Dust collector must have a filter cleaning mechanism

The DEWALT systems outlined in the table are examples of compliant methods used to drill the hole as required in published installation instructions.

DEWALT OSHA 29 CFR 1926.1153 Table 1 Compliant Drilling Systems

Tool	Accessories and Shrouds	Dust Extractor
SDS-Max Drills		
 Cordless	 SDS-Max Hollow Drill Bit	 Dust Extractor
 Corded	  SDS-Max With Shroud	
SDS-Plus Drills		
 Cordless	 SDS-Plus Bit	 Cordless Dust Extractor
	 SDS-Plus Hollow Drill Bit	 Dust Extractor
 Corded	 SDS-Plus With Telescope	
	 SDS-Plus With Shroud	

Contact DEWALT for information on the DustX+ extraction system which is used to automatically clean holes during drilling (hole cleaning following drilling is not required).

DUST X+™
ANCHOR INSTALLATION SYSTEM

ADHESIVES ANCHORING SYSTEMS


DEWALT
AC200+
Pure110+
AC200+
20V XR 6.0Ah

			Base Material								Anchor Diameter												Chemistry		Hole Drill Method*		Hole Condition		
			Concrete	Lightweight Concrete	Grout-filled Concrete Masonry	Hollow Concrete Masonry	Solid Brick	Hollow Brick	Stone	Structural Clay/Tile	1/4"	3/8" (#3)	1/2" (#4)	5/8" (#5)	3/4" (#6)	7/8" (#7)	1" (#8)	1-1/4" (# 10)	1-3/8"	1-1/2"	1-3/4"	2"	Epoxy Resin	Hybrid / Ester Based Resin	Hammer-drill	Core-drill	Dry	Wet	Building Code / Jurisdiction Recognition
Injection Adhesives	Fast Cure Acrylics	**AC200+™**	●	●	○		○					●	●	●	●	●	●	●	○	○				●	●		●	●	ICC-ES ESR-4027 IBC, NBC, City of LA, FBC, NSF, DOT
Injection Adhesives	Fast Cure Acrylics	**AC100+ Gold®**	●	●	●	●	●	○	○	○	○	●	●	●	●	●	●	●	○	○	○	○		●	●		●	●	ICC-ES ESR-2582 IBC, NBC, City of LA, FBC, NSF, DOT
Injection Adhesives	Fast Cure Acrylics	**AC50™**	●	○								●	●	●	●	○	●	○						●	●		●		DOT
Injection Adhesives	Standard Cure Epoxies	**Pure110+®**	●	●	●	●	○	○	○	○	○	●	●	●	●	●	●	●	○	○	○	○	●		●	○	●	●	ICC-ES ESR-3298 IBC, NBC, City of LA, FBC, NSF, DOT
Injection Adhesives	Standard Cure Epoxies	**Pure GP**	●	○								●	●	●	●	○	●	○					●		●		●	●	DOT
Injection Adhesives	Standard Cure Epoxies	**Pure50+™**	●	●	○	○	○		○			●	●	●	●	●	●	●					●		●	○	●	●	ICC-ES ESR-3576 IBC, FBC, NSF, DOT
Injection Adhesives	Standard Cure Epoxies	**PE1000+®**	●	●	●	○	○		○	○	○	●	●	●	●	●	●	●	○	○	○	○	●		●	●	●	●	ICC-ES ESR-2583 IBC, FBC, NSF, DOT
Glass Capsules		**Hammer-Capsule®**	●	○	●							●	●	●	●	●	●							●	●		●	●	DOT

● Suitable ○ May be Suitable

*Hammer-drill, i.e. rotary impact drills or rock drills with a carbide drill bit (including hollow drill bits); core-drill i.e. core-drill with a diamond core-drill bit.

GENERAL INFORMATION

AC200+™

Acrylic Injection Adhesive Anchoring System
and Post-Installed Reinforcing Bar Connections

PRODUCT DESCRIPTION

The AC200+ is a two-component, high strength adhesive anchoring system. The system includes injection adhesive in plastic cartridges, mixing nozzles, dispensing tools and hole cleaning equipment. The AC200+ is designed for bonding threaded rod and reinforcing bar hardware into drilled holes in concrete base materials and for post-installed reinforcing bar connections.

GENERAL APPLICATIONS AND USES

- Bonding threaded rod and reinforcing bar into hardened concrete
- Evaluated for installation and use in dry and wet concrete
- Fast curing system which can be installed in a wide range of base material temperatures
- Qualified for seismic (earthquake) and wind loading

FEATURES AND BENEFITS

+ Designed for use with threaded rod and reinforcing bar hardware elements
+ Evaluated and recognized for freeze/thaw performance
+ Versatile system which can be used in a wide range of embedments in low and high strength concrete
+ Cartridge design allows for multiple uses using extra mixing nozzles
+ Mixing nozzles proportion adhesive and provide simple delivery method into drilled holes
+ Evaluated and recognized for long term and short term loading (see performance tables)

APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES) ESR-4027 for cracked and uncracked concrete
- Code Compliant with 2015 IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, and 2009 IRC
- Tested in accordance with ACI 355.4, ASTM E 488, and ICC-ES AC308 for use in structural concrete (Design according to ACI 318-14, Chapter 17 and ACI 318-11/08 Appendix D)
- Evaluated and qualified by an accredited independent testing laboratory for recognition in cracked and uncracked concrete including seismic and wind loading
- Compliant with NSF/ANSI 61 for drinking water system components - health effects; minimum requirements for materials in contact with potable water and water treatment
- Conforms to requirements of ASTM C881 and AASHTO M235, Types I, II, IV and V, Grade 3, Class A
- Department of Transportation listings - see www.DEWALT.com or contact transportation agency

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, and 05 05 19 Post-Installed Concrete Anchors. Adhesive anchoring system shall be AC200+ as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and requirements of the Authority Having Jurisdiction.

CODE LISTED
ICC-ES ESR-4027
CONCRETE

SECTION CONTENTS

PACKAGING

Coaxial Cartridge

- 10 fl. oz.

Dual (side-by-side) Cartridge

- 28 fl. oz.

STORAGE LIFE & CONDITIONS

Dual cartridge: Eighteen months
Coaxial cartridge: Eighteen months
In a dry, dark environment with temperature ranging from 41°F to 90°F (5°C to 32°C)

ANCHOR SIZE RANGE (TYPICAL)

- 3/8" to 1-1/4" diameter threaded rod
- No. 3 to No. 10 reinforcing bar (rebar)

SUITABLE BASE MATERIALS

- Normal-weight concrete
- Lightweight concrete

PERMISSIBLE INSTALLATION CONDITIONS (ADHESIVE)

- Dry concrete
- Water-saturated concrete (wet)

STRENGTH DESIGN (SD)

Installation Specifications for Threaded Rod and Reinforcing Bar[1]

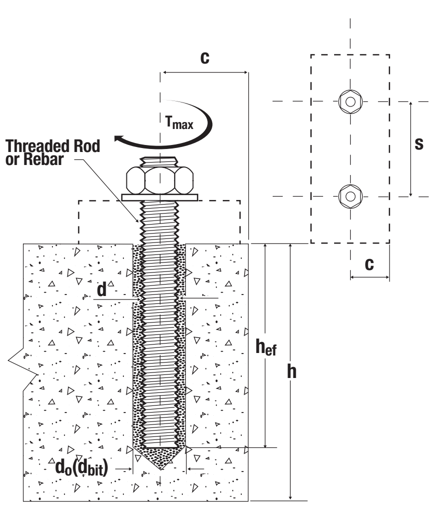
CODE LISTED
ICC-ES ESR-4027

STRENGTH DESIGN SD TABLES

Dimension/Property	Notation	Units	Nominal Anchor Size											
Threaded Rod	-	-	3/8	-	1/2	-	5/8	-	3/4	7/8	1	-	1-1/4	-
Reinforcing Bar	-	-	-	#3	-	#4	-	#5	#6	#7	#8	#9	-	#10
Nominal anchor diameter	d_a	in. (mm)	0.375 (9.5)		0.500 (12.7)		0.625 (15.9)		0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.125 (28.6)	1.250 (31.8)	
Nominal ANSI drill bit size	d_o [d_{bit}]	in.	7/16 ANSI	1/2 ANSI	9/16 ANSI	5/8 ANSI	11/16 ANSI	3/4 ANSI	7/8 ANSI	1 ANSI	1-1/8 ANSI	1-3/8 ANSI	1-3/8 ANSI	1-1/2 ANSI
Minimum embedment	$h_{ef,min}$	in. (mm)	2-3/8 (60)		2-3/4 (70)		3-1/8 (79)		3-1/2 (89)	3-1/2 (89)	4 (102)	4-1/2 (114)	5 (127)	
Maximum embedment	$h_{ef,max}$	in. (mm)	7-1/2 (191)		10 (254)		12-1/2 (318)		15 (381)	17-1/2 (445)	20 (508)	22-1/2 (572)	25 (635)	
Minimum concrete member thickness	h_{min}	in. (mm)	hef + 1-1/4 (hef + 30)				hef + 2do							
Minimum spacing distance	s_{min}	in. (mm)	1-7/8 (48)		2-1/2 (62)		3 (76)		3-5/8 (92)	4-1/4 (108)	4-3/4 (121)	5-1/4 (133)	5-7/8 (149)	
Minimum edge distance (100% T_{max})	c_{min}	in. (mm)	1-5/8 (41)		1-3/4 (44)		2 (51)		2-3/8 (60)	2-1/2 (64)	2-3/4 (70)	3 (75)	3-1/4 (80)	
Maximum Torque[2]	T_{max}	ft-lbs	15[3]		30		44		66	96	147	185	221	
Minimum edge distance, reduced[2,4,5] (45% T_{max})	$c_{min,red}$	in (mm)	-		-		1-3/4 (44)		1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	2-3/4 (70)	2-3/4 (70)	
Maximum Torque, reduced[2]	$T_{max,red}$	ft-lbs	7[3]		14		20		30	43	66	83	99	

1. For use with the design provisions of ACI 318-14 Ch. 17 or ACI 318-11 Appendix D as applicable, ICC-ES AC308, Section 4.2 and ESR-4027
2. Torque may not be applied to the anchors until the full cure time of the adhesive has been achieved
3. For ASTM A36/F1554 Grade 36 carbon steel threaded rods, T_{max} = 11 ft.-lb, $T_{max,red}$ = 5.
4. For installations at the reduced minimum edge distance, $c_{min,red}$, the maximum toque applied must be max torque reduced, $T_{max,red}$.
5. For installations at the reduced minimum edge distance, $c_{min,red}$, the miminim spacing, s_{min} = 5 x d_a.

Detail of Steel Hardware Elements used with Injection Adhesive System



Threaded Rod and Deformed Reinforcing Bar Material Properties

Steel Description (General)	Steel Specification (ASTM)	Nominal Anchor Size (inch)	Minimum Ultimate Strength f_u psi (MPa)	Minimum Yield Strength f_y psi (MPa)
Carbon Rod	ASTM A36 or F1554, Grade 36	3/8 through 1-1/4	58,000 (400)	36,000 (250)
	ASTM F1554 Grade 55		75,000 (517)	55,000 (380)
	ASTM A193 Grade B7		125,000 (860)	105,000 (724)
	ASTM F1554 Grade 105		125,000 (860)	105,000 (724)
	ASTM A449	3/8 through 1	120,000 (828)	92,000 (635)
	ASTM A449	1-1/4	105,000 (720)	81,000 (560)
	ASTM F568M Class 5.8	3/4 through 1-1/4	72,500 (500)	58,000 (400)
Stainless Rod (Alloy 304 / 316)	ASTM F593 CW1	3/8 through 5/8	100,000 (690)	65,000 (450)
	ASTM F593 CW2	3/4 through 1-1/4	85,000 (590)	45,000 (310)
	ASTM A193/A193M Grade B8/B8M2, Class 2B	3/8 through 1-1/4	95,000 (655)	75,000 (515)
Grade 60 Reinforcing Bar	ASTM A615, A767, A996 Grade 60	3/8 through 1-1/4 (#3 through #10)	90,000 (620)	60,000 (414)
	ASTM A706 Grade 60		80,000 (550)	60,000 (414)
Grade 40 Reinforcing Bar	ASTM A615 Grade 40	3/8 through 3/4 (#3 through #6)	60,000 (415)	40,000 (275)

Steel Tension and Shear Design for Threaded Rod in Normal Weight Concrete (For use with load combinations taken from ACI 318-14 Section 5.3)

CODE LISTED
ICC-ES ESR-4027

STRENGTH DESIGN SD TABLES

Design Information		Symbol	Units	Nominal Rod Diameter[1] (inch)						
				3/8	1/2	5/8	3/4	7/8	1	1-1/4
Threaded rod nominal outside diameter		d	inch (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.250 (31.8)
Threaded rod effective cross-sectional area		A_{se}	inch² (mm²)	0.0775 (50)	0.1419 (92)	0.2260 (146)	0.3345 (216)	0.4617 (298)	0.6057 (391)	0.9691 (625)
ASTM A 36 and ASTM F 1554 Grade 36	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	4,495 (20.0)	8,230 (36.6)	13,110 (58.3)	19,400 (86.3)	26,780 (119.1)	35,130 (156.3)	56,210 (250.0)
		V_{sa}	lbf (kN)	2,695 (12.0)	4,940 (22.0)	7,860 (35.0)	11,640 (51.8)	16,070 (71.4)	21,080 (93.8)	33,725 (150.0)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.60						
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM F 1554 Grade 55	Nominal strength as governed by steel strength(for a single anchor)	N_{sa}	lbf (kN)	5,810 (25.9)	10,640 (47.3)	16,950 (75.4)	25,085 (111.6)	34,625 (154.0)	45,425 (202.0)	72,680 (323.3)
		V_{sa}	lbf (kN)	3,485 (15.5)	6,385 (28.4)	10,170 (45.2)	15,050 (67.0)	20,775 (92.4)	27,255 (121.2)	43,610 (194.0)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.60						
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM A 193 Grade B7 and ASTM F 1554 Grade 105	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	9,685 (43.1)	17,735 (78.9)	28,250 (125.7)	41,810 (186.0)	57,710 (256.7)	75,710 (336.8)	121,135 (538.8)
		V_{sa}	lbf (kN)	5,815 (25.9)	10,640 (7.3)	16,950 (75.4)	25,085 (111.6)	34,625 (154.0)	45,425 (202.1)	72,680 (323.3)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.60						
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM A 449	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	9,300 (41.4)	17,025 (75.7)	27,120 (120.6)	40,140 (178.5)	55,905 (248.7)	72,685 (323.3)	101,755 (452.6)
		V_{sa}	lbf (kN)	5,580 (24.8)	10,215 (45.4)	16,270 (72.4)	24,085 (107.1)	33,540 (149.2)	43,610 (194.0)	61,050 (271.6)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.60						
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM F 568M Class 5.8	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	5,620 (25.0)	10,290 (45.8)	16,385 (72.9)	24,250 (107.9)	33,475 (148.9)	43,915 (195.4)	70,260 (312.5)
		V_{sa}	lbf (kN)	3,370 (15.0)	6,175 (27.5)	9,830 (43.7)	14,550 (64.7)	20,085 (89.3)	26,350 (117.2)	42,155 (187.5)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.60						
	Strength reduction factor for tension[2]	ϕ	-	0.65						
	Strength reduction factor for shear[2]	ϕ	-	0.60						
ASTM F 593 CW Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	7,750 (34.5)	14,190 (63.1)	22,600 (100.5)	28,430 (126.5)	39,245 (174.6)	51,485 (229.0)	82,370 (366.4)
		V_{sa}	lbf (kN)	4,650 (20.7)	8,515 (37.9)	13,560 (60.3)	17,060 (75.9)	23,545 (104.7)	30,890 (137.4)	49,425 (219.8)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.60						
	Strength reduction factor for tension[2]	ϕ	-	0.65						
	Strength reduction factor for shear[2]	ϕ	-	0.60						
ASTM A 193 Grade B8/ B8M2, Class 2B Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	7,365 (32.8)	13,480 (60.0)	21,470 (95.5)	31,775 (141.3)	43,860 (195.1)	57,545 (256.0)	92,065 (409.5)
		V_{sa}	lbf (kN)	4,420 (19.7)	8,085 (36.0)	12,880 (57.3)	19,065 (84.8)	26,315 (117.1)	34,525 (153.6)	55,240 (245.7)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.60						
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						

For SI: 1 inch = 25.4 mm, 1 lbf = 4.448 N. For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf.

1. Values provided for steel element material types are based on minimum specified strengths and calculated in accordance with ACI 318-14 Eq. 17.4.1.2 and Eq. 17.5.1.2b or ACI 318-11 Eq. (D-2) and Eq. (D-29), as applicable, except where noted. Nuts and washers must be appropriate for the rod. Nuts must have specified proof load stresses equal to or greater than the minimum tensile strength of the specified threaded rod.
2. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4.

Steel Tension and Shear Design for Reinforcing Bars in Normal Weight Concrete (For use with load combinations taken from ACI 318-14 Section 5.3)

CODE LISTED ICC-ES ESR-4027

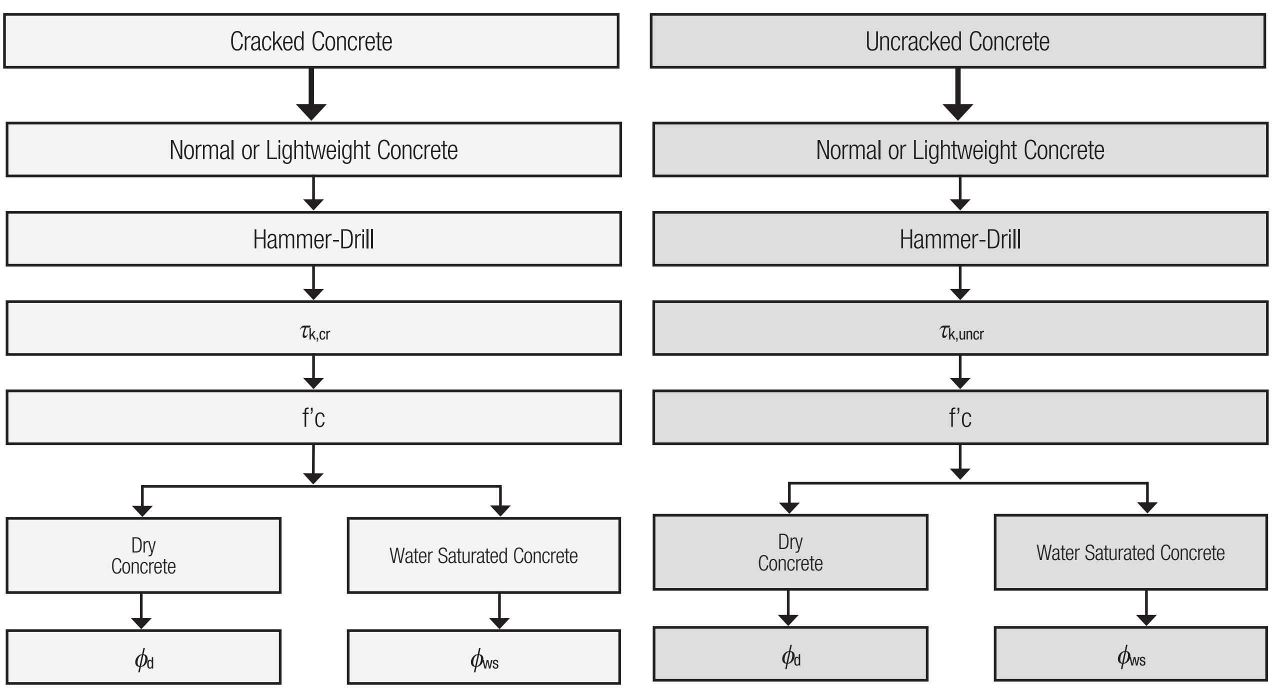
STRENGTH DESIGN TABLES SD

Design Information		Symbol	Units	Nominal Reinforcing Bar Size (Rebar)[1]							
				No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10
Rebar nominal outside diameter		d	inch (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.125 (28.7)	1.250 (32.3)
Rebar effective cross-sectional area		A_{se}	inch² (mm²)	0.110 (71.0)	0.200 (129.0)	0.310 (200.0)	0.440 (283.9)	0.600 (387.1)	0.790 (509.7)	1.000 (645.2)	1.270 (819.4)
ASTM A615, A767, A996 Grade 60	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	9,900 (44.0)	18,000 (80.1)	27,900 (124.1)	39,600 (176.1)	54,000 (240.2)	71,100 (316.3)	90,000 (400.3)	114,300 (508.4)
		V_{sa}	lbf (kN)	5,940 (26.4)	10,800 (48.0)	16,740 (74.5)	23,760 (105.7)	32,400 (144.1)	42,660 (189.8)	54,000 (240.2)	68,580 (305.0)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.65							
	Strength reduction factor for tension[2]	ϕ	-	0.65							
	Strength reduction factor for shear[2]	ϕ	-	0.60							
ASTM A706 Grade 60	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	8,800 (39.1)	16,000 (71.2)	24,800 (110.3)	35,200 (156.6)	48,000 (213.5)	63,200 (281.1)	80,000 (355.9)	101,600 (452.0)
		V_{sa}	lbf (kN)	5,280 (23.5)	9,600 (42.7)	14,880 (66.2)	21,120 (94.0)	28,800 (128.1)	37,920 (168.7)	48,000 (213.5)	60,960 (271.2)
	Reduction factor for seismic shear	$\alpha_{V,seis}$		0.65							
	Strength reduction factor for tension[2]	ϕ	-	0.75							
	Strength reduction factor for shear[2]	ϕ	-	0.65							
ASTM A 615 Grade 40	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	6,600 (29.4)	12,000 (53.4)	18,600 (82.7)	26,400 (117.4)	In accordance with ASTM A 615, Grade 40 bars are furnished only in sizes No. 3 through No. 6			
		V_{sa}	lbf (kN)	3,960 (17.6)	7,200 (32.0)	11,160 (49.6)	15,840 (70.5)				
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.65							
	Strength reduction factor for tension[2]	ϕ	-	0.65							
	Strength reduction factor for shear[2]	ϕ	-	0.60							

For SI: 1 inch = 25.4 mm, 1 lbf = 4.448 N. For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf.

1. Values provided for reinforcing bar material types based on minimum specified strengths and calculated in accordance with ACI 318-14 Eq. 17.4.1.2 and Eq. 17.5.1.2b or ACI 318-11 Eq. (D-2) and Eq. (D-29), as applicable.
2. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4.

FLOWCHART FOR THE ESTABLISHMENT OF DESIGN BOND STRENGTH



Concrete Breakout Design Information for Threaded Rod and in Holes Drilled with a Hammer Drill and Carbide Bit[1]

CODE LISTED ICC-ES ESR-4027

STRENGTH DESIGN SD TABLES

Design Information	Symbol	Units	Nominal Rod Diameter (inch)						
			3/8	1/2	5/8	3/4	7/8	1	1-1/4
Effectiveness factor for cracked concrete	$k_{c,cr}$	- (SI)	17 (7.1)						
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	- (SI)	24 (10.0)						
Minimum embedment	$h_{ef,min}$	inch (mm)	2-3/8 (60)	2-3/4 (70)	3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	5 (127)
Maximum embedment	$h_{ef,max}$	inch (mm)	7-1/2 (191)	10 (254)	12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)	25 (635)
Minimum anchor spacing	s_{min}	inch (mm)	1-7/8 (48)	2-1/2 (64)	3-1/8 (79)	3-5/8 (90)	4-1/8 (105)	4-3/4 (120)	5-7/8 (150)
Minimum edge distance[2]	c_{min}	inch (mm)	1-5/8 (41)	1-3/4 (44)	2 (51)	2-3/8 (60)	2-1/2 (64)	2-3/4 (70)	3-1/4 (80)
Minimum edge distance, reduced[2] (45% T_{max})	$c_{min,red}$	inch (mm)	-	-	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	2-3/4 (70)
Minimum member thickness	h_{min}	inch (mm)	h_{ef} + 1-1/4 (h_{ef} + 30)		$h_{ef} + 2d_o$ where d_o is hole diameter;				
Critical edge distance—splitting (for uncracked concrete only)[3]	c_{ac}	inch	$c_{ac} = h_{ef} \cdot (\frac{\tau_{uncr}}{1160})^{0.4} \cdot [3.1-0.7 \frac{h}{h_{ef}}]$						
		(mm)	$c_{ac} = h_{ef} \cdot (\frac{\tau_{uncr}}{8})^{0.4} \cdot [3.1-0.7 \frac{h}{h_{ef}}]$						
Strength reduction factor for tension, concrete failure modes, Condition B[4]	ϕ	-	0.65						
Strength reduction factor for shear, concrete failure modes, Condition B[4]	ϕ	-	0.70						

For SI: 1 inch = 25.4 mm, 1 lbf = 4.448 N. For pound-inch units: 1 mm = 0.03937 inch, 1 N = 0.2248 lbf.

1. Additional setting information is described in the installation instructions.
2. For installation between the minimum edge distance, c_{min}, and the reduced minimum edge distance, $c_{min,red}$, the maximum torque applied must be reduced (multiplied) by a factor of 0.45.
3. $\tau_{k,uncr}$ need not be taken as greater than: $\tau_{k,uncr} = \frac{k_{uncr} \bullet \sqrt{h_{ef} \bullet f'c}}{\pi \bullet d}$ and $\frac{h}{h_{ef}}$ need not be taken as larger than 2.4.
4. Condition A requires supplemental reinforcement, while Condition B applies where supplemental reinforcement is not provided or where pryout governs, as set forth in ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4.

Bond Strength Design Information for Threaded Rod in Holes Drilled with a Hammer Drill and Carbide Bit[1]

CODE LISTED ICC-ES ESR-4027

STRENGTH DESIGN SD TABLES

Design Information		Symbol	Units	Nominal Rod Diameter (inch)						
				3/8	1/2	5/8	3/4	7/8	1	1-1/4
Minimum embedment		$h_{ef,min}$	inch (mm)	2-3/8 (60)	2-3/4 (70)	3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	5 (127)
Maximum embedment		$h_{ef,max}$	inch (mm)	7-1/2 (191)	10 (254)	12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)	25 (635)
Temperature Range A 122°F (50°C) Maximum Long-Term Service Temperature; 176°F (80°C) Maximum Short-Term Service Temperature[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	psi (N/mm^2)	1,041 (7.2)	1,041 (7.2)	1,111 (7.7)	1,219 (8.4)	1,212 (8.4)	1,206 (8.3)	1,146 (7.9)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	psi (N/mm^2)	2,601 (17.9)	2,415 (16.7)	2,262 (15.6)	2,142 (14.8)	2,054 (14.2)	2,000 (13.8)	1,990 (13.7)
Temperature Range B 161°F (72°C) Maximum Long-Term Service Temperature; 248°F (120°C) Maximum Short-Term Service Temperature[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	psi (N/mm^2)	905 (6.2)	906 (6.2)	966 (6.7)	1060 (7.3)	1054 (7.3)	1049 (7.2)	997 (6.9)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	psi (N/mm^2)	2,263 (15.6)	2,101 (14.5)	1,968 (13.6)	1,863 (12.8)	1,787 (12.3)	1,740 (12.0)	1732 (11.9)
Temperature Range C 212°F (100°C) Maximum Long-Term Service Temperature; 320°F (160°C) Maximum Short-Term Service Temperature[2,3]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	psi (N/mm^2)	652 (4.5)	653 (4.5)	696 (4.8)	764 (5.3)	760 (5.2)	756 (5.2)	719 (5.0)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	psi (N/mm2)	1631 (11.2)	1514 (10.4)	1418 (9.8)	1343 (9.3)	1288 (8.9)	1254 (8.6)	1248 (8.6)
Dry concrete	Anchor Category	-	-	1						
	Strength reduction factor	ϕ_d	-	0.65						
Water-saturated concrete	Anchor Category	-	-	2						
	Strength reduction factor	ϕ_{ws}	-	0.55						
Reduction factor for seismic tension[9]		$\alpha_{N,seis}$	-	0.95						

For SI: 1 inch = 25.4 mm, 1 psi = 0.006894 MPa. For pound-inch units: 1 mm = 0.03937 inch, 1 MPa = 145.0 psi.

1. Bond strength values correspond to a normal-weight concrete compressive strength f'c = 2,500 psi (17.2 MPa). For concrete compressive strength, f'c between 2,500 psi and 8,000 psi (17.2 MPa and 55.2 MPa), the tabulated characteristic bond strength may be increased by a factor of $(f'c / 2,500)^{0.10}$ [For SI: $(f'c / 17.2)^{0.10}$].
2. Short-term elevated concrete base material service temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling. Long-term elevated concrete base material service temperatures are roughly constant over significant periods of time.
3. Characteristic bond strengths are for sustained loads including dead and live loads. For load combinations consisting of short-term loads only, such as wind, bond strengths may be increased by 23 percent for the temperature range C.

ADHESIVES

AC200+™ Acrylic Injection Adhesive Anchoring System

Concrete Breakout Design Information for Reinforcing Bars in Holes Drilled with a Hammer Drill and Carbide Bit[1]

CODE LISTED ICC-ES ESR-4027

Design Information	Symbol	Units	#3	#4	#5	#6	#7	#8	#9	#10
			Nominal Bar Size							
Effectiveness factor for cracked concrete	$k_{c,cr}$	- (SI)	17 (7.1)							
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	- (SI)	24 (10.0)							
Minimum embedment	$h_{ef,min}$	inch (mm)	2-3/8 (60)	2-3/4 (70)	3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	4-1/2 (114)	5 (127)
Maximum embedment	$h_{ef,max}$	inch (mm)	7-1/2 (191)	10 (254)	12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)	22-1/2 (572)	25 (635)
Minimum anchor spacing	s_{min}	inch (mm)	1-7/8 (48)	2-1/2 (64)	3 (79)	3-5/8 (92)	4-1/4 (105)	4-3/4 (120)	5-1/4 (133)	5-7/8 (150)
Minimum edge distance[2]	c_{min}	inch (mm)	1-5/8 (41)	1-3/4 (44)	2 (51)	2-3/8 (60)	2-1/2 (64)	2-3/4 (70)	3 (75)	3-1/4 (80)
Minimum edge distance, reduced[2]	$c_{min,red}$	inch (mm)	-	-	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	2-3/4 (70)	2-3/4 (70)
Minimum member thickness	h_{min}	inch (mm)	h_{ef} + 1-1/4 (h_{ef} + 30)		$h_{ef} + 2d_o$ where d_o is hole diameter;					
Critical edge distance—splitting (for uncracked concrete only)[3]	c_{ac}	inch	$c_{ac} = h_{ef} \cdot (\frac{\tau_{uncr}}{1160})^{0.4} \cdot [3.1-0.7\frac{h}{h_{ef}}]$							
		(mm)	$c_{ac} = h_{ef} \cdot (\frac{\tau_{uncr}}{8})^{0.4} \cdot [3.1-0.7\frac{h}{h_{ef}}]$							
Strength reduction factor for tension, concrete failure modes, Condition B[4]	ϕ	-	0.65							
Strength reduction factor for shear, concrete failure modes, Condition B[4]	ϕ	-	0.70							

For SI: 1 inch = 25.4 mm, 1 lbf = 4.448 N. For pound-inch units: 1 mm = 0.03937 inch, 1 N = 0.2248 lbf.

1. Additional setting information is described in the installation instructions.
2. For installation between the minimum edge distance, c_{min}, and the reduced minimum edge distance, $c_{min,red}$, the maximum torque applied must be reduced (multiplied) by a factor of 0.45.
3. $\tau_{k,uncr}$ need not be taken as greater than: $\tau_{k,uncr} = \frac{k_{uncr} \cdot \sqrt{h_{ef} \cdot f'c}}{\pi \cdot d}$ and $\frac{h}{h_{ef}}$ need not be taken as larger than 2.4.
4. Condition A requires supplemental reinforcement, while Condition B applies where supplemental reinforcement is not provided or where pryout governs, as set forth in ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4.

Bond Strength Design Information for Reinforcing Bars in Holes Drilled with a Hammer Drill and Carbide Bit[1]

CODE LISTED ICC-ES ESR-4027

Design Information		Symbol	Units	#3	#4	#5	#6	#7	#8	#9	#10
				Nominal Bar Size							
Minimum embedment		$h_{ef,min}$	inch (mm)	2-3/8 (60.0)	2-3/4 (70.0)	3-1/8 (79.0)	3-1/2 (89.0)	3-1/2 (89.0)	4 (102.0)	4-1/2 (114.0)	5 (127.0)
Maximum embedment		$h_{ef,max}$	inch (mm)	7-1/2 (191.0)	10 (254.0)	12-1/2 (318.0)	15 (381.0)	17-1/2 (445.0)	20 (508.0)	22-1/2 (572.0)	25 (635.0)
Temperature Range A 122°F (50°C) Maximum Long-Term Service Temperature; 176°F (80°C) Maximum Short-Term Service Temperature[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	psi (N/mm²)	1,088 (7.5)	1,053 (7.3)	1,128 (7.8)	1,169 (8.1)	1,174 (8.1)	1,156 (8.0)	1,141 (7.9)	1,164 (8.0)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	psi (N/mm²)	2,200 (15.2)	2,101 (14.5)	2,028 (14.0)	1,969 (13.6)	1,921 (13.2)	1,881 (13.0)	1,846 (12.7)	1,815 (12.5)
Temperature Range B 161°F (72°C) Maximum Long-Term Service Temperature; 248°F (120°C) Maximum Short-Term Service Temperature[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	psi (N/mm²)	947 (6.5)	916 (6.3)	982 (6.8)	1,017 (7.0)	1,021 (7.0)	1,006 (6.9)	993 (6.8)	1,012 (7.0)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	psi (N/mm²)	1,914 (13.2)	1,828 (12.6)	1,764 (12.2)	1,713 (11.8)	1,672 (11.5)	1,636 (11.3)	1,616 (11.1)	1,579 (10.9)
Temperature Range C 212°F (100°C) Maximum Long-Term Service Temperature; 320°F (160°C) Maximum Short-Term Service Temperature[2,3]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	psi (N/mm²)	682 (4.7)	660 (4.6)	707 (4.9)	733 (5.1)	736 (5.1)	725 (5.0)	715 (4.9)	730 (5.0)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	psi (N/mm²)	1,379 (9.5)	1,317 (9.1)	1,271 (8.8)	1,235 (8.5)	1,205 (8.3)	1,179 (8.1)	1,157 (8.0)	1,138 (7.8)
Dry concrete	Anchor Category	-	-	1							
	Strength reduction factor	ϕ_d	-	0.65							
Water-saturated concrete	Anchor Category	-	-	2							
	Strength reduction factor	ϕ_{ws}	-	0.55							
Reduction factor for seismic tension[9]		$\alpha_{N,seis}$	-	0.95		1.00					

For SI: 1 inch = 25.4 mm, 1 psi = 0.006894 MPa. For pound-inch units: 1 mm = 0.03937 inch, 1 MPa = 145.0 psi.

1. Bond strength values correspond to a normal-weight concrete compressive strength f'c = 2,500 psi (17.2 MPa). For concrete compressive strength, f'c between 2,500 psi and 8,000 psi (17.2 MPa and 55.2 MPa), the tabulated characteristic bond strength may be increased by a factor of $(f'c / 2{,}500)^{0.10}$ [For SI: $(f'c / 17.2)^{0.10}$].
2. Short-term elevated concrete base material service temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling. Long-term elevated concrete base material service temperatures are roughly constant over significant periods of time.
3. Characteristic bond strengths are for sustained loads including dead and live loads. For load combinations consisting of short-term loads only, such as wind, bond strengths may be increased by 23 percent for the temperature range C.

Tension and Shear Design Strength for Threaded Rod Installed in Uncracked Concrete (Bond or Concrete Strength)
Drilled with a Hammer-Drill and Carbide Bit in a Dry Hole Condition
Temperature Range A: 122°F (50°C) Maximum Long-Term Service Temperature; 176°F (80°C) Maximum Short-Term Service Temperature[1,2,3,4,5,6,7,8,9]

STRENGTH DESIGN SD TABLES

Nominal Rod Size (in.)	Embed. Depth hef (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)
3/8	2-3/8	2,855	2,570	3,125	2,920	3,610	3,575	4,425	4,745	5,105	5,500
	3	4,055	4,010	4,440	4,555	5,125	5,570	6,280	7,400	6,710	8,775
	4-1/2	7,445	7,935	8,155	9,015	9,395	11,015	9,785	13,710	10,070	16,015
	7-1/2	14,940	18,190	15,215	20,070	15,655	23,445	16,305	29,180	16,780	34,085
1/2	2-3/4	3,555	3,305	3,895	3,755	4,500	4,590	5,510	6,095	6,365	7,455
	4	6,240	6,700	6,835	7,610	7,895	9,310	9,665	12,365	11,080	15,080
	6	11,465	13,235	12,560	15,035	14,500	18,390	16,150	23,515	16,620	27,470
	10	24,660	31,215	25,110	34,445	25,845	40,235	26,915	50,085	27,700	58,500
5/8	3-1/8	4,310	4,120	4,720	4,680	5,450	5,720	6,675	7,600	7,710	9,295
	5	8,720	9,985	9,555	11,345	11,030	13,875	13,510	18,430	15,600	22,540
	7-1/2	16,020	19,725	17,550	22,410	20,265	27,410	23,635	35,695	24,325	41,695
	12-1/2	34,470	46,550	36,750	52,320	37,825	61,110	39,390	76,070	40,540	87,310
3/4	3-1/2	5,105	5,015	5,595	5,700	6,460	6,970	7,910	9,255	9,135	11,320
	6	11,465	13,595	12,560	15,445	14,500	18,895	17,760	25,095	20,505	30,695
	9	21,060	26,855	23,070	30,510	26,640	37,320	32,225	49,325	33,165	57,615
	15	45,315	63,370	49,640	72,000	51,575	84,420	53,710	105,080	55,280	119,060
7/8	3-1/2	5,105	4,930	5,595	5,605	6,460	6,855	7,910	9,100	9,135	11,130
	7	14,445	16,605	15,825	18,865	18,275	23,075	22,380	30,650	25,840	37,485
	10-1/2	26,540	32,800	29,070	37,265	33,570	45,580	41,115	60,540	43,290	71,360
	17-1/2	57,100	77,405	62,550	87,940	67,315	104,575	70,100	130,170	72,150	152,045
1	4	6,240	6,115	6,835	6,945	7,895	8,495	9,665	11,280	11,160	13,800
	8	17,650	19,750	19,335	22,435	22,325	27,440	27,340	36,450	31,570	44,580
	12	32,425	39,005	35,520	44,315	41,015	54,200	50,230	71,990	55,055	86,235
	20	69,765	92,055	76,425	104,585	85,610	126,375	89,155	157,310	91,755	183,745
1-1/4	5	8,720	8,170	9,555	9,285	11,030	11,355	13,510	15,085	15,600	18,450
	10	24,665	26,380	27,020	29,975	31,200	36,660	38,210	48,690	44,125	59,555
	15	45,315	52,110	49,640	59,200	57,320	72,410	70,200	96,175	81,060	117,630
	25	97,500	122,990	106,805	139,730	123,330	170,905	138,610	219,325	142,655	256,185

☐ - Concrete Breakout Strength ☐ - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in uncracked normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac}
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.
2. Calculations were performed according to ACI 318-14 Ch.17 and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls.
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318-14 Section 5.3 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-4027.
5. Tabular values are permitted for static loads only, seismic loading is not considered with these tables. Periodic special inspection must be performed where required by code, see ESR-4027 for applicable information.
6. For anchors subjected to tension resulting from sustained loading a supplemental check must be performed according to ACI 318-14 17.3.1.2.
7. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Ch.17.
8. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-14 Ch.17, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-14 Ch.17 and ICC-ES AC308 and ESR-4027.
9. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Tension and Shear Design Strength in Threaded Rod Installed in Cracked Concrete (Bond or Concrete Strength)
Drilled with a Hammer-Drill and Carbide Bit in a Dry Hole Condition
Temperature Range A: 122°F (50°C) Maximum Long-Term Service Temperature; 176°F (80°C) Maximum Short-Term Service Temperature[1,2,3,4,5,6,7,8,9]

Nominal Rod Size (in.)	Embed. Depth hef (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)
3/8	2-3/8	1,895	1,835	1,930	2,075	1,985	2,135	2,065	2,225	2,125	2,290
	3	2,390	2,865	2,435	3,255	2,505	3,980	2,610	5,285	2,685	5,785
	4-1/2	3,585	5,665	3,655	6,440	3,760	7,865	3,915	8,435	4,030	8,680
	7-1/2	5,980	12,875	6,090	13,115	6,265	13,495	6,525	14,055	6,715	14,465
1/2	2-3/4	2,520	2,360	2,760	2,680	3,065	3,280	3,190	4,355	3,285	5,325
	4	4,250	4,785	4,330	5,435	4,455	6,650	4,640	8,830	4,775	10,285
	6	6,375	9,455	6,495	10,740	6,685	13,135	6,960	14,990	7,165	15,430
	10	10,630	22,300	10,825	23,315	11,140	23,995	11,600	24,985	11,940	25,715
5/8	3-1/8	3,050	2,940	3,345	3,340	3,860	4,085	4,730	5,430	4,980	6,640
	5	6,175	7,135	6,765	8,105	7,430	9,910	7,740	13,165	7,965	16,100
	7-1/2	10,635	14,090	10,830	16,005	11,145	19,575	11,610	25,000	11,945	25,730
	12-1/2	17,725	33,250	18,050	37,370	18,575	40,010	19,345	41,670	19,910	42,885
3/4	3-1/2	3,620	3,580	3,965	4,070	4,575	4,980	5,605	6,610	6,470	8,085
	6	8,120	9,710	8,895	11,035	10,270	13,495	12,225	17,925	12,585	21,925
	9	14,920	19,185	16,340	21,795	17,610	26,655	18,340	35,230	18,875	40,655
	15	28,005	45,265	28,520	51,425	29,350	60,300	30,565	65,835	31,460	67,755
7/8	3-1/2	3,620	3,525	3,965	4,000	4,575	4,895	5,605	6,500	6,470	7,950
	7	10,230	11,860	11,210	13,475	12,945	16,485	15,850	21,895	17,030	26,775
	10-1/2	18,800	23,430	20,590	26,620	23,780	32,555	24,820	43,240	25,545	50,970
	17-1/2	37,900	55,290	38,595	62,815	39,720	74,695	41,365	89,095	42,570	91,695
1	4	4,420	4,365	4,840	4,960	5,590	6,065	6,845	8,060	7,905	9,855
	8	12,500	14,105	13,695	16,025	15,815	19,600	19,365	26,035	22,130	31,845
	12	22,965	27,860	25,160	31,655	29,050	38,715	32,255	51,425	33,200	61,595
	20	49,255	65,755	50,160	74,705	51,625	90,270	53,760	112,365	55,330	119,170
1-1/4	5	6,175	5,835	6,765	6,630	7,815	8,110	9,570	10,775	11,050	13,175
	10	17,470	18,845	19,140	21,410	22,100	26,185	27,065	34,780	31,255	42,540
	15	32,095	37,220	35,160	42,285	40,600	51,720	47,895	68,695	49,290	84,020
	25	69,060	87,850	74,475	99,810	76,650	122,075	79,820	156,660	82,150	176,940

☐ - Concrete Breakout Strength ☐ - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in cracked normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac}
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.
2. Calculations were performed according to ACI 318-14 Ch.17 and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls.
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318-14 Section 5.3 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-4027.
5. Tabular values are permitted for static loads only, seismic loading is not considered with these tables. Periodic special inspection must be performed where required by code, see ESR-4027 for applicable information.
6. For anchors subjected to tension resulting from sustained loading a supplemental check must be performed according to ACI 318-14 17.3.1.2.
7. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Ch.17.
8. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-14 Ch.17, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-14 Ch.17 and ICC-ES AC308 and ESR-4027.
9. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Tension and Shear Design Strength for Reinforcing Bar Installed in Uncracked Concrete (Bond or Concrete Strength) Drilled with a Hammer-Drill and Carbide Bit in a Dry Hole Condition Temperature Range A: 122°F (50°C) Maximum Long-Term Service Temperature; 176°F (80°C) Maximum Short-Term Service Temperature[1,2,3,4,5,6,7,8,9]

STRENGTH DESIGN SD TABLES

Nominal Rod Size (in.)	Embed. Depth hef (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)
#3	2-3/8	2,855	2,570	3,125	2,920	3,610	3,575	4,365	4,705	4,495	4,840
	3	4,055	4,010	4,440	4,555	5,125	5,570	5,515	7,025	5,675	8,205
	4-1/2	7,445	7,935	7,720	8,820	7,945	10,300	8,275	12,820	8,515	14,975
	7-1/2	12,635	17,010	12,870	18,770	13,245	21,925	13,790	27,290	14,195	30,570
#4	2-3/4	3,555	3,305	3,895	3,755	4,500	4,590	5,510	6,095	6,365	7,455
	4	6,240	6,700	6,835	7,610	7,895	9,310	9,365	12,210	9,640	14,260
	6	11,465	13,235	12,560	15,035	13,490	17,870	14,050	22,240	14,460	25,980
	10	21,450	29,525	21,845	32,580	22,485	38,055	23,415	47,370	24,100	51,905
#5	3-1/8	4,310	4,120	4,720	4,680	5,450	5,725	6,675	7,600	7,710	9,295
	5	8,720	10,005	9,555	11,365	11,030	13,900	13,510	18,465	14,540	21,955
	7-1/2	16,020	19,760	17,550	22,450	20,265	27,460	21,190	34,235	21,805	39,985
	12-1/2	32,355	45,455	32,950	50,155	33,910	58,585	35,315	72,925	36,345	78,280
#6	3-1/2	5,105	5,015	5,595	5,700	6,460	6,970	7,910	9,255	9,135	11,320
	6	11,465	13,595	12,560	15,445	14,500	18,895	17,760	25,095	20,325	30,585
	9	21,060	26,855	23,070	30,510	26,640	37,320	29,625	47,690	30,490	55,705
	15	45,235	63,325	46,065	69,880	47,410	81,620	49,370	101,600	50,815	109,445
#7	3-1/2	5,105	4,930	5,595	5,605	6,460	6,855	7,910	9,100	9,135	11,130
	7	14,445	16,605	15,825	18,865	18,275	23,075	22,380	30,650	25,840	37,485
	10-1/2	26,540	32,800	29,070	37,265	33,570	45,580	39,340	59,480	40,485	69,475
	17-1/2	57,100	77,405	61,170	87,160	62,960	101,810	65,565	126,730	67,475	145,335
#8	4	6,240	6,115	6,835	6,945	7,895	8,495	9,665	11,280	11,160	13,800
	8	17,650	19,750	19,335	22,435	22,325	27,440	27,340	36,450	31,570	44,580
	12	32,425	39,005	35,520	44,315	41,015	54,200	50,230	71,990	51,780	84,145
	20	69,765	92,055	76,425	104,585	80,520	123,310	83,850	153,495	86,295	179,295
#9	4-1/2	7,445	7,110	8,155	8,080	9,420	9,880	11,535	13,125	13,320	16,055
	9	21,060	23,055	23,070	26,190	26,640	32,035	32,625	42,550	37,675	52,040
	13-1/2	38,690	45,540	42,380	51,740	48,940	63,280	59,940	84,050	64,315	99,830
	22-1/2	83,245	107,440	91,190	122,065	100,010	146,245	104,150	182,045	107,190	212,640
#10	5	8,720	8,160	9,555	9,270	11,030	11,335	13,510	15,060	15,600	18,420
	10	24,665	26,430	27,020	30,025	31,200	36,725	38,210	48,780	44,125	59,660
	15	45,315	52,205	49,640	59,310	57,320	72,545	70,200	96,350	78,065	116,085
	25	97,500	123,170	106,805	139,935	121,395	170,075	126,420	211,705	130,110	247,285

☐ - Concrete Breakout Strength ☐ - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in uncracked normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac}
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.
2. Calculations were performed according to ACI 318-14 Ch.17 and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls.
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318-14 Section 5.3 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-4027.
5. Tabular values are permitted for static loads only, seismic loading is not considered with these tables. Periodic special inspection must be performed where required by code, see ESR-4027 for applicable information.
6. For anchors subjected to tension resulting from sustained loading a supplemental check must be performed according to ACI 318-14 17.3.1.2.
7. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Ch.17.
8. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-14 Ch.17, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-14 Ch.17 and ICC-ES AC308 and ESR-4027.
9. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Tension and Shear Design Strength for Reinforcing Bar Installed in Cracked Concrete (Bond or Concrete Strength) Drilled with a Hammer-Drill and Carbide Bit in a Dry Hole Condition Temperature Range A: 122°F (50°C) Maximum Long-Term Service Temperature; 176°F (80°C) Maximum Short-Term Service Temperature[1,2,3,4,5,6,7,8,9]

STRENGTH DESIGN SD TABLES

Nominal Rod Size (in.)	Embed. Depth hef (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ϕN_{cb} or ϕN_{a} Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_{a} Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_{a} Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_{a} Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_{a} Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)
#3	2-3/8	1,980	1,835	2,015	2,085	2,075	2,235	2,160	2,325	2,225	2,395
	3	2,500	2,865	2,545	3,255	2,620	3,980	2,730	5,020	2,810	5,860
	4-1/2	3,750	5,665	3,820	6,300	3,930	7,355	4,090	8,815	4,210	9,070
	7-1/2	6,250	12,150	6,365	13,405	6,550	14,105	6,820	14,690	7,020	15,120
#4	2-3/4	2,520	2,360	2,760	2,680	3,100	3,280	3,225	4,355	3,320	5,325
	4	4,300	4,785	4,380	5,435	4,505	6,650	4,695	8,720	4,830	10,185
	6	6,450	9,455	6,570	10,740	6,760	12,765	7,040	15,165	7,245	15,610
	10	10,750	21,090	10,950	23,270	11,270	24,270	11,735	25,275	12,075	26,015
#5	3-1/8	3,050	2,940	3,345	3,340	3,860	4,090	4,730	5,430	5,055	6,640
	5	6,175	7,145	6,765	8,120	7,545	9,930	7,855	13,190	8,085	15,680
	7-1/2	10,795	14,115	10,995	16,035	11,315	19,615	11,785	24,455	12,130	26,125
	12-1/2	17,995	32,465	18,325	35,825	18,860	40,625	19,640	42,305	20,215	43,540
#6	3-1/2	3,620	3,580	3,965	4,070	4,575	4,980	5,605	6,610	6,470	8,085
	6	8,120	9,710	8,895	11,035	10,270	13,495	11,725	17,925	12,065	21,845
	9	14,920	19,185	16,340	21,795	16,890	26,655	17,585	34,065	18,100	38,985
	15	26,855	45,235	27,350	49,915	28,150	58,300	29,310	63,135	30,170	64,975
#7	3-1/2	3,620	3,525	3,965	4,000	4,575	4,895	5,605	6,500	6,470	7,950
	7	10,230	11,860	11,210	13,475	12,945	16,485	15,850	21,895	16,495	26,775
	10-1/2	18,800	23,430	20,590	26,620	23,085	32,555	24,040	42,485	24,745	49,625
	17-1/2	36,710	55,290	37,385	62,260	38,475	72,720	40,070	86,300	41,240	88,820
#8	4	4,420	4,365	4,840	4,960	5,590	6,065	6,845	8,060	7,905	9,855
	8	12,500	14,105	13,695	16,025	15,815	19,600	19,365	26,035	21,215	31,845
	12	22,965	27,860	25,160	31,655	29,050	38,715	30,920	51,425	31,820	60,105
	20	47,210	65,755	48,080	74,705	49,485	88,080	51,530	109,640	53,035	114,230
#9	4-1/2	5,275	5,080	5,780	5,770	6,670	7,060	8,170	9,375	9,435	11,465
	9	14,920	16,465	16,340	18,710	18,870	22,880	23,110	30,390	26,500	37,170
	13-1/2	27,405	32,530	30,020	36,955	34,665	45,200	38,625	60,035	39,750	71,305
	22-1/2	58,965	76,740	60,060	87,190	61,815	104,460	64,375	130,030	66,250	142,695
#10	5	6,175	5,830	6,765	6,620	7,815	8,100	9,570	10,755	11,050	13,155
	10	17,470	18,880	19,140	21,445	22,100	26,230	27,065	34,840	31,255	42,615
	15	32,095	37,290	35,160	42,365	40,600	51,815	48,645	68,825	50,065	82,920
	25	69,060	87,980	75,645	99,955	77,855	121,485	81,075	151,220	83,440	176,635

☐ - Concrete Breakout Strength ☐ - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in cracked normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac}
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.
2. Calculations were performed according to ACI 318-14 Ch.17 and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls.
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318-14 Section 5.3 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-4027.
5. Tabular values are permitted for static loads only, seismic loading is not considered with these tables. Periodic special inspection must be performed where required by code, see ESR-4027 for applicable information.
6. For anchors subjected to tension resulting from sustained loading a supplemental check must be performed according to ACI 318-14 17.3.1.2.
7. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Ch.17.
8. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-14 Ch.17, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-14 Ch.17 and ICC-ES AC308 and ESR-4027.
9. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

STRENGTH DESIGN TABLES SD

Tension Design of Steel Elements (Steel Strength)[1,2]

Nominal Rod/Rebar Size (in. or No.)	Steel Elements - Threaded Rod and Reinforcing Bar									
	ASTM A36 and ASTM F1554 Grade 36	ASTM F1554 Grade 55	ASTM A193 Grade B7 and ASTM F1554 Grade 105	ASTM A449	ASTM F568M Class 5.8	ASTM F593 CW Stainless (Types 304 and 316)	ASTM A193 Grade B8/ B8M2, Class 2B Stainless (Types 304 and 316)	ASTM A615 Grade 60 Rebar	ASTM A706 Grade 60 Rebar	ASTM A615 Grade 40 Rebar
	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)
3/8 or #3	3,370	4,360	7,265	6,975	3,655	5,040	5,525	6,435	6,600	4,290
1/2 or #4	6,175	7,980	13,300	12,770	6,690	9,225	10,110	11,700	12,000	7,800
5/8 or #5	9,835	12,715	21,190	20,340	10,650	14,690	16,105	18,135	18,600	12,090
3/4 or #6	14,550	18,815	31,360	30,105	15,765	18,480	23,830	25,740	26,400	17,160
7/8 or #7	20,085	25,970	43,285	41,930	21,760	25,510	32,895	35,100	36,000	-
1 or #8	26,350	34,070	56,785	54,515	28,545	33,465	43,160	46,215	47,400	-
#9	-	-	-	-	-	-	-	58,500	60,000	-
1-1/4 or #10	42,160	54,510	90,850	76,315	45,670	53,540	69,050	74,295	76,200	-

■ - Steel Strength

1. Steel tensile design strength according to ACI 318-14 Ch.17, $\phi N_{sa} = \phi \bullet A_{se,N} \bullet f_{uta}$
2. The tabulated steel design strength in tension must be checked against the bond strength/concrete capacity design strength to determine the controlling failure mode, the lowest load level controls.

Shear Design of Steel Elements (Steel Strength)[1,2]

Nominal Rod/Rebar Size (in. or No.)	Steel Elements - Threaded Rod and Reinforcing Bar									
	ASTM A36 and ASTM F1554 Grade 36	ASTM F1554 Grade 55	ASTM A193 Grade B7 and ASTM F1554 Grade 105	ASTM A449	ASTM F568M Class 5.8	ASTM F593 CW Stainless (Types 304 and 316)	ASTM A193 Grade B8/ B8M2, Class 2B Stainless (Types 304 and 316)	ASTM A615 Grade 60 Rebar	ASTM A706 Grade 60 Rebar	ASTM A615 Grade 40 Rebar
	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)
3/8 or #3	1,755	2,265	3,775	3,625	2,020	2,790	2,870	3,565	3,430	2,375
1/2 or #4	3,210	4,150	6,915	6,640	3,705	5,110	5,255	6,480	6,240	4,320
5/8 or #5	5,115	6,610	11,020	10,575	5,900	8,135	8,375	10,045	9,670	6,695
3/4 or #6	7,565	9,785	16,305	15,655	8,730	10,235	12,390	14,255	13,730	9,505
7/8 or #7	10,445	13,505	22,505	21,805	12,050	14,130	17,105	19,440	18,720	-
1 or #8	13,700	17,715	29,525	28,345	15,810	18,535	22,445	25,595	24,650	-
#9	-	-	-	-	-	-	-	32,400	31,200	-
1-1/4 or #10	21,920	28,345	47,250	39,685	25,295	29,655	35,905	41,150	39,625	-

■ - Steel Strength

1. Steel shear design strength according to ACI 318-14 Ch.17, $\phi V_{sa} = \phi \bullet 0.60 \bullet A_{se,V} \bullet f_{uta}$
2. The tabulated steel design strength in shear must be checked against the bond strength/concrete capacity design strength to determine the controlling failure mode, the lowest load level controls.

Development Lengths for Common Reinforcing Bar Connections[1,2,3,6]

Design Information	Symbol	Reference Standard	Units	Nominal Rebar Size (US)							
				#3	#4	#5	#6	#7	#8	#9	#10
Nominal rebar diameter	d_b	ASTM A615/A706, Grade 60 (fy = 60 ksi)	in. (mm)	0.375 (9.5)	0.5 (12.7)	0.625 (15.9)	0.75 (19.1)	0.875 (22.2)	1 (25.4)	1.128 (28.6)	1.27 (32.3)
Nominal rebar area	A_b		in² (mm²)	0.11 (71)	0.2 (127)	0.31 (198)	0.44 (285)	0.6 (388)	0.79 (507)	1 (645)	1.27 (817)
Development length in f'c = 2,500 psi concrete[4,5]	l_d	ACI 318-14 25.4.2.3 or ACI 318-11 12.2.3 as applicable	in. (mm)	12 (305)	14.4 (366)	18 (457)	21.6 (549)	31.5 (800)	36 (914)	40.6 (1031)	45.7 (1161)
Development length in f'c = 3,000 psi concrete[4,5]			in. (mm)	12 (305)	13.1 (334)	16.4 (417)	19.7 (501)	28.8 (730)	32.9 (835)	37.1 (942)	41.7 (1060)
Development length in f'c = 4,000 psi concrete[4,5]			in. (mm)	12 (305)	12 (305)	14.2 (361)	17.1 (434)	24.9 (633)	28.5 (723)	32.1 (815)	36.2 (920)
Development length in f'c = 6,000 psi concrete[4,5]			in. (mm)	12 (305)	12 (305)	12 (305)	13.9 (354)	20.3 (516)	23.2 (590)	26.2 (666)	29.5 (750)
Development length in f'c = 8,000 psi concrete[4,5]			in. (mm)	12 (305)	12 (305)	12 (305)	12.1 (307)	17.6 (443)	20.1 (511)	22.7 (577)	25.6 (649)

For SI: 1 inch = 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa; for pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi.

1. Calculated development lengths in accordance with ACI 318-14 25.4.2.3 or ACI 318-11 12.2.3, as applicable, for reinforcing bars are valid for static, wind, and earthquake loads.
2. Calculated development lengths in SDC C through F must comply with ACI 318-14 Chapter 18 or ACI 318-11 Chapter 21, as applicable.
3. For Class B splices, minimum length of lap for tension lap splices is $1.3l_d$ in accordance with ACI 318-14 25.5.2 and ACI 318-11 12.15.1, as applicable.
4. For lightweight concrete, λ = 0.75; therefore multiply development lengths by 1.33 (increase development length by 33 percent), unless the provisions of ACI 318-14 25.4.2.4 or ACI 318-11 12.2.4 (d), as applicable, are met to permit alternate values of λ (e.g for sand-lightweight concrete, λ = 0.85; therefore multiply development lengths by 1.18). Refer to ACI 318-14 19.2.4 or ACI 318-11 8.6.1, as applicable.
5. $\left(\frac{c_b + K_{tr}}{d_b}\right) = 2.5$, $\psi_t=1.0$, $\psi_e=1.0$, $\psi_s=0.8$ for $d_b \le$ #6,1.0 for $d_b >$ #6. Refer to ACI 318-14 25.4.2.4 or ACI 318-11 12.2.4, as applicable.
6. Calculations may be performed for other steel grades and concrete compressive strengths per ACI 318-14 Chapter 25 or ACI 318-11 Chapter 12, as applicable.

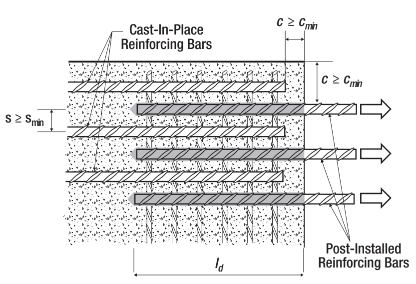
Installation Parameters for Common Post-Installed Reinforcing Bar Connections

Parameter	Symbol	Units	Nominal Rebar Size (US)							
			#3	#4	#5	#6	#7	#8	#9	#10
Nominal hole diameter[1]	d_o	in.	7/16	5/8	3/4	7/8	1	11/8	1-3/8	1-1/2
Effective embedment	h_{ef}	in.	2-3/8 to 7-1/2	2-3/4 to 10	3-1/8 to 12-1/2	3-1/2 to 15	3-1/2 to 17-1/2	4 to 20	4-1/2 to 22-1/2	5 to 25
Nominal hole diameter[1]	d_o	in.	1/2	5/8	3/4	1	1-1/8	1-1/4	1-3/8	1-1/2
Effective embedment	h_{ef}	in.	7-1/2 to 22-1/2	10 to 30	12-1/2 to 37-1/2	15 to 45	17-1/2 to 52-1/2	20 to 60	22-1/2 to 67-1/2	25 to 75

For SI: 1 inch = 25.4 mm,; for pound-inch units: 1 mm = 0.03937 inches.

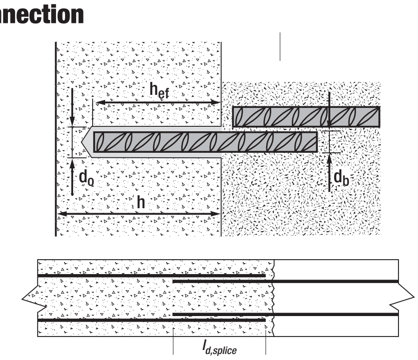
1. For any case, it must be possible for the reinforcing bar (rebar) to be inserted into the cleaned hole without resistance.
2. Consideration should be given regarding the commercial availability of carbide drill bits (including hollow drill bits), as applicable, with lengths necessary to achieve effective embedments for post-installed reinforcing bar connections.

Installation Detail for Post-Installed Reinforcing Bar Connection



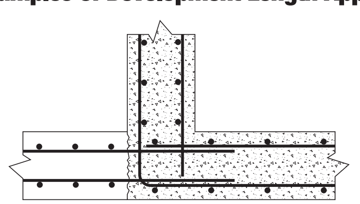
Development Length

c = edge distance
s = spacing

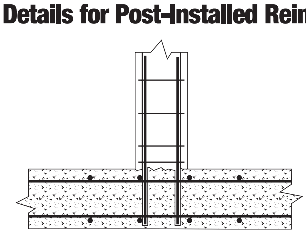


d_b = nomial bar diameter
d_o = nominal hole diameter
h_{ef} = effective embedment
h = member thickness

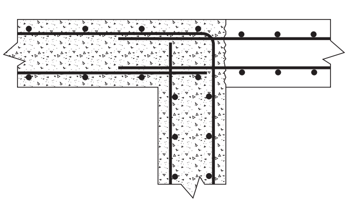
Examples of Development Length Application Details for Post-Installed Reinforcing Bar Connections Provided for Illustrator



Tension Lap Splice with Existing Reinforcement for Footing and Foundation Extensions



Tension Development of Column, Cap or Wall Dowels



Tension Lap Splice with Existing Flexural Reinforcement For Slab and Beam Extensions

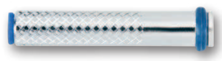
Hole Cleaning Tools and Accessories for Post-Installed Rebar Connections[1,2,3,4,5,6,7]

Rebar Size (No.)	Drill Bit Size (inch)	Brush Size (inch)	Brush Length (inches)	Wire Brush (Cat. No.)	Plug Size (inch)	Piston Plug (Cat. No.)
3	7/16	7/16	6-3/4	PFC1671050	N/A	N/A
	1/2	1/2	6-3/4	PFC1671010	N/A	N/A
4	5/8	5/8	6-3/4	PFC1671200	N/A	N/A
5	3/4	3/4	7-7/8	PFC1671250	3/4	PFC1691520
6	7/8	7/8	7-7/8	PFC1671300	7/8	PFC1691530
	1	1	11-7/8	PFC1671350	1	PFC1691540
7	1	1	11-7/8	PFC1671350	1	PFC1691540
	1-1/8	1-1/8	11-7/8	PFC1671400	1-1/8	PFC1691550
8	1-1/8	1-1/8	11-7/8	PFC1671425	1-1/8	PFC1691550
	1-1/4	1-1/4	11-7/8	PFC1671450	1-1/4	PFC1691555
9	1-3/8	1-3/8	11-7/8	PFC1671450	1-3/8	PFC1691560
10	1-1/2	1-1/2	11-7/8	PFC1671500	1-1/2	PFC1691570

1. If the DEWALT DustX+ extraction system is used to automatically clean the holes during drilling, standard hole cleaning (brushing and blowing following drilling) is not required.
2. Holes may be drilled with hammer-drill, i.e. rotary impact drills or rock drills with a carbide drill bit (including hollow bits).
3. For any case, it must be possible for the reinforcing bar to be inserted into the cleaned drill hole without resistance.
4. A brush extension (Cat.#08282) must be used with a steel wire brush for holes drilled deeper than the listed brush length.
5. Brush adaptors for power tool connections are available for drill chuck (Cat.#08296) and SDS (Cat.#08283).
6. A flexible extension tube (Cat.#08297) or flexible extension hose (Cat.#PFC1640600) or equivalent approved by DEWALT must be used if the bottom or back of the anchor hole is not reached with the mixing nozzle only.
7. All overhead (i.e upwardly inclined) installations require the use of piston plugs during where one is tabulated together with the anchor size (see table). N/A = Not applicable. All horizontal installations require the use of piston plugs where one is tabulated together with the anchor size and where the embedment depth is greater than 8 inches. A flexible extension tube (Cat.#08297) or flexible extension hose (Cat.#PFC1640600) or equivalent approved by DEWALT must be used with piston plugs.


Wire Brush


Brush Extension


Drill Chuck Adapter


SDS Adapter

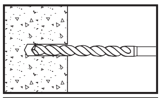

Premium Piston Plug


Compressed Air Nozzle


DustX+™ System

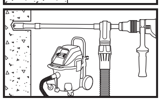
INSTALLATION INSTRUCTIONS (SOLID BASE MATERIALS)

DRILLING



1- Drill a hole into the base material with rotary hammer drill (i.e. percussion drill) and a carbide drill bit to the size and embedment required by the selected steel hardware element (reference installation specifications for threaded rod and reinforcing bar). The tolerances of the carbide drill bits, including hollow bits, must meet ANSI Standard B212.15.

- Precaution: Use suitable eye and skin protection. Avoid inhalation of dust during drilling and/or removal.

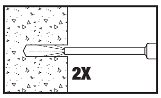


- Note! In case of standing water in the drilled hole (flooded hole condition), all the water has to be removed from the hole (e.g. vacuum, compressed air, etc.) prior to cleaning.

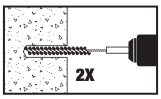
Drilling in dry base material is recommended when using hollow drill bits (vacuum must be on).

GO TO STEP 3 FOR HOLES DRILLED WITH DUSTX+™ EXTRACTION SYSTEM (NO FURTHER HOLE CLEANING IS REQUIRED). OTHERWISE GO TO STEP 2A FOR HOLE CLEANING INSTRUCTIONS.

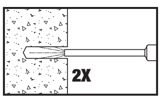
HOLE CLEANING DRY OR WET/WATER-SATURATED HOLES (BLOW 2X, BRUSH 2X, BLOW 2X)



2a- Starting from the bottom or back of the anchor hole, blow the hole clean with compressed air (min. 90 psi / 6 bar) a minimum of two times (2x). If the back of the drilled hole is not reached an extension shall be used.

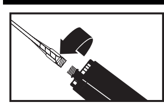


2b- Determine brush diameter (see hole cleaning equipment selection table) for the drilled hole and brush the hole by hand or attach the brush with adaptor to a rotary drill tool or battery screw gun. Brush the hole with the selected wire brush a minimum of two times (2x). A brush extension (supplied by DEWALT) must be used for drill hole depth > 6" (150mm). The wire brush diameter must be checked periodically during use. The wire brush diameter must be checked periodically during use. The brush should resist insertion into the drilled hole, if not, the brush is too small and must be replaced with proper brush diameter (i.e. new wire brush).



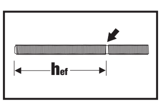
2c- Finally blow the hole clean again with compressed air (min. 90 psi / 6 bar) a minimum of two times (2x). If the back of the drilled hole is not reached an extension shall be used. When finished the hole should be clean and free of dust, debris, ice, grease, oil or other foreign material.

PREPARING

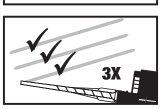


3- Check adhesive expiration date on cartridge label. Do not use expired product. Review Safety Data Sheet (SDS) before use. Cartridge temperature must be between 41°F - 104°F (5°C - 40°C) when in use. Review published working and cure times. Consideration should be given to the reduced gel (working) time of the adhesive in warm temperatures. For permitted range of the base material temperature, see published gel and curing times.

- Attach a supplied mixing nozzle to the cartridge. Unless otherwise noted do not modify the mixer in any way and make sure the mixing element is inside the nozzle. Load the cartridge into the correct dispensing tool.
- Note: Always use a new mixing nozzle with new cartridge of adhesive and also for all work interruptions exceeding the published gel (working) time of the adhesive.



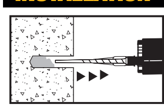
4- Prior to inserting the anchor rod or rebar into the filled drilled hole, the position of the embedment depth has to be marked on the anchor. Verify anchor element is straight and free of surface damage.



5- Adhesives must be properly mixed to achieve published properties. For new cartridges and nozzles, prior to dispensing adhesive into the drilled hole, separately dispense at least three full strokes of adhesive through the mixing nozzle until the adhesive is a consistent **GRAY** color.

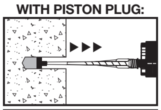
- Review and note the published working and cure times (reference gel time and curing time table) prior to injection of the mixed adhesive into the cleaned anchor hole.

INSTALLATION



6- Fill the cleaned hole approximately two-thirds full with mixed adhesive starting from the bottom or back of the anchor hole. Slowly withdraw the mixing nozzle as the hole fills to avoid creating air pockets or voids. A plastic extension tube (Cat# 08281 or 08297) or equivalent approved by DEWALT must be used with the mixing nozzle if the bottom or back of the anchor hole is not reached with the mixing nozzle (see reference tables for installation).

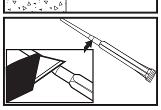
WITH PISTON PLUG:



Note! Piston plugs (see hole cleaning equipment selection table) must be used with and attached to the mixing nozzle and extension tube for:

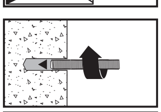
- Overhead installations and installations between horizontal and overhead in concrete with anchor rod 5/8" to 1-1/4" diameter and rebar size #5 to #10
- All installations with drill hole depth > 10" (250mm) with anchor rod 5/8" to 1-1/4" diameter and rebar sizes #5 to #10

Insert piston plug to the back of the drilled hole and inject as described in the method above. During installation the piston plug will be naturally extruded from the drilled hole by the adhesive pressure.

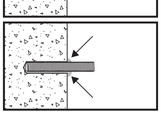


In the case that flexible tubing is used (Cat. #PFC1640600), the mixing nozzle may be trimmed at the preforation on the front port before attachment of the tubing. Verify the mixing element is inside the nozzle before use.

Attention! Do not install anchors overhead or upwardly inclined without installation hardware supplied by DEWALT and also receiving proper training and/or certification. Contact DEWALT for details prior to use.

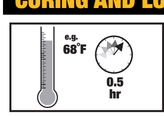


7- The anchor should be free of dirt, grease, oil or other foreign material. Push clean threaded rod or reinforcing bar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached. Observe the gel (working) time.



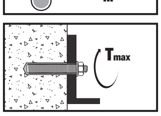
8- Ensure that the anchor element is installed to the specific embedment depth. Adhesive must completely fill the annular gap at the concrete surface. Following installation of the anchor element, remove excess adhesive. Protect the anchor element threads from fouling with adhesive. For all installations the anchor element must be restrained from movement throughout the specified curing period (as necessary) through the use of temporary wedges, external supports, or other methods. Minor adjustment to the position of the anchor element may be performed during the gel (working) time only.

CURING AND LOADING



9- Allow the adhesive anchor to cure to the specified full curing time prior to applying any load (reference gel time and curing time table).

- Do not disturb, torque or load the anchor until it is fully cured.

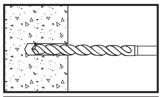


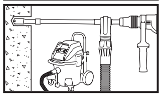
10- After full curing of the adhesive anchor, a fixture can be installed to the anchor and tightened up to the maximum torque (reference installation specifications for threaded rod and reinforcing bar table) by using a calibrated torque wrench.

- Take care not to exceed the maximum torque for the selected anchor.

INSTALLATION INSTRUCTIONS (POST-INSTALLED REBAR)

HAMMER DRILLING





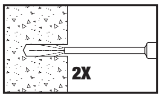
1- Drill a hole into the base material with rotary hammer drill (i.e. percussion drill) and a carbide drill bit to the size and embedment required by the selected steel hardware element (reference installation specifications for threaded rod and reinforcing bar). The tolerances of the carbide drill bits, including hollow bits, must meet ANSI Standard B212.15.

- Precaution: Use suitable eye and skin protection. Avoid inhalation of dust during drilling and/or removal.
- Note! In case of standing water in the drilled hole (flooded hole condition), all the water has to be removed from the hole (e.g. vacuum, compressed air, etc.) prior to cleaning.

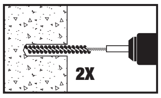
Drilling in dry base materials is recommended when using hollow drill bits (vacuum must be on).

GO TO STEP 3 FOR HOLES DRILLED WITH DUSTX+™ EXTRACTION SYSTEM (NO FURTHER HOLE CLEANING IS REQUIRED). OTHERWISE GO TO STEP 2A FOR HOLE CLEANING INSTRUCTIONS.

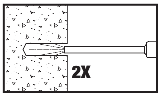
HOLE CLEANING DRY OR WET HOLES (BLOW 2X, BRUSH 2X, BLOW 2X)



2a- Starting from the bottom or back of the drilled hole, blow the hole clean a minimum of two times (2x). Use a compressed air nozzle (min. 90 psi) for all sizes of reinforcing bar (rebar).



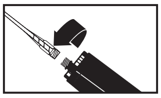
2b- Determine brush diameter (see hole cleaning accessories for post-installed rebar selection table) for the drilled hole and brush the hole by hand or attach the brush with adaptor to a rotary drill tool or battery screw gun. Brush the hole with the selected wire brush a minimum of two times (2x). A brush extension (supplied by DEWALT) must be used for drill hole depth > 6" (150mm). The wire brush diameter must be checked periodically during use. The wire brush diameter must be checked periodically during use. The brush should resist insertion into the drilled hole, if not, the brush is too small and must be replaced with proper brush diameter (i.e. new wire brush).



2c- Repeat Step 2a again by blowing the hole clean a minimum of two times (2x).

When finished the hole should be clean and free of dust, debris, oil or other foreign material.

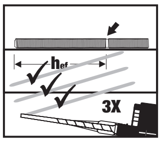
PREPARING



3- Check adhesive expiration date on cartridge label. Do not use expired product. Review Safety Data Sheet (SDS) before use. Review published gel (working) and cure times. Cartridge adhesive temperature must be between 41°F - 104°F (5°C - 40°C) when in use.

Note: Consideration should be given to the reduced gel (working) time of the adhesive in warm temperatures. For the permitted range of the base material temperature see published gel and cure times.
Attach a supplied mixing nozzle to the cartridge. Unless otherwise noted do not modify the mixer in any way and make sure the mixing element is inside the nozzle. Load the cartridge into the correct dispensing tool.

- Note: Always use a new mixing nozzle with new cartridge of adhesive and also for all work interruptions exceeding the published gel (working) time of the adhesive.

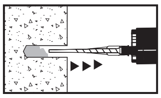


4- Prior to inserting the rebar into the filled drilled hole, the position of the embedment depth has to be marked on the anchor. Verify anchor element is straight and free of surface damage.

5- Adhesive must be properly mixed to achieve published properties. Prior to dispensing adhesive into the drilled hole, separately dispense at least three full strokes of adhesive through the mixing nozzle until the adhesive is a consistent **GRAY** color.

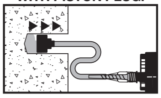
Review and note the published gel (working) and cure times prior to injection of the mixed adhesive into the cleaned anchor hole.

INSTALLATION



6- Fill the cleaned hole approximately two-thirds full with mixed adhesive starting from the bottom or back of the anchor hole. Slowly withdraw the mixing nozzle as the hole fills to avoid creating air pockets or voids. A flexible extension tube (Cat.# 08297) or flexible extension hose (Cat.# PFC1640600) or equivalent approved by DEWALT must be used with the mixing nozzle if the bottom or back of the anchor hole is not reached with the mixing nozzle (see reference tables for installation). (see hole cleaning tools and accessories for post-installed rebar table).

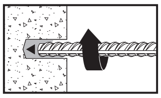
WITH PISTON PLUG:



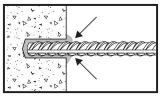
Note! Piston plugs must be used with and attached to mixing nozzle and extension tube for overhead (i.e. upwardly inclined) installations and horizontal installations with rebar sizes as indicated in the hole cleaning tools and accessories for post-installed rebar table. Insert piston plug to the back of the drilled hole and inject as described in the method above. During injection of the adhesive the piston plug will be naturally extruded from the drilled hole by the adhesive pressure.

- In the case that flexible tubing is used (Cat. #PFC1640600), the mixing nozzle may be trimmed at the preforation on the front port before attachment of the tubing. Verify the mixing element is inside the nozzle before use.

Attention! Do not install anchors overhead or upwardly inclined without installation hardware supplied by DEWALT and also receiving proper training and/or certification. Contact DEWALT for details prior to use.

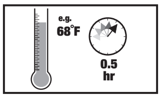


7- The reinforcing bar should be free of dirt, grease, oil or other foreign material. Push clean rebar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached. Observe the gel (working) time.



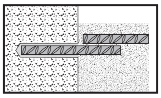
8- Ensure that the anchor element is installed to the specific embedment depth. Adhesive must completely fill the annular gap at the concrete surface. Following installation of the anchor element, remove excess adhesive. Protect the anchor element threads from fouling with adhesive. For all installations the anchor element must be restrained from movement throughout the specified curing period (as necessary) through the use of temporary wedges, external supports, or other methods. Minor adjustment to the position of the anchor element may be performed during the gel (working) time only.

CURING AND LOADING



9- Allow the adhesive anchor to cure to the specified full curing time prior to applying any load (reference gel time and curing time table).

- Do not disturb, torque or load the anchor until it is fully cured.



10- After full curing of the rebar connection, new concrete can be poured (placed) to the installed rebar connection.

REFERENCE INSTALLATION TABLES

Gel (working) Time and Curing Table

Temperature of base material	Gel (working) time	Full curing time
23°F (-5°C) to 31°F (-1°C)	50 minutes	5 hours
32°F (0°C) to 40°F (4°C)	25 minutes	3.5 hours
41°F (5°C) to 49°F (9°C)	15 minutes	2 hours
50°F (10°C) to 58°F (14°C)	10 minutes	1 hour
59°F (15°C) to 67°F (19°C)	6 minutes	40 minutes
68°F (20°C) to 85°F (29°C)	3 minutes	30 minutes
86°F (30°C) to 104°F (40°C)	2 minutes	30 minutes

Linear interpolation for intermediate base material temperature is possible.
Cartridge temperature must be between 41ºF (5ºC) and 104ºF (40ºC) when in use.

Hole Cleaning Equipment Selection Table for AC200+

Rod Diameter (inch)	Rebar Size (No.)	ANSI Drill Bit Diameter (inch)	Brush Length (inches)	Steel Wire Brush[1,2] (Cat. #)	Blowout Tool	Number of cleaning actions
Solid Base Material						
3/8	-	7/16	5-3/8	PFC1671050	Compressed air nozzle only, Cat #8292 (min. 90 psi)	2x blowing 2x brushing 2x blowing
-	#3	1/2	5-3/8	PFC1671100		
1/2	-	9/16	5-3/8	PFC1671150		
-	#4	5/8	5-3/8	PFC1671200		
5/8	-	11/16	5-3/8	PFC1671225		
-	#5	3/4	5-3/8	PFC1671250		
3/4	#6	7/8	5-3/8	PFC1671300		
7/8	#7	1	5-3/8	PFC1671350		
1	#8	1-1/8	5-3/8	PFC1671400		
1-1/4	#9	1-3/8	5-3/8	PFC1671450		
-	#10	1-1/2	5-3/8	PFC1671500		

1. For any case, it must be possible for the steel anchor element to be inserted into the cleaned drill hole without resistance.
2. An SDS-plus adaptor (Cat. #PFC1671830) is required to attach a steel wire brush to the drill tool. For hand brushing, attach manual brush wood handle (Cat. #PFC1671000) to the steel brush.
3. A brush extension (Cat. #PFC1671820) must be used with a steel wire brush for holes drilled deeper than the listed brush length.

Piston Plugs for Adhesive Anchors[1,2,3]

Plug Size (inch)	ANSI Drill Bit Diameter (inch)	Piston Plug (Cat. #)	Piston Plug
Solid Base Materials			
11/16	11/16	08258	
3/4	3/4	08259	
7/8	7/8	08300	
1	1	08301	
1-1/8	1-1/8	08303	
1-1/4	1-1/4	08307	
1-3/8	1-3/8	08305	
1-1/2	1-1/2	08309	

1. All overhead or upwardly inclined installations require the use of piston plugs where one is tabulated together with the anchor size.
2. All installations require the use of piston plugs where one is tabulated together with the anchor size and where the embedment depth is greater than 10 inches.
3. A flexible plastic extension tube (Cat. #08281 or #08297) or equivalent approved by DEWALT must be used with piston plugs.

PERMISSIBLE INSTALLATION CONDITIONS (ADHESIVE)

Dry Concrete: cured concrete that, at the time of adhesive anchor installation, has not been exposed to water for the preceding 14 days.
Water-Saturated Concrete (wet): cured concrete that, at the time of adhesive anchor installation, has been exposed to water over a sufficient length of time to have the maximum possible amount of absorbed water into the concrete pore structure to a depth equal to the anchor embedment depth.

ORDERING INFORMATION

AC200+ Cartridges

Cat. No.	Description	Std. Box	Std. Ctn.	Pallet
PFC1271050	AC200+ 10 fl. oz. Quik-Shot	12	36	648
PFC1271150	AC200+ 28 fl. oz. Dual cartridge	-	8	240
One AC200+ mixing nozzle is packaged with each cartridge. AC200+ mixing nozzles must be used to ensure complete and proper mixing of the adhesive.				

Cartridge System Mixing Nozzles

Cat. No.	Description	Std. Pkg.	Std. Ctn.
PFC1641600	Mixing nozzle (with 8" extension)	2	24
08281	Mixing nozzle extension, 8" long	2	24
08297	Mixing nozzle extension, 20" long	1	12

Dispensing Tools for Injection Adhesive

Cat. No.	Description	Std. Box	Std. Ctn.
08437	Manual caulking gun for Quik-Shot	1	12
08479	High performance caulking gun for Quik-Shot	1	12
DCE560D1	10 fl. oz. cordless 20v battery powered dispensing tool	1	-
08485	12 fl. oz. High performance metal manual tool	1	20
08494	28 fl. oz. Standard all metal manual tool	1	-
08496	28 fl. oz. High performance pneumatic tool	1	-
DCE595D1	28 fl. oz. cordless 20v battery powered dispensing tool	1	-

Hole Cleaning Tools and Accessories

Cat No.	Description	Std. Box
PFC1671050	Premium Wire brush for 7/16" ANSI hole	1
PFC1671100	Premium Wire brush for 1/2" hole	1
PFC1671150	Premium Wire brush for 9/16" ANSI hole	1
PFC1671200	Premium Wire brush for 5/8" ANSI hole	1
PFC1671225	Premium Wire brush for 11/16" ANSI hole	1
PFC1671250	Premium Wire brush for 3/4" ANSI hole	1
PFC1671300	Premium Wire brush for 7/8" ANSI hole	1
PFC1671350	Premium Wire brush for 1" ANSI hole	1
PFC1671400	Premium Wire brush for 1-1/8" ANSI hole	1
PFC1671450	Premium Wire brush for 1-3/8" ANSI hole	1
PFC1671500	Premium Wire brush for 1-1/2" ANSI hole	1
PFC1671830	Premium SDS-plus adapter for steel brushes	1
PFC1671000	Premium manual brush wood handle	1
PFC1671820	Premium Steel brush extension, 12" length	1
08292	Air compressor nozzle with extension, 18" length	1

Piston Plugs for Adhesive Anchors

Cat. #	Description	ANSI Drill Bit Dia.	Std. Bag
08258	11/16" Plug	11/16"	10
08259	3/4" Plug	3/4"	10
08300	7/8" Plug	7/8"	10
08301	1" Plug	1"	10
08303	1-1/8" Plug	1-1/8"	10
08307	1-1/4" Plug	1-1/4	10
08305	1-3/8" Plug	1-3/8"	10
08309	1-1/2" Plug	1-1/2"	10

Piston Plugs for Post-Installed Rebar Connections

Cat. No.	Description	ANSI Drill Bit Dia.	Qty.
PFC1691520	3/4" Plug	3/4	10
PFC1691530	7/8" Plug	7/8	10
PFC1691540	1" Plug	1	10
PFC1691550	1-1/8" Plug	1-1/8	10
PFC1691555	1-1/4" Plug	1-1/4	10
PFC1691560	1-3/8" Plug	1-3/8	10
PFC1691570	1-1/2" Plug	1-1/2	10

SDS Max 4-Cutter Carbide Drill Bits

Cat. No.	Diameter	Usable Length	Overall Length
DW5806	5/8"	8"	13-1/2"
DW5809	5/8"	16"	21-1/2"
DW5807	5/8"	31"	36"
DW5808	11/16"	16"	21-1/2"
DW5810	3/4"	8"	13-1/2"
DW5812	3/4"	16"	21-1/2"
DW5813	3/4"	31"	36"
DW5814	13/16"	16"	21-1/2"
DW5815	7/8"	8"	13-1/2"
DW5816	7/8"	16"	21-1/2"
DW5851	7/8"	31"	36"
DW5817	27/32"	16"	21-1/2"
DW5818	1"	8"	13-1/2"
DW5819	1"	16"	22-1/2"
DW5852	1"	24"	29"
DW5820	1"	31"	36"
DW5821	1-1/8"	10"	15"
DW5822	1-1/8"	18"	22-1/2"
DW5853	1-1/8"	24"	29"
DW5854	1-1/8"	31"	36"
DW5824	1-1/4"	10"	15"
DW5825	1-1/4"	18"	22-1/2"

SDS+ Full Head Carbide Drill Bits

Cat. No.	Diameter	Usable Length	Overall Length
DW5502	3/16"	2"	4-1/2"
DW5503	3/16"	4"	6-1/2"
DW5504	3/16"	5"	8-1/2"
DW5506	3/16"	10"	12"
DW5512	7/32"	8"	10"
DW5517	1/4"	4"	6"
DW5518	1/4"	6"	8-1/2"
DW55200	1/4"	10"	12"
DW5521	1/4"	12"	14"
DW5524	5/16"	4"	6"
DW5526	5916"	10"	12"
DW5527	3/8"	4"	6-1/2"
DW5529	3/8"	8"	10"
DW55300	3/8"	10"	12"
DW5531	3/8"	16"	18"
DW5537	1/2"	4"	6"
DW5538	1/2"	8"	10-1/2"
DW5539	1/2"	10"	12"
DW5540	1/2"	16"	18"

SDS+ 4-Cutter Carbide Drill Bits

Cat. No.	Diameter	Usable Length	Overall Length
DW5471	5/8"	8"	10"
DW5472	5/8"	16"	18"
DW5474	3/4"	8"	10"
DW5475	3/4"	16"	18"
DW5477	7/8"	8"	10"
DW5478	7/8"	16"	18"
DW5479	1"	8"	10"
DW5480	1"	16"	18"
DW5481	1-1/8"	8"	10"
DW5482	1-1/8"	6"	18"

Dust Extraction

Cat. No.	Description
DWV012	10 Gallon Wet/Dry Hepa/Rrp Dust Extractor DWV9402 Fleece bag (5 pack) for DEWALT dust extractors DWV9316 Replacement Anti-Static Hose DWV9320 Replacement HEPA Filter Set (Type 1)
DWH050K	Dust Extraction with two interchangeable drilling heads
DCB1800M3T1	1800 Watt Portable Power Station & Parallel Battery Charger with 3 20V Max* 5Ah Batteries and 1 60V Max* Flexvolt® Battery

Hollow Drill Bits

	Cat. No.	Diameter	Overall Length	Usable Length	Recommended Ham mer
SDS+	DWA54012	1/2"	14-1/2"	9-3/4"	DCH133 / DCH273 / DCH293
	DWA54916	9/16"	14-1/2"	9-3/4"	DCH133 / DCH273 / DCH293
	DWA54058	5/8"	14-1/2"	9-3/4"	DCH133 / DCH273 / DCH293
	DWA54034	3/4"	14-1/2"	9-3/4"	DCH133 / DCH273 / DCH293
SDS Max	DWA58058	5/8"	23-5/8"	15-3/4"	DCH481 / D25603K
	DWA58034	3/4"	23-5/8"	15-3/4"	DCH481 / D25603K
	DWA58078	7/8"	23-5/8"	15-3/4"	DCH481 / D25603K
	DWA58001	1"	23-5/8"	15-3/4"	DCH481 / D25603K
	DWA58118	1-1/8"	23-5/8"	15-3/4"	DCH481 / D25603K

GENERAL INFORMATION

AC100+ GOLD®

Vinylester Injection Adhesive Anchoring System

PRODUCT DESCRIPTION

The AC100+ Gold is a two-component vinylester adhesive anchoring system. The system includes injection adhesive in plastic cartridges, mixing nozzles, dispensing tools and hole cleaning equipment. The AC100+ Gold is designed for bonding threaded rod and reinforcing bar elements into drilled holes in concrete and masonry base materials.

GENERAL APPLICATIONS AND USES

- Bonding threaded rod and reinforcing bar into hardened concrete and masonry
- Evaluated for use in dry and water-saturated concrete (including water filled holes)
- Suitable to resist loads in cracked or uncracked concrete base materials
- Fast curing system which can be installed in a wide range of base material temperatures; qualified for structural applications in concrete and masonry as low as 14ºF (-10ºC)
- Qualified for seismic (earthquake) and wind loading

FEATURES AND BENEFITS

+ Designed for use with threaded rod and reinforcing bar hardware elements
+ Consistent performance in low and high strength concrete
+ Evaluated and recognized for freeze/thaw performance (interior and exterior applications)
+ Evaluated and recognized for a range of embedments
+ Versatile low odor formula with quick cure time
+ Evaluated and recognized for long term and short term loading (see performance tables)
+ Mixing nozzles proportion adhesive and provide simple delivery method into drilled holes
+ Cartridge design allows for multiple uses using extra mixing nozzles
+ Universal product for concrete and masonry (hollow and solid base materials)

APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES) ESR-2582 for concrete
- International Code Council, Evaluation Service (ICC-ES) ESR-3200 for masonry
- International Code Council, Evaluation Service (ICC-ES) ESR-4105 for Unreinforced Masonry (URM)
- Code compliant with the 2015 IRC, 2015 IBC, 2012 IBC, 2012 IRC, 2009 IBC, and 2009 IRC.
- Tested in accordance with ASTM E488 / ACI 355.4 and ICC-ES AC308 for use in structural concrete with ACI 318-14 Chapter 17 or ACI 318-11/08 Appendix D.
- Compliant with NSF/ANSI Standard 61 for drinking water system components – health effects; meets requirements for materials in contact with potable water and water treatment
- Conforms to requirements of ASTM C 881 and AASHTO M235, Types I, II, IV and V, Grade 3, Classes A & B (meets Type III with exception of elongation)
- Department of Transportation listings – see www.DEWALT.com or contact transportation agency

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Adhesive anchoring system shall be AC100+ Gold as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and requirements of the Authority Having Jurisdiction.

TENSION ZONE CRACKED CONCRETE | SEISMIC REGION QUALIFICATION | NSF

CODE LISTED ICC-ES ESR-2582 CONCRETE | CODE LISTED ICC-ES ESR-3200 MASONRY | CODE LISTED ICC-ES ESR-4105 URM

DDA DEWALT DESIGN ASSIST™

SECTION CONTENTS

AC100+ GOLD

PACKAGING

Coaxial Cartridge

- 10 fl. oz. (280 ml or 17.1 in³)

Dual (side-by-side Cartridge)

- 12 fl. oz. (345 ml or 21.0 in³)
- 28 fl. oz. (825 ml or 50.3 in³)

STORAGE LIFE & CONDITIONS

Eighteen months in a dry, dark environment with temperature ranging from 32°F and 86°F (-0°C to 30°C)

ANCHOR SIZE RANGE (TYPICAL)

- 3/8" to 1-1/4" diameter rod
- No. 3 to No. 10 rebar

SUITABLE BASE MATERIALS

- Normal-weight concrete
- Lightweight concrete
- Grouted concrete masonry (CMU)
- Hollow concrete masonry (CMU)
- Brick masonry

PERMISSIBLE INSTALLATION CONDITIONS (ADHESIVE)

- Dry concrete
- Water-saturated concrete (wet)
- Water-filled holes (flooded)

REFERENCE DATA (ASD)

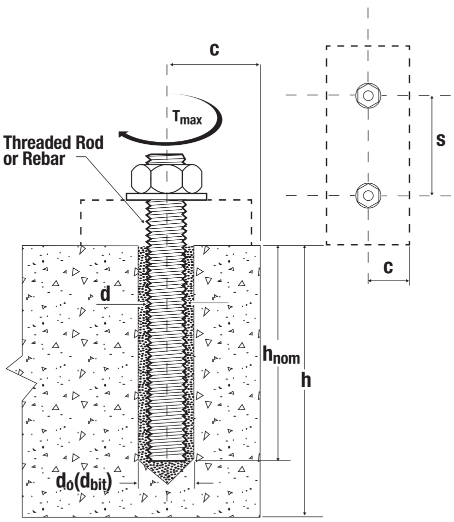
Allowable Stress Design (ASD) Installation Table for AC100+ Gold (Solid Concrete Base Materials)

Dimension/Property		Notation	Units	Nominal Anchor Size									
Threaded rod		-	-	3/8"	1/2"	-	5/8"	3/4'"	7/8"	1"	-	1-1/4"	-
Reinforcing bar		-	-	#3	-	#4	#5	#6	#7	#8	#9	-	#10
Nominal anchor diameter		d	in. (mm)	0.375 (9.5)	0.500 (12.7)		0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.125 (28.6)	1.250 (31.8)	1.250 (31.8)
Nominal diameter of drilled hole		d_{bit}	in.	7/16 ANSI	9/16 ANSI	5/8 ANSI	11/16 or 3/4 ANSI	7/8 ANSI	1 ANSI	1-1/8 ANSI	1-3/8 ANSI	1-3/8 ANSI	1-1/2 ANSI
Minimum nominal embedment depth		h_{nom}	in. (mm)	2-3/8 (61)	2-3/4 (70)		3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	4-1/2 (114)	5 (127)	5 (127)
Maximum torque (only possible after full cure time of adhesive)	A36 or F1554 carbon steel rod	T_{max}	ft.-lb. (N-m)	10 (13)	25 (34)		50 (68)	90 (122)	125 (169)	165 (224)	-	280 (379)	-
	F593 Condition CW stainless steel rod or ASTM A193, Grade B7 carbon steel rod	T_{max}	ft.-lb. (N-m)	16 (22)	33 (45)		60 (81)	105 (142)	125 (169)	165 (224)	-	280 (379)	-

Allowable Stress Design (ASD) Installation Table for AC100+ Gold (Hollow Base Material with Screen Tube)

Dimension/Property	Notation	Units	Nominal Size - Stainless Steel					Nominal Size - Plastic			
Threaded Rod	-	-	1/4"	3/8"	1/2"	5/8"	3/4"	1/4"	3/8"	1/2"	5/8"
Nominal threaded rod diameter	d	in. (mm)	0.250 (6.4)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	0.250 (6.4)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)
Nominal screen tube diameter	-	in.	1/4	3/8	1/2	5/8	3/4	1/4	3/8	1/2	5/8
Nominal diameter of drilled hole	d_{bit}	in. (mm)	3/8 ANSI	1/2 ANSI	5/8 ANSI	3/4 ANSI	7/8 ANSI	1/2 ANSI	9/16 ANSI	3/4 ANSI	7/8 ANSI
Maximum torque (only possible after full cure time of adhesive)	T_{max}	ft.-lbf. (N-m)	4 (5)	6 (8)	10 (14)	10 (14)	10 (14)	4 (5)	6 (8)	10 (14)	10 (14)

Detail of Steel Hardware Elements used with Injection Adhesive System



Threaded Rod and Deformed Reinforcing Bar Material Properties

Steel Description (General)	Steel Specification (ASTM)	Nominal Anchor Size (inch)	Minimum Yield Strength, f_y (ksi)	Minimum Ultimate Strength, f_u (ksi)
Carbon Rod	A 36 or F1554 Grade 36	3/8 through 1-1/4	36.0	58.0
Stainless Rod (Alloy 304 / 316)	F 593, Condition CW	3/8 through 5/8	65.0	100.0
		3/4 through 1-1/4	45.0	85.0
High Strength Carbon Rod	A 193 Grade B7	3/8 through 1-1/4	105.0	125.0
Reinforcing Bar	A 615, A 767, Grade 75	3/8 through 1-1/4 (#3 through #10)	75.0	100.0
	A 615, A 767, Grade 60	3/8 through 1-1/4 (#3 through #10)	60.0	90.0
	A 706, A 767, Grade 60	3/8 through 1-1/4 (#3 through #10)	60.0	80.0
	A 615, A 767, Grade 40	3/8 through 1-1/4 (#3 through #10)	40.0	60.0

Nomenclature

d = Diameter of anchor
d_{bit} = Diameter of drilled hole
h = Base material thickness
The greater of:
[h_{nom} + 1-1/4"] and [h_{nom} + $2d_{bit}$]
h_{nom} = Minimum embedment depth

Ultimate and Allowable Load Capacities for AC100+ Gold Installed into Normal-Weight Concrete with Threaded Rod and Reinforcing Bar (based on bond strength/concrete capacity)[1,2,3,4,5,6]

ALLOWABLE STRESS DESIGN ASD

Nominal Rod Diameter or Rebar Size d in. or #	Minimum Embedment Depth in.	Minimum Concrete Compressive Strength							
		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 5,000 psi		f'c = 6,000 psi	
		Ultimate Tension Load Capacity lbs	Allowable Tension Load Capacity lbs	Ultimate Tension Load Capacity lbs	Allowable Tension Load Capacity lbs	Ultimate Tension Load Capacity lbs	Allowable Tension Load Capacity lbs	Ultimate Tension Load Capacity lbs	Allowable Tension Load Capacity lbs
3/8 or #3	2-3/8	4,840	1,210	5,040	1,260	5,180	1,295	5,320	1,330
	3-1/2	7,140	1,785	7,420	1,855	7,640	1,910	7,820	1,955
	4-1/2	9,180	2,295	9,540	2,385	9,820	2,455	10,060	2,515
1/2 or #4	2-3/4	7,980	1,995	8,280	2,070	8,540	2,135	8,740	2,185
	4-3/8	12,720	3,180	13,200	3,300	13,580	3,395	13,900	3,475
	6	17,420	4,355	18,100	4,525	18,620	4,655	19,080	4,770
5/8 or #5	3-1/8	11,220	2,805	11,660	2,915	12,000	3,000	12,300	3,075
	5-1/4	19,200	4,800	19,960	4,990	20,540	5,135	21,020	5,255
	7-1/2	27,660	6,915	28,720	7,180	29,560	7,390	30,280	7,570
3/4 or #6	3-1/2	13,320	3,330	13,820	3,455	14,220	3,555	14,560	3,640
	6-1/4	26,880	6,720	27,900	6,975	28,720	7,180	29,420	7,355
	9	40,440	10,110	42,000	10,500	43,220	10,805	44,260	11,065
7/8 or #7	3-1/2	13,320	3,330	13,820	3,455	14,220	3,555	14,560	3,640
	7	36,680	9,170	38,080	9,520	39,200	9,800	40,140	10,035
	10-1/2	60,040	15,010	62,340	15,585	64,180	16,045	65,700	16,425
1 or #8	4	16,260	4,065	16,880	4,220	17,380	4,345	17,800	4,450
	8	46,540	11,635	48,300	12,075	49,740	12,435	50,920	12,730
	12	76,820	19,205	79,740	19,935	82,080	20,520	84,060	21,015
1-1/4 or #10	5	22,740	5,685	23,600	5,900	24,300	6,075	24,880	6,220
	10	65,880	16,470	68,400	17,100	70,420	17,605	72,100	18,025
	15	109,040	27,260	113,200	28,300	116,540	29,135	119,320	29,830

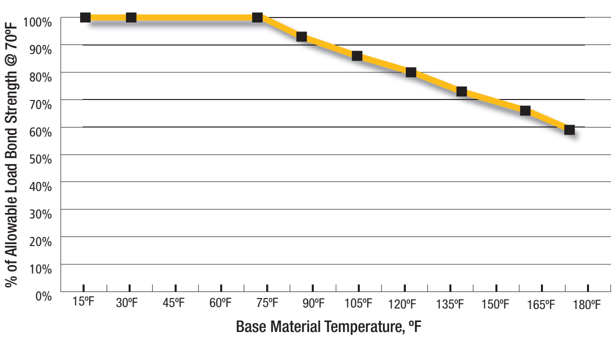
1. Allowable load capacities listed are calculated using an applied safety factor of 4.0 which includes an assessment of freezing/thawing conditions and sensitivity to sustained loads (i.e. creep resistance). Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
3. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances and where the minimum member thickness is the greater of [h_{nom} + 1-1/4] and [h_{nom} + 2d_{bit}].
4. The tabulated load values are applicable for dry concrete. Holes must be drilled with a hammer drill and an ANSI carbide drill bit. Installations in wet concrete or water-filled holes may require a reduction in capacity. Contact DEWALT for more information concerning these installation conditions.
5. Adhesives experience reductions in capacity at elevated temperatures. See the In-Service Temperature chart for allowable loads capacity reduction factors.
6. Allowable bond strength/concrete capacity must be checked against allowable steel strength to determine the controlling allowable load. Allowable shear capacity is controlled by allowable steel strength for the given conditions.

Allowable Load Capacities for Threaded Rod and Reinforcing Bar (Based on Steel Strength)[1,2,3,4,5]

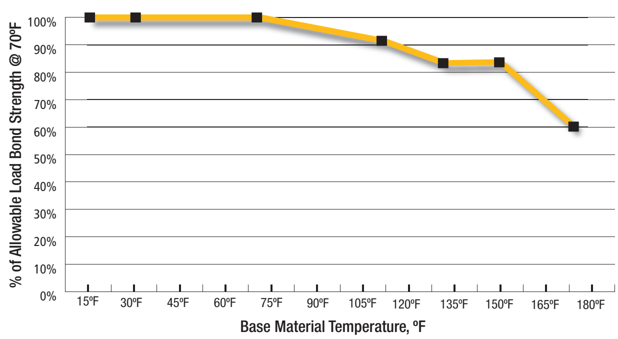
Nominal Rod Diameter or Rebar Size (in. or #)	Steel Elements - Threaded Rod and Reinforcing Bar																	
	A36 or F1554, Grade 36		A36 or F1554, Grade 55		A 193, Grade B7 or F1554, Grade 105		F 593, CW (SS)		ASTM A615 Grade 40 Rebar		ASTM A615 Grade 60 Rebar		ASTM A706 Grade 60 Rebar		ASTM A615 Grade 75 Rebar		ASTM A706 Grade 80 Rebar	
	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)	Tension lbs. (kN)	Shear lbs (kN)	Tension lbs. (kN)	Shear lbs (kN)	Tension lbs. (kN)	Shear lbs (kN)
3/8 or #3	2,115 (9.4)	1,090 (4.8)	2,735 (12.2)	1,410 (6.3)	4,555 (20.3)	2,345 (10.4)	3,645 (16.2)	1,880 (8.4)	2,210 (9.8)	1,125 (5.0)	2,650 (11.8)	1,690 (7.5)	2,650 (11.8)	1,500 (6.7)	2,650 (11.8)	1,875 (8.3)	2,650 (11.8)	1,875 (8.3)
1/2 or #4	3,760 (16.7)	1,935 (8.6)	4,860 (21.6)	2,505 (11.1)	8,100 (36.0)	4,170 (18.5)	6,480 (28.8)	3,340 (14.9)	3,925 (17.5)	2,005 (8.9)	4,710 (21.0)	3,005 (13.4)	4,710 (21.0)	2,670 (11.9)	4,710 (21.0)	3,335 (14.8)	4,710 (21.0)	3,335 (14.8)
5/8 or #5	5,870 (26.1)	3,025 (13.5)	7,595 (33.8)	3,910 (17.4)	12,655 (56.3)	6,520 (29.0)	10,125 (45.0)	5,215 (23.2)	6,135 (27.3)	3,130 (13.9)	7,365 (32.8)	4,695 (20.9)	7,365 (32.8)	4,170 (18.5)	7,365 (32.8)	5,215 (23.2)	7,365 (32.8)	5,215 (23.2)
3/4 or #6	8,455 (37.6)	4,355 (19.4)	10,935 (48.6)	5,635 (25.1)	18,225 (81.1)	9,390 (41.8)	12,390 (55.1)	6,385 (28.4)	8,835 (39.3)	4,505 (20.0)	10,605 (47.2)	6,760 (30.1)	10,605 (47.2)	6,010 (26.7)	10,605 (47.2)	7,510 (33.4)	10,605 (47.2)	7,510 (33.4)
7/8 or #7	11,510 (51.2)	5,930 (26.4)	14,885 (66.2)	7,665 (34.1)	24,805 (110.3)	12,780 (56.8)	16,865 (75.0)	8,690 (38.7)	-	-	14,430 (64.2)	9,200 (40.9)	14,430 (64.2)	8,180 (36.4)	14,430 (64.2)	10,220 (45.5)	14,430 (64.2)	10,220 (45.5)
1 or #8	15,035 (66.9)	7,745 (34.5)	19,440 (86.5)	10,015 (44.5)	32,400 (144.1)	16,690 (74.2)	22,030 (98.0)	11,350 (50.5)	-	-	18,850 (83.8)	12,015 (53.4)	18,850 (83.8)	10,680 (47.5)	18,850 (83.8)	13,350 (59.4)	18,850 (83.8)	13,350 (59.4)
#9	-	-	-	-	-	-	-	-	-	-	23,985 (106.7)	15,290 (68.0)	23,985 (106.7)	13,590 (60.5)	23,985 (106.7)	16,990 (75.6)	23,985 (106.7)	16,990 (75.6)
1-1/4	23,490 (104.5)	12,100 (53.8)	30,375 (135.1)	15,645 (69.6)	50,620 (225.2)	26,080 (116.0)	34,425 (153.1)	17,735 (78.9)	-	-	-	-	-	-	-	-	-	-
#10	-	-	-	-	-	-	-	-	-	-	30,405 (135.2)	19,380 (86.2)	30,405 (135.2)	17,230 (76.6)	30,405 (135.2)	21,535 (95.8)	30,405 (135.2)	21,535 (95.8)

1. AISC defined steel strength (ASD) for threaded rod: Tensile = 0.33 • F_u • A_{nom}, Shear = 0.17 • F_u • A_{nom}
2. For reinforcing bars: The allowable steel tensile strength is based on 20 ksi for Grade 40 and 24 ksi for Grade 60 and higher, applied to the cross sectional area of the bar; allowable steel shear strength = 0.17 • F_u • A_{nom}
3. Allowable load capacities are calculated for the steel element type. Consideration of applying additional safety factors may be necessary depending on the application, such as life safety or overhead.
4. Allowable steel strength in tension must be checked against allowable bond strength/concrete capacity in tension to determine the controlling allowable load.
5. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances and where the minimum member thickness is the greater of [h_{nom} + 1-1/4"] and [h_{nom} + $2d_{bit}$]

Load-Temperature Reduction Curve Concrete Base Materials



Load-Temperature Reduction Curve Masonry Units



Allowable Load Capacities for Threaded Rod Installed with AC100+ Gold into Grout-Filled Concrete Masonry (Based on Bond Strength/Masonry Strength)[1,2,3,7,9,12]

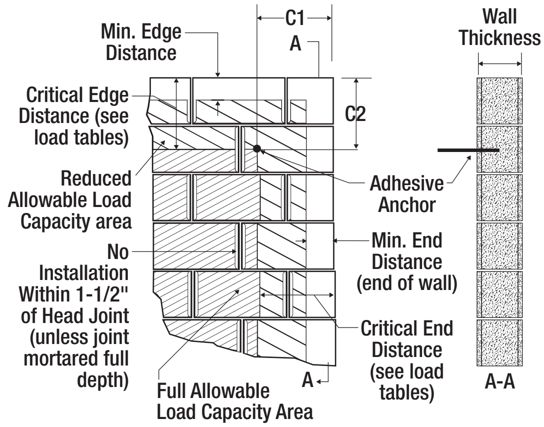
Anchor Diameter d (inch)	Minimum Embedment h_{nom} (inch)	Critical Spacing Distance s_{cr} (inch)	Minimum Edge Distance cmin (inch)	Minimum End Distance c_{min} (inch)	Tension Load (lbs)	Direction of Shear Loading	Shear Load (lbs)
Anchor Installed Into Grouted Masonry Wall Faces[4,5,6,8,10,11,13]							
3/8	3	6	3	3	615	Towards Edge/End	275
		6	3	3	615	Away From Edge/End	340
		6	3	4	735	Any	490
		6	12	12	960	Any	855
1/2	4	8	3	3	720	Towards Edge/End	429
		8	3	3	720	Away From Edge/End	1320
		8	4	4	985	Any	655
		8	12	12	960	Towards Edge/End	1430
		8	12	12	960	Away From Edge/End	1760
		8	7-3/4 (Bed Joint)	3	935	Load To Edge	460
5/8	5	10	3	3	712	Towards Edge/End	459
		10	3	3	712	Away From Edge/End	1410
		10	12	12	1095	Towards Edge/End	1530
		10	12	12	1095	Away From Edge/End	1880
		10	7-3/4 (Bed Joint)	3	1030	Load To Edge	590
3/4	6	12	4	4	754	Towards Edge/End	628
		12	4	4	754	Away From Edge/End	1448
		12	12	12	1160	Towards Edge/End	1570
		12	12	12	1160	Away From Edge/End	1930
		12	7-3/4 (Bed Joint)	4	945	Load To Edge	565

Anchor Installed Into Tops of Grouted Masonry Walls[14,15]

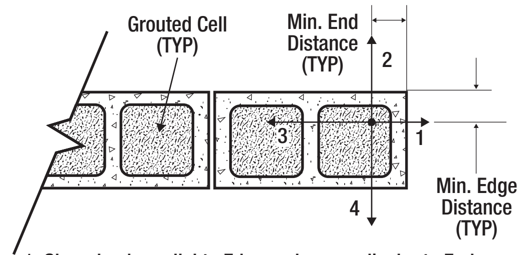
Anchor Diameter d (inch)	Minimum Embedment h_{nom} (inch)	Minimum Spacing Distance	Minimum Edge Distance c_{min} (inch)	Minimum End Distance c_{min} (inch)	Tension Load (lbs)	Direction of Shear Loading	Shear Load (lbs)
1/2	2.75	1 anchor per cell	1.75	4	595	Any	300
	4	1 anchor per cell	1.75	3	520	Load To Edge	190
	4	1 anchor per cell	1.75	3	520	Load To End	300
	10	1 anchor per block[16]	1.75	10.5	1670	Load To Edge	190
	10	1 anchor per block[16]	1.75	10.5	1670	Load To End	300
5/8	5	1 anchor per cell	1.75	3	745	Load To Edge	240
	5	1 anchor per cell	1.75	3	745	Load To End	300
	12.5	1 anchor per block[16]	2.75	10.5	2095	Load To Edge	240
	12.5	1 anchor per block[16]	2.75	10.5	2095	Load To End	300
3/4	6	1 anchor per cell	2.75	4	1260	Load To Edge	410
	6	1 anchor per cell	2.75	4	1260	Load To End	490

1. Tabulated load values are for anchors installed in nominal 8-inch wide (203 mm) Grade N, Type II, lightweight, medium-weight or normal-weight grout filled concrete masonry units with a minimum masonry strength, f'm, of 1,500 psi (10.3 MPa) conforming to ASTM C 90. If the specified compressive strength of the masonry, f'm, is 2,000 psi (13.8 MPa) minimum the tabulated values may be increased by 4 percent (multiplied by 1.04).
2. Allowable bond or masonry strengths in tension and shear are calculated using a safety factor of 5.0 and must be checked against the allowable tension and shear capacities for threaded rod based on steel strength to determine the controlling factor. See allowable load table based on steel strength.
3. Embedment is measured from the outside surface of the concrete masonry unit to the embedded end of the anchor.
4. Anchors may be installed in the grouted cells, cell webs and bed joints not closer than 1-1/2-inch from the vertical mortar joint (head joint) provided the minimum edge and end distances are maintained. Anchors may be placed in the head joint if the vertical joint is mortared full-depth.
5. A maximum of two anchors may be installed in a single masonry cell in accordance with the spacing and edge or end distance requirements.
6. The critical spacing, s_{cr}, for use with the anchor values shown in this table is 16 anchor diameters. The critical spacing, s_{cr}, distance is the distance where the full load values in the table may be used. The minimum spacing distance, s_{min}, is the minimum anchor spacing for which values are available and installation is permitted. For 3/8-inch diameter anchors, the spacing may be reduced to 8 anchor diameters when using a tension reduction factor of 0.70 and a shear reduction factor of 0.45. For ½ - and 5/8 – inch diameter anchors, the spacing may be reduced to 8 anchor diameters when using a tension reduction factor of 0.85 and a shear reduction factor of 0.45. For 3/4-inch diameter anchors, the spacing may be reduced to 8 anchor diameters when using a tension reduction factor of 1.00 and a shear reduction factor of 0.45.
7. Spacing distance is measured from the centerline to centerline between two anchors.
8. The critical edge or end distance, c_{cr}, is the distance where full load values in the table may be used. The minimum edge or end distance, c_{min}, is the minimum distance for which values are available and installation is permitted.
9. Edge or end distance is measured from anchor centerline to the closest unrestrained edge.
10. Linear interpolation of load values between the minimum spacing, s_{min}, and critical spacing, s_{cr}, distances and between minimum edge or end distance, c_{min}, and critical edge or end distance, c_{cr}, is permitted.
11. The tabulated values are applicable for anchors in the ends of grout-filled concrete masonry units where minimum edge and end distances are maintained.
12. The tabulated values must be adjusted for increased in-service base material temperatures in accordance with the In-Service Temperature chart, as applicable.
13. Concrete masonry width (wall thickness) must be equal to or greater than 1.5 times the anchor embedment depth (e.g. 3/8-inch and 1/2-inch diameter anchors are permitted in nominally 6-inch-thick concrete masonry). The 5/8-inch and 3/4-inch diameter anchors must be installed in minimum nominally 8-inch-thck concrete masonry.
14. Anchors must be installed into the grouted cell; anchors are not permitted to be installed in a head joint, flange or wen of the concrete masonry unit.
15. Allowable shear loads parallel or perpendicular to the edge of a masonry wall may be applied in or out of plane.
16. Anchors with minimum spacing distance of one anchor per block may not be installed in adjacent cells (i.e. one cell must separate the anchor locations).

AC100+ Gold Adhesive Anchors Installed into Grouted Concrete Masonry Wall

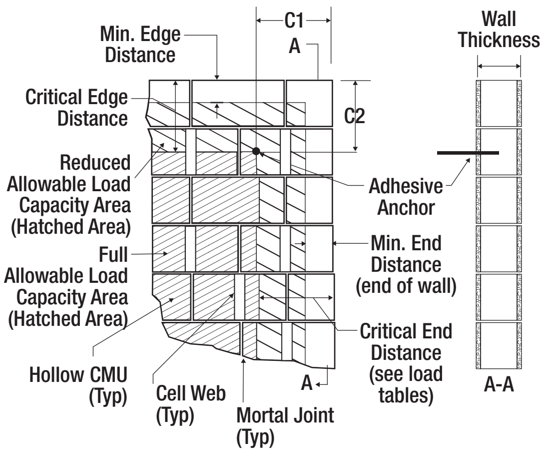


AC100+ Gold Adhesive Anchors Installed into Top of Grouted Concrete Masonry Wall

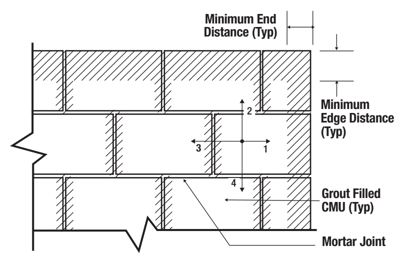


1. Shear load parallel to Edge and perpendicular to End
2. Shear load parallel to End and perpendicular to Edge
3. Shear load parallel to Edge and perpendicular away from End
4. Shear load parallel to End and perpendicular to opposite Edge

AC100+ Gold Adhesive Anchors Installed into Hollow Concrete Masonry Wall



Direction of Shear Loading in Relation to Edge and End of Masonry Wall



1. Shear load parallel to Edge and perpendicular to End
2. Shear load parallel to End and perpendicular to Edge
3. Shear load parallel to Edge and perpendicular away from End
4. Shear load parallel to End and perpendicular away from Edge

Allowable Load Capacities for Threaded Rod Installed with AC100+ Gold into Hollow Concrete Masonry Walls with Stainless Steel and Plastic Screen Tubes[1,2,3,4,5,6,7,8,9,10,11,12,13]

Anchor Diameter d (inch)	Screen Tube (type)	Minimum Embedment h_{nom} (inch)	Critical Spacing Distance s_{cr} (inch)	Minimum Edge Distance c_{min} (inch)	Minimum End Distance c_{min} (inch)	Allowable Load		
						Tension Load (lbs)	Direction of Shear Loading	Shear Load (lbs)
1/4 (6.4)	Stainless Steel	1-1/4 (31.8)	4 (101.6)	1-1/2 (38.1)	1-1/2 (38.1)	280 (1.2)	Towards Edge/End	140 (0.6)
		1-1/4 (31.8)	4 (101.6)	3 (76.2)	3 (76.2)	350 (1.6)	Towards Edge/End	275 (1.2)
		1-1/4 (31.8)	4 (101.6)	1-1/2 (38.1)	1-1/2 (38.1)	280 (1.2)	Away From Edge/End	235 (1.0)
		1-1/4 (31.8)	4 (101.6)	3 (76.2)	3 (76.2)	350 (1.6)	Away From Edge/End	465 (2.1)
	Plastic	1-1/4 (31.8)	1 anchor per cell	3 (76.2)	3 (76.2)	140 (0.6)	Towards Edge/End	235 (1.0)
3/8 (9.5)	Stainless Steel	1-1/4 (31.8)	6 (152.4)	1-7/8 (47.6)	1-7/8 (47.6)	320 (1.4)	Towards Edge/End	145 (0.6)
		1-1/4 (31.8)	6 (152.4)	3-3/4 (95.3)	3-3/4 (95.3)	400 (1.8)	Towards Edge/End	290 (1.3)
		1-1/4 (31.8)	6 (152.4)	1-7/8 (47.6)	1-7/8 (47.6)	320 (1.4)	Away From Edge/End	245 (1.1)
		1-1/4 (31.8)	6 (152.4)	3-3/4 (95.3)	3-3/4 (95.3)	400 (1.8)	Away From Edge/End	490 (2.2)
	Plastic	1-1/4 (31.8)	1 anchor per cell	3 (76.2)	3 (76.2)	140 (0.6)	Towards Edge/End	235 (1.0)
1/2 (12.7)	Stainless Steel	1-1/4 (31.8)	8 (203.2)	3-3/4 (95.3)	3-3/4 (95.3)	380 (1.7)	Towards Edge/End	215 (1.0)
		1-1/4 (31.8)	8 (203.2)	11-1/4 (285.8)	11-1/4 (285.8)	400 (1.8)	Towards Edge/End	430 (1.9)
		1-1/4 (31.8)	8 (203.2)	3-3/4 (95.3)	3-3/4 (95.3)	380 (1.7)	Away From Edge/End	365 (1.6)
		1-1/4 (31.8)	8 (203.2)	11-1/4 (285.8)	11-1/4 (285.8)	400 (1.8)	Away From Edge/End	730 (3.2)
	Plastic	1-1/4 (31.8)	1 anchor per cell	3 (76.2)	3 (76.2)	150 (0.7)	Towards Edge/End	215 (1.0)
5/8 (15.9)	Stainless Steel	1-1/4 (31.8)	8 (203.2)	3-3/4 (95.3)	3-3/4 (95.3)	380 (1.7)	Towards Edge/End	215 (1.0)
		1-1/4 (31.8)	8 (203.2)	11-1/4 (285.8)	11-1/4 (285.8)	400 (1.8)	Towards Edge/End	430 (1.9)
		1-1/4 (31.8)	8 (203.2)	3-3/4 (95.3)	3-3/4 (95.3)	380 (1.7)	Away From Edge/End	365 (1.6)
		1-1/4 (31.8)	8 (203.2)	11-1/4 (285.8)	11-1/4 (285.8)	400 (1.8)	Away From Edge/End	730 (3.2)
	Plastic	1-1/4 (31.8)	1 anchor per cell	3 (76.2)	3 (76.2)	150 (0.7)	Towards Edge/End	215 (1.0)
3/4 (19.1)	Stainless Steel	1-1/4 (31.8)	8 (203.2)	3-3/4 (95.3)	3-3/4 (95.3)	380 (1.7)	Towards Edge/End	215 (1.0)
		1-1/4 (31.8)	8 (203.2)	11-1/4 (285.8)	11-1/4 (285.8)	400 (1.8)	Towards Edge/End	430 (1.9)
		1-1/4 (31.8)	8 (203.2)	3-3/4 (95.3)	3-3/4 (95.3)	380 (1.7)	Away From Edge/End	365 (1.6)
		1-1/4 (31.8)	8 (203.2)	11-1/4 (285.8)	11-1/4 (285.8)	400 (1.8)	Away From Edge/End	730 (3.2)

1. Tabulated load values are for anchors installed in hollow concrete masonry with minimum masonry strength, f'm, of 1,500 psi (10.3 MPa). Concrete masonry units must be lightweight, medium-weight or normal-weight conforming to ASTM C 90. Allowable loads have been calculated using a safety factor of 5.0.
2. Anchors must be installed into the hollow cell; anchors are not permitted to be installed in a mortar joint, flange or web of the concrete masonry unit.
3. A maximum of two anchor may be installed in a single masonry cell in accordance with the spacing and edge distance requirements, except as noted in the table.
4. Embedment is measured from the outside surface of the concrete masonry unit to the embedded end of the anchor.
5. Edge or end distance is measured from anchor centerline to the closest unrestrained edge of the CMU block.
6. The critical spacing, s_{cr}, for use with the anchor values shown in this table is 16 anchor diameters, except as noted in the table. The critical spacing, s_{cr}, distance is the distance where the full load values in the table may be used. The minimum spacing distance, s_{min}, is the minimum anchor spacing for which values are available and installation is permitted. The spacing may be reduced to 8 anchor diameters by multiplying the tension load value by a reduction factor of 0.60 and multiplying the shear load value by a reduction factor of 0.45.
7. Spacing distance is measured from the centerline to centerline between two anchors.
8. Linear interpolation of load values between the minimum spacing, s_{min}, and critical spacing, s_{cr}, distances and between minimum edge or end distance, c_{min}, and critical edge or end distance, c_{cr}, is permitted if applicable.
9. Concrete masonry width (wall thickness) may be minimum nominal 6-inch-thick provided the minimum embedment (i.e. face shell thickness) is maintained.
10. The tabulated values are applicable for anchors in the ends of hollow concrete masonry units where minimum face shell thickness, minimum edge and end distances are maintained.
11. Anchors are recognized to resist dead, live and wind tension and shear load applications.
12. Allowable loads must be the lesser of the adjusted masonry or bond values tabulated above and the steel strength values.
13. The tabulated values must be adjusted for increased in-service base material temperatures in accordance with the In-Service Temperature chart, as applicable.

Ultimate and Allowable Load Capacities for Threaded Rod Installed with AC100+ Gold into Brick Masonry Walls[1,2,3]

Anchor Diameter d in.	Drill Diameter d_{bit} in.	Minimum Embedment Depth in.	Minimum End Distance in.	Minimum Edge Distance in.	Ultimate Load		Allowable Load	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
Anchors Installed into the Face of Brick Masonry Walls								
3/8	1/2	3.5 (88.9)	2.5 (63.5)	2.5 (63.5)	3,600 (16.0)	4,505 (20.0)	720 (3.2)	900 (4.0)
		3.5 (88.9)	6 (152.4)	6 (152.4)	5,845 (26.0)	4,580 (20.4)	1,170 (5.2)	915 (4.1)
		6 (152.4)	6 (152.4)	6 (152.4)	10,420 (46.4)	-	2,085 (9.3)	-
1/2	5/8	6 (152.4)	8 (203.2)	8 (203.2)	11,500 (51.2)	9,300 (41.4)	2,300 (10.2)	1,860 (8.3)
Anchors Installed into the Top of Brick Masonry Walls								
3/8	1/2	3.5 (88.9)	2.5 (63.5)	2.5 (63.5)	3,665 (16.3)	2,435 (10.8)	735 (3.3)	485 (2.2)

1. Tabulated load values are for anchors installed in minimum 2 wythe, Grade SW, solid clay brick masonry conforming to ASTM C 62. Motar must be N, S or M.
2. Allowable loads are calculated using an applied safety factor or 5.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety.
3. Allowable loads apply to installations in the face of brick or mortar joint. The tabulated values are for anchors installed at a minimum of 16 anchor diameters on center for 100 percent capacity.

Allowable Load Capacities for Threaded Rods and Reinforcing Bars or Rebar Dowel for AC100+ Gold Installed in Unreinforced Brick Masonry (URM Walls)[1,2]

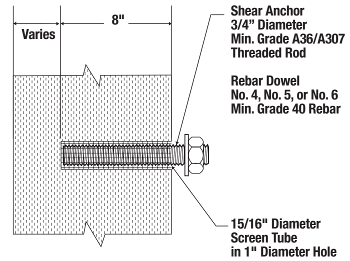


Figure 1

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)
3/4 (19.1)	8 (203.2)	13 (330.2)	-	1,000 (4.5)
No. 4	8 (203.2)	13 (330.2)	-	500 (2.3)
No. 5	8 (203.2)	13 (330.2)	-	750 (3.4)
No. 6	8 (203.2)	13 (330.2)	-	1,000 (4.5)

1. Allowable load values are applicable only where in-place shear tests indicate minimum mortar strength of 35 psi net. The anchors installed in unreinforced brick walls are limited to resisting seismic or wind loads only.

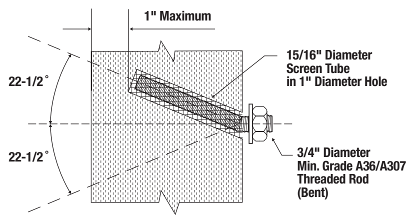


Figure 2

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)
3/4 (19.1)	Within 1 inch of opposite wall surface	13 (330.2)	1,200 (5.4)	1,000 (4.5)

2. Allowable load values are applicable only where in-place shear tests indicate minimum mortar strength of 35 psi net. The anchors installed in unreinforced brick walls are limited to resisting seismic or wind loads only.

Anchor Description	Minimum Vertical Spacing in.	Minimum Horizontal Spacing in.	Minimum Edge Distance in.
Shear Anchor Configuration A – (See Figure 1)	16	16	16
22-1/2° Combination Anchor Configuration B – (See Figure 2)	16	16	16

STRENGTH DESIGN (SD)

CODE LISTED
ICC-ES ESR-2582

STRENGTH DESIGN TABLES SD

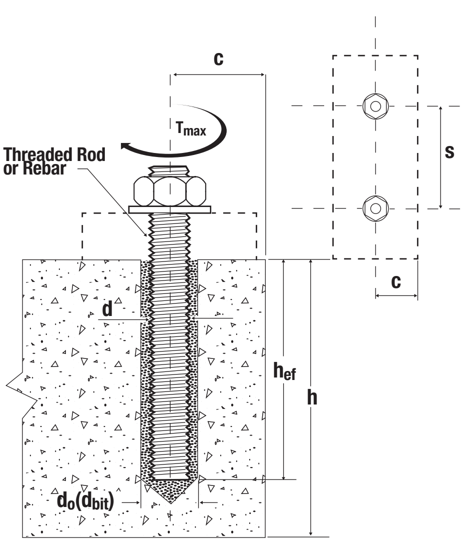
Strength Design Installation Table for AC100+ Gold[1]

Parameter	Symbol	Units	Fractional Nominal Rod Diameter (Inch) / Reinforcing Bar Size									
			3/8 or #3	1/2	#4	5/8 or #5	3/4 or #6	7/8 or #7	1 or #8	#9	1-1/4	#10
Threaded rod outside diameter	d	inch (mm)	0.375 (9.5)	0.500 (12.7)		0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	-	1.250 (31.8)	-
Rebar nominal outside diameter	d	inch (mm)	0.375 (9.5)	0.500 (12.7)		0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.125 (28.7)	-	1.250 (31.8)
Carbide drill bit nominal size	d_o (d_{bit})	inch	7/16	9/16	5/8	11/16 or 3/4	7/8	1	1-1/8	1-3/8	1-3/8	1-1/2
Minimum embedment	$h_{ef,min}$	inch (mm)	2-3/8 (60)	2-3/4 (70)		3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	4-1/2 (114)	5 (127)	5 (127)
Maximum embedment	$h_{ef,max}$	inch (mm)	4-1/2 (114)	6 (152)		7-1/2 (191)	9 (229)	10-1/2 (267)	12 (305)	13-1/2 (343)	15 (381)	15 (381)
Minimum member thickness	h_{min}	inch (mm)	h_{ef} + 1-1/4 (h_{ef} + 30)			$h_{ef} + 2d_o$						
Minimum anchor spacing	s_{min}	inch (mm)	1-7/8 (48)	2-1/2 (64)		3-1/8 (79)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)	6-1/4 (159)
Minimum edge distance	c_{min}	inch (mm)	1-7/8 (48)	2-1/2 (64)		3-1/8 (79)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)	6-1/4 (159)
Max. rod torque[2]	T_{max}	ft-lbs	15	33		60	105	125	165	-	280	-
Max. torque[2,3] (A36/Grade 36 rod)	T_{max}	ft-lbs	10	25		50	90	125	165	-	280	-
Max. torque[2,4] (Class 1 SS rod)	T_{max}	ft-lbs	5	20		40	60	100	165	-	280	-
Minimum edge distance, reduced[5]	$c_{min,red}$	inch (mm)	1-3/4 (45)	1-3/4 (45)		1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	2-3/4 (70)	2-3/4 (70)	2-3/4 (70)

For pound-inch units: 1 mm = 0.03937 inch, 1 N-m = 0.7375 ft-lbf. For SI: 1 inch = 25.4 mm, 1 ft-lbf = 1.356 N-m.

1. For use with the design provisions of ACI 318-14 Ch. 17 or ACI 318-11 Appendix D as applicable and ICC-ES AC308, Section 4.2 and ESR-2582.
2. Torque may not be applied to the anchors until the full cure time of the adhesive has been achieved.
3. These torque values apply to ASTM A 36 / F 1554 Grade 36 carbon steel threaded rods
4. These torque values apply to ASTM A 193 Grade B8/B8M (Class 1) stainless steel threaded rods.
5. For installation between the minimum edge distance, c_{min}, and the reduced minimum edge distance, $c_{min,red}$, the maximum torque must be reduced (multiplied) by a factor of 0.45.

Detail of Steel Hardware Elements used with Injection Adhesive System



Threaded Rod and Deformed Reinforcing Bar Material Properties

Steel Description (General)	Steel Specification (ASTM)	Nominal Anchor Size (inch)	Minimum Yield Strength, f_y (ksi)	Minimum Ultimate Strength, f_u (ksi)
Carbon rod	ASTM A 36 and F 1554 Grade 36	3/8 through 1-1/4	36.0	58.0
	ASTM F 1554 Grade 55	3/8 through 1-1/4	55.0	75.0
	ASTM A 449	3/8 through 1	92.0	120.0
		1-1/4	81.0	105.0
High Strength Carbon rod	ASTM A 193 Grade B7 and F 1554 Grade 105	3/8 through 1-1/4	105.0	125.0
Stainless rod (Alloy 304/316)	ASTM F 593 Condition CW	3/8 through 5/8	65.0	100.0
		3/4 through 1-1/4	45.0	85.0
	ASTM A 193 Grade B8/B8M, Class 1	3/8 through 1-1/4	30.0	75.0
	ASTM A 193 Grade B8/B8M2, Class 2B	3/8 through 1-1/4	75.0	95.0
Reinforcing Bar	ASTM A 615, A 767, Grade 75	3/8 through 1-1/4 (#3 through #10)	75.0	100.0
	ASTM A 615, A 767, Grade 60	3/8 through 1-1/4 (#3 through #10)	60.0	90.0
	ASTM A 706, A 767, Grade 60	3/8 through 1-1/4 (#3 through #10)	60.0	80.0
	ASTM A 615, A 767, Grade 40	3/8 through 1-1/4 (#3 through #10)	40.0	60.0

Steel Tension and Shear Design for Threaded Rod in Normal Weight Concrete (For use with load combinations taken from ACI 318-14 Section 5.3)

CODE LISTED
ICC-ES ESR-2582

Design Information		Symbol	Units	Nominal Rod Diameter[1] (inch)						
				3/8	1/2	5/8	3/4	7/8	1	1-1/4
Threaded rod nominal outside diameter		d	inch (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.250 (31.8)
Threaded rod effective cross-sectional area		A_{se}	inch² (mm²)	0.0775 (50)	0.1419 (92)	0.2260 (146)	0.3345 (216)	0.4617 (298)	0.6057 (391)	0.9691 (625)
ASTM A 36 and ASTM F 1554 Grade 36	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	4,495 (20.0)	8,230 (36.6)	13,110 (58.3)	19,400 (86.3)	26,780 (119.1)	35,130 (156.3)	56,210 (250.0)
		V_{sa}	lbf (kN)	2,695 (12.0)	4,940 (22.0)	7,860 (35.0)	11,640 (51.8)	16,070 (71.4)	21,080 (93.8)	33,725 (150.0)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM F 1554 Grade 55	Nominal strength as governed by steel strength(for a single anchor)	N_{sa}	lbf (kN)	5,810 (25.9)	10,640 (47.3)	16,950 (75.4)	25,085 (111.6)	34,625 (154.0)	45,425 (202.0)	72,680 (323.3)
		V_{sa}	lbf (kN)	3,485 (15.5)	6,385 (28.4)	10,170 (45.2)	15,050 (67.0)	20,775 (92.4)	27,255 (121.2)	43,610 (194.0)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM A 193 Grade B7 and ASTM F 1554 Grade 105	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	9,685 (43.1)	17,735 (78.9)	28,250 (125.7)	41,810 (186.0)	57,710 (256.7)	75,710 (336.8)	121,135 (538.8)
		V_{sa}	lbf (kN)	5,815 (25.9)	10,640 (7.3)	16,950 (75.4)	25,085 (111.6)	34,625 (154.0)	45,425 (202.1)	72,680 (323.3)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM A 449	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	9,300 (41.4)	17,025 (75.7)	27,120 (120.6)	40,140 (178.5)	55,905 (248.7)	72,685 (323.3)	101,755 (452.6)
		V_{sa}	lbf (kN)	5,580 (24.8)	10,215 (45.4)	16,270 (72.4)	24,085 (107.1)	33,540 (149.2)	43,610 (194.0)	61,050 (271.6)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM F 593 CW Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	7,750 (34.5)	14,190 (63.1)	22,600 (100.5)	28,430 (126.5)	39,245 (174.6)	51,485 (229.0)	82,370 (366.4)
		V_{sa}	lbf (kN)	4,650 (20.7)	8,515 (37.9)	13,560 (60.3)	17,060 (75.9)	23,545 (104.7)	30,890 (137.4)	49,425 (219.8)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[3]	ϕ	-	0.65						
	Strength reduction factor for shear[3]	ϕ	-	0.60						
ASTM A 193 Grade B8/B8M, Class 1 Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)[4]	N_{sa}	lbf (kN)	4,420 (19.7)	8,090 (36.0)	12,880 (57.3)	19,065 (84.8)	26,315 (117.1)	34,525 (153.6)	55,240 (245.7)
		V_{sa}	lbf (kN)	2,650 (11.8)	4,855 (21.6)	7,730 (34.4)	11,440 (50.9)	15,790 (70.2)	20,715 (92.1)	33,145 (147.4)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM A 193 Grade B8/ B8M2, Class 2B Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	7,365 (32.8)	13,480 (60.0)	21,470 (95.5)	31,775 (141.3)	43,860 (195.1)	57,545 (256.0)	92,065 (409.5)
		V_{sa}	lbf (kN)	4,420 (19.7)	8,085 (36.0)	12,880 (57.3)	19,065 (84.8)	26,315 (117.1)	34,525 (153.6)	55,240 (245.7)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						

For SI: 1 inch = 25.4 mm, 1 lbf = 4.448 N. For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf.

1. Values provided for steel element material types are based on minimum specified strengths and calculated in accordance with ACI 318-14 Eq. 17.4.1.2 and Eq. 17.5.1.2b or ACI 318-11 Eq. (D-2) and Eq. (D-29), as applicable, except where noted. Nuts and washers must be appropriate for the rod. Nuts must have specified proof load stresses equal to or greater than the minimum tensile strength of the specified threaded rod.
2. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4. Values correspond to ductile steel elements.
3. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4. Values correspond to brittle steel elements
4. In accordance with ACI 318-14 17.4.1.2 and 17.5.1.2 or ACI 318-11 D.5.1.2 and D.6.1.2, as applicable, the calculated values for nominal tension and shear strength for ASTM A193 Grade B8/B8M Class 1 stainless steel threaded rods are based on limiting the specified tensile strength of the anchor steel to 1.9fy or 57,000 psi (393 MPa).

Steel Tension and Shear Design for Reinforcing Bars in Normal Weight Concrete (For use with load combinations taken from ACI 318-14 Section 5.3)

CODE LISTED
ICC-ES ESR-2582

STRENGTH DESIGN TABLES SD

Design Information		Symbol	Units	Nominal Reinforcing Bar Size (Rebar)[1]							
				No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10
Rebar nominal outside diameter		d	inch (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.125 (28.7)	1.250 (32.3)
Rebar effective cross-sectional area		A_{se}	inch² (mm²)	0.110 (71.0)	0.200 (129.0)	0.310 (200.0)	0.440 (283.9)	0.600 (387.1)	0.790 (509.7)	1.000 (645.2)	1.270 (819.4)
ASTM A 615 Grade 75	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	11,000 (48.9)	20,000 (89.0)	31,000 (137.9)	44,000 (195.7)	60,000 (266.9)	79,000 (351.4)	100,000 (444.8)	127,000 (564.9)
		V_{sa}	lbf (kN)	6,600 (29.4)	12,000 (53.4)	18,600 (82.7)	26,400 (117.4)	36,000 (160.1)	47,400 (210.8)	60,000 (266.9)	76,200 (338.9)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[3]	ϕ	-	0.65							
	Strength reduction factor for shear[3]	ϕ	-	0.60							
ASTM A 615 Grade 60	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	9,900 (44.0)	18,000 (80.1)	27,900 (124.1)	39,600 (176.1)	54,000 (240.2)	71,100 (316.3)	90,000 (400.3)	114,300 (508.4)
		V_{sa}	lbf (kN)	5,940 (26.4)	10,800 (48.0)	16,740 (74.5)	23,760 (105.7)	32,400 (144.1)	42,660 (189.8)	54,000 (240.2)	68,580 (305.0)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75							
	Strength reduction factor for shear[2]	ϕ	-	0.65							
ASTM A 706 Grade 60	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	8,800 (39.1)	16,000 (71.2)	24,800 (110.3)	35,200 (156.6)	48,000 (213.5)	63,200 (281.1)	80,000 (355.9)	101,600 (452.0)
		V_{sa}	lbf (kN)	5,280 (23.5)	9,600 (42.7)	14,880 (66.2)	21,120 (94.0)	28,800 (128.1)	37,920 (168.7)	48,000 (213.5)	60,960 (271.2)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75							
	Strength reduction factor for shear[2]	ϕ	-	0.65							
ASTM A 615 Grade 40	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	6,600 (29.4)	12,000 (53.4)	18,600 (82.7)	26,400 (117.4)	In accordance with ASTM A 615, Grade 40 bars are furnished only in sizes No. 3 through No. 6			
		V_{sa}	lbf (kN)	3,960 (17.6)	7,200 (32.0)	11,160 (49.6)	15,840 (70.5)				
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80				
	Strength reduction factor for tension[2]	ϕ	-	0.75							
	Strength reduction factor for shear[2]	ϕ	-	0.65							

1. Values provided for reinforcing bar material types based on minimum specified strengths and calculated in accordance with ACI 318-14 Eq. 17.4.1.2 and Eq. 17.5.1.2b or ACI 318-11 Eq. (D-2) and Eq. (D-29), as applicable.
2. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4. Values correspond to ductile steel elements. In accordance with ACI 318-14 17.2.3.4.3(a)(vi) or ACI 318-11 D.3.3.4.3(a)6, as applicable, deformed reinforcing bars meeting this specification used as ductile steel elements to resist earthquake effects shall be limited to reinforcing bars satisfying the requirements of ACI 318-14 20.2.2.4 and 20.2.2.5 or ACI 318-11 21.1.5.2 (a) and (b), as applicable.
3. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4. Values correspond to brittle steel elements.

Concrete Breakout Design Information for Threaded Rod and Reinforcing Bars (For use with loads combinations taken from ACI 318-14 Section 5.3)[1]

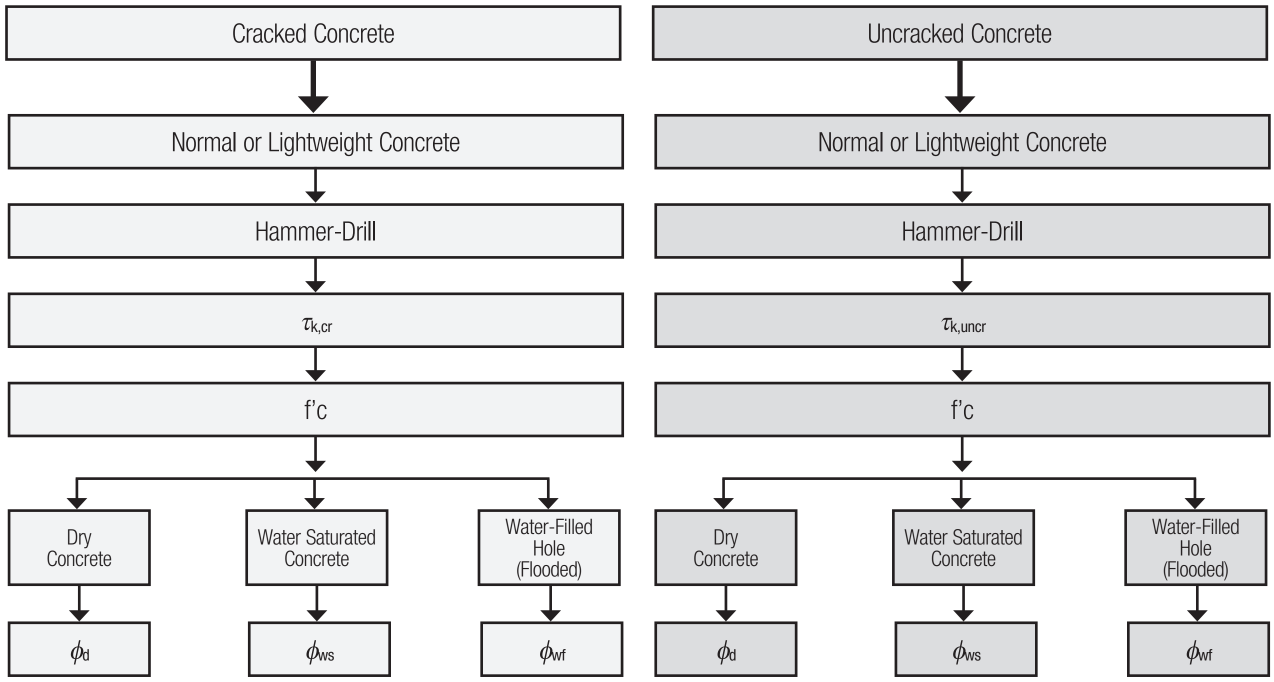
CODE LISTED
ICC-ES ESR-2582

Design Information	Symbol	Units	Nominal Rod Diameter (inch) / Reinforcing Bar Size							
			3/8 or #3	1/2 or #4	5/8 or #5	3/4 or #6	7/8 or #7	1 or #8	#9	1-1/4 or #10
Effectiveness factor for cracked concrete	$k_{c,cr}$	- (SI)	Not Applicable	17 (7.1)						
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	- (SI)	24 (10.0)							
Minimum embedment	$h_{ef,min}$	inch (mm)	2-3/8 (60)	2-3/4 (70)	3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	4-1/2 (114)	5 (127)
Maximum embedment	$h_{ef,max}$	inch (mm)	4-1/2 (114)	6 (152)	7-1/2 (191)	9 (229)	10-1/2 (267)	12 (305)	13-1/2 (343)	15 (381)
Minimum anchor spacing	s_{min}	inch (mm)	1-7/8 (48)	2-1/2 (64)	3-1/8 (79)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)
Minimum edge distance[2]	c_{min}	inch (mm)	5*d* where *d* is nominal outside diameter of the anchor							
Minimum edge distance, reduced[2]	$c_{min,red}$	inch (mm)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	2-3/4 (70)	2-3/4 (70)
Minimum member thickness	h_{min}	inch (mm)	h_{ef} + 1-1/4 (h_{ef} + 30)		$h_{ef} + 2d_o$ where d_o is hole diameter;					
Critical edge distance—splitting (for uncracked concrete only)[3]	c_{ac}	inch	$c_{ac} = h_{ef} \cdot \left(\frac{\tau_{uncr}}{1160}\right)^{0.4} \cdot \left[3.1-0.7\frac{h}{h_{ef}}\right]$							
		(mm)	$c_{ac} = h_{ef} \cdot \left(\frac{\tau_{uncr}}{8}\right)^{0.4} \cdot \left[3.1-0.7\frac{h}{h_{ef}}\right]$							
Strength reduction factor for tension, concrete failure modes, Condition B[4]	ϕ	-	0.65							
Strength reduction factor for shear, concrete failure modes, Condition B[4]	ϕ	-	0.70							

For SI: 1 inch = 25.4 mm, 1 lbf = 4.448 N. For pound-inch units: 1 mm = 0.03937 inch, 1 N = 0.2248 lbf.

1. Additional setting information is described in the installation instructions.
2. For installation between the minimum edge distance, c_{min}, and the reduced minimum edge distance, $c_{min,red}$, the maximum torque applied must be reduced (multiplied) by a factor of 0.45.
3. $\tau_{k,uncr}$ need not be taken as greater than: $\tau_{k,uncr} = \frac{k_{uncr} \cdot \sqrt{h_{ef} \cdot f'_c}}{\pi \cdot d}$ and $\frac{h}{h_{ef}}$ need not be taken as larger than 2.4.
4. Condition A requires supplemental reinforcement, while Condition B applies where supplemental reinforcement is not provided or where pryout governs, as set forth in ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4.

FLOWCHART FOR THE ESTABLISHMENT OF DESIGN BOND STRENGTH



Bond Strength Design Information for Threaded Rods (For use with load combinations taken from ACI 318-14 Section 5.3)[1,2]

Design Information		Symbol	Units	Nominal Rod Diameter (Inch) / Reinforcing Bar Size						
				3/8	1/2	5/8	3/4	7/8	1	1-1/4
Minimum embedment		$h_{ef,min}$	inch (mm)	2-3/8 (60)	2-3/4 (70)	3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	5 (127)
Maximum embedment		$h_{ef,max}$	inch (mm)	4-1/2 (114)	6 (152)	7-1/2 (191)	9 (229)	10-1/2 (267)	12 (305)	15 (381)
122°F (50°C) Maximum Long-Term Service Temperature; 176°F (80°C) Maximum Short-Term Service Temperature[3,4]	Characteristic bond strength in cracked concrete[4,7]	$\tau_{k,cr}$	psi (N/mm²)	Not Applicable	498 (3.4)	519 (3.6)	519 (3.6)	519 (3.6)	519 (3.6)	525 (3.6)
	Characteristic bond strength in uncracked concrete[4,8]	$\tau_{k,uncr}$	psi (N/mm²)	823 (5.7)	823 (5.7)	823 (5.7)	823 (5.7)	823 (5.7)	743 (5.1)	588 (4.1)
									Not applicable in water-filled hole installation condition	
162°F (72°C) Maximum Long-Term Service Temperature; 248°F (120°C) Maximum Short-Term Service Temperature[3,4]	Characteristic bond strength in cracked concrete[4,7]	$\tau_{k,cr}$	psi (N/mm²)	Not Applicable	245 (1.7)	255 (1.8)	255 (1.8)	255 (1.8)	255 (1.8)	255 (1.8)
	Characteristic bond strength in uncracked concrete[4,8]	$\tau_{k,uncr}$	psi (N/mm²)	405 (2.8)	405 (2.8)	405 (2.8)	405 (2.8)	405 (2.8)	366 (2.5)	Not Applicable
								Not applicable in water-filled hole installation condition		
Permissible installation conditions[6]	Dry concrete	ϕ_d	-	0.65				0.65	0.65	0.65
	Water-saturated concrete	ϕ_{ws}	-	0.55				0.55	0.55	0.55
	Water-filled hole (flooded)	ϕ_{wf}	-	0.45				0.45	0.45	0.45
		κ_{wf}		0.78				0.70	0.69	0.67
Reduction factor for seismic tension		$\alpha_{N,seis}$	-	0.95						

For SI: 1 inch = 25.4 mm, 1 psi = 0.006894 MPa. For pound-inch units: 1 mm = 0.03937 inch, 1 MPa = 145.0 psi.

1. Bond strength values correspond to a normal-weight concrete compressive strength f'c = 2,500 psi (17.2 MPa). For concrete compressive strength, f'c between 2,500 psi and 8,000 psi (17.2 MPa and 55.2 MPa), the tabulated characteristic bond strength may be increased by a factor of $(f'c / 2{,}500)^{0.13}$ [For SI: $(f'c / 17.2)^{0.13}$].
2. The modification factor for bond strength of adhesive anchors in lightweight concrete shall be taken as given in ACI 318-14 17.2.6 where applicable.
3. Long-term and short-term temperatures meet the requirements of Section 8.5 of ACI 355.4 and Table 9.1, Temperature Category A.
4. Short-term base material service temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling. Long-term base material service temperatures are roughly constant over significant periods of time.
5. Characteristic bond strengths are for sustained loads including dead and live loads.
6. Permissible installation conditions include dry concrete, water-saturated concrete and water-filled holes. Water-filled holes include applications in dry or water-saturated concrete where the drilled holes contain standing water at the time of anchor installation.
7. For structures assigned to Seismic Design Categories C, D, E or F, the tabulated bond strength values for cracked concrete must be adjusted by an additional reduction factor, $\alpha_{N,seis}$, as given in this table.
8. Bond strength values for uncracked concrete are applicable for structures assigned to Seismic Design Categories A and B only.

Bond Strength Design Information for Reinforcing Bar (For use with load combinations taken from ACI 318-14 Section 5.3)[1,2]

Design Information		Symbol	Units	#3	#4	#5	#6	#7	#8	#9	#10
				Nominal Rod Diameter (Inch) / Reinforcing Bar Size							
Minimum embedment		$h_{ef,min}$	inch (mm)	2-3/8 (60)	2-3/4 (70)	3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	4-1/2 (114)	5 (127)
Maximum embedment		$h_{ef,max}$	inch (mm)	4-1/2 (114)	6 (152)	7-1/2 (191)	9 (229)	10-1/2 (267)	12 (305)	13-1/2 (343)	15 (381)
122°F (50°C) Maximum Long-Term Service Temperature; 176°F (80°C) Maximum Short-Term Service Temperature[3,4]	Characteristic bond strength in cracked concrete[4,7]	$\tau_{k,cr}$	psi (N/mm²)	Not Applicable	331 (2.3)	345 (2.4)	345 (2.4)	345 (2.4)	345 (2.4)	349 (2.4)	349 (2.4)
	Characteristic bond strength in uncracked concrete[4,8]	$\tau_{k,uncr}$	psi (N/mm²)	823 (5.7)	823 (5.7)	823 (5.7)	823 (5.7)	823 (5.7)	743 (5.1)	655 (4.5)	588 (4.1)
									Not applicable in water-filled hole installation condition		
162°F (72°C) Maximum Long-Term Service Temperature; 248°F (120°C) Maximum Short-Term Service Temperature[3,4]	Characteristic bond strength in cracked concrete[4,7]	$\tau_{k,cr}$	psi (N/mm²)	Not Applicable	163 (1.1)	170 (1.2)	170 (1.2)	170 (1.2)	170 (1.2)	170 (1.2)	170 (1.2)
	Characteristic bond strength in uncracked concrete[4,8]	$\tau_{k,uncr}$	psi (N/mm²)	405 (2.8)	405 (2.8)	405 (2.8)	405 (2.8)	405 (2.8)	366 (2.5)	329 (2.3)	Not Applicable
								Not applicable in water-filled hole installation condition			
Permissible installation conditions[6]	Dry concrete	ϕ_d	-	0.65				0.65	0.65	0.65	0.65
	Water-saturated concrete	ϕ_{ws}	-	0.55				0.55	0.55	0.55	0.55
	Water-filled hole (flooded)	ϕ_{wf}	-	0.45				0.45	0.45	0.45	0.45
		κ_{wf}		0.78				0.70	0.69	0.68	0.67
Reduction factor for seismic tension		$\alpha_{N,seis}$	-	0.95							

For SI: 1 inch = 25.4 mm, 1 psi = 0.006894 MPa. For pound-inch units: 1 mm = 0.03937 inch, 1 MPa = 145.0 psi.

1. Bond strength values correspond to a normal-weight concrete compressive strength f'c = 2,500 psi (17.2 MPa). For concrete compressive strength, f'c between 2,500 psi and 8,000 psi (17.2 MPa and 55.2 MPa), the tabulated characteristic bond strength may be increased by a factor of $(f'c / 2,500)^{0.13}$ [For SI: $(f'c / 17.2)^{0.13}$].
2. The modification factor for bond strength of adhesive anchors in lightweight concrete shall be taken as given in ACI 318-14 17.2.6 where applicable.
3. Long-term and short-term temperatures meet the requirements of Section 8.5 of ACI 355.4 and Table 9.1, Temperature Category A.
4. Short-term base material service temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling. Long-term base material service temperatures are roughly constant over significant periods of time.
5. Characteristic bond strengths are for sustained loads including dead and live loads.
6. Permissible installation conditions include dry concrete, water-saturated concrete and water-filled holes. Water-filled holes include applications in dry or water-saturated concrete where the drilled holes contain standing water at the time of anchor installation.
7. For structures assigned to Seismic Design Categories C, D, E or F, the tabulated bond strength values for cracked concrete must be adjusted by an additional reduction factor, $\alpha_{N,seis}$, as given in this table.
8. Bond strength values for uncracked concrete are applicable for structures assigned to Seismic Design Categories A and B only.

Tension and Shear Design Strength for Threaded Rod and Reinforcing Bar Installed in Uncracked Concrete (Bond or Concrete Strength)
Drilled with a Hammer-Drill and Carbide Bit in a Dry Hole Condition
122°F (50°C) Maximum Long-Term Service Temperature; 176°F (80°C) Maximum Short-Term Service Temperature[1,2,3,4,5,6,7,8,9]

Nominal Rod/Rebar Size (in. or #)	Embed. Depth h_{ef} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 (psi)		f'c = 3,000 (psi)		f'c = 4,000 (psi)		f'c = 6,000 (psi)		f'c = 8,000 (psi)	
		ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)
3/8 or #3	2-3/8	1,495	1,610	1,535	1,650	1,590	1,715	1,675	1,805	1,740	1,875
	3	1,890	2,955	1,935	3,270	2,010	3,830	2,120	4,565	2,200	4,735
	4-1/2	2,835	5,395	2,905	5,965	3,015	6,495	3,180	6,845	3,300	7,105
1/2 or #4	2-3/4	2,310	2,780	2,365	3,075	2,455	3,605	2,590	4,505	2,690	5,280
	4	3,360	5,230	3,440	5,785	3,575	6,780	3,765	8,110	3,910	8,420
	6	5,040	9,530	5,165	10,540	5,360	11,545	5,650	12,170	5,865	12,630
5/8 or #5	3-1/8	3,280	3,695	3,360	4,085	3,490	4,785	3,680	5,990	3,820	7,020
	5	5,250	8,155	5,380	9,015	5,585	10,565	5,885	12,675	6,110	13,160
	7-1/2	7,880	14,850	8,065	16,420	8,375	18,035	8,825	19,015	9,165	19,735
3/4 or #6	3-1/2	4,285	4,730	4,380	5,230	4,535	6,130	4,760	7,670	4,925	8,990
	6	7,565	11,515	7,745	12,730	8,040	14,925	8,475	18,250	8,795	18,950
	9	11,345	20,970	11,615	23,190	12,060	25,975	12,710	27,380	13,195	28,420
7/8 or #7	3-1/2	4,370	4,930	4,475	5,470	4,635	6,410	4,865	8,020	5,040	9,400
	7	10,295	14,500	10,540	16,035	10,940	18,795	11,535	23,510	11,975	25,790
	10-1/2	15,440	26,410	15,810	29,210	16,415	34,235	17,300	37,265	17,960	38,685
1 or #8	4	5,210	6,045	5,325	6,685	5,515	7,835	5,795	9,800	6,000	11,490
	8	12,140	17,000	12,430	18,800	12,905	22,040	13,600	27,565	14,120	30,410
	12	18,205	30,965	18,645	34,245	19,355	40,140	20,400	43,940	21,180	45,615
#9	5	5,795	6,845	5,925	7,570	6,135	8,875	6,445	11,100	6,670	13,010
	10	13,545	19,320	13,865	21,365	14,395	25,045	15,175	31,325	15,755	33,930
	15	20,315	35,195	20,800	38,920	21,595	45,620	22,760	49,025	23,630	50,895
1-1/4	5	6,575	7,695	6,720	8,510	6,955	9,975	7,305	12,480	7,565	14,625
	10	15,010	21,630	15,370	23,920	15,955	28,035	16,820	35,065	17,460	37,605
	15	22,515	39,390	23,055	43,560	23,930	51,060	25,225	54,335	26,190	56,405
#10	5	6,490	7,685	6,635	8,495	6,870	9,960	7,215	12,455	7,470	14,600
	10	15,010	21,665	15,370	23,960	15,955	28,085	16,820	35,130	17,460	37,605
	15	22,515	39,465	23,055	43,640	23,930	51,155	25,225	54,335	26,190	56,405

☐ - Concrete Breakout Strength ☐ - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in uncracked normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac}
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.
2. Calculations were performed according to ACI 318-14, Ch.17 and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls.
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318-14 Section 5.3 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-2582.
5. Tabular values are permitted for static loads only, seismic loading is not considered with these tables. Periodic special inspection must be performed where required by code, see ESR-2582 for applicable information.
6. For anchors subjected to tension resulting from sustained loading a supplemental check must be performed according to ACI 318-14 17.3.1.2.
7. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14, Ch.17.
8. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-14, Ch.17, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-14, Ch.17 and ICC-ES AC308 and ESR-2582.
9. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Tension and Shear Design Strength for Threaded Rod Installed in Cracked Concrete (Bond or Concrete Strength) Drilled with a Hammer-Drill and Carbide Bit in a Dry Hole Condition 122°F (50°C) Maximum Long-Term ServiceTemperature; 176°F (80°C) Maximum Short-Term Service Temperature[1,2,3,4,5,6,7,8,9]

STRENGTH DESIGN SD TABLES

Nominal Rod/Rebar Size (in.)	Embed. Depth h_{ef} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 (psi)		f'c = 3,000 (psi)		f'c = 4,000 (psi)		f'c = 6,000 (psi)		f'c = 8,000 (psi)	
		ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)
1/2	2-3/4	1,400	1,985	1,430	2,195	1,485	2,575	1,565	3,220	1,625	3,505
	4	2,035	3,735	2,085	4,130	2,160	4,655	2,280	4,910	2,365	5,095
	6	3,050	6,570	3,125	6,730	3,245	6,985	3,420	7,365	3,550	7,645
5/8	3-1/8	2,070	2,640	2,120	2,915	2,200	3,420	2,320	4,275	2,410	5,015
	5	3,310	5,825	3,390	6,440	3,520	7,550	3,710	7,995	3,855	8,300
	7-1/2	4,970	10,605	5,085	10,955	5,280	11,375	5,565	11,990	5,780	12,445
3/4	3-1/2	2,705	3,380	2,760	3,735	2,860	4,380	3,000	5,480	3,105	6,420
	6	4,770	8,225	4,885	9,095	5,070	10,660	5,345	11,510	5,550	11,950
	9	7,155	14,980	7,325	15,780	7,605	16,380	8,015	17,265	8,320	17,925
7/8	3-1/2	2,755	3,525	2,820	3,910	2,920	4,580	3,070	5,730	3,180	6,715
	7	6,490	10,360	6,645	11,455	6,900	13,425	7,275	15,665	7,550	16,265
	10-1/2	9,735	18,865	9,970	20,865	10,350	22,295	10,910	23,500	11,325	24,395
1	4	3,640	4,320	3,720	4,775	3,855	5,595	4,045	7,000	4,190	8,205
	8	8,480	12,145	8,680	13,430	9,015	15,740	9,500	19,690	9,865	21,240
	12	12,720	22,120	13,025	24,460	13,520	28,670	14,250	30,695	14,795	31,865
1-1/4	5	5,870	5,495	6,000	6,080	6,210	7,125	6,525	8,915	6,755	10,445
	10	13,400	15,450	13,720	17,085	14,245	20,025	15,015	25,050	15,590	29,360
	15	20,100	28,135	20,585	31,115	21,370	36,470	22,525	45,620	23,385	50,365

- Concrete Breakout Strength - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in cracked normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac}
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.
2. Calculations were performed according to ACI 318-14 Ch.17 and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls.
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318-14 Section 5.3 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-2582.
5. Tabular values are permitted for static loads only, seismic loading is not considered with these tables. Periodic special inspection must be performed where required by code, see ESR-2582 for applicable information.
6. For anchors subjected to tension resulting from sustained loading a supplemental check must be performed according to ACI 318-14 17.3.1.2.
7. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Ch.17.
8. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-14 Ch.17, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-14 Ch.17 and ICC-ES AC308 and ESR-2582.
9. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Tension and Shear Design Strength for Reinforcing Bar Installed in Cracked Concrete (Bond or Concrete Strength) Drilled with a Hammer-Drill and Carbide Bit in a Dry Hole Condition 122°F (50°C) Maximum Long-Term Service Temperature; 176°F (80°C) Maximum Short-Term Service Temperature[1,2,3,4,5,6,7,8,9]

STRENGTH DESIGN SD TABLES

Nominal Rod/Rebar Size (#)	Embed. Depth h_{ef} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 (psi)		f'c = 3,000 (psi)		f'c = 4,000 (psi)		f'c = 6,000 (psi)		f'c = 8,000 (psi)	
		ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)
#4	2-3/4	930	1,985	950	2,050	990	2,130	1,040	2,245	1,080	2,330
	4	1,350	2,910	1,385	2,980	1,435	3,095	1,515	3,265	1,575	3,385
	6	2,030	4,365	2,075	4,470	2,155	4,645	2,270	4,895	2,360	5,080
#5	3-1/8	1,375	2,640	1,410	2,915	1,465	3,150	1,540	3,320	1,600	3,445
	5	2,200	4,740	2,255	4,855	2,340	5,040	2,465	5,315	2,560	5,515
	7-1/2	3,300	7,115	3,380	7,285	3,510	7,560	3,700	7,970	3,840	8,275
#6	3-1/2	1,795	3,380	1,835	3,735	1,900	4,095	1,995	4,300	2,065	4,450
	6	3,170	6,830	3,245	6,990	3,370	7,260	3,550	7,650	3,690	7,945
	9	4,755	10,240	4,870	10,490	5,055	10,890	5,330	11,475	5,530	11,915
#7	3-1/2	1,830	3,525	1,875	3,910	1,945	4,185	2,040	4,395	2,110	4,550
	7	4,315	9,295	4,420	9,515	4,585	9,880	4,835	10,415	5,020	10,810
	10-1/2	6,475	13,940	6,630	14,275	6,880	14,820	7,255	15,620	7,530	16,215
#8	4	2,420	4,320	2,475	4,775	2,560	5,515	2,690	5,795	2,785	6,000
	8	5,635	12,140	5,770	12,430	5,990	12,905	6,315	13,600	6,555	14,120
	12	8,455	18,210	8,655	18,645	8,985	19,355	9,475	20,405	9,835	21,180
#9	5	3,090	4,890	3,155	5,410	3,270	6,340	3,435	7,395	3,555	7,655
	10	7,215	13,800	7,390	15,260	7,670	16,520	8,085	17,415	8,395	18,080
	15	10,825	23,315	11,085	23,870	11,505	24,780	12,130	26,125	12,590	27,120
#10	5	3,855	5,490	3,940	6,070	4,080	7,115	4,280	8,900	4,435	9,550
	10	8,910	15,475	9,120	17,115	9,470	20,060	9,980	21,500	10,365	22,320
	15	13,365	28,190	13,685	29,470	14,205	30,595	14,975	32,250	15,545	33,480

☐ - Concrete Breakout Strength ☐ - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in cracked normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac}
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.
2. Calculations were performed according to ACI 318-14 Ch.17 and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls.
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318-14 Section 5.3 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-2582.
5. Tabular values are permitted for static loads only, seismic loading is not considered with these tables. Periodic special inspection must be performed where required by code, see ESR-2582 for applicable information.
6. For anchors subjected to tension resulting from sustained loading a supplemental check must be performed according to ACI 318-14 17.3.1.2.
7. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Ch.17.
8. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-14 Ch.17, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-14 Ch.17 and ICC-ES AC308 and ESR-2582.
9. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Tension Design of Steel Elements (Steel Strength)[1,2]

Nominal Rod/Rebar Size (in. or No.)	Steel Elements - Threaded Rod and Reinforcing Bar									
	ASTM A36 and ASTM F1554 Grade 36	ASTM F1554 Grade 55	ASTM A193 Grade B7 and ASTM F1554 Grade 105	ASTM F593 CW Stainless (Types 304 and 316)	ASTM A193 Grade B8/ B8M, Class 1 Stainless (Types 304 and 316)	ASTM A193 Grade B8/ B8M2, Class 2B Stainless (Types 304 and 316)	ASTM A615 Grade 75 Rebar	ASTM A615 Grade 60 Rebar	ASTM A706 Grade 60 Rebar	ASTM A615 Grade 40 Rebar
	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)
3/8 or #3	3,370	4,360	7,265	5,040	3,315	5,525	7,150	7,425	6,600	4,950
1/2 or #4	6,175	7,980	13,300	9,225	6,070	10,110	13,000	13,500	12,000	9,000
5/8 or #5	9,835	12,715	21,190	14,690	9,660	16,105	20,150	20,925	18,600	13,950
3/4 or #6	14,550	18,815	31,360	18,480	14,300	23,830	28,600	29,700	26,400	19,800
7/8 or #7	20,085	25,970	43,285	25,510	19,735	32,895	39,000	40,500	36,000	-
1 or #8	26,350	34,070	56,785	33,465	25,895	43,160	51,350	53,325	47,400	-
#9	-	-	-	-	-	-	65,000	67,500	60,000	-
1-1/4 or #10	42,160	54,510	90,850	53,540	41,430	69,050	82,550	85,725	76,200	-

■ - Steel Strength

1. Steel tensile design strength according to ACI 318-14 Ch.17 Appendix D, $\phi N_{sa} = \phi \bullet A_{se,N} \bullet f_{uta}$
2. The tabulated steel design strength in tension must be checked against the bond strength/concrete capacity design strength to determine the controlling failure mode, the lowest load level controls.

Shear Design of Steel Elements (Steel Strength)[1,2]

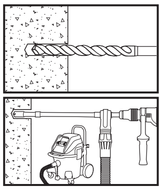
Nominal Rod/Rebar Size (in. or No.)	Steel Elements - Threaded Rod and Reinforcing Bar									
	ASTM A36 and ASTM F1554 Grade 36	ASTM F1554 Grade 55	ASTM A193 Grade B7 and ASTM F1554 Grade 105	ASTM F593 CW Stainless (Types 304 and 316)	ASTM A193 Grade B8/ B8M, Class 1 Stainless (Types 304 and 316)	ASTM A193 Grade B8/ B8M2, Class 2B Stainless (Types 304 and 316)	ASTM A615 Grade 75 Rebar	ASTM A615 Grade 60 Rebar	ASTM A706 Grade 60 Rebar	ASTM A615 Grade 40 Rebar
	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)
3/8 or #3	1,755	2,265	3,775	2,790	1,725	2,870	3,960	3,860	3,430	2,575
1/2 or #4	3,210	4,150	6,915	5,110	3,155	5,255	7,200	7,020	6,240	4,680
5/8 or #5	5,115	6,610	11,020	8,135	5,025	8,375	11,160	10,880	9,670	7,255
3/4 or #6	7,565	9,785	16,305	10,235	7,435	12,390	15,840	15,445	13,730	10,295
7/8 or #7	10,445	13,505	22,505	14,130	10,265	17,105	21,600	21,060	18,720	-
1 or #8	13,700	17,715	29,525	18,535	13,465	22,445	28,440	27,730	24,650	-
#9	-	-	-	-	-	-	36,000	35,100	31,200	-
1-1/4 or #10	21,920	28,345	47,240	29,655	21,545	35,905	45,720	44,575	39,625	-

■ - Steel Strength

1. Steel shear design strength according to ACI 318-14 Ch.17 Appendix D, $\phi V_{sa} = \phi \bullet 0.60 \bullet A_{se,V} \bullet f_{uta}$
2. The tabulated steel design strength in shear must be checked against the bond strength/concrete capacity design strength to determine the controlling failure mode, the lowest load level controls.

INSTALLATION INSTRUCTIONS (SOLID BASE MATERIALS)

DRILLING



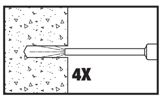
1- Drill a hole into the base material with rotary hammer drill (i.e. percussion drill) and a carbide drill bit to the size and embedment required by the selected steel hardware element (reference installation specifications for threaded rod and reinforcing bar). The tolerances of the carbide drill bits, including hollow bits, must meet ANSI Standard B212.15.

- Precaution: Use suitable eye and skin protection. Avoid inhalation of dust during drilling and/or removal (see dust extraction equipment by DEWALT to minimize dust emission).
- Note! In case of standing water in the drilled hole (flooded hole condition), all the water has to be removed from the hole (e.g. vacuum, compressed air, etc.) prior to cleaning.

Drilling in dry base material is recommended when using hollow drill bits (vacuum must be on).

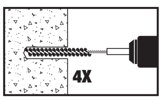
GO TO STEP 3 FOR HOLES DRILLED WITH DUSTX+™ DRILLING AND CLEANING SYSTEM; OTHERWISE GO TO STEP 2A.

HOLE CLEANING DRY (BLOW 4X, BRUSH 4X, BLOW 4X)



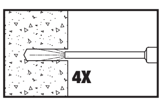
2a- Starting from the bottom or back of the anchor hole, blow the hole clean using a compressed air nozzle (min. 90 psi) or a hand pump (supplied by DEWALT) a minimum of four times (4x).

- Use a compressed air nozzle (min. 90 psi) or a hand pump (min. volume 25 fl. oz.) for anchor rod 3/8" to 3/4" diameter or reinforcing bar (rebar) sizes #3 to #6.
- Use a compressed air nozzle (min. 90 psi) for anchor rod 7/8" to 1-1/4" diameter and rebar sizes #7 to #10. A hand pump shall not be used with these anchor sizes.



2b- Determine wire brush diameter (see installation specifications) and attach the brush with adaptor to a rotary drill tool or battery screwgun. Brush the hole with the selected wire brush a minimum of four times (4x). A brush extension (supplied by DEWALT, Cat. #08282) should be used for holes drilled deeper than the listed brush length.

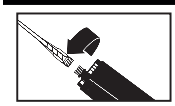
- The wire brush diameter should be checked periodically during use. The brush should resist insertion into the drilled hole and come into contact with the sides of the drilled hole. If not the brush is too small and must be replaced.



2c- Finally, blow the hole clean again a minimum of four times (4x).

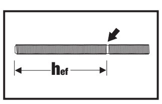
- Use a compressed air nozzle (min. 90 psi) or a hand pump (min. volume 25 fl. oz.) for anchor rod 3/8" to 3/4" diameter or reinforcing bar (rebar) sizes #3 to #6.
- Use a compressed air nozzle (min. 90 psi) for anchor rod 7/8" to 1-1/4" diameter and rebar sizes #7 to #10. A hand pump shall not be used with these anchor sizes.
- When finished the hole should be clean and free of dust, debris, ice, grease, oil or other foreign material.

PREPARING



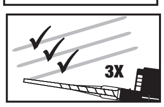
3- Check adhesive expiration date on cartridge label. Do not use expired product. Review Safety Data Sheet (SDS) before use. Cartridge temperature must be between 23°F - 95°F (-5°C - 35°C) when in use unless otherwise noted. Review gel (working) and cure time table. Consideration should be given to the reduced gel time of the adhesive in warm temperatures.

- Attach a supplied mixing nozzle to the cartridge. Unless otherwise noted do not modify the mixer in any way and make sure the mixing element is inside the nozzle. Load the cartridge into the correct dispensing tool.
- Note: Always use a new mixing nozzle with new cartridges of adhesive and also for all work interruptions exceeding the published working time of the adhesive.



4- Prior to inserting the anchor rod or rebar into the filled bore hole, the position of the embedment depth has to be marked on the anchor

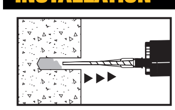
- Verify anchor element is straight and free of surface damage.



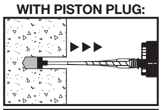
5- Adhesive must be properly mixed to achieve published properties. For new cartridges and nozzles, prior to dispensing adhesive into the drilled hole, separately dispense at least three full strokes of adhesive through the mixing nozzle until the adhesive is a consistent **GRAY** color. Do not attach a used nozzle when changing to a new cartridge.

- Review and note the published working and cure times (see gel time and curing time table) prior to injection of the mixed adhesive into the cleaned anchor hole.

INSTALLATION

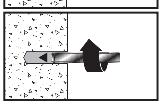


WITH PISTON PLUG:

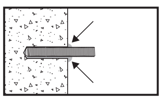


6- Fill the cleaned hole approximately to two-thirds full with mixed adhesive starting from the bottom or back of the anchor hole. Slowly withdraw the mixing nozzle as the hole fills to avoid creating air pockets or voids. If the bottom or back of the anchor hole is not reached with the mixing nozzle only, a plastic extension tube must be used with the mixing nozzle (see reference tables for installation).

- Piston plugs (see installation specifications) must be used with and attached to the mixing nozzle and extension tube for horizontal and overhead installations in concrete with anchor rod 5/8" to 1-1/4" diameter and rebar size #5 to #10. Insert piston plug to the back of the drilled hole and inject as described in the method above. During installation the piston plug will be naturally extruded from the drilled hole by the adhesive pressure.
- **Attention!** Do not install anchors overhead without proper training and installation hardware provided by DEWALT. Contact DEWALT for details prior to use.

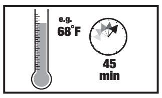


7- The anchor should be free of dirt, grease, oil or other foreign material. Push clean threaded rod or reinforcing bar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached. Observe the gel (working) time.



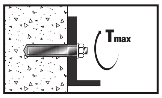
8- Be sure that the anchor is fully seated at the bottom of the hole to the specified embedment. Adhesive must completely fill the annular gap between the anchor and the base material. Protect the anchor element threads from fouling with adhesive. For all installations the rebar must be restrained from movement throughout the specified curing period (as necessary) where necessary through the use of temporary wedges, external supports, or other methods. Minor adjustments to the position of the anchor element may be performed during the gel (working) time only.

CURING AND LOADING



9- Allow the adhesive anchor to cure to the specified full curing time prior to applying any load (reference gel time and curing time table).

- Do not disturb, torque or load the anchor until it is fully cured.

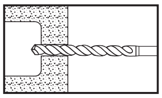


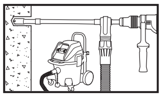
10- After full curing of the adhesive anchor, a fixture can be installed to the anchor and tightened up to the maximum torque (reference gel time and curing table) by using a calibrated torque wrench.

- Take care not to exceed the maximum torque for the selected anchor.

INSTALLATION INSTRUCTIONS (UNREINFORCED MASONRY [URM] AND HOLLOW BASE MATERIALS)

DRILLING





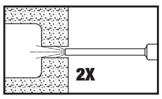
1- Drill a hole into the base material with a rotary drill tool to the size and embedment required by the selected screen tube size and steel anchor element (see installation specifications for threaded rod in hollow base material with screen tube supplied by DEWALT). Holes drilled in hollow concrete masonry units may be drilled with a rotary hammer-drill. The tolerances of the drill bit, including hollow drill bits, must meet the requirements of ANSI B212.15.

- Precaution: Wear suitable eye and skin protection. Avoid inhalation of dust during drilling and/or removal (see dust extraction by DEWALT to minimize dust emission).

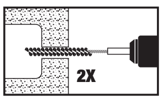
Drilling in dry base materials is recommended when using hollow drill bits (vacuum must be on).

GO TO STEP 3 FOR HOLES DRILLED WITH DUSTX+™ DRILLING AND CLEANING SYSTEM; OTHERWISE GO TO STEP 2A.

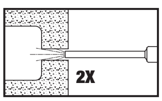
HOLE CLEANING (BLOW 2X, BRUSH 2X, BLOW 2X)



2- Starting from the bottom or back of the anchor hole, blow the hole clean with a hand pump (min. volume 25 fl.oz. supplied by DEWALT) or compressed air nozzle a minimum of two times (2x).

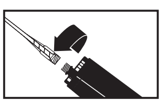


- Determine the wire brush diameter (see installation specifications) and attach the brush with adaptor to a rotary drill tool or battery screw gun. Brush the hole with the selected wire brush a minimum of two times (2x). A brush extension (supplied by DEWALT, Cat #08282) should be used for holes drilled deeper than the listed brush length.
- The wire brush should be checked periodically during use. The brush should resist insertion into the drilled hole and come into contact with the sides of the drilled hole. If not the brush is too small and must be replaced.



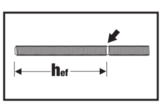
- Finally, blow the hole clean again a minimum of two times (2x)
- When finished the hole should be clean and free of dust, debris, ice, grease, oil or other foreign material.

PREPARING

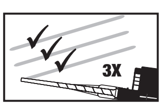


3- Check adhesive expiration date on cartridge label. Do not use expired product. Review Safety Data Sheet (SDS) before use. Cartridge temperature must be between 23°F - 95°F (-5°C - 35°C) when in use unless otherwise noted. Review gel (working) time and curing time table. Consideration should be given to the reduced gel (working) time of the adhesive in warm temperatures.

- Attach a supplied mixing nozzle to the cartridge. Unless otherwise noted do not modify the mixer in any way and make sure the mixing element is inside the nozzle. Load the cartridge into the correct dispensing tool.
- Note: Always use a new mixing nozzle with new cartridges of adhesive and also for all work interruptions exceeding the published working time of the adhesive.



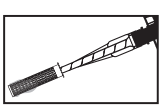
4- Prior to inserting the anchor into the filled screen tube, the position of the embedment depth has to be marked on the anchor. Verify anchor element is straight and free of surface damage.



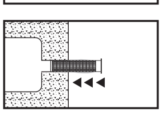
5- Adhesive must be properly mixed to achieve published properties. Prior to dispensing adhesive into the drilled hole, separately dispense at least three full strokes of adhesive through the mixing nozzle until the adhesive is a consistent **GRAY** color. Do not attach a used nozzle when changing to a new cartridge.

- Review and note the published working and cure times (see gel time and curing time table) prior to injection of the mixed adhesive into the screen tube.

INSTALLATION

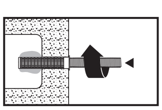


6- Select a screen tube of suitable length (supplied by DEWALT). Fill the screen tube full with adhesive starting from the bottom or back of the tube. Slowly withdraw the mixing nozzle as the screen fills to avoid creating air pockets or voids. A plastic extension tube must be used with the mixing nozzle if the back of the screen tube cannot be reached (see reference tables for installation).



7- Insert the screen tube filled with adhesive into the cleaned anchor hole. Inject additional adhesive into the screen tube as necessary to ensure the screen tube is completely filled.

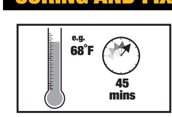
- Note: Overfilling the screen tube is acceptable but not required.



8- Prior to inserting the anchor rod into the screen tube inspect it to ensure that it is free of dirt, grease, oil or other foreign material.

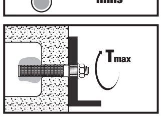
- Push the threaded rod into the screen tube while turning slightly to ensure positive distribution of the adhesive until back of the tube is reached.
- Note: In cases where the drilled hole size is larger than specified due to rotary drilling (e.g. an elongated opening), the annular space between the screen tube and the hole at the base material surface must be filled with adhesive.

CURING AND FIXTURE



9- Allow the adhesive anchor to cure to the specified full curing time prior to applying any load.

- Do not disturb, torque or load the anchor until it is fully cured (see gel time and curing time table).



10- After full curing of the adhesive anchor, a fixture can be installed to the anchor and tightened up to the maximum torque (see installation specifications for threaded rod in hollow base material) by using a calibrated torque wrench.

- Take care not to exceed the maximum torque for the selected anchor.

REFERENCE TABLES FOR INSTALLATION

Gel (working) Time and Curing Table

Temperature of Base Material		Gel (working) Time	Full Curing Time
°F	°C		
14	-10	90 minutes	24 hours
23	-5	90 minutes	14 hours
32	0	45 minutes	7 hours
41	5	25 minutes	2 hours
50	10	15 minutes	90 minutes
68	20	6 minutes	45 minutes
86	30	4 minutes	25 minutes
95	35	2 minutes	20 minutes
104	40	1.5 minutes	15 minutes

The gel (working) times listed for 32°F to 95°F are also applicable for the temperature of the adhesive and use of mixing nozzes during installation.
For installations in base material temperatures between 14°F and 23°F (-10ºC and -5ºC) the cartridge temperature must be conditioned to between 68°F and 95°F (20°C - 35°C).

Hole Cleaning Equipment Selection Table for AC100+ Gold[1,2,3,4]

Threaded Rod Diameter (inch)	Rebar Size (no.)	ANSI Drill Bit Diameter (inch)	Brush Length, L (inches)	Steel Wire Brush (Cat. #)	Blowout Tool	Number of Cleaning Actions
Solid Base Material						
3/8	#3	7/16	6-3/4	08284	Hand-pump (Cat #08280) or compressed air nozzle	4x blowing 4x brushing 4x blowing
1/2	-	9/16	6-3/4	08285		
-	#4	5/8	6-3/4	08275		
5/8	#5	11/16	7-7/8	08286		
5/8	#5	3/4	7-7/8	08278		
3/4	#6	7/8	7-7/8	08287		
7/8	#7	1	11-7/8	08288	Compressed air nozzle only	
1	#8	1-1/8	11-7/8	08289		
1-1/4	#9	1-3/8	11-7/8	08290		
-	#10	1-1/2	11-7/8	08291		
Hollow Base Material						
1/4	-	3/8	6-3/4	08284	Hand pump (Cat# 08280) or compressed air nozzle	2x blowing 2x brushing 2x blowing
1/4	-	1/2	6-3/4	08284		
3/8	-	1/2	6-3/4	08284		
3/8	-	9/16	6-3/4	08285		
1/2	-	5/8	6-3/4	08275		
1/2	-	3/4	7-7/8	08278		
5/8	-	3/4	7-7/8	08278		
5/8	-	7/8	7-7/8	08287		
3/4	-	7/8	7-7/8	08287		

1. An SDS-plus adaptor (Cat. #08283) or Jacobs chuck style adaptor (Cat. #08296) is required to attach a steel wire brush to the drill tool.
2. A brush extension (Cat. #08282) must be used for holes drilled deeper than the listed brush length.
3. See ordering information for selection of piston plugs (where applicable).
4. For any case, it must be possible for the steel anchor element to be inserted into the cleaned hole without resistance.

PERMISSIBLE INSTALLATION CONDITIONS (ADHESIVE)

Dry Concrete: cured concrete that, at the time of adhesive anchor installation, has not been exposed to water for the preceding 14 days.
Water-Saturated Concrete (wet): cured concrete that, at the time of adhesive anchor installation, has been exposed to water over a sufficient length of time to have the maximum possible amount of absorbed water into the concrete pore structure to a depth equal to the anchor embedment depth.
Water-Filled Holes (flooded): cured concrete that is water-saturated and where the drilled hole contains standing water at the time of anchor installation.

ORDERING INFORMATION

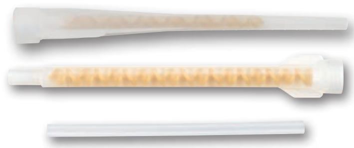
AC100+ Gold Cartridges

Cat No.	Description	Std. Box	Std. Carton	Pallet
8478SD	AC100+ Gold 10 fl. oz. Quik-Shot	12	36	648
8486SD	AC100+ Gold 12 fl. oz. dual cartridge	-	12	540
8490SD	AC100+ Gold 28 fl. oz. dual cartridge	-	8	240

One AC100+ Gold mixing nozzle is packaged with each cartridge.
AC100+ Gold mixing nozzles must be used to ensure complete and proper mixing of the adhesive.

Cartridge System Mixing Nozzles

Cat No.	Description	Std. Pack/ Box	Std. Carton
08293	Extra mixing nozzle for AC100+ Gold (10 oz. & 12 oz.)	2	24
08294	Extra mixing nozzle (with an 8" extension) for AC100+ Gold 28 oz.	2	24
08281	Mixing nozzle extension, 8" minimum	2	24
08297	Mixing nozzle extension, 20" long		



Dispensing Tools for Injection Adhesive

Cat No.	Description	Std. Box	Std. Ctn.
08437	Manual caulking gun for Quik-Shot	1	12
08479	High performance caulking gun for Quik-Shot	1	6
08485	AC100+ Gold 10 oz. & 12 oz. high performance manual tool	1	20
08494	AC100+ Gold 28 oz. standard all metal manual tool	1	-
08496	AC100+ Gold 28 oz. pneumatic tool	1	-
DCE595D1	AC100+ Gold 28 oz. 20v battery powered dispensing tool	1	-

Piston Plugs for Adhesive Anchors

Cat. No.	Description	ANSI Drill Bit Dia.	Std. Bag	Std. Ctn.
08304	5/8" Plug	5/8"	10	100
08258	11/16" Plug	11/16"	10	100
08259	3/4" Plug	3/4"	10	100
08300	7/8" Plug	7/8"	10	100
08301	1" Plug	1"	10	100
08303	1-1/8" Plug	1-1/8"	10	100
08305	1-3/8" Plug	1-3/8"	10	100
08307	1-1/4" Plug	1-1/4"	10	100
08309	1-1/2" Plug	1-1/2"	10	100

A plastic extension tube (Cat# 08281 or 08297) or equivalent approved by DEWALT must be used with piston plugs.

Hole Cleaning Tools and Accessories

Cat No.	Description	Std. Box
08284	Wire brush for 7/16" or 1/2" ANSI hole, 6-3/4" length	1
08285	Wire brush for 9/16" ANSI hole, 6-3/4" length	1
08275	Wire brush for 5/8" ANSI hole, 6-3/4" length	1
08286	Wire brush for 11/16" ANSI hole, 7-7/8" length	1
08278	Wire brush for 3/4" ANSI hole, 7-7/8" length	1
08287	Wire brush for 7/8" ANSI hole, 7-7/8" length	1
08288	Wire brush for 1" ANSI hole, 11-7/8" length	1
08289	Wire brush for 1-1/8" ANSI hole, 11-7/8" length	1
08276	Wire brush for 1-1/4" ANSI hole, 11-7/8" length	1
08290	Wire brush for 1-3/8" ANSI hole, 11-7/8" length	1
08291	Wire brush for 1-1/2" ANSI hole, 11-7/8" length	1
08283	SDS-plus adapter for steel brushes	1
08296	Standard drill adapter for steel brushes (e.g. Jacobs Chuck)	1
08282	Steel brush extension, 12" length	1
08280	Hand pump/dust blower (25 ft. oz. clylinder volume)	1
08292	Air compressor nozzle with extension, 18" length	1
52073	Adhesive cleaning kit, includes 4 wire brushes (08284, 08285, 08286, 08287), steel brush extension (08282), SDS-plus adapter (08283), standard drill adapter (08296), hand pump/dust blower (08280), gloves and safety glasses	1

Stainless Steel Screen Tubes

Cat. No.	Description	Drill Diameter	Std. Ctn.
07960	1/4" x 2" Screen Tube	3/8"	25
07862	1/4" x 6" Screen Tube*	3/8"	25
07864	1/4" x 8"Screen Tube*	3/8"	25
07856	3/8" x 2" Screen Tube	1/2"	25
07961	3/8" x 3-1/2" Screen Tube	1/2"	25
07962	3/8" x 6" Screen Tube*	1/2"	25
07963	3/8" x 8" Screen Tube*	1/2"	25
07964	3/8" x 10" Screen Tube*	1/2"	25
07959	3/8" x 12" Screen Tube*	1/2"	25
07857	1/2" x 2" Screen Tube	5/8"	25
07965	1/2" x 3-1/2" Screen Tube	5/8"	25
07966	1/2" x 6" Screen Tube*	5/8"	25
07967	1/2" x 8" Screen Tube*	5/8"	25
07968	1/2" x 10" Screen Tube*	5/8"	25
07858	5/8" x 2" Screen Tube	3/4"	25
07969	5/8" x 4-1/2" Screen Tube	3/4"	20
07970	5/8" x 6" Screen Tube	3/4"	20
07971	5/8" x 8" Screen Tube*	3/4"	20
07972	5/8" x 10" Screen Tube*	3/4"	20
07859	3/4" x 2" Screen Tube	7/8"	25
07855	15/16" x 2" Screen Tube	1"	25
07865	15/16" x 8" Screen Tube	1"	10
07867	15/16" x 13" Screen Tube	1"	10

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	ANSI Drill Diameter	Standard Carton
08310	3/8" x 3-1/2" Plastic Screen	9/16"	25
08311	3/8" x 6" Plastic Screen	9/16"	25
08313	3/8" x 8" Plastic Screen	9/16"	25
08315	1/2" x 3-1/2" Plastic Screen	3/4"	25
08317	1/2" x 6" Plastic Screen	3/4"	25
08321	5/8" x 6" Plastic Screen	7/8"	25
08323	3/4" x 6" Plastic Screen	1"	10
For availability of stainless steel screen tubes, Contact DEWALT			

Dust Extraction

Cat. No.	Description
DWV012	10 Gallon Wet/Dry Hepa/Rrp Dust Extractor DWV9402 Fleece bag (5 pack) for DEWALT dust extractors DWV9316 Replacement Anti-Static Hose DWV9320 Replacement HEPA Filter Set (Type 1)
DWH050K	Dust Extraction with two interchangeable drilling heads
DCB1800M3T1	1800 Watt Portable Power Station & Parallel Battery Charger with 3 20V Max* 5Ah Batteries and 1 60V Max* Flexvolt® Battery

SDS Max 4-Cutter Carbide Drill Bits

Cat. No.	Diameter	Usable Length	Overall Length
DW5806	5/8"	8"	13-1/2"
DW5809	5/8"	16"	21-1/2"
DW5807	5/8"	31"	36"
DW5808	11/16"	16"	21-1/2"
DW5810	3/4"	8"	13-1/2"
DW5812	3/4"	16"	21-1/2"
DW5813	3/4"	31"	36"
DW5814	13/16"	16"	21-1/2"
DW5815	7/8"	8"	13-1/2"
DW5816	7/8"	16"	21-1/2"
DW5851	7/8"	31"	36"
DW5817	27/32"	16"	21-1/2"
DW5818	1"	8"	13-1/2"
DW5819	1"	16"	22-1/2"
DW5852	1"	24"	29"
DW5820	1"	31"	36"
DW5821	1-1/8"	10"	15"
DW5822	1-1/8"	18"	22-1/2"
DW5853	1-1/8"	24"	29"
DW5854	1-1/8"	31"	36"
DW5824	1-1/4"	10"	15"
DW5825	1-1/4"	18"	22-1/2"

SDS+ Full Head Carbide Drill Bits

Cat. No.	Diameter	Usable Length	Overall Length
DW5502	3/16"	2"	4-1/2"
DW5503	3/16"	4"	6-1/2"
DW5504	3/16"	5"	8-1/2"
DW5506	3/16"	10"	12"
DW5512	7/32"	8"	10"
DW5517	1/4"	4"	6"
DW5518	1/4"	6"	8-1/2"
DW55200	1/4"	10"	12"
DW5521	1/4"	12"	14"
DW5524	5/16"	4"	6"
DW5526	5916"	10"	12"
DW5527	3/8"	4"	6-1/2"
DW5529	3/8"	8"	10"
DW55300	3/8"	10"	12"
DW5531	3/8"	16"	18"
DW5537	1/2"	4"	6"
DW5538	1/2"	8"	10-1/2"
DW5539	1/2"	10"	12"
DW5540	1/2"	16"	18"

SDS+ 4-Cutter Carbide Drill Bits

Cat. No.	Diameter	Usable Length	Overall Length
DW5471	5/8"	8"	10"
DW5472	5/8"	16"	18"
DW5474	3/4"	8"	10"
DW5475	3/4"	16"	18"
DW5477	7/8"	8"	10"
DW5478	7/8"	16"	18"
DW5479	1"	8"	10"
DW5480	1"	16"	18"
DW5481	1-1/8"	8"	10"
DW5482	1-1/8"	6"	18"

Hollow Drill Bits

	Cat. No.	Diameter	Overall Length	Usable Length	Recommended Hammer Drill
SDS+	DWA54012	1/2"	14-1/2"	9-3/4"	DCH133 / DCH273 / DCH293
	DWA54916	9/16"	14-1/2"	9-3/4"	DCH133 / DCH273 / DCH293
	DWA54058	5/8"	14-1/2"	9-3/4"	DCH133 / DCH273 / DCH293
	DWA54034	3/4"	14-1/2"	9-3/4"	DCH133 / DCH273 / DCH293
SDS Max	DWA58058	5/8"	23-5/8"	15-3/4"	DCH481 / D25603K
	DWA58034	3/4"	23-5/8"	15-3/4"	DCH481 / D25603K
	DWA58078	7/8"	23-5/8"	15-3/4"	DCH481 / D25603K
	DWA58001	1"	23-5/8"	15-3/4"	DCH481 / D25603K
	DWA58118	1-1/8"	23-5/8"	15-3/4"	DCH481 / D25603K

GENERAL INFORMATION

AC50™

Adhesive Anchoring System

PRODUCT DESCRIPTION

The AC50 is a two-component, adhesive anchoring system. The system includes injection adhesive in plastic cartridges, mixing nozzles, dispensing tools and hole cleaning equipment. The AC50 is designed for bonding threaded rod and reinforcing bar hardware into drilled holes in solid concrete base materials.

GENERAL APPLICATIONS AND USES

- Bonding threaded rod and reinforcing bar into hardened concrete
- Evaluated for installation and use in dry holes
- Can be installed in a range of base material temperatures (as low as 5ºF)

FEATURES AND BENEFITS

+ Designed for use with threaded rod and reinforcing bar hardware elements
+ Cartridge design allows for multiple uses using extra mixing nozzles
+ Mixing nozzles proportion adhesive and provide simple delivery method into drilled holes
+ Evaluated and recognized for long term and short term loading

APPROVALS AND LISTINGS

- Conforms to requirements of ASTM C 881 and AASHTO M235, Types I, II, IV and V, Grade 3, Classes A & B (also meets Type III except for elongation)
- Tested in accordance with ASTM E488
- Department of Transportation listings – see www.DEWALT.com or contact transportation agency

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors and 05 05 19 - Post-Installed Concrete Anchors. Adhesive anchoring system shall be AC50 as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and requirements of the Authority Having Jurisdiction.

SECTION CONTENTS

PACKAGING

Dual (side-by-side Cartridge)

- 28 fl. oz. (825 mL), 10:1 mix ratio

STORAGE LIFE & CONDITIONS

Fifteen months in a dry, dark environment with temperature ranging from 32ºF to 86ºF (0ºC to 30ºC)

ANCHOR SIZE RANGE (TYPICAL)

- 3/8" through 1" diameter threaded rod
- No. 3 through No. 8 rebar

SUITABLE BASE MATERIALS (ADHESIVE)

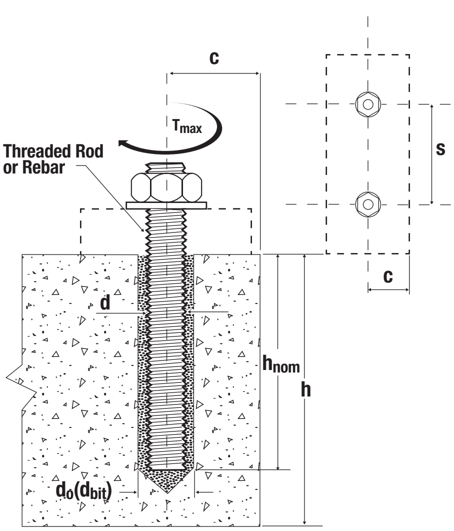
- Normal-weight concrete

INSTALLATION SPECIFICATIONS

Installation Specifications for Threaded Rod and Reinforcing Bar

Dimension/Property		Notation	Units	Nominal Anchor Size				
Threaded Rod		-	-	3/8"	1/2"	5/8"	3/4"	1"
Reinforcing Bar		-	-	#3	#4	#5	#6	#8
Nominal anchor diameter		d	in. (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	0.875 (22.2)
Nominal diameter of drilled hole		d_o, (d_{bit})	in.	7/16 ANSI	9/16 ANSI	3/4 ANSI	7/8 ANSI	1-1/8 ANSI
Minimum embedment		h_{nom}	in. (mm)	2-3/8 (60)	2-3/4 (70)	3-1/8 (79)	3-1/2 (89)	4 (102)
Minimum concrete member thickness		h_{min}	in. (mm)	h_{ef} + 1-1/4 (h_{ef} + 30)		h_{ef} + 2 d_o		
Minimum spacing distance		s_{min}	in. (mm)	1-7/8 (48)	2-1/2 (64)	3-1/8 (79)	3-3/4 (95)	5 (127)
Minimum edge distance		c_{min}	in. (mm)	1-7/8 (48)	2-1/2 (64)	3-1/8 (79)	3-3/4 (95)	5 (127)
Critical edge distance		c_{cr}	in. (mm)	2h_{ef}				
Maximum torque (only possible after full cure time of adhesive)	ASTM A36 or F1554 Grade 36	T_{max}	ft.- lbs. (N-m)	10 (13)	25 (34)	50 (68)	90 (122)	165 (224)
	ASTM F593 Condition CW stainless steel rod or ASTM A193 Grade B7 carbon steel rod	T_{max}	ft.- lbs. (N-m)	15 (20)	33 (45)	60 (81)	105 (142)	165 (224)
Effective cross sectional area of threaded rod		A_{se}	in.^{2} (mm^2)	0.078 (50)	0.142 (92)	0.226 (146)	0.335 (216)	0.606 (391)
Effective cross sectional area of reinforcing bar		A_{se}	in.^{2} (mm^2)	0.110 (71)	0.200 (129)	0.310 (200)	0.440 (284)	0.790 (510)

Detail of Steel Hardware Elements used with Injection Adhesive System



Threaded Rod and Deformed Reinforcing Bar Material Properties

Steel Description (General)	Steel Specification (ASTM)	Nominal Anchor Size (inch)	Minimum Yield Strength, f_y (ksi)	Minimum Ultimate Strength, f_u (ksi)
Carbon Rod	A 36 or F1554 Grade 36	3/8 through 1	36.0	58.0
Stainless Rod (Alloy 304 / 316)	F 593, Condition CW	3/8 through 5/8	65.0	100.0
		3/4 through 1	45.0	85.0
High Strength Carbon Rod	A 193 Grade B7	3/8 through 1	105.0	125.0
Grade 60 Reinforcing Bar	A 615, A 767, or A 996	3/8 through 1 (#3 through #8)	60.0	90.0
Grade 40 Reinforcing Bar	A 615	3/8 through 3/4 (#3 through #6)	40.0	70.0

PERFORMANCE DATA

Ultimate and Allowable Tension Load Capacities for AC50 Installed with Threaded Rod into Normal Weight Concrete (based on bond strength/concrete capacity)[1,2,3,4,5,6,7]

Nominal Anchor Diameter d (in.)	Minimum Embedment Depth h_{nom} (in.)	Minimum Concrete Compressive Strength - f'c (psi)					
		2,500 psi		3,000 psi		4,000 psi	
		Ultimate Tension Load Capacity lbs. (kN)	Allowable Tension Load Capacity lbs. (kN)	Ultimate Tension Load Capacity lbs. (kN)	Allowable Tension Load Capacity lbs. (kN)	Ultimate Tension Load Capacity lbs. (kN)	Allowable Tension Load Capacity lbs. (kN)
3/8	3-3/8 (85.7)	6,520 (29.0)	1,630 (7.3)	6,765 (30.1)	1,690 (7.5)	7,165 (31.9)	1,790 (8.0)
1/2	4-1/2 (114.3)	11,860 (52.8)	2,965 (13.2)	12,300 (54.7)	3,075 (13.7)	13,025 (57.9)	3,255 (14.5)
5/8	5-5/8 (142.9)	18,520 (82.4)	4,630 (20.6)	19,205 (85.4)	4,800 (21.4)	20,345 (90.5)	5,085 (22.6)
3/4	6-3/4 (171.5)	22,420 (99.7)	5,605 (24.9)	23,255 (103.4)	5,815 (25.9)	24,630 (109.6)	6,160 (27.4)
1	9 (228.6)	29,005 (129.0)	7,250 (32.2)	30,080 (133.8)	7,520 (33.5)	31,860 (141.7)	7,965 (35.4)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
3. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances and where the minimum member thickness is 2 times the embedment depth.
4. The tabulated load values are applicable for dry concrete. Holes must be drilled with a hammer drill and an ANSI carbide drill bit.
5. Adhesives experience reductions in capacity at elevated temperatures. See the in-service temperature chart for allowable load capacities.
6. Allowable bond strength/concrete capacity must be checked against allowable steel strength in tension to determine the controlling allowable load.
7. Allowable shear capacity is controlled by allowable steel strength for the given conditions.

Ultimate and Allowable Tension Load Capacities for AC50 Installed with Reinforcing Bar into Normal Weight Concrete (based on bond strength/concrete capacity)[1,2,3,4,5,6,7]

Nominal Anchor Diameter d (in.)	Minimum Embedment Depth h_{nom} (in.)	Minimum Concrete Compressive Strength - f'c (psi)					
		2,500 psi		3,000 psi		4,000 psi	
		Ultimate Tension Load Capacity lbs. (kN)	Allowable Tension Load Capacity lbs. (kN)	Ultimate Tension Load Capacity lbs. (kN)	Allowable Tension Load Capacity lbs. (kN)	Ultimate Tension Load Capacity lbs. (kN)	Allowable Tension Load Capacity lbs. (kN)
#3	3-3/8 (85.7)	6,225 (27.7)	1,555 (6.9)	6,460 (28.7)	1,615 (7.2)	6,840 (30.4)	1,710 (7.6)
#4	4-1/2 (114.3)	10,480 (46.6)	2,620 (11.7)	10,870 (48.4)	2,720 (12.1)	11,515 (51.2)	2,880 (12.8)
#5	5-5/8 (142.9)	16,830 (74.9)	4,210 (18.7)	17,455 (77.6)	4,365 (19.4)	18,490 (82.2)	4,625 (20.6)
#6	6-3/4 (171.5)	15,545 (69.1)	3,885 (17.3)	16,120 (71.7)	4,030 (17.9)	17,075 (76.0)	4,270 (19.0)
#6	9 (228.6)	16,015 (71.2)	4,005 (17.8)	16,610 (73.9)	4,155 (18.5)	17,590 (78.2)	4,400 (19.6)
#8	9 (228.6)	34,095 (151.7)	8,525 (37.9)	35,360 (157.3)	8,840 (39.3)	37,455 (166.6)	9,365 (41.7)
#8	12 (304.8)	39,060 (173.7)	9,765 (43.4)	40,510 (180.2)	10,130 (45.1)	42,910 (190.9)	10,730 (47.7)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
3. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances and where the minimum member thickness is 2 times the embedment depth.
4. The tabulated load values are applicable for dry concrete. Holes must be drilled with a hammer drill and an ANSI carbide drill bit.
5. Adhesives experience reductions in capacity at elevated temperatures. See the in-service temperature chart for allowable load capacities.
6. Allowable bond strength/concrete capacity must be checked against allowable steel strength in tension to determine the controlling allowable load.
7. Allowable shear capacity is controlled by allowable steel strength for the given conditions.

Allowable Load Capacities for Threaded Rod and Reinforcing Bar (Based on Steel Strength)[1,2,3,4,5]

Nominal Rod Diameter or Rebar Size (in. or #)	Steel Elements - Threaded Rod and Reinforcing Bar																	
	A36 or F1554, Grade 36		A36 or F1554, Grade 55		A 193, Grade B7 or F1554, Grade 105		F 593, CW (SS)		ASTM A615 Grade 40 Rebar		ASTM A615 Grade 60 Rebar		ASTM A706 Grade 60 Rebar		ASTM A615 Grade 75 Rebar		ASTM A706 Grade 80 Rebar	
	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)	Tension lbs. (kN)	Shear lbs (kN)	Tension lbs. (kN)	Shear lbs (kN)	Tension lbs. (kN)	Shear lbs (kN)
3/8 or #3	2,115 (9.4)	1,090 (4.8)	2,735 (12.2)	1,410 (6.3)	4,555 (20.3)	2,345 (10.4)	3,645 (16.2)	1,880 (8.4)	2,210 (9.8)	1,125 (5.0)	2,650 (11.8)	1,690 (7.5)	2,650 (11.8)	1,500 (6.7)	2,650 (11.8)	1,875 (8.3)	2,650 (11.8)	1,875 (8.3)
1/2 or #4	3,760 (16.7)	1,935 (8.6)	4,860 (21.6)	2,505 (11.1)	8,100 (36.0)	4,170 (18.5)	6,480 (28.8)	3,340 (14.9)	3,925 (17.5)	2,005 (8.9)	4,710 (21.0)	3,005 (13.4)	4,710 (21.0)	2,670 (11.9)	4,710 (21.0)	3,335 (14.8)	4,710 (21.0)	3,335 (14.8)
5/8 or #5	5,870 (26.1)	3,025 (13.5)	7,595 (33.8)	3,910 (17.4)	12,655 (56.3)	6,520 (29.0)	10,125 (45.0)	5,215 (23.2)	6,135 (27.3)	3,130 (13.9)	7,365 (32.8)	4,695 (20.9)	7,365 (32.8)	4,170 (18.5)	7,365 (32.8)	5,215 (23.2)	7,365 (32.8)	5,215 (23.2)
3/4 or #6	8,455 (37.6)	4,355 (19.4)	10,935 (48.6)	5,635 (25.1)	18,225 (81.1)	9,390 (41.8)	12,390 (55.1)	6,385 (28.4)	8,835 (39.3)	4,505 (20.0)	10,605 (47.2)	6,760 (30.1)	10,605 (47.2)	6,010 (26.7)	10,605 (47.2)	7,510 (33.4)	10,605 (47.2)	7,510 (33.4)
7/8 or #7	11,510 (51.2)	5,930 (26.4)	14,885 (66.2)	7,665 (34.1)	24,805 (110.3)	12,780 (56.8)	16,865 (75.0)	8,690 (38.7)	-	-	14,430 (64.2)	9,200 (40.9)	14,430 (64.2)	8,180 (36.4)	14,430 (64.2)	10,220 (45.5)	14,430 (64.2)	10,220 (45.5)
1 or #8	15,035 (66.9)	7,745 (34.5)	19,440 (86.5)	10,015 (44.5)	32,400 (144.1)	16,690 (74.2)	22,030 (98.0)	11,350 (50.5)	-	-	18,850 (83.8)	12,015 (53.4)	18,850 (83.8)	10,680 (47.5)	18,850 (83.8)	13,350 (59.4)	18,850 (83.8)	13,350 (59.4)
#9	-	-	-	-	-	-	-	-	-	-	23,985 (106.7)	15,290 (68.0)	23,985 (106.7)	13,590 (60.5)	23,985 (106.7)	16,990 (75.6)	23,985 (106.7)	16,990 (75.6)
1-1/4	23,490 (104.5)	12,100 (53.8)	30,375 (135.1)	15,645 (69.6)	50,620 (225.2)	26,080 (116.0)	34,425 (153.1)	17,735 (78.9)	-	-	-	-	-	-	-	-	-	-
#10	-	-	-	-	-	-	-	-	-	-	30,405 (135.2)	19,380 (86.2)	30,405 (135.2)	17,230 (76.6)	30,405 (135.2)	21,535 (95.8)	30,405 (135.2)	21,535 (95.8)

1. AISC defined steel strength (ASD) for threaded rod: Tensile = $0.33 \bullet F_u \bullet A_{nom}$, Shear = $0.17 \bullet F_u \bullet A_{nom}$
2. For reinforcing bars: The allowable steel tensile strength is based on 20 ksi for Grade 40 and 24 ksi for Grade 60 and higher, applied to the cross sectional area of the bar; allowable steel shear strength = $0.17 \bullet F_u \bullet A_{nom}$
3. Allowable load capacities are calculated for the steel element type. Consideration of applying additional safety factors may ne necessary depending on the application, such as life safety or overhead.
4. Allowable steel strength in tension must be checked against allowable bond strength/concrete capacity in tension to determine the controlling allowable load.
5. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances and where the minimum member thickness is the greater of [h_{nom} + 1-1/4"] and [$h_{nom} + 2d_{bit}$]

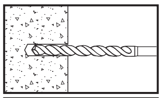
In-Service Temperature Chart For Allowable Load Capacities[1]

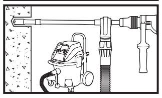
Base Material Temperature		Reduction Factor For Temperature
° F	° C	
0	-18	1.00
32	0	1.00
50	10	1.00
70	20	1.00
90	30	0.91
110	40	0.82
140	60	0.69
180	82	0.52

1. Linear interpolation may be used to derive reduction factors for temperatures between those listed.

INSTALLATION INSTRUCTIONS (SOLID BASE MATERIALS)

DRILLING



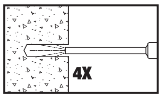


1- Drill a hole into the base material with rotary hammer drill (i.e. percussion drill) and a carbide drill bit to the size and embedment required by the selected steel hardware element (reference installation specifications for threaded rod and reinforcing bar). The tolerances of the carbide drill bits, including hollow bits, must meet ANSI Standard B212.15.

- Precaution: Use suitable eye and skin protection. Avoid inhalation of dust during drilling and/or removal.
- Note! In case of standing water in the drilled hole (flooded hole condition), all the water has to be removed from the hole (e.g. vacuum, compressed air, etc.) prior to cleaning.

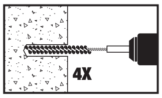
Drilling in dry base materials is recommended when using hollow drill bits (vacuum must be on).

HOLE CLEANING (BLOW 4X, BRUSH 4X, BLOW 4X)



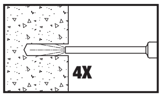
2a- Starting from the bottom or back of the anchor hole, blow the hole clean using a compressed air nozzle (min. 90 psi) a minimum of four times (4x).

- Use a compressed air nozzle (min. 90 psi) for anchor rod 3/8" to 1" diameter or reinforcing bar (rebar) sizes #3 to #8.



2b- Determine wire brush diameter (reference hole cleaning equipment selection table) and attach the brush with adaptor to a rotary drill tool or battery screwgun. Brush the hole with the selected wire brush a minimum of four times (4x). A brush extension (supplied by DEWALT, Cat. #08282) should be used for holes drilled deeper than the listed brush length.

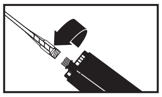
- The wire brush diameter should be checked periodically during use. The brush must be replaced if it becomes worn (less than D_{min}, reference hole cleaning equipment selection table) or does not come into contact with the sides of the drilled hole.



2c- Finally, blow the hole clean again a minimum of four times (4x)

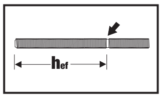
- Use a compressed air nozzle (min. 90 psi) for anchor rod 3/8" to 1" diameter or reinforcing bar (rebar) sizes #3 to #8.
- When finished the hole should be clean and free of dust, debris, ice, grease, oil or other foreign material.

PREPARING

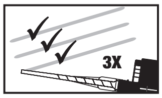


3- Check adhesive expiration date on cartridge label. Do not use expired product. Review Material Safety Data Sheet (MSDS) before use. Cartridge temperature must be between 32°F - 95°F (0°C - 35°C) when in use. Consideration should be given to the reduced gel time of the adhesive in warm temperatures.

- Attach a supplied mixing nozzle to the cartridge. Do not modify the mixer in any way and make sure the mixing element is inside the nozzle. Load the cartridge into the correct dispensing tool. A new mixing nozzle must be used for every working interruption longer than the published working times (reference gel time and curing time table) as well as for new cartridges.



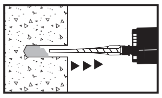
4- Prior to inserting the anchor rod or rebar into the filled bore hole, the position of the embedment depth has to be marked on the anchor. Verify anchor element is straight and free of surface damage.



5- For new cartridges and nozzles; prior to dispensing adhesive into the anchor hole, squeeze out separately a minimum three full strokes of the mixed adhesive. Discard non-uniform adhesive until the adhesive is a consistent gray color. Do not attach a used nozzle when changing to a new cartridge.

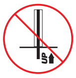
- Review and note the published working and cure times (see gel time and curing time table) prior to injection of the mixed adhesive into the cleaned anchor hole.

INSTALLATION

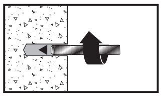


6- Fill the cleaned hole approximately two-thirds full with mixed adhesive starting from the bottom or back of the anchor hole. Slowly withdraw the mixing nozzle as the hole fills to avoid creating air pockets or voids. For embedment depth greater than 7-1/2" an extension nozzle must be used with the mixing nozzle.

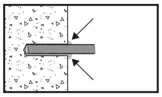
- Piston plugs (see adhesive piston plug table) must be used with and attached to the mixing nozzle and extension tube for horizontal installations where embedment is greater than 7-1/2 inches with anchor rod from 5/8" to 1" diameter and rebar sizes #5 to #8. Insert piston plug to the back of the drilled hole and inject as described in the method above. During installation the piston plug will be naturally extruded from the drilled hole by the adhesive pressure.



Attention! Do not install anchors overhead or upwardly inclined.

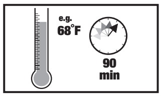


7- The anchor should be free of dirt, grease, oil or other foreign material. Push clean threaded rod or reinforcing bar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached. Observe the gel (working) time.



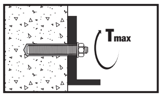
8- Be sure that the anchor is fully seated at the bottom of the hole and that some adhesive has flowed from the hole and all around the top of the anchor. If there is not enough adhesive in the hole, the installation must be repeated. Minor adjustments to the anchor may be performed during the gel time but the anchor shall not be moved after final placement and during cure.

CURING AND LOADING



9- Allow the adhesive anchor to cure to the specified full curing time prior to applying any load (see gel time and curing time table).

- Do not disturb, torque or load the anchor until it is fully cured.



10- After full curing of the adhesive anchor, a fixture can be installed to the anchor and tightened up to the maximum torque (reference gel time and curing table) by using a calibrated torque wrench.

- Take care not to exceed the maximum torque for the selected anchor.

REFERENCE TABLES FOR INSTALLATION

Gel (working) Time and Curing Table

Temperature of Base Material		Gel (working) Time	Full Curing Time
˚F	˚C		
5	-15	120 minutes	48 hours
14	-10	90 minutes	24 hours
23	-5	90 minutes	14 hours
32	0	45 minutes	7 hours
41	5	35 minutes	4 hours
60	15	15 minutes	3 hours
68	20	8 minutes	90 minutes
86	30	4 minutes	60 minutes
95	35	3 minutes	45 minutes
For installations in base material temperatures between 5°F and 32°F the cartridge temperature must be conditioned to between 68°F and 95°F (20°C - 35°C)			

Hole Cleaning Equipment Selection Table for AC50

Threaded Rod Diameter (inch)	Rebar Size (no.)	ANSI Drill Bit Diameter (inch)	Brush Length, L (inches)	Steel Wire Brush (Cat. #)	Blowout Tool	Number of Cleaning Actions
Solid Base Material						
3/8	#3	7/16	6-3/4	08284	Compressed air nozzle only (min. 90 psi)	4x blowing 4x brushing 4x blowing
1/2	#4	9/16	6-3/4	08285		
5/8	#5	11/16	7-7/8	08286		
		3/4	7-7/8	08278		
3/4	#6	7/8	7-7/8	08287		
7/8	#7	1	11-7/8	08288		
1	#8	1-1/8	11-7/8	08289		
An SDS-plus adaptor (Cat. #08283) or Jacobs chuck style adaptor (Cat. #08296) is required to attach a steel wire brush to the drill tool.						

Adhesive Piston Plugs

Plug Size (inch)	ANSI Drill Bit Diameter (inch)	Piston Plug (Cat. #)	Horizontal Installations
11/16	11/16	08258	
3/4	3/4	08259	
7/8	7/8	08300	
1	1	08301	
1-1/8	1-1/8	08303	

1. All horizontal installations require the use of piston plugs where one is tabulated together with the anchor size and where the embedment depth is greater than 8 inches.
2. A plastic extension tube (3/8" dia., Cat. #08281) or equivalent approved by DEWALT must be used with piston plugs.

ORDERING INFORMATION

AC50 Cartridges

Cat No.	Description	Std. Carton	Pallet
8497	AC50 28 fl. oz. dual cartridge	8	400
One mixing nozzle is packaged with each cartridge. AC50 mixing nozzles must be used to ensure complete and proper mixing of the adhesive.			

Cartridge System Mixing Nozzles

Cat No.	Description	Std. Pack/ Box	Std. Carton
08294	Extra mixing nozzle (with 8" extension) for AC50	2	24
08281	Mixing nozzle extension, 8" minimum	2	24

Dispensing Tools for Injection Adhesive

Cat No.	Description	Std. Box	Std. Carton
08494	28 oz. Standard metal manual tool	1	10
DCE595D1	28 oz. 20v Battery powered dispensing tool	1	-
08496	28 oz. Pneumatic tool	1	-

AC50 Adhesive Anchor System

Hole Cleaning Tools and Accessories

Cat No.	Description	Std. Box
08284	Wire brush for 7/16" or 1/2" ANSI hole, 6-3/4" length	1
08285	Wire brush for 9/16" ANSI hole, 6-3/4" length	1
08275	Wire brush for 5/8" ANSI hole, 6-3/4" length	1
08286	Wire brush for 11/16" ANSI hole, 7-7/8" length	1
08278	Wire brush for 3/4" ANSI hole, 7-7/8" length	1
08287	Wire brush for 7/8" ANSI hole, 7-7/8" length	1
08288	Wire brush for 1" ANSI hole, 11-7/8" length	1
08289	Wire brush for 1-1/8" ANSI hole, 11-7/8" length	1
08283	SDS-plus adapter for steel brushes	1
08296	Standard drill adapter for steel brushes (e.g. Jacobs Chuck)	1
08282	Steel brush extension, 12" length	1
08292	Air compressor nozzle with extension, 18" length	1

Adhesive Pistons Plugs

Cat. No.	Description	ANSI Drill Dia.	Std. Bag	Std. Ctd.
08302	9/16" Plug	9/16"	10	100
08304	5/8" Plug	5/8"	10	100
08258	11/16" Plug	11/16"	10	100
08259	3/4" Plug	3/4"	10	100
08300	7/8" Plug	7/8"	10	100
08301	1" Plug	1"	10	100
08303	1-1/8" Plug	1-1/8"	10	100

GENERAL INFORMATION

PURE110+®

Epoxy Injection Adhesive Anchoring System
and Post-Installed Reinforcing Bar Connections

PRODUCT DESCRIPTION

The Pure110+ is a two-component, high strength adhesive anchoring system. The system includes injection adhesive in plastic cartridges, mixing nozzles, dispensing tools and hole cleaning equipment. The Pure110+ is designed for bonding threaded rod and reinforcing bar hardware into drilled holes in concrete and masonry base materials and for post-installed reinforcing bar connections.

Pure110+ has the same bond strength at room temperature and at 110ºF.

GENERAL APPLICATIONS AND USES

- Bonding threaded rod and reinforcing bar into hardened concrete
- Evaluated for installation and use in dry and wet holes, including water filled and submerged
- Can be installed in a wide range of base material temperatures
- Cracked and uncracked concrete
- Seismic and wind loading
- Oversized hammer-drilled holes in concrete, for short term loading only (contact DEWALT for details)

FEATURES AND BENEFITS

+ Designed for use with threaded rod and reinforcing bar hardware elements
+ Evaluated and recognized for freeze/thaw performance
+ Cartridge design allows for multiple uses using extra mixing nozzles
+ Mixing nozzles proportion adhesive and provide simple delivery method into drilled holes
+ Evaluated and recognized for long term and short term loading (see performance tables)
+ Same bond strength at room temperature and at 110ºF.

APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES) ESR-3298 for cracked and uncracked concrete
- Code Compliant with 2015 IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, and 2009 IRC.
- Conforms to requirements of ASTM C 881 and AASHTO M235, Types I, II, IV and V, Grade 3, Classes B & C (also meets Type III except for elongation)
- Department of Transportation listings – see www.DEWALT.com or contact transportation agency
- Tested in accordance with ACI 355.4, ASTM E 488, and ICC-ES AC308 for use in structural concrete (Design according to ACI 318-14, Chapter 17 and ACI 318-11/08 Appendix D)
- Tested and qualified for use in post-installed reinforcing bar connections
- Evaluated and qualified by an accredited independent testing laboratory for recognition in cracked and uncracked concrete including seismic and wind loading
- Compliant with NSF/ANSI 61 for drinking water system components - health effects; minimum requirements for materials in contact with potable water and water treatment

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 Masonry Anchors and 05 05 19 Post-Installed Concrete Anchors. Adhesive anchoring system shall be Pure110+ as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and requirements of the Authority Having Jurisdiction.

TENSION ZONE CRACKED CONCRETE · SEISMIC REGION QUALIFICATION · TESTED AND VALIDATED WaterQuality UNDER INDUSTRY STANDARDS · CODE LISTED ICC-ES ESR-3298 CONCRETE · DDA DEWALT DESIGN ASSIST™ · DUSTX+™ ANCHOR INSTALLATION SYSTEM

SECTION CONTENTS

PACKAGING

Coaxial Cartridge

- 9 fl. oz. (265 ml or 16.2 in³)

Dual (side-by-side) Cartridge

- 21 fl. oz. (620 ml or 37.8 in³), 1:1 mix ratio
- 51 fl. oz. (1510 ml or 92.1 in³), 1:1 mix ratio
- 13 fl. oz. (385 ml or 23.5 in³), 3:1 mix ratio
- 20 fl. oz. (585 ml or 35.7 in³), 3:1 mix ratio

STORAGE LIFE & CONDITIONS

Dual cartridge: Two years
Coaxial cartridge: Eighteen months
In a dry, dark environment with temperature ranging from 41°F to 86°F (5°C to 30°C)

ANCHOR SIZE RANGE (TYPICAL)

- 3/8" to 1-1/4" diameter threaded rod
- No. 3 to No. 10 reinforcing bar (rebar)

SUITABLE BASE MATERIALS

- Normal-weight concrete
- Lightweight concrete
- Grouted Concrete Masonry
- Hollow Concrete Masonry

PERMISSIBLE INSTALLATION CONDITIONS (ADHESIVE)

- Dry concrete
- Water-saturated concrete (wet)
- Water-filled holes (flooded)
- Underwater concrete (submerged)

REFERENCE DATA (ASD)

Installation Table for Pure110+ (Solid Concrete Base Materials)

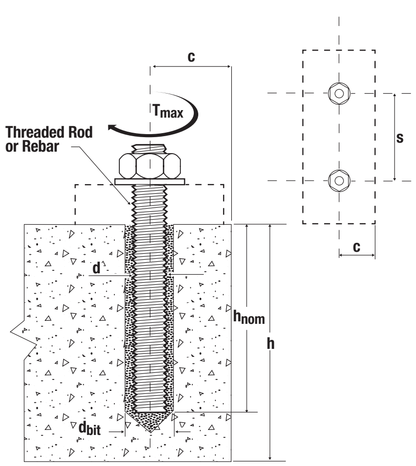
Dimension/Property	Notation	Units	Nominal Anchor Size									
Threaded Rod	-	-	3/8	1/2	-	5/8	3/4	7/8	1	-	1-1/4	-
Reinforcing Bar	-	-	#3	-	#4	#5	#6	#7	#8	#9	-	#10
Nominal anchor diameter	d	in. (mm)	0.375 (9.5)	0.500 (12.7)		0.625 (15.9)	0.750 (19.1)	0.875 (22.5)	1.000 (25.4)	1.125 (28.6)	1.250 (31.8)	1.250 (31.8)
Carbide drill bit nominal size[3]	d_{bit}	in.	7/16 ANSI	9/16 ANSI	5/8 ANSI	11/16 or 3/4 ANSI	7/8 ANSI	1 ANSI	1-1/8 ANSI	1-3/8 ANSI	1-3/8 ANSI	1-1/2 ANSI
Minimum embedment	h_{nom}	in. (mm)	2-3/8 (61)	2-3/4 (70)		3-1/8 (80)	3-1/2 (89)	3-1/2 (89)	4 (102)	4-1/2 (114)	5 (127)	5 (127)
Minimum spacing distance	s_{min}	in. (mm)	1-7/8 (48)	2-1/2 (62)		3-1/8 (80)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)	6-1/4 (159
Minimum edge distance	c_{min}	in. (mm)	1-7/8 (48)	2-1/2 (62)		3-1/8 (80)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)	6-1/4 (159
Maximum torque[1]	T_{max}	ft.-lb. (N-m)	15 (20)	30 (41)		60 (81)	105 (142)	125 (169)	165 (223)	200 (270)	280 (379)	280 (379)
Maximum torque (low strength rods)[1,2]		ft.-lb. (N-m)	5 (7)	20 (27)		40 (54)	60 (81)	100 (136)	165 (223)	-	280 (379)	-

1. Torque may not be applied to the anchors until the full cure time of the adhesive has been achieved.
2. These torque values apply to ASTM A 36 / F 1554, Grade 36 carbon steel threaded rods; ASTM F1554 Grade 55 carbon steel threaded rods; and ASTM A193 Grade B8/B8M (Class 1) stainless steel threaded rods.
3. For any case, it must be possible for the steel anchor element to be inserted into the cleaned drilled hole without resistance.

Installation Table for Pure110+ (Hollow Base Material with Screen Tube)

Dimensions/property	Notation	Units	Nominal Size - Plastic			
			3/8"	1/2"	5/8"	3/4"
Nominal threaded rod diameter	d	in (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.0)
Nominal screen tube diameter	-	in.	3/8	1/2	5/8	3/4
Nominal diameter of drilled hole	d_{bit}	in.	9/16 ANSI	3/4 ANSI	7/8 ANSI	1 ANSI
Maximum torque (only possible after full cure time of adhesive)	T_{max}	ft.-lb. (N-m)	10 (8)	10 (8)	10 (8)	10 (8)

Detail of Steel Hardware Elements used with Injection Adhesive System



Nomenclature

d = Diameter of anchor
d_{bit} = Diameter of drilled hole
h = Base material thickness
The greater of:
[h_{nom} + 1-1/4"] and [h_{nom} + $2d_{bit}$]
h_{nom} = Minimum embedment depth

Threaded Rod and Deformed Reinforcing Bar Material Properties

Steel Description (General)	Steel Specification (ASTM)	Nominal Anchor Size (inch)	Minimum Yield Strength, f_y (ksi)	Minimum Ultimate Strength, f_u (ksi)
Carbon Steel	A 36 or F1554 Grade 36	3/8 through 1-1/4	36.0	58.0
	F 1554 Grade 55		55.0	75.0
	A 449	3/8 through 1	92.0	120.0
		1-1/4	81.0	105.0
	A 193, Grade B7 or F 1554, Grade 105	3/8 through 1-1/4	105.0	125.0
	F 568M Class 5.8	3/4 through 1-1/4	58.0	72.5
Stainless Steel	F 593, Condition CW	3/8 through 5/8	65.0	100.0
		3/4 through 1-1/4	45.0	85.0
	A 193/A193M Grade B8/B8M2, Class 1	3/4 through 1-1/4	30.0	75.0
	A 193/A193M Grade B8/B8M2, Class 2B	3/8 through 1-1/4	75.0	95.0
Grade 40 Reinforcing Bar	A 615, A 767	3/8 through 3/4 (#3 through #6)	40.0	60.0
Grade 60 Reinforcing Bar	A 615, A 767	3/8 through 1-1/4 (#3 through #10)	60.0	90.0
	A 706, A 767		60.0	80.0
Grade 75 Reinforcing Bar	A 615, A 767	3/8 through 1-1/4 (#3 through #10)	75.0	100.0

Ultimate and Allowable Load Capacities for Pure110+ Installed with Threaded Rod into Normal Weight Concrete (based on bond strength/concrete capacity)[1,2,3,4,5,6,7]

ALLOWABLE STRESS ASD DESIGN

Rod Diameter d in.	Drill Diameter d_{bit} in.	Minimum Embedment Depth in. (mm)	Minimum Concrete Compressive Strength			
			f'c = 3,000 psi (20.7 MPa)		f'c = 4,000 psi (27.6 MPa)	
			Ultimate Tension Load Capacity lbs. (kN)	Allowable Tension Load Capacity lbs. (kN)	Ultimate Tension Load Capacity lbs. (kN)	Allowable Tension Load Capacity lbs. (kN)
3/8	7/16	3-3/8 (85.7)	10,445 (46.5)	2,610 (11.6)	10,445 (46.5)	2,610 (11.6)
1/2	9/16	4 1/2 (114.3)	17,470 (77.7)	4,370 (19.4)	20,225 (90.0)	5,055 (22.5)
5/8	11/16 or 3/4	5-5/8 (142.9)	23,335 (103.8)	5,835 (26.0)	28,600 (127.2)	7,150 (31.8)
3/4	7/8	6-3/4 (171.5)	36,255 (161.3)	9,065 (40.3)	40,930 (182.1)	10,235 (45.5)
7/8	1	7-7/8 (200.0)	46,275 (205.8)	11,570 (51.5)	52,920 (235.4)	13,230 (58.8)
1	1-1/8	9 (228.6)	57,015 (253.6)	14,255 (63.4)	79,295 (352.7)	19,825 (88.2)
		10 (254.0)	77,445 (344.5)	19,360 (86.1)	82,745 (368.1)	20,685 (92.0)
1-1/4	1-3/8	11-1/4 (285.8)	91,885 (408.7)	22,970 (102.2)	98,170 (436.7)	24,545 (109.2)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
3. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances and where the minimum member thickness is the greater of [h_{nom} + 1-1/4"] and [h_{nom} + $2d_{bit}$]
4. The tabulated load values are applicable for dry concrete. Holes must be drilled with a hammer drill and an ANSI carbide drill bit. Installations in water-saturated concrete (wet) or in water-filled holes (flooded) require a 15% reduction in capacity. Installations in underwater concrete (submerged) require a 30% reduction in capacity. Contact DEWALT for more information concerning these installation conditions.
5. Adhesives experience reductions in capacity at elevated temperatures. See the in-service temperature chart for allowable load capacity reduction factors.
6. Allowable bond strength/concrete capacity must be checked against allowable steel strength in tension to determine the controlling allowable load.
7. Allowable shear capacity is controlled by allowable steel strength for the given conditions.

Ultimate and Allowable Load Capacities for Pure110+ Installed with Reinforcing Bar into Normal Weight Concrete (based on bond strength/concrete capacity)[1,2,3,4,5,6,7]

ALLOWABLE STRESS ASD DESIGN

Bar Diameter d #	Drill Diameter dbit in.	Minimum Embedment Depth in. (mm)	Minimum Concrete Compressive Strength			
			f'c = 3,000 psi (20.7 MPa)		f'c = 4,000 psi (27.6 MPa)	
			Ultimate Tension Load Capacity lbs. (kN)	Allowable Tension Load Capacity lbs. (kN)	Ultimate Tension Load Capacity lbs. (kN)	Allowable Tension Load Capacity lbs. (kN)
#3	7/16	3-3/8 (85.7)	11,155 (49.6)	2,790 (12.4)	11,155 (49.6)	2,790 (12.4)
#4	9/16	4-1/2 (114.3)	17,735 (78.9)	4,435 (19.7)	19,200 (85.4)	4,800 (21.4)
#5	11/16 or 3/4	4 (101.6)	16,740 (74.5)	4,185 (18.6)	16,910 (75.2)	4,230 (18.8)
		5-5/8 (142.9)	23,420 (104.2)	5,855 (26.0)	25,705 (114.3)	6,425 (28.6)
#6	7/8	6-3/4 (171.5)	34,266 (152.4)	8,565 (38.1)	40,775 (181.4)	10,195 (45.3)
#8	1-1/8	9 (228.6)	55,140 (245.3)	13,785 (61.3)	72,575 (322.8)	18,145 (80.7)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
3. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances and where the minimum member thickness is The greater of [h_{nom} + 1-1/4"] and [h_{nom} + $2d_{bit}$].
4. The tabulated load values are applicable for dry concrete. Holes must be drilled with a hammer drill and an ANSI carbide drill bit. Installations in water-saturated concrete (wet) or in water-filled holes (flooded) require a 15% reduction in capacity. Installations in underwater concrete (submerged) require a 30% reduction in capacity. Contact DEWALT for more information concerning these installation conditions.
5. Adhesives experience reductions in capacity at elevated temperatures. See the in-service temperature chart for allowable load capacity reduction factors.
6. Allowable bond strength/concrete capacity must be checked against allowable steel strength in tension to determine the controlling allowable load.
7. Allowable shear capacity is controlled by allowable steel strength for the given conditions.

Allowable Load Capacities for Threaded Rod and Reinforcing Bar (Based on Steel Strength)[1,2,3,4,5]

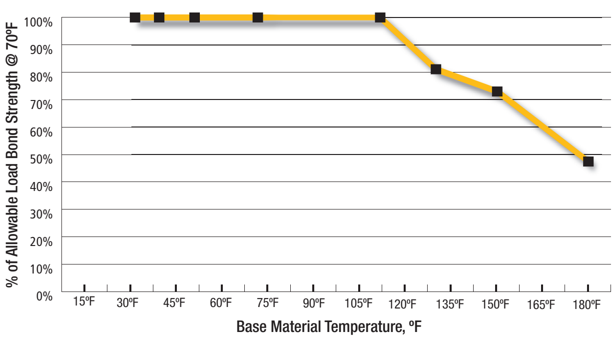
Nominal Rod Diameter or Rebar Size (in. or #)	Steel Elements - Threaded Rod and Reinforcing Bar																			
	A36 or F1554, Grade 36		A36 or F1554, Grade 55		A 193, Grade B7 or F1554, Grade 105		F 593, CW (SS)		ASTM A615 Grade 40 Rebar		ASTM A615 Grade 60 Rebar		ASTM A706 Grade 60 Rebar		ASTM A615 Grade 75 Rebar		ASTM A706 Grade 80 Rebar			
	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)	Tension lbs. (kN)	Shear lbs (kN)	Tension lbs. (kN)	Shear lbs (kN)	Tension lbs. (kN)	Shear lbs (kN)		
3/8 or #3	2,115 (9.4)	1,090 (4.8)	2,735 (12.2)	1,410 (6.3)	4,555 (20.3)	2,345 (10.4)	3,645 (16.2)	1,880 (8.4)	2,210 (9.8)	1,125 (5.0)	2,650 (11.8)	1,690 (7.5)	2,650 (11.8)	1,500 (6.7)	2,650 (11.8)	1,875 (8.3)	2,650 (11.8)	1,875 (8.3)		
1/2 or #4	3,760 (16.7)	1,935 (8.6)	4,860 (21.6)	2,505 (11.1)	8,100 (36.0)	4,170 (18.5)	6,480 (28.8)	3,340 (14.9)	3,925 (17.5)	2,005 (8.9)	4,710 (21.0)	3,005 (13.4)	4,710 (21.0)	2,670 (11.9)	4,710 (21.0)	3,335 (14.8)	4,710 (21.0)	3,335 (14.8)		
5/8 or #5	5,870 (26.1)	3,025 (13.5)	7,595 (33.8)	3,910 (17.4)	12,655 (56.3)	6,520 (29.0)	10,125 (45.0)	5,215 (23.2)	6,135 (27.3)	3,130 (13.9)	7,365 (32.8)	4,695 (20.9)	7,365 (32.8)	4,170 (18.5)	7,365 (32.8)	5,215 (23.2)	7,365 (32.8)	5,215 (23.2)		
3/4 or #6	8,455 (37.6)	4,355 (19.4)	10,935 (48.6)	5,635 (25.1)	18,225 (81.1)	9,390 (41.8)	12,390 (55.1)	6,385 (28.4)	8,835 (39.3)	4,505 (20.0)	10,605 (47.2)	6,760 (30.1)	10,605 (47.2)	6,010 (26.7)	10,605 (47.2)	7,510 (33.4)	10,605 (47.2)	7,510 (33.4)		
7/8 or #7	11,510 (51.2)	5,930 (26.4)	14,885 (66.2)	7,665 (34.1)	24,805 (110.3)	12,780 (56.8)	16,865 (75.0)	8,690 (38.7)	-	-	14,430 (64.2)	9,200 (40.9)	14,430 (64.2)	8,180 (36.4)	14,430 (64.2)	10,220 (45.5)	14,430 (64.2)	10,220 (45.5)		
1 or #8	15,035 (66.9)	7,745 (34.5)	19,440 (86.5)	10,015 (44.5)	32,400 (144.1)	16,690 (74.2)	22,030 (98.0)	11,350 (50.5)	-	-	18,850 (83.8)	12,015 (53.4)	18,850 (83.8)	10,680 (47.5)	18,850 (83.8)	13,350 (59.4)	18,850 (83.8)	13,350 (59.4)		
#9	-	-	-	-	-	-	-	-	-	-	23,985 (106.7)	15,290 (68.0)	23,985 (106.7)	13,590 (60.5)	23,985 (106.7)	16,990 (75.6)	23,985 (106.7)	16,990 (75.6)		
1-1/4	23,490 (104.5)	12,100 (53.8)	30,375 (135.1)	15,645 (69.6)	50,620 (225.2)	26,080 (116.0)	34,425 (153.1)	17,735 (78.9)	-	-	-	-	-	-	-	-	-	-		
#10	-	-	-	-	-	-	-	-	-	-	30,405 (135.2)	19,380 (86.2)	30,405 (135.2)	17,230 (76.6)	30,405 (135.2)	21,535 (95.8)	30,405 (135.2)	21,535 (95.8)		

1. AISC defined steel strength (ASD) for threaded rod: Tensile = $0.33 \bullet F_u \bullet A_{nom}$, Shear = $0.17 \bullet F_u \bullet A_{nom}$
2. For reinforcing bars: The allowable steel tensile strength is based on 20 ksi for Grade 40 and 24 ksi for Grade 60 and higher, applied to the cross sectional area of the bar; allowable steel shear strength = $0.17 \bullet F_u \bullet A_{nom}$
3. Allowable load capacities are calculated for the steel element type. Consideration of applying additional safety factors may be necessary depending on the application, such as life safety or overhead.
4. Allowable steel strength in tension must be checked against allowable bond strength/concrete capacity in tension to determine the controlling allowable load.
5. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances and where the minimum member thickness is the greater of [h_{nom} + 1-1/4"] and [$h_{nom} + 2d_{bit}$]

In-Service Temperature Chart For Allowable Load Capacities[1]

Base Material Temperature		Reduction Factor For Temperature
°F	°C	
32	0	1.00
41	5	1.00
50	10	1.00
70	20	1.00
110	43	1.00
130	54	0.82
150	66	0.73
180	82	0.48

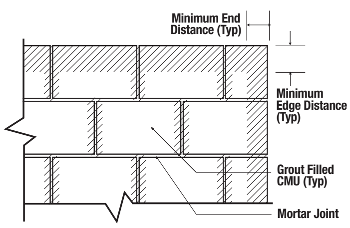
1. Linear interpolation may be used to derive reduction factors for temperatures between those listed.



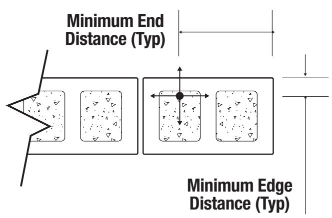
Ultimate and Allowable Load Capacities for Threaded Rod Installed with Pure110+ into Grout-Filled Masonry[1,2,3,4,5]

Anchor Installed Into Grouted Masonry Wall Faces								
Nominal Diameter d in.	Minimum Embed. h_v in. (mm)	Nominal Drill Bit Diameter in.	Minimum End Distance in. (mm)	Minimum Edge Distance in. (mm)	Ultimate Load		Allowable Load	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/8	3 (76.2)	7/16 ANSI	12 (304.8)	12 (304.8)	6,005 (26.7)	5,200 (23.1)	1,200 (5.3)	1,040 (4.6)
1/2	4 (101.6)	9/16 ANSI	12 (304.8)	12 (304.8)	8,650 (38.5)	8,845 (39.3)	1,730 (7.7)	1,770 (7.9)
5/8	5 (127)	11/16 ANSI	12 (304.8)	12 (304.8)	12,840 (57.1)	8,430 (37.5)	2,570 (11.4)	1,685 (7.5)
3/4	6 (152.4)	7/8 ANSI	20 (508)	20 (508)	19,560 (87.0)	12,685 (56.4)	3,910 (17.4)	2,540 (11.3)
Anchor Installed in the Tops of Grouted Masonry Walls[6]								
Nominal Diameter d in.	Minimum Embed. h_v in. (mm)	Nominal Drill Bit Diameter in.	Minimum End Distance in. (mm)	Minimum Edge Distance in. (mm)	Ultimate Load		Allowable Load	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/2	4 (101.6)	9/16 ANSI	4 (101.6)	1.75 (44.5)	5,135 (22.8)	1,750 (7.8)	1,030 (4.6)	350 (1.6)
5/8	5 (127)	11/16 ANSI	4 (101.6)	2.75 (69.9)	5,360 (23.6)	3,130 (13.9)	1,070 (4.8)	625 (2.8)

1. Tabulated load values are for 3/8" and 1/2" diameter anchors installed in minimum 6" wide, Grade N, Type II, light 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 ≥ 1,500 psi).
2. Tabulated load values are for 5/8" and 3/4" diameter anchors installed in 8" wide, Grade N, Type II, light 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 ≥ 1,500 psi).
3. Anchors must be installed in grouted cells and the minimum edge and end distances must be maintained.
4. Allowable load capacities listed are calculated using an applied safety factor of 5.0 and must be checked against the allowable tension and shear capacities for threaded rod based on steel strength to determine the controlling factor.
5. The tabulated values are applicable for anchors installed into grouted masonry wall faces and masonry wall tops at a critical spacing distance, s_{cr}, between anchors of 3 times the embedment depth.
6. Anchor installations into tops of grouted masonry walls are limited to one per masonry cell.



Wall Face
Permissible Anchor Locations
(Un-hatched Area)



Top of Wall

Ultimate and Allowable Load Capacities for Threaded Rod Installed with Pure110+ into Hollow Concrete Masonry Walls with Plastic Screen Tubes[1,2,3]

Nominal Anchor Diameter in.	Minimum Screen Tube Length in.	Minimum End Distance in. (mm)	Minimum Edge Distance in. (mm)	ASTM C-90 Block Type	Ultimate Load	Allowable Load
					Tension lbs. (kN)	Tension lbs. (kN)
3/8	3-1/2	3-3/4 (95.3)	3-3/4 (95.3)	Lightweight	790 (3.5)	160 (0.7)
1/2	3-1/2	3-3/4 (95.3)	3-3/4 (95.3)	Lightweight	1,255 (5.6)	250 (1.1)
5/8	6	3-3/4 (95.3)	3-3/4 (95.3)	Normal-weight[4]	1,545 (6.9)	310 (1.4)
3/4	6	3-3/4 (95.3)	3-3/4 (95.3)	Normal-weight[4]	1,545 (6.9)	310 (1.4)

1. Tabulated load values are for anchors installed in minimum 8" wide, Grade N, Type II, lightweight or normal weight concrete masonry units conforming to ASTM C 90 that have reached a designated ultimate compressive strength at the time of installation (f'm ≥ 1,500 psi). Mortar must be type N, S or M.
2. Allowable loads are calculated using an applied safety factor of 5.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety.
3. Anchor spacing is limited to one per masonry cell.
4. The tabulated load values are applicable to normal-weight concrete masonry units with a minimum face shell thickness of 1-1/2 inches.

STRENGTH DESIGN (SD)

Installation Specifications for Threaded Rod and Reinforcing Bar[1]

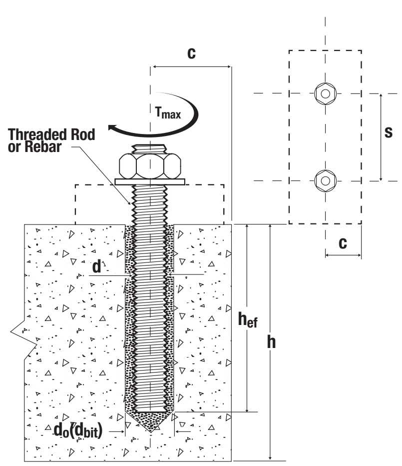
CODE LISTED ICC-ES ESR-3298
STRENGTH DESIGN TABLES SD

Parameter	Symbol	Units	Fractional Nominal Rod Diameter (Inch) / Reinforcing Bar Size									
			3/8 or #3	1/2	#4	5/8 or #5	3/4 or #6	7/8 or #7	1 or #8	#9	1-1/4	#10
Threaded rod outside diameter	d	inch (mm)	0.375 (9.5)	0.500 (12.7)		0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	-	1.250 (31.8)	-
Rebar nominal outside diameter	d	inch (mm)	0.375 (9.5)	0.500 (12.7)		0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.125 (28.7)	-	1.250 (31.8)
Carbide drill bit nominal size[6]	d_o (d_{bit})	inch	7/16	9/16	5/8	11/16 or 3/4	7/8	1	1-1/8	1-3/8	1-3/8	1-1/2
Minimum embedment	$h_{ef,min}$	inch (mm)	2-3/8 (60)	2-3/4 (70)		3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	4-1/2 (114)	5 (127)	5 (127)
Maximum embedment	$h_{ef,max}$	inch (mm)	7-1/2 (191)	10 (254)		12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)	22-1/2 (572)	25 (635)	25 (635)
Minimum member thickness	h_{min}	inch (mm)	h_{ef} + 1-1/4 (h_{ef} + 30)			$h_{ef} + 2d_o$						
Minimum anchor spacing	s_{min}	inch (mm)	1-7/8 (48)	2-1/2 (64)		3-1/8 (79)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)	6-1/4 (159)
Minimum edge distance	c_{min}	inch (mm)	1-7/8 (48)	2-1/2 (64)		3-1/8 (79)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)	6-1/4 (159)
Max. torque[2]	T_{max}	ft-lbs (N-m)	15 (20)	30 (41)		60 (81)	105 (142)	125 (169)	165 (221)	200 (280)	280 (379)	280 (379)
Max. torque[2,3] (low strength rods)	T_{max}	ft-lbs (N-m)	5 (7)	20 (27)		40 (54)	60 (81)	100 (136)	165 (223)	-	280 (379)	-
Minimum edge distance, reduced[5]	$c_{min,red}$	inch (mm)	1-3/4 (45)	1-3/4 (45)		1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	2-3/4 (70)	2-3/4 (70)	2-3/4 (70)
Max. torque, reduced[2]	$T_{max,red}$	ft-lbs (N-m)	7 [5][4]	14 (19)		27 (37)	47 (64)	56 (76)	74 (100)	90 (122)	126 (171)	126 (171)

For pound-inch units: 1 mm = 0.03937 inch, 1 N-m = 0.7375 ft-lbf. For SI: 1 inch = 25.4 mm, 1 ft-lbf = 1.356 N-m.

1. For use with the design provisions of ACI 318-14 Ch.17 or ACI 318-11 Appendix D as applicable, ICC-ES AC308, Section 4.2 and ESR-3298
2. Torque may not be applied to the anchors until the full cure time of the adhesive has been achieved.
3. These torque values apply to ASTM A 36 / F 1554 Grade 36 carbon steel threaded rods; ASTM F 1554 Grade 55 carbon steel threaded rods; and ASTM A 193 Grade B8/B8M (Class 1) stainless steel threaded rods.
4. These torque values apply to ASTM A 193 Grade B8/B8M (Class 1) stainless steel threaded rods.
5. For Installation between the minimum edge distance, c_{min}, and the reduced minimum edge distance, $c_{min,red}$, the maximum torque applied must be max torque reduced, $T_{max,red}$.
6. For any case, it must be possible for the steel anchor element to be inserted into the cleaned drill hole without resistance.

Detail of Steel Hardware Elements used with Injection Adhesive System



Threaded Rod and Deformed Reinforcing Bar Material Properties

Steel Description (General)	Steel Specification (ASTM)	Nominal Anchor Size (inch)	Minimum Yield Strength, f_y (ksi)	Minimum Ultimate Strength, f_u (ksi)
Carbon rod	A 36 or F 1554 Grade 36	3/8 through 1-1/4	36.0	58.0
	F 1554 Grade 55		55.0	75.0
	A 449	3/8 through 1	92.0	120.0
		1-1/4	81.0	105.0
	A 193, Grade B7 or F 1554, Grade 105	3/8 through 1-1/4	105.0	125.0
	F 568M Class 5 8	3/4 through 1-1/4	58.0	72.5
Stainless rod	F 593 Condition CW	3/8 through 5/8	65.0	100.0
		3/4 through 1-1/4	45.0	85.0
	A 193/193M Grade B8/B8M, Class 1	3/8 through 1-1/4	30.0	75.0
	A 193/A193M Grade B8/B8M2, Class 2B	3/8 through 1-1/4	75.0	95.0
Grade 40 Reinforcing Bar	A 615, A 767	3/8 through 1-1/4 (#3 through #10)	40.0	60.0
Grade 60 Reinforcing Bar	A 615, A 767	3/8 through 1-1/4 (#3 through #10)	60.0	90.0
	A 706, A 767		60.0	80.0
Grade 75 Reinforcing Bar	A 615, A 767	3/8 through 1-1/4 (#3 through #10)	75.0	100.0

Steel Tension and Shear Design for Threaded Rod in Normal Weight Concrete (For use with load combinations taken from ACI 318-14 Section 5.3)

CODE LISTED
ICC-ES ESR-3298

STRENGTH DESIGN SD TABLES

Design Information		Symbol	Units	Nominal Rod Diameter[1] (inch) 3/8	1/2	5/8	3/4	7/8	1	1-1/4
Threaded rod nominal outside diameter		d	inch (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.250 (31.8)
Threaded rod effective cross-sectional area		A_{se}	inch² (mm²)	0.0775 (50)	0.1419 (92)	0.2260 (146)	0.3345 (216)	0.4617 (298)	0.6057 (391)	0.9691 (625)
ASTM A 36 and ASTM F 1554 Grade 36	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	4,495 (20.0)	8,230 (36.6)	13,110 (58.3)	19,400 (86.3)	26,780 (119.1)	35,130 (156.3)	56,210 (250.0)
		V_{sa}	lbf (kN)	2,695 (12.0)	4,940 (22.0)	7,860 (35.0)	11,640 (51.8)	16,070 (71.4)	21,080 (93.8)	33,725 (150.0)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM F 1554 Grade 55	Nominal strength as governed by steel strength(for a single anchor)	N_{sa}	lbf (kN)	5,810 (25.9)	10,640 (47.3)	16,950 (75.4)	25,085 (111.6)	34,625 (154.0)	45,425 (202.0)	72,680 (323.3)
		V_{sa}	lbf (kN)	3,485 (15.5)	6,385 (28.4)	10,170 (45.2)	15,050 (67.0)	20,775 (92.4)	27,255 (121.2)	43,610 (194.0)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM A 193 Grade B7 and ASTM F 1554 Grade 105	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	9,685 (43.1)	17,735 (78.9)	28,250 (125.7)	41,810 (186.0)	57,710 (256.7)	75,710 (336.8)	121,135 (538.8)
		V_{sa}	lbf (kN)	5,815 (25.9)	10,640 (7.3)	16,950 (75.4)	25,085 (111.6)	34,625 (154.0)	45,425 (202.1)	72,680 (323.3)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM A 449	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	9,300 (41.4)	17,025 (75.7)	27,120 (120.6)	40,140 (178.5)	55,905 (248.7)	72,685 (323.3)	101,755 (452.6)
		V_{sa}	lbf (kN)	5,580 (24.8)	10,215 (45.4)	16,270 (72.4)	24,085 (107.1)	33,540 (149.2)	43,610 (194.0)	61,050 (271.6)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ISO 898-1 Class 5.8	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	5,620 (25.0)	10,290 (45.8)	16,385 (72.9)	24,250 (107.9)	33,475 (148.9)	43,915 (195.4)	-[5]
		V_{sa}	lbf (kN)	3,370 (15.0)	6,175 (27.5)	9,830 (43.7)	14,550 (64.7)	20,085 (89.3)	26,350 (117.2)	-[5]
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	-[5]
	Strength reduction factor for tension[3]	ϕ	-	0.65						
	Strength reduction factor for shear[3]	ϕ	-	0.60						
ASTM F 593 CW Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	7,750 (34.5)	14,190 (63.1)	22,600 (100.5)	28,430 (126.5)	39,245 (174.6)	51,485 (229.0)	82,370 (366.4)
		V_{sa}	lbf (kN)	4,650 (20.7)	8,515 (37.9)	13,560 (60.3)	17,060 (75.9)	23,545 (104.7)	30,890 (137.4)	49,425 (219.8)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[3]	ϕ	-	0.65						
	Strength reduction factor for shear[3]	ϕ	-	0.60						
ASTM A 193 Grade B8/B8M, Class 1 Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)[4]	N_{sa}	lbf (kN)	4,420 (19.7)	8,090 (36.0)	12,880 (57.3)	19,065 (84.8)	26,315 (117.1)	34,525 (153.6)	55,240 (245.7)
		V_{sa}	lbf (kN)	2,650 (11.8)	4,855 (21.6)	7,730 (34.4)	11,440 (50.9)	15,790 (70.2)	20,715 (92.1)	33,145 (147.4)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM A 193 Grade B8/ B8M2, Class 2B Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	7,365 (32.8)	13,480 (60.0)	21,470 (95.5)	31,775 (141.3)	43,860 (195.1)	57,545 (256.0)	92,065 (409.5)
		V_{sa}	lbf (kN)	4,420 (19.7)	8,085 (36.0)	12,880 (57.3)	19,065 (84.8)	26,315 (117.1)	34,525 (153.6)	55,240 (245.7)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						

For SI: 1 inch = 25.4 mm, 1 lbf = 4.448 N. For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf.

1. Values provided for steel element material types are based on minimum specified strengths and calculated in accordance with ACI 318-14 Eq. 17.4.1.2 and Eq. 17.5.1.2b or ACI 318-11 Eq. (D-2) and Eq. (D-29), as applicable, except where noted. Nuts and washers must be appropriate for the rod. Nuts must have specified proof load stresses equal to or greater than the minimum tensile strength of the specified threaded rod.
2. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4. Values correspond to ductile steel elements.
3. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4. Values correspond to brittle steel elements
4. In accordance with AACI 318-14 17.4.1.2 and 17.5.1.2 or ACI 318-11 D.5.1.2 and D.6.1.2, as applicable, the calculated values for nominal tension and shear strength for ASTM A193 Grade B8/B8M Class 1 stainless steel threaded rods are based on limiting the specified tensile strength of the anchor steel to 1.9fy or 57,000 psi (393 MPa).
5. The referenced standard includes rod diameters up to and including 1-inch (24 mm).

Steel Tension and Shear Design for Reinforcing Bars in Normal Weight Concrete (For use with load combinations taken from ACI 318-14 Section 5.3)

CODE LISTED
ICC-ES ESR-3298

Design Information		Symbol	Units	Nominal Reinforcing Bar Size (Rebar)[1]							
				No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10
Rebar nominal outside diameter		d	inch (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.125 (28.7)	1.250 (32.3)
Rebar effective cross-sectional area		A_{se}	inch² (mm²)	0.110 (71.0)	0.200 (129.0)	0.310 (200.0)	0.440 (283.9)	0.600 (387.1)	0.790 (509.7)	1.000 (645.2)	1.270 (819.4)
ASTM A 615 Grade 75	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	11,000 (48.9)	20,000 (89.0)	31,000 (137.9)	44,000 (195.7)	60,000 (266.9)	79,000 (351.4)	100,000 (444.8)	127,000 (564.9)
		V_{sa}	lbf (kN)	6,600 (29.4)	12,000 (53.4)	18,600 (82.7)	26,400 (117.4)	36,000 (160.1)	47,400 (210.8)	60,000 (266.9)	76,200 (338.9)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[3]	ϕ	-	0.65							
	Strength reduction factor for shear[3]	ϕ	-	0.60							
ASTM A 615 Grade 60	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	9,900 (44.0)	18,000 (80.1)	27,900 (124.1)	39,600 (176.1)	54,000 (240.2)	71,100 (316.3)	90,000 (400.3)	114,300 (508.4)
		V_{sa}	lbf (kN)	5,940 (26.4)	10,800 (48.0)	16,740 (74.5)	23,760 (105.7)	32,400 (144.1)	42,660 (189.8)	54,000 (240.2)	68,580 (305.0)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75							
	Strength reduction factor for shear[2]	ϕ	-	0.65							
ASTM A 706 Grade 60	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	8,800 (39.1)	16,000 (71.2)	24,800 (110.3)	35,200 (156.6)	48,000 (213.5)	63,200 (281.1)	80,000 (355.9)	101,600 (452.0)
		V_{sa}	lbf (kN)	5,280 (23.5)	9,600 (42.7)	14,880 (66.2)	21,120 (94.0)	28,800 (128.1)	37,920 (168.7)	48,000 (213.5)	60,960 (271.2)
	Reduction factor for seismic shear	$\alpha_{V,seis}$		0.70	0.70	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75							
	Strength reduction factor for shear[2]	ϕ	-	0.65							
ASTM A 615 Grade 40	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	6,600 (29.4)	12,000 (53.4)	18,600 (82.7)	26,400 (117.4)	In accordance with ASTM A 615, Grade 40 bars are furnished only in sizes No. 3 through No. 6			
		V_{sa}	lbf (kN)	3,960 (17.6)	7,200 (32.0)	11,160 (49.6)	15,840 (70.5)				
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80				
	Strength reduction factor for tension[2]	ϕ	-	0.75							
	Strength reduction factor for shear[2]	ϕ	-	0.65							

For SI: 1 inch = 25.4 mm, 1 lbf = 4.448 N. For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf.

1. Values provided for reinforcing bar material types based on minimum specified strengths and calculated in accordance with ACI 318-14 Eq. 17.4.1.2 and Eq. 17.5.1.2b or ACI 318-11 Eq. (D-2) and Eq. (D-29), as applicable.
2. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4. Values correspond to ductile steel elements. In accordance with ACI 318-14 17.2.3.4.3(a)(vi) or ACI 318-11 D.3.3.4.3(a)6, as applicable, deformed reinforcing bars meeting this specification used as ductile steel elements to resist earthquake effects shall be limited to reinforcing bars satisfying the requirements of ACI 318-14 20.2.2.4 and 20.2.2.5 or ACI 318-11 21.1.5.2 (a) and (b), as applicable.
3. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4. Values correspond to brittle steel elements.

Concrete Breakout Design Information for Threaded Rod and Reinforcing Bars (For use with loads combinations taken from ACI 318-14 Section 5.3)[1]

CODE LISTED
ICC-ES ESR-3298

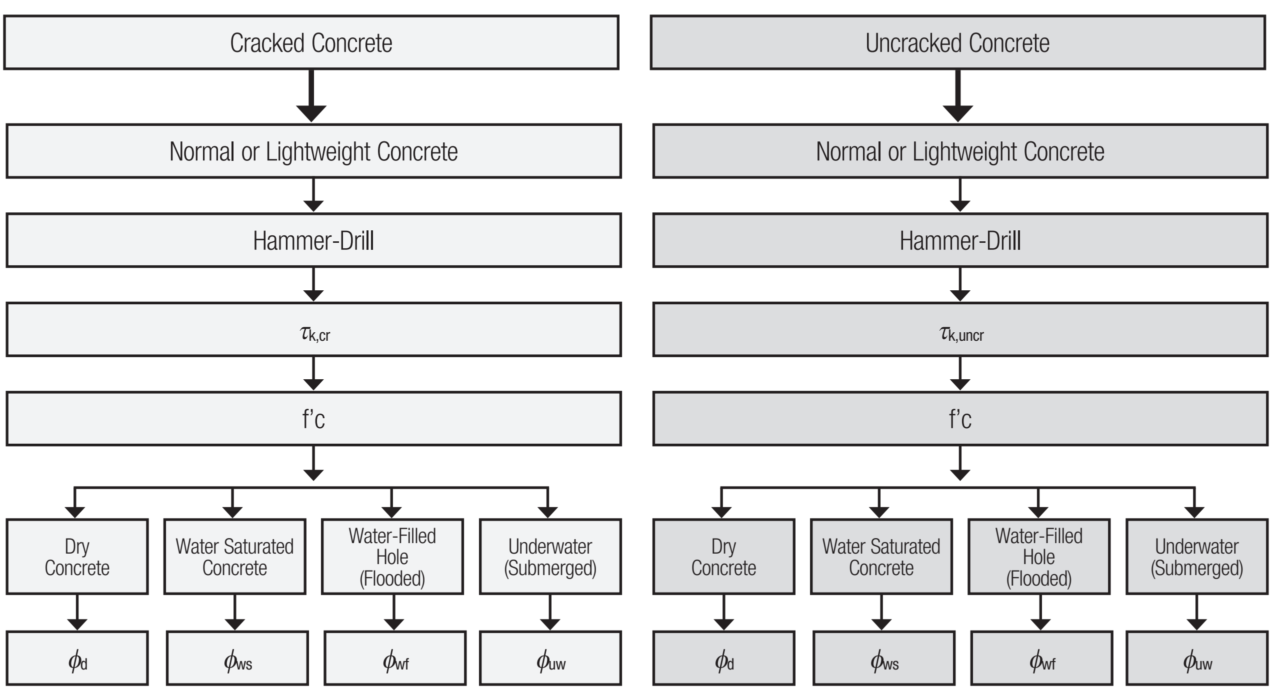
STRENGTH DESIGN SD TABLES

Design Information	Symbol	Units	Nominal Rod Diameter (inch) / Reinforcing Bar Size							
			3/8 or #3	1/2 or #4	5/8 or #5	3/4 or #6	7/8 or #7	1 or #8	#9	1-1/4 or #10
Effectiveness factor for cracked concrete	$k_{c,cr}$	- (SI)	17 (7.1)							
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	- (SI)	24 (10.0)							
Minimum embedment	$h_{ef,min}$	inch (mm)	2-3/8 (60)	2-3/4 (70)	3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	4-1/2 (114)	5 (127)
Maximum embedment	$h_{ef,max}$	inch (mm)	7-1/2 (191)	10 (254)	12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)	22-1/2 (572)	25 (635)
Minimum anchor spacing	s_{min}	inch (mm)	1-7/8 (48)	2-1/2 (64)	3-1/8 (79)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)
Minimum edge distance[2]	c_{min}	inch (mm)	5*d* where *d* is nominal outside diameter of the anchor							
Minimum edge distance, reduced[2]	$c_{min,red}$	inch (mm)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	2-3/4 (70)	2-3/4 (70)
Minimum member thickness	h_{min}	inch (mm)	h_{ef} + 1-1/4 (h_{ef} + 30)		$h_{ef} + 2d_o$ where d_o is hole diameter;					
Critical edge distance—splitting (for uncracked concrete only)[3]	c_{ac}	inch	$c_{ac} = h_{ef} \cdot (\frac{\tau_{uncr}}{1160})^{0.4} \cdot [3.1-0.7\frac{h}{h_{ef}}]$							
		(mm)	$c_{ac} = h_{ef} \cdot (\frac{\tau_{uncr}}{8})^{0.4} \cdot [3.1-0.7\frac{h}{h_{ef}}]$							
Strength reduction factor for tension, concrete failure modes, Condition B[4]	ϕ	-	0.65							
Strength reduction factor for shear, concrete failure modes, Condition B[4]	ϕ	-	0.70							

For SI: 1 inch = 25.4 mm, 1 lbf = 4.448 N. For pound-inch units: 1 mm = 0.03937 inch, 1 N = 0.2248 lbf.

1. Additional setting information is described in the installation instructions.
2. For installation between the minimum edge distance, c_{min}, and the reduced minimum edge distance, $c_{min,red}$, the maximum torque applied must be reduced (multiplied) by a factor of 0.45.
3. $\tau_{k,uncr}$ need not be taken as greater than: $\tau_{k,uncr} = \frac{k_{uncr} \bullet \sqrt{h_{ef} \bullet f'_c}}{\pi \bullet d}$ and $\frac{h}{h_{ef}}$ need not be taken as larger than 2.4.
4. Condition A requires supplemental reinforcement, while Condition B applies where supplemental reinforcement is not provided or where pryout governs, as set forth in ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4.

FLOWCHART FOR THE ESTABLISHMENT OF DESIGN BOND STRENGTH



Bond Strength Design Information for Threaded Rods and Reinforcing Bars[1,2]

CODE LISTED
ICC-ES ESR-3298

Design Information		Symbol	Units	Nominal Rod Diameter (inch)						
				3/8	1/2	5/8	3/4	7/8	1	1-1/4
Minimum embedment		$h_{ef,min}$	inch (mm)	2-3/8 (60)	2-3/4 (70)	3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	5 (127)
Maximum embedment		$h_{ef,max}$	inch (mm)	7-1/2 (191)	10 (254)	12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)	25 (635)
110°F (43°C) Maximum Long-Term Service Temperature; 140°F (60°C) Maximum Short-Term Service Temperature[3,5]	Characteristic bond strength in cracked concrete[6,9]	$\tau_{k,cr}$	psi (N/mm²)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)
	Characteristic bond strength in cracked concrete, short-term loading only[9]	$\tau_{k,cr}$	psi (N/mm²)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	psi (N/mm²)	1,829 (12.6)	1,738 (12.0)	1,671 (11.5)	1,617 (11.1)	1,567 (10.8)	1,538 (10.6)	1,479 (10.2)
	Characteristic bond strength in uncracked concrete, short-term loading only[8]	$\tau_{k,uncr}$	psi (N/mm²)	1,829 (12.6)	1,738 (12.0)	1,671 (11.5)	1,617 (11.1)	1,567 (10.8)	1,538 (10.6)	1,479 (10.2)
110°F (43°C) Maximum Long-Term Service Temperature; 176°F (80°C) Maximum Short-Term Service Temperature[4,5]	Characteristic bond strength in cracked concrete[6,9]	$\tau_{k,cr}$	psi (N/mm²)	882 (6.1)	882 (6.1)	882 (6.1)	882 (6.1)	882 (6.1)	882 (6.1)	882 (6.1)
	Characteristic bond strength in cracked concrete, short-term loading only[9]	$\tau_{k,cr}$	psi (N/mm²)	882 (6.1)	882 (6.1)	882 (6.1)	882 (6.1)	882 (6.1)	882 (6.1)	882 (6.1)
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	psi (N/mm²)	1,334 (9.2)	1,262 (8.7)	1,218 (8.4)	1,175 (8.1)	1,146 (7.9)	1,117 (7.7)	1,073 (7.4)
	Characteristic bond strength in uncracked concrete, short-term loading only[8]	$\tau_{k,uncr}$	psi (N/mm²)	1,334 (9.2)	1,262 (8.7)	1,218 (8.4)	1,175 (8.1)	1,146 (7.9)	1,117 (7.7)	1,073 (7.4)

Design Information		Symbol	Units	Nominal Bar Size							
				#3	#4	#5	#6	#7	#8	#9	#10
Minimum embedment		$h_{ef,min}$	inch (mm)	2-3/8 (60.0)	2-3/4 (70.0)	3-1/8 (79.0)	3-1/2 (89.0)	3-1/2 (89.0)	4 (102.0)	4-1/2 (114.0)	5 (127.0)
Maximum embedment		$h_{ef,max}$	inch (mm)	7-1/2 (191.0)	10 (254.0)	12-1/2 (318.0)	15 (381.0)	17-1/2 (445.0)	20 (508.0)	22-1/2 (572.0)	25 (635.0)
110°F (43°C) Maximum Long-Term Service Temperature; 140°F (60°C) Maximum Short-Term Service Temperature[3,5]	Characteristic bond strength in cracked concrete[6,9]	$\tau_{k,cr}$	psi (N/mm²)	1,206 (8.3)	1,170 (8.1)	1,122 (7.7)	1,122 (7.7)	1,122 (7.7)	1,122 (7.7)	1,122 (7.7)	1,122 (7.7)
	Characteristic bond strength in cracked concrete, short-term loading only[9]	$\tau_{k,cr}$	psi (N/mm²)	1,206 (8.3)	1,170 (8.1)	1,122 (7.7)	1,122 (7.7)	1,122 (7.7)	1,122 (7.7)	1,122 (7.7)	1,122 (7.7)
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	psi (N/mm²)	1,829 (12.6)	1,738 (12.0)	1,671 (11.5)	1,617 (11.1)	1,567 (10.8)	1,538 (10.6)	1,507 (10.4)	1,479 (10.2)
	Characteristic bond strength in uncracked concrete, short-term loading only[8]	$\tau_{k,uncr}$	psi (N/mm²)	1,829 (12.6)	1,738 (12.0)	1,671 (11.5)	1,617 (11.1)	1,567 (10.8)	1,538 (10.6)	1,507 (10.4)	1,479 (10.2)
110°F (43°C) Maximum Long-Term Service Temperature; 176°F (80°C) Maximum Short-Term Service Temperature[4,5]	Characteristic bond strength in cracked concrete[6,9]	$\tau_{k,cr}$	psi (N/mm²)	882 (6.1)	848 (5.8)	814 (5.6)	814 (5.6)	814 (5.6)	814 (5.6)	814 (5.6)	814 (5.6)
	Characteristic bond strength in cracked concrete, short-term loading only[9]	$\tau_{k,cr}$	psi (N/mm²)	882 (6.1)	848 (5.8)	814 (5.6)	814 (5.6)	814 (5.6)	814 (5.6)	814 (5.6)	814 (5.6)
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	psi (N/mm²)	1,334 (9.2)	1,262 (8.7)	1,218 (8.4)	1,175 (8.1)	1,146 (7.9)	1,117 (7.7)	1,102 (7.6)	1,073 (7.4)
	Characteristic bond strength in uncracked concrete, short-term loading only[8]	$\tau_{k,uncr}$	psi (N/mm²)	1,334 (9.2)	1,262 (8.7)	1,218 (8.4)	1,175 (8.1)	1,146 (7.9)	1,117 (7.7)	1,102 (7.6)	1,073 (7.4)
Permissible installation conditions[7]	Dry concrete	Anchor Category		1							
		ϕ_d		0.65							
	Water-saturated concrete, Water-filled hole (flooded)	Anchor Category		2							
		ϕ_{ws}, ϕ_{wf}		0.55							
	Underwater (submerged)	Anchor Category		2				3			
		ϕ_{uw}		0.55				0.45			
Reduction factor for seismic tension[9]		$\alpha_{N,seis}$		1.00							

For SI: 1 inch = 25.4 mm, 1 psi = 0.006894 MPa. For pound-inch units: 1 mm = 0.03937 inch, 1 MPa = 145.0 psi.

1. Bond strength values correspond to a normal-weight concrete compressive strength f'c = 2,500 psi (17.2 MPa). For concrete compressive strength, f'c between 2,500 psi and 8,000 psi (17.2 MPa and 55.2 MPa), the tabulated characteristic bond strength may be increased by a factor of $(f'c / 2{,}500)^{0.23}$ [For SI: $(f'c / 17.2)^{0.23}$].
2. The modification factor for bond strength of adhesive anchors in lightweight concrete shall be taken as given in ACI 318-14 17.2.6 or ACI 318-11 D.3.6, as applicable, where applicable.
3. The maximum short-term service temperature may be increased to 162°F (72°C) provided characteristic bond strengths are reduced by 3 percent. Long-term and short-term temperatures meet the requirements of Section 8.5 of ACI 355.4 and Table 8.1, Temperature Category B.
4. Long-term and short-term temperatures meet the requirements of Section 8.5 of ACI 355.4 and Table 8.1, Temperature Category A.
5. Short-term base material service temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling. Long-term elevated concrete base material service temperatures are roughly constant over significant periods of time.
6. Characteristic bond strengths are for sustained loads including dead and live loads.
7. Permissible installation conditions include dry concrete, water-saturated concrete, water-filled holes and underwater. Water-filled holes include applications in dry or water-saturated concrete where the drilled holes contain standing water at the time of anchor installation.
8. Bond strength values for uncracked concrete are applicable for structures assigned to Seismic Design Categories A and B only.
9. For structures assigned to Seismic Design Categories C, D, E or F, the tabulated bond strength values for cracked concrete do not require an additional reduction factor applied for seismic tension ($\alpha_{N,seis}$ = 1.0), where seismic design is applicable.

Tension and Shear Design Strength for Threaded Rod Installed in Uncracked Concrete (Bond or Concrete Strength)
Drilled with a Hammer-Drill and Carbide Bit in a Dry Hole Condition
110°F (43°C) Maximum Long-Term Service Temperature; 140°F (60°C) Maximum Short-Term Service Temperature[1,2,3,4,5,6,7,8,9]

STRENGTH DESIGN SD TABLES

Nominal Rod/Rebar Size (in.)	Embed. Depth h_{ef} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 (psi)		f'c = 3,000 (psi)		f'c = 4,000 (psi)		f'c = 6,000 (psi)		f'c = 8,000 (psi)	
		ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)
3/8	2-3/8	2,855	2,570	3,125	2,920	3,610	3,575	4,070	4,380	4,345	4,680
	3	4,055	4,010	4,380	4,530	4,680	5,370	5,140	6,830	5,490	8,095
	4-1/2	6,305	7,420	6,575	8,270	7,020	9,805	7,710	12,465	8,235	14,775
	7-1/2	10,505	15,800	10,955	17,600	11,705	20,865	12,845	26,530	13,725	29,565
1/2	2-3/4	3,555	3,305	3,895	3,755	4,500	4,590	5,510	6,095	6,365	7,455
	4	6,240	6,700	6,835	7,610	7,895	9,310	8,680	11,845	9,275	14,045
	6	10,645	12,850	11,105	14,315	11,865	16,970	13,020	21,575	13,915	25,585
	10	17,745	27,370	18,505	30,485	19,770	36,150	21,705	45,955	23,190	49,945
5/8	3-1/8	4,310	4,120	4,720	4,680	5,450	5,725	6,675	7,600	7,710	9,295
	5	8,720	10,005	9,555	11,365	11,030	13,900	13,040	18,205	13,935	21,585
	7-1/2	15,995	19,745	16,680	22,000	17,820	26,080	19,565	33,160	20,900	39,315
	12-1/2	26,660	42,065	27,800	46,860	29,700	55,560	32,605	70,225	34,835	75,030
3/4	3-1/2	5,105	5,015	5,595	5,700	6,460	6,970	7,910	9,255	9,135	11,320
	6	11,465	13,595	12,560	15,445	14,500	18,895	17,760	25,095	19,415	30,030
	9	21,060	26,855	23,070	30,510	24,835	36,285	27,260	46,130	29,125	54,695
	15	37,145	58,530	38,740	65,200	41,390	77,305	45,435	97,855	48,540	104,550
7/8	3-1/2	5,105	4,930	5,595	5,605	6,460	6,855	7,910	9,100	9,135	11,130
	7	14,445	16,605	15,825	18,865	18,275	23,075	22,380	30,650	25,610	37,355
	10-1/2	26,540	32,800	29,070	37,265	32,755	45,135	35,955	57,380	38,415	68,035
	17-1/2	49,000	72,810	51,095	81,105	54,590	96,165	59,930	122,255	64,025	137,905
1	4	6,240	6,115	6,835	6,945	7,895	8,495	9,665	11,280	11,160	13,800
	8	17,650	19,750	19,335	22,435	22,325	27,440	27,340	36,450	31,570	44,580
	12	32,425	39,005	35,520	44,315	41,015	54,200	46,095	69,560	49,250	82,475
	20	62,815	88,270	65,505	98,330	69,985	116,585	76,825	148,215	82,080	175,735
1-1/4	5	8,720	8,170	9,555	9,285	11,030	11,355	13,510	15,085	15,600	18,450
	10	24,665	26,380	27,020	29,975	31,200	36,660	38,210	48,690	44,125	59,555
	15	45,315	52,110	49,640	59,200	57,320	72,410	69,260	95,655	74,000	113,420
	25	94,380	121,400	98,420	135,235	105,155	160,345	115,435	203,845	123,330	241,695

- Concrete Breakout Strength - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in uncracked normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac}
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.
2. Calculations were performed according to ACI 318-14 Ch.17 and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls.
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318-14 Section 5.3 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-3298.
5. Tabular values are permitted for static loads only, seismic loading is not considered with these tables. Periodic special inspection must be performed where required by code, see ESR-3298 for applicable information.
6. For anchors subjected to tension resulting from sustained loading a supplemental check must be performed according to ACI 318-14 17.3.1.2.
7. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Ch.17.
8. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-14 Ch.17, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-14 Ch.17 and ICC-ES AC308 and ESR-3298.
9. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Tension and Shear Design Strength for Threaded Rod Installed in Cracked Concrete (Bond or Concrete Strength) Drilled with a Hammer-Drill and Carbide Bit in a Dry Hole Condition 110°F (43°C) Maximum Long-Term Service Temperature; 140°F (60°C) Maximum Short-Term Service Temperature[1,2,3,4,5,6,7,8,9]

Nominal Rod/Rebar Size (in. or #)	Embed. Depth h_{ef} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 (psi)		f'c = 3,000 (psi)		f'c = 4,000 (psi)		f'c = 6,000 (psi)		f'c = 8,000 (psi)	
		ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)
3/8	2-3/8	2,020	1,835	2,215	2,085	2,445	2,555	2,685	2,890	2,865	3,085
	3	2,770	2,865	2,890	3,235	3,085	3,835	3,390	4,875	3,620	5,785
	4-1/2	4,155	5,300	4,335	5,905	4,630	7,005	5,085	8,900	5,430	10,555
	7-1/2	6,925	11,285	7,225	12,570	7,715	14,905	8,470	18,245	9,050	19,495
1/2	2-3/4	2,520	2,360	2,760	2,680	3,185	3,280	3,905	4,355	4,425	5,325
	4	4,420	4,785	4,840	5,435	5,490	6,650	6,025	8,460	6,435	10,030
	6	7,390	9,180	7,705	10,225	8,230	12,125	9,035	15,410	9,655	18,275
	10	12,315	19,550	12,840	21,775	13,720	25,820	15,060	32,435	16,090	34,655
5/8	3-1/8	3,050	2,940	3,345	3,340	3,860	4,090	4,730	5,430	5,460	6,640
	5	6,175	7,145	6,765	8,120	7,815	9,930	9,415	13,005	10,055	15,415
	7-1/2	11,350	14,105	12,040	15,715	12,860	18,630	14,120	23,685	15,085	28,080
	12-1/2	19,240	30,045	20,065	33,470	21,435	39,685	23,530	50,455	25,140	54,150
3/4	3-1/2	3,620	3,580	3,965	4,070	4,575	4,980	5,605	6,610	6,470	8,085
	6	8,120	9,710	8,895	11,035	10,270	13,495	12,580	17,925	14,480	21,450
	9	14,920	19,185	16,340	21,795	18,520	25,920	20,330	32,950	21,720	39,070
	15	27,705	41,805	28,890	46,570	30,870	55,220	33,885	70,200	36,205	77,975
7/8	3-1/2	3,620	3,525	3,965	4,000	4,575	4,895	5,605	6,500	6,470	7,950
	7	10,230	11,860	11,210	13,475	12,945	16,485	15,850	21,895	18,305	26,680
	10-1/2	18,800	23,430	20,590	26,620	23,780	32,240	27,675	40,985	29,565	48,595
	17-1/2	37,710	52,005	39,325	57,935	42,015	68,690	46,120	87,325	49,275	103,540
1	4	4,420	4,365	4,840	4,960	5,590	6,065	6,845	8,060	7,905	9,855
	8	12,500	14,105	13,695	16,025	15,815	19,600	19,365	26,035	22,365	31,845
	12	22,965	27,860	25,160	31,655	29,050	38,715	35,580	49,685	38,615	58,910
	20	49,255	63,050	51,365	70,235	54,875	83,275	60,240	105,870	64,360	125,525
1-1/4	5	6,175	5,835	6,765	6,630	7,815	8,110	9,570	10,775	11,050	13,175
	10	17,470	18,845	19,140	21,410	22,100	26,185	27,065	34,780	31,255	42,540
	15	32,095	37,220	35,160	42,285	40,600	51,720	49,725	68,325	57,415	81,015
	25	69,060	86,715	75,655	96,595	85,745	114,530	94,125	145,605	100,565	172,640

☐ - Concrete Breakout Strength ☐ - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in cracked normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac}
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.
2. Calculations were performed according to ACI 318-14 Ch.17 and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls.
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318-14 Section 5.3 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-3298.
5. Tabular values are permitted for static loads only, seismic loading is not considered with these tables. Periodic special inspection must be performed where required by code, see ESR-3298 for applicable information.
6. For anchors subjected to tension resulting from sustained loading a supplemental check must be performed according to ACI 318-14 17.3.1.2.
7. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Ch.17.
8. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-14 Ch.17, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-14 Ch.17 and ICC-ES AC308 and ESR-3298.
9. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Tension and Shear Design Strength for Reinforcing Bar Installed in Uncracked Concrete (Bond or Concrete Strength)
Drilled with a Hammer-Drill and Carbide Bit in a Dry Hole Condition
110°F (43°C) Maximum Long-Term Service Temperature; 140°F (60°C) Maximum Short-Term Service Temperature[1,2,3,4,5,6,7,8,9]

STRENGTH DESIGN TABLES SD

Nominal Rod/Rebar Size (#)	Embed. Depth h_{ef} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 (psi)		f'c = 3,000 (psi)		f'c = 4,000 (psi)		f'c = 6,000 (psi)		f'c = 8,000 (psi)	
		ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)
#3	2-3/8	2,855	2,570	3,125	2,920	3,610	3,575	4,070	4,380	4,345	4,680
	3	4,055	4,010	4,380	4,530	4,680	5,370	5,140	6,830	5,490	8,095
	4-1/2	6,305	7,420	6,575	8,270	7,020	9,805	7,710	12,465	8,235	14,775
	7-1/2	10,505	15,800	10,955	17,600	11,705	20,865	12,845	26,530	13,725	29,565
#4	2-3/4	3,555	3,305	3,895	3,755	4,500	4,590	5,510	6,095	6,365	7,455
	4	6,240	6,700	6,835	7,610	7,895	9,310	8,680	11,845	9,275	14,045
	6	10,645	12,850	11,105	14,315	11,865	16,970	13,020	21,575	13,915	25,585
	10	17,745	27,370	18,505	30,485	19,770	36,150	21,705	45,955	23,190	49,945
#5	3-1/8	4,310	4,120	4,720	4,680	5,450	5,725	6,675	7,600	7,710	9,295
	5	8,720	10,005	9,555	11,365	11,030	13,900	13,040	18,205	13,935	21,585
	7-1/2	15,995	19,745	16,680	22,000	17,820	26,080	19,565	33,160	20,900	39,315
	12-1/2	26,660	42,065	27,800	46,860	29,700	55,560	32,605	70,225	34,835	75,030
#6	3-1/2	5,105	5,015	5,595	5,700	6,460	6,970	7,910	9,255	9,135	11,320
	6	11,465	13,595	12,560	15,445	14,500	18,895	17,760	25,095	19,415	30,030
	9	21,060	26,855	23,070	30,510	24,835	36,285	27,260	46,130	29,125	54,695
	15	37,145	58,530	38,740	65,200	41,390	77,305	45,435	97,855	48,540	104,550
#7	3-1/2	5,105	4,930	5,595	5,605	6,460	6,855	7,910	9,100	9,135	11,130
	7	14,445	16,605	15,825	18,865	18,275	23,075	22,380	30,650	25,610	37,355
	10-1/2	26,540	32,800	29,070	37,265	32,755	45,135	35,955	57,380	38,415	68,035
	17-1/2	49,000	72,810	51,095	81,105	54,590	96,165	59,930	122,255	64,025	137,905
#8	4	6,240	6,115	6,835	6,945	7,895	8,495	9,665	11,280	11,160	13,800
	8	17,650	19,750	19,335	22,435	22,325	27,440	27,340	36,450	31,570	44,580
	12	32,425	39,005	35,520	44,315	41,015	54,200	46,095	69,560	49,250	82,475
	20	62,815	88,270	65,505	98,330	69,985	116,585	76,825	148,215	82,080	175,735
#9	4-1/2	7,445	7,110	8,155	8,080	9,420	9,880	11,535	13,125	13,320	16,055
	9	21,060	23,055	23,070	26,190	26,640	32,035	32,625	42,550	37,675	52,040
	13-1/2	38,690	45,540	42,380	51,740	48,940	63,280	57,165	82,475	61,075	97,785
	22-1/2	77,895	104,620	81,230	116,545	86,790	138,185	95,270	175,670	101,790	208,290
#10	5	8,720	8,160	9,555	9,270	11,030	11,335	13,510	15,060	15,600	18,420
	10	24,665	26,430	27,020	30,025	31,200	36,725	38,210	48,780	44,125	59,660
	15	45,315	52,205	49,640	59,310	57,320	72,545	69,260	95,835	74,000	113,625
	25	94,380	121,580	98,420	135,435	105,155	160,580	115,435	204,145	123,330	242,050

- Concrete Breakout Strength - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in uncracked normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac}
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.
2. Calculations were performed according to ACI 318-14 Ch.17 and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls.
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318-14 Section 5.3 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-3298.
5. Tabular values are permitted for static loads only, seismic loading is not considered with these tables. Periodic special inspection must be performed where required by code, see ESR-3298 for applicable information.
6. For anchors subjected to tension resulting from sustained loading a supplemental check must be performed according to ACI 318-14 17.3.1.2.
7. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Ch.17.
8. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-14 Ch.17, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-14 Ch.17 and ICC-ES AC308 and ESR-3298.
9. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Tension and Shear Design Strength for Reinforcing Bar Installed in Cracked Concrete (Bond or Concrete Strength)
Drilled with a Hammer-Drill and Carbide Bit in a Dry Hole Condition
110°F (43°C) Maximum Long-Term Service Temperature; 140°F (60°C) Maximum Short-Term Service Temperature[1,2,3,4,5,6,7,8,9]

STRENGTH DESIGN SD TABLES

Nominal Rod/Rebar Size (#)	Embed. Depth h_{ef} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 (psi)		f'c = 3,000 (psi)		f'c = 4,000 (psi)		f'c = 6,000 (psi)		f'c = 8,000 (psi)	
		ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)
#3	2-3/8	2,020	1,835	2,215	2,085	2,445	2,555	2,685	2,890	2,865	3,085
	3	2,770	2,865	2,890	3,235	3,085	3,835	3,390	4,875	3,620	5,785
	4-1/2	4,155	5,300	4,335	5,905	4,630	7,005	5,085	8,900	5,430	10,555
	7-1/2	6,925	11,285	7,225	12,570	7,715	14,905	8,470	18,245	9,050	19,495
#4	2-3/4	2,520	2,360	2,760	2,680	3,185	3,280	3,905	4,355	4,295	5,325
	4	4,420	4,785	4,840	5,435	5,325	6,650	5,845	8,460	6,245	10,030
	6	7,170	9,180	7,475	10,225	7,985	12,125	8,765	15,410	9,365	18,275
	10	11,945	19,550	12,455	21,775	13,310	25,820	14,610	31,470	15,610	33,620
#5	3-1/8	3,050	2,940	3,345	3,340	3,860	4,090	4,730	5,430	5,380	6,640
	5	6,175	7,145	6,765	8,120	7,815	9,930	8,755	13,005	9,355	15,415
	7-1/2	10,740	14,105	11,200	15,715	11,965	18,630	13,135	23,685	14,035	28,080
	12-1/2	17,900	30,045	18,665	33,470	19,945	39,685	21,890	47,155	23,390	50,380
#6	3-1/2	3,620	3,580	3,965	4,070	4,575	4,980	5,605	6,610	6,470	8,085
	6	8,120	9,710	8,895	11,035	10,270	13,495	12,580	17,925	13,475	21,450
	9	14,920	19,185	16,130	21,795	17,230	25,920	18,915	32,950	20,210	39,070
	15	25,775	41,805	26,880	46,570	28,720	55,220	31,525	67,900	33,680	72,545
#7	3-1/2	3,620	3,525	3,965	4,000	4,575	4,895	5,605	6,500	6,470	7,950
	7	10,230	11,860	11,210	13,475	12,945	16,485	15,850	21,895	18,305	26,680
	10-1/2	18,800	23,430	20,590	26,620	23,455	32,240	25,745	40,985	27,505	48,595
	17-1/2	35,085	52,005	36,585	57,935	39,090	68,690	42,910	87,325	45,845	98,740
#8	4	4,420	4,365	4,840	4,960	5,590	6,065	6,845	8,060	7,905	9,855
	8	12,500	14,105	13,695	16,025	15,815	19,600	19,365	26,035	22,365	31,845
	12	22,965	27,860	25,160	31,655	29,050	38,715	33,625	49,685	35,925	58,910
	20	45,825	63,050	47,785	70,235	51,055	83,275	56,045	105,870	59,880	125,525
#9	4-1/2	5,275	5,080	5,780	5,770	6,670	7,060	8,170	9,375	9,435	11,465
	9	14,920	16,465	16,340	18,710	18,870	22,880	23,110	30,390	26,685	37,170
	13-1/2	27,405	32,530	30,020	36,955	34,665	45,200	42,455	58,910	45,470	69,845
	22-1/2	57,995	74,730	60,480	83,245	64,615	98,700	70,930	125,480	75,785	148,775
#10	5	6,175	5,830	6,765	6,620	7,815	8,100	9,570	10,755	11,050	13,155
	10	17,470	18,880	19,140	21,445	22,100	26,230	27,065	34,840	31,255	42,615
	15	32,095	37,290	35,160	42,365	40,600	51,815	49,725	68,455	56,135	81,160
	25	69,060	86,840	74,665	96,740	79,775	114,700	87,570	145,820	93,560	172,890

■ - Concrete Breakout Strength ■ - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in cracked normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac}
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.
2. Calculations were performed according to ACI 318-14 Ch.17 and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls.
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318-14 Section 5.3 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-3298.
5. Tabular values are permitted for static loads only, seismic loading is not considered with these tables. Periodic special inspection must be performed where required by code, see ESR-3298 for applicable information.
6. For anchors subjected to tension resulting from sustained loading a supplemental check must be performed according to ACI 318-14 17.3.1.2.
7. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Ch.17.
8. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-14 Ch.17, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-14 Ch.17 and ICC-ES AC308 and ESR-3298.
9. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

STRENGTH DESIGN TABLES

Tension Design of Steel Elements (Steel Strength)[1,2]

Steel Elements - Threaded Rod and Reinforcing Bar												
Nominal Rod/Rebar Size (in. or No.)	ASTM A36 and ASTM F1554 Grade 36	ASTM F1554 Grade 55	ASTM A193 Grade B7 and ASTM F1554 Grade 105	ASTM A449	ASTM F568M Class 5.8 and ISO 898-1 Class 5.8	ASTM F593 CW Stainless (Types 304 and 316)	ASTM A193 Grade B8/B8M, Class 1 Stainless (Types 304 and 316)	ASTM A193 Grade B8/ B8M2, Class 2B Stainless (Types 304 and 316)	ASTM A615 Grade 75 Rebar	ASTM A615 Grade 60 Rebar	ASTM A706 Grade 60 Rebar	ASTM A615 Grade 40 Rebar
	$ØN_{sa}$ Tension (lbs.)	$ØN_{sa}$ Tension (lbs.)	$ØN_{sa}$ Tension (lbs.)	$ØN_{sa}$ Tension (lbs.)	$ØN_{sa}$ Tension (lbs.)	$ØN_{sa}$ Tension (lbs.)	$ØN_{sa}$ Tension (lbs.)	$ØN_{sa}$ Tension (lbs.)	$ØN_{sa}$ Tension (lbs.)	$ØN_{sa}$ Tension (lbs.)	$ØN_{sa}$ Tension (lbs.)	$ØN_{sa}$ Tension (lbs.)
3/8 or #3	3,370	4,360	7,265	6,975	3,655	5,040	3,315	5,525	7,150	7,425	6,600	4,950
1/2 or #4	6,175	7,980	13,300	12,770	6,690	9,225	6,070	10,110	13,000	13,500	12,000	9,000
5/8 or #5	9,835	12,715	21,190	20,340	10,650	14,690	9,660	16,105	20,150	20,925	18,600	13,950
3/4 or #6	14,550	18,815	31,360	30,105	15,765	18,480	14,300	23,830	28,600	29,700	26,400	19,800
7/8 or #7	20,085	25,970	43,285	41,930	21,760	25,510	19,735	32,895	39,000	40,500	36,000	-
1 or #8	26,350	34,070	56,785	54,515	28,545	33,465	25,895	43,160	51,350	53,325	47,400	-
#9	-	-	-	-	-	-	-	-	65,000	67,500	60,000	-
1-1/4 or #10	42,160	54,510	90,850	76,315	-	53,540	41,430	69,050	82,550	85,725	76,200	-

■ - Steel Strength

1. Steel tensile design strength according to ACI 318-14 Ch.17, $\phi N_{sa} = \phi \bullet A_{se,N} \bullet f_{uta}$
2. The tabulated steel design strength in tension must be checked against the bond strength/concrete capacity design strength to determine the controlling failure mode, the lowest load level controls.

Shear Design of Steel Elements (Steel Strength)[1,2]

Steel Elements - Threaded Rod and Reinforcing Bar												
Nominal Rod/Rebar Size (in. or No.)	ASTM A36 and ASTM F1554 Grade 36	ASTM F1554 Grade 55	ASTM A193 Grade B7 and ASTM F1554 Grade 105	ASTM A449	ASTM F568M Class 5.8 and ISO 898-1 Class 5.8	ASTM F593 CW Stainless (Types 304 and 316)	ASTM A193 Grade B8/B8M, Class 1 Stainless (Types 304 and 316)	ASTM A193 Grade B8/ B8M2, Class 2B Stainless (Types 304 and 316)	ASTM A615 Grade 75 Rebar	ASTM A615 Grade 60 Rebar	ASTM A706 Grade 60 Rebar	ASTM A615 Grade 40 Rebar
	$ØV_{sa}$ Shear (lbs.)	$ØV_{sa}$ Shear (lbs.)	$ØV_{sa}$ Shear (lbs.)	$ØV_{sa}$ Shear (lbs.)	$ØV_{sa}$ Shear (lbs.)	$ØV_{sa}$ Shear (lbs.)	$ØV_{sa}$ Shear (lbs.)	$ØV_{sa}$ Shear (lbs.)	$ØV_{sa}$ Shear (lbs.)	$ØV_{sa}$ Shear (lbs.)	$ØV_{sa}$ Shear (lbs.)	$ØV_{sa}$ Shear (lbs.)
3/8 or #3	1,755	2,265	3,775	3,625	2,025	2,790	1,725	2,870	3,960	3,860	3,430	2,575
1/2 or #4	3,210	4,150	6,915	6,640	3,705	5,110	3,155	5,255	7,200	7,020	6,240	4,680
5/8 or #5	5,115	6,610	11,020	10,575	5,900	8,135	5,025	8,375	11,160	10,880	9,670	7,255
3/4 or #6	7,565	9,785	16,305	15,655	8,730	10,235	7,435	12,390	15,840	15,445	13,730	10,295
7/8 or #7	10,445	13,505	22,505	21,805	12,050	14,130	10,265	17,105	21,600	21,060	18,720	-
1 or #8	13,700	17,715	29,525	28,345	15,810	18,535	13,465	22,445	28,440	27,730	24,650	-
#9	-	-	-	-	-	-	-	-	36,000	35,100	31,200	-
1-1/4 or #10	21,920	28,345	47,240	39,685	-	29,655	21,545	35,905	45,720	44,575	39,625	-

■ - Steel Strength

1. Steel shear design strength according to ACI 318-14 Ch.17, $\phi V_{sa} = \phi \bullet 0.60 \bullet A_{se,V} \bullet f_{uta}$
2. The tabulated steel design strength in shear must be checked against the bond strength/concrete capacity design strength to determine the controlling failure mode, the lowest load level controls.

Development Lengths for Common Reinforcing Bar Connections[1,2,3,6]

Design Information	Symbol	Reference Standard	Units	Nominal Rebar Size (US)								
				#3	#4	#5	#6	#7	#8	#9	#10	#11
Nominal rebar diameter	d_b	ASTM A615/A706, Grade 60 (fy = 60 ksi)	in. (mm)	0.375 (9.5)	0.5 (12.7)	0.625 (15.9)	0.75 (19.1)	0.875 (22.2)	1 (25.4)	1.128 (28.6)	1.27 (32.3)	1.41 (35.8)
Nominal rebar area	A_b		in² (mm²)	0.11 (71)	0.2 (127)	0.31 (198)	0.44 (285)	0.6 (388)	0.79 (507)	1 (645)	1.27 (817)	1.56 (1006)
Development length in f'c = 2,500 psi concrete[4,5]	l_d	ACI 318-14 25.4.2.3 or ACI 318-11 12.2.3 as applicable	in. (mm)	12 (305)	14.4 (366)	18 (457)	21.6 (549)	31.5 (800)	36 (914)	40.6 (1031)	45.7 (1161)	50.8 (1290)
Development length in f'c = 3,000 psi concrete[4,5]			in. (mm)	12 (305)	13.1 (334)	16.4 (417)	19.7 (501)	28.8 (730)	32.9 (835)	37.1 (942)	41.7 (1060)	46.3 (1177)
Development length in f'c = 4,000 psi concrete[4,5]			in. (mm)	12 (305)	12 (305)	14.2 (361)	17.1 (434)	24.9 (633)	28.5 (723)	32.1 (815)	36.2 (920)	40.1 (1019)
Development length in f'c = 6,000 psi concrete[4,5]			in. (mm)	12 (305)	12 (305)	12 (305)	13.9 (354)	20.3 (516)	23.2 (590)	26.2 (666)	29.5 (750)	32.8 (832)
Development length in f'c = 8,000 psi concrete[4,5]			in. (mm)	12 (305)	12 (305)	12 (305)	12.1 (307)	17.6 (443)	20.1 (511)	22.7 (577)	25.6 (649)	28.4 (721)

For SI: 1 inch = 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa; for pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi.

1. Calculated development lengths in accordance with ACI 318-14 25.4.2.3 or ACI 318-11 12.2.3, as applicable, for reinforcing bars are valid for static, wind, and earthquake loads.
2. Calculated development lengths in SDC C through F must comply with ACI 318-14 Chapter 18 or ACI 318-11 Chapter 21, as applicable. The value of f 'c used to calculate development lengths shall not exceed 2,500 psi for post-installed reinforcing bar applications in SDC's C, D, E and F.
3. For Class B splices, minimum length of lap for tension lap splices is $1.3l_d$ in accordance with ACI 318-14 25.5.2 and ACI 318-11 12.15.1, as applicable.
4. For lightweight concrete, λ = 0.75; therefore multiply development lengths by 1.33 (increase development length by 33 percent), unless the provisions of ACI 318-14 25.4.2.4 or ACI 318-11 12.2.4 (d), as applicable, are met to permit alternate values of λ (e.g for sand-lightweight concrete, λ = 0.85; therefore multiply development lengths by 1.18). Refer to ACI 318-14 19.2.4 or ACI 318-11 8.6.1, as applicable.
5. $\left(\frac{c_b + K_{tr}}{d_b}\right) = 2.5$, $\psi_t=1.0$, $\psi_e=1.0$, $\psi_s=0.8$ for $d_b \le$ #6,1.0 for $d_b >$ #6. Refer to ACI 318-14 25.4.2.4 or ACI 318-11 12.2.4, as applicable.
6. Calculations may be performed for other steel grades and concrete compressive strengths per ACI 318-14 Chapter 25 or ACI 318-11 Chapter 12, as applicable.

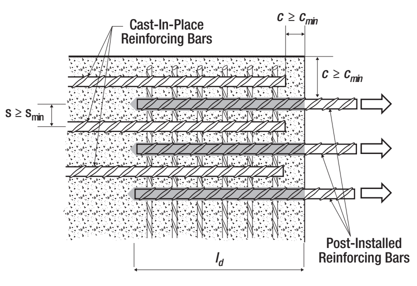
Installation Parameters for Common Post-Installed Reinforcing Bar Connections

Parameter	Symbol	Units	Nominal Rebar Size (US)								
			#3	#4	#5	#6	#7	#8	#9	#10	#11
Nominal hole diameter[1]	d_o	in.	7/16	5/8	3/4	7/8	1	11/8	1-3/8	1-1/2	1-3/4
Effective embedment	h_{ef}	in.	2-3/8 to 7-1/2	2-3/4 to 10	3-1/8 to 12-1/2	3-1/2 to 15	3-1/2 to 17-1/2	4 to 20	4-1/2 to 22-1/2	5 to 25	5-1/2 to 27-1/2
Nominal hole diameter[1]	d_o	in.	1/2	5/8	3/4	1	1-1/8	1-1/4	1-3/8	1-1/2	1-3/4
Effective embedment	h_{ef}	in.	7-1/2 to 22-1/2	10 to 30	12-1/2 to 37-1/2	15 to 45	17-1/2 to 52-1/2	20 to 60	22-1/2 to 67-1/2	25 to 75	27-1/2 to 82-1/2

For SI: 1 inch = 25.4 mm,; for pound-inch units: 1 mm = 0.03937 inches.

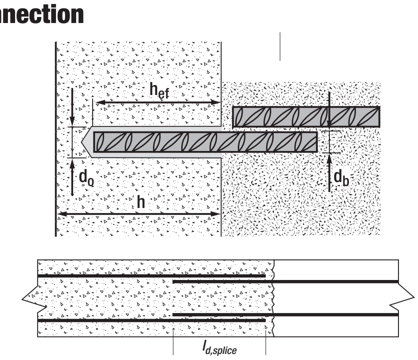
1. For any case, it must be possible for the reinforcing bar (rebar) to be inserted into the cleaned hole without resistance.
2. Consideration should be given regarding the commercial availability of carbide drill bits (including hollow drill bits) and diamond core bits, as applicable, with lengths necessary to achieve effective embedments for post-installed reinforcing bar connections.

Installation Detail for Post-Installed Reinforcing Bar Connection



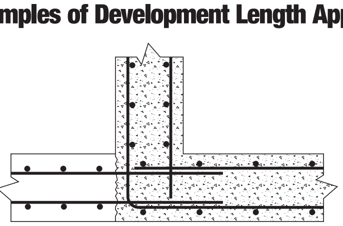
Development Length

c = edge distance
s = spacing

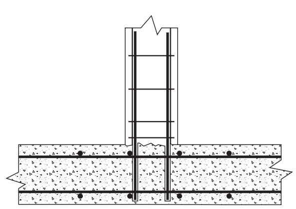


d_b = nomial bar diameter
d_o = nominal hole diameter
h_{ef} = effective embedment
h = member thickness

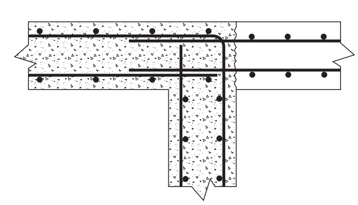
Examples of Development Length Application Details for Post-Installed Reinforcing Bar Connections Provided for Illustrator



Tension Lap Splice with Existing Reinforcement for Footing and Foundation Extensions



Tension Development of Column, Cap or Wall Dowels



Tension Lap Splice with Existing Flexural Reinforcement For Slab and Beam Extensions

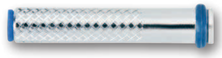
Hole Cleaning Tools and Accessories for Post-Installed Rebar Connections[1,2,3,4,5,6,7]

Rebar Size (No.)	Drill Bit Size (inch)	Brush Size (inch)	Brush Length (inches)	Wire Brush (Cat. No.)	Plug Size (inch)	Piston Plug (Cat. No.)
3	7/16	7/16	6-3/4	08284	N/A	N/A
	1/2	1/2	6-3/4	08285	N/A	N/A
4	5/8	5/8	6-3/4	08275	N/A	N/A
5	3/4	3/4	7-7/8	08278	3/4	PFC1691520
6	7/8	7/8	7-7/8	08287	7/8	PFC1691530
	1	1	11-7/8	08288	1	PFC1691540
7	1	1	11-7/8	08288	1	PFC1691540
	1-1/8	1-1/8	11-7/8	08289	1-1/8	PFC1691550
8	1-1/8	1-1/8	11-7/8	08289	1-1/8	PFC1691550
	1-1/4	1-1/4	11-7/8	08290	1-1/4	PFC1691555
9	1-3/8	1-3/8	11-7/8	08290	1-3/8	PFC1691560
10	1-1/2	1-1/2	11-7/8	08291	1-1/2	PFC1691570
11	1-3/4	1-3/4	11-7/8	08299	1-3/4	PFC1691580

1. If the DEWALT DustX+ extraction system is used to automatically clean the holes during drilling, standard hole cleaning (brushing and blowing following drilling) is not required.
2. Holes may be drilled with hammer-drill, i.e. rotary impact drills or rock drills with a carbide drill bit (including hollow bits) or core-drill, i.e. core drill with a diamond core drill bit.
3. For any case, it must be possible for the reinforcing bar to be inserted into the cleaned hole without resistance.
4. A brush extension (Cat.#08282) must be used with a steel wire brush for holes drilled deeper than the listed brush length.
5. Brush adaptors for power tool connections are available for drill chuck (Cat.#08296) and SDS (Cat.#08283).
6. A flexible extension tube (Cat.#08297) or flexible extension hose (Cat.#PFC1640600) or equivalent approved by DEWALT must be used if the bottom or back of the anchor hole is not reached with the mixing nozzle only.
7. All overhead (i.e upwardly inclined) installations require the use of piston plugs during where one is tabulated together with the anchor size (see table). N/A = Not applicable. All horizontal installations require the use of piston plugs where one is tabulated together with the anchor size and where the embedment depth is greater than 8 inches. A flexible extension tube (Cat.#08297) or flexible extension hose (Cat.#PFC1640600) or equivalent approved by DEWALT must be used with piston plugs.


Wire Brush


Brush Extension


Drill Chuck Adapter


SDS Adapter


Premium Piston Plug


Compressed Air Nozzle


DustX+™ System

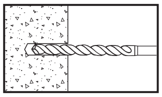
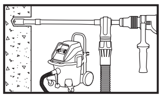
DUST X+ ANCHOR INSTALLATION SYSTEM

INSTALLATION INSTRUCTIONS FOR ADHESIVE ANCHORS (SOLID BASE MATERIALS)

PERMISSIBLE INSTALLATION CONDITIONS (ADHESIVE)

Dry Concrete: cured concrete that, at the time of adhesive anchor installation, has not been exposed to water for the preceding 14 days.
Water-Saturated Concrete (wet): cured concrete that, at the time of adhesive anchor installation, has been exposed to water over a sufficient length of time to have the maximum possible amount of absorbed water into the concrete pore structure to a depth equal to the anchor embedment depth.
Water-Filled Holes (flooded): cured concrete that is water-saturated and where the drilled hole contains standing water at the time of anchor installation.
Underwater Concrete (submerged): cured concrete that is water-saturated and covered with water at the time of anchor installation.

DRILLING

1- Drill a hole into the base material with rotary hammer drill (i.e. percussion drill) and a carbide drill bit to the size and embedment required by the selected steel hardware element (reference installation specifications for threaded rod and reinforcing bar). The tolerances of the carbide drill bits, including hollow bits, must meet ANSI Standard B212.15.

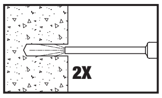
- Precaution: Use suitable eye and skin protection. Avoid inhalation of dust during drilling and/or removal.
- Note! In case of standing water in the drilled hole (flooded hole condition), all the water has to be removed from the hole (e.g. vacuum, compressed air, etc.) prior to cleaning.

Drilling in dry base materials is recommended when using hollow drill bits (vacuum must be on).

GO TO STEP 3 FOR HOLES DRILLED WITH DUSTX+™ EXTRACTION SYSTEM (NO FURTHER HOLE CLEANING IS REQUIRED). OTHERWISE GO TO STEP 2A FOR HOLE CLEANING INSTRUCTIONS.

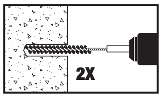
IN THE CASE OF AN UNDERWATER (SUBMERGED) INSTALLATION CONDITION GO TO STEP 2UW-I FOR SEPARATE SPECIFIC HOLE CLEANING INSTRUCTIONS.

HOLE CLEANING DRY OR WET/WATER-SATURATED HOLES (BLOW 2X, BRUSH 2X, BLOW 2X)



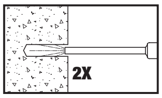
2a- Starting from the bottom or back of the drilled anchor hole, blow the hole clean a minimum of two times (2x).

- Use a compressed air nozzle (min. 90 psi) for all sizes of anchor rod and reinforcing bar (rebar).



2b- Determine wire brush diameter (see hole cleaning equipment selection table) for the drilled hole and attach the brush with adaptor to a rotary drill tool or battery screw gun. Brush the hole with the selected wire brush a minimum of two times (2x).
A brush extension (supplied by DEWALT) must be used for holes drilled deeper than the listed brush length.

- The wire brush diameter must be checked periodically during use. The brush should resist insertion into the drilled hole, if not, the brush is too small and must be replaced with proper brush diameter (i.e. new wire brush).

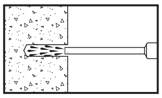


2c- Repeat Step 2a- again by blowing the hole clean a minimum of two times (2x).

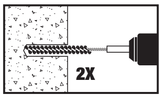
- When finished the hole should be clean and free of dust, debris, ice, grease, oil or other foreign material.

NEXT GO TO STEP 3.

HOLE CLEANING UNDERWATER INSTALLATION (FLUSH, BRUSH 2X, FLUSH)

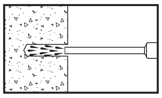


2uw-i- Starting from the bottom or back of the drilled anchor hole, rinse/flush the hole clean with air/water (air/water line pressure) until clear water comes out.



2uw-ii- Determine brush diameter (see hole cleaning equipment selection table) for the drilled hole and attach the brush with adaptor to a rotary drill tool. Brush the hole with the selected wire brush a minimum of two times (2x). A brush extension (supplied by DEWALT) must be used for holes drilled deeper than the listed brush length.

- The wire brush diameter must be checked periodically during use. The brush should resist insertion into the drilled hole, if not, the brush is too small and must be replaced with proper brush diameter (i.e. new wire brush).

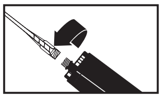


2uw-iii- Repeat Step 2a- again by rinse/flushing the hole clean with air/water.

- When finished the hole should be clean and free of dust, debris, ice, grease, oil or other foreign material.

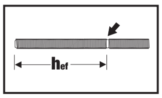
NEXT GO TO STEP 3.

PREPARING

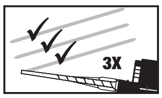


3- Check adhesive expiration date on cartridge label. Do not use expired product. Review Safety Data Sheet (SDS) before use. Cartridge temperature must be between 50°F - 110°F (10°C - 43°C) when in use; for overhead applications cartridge temperature must be between 50ºF - 90ºF (10ºC - 32ºC) when in use. For best experience, suggested minimum cartridge adhesive temperature is 68ºF (20ºC) when in use. Review published gel (working) and cure times. Consideration should be given to the reduced gel (working) time of the adhesive in warm temperatures. For permitted range of the base material temperature, see published gel and curing times.

- Attach a supplied mixing nozzle to the cartridge. Unless otherwise noted do not modify the mixer in any way and make sure the mixing element is inside the nozzle. Load the cartridge into the correct dispensing tool.
- Note: Always use a new mixing nozzle with new cartridge of adhesive and also for all work interruptions exceeding the published gel (working) time of the adhesive.



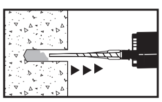
4- Prior to inserting the anchor rod or rebar into the drilled hole, the position of the embedment depth has to be marked on the anchor. Verify anchor element is straight and free of surface damage.



5- Adhesives must be properly mixed to achieve published properties. For new cartridges and nozzles, prior to dispensing adhesive into the drilled hole, separately dispense at least three full strokes of adhesive through the mixing nozzle until the adhesive is a consistent **RED** color.

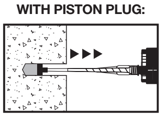
- Review and note the published gel (working) and cure times (reference gel time and curing time table) prior to injection of the mixed adhesive into the cleaned anchor hole.

INSTALLATION



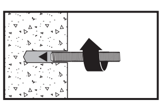
6- Fill the cleaned hole approximately two-thirds full with mixed adhesive starting from the bottom or back of the anchor hole. Slowly withdraw the mixing nozzle as the hole fills to avoid creating air pockets or voids. A plastic extension tube (Cat# 08281 or 08297) or equivalent approved by DEWALT must be used with the mixing nozzle if the bottom or back of the anchor hole is not reached with the mixing nozzle only.

WITH PISTON PLUG:

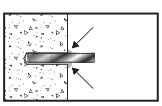


- Piston plugs (see installation specifications) must be used with and attached to the mixing nozzle and extension tube for overhead (i.e. upwardly inclined) installations and horizontal installations in concrete with anchor rod 5/8" to 1-1/4" diameter and rebar size #5 to #10. Insert piston plug to the back of the drilled hole and inject as described in the method above. During injection of the adhesive the piston plug will be naturally extruded from the drilled hole by the adhesive pressure.
- The use of piston plugs is also recommended for underwater installations for anchor rod 5/8" to 1-1/4" diameter and rebar size #5 to #10.

Attention! Do not install anchors overhead without proper training and installation hardware provided by the DEWALT. Contact DEWALT for details prior to use.

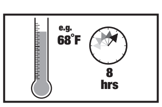


7- The anchor should be free of dirt, grease, oil or other foreign material. Push clean threaded rod or reinforcing bar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached. Observe the gel (working) time.



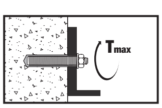
8- Ensure that the anchor element is installed to the specific embedment depth. Adhesive must completely fill the annular gap at the concrete surface. Following installation of the anchor element, remove excess adhesive. Protect the anchor element threads from fouling with adhesive. For all installations the anchor element must be restrained from movement throughout the specified curing period, (as necessary) through the use of temporary wedges, external supports, or other methods. Minor adjustment to the position of the anchor element may be performed during the gel (working) time only.

CURING AND LOADING



9- Allow the adhesive anchor to cure to the specified full curing time prior to applying any load (reference gel time and curing time table).

- Do not disturb, torque or load the anchor until it is fully cured.

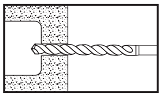
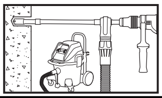


10- After full curing of the adhesive anchor, a fixture can be installed to the anchor and tightened up to the maximum torque (reference gel time and curing table) by using a calibrated torque wrench.

- Take care not to exceed the maximum torque for the selected anchor.

INSTALLATION INSTRUCTIONS FOR ADHESIVE ANCHORS (HOLLOW BASE MATERIALS)

DRILLING

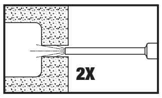



1- Drill a hole into the base material with a rotary drill tool to the size and embedment for the required screen size (see installation specifications for threaded rod in hollow concrete base material with screen tube supplied by DEWALT). Holes drilled in hollow concrete masonry units may be drilled with a rotary hammer-drill. The tolerances of the drill bit used should meet the requirements of ANSI B212.15.

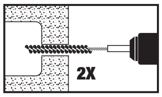
- Precaution: Wear suitable eye and skin protection. Avoid inhalation of dust during drilling and/or removal.

Drilling in dry base materials is recommended when using hollow drill bits (vacuum must be on).

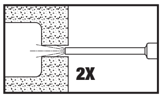
HOLE CLEANING (BLOW 2X, BRUSH 2X, BLOW 2X)



2- Starting from the bottom or back of the anchor hole, blow the hole clean with a hand pump (min. volume 25 fl.oz. supplied by DEWALT) or compressed air nozzle a minimum of two times (2x).

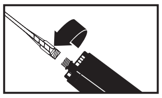


- Determine the wire brush diameter (see installation specifications) and attach the brush with adaptor to a rotary drill tool or battery screw gun. Brush the hole with the selected wire brush a minimum of two times (2x). A brush extension (supplied by DEWALT, Cat #08282) should be used for holes drilled deeper than the listed brush length.
- The wire brush should be checked periodically during use. The brush should resist insertion into the drilled hole and come into contact with the sides of the drilled hole. If not the brush is too small and must be replaced.



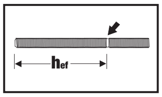
- Finally, blow the hole clean again a minimum of two times (2x)
- When finished the hole should be clean and free of dust, debris, ice, grease, oil or other foreign material.

PREPARING

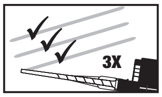


3- Check adhesive expiration date on cartridge label. Do not use expired product. Review Safety Data Sheet (SDS) before use. Cartridge temperature must be between 50°F - 110°F (10°C - 43°C) when in use. For best experience, suggested minimum cartridge adhesive temperature is 68°F (20°C) when in use. Review gel (working) time and curing time table. Consideration should be given to the reduced gel (working) time of the adhesive in warm temperatures.

- Attach a supplied mixing nozzle to the cartridge. Unless otherwise noted do not modify the mixer in any way and make sure the mixing element is inside the nozzle. Load the cartridge into the correct dispensing tool.
- Note: Always use a new mixing nozzle with new cartridges of adhesive and also for all work interruptions exceeding the published working time of the adhesive.



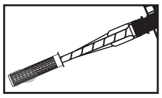
4- Prior to inserting the anchor rod into the filled screen tube, the position of the embedment depth has to be marked on the anchor. Verify anchor element is straight and free of surface damage.



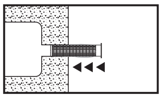
5- Adhesive must be properly mixed to achieve published properties. Prior to dispensing adhesive into the drilled hole, separately dispense at least three full strokes of adhesive through the mixing nozzle until the adhesive is a consistent RED color. Do not attach a used nozzle when changing to a new cartridge.

- Review and note the published working and cure times (see gel time and curing time table) prior to injection of the mixed adhesive into the screen tube.

INSTALLATION

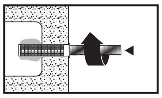


6- Select a screen tube of suitable length (supplied by DEWALT). Fill the screen tube full with adhesive starting from the bottom or back of the tube. Slowly withdraw the mixing nozzle as the screen fills to avoid creating air pockets or voids. A plastic extension tube (Cat# 08281 or 08297) or equivalent approved by DEWALT must be used with the mixing nozzle if the bottom or back of the screen tube is not reached with the mixing nozzle only.



7- Insert the screen tube filled with adhesive into the cleaned anchor hole.

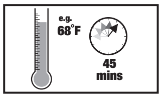
- Note: Overfilling the screen tube is acceptable but not required.



8- Prior to inserting the anchor rod into the screen tube inspect it to ensure that it is free of dirt, grease, oil or other foreign material.

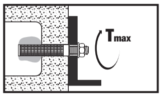
- Push the threaded rod into the screen tube while turning slightly to ensure positive distribution of the adhesive until back of the tube is reached.
- Note: In cases where the drilled hole size is larger than specified due to rotary drilling (e.g. an elongated opening), the annular space between the screen tube and the hole at the base material surface must be filled with adhesive.

CURING AND FIXTURE



9- Allow the adhesive anchor to cure to the specified full curing time prior to applying any load.

- Do not disturb, torque or load the anchor until it is fully cured (see gel time and curing time table).



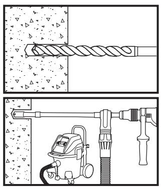
10- After full curing of the adhesive anchor, a fixture can be installed to the anchor and tightened up to the maximum torque (see installation specifications for threaded rod in hollow base material) by using a calibrated torque wrench.

- Take care not to exceed the maximum torque for the selected anchor.

INSTALLATION INSTRUCTIONS (POST-INSTALLED REBAR)

HAMMER DRILLING

DRILLING



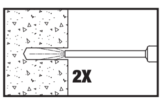
1- Drill a hole into the base material with rotary hammer drill (i.e. percussion drill) and a carbide drill bit to the size and embedment required by the selected steel hardware element (reference installation specifications for threaded rod and reinforcing bar). The tolerances of the carbide drill bits, including hollow bits, must meet ANSI Standard B212.15.

- Precaution: Use suitable eye and skin protection. Avoid inhalation of dust during drilling and/or removal.
- Note! In case of standing water in the drilled hole (flooded hole condition), all the water has to be removed from the hole (e.g. vacuum, compressed air, etc.) prior to cleaning.

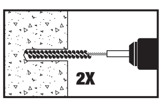
Drilling in dry base materials is recommended when using hollow drill bits (vacuum must be on).

GO TO STEP 3 FOR HOLES DRILLED WITH DUSTX+™ EXTRACTION SYSTEM (NO FURTHER HOLE CLEANING IS REQUIRED). OTHERWISE GO TO STEP 2A FOR HOLE CLEANING INSTRUCTIONS.

HOLE CLEANING DRY OR WET HOLES (BLOW 2X, BRUSH 2X, BLOW 2X)

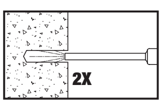


2a- Starting from the bottom or back of the drilled hole, blow the hole clean a minimum of two times (2x). Use a compressed air nozzle (min. 90 psi) for all sizes of reinforcing bar (rebar).



2b- Determine brush diameter (see hole cleaning accessories for post-installed rebar selection table) for the drilled hole and brush the hole by hand or attach the brush with adaptor to a rotary drill tool or battery screw gun. Brush the hole with the selected wire brush a minimum of two times (2x).

- A brush extension (supplied by DEWALT) must be used for drill hole depth than the listed brush length. The wire brush diameter must be checked periodically during use; The brush should resist insertion into the drilled hole, if not the brush is too small and must be replaced with the proper brush diameter (i.e. new wire brush).



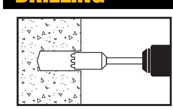
2c- Repeat Step 2a again by blowing the hole clean a minimum of two times (2x).

When finished the hole should be clean and free of dust, debris, oil or other foreign material.

NEXT GO TO STEP 3.

CORE DRILLING

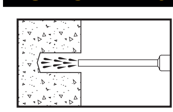
DRILLING



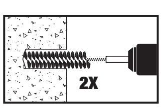
1- Drill a hole into the base material with a core drill tool to the size and embedment required by the selected steel hardware element

Precaution: Use suitable eye and skin protection. Avoid inhalation of dust during drilling and/or removal.

HOLE CLEANING (RINSE, BRUSH 2X, RINSE, BLOW 2X)

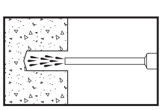


2a- Starting from the bottom or back of the drilled hole, rinse/flush the hole clean with air/water (air/water line pressure) until clear water comes out.

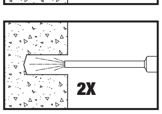


2b- Determine brush diameter (see hole cleaning accessories for post-installed rebar selection table) for drilled hole and attach the brush with adaptor to a rotary drill tool or battery screw gun. Brush the hole with the selected wire brush a minimum of two times (2x).

- A brush extension (supplied by DEWALT) must be used for holes drilled deeper than the listed brush length. The wire brush diameter must be checked periodically during use The brush should resist insertion into the drilled hole, if not the brush is small and must be replaced with the proper brush diameter (i.e. new wire brush).

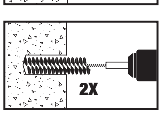


2c- Repeat Step 2a again by rinse/flush the hole clean with water.

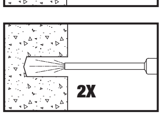


2d- Starting from the bottom or back of the drilled anchor hole, blow the hole clean a minimum if two times (2x). Use a compressed air nozzle (min. 90 psi) for all sizes of anchor rod and reinforcing bar (rebar)

When finished the hole should be clean and free of water, debris, oil or other foreign material.



2e- Repeat Step 2b again by brushing the hole with a wire brush a minimum if two times (2x).

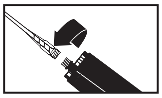


2f- Repeat Step 2d again by blowing the hole clean a minimum if two times (2x).

When finished the hole should be clean and free of water, debris, oil or other foreign material.

NEXT GO TO STEP 3.

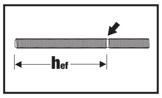
PREPARING



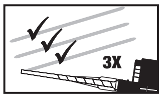
3- Check adhesive expiration date on cartridge label. Do not use expired product. Review Safety Data Sheet (SDS) before use. Review published gel (working) and cure times. Cartridge adhesive temperature must be between 50°F - 110°F (10°C - 43°C) when in use; except for overhead applications cartridge adhesive temperature must be between 50°F - 90°F (10°C - 32°C) when in use. For best experience, the suggested minimum cartridge adhesive temperature is 68°F (20°C) when in use. Consideration should be given to the reduced gel (working) time of the adhesive in warm temperatures. For the permitted range of the base material temperature see published gel and cure times.

Attach a supplied mixing nozzle to the cartridge. Unless otherwise noted do not modify the mixer in any way and make sure the mixing element is inside the nozzle. Load the cartridge into the correct dispensing tool.

- Note: Always use a new mixing nozzle with new cartridge of adhesive and also for all work interruptions exceeding the published gel (working) time of the adhesive.



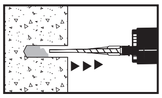
4- Prior to inserting the rebar into the filled drilled hole, the position of the embedment depth has to be marked on the anchor. Verify anchor element is straight and free of surface damage.



5- Adhesive must be properly mixed to achieve published properties. Prior to dispensing adhesive into the drilled hole, separately dispense at least three full strokes of adhesive through the mixing nozzle until the adhesive is a consistent **RED** color.

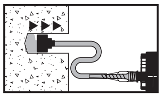
Review and note the published gel (working) and cure times prior to injection of the mixed adhesive into the cleaned anchor hole.

INSTALLATION



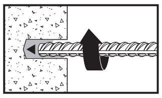
6- Fill the cleaned hole approximately two-thirds full with mixed adhesive starting from the bottom or back of the anchor hole. Slowly withdraw the mixing nozzle as the hole fills to avoid creating air pockets or voids. A flexible extension tube (Cat.# 08297) or flexible extension hose (Cat.# PFC1640600) or equivalent approved by DEWALT must be used with the mixing nozzle if the bottom or back of the anchor hole is not reached with the mixing nozzle only (see hole cleaning tools and accessories for post-installed rebar table).

WITH PISTON PLUG:

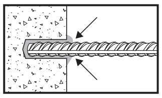


Note: Piston plugs must be used with and attached to mixing nozzle and extension tube for overhead (i.e. upwardly inclined) installations and horizontal installations with rebar sizes as indicated in the hole cleaning tools and accessories for post-installed rebar table. Insert piston plug to the back of the drilled hole and inject as described in the method above. During injection of the adhesive the piston plug will be naturally extruded from the drilled hole by the adhesive pressure.

Attention! Do not install anchors overhead or upwardly inclined without installation hardware supplied by DEWALT and also receiving proper training and/or certification. Contact DEWALT for details prior to use.

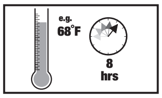


7- The reinforcing bar should be free of dirt, grease, oil or other foreign material. Push clean rebar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached. Observe the gel (working) time.



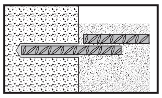
8- Ensure that the reinforcing bar is installed to the specified embedment depth. Adhesive must completely fill the annular gap at the concrete surface. Following installation of the rebar, remove excess adhesive. For all installations the rebar must be restrained from movement throughout the specified curing period, (as necessary) through the use of temporary wedges, external supports, or other methods. Minor adjustments to the position of the rebar may be performed during the gel (working) time only.

CURING AND LOADING



9- Allow the adhesive anchor to cure to the specified full curing time prior to applying any load (reference gel time and curing time table).

- Do not disturb, torque or load the anchor until it is fully cured.



10- After full curing of the rebar connection, new concrete can be poured (placed) to the installed rebar connection.

REFERENCE INSTALLATION TABLES

Gel (working) Time and Curing Table

Temperature of base material		Gel (working) time	Full curing time
°F	°C		
41	5	120 minutes	48 hours
50	10	90 minutes	24 hours
68	20	25 minutes	8 hours
86	30	20 minutes	8 hours
95	35	15 minutes	6 hours
104	40	12 minutes	4 hours
110	43	10 minutes	4 hours

Linear interpolation for intermediate base material temperature is possible.

Cartridge adhesive temperature must be between 50°F - 110°F (10°C - 43°C) when in use; for overhead applications cartridge adhesive temperature must be between 50°F - 90°F (10°C - 32°C) when in use. For best experience, suggested minimum cartridge adhesive temperature is 68°F (20°C) when in use.

Hole Cleaning Equipment Selection Table for Pure110+ Adhesive Anchors[1,2,3]

Rod Diameter (inch)	Rebar Size (No.)	ANSI Drill Bit Diameter[1] (inch)	Brush Length, L (inches)	Steel Wire Brush[2,3] (Cat. #)	Blowout Tool	Number of cleaning actions
Solid Base Material						
3/8	#3	7/16	6-3/4	08284	Compressed air nozzle only, Cat #8292 (min. 90 psi)	2x blowing 2x brushing 2x blowing
1/2	-	9/16	6-3/4	08285		
-	#4	5/8	6-3/4	08275		
5/8	#5	11/16	7-7/8	08286		
		3/4	7-7/8	08278		
3/4	#6	7/8	7-7/8	08287		
7/8	#7	1	11-7/8	08288		
1	#8	1-1/8	11-7/8	08289		
1-1/4	#9	1-3/8	11-7/8	08290		
-	#10	1-1/2	11-7/8	08291		
Hollow Base Material (with plastic screen tube)						
3/8	-	9/16	6-3/4	08285	Compressed air nozzle only, Cat #8292 (min. 90 psi)	2x blowing 2x brushing 2x blowing
1/2	-	3/4	7-7/8	08278		
5/8	-	7/8	7-7/8	08287		
3/4	-	1	11-7/8	08288		

1. For any case, it must be possible for the steel anchor element to be inserted into the cleaned hole without resistance.
2. An SDS-plus adaptor (Cat. #08283) or Jacobs chuck style adaptor (Cat. #08296) is required to attach a steel wire brush to the drill tool.
3. A brush extension (Cat. #08282) must be used with a steel wire brush for holes drilled deeper than the listed brush length.

Piston Plugs for Adhesive Anchors[1,2,3,4]

Plug Size (inch)	ANSI Drill Bit Diameter (inch)	Piston Plug (Cat. #)	Piston Plug
Solid Base Materials			
11/16	11/16	08258	
3/4	3/4	08259	
7/8	7/8	08300	
1	1	08301	
1-1/8	1-1/8	08303	
1-1/4	1-1/4	08307	
1-3/8	1-3/8	08305	
1-1/2	1-1/2	08309	

1. All overhead installations require the use of piston plugs where one is tabulated together with the anchor size.
2. All horizontal installations require the use of piston plugs where one is tabulated together with the anchor size and where the embedment depth is greater than 8 inches.
3. The use of piston plugs is also recommended for underwater installations where one is tabulated together with the anchor size.
4. A flexible plastic extension tube (Cat. #08281 or #08297) or equivalent approved by DEWALT must be used with piston plugs.

ORDERING INFORMATION

Pure110+ Cartridges

Cat. No.	Description	Std. Box	Std. Ctn.	Pallet
08310SD	Pure110+ 9 fl. oz. Quik-Shot cartridge (1:1 mix ratio)	12	24	432
08321SD	Pure110+ 21 fl. oz. dual cartridge (1:1 mix ratio)	12	-	540
08351SD	Pure110+ 51 fl. oz. dual cartridge (1:1 mix ratio)	5	-	
08313SD	Pure110+ 13 fl. oz. dual cartridge (3:1 mix ratio)	12	-	540
08320SD	Pure110+ 20 fl. oz. dual cartridge (3:1 mix ratio)	12	-	540

One Pure110+ mixing nozzle is packaged with each cartridge.
Pure110+ mixing nozzles must be used to ensure complete and proper mixing of the adhesive.

Cartridge System Mixing Nozzles and Nozzle Extensions

Cat. No.	Description	Std. Pkg.	Std. Ctn.
PFC1641600	Mixing nozzle (with 8" extension) for Pure110+ Quik-Shot	2	24
08609	Extra high flow mixing nozzle (with 8" extension) for Pure110+ dual cartridge	2	24
08281	Mixing nozzle extension, 8" long	2	24
08297	Mixing nozzle extension, 18" long	1	12
PFC1640600	Flexible Extension Hose, 25 ft.	1	12

Dispensing Tools for Injection Adhesive

Cat. No.	Description	Std. Box	Std. Ctn.
08437	Manual caulking gun for Quik-Shot	1	12
08479	High performance caulking gun for Quik-Shot	1	12
DCE560D1	Cordless 20v Battery powereed dispensing tool for Quik-Shot	1	-
08409	21 fl. oz. Standard metal manual tool	1	10
08421	21 fl. oz. High performance manual tool	1	10
DCE591D1	21 fl. oz. cordless 20v Battery powered dispensing tool	1	-
08413	21 fl. oz. Pneumatic tool	1	-
08298	13 fl. oz. + 20 fl. oz. Manual tool (3:1 mix ratio)	1	6
DCE593D1	13 fl. oz + 20 fl. oz. cordless 20v Battery powered dispensing tool (3:1 mix ratio)	1	-
08497SD	13 fl. oz. + 20 fl. oz Pneumatic tool (3:1 mix ratio)	1	6
08438	51 fl. oz. Pneumatic tool	1	-

Hole Cleaning Tools and Accessories

Cat No.	Description	Std. Box
08284	Wire brush for 7/16" or 1/2" ANSI hole, 6-3/4" length	1
08285	Wire brush for 9/16" ANSI hole, 6-3/4" length	1
08275	Wire brush for 5/8" ANSI hole, 6-3/4" length	1
08286	Wire brush for 11/16" ANSI hole, 7-7/8" length	1
08278	Wire brush for 3/4" ANSI hole, 7-7/8" length	1
08287	Wire brush for 7/8" ANSI hole, 7-7/8" length	1
08288	Wire brush for 1" ANSI hole, 11-7/8" length	1
08289	Wire brush for 1-1/8" ANSI hole, 11-7/8" length	1
08276	Wire brush for 1-1/4" ANSI hole, 11-7/8" length	1
08290	Wire brush for 1-3/8" ANSI hole, 11-7/8" length	1
08291	Wire brush for 1-1/2" ANSI hole, 11-7/8" length	1
08273	Wire brush for 1-5/8" ANSI hole, 11-7/8" length	1
08299	Wire brush for 1-3/4" ANSI hole, 11-7/8" length	1
08283	SDS-plus adapter for steel brushes	1
08296	Standard drill adapter for steel brushes (e.g. Jacobs Chuck)	1
08282	Steel brush extension, 12" length	1
08292	Air compressor nozzle with extension, 18" length	1

Piston Plugs for Adhesive Anchors

Cat. No.	Description	ANSI Drill Bit Dia.	Qty.
08258	11/16" Plug	11/16"	10
08259	3/4" Plug	3/4"	10
08300	7/8" Plug	7/8"	10
08301	1" Plug	1"	10
08303	1-1/8" Plug	1-1/8"	10
08305	1-3/8" Plug	1-3/8"	10
08309	1-1/2" Plug	1-1/2"	10

Piston Plugs for Post-Installed Rebar Connections

Cat. No.	Description	ANSI Drill Bit Dia.	Qty.
PFC1691520	3/4" Plug	3/4	10
PFC1691530	7/8" Plug	7/8	10
PFC1691540	1" Plug	1	10
PFC1691550	1-1/8" Plug	1-1/8	10
PFC1691555	1-1/4" Plug	1-1/4	10
PFC1691560	1-3/8" Plug	1-3/8	10
PFC1691570	1-1/2" Plug	1-1/2	10
PFC1691580	1-3/4" Plug	1-3/4	10

Plastic Screen Tubes

Cat. No.	Description	ANSI Drill Diameter	Standard Carton
08310	3/8" x 3-1/2" Plastic Screen	9/16"	25
08311	3/8" x 6" Plastic Screen	9/16"	25
08313	3/8" x 8" Plastic Screen	9/16"	25
08315	1/2" x 3-1/2" Plastic Screen	3/4"	25
08317	1/2" x 6" Plastic Screen	3/4"	25
08321	5/8" x 6" Plastic Screen	7/8"	25
08323	3/4" x 6" Plastic Screen	1"	10
For availability of stainless steel screen tubes, Contact DEWALT			

SDS Max 4-Cutter Carbide Drill Bits

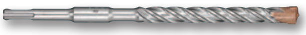
Cat. No.	Diameter	Usable Length	Overall Length
DW5806	5/8"	8"	13-1/2"
DW5809	5/8"	16"	21-1/2"
DW5807	5/8"	31"	36"
DW5808	11/16"	16"	21-1/2"
DW5810	3/4"	8"	13-1/2"
DW5812	3/4"	16"	21-1/2"
DW5813	3/4"	31"	36"
DW5814	13/16"	16"	21-1/2"
DW5815	7/8"	8"	13-1/2"
DW5816	7/8"	16"	21-1/2"
DW5851	7/8"	31"	36"
DW5817	27/32"	16"	21-1/2"
DW5818	1"	8"	13-1/2"
DW5819	1"	16"	22-1/2"
DW5852	1"	24"	29"
DW5820	1"	31"	36"
DW5821	1-1/8"	10"	15"
DW5822	1-1/8"	18"	22-1/2"
DW5853	1-1/8"	24"	29"
DW5854	1-1/8"	31"	36"
DW5824	1-1/4"	10"	15"
DW5825	1-1/4"	18"	22-1/2"

Dust Extraction

Cat. No.	Description
DWV012	10 Gallon Wet/Dry Hepa/Rrp Dust Extractor DWV9402 Fleece bag (5 pack) for DEWALT dust extractors DWV9316 Replacement Anti-Static Hose DWV9320 Replacement HEPA Filter Set (Type 1)
DWH050K	Dust Extraction with two interchangeable drilling heads
DCB1800M3T1	1800 Watt Portable Power Station & Parallel Battery Charger with 3 20V Max* 5Ah Batteries and 1 60V Max* Flexvolt® Battery

SDS+ Full Head Carbide Drill Bits

Cat. No.	Diameter	Usable Length	Overall Length
DW5502	3/16"	2"	4-1/2"
DW5503	3/16"	4"	6-1/2"
DW5504	3/16"	5"	8-1/2"
DW5506	3/16"	10"	12"
DW5512	7/32"	8"	10"
DW5517	1/4"	4"	6"
DW5518	1/4"	6"	8-1/2"
DW55200	1/4"	10"	12"
DW5521	1/4"	12"	14"
DW5524	5/16"	4"	6"
DW5526	5916"	10"	12"
DW5527	3/8"	4"	6-1/2"
DW5529	3/8"	8"	10"
DW55300	3/8"	10"	12"
DW5531	3/8"	16"	18"
DW5537	1/2"	4"	6"
DW5538	1/2"	8"	10-1/2"
DW5539	1/2"	10"	12"
DW5540	1/2"	16"	18"



SDS+ 4-Cutter Carbide Drill Bits

Cat. No.	Diameter	Usable Length	Overall Length
DW5471	5/8"	8"	10"
DW5472	5/8"	16"	18"
DW5474	3/4"	8"	10"
DW5475	3/4"	16"	18"
DW5477	7/8"	8"	10"
DW5478	7/8"	16"	18"
DW5479	1"	8"	10"
DW5480	1"	16"	18"
DW5481	1-1/8"	8"	10"
DW5482	1-1/8"	6"	18"

Hollow Drill Bits

	Cat. No.	Diameter	Overall Length	Usable Length	Recommended Hammer Drill
SDS+	DWA54012	1/2"	14-1/2"	9-3/4"	DCH133 / DCH273 / DCH293
	DWA54916	9/16"	14-1/2"	9-3/4"	DCH133 / DCH273 / DCH293
	DWA54058	5/8"	14-1/2"	9-3/4"	DCH133 / DCH273 / DCH293
	DWA54034	3/4"	14-1/2"	9-3/4"	DCH133 / DCH273 / DCH293
SDS Max	DWA58058	5/8"	23-5/8"	15-3/4"	DCH481 / D25603K
	DWA58034	3/4"	23-5/8"	15-3/4"	DCH481 / D25603K
	DWA58078	7/8"	23-5/8"	15-3/4"	DCH481 / D25603K
	DWA58001	1"	23-5/8"	15-3/4"	DCH481 / D25603K
	DWA58118	1-1/8"	23-5/8"	15-3/4"	DCH481 / D25603K

DUST X+ ANCHOR INSTALLATION SYSTEM

GENERAL INFORMATION

PURE50+™

Epoxy Injection Adhesive Anchoring System

PRODUCT DESCRIPTION

The Pure50+ is a two-component adhesive anchoring system. The system includes injection adhesive in plastic cartridges, mixing nozzles, dispensing tools and hole cleaning equipment. The Pure50+ is designed for bonding threaded rod and reinforcing bar hardware into drilled holes in solid concrete base materials.

GENERAL APPLICATIONS AND USES

- Bonding threaded rod and reinforcing bar into hardened concrete
- Evaluated for installation and use in dry, wet, and water-filled holes
- Can be installed in a wide range of base material temperatures

FEATURES AND BENEFITS

+ Designed for use with threaded rod and reinforcing bar hardware elements
+ Evaluated and recognized for freeze/thaw performance
+ Cartridge design allows for multiple uses using extra mixing nozzles
+ Mixing nozzles proportion adhesive and provide simple delivery method into drilled holes
+ Evaluated and recognized for long term and short term loading (see performance tables)
+ Oversized hammer-drilled holes in concrete, for short term loading only (contact DEWALT for details)

APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES) ESR-3576 for cracked and uncracked concrete.
- Code Compliant with the 2015 IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, and 2009 IRC.
- Conforms to requirements of ASTM C 881 and AASHTO M235, Types I, II, IV and V, Grade 3, Classes B & C(also meets Type III except for elongation)
- Department of Transportation listings - see www.DEWALT.com or contact transportation agency
- Tested in accordance with ACI 355.4 / ASTM E488, and ICC-ES AC308 for use in concrete (Design according to ACI 318-14 Chapter 17 and 318-11/08 Appendix D)
- Evaluated and qualified by an accredited independent testing laboratory for recognition in cracked and uncracked concrete including seismic and wind loading
- Compliant with NSF/ANSI Standard 61 for Drinking Water System Components - Health Effects; minimum requirements for material in contact with potable water and water treatment

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors. and 05 05 19 - Post-Installed Concrete Anchors. Adhesive anchoring system shall be Pure50+ as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and requirements of the Authority Having Jurisdiction.

SECTION CONTENTS

PACKAGING

Coaxial Cartridge

- 9 fl. oz. (265ml) 1:1 mix ratio

Dual (side-by-side Cartridge)

1:1 mix ratio

- 21 fl. oz. (620 ml) 1:1 mix ratio
- 51 fl. oz. (1400 ml) 1:1 mix ratio

STORAGE LIFE & CONDITIONS

Dual cartridge: Two years
Coaxial cartridge: Eighteen months
In a dry, dark environment with temperature ranging from 41°F to 86°F (5°C to 30°C)

ANCHOR SIZE RANGE (TYPICAL)

- 3/8" to 1-1/4" diameter threaded rod
- No. 3 to No. 10 reinforcing bar (rebar)

SUITABLE BASE MATERIALS

- Normal-weight Concrete
- Lightweight Concrete

PERMISSIBLE INSTALLATION CONDITIONS (ADHESIVE)

- Dry Concrete
- Water Saturated Concrete
- Water-Filled Holes

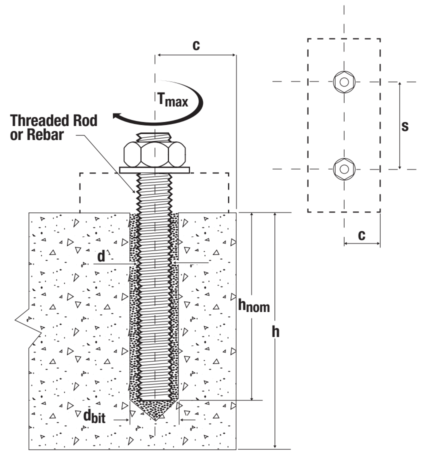
REFERENCE DATA (ASD)

Installation Table for Pure50+ (Solid Concrete Base Materials)

Dimension/Property	Notation	Units	Nominal Anchor Size									
Threaded Rod	-	-	3/8	1/2	-	5/8	3/4	7/8	1	-	1-1/4	-
Reinforcing Bar	-	-	#3	-	#4	#5	#6	#7	#8	#9	-	#10
Nominal anchor diameter	d	in. (mm)	0.375 (9.5)	0.500 (12.7)		0.625 (15.9)	0.750 (19.1)	0.875 (22.5)	1.000 (25.4)	1.125 (28.6)	1.250 (31.8)	1.250 (31.8)
Carbide drill bit nominal size[3]	d_{bit}	in.	7/16 ANSI	9/16 ANSI	5/8 ANSI	11/16 or 3/4 ANSI	7/8 ANSI	1 ANSI	1-1/8 ANSI	1-3/8 ANSI	1-3/8 ANSI	1-1/2 ANSI
Minimum embedment	h_{nom}	in. (mm)	2-3/8 (61)	2-3/4 (70)		3-1/8 (80)	3-1/2 (89)	3-1/2 (89)	4 (102)	4-1/2 (114)	5 (127)	5 (127)
Minimum spacing distance	s_{min}	in. (mm)	1-7/8 (48)	2-1/2 (62)		3-1/8 (80)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)	6-1/4 (159
Minimum edge distance	c_{min}	in. (mm)	1-7/8 (48)	2-1/2 (62)		3-1/8 (80)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)	6-1/4 (159
Maximum torque[1]	T_{max}	ft.-lb. (N-m)	15 (20)	30 (41)		60 (81)	105 (142)	125 (169)	165 (223)	200 (270)	280 (379)	280 (379)
Maximum torque (low strength rods)[1,2]		ft.-lb. (N-m)	5 (7)	20 (27)		40 (54)	60 (81)	100 (136)	165 (223)	-	280 (379)	-

1. Torque may not be applied to the anchors until the full cure time of the adhesive has been achieved.
2. These torque values apply to ASTM A 36 / F 1554, Grade 36 carbon steel threaded rods; ASTM F1554 Grade 55 carbon steel threaded rods; and ASTM A193 Grade B8/B8M (Class 1) stainless steel threaded rods.
3. For any case, it must be possible for the steel anchor element to be inserted into the cleaned drill hole without resistance.

Detail of Steel Hardware Elements used with Injection Adhesive System



Nomenclature

d = Diameter of anchor
d_{bit} = Diameter of drilled hole
h = Base material thickness
The greater of:
[h_{nom} + 1-1/4"] and [h_{nom} + $2d_{bit}$]
h_{nom} = Minimum embedment depth

Threaded Rod and Deformed Reinforcing Bar Material Properties

Steel Description (General)	Steel Specification (ASTM)	Nominal Anchor Size (inch)	Minimum Yield Strength, f_y (ksi)	Minimum Ultimate Strength, f_u (ksi)
Carbon Steel	A 36 or F1554 Grade 36	3/8 through 1-1/4	36.0	58.0
	F 1554 Grade 55		55.0	75.0
	A 449	3/8 through 1	92.0	120.0
		1-1/4	81.0	105.0
	A 193, Grade B7 or F 1554, Grade 105	3/8 through 1-1/4	105.0	125.0
	F 568M Class 5.8	3/4 through 1-1/4	58.0	72.5
Stainless Steel	F 593, Condition CW	3/8 through 5/8	65.0	100.0
		3/4 through 1-1/4	45.0	85.0
	A 193/A193M Grade B8/B8M2, Class 1	3/4 through 1-1/4	30.0	75.0
	A 193/A193M Grade B8/B8M2, Class 2B	3/8 through 1-1/4	75.0	95.0
Grade 40 Reinforcing Bar	A 615, A 767	3/8 through 3/4 (#3 through #6)	40.0	60.0
Grade 60 Reinforcing Bar	A 615, A 767	3/8 through 1-1/4 (#3 through #10)	60.0	90.0
	A 706, A 767		60.0	80.0
Grade 75 Reinforcing Bar	A 615, A 767	3/8 through 1-1/4 (#3 through #10)	75.0	100.0

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Pure50+ Installed with Threaded Rod into Normal-Weight Concrete (based on bond strength/concrete capacity)[1,2,3,4,5,6,7]

Rod Diameter d in.	Drill Diameter d_{bit} in.	Minimum Embedment Depth h_{ef} in.	Minimum Concrete Compressive Strength			
			3,000 psi		4,000 psi	
			Ultimate Tension Load Capacity (lbs.)	Allowable Tension Load Capacity (lbs.)	Ultimate Tension Load Capacity (lbs.)	Allowable Tension Load Capacity (lbs.)
3/8	7/16	3-3/8	9,725	2,430	9,725	2,430
1/2	9/16	4-1/2	15,240	3,810	17,745	4,435
5/8	11/16 or 3/4	5-5/8	22,870	5,720	28,200	7,050
3/4	7/8	6-3/4	31,765	7,940	36,470	9,120
7/8	1	7-7/8	39,615	9,905	45,745	11,435
1	1-1/8	9	48,750	12,185	66,950	16,740
		10	56,665	14,165	69,305	17,325
1-1/4	1-3/8	11-1/4	76,985	19,245	88,895	22,225

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
3. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances and where the minimum member thickness is greater of [h_{nom} + 1-1/4"] and [h_{nom} + $2d_{bit}$].
4. The tabulated load values are for applicable for dry concrete. Holes must be drilled with a hammer drill and an ANSI carbide drill bit. Installations in water saturated (wet) concrete or in water-filled holes (flooded) require a 15% reduction in capacity. Contact DEWALT for more information concerning these installation conditions.
5. Adhesives experience reductions in capacity at elevated temperatures. See the in-service temperature chart for allowable load capacity reduction factors.
6. Allowable bond strength/concrete capacity must be checked against allowable steel strength in tension to determine the controlling allowable load.
7. Allowable shear capacity is controlled by allowable steel strength for the given conditions.

Ultimate and Allowable Load Capacities for Pure50+ Installed with Reinforcing Bar into Normal-Weight Concrete (based on bond strength/concrete capacity)[1,2,3,4,5,6,7]

Bar Diameter d in.	Drill Diameter d_{bit} in.	Minimum Embedment Depth h_{ef} in.	Minimum Concrete Compressive Strength			
			3,000 psi		4,000 psi	
			Ultimate Tension Load Capacity (lbs.)	Allowable Tension Load Capacity (lbs.)	Ultimate Tension Load Capacity (lbs.)	Allowable Tension Load Capacity (lbs.)
#3	7/16	3-3/8	9,950	2,490	9,950	2,490
#4	9/16	4-1/2	16,340	4,085	18,045	4,510
#5	11/16 or 3/4	4	16,405	4,100	16,670	4,170
		5-5/8	22,955	5,740	25,345	6,335
#6	7/8	6-3/4	29,690	7,425	35,930	8,985
#8	1-1/8	9	48,465	12,115	65,270	16,320

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths..
3. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances and where the minimum member thickness is greater of [h_{nom} + 1-1/4"] and [h_{nom} + $2d_{bit}$]
4. The tabulated load values are for applicable for dry concrete. Holes must be drilled with a hammer drill and an ANSI carbide drill bit. Installations in water saturated (wet) concrete or in water-filled holes (flooded) require a 15% reduction in capacity. Contact DEWALT for more information concerning these installation conditions.
5. Adhesives experience reductions in capacity at elevated temperatures. See the in-service temperature chart for allowable load capacity reduction factors.
6. Allowable bond strength/concrete capacity must be checked against allowable steel strength in tension to determine the controlling allowable load.
7. Allowable shear capacity is controlled by allowable steel strength for the given conditions.

Ultimate Load Capacities for Pure50+ Installed with Threaded Rod into Normal-Weight Concrete, with 1-3/4" Edge Distance (Based on Bond Strength/Concrete Capacity)[1,2,3,4]

Nominal Anchor Diameter (in.)	Minimum Embedment Depth (in.)	Minimum Concrete Compressive Strength - f'c (psi)					
		2,500 psi		3,000 psi		4,000 psi	
		Ultimate Tension Load Capacity (lbs.)	Ultimate Shear Load Capacity (lbs.)	Ultimate Tension Load Capacity (lbs.)	Ultimate Shear Load Capacity (lbs.)	Ultimate Tension Load Capacity (lbs.)	Ultimate Shear Load Capacity (lbs.)
3/8	3-3/8	6,460	7,200	6,700	7,200	7,100	7,200
1/2	4-1/2	9,625	9,925	9,980	9,925	10,570	9,925
5/8	5-5/8	11,610	12,785	12,040	12,785	12,750	12,785
3/4	6-3/4	12,390	10,360	12,850	10,360	13,615	10,360
1	9	12,390	-	12,850	-	13,615	-

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. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety.
2. Allowable bond strength/concrete capacity must be checked against allowable steel strength to determine the controlling allowable load.
3. The tabulated data is applicable to single anchors at critical edge distance in uncracked concrete, normal-weight concrete having a compressive strength as listed. Values are for dry concrete in holes drilled with a hammer drill and an ANSI carbide drill bit.
4. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.

Allowable Load Capacities for Pure50+ Installed with Threaded Rod into Normal-Weight Concrete with 1-3/4" Edge Distance (Based on Bond Strength / Concrete Capacity)[1,2,3,4,5,6]

Nominal Anchor Diameter (in.)	Minimum Embedment Depth (in.)	Minimum Concrete Compressive Strength - f'c (psi)					
		2,500 psi		3,000 psi		4,000 psi	
		Allowable Tension Load Capacity (lbs.)	Allowable Shear Load Capacity (lbs.)	Allowable Tension Load Capacity (lbs.)	Allowable Shear Load Capacity (lbs.)	Allowable Tension Load Capacity (lbs.)	Allowable Shear Load Capacity (lbs.)
3/8	3-3/8	1,615	1,800	1,675	1,800	1,775	1,800
1/2	4 1/2	2,405	2,480	2,495	2,480	2,645	2,480
5/8	5-5/8	2,900	3,195	3,010	3,195	3,190	3,195
3/4	6-3/4	3,100	2,590	3,215	2,590	3,405	2,590
1	9	3,100	-	3,215	-	3,405	-

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths..
3. The tabulated load values are applicable to single anchors where the minimum member thickness is greater of [h_{nom} + 1-1/4"] and [h_{nom} + $2d_{bit}$]
4. The tabulated load values are for applicable for dry concrete. Holes must be drilled with a hammer drill and an ANSI carbide drill bit. Installations in wet concrete or in water-filled holes may require a reduction in capacity. Contact DEWALT for more information concerning these installation conditions.
5. Adhesives experience reductions in capacity at elevated temperatures. See the in-service temperature chart for allowable load capacity reduction factors.
6. Allowable bond strength/concrete capacity must be checked against allowable steel strength in tension to determine the controlling allowable load.

Allowable Load Capacities for Threaded Rod and Reinforcing Bar (Based on Steel Strength)[1,2,3,4,5]

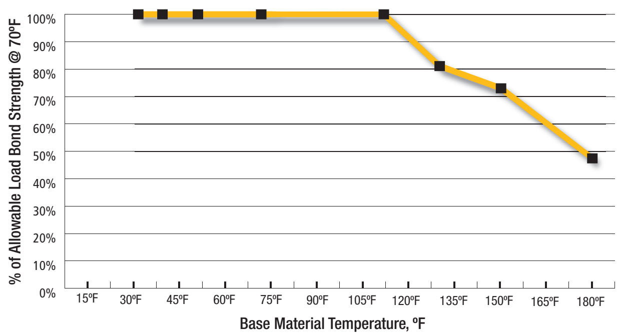
Nominal Rod Diameter or Rebar Size (in. or #)	Steel Elements - Threaded Rod and Reinforcing Bar																	
	A36 or F1554, Grade 36		A36 or F1554, Grade 55		A 193, Grade B7 or F1554, Grade 105		F 593, CW (SS)		ASTM A615 Grade 40 Rebar		ASTM A615 Grade 60 Rebar		ASTM A706 Grade 60 Rebar		ASTM A615 Grade 75 Rebar		ASTM A706 Grade 80 Rebar	
	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)	Tension lbs. (kN)	Shear lbs (kN)	Tension lbs. (kN)	Shear lbs (kN)	Tension lbs. (kN)	Shear lbs (kN)
3/8 or #3	2,115 (9.4)	1,090 (4.8)	2,735 (12.2)	1,410 (6.3)	4,555 (20.3)	2,345 (10.4)	3,645 (16.2)	1,880 (8.4)	2,210 (9.8)	1,125 (5.0)	2,650 (11.8)	1,690 (7.5)	2,650 (11.8)	1,500 (6.7)	2,650 (11.8)	1,875 (8.3)	2,650 (11.8)	1,875 (8.3)
1/2 or #4	3,760 (16.7)	1,935 (8.6)	4,860 (21.6)	2,505 (11.1)	8,100 (36.0)	4,170 (18.5)	6,480 (28.8)	3,340 (14.9)	3,925 (17.5)	2,005 (8.9)	4,710 (21.0)	3,005 (13.4)	4,710 (21.0)	2,670 (11.9)	4,710 (21.0)	3,335 (14.8)	4,710 (21.0)	3,335 (14.8)
5/8 or #5	5,870 (26.1)	3,025 (13.5)	7,595 (33.8)	3,910 (17.4)	12,655 (56.3)	6,520 (29.0)	10,125 (45.0)	5,215 (23.2)	6,135 (27.3)	3,130 (13.9)	7,365 (32.8)	4,695 (20.9)	7,365 (32.8)	4,170 (18.5)	7,365 (32.8)	5,215 (23.2)	7,365 (32.8)	5,215 (23.2)
3/4 or #6	8,455 (37.6)	4,355 (19.4)	10,935 (48.6)	5,635 (25.1)	18,225 (81.1)	9,390 (41.8)	12,390 (55.1)	6,385 (28.4)	8,835 (39.3)	4,505 (20.0)	10,605 (47.2)	6,760 (30.1)	10,605 (47.2)	6,010 (26.7)	10,605 (47.2)	7,510 (33.4)	10,605 (47.2)	7,510 (33.4)
7/8 or #7	11,510 (51.2)	5,930 (26.4)	14,885 (66.2)	7,665 (34.1)	24,805 (110.3)	12,780 (56.8)	16,865 (75.0)	8,690 (38.7)	-	-	14,430 (64.2)	9,200 (40.9)	14,430 (64.2)	8,180 (36.4)	14,430 (64.2)	10,220 (45.5)	14,430 (64.2)	10,220 (45.5)
1 or #8	15,035 (66.9)	7,745 (34.5)	19,440 (86.5)	10,015 (44.5)	32,400 (144.1)	16,690 (74.2)	22,030 (98.0)	11,350 (50.5)	-	-	18,850 (83.8)	12,015 (53.4)	18,850 (83.8)	10,680 (47.5)	18,850 (83.8)	13,350 (59.4)	18,850 (83.8)	13,350 (59.4)
#9	-	-	-	-	-	-	-	-	-	-	23,985 (106.7)	15,290 (68.0)	23,985 (106.7)	13,590 (60.5)	23,985 (106.7)	16,990 (75.6)	23,985 (106.7)	16,990 (75.6)
1-1/4	23,490 (104.5)	12,100 (53.8)	30,375 (135.1)	15,645 (69.6)	50,620 (225.2)	26,080 (116.0)	34,425 (153.1)	17,735 (78.9)	-	-	-	-	-	-	-	-	-	-
#10	-	-	-	-	-	-	-	-	-	-	30,405 (135.2)	19,380 (86.2)	30,405 (135.2)	17,230 (76.6)	30,405 (135.2)	21,535 (95.8)	30,405 (135.2)	21,535 (95.8)

1. AISC defined steel strength (ASD) for threaded rod: Tensile = 0.33 • F_u • A_{nom}, Shear = 0.17 • F_u • A_{nom}
2. For reinforcing bars: The allowable steel tensile strength is based on 20 ksi for Grade 40 and 24 ksi for Grade 60 and higher, applied to the cross sectional area of the bar; allowable steel shear strength = 0.17 • F_u • A_{nom}
3. Allowable load capacities are calculated for the steel element type. Consideration of applying additional safety factors may be necessary depending on the application, such as life safety or overhead.
4. Allowable steel strength in tension must be checked against allowable bond strength/concrete capacity in tension to determine the controlling allowable load.
5. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances and where the minimum member thickness is the greater of [h_{nom} + 1-1/4"] and [h_{nom} + $2d_{bit}$]

In-Service Temperature Chart For Allowable Load Capacities[1]

Base Material Temperature		Reduction Factor For Temperature
°F	°C	
32	0	1.00
41	5	1.00
50	10	1.00
70	20	1.00
110	43	1.00
130	54	0.85
150	66	0.76
180	82	0.51

1. Linear interpolation may be used to derive reduction factors for temperatures between those listed.



STRENGTH DESIGN (SD)

Installation Specifications for Threaded Rod and Reinforcing Bar[1]

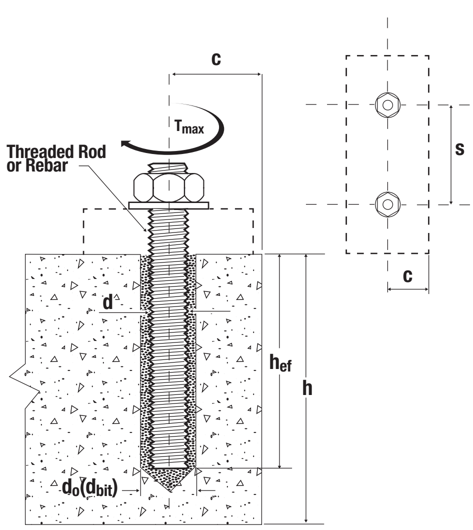
CODE LISTED
ICC-ES ESR-3576

Parameter	Symbol	Units	Fractional Nominal Rod Diameter (Inch) / Reinforcing Bar Size									
			3/8 or #3	1/2	#4	5/8 or #5	3/4 or #6	7/8 or #7	1 or #8	#9	1-1/4	#10
Threaded rod outside diameter	d	inch (mm)	0.375 (9.5)	0.500 (12.7)		0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	-	1.250 (31.8)	-
Rebar nominal outside diameter	d	inch (mm)	0.375 (9.5)	0.500 (12.7)		0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.125 (28.7)	-	1.250 (31.8)
Carbide drill bit nominal size[6]	d_o (d_{bit})	inch	7/16	9/16	5/8	11/16 or 3/4	7/8	1	1-1/8	1-3/8	1-3/8	1-1/2
Minimum embedment	$h_{ef,min}$	inch (mm)	2-3/8 (60)	2-3/4 (70)		3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	4-1/2 (114)	5 (127)	5 (127)
Maximum embedment	$h_{ef,max}$	inch (mm)	7-1/2 (191)	10 (254)		12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)	22-1/2 (572)	25 (635)	25 (635)
Minimum member thickness	h_{min}	inch (mm)	h_{ef} + 1-1/4 (h_{ef} + 30)			$h_{ef} + 2d_o$						
Minimum anchor spacing	s_{min}	inch (mm)	1-7/8 (48)	2-1/2 (64)		3-1/8 (79)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)	6-1/4 (159)
Minimum edge distance	c_{min}	inch (mm)	1-7/8 (48)	2-1/2 (64)		3-1/8 (79)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)	6-1/4 (159)
Max. torque[2]	T_{max}	ft-lbs (N-m)	15 (20)	30 (41)		60 (81)	105 (142)	125 (169)	165 (221)	200 (280)	280 (379)	280 (379)
Max. torque[2,3] (low strength rods)	T_{max}	ft-lbs (N-m)	5 (7)	20 (27)		40 (54)	60 (81)	100 (136)	165 (223)	-	280 (379)	-
Minimum edge distance, reduced[5]	$c_{min,red}$	inch (mm)	1-3/4 (45)	1-3/4 (45)		1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	2-3/4 (70)	2-3/4 (70)	2-3/4 (70)
Max. torque, reduced[2]	$T_{max,red}$	ft-lbs (N-m)	7 [5][4]	14 (19)		27 (37)	47 (64)	56 (76)	74 (100)	90 (122)	126 (171)	126 (171)

For pound-inch units: 1 mm = 0.03937 inch, 1 N-m = 0.7375 ft-lbf. For SI: 1 inch = 25.4 mm, 1 ft-lbf = 1.356 N-m.

1. For use with the design provisions of ACI 318-14 Ch.17 or ACI 318-11 Appendix D as applicable, ICC-ES AC308, Section 4.2 and ESR-3576
2. Torque may not be applied to the anchors until the full cure time of the adhesive has been achieved.
3. These torque values apply to ASTM A 36 / F 1554 Grade 36 carbon steel threaded rods; ASTM F 1554 Grade 55 carbon steel threaded rods; and ASTM A 193 Grade B8/B8M (Class 1) stainless steel threaded rods.
4. These torque values apply to ASTM A 193 Grade B8/B8M (Class 1) stainless steel threaded rods.
5. For Installation between the minimum edge distance, c_{min}, and the reduced minimum edge distance, $c_{min,red}$, the maximum torque applied must be max torque reduced, $T_{max,red}$.
6. For any case, it must be possible for the steel anchor element to be inserted into the cleaned drill hole without resistance.

Detail of Steel Hardware Elements used with Injection Adhesive System



Threaded Rod and Deformed Reinforcing Bar Material Properties

Steel Description (General)	Steel Specification (ASTM)	Nominal Anchor Size (inch)	Minimum Yield Strength, f_y (ksi)	Minimum Ultimate Strength, f_u (ksi)
Carbon rod	A 36 or F 1554 Grade 36	3/8 through 1-1/4	36.0	58.0
	F 1554 Grade 55		55.0	75.0
	A 449	3/8 through 1	92.0	120.0
		1-1/4	81.0	105.0
	A 193, Grade B7 or F 1554, Grade 105	3/8 through 1-1/4	105.0	125.0
	F 568M Class 5.8	3/4 through 1-1/4	58.0	72.5
Stainless rod	F 593 Condition CW	3/8 through 5/8	65.0	100.0
		3/4 through 1-1/4	45.0	85.0
	A 193/193M Grade B8/B8M, Class 1	3/8 through 1-1/4	30.0	75.0
	A 193/A193M Grade B8/B8M2, Class 2B	3/8 through 1-1/4	75.0	95.0
Grade 40 Reinforcing Bar	A 615, A 767	3/8 through 1-1/4 (#3 through #6)	40.0	60.0
Grade 60 Reinforcing Bar	A 615, A 767	3/8 through 1-1/4 (#3 through #10)	60.0	90.0
	A 706, A 767		60.0	80.0
Grade 75 Reinforcing Bar	A 615, A 767	3/8 through 1-1/4 (#3 through #10)	75.0	100.0

Steel Tension and Shear Design for Threaded Rod in Normal Weight Concrete (For use with load combinations taken from ACI 318-14 Section 5.3)

CODE LISTED
ICC-ES ESR-3576
STRENGTH DESIGN SD TABLES

Design Information		Symbol	Units	Nominal Rod Diameter[1] (inch)						
				3/8	1/2	5/8	3/4	7/8	1	1-1/4
Threaded rod nominal outside diameter		d	inch (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.250 (31.8)
Threaded rod effective cross-sectional area		A_{se}	inch² (mm²)	0.0775 (50)	0.1419 (92)	0.2260 (146)	0.3345 (216)	0.4617 (298)	0.6057 (391)	0.9691 (625)
ASTM A 36 and ASTM F 1554 Grade 36	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	4,495 (20.0)	8,230 (36.6)	13,110 (58.3)	19,400 (86.3)	26,780 (119.1)	35,130 (156.3)	56,210 (250.0)
		V_{sa}	lbf (kN)	2,695 (12.0)	4,940 (22.0)	7,860 (35.0)	11,640 (51.8)	16,070 (71.4)	21,080 (93.8)	33,725 (150.0)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM F 1554 Grade 55	Nominal strength as governed by steel strength(for a single anchor)	N_{sa}	lbf (kN)	5,810 (25.9)	10,640 (47.3)	16,950 (75.4)	25,085 (111.6)	34,625 (154.0)	45,425 (202.0)	72,680 (323.3)
		v_{sa}	lbf (kN)	3,485 (15.5)	6,385 (28.4)	10,170 (45.2)	15,050 (67.0)	20,775 (92.4)	27,255 (121.2)	43,610 (194.0)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM A 193 Grade B7 and ASTM F 1554 Grade 105	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	9,685 (43.1)	17,735 (78.9)	28,250 (125.7)	41,810 (186.0)	57,710 (256.7)	75,710 (336.8)	121,135 (538.8)
		V_{sa}	lbf (kN)	5,815 (25.9)	10,640 (7.3)	16,950 (75.4)	25,085 (111.6)	34,625 (154.0)	45,425 (202.1)	72,680 (323.3)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM A 449	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	9,300 (41.4)	17,025 (75.7)	27,120 (120.6)	40,140 (178.5)	55,905 (248.7)	72,685 (323.3)	101,755 (452.6)
		V_{sa}	lbf (kN)	5,580 (24.8)	10,215 (45.4)	16,270 (72.4)	24,085 (107.1)	33,540 (149.2)	43,610 (194.0)	61,050 (271.6)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM F568 Class 5.8 (ISO 898-1)	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	5,620 (25.0)	10,290 (45.8)	16,385 (72.9)	24,250 (107.9)	33,475 (148.9)	43,915 (195.4)	-[5]
		V_{sa}	lbf (kN)	3,370 (15.0)	6,175 (27.5)	9,830 (43.7)	14,550 (64.7)	20,085 (89.3)	26,350 (117.2)	-[5]
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	-[5]
	Strength reduction factor for tension[3]	ϕ	-	0.65						
	Strength reduction factor for shear[3]	ϕ	-	0.60						
ASTM F 593 CW Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	7,750 (34.5)	14,190 (63.1)	22,600 (100.5)	28,430 (126.5)	39,245 (174.6)	51,485 (229.0)	82,370 (366.4)
		V_{sa}	lbf (kN)	4,650 (20.7)	8,515 (37.9)	13,560 (60.3)	17,060 (75.9)	23,545 (104.7)	30,890 (137.4)	49,425 (219.8)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[3]	ϕ	-	0.65						
	Strength reduction factor for shear[3]	ϕ	-	0.60						
ASTM A 193 Grade B8/B8M, Class 1 Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)[4]	N_{sa}	lbf (kN)	4,420 (19.7)	8,090 (36.0)	12,880 (57.3)	19,065 (84.8)	26,315 (117.1)	34,525 (153.6)	55,240 (245.7)
		V_{sa}	lbf (kN)	2,650 (11.8)	4,855 (21.6)	7,730 (34.4)	11,440 (50.9)	15,790 (70.2)	20,715 (92.1)	33,145 (147.4)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM A 193 Grade B8/ B8M2, Class 2B Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	7,365 (32.8)	13,480 (60.0)	21,470 (95.5)	31,775 (141.3)	43,860 (195.1)	57,545 (256.0)	92,065 (409.5)
		V_{sa}	lbf (kN)	4,420 (19.7)	8,085 (36.0)	12,880 (57.3)	19,065 (84.8)	26,315 (117.1)	34,525 (153.6)	55,240 (245.7)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						

For SI: 1 inch = 25.4 mm, 1 lbf = 4.448 N. For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf.

1. Values provided for steel element material types are based on minimum specified strengths and calculated in accordance with ACI 318-14 Eq. 17.4.1.2 and Eq. 17.5.1.2b or ACI 318-11 Eq. (D-2) and Eq. (D-29), as applicable, except where noted. Nuts and washers must be appropriate for the rod. Nuts must have specified proof load stresses equal to or greater than the minimum tensile strength of the specified threaded rod.
2. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4. Values correspond to ductile steel elements.
3. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4. Values correspond to brittle steel elements
4. In accordance with ACI 318-14 17.4.1.2 and 17.5.1.2 or ACI 318-11 D.5.1.2 and D.6.1.2, as applicable, the calculated values for nominal tension and shear strength for ASTM A193 Grade B8/B8M Class 1 stainless steel threaded rods are based on limiting the specified tensile strength of the anchor steel to 1.9fy or 57,000 psi (393 MPa).
5. The referenced standard includes rod diameters up to and including 1-inch (24 mm).

Steel Tension and Shear Design for Reinforcing Bars in Normal Weight Concrete
(For use with load combinations taken from ACI 318-14 Section 5.3)

CODE LISTED
ICC-ES ESR-3576

STRENGTH DESIGN SD TABLES

Design Information		Symbol	Units	Nominal Reinforcing Bar Size (Rebar)[1]							
				No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10
Rebar nominal outside diameter		d	inch (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.125 (28.7)	1.250 (32.3)
Rebar effective cross-sectional area		A_{se}	inch² (mm²)	0.110 (71.0)	0.200 (129.0)	0.310 (200.0)	0.440 (283.9)	0.600 (387.1)	0.790 (509.7)	1.000 (645.2)	1.270 (819.4)
ASTM A 615 Grade 75	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	11,000 (48.9)	20,000 (89.0)	31,000 (137.9)	44,000 (195.7)	60,000 (266.9)	79,000 (351.4)	100,000 (444.8)	127,000 (564.9)
		V_{sa}	lbf (kN)	6,600 (29.4)	12,000 (53.4)	18,600 (82.7)	26,400 (117.4)	36,000 (160.1)	47,400 (210.8)	60,000 (266.9)	76,200 (338.9)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[3]	ϕ	-	0.65							
	Strength reduction factor for shear[3]	ϕ	-	0.60							
ASTM A 615 Grade 60	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	9,900 (44.0)	18,000 (80.1)	27,900 (124.1)	39,600 (176.1)	54,000 (240.2)	71,100 (316.3)	90,000 (400.3)	114,300 (508.4)
		V_{sa}	lbf (kN)	5,940 (26.4)	10,800 (48.0)	16,740 (74.5)	23,760 (105.7)	32,400 (144.1)	42,660 (189.8)	54,000 (240.2)	68,580 (305.0)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75							
	Strength reduction factor for shear[2]	ϕ	-	0.65							
ASTM A 706 Grade 60	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	8,800 (39.1)	16,000 (71.2)	24,800 (110.3)	35,200 (156.6)	48,000 (213.5)	63,200 (281.1)	80,000 (355.9)	101,600 (452.0)
		V_{sa}	lbf (kN)	5,280 (23.5)	9,600 (42.7)	14,880 (66.2)	21,120 (94.0)	28,800 (128.1)	37,920 (168.7)	48,000 (213.5)	60,960 (271.2)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75							
	Strength reduction factor for shear[2]	ϕ	-	0.65							
ASTM A 615 Grade 40	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	6,600 (29.4)	12,000 (53.4)	18,600 (82.7)	26,400 (117.4)	In accordance with ASTM A 615, Grade 40 bars are furnished only in sizes No. 3 through No. 6			
		V_{sa}	lbf (kN)	3,960 (17.6)	7,200 (32.0)	11,160 (49.6)	15,840 (70.5)				
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80				
	Strength reduction factor for tension[2]	ϕ	-	0.75							
	Strength reduction factor for shear[2]	ϕ	-	0.65							

For SI: 1 inch = 25.4 mm, 1 lbf = 4.448 N. For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf.

1. Values provided for reinforcing bar material types based on minimum specified strengths and calculated in accordance with ACI 318-14 Eq. 17.4.1.2 and Eq. 17.5.1.2b or ACI 318-11 Eq. (D-2) and Eq. (D-29), as applicable.
2. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4. Values correspond to ductile steel elements. In accordance with ACI 318-14 17.2.3.4.3(a)(vi) or ACI 318-11 D.3.3.4.3(a)6, as applicable, deformed reinforcing bars meeting this specification used as ductile steel elements to resist earthquake effects shall be limited to reinforcing bars satisfying the requirements of ACI 318-14 20.2.2.4 and 20.2.2.5 or ACI 318-11 21.1.5.2 (a) and (b), as applicable.
3. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4. Values correspond to brittle steel elements.

Concrete Breakout Design Information for Threaded Rod and Reinforcing Bars (For use with loads combinations taken from ACI 318-14 Section 5.3)[1]

CODE LISTED ICC-ES ESR-3576

STRENGTH DESIGN TABLES SD

Design Information	Symbol	Units	Nominal Rod Diameter (inch) / Reinforcing Bar Size							
			3/8 or #3	1/2 or #4	5/8 or #5	3/4 or #6	7/8 or #7	1 or #8	#9	1-1/4 or #10
Effectiveness factor for cracked concrete	$k_{c,cr}$	- (SI)	17 (7.1)							
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	- (SI)	24 (10.0)							
Minimum embedment	$h_{ef,min}$	inch (mm)	2-3/8 (60)	2-3/4 (70)	3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	4-1/2 (114)	5 (127)
Maximum embedment	$h_{ef,max}$	inch (mm)	7-1/2 (191)	10 (254)	12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)	22-1/2 (572)	25 (635)
Minimum anchor spacing	s_{min}	inch (mm)	1-7/8 (48)	2-1/2 (64)	3-1/8 (79)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)
Minimum edge distance[2]	c_{min}	inch (mm)	5*d* where *d* is nominal outside diameter of the anchor							
Minimum edge distance, reduced[2]	$c_{min,red}$	inch (mm)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	2-3/4 (70)	2-3/4 (70)
Minimum member thickness	h_{min}	inch (mm)	h_{ef} + 1-1/4 (h_{ef} + 30)	$h_{ef} + 2d_o$ where d_o is hole diameter;						
Critical edge distance—splitting (for uncracked concrete only)[3]	c_{ac}	inch	$c_{ac} = h_{ef} \cdot (\frac{\tau_{uncr}}{1160})^{0.4} \cdot [3.1\text{-}0.7\frac{h}{h_{ef}}]$							
		(mm)	$c_{ac} = h_{ef} \cdot (\frac{\tau_{uncr}}{8})^{0.4} \cdot [3.1\text{-}0.7\frac{h}{h_{ef}}]$							
Strength reduction factor for tension, concrete failure modes, Condition B[4]	ϕ	-	0.65							
Strength reduction factor for shear, concrete failure modes, Condition B[4]	ϕ	-	0.70							

For SI: 1 inch = 25.4 mm, 1 lbf = 4.448 N. For pound-inch units: 1 mm = 0.03937 inch, 1 N = 0.2248 lbf.

1. Additional setting information is described in the installation instructions.
2. For installation between the minimum edge distance, c_{min}, and the reduced minimum edge distance, $c_{min,red}$, the maximum torque applied must be reduced (multiplied) by a factor of 0.45.
3. $\tau_{k,uncr}$ need not be taken as greater than: $\tau_{k,uncr} = \frac{k_{uncr} \bullet \sqrt{h_{ef} \bullet f'_c}}{\pi \bullet d}$ and $\frac{h}{h_{ef}}$ need not be taken as larger than 2.4.
4. Condition A requires supplemental reinforcement, while Condition B applies where supplemental reinforcement is not provided or where pryout governs, as set forth in ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4.

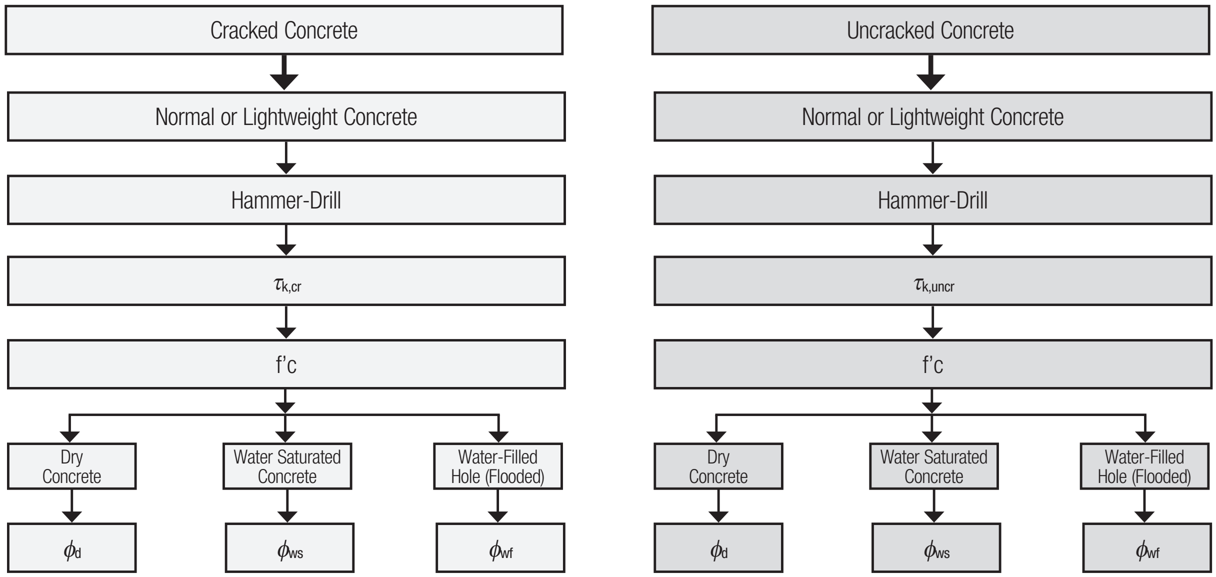
Bond Strength Design Information for Threaded Rods and Reinforcing Bars (For use with load combinations taken from ACI 318-14 Section 5.3)[1]

Design Information		Symbol	Units	Nominal Rod Diameter (inch) / Reinforcing Bar Size							
				3/8 or #3	1/2 or #4	5/8 or #5	3/4 or #6	7/8 or #7	1 or #8	#9	1-1/4 or #10
Minimum embedment		$h_{ef,min}$	inch (mm)	2-3/8 (60)	2-3/4 (70)	3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	4-1/2 (114)	5 (127)
Maximum embedment		$h_{ef,max}$	inch (mm)	7-1/2 (191)	10 (254)	12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)	22-1/2 (572)	25 (635)
110°F (43°C) Maximum Long-Term Service Temperature; 140°F (60°C) Maximum Short-Term Service Temperature[3,5]	Characteristic bond strength in cracked concrete[6,9]	$\tau_{k,cr}$	psi (N/mm²)	684 (4.7)	658 (4.5)	632 (4.4)	608 (4.2)	585 (4.0)	562 (3.9)	562 (3.9)	562 (3.9)
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	psi (N/mm²)	1,444 (10.0)	1,389 (9.6)	1,335 (9.2)	1,283 (8.8)	1,234 (8.5)	1,184 (8.2)	1,184 (8.2)	1,184 (8.2)
110°F (43°C) Maximum Long-Term Service Temperature; 176°F (80°C) Maximum Short-Term Service Temperature[4,5]	Characteristic bond strength in cracked concrete[6,9]	$\tau_{k,cr}$	psi (N/mm²)	475 (3.3)	457 (3.2)	439 (3.0)	422 (2.9)	406 (2.8)	390 (2.7)	390 (2.7)	390 (2.7)
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	psi (N/mm²)	1,024 (7.1)	985 (6.8)	947 (6.5)	910 (6.3)	875 (6.0)	840 (5.8)	840 (5.8)	840 (5.8)
Permissible Installation Conditions[7]	Dry concrete	Anchor Category	-	1							
		ϕ_d	-	0.65							
	Water-saturated concrete, Water-filled hole (flooded)	Anchor Category	-	2							
		ϕ_{ws}, ϕ_{wf},	-	0.55							
Reduction factor for seismic tension[9]		$\alpha_{N,seis}$	-	1							

For SI: 1 inch = 25.4 mm, 1 psi = 0.006894 MPa. For pound-inch units: 1 mm = 0.03937 inch, 1 MPa = 145.0 psi.

1. Bond strength values correspond to a normal-weight concrete compressive strength f'c = 2,500 psi (17.2 MPa). For concrete compressive strength, f'c between 2,500 psi and 8,000 psi (17.2 MPa and 55.2 MPa), the tabulated characteristic bond strength may be increased by a factor of $(f'c / 2{,}500)^{0.23}$ [For SI: $(f'c / 17.2)^{0.23}$]. See Section 4.1.4 of this report for bond strength determination.
2. The modification factor for bond strength of adhesive anchors in lightweight concrete shall be taken as given in ACI 318-14 17.2.6 where applicable.
3. The maximum short-term service temperature may be increased to 162°F (72°C) provided characteristic bond strengths are reduced by 3 percent. Long-term and short-term temperatures meet the requirements of Section 8.5 of ACI 355.4 and Table 8.1, Temperature Category B.
4. Long-term and short-term temperatures meet the requirements of Section 8.5 of ACI 355.4 and Table 8.1, Temperature Category A.
5. Short-term base material service temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling. Long-term base material service temperatures are roughly constant over significant periods of time.
6. Characteristic bond strengths are for sustained loads including dead and live loads.
7. Permissible installation conditions include dry concrete, water-saturated concrete, and water-filled holes. Water-filled holes include applications in dry or water-saturated concrete where the drilled holes contain standing water at the time of anchor installation.
8. Bond strength values for uncracked concrete are applicable for structures assigned to Seismic Design Categories A and B only.
9. For structures assigned to Seismic Design Categories C, D, E or F, the tabulated bond strength values for cracked concrete do not require an additional reduction factor applied for seismic tension ($\alpha_{N,seis}$ = 1.0), where seismic design is applicable.

FLOWCHART FOR THE ESTABLISHMENT OF DESIGN BOND STRENGTH



Tension and Shear Design Strength Installed in Uncracked Concrete (Bond or Concrete Strength) Drilled with a Hammer-Drill and Carbide Bit in a Dry Hole Condition 110°F (43°C) Maximum Long-Term Service Temperature; 140°F (60°C) Maximum Short-Term Service Temperature[1,2,3,4,5,6,7,8,9]

STRENGTH DESIGN SD TABLES

Nominal Rod/Rebar Size (in. or #)	Embed. Depth h_{ef} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 (psi)		f'c = 3,000 (psi)		f'c = 4,000 (psi)		f'c = 6,000 (psi)		f'c = 8,000 (psi)	
		ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)
3/8 or #3	2-3/8	2,625	2,490	2,740	2,770	2,925	3,150	3,210	3,460	3,430	3,695
	3	3,315	3,700	3,460	4,120	3,695	4,885	4,055	6,210	4,335	7,365
	4-1/2	4,975	6,755	5,190	7,525	5,545	8,920	6,085	11,340	6,500	13,445
	7-1/2	8,295	14,375	8,650	16,010	9,240	18,985	10,145	21,845	10,835	23,340
1/2 or #4	2-3/4	3,555	3,305	3,895	3,755	4,345	4,525	4,770	5,755	5,095	6,825
	4	5,675	6,450	5,915	7,185	6,320	8,520	6,940	10,830	7,415	12,840
	6	8,510	11,750	8,875	13,085	9,480	15,515	10,405	19,725	11,120	23,390
	10	14,180	25,020	14,790	27,875	15,800	33,050	17,345	37,360	18,530	39,915
5/8 or #5	3-1/8	4,310	4,120	4,720	4,680	5,450	5,720	6,430	7,525	6,835	8,920
	5	8,520	9,895	8,885	11,020	9,490	13,065	10,420	16,610	11,130	19,695
	7-1/2	12,780	18,020	13,325	20,070	14,235	23,800	15,630	30,255	16,700	35,870
	12-1/2	21,300	38,395	22,210	42,775	23,730	50,715	26,050	56,105	27,830	59,940
3/4 or #6	3-1/2	5,105	5,015	5,595	5,700	6,460	6,970	7,635	9,255	8,265	11,245
	6	11,465	13,595	12,295	15,315	13,135	18,160	14,420	23,090	15,405	27,375
	9	17,685	25,045	18,440	27,900	19,705	33,080	21,630	42,050	23,110	49,775
	15	29,475	53,355	30,735	59,435	32,840	70,470	36,050	77,645	38,515	82,955
7/8 or #7	3-1/2	5,105	4,930	5,595	5,605	6,460	6,855	7,350	9,100	7,975	11,130
	7	14,445	16,605	15,825	18,865	17,195	22,525	18,875	28,635	20,170	33,950
	10-1/2	23,150	31,060	24,145	34,595	25,795	41,020	28,315	52,150	30,250	61,830
	17-1/2	38,585	66,175	40,240	73,715	42,990	87,400	47,195	101,645	50,420	108,600
1 or #8	4	6,240	6,115	6,835	6,945	7,895	8,495	9,190	11,280	9,980	13,800
	8	17,650	19,750	19,335	22,435	21,550	27,055	23,655	34,395	25,275	40,785
	12	29,015	37,310	30,255	41,560	32,325	49,280	35,485	62,650	37,910	74,280
	20	48,355	79,500	50,425	88,560	53,875	105,005	59,140	127,380	63,185	136,095
#9	4-1/2	7,445	7,110	8,155	8,080	9,420	9,880	11,335	13,125	12,300	16,055
	9	21,060	23,055	23,070	26,190	26,640	32,035	29,940	41,110	31,990	48,745
	13-1/2	36,720	44,600	38,290	49,680	40,910	58,905	44,910	74,885	47,985	88,790
	22-1/2	61,200	94,995	63,820	105,825	68,185	125,475	74,850	159,515	79,970	172,245
1-1/4	5	8,720	8,170	9,555	9,285	11,030	11,355	13,510	15,085	15,190	18,450
	10	24,665	26,380	27,020	29,975	31,200	36,660	36,965	48,050	39,490	56,970
	15	45,315	52,110	47,275	58,060	50,510	68,835	55,445	87,515	59,240	103,760
	25	75,555	111,065	78,790	123,720	84,180	146,695	92,410	186,490	98,730	212,650
#10	5	8,720	8,160	9,555	9,270	11,030	11,335	13,510	15,060	15,020	18,420
	10	24,665	26,430	27,020	30,025	31,200	36,725	36,965	48,135	39,490	57,070
	15	45,315	52,205	47,275	58,165	50,510	68,965	55,445	87,675	59,240	103,955
	25	75,555	111,225	78,790	123,905	84,180	146,910	92,410	186,765	98,730	212,650

☐ - Concrete Breakout Strength ☐ - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in uncracked normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac}
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.
2. Calculations were performed according to ACI 318-14 Ch.17 and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/ pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls.
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318-14 Section 5.3 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-3576.
5. Tabular values are permitted for static loads only, seismic loading is not considered with these tables. Periodic special inspection must be performed where required by code, see ESR-3576 for applicable information.
6. For anchors subjected to tension resulting from sustained loading a supplemental check must be performed according to ACI 318-14 17.3.1.2.
7. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Ch.17.
8. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-14 Ch.17, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-14 Ch.17 and ICC-ES AC308 and ESR-3576.
9. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Tension and Shear Design Strength Installed in Cracked Concrete (Bond or Concrete Strength) Drilled with a Hammer-Drill and Carbide Bit in a Dry Hole Condition 110°F (43°C) Maximum Long-Term Service Temperature; 140°F (60°C) Maximum Short-Term Service Temperature[1,2,3,4,5,6,7,8,9]

Nominal Rod/Rebar Size (in. or #)	Embed. Depth h_{ef} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 (psi)		f'c = 3,000 (psi)		f'c = 4,000 (psi)		f'c = 6,000 (psi)		f'c = 8,000 (psi)	
		ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)
3/8 or #3	2-3/8	1,245	1,340	1,295	1,395	1,385	1,495	1,520	1,640	1,625	1,750
	3	1,570	2,645	1,640	2,945	1,750	3,490	1,920	4,140	2,055	4,425
	4-1/2	2,355	4,825	2,460	5,295	2,625	5,655	2,885	6,210	3,080	6,635
	7-1/2	3,930	8,460	4,095	8,825	4,375	9,425	4,805	10,350	5,135	11,055
1/2 or #4	2-3/4	1,850	2,360	1,925	2,680	2,060	3,235	2,260	4,110	2,415	4,875
	4	2,685	4,605	2,800	5,130	2,995	6,085	3,285	7,080	3,510	7,565
	6	4,030	8,390	4,205	9,055	4,490	9,675	4,930	10,620	5,265	11,345
	10	6,720	14,470	7,005	15,090	7,485	16,120	8,215	17,700	8,780	18,910
5/8 or #5	3-1/8	2,365	2,940	2,500	3,340	2,720	4,085	3,045	5,375	3,235	6,375
	5	4,035	7,065	4,205	7,870	4,495	9,335	4,935	10,625	5,270	11,350
	7-1/2	6,050	12,870	6,310	13,590	6,740	14,515	7,400	15,935	7,905	17,025
	12-1/2	10,085	21,715	10,515	22,645	11,235	24,195	12,330	26,560	13,175	28,375
3/4 or #6	3-1/2	2,805	3,580	2,955	4,070	3,215	4,980	3,620	6,610	3,920	8,035
	6	5,585	9,710	5,825	10,940	6,225	12,970	6,835	14,720	7,300	15,725
	9	8,380	17,890	8,740	18,825	9,335	20,110	10,250	22,075	10,950	23,585
	15	13,970	30,085	14,565	31,370	15,560	33,520	17,085	36,795	18,250	39,310
7/8 or #7	3-1/2	2,720	3,525	2,860	4,000	3,105	4,895	3,485	6,500	3,780	7,950
	7	7,315	11,860	7,630	13,475	8,150	16,090	8,950	19,275	9,560	20,595
	10-1/2	10,975	22,185	11,445	24,650	12,230	26,340	13,425	28,910	14,340	30,890
	17-1/2	18,290	39,400	19,075	41,085	20,380	43,895	22,370	48,185	23,905	51,485
1 or #8	4	3,405	4,365	3,585	4,960	3,890	6,065	4,365	8,060	4,735	9,855
	8	9,180	14,105	9,575	16,025	10,230	19,325	11,230	24,185	11,995	25,840
	12	13,770	26,650	14,360	29,685	15,345	33,050	16,845	36,280	17,995	38,760
	20	22,950	49,435	23,935	51,555	25,575	55,080	28,070	60,465	29,995	64,600
#9	4-1/2	4,205	5,080	4,425	5,770	4,800	7,060	5,380	9,375	5,840	11,465
	9	11,620	16,465	12,115	18,710	12,945	22,880	14,210	29,365	15,185	32,705
	13-1/2	17,430	31,855	18,175	35,485	19,420	41,825	21,315	45,915	22,775	49,055
	22-1/2	29,050	62,570	30,295	65,245	32,365	69,710	35,530	76,525	37,960	81,760
1-1/4	5	5,190	5,835	5,465	6,630	5,925	8,110	6,645	10,775	7,210	13,175
	10	14,345	18,845	14,960	21,410	15,985	26,185	17,545	34,320	18,745	40,375
	15	21,520	37,220	22,440	41,470	23,975	49,170	26,320	56,685	28,120	60,560
	25	35,865	77,245	37,400	80,550	39,955	86,060	43,865	94,475	46,865	100,935
#10	5	5,135	5,830	5,405	6,620	5,860	8,100	6,570	10,755	7,130	13,155
	10	14,345	18,880	14,960	21,445	15,985	26,230	17,545	34,380	18,745	40,375
	15	21,520	37,290	22,440	41,545	23,975	49,260	26,320	56,685	28,120	60,560
	25	35,865	77,245	37,400	80,550	39,955	86,060	43,865	94,475	46,865	100,935

- Concrete Breakout Strength - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in cracked normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac}
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.
2. Calculations were performed according to ACI 318-14 Ch.17 and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls.
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318-14 Section 5.3 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-3576.
5. Tabular values are permitted for static loads only, seismic loading is not considered with these tables. Periodic special inspection must be performed where required by code, see ESR-3576 for applicable information.
6. For anchors subjected to tension resulting from sustained loading a supplemental check must be performed according to ACI 318-14 17.3.1.2.
7. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Ch.17.
8. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-14 Ch.17, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-14 Ch.17 and ICC-ES AC308 and ESR-3576.
9. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Tension Design of Steel Elements (Steel Strength)[1,2]

Nominal Rod/Rebar Size (in. or No.)	Steel Elements - Threaded Rod and Reinforcing Bar											
	ASTM A36 and ASTM F1554 Grade 36	ASTM F1554 Grade 55	ASTM A193 Grade B7 and ASTM F1554 Grade 105	ASTM A449	ASTM F568M Class 5.8 and ISO 898-1 Class 5.8	ASTM F593 CW Stainless (Types 304 and 316)	ASTM A193 Grade B8/B8M, Class 1 Stainless (Types 304 and 316)	ASTM A193 Grade B8/ B8M2, Class 2B Stainless (Types 304 and 316)	ASTM A615 Grade 75 Rebar	ASTM A615 Grade 60 Rebar	ASTM A706 Grade 60 Rebar	ASTM A615 Grade 40 Rebar
	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)
3/8 or #3	3,370	4,360	7,265	6,975	3,655	5,040	3,315	5,525	7,150	7,425	6,600	4,950
1/2 or #4	6,175	7,980	13,300	12,770	6,690	9,225	6,070	10,110	13,000	13,500	12,000	9,000
5/8 or #5	9,835	12,715	21,190	20,340	10,650	14,690	9,660	16,105	20,150	20,925	18,600	13,950
3/4 or #6	14,550	18,815	31,360	30,105	15,765	18,480	14,300	23,830	28,600	29,700	26,400	19,800
7/8 or #7	20,085	25,970	43,285	41,930	21,760	25,510	19,735	32,895	39,000	40,500	36,000	-
1 or #8	26,350	34,070	56,785	54,515	28,545	33,465	25,895	43,160	51,350	53,325	47,400	-
#9	-	-	-	-	-	-	-	-	65,000	67,500	60,000	-
1-1/4 or #10	42,160	54,510	90,850	76,315	-	53,540	41,430	69,050	82,550	85,725	76,200	-

■ - Steel Strength

1. Steel tensile design strength according to ACI 318-14 Ch.17, $\phi N_{sa} = \phi \bullet A_{se,N} \bullet f_{uta}$
2. The tabulated steel design strength in tension must be checked against the bond strength/concrete capacity design strength to determine the controlling failure mode, the lowest load level controls.

Shear Design of Steel Elements (Steel Strength)[1,2]

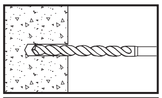
Nominal Rod/Rebar Size (in. or No.)	Steel Elements - Threaded Rod and Reinforcing Bar											
	ASTM A36 and ASTM F1554 Grade 36	ASTM F1554 Grade 55	ASTM A193 Grade B7 and ASTM F1554 Grade 105	ASTM A449	ASTM F568M Class 5.8 and ISO 898-1 Class 5.8	ASTM F593 CW Stainless (Types 304 and 316)	ASTM A193 Grade B8/B8M, Class 1 Stainless (Types 304 and 316)	ASTM A193 Grade B8/ B8M2, Class 2B Stainless (Types 304 and 316)	ASTM A615 Grade 75 Rebar	ASTM A615 Grade 60 Rebar	ASTM A706 Grade 60 Rebar	ASTM A615 Grade 40 Rebar
	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)
3/8 or #3	1,755	2,265	3,775	3,625	2,025	2,790	1,725	2,870	3,960	3,860	3,430	2,575
1/2 or #4	3,210	4,150	6,915	6,640	3,705	5,110	3,155	5,255	7,200	7,020	6,240	4,680
5/8 or #5	5,115	6,610	11,020	10,575	5,900	8,135	5,025	8,375	11,160	10,880	9,670	7,255
3/4 or #6	7,565	9,785	16,305	15,655	8,730	10,235	7,435	12,390	15,840	15,445	13,730	10,295
7/8 or #7	10,445	13,505	22,505	21,805	12,050	14,130	10,265	17,105	21,600	21,060	18,720	-
1 or #8	13,700	17,715	29,525	28,345	15,810	18,535	13,465	22,445	28,440	27,730	24,650	-
#9	-	-	-	-	-	-	-	-	36,000	35,100	31,200	-
1-1/4 or #10	21,920	28,345	47,240	39,685	-	29,655	21,545	35,905	45,720	44,575	39,625	-

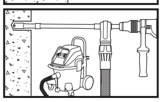
■ - Steel Strength

1. Steel shear design strength according to ACI 318-14 Ch.17, $\phi V_{sa} = \phi \bullet 0.60 \bullet A_{se,V} \bullet f_{uta}$
2. The tabulated steel design strength in shear must be checked against the bond strength/concrete capacity design strength to determine the controlling failure mode, the lowest load level controls.

INSTALLATION INSTRUCTIONS (SOLID BASE MATERIALS)

DRILLING





1- Drill a hole into the base material with rotary hammer drill (i.e. percussion drill) and a carbide drill bit to the size and embedment required by the selected steel hardware element (reference installation specifications for threaded rod and reinforcing bar). The tolerances of the carbide drill bits, including hollow bits, must meet ANSI Standard B212.15.

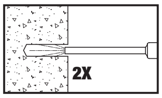
- Precaution: Use suitable eye and skin protection. Avoid inhalation of dust during drilling and/or removal.

Note! In case of standing water in the drilled hole (flooded hole condition), all the water has to be removed from the hole (e.g. vacuum, compressed air, etc.) prior to cleaning.

Drilling in dry base materials is recommended when using hollow drill bits (vacuum must be on).

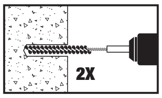
GO TO STEP 3 FOR HOLES DRILLED WITH DUSTX+™ EXTRACTION SYSTEM (NO FURTHER HOLE CLEANING IS REQUIRED). OTHERWISE GO TO STEP 2A FOR HOLE CLEANING INSTRUCTIONS.

HOLE CLEANING DRY OR WET/WATER-SATURATED HOLES (BLOW 2X, BRUSH 2X, BLOW 2X)



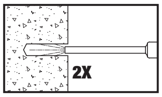
2a- Starting from the bottom or back of the drilled anchor hole, blow the hole clean a minimum of two times (2x).

- Use a compressed air nozzle (min. 90 psi) for all sizes of anchor rod and reinforcing bar (rebar).



2b- Determine wire brush diameter (see installation specifications) for the drilled hole and attach the brush with adaptor to a rotary drill tool or battery screw gun. Brush the hole with the selected wire brush a minimum of two times (2x). A brush extension (supplied by DEWALT) must be used for holes drilled deeper than the listed brush length.

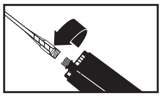
- The wire brush diameter must be checked periodically during use. The brush should resist insertion into the drilled hole, if it does not come into contact with the sides of the drilled hole, the brush is too small and must be replaced.



2c- Repeat Step 2a- again by blowing the hole clean a minimum of two times (2x).

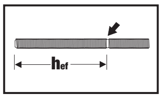
- When finished the hole should be clean and free of dust, debris, ice, grease, oil or other foreign material.

PREPARING

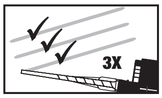


3- Check adhesive expiration date on cartridge label. Do not use expired product. Review Safety Data Sheet (SDS) before use. Cartridge temperature must be between 50°F - 104°F (10°C - 40°C) when in use; for overhead applications cartridge temperature must be between 50ºF - 90ºF (10ºC - 30ºC). Review published working and cure times. Consideration should be given to the reduced gel (working) time of the adhesive in warm temperatures. For permitted range of the base material temperature, see published gel and curing times.

- Attach a supplied mixing nozzle to the cartridge. Unless otherwise noted do not modify the mixer in any way and make sure the mixing element is inside the nozzle. Load the cartridge into the correct dispensing tool.
- Note: Always use a new mixing nozzle with new cartridge of adhesive and also for all work interruptions exceeding the published gel (working) time of the adhesive.



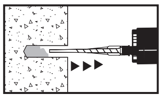
4- Prior to inserting the anchor rod or rebar into the filled bore hole, the position of the embedment depth has to be marked on the anchor. Verify anchor element is straight and free of surface damage.



5- Adhesives must be properly mixed to achieve published properties. For new cartridges and nozzles, prior to dispensing adhesive into the drilled hole, separately dispense at least three full strokes of adhesive through the mixing nozzle until the adhesive is a consistent **GRAY** color.

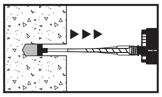
- Review and note the published working and cure times (reference gel time and curing time table) prior to injection of the mixed adhesive into the cleaned anchor hole.

INSTALLATION



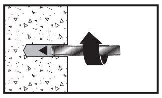
6- Fill the cleaned hole approximately two-thirds full with mixed adhesive starting from the bottom or back of the anchor hole. Slowly withdraw the mixing nozzle as the hole fills to avoid creating air pockets or voids. A plastic extension tube (Cat# 08281 or 08297) or equivalent approved by DEWALT must be used with the mixing nozzle if the bottom or back of the anchor hole is not reached with the mixing nozzle only.

WITH PISTON PLUG:

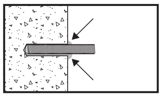


- Piston plugs (see adhesive piston plug table) must be used with and attached to the mixing nozzle and extension tube for horizontal installations where embedment is greater than 8 inches and overhead installations in concrete with anchor rod from 5/8" to 1-1/4" diameter and rebar size #5 to #10. Insert piston plug to the back of the drilled hole and inject as described in the method above. During installation the piston plug will be naturally extruded from the drilled hole by the adhesive pressure.

Attention! Do not install anchors overhead without proper training and installation hardware provided by the DEWALT. Contact DEWALT for details prior to use.

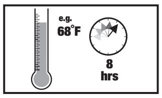


7- The anchor should be free of dirt, grease, oil or other foreign material. Push clean threaded rod or reinforcing bar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached. Observe the gel (working) time.



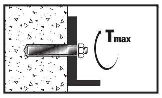
8- Ensure that the anchor element is installed to the specific embedment depth. Adhesive must completely fill the annular gap at the concrete surface. Following installation of the anchor element, remove excess adhesive. Protect the anchor element threads from fouling with adhesive. For all installations the anchor element must be restrained from movement throughout the specified curing period (as necessary) through the use of temporary wedges, external supports, or other methods. Minor adjustment to the position of the anchor element may be performed during the gel time only.

CURING AND LOADING



9- Allow the adhesive anchor to cure to the specified full curing time prior to applying any load (reference gel time and curing time table).

- Do not disturb, torque or load the anchor until it is fully cured.



10- After full curing of the adhesive anchor, a fixture can be installed to the anchor and tightened up to the maximum torque (reference gel time and curing table) by using a calibrated torque wrench.

- Take care not to exceed the maximum torque for the selected anchor.

REFERENCE INSTALLATION TABLES

Gel (working) Time and Curing Table

Temperature of base material		Gel (working) time	Full curing time
°F	°C		
50	10	90 minutes	24 hours
68	20	25 minutes	8 hours
86	30	20 minutes	8 hours
95	35	15 minutes	6 hours
104	40	12 minutes	4 hours

Linear interpolation for intermediate base material temperature is possible.

Cartridge adhesive temperature must be between 50°F - 110°F (10°C - 43°C) when in use; for overhead applications cartridge adhesive temperature must be between 50°F - 90°F (10°C - 32°C) when in use. For best experience, suggested minimum cartridge adhesive temperature is 68°F (20°C) when in use

Hole Cleaning Equipment Selection Table for Pure50+[1,2,3]

Rod Diameter (inch)	Rebar Size (No.)	ANSI Drill Bit Diameter[1] (inch)	Brush Length, L (inches)	Steel Wire Brush[2,3] (Cat. #)	Blowout Tool	Number of cleaning actions
Solid Base Material						
3/8	#3	7/16	6-3/4	08284	Compressed air nozzle only, Cat #8292 (min. 90 psi)	2x blowing 2x brushing 2x blowing
1/2	-	9/16	6-3/4	08285		
-	#4	5/8	6-3/4	08275		
5/8	#5	11/16	7-7/8	08286		
		3/4	7-7/8	08278		
3/4	#6	7/8	7-7/8	08287		
7/8	#7	1	11-7/8	08288		
1	#8	1-1/8	11-7/8	08289		
1-1/4	#9	1-3/8	11-7/8	08290		
-	#10	1-1/2	11-7/8	08291		

1. For any case, it must be possible for the steel anchor element to be inserted into the cleaned hole without resistance.
2. An SDS-plus adaptor (Cat. #08283) or Jacobs chuck style adaptor (Cat. #08296) is required to attach a steel wire brush to the drill tool.
3. A brush extension (Cat. #08282) must be used with a steel wire brush for holes drilled deeper than the listed brush length.

Adhesive Piston Plugs[1,2,3]

Plug Size (inch)	ANSI Drill Bit Diameter (inch)	Piston Plug (Cat. #)	Piston Plug
Solid Base Materials			
11/16	11/16	08258	
3/4	3/4	08259	
7/8	7/8	08300	
1	1	08301	
1-1/8	1-1/8	08303	
1-1/4	1-1/4	08307	
1-3/8	1-3/8	08305	
1-1/2	1-1/2	08309	

1. All overhead installations require the use of piston plugs where one is tabulated together with the anchor size.
2. All horizontal installations require the use of piston plugs where one is tabulated together with the anchor size and where the embedment depth is greater than 8 inches.
3. A flexible plastic extension tube (Cat. #08281 or 08297) or equivalent approved by DEWALT must be used with piston plugs.

PERMISSIBLE INSTALLATION CONDITIONS (ADHESIVE)

Dry Concrete: cured concrete that, at the time of adhesive anchor installation, has not been exposed to water for the preceding 14 days.

Water-Saturated Concrete (wet): cured concrete that, at the time of adhesive anchor installation, has been exposed to water over a sufficient length of time to have the maximum possible amount of absorbed water into the concrete pore structure to a depth equal to the anchor embedment depth.

Water-Filled Holes (flooded): cured concrete that is water-saturated and where the drilled hole contains standing water at the time of anchor installation.

ORDERING INFORMATION

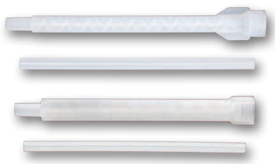
Pure50+ Cartridges

Cat No.	Description	Std. Ctn.	Pallet
08600	Pure50+ 9 fl. oz Quik-Shot cartridge	12	432
08605	Pure50+ 21 fl. oz. cartridge	12	540
08651	Pure50+ 51 fl. oz. cartridge	8	216

One Pure50+ mixing nozzle is packaged with each cartridge.
Pure50+ mixing nozzles must be used to ensure complete and proper mixing of the adhesive.

Cartridge System Mixing Nozzles

Cat. No.	Description	Std. Pkg.	Std. Ctn.
08294	Extra mixing nozzle (with 8" extension) for Pure50+ 21 fl. oz.	2	24
08609	High flow mixing nozzle (with 8" extension)	2	24
08281	Mixing nozzle extension, 8" long	2	24
08297	Mixing nozzle extension, 20" long	1	12



Dispensing Tools for Injection Adhesive

Cat No.	Description	Std. Box	Std. Ctn.
08437	Manual caulking gun for Quik-Shot	1	12
08479	High performance caulking gun for Quik-Shot	1	12
DCE560D1	Quik-Shot 20v Battery powered dispensing tool	1	-
08409	21 fl. oz. Standard metal manual tool	1	10
08421	21 fl. oz. High performance manual tool	1	10
DCE591D1	21 fl. oz. 20v Battery powered dispensing tool	1	-
08459	21 fl. oz. Pneumatic tool	1	-
08438	51 fl. oz. Pneumatic tool	1	-

Hole Cleaning Tools and Accessories

Cat No.	Description	Std. Box
08284	Wire brush for 7/16" or 1/2" ANSI hole, 6-3/4" length	1
08285	Wire brush for 9/16" ANSI hole, 6-3/4" length	1
08275	Wire brush for 5/8" ANSI hole, 6-3/4" length	1
08286	Wire brush for 11/16" ANSI hole, 7-7/8" length	1
08278	Wire brush for 3/4" ANSI hole, 7-7/8" length	1
08287	Wire brush for 7/8" ANSI hole, 7-7/8" length	1
08288	Wire brush for 1" ANSI hole, 11-7/8" length	1
08289	Wire brush for 1-1/8" ANSI hole, 11-7/8" length	1
08276	Wire brush for 1-1/4" ANSI hole, 11-7/8" length	1
08290	Wire brush for 1-3/8" ANSI hole, 11-7/8" length	1
08291	Wire brush for 1-1/2" ANSI hole, 11-7/8" length	1
08283	SDS-plus adapter for steel brushes	1
08296	Standard drill adapter for steel brushes (e.g. Jacobs Chuck)	1
08282	Steel brush extension, 12" length	1
08292	Air compressor nozzle with extension, 18" length	1
52703	Adhesives cleaning kit includes 4 wire brushes (08284, 08285, 08286, 08287), Steel brush extension (08282), SDS-Plus adapter (08283), Standard drill adapter (08296), Hand pump/dust blower (08280), glove and safety glasses	1

Adhesive Piston Plugs for Adhesive Anchors

Cat No.	Description	ANSI Drill Bit Dia.	Std. Bag
08258	11/16" Plug	11/16"	10
08259	3/4" Plug	3/4"	10
08300	7/8" Plug	7/8"	10
08301	1" Plug	1"	10
08303	1-1/8" Plug	1-1/8"	10
08307	1-1/4" Plug	1-1/4"	10
08305	1-3/8" Plug	1-3/8"	10
08309	1-1/2" Plug	1-1/2"	10

SDS Max 4-Cutter Carbide Drill Bits

Cat. No.	Diameter	Usable Length	Overall Length
DW5806	5/8"	8"	13-1/2"
DW5809	5/8"	16"	21-1/2"
DW5807	5/8"	31"	36"
DW5808	11/16"	16"	21-1/2"
DW5810	3/4"	8"	13-1/2"
DW5812	3/4"	16"	21-1/2"
DW5813	3/4"	31"	36"
DW5814	13/16"	16"	21-1/2"
DW5815	7/8"	8"	13-1/2"
DW5816	7/8"	16"	21-1/2"
DW5851	7/8"	31"	36"
DW5817	27/32"	16"	21-1/2"
DW5818	1"	8"	13-1/2"
DW5819	1"	16"	22-1/2"
DW5852	1"	24"	29"
DW5820	1"	31"	36"
DW5821	1-1/8"	10"	15"
DW5822	1-1/8"	18"	22-1/2"
DW5853	1-1/8"	24"	29"
DW5854	1-1/8"	31"	36"
DW5824	1-1/4"	10"	15"
DW5825	1-1/4"	18"	22-1/2"

Dust Extraction

Cat. No.	Description
DWV012	10 Gallon Wet/Dry Hepa/Rrp Dust Extractor DWV9402 Fleece bag (5 pack) for DEWALT dust extractors DWV9316 Replacement Anti-Static Hose DWV9320 Replacement HEPA Filter Set (Type 1)
DWH050K	Dust Extraction with two interchangeable drilling heads
DCB1800M3T1	1800 Watt Portable Power Station & Parallel Battery Charger with 3 20V Max* 5Ah Batteries and 1 60V Max* Flexvolt® Battery

SDS+ Full Head Carbide Drill Bits

Cat. No.	Diameter	Usable Length	Overall Length
DW5502	3/16"	2"	4-1/2"
DW5503	3/16"	4"	6-1/2"
DW5504	3/16"	5"	8-1/2"
DW5506	3/16"	10"	12"
DW5512	7/32"	8"	10"
DW5517	1/4"	4"	6"
DW5518	1/4"	6"	8-1/2"
DW55200	1/4"	10"	12"
DW5521	1/4"	12"	14"
DW5524	5/16"	4"	6"
DW5526	5916"	10"	12"
DW5527	3/8"	4"	6-1/2"
DW5529	3/8"	8"	10"
DW55300	3/8"	10"	12"
DW5531	3/8"	16"	18"
DW5537	1/2"	4"	6"
DW5538	1/2"	8"	10-1/2"
DW5539	1/2"	10"	12"
DW5540	1/2"	16"	18"

SDS+ 4-Cutter Carbide Drill Bits

Cat. No.	Diameter	Usable Length	Overall Length
DW5471	5/8"	8"	10"
DW5472	5/8"	16"	18"
DW5474	3/4"	8"	10"
DW5475	3/4"	16"	18"
DW5477	7/8"	8"	10"
DW5478	7/8"	16"	18"
DW5479	1"	8"	10"
DW5480	1"	16"	18"
DW5481	1-1/8"	8"	10"
DW5482	1-1/8"	6"	18"

Hollow Drill Bits

	Cat. No.	Diameter	Overall Length	Usable Length	Recommended Hammer Drill
SDS+	DWA54012	1/2"	14-1/2"	9-3/4"	DCH133 / DCH273 / DCH293
	DWA54916	9/16"	14-1/2"	9-3/4"	DCH133 / DCH273 / DCH293
	DWA54058	5/8"	14-1/2"	9-3/4"	DCH133 / DCH273 / DCH293
	DWA54034	3/4"	14-1/2"	9-3/4"	DCH133 / DCH273 / DCH293
SDS Max	DWA58058	5/8"	23-5/8"	15-3/4"	DCH481 / D25603K
	DWA58034	3/4"	23-5/8"	15-3/4"	DCH481 / D25603K
	DWA58078	7/8"	23-5/8"	15-3/4"	DCH481 / D25603K
	DWA58001	1"	23-5/8"	15-3/4"	DCH481 / D25603K
	DWA58118	1-1/8"	23-5/8"	15-3/4"	DCH481 / D25603K

GENERAL INFORMATION

PURE GP™

Epoxy Injection Adhesive Anchoring System

PRODUCT DESCRIPTION

The Pure GP is a two-component adhesive anchoring system. The system includes injection adhesive in plastic cartridges, mixing nozzles, dispensing tools and hole cleaning equipment.
Pure GP is designed for bonding threaded rod and reinforcing bar hardware into drilled holes in solid concrete base materials.

GENERAL APPLICATIONS AND USES

- Bonding threaded rod and reinforcing bar into hardened concrete
- Evaluated for installation and use in dry and wet holes
- Can be installed in a wide range of base material temperatures

FEATURES AND BENEFITS

+ Designed for use with threaded rod and reinforcing bar hardware elements
+ Cartridge design allows for multiple uses using extra mixing nozzles
+ Mixing nozzles proportion adhesive and provide simple delivery method into drilled holes

APPROVALS AND LISTINGS

- Conforms to requirements of ASTM C 881 and AASHTO M235, Types I, II, IV and V, Grade 3, Classes B & C (also meets Type III except for elongation)
- Department of Transportation listings - see www.DEWALT.com or contact transportation agency

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors and 05 05 19 - Post-Installed Concrete Anchors. Adhesive anchoring system shall be Pure GP as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and requirements of the Authority Having Jurisdiction.

SECTION CONTENTS

PACKAGING

Dual (side-by-side Cartridge)

- 21 fl. oz. (620 ml), 1:1 mix ratio

STORAGE LIFE & CONDITIONS

Two years in a dry, dark environment with temperature ranging from 41°F and 86°F (5°C to 30°C)

ANCHOR SIZE RANGE (TYPICAL)

- 3/8" to 1" diameter threaded rod
- No. 3 to No. 8 rebar

SUITABLE BASE MATERIALS

- Normal-weight Concrete

PERMISSIBLE INSTALLATION CONDITIONS (ADHESIVE)

- Dry Concrete
- Water Saturated Concrete

REFERENCE INSTALLATION TABLES

Installation Table for Pure GP (Solid Concrete Base Materials)

Dimension/Property	Notation	Units	Nominal Anchor Size					
Threaded Rod	-	in.	3/8	1/2	-	5/8	3/4	1
Reinforcing Bar	-	-	#3	-	#4	#5	#6	#8
Nominal anchor diameter	d_a	in. (mm)	0.375 (9.5)	0.500 (12.7)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	1.000 (25.4)
Carbide drill bit nominal size	d_{bit}	in.	7/16 ANSI	9/16 ANSI	5/8 ANSI	11/16 or 3/4 ANSI	7/8 ANSI	1-1/8 ANSI
Embedment	h_{nom}	in. (mm)	3-3/8 (95)	4-1/2 (114)	4-1/2 (114)	5-5/8 (143)	6-3/4 (172)	9 (229)

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

1. The minimum base material thickness should be 1.5 h_{nom}.

Hole Cleaning Equipment Selection Table for Pure GP

Rod Diameter (inch)	Rebar Size (No.)	ANSI Drill Bit Diameter[1] (inch)	Brush Length, L (inches)	Steel Wire Brush[2,3] (Cat. #)	Blowout Tool	Number of cleaning actions
Solid Base Material						
3/8	#3	7/16	6-3/4	08284	Compressed air nozzle only, Cat #8292 (min. 90 psi)	2x blowing 2x brushing 2x blowing
1/2	-	9/16	6-3/4	08285		
-	#4	5/8	6-3/4	08275		
5/8	#5	11/16	7-7/8	08286		
		3/4	7-7/8	08278		
3/4	#6	7/8	7-7/8	08287		
7/8	#7	1	11-7/8	08288		
1	#8	1-1/8	11-7/8	08289		

1. For installations with 5/8-inch threaded rod and #5 rebar size, the preferred ANSI drill bit diameter is 3/4-inch. If an 11/16-inch ANSI drill bit is used the user must check before injecting the adhesive to verify that the steel anchor element can be inserted into the cleaned borehole without resistance.
2. An SDS-plus adaptor (Cat. #08283) or Jacobs chuck style adaptor (Cat. #08296) is required to attach a steel wire brush to the drill tool.
3. A brush extension (Cat. #08282) must be used with a steel wire brush for holes drilled deeper than the listed brush length.

Adhesive Piston Plugs[1]

Plug Size (inch)	ANSI Drill Bit Diameter (inch)	Piston Plug (Cat. #)	Piston Plug
Solid Base Materials			
11/16	11/16	08258	
3/4	3/4	08259	
7/8	7/8	08300	
1	1	08301	
1-1/8	1-1/8	08303	

1. All horizontal installations require the use of piston plugs where one is tabulated together with the anchor size and where the embedment depth is greater than 8 inches.

Gel (working) Time and Curing Table

Temperature of base material		Gel (working) time	Full curing time
°F	°C		
50	10	90 minutes	24 hours
68	20	25 minutes	8 hours
86	30	20 minutes	8 hours
95	35	15 minutes	6 hours
104	40	12 minutes	4 hours

Linear interpolation for intermediate base material temperature is possible.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Pure GP Adhesive Installed with Threaded Rod into Normal-Weight Concrete[1,2,3,4,5,6]

Rod / Anchor Diameter d_a in.	Nominal ANSI Drill Bit Diameter d_{bit}	Embedment Depth h_{nom} in. (mm)	Based on Bond/Concrete Strength		Based on Steel Strength	
			Concrete Compressive Strength, f 'c ≥ 3,000 psi		ASTM A36 / A307 Grade C ASTM F1554, Grade 36 (F_u = 58,000 psi)	ASTM A193, Grade B7 (F_u = 125,000 psi)
			Tension		Tension	Tension
			Ultimate lbs. (kN)	Allowable lbs. (kN)	Allowable lbs. (kN)	Allowable lbs. (kN)
3/8	7/16	3-3/8 (86)	8,090 (36.0)	2,025 (9.0)	2,115 (9.4)	4,555 (20.3)
1/2	9/16	4-1/2 (114)	13,065 (58.1)	3,265 (14.5)	3,760 (16.7)	8,100 (36.0)
5/8	11/16 or 3/4	5-5/8 (143)	21,045 (93.6)	5,260 (23.4)	5,870 (26.1)	12,655 (56.3)
3/4	7/8	6-3/4 (171)	28,055 (124.8)	7,015 (31.2)	8,455 (37.6)	18,225 (81.1)
1	1-1/8	9 (229)	47,970 (213.4)	11,995 (53.4)	15,035 (66.9)	32,400 (144.1)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety.
2. The tabulated load values are applicable to single anchor installed at critical edge and spacing distances and where the minimum member thickness is greater than or equal to 1.5*h_{nom}.
3. The tabulated load values are for applicable for dry or wet concrete. Holes must be drilled with a hammer drill and an ANSI carbide drill bit.
4. Adhesives experiences reductions in capacity at elevated temperature. Tabulated load values are applicable for temperature range of 40ºF - 130ºF (4ºC - 54ºC).
5. Allowable bond/concrete strength capacities must be checked against allowable steel strength.
6. Allowable shear capacity is controlled by allowable steel strength for the given conditions.

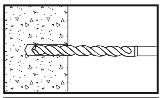
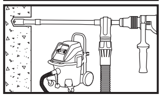
Ultimate and Allowable Load Capacities for Pure GP Adhesive Installed with Reinforcing Bar into Normal-Weight Concrete[1,2,3,4,5,6]

Rod / Anchor Diameter d_a in.	Nominal ANSI Drill Bit Diameter d_{bit}	Embedment Depth h_{nom} in. (mm)	Based on Bond/Concrete Strength		Based on Steel Strength	
			Concrete Compressive Strength, f 'c ≥ 3,000 psi		ASTM A 706, Grade 60 (F_u = 80,000 psi, F_y = 60,000 psi)	ASTM A 615, Grade 60 (F_u = 90,000 psi, F_y = 60,000 psi)
			Tension		Tension	Tension
			Ultimate lbs. (kN)	Allowable lbs. (kN)	Allowable lbs. (kN)	Allowable lbs. (kN)
#3 (3/8)	7/16	3-3/8 (86)	8,855 (39.4)	2,215 (9.9)	2,650 (11.8)	2,650 (11.8)
#4 (1/2)	5/8	4-1/2 (114)	15,015 (66.8)	3,755 (16.7)	4,710 (21.0)	4,710 (21.0)
#5 (5/8)	3/4	5-5/8 (143)	22,025 (98.0)	5,505 (24.5)	7,365 (32.8)	7,365 (32.8)
#6 (3/4)	7/8	6-3/4 (171)	28,910 (128.6)	7,230 (32.2)	10,605 (47.2)	10,605 (47.2)
#8 (1)	1-1/8	9 (229)	49,940 (222.1)	12,485 (55.5)	18,850 (83.8)	18,850 (83.8)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety.
2. The tabulated load values are applicable to single anchor installed at critical edge and spacing distances and where the minimum member thickness is greater than or equal to 1.5*h_{nom}.
3. The tabulated load values are for applicable for dry or wet concrete. Holes must be drilled with a hammer drill and an ANSI carbide drill bit.
4. Adhesives experiences reductions in capacity at elevated temperature. Tabulated load values are applicable for temperature range of 40ºF - 130ºF (4ºC - 54ºC).
5. Allowable bond/concrete strength capacities must be checked against allowable steel strength.
6. Allowable shear capacity is controlled by allowable steel strength for the given conditions.

INSTALLATION INSTRUCTIONS (SOLID BASE MATERIALS)

DRILLING

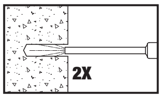



1- Drill a hole into the base material with rotary hammer drill (i.e. percussion drill) and a carbide drill bit to the size and embedment required by the selected steel hardware element (reference installation specifications for threaded rod and reinforcing bar). The tolerances of the carbide drill bits, including hollow bits, must meet ANSI Standard B212.15.

- Precaution: Use suitable eye and skin protection. Avoid inhalation of dust during drilling and/or removal.
- Note! In case of standing water in the drilled hole (flooded hole condition), all the water has to be removed from the hole (e.g. vacuum, compressed air, etc.) prior to cleaning.

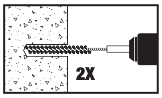
Drilling in dry base materials is recommended when using hollow drill bits (vacuum must be on).

HOLE CLEANING DRY OR WET HOLES (BLOW 2X, BRUSH 2X, BLOW 2X)



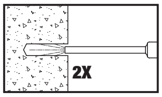
2a- Starting from the bottom or back of the drilled anchor hole, blow the hole clean (free of noticeable dust) a minimum of two times (2x).

- Use a compressed air nozzle (min. 90 psi) for all sizes of anchor rod and reinforcing bar (rebar).



2b- Determine wire brush diameter (see installation specifications) for the drilled hole and attach the brush with adaptor to a rotary drill tool or battery screw gun. Brush the hole with the selected wire brush a minimum of two times (2x). A brush extension (supplied by DEWALT) must be used for holes drilled deeper than the listed brush length.

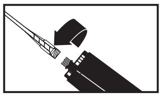
- The wire brush diameter must be checked periodically during use. The brush should resist insertion into the drilled hole, if it does not come into contact with the sides of the drilled hole, the brush is too small and must be replaced.



2c- Repeat Step 2a- again by blowing the hole clean a minimum of two times (2x).

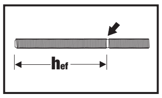
- When finished the hole should be clean and free of dust, debris, ice, grease, oil or other foreign material.

PREPARING

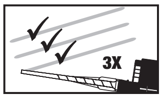


3- Check adhesive expiration date on cartridge label. Do not use expired product. Review Safety Data Sheet (SDS) before use. Cartridge temperature must be between 50°F - 104°F (10°C - 40°C) when in use. For best manual dispensing experience, the suggested minimum cartridge adhesive temperature is 68°F (20°C). Review published working and cure times. Consideration should be given to the reduced gel (working) time of the adhesive in warm temperatures. For permitted range of the base material temperature, see published gel and curing times.

- Attach a supplied mixing nozzle to the cartridge. Do not modify the mixer in any way and make sure the mixing element is inside the nozzle. Load the cartridge into the correct dispensing tool.
- Note: Always use a new mixing nozzle with new cartridge of adhesive and also for all work interruptions exceeding the published gel (working) time of the adhesive.



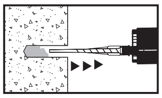
4- Prior to inserting the anchor rod or rebar into the filled bore hole, the position of the embedment depth has to be marked on the anchor. Verify anchor element is straight and free of surface damage.



5- Adhesives must be properly mixed to achieve published properties. Prior to dispensing adhesive into the drilled hole, separately dispense at least three full strokes of adhesive through the mixing nozzle until the adhesive is a consistent **GRAY** color.

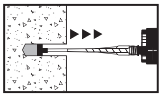
- Review and note the published working and cure times (reference gel time and curing time table) prior to injection of the mixed adhesive into the cleaned anchor hole.

INSTALLATION

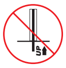


6- Fill the cleaned hole approximately two-thirds full with mixed adhesive starting from the bottom or back of the anchor hole. Slowly withdraw the mixing nozzle as the hole fills to avoid creating air pockets or voids. For embedment depth greater than 8 inches an extension nozzle must be used with the mixing nozzle.

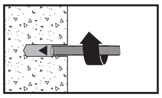
WITH PISTON PLUG:



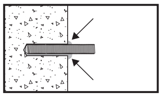
- Piston plugs (see adhesive piston plug table) must be used with and attached to the mixing nozzle and extension tube for horizontal installations where embedment is greater than 8 inches in concrete with anchor rod from 5/8" to 1" diameter and rebar sizes #5 to #8. Insert piston plug to the back of the drilled hole and inject as described in the method above. During installation the piston plug will be naturally extruded from the drilled hole by the adhesive pressure.



Attention! Do not install anchors overhead or upwardly inclined.

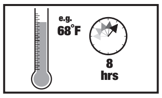


7- The anchor should be free of dirt, grease, oil or other foreign material. Push clean threaded rod or reinforcing bar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached. Observe the gel (working) time.



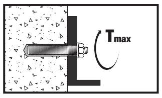
8- Ensure that the anchor element is installed to the specific embedment depth. Adhesive must completely fill the annular gap at the concrete surface. Following installation of the anchor element, remove excess adhesive. Protect the anchor element threads from fouling with adhesive. For all installations the anchor element must be fully restrained from movement throughout the specified curing period, where necessary through the use of temporary wedges, external supports, or other methods. Minor adjustment to the position of the anchor element may be performed during the gel time only.

CURING AND LOADING



9- Allow the adhesive anchor to cure to the specified full curing time prior to applying any load (reference gel time and curing time table).

- Do not disturb, torque or load the anchor until it is fully cured.



10- After full curing of the adhesive anchor, a fixture can be installed to the anchor and tightened up to the maximum torque (reference gel time and curing table) by using a calibrated torque wrench.

- Take care not to exceed the maximum torque for the selected anchor.

ORDERING INFORMATION

Pure GP Cartridges

Cat No.	Description	Std. Carton	Pallet
08821	Pure GP 21 fl. oz. cartridge	12	540
Pure GP mixing nozzles must be used to ensure complete and proper mixing of the adhesive.			

Cartridge System Mixing Nozzles

Cat. No.	Description	Std. Pkg.	Std. Ctn.
08294	Mixing nozzle (with 8" extension)	2	24
08281	Mixing nozzle extension, 8" long	2	24
08297	Mixing nozzle extension, 20" long	1	12

Dispensing Tools for Injection Adhesive

Cat No.	Description	Std. Box	Std. Carton
08409	21 fl. oz. Standard metal manual tool	1	10
08421	21 fl. oz. High performance manual tool	1	10
08459	21 fl. oz. Pneumatic tool	1	-
DCE591D1	21 fl. oz. 20v Battery powered dispensing tool	1	-

Hole Cleaning Tools and Accessories

Cat No.	Description	Std. Box
08284	Wire brush for 7/16" or 1/2" ANSI hole, 6-3/4" length	1
08285	Wire brush for 9/16" ANSI hole, 6-3/4" length	1
08275	Wire brush for 5/8" ANSI hole, 6-3/4" length	1
08286	Wire brush for 11/16" ANSI hole, 7-7/8" length	1
08278	Wire brush for 3/4" ANSI hole, 7-7/8" length	1
08287	Wire brush for 7/8" ANSI hole, 7-7/8" length	1
08288	Wire brush for 1" ANSI hole, 11-7/8" length	1
08289	Wire brush for 1-1/8" ANSI hole, 11-7/8" length	1
08283	SDS-plus adapter for steel brushes	1
08296	Standard drill adapter for steel brushes (e.g. Jacobs Chuck)	1
08282	Steel brush extension, 12" length	1
08292	Air compressor nozzle with extension, 18" length	1

Adhesive Piston Plugs

Cat No.	Description	ANSI Drill Bit Dia.	Std. Bag
08302	9/16" Plug	9/16"	10
08304	5/8" Plug	5/8"	10
08258	11/16" Plug	11/16"	10
08259	3/4" Plug	3/4"	10
08300	7/8" Plug	7/8"	10
08301	1" Plug	1"	10
08303	1-1/8" Plug	1-1/8"	10

GENERAL INFORMATION

PE1000+®

Epoxy Injection Adhesive Anchoring System

PRODUCT DESCRIPTION

The PE1000+ is a two-component, high strength adhesive anchoring system. The system includes injection adhesive in plastic cartridges, mixing nozzles, dispensing tools and hole cleaning equipment. The PE1000+ is designed for bonding threaded rod and reinforcing bar hardware into drilled holes in concrete and solid masonry base materials.

GENERAL APPLICATIONS AND USES

- Bonding threaded rod and reinforcing bar into hardened concrete and grouted masonry units
- Evaluated for use in dry and water-saturated concrete (including water-filled holes)
- Cracked and uncracked concrete
- Seismic and wind loading
- Hammer-drill and diamond core drilled hole
- Oversized hammer-drilled holes in concrete, for short term loading only (contact DEWALT for details)
- Can be installed in a wide range of base material temperatures

FEATURES AND BENEFITS

\+ Designed for use with threaded rod and reinforcing bar hardware elements
\+ Consistent performance in low and high strength concrete (2,500 to 8,500 psi)
\+ Evaluated and recognized for freeze/thaw performance
\+ Evaluated and recognized for long term and short term loading (see performance tables for applicable temperature ranges)
\+ Evaluated and recognized for variable embedments (see installation specifications)
\+ Cartridge design allows for multiple uses using extra mixing nozzles
\+ Mixing nozzles proportion adhesive and provide simple delivery method into drilled holes
\+ Easy dispensing reduces applicator fatigue

APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES) ESR-2583
- Code compliant with the 2015 IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, and 2009 IRC
- Tested in accordance with ACI 355.4 and AC308 for use in structural concrete according to (Strength Design) ACI 318-14 Chapter 17 and ACI 318-11/08 Appendix D.
- Evaluated and qualified by an accredited independent testing laboratory for recognition in cracked and uncracked concrete including seismic and wind loading
- Compliant with NSF/ANSI Standard 61 for drinking water system components – health effects; minimum requirements for materials in contact with potable waterand water treatment
- Conforms to requirements of ASTM C 881 and AASHTO M235, Types I, II, IV and V, Grade 3, Classes B & C (also meets type III except for elongation)
- Department of Transportation listings – see www.DEWALT.com or contact transportation agency

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Adhesive anchoring system shall be PE1000+ as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and requirements of the Authority Having Jurisdiction.

SECTION CONTENTS

PACKAGING

Dual (side-by-side) Cartridge

- 13 fl. oz. (385 ml), 3:1 mix ratio
- 20 fl. oz. (585ml), 3:1 mix ratio

STORAGE LIFE & CONDITIONS

Two years in a dry, dark environment with temperature ranging from 41ºF to 95ºF (5ºC to 35ºC)

ANCHOR SIZE RANGE (TYPICAL)

- 3/8" to 1-1/4" diameter threaded rod
- No. 3 to No. 10 reinforcing bar (rebar)

SUITABLE BASE MATERIALS

- Normal-weight concrete
- Lightweight concrete
- Grouted concrete masonry

PERMISSIBLE INSTALLATION CONDITIONS (ADHESIVE)

- Dry concrete
- Water-saturated concrete (wet)
- Water-filled holes (flooded)

TENSION ZONE CRACKED CONCRETE
SEISMIC REGION QUALIFICATION
CODE LISTED ICC-ES ESR-2583 CONCRETE
DDA DEWALT DESIGN ASSIST™

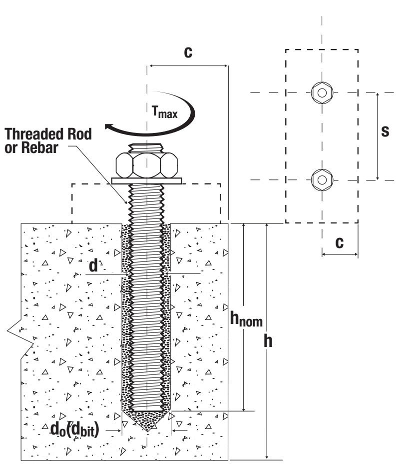
REFERENCE DATA (ASD)

Installation Table for PE1000+ (Solid Concrete Base Materials)

Dimension/Property	Notation	Units	Nominal Anchor Size									
Threaded Rod	-	-	3/8"	1/2"	-	5/8"	3/4"	7/8"	1"	-	1-1/4"	-
Reinforcing Bar	-	-	#3	-	#4	#5	#6	#7	#8	#9	-	#10
Nominal anchor diameter	d	in. (mm)	0.375 (9.5)	0.500 (12.7)		0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.125 (28.6)	1.250 (31.8)	1.250 (31.8)
Carbide drill bit nominal size	d_o [d_{bit}]	in.	7/16 ANSI	9/16 ANSI	5/8 ANSI	11/16 or 3/4 ANSI	7/8 ANSI	1 ANSI	1-1/8 ANSI	1-3/8 ANSI	1-3/8 ANSI	1-1/2 ANSI
Diamond core bit nominal size	d_o [d_{bit}]	in.	-	5/8		3/4	7/8	1	1-1/8	-	-	-
Minimum nominal embedment	h_{nom}	in. (mm)	2-3/8 (61)	2-3/4 (70)		3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	4-1/2 (114)	5 (127)	5 (127)
Minimum spacing distance	s_{min}	in. (mm)	1-7/8 (48)	2-1/2 (62)		3-1/8 (80)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)	6-1/4 (159)
Minimum edge distance	c_{min}	in (mm)	5d where d is nominal outside diameter of the anchor									
Minimum edge distance, reduced[4]	$c_{min,red}$	in (mm)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	2-3/4 (70)	2-3/4 (70)	2-3/4 (70)
Max. Torque[1]	T_{max}	ft-lbs	15	33		60	105	125	165	200	280	280
Max. Torque[1,2] (A36/Grade 36 rod)	T_{max}	ft-lbs	10	25		50	90	125	165	N/A	280	N/A
Max. Torque[1,3] (Class 1 SS rod)	T_{max}	ft-lbs	5	20		40	60	100	165	N/A	280	N/A
Effective cross sectional area of threaded rod	A_{se}	in.^{2} (mm^2)	0.078 (50)	0.142 (92)		0.226 (146)	0.335 (216)	0.462 (298)	0.606 (391)	-	0.969 (625)	-
Effective cross sectional area of reinforcing bar	A_{se}	in.^{2} (mm^2)	0.110 (71)	0.200 (129)		0.310 (200)	0.440 (284)	0.600 (387)	0.790 (510)	1.000 (645)	-	1.270 (819)

1. Torque may not be applied until the full cure time of the adhesive has been achieved.
2. Applies to ASTM A36/F 1554 Grade 36 carbon steel threaded rods only.
3. These torque values apply to ASTM A193 Grade B8/B8m (Class 1) stainless steel threaded rods only.
4. For installations at the reduced minimum edge, $c_{min,red}$, the max torque, T_{max}, must be multiplied by a reduction factor of 0.45.

Detail of Steel Hardware Elements used with Injection Adhesive System



Nomenclature

d = Diameter of anchor
d_{bit} = Diameter of drilled hole
h = Base material thickness
The minimum value of h should be $1.5h_{nom}$ or 3", whichever is greater.
h_{nom} = Minimum embedment depth

Steel Description (General)	Steel Specification (ASTM)	Nominal Anchor Size (inch)	Minimum Yield Strength fy (ksi)	Minimum Ultimate Strength fu (ksi)
Carbon Rod	A 36 or F 1554, Grade 36	3/8 through 1-1/4	36.0	58.0
	F 1554 Grade 55		55.0	75.0
	A 193, Grade B7 or F 1554, Grade 105		105.0	125.0
Stainless Rod (Alloy 304 / 316)	F 593 Condition CW	3/8 through 5/8	65.0	100.0
		3/4 through 1-1/4	45.0	85.0
Grade 60 Reinforcing Bar	A 615, or A 767, A 996	3/8 through 1-1/4 (#3 through #10)	60.0	90.0
Grade 40 Reinforcing Bar	A 615	3/8 through 3/4 (#3 through #6)	40.0	60.0

Allowable Load Capacities for PE1000+ Installed into Uncracked Normal-Weight Concrete with Threaded Rod and Reinforcing Bar (Based on Bond Strength/Concrete Capacity)[1,2,3,4,5,6]

ALLOWABLE STRESS DESIGN ASD

Nominal Rod/Rebar Size (in. or #)	Minimum Embedment Depth (in.)	Minimum Concrete Compressive Strength, (f'c)			
		3,000 psi	4,000 psi	5,000 psi	6,000 psi
		Tension (lbs)			
3/8 or #3	2-3/8	1,195	1,235	1,270	1,300
	3-1/2	1,760	1,825	1,875	1,915
	4-1/2	2,265	2,345	2,410	2,460
1/2 or #4	2-3/4	1,770	1,835	1,885	1,925
	4-3/8	2,820	2,915	2,995	3,065
	6	3,865	4,000	4,110	4,200
5/8 or #5	3-1/8	2,420	2,505	2,575	2,630
	5-1/4	4,145	4,290	4,405	4,505
	7-1/2	5,970	6,180	6,345	6,485
3/4 or #6	3-1/2	2,870	2,970	3,050	3,120
	6-1/4	5,715	5,915	6,075	6,210
	9	8,560	8,860	9,100	9,300
7/8 or #7	3-1/2	2,870	2,970	3,050	3,120
	7	7,285	7,540	7,745	7,915
	10-1/2	11,700	12,110	12,440	12,715
1 or #8	4	3,505	3,630	3,725	3,810
	8	9,570	9,905	10,175	10,400
	12	15,635	16,185	16,625	16,990
1-1/8 or #9	4-1/2	4,185	4,330	4,445	4,545
	9	12,025	12,445	12,785	13,065
	13-1/2	19,865	20,560	21,120	21,585
1-1/4 or #10	5	4,900	5,070	5,210	5,325
	10	15,030	15,560	15,980	16,335
	15	25,165	26,045	26,755	27,345

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
3. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances and at the minimum member thickness.
4. The tabulated load values are for applicable for dry concrete. Holes must be drilled with a hammer drill and an ANSI carbide drill bit. Installations in wet concrete or in water-filled holes may require a reduction in capacity. Contact DEWALT for more information concerning these installation conditions.
5. Adhesives experience reductions in capacity at elevated temperatures. See the in-service temperature chart for allowable load capacity reduction factors.
6. Allowable bond strength/concrete capacity must be checked against allowable steel strength in tension to determine the controlling allowable load. Allowable shear capacity is controlled by steel strength for the given conditions.

ALLOWABLE STRESS DESIGN ASD

Allowable Load Capacities for Threaded Rod and Reinforcing Bar (Based on Steel Strength)[1,2,3,4,5]

Nominal Rod Diameter or Rebar Size (in. or #)	Steel Elements - Threaded Rod and Reinforcing Bar																	
	A36 or F1554, Grade 36		A36 or F1554, Grade 55		A 193, Grade B7 or F1554, Grade 105		F 593, CW (SS)		ASTM A615 Grade 40 Rebar		ASTM A615 Grade 60 Rebar		ASTM A706 Grade 60 Rebar		ASTM A615 Grade 75 Rebar		ASTM A706 Grade 80 Rebar	
	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)	Tension lbs. (kN)	Shear lbs (kN)	Tension lbs. (kN)	Shear lbs (kN)	Tension lbs. (kN)	Shear lbs (kN)
3/8 or #3	2,115 (9.4)	1,090 (4.8)	2,735 (12.2)	1,410 (6.3)	4,555 (20.3)	2,345 (10.4)	3,645 (16.2)	1,880 (8.4)	2,210 (9.8)	1,125 (5.0)	2,650 (11.8)	1,690 (7.5)	2,650 (11.8)	1,500 (6.7)	2,650 (11.8)	1,875 (8.3)	2,650 (11.8)	1,875 (8.3)
1/2 or #4	3,760 (16.7)	1,935 (8.6)	4,860 (21.6)	2,505 (11.1)	8,100 (36.0)	4,170 (18.5)	6,480 (28.8)	3,340 (14.9)	3,925 (17.5)	2,005 (8.9)	4,710 (21.0)	3,005 (13.4)	4,710 (21.0)	2,670 (11.9)	4,710 (21.0)	3,335 (14.8)	4,710 (21.0)	3,335 (14.8)
5/8 or #5	5,870 (26.1)	3,025 (13.5)	7,595 (33.8)	3,910 (17.4)	12,655 (56.3)	6,520 (29.0)	10,125 (45.0)	5,215 (23.2)	6,135 (27.3)	3,130 (13.9)	7,365 (32.8)	4,695 (20.9)	7,365 (32.8)	4,170 (18.5)	7,365 (32.8)	5,215 (23.2)	7,365 (32.8)	5,215 (23.2)
3/4 or #6	8,455 (37.6)	4,355 (19.4)	10,935 (48.6)	5,635 (25.1)	18,225 (81.1)	9,390 (41.8)	12,390 (55.1)	6,385 (28.4)	8,835 (39.3)	4,505 (20.0)	10,605 (47.2)	6,760 (30.1)	10,605 (47.2)	6,010 (26.7)	10,605 (47.2)	7,510 (33.4)	10,605 (47.2)	7,510 (33.4)
7/8 or #7	11,510 (51.2)	5,930 (26.4)	14,885 (66.2)	7,665 (34.1)	24,805 (110.3)	12,780 (56.8)	16,865 (75.0)	8,690 (38.7)	-	-	14,430 (64.2)	9,200 (40.9)	14,430 (64.2)	8,180 (36.4)	14,430 (64.2)	10,220 (45.5)	14,430 (64.2)	10,220 (45.5)
1 or #8	15,035 (66.9)	7,745 (34.5)	19,440 (86.5)	10,015 (44.5)	32,400 (144.1)	16,690 (74.2)	22,030 (98.0)	11,350 (50.5)	-	-	18,850 (83.8)	12,015 (53.4)	18,850 (83.8)	10,680 (47.5)	18,850 (83.8)	13,350 (59.4)	18,850 (83.8)	13,350 (59.4)
#9	-	-	-	-	-	-	-	-	-	-	23,985 (106.7)	15,290 (68.0)	23,985 (106.7)	13,590 (60.5)	23,985 (106.7)	16,990 (75.6)	23,985 (106.7)	16,990 (75.6)
1-1/4	23,490 (104.5)	12,100 (53.8)	30,375 (135.1)	15,645 (69.6)	50,620 (225.2)	26,080 (116.0)	34,425 (153.1)	17,735 (78.9)	-	-	-	-	-	-	-	-	-	-
#10	-	-	-	-	-	-	-	-	-	-	30,405 (135.2)	19,380 (86.2)	30,405 (135.2)	17,230 (76.6)	30,405 (135.2)	21,535 (95.8)	30,405 (135.2)	21,535 (95.8)

1. AISC defined steel strength (ASD) for threaded rod: Tensile = 0.33 • F_u • A_{nom}, Shear = 0.17 • F_u • A_{nom}
2. For reinforcing bars: The allowable steel tensile strength is based on 20 ksi for Grade 40 and 24 ksi for Grade 60 and higher, applied to the cross sectional area of the bar; allowable steel shear strength = 0.17 • F_u • A_{nom}
3. Allowable load capacities are calculated for the steel element type. Consideration of applying additional safety factors may be necessary depending on the application, such as life safety or overhead.
4. Allowable steel strength in tension must be checked against allowable bond strength/concrete capacity in tension to determine the controlling allowable load.
5. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances and where the minimum member thickness is the greater of [h_{nom} + 1-1/4"] and [h_{nom} + $2d_{bit}$]

In-Service Temperature Chart for Allowable Load Capacities[1]

Base Material Temperature		Bond Strength Reduction Factor for Temperature
°F	°C	
41	5	1.00
50	10	1.00
68	20	1.00
75	14	1.00
104	40	0.85
110	43	0.82
122	50	0.76
140	60	0.69

1. Linear interpolation may be used to derive reduction factors between those listed.

Ultimate Load Capacities for Threaded Rod Installed with PE1000+ into the Block Face of Grout-Filled Concrete Masonry Walls[1,2]

ALLOWABLE STRESS DESIGN ASD

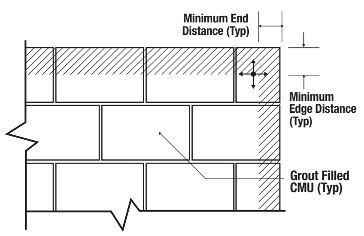
Nominal Rod Diameter d. in.	Drill Diameter d_{bit} in.	Minimum Embedment Depth in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Ultimate Load[3]		Allowable Load	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/8	7/16	3 (76.2)	2-1/2 (63.5)	2-1/2 (63.5)	3,350 (14.9)	2,100 (9.3)	670 (2.9)	420 (1.9)
1/2	9/16	4 (101.6)	3 (76.2)	3 (76.2)	4,575 (20.3)	2,550 (11.3)	915 (4.1)	510 (2.3)
5/8	11/16	5 (127.0)	3-3/4 (95.3)	4 (101.6)	6,900 (30.7)	5,275 (23.5)	1,380 (6.1)	1,055 (4.7)

1. Tabulated load values are for anchors installed in minimum 8" wide, minimum Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90 that have reached a designated minimum compressive strength at the time of installation (f'm ≥1,500 psi). Mortar must be type N, S or M.
2. Anchor installations are limited to one per masonry cell. Shear loads may be applied in any direction.
3. The values listed are ultimate load capacities which should be reduced by a minimum safety factor of 5.0 or greater to determine the allowable working load. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety.

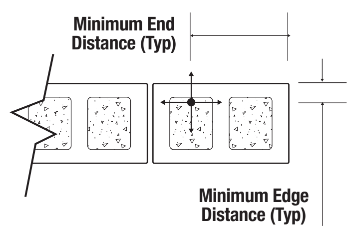
Load Capacities for Threaded Rod Installed with PE1000+ in the Top of Grout-Filled Concrete Masonry Walls[1,2]

Nominal Rod Diameter d. in.	Drill Diameter d_{bit} in.	Minimum Embedment Depth in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Ultimate Load[3]		Allowable Load	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/2	9/16	6 (152.4)	1-3/4 (44.5)	3 (76.2)	5,950 (26.4)	1,450 (6.5)	1,190 (5.3)	290 (1.3)
5/8	11/16	8 (203.2)	1-3/4 (44.5)	4 (101.6)	9,450 (42.0)	1,700 (7.5)	1,890 (8.4)	340 (1.4)

1. Tabulated load values are for anchors installed in a minimum Grade N, Type II, lightweight, medium-weight or normal-weight masonry units conforming to ASTM C 90 that have reached a designated minimum compressive strength at the time of installation (f'm ≥1,500 psi). Mortar must be type N, S or M.
2. Anchor installations are limited to one per masonry cell. Shear loads may be applied in any direction.
3. The values listed are ultimate load capacities which should be reduced by a minimum safety factor of 5.0 or greater to determine the allowable working load. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety.



Face Shell Permissible Anchor Locations
(Un-hatched Area / Through Face Shell)



Top of Wall

STRENGTH DESIGN (SD)

Installation Specifications for Threaded Rod and Reinforcing Bar[1]

CODE LISTED ICC-ES ESR-2583

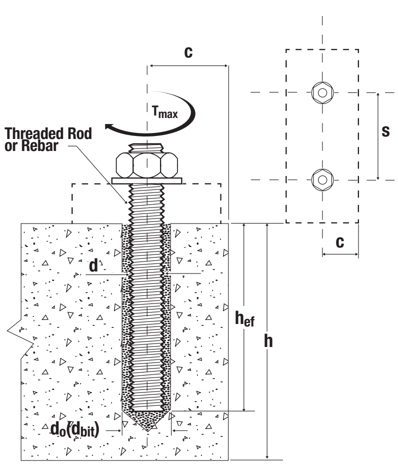
STRENGTH DESIGN SD TABLES

Dimension/Property	Notation	Units	Nominal Anchor Size									
Threaded Rod	-	-	3/8"	1/2"	-	5/8"	3/4"	7/8"	1"	-	1-1/4"	-
Reinforcing Bar	-	-	#3	-	#4	#5	#6	#7	#8	#9	-	#10
Nominal anchor diameter	d	in. (mm)	0.375 (9.5)	0.500 (12.7)		0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.125 (28.6)	1.250 (31.8)	1.250 (31.8)
Carbide drill bit nominal size	d_o [d_{bit}]	in.	7/16 ANSI	9/16 ANSI	5/8 ANSI	11/16 or 3/4 ANSI	7/8 ANSI	1 ANSI	1-1/8 ANSI	1-3/8 ANSI	1-3/8 ANSI	1-1/2 ANSI
Diamond core bit nominal size	d_o [d_{bit}]	in.	-	5/8		3/4	7/8	1	1-1/8	-	-	-
Minimum embedment	$h_{ef,min}$	in. (mm)	2-3/8 (61)	2-3/4 (70)		3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	4-1/2 (114)	5 (127)	5 (127)
Maximum embedment[4]	$h_{ef,max}$	in. (mm)	4-1/2 (114)	10 (254)		12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)	22-1/2 (572)	25 (635)	25 (635)
Minimum concrete member thickness	h_{min}	in. (mm)	h_{ef} + 1-1/4 (h_{ef} + 30)			$h_{ef} + 2d_o$						
Minimum spacing distance	s_{min}	in. (mm)	1-7/8 (48)	2-1/2 (62)		3-1/8 (80)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)	6-1/4 (159)
Minimum edge distance	c_{min}	in (mm)	5d where d is nominal outside diameter of the anchor									
Minimum edge distance, reduced5	$c_{min,red}$	in (mm)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	2-3/4 (70)	2-3/4 (70)	2-3/4 (70)
Max. Torque[2]	T_{max}	ft-lbs	15	33		60	105	125	165	200	280	280
Max. Torque[2,3] (A36/Grade 36 rod)	T_{max}	ft-lbs	10	25		50	90	125	165	N/A	280	N/A
Max. Torque[2,4] (Class 1 SS rod)	T_{max}	ft-lbs	5	20		40	60	100	165	N/A	280	N/A
Effective cross sectional area of threaded rod	A_{se}	in.² (mm²)	0.078 (50)	0.142 (92)		0.226 (146)	0.335 (216)	0.462 (298)	0.606 (391)	-	0.969 (625)	-
Effective cross sectional area of reinforcing bar	A_{se}	in.² (mm²)	0.110 (71)	0.200 (129)		0.310 (200)	0.440 (284)	0.600 (387)	0.790 (510)	1.000 (645)	-	1.270 (819)

For SI: 1 inch = 25.4 mm, 1 ft-lbf = 1.356 N-m. For pound-inch units: 1 mm = 0.03937 inch, 1 N-m = 0.7375 ft-lbf.

1. For use with the design provisions of ACI 318-14 Ch.17 or ACI 318-11 Appendix D as applicable, ICC-ES AC308 Section 4.2 and ESR-2583
2. Torque may not be applied to the anchors until the full cure time of the adhesive has been achieved
3. These torque values apply to ASTM A36/F 1554 Grade 36 carbon steel threaded rods only.
4. These torque values apply to ASTM A197 Grade B8/BBM (Class 1) stainless steel threaded rods only
5. For installation at the reduced minimum edge distance, $c_{min,red}$, the max torque, T_{max} must be multiplied by a reduction factor of 0.45.
6. The maximum embedment is limited to 12 diameters for the horizontal and upwardly inclined installations and for installations in water-filled (flooded) holes with a carbide drill bit.

Detail of Steel Hardware Elements used with Injection Adhesive System



Steel Description (General)	Steel Specification (ASTM)	Nominal Anchor Size (inch)	Minimum Yield Strength f_y (ksi)	Minimum Ultimate Strength f_u (ksi)
Carbon Rod	A 36 or F 1554, Grade 36	3/8 through 1-1/4	36.0	58.0
	F 1554 Grade 55		55.0	75.0
	A 193, Grade B7 or F 1554, Grade 105		105.0	125.0
Stainless Rod (Alloy 304 / 316)	F 593 Condition CW	3/8 through 5/8	65.0	100.0
		3/4 through 1-1/4	45.0	85.0
Grade 60 Reinforcing Bar	A 615, or A 767, A 996	3/8 through 1-1/4 (#3 through #10)	60.0	90.0
	A 706		60.0	80.0
Grade 40 Reinforcing Bar	A 615	3/8 through 3/4 (#3 through #6)	40.0	60.0

Steel Tension and Shear Design for Threaded Rod in Normal Weight Concrete (For use with load combinations taken from ACI 318-14 Section 5.3)

CODE LISTED
ICC-ES ESR-2583

STRENGTH DESIGN SD TABLES

Design Information		Symbol	Units	Nominal Rod Diameter[1] (inch) 3/8	1/2	5/8	3/4	7/8	1	1-1/4
Threaded rod nominal outside diameter		d	inch (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.250 (31.8)
Threaded rod effective cross-sectional area		A_{se}	inch² (mm²)	0.0775 (50)	0.1419 (92)	0.2260 (146)	0.3345 (216)	0.4617 (298)	0.6057 (391)	0.9691 (625)
ASTM A 36 and ASTM F 1554 Grade 36	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	4,495 (20.0)	8,230 (36.6)	13,110 (58.3)	19,400 (86.3)	26,780 (119.1)	35,130 (156.3)	56,210 (250.0)
		V_{sa}	lbf (kN)	2,695 (12.0)	4,940 (22.0)	7,860 (35.0)	11,640 (51.8)	16,070 (71.4)	21,080 (93.8)	33,725 (150.0)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM F 1554 Grade 55	Nominal strength as governed by steel strength(for a single anchor)	N_{sa}	lbf (kN)	5,810 (25.9)	10,640 (47.3)	16,950 (75.4)	25,085 (111.6)	34,625 (154.0)	45,425 (202.0)	72,680 (323.3)
		V_{sa}	lbf (kN)	3,485 (15.5)	6,385 (28.4)	10,170 (45.2)	15,050 (67.0)	20,775 (92.4)	27,255 (121.2)	43,610 (194.0)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM A 193 Grade B7 and ASTM F 1554 Grade 105	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	9,685 (43.1)	17,735 (78.9)	28,250 (125.7)	41,810 (186.0)	57,710 (256.7)	75,710 (336.8)	121,135 (538.8)
		V_{sa}	lbf (kN)	5,815 (25.9)	10,640 (7.3)	16,950 (75.4)	25,085 (111.6)	34,625 (154.0)	45,425 (202.1)	72,680 (323.3)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM F 593 CW Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	7,750 (34.5)	14,190 (63.1)	22,600 (100.5)	28,430 (126.5)	39,245 (174.6)	51,485 (229.0)	82,370 (366.4)
		V_{sa}	lbf (kN)	4,650 (20.7)	8,515 (37.9)	13,560 (60.3)	17,060 (75.9)	23,545 (104.7)	30,890 (137.4)	49,425 (219.8)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[3]	ϕ	-	0.65						
	Strength reduction factor for shear[3]	ϕ	-	0.60						
ASTM A 193 Grade B8/B8M, Class 1 Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)[4]	N_{sa}	lbf (kN)	4,420 (19.7)	8,090 (36.0)	12,880 (57.3)	19,065 (84.8)	26,315 (117.1)	34,525 (153.6)	55,240 (245.7)
		V_{sa}	lbf (kN)	2,650 (11.8)	4,855 (21.6)	7,730 (34.4)	11,440 (50.9)	15,790 (70.2)	20,715 (92.1)	33,145 (147.4)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM A 193 Grade B8/ B8M2, Class 2B Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	7,365 (32.8)	13,480 (60.0)	21,470 (95.5)	31,775 (141.3)	43,860 (195.1)	57,545 (256.0)	92,065 (409.5)
		V_{sa}	lbf (kN)	4,420 (19.7)	8,085 (36.0)	12,880 (57.3)	19,065 (84.8)	26,315 (117.1)	34,525 (153.6)	55,240 (245.7)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						

For SI: 1 inch = 25.4 mm, 1 lbf = 4.448 N. For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf.

1. Values provided for steel element material types are based on minimum specified strengths and calculated in accordance with ACI 318-14 Eq. 17.4.1.2 and Eq. 17.5.1.2b or ACI 318-11 Eq. (D-2) and Eq. (D-29), as applicable, except where noted. Nuts and washers must be appropriate for the rod. Nuts must have specified proof load stresses equal to or greater than the minimum tensile strength of the specified threaded rod.
2. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4. Values correspond to ductile steel elements.
3. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4. Values correspond to brittle steel elements
4. In accordance with ACI 318-14 17.4.1.2 and 17.5.1.2 or ACI 318-11 D.5.1.2 and D.6.1.2, as applicable, the calculated values for nominal tension and shear strength for ASTM A193 Grade B8/B8M Class 1 stainless steel threaded rods are based on limiting the specified tensile strength of the anchor steel to 1.9fy or 57,000 psi (393 MPa).

Steel Tension and Shear Design for Reinforcing Bars in Normal Weight Concrete (For use with load combinations taken from ACI 318-14 Section 5.3)

CODE LISTED
ICC-ES ESR-2583

Design Information		Symbol	Units	Nominal Reinforcing Bar Size (Rebar)[1]							
				No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10
Rebar nominal outside diameter		d	inch (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.125 (28.7)	1.250 (32.3)
Rebar effective cross-sectional area		A_{se}	inch² (mm²)	0.110 (71.0)	0.200 (129.0)	0.310 (200.0)	0.440 (283.9)	0.600 (387.1)	0.790 (509.7)	1.000 (645.2)	1.270 (819.4)
ASTM A 615 Grade 75	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	11,000 (48.9)	20,000 (89.0)	31,000 (137.9)	44,000 (195.7)	60,000 (266.9)	79,000 (351.4)	100,000 (444.8)	127,000 (564.9)
		V_{sa}	lbf (kN)	6,600 (29.4)	12,000 (53.4)	18,600 (82.7)	26,400 (117.4)	36,000 (160.1)	47,400 (210.8)	60,000 (266.9)	76,200 (338.9)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[3]	ϕ	-	0.65							
	Strength reduction factor for shear[3]	ϕ	-	0.60							
ASTM A 615 Grade 60	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	9,900 (44.0)	18,000 (80.1)	27,900 (124.1)	39,600 (176.1)	54,000 (240.2)	71,100 (316.3)	90,000 (400.3)	114,300 (508.4)
		V_{sa}	lbf (kN)	5,940 (26.4)	10,800 (48.0)	16,740 (74.5)	23,760 (105.7)	32,400 (144.1)	42,660 (189.8)	54,000 (240.2)	68,580 (305.0)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75							
	Strength reduction factor for shear[2]	ϕ	-	0.65							
ASTM A 706 Grade 60	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	8,800 (39.1)	16,000 (71.2)	24,800 (110.3)	35,200 (156.6)	48,000 (213.5)	63,200 (281.1)	80,000 (355.9)	101,600 (452.0)
		V_{sa}	lbf (kN)	5,280 (23.5)	9,600 (42.7)	14,880 (66.2)	21,120 (94.0)	28,800 (128.1)	37,920 (168.7)	48,000 (213.5)	60,960 (271.2)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75							
	Strength reduction factor for shear[2]	ϕ	-	0.65							
ASTM A 615 Grade 40	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	6,600 (29.4)	12,000 (53.4)	18,600 (82.7)	26,400 (117.4)	In accordance with ASTM A 615, Grade 40 bars are furnished only in sizes No. 3 through No. 6			
		V_{sa}	lbf (kN)	3,960 (17.6)	7,200 (32.0)	11,160 (49.6)	15,840 (70.5)				
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80				
	Strength reduction factor for tension[2]	ϕ	-	0.75							
	Strength reduction factor for shear[2]	ϕ	-	0.65							

For SI: 1 inch = 25.4 mm, 1 lbf = 4.448 N. For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf.

1. Values provided for reinforcing bar material types based on minimum specified strengths and calculated in accordance with ACI 318-14 Eq. 17.4.1.2 and Eq. 17.5.1.2b or ACI 318-11 Eq. (D-2) and Eq. (D-29), as applicable.
2. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4. Values correspond to ductile steel elements. In accordance with ACI 318-14 17.2.3.4.3(a)(vi) or ACI 318-11 D.3.3.4.3(a)6, as applicable, deformed reinforcing bars meeting this specification used as ductile steel elements to resist earthquake effects shall be limited to reinforcing bars satisfying the requirements of ACI 318-14 20.2.2.4 and 20.2.2.5 or ACI 318-11 21.1.5.2 (a) and (b), as applicable.
3. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4. Values correspond to brittle steel elements.

Concrete Breakout Design Information for Threaded Rod and Reinforcing Bars (For use with loads combinations taken from ACI 318-14 Section 5.3)[1]

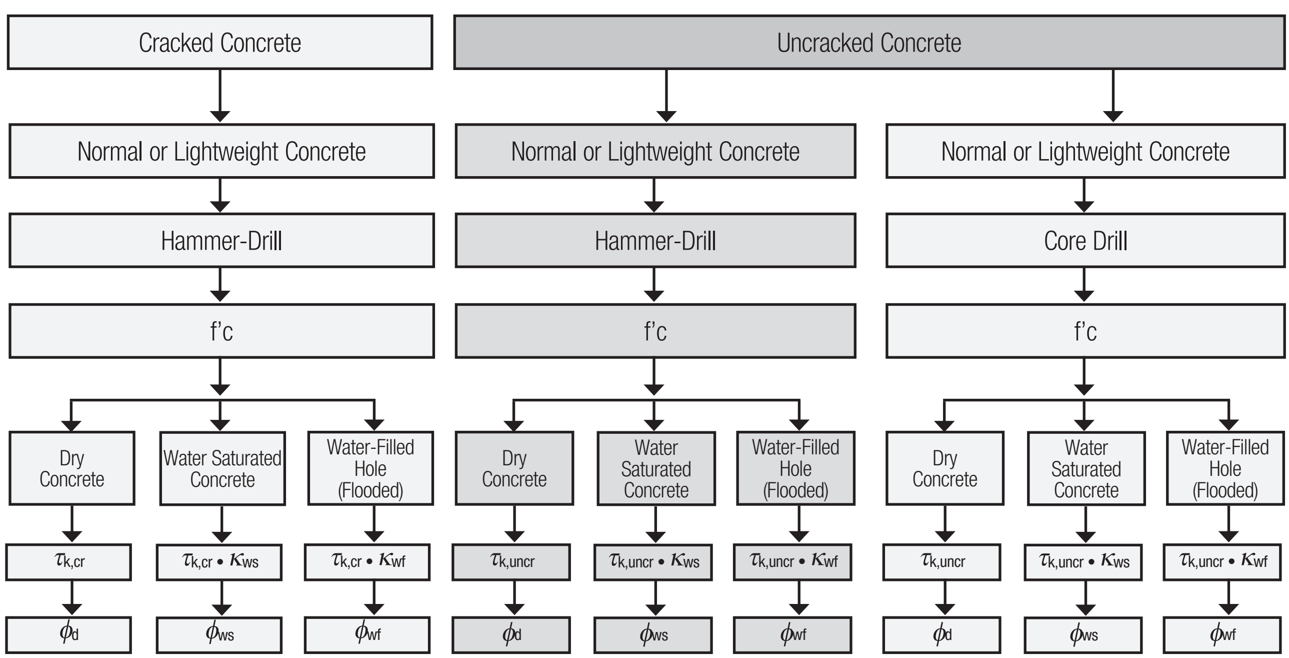
CODE LISTED ICC-ES ESR-2583

Design Information	Symbol	Units	Nominal Rod Diameter (inch) / Reinforcing Bar Size							
			3/8 or #3	1/2 or #4	5/8 or #5	3/4 or #6	7/8 or #7	1 or #8	#9	1-1/4 or #10
Effectiveness factor for cracked concrete	$k_{c,cr}$	- (SI)	Not Applicable	17 (7.1)						
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	- (SI)	24 (10.0)							
Minimum embedment	$h_{ef,min}$	inch (mm)	2-3/8 (60)	2-3/4 (70)	3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	4-1/2 (114)	5 (127)
Maximum embedment	$h_{ef,max}$	inch (mm)	7-1/2 (191)	10 (254)	12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)	22-1/2 (572)	25 (635)
Minimum anchor spacing	s_{min}	inch (mm)	1-7/8 (48)	2-1/2 (64)	3-1/8 (79)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)
Minimum edge distance[2]	c_{min}	inch (mm)	5*d* where *d* is nominal outside diameter of the anchor							
Minimum edge distance,reduced[2]	$c_{min,red}$	inch (mm)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	2-3/4 (70)	2-3/4 (70)
Minimum member thickness	h_{min}	inch (mm)	h_{ef} + 1-1/4 (h_{ef} + 30)		$h_{ef} + 2d_o$ where d_o is hole diameter;					
Critical edge distance—splitting (for uncracked concrete only)[3]	c_{ac}	inch	$c_{ac} = h_{ef}\cdot\left(\frac{\tau_{uncr}}{1160}\right)^{0.4}\cdot\left[3.1-0.7\frac{h}{h_{ef}}\right]$							
		(mm)	$c_{ac} = h_{ef}\cdot\left(\frac{\tau_{uncr}}{8}\right)^{0.4}\cdot\left[3.1-0.7\frac{h}{h_{ef}}\right]$							
Strength reduction factor for tension, concrete failure modes, Condition B[4]	ϕ	-	0.65							
Strength reduction factor for shear, concrete failure modes, Condition B[4]	ϕ	-	0.70							

For SI: 1 inch = 25.4 mm, 1 lbf = 4.448 N. For pound-inch units: 1 mm = 0.03937 inch, 1 N = 0.2248 lbf.

1. Additional setting information is described in the installation instructions.
2. For installation between the minimum edge distance, c_{min}, and the reduced minimum edge distance, $c_{min,red}$, the maximum torque applied must be reduced (multiplied) by a factor of 0.45.
3. $\tau_{k,uncr}$ need not be taken as greater than: $\tau_{k,uncr} = \frac{k_{uncr}\cdot\sqrt{h_{ef}\cdot f'_c}}{\pi\cdot d}$ and $\frac{h}{h_{ef}}$ need not be taken as larger than 2.4.
4. Condition A requires supplemental reinforcement, while Condition B applies where supplemental reinforcement is not provided or where pryout governs, as set forth in ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4.

FLOWCHART FOR THE ESTABLISHMENT OF DESIGN BOND STRENGTH



Bond Strength Design Information for Threaded Rods and Reinforcing Bars in Holes Drilled with a Hammer Drill and Carbide Bit (For use with load combinations taken from ACI 318-14 Section 5.3)[1]

STRENGTH DESIGN SD TABLES

Design Information		Symbol	Units	Nominal Rod Diameter (inch) / Reinforcing Bar Size							
				3/8 or #3	1/2 or #4	5/8 or #5	3/4 or #6	7/8 or #7	1 or #8	#9	11/4 or #10
Minimum embedment		$h_{ef,min}$	inch (mm)	2-3/8 (60)	2-3/4 (70)	3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102	4-1/2 (114)	5 (127)
Maximum embedment	Dry concrete and saturated concrete[7]	$h_{ef,max}$	inch (mm)	4-1/2 (114)	10 (254)	12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)	22-1/2 (572)	25 (635)
	Water-filled hole (flooded)	$h_{ef,max}$	inch (mm)	4-1/2 (114)	6 (152)	7-1/2 (190)	9 (225)	10-1/2 (267)	12 (305)	13-1/2 (343)	15 (381)
110°F (43°C) Maximum Long-Term Service Temperature; 140°F (60°C) Maximum Short-Term Service Temperature[2,4]	Characteristic bond strength in cracked concrete[5,8]	$\tau_{k,cr}$	psi (N/mm²)	N/A	576 (4.0)	474 (3.3)	441 (3.0)	416 (2.9)	416 (2.9)	416 (2.9)	416 (2.9)
	Characteristic bond strength in uncracked concrete[5,9]	$\tau_{k,uncr}$	psi (N/mm²)	1,223 (8.4)	1,156 (8.0)	1,106 (7.6)	1,067 (7.4)	1,036 (7.1)	1,010 (7.0)	986 (6.8)	966 (6.7)
110°F (43°C) Maximum Long-Term Service Temperature; 176°F (80°C) Maximum Short-Term Service Temperature[3,4]	Characteristic bond strength in cracked concrete[5,8]	$\tau_{k,cr}$	psi (N/mm²)	N/A	455 (3.1)	374 (2.6)	349 (2.4)	329 (2.3)	329 (2.3)	329 (2.3)	329 (2.3)
	Characteristic bond strength in uncracked concrete[5,9]	$\tau_{k,uncr}$	psi (N/mm²)	966 (6.7)	913 (6.3)	874 (6.0)	843 (5.8)	819 (5.6)	798 (5.5)	779 (5.4)	763 (5.3)
Permissible installation conditions[6]	Dry concrete	ϕ_d	-	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
	Water-saturated concrete	ϕ_{ws}	-	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
		κ_{ws}		0.93	0.9	0.96	1.0	1.0	1.0	1.0	0.99
	Water-filled hole (flooded)	ϕ_{wf}	-	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
		κ_{wf}		0.93	0.83	0.75	0.70	0.65	0.62	0.59	0.56
Reduction factor for seismic tension		$\alpha_{N,seis}$	-	1.0							

For SI: 1 inch = 25.4 mm, 1 psi = 0.006894 MPa. For pound-inch units: 1 mm = 0.03937 inch, 1 MPa = 145.0 psi.

1. Bond strength values correspond to a normal-weight concrete compressive strength f'c = 2,500 psi (17.2 MPa). For concrete compressive strength, f'c between 2,500 psi and 8,000 psi (17.2 MPa and 55.2 MPa), the tabulated characteristic bond strength may be increased by a factor of $(f'c / 2{,}500)^{0.12}$ [For SI: $(f'c / 17.2)^{0.12}$].
2. The maximum short-term service temperature may be increased to 162°F (72°C) provided characteristic bond strengths are reduced by 10 percent. Long-term and short-term temperatures meet the requirements of Section 8.5 of ACI 355.4 and Table 8.1, Temperature Category B.
3. Long-term and short-term temperatures meet the requirements of Section 8.5 of ACI 355.4 and Table 8.1, Temperature Category A.
4. Short-term base material service temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling. Long-term base material service temperatures are roughly constant over significant periods of time.
5. Characteristic bond strengths are for sustained loads including dead and live loads.
6. Permissible installation conditions include dry concrete, water-saturated concrete and water-filled holes. Water-filled holes include applications in dry or water-saturated concrete where the drilled holes contain standing water at the time of anchor installation.
7. Maximum embedment is limited to twelve anchor diameters for horizontal and upwardly inclined installations.
8. For structures assigned to Seismic Design Categories C, D, E or F, bond strength values for cracked concrete do not require an additional reduction factor applied for seismic tension ($\alpha_{N,seis}$ = 1.0), where seismic design is applicable.
9. Bond strength values for uncracked concrete are applicable for structures assigned to Seismic Design Categories A and B only.

Bond Strength Design Information for Threaded Rods and Reinforcing Bars in Holes Drilled with a Core Drill and Diamond Core Bit (For use with load combinations taken from ACI 318-14 Section 5.3)[1]

Design Characteristic		Notation	Units	Nominal Rod Diameter (inch) / Reforcing Bar Size				
				1/2" or #4	5/8" or #5	3/4" or #6	7/8" or #7	1" or #8
Minimum embedment		$h_{ef,min}$	in. (mm)	2-3/4 (70)	3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)
Maximum embedment[7]		$h_{ef,max}$	in. (mm)	10 (54)	12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)
110°F (43°C) Maximum Long-Term Service Temperature; 140°F (60°C) Maximum Short-Term Service Temperature[2,4]	Characteristic bond strength in uncracked concrete[5,8]	$\tau_{k,uncr}$	psi (N/mm²)	1,133 (7.8)	1,075 (7.4)	1,033 (7.1)	1,022 (6.9)	975 (6.7)
110°F (43°C) Maximum Long-Term Service Temperature; 176°F (80°C) Maximum Short-Term Service Temperature[3,4]	Characteristic bond strength in uncracked concrete[5,8]	$\tau_{k,uncr}$	psi (N/mm²)	895 (6.2)	849 (5.9)	816 (5.6)	791 (5.5)	770 (5.3)
Permissible Installation Conditions[6]	Dry concrete	ϕ_d	-	0.55	0.45	0.45	0.45	0.45
	Water-saturated concrete	ϕ_{ws}	-	0.45	0.45	0.45	0.45	0.45
		κ_{ws}	-	1.0	1.0	1.0	1.0	1.0
	Water-filled hole (flooded)	ϕ_{ws}	-	0.45	0.45	0.45	0.45	0.45
		κ_{wf}	-	0.94	0.95	0.95	0.95	0.96

For SI: 1 inch = 25.4 mm, 1 psi = 0.006894 MPa. For pound-inch units: 1 mm = 0.03937 inch, 1 MPa = 145.0 psi.

1. Bond strength values correspond to a normal-weight concrete compressive strength f'c = 2,500 psi (17.2 MPa). For concrete compressive strength, f'c between 2,500 psi and 8,000 psi (17.2 MPa and 55.2 MPa), the tabulated characteristic bond strength may be increased by a factor of $(f'c / 2{,}500)^{0.12}$ [For SI: $(f'c / 17.2)^{0.12}$].
2. The maximum short-term service temperature may be increased to 162°F (72°C) provided characteristic bond strengths are reduced by 10 percent. Long-term and short-term temperatures meet the requirements of Section 8.5 of ACI 355.4 and Table 8.1, Temperature Category B.
3. Long-term and short-term temperatures meet the requirements of Section 8.5 of ACI 355.4 and Table 8.1, Temperature Category A.
4. Short-term base material service temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling. Long-term base material service temperatures are roughly constant over significant periods of time.
5. Characteristic bond strengths are for sustained loads including dead and live loads.
6. Permissible installation conditions include dry concrete, water-saturated concrete and water-filled holes. Water-filled holes include applications in dry or water-saturated concrete where the drilled holes contain standing water at the time of anchor installation.
7. Maximum embedment is limited to twelve anchor diameters for horizontal and upwardly inclined installations.
8. For structures assigned to Seismic Design Categories C, D, E or F, bond strength values for cracked concrete do not require an additional reduction factor applied for seismic tension ($\alpha_{N,seis}$ = 1.0), where seismic design is applicable.
9. Bond strength values for uncracked concrete are applicable for structures assigned to Seismic Design Categories A and B only.

Tension and Shear Design Strength Installed in Uncracked Concrete (Bond or Concrete Strength) Drilled with a Hammer-Drill and Carbide Bit in a Dry Hole Condition 110°F (43°C) Maximum Long-Term Service Temperature; 140°F (60°C) Maximum Short-Term Service Temperature[1,2,3,4,5,6,7,8,9]

STRENGTH DESIGN SD TABLES

Nominal Rod/Rebar Size (in. or #)	Embed. Depth h_{ef} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ΦN_{cb} or ΦN_a Tension (lbs.)	ΦV_{cb} or ΦV_{cp} Shear (lbs.)	ΦN_{cb} or ΦN_a Tension (lbs.)	ΦV_{cb} or ΦV_{cp} Shear (lbs.)	ΦN_{cb} or ΦN_a Tension (lbs.)	ΦV_{cb} or ΦV_{cp} Shear (lbs.)	ΦN_{cb} or ΦN_a Tension (lbs.)	ΦV_{cb} or ΦV_{cp} Shear (lbs.)	ΦN_{cb} or ΦN_a Tension (lbs.)	ΦV_{cb} or ΦV_{cp} Shear (lbs.)
3/8 or #3	2-3/8	2,225	2,330	2,275	2,450	2,355	2,535	2,470	2,660	2,555	2,755
	3	2,810	3,460	2,870	3,825	2,975	4,480	3,120	5,595	3,230	6,550
	4-1/2	4,215	6,320	4,310	6,985	4,460	8,175	4,680	10,085	4,845	10,435
1/2 or #4	2-3/4	3,245	3,185	3,320	3,520	3,435	4,120	3,605	5,145	3,730	6,025
	4	4,720	5,990	4,825	6,620	4,995	7,755	5,245	9,680	5,430	11,335
	6	7,080	10,915	7,240	12,065	7,495	14,125	7,865	16,945	8,145	17,540
	10	11,805	23,250	12,065	25,690	12,490	26,895	13,110	28,240	13,570	29,230
5/8 or #5	3-1/8	4,310	4,120	4,510	4,595	4,665	5,375	4,900	6,715	5,070	7,860
	5	7,060	9,175	7,215	10,140	7,465	11,870	7,840	14,825	8,115	17,355
	7-1/2	10,585	16,710	10,820	18,465	11,200	21,620	11,760	25,330	12,170	26,220
	12-1/2	17,645	35,610	18,035	38,845	18,670	40,210	19,600	42,215	20,285	43,695
3/4 or #6	3-1/2	5,105	5,015	5,480	5,700	5,735	6,790	6,000	8,480	6,195	9,925
	6	9,805	12,775	10,020	14,115	10,375	16,525	10,890	20,635	11,275	24,160
	9	14,705	23,265	15,035	25,710	15,560	30,100	16,335	35,185	16,910	36,420
	15	24,510	49,560	25,055	53,965	25,935	55,860	27,225	58,645	28,185	60,705
7/8 or #7	3-1/2	5,085	4,930	5,290	5,605	5,625	6,855	5,980	8,765	6,175	10,260
	7	12,960	15,900	13,245	17,570	13,710	20,570	14,395	25,690	14,900	30,075
	10-1/2	19,435	28,960	19,865	32,000	20,565	37,465	21,590	46,500	22,350	48,135
	17-1/2	32,395	61,700	33,110	68,185	34,275	73,820	35,985	77,500	37,245	80,225
1 or #8	4	6,240	6,115	6,685	6,945	7,110	8,495	7,645	11,045	7,895	12,930
	8	16,500	19,225	16,865	21,245	17,455	24,870	18,325	31,060	18,970	36,360
	12	24,750	35,010	25,295	38,690	26,185	45,295	27,490	56,570	28,455	61,290
	20	41,250	74,605	42,160	82,440	43,640	94,000	45,820	98,685	47,430	102,150
#9	4-1/2	7,445	7,110	8,105	8,080	8,615	9,880	9,350	13,025	9,655	15,250
	9	20,385	22,755	20,835	25,145	21,570	29,440	22,645	36,765	23,440	43,045
	13-1/2	30,580	41,450	31,255	45,805	32,355	53,630	33,965	66,970	35,160	75,730
	22-1/2	50,965	88,290	52,095	97,570	53,920	114,230	56,610	121,930	58,600	126,215
1-1/4	5	8,720	8,170	9,555	9,285	10,495	11,355	11,450	15,085	11,870	17,755
	10	24,660	26,380	25,205	29,150	26,090	34,130	27,390	42,620	28,350	49,895
	15	36,985	48,045	37,805	53,090	39,130	62,155	41,085	77,625	42,525	90,880
	25	61,645	102,380	63,005	113,140	65,220	132,460	68,470	147,480	70,875	152,660
#10	5	8,720	8,160	9,555	9,270	10,375	11,335	11,315	15,060	11,725	17,725
	10	24,660	26,425	25,205	29,200	26,090	34,190	27,390	42,695	28,350	49,985
	15	36,985	48,130	37,805	53,190	39,130	62,270	41,085	77,765	42,525	91,045
	25	61,645	102,530	63,005	113,305	65,220	132,655	68,470	147,480	70,875	152,660

▢ - Concrete Breakout Strength ▢ - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in uncracked normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac}
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.
2. Calculations were performed according to ACI 318-14 Ch.17 and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls.
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318-14 Section 5.3 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-2583.
5. Tabular values are permitted for static loads only, seismic loading is not considered with these tables. Periodic special inspection must be performed where required by code, see ESR-2583 for applicable information.
6. For anchors subjected to tension resulting from sustained loading a supplemental check must be performed according to ACI 318-14 17.3.1.2.
7. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Ch.17.
8. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-14 Ch.17, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-14 Ch.17 and ICC-ES AC308 and ESR-2583.
9. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Tension and Shear Design Strength Installed in Cracked Concrete (Bond or Concrete Strength) Drilled with a Hammer-Drill and Carbide Bit in a Dry Hole Condition 110°F (43°C) Maximum Long-Term Service Temperature; 140°F (60°C) Maximum Short-Term Service Temperature[1,2,3,4,5,6,7,8,9]

Nominal Rod/Rebar Size (in. or #)	Embed. Depth h_{ef} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)
1/2 or #4	2-3/4	1,615	2,275	1,655	2,515	1,710	2,945	1,795	3,675	1,860	4,005
	4	2,350	4,280	2,405	4,730	2,490	5,360	2,615	5,630	2,705	5,825
	6	3,530	7,600	3,605	7,770	3,735	8,040	3,920	8,440	4,055	8,740
	10	5,880	12,665	6,010	12,945	6,220	13,400	6,535	14,070	6,760	14,565
5/8 or #5	3-1/8	1,890	2,940	1,930	3,280	2,000	3,840	2,100	4,525	2,175	4,680
	5	3,025	6,515	3,090	6,660	3,200	6,895	3,360	7,235	3,480	7,490
	7-1/2	4,535	9,770	4,640	9,990	4,800	10,340	5,040	10,855	5,215	11,235
	12-1/2	7,560	16,285	7,730	16,645	8,000	17,230	8,400	18,090	8,695	18,725
3/4 or #6	3-1/2	2,175	3,580	2,265	4,070	2,370	4,850	2,480	5,340	2,560	5,515
	6	4,050	8,730	4,140	8,920	4,290	9,235	4,500	9,695	4,660	10,035
	9	6,080	13,090	6,215	13,380	6,430	13,850	6,750	14,545	6,990	15,055
	15	10,130	21,820	10,355	22,305	10,720	23,085	11,255	24,240	11,650	25,090
7/8 or #7	3-1/2	2,045	3,525	2,125	4,000	2,260	4,865	2,400	5,170	2,480	5,340
	7	5,205	11,205	5,320	11,455	5,505	11,855	5,780	12,450	5,980	12,885
	10-1/2	7,805	16,810	7,975	17,180	8,255	17,785	8,670	18,670	8,975	19,330
	17-1/2	13,010	28,015	13,295	28,635	13,760	29,640	14,450	31,120	14,955	32,215
1 or #8	4	2,650	4,365	2,755	4,960	2,930	6,065	3,150	6,780	3,250	7,005
	8	6,795	13,730	6,945	14,960	7,190	15,485	7,550	16,260	7,815	16,830
	12	10,195	21,955	10,420	22,440	10,785	23,230	11,325	24,390	11,720	25,245
	20	16,990	36,595	17,365	37,405	17,975	38,715	18,870	40,645	19,535	42,075
#9	4-1/2	3,290	5,080	3,420	5,770	3,635	7,060	3,945	8,495	4,075	8,775
	9	8,600	16,255	8,790	17,960	9,100	19,600	9,555	20,575	9,890	21,300
	13-1/2	12,900	27,790	13,185	28,405	13,650	29,400	14,330	30,865	14,835	31,950
	22-1/2	21,505	46,315	21,980	47,340	22,750	49,000	23,885	51,445	24,725	53,250
1-1/4	5	4,090	5,835	4,250	6,630	4,520	8,110	4,930	10,620	5,110	11,010
	10	10,620	18,840	10,855	20,820	11,235	24,200	11,795	25,405	12,210	26,295
	15	15,930	34,305	16,280	35,065	16,850	36,295	17,690	38,105	18,315	39,445
	25	26,545	57,175	27,135	58,440	28,085	60,495	29,485	63,510	30,525	65,740
#10	5	4,045	5,830	4,205	6,620	4,465	8,100	4,870	10,495	5,050	10,880
	10	10,620	18,875	10,855	20,860	11,235	24,200	11,795	25,405	12,210	26,295
	15	15,930	34,305	16,280	35,065	16,850	36,295	17,690	38,105	18,315	39,445
	25	26,545	57,175	27,135	58,440	28,085	60,495	29,485	63,510	30,525	65,740

☐ - Concrete Breakout Strength ☐ - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in cracked normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac}
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.
2. Calculations were performed according to ACI 318-14 Ch.17 and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls.
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318-14 Section 5.3 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-2583.
5. Tabular values are permitted for static loads only, seismic loading is not considered with these tables. Periodic special inspection must be performed where required by code, see ESR-2583 for applicable information.
6. For anchors subjected to tension resulting from sustained loading a supplemental check must be performed according to ACI 318-14 17.3.1.2.
7. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Ch.17.
8. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-14 Ch.17, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-14 Ch.17 and ICC-ES AC308 and ESR-2583.
9. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Tension and Shear Design Strength Installed in Uncracked Concrete (Bond or Concrete Strength) Drilled with a Core-Drill and Diamond Core Bit in a Dry Hole Condition 110°F (43°C) Maximum Long-Term Service Temperature; 140°F (60°C) Maximum Short-Term Service Temperature[1,2,3,4,5,6,7,8,9]

Nominal Rod/Rebar Size (in. or #)	Embed. Depth h_{ef} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ΦNcb or ΦNa Tension (lbs.)	ΦVcb or ΦVcp Shear (lbs.)	ΦNcb or ΦNa Tension (lbs.)	ΦVcb or ΦVcp Shear (lbs.)	ΦNcb or ΦNa Tension (lbs.)	ΦVcb or ΦVcp Shear (lbs.)	ΦNcb or ΦNa Tension (lbs.)	ΦVcb or ΦVcp Shear (lbs.)	ΦNcb or ΦNa Tension (lbs.)	ΦVcb or ΦVcp Shear (lbs.)
1/2 or #4	2-3/4	2,690	3,160	2,750	3,490	2,850	4,085	2,990	5,105	3,095	5,975
	4	3,915	5,945	4,000	6,570	4,145	7,690	4,350	9,605	4,500	11,245
	6	5,875	10,830	6,005	11,965	6,215	14,010	6,525	16,605	6,755	17,190
	10	9,790	23,065	10,005	25,465	10,355	26,360	10,875	27,675	11,255	28,650
5/8 or #5	3-1/8	2,970	4,110	3,035	4,540	3,140	5,320	3,295	6,640	3,410	7,775
	5	4,750	9,090	4,855	10,045	5,025	11,760	5,275	14,685	5,460	16,990
	7-1/2	7,125	16,555	7,280	18,290	7,535	21,415	7,915	24,620	8,190	25,485
	12-1/2	11,875	35,260	12,135	37,755	12,560	39,080	13,190	41,030	13,650	42,470
3/4 or #6	3-1/2	3,570	5,015	3,720	5,700	3,855	6,700	4,030	8,370	4,160	9,800
	6	6,570	12,610	6,715	13,935	6,955	16,310	7,300	20,370	7,555	23,510
	9	9,855	22,965	10,075	25,375	10,430	29,710	10,950	34,065	11,335	35,260
	15	16,430	48,925	16,795	52,245	17,380	54,080	18,250	56,775	18,890	58,770
7/8 or #7	3-1/2	3,445	4,930	3,580	5,605	3,810	6,855	4,015	8,645	4,145	10,125
	7	8,675	15,690	8,870	17,340	9,180	20,300	9,635	25,350	9,975	29,675
	10-1/2	13,015	28,575	13,300	31,580	13,770	36,970	14,455	44,975	14,965	46,555
	17-1/2	21,690	60,885	22,170	67,280	22,950	71,400	24,095	74,960	24,940	77,590
1 or #8	4	4,350	6,115	4,520	6,945	4,810	8,495	5,120	10,890	5,290	12,745
	8	11,025	18,955	11,270	20,945	11,665	24,520	12,250	30,625	12,680	35,855
	12	16,540	34,520	16,905	38,150	17,500	44,665	18,375	55,775	19,020	59,165
	20	27,565	73,560	28,175	81,285	29,165	90,740	30,620	95,265	31,695	98,610

☐ - Concrete Breakout Strength ☐ - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in uncracked normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac}
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.
2. Calculations were performed according to ACI 318-14 Ch.17 and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls.
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318-14 Section 5.3 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-2583.
5. Tabular values are permitted for static loads only, seismic loading is not considered with these tables. Periodic special inspection must be performed where required by code, see ESR-2583 for applicable information.
6. For anchors subjected to tension resulting from sustained loading a supplemental check must be performed according to ACI 318-14 17.3.1.2.
7. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Ch.17.
8. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-14 Ch.17, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-14 Ch.17 and ICC-ES AC308 and ESR-2583.
9. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

STRENGTH DESIGN TABLES

Tension Design of Steel Elements (Steel Strength)[1,2]

Nominal Rod/Rebar Size (in. or No.)	Steel Elements - Threaded Rod and Reinforcing Bar									
	ASTM A36 and ASTM F1554 Grade 36	ASTM F1554 Grade 55	ASTM A193 Grade B7 and ASTM F1554 Grade 105	ASTM F593 CW Stainless (Types 304 and 316)	ASTM A193 Grade B8/ B8M, Class 1 Stainless (Types 304 and 316)	ASTM A193 Grade B8/ B8M2, Class 2B Stainless (Types 304 and 316)	ASTM A615 Grade 75 Rebar	ASTM A615 Grade 60 Rebar	ASTM A706 Grade 60 Rebar	ASTM A615 Grade 40 Rebar
	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)
3/8 or #3	3,370	4,360	7,265	5,040	3,315	5,525	7,150	7,425	6,600	4,950
1/2 or #4	6,175	7,980	13,300	9,225	6,070	10,110	13,000	13,500	12,000	9,000
5/8 or #5	9,835	12,715	21,190	14,690	9,660	16,105	20,150	20,925	18,600	13,950
3/4 or #6	14,550	18,815	31,360	18,480	14,300	23,830	28,600	29,700	26,400	19,800
7/8 or #7	20,085	25,970	43,285	25,510	19,735	32,895	39,000	40,500	36,000	-
1 or #8	26,350	34,070	56,785	33,465	25,895	43,160	51,350	53,325	47,400	-
#9	-	-	-	-	-	-	65,000	67,500	60,000	-
1-1/4 or #10	42,160	54,510	90,850	53,540	41,430	69,050	82,550	85,725	76,200	-

■ - Steel Strength

1. Steel tensile design strength according to ACI 318-14 Ch. 17, $\phi N_{sa} = \phi \bullet A_{se,N} \bullet f_{uta}$
2. The tabulated steel design strength in tension must be checked against the bond strength/concrete capacity design strength to determine the controlling failure mode, the lowest load level controls.

Shear Design of Steel Elements (Steel Strength)[1,2]

Nominal Rod/Rebar Size (in. or No.)	Steel Elements - Threaded Rod and Reinforcing Bar									
	ASTM A36 and ASTM F1554 Grade 36	ASTM F1554 Grade 55	ASTM A193 Grade B7 and ASTM F1554 Grade 105	ASTM F593 CW Stainless (Types 304 and 316)	ASTM A193 Grade B8/ B8M, Class 1 Stainless (Types 304 and 316)	ASTM A193 Grade B8/ B8M2, Class 2B Stainless (Types 304 and 316)	ASTM A615 Grade 75 Rebar	ASTM A615 Grade 60 Rebar	ASTM A706 Grade 60 Rebar	ASTM A615 Grade 40 Rebar
	ϕV_{sa} Tension (lbs.)	ϕV_{sa} Tension (lbs.)	ϕV_{sa} Tension (lbs.)	ϕV_{sa} Tension (lbs.)	ϕV_{sa} Tension (lbs.)	ϕV_{sa} Tension (lbs.)	ϕV_{sa} Tension (lbs.)	ϕV_{sa} Tension (lbs.)	ϕV_{sa} Tension (lbs.)	ϕV_{sa} Tension (lbs.)
3/8 or #3	1,755	2,265	3,775	2,790	1,725	2,870	3,960	3,860	3,430	2,575
1/2 or #4	3,210	4,150	6,915	5,110	3,155	5,255	7,200	7,020	6,240	4,680
5/8 or #5	5,115	6,610	11,020	8,135	5,025	8,375	11,160	10,880	9,670	7,255
3/4 or #6	7,565	9,785	16,305	10,235	7,435	12,390	15,840	15,445	13,730	10,295
7/8 or #7	10,445	13,505	22,505	14,130	10,265	17,105	21,600	21,060	18,720	-
1 or #8	13,700	17,715	29,525	18,535	13,465	22,445	28,440	27,730	24,650	-
#9	-	-	-	-	-	-	36,000	35,100	31,200	-
1-1/4 or #10	21,920	28,345	47,240	29,655	21,545	35,905	45,720	44,575	39,625	-

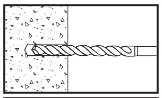
■ - Steel Strength

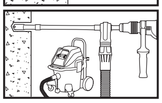
1. Steel shear design strength according to ACI 318-14 Ch. 17, $\phi V_{sa} = \phi \bullet 0.60 \bullet A_{se,N} \bullet f_{uta}$
2. The tabulated steel design strength in shear must be checked against the bond strength/concrete capacity design strength to determine the controlling failure mode, the lowest load level controls.

INSTALLATION INSTRUCTIONS (SOLID BASE MATERIALS)

HAMMER DRILLING

DRILLING



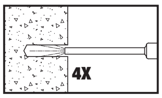


1- Drill a hole into the base material with rotary hammer drill (i.e. percussion drill) and a carbide drill bit to the size and embedment required by the selected steel hardware element (reference installation specifications for threaded rod and reinforcing bar). The tolerances of the carbide drill bits, including hollow bits, must meet ANSI Standard B212.15.

- Precaution: Use suitable eye and skin protection. Avoid inhalation of dust during drilling and/or removal.
- Note! In case of standing water in the drilled hole (flooded hole condition), all the water has to be removed from the hole (e.g. vacuum, compressed air, etc.) prior to cleaning.

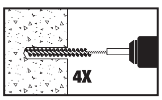
Drilling in dry base materials is recommended when using hollow drill bits (vacuum must be on).

HOLE CLEANING (BLOW 4X, BRUSH 4X, BLOW 4X)



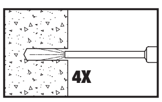
2a- Starting from the bottom or back of the drilled anchor hole, blow the hole clean using a compressed air nozzle (min. 90 psi) or a hand pump (supplied by DEWALT) a minimum of four times (4x).

- Use a compressed air nozzle (min. 90 psi) or a hand pump (min. volume 25 fl. oz.) for anchor rod 3/8" to 3/4" diameter or reinforcing bar (rebar) sizes #3 to #6.
- Use a compressed air nozzle (min. 90 psi) for anchor rod 7/8" to 1-1/4" diameter and rebar sizes #7 to #10. A hand pump shall not be used with these anchor sizes.



2b- Determine wire brush diameter (reference hole cleaning equipment selection table) and attach the brush with adaptor to a rotary drill tool or battery screw gun. Brush the hole with the selected wire brush a minimum of four times (4x). A brush extension (supplied by DEWALT, Cat. #08282) should be used for holes drilled deeper than the listed brush length.

- The wire brush diameter must be checked periodically during use. The brush should resist insertion into the drilled hole and come into contact with the sides of the drilled hole. If not the brush is too small and must be replaced.



2c- Finally, blow the hole clean again a minimum of four times (4x).

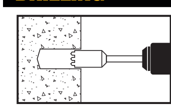
- Use a compressed air nozzle (min. 90 psi) or a hand pump (min. volume 25 fl. oz.) for anchor rod 3/8" to 3/4" diameter or reinforcing bar (rebar) sizes #3 to #6.
- Use a compressed air nozzle (min. 90 psi) for anchor rod 7/8" to 1-1/4" diameter and rebar sizes #7 to #10. A hand pump shall not be used with these anchor sizes.

When finished the hole should be clean and free of dust, debris, ice, grease, oil or other foreign material.

NEXT GO TO STEP 3.

CORE DRILLING

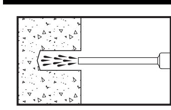
DRILLING



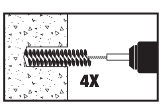
1- Drill a hole into the base material with a core drill tool to the size and embedment required by the selected steel hardware element (reference installation table). The tolerances of the carbide drill bit must meet ANSI Standard B212.15.

- Precaution: Use suitable eye and skin protection. Avoid inhalation of dust during drilling and/or removal.

HOLE CLEANING (RINSE, BRUSH 4X, RINSE, BLOW 4X, BRUSH 4X, BLOW 4X)

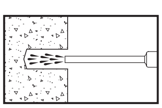


2a- Starting from the bottom or back of the drilled anchor hole, rinse/flush the hole clean with water (water line pressure) until clear water comes out.



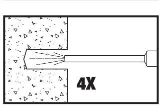
2b- Determine brush diameter (see installation table) for drilled hole and attach the brush with adaptor to a rotary drill tool or battery screw gun. Brush the hole with the selected wire brush a minimum of four times (4x). A brush extension (supplied by DEWALT) must be used for holes drilled deeper than the listed brush length.

- The wire brush diameter must be checked periodically during use The brush should resist insertion into the drilled hole and come into contact with the sides of the drilled hole. If not the brush is too small and must be replaced.

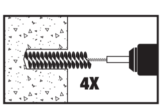


2c- Repeat Step 2a again by rinse/flush the hole clean with water.

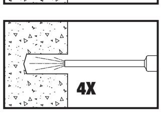
Following this remove all standing water completely (e.g. vacuum, compressed air, etc.) prior to further cleaning. To attain a dried borehole a DEWALT compressed air nozzle is recommended.



2d- Starting from the bottom or back of the drilled anchor hole, blow the hole clean (free of noticeable dust) a minimum if four times (4x). Use a compressed air nozzle (min. 90 psi) for all sizes of anchor rod and reinforcing bar (rebar)



2e- Repeat Step 2b again by brushing the hole with a wire brush a minimum of four times (4x).

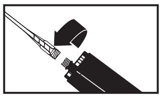


2f- Repeat Step 2d again by blowing the hole clean a minimum of four times (4x).

When finished the hole should be clean and free of dust, debris, ice, grease, oil or other foreign material.

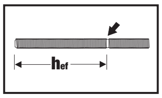
NEXT GO TO STEP 3.

PREPARING

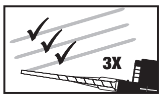


3- Check adhesive expiration date on cartridge label. Do not use expired product. Review Safety Data Sheet (SDS) before use. Cartridge temperature must be between 41°F - 95°F (5°C - 35°C) when in use; for downward applications only the adhesive temperature may be up to 104°F (40°C). Consideration should be given to the reduced gel time of the adhesive in warm temperatures.

- Attach a supplied mixing nozzle to the cartridge. Unless otherwise noted do not modify the mixer in any way and make sure the mixing element is inside the nozzle. Load the cartridge into the correct dispensing tool.
- A new mixing nozzle must be used for every working interruption longer than the published working times (reference gel time and curing time table) as well as for new cartridges.
- Note: Always use a new mixing nozzle with new cartridge of adhesive and also for all work interruptions exceeding the published gel (working) time of the adhesive.



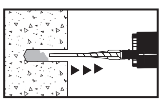
4- Prior to inserting the anchor rod or rebar into the filled bore hole, the position of the embedment depth has to be marked on the anchor. Verify anchor element is straight and free of surface damage.



5- For new cartridges and nozzles: prior to dispensing into the anchor hole, squeeze out separately a minimum three full strokes of the mixed adhesive. Discard non-uniform adhesives until the adhesive is a consistent **RED** color.

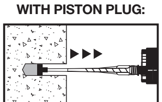
- Review and note the published working and cure times (reference gel time and curing time table) prior to injection of the mixed adhesive into the cleaned anchor hole.

INSTALLATION

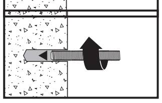


6- Fill the cleaned hole approximately two-thirds full with mixed adhesive starting from the bottom or back of the anchor hole. If the bottom or back of the anchor hole is not reached with the mixing nozzle only, a plastic extension tube must be used with the mixing nozzle (see reference tables for installation). Slowly withdraw the mixing nozzle as the hole fills to avoid creating air pockets or voids.

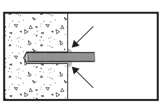
WITH PISTON PLUG:



- Piston plugs (see adhesive piston plug table) must be used with and attached to the mixing nozzle and extension tube for horizontal and overhead installations with anchor rod from 5/8" to 1-1/4" diameter and rebar size #5 to #10. Insert piston plug to the back of the drilled hole and inject as described in the method above. During installation the piston plug will be naturally extruded from the drilled hole by the adhesive pressure.
- **Attention!** Do not install anchors overhead without proper training and installation hardware provided by the DEWALT. Contact DEWALT for details prior to use.

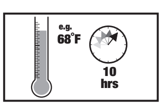


7- The anchor should be free of dirt, grease, oil or other foreign material. Push clean threaded rod or reinforcing bar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached. Air pockets are present when the threaded rod or rebar springs or air pockets burst during installation. In case of air pockets: remove rod or rebar, let the adhesive harden, re-drill the hole and repeat the complete installation.



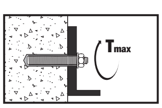
8- Be sure that the anchor is fully seated at the bottom of the hole to the specified embedment. Adhesive must completely fill the annular gap between the anchor and the base material. Protect the anchor element threads from fouling with adhesive. For all installations the rebar must be restrained from movement throughout the specified curing period (as necessary) where necessary through the use of temporary wedges, external supports, or other methods. Minor adjustments to the position of the anchor element may be performed during the gel (working) time only.

CURING AND LOADING



9- Allow the adhesive anchor to cure to the specified full curing time prior to applying any load (reference gel time and curing time table).

- Do not disturb, torque or load the anchor until it is fully cured.



10- After full curing of the adhesive anchor, a fixture can be installed to the anchor and tightened up to the maximum torque (reference gel time and curing table) by using a calibrated torque wrench.

- Take care not to exceed the maximum torque for the selected anchor.

REFERENCE TABLES FOR INSTALLATION

Gel (working) Time and Curing Table

Temperature of Base Material		Gel (working) Time	Full Curing Time
°F	°C		
41	5	180 minutes	50 hours
50	10	120 minutes	30 hours
68	20	30 minutes	10 hours
86	30	20 minutes	6 hours
95	35	15 minutes	5 hours
104	40	12 minutes	4 hours
Cartridge temperature must be between 41°F - 95°F (5°C - 35°C) when in use; for downward applications only the adhesive temperature may be up to 104°F (40°C).			

Hole Cleaning Equipment Selection Table for PE1000+[1,2,3]

Threaded rod diameter (inch)	Rebar size (no.)	ANSI drill bit diameter (inch)	Core drill bit diameter (inch)	Brush length (inches)	Steel wire brush (Cat. #)	Blowout tool	Number of cleaning actions
3/8	#3	7/16	7/16	6-3/4	08284	Hand-pump or compressed air nozzle (min. 90 psi)	4x blowing 4x brushing 4x blowing
1/2	-	9/16	9/16	6-3/4	08285		
-	#4	5/8	5/8	6-3/4	08275		
5/8	#5	11/16	11/16	7-7/8	08286		
		3/4	3/4	7-7/8	08278		
3/4	#6	7/8	7/8	7-7/8	08287		
7/8	#7	1	1	11-7/8	08288	Compressed air nozzle only (min. 90 psi)	
1	#8	1-1/8	1-1/8	11-7/8	08289		
		1-1/4	1-1/4	11-7/8	08274		
1-1/4	#9	1-3/8	1-3/8	11-7/8	08290		
-	#10	1-1/2	1-1/2	11-7/8	08291		

1. An SDS-plus adaptor (Cat. #08283) or Jacobs chuck style adaptor (Cat. #08296) is required to attach a steel wire brush to the drill tool.
2. For any case, it must be possible for the steel anchor element to be inserted into the cleaned hole without resistance.
3. A brush extension (Cat. #08282) must be used with a steel wire brush for holes drilled deeper than the listed brush length.

Piston Plugs for Adhesive Anchors[1,2]

Plug Size (inch)	ANSI Drill Bit Diameter (inch)	Plastic Plug (Cat. #)	Piston Plug
11/16	11/16	08258	
3/4	3/4	08259	
7/8	7/8	08300	
1	1	08301	
1-1/8	1-1/8	08303	
1-1/4	1-1/4	08307	
1-3/8	1-3/8	08305	
1-1/2	1-1/2	08309	

1. Overhead and horizontal installations require the use of piston plugs where one is tabulated together with the anchor size.
2. A plastic extension tube (Cat. #08281 or Cat. #08297) or equivalent approved by DEWALT must be used with piston plugs.

PERMISSIBLE INSTALLATION CONDITIONS (ADHESIVE)

Dry Concrete: cured concrete that, at the time of adhesive anchor installation, has not been exposed to water for the preceding 14 days.
Water-Saturated Concrete (wet): cured concrete that, at the time of adhesive anchor installation, has been exposed to water over a sufficient length of time to have the maximum possible amount of absorbed water into the concrete pore structure to a depth equal to the anchor embedment depth.
Water-Filled Holes (flooded): cured concrete that is water-saturated and where the drilled hole contains standing water at the time of anchor installation.

ORDERING INFORMATION

PE1000+ Cartridge System

Cat No.	Description	Std. Ctn.	Pallet
0500SD	PE1000+ 13 fl. oz. dual cartridge	12	540
0502SD	PE1000+ 20 fl. oz. dual cartridge	12	540
One PE1000+ mixing nozzle is packaged with each cartridge. PE1000+ mixing nozzles must be used to ensure complete and proper mixing of the adhesive.			

Extra Mixing Nozzles

Cat No.	Description	Std. Ctn.	Pallet
08294	Extra mixing nozzle (with an 8" extension) for PE1000+	2	24
08281	Mixing nozzle extension, 8" long	2	24
08297	Mixing nozzle extension, 20" long	1	12

Dispensing Tools for Injection Adhesive

Cat No.	Description	Std. Ctn.	Std. Carton
08298	13 fl. oz. and 20 fl. oz. Manual Tool	1	6
08497SD	20 fl. oz. Pneumatic tool	1	-
DCE593D1	13 fl. oz. and 20 fl. oz. 20 v Battery powered dispensing tool	1	-

Hole Cleaning Tools and Accessories

Cat No.	Description	Std. Box
08284	Wire brush for 7/16" or 1/2" ANSI hole, 6-3/4" length	1
08285	Wire brush for 9/16" ANSI hole, 6-3/4" length	1
08275	Wire brush for 5/8" ANSI hole, 6-3/4" length	1
08286	Wire brush for 11/16" ANSI hole, 7-7/8" length	1
08278	Wire brush for 3/4" ANSI hole, 7-7/8" length	1
08287	Wire brush for 7/8" ANSI hole, 7-7/8" length	1
08288	Wire brush for 1" ANSI hole, 11-7/8" length	1
08289	Wire brush for 1-1/8" ANSI hole, 11-7/8" length	1
08274	Wire brush for 1-1/4" ANSI hole, 11-7/8" length	1
08290	Wire brush for 1-3/8" ANSI hole, 11-7/8" length	1
08291	Wire brush for 1-1/2" ANSI hole, 11-7/8" length	1
08283	SDS-plus adapter for steel brushes	1
08296	Standard drill adapter for steel brushes (e.g. Jacobs Chuck)	1
08282	Steel brush extension, 12" length	1
08280	Hand pump/dust blower (25 fl. oz. cylinder volume)	1
08292	Air compressor nozzle with extension, 18" length	1
52073	Adhesive cleaning kit, includes 4 wire brushes (08284, 08285, 08286, 08287), steel brush extension (08282), SDS-plus adapter (08283), standard drill adapter (08296), hand pump/dust blower (08280), gloves and safety glasses	1

Adhesive Piston Plugs

Cat No.	Description	ANSI Drill Bit Dia.	Std. Bag
08258	11/16" Plug	11/16"	10
08259	3/4" Plug	3/4"	10
08300	7/8" Plug	7/8"	10
08301	1" Plug	1"	10
08303	1-1/8" Plug	1-1/8"	10
08307	1-1/4" Plug	1-1/4"	10
08305	1-3/8" Plug	1-3/8"	10
08309	1-1/2" Plug	1-1/2"	10

GENERAL INFORMATION

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
- Resistant to vibratory loads introduced from machinery, moving vehicles, etc
- Barriers, fencing and railing attachments

FEATURES AND BENEFITS

+ Fast, easy installation - no special adaptors required for setting
+ Excellent chemical resistance
+ Components are mixed during installation of rod or rebar
+ Pre-measured chemical component volumes – no waste and simplified placement
+ Ideal for small projects

APPROVALS AND LISTINGS

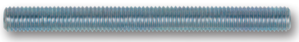
- Department of Transportation listings - see www.DEWALT.com or contact transportation agency
- Independently tested to ASTM E1512 and AC58 criteria including creep resistance

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Capsule adhesive anchoring system shall be Hammer-Capsule as supplied by DEWALT, Towson, MD.

SECTION CONTENTS

HAMMER-CAPSULE



STRAIGHT CUT THREADED ROD

ANCHOR SIZE RANGE (TYPICAL)

- 3/8" to 1" diameter rod
- No. 3 to No. 8 reinforcing bar

SUITABLE BASE MATERIALS

- Normal-weight concrete
- Grouted concrete masonry

PERMISSIBLE INSTALLATION CONDITIONS (ADHESIVE)

- Dry concrete
- Water-saturated concrete (wet)

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 (mixed, prior to curing)	Paste mortar

Curing Times[1]

Minimum Base Material Temperature	Curing Time
68°F (20°C)	1 hour
50°F (10°C)	2 hours
32°F (0°C)	5 hours

1. Cure time should be doubled for wet concrete.

INSTALLATION SPECIFICATIONS

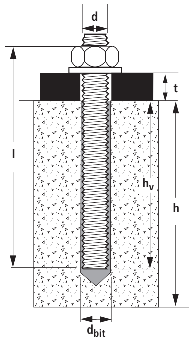
Hammer-Capsule[1,2]

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 (in³)	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 capsules offered by other suppliers because of variations in air content. When comparing capsules, use the installed mortar volume.

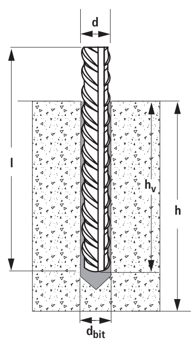
Nomenclature

d = Diameter of anchor
d_{bit} = Diameter of drill bit
d_h = Diameter of fixture clearance hole
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 (only possible after curing time)



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 (in²)	0.111	0.196	0.307	0.442	0.601	0.785
A_{se} = Tensile stress area of rod (in²)	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 (in³)	0.094	0.133	0.184	0.326	0.390	0.478

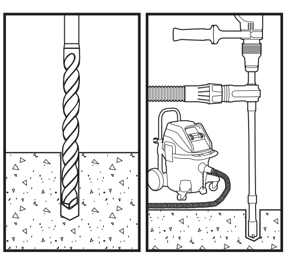


Reinforcing Bar in Normal-Weight Concrete[1]

Dimension	Reinforcing Bar Size					
	No.3	No.4	No.5	No.6	No.7	No.8
A_{nom} = Nominal area of threaded rod (in²)	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 (in³)	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.

Installation Guidelines

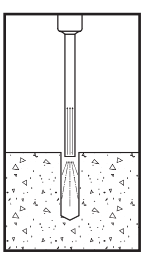


1. Drill a hole using a carbide tipped bit meeting the diameter requirements of ANSI B212.15 to the minimum depth required as shown in the chart.

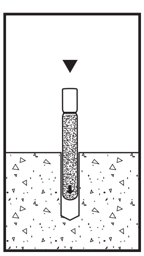
Precaution: Use suitable eye and skin protection. Avoid inhalation of dust during drilling and/or removal.

Note! In case of standing water in the drilled hole (flooded hole condition), all the water has to be removed from the hole (e.g. vacuum, compressed air, etc.) prior to cleaning.

Drilling in dry base materials is recommended when using hollow drill bits (vacuum must be on).

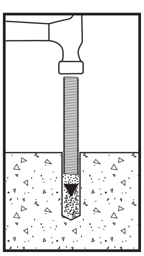


2. Starting from the bottom or back of the anchor hole, remove dust and debris from the hole (e.g. dust extractor) to remove loose particles from drilling, brush the hole with a nylon brush, and again remove any remaining loose particles. Anchor holes may be dry or damp, but should be free of standing 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



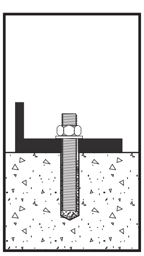
3. Prior to installation check the capsule to be sure it is not damaged and invert several times at 60°F or above to confirm all of the resin is in a liquid state. Insert the capsule into the hole.

Note! Be careful to observe the direction of insertion. The arrow on the capsule should point toward the bottom of the hole.



4. 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.



5. Allow the Hammer-Capsule to cure for specified time before loading anchor. Do not disturb, torque or load the anchor once the material has begun to set.

Note! Consideration must be given to installation direction. Overhead installations with glass capsules are sensitive and extremely dependent upon the skill and care taken by the user; additional equipment not supplied by DEWALT may be required. Consequently DEWALT does not recommend the use of the Hammer Capsule for overhead applications at this time. Use of the product in adverse installation conditions should not be done without proper training and direct supervision by the Design Professional.

STEEL MATERIAL

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
		A307 Grade C or F1554, Grade 36	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 706, A 767 or A996	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 F1554 Grade 36 lbs. (kN)	ASTM A193 Grade B7 lbs. (kN)	ASTM F593 304/316 SS lbs. (kN)	ASTM A36 lbs. (kN)	ASTM F1554 Grade 36 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. Allowable steel strength capacities are based on the standard minimum strengths of the tabulated materials.

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)

1. Allowable 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:

$T = f_s * A_{br}$

$V = 0.17 * f_u * A_{br}$

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 (in²).
A_{br} = Nominal cross-sectional area of reinforcing bar (in²).

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)	6,320 (28.2)	4,440 (20.0)	6,320 (28.2)	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)	12,640 (56.4)	4,440 (20.0)	12,640 (56.4)	4,440 (20.0)
1/2 (12.7)	4-1/4 (108.0)	One 1/2"	8,235 (37.1)	10,720 (48.2)	10,240 (45.7)	10,720 (48.2)	10,240 (45.7)	10,720 (48.2)	10,240 (45.7)	10,720 (48.2)	10,240 (45.7)	10,720 (48.2)
	8-1/2 (215.9)	Two 1/2"	16,470 (74.1)	10,720 (48.2)	20,460 (91.3)	10,720 (48.2)	20,460 (91.3)	10,720 (48.2)	20,460 (91.3)	10,720 (48.2)	20,460 (91.3)	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)	15,060 (67.2)	17,160 (77.2)	15,060 (67.2)	17,160 (77.2)	15,060 (67.2)	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)	30,100 (134.4)	17,160 (77.2)	30,100 (134.4)	17,160 (77.2)	30,100 (134.4)	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)	29,500 (32.9)	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)	59,000 (263.4)	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. Consideration of safety factors of 10.0 or higher may be necessary depending on the application, such as life safety.
2. Linear interpolation may be used to determine ultimate load capacities for intermediate embedments and compressive strengths.

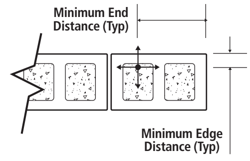
Allowable Load Capacities for Threaded Rod Installed with Hammer-Capsule in Normal-Weight Concrete[1,2,3]

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)	1,580 (7.1)	1,110 (5.0)	1,580 (7.1)	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)	3,160 (14.1)	1,110 (5.0)	3,160 (14.1)	1,110 (5.0)
1/2 (12.7)	4-1/4 (108.0)	One 1/2"	2,060 (9.3)	2,680 (12.1)	2,560 (11.4)	2,680 (12.1)	2,560 (11.4)	2,680 (12.1)	2,560 (11.4)	2,680 (12.1)	2,560 (11.4)	2,680 (12.1)
	8-1/2 (215.9)	Two 1/2"	4,120 (18.5)	2,680 (12.1)	5,115 (22.8)	2,680 (12.1)	5,115 (22.8)	2,680 (12.1)	5,115 (22.8)	2,680 (12.1)	5,115 (22.8)	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)	3,765 (16.8)	4,290 (19.3)	3,765 (16.8)	4,290 (19.3)	3,765 (16.8)	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)	7,525 (33.6)	4,290 (19.3)	7,525 (33.6)	4,290 (19.3)	7,525 (33.6)	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)	7,375 (32.9)	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)	14,750 (65.0)	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. Consideration of safety factors of 10.0 or higher may be necessary depending on the application, such as life safety.
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.

Ultimate Load Capacities for Threaded Rod Installed with Hammer-Capsule in Grout-Filled Concrete Masonry[1,2,3]

Anchor installed in Cell Opening (Top of Wall) For Sill Plates and Other Attachments							
Anchor Diameter d in. (mm)	**Drill Bit Diameter d_{bit} in.**	**Minimum Block Width in. (mm)**	**Minimum Embedment Depth h_v in. (mm)**	**Minimum Edge Distance in. (mm)**	**Minimum End Distance in. (mm)**	**Tension lbs. (kN)**	**Shear Towards the Edge lbs. (kN)**
3/8 (9.5)	7/16	6 (152.4)	3-1/2 (88.9)	2-1/4 (57.2)	4 (101.6)	2,756 (12.4)	1,622 (7.3)
1/2 (12.7)	9/16	6 (152.4)	4-1/4 (108.0)	2-3/4 (69.9)	4 (101.6)	4,902 (22.0)	2,086 (9.3)
5/8 (15.9)	11/16	8 (203.2)	5 (127.0)	2-3/4 (69.9)	11-1/4 (285.8)	6,189 (27.7)	1,877 (8.4)
3/4 (19.1)	7/8	8 (203.2)	6-5/8 (168.3)	2-3/4 (69.9)	11-1/4 (285.8)	7,887 (35.3)	2,005 (9.0)
7/8 (22.2)	1	8 (203.2)	7 (177.8)	3-3/4 (95.3)	11-1/4 (285.8)	8,648 (38.8)	3,379 (15.1)
1 (25.4)	1-1/8	8 (203.2)	8-1/4 (209.6)	3-3/4 (95.3)	11-1/4 (285.8)	10,679 (47.9)	3,139 (14.1)



Top of Wall

1. Tabulated load capacities 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 are fully grouted and have reached a designated minimum compressive strength at the time of installation. Mortar must be Types N, S or M.
2. The allowable loads are calculated using a safety factor of 5.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety.
3. Masonry members must have a minimum nominal width of 8 inches with the exception of 3/8" and 1/2" diameter anchors which may be installed in minimum nominal 6-inch width masonry members.

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Combined Loading

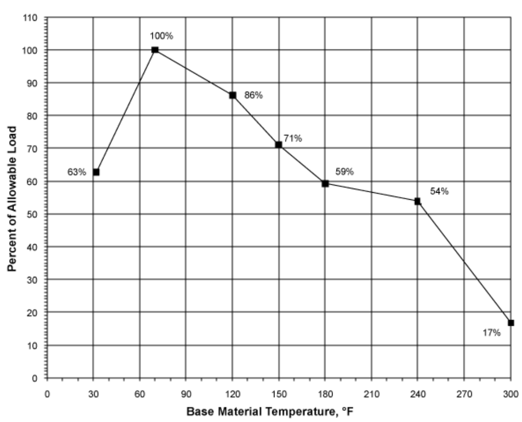
For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

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

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

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 (%)**
32	0	63
70	21	100
120	49	86
150	65	71
180	82	59
240	115	54
300	149	17

LOAD ADJUSTMENT FACTORS FOR SPACING AND EDGE DISTANCES

Anchor Installed in Normal-Weight Concrete

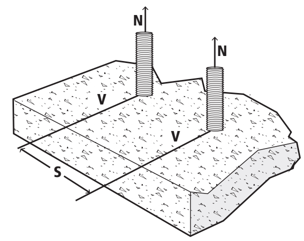
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (s)	Tension and Shear	$s_{cr} = 8d$	$F_{NS} = F_{VS} = 1.0$	$s_{min} = 4d$	$F_{NS} = F_{VS} = 0.70$
Edge Distance (c)	Tension	$c_{cr} = 8d$	$F_{NC} = 1.0$	$c_{min} = 4d$	$F_{NC} = 0.60$
	Shear	$c_{cr} = 12d$	$F_{VC} = 1.0$	$c_{min} = 4d$	$F_{VC} = 0.50$

Spacing, Tension (F_{NS}) & Shear (F_{VS})

	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	1.00	0.90	0.78	0.70	-	-	-
	3	1.00	1.00	0.85	0.76	0.70	-	-
	3-1/2	1.00	1.00	0.93	0.82	0.75	0.70	-
	4	1.00	1.00	1.00	0.88	0.80	0.74	0.70
	5	1.00	1.00	1.00	1.00	0.90	0.83	0.78
	5-1/2	1.00	1.00	1.00	1.00	0.95	0.87	0.81
	6	1.00	1.00	1.00	1.00	1.00	0.91	0.85
	7	1.00	1.00	1.00	1.00	1.00	1.00	0.93
	8	1.00	1.00	1.00	1.00	1.00	1.00	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.

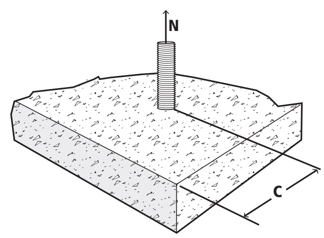


Edge Distance, Tension (F_{NC})

	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	1.00	0.87	0.70	0.60	-	-	-
	3	1.00	1.00	0.80	0.68	0.60	-	-
	3-1/2	1.00	1.00	0.90	0.76	0.67	0.60	-
	4	1.00	1.00	1.00	0.84	0.73	0.66	0.60
	5	1.00	1.00	1.00	1.00	0.87	0.77	0.70
	6	1.00	1.00	1.00	1.00	1.00	0.89	0.80
	7	1.00	1.00	1.00	1.00	1.00	1.00	0.90
	8	1.00	1.00	1.00	1.00	1.00	1.00	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.

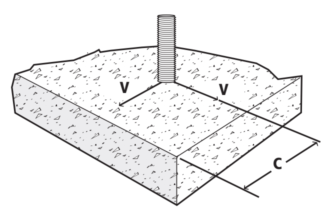


Edge Distance, Shear (F_{VC})

	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	1.00	0.83	0.69	0.60	0.54	0.50	-
	4	1.00	0.92	0.75	0.65	0.58	0.54	0.50
	4-1/2	1.00	1.00	0.81	0.70	0.63	0.57	0.53
	5	1.00	1.00	0.88	0.75	0.67	0.61	0.56
	5-1/2	1.00	1.00	0.94	0.80	0.71	0.64	0.59
	6	1.00	1.00	1.00	0.85	0.75	0.68	0.63
	7-1/2	1.00	1.00	1.00	1.00	0.88	0.79	0.72
	9	1.00	1.00	1.00	1.00	1.00	0.89	0.81
	10-1/2	1.00	1.00	1.00	1.00	1.00	1.00	0.91
	12	1.00	1.00	1.00	1.00	1.00	1.00	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.



ORDERING INFORMATION

Hammer-Capsule

Cat.No.	Description	Standard Box	Std. Carton
6702	3/8" Hammer-Capsule	10	500
6703	1/2" Hammer-Capsule	10	200
6704	5/8" Hammer-Capsule	10	100
6705	3/4" Hammer-Capsule	6	60
6706	7/8" Hammer-Capsule	6	60
6707	1" Hammer-Capsule	6	60
For availability of threaded rod please contact DEWALT			

NOTES

NOTES


DEWALT
25'

MECHANICAL ANCHORS

		Base Material											Anchor Diameter										Head Style									Coating/Material							
		Concrete	Lightweight Concrete	Hollow Core Plank	Grout-filled Concrete Masonry	Hollow Concrete Masonry	Solid Brick	Hollow Brick	Stone	Structural Clay Tile	Wood	Steel	3/16"	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	7/8"	1" (24mm)	1-1/4" (28mm)	Finished Hex Head	Hex Head	Round/Acorn Head	Flat Head (Countersunk)	Mushroom Head	Removable	Tie-Wire Head	Tamperproof	Internal Thread	Coated/Plated Carbon Steel	Galvanized Carbon Steel	Type 303/304 Stainless Steel	Type 316 Stainless Steel	Type 410 Stainless Steel	Perma-Seal Coated	Nylon/Plastic	Building Code / Jurisdiction Recognition
	Atomic+ Undercut®	●	●													●	●	●	●					●								●			●				ICC-ES ESR-3067
Expansion Anchors	Power-Stud®+ SD1	●	●		●				○					●		●	●	●	●	●	●	●		●					●			●							ICC-ES ESR-2818 & 2966 IBC, NBC, City of LA, FBC, FM, UL
Expansion Anchors	Power-Stud®+ SD2	●	●		●				○							●	●	●	●					●								●							ICC-ES ESR-2502 IBC, NBC, City of LA, FBC, FM, UL
Expansion Anchors	Power-Stud®+ SD4/SD6	●	●		●				○					●		●	●	●	●					●										●	●				ICC-ES ESR-2502 IBC, NBC, City of LA, FBC
Expansion Anchors	Power-Stud® HD5	●	●		●											●	●	●	●														●						
Expansion Anchors	Power-Bolt®+	●	●		○				○					●		●	●	●	●				●					●				●							ICC-ES ESR-3260 IBC, City of LA
Expansion Anchors	Power-Bolt®	●	●	○	●	●	●	○	○							●	●	●					●			●		●				●		●					
Expansion Anchors	PB-PRO™	●	○																		●	●	●									●							
Expansion Anchors	Lok-Bolt AS®	●	○	○	●	●	●	○	○					●	●	●	●	●	●					●	●	●			●		●	●		●					
Screw Anchors	Screw-Bolt+™	●	●	○	●	○	●							●		●	●	●	●				●					●				●	●						ICC-ES ESR-3889 IBC, City of LA, FBC
Screw Anchors	316 Stainless Steel Wedge-Bolt™	●			●		●							●		●	●						●					●							●				
Screw Anchors	Snake+®	●	●											●		●	●											●			●	●							ICC-ES ESR-2272 IBC, City of LA, FM
Drop-in Anchors	Steel Dropin™	●	●						○					●		●	●	●	●												●	●		●	●				FM, UL
Drop-in Anchors	Smart DI™	●	○						○					●		●	●														●	●							FM, UL
Drop-in Anchors	Mini Dropin™	●	●	●	○				○					●		●	●														●	●							FM
Drop-in Anchors	Hollow-Set Dropin™	●	○	●	●	●	●	○	○					●	●	●	●	●													●	●		●					UL
Rod Hanging System	Hangermate®+	●	●	○										●		●												●			●	●							ICC-ES ESR-3889 IBC, City of LA, FBC, FM
Rod Hanging System	Mini-Undercut+™	●		●												●															●	●							ICC-ES ESR-3912 IBC, City of LA, FM
Rod Hanging System	Wood-Knocker II+®	●	●											●		●	●	●	●												●	●						●	ICC-ES ESR-3657 IBC, NBC, City of LA, FM, UL
Rod Hanging System	Bang-it+®	●	●											●		●	●	●	●												●	●						●	ICC-ES ESR-3657 IBC, NBC, City of LA, FM, UL
Rod Hanging System	DDI+™	●	●													●	●	●	●	●												●							ICC-ES ESR-3958 IBC, City of LA, FM

● Suitable ○ May be Suitable

GENERAL INFORMATION

ATOMIC+ UNDERCUT®

Heavy Duty Undercut Anchor

PRODUCT DESCRIPTION

The Atomic+ Undercut anchor is designed for applications in cracked and uncracked concrete. The anchors are is available in standard ASTM A 36 steel, high strength ASTM A 193 Grade B7 steel and Type 316 stainless steel in Class 1 and Class 2 strength designations.

The Type 316 stainless steel version can be considered for exterior use and industrial applications where a high level of corrosion resistance is required.

The Atomic+ Undercut anchor is installed into a pre-drilled hole which has been enlarged at the bottom in the shape of a reversed cone using the undercut drill bit supplied by DEWALT. The result is an anchor which transfers load mainly through bearing, and unlike a typical expansion anchor is not dependent upon friction between the expansion sleeve and the concrete. Due to the use of a thick walled expansion sleeve, the load is distributed to a large area which can provide ductile behavior of the anchor even at relatively shallow embedments.

GENERAL APPLICATIONS AND USES

- Structural connections, beam and column anchorage
- Safety related attachments
- Tension zone applications
- Heavy duty loading
- Pipe supports, strut & base mounts
- Suspended equipment
- Seismic and wind loading

FEATURE AND BENEFITS

+ Consistent performance in high and low strength concrete
+ Anchors available for standard pre-set installations and for through bolt applications
+ Length ID code and identifying marking stamped on head of each anchor
+ Load transfers to concrete through bearing, not friction, behaves like a cast-in-place bolt
+ Bearing load transfer allows for closer spacing and edge distances
+ Can be designed for predictable ductile steel performance
+ Undercut created in seconds with durable undercutting tool

APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES), ESR-3067
  Code compliant with the 2015 IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, 2009 IRC, 2006 IBC, and 2006 IRC
- Tested in accordance with ACI 355.2/ASTM E488 and ICC-ES AC193 for use in structural concrete under the design provisions of ACI 318-14 Chapter 17 or ACI 318-11/08 Appendix D
- Evaluated and qualified by an accredited independent testing laboratory for recognition in cracked and uncracked concrete including seismic and wind loading (Category 1 anchors)

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 – Concrete Anchors and 05 05 19 - Post-Installed Concrete Anchors. Undercut anchors shall be Atomic+ Undercut as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

ATOMIC+ UNDERCUT ASSEMBLY

THREAD VERSION

- UNC threaded stud

ANCHOR MATERIALS

- Zinc Plated Carbon Steel
- Type 316 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

- 3/8" through 3/4" diameter

SUITABLE BASE MATERIALS

- Normal-weight concrete
- Sand-lightweight concrete

TENSION ZONE CRACKED CONCRETE

SEISMIC REGION QUALIFICATION

CODE LISTED
ICC-ES ESR-3067
CONCRETE

DDA
DEWALT DESIGN ASSIST™

MATERIAL SPECIFICATIONS

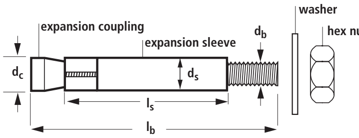
Anchor Component	Anchor Designation			
	Carbon Steel	High Strength Carbon Steel	Stainless Steel (Type 316)	High Strength Stainless Steel (Type 316)
Threaded Rod	ASTM A 36	ASTM A 193, Grade B7	ASTM A193, Grade B8M, Class 1	ASTM A193, Grade B8M, Class 2
Expansion Coupling (Cone)	ASTM A 108 12L14		ASTM A 274 S	
Expansion/Spacer Sleeve	ASTM A 513 Type 5		ASTM A 274 S	
Hex Nut	ASTM A 563, Grade C		ASTM A 194, Grade 8M	
Washer	ASTM F 844; Meets dimensional requirements of ANSI B18.22.1, Type A plain		Type 316 SS; Meets dimensional requirements of ANSI B18.22.1, Type A plain	
Plating	Zinc plating in accordance with ASTM B 633, SC1 (Fe/Zn 5) or equivalent; Minimum plating requirement for Mild Service Condition		Not applicable	

ANCHOR SPECIFICATIONS

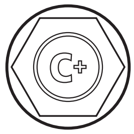
Dimensional Characteristics Table for Atomic+ Undercut

Anchor Designation	Anchor Type	Anchor Rod ASTM Designation	Rod Diameter, d_b (inch)	Anchor Length, l_b (inches)	Sleeve Length, l_s (inches)	Sleeve Diameter, d_s (inch)	Expansion Coupling Diameter d_c (inch)	Max. Fixture Thickness, t (inches)
03100SD	Standard	A 36	3/8	5-1/2	2-3/4	5/8	5/8	1-3/4
03102SD	Through bolt (TB)	A 36	3/8	5-1/2	4-1/2	5/8	5/8	1-3/4
03600SD	Standard	A 193, Grade B8M, Class 1	3/8	5-1/2	2-3/4	5/8	5/8	1-3/4
03602SD	Through bolt (TB)	A 193, Grade B8M, Class 1	3/8	5-1/2	4-1/2	5/8	5/8	1-3/4
03603SD	Standard	A193, Grade B8M, Class 2	3/8	6-3/4	4	5/8	5/8	1-3/4
03605SD	Through Bolt (TB)	A193, Grade B8M, Class 2	3/8	6-3/4	5-3/4	5/8	5/8	1-3/4
03104SD	Standard	A 193, Grade B7	3/8	6-3/4	4	5/8	5/8	1-3/4
03106SD	Through bolt (TB)	A 193, Grade B7	3/8	6-3/4	5-3/4	5/8	5/8	1-3/4
03108SD	Standard	A 36	1/2	7	4	3/4	3/4	1-3/4
03110SD	Through bolt (TB)	A 36	1/2	7	5-3/4	3/4	3/4	1-3/4
03608SD	Standard	A 193, Grade B8M, Class 1	1/2	7	4	3/4	3/4	1-3/4
03610SD	Through bolt (TB)	A 193, Grade B8M, Class 1	1/2	7	5-3/4	3/4	3/4	1-3/4
03609SD	Standard	A193, Grade B8M, Class 2	1/2	8	5	3/4	3/4	1-3/4
03613SD	Through Bolt (TB)	A193, Grade B8M, Class 2	1/2	8	6-3/4	3/4	3/4	1-3/4
03112SD	Standard	A 193, Grade B7	1/2	8	5	3/4	3/4	1-3/4
03114SD	Through bolt (TB)	A 193, Grade B7	1/2	8	6-3/4	3/4	3/4	1-3/4
03116SD	Standard	A 193, Grade B7	1/2	9-3/4	6-3/4	3/4	3/4	1-3/4
03118SD	Through bolt (TB)	A 193, Grade B7	1/2	9-3/4	8-1/2	3/4	3/4	1-3/4
03120SD	Standard	A 36	5/8	7-3/4	4-1/2	1	1	1-3/4
03122SD	Through bolt (TB)	A 36	5/8	7-3/4	6-1/4	1	1	1-3/4
03620SD	Standard	A 193, Grade B8M, Class 1	5/8	7-3/4	4-1/2	1	1	1-3/4
03622SD	Through bolt (TB)	A 193, Grade B8M, Class 1	5/8	7-3/4	6-1/4	1	1	1-3/4
03635SD	Standard	A193, Grade B8M, Class 2	5/8	10-3/4	7-1/2	1	1	1-3/4
03639SD	Through Bolt (TB)	A193, Grade B8M, Class 2	5/8	10-3/4	9-1/4	1	1	1-3/4
03124SD	Standard	A 193, Grade B7	5/8	10-3/4	7-1/2	1	1	1-3/4
03126SD	Through bolt (TB)	A 193, Grade B7	5/8	10-3/4	9-1/4	1	1	1-3/4
03128SD	Standard	A 193, Grade B7	5/8	12-1/4	9	1	1	1-3/4
03130SD	Through bolt (TB)	A 193, Grade B7	5/8	12-1/4	10-3/4	1	1	1-3/4
03132SD	Standard	A 36	3/4	8-5/8	5	1-1/8	1-1/8	1-3/4
03134SD	Through bolt (TB)	A 36	3/4	8-5/8	6-3/4	1-1/8	1-1/8	1-3/4
03632SD	Standard	A 193, Grade B8M, Class 1	3/4	8-5/8	5	1-1/8	1-1/8	1-3/4
03634SD	Through bolt (TB)	A 193, Grade B8M, Class 1	3/4	8-5/8	6-3/4	1-1/8	1-1/8	1-3/4
03648SD	Standard	A193, Grade B8M, Class 2	3/4	13-5/8	10	1-1/8	1-1/8	1-3/4
03649SD	Through Bolt (TB)	A193, Grade B8M, Class 2	3/4	13-5/8	11-3/4	1-1/8	1-1/8	1-3/4
03136SD	Standard	A 193, Grade B7	3/4	13-5/8	10	1-1/8	1-1/8	1-3/4
03138SD	Through bolt (TB)	A 193, Grade B7	3/4	13-5/8	11-3/4	1-1/8	1-1/8	1-3/4

Atomic+ Undercut Anchor Detail



Head Marking



Legend
Letter Code = Length Identification Mark
'+' Symbol = Strength Design Compliant Anchor
(see ordering information)

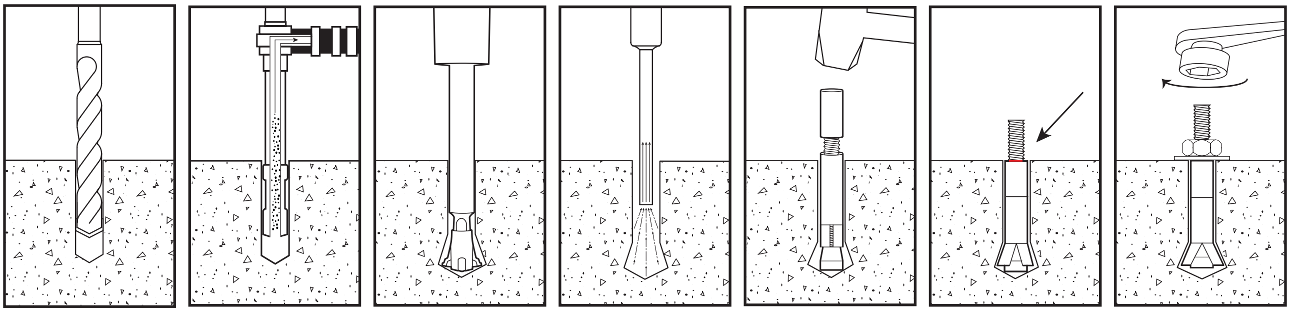
Length Identification

Mark	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
From	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"	10"	11"	12"
Up to but not including	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"	10"	11"	12"	13"

Length identification mark indicates overall length of anchor.

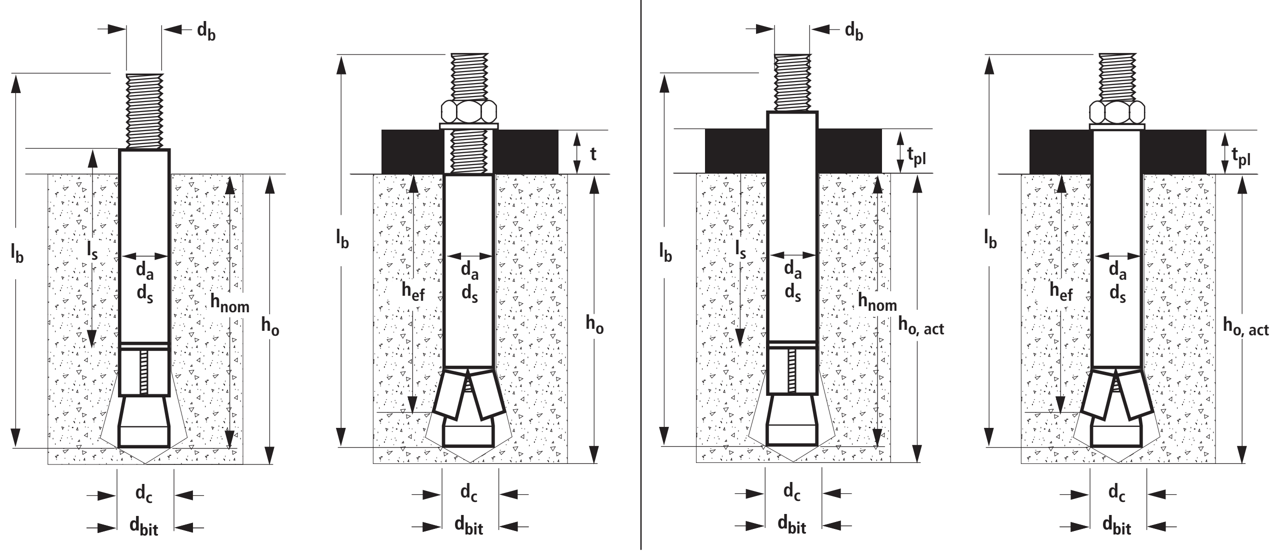
INSTALLATION INSTRUCTIONS

Installation Instructions for Atomic+ Undercut Anchors



1. Using the proper drill bit size, 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.
2. Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.
3. Insert the undercut bit and start the rotohammer. Undercutting is complete when the stopper sleeve is fully compressed (gap closed)
4. Remove dust and debris from the hole following drilling (e.g. suction, forced air)
5. Insert anchor into hole. Place setting sleeve over anchor and drive the expansion sleeve over the expansion coupling.
6. Verify that the setting mark is visible on the theaded rod above the sleeve.
7. Apply proper torque; Do not exceed maximum torque.

Atomic+ Undercut Anchor Detail (before and after application of setting sleeve and attachment)



Before | After

Standard Type (Pre-set Version)

Before | After

Through Bolt Type

Axial Stiffness Values, β, for Atomic+ Undercut Anchors in Normal-Weight Concrete[1]

Concrete State	Notation	Units	Nominal Anchor Size / Rod Diameter (inch)			
			3/8	1/2	5/8	3/4
Uncracked concrete	β_{min}	10^3 lbf/in	131			
	β_m	10^3 lbf/in	930			
	β_{max}	10^3 lbf/in	1,444			
Cracked concrete	β_{min}	10^3 lbf/in	91			
	β_m	10^3 lbf/in	394			
	β_{max}	10^3 lbf/in	1,724			

1. Valid for anchors with high strength threaded rod (A 193 Grade B7). For anchors with low strength threaded rod (A 36) values must be multiplied by 0.7.

INSTALLATION SPECIFICATIONS

Installation Specifications for Atomic+ Undercut Anchors

Anchor Property/Setting Information	Notation	Units	Nominal Anchor Diameter									
			3/8 inch		1/2 inch			5/8 inch			3/4 inch	
Outside anchor diameter	d_a	in. (mm)	0.625 (15.9)		0.750 (19.1)			1.000 (25.4)			1.125 (28.6)	
Minimum diameter of hole clearance in fixture[2]	d_h	in. (mm)	7/16 (11.1)		9/16 (14.3)			11/16 (17.5)			13/16 (20.6)	
Anchor rod designation, carbon steel	ASTM	-	A36	A193 Gr. B7	A36	A193 Grade B7		A36	A193 Grade B7		A36	A193 Gr. B7
Anchor rod designation, stainless steel	ASTM	-	A193 Gr. B8M Class 1	A193 Gr. B8M Class 2	A193 Gr. B8M Class 1	A193 Gr. B8M Class 2	-	A193 Gr. B8M Class 1	A193 Gr. B8M Class 2	-	A193 Gr. B8M Class 1	A193 Gr. B8M Class 2
Minimum nominal embedment depth	h_{nom}	in. (mm)	3-1/8 (79)	4-3/8 (111)	4-1/4 (108)	5-1/4 (133)	7 (178)	5 (127)	8 (203)	9-1/2 (241)	5-7/8 (149)	10-7/8 (276)
Effective embedment	h_{ef}	in. (mm)	2-3/4 (68)	4 (102)	4 (102)	5 (127)	6-3/4 (171)	4-1/2 (114)	7-1/2 (190)	9 (229)	5 (127)	10 (254)
Minimum hole depth[1]	h_o	in. (mm)	3-1/8 (79)	4-3/8 (111)	4-1/4 (108)	5-1/4 (133)	7 (178)	5 (127)	8 (204)	9-1/2 (241)	5-7/8 (149)	10-7/8 (276)
Minimum concrete member thickness	For h_{min1}	in. (mm)	5-1/2 (140)	8 (204)	8 (204)	10 (254)	13-1/2 (343)	9 (229)	15 (381)	18 (457)	10 (254)	20 (508)
	$c_{ac,1} \geq$	in. (mm)	4-1/8 (105)	6 (152)	6 (152)	7-1/2 (190)	10-1/8 (257)	6-3/4 (171)	11-1/4 (256)	13-1/2 (343)	7-1/2 (190)	15 (381)
	For h_{min2}	in. (mm)	4-3/8 (111)	6 (152)	6 (152)	7-1/2 (190)	10-1/8 (257)	6-3/4 (171)	11-1/4 (256)	13-1/2 (343)	7-1/2 (190)	15 (381)
	$c_{ac,2} \geq$	in. (mm)	5-1/2 (140)	10-1/4 (260)	9-1/4 (235)	13 (330)	20-1/4 (514)	9-1/2 (241)	21 (533)	27 (686)	10-1/2 (267)	30 (762)
Minimum edge distance	c_{min}	in. (mm)	2-1/4 (57)	3-1/4 (82)	3-1/4 (82)	4 (102)	5-3/8 (86)	3-5/8 (92)	6 (152)	7-1/4 (184)	4 (102)	8 (204)
Minimum spacing distance	s_{min}	in. (mm)	2-3/4 (70)	4 (102)	4 (102)	5 (127)	6-3/4 (171)	4-1/2 (114)	7-1/2 (190)	9 (229)	5 (127)	10 (254)
Maximum thickness of fixture	t	in. (mm)	1-3/4 (44)		1-3/4 (44)			1-3/4 (44)			1-3/4 (44)	
Maximum torque	T_{inst}	ft.-lbf.	26		44			60			133	
Torque wrench / socket size	-	in.	11/16		7/8			1-1/16			1-1/4	
Nut Height	-	in.	23/64		31/64			39/64			47/64	
Stop Drill Bit												
Nominal stop drill bit diameter	d_{bit}	in.	5/8 ANSI		3/4 ANSI			1 ANSI			1-1/8 ANSI	
Stop drill bit for anchor installation	-	-	3220SD	3221SD	3222SD	3223SD	3224SD	3225SD	3226SD	3227SD	3228SD	3229SD
Drilled hole depth of stop bit[1]	-	-	3-1/8	4-3/8	4-1/4	5-1/4	7	5	8	9-1/2	5-7/8	10-7/8
Stop drill bit shank type	-	-	SDS		SDS			SDS-Max			SDS-Max	
Undercut Drill Bit												
Nominal undercut drill bit diameter	d_{uc}	in.	5/8		3/4			1			1-1/8	
Undercut drill bit designation	-	-	3200SD		3201SD			3202SD			3203SD	
Maximum depth of hole for undercut drill bit	-	in. (mm)	9 (229)		10-1/4 (260)			12-1/4 (311)			13-1/2 (343)	
Undercut drill bit shank type	-	-	SDS		SDS			SDS-Max			SDS-Max	
Required impact drill energy	-	ft.-lbf.	1.6		2.5			3.2			4.0	
Setting Sleeve												
Recommended setting sleeve	-	-	3210SD		3211SD			3212SD			3213SD	

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

1. For through bolt applications, the actual hole depth is given by the minimum hole depth plus the maximum thickness of fixture less the thickness of the actual part(s) being fastened to the base material ($h_{o,act} = h_o + t - t_{pl}$).
2. For through bolt applications the minimum diameter of hole clearance in fixture is 1/16-inch larger than the nominal outside anchor diameter.

PERFORMANCE DATA

Tension and Shear Design Information For Atomic+ Undercut Anchor in Concrete (For use with load combinations taken from ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2)[1]

Anchor Property / Setting Information		Notation	Units	Nominal Anchor Diameter									
				3/8 inch		1/2 inch			5/8 inch			3/4 inch	
Anchor category		1,2 or 3	-	1									
Outside anchor diameter		$d_a [d_o]$[8]	in. (mm)	0.625 (15.9)		0.750 (19.1)			1.000 (25.4)			1.125 (28.6)	
Effective embedment		h_{ef}	in. (mm)	2-3/4 (68)	4 (102)	4 (102)	5 (127)	6-3/4 (171)	4-1/2 (114)	7-1/2 (190)	9 (229)	5 (127)	10 (254)
STEEL STRENGTH IN TENSION AND SHEAR[3]													
Tensile stress area of anchor rod steel		A_{se}	in.² (mm²)	0.0775 (50)		0.1419 (91)			0.2260 (146)			0.3345 (216)	
ASTM A36 (fy ≥ 36 ksi) ASTM A193 Grade B7 (fy ≥ 105 ksi)	Minimum specified yield strength of anchor rod[10]	f_y	ksi (N/mm²)	36 (248)	105 (723)	36 (248)	105 (723)	105 (723)	36 (248)	105 (723)	105 (723)	36 (248)	105 (723)
	Minimum specified ultimate tensile strength of anchor rod[10]	f_{uta}	ksi (N/mm²)	58 (400)	125 (860)	58 (400)	125 (860)	125 (860)	58 (400)	125 (860)	125 (860)	58 (400)	125 (860)
	Steel strength in tension, static[10]	N_{sa}	lb (kN)	4,495 (20.1)	9,685 (43.2)	8,230 (36.7)	17,735 (79.1)	17,735 (79.1)	13,100 (58.5)	28,250 (126.1)	28,250 (126.1)	19,400 (86.3)	41,810 (186.0)
	Steel strength in shear, static[9,10]	V_{sa}	lb (kN)	2,245 (10.0)	4,885 (21.7)	4,110 (18.4)	8,855 (39.5)	8,855 (39.5)	6,560 (29.3)	14,110 (63.0)	14,110 (63.0)	9,685 (43.2)	20,875 (93.2)
	Steel strength in shear, seismic[9,10]	V_{eq}	lb (kN)	2,245 (10.0)	4,885 (21.7)	4,110 (18.4)	8,855 (39.5)	8,855 (39.5)	6,560 (29.3)	14,110 (63.0)	14,110 (63.0)	9,685 (43.2)	20,875 (93.2)
ASTM A193 Grade B8M, Class 1 (fy >= 30 ksi) ASTM A193 Grade B8M, Class 2 (fy >= 95 ksi)	Minimum specified yield strength of anchor rod (Type 316 stainless steel anchor)	$f_{y,ss}$	ksi (N/mm²)	30 (205)	95 (655)	30 (205)	95 (655)	-	30 (205)	95 (655)	-	30 (205)	95 (655)
	Minimum specified ultimate tensile strength of anchor rod (Type 316 stainless steel anchor)	$f_{uta,ss}$	ksi (N/mm²)	75 (515)	105 (760)	75 (515)	105 (760)	-	75 (515)	105 (760)	-	75 (515)	105 (760)
	Steel strength in tension, static (Type 316 stainless steel anchor)[11]	$N_{sa,ss}$	lb (kN)	4,415 (19.6)	8,525 (37.9)	8,085 (36.0)	15,610 (69.4)	-	12,880 (57.3)	24,860 (110.6)	-	19,065 (84.8)	36,795 (163.7)
	Steel strength in shear, static (Type 316 stainless steel anchor)[11]	$V_{sa,ss}$	lb (kN)	2,210 (9.8)	4,265 (19.0)	4,045 (18.0)	7,805 (34.7)	-	6,440 (28.6)	12,430 (55.3)	-	9,535 (42.4)	18,400 (81.8)
Reduction factor for steel strength in tension[2]		ϕ	-	0.75									
Reduction factor for steel strength in shear[2]		ϕ	-	0.65									
CONCRETE BREAKOUT STRENGTH IN TENSION AND SHEAR[7]													
Effectiveness factor for uncracked concrete		k_{uncr}	-	30		30			30			30	
Effectiveness factor for cracked concrete		k_{cr}	-	24		24			24			24	
Modification factor for cracked and uncracked concrete[4]		$\Psi_{c,N}$	-	1.0 (See note 4)		1.0 (See note 4)			1.0 (See note 4)			1.0 (See note 4)	
Reduction factor for concrete breakout strength in tension[2]		ϕ	-	0.65 (Condition B)									
Reduction factor for concrete breakout strength in shear[2]		ϕ	-	0.70 (Condition B)									
PULLOUT STRENGTH IN TENSION[7]													
Characteristic pullout strength, uncracked concrete (2,500 psi)[5]		$N_{p,uncr}$	lb (kN)	See note 6		See note 6			See note 6			See note 6	
Characteristic pullout strength, cracked concrete (2,500 psi)[5]		$N_{p,cr}$	lb (kN)	See note 6	9,000 (40.2)	See note 6	11,500 (51.3)		See note 6	15,000 (67.0)		See note 6	22,000 (98.2)
Characteristic pullout strength, seismic (2,500 psi)[5,10]		N_{eq}	lb (kN)	See note 6	9,000 (40.2)	See note 6	11,500 (51.3)		See note 6	15,000 (67.0)		See note 6	22,000 (98.2)
Reduction factor for pullout strength[2]		ϕ	-	0.65 (Condition B)									
PRYOUT STRENGTH IN SHEAR[7]													
Coefficient for pryout strength		k_{cp}	-	2.0		2.0			2.0			2.0	
Reduction factor for pryout strength[2]		ϕ	-	0.70 (Condition B)									

For SI: 1 inch = 25.4 mm, 1 ksi = 6.895 MPa (N/mm²), 1 lbf = 0.0044 kN, 1 in² = 645 mm².

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable, shall apply.
2. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable. If the load combinations of ACI 318-11 Appendix C are used, then the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4. For reinforcement that meets ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable, requirements for Condition A, see ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c), as applicable, for the appropriate ϕ factor when the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used.
3. Anchors are considered a ductile steel element as defined by ACI 318-14 2.3 or ACI 318-11 D.1, as applicable.
4. For all design cases $\Psi_{c,N}$ =1.0. The appropriate effectiveness factor for cracked concrete (k_{cr}) or uncracked concrete (k_{uncr}) must be used.
5. For all design cases $\Psi_{c,P}$ =1.0. For concrete compressive strength greater than 2,500 psi N_{pn} = (pullout strength from table)*(specified concrete compressive strength/2,500)$^{0.5}$.
6. Pullout strength does not control design of indicated anchors. Do not calculate pullout strength for indicated anchor size and embedment.
7. Anchors are permitted to be used in lightweight concrete provided the modification factor λ_a equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n and V_n. λ shall be determined in accordance with the corresponding version of ACI 318.
8. The notation in brackets is for the 2006 IBC.
9. Shear strength values are based on standard (pre-set) installation, and must be used for both standard (pre-set) and through-bolt installations.
10. These values are only applicable to carbon steel anchors; values are not established for stainless steel anchors.
11. Calculated using $f_{uta,ss}$ = 57 ksi (1.9fy) in accordance with ACI 318-14 Chapter 17 or ACI 318-11 Appendix D.

FACTORED DESIGN STRENGTH (ϕN_N AND ϕV_N) CALCULATED IN ACCORDANCE WITH ACI 318-14 CHAPTER 17:

1- Tabular values are provided for illustration and are applicable for single anchors installed in normal-weight concrete with minimum slab thickness, $h_a = h_{min2}$, and with the following conditions:
  - c_{a1} is greater than or equal to the critical edge distance, c_{ac} (table values based on $c_{a1} = c_{ac}$).
  - c_{a2} is greater than or equal to 1.5 times c_{a1}.

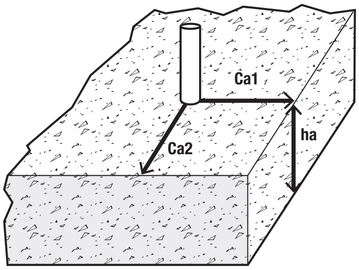
2- Calculations were performed according to ACI 318-14 Chapter 17. The load level corresponding to the controlling failure mode is listed. (e.g. For tension: steel, concrete breakout and pullout; For shear: steel, concrete breakout and pryout). Furthermore, the capacities for concrete breakout strength in tension and pryout strength in shear are calculated using the effective embedment values, hef, for the selected anchors as noted in the design information tables. Please also reference the installation specifications for more information.

3- Strength reduction factors (ø) were based on ACI 318-14 Section 5.3 for load combinations. Condition B is assumed.

4- Tabular values are permitted for static loads only, seismic loading is not considered with these tables.

5- For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Chapter 17.

6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318-14 Chapter 17. For other design conditions including seismic considerations please see ACI 318-14 Chapter 17.



Tension and Shear Design Strength for Carbon Steel Atomic+ Undercut in Cracked Concrete

STRENGTH DESIGN SD TABLES

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Anchor Rod Designation (ASTM)	Minimum Concrete Compressive Strength, f'c (psi)									
			2,500		3,000		4,000		6,000		8,000	
			ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)
3/8	3-1/8	A 36	3,370	1,460	3,370	1,460	3,370	1,460	3,370	1,460	3,370	1,460
	4-3/8	A 193, Gr. B7	5,850	3,175	6,410	3,175	7,265	3,175	7,265	3,175	7,265	3,175
1/2	4-1/4	A 36	6,175	2,670	6,175	2,670	6,175	2,670	6,175	2,670	6,175	2,670
	5-1/4	A 193, Gr. B7	7,475	5,755	8,190	5,755	9,455	5,755	11,580	5,755	13,300	5,755
	7	A 193, Gr. B7	7,475	5,755	8,190	5,755	9,455	5,755	11,580	5,755	13,300	5,755
5/8	5	A 36	7,445	4,265	8,155	4,265	9,420	4,265	9,825	4,265	9,825	4,265
	8	A 193, Gr. B7	9,750	9,170	10,680	9,170	12,335	9,170	15,105	9,170	17,440	9,170
	9-1/2	A 193, Gr. B7	9,750	9,170	10,680	9,170	12,335	9,170	15,105	9,170	17,440	9,170
3/4	5-7/8	A 36	8,720	6,410	9,555	6,410	11,030	6,410	13,510	6,410	14,550	6,410
	10-7/8	A 193, Gr. B7	14,300	13,570	15,665	13,570	18,090	13,570	22,155	13,570	25,580	13,570

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

Tension and Shear Design Strength for Carbon Steel Atomic+ Undercut in Uncracked Concrete

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Anchor Rod Designation (ASTM)	Minimum Concrete Compressive Strength, f'c (psi)									
			2,500		3,000		4,000		6,000		8,000	
			ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)
3/8	3-1/8	A 36	3,370	1,460	3,370	1,460	3,370	1,460	3,370	1,460	3,370	1,460
	4-3/8	A 193, Gr. B7	7,265	3,175	7,265	3,175	7,265	3,175	7,265	3,175	7,265	3,175
1/2	4-1/4	A 36	6,175	2,670	6,175	2,670	6,175	2,670	6,175	2,670	6,175	2,670
	5-1/4	A 193, Gr. B7	10,900	5,755	11,940	5,755	13,300	5,755	13,300	5,755	13,300	5,755
	7	A 193, Gr. B7	13,300	5,755	13,300	5,755	13,300	5,755	13,300	5,755	13,300	5,755
5/8	5	A 36	9,305	4,265	9,825	4,265	9,825	4,265	9,825	4,265	9,825	4,265
	8	A 193, Gr. B7	20,025	9,170	21,190	9,170	21,190	9,170	21,190	9,170	21,190	9,170
	9-1/2	A 193, Gr. B7	21,190	9,170	21,190	9,170	21,190	9,170	21,190	9,170	21,190	9,170
3/4	5-7/8	A 36	10,900	6,410	11,940	6,410	13,790	6,410	14,550	6,410	14,550	6,410
	10-7/8	A 193, Gr. B7	30,830	13,570	31,360	13,570	31,360	13,570	31,360	13,570	31,360	13,570

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

Converted Allowable Loads for Carbon Steel Atomic+ Undercut in Cracked Concrete[1,2]

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	Anchor Rod Designation (ASTM)	Minimum Concrete Compressive Strength									
			f 'c = 2,500 psi		f 'c = 3,000 psi		f 'c = 4,000 psi		f 'c = 6,000 psi		f 'c = 8,000 psi	
			$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)
3/8	3-1/8	A 36	2,405	1,045	2,405	1,045	2,405	1,045	2,405	1,045	2,405	1,045
	4-3/8	A 193, Gr. B7	4,180	2,270	4,580	2,270	5,190	2,270	5,190	2,270	5,190	2,270
1/2	4-1/4	A 36	4,410	1,905	4,410	1,905	4,410	1,905	4,410	1,905	4,410	1,905
	5-1/4	A 193, Gr. B7	5,340	4,110	5,850	4,110	6,755	4,110	8,270	4,110	9,500	4,110
	7	A 193, Gr. B7	5,340	4,110	5,850	4,110	6,755	4,110	8,270	4,110	9,500	4,110
5/8	5	A 36	5,320	3,045	5,825	3,045	6,730	3,045	7,020	3,045	7,020	3,045
	8	A 193, Gr. B7	6,965	6,550	7,630	6,550	8,810	6,550	10,790	6,550	12,455	6,550
	9-1/2	A 193, Gr. B7	6,965	6,550	7,630	6,550	8,810	6,550	10,790	6,550	12,455	6,550
3/4	5-7/8	A 36	6,230	4,580	6,825	4,580	7,880	4,580	9,650	4,580	10,395	4,580
	10-7/8	A 193, Gr. B7	10,215	9,695	11,190	9,695	12,920	9,695	15,825	9,695	18,270	9,695

1. Allowable load values are calculated using a conversion factor, α, from Factored Design Strengths and conditions shown on the previous page.
2. Tabulated allowable load values assume 50% dead load and 50% live load, with controlling load combination 1.2D + 1.6L. Calculated weighted average for the conversion factor α : 1.2(0.5) + 1.6(0.5) = 1.4.

Converted Allowable Loads for Carbon Steel Atomic+ Undercut in Uncracked Concrete[1,2]

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	Anchor Rod Designation (ASTM)	Minimum Concrete Compressive Strength									
			f 'c = 2,500 psi		f 'c = 3,000 psi		f 'c = 4,000 psi		f 'c = 6,000 psi		f 'c = 8,000 psi	
			$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)
3/8	3-1/8	A 36	2,405	1,045	2,405	1,045	2,405	1,045	2,405	1,045	2,405	1,045
	4-3/8	A 193, Gr. B7	5,190	2,270	5,190	2,270	5,190	2,270	5,190	2,270	5,190	2,270
1/2	4-1/4	A 36	4,410	1,905	4,410	1,905	4,410	1,905	4,410	1,905	4,410	1,905
	5-1/4	A 193, Gr. B7	7,785	4,110	8,530	4,110	9,500	4,110	9,500	4,110	9,500	4,110
	7	A 193, Gr. B7	9,500	4,110	9,500	4,110	9,500	4,110	9,500	4,110	9,500	4,110
5/8	5	A 36	6,645	3,045	7,020	3,045	7,020	3,045	7,020	3,045	7,020	3,045
	8	A 193, Gr. B7	14,305	6,550	15,135	6,550	15,135	6,550	15,135	6,550	15,135	6,550
	9-1/2	A 193, Gr. B7	15,135	6,550	15,135	6,550	15,135	6,550	15,135	6,550	15,135	6,550
3/4	5-7/8	A 36	7,785	4,580	8,530	4,580	9,850	4,580	10,395	4,580	10,395	4,580
	10-7/8	A 193, Gr. B7	22,020	9,695	22,400	9,695	22,400	9,695	22,400	9,695	22,400	9,695

1. Allowable load values are calculated using a conversion factor, α, from Factored Design Strengths and conditions shown on the previous page.
2. Tabulated allowable load values assume 50% dead load and 50% live load, with controlling load combination 1.2D + 1.6L. Calculated weighted average for the conversion factor α : 1.2(0.5) + 1.6(0.5) = 1.4.

FACTORED DESIGN STRENGTH (ϕN_N AND ϕV_N) CALCULATED IN ACCORDANCE WITH ACI 318-14 CHAPTER 17:

1- Tabular values are provided for illustration and are applicable for single anchors installed in normal-weight concrete with minimum slab thickness, $h_a = h_{min2}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac} (table values based on $c_{a1} = c_{ac}$).
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.

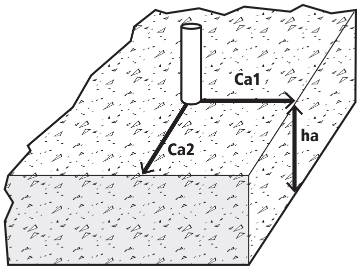
2- Calculations were performed according to ACI 318-14 Chapter 17. The load level corresponding to the controlling failure mode is listed. (e.g. For tension: steel, concrete breakout and pullout; For shear: steel, concrete breakout and pryout). Furthermore, the capacities for concrete breakout strength in tension and pryout strength in shear are calculated using the effective embedment values, hef, for the selected anchors as noted in the design information tables. Please also reference the installation specifications for more information.

3- Strength reduction factors (ø) were based on ACI 318-14 Section 5.3 for load combinations. Condition B is assumed.

4- Tabular values are permitted for static loads only, seismic loading is not considered with these tables.

5- For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Chapter 17.

6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318-14 Chapter 17. For other design conditions including seismic considerations please see ACI 318-14 Chapter 17.



Tension and Shear Design Strength for Stainless Steel Atomic+ Undercut Anchor in Cracked Concrete

STRENGTH DESIGN SD TABLES

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Anchor Rod Designation (ASTM)	Minimum Concrete Compressive Strength, f'c (psi)									
			2,500		3,000		4,000		6,000		8,000	
			ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)
3/8	3-1/8	A 193, Gr. B8M Class 1	3,310	1,435	3,310	1,435	3,310	1,435	3,310	1,435	3,310	1,435
	4-3/8	A 193, Gr. B8M Class 2	5,850	2,770	6,395	2,770	6,395	2,770	6,395	2,770	6,395	2,770
1/2	4-1/4	A 193, Gr. B8M Class 1	6,065	2,625	6,065	2,625	6,065	2,625	6,065	2,625	6,065	2,625
	5-1/4	A 193, Gr. B8M Class 2	7,475	5,075	8,190	5,075	9,455	5,075	11,580	5,075	11,705	5,075
5/8	5	A 193, Gr. B8M Class 1	7,445	4,185	8,155	4,185	9,420	4,185	9,660	4,185	9,660	4,185
	8	A 193, Gr. B8M Class 2	9,750	8,080	10,680	8,080	12,335	8,080	15,105	8,080	17,440	8,080
3/4	5-7/8	A 193, Gr. B8M Class 1	8,720	6,195	9,555	6,195	11,030	6,195	13,510	6,195	14,300	6,195
	10-7/8	A 193, Gr. B8M Class 2	14,300	11,955	15,665	11,955	18,090	11,955	22,155	11,955	25,580	11,955

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

Tension and Shear Design Strength for Stainless Steel Atomic+ Undercut Anchor in Uncracked Concrete

STRENGTH DESIGN SD TABLES

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Anchor Rod Designation (ASTM)	Minimum Concrete Compressive Strength, f'c (psi)									
			2,500		3,000		4,000		6,000		8,000	
			ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)
3/8	3-1/8	A 193, Gr. B8M Class 1	3,310	1,435	3,310	1,435	3,310	1,435	3,310	1,435	3,310	1,435
	4-3/8	A 193, Gr. B8M Class 2	6,395	2,770	6,395	2,770	6,395	2,770	6,395	2,770	6,395	2,770
1/2	4-1/4	A 193, Gr. B8M Class 1	6,065	2,625	6,065	2,625	6,065	2,625	6,065	2,625	6,065	2,625
	5-1/4	A 193, Gr. B8M Class 2	10,900	5,075	11,705	5,075	11,705	5,075	11,705	5,075	11,705	5,075
5/8	5	A 193, Gr. B8M Class 1	9,305	4,185	9,660	4,185	9,660	4,185	9,660	4,185	9,660	4,185
	8	A 193, Gr. B8M Class 2	18,645	8,080	18,645	8,080	18,645	8,080	18,645	8,080	18,645	8,080
3/4	5-7/8	A 193, Gr. B8M Class 1	10,900	6,195	11,940	6,195	13,790	6,195	14,300	6,195	14,300	6,195
	10-7/8	A 193, Gr. B8M Class 2	27,595	11,955	27,595	11,955	27,595	11,955	27,595	11,955	27,595	11,955

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

Converted Allowable Loads for Stainless Steel Atomic+ Undercut in Cracked Concrete[1,2]

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	Anchor Rod Designation (ASTM)	Minimum Concrete Compressive Strength									
			f 'c = 2,500 psi		f 'c = 3,000 psi		f 'c = 4,000 psi		f 'c = 6,000 psi		f 'c = 8,000 psi	
			$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)
3/8	3-1/8	A 193, Gr. B8M Class 1	2,365	1,025	2,365	1,025	2,365	1,025	2,365	1,025	2,365	1,025
	4-3/8	A 193, Gr. B8M Class 2	4,180	1,980	4,570	1,980	4,570	1,980	4,570	1,980	4,570	1,980
1/2	4-1/4	A 193, Gr. B8M Class 1	4,330	1,875	4,330	1,875	4,330	1,875	4,330	1,875	4,330	1,875
	5-1/4	A 193, Gr. B8M Class 2	5,340	3,625	5,850	3,625	6,755	3,625	8,270	3,625	8,360	3,625
5/8	5	A 193, Gr. B8M Class 1	5,320	2,990	5,825	2,990	6,730	2,990	6,900	2,990	6,900	2,990
	8	A 193, Gr. B8M Class 2	6,965	5,770	7,630	5,770	8,810	5,770	10,790	5,770	12,455	5,770
3/4	5-7/8	A 193, Gr. B8M Class 1	6,230	4,425	6,825	4,425	7,880	4,425	9,650	4,425	10,215	4,425
	10-7/8	A 193, Gr. B8M Class 2	10,215	8,540	11,190	8,540	12,920	8,540	15,825	8,540	18,270	8,540

1. Allowable load values are calculated using a conversion factor, α, from Factored Design Strengths and conditions shown on the previous page.
2. Tabulated allowable load values assume 50% dead load and 50% live load, with controlling load combination 1.2D + 1.6L. Calculated weighted average for the conversion factor α : 1.2(0.5) + 1.6(0.5) = 1.4.

Converted Allowable Loads for Stainless Steel Atomic+ Undercut in Uncracked Concrete[1,2]

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	Anchor Rod Designation (ASTM)	Minimum Concrete Compressive Strength									
			f 'c = 2,500 psi		f 'c = 3,000 psi		f 'c = 4,000 psi		f 'c = 6,000 psi		f 'c = 8,000 psi	
			$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)
3/8	3-1/8	A 193, Gr. B8M Class 1	2,365	1,025	2,365	1,025	2,365	1,025	2,365	1,025	2,365	1,025
	4-3/8	A 193, Gr. B8M Class 2	4,570	1,980	4,570	1,980	4,570	1,980	4,570	1,980	4,570	1,980
1/2	4-1/4	A 193, Gr. B8M Class 1	4,330	1,875	4,330	1,875	4,330	1,875	4,330	1,875	4,330	1,875
	5-1/4	A 193, Gr. B8M Class 2	7,785	3,625	8,360	3,625	8,360	3,625	8,360	3,625	8,360	3,625
5/8	5	A 193, Gr. B8M Class 1	6,645	2,990	6,900	2,990	6,900	2,990	6,900	2,990	6,900	2,990
	8	A 193, Gr. B8M Class 2	13,320	5,770	13,320	5,770	13,320	5,770	13,320	5,770	13,320	5,770
3/4	5-7/8	A 193, Gr. B8M Class 1	7,785	4,425	8,530	4,425	9,850	4,425	10,215	4,425	10,215	4,425
	10-7/8	A 193, Gr. B8M Class 2	19,710	8,540	19,710	8,540	19,710	8,540	19,710	8,540	19,710	8,540

1. Allowable load values are calculated using a conversion factor, α, from Factored Design Strengths and conditions shown on the previous page.
2. Tabulated allowable load values assume 50% dead load and 50% live load, with controlling load combination 1.2D + 1.6L. Calculated weighted average for the conversion factor α : 1.2(0.5) + 1.6(0.5) = 1.4.

ORDERING INFORMATION

Atomic+ Undercut Anchor Zinc Plated Carbon Steel

Cat. No.	Anchor Rod ASTM Designation	Nominal Anchor Diameter	Anchor Outside Diameter	Overall Length	Required Undercut Bit (Cat. No.)	Required Stop Bit (Cat. No.)	Anchor Type	Std. Box
03100SD	ASTM A36	3/8"	5/8"	5-1/2"	03200SD	03220SD	Standard	20
03102SD	ASTM A36	3/8"	5/8"	5-1/2"		*	Through Bolt	20
03104SD	ASTM A193 Gr. B7	3/8"	5/8"	6-3/4"		03221SD	Standard	20
03106SD	ASTM A193 Gr. B7	3/8"	5/8"	6-3/4"		*	Through Bolt	20
03108SD	ASTM A36	1/2"	3/4"	7"	03201SD	03222SD	Standard	15
03110SD	ASTM A36	1/2"	3/4"	7"		*	Through Bolt	15
03112SD	ASTM A193 Gr. B7	1/2"	3/4"	8"		03223SD	Standard	15
03114SD	ASTM A193 Gr. B7	1/2"	3/4"	8"		*	Through Bolt	15
03116SD	ASTM A193 Gr. B7	1/2"	3/4"	9-3/4"		03224SD	Standard	15
03118SD	ASTM A193 Gr. B7	1/2"	3/4"	9-3/4"		*	Through Bolt	15
03120SD	ASTM A36	5/8"	1"	7-3/4"	03202SD	03225SD	Standard	10
03122SD	ASTM A36	5/8"	1"	7-3/4"		*	Through Bolt	10
03124SD	ASTM A193 Gr. B7	5/8"	1"	10-3/4"		03226SD	Standard	10
03126SD	ASTM A193 Gr. B7	5/8"	1"	10-3/4"		*	Through Bolt	10
03128SD	ASTM A193 Gr. B7	5/8"	1"	12-1/4"		03227SD	Standard	10
03130SD	ASTM A193 Gr. B7	5/8"	1"	12-1/4"		*	Through Bolt	10
03132SD	ASTM A36	3/4"	1-1/8"	8-5/8"	03203SD	03228SD	Standard	8
03134SD	ASTM A36	3/4"	1-1/8"	8-5/8"		*	Through Bolt	8
03136SD	ASTM A193 Gr. B7	3/4"	1-1/8"	13-5/8"		03229SD	Standard	8
03138SD	ASTM A193 Gr. B7	3/4"	1-1/8"	13-5/8"		*	Through Bolt	8

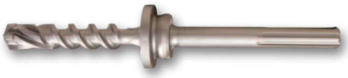
For availability of all anchor lengths please contact DEWALT.
*Contact DEWALT for appropriate drilling method and hardware

Atomic+ Undercut Anchor Type 316 Stainless Steel

Cat. No.	Anchor Rod ASTM Designation	Nominal Anchor Diameter	Anchor Outside Diameter	Overall Length	Required Undercut Bit (Cat. No.)	Required Stop Bit (Cat. No.)	Anchor Type	Std. Box
03600SD	ASTM A193, Grade B8M, Class 1	3/8"	5/8"	5-1/2"	03200SD	03220SD	Standard	20
03602SD	ASTM A193, Grade B8M, Class 1	3/8"	5/8"	5-1/2"		*	Through Bolt	20
03603SD	ASTM A193, Grade B8M, Class 2	3/8"	5/8"	6-3/4"		03221SD	Standard	20
03605SD	ASTM A193, Grade B8M, Class 2	3/8"	5/8"	6-3/4"		*	Through Bolt	20
03608SD	ASTM A193, Grade B8M, Class 1	1/2"	3/4"	7"	03201SD	03222SD	Standard	15
03610SD	ASTM A193, Grade B8M, Class 1	1/2"	3/4"	7"		*	Through Bolt	15
03609SD	ASTM A193, Grade B8M, Class 2	1/2"	3/4"	8"		03223SD	Standard	15
03613SD	ASTM A193, Grade B8M, Class 2	1/2"	3/4"	8"		*	Through Bolt	15
03620SD	ASTM A193, Grade B8M, Class 1	5/8"	1"	7-3/4"	03202SD	03225SD	Standard	10
03622SD	ASTM A193, Grade B8M, Class 1	5/8"	1"	7-3/4"		*	Through Bolt	10
03635SD	ASTM A193, Grade B8M, Class 2	5/8"	1"	10-3/4"		03226SD	Standard	10
03639SD	ASTM A193, Grade B8M, Class 2	5/8"	1"	10-3/4"		*	Through Bolt	10
03632SD	ASTM A193, Grade B8M, Class 1	3/4"	1-1/8"	8-5/8"	03203SD	03228SD	Standard	8
03634SD	ASTM A193, Grade B8M, Class 1	3/4"	1-1/8"	8-5/8"		*	Through Bolt	8
03648SD	ASTM A193, Grade B8M, Class 2	3/4"	1-1/8"	13-5/8"		03229SD	Standard	8
03649SD	ASTM A193, Grade B8M, Class 2	3/4"	1-1/8"	13-5/8"		*	Through Bolt	8

For availability of all anchor lengths please contact DEWALT.
*Contact DEWALT for appropriate drilling method and hardware

Stop Drill Bits



Cat. No.	Nominal Stop Drill Bit Diameter	Corresponding Nominal Anchor Diameter	Max. Drill Depth	Shank Type	Std. Tube
03220SD	5/8	3/8	3-1/8"	SDS	1
03221SD	5/8	3/8	4-3/8"	SDS	1
03222SD	3/4	1/2	4-1/4"	SDS	1
03223SD	3/4	1/2	5-1/4"	SDS	1
03224SD	3/4	1/2	7"	SDS	1
03225SD	1	5/8	5"	SDS-Max	1
03226SD	1	5/8	8"	SDS-Max	1
03227SD	1	5/8	9-1/2"	SDS-Max	1
03228SD	1-1/8	3/4	5-13/16"	SDS-Max	1
03229SD	1-1/8	3/4	10-13/16"	SDS-Max	1

The Stop Drill Bit creates a drill hole to the proper depth for standard installations of the Atomic+ Undercut anchor.
(For through bolt applications please contact DEWALT for appropriate drilling method and hardware)

Undercut Drill Bits

Cat. No.	Nominal Undercut Drill Bit Diameter	Corresponding Nominal Anchor Diameter	Maximum Depth of Hole	Shank Type	Std. Tube
03200SD	5/8	3/8	9"	SDS	1
03201SD	3/4	1/2	10-1/4"	SDS	1
03202SD	1	5/8	12-1/4"	SDS-Max	1
03203SD	1-1/8	3/4	13-1/2"	SDS-Max	1

The Undercut Drill Bit has a unique design that enlarges the bottom of the drill hole creating a reverse cone sized to receive the Atomic+ Undercut anchor.

Setting Sleeve for Undercut Anchors

Cat.. No.	Corresponding Nominal Anchor Diameter	Std. Box
03210SD	3/8	1
03211SD	1/2	1
03218SD	5/8	1
03213SD	3/4	1

Replacement Blade Assemblies for Undercut Drill Bit

Cat.. No.	Description	Std. Tube
03205SD	Atomic+ (3/8") Cutter Blade - 5/8"	1
03206SD	Atomic+ (1/2") Cutter Blade - 3/4"	1
03208SD	Atomic+ (5/8") Cutter Blade - 1"	1
03209SD	Atomic+ (3/4") Cutter Blade - 1-1/8"	1

Replacement Bow Jaws for Undercut Drill Bit

Cat.. No.	Description	Std. Tube
03212SD	3/8" Bow Jaw for 5/8" Hole	1
03215SD	1/2" Bow Jaw for 3/4" Hole	1
03216SD	5/8" Bow Jaw for 1" Hole	1
03217SD	3/4" Bow Jaw for 1-1/8" Hole	1

GENERAL INFORMATION

POWER-STUD®+ SD1

Wedge Expansion Anchor

PRODUCT DESCRIPTION

The Power-Stud+ SD1 anchor is a fully threaded, torque-controlled, wedge expansion anchor which is designed for consistent performance in cracked and uncracked concrete. Suitable base materials include normal-weight concrete, sand-lightweight concrete, concrete over steel deck, and grouted concrete masonry. The anchor is manufactured with a zinc plated carbon steel body and expansion clip for premium performance. Nut and washer are included.

GENERAL APPLICATIONS AND USES

- Structural connections, i.e., beam and column anchorage
- Safety-related attachments
- Protective barriers and racking
- Tension zone applications, i.e., cable trays and strut, pipe supports, fire sprinklers
- Seismic and wind loading
- Interior applications / low level corrosion environment

FEATURES AND BENEFITS

+ Consistent performance in high and low strength concrete
+ Nominal drill bit size is the same as the anchor diameter
+ Anchor can be installed through standard fixture holes
+ Length ID code and identifying marking stamped on head of each anchor
+ Anchor design allows for follow-up expansion after setting under tensile loading

APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES), ESR-2818 for cracked and uncracked concrete
- International Code Council, Evaluation Service (ICC-ES), ESR-2966 for masonry
- Code compliant with the 2015 IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, and 2009 IRC
- Tested in accordance with ACI 355.2/ASTM E 488 and ICC-ES AC193 for use in structural concrete under the design provisions of ACI 318-14 Chapter 17 or ACI 318-11/08 Appendix D
- Evaluated and qualified by an accredited independent testing laboratory for recognition in cracked and uncracked concrete including seismic and wind loading (Category 1 anchors)
- Tested in accordance with ICC-ES AC01 for use in masonry
- Underwriters Laboratories (UL Listed) - File No. EX1289, see listing for sizes

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Expansion anchors shall be Power-Stud+ SD1 as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

POWER-STUD+ SD1 ASSEMBLY

THREAD VERSION

- UNC threaded stud

ANCHOR MATERIALS

- Zinc plated carbon steel body with expansion clip, nut and washer

ANCHOR SIZE RANGE (TYP.)

- 1/4" diameter through 1-1/4" diameter

SUITABLE BASE MATERIALS

- Normal-weight concrete
- Sand-lightweight concrete
- Concrete over steel deck
- Grouted concrete masonry (CMU)

TENSION ZONE CRACKED CONCRETE

SEISMIC REGION QUALIFICATION

CODE LISTED ICC-ES ESR-2818 CONCRETE

CODE LISTED ICC-ES ESR-2966 MASONRY

DDA DEWALT DESIGN ASSIST

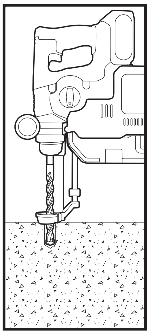
DUST X+ ANCHOR INSTALLATION SYSTEM

MATERIAL SPECIFICATIONS

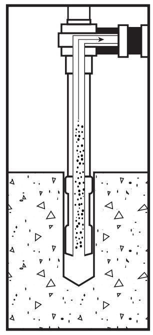
Anchor component	Specification
Anchor Body	Medium carbon steel
Hex nut	Carbon steel, ASTM A 563, Grade A
Washer	Carbon Steel, ASTM F 844; meets dimensional requirements of ANSI B18.22.2. Type A Plain
Expansion wedge (clip)	Carbon Steel
Plating	Zinc plating according to ASTM B 633, SC1 Type III (Fe/Zn 5). Minimum plating requirements for Mild Service Condition.

INSTALLATION INSTRUCTIONS

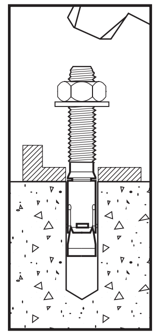
Installation Instructions for Power-Stud+ SD1



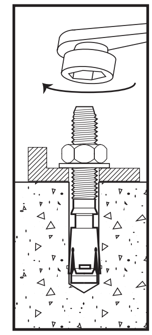
Step 1
Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



Step 2
Remove the dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.

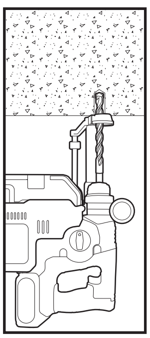


Step 3
Position the washer on the anchor and thread on the nut. If installing through a fixture, drive the anchor through the fixture into the hole. Be sure the anchor is driven to the minimum required embedment depth, h_{nom}.

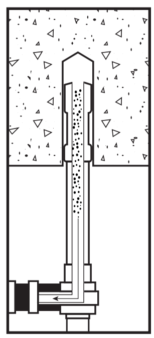


Step 4
Tighten the anchor with a torque wrench by applying the required installation torque, T_{inst}. Note: The threaded stud will draw up during tightening of the nut; the expansion wedge (clip) remains in original position.

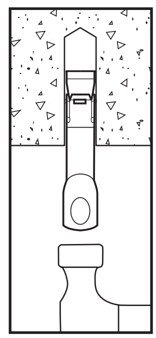
Installation Instructions for Power-Stud+ SD1 Tie Wire Version



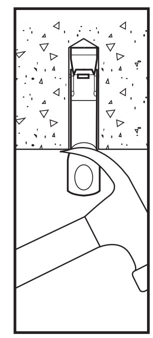
Step 1
Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



Step 2
Remove the dust and debris from the hole during drilling (e.g. dust extractor) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.

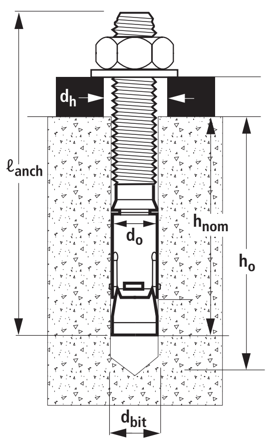


Step 3
Drive the anchor into the hole until the head is firmly seated against the base material. Be sure the anchor is driven to the required embedment depth.

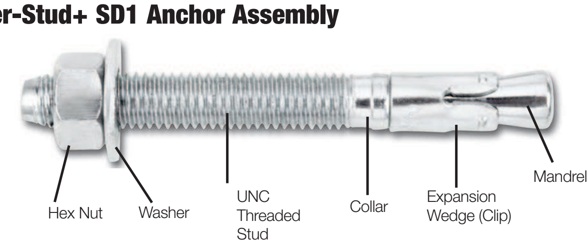


Step 4
Set the anchor with a prying action using a claw hammer.

Power-Stud+ SD1 Anchor Detail



Power-Stud+ SD1 Anchor Assembly



Head Marking

Legend

Letter Code = Length Identification Mark

'+' Symbol = Strength Design Compliant Anchor (see ordering information)

Number Code 1 = Carbon Steel Body and Carbon Steel Expansion Clip (not on 1/4" diameter anchors)

Length Identification

Mark	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
From	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"	10"	11"	12"
Up to but not including	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"	10"	11"	12"	13"
Length identification mark indicates overall length of anchor.																				

REFERENCE DATA (ASD)

Installation Specifications for Power-Stud+ SD1 in Concrete[1,2]

Anchor Property/ Setting Information	Notation	Units	Nominal Anchor Diameter							
			1/4	3/8	1/2	5/8	3/4	7/8	1	1-1/4
Anchor diameter	d_o	in. (mm)	0.250 (6.4)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.250 (31.8)
Minimum diameter of hole clearance in fixture	d_h	in. (mm)	5/16 (7.5)	7/16 (11.1)	9/16 (14.3)	11/16 (17.5)	13/16 (20.6)	1 (25.4)	1-1/8 (28.6)	1-3/8 (34.9)
Nominal drill bit diameter	d_{bit}	in.	1/4" ANSI	3/8" ANSI	1/2" ANSI	5/8" ANSI	3/4" ANSI	7/8" ANSI	1" ANSI	1-1/4" ANSI
Minimum nominal embedment depth	h_{nom}	in. (mm)	1-1/8 (29)	1-5/8 (41)	2-1/4 (57)	2-3/4 (70)	3-3/8 (86)	4-1/2 (114)	4-1/2 (114)	6-1/2 (165)
Minimum hole depth	h_o	in. (mm)	1-1/4 (48)	1-3/4 (44)	2-1/2 (64)	3-1/8 (79)	3-5/8 (92)	4-7/8 (122)	4-7/8 (122)	7-1/4 (184)
Installation torque	T_{inst}	ft.-lbf. (N-m)	4 (5)	20 (27)	40 (54)	80 (108)	110 (149)	175 (237)	225 (305)	375 (508)
Torque wrench/ socket size	-	in.	7/16	9/16	3/4	15/16	1-1/8	1-5/16	1-1/2	1-7/8
Nut height	-	In.	7/32	21/64	7/16	35/64	41/64	3/4	55/64	1-1/16

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

1. The minimum base material thickness should be $1.5h_{nom}$ or 3", whichever is greater.
2. See Performance Data in Concrete for additional embedment depths.

Ultimate Load Capacities for Power-Stud+ SD1 in Normal-Weight Concrete[1,2]

Nominal Anchor Diameter in.	Minimum Embedment Depth in. (mm)	Minimum Concrete Compressive Strength							
		f'c = 2,500 psi (17.3 MPa)		f'c = 3,000 psi (20.7 MPa)		f'c = 4,000 psi (27.6 MPa)		f'c = 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	1-1/8 (28)	1,320 (5.9)	1,160 (5.2)	1,435 (6.4)	1,255 (5.6)	1,660 (7.4)	1,255 (5.6)	-	-
	1-3/4 (44)	2,775 (12.4)	1,255 (5.6)	2,775 (12.4)	1,255 (5.6)	2,775 (12.4)	1,255 (5.6)	2,775 (12.4)	1,255 (5.6)
3/8	1-5/8 (41)	2,240 (10.9)	2,320 (10.3)	2,685 (12)	2,540 (11.3)	3,100 (13.8)	2,540 (11.3)	-	-
	2-3/8 (60)	3,485 (15.5)	2,540 (11.3)	3,815 (17)	2,540 (11.3)	4,410 (19.6)	2,540 (11.3)	5,400 (24)	2,540 (11.3)
1/2	2-1/4 (57)	3,800 (16.9)	3,840 (17.1)	4,155 (18.5)	4,195 (18.7)	4,800 (21.4)	4,195 (18.7)	-	-
	2-1/2 (64)	3,910 (17.4)	4,195 (18.7)	4,285 (19.1)	4,195 (18.7)	4,950 (22)	4,195 (18.7)	6,060 (27)	4,195 (18.7)
	3-3/4 (95)	7,955 (35.4)	4,195 (18.7)	8,715 (38.8)	4,195 (18.7)	10,065 (44.8)	4,195 (18.7)	12,325 (54.8)	4,195 (18.7)
5/8	2-3/4 (70)	4,960 (22.1)	6,220 (27.7)	5,440 (24.3)	6,815 (30.3)	6,285 (28)	6,815 (30.3)	-	-
	3-3/8 (86)	6,625 (29.5)	6,815 (30.3)	7,260 (32.3)	6,815 (30.3)	8,380 (37.3)	6,815 (30.3)	10,265 (45.7)	6,815 (30.3)
	4-5/8 (117)	11,260 (50.1)	6,815 (30.3)	12,335 (54.9)	6,815 (30.3)	14,245 (63.4)	6,815 (30.3)	14,465 (65.7)	6,815 (30.3)
3/4	3-3/8 (86)	7,180 (31.9)	11,480 (51.5)	7,860 (32.2)	12,580 (56.0)	9,075 (40.5)	12,580 (56.0)	-	-
	4 (102)	9,530 (42.4)	12,580 (56.0)	10,440 (46.5)	12,580 (56.0)	12,060 (53.6)	12,580 (56.0)	14,770 (65.7)	12,580 (56.0)
	5-5/8 (143)	17,670 (78.6)	12,580 (56.0)	19,355 (86.1)	12,580 (56.0)	22,350 (99.4)	12,580 (56.0)	25,065 (111.5)	12,580 (56.0)
7/8	3-7/8 (98)	9,120 (40.6)	10,680 (47.5)	10,005 (44.5)	11,690 (52.0)	11,555 (51.4)	11,690 (52.0)	-	-
	4-1/2 (114)	11,320 (50.4)	11,690 (52.0)	12,405 (55.2)	11,690 (52.0)	15,125 (67.3)	11,690 (52.0)	19,470 (86.6)	11,690 (52.0)
1	4-1/2 (114)	12,400 (55.2)	19,320 (85.9)	13,580 (60.4)	21,155 (94.1)	15,680 (69.7)	21,155 (94.1)	-	-
	5-1/2 (140)	16,535 (73.6)	21,155 (94.1)	18,115 (80.6)	21,155 (94.1)	20,915 (93)	21,155 (94.1)	25,615 (114)	21,155 (94.1)
	8 (203)	19,640 (87.4)	21,155 (94.1)	21,530 (95.8)	21,155 (94.1)	24,865 (110.6)	21,155 (94.1)	-	-
1-1/4	5-1/2 (140)	18,520 (82.5)	26,560 (118.1)	20,275 (90.9)	29,105 (129.4)	23,410 (105.0)	29,105 (129.4)	-	-
	6-1/2 (165)	22,485 (100.0)	29,105 (129.4)	24,630 (109.6)	29,105 (129.4)	28,440 (126.5)	29,105 (129.4)	37,360 (166.2)	29,105 (129.4)

1. Tabulated load values are for anchors installed in uncracked concrete with no edge or spacing considerations. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working loads.

Allowable Load Capacities for Power-Stud+ SD1 in Normal-Weight Concrete[1,2,3,4]

Nominal Anchor Diameter (in.)	Minimum Embedment Depth in. (mm)	Minimum Concrete Compressive Strength							
		f'c = 2,500 psi (17.3 MPa)		f'c = 3,000 psi (20.7 MPa)		f'c = 4,000 psi (27.6 MPa)		f'c = 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	1-1/8 (28)	330 (1.5)	290 (1.3)	360 (1.6)	315 (1.4)	415 (1.8)	315 (1.4)	-	-
	1-3/4 (44)	695 (3.1)	315 (1.4)	695 (3.1)	315 (1.4)	695 (3.1)	315 (1.4)	695 (3.1)	315 (1.4)
3/8	1-5/8 (41)	610 (2.7)	580 (2.6)	670 (3.0)	635 (2.8)	775 (3.4)	635 (2.8)	-	-
	2-3/8 (60)	870 (3.9)	635 (2.8)	955 (4.2)	635 (2.8)	1,105 (4.9)	635 (2.8)	1,350 (6.0)	635 (2.8)
1/2	2-1/4 (57)	950 (4.2)	960 (4.3)	1,040 (4.6)	1,050 (4.7)	1,200 (5.3)	1,050 (4.7)	-	-
	2-1/2 (64)	980 (4.4)	1,050 (4.7)	1,070 (4.8)	1,050 (4.7)	1,240 (5.5)	1,050 (4.7)	1,515 (6.7)	1,050 (4.7)
	3-3/4 (95)	1,990 (8.9)	1,050 (4.7)	2,180 (9.7)	1,050 (4.7)	2,515 (11.2)	1,050 (4.7)	3,080 (13.7)	1,050 (4.7)
5/8	2-3/4 (70)	1,240 (5.5)	1,555 (6.9)	1,360 (6.0)	1,705 (7.6)	1,570 (7.0)	1,705 (7.6)	-	-
	3-3/8 (86)	1,655 (7.4)	1,705 (7.6)	1,815 (8.1)	1,705 (7.6)	2,095 (9.3)	1,705 (7.6)	2,565 (11.4)	1,705 (7.6)
	4-5/8 (117)	2,815 (12.5)	1,705 (7.6)	3,085 (13.7)	1,705 (7.6)	3,560 (15.8)	1,705 (7.6)	3,615 (16.1)	1,705 (7.6)
3/4	3-3/8 (86)	1,795 (8.0)	2,870 (12.8)	1,965 (8.7)	3,145 (14.0)	2,270 (10.1)	3,145 (14.0)	-	-
	4 (102)	2,385 (10.6)	3,145 (14.0)	2,610 (11.6)	3,145 (14.0)	3,015 (13.4)	3,145 (14.0)	3,620 (16.1)	3,145 (14.0)
	5-5/8 (143)	4,420 (19.7)	3,145 (14.0)	4,840 (21.5)	3,145 (14.0)	5,590 (24.9)	3,145 (14.0)	6,265 (27.9)	3,145 (14.0)
7/8	3-7/8 (98)	2,280 (10.1)	2,670 (11.9)	2,500 (11.1)	2,925 (13.0)	2,890 (12.9)	2,925 (13.0)	-	-
	4-1/2 (114)	2,830 (12.6)	2,925 (13.0)	3,100 (13.8)	2,925 (13.0)	3,780 (16.8)	2,925 (13.0)	4,870 (21.7)	2,925 (13.0)
1	4-1/2 (114)	3,100 (13.8)	4,830 (21.5)	3,395 (15.1)	5,290 (23.5)	3,920 (17.4)	5,290 (23.5)	-	-
	5-1/2 (140)	4,135 (18.4)	5,290 (23.5)	4,530 (20.2)	5,290 (23.5)	5,230 (23.3)	5,290 (23.5)	6,405 (28.5)	5,290 (23.5)
	8 (203)	4,910 (21.8)	5,290 (23.5)	5,380 (23.9)	5,290 (23.5)	6,215 (27.6)	5,290 (23.5)	-	-
1-1/4	5-1/2 (140)	4,630 (20.6)	6,640 (29.5)	5,070 (22.6)	7,275 (32.4)	5,850 (26.0)	7,275 (32.4)	-	-
	6-1/2 (165)	5,620 (25.0)	7,275 (32.4)	6,160 (27.4)	7,275 (32.4)	7,110 (31.6)	7,275 (32.4)	9,340 (41.5)	7,275 (32.4)

1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the minimum at the time of installation.
2. Allowable load capacities are calculated using an applied safety factor of 4.0.
3. Allowable load capacities must be multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.
4. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.

Spacing Distance and Edge Distance Tension (F_{NS}, F_{NC}) Adjustment Factors for Normal-Weight Concrete

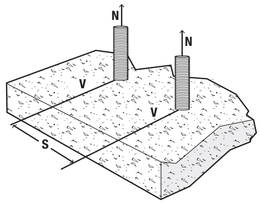
Dia. (in)		1/4	3/8	1/2	1/2	5/8	5/8	3/4	3/4	7/8	1	1-1/4
h_{nom} (in.)		1-3/4	2-3/8	2-1/2	3-3/4	3-3/8	4-5/8	4	5-5/8	4-1/2	5-1/2	6-1/2
s_{min} (in.)		2-1/4	3-1/2	4-1/2	5	6	4-1/4	6	6-1/2	6-1/2	8	8
Spacing Distance (inches)	2	-	-	-	-	-	-	-	-	-	-	-
	2-1/4	0.78	-	-	-	-	-	-	-	-	-	-
	2-1/2	0.80	-	-	-	-	-	-	-	-	-	-
	2-3/4	0.83	-	-	-	-	-	-	-	-	-	-
	3	0.85	-	-	-	-	-	-	-	-	-	-
	3-1/2	0.90	0.84	-	-	-	-	-	-	-	-	-
	4	0.95	0.87	-	-	-	-	-	-	-	-	-
	4-1/4	0.98	0.89	-	-	-	0.72	-	-	-	-	-
	4-1/2	1.00	0.90	0.91	-	-	0.73	-	-	-	-	-
	5	1.00	0.94	0.94	0.79	-	0.75	-	-	-	-	-
	5-1/2	1.00	0.97	0.97	0.81	-	0.77	-	-	-	-	-
	6	1.00	1.00	1.00	0.83	0.88	0.79	0.87	-	-	-	-
	6-1/2	1.00	1.00	1.00	0.86	0.90	0.80	0.89	0.79	0.85	-	-
	7	1.00	1.00	1.00	0.88	0.93	0.82	0.91	0.81	0.87	-	-
	7-1/2	1.00	1.00	1.00	0.90	0.96	0.84	0.93	0.82	0.89	-	-
	8	1.00	1.00	1.00	0.92	0.99	0.86	0.95	0.83	0.91	0.84	0.82
	8-1/2	1.00	1.00	1.00	0.94	1.00	0.88	0.97	0.85	0.93	0.85	0.83
	9	1.00	1.00	1.00	0.97	1.00	0.89	0.99	0.86	0.94	0.87	0.84
	9-1/2	1.00	1.00	1.00	0.99	1.00	0.91	1.00	0.87	0.96	0.89	0.85
	10	1.00	1.00	1.00	1.00	1.00	0.93	1.00	0.89	0.98	0.90	0.86
	10-1/2	1.00	1.00	1.00	1.00	1.00	0.95	1.00	0.90	1.00	0.92	0.87
	11	1.00	1.00	1.00	1.00	1.00	0.96	1.00	0.91	1.00	0.93	0.88
	11-1/2	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.93	1.00	0.95	0.90
	12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	1.00	0.96	0.91
	12-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	0.98	0.92
	13	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	1.00	0.93
	13-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	0.94
	14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.95
	14-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96
	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97
	15-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99
	16	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

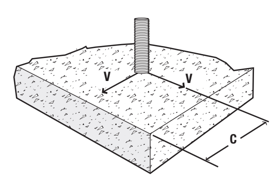
Dia. (in)		1/4	3/8	1/2	1/2	5/8	5/8	3/4	3/4	7/8	1	1-1/4
h_{nom} (in.)		1-3/4	2-3/8	2-1/2	3-3/4	3-3/8	4-5/8	4	5-5/8	4-1/2	5-1/2	6-1/2
c_{ac} (in.)		3-1/2	6-1/2	8	8	6	10	11	16	11-1/2	12	20
c_{min} (in.)		1-3/4	2-1/4	3-1/4	2-3/4	5-1/2	4-1/4	5	6	7	8	8
Edge Distance (inches)	1-3/4	0.50	-	-	-	-	-	-	-	-	-	-
	2	0.57	-	-	-	-	-	-	-	-	-	-
	2-1/4	0.64	0.35	-	-	-	-	-	-	-	-	-
	2-1/2	0.71	0.38	-	-	-	-	-	-	-	-	-
	2-3/4	0.79	0.42	-	0.34	-	-	-	-	-	-	-
	3	0.86	0.46	-	0.38	-	-	-	-	-	-	-
	3-1/4	0.93	0.50	0.41	0.41	-	-	-	-	-	-	-
	3-1/2	1.00	0.54	0.44	0.44	-	-	-	-	-	-	-
	4	1.00	0.62	0.50	0.50	-	-	-	-	-	-	-
	4-1/4	1.00	0.65	0.53	0.53	-	0.43	-	-	-	-	-
	4-1/2	1.00	0.69	0.56	0.56	-	0.45	-	-	-	-	-
	5	1.00	0.77	0.63	0.63	-	0.50	0.45	-	-	-	-
	5-1/2	1.00	0.85	0.69	0.69	0.92	0.55	0.50	-	-	-	-
	6	1.00	0.92	0.75	0.75	1.00	0.60	0.55	0.38	-	-	-
	6-1/2	1.00	1.00	0.81	0.81	1.00	0.65	0.59	0.41	-	-	-
	7	1.00	1.00	0.88	0.88	1.00	0.70	0.64	0.44	0.61	-	-
	7-1/2	1.00	1.00	0.94	0.94	1.00	0.75	0.68	0.47	0.65	-	-
	8	1.00	1.00	1.00	1.00	1.00	0.80	0.73	0.50	0.70	0.67	0.40
	8-1/2	1.00	1.00	1.00	1.00	1.00	0.85	0.77	0.53	0.74	0.71	0.43
	9	1.00	1.00	1.00	1.00	1.00	0.90	0.82	0.56	0.78	0.75	0.45
	9-1/2	1.00	1.00	1.00	1.00	1.00	0.95	0.86	0.59	0.83	0.79	0.48
	10	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.63	0.87	0.83	0.50
	10-1/2	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.66	0.91	0.88	0.53
	11	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.69	0.96	0.92	0.55
	11-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.72	1.00	0.96	0.58
	12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.75	1.00	1.00	0.60
	12-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.78	1.00	1.00	0.63
	13	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.81	1.00	1.00	0.65
	13-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.84	1.00	1.00	0.68
	14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88	1.00	1.00	0.70
	14-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	1.00	0.73
	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	1.00	1.00	0.75
	15-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	1.00	0.78
	16	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.80
	16-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.83
	17	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.85
	17-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88
	18	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90
	18-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93
	19	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95
	19-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98
	20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Spacing Distance and Edge Distance Shear (F_{VS}, F_{VC}) Adjustment Factors for Normal-Weight Concrete

Dia. (in)		1/4	3/8	1/2	1/2	5/8	5/8	3/4	3/4	7/8	1	1-1/4
h_{nom} (in.)		1-3/4	2-3/8	2-1/2	3-3/4	3-3/8	4-5/8	4	5-5/8	4-1/2	5-1/2	6-1/2
s_{min} (in.)		2-1/4	3-1/2	4-1/2	5	6	4-1/4	6	6-1/2	6-1/2	8	8
Spacing Distance (inches)	2-1/4	0.85	-	-	-	-	-	-	-	-	-	-
	2-1/2	0.87	-	-	-	-	-	-	-	-	-	-
	2-3/4	0.88	-	-	-	-	-	-	-	-	-	-
	3	0.90	-	-	-	-	-	-	-	-	-	-
	3-1/2	0.93	0.90	-	-	-	-	-	-	-	-	-
	4	0.97	0.92	-	-	-	-	-	-	-	-	-
	4-1/4	0.98	0.93	-	-	-	0.82	-	-	-	-	-
	4-1/2	1.00	0.94	0.95	-	-	0.82	-	-	-	-	-
	5	1.00	0.96	0.97	0.86	-	0.83	-	-	-	-	-
	5-1/2	1.00	0.98	0.98	0.87	-	0.85	-	-	-	-	-
	6	1.00	1.00	1.00	0.89	0.91	0.86	0.92	-	-	-	-
	6-1/2	1.00	1.00	1.00	0.90	0.93	0.87	0.93	0.88	0.91	-	-
	7	1.00	1.00	1.00	0.92	0.95	0.88	0.94	0.88	0.92	-	-
	7-1/2	1.00	1.00	1.00	0.93	0.97	0.89	0.96	0.89	0.93	-	-
	8	1.00	1.00	1.00	0.95	0.99	0.90	0.97	0.90	0.94	0.90	0.89
	8-1/2	1.00	1.00	1.00	0.96	1.00	0.92	0.98	0.91	0.96	0.91	0.90
	9	1.00	1.00	1.00	0.98	1.00	0.93	0.99	0.92	0.97	0.92	0.91
	9-1/2	1.00	1.00	1.00	0.99	1.00	0.94	1.00	0.92	0.98	0.93	0.91
	10	1.00	1.00	1.00	1.00	1.00	0.95	1.00	0.93	0.99	0.94	0.92
	10-1/2	1.00	1.00	1.00	1.00	1.00	0.96	1.00	0.94	1.00	0.95	0.93
	11	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.95	1.00	0.96	0.93
	11-1/2	1.00	1.00	1.00	1.00	1.00	0.99	1.00	0.96	1.00	0.97	0.94
	12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	1.00	0.98	0.95
	12-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	0.99	0.95
	13	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	0.96
	13-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.97
	14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97
	14-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98
	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99
	15-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99
	16	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Dia. (in)		1/4	3/8	1/2	1/2	5/8	5/8	3/4	3/4	7/8	1	1-1/4
h_{nom} (in.)		1-3/4	2-3/8	2-1/2	3-3/4	3-3/8	4-5/8	4	5-5/8	4-1/2	5-1/2	6-1/2
c_{min} (in.)		1-3/4	2-1/4	3-1/4	2-3/4	5-1/2	4-1/4	5	6	7	8	8
Edge Distance (inches)	1-3/4	0.39	-	-	-	-	-	-	-	-	-	-
	2	0.44	-	-	-	-	-	-	-	-	-	-
	2-1/4	0.50	0.38	-	-	-	-	-	-	-	-	-
	2-1/2	0.56	0.42	-	-	-	-	-	-	-	-	-
	2-3/4	0.61	0.46	-	0.28	-	-	-	-	-	-	-
	3	0.67	0.50	-	0.31	-	-	-	-	-	-	-
	3-1/4	0.72	0.54	0.54	0.33	-	-	-	-	-	-	-
	3-1/2	0.78	0.58	0.58	0.36	-	-	-	-	-	-	-
	4	0.89	0.67	0.67	0.41	-	-	-	-	-	-	-
	4-1/4	0.94	0.71	0.71	0.44	-	0.35	-	-	-	-	-
	4-1/2	1.00	0.75	0.75	0.46	-	0.38	-	-	-	-	-
	5	1.00	0.83	0.83	0.51	-	0.42	0.53	-	-	-	-
	5-1/2	1.00	0.92	0.92	0.56	0.67	0.46	0.59	-	-	-	-
	6	1.00	1.00	1.00	0.62	0.73	0.50	0.64	0.42	-	-	-
	6-1/2	1.00	1.00	1.00	0.67	0.79	0.54	0.69	0.46	-	-	-
	7	1.00	1.00	1.00	0.72	0.85	0.58	0.75	0.49	0.67	-	-
	7-1/2	1.00	1.00	1.00	0.77	0.91	0.63	0.80	0.53	0.71	-	-
	8	1.00	1.00	1.00	0.82	0.97	0.67	0.85	0.56	0.76	0.61	0.50
	8-1/2	1.00	1.00	1.00	0.87	1.00	0.71	0.91	0.60	0.81	0.65	0.53
	9	1.00	1.00	1.00	0.92	1.00	0.75	0.96	0.63	0.86	0.69	0.56
	9-1/2	1.00	1.00	1.00	0.97	1.00	0.79	1.00	0.67	0.90	0.72	0.59
	10	1.00	1.00	1.00	1.00	1.00	0.83	1.00	0.70	0.95	0.76	0.62
	10-1/2	1.00	1.00	1.00	1.00	1.00	0.88	1.00	0.74	1.00	0.80	0.65
	11	1.00	1.00	1.00	1.00	1.00	0.92	1.00	0.77	1.00	0.84	0.68
	11-1/2	1.00	1.00	1.00	1.00	1.00	0.96	1.00	0.81	1.00	0.88	0.71
	12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.84	1.00	0.91	0.74
	12-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88	1.00	0.95	0.78
	13	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.99	0.81
	13-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.84
	14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	0.87
	14-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90
	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93
	15-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96
	16	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99
	16-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

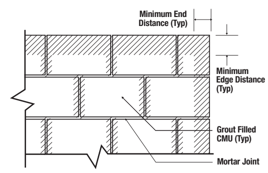




Ultimate and Allowable Load Capacities in Tension for Power-Stud+ SD1 in Grout Filled Concrete Masonry Wall Faces[1,2,3,4,5,6]

CODE LISTED
ICC-ES ESR-2966

Nominal Anchor Diameter in.	Nominal Drill Bit Diameter in.	Min. Embed. Depth in. (mm)	Min. Edge Distance in. (mm)	Min. End Distance in. (mm)	Installation Torque T_{inst} ft-lbf (N-m)	Grout-Filled Concrete Masonry f'm = 1,500 psi: Ultimate Load Tension lbs. (kN)	f'm = 1,500 psi: Allowable Load Tension lbs. (kN)	f'm = 2,000 psi: Ultimate Load Tension lbs. (kN)	f'm = 2,000 psi: Allowable Load Tension lbs. (kN)
3/8	3/8 ANSI	2-3/8 (60.3)	4 (101.6)	4 (101.6)	20 (27)	2,225 (10.0)	445 (2.0)	2,670 (12.0)	535 (2.4)
1/2	1/2 ANSI	2-1/2 (63.5)	4 (101.6)	4 (101.6)	40 (54)	2,650 (11.9)	530 (2.4)	3,180 (14.3)	635 (2.9)
5/8	5/8 ANSI	3-3/8 (85.7)	4 (101.6)	4 (101.6)	50 (68)	3,525 (15.9)	705 (3.2)	4,230 (19.0)	845 (3.8)
3/4	3/4 ANSI	3-3/8 (85.7)	12 (304.8)	12 (304.8)	80 (108)	7,575 (33.7)	1,515 (6.7)	8,175 (36.4)	1,635 (7.3)
			20 (508.0)	20 (508.0)	80 (108)	7,575 (33.7)	1,515 (6.7)	8,175 (36.4)	1,635 (7.3)
		4-3/4 (120.7)	12 (304.8)	12 (304.8)	80 (108)	7,580 (34.1)	1,515 (6.8)	8,755 (39.4)	1,750 (7.9)



Wall Face
Permissible Anchor Locations
(Un-hatched Area)

1. Tabulated load values for 3/8", 1/2" and 5/8" diameter anchors are installed in minimum 6" wide, Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry compressive strength must be at specified minimum at the time of installation.
2. Tabulated load values for 3/4" diameter anchors are installed in minimum 8" wide, Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry compressive strength must be at specified minimum at the time of installation.
3. Allowable load capacities listed are calculated using an applied safety factor of 5.0.
4. The tabulated values are applicable for anchors installed into grouted masonry wall faces at a critical spacing distance, s_{cr}, between anchors of 16 times the anchor diameter. The spacing distance between two anchors may be reduced to minimum distance, s_{min}, of 8 times the anchor diameter provided the allowable tension loads are multiplied by a reduction factor 0.80 and allowable shear loads are multiplied by a reduction factor of 0.90. Linear interpolation for calculation of allowable loads may be used for intermediate anchor spacing distances.
5. Anchors may be installed in the grouted cells and in cell webs and bed joints not closer than 1-3/8" from head joints. The minimum edge and end distances must also be maintained.
6. Allowable tension values for anchors installed into bed joints of grouted masonry wall faces with a minimum of 12" edge distance and end distance may be increased by 20 percent for the 1/2-inch diameter and 10 percent for the 5/8-inch diameter.

Ultimate and Allowable Load Capacities in Shear for Power-Stud+ SD1 in Grout Filled Concrete Masonry Wall Faces[1,2,3,4,5]

CODE LISTED
ICC-ES ESR-2966

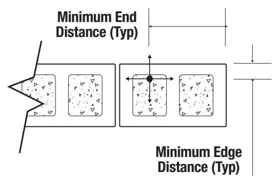
Nominal Anchor Diameter in.	Nominal Drill Bit Diameter in.	Min. Embed. Depth in. (mm)	Min. Edge Distance in. (mm)	Min. End Distance in. (mm)	Direction of Loading	Installation Torque T_{inst} ft-lbf (N-m)	Grout-Filled Concrete Masonry f'm = 1,500 psi: Ultimate Load Shear lbs. (kN)	f'm = 1,500 psi: Allowable Load Shear lbs. (kN)	f'm = 2,000 psi: Ultimate Load Shear lbs. (kN)	f'm = 2,000 psi: Allowable Load Shear lbs. (kN)
3/8	3/8 ANSI	2-3/8 (60.3)	4 (101.6)	4 (101.6)	Perpendicular or parallel to wall edge or end	20 (27)	2,975 (13.4)	595 (2.7)	3,570 (16.1)	715 (3.2)
1/2	1/2 ANSI	2-1/2 (63.5)	4 (101.6)	12 (304.8)	Perpendicular or parallel to wall edge or end	40 (54)	2,800 (12.6)	560 (2.5)	3,360 (15.1)	670 (3.0)
			12 (304.8)	4 (101.6)	Parallel to wall end		4,025 (18.1)	805 (3.6)	4,830 (21.7)	965 (4.3)
			4 (101.6)	12 (304.8)	Parallel to wall edge					
5/8	5/8 ANSI	3-3/8 (85.7)	4 (101.6)	4 (101.6)	Perpendicular or parallel to wall edge or end	50 (68)	3,425 (15.4)	685 (3.1)	4,110 (18.5)	820 (3.7)
			12 (304.8)	4 (101.6)	Parallel to wall end		5,325 (24.0)	1,065 (4.8)	6,390 (28.8)	1,280 (5.8)
			4 (101.6)	12 (304.8)	Parallel to wall edge					
3/4	3/4 ANSI	3-3/8 (85.7)	12 (304.8)	12 (304.8)	Perpendicular or parallel to wall edge or end	80 (108)	8,850 (39.4)	1,770 (7.9)	9,375 (41.7)	1,875 (8.3)
			20 (508.0)	20 (508.0)			10,200 (45.4)	2,040 (9.1)	10,800 (48.0)	2,160 (9.6)
		4-3/4 (120.7)	12 (304.8)	12 (304.8)			12,735 (56.7)	2,545 (11.3)	12,735 (56.7)	2,545 (11.3)

1. Tabulated load values for 3/8", 1/2" and 5/8" diameter anchors are installed in minimum 6" wide, Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry compressive strength must be at specified minimum at the time of installation.
2. Tabulated load values for 3/4" diameter anchors are installed in minimum 8" wide, Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry compressive strength must be at specified minimum at the time of installation.
3. Allowable load capacities listed are calculated using an applied safety factor of 5.0.
4. The tabulated values are applicable for anchors installed into grouted masonry wall faces at a critical spacing distance, s_{cr}, between anchors of 16 times the anchor diameter. The spacing distance between two anchors may be reduced to minimum distance, s_{min}, of 8 times the anchor diameter provided the allowable tension loads are multiplied by a reduction factor 0.80 and allowable shear loads are multiplied by a reduction factor of 0.90. Linear interpolation for calculation of allowable loads may be used for intermediate anchor spacing distances.
5. Anchors may be installed in the grouted cells and in cell webs and bed joints not closer than 1-3/8" from head joints. The minimum edge and end distances must also be maintained.

Ultimate and Allowable Load Capacities in Tension for Power-Stud+ SD1 in Grout Filled Concrete Masonry Wall Tops[1,2,3,4]

CODE LISTED
ICC-ES ESR-2966
ALLOWABLE STRESS DESIGN ASD

Nominal Anchor Diameter in.	Nominal Drill Bit Diameter in.	Minimum Embed. Depth in. (mm)	Min. Edge Distance in. (mm)	Min. End Distance in. (mm)	Installation Torque T_{inst} ft-lbf (N-m)	Grout-Filled Concrete Masonry			
						f'm = 1,500 psi		f'm = 2,000 psi	
						Ultimate Load Tension lbs. (kN)	Allowable Load Tension lbs. (kN)	Ultimate Load Tension lbs. (kN)	Allowable Load Tension lbs. (kN)
3/8	3/8 ANSI	2-3/8 (60.3)	1-3/4 (44.5)	12 (304.8)	20 (27)	1,475 (6.6)	295 (1.3)	1,770 (8.0)	355 (1.6)
1/2	1/2 ANSI	2-1/2 (63.5)	2-1/4 (57.1)		40 (54)	2,225 (9.9)	445 (2.0)	2,575 (11.5)	515 (2.3)
		5 (127)				3,425 (15.4)	685 (3.1)	4,110 (18.5)	820 (3.7)
5/8	5/8 ANSI	3-3/8 (85.7)			50 (68)	3,825 (17.2)	765 (3.4)	4,590 (20.7)	920 (4.1)



Top of Wall

1. Tabulated load values are for anchors installed in minimum 8-inch wide, minimum Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety.
3. Anchors must be installed in the grouted cells and the minimum edge and end distances must be maintained.
4. The tabulated values are applicable for anchors installed in top of grouted masonry walls at a critical spacing distance, s_{cr}, between anchors of 16 times the anchor diameter.

Ultimate and Allowable Load Capacities in Shear for Power-Stud+ SD1 in Grout Filled Concrete Masonry Wall Tops[1,2,3,4]

CODE LISTED
ICC-ES ESR-2966
ALLOWABLE STRESS DESIGN ASD

Nominal Anchor Diameter in.	Nominal Drill Bit Diameter in.	Minimum Embed. Depth in. (mm)	Min. Edge Distance in. (mm)	Min. End Distance in. (mm)	Direction of Loading	Installation Torque T_{inst} ft-lbf (N-m)	Grout-Filled Concrete Masonry			
							f'm = 1,500 psi		f'm = 2,000 psi	
							Ultimate Load Shear lbs. (kN)	Allowable Load Shear lbs. (kN)	Ultimate Load Shear lbs. (kN)	Allowable Load Shear lbs. (kN)
3/8	3/8 ANSI	2-3/8 (60.3)	1-3/4 (44.5)	12 (304.8)	Perpendicular to wall toward minimum edge	20 (27)	1,150 (5.2)	230 (1.0)	1,380 (6.2)	275 (1.2)
					Parallel to wall edge		2,425 (10.9)	485 (2.2)	2,910 (13.1)	580 (2.6)
1/2	1/2 ANSI	2-1/2 (63.5)	2-1/4 (57.1)	12 (304.8)	Any	40 (54)	1,150 (5.2)	230 (1.0)	1,380 (6.2)	275 (1.2)
		5 (127)			Perpendicular to wall toward minimum edge		1,400 (6.3)	280 (1.3)	1,680 (7.6)	325 (1.5)
					Parallel to wall edge		2,825 12.7	565 (2.5)	3,390 (15.3)	680 (3.1)
5/8	5/8 ANSI	3-3/8 (85.7)	2-1/4 (57.1)	12 (304.8)	Any	50 (68)	1,150 (5.2)	230 (1.0)	1,380 (6.2)	275 (1.2)
		6-1/4 (158.8)			Perpendicular to wall toward minimum edge		1,700 (7.7)	340 (1.5)	2,040 (9.2)	410 (1.8)
					Parallel to wall edge		3,525 (15.9)	705 (3.2)	4,230 (19.0)	845 (3.8)

1. Tabulated load values are for anchors installed in minimum 6-inch wide, minimum Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities listed are calculated using an applied safety factor of 5.0. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety.
3. Anchors must be installed in the grouted cells and the minimum edge and end distances must be maintained.
4. The tabulated values are applicable for anchors installed in top of grouted masonry walls at a critical spacing distance, s_{cr}, between anchors of 16 times the anchor diameter.

DEWALT
ENGINEERED BY Powers

MECHANICAL ANCHORS

POWER-STUD®+ SD1
Wedge Expansion Anchor

STRENGTH DESIGN (SD)

Power-Stud+ SD1 Anchor Installation Specifications in Concrete[1]

CODE LISTED
ICC-ES ESR-2818

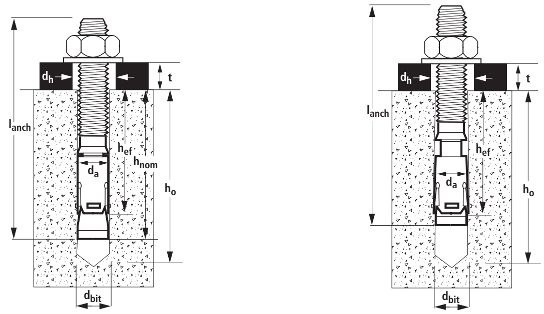
STRENGTH DESIGN SD TABLES

Anchor Property / Setting Information	Notation	Units	Nominal Anchor Diameter: 1/4 inch	3/8 inch			1/2 inch				5/8 inch			3/4 inch		7/8 inch	1 inch	1-1/4 inch
Anchor diameter	d_a	in. (mm)	0.250 (6.4)	0.375 (9.5)			0.500 (12.7)				0.625 (15.9)			0.750 (19.1)		0.875 (22.2)	1.000 (25.4)	1.250 (31.8)
Minimum diameter of hole clearance in fixture	d_h	in. (mm)	5/16 (7.5)	7/16 (11.1)			9/16 (14.3)				11/16 (17.5)			13/16 (20.6)		1 (25.4)	1-1/8 (28.6)	1-3/8 (34.9)
Nominal drill bit diameter	d_{bit}	in.	1/4 ANSI	3/8 ANSI			1/2 ANSI				5/8 ANSI			3/4 ANSI		7/8 ANSI	1 ANSI	1-1/4 ANSI
Nominal embedment depth	h_{nom}	in. (mm)	1-3/4 (44)	2-3/8 (60)			2-1/2 (64)		3-3/4 (95)		3-3/8 (86)		4-5/8 (117)	4 (102)	5-5/8 (143)	4-1/2 (114)	5-1/2 (140)	6-1/2 (165)
Effective embedment depth	h_{ef}	in. (mm)	1.50 (38)	2.00 (51)			2.00 (51)		3.25 (83)		2.75 (70)		4.00 (102)	3.125 (79)	4.75 (114)	3.50 (89)	4.375 (111)	5.375 (137)
Minimum hole depth	h_{hole}	in. (mm)	1-7/8 (48)	2-1/2 (64)			2-3/4 (70)		4 (102)		3-3/4 (95)		5 (127)	4-1/4 (108)	5-7/8 (149)	4-7/8 (124)	5-7/8 (149)	7-1/4 (184)
Minimum overall anchor length[2]	ℓ_{anch}	in. (mm)	2-1/4 (57)	3 (76)			3-3/4 (95)		4-1/2 (114)		4-1/2 (114)		6 (152)	5-1/2 (140)	7 (178)	8 (203)	9 (229)	9 (229)
Installation torque[6]	T_{inst}	ft.-lbf. (N-m)	4 (5)	20 (27)			40 (54)				80 (108)			110 (149)		175 (237)	225 (305)	375 (508)
Torque wrench/socket size	-	in.	7/16	9/16			3/4				15/16			1-1/8		1-5/16	1-1/2	1-7/8
Nut height	-	in.	7/32	21/64			7/16				35/64			41/64		3/4	55/64	1-1/16
Anchors Installed in Concrete Construction																		
Minimum member thickness	h_{min}	in. (mm)	3-1/4 (83)	3-3/4 (95)		4 (102)	4 (102)		6 (152)		6 (152)		7 (178)	6 (152)	10 (254)	10 (254)	10 (254)	12 (305)
Minimum edge distance	c_{min}	in. (mm)	1-3/4 (45)	6 (152)	2-3/4 (70)	2-1/4 (57)	6 (152)	3-1/4 (95)	4 (102)	2-3/4 (70)	6 (152)	5-1/2 (140)	4-1/4 (108)	5 (127)	6 (152)	7` (178)	8 (203)	8 (203)
Minimum spacing distance	s_{min}	in. (mm)	2-1/4 (57)	3-1/2 (89)	9 (229)	3-3/4 (95)	4-1/2 (114)	10 (254)	5 (127)	6 (152)	6 (152)	11 (270)	4-1/4 (108)	6 (152)	6-1/2 (165)	6-1/2 (165)	8 (203)	8 (203)
Critical edge distance (uncracked concrete only)	c_{ac}	in. (mm)	3-1/2 (89)	6-1/2 (165)			8 (203)		8 (203)		6 (152)		10 (254)	11 (279)	16 (406)	11-1/2 (292)	12 (305)	20 (508)
Anchors Installed in the Topside of Concrete-filled Steel Deck Assemblies[3,4]																		
Minimum member topping thickness	$h_{min,deck}$	in. (mm)	3-1/4 (83)	3-1/4 (83)			3-1/4 (83)		See note 3		See note 3			See note 3		See note 3	See note 3	See note 3
Minimum edge distance	$c_{min,deck,top}$	in. (mm)	1-3/4 (45)	2-3/4 (70)			4-1/2 (114)											
Minimum spacing distance	$s_{min,deck,top}$	in. (mm)	2-1/4 (57)	4 (102)			6-1/2 (165)											
Critical edge distance (uncracked concrete only)	$c_{ac,deck,top}$	in. (mm)	3-1/2 (89)	6-1/2 (165)			6 (152)											
Anchors Installed Through the Soffit of Steel Deck Assemblies into Concrete[5]																		
Minimum member topping thickness (see detail in Figure 2A)	$h_{min,deck}$	in. (mm)	Not Applicable	3-1/4 (95)			3-1/4 (95)				3-1/4 (95)			3-1/4 (95)		Not Applicable	Not Applicable	Not Applicable
Minimum edge distance, lower flute (see detail in Figure 2A)	c_{min}	in. (mm)		1-1/4 (32)			1-1/4 (32)				1-1/4 (32)			1-1/4 (32)				
Minimum axial spacing distance along flute (see detail in Figure 2A)	s_{min}	in. (mm)		6-3/4 (171)			6-3/4 (171)		9-3/4 (248)		8-1/4 (210		12 (305)	9-3/8 (238)	14-1/4 (362)			
Minimum member topping thickness (see detail in Figure 2B)	$h_{min,deck}$	in. (mm)		2-1/4 (57)			2-1/4 (57)				Not Applicable			Not Applicable		Not Applicable	Not Applicable	Not Applicable
Minimum edge distance, lower flute (see detail in Figure 2B)	c_{min}	in. (mm)		3/4 (19)			3/4 (19)											
Minimum axial spacing distance along flute (see detail in Figure 2B)	s_{min}	in. (mm)		6 (152)			6 (152)		9-3/4 (248)									

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

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable.
2. The listed minimum overall anchor length is based on anchor sizes commercially available at the time of publication compared with the requirements to achieve the minimum nominal embedment depth, nut height and washer thickness, and consideration of a possible fixture attachment.
3. The 1/4 -inch-diameter (6.4 mm) anchors may be installed in the topside of uncracked concrete-filled steel deck assemblies where concrete thickness above the upper flute meets the minimum member thicknesses specified in this table. The 3/8 -inch (9.5 mm) through 1-1/4 -inch-diameter (31.8 mm) anchors may be installed in the topside of cracked and uncracked concrete-filled steel deck assemblies where concrete thickness above the upper flute meets the minimum member thicknesses specified in this table under Anchors Installed in Concrete Construction.
4. For installations in the topside of concrete-filled steel deck assemblies, see the installation detail in Figure 1.
5. For installations through the soffit of steel deck assemblies into concrete, see the installation details in Figures 2A and 2B. In accordance with the figures, anchors shall have an axial spacing along the flute equal to the greater of $3h_{ef}$ or 1.5 times the flute width.
6. For installation of 5/8 -inch diameter anchors through the soffit of the steel deck into concrete, the installation torque is 50 ft.-lbf. For installation of 3/4-inch-diameter anchors through the soffit of the steel deck into concrete, installation torque is 80 ft.-lbf.

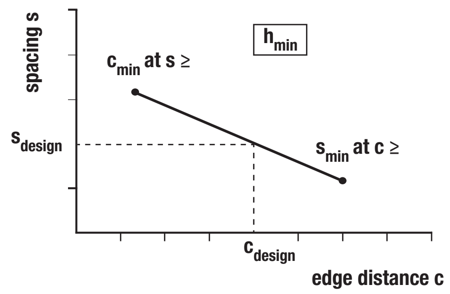
Power-Stud+ SD1 Anchor Detail



Before After

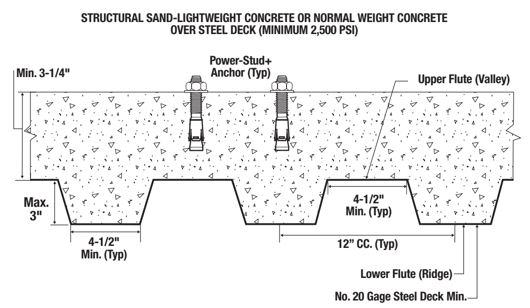
Application of Installation Torque

Interpolation of Minimum Edge Distance and Anchor Spacing



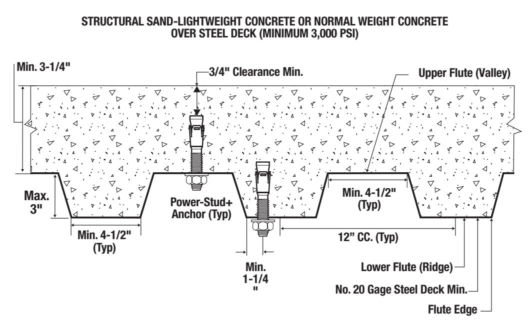
This interpolation applies to the cases when two sets of minimum edge distances, c_{min}, and minimum spacing distances, s_{min}, are given in the SD Installation Specifications for Concrete table for a given anchor diameter under the same effective embedment depth, h_{ef}, and corresponding minimum member thickness, h_{min}.

Figure 1 - Power-Stud+ SD1 Installation Detail for Anchors in the Topside Of Concrete Filled Steel Deck Floor and Roof Assemblies (See Dimensional Profile Requirements)



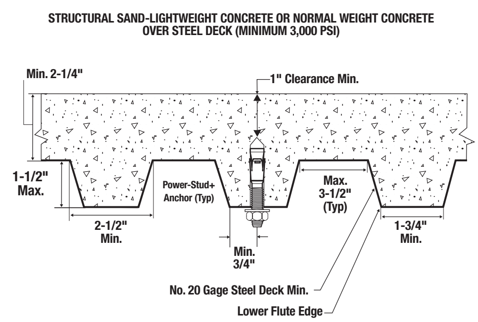
Anchors may be placed in the topside of steel deck profiles in accordance with Figure 1 provided the minimum member topping thickness, minimum spacing distance and minimum edge distance are satisfied as given in Installation Specifications.

Figure 2A - Power-Stud+ SD1 Installation Detail for Anchors in the Soffit Of Concrete Over Steel Deck Floor and Roof Assemblies (See Dimensional Profile Requirements)



Anchors may be placed in the upper flute or lower flute of the steel deck profiles in accordance with Figure 2A provided the minimum hole clearance is satisfied. Anchors in the lower flute of Figure 2A profiles may be installed with a maximum 1-inch offset in either direction from the center of the flute. The offset distance may be increased proportionally for profiles with lower flute widths greater than those shown provided the minimum lower flute edge distance is also satisfied. In addition, the anchors must have an axial spacing along the flute equal to the greater of $3h_{ef}$ or 1.5 times the flute width.

Figure 2B - Power-Stud+ SD1 Installation Detail for Anchors in the Soffit Of Concrete Over Steel Deck Floor and Roof Assemblies (See Dimensional Profile Requirements)



Anchors may be placed in the lower flute of the steel deck profiles in accordance with Figure 2B provided the minimum hole clearance is satisfied. Anchors in the lower flute of Figure 2B profiles may be installed with a maximum 1/8-inch offset in either direction from the center of the flute. The offset distance may be increased proportionally for profiles with lower flute widths greater than those shown provided the minimum lower flute edge distance is also satisfied. In addition, the anchors must have an axial spacing along the flute equal to the greater of $3h_{ef}$ or 1.5 times the flute width. Anchors may be placed in the upper flute of the steel deck profiles in accordance with Figure 2B provided the concrete thickness above the upper flute is minimum 3-1/4-inch and a minimum hole clearance of 3/4-inch is satisfied.

Tension Design Information for Power-Stud+ SD1 Anchor in Concrete (For use with load combinations taken from ACI 318-14, Section 5.3 or ACI 318-11, Section 9.2)[1,2]

CODE LISTED
ICC-ES ESR-2818

STRENGTH DESIGN SD TABLES

Design Characteristic	Notation	Units	Nominal Anchor Diameter										
			1/4 inch	3/8 inch	1/2 inch		5/8 inch		3/4 inch		7/8 inch	1 inch	1-1/4 inch
Anchor category	1, 2 or 3	-	1	1	1		1		1		1	1	1
STEEL STRENGTH IN TENSION[4]													
Minimum specified yield strength	f_{ya}	ksi (N/mm²)	88.0 (606)	88.0 (606)	80.0 (551)		80.0 (551)		64.0 (441)		58.0 (400)	58.0 (400)	58.0 (400)
Minimum specified ultimate tensile strength (neck)	f_{uta}[12]	ksi (N/mm²)	110.0 (758)	110.0 (758)	100.0 (689)		100.0 (689)		80.0 (552)		75.0 (517)	75.0 (517)	75.0 (517)
Effective tensile stress area (neck)	$A_{se,N}$	in² (mm²)	0.0220 (14.2)	0.0531 (34.3)	0.1018 (65.7)		0.1626 (104.9)		0.2376 (150.9)		0.327 (207.5)	0.430 (273.1)	0.762 (484)
Steel strength in tension[4]	N_{sa}[12]	lb (kN)	2,255 (10.0)	5,455 (24.3)	9,080 (40.4)		14,465 (64.3)		19,000 (84.5)		24,500 (109.0)	32,250 (143.5)	56,200 (250)
Reduction factor for steel strength[3]	ϕ	-	0.75										
CONCRETE BREAKOUT STRENGTH IN TENSION[8]													
Effective embedment depth	h_{ef}	in. (mm)	1.50 (38)	2.00 (51)	2.00 (51)	3.25 (83)	2.75 (70)	4.00 (102)	3.125 (79)	4.75 (114)	3.50 (89)	4.375 (111)	5.375 (137)
Effectiveness factor for uncracked concrete	k_{uncr}	-	24	24	24		24		24	24	24	24	27
Effectiveness factor for cracked concrete	k_{cr}	-	Not Applicable	17	17		17		21	17	21	24	24
Modification factor for cracked and uncracked concrete[5]	$\Psi_{c,N}$[12]	-	1.0	1.0	1.0		1.0		1.0		1.0	1.0	1.0
Critical edge distance (uncracked concrete only)	c_{ac}	in. (mm)	See Installation Specifications										
Reduction factor for concrete breakout strength[3]	ϕ	-	0.65 (Condition B)										
PULLOUT STRENGTH IN TENSION (NON SEISMIC-APPLICATIONS)[8,9]													
Characteristic pullout strength, uncracked concrete (2,500 psi)[6]	$N_{p,uncr}$	lb (kN)	See note 7	2,865 (12.8)	3,220 (14.3)	5,530 (24.6)	See note 7	See note 7	See note 7		See note 7	See note 7	See note 7
Characteristic pullout strength, cracked concrete (2,500 psi)[6]	$N_{p,cr}$	lb (kN)	Not Applicable	2,035 (9.1)	See note 7	2,505 (11.2)	See note 7	4,450 (19.8)	See note 7		See note 7	See note 7	11,350 (50.5)
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)										
PULLOUT STRENGTH IN TENSION FOR SEISMIC APPLICATIONS[8,9]													
Characteristic pullout strength, seismic (2,500 psi)[6,10]	$N_{p,eq}$[12]	lb (kN)	Not Applicable	2,035 (9.1)	See note 7	2,505 (11.2)	See note 7	4,450 (19.8)	See note 7		See note 7	See note 7	11,350 (50.5)
Reduction factor for pullout strength, seismic[3]	ϕ	-	0.65 (Condition B)										
PULLOUT STRENGTH IN TENSION FOR ANCHORS INSTALLED THROUGH THE SOFFIT OF SAND-LIGHTWEIGHT AND NORMAL-WEIGHT CONCRETE OVER STEEL DECK													
Characteristic pullout strength, uncracked concrete over steel deck(Figure 2A)[6,11]	$N_{p,deck,uncr}$	lb (kN)	Not Applicable	1,940 (8.6)	3,205 (14.2)		2,795 (12.4)		3,230 (14.4)		Not Applicable	Not Applicable	Not Applicable
Characteristic pullout strength, cracked concrete over steel deck (Figure 2A)[6,11]	$N_{p,deck,cr}$	lb (kN)		1,375 (6.1)	2,390 (10.6)		1,980 (8.8)		2,825 (12.4)				
Characteristic pullout strength, cracked concrete over steel deck, seismic (Figure 2A)[6,11]	$N_{p,deck,eq}$	lb (kN)		1,375 (6.1)	2,390 (10.6)		1,980 (8.8)		2,825 (12.4)				
Characteristic pullout strength, uncracked concrete over steel deck (Figure 2B)[6,11]	$N_{p,deck,uncr}$	lb (kN)		1,665 (7.4)	1,900 (8.5)		Not Applicable		Not Applicable				
Characteristic pullout strength, cracked concrete over steel deck (Figure 2B)[6,11]	$N_{p,deck,cr}$	lb (kN)		1,180 (5.2)	1,420 (6.3)								
Characteristic pullout strength, cracked concrete over steel deck, seismic (Figure 2B)[6,11]	$N_{p,deck,eq}$	lb (kN)		1,180 (5.2)	1,420 (6.3)								
Reduction factor for pullout strength, steel deck[3]	ϕ	-	0.65 (Condition B)										

For SI: 1 inch = 25.4 mm; 1 ksi = 6.894 N/mm²; 1 lbf = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318 -11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable, must apply.
2. Installation must comply with published instructions and details.
3. All values of ϕ apply to the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable. If the load combinations of ACI 318-11 Appendix C are used, then the appropriate value of ϕ must be determined in accordance with ACI 318-11 D4.4. For reinforcement that meets ACI 318-14 Chapter 17 or ACI 318-11 Appendix D requirements for Condition A, see ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c), as applicable, for the appropriate ϕ factor when the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used.
4. The Power-Stud+ SD1 is considered a ductile steel element as defined by ACI 318-14 2.3 or ACI 318-11 D.1, as applicable. Tabulated values for steel strength in tension are based on test results per ACI 355.2 and must be used for design.
5. For all design cases use $\Psi_{c,N} = 1.0$. The appropriate effectiveness factor for cracked concrete (k_{cr}) or uncracked concrete (k_{uncr}) must be used.
6. For all design cases use $\Psi_{c,P} = 1.0$. For concrete compressive strength greater than 2,500 psi N_{pn} = (pullout strength from table)*(specified concrete compressive strength/2,500)$^{0.5}$. For concrete over steel deck the value of 2,500 must be replaced with the value of 3,000.
7. Pullout strength does not control design of indicated anchors. Do not calculate pullout strength for indicated anchor size and embedment.
8. Anchors are permitted to be used in lightweight concrete provided the modification factor λ_a equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n and V_n. λ shall be determined in accordance with the corresponding version of ACI 318.
9. For anchors in the topside of concrete-filled steel deck assemblies, see Figure 1.
10. Tabulated values for characteristic pullout strength in tension are for seismic applications and based on test results in accordance with ACI 355.2, Section 9.5.
11. Values for $N_{p,deck}$ are for sand-lightweight concrete (f'c, min = 3,000 psi) and additional lightweight concrete reduction factors need not be applied. In addition, evaluation for the concrete breakout capacity in accordance with ACI 318-14 17.4.2 or ACI 318-11 D.5.2, as applicable, is not required for anchors installed in the deck soffit (flute).

Shear Design Information for Power-Stud+ SD1 Anchor in Concrete (For use with load combinations taken from ACI 318-14, Section 5.3 or ACI 318-11, Section 9.2)[1,2]

CODE LISTED
ICC-ES ESR-2818
STRENGTH DESIGN SD TABLES

Design Characteristic	Notation	Units	Nominal Anchor Diameter										
			1/4 inch	3/8 inch	1/2 inch		5/8 inch		3/4 inch		7/8 inch	1 inch	1-1/4 inch
Anchor category	1, 2 or 3	-	1	1	1		1		1		1	1	1
STEEL STRENGTH IN SHEAR[4]													
Minimum specified yield strength (threads)	f_{ya}	ksi (N/mm^2)	70.0 (482)	80.0 (552)	70.4 (485)		70.4 (485)		64.0 (441)		58.0 (400)	58.0 (400)	58.0 (400)
Minimum specified ultimate strength (threads)	f_{uta}	ksi (N/mm^2)	88.0 (606)	100.0 (689)	88.0 (607)		88.0 (607)		80.0 (552)		75.0 (517)	75.0 (517)	75.0 (517)
Effective tensile stress area (threads)	$A_{se,V}$	in^2 (mm^2)	0.0318 (20.5)	0.0775 (50.0)	0.1419 (91.5)		0.2260 (145.8)		0.3345 (212.4)		0.462 (293.4)	0.6060 (384.8)	0.969 (615)
Steel strength in shear[5]	V_{sa}	lb (kN)	925 (4.1)	2,990 (13.3)	4,620 (20.6)		9,030 (40.2)		10,640 (47.3)	11,655 (54.8)	8,820 (39.2)	10,935 (48.6)	17,750 (79.0)
Reduction factor for steel strength[3]	ϕ	-	0.65										
CONCRETE BREAKOUT STRENGTH IN SHEAR[6,7]													
Load bearing length of anchor (h_{ef} or $8d_o$, whichever is less)	ℓ_e	in. (mm)	1.50 (38)	2.00 (51)	2.00 (51)	3.25 (83)	2.75 (70)	4.00 (102)	3.125 (79)	4.75 (114)	3.50 (88.9)	4.375 (111)	5.375 (137)
Nominal anchor diameter	d_a	in. (mm)	0.250 (6.4)	0.375 (9.5)	0.500 (12.7)		0.625 (15.9)		0.750 (19.1)		0.875 (22.2)	1.000 (25.4)	1.25 (31.8)
Reduction factor for concrete breakout[3]	ϕ	-	0.70 (Condition B)										
PRYOUT STRENGTH IN SHEAR[6,7]													
Coefficient for pryout strength (1.0 for h_{ef} < 2.5 in., 2.0 for $h_{ef} \geq$ 2.5 in.)	k_{cp}	-	1.0	1.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Effective embedment	h_{ef}	in. (mm)	1.50 (38)	2.00 (51)	2.00 (51)	3.25 (83)	2.75 (70)	4.00 (102)	3.125 (79)	4.75 (114)	3.50 (88.9)	4.375 (111)	5.375 (137)
Reduction factor for pryout strength[3]	ϕ	-	0.70 (Condition B)										
STEEL STRENGTH IN SHEAR FOR SEISMIC APPLICATIONS													
Steel strength in shear, seismic[8]	$V_{sa,eq}$	lb (kN)	N/A	2,440 (10.9)	3,960 (17.6)		6,000 (26.7)		8,580 (38.2)	9,635 (42.9)	8,820 (39.2)	9,845 (43.8)	17,750 (79.0)
Reduction factor for steel strength in shear for seismic[3]	ϕ	-	0.65										
STEEL STRENGTH IN SHEAR FOR FOR ANCHORS INSTALLED THROUGH THE SOFFIT OF SAND-LIGHTWEIGHT AND NORMAL-WEIGHT CONCRETE OVER STEEL DECK[9,10]													
Steel strength in shear, concrete over steel deck (Figure 2A)[9]	$V_{sa,deck}$	lb (kN)	Not Applicable	2,120 (9.4)	2,290 (10.2)		3,710 (16.5)		5,505 (24.5)		Not Applicable	Not Applicable	Not Applicable
Steel strength in shear, concrete over steel deck, seismic (Figure 2A)[9]	$V_{sa,deck,eq}$	lb (kN)	Not Applicable	2,120 (9.4)	2,290 (10.2)		3,710 (16.5)		4,570 (20.3)		Not Applicable	Not Applicable	Not Applicable
Steel strength in shear, concrete over steel deck (Figure 2B)[9]	$V_{sa,deck}$	lb (kN)	Not Applicable	2,120 (9.4)	2,785 (12.4)		Not Applicable		Not Applicable		Not Applicable	Not Applicable	Not Applicable
Steel strength in shear, concrete over steel deck, seismic (Figure 2B)[9]	$V_{sa,deck,eq}$	lb (kN)	Not Applicable	2,120 (9.4)	2,785 (12.4)		Not Applicable		Not Applicable		Not Applicable	Not Applicable	Not Applicable
Reduction factor for steel strength in shear, steel deck[3]	ϕ	-	0.65										

For SI: 1 inch = 25.4 mm; 1 ksi = 6.894 N/mm^2; 1 lbf = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable, must apply.
2. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2. If the load combinations of ACI 318-11 Appendix C are used, then the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4. For reinforcement that meets ACI 318-14 Chapter 17 or ACI 318-11 Appendix D requirements for Condition A, see ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c), as applicable, for the appropriate ϕ factor when the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used.
4. The Power-Stud+ SD1 is considered a ductile steel element as defined by ACI 318-14 2.3 or ACI 318-11 D.1, as applicable.
5. Tabulated values for steel strength in shear must be used for design. These tabulated values are lower than calculated results using equation D-20 in ACI 318-08.
6. Anchors are permitted to be used in lightweight concrete provided the modification factor λ_a equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n and V_n. λ shall be determined in accordance with the corresponding version of ACI 318.
7. For anchors in the topside of concrete-filled steel deck assemblies, see Figure 1.
8. Tabulated values for steel strength in shear are for seismic applications and based on test results in accordance with ACI 355.2, Section 9.6.
9. Tabulated values for $V_{sa,deck}$ and $V_{sa,deck,eq}$ are for sand-lightweight concrete (f'c, min = 3,000 psi); additional lightweight concrete reduction factors need not be applied. In addition, evaluation for the concrete breakout capacity in accordance with ACI 318-14 17.5.2 or ACI 318-11 D.6.2, as applicable, and the pryout capacity in accordance with ACI 318-14 17.5.3 or ACI 318-11 D.6.3, as applicable, are not required for anchors installed in the deck soffit (flute).
10. Shear loads for anchors installed through steel deck into concrete may be applied in any direction.

STRENGTH DESIGN PERFORMANCE DATA

Factored design strength ϕN_n and ϕV_n
Calculated in accordance with ACI 318-14 Chapter 17
Compliant with the International Building Code

STRENGTH DESIGN SD TABLES

Tension and Shear Design Strengths for Power-Stud+ SD1 in Cracked Concrete[1-6]

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	f'_c = 2,500 psi: ϕN_n Tension (lbs.)	f'_c = 2,500 psi: ϕV_n Shear (lbs.)	f'_c = 3,000 psi: ϕN_n Tension (lbs.)	f'_c = 3,000 psi: ϕV_n Shear (lbs.)	f'_c = 4,000 psi: ϕN_n Tension (lbs.)	f'_c = 4,000 psi: ϕV_n Shear (lbs.)	f'_c = 6,000 psi: ϕN_n Tension (lbs.)	f'_c = 6,000 psi: ϕV_n Shear (lbs.)	f'_c = 8,000 psi: ϕN_n Tension (lbs.)	f'_c = 8,000 psi: ϕV_n Shear (lbs.)
1/4	1-3/4	-	-	-	-	-	-	-	-	-	-
3/8	2-3/8	1,325	1,685	1,450	1,845	1,675	1,945	2,050	1,945	2,365	1,945
1/2	2-1/2	1,565	1,685	1,710	1,845	1,975	2,130	2,420	2,605	2,795	3,005
	3-3/4	1,630	3,005	1,785	3,005	2,060	3,005	2,520	3,005	2,915	3,005
5/8	3-3/8	2,520	3,125	2,760	3,425	3,185	3,955	3,905	4,845	4,505	5,590
	4-5/8	2,895	5,870	3,170	5,870	3,660	5,870	4,480	5,870	5,175	5,870
3/4	4	3,770	6,210	4,130	6,800	4,770	6,915	5,840	6,915	6,735	6,915
	5-5/8	5,720	7,575	6,265	7,575	7,235	7,575	8,860	7,575	10,230	7,575
7/8	4-1/2	4,470	5,735	4,895	5,735	5,655	5,735	6,925	5,735	7,995	5,735
1	5-1/2	7,140	7,110	7,820	7,110	9,030	7,110	11,060	7,110	12,770	7,110
1-1/4	6-1/2	7,380	11,540	8,080	11,540	9,330	11,540	11,430	11,540	13,195	11,540

Minimum Concrete Compressive Strength

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

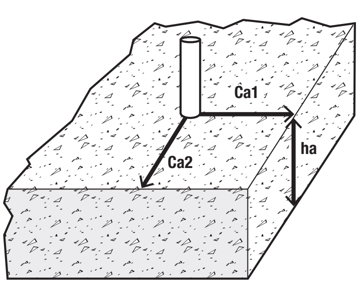
Tension and Shear Design Strengths for Power-Stud+ SD1 in Uncracked Concrete[1-6]

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	f'_c = 2,500 psi: ϕN_n Tension (lbs.)	f'_c = 2,500 psi: ϕV_n Shear (lbs.)	f'_c = 3,000 psi: ϕN_n Tension (lbs.)	f'_c = 3,000 psi: ϕV_n Shear (lbs.)	f'_c = 4,000 psi: ϕN_n Tension (lbs.)	f'_c = 4,000 psi: ϕV_n Shear (lbs.)	f'_c = 6,000 psi: ϕN_n Tension (lbs.)	f'_c = 6,000 psi: ϕV_n Shear (lbs.)	f'_c = 8,000 psi: ϕN_n Tension (lbs.)	f'_c = 8,000 psi: ϕV_n Shear (lbs.)
1/4	1-3/4	1,435	600	1,570	600	1,690	600	1,690	600	1,690	600
3/8	2-3/8	1,860	1,945	2,040	1,945	2,335	1,945	2,885	1,945	3,330	1,945
1/2	2-1/2	2,095	2,375	2,295	2,605	2,645	3,005	3,240	3,005	3,745	3,005
	3-3/4	3,595	3,005	3,940	3,005	4,545	3,005	5,570	3,005	6,430	3,005
5/8	3-3/8	3,555	4,375	3,895	4,795	4,500	5,535	5,510	5,870	6,365	5,870
	4-5/8	6,240	5,870	6,835	5,870	7,895	5,870	9,665	5,870	10,850	5,870
3/4	4	4,310	6,915	4,720	6,915	5,450	6,915	6,675	6,915	7,710	6,915
	5-5/8	8,075	7,575	8,845	7,575	10,215	7,575	12,510	7,575	14,250	7,575
7/8	4-1/2	5,105	5,735	5,595	5,735	6,460	5,735	7,910	5,735	9,135	5,735
1	5-1/2	7,140	7,110	7,820	7,110	9,030	7,110	11,060	7,110	12,770	7,110
1-1/4	6-1/2	10,935	11,540	11,980	11,540	13,830	11,540	16,940	11,540	19,560	11,540

Minimum Concrete Compressive Strength

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

1- Tabular values are provided for illustration and are applicable for single anchors installed in normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac} (table values based on $c_{a1} = c_{ac}$).
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.
2- Calculations were performed according to ACI 318-14 Chapter 17. The load level corresponding to the controlling failure mode is listed. (e.g. For tension: steel, concrete breakout and pullout; For shear: steel, concrete breakout and pryout). Furthermore, the capacities for concrete breakout strength in tension and pryout strength in shear are calculated using the effective embedment values, h_{ef}, for the selected anchors as noted in the design information tables. Please also reference the installation specifications for more information.
3- Strength reduction factors (ø) were based on ACI 318-14 Section 5.3 for load combinations. Condition B is assumed.
4- Tabular values are permitted for static loads only, seismic loading is not considered with these tables.
5- For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Chapter 17.
6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318-14 Chapter 17. For other design conditions including seismic considerations please see ACI 318-14 Chapter 17.



ORDERING INFORMATION

Power-Stud+ SD1 (Carbon Steel Body and Expansion Clip)

Cat. No.	Anchor Size	Thread Length	Box Qty.	Carton Qty.	Wt./100 (lbs.)	Suggested ANSI Carbide Drill Bit Cat. No.				
						Full Head SDS-Plus	SDS-Plus	SDS-Max	Hollow Bit SDS-Plus	Hollow Bit SDS-Max
7400SD1	1/4" x 1-3/4"	3/4"	100	600	3	DW5517	DW5416	-	-	-
7402SD1	1/4" x 2-1/4"	1-1/4"	100	600	4	DW5517	DW5417	-	-	-
7404SD1	1/4" x 3-1/4"	2-1/4"	100	600	5	DW5517	DW5417	-	-	-
7410SD1	3/8" x 2-1/4"	7/8"	50	300	8	DW5527	DW5427	-	-	-
7412SD1	3/8" x 2-3/4"	1-3/8"	50	300	9	DW5527	DW5427	-	-	-
7413SD1	3/8" x 3"	1-5/8"	50	300	10	DW5527	DW5427	-	-	-
7414SD1	3/8" x 3-1/2"	2-1/8"	50	300	12	DW5527	DW5427	-	-	-
7415SD1	3/8" x 3-3/4"	2-3/8"	50	300	13	DW5527	DW5427	-	-	-
7416SD1	3/8" x 5"	3-5/8"	50	300	15	DW55300	DW5429	-	-	-
7417SD1	3/8" x 7"	5-5/8"	50	300	21	DW55300	DW5429	-	-	-
7420SD1	1/2" x 2-3/4"	1"	50	200	19	DW5537	DW5437	DW5803	DWA54012	-
7422SD1	1/2" x 3-3/4"	2"	50	200	23	DW5537	DW5437	DW5803	DWA54012	-
7423SD1	1/2" x 4-1/2"	2-3/4"	50	200	27	DW5539	DW5438	DW5803	DWA54012	-
7424SD1	1/2" x 5-1/2"	3-3/4"	50	150	30	DW5539	DW5438	DW5803	DWA54012	-
7426SD1	1/2" x 7"	5-1/4"	25	100	38	DW5539	DW5438	DW5803	DWA54012	-
7427SD1	1/2" x 8-1/2"	6-3/4"	25	100	44	DW5539	DW5439	DW5804	DWA54012	-
7428SD1	1/2" x 10"	8-1/4"	25	100	53	DW5539	DW5439	DW5804	DWA54012	-
7430SD1	5/8" x 3-1/2"	1-1/2"	25	100	37	-	DW5446	DW5806	DWA54058	DWA54058
7432SD1	5/8" x 4-1/2"	2-1/2"	25	100	43	-	DW5446	DW5806	DWA54058	DWA54058
7433SD1	5/8" x 5"	3"	25	100	47	-	DW5446	DW5806	DWA54058	DWA54058
7434SD1	5/8" x 6"	4"	25	75	53	-	DW5446	DW5806	DWA54058	DWA54058
7436SD1	5/8" x 7"	5"	25	75	60	-	DW5447	DW5806	DWA54058	DWA54058
7438SD1	5/8" x 8-1/2"	6-1/2"	25	50	70	-	DW5447	DW5809	DWA54058	DWA54058
7439SD1	5/8" x 10"	8"	25	75	87	-	DW5447	DW5809	DWA54058	DWA54034
7440SD1	3/4" x 4-1/4"	1-3/4"	20	60	63	-	DW5453	DW5810	DWA54034	DWA54034
7441SD1	3/4" x 4-3/4"	2-1/4"	20	60	68	-	DW5453	DW5810	DWA54034	DWA54034
7442SD1	3/4" x 5-1/2"	3"	20	60	76	-	DW5453	DW5810	DWA54034	DWA54034
7444SD1	3/4" x 6-1/4"	3-3/4"	20	60	83	-	DW5455	DW5810	DWA54034	DWA54034
7446SD1	3/4" x 7"	4-1/2"	20	60	91	-	DW5455	DW5810	DWA54034	DWA54034
7448SD1	3/4" x 8-1/2"	6"	10	40	107	-	DW5455	DW5812	DWA54034	DWA54034
7449SD1	3/4" x 10"	7-1/2"	10	30	123	-	DW5455	DW5812	DWA54034	DWA54034
7451SD1	3/4" x 12"	9-1/2"	10	30	144	-	DW5456	DW5812	DWA54034	DWA54034
7450SD1	7/8" x 6"	2-3/4"	10	20	128	-	-	DW5815	-	DWA54078
7452SD1	7/8" x 8"	4-3/4"	10	40	161	-	-	DW5815	-	DWA54078
7454SD1	7/8" x 10"	6-3/4"	10	30	187	-	-	DW5816	-	DWA54078
7461SD1	1" x 6"	2-3/8"	10	30	168	-	-	DW5818	-	DWA58001
7463SD1	1" x 9"	5-3/8"	10	30	234	-	-	DW5819	-	DWA58001
7465SD1	1" x 12"	8-3/8"	5	15	307	-	-	DW5819	-	DWA58001
7473SD1	1-1/4" x 9"	4-3/4"	5	15	374	-	-	DW5820	-	-
7475SD1	1-1/4" x 12"	7-3/4"	5	15	476	-	-	DW5825	-	-

Tie Wire Power-Stud+ SD1
(Carbon Steel Body and Expansion clip)

Cat. No.	Anchor Size	Thread Length	Box Qty.	Carton Qty.	Wt./100 (lbs.)
7409SD1	1/4" x 2"	N/A	100	500	3

Shaded catalog numbers denote sizes which are less than the minimum standard anchor length for strength design.
The published size includes the diameter and the overall length of the anchor.
All anchors are packaged with nuts and washers (not including tie wire version).
See the DEWALT website or Buyers Guide for additional information on carbide drill bits.
A manual hand pump is available (Cat. No. 08280).
Hollow drill bits must be used with a dust extraction vacuum (Cat. No. DW012).

GENERAL INFORMATION

POWER-STUD® +SD2

High Performance Wedge Expansion Anchor

PRODUCT DESCRIPTION

The Power-Stud+ SD2 anchor is a fully threaded, torque-controlled, wedge expansion anchor which is designed for consistent performance in cracked and uncracked concrete. Suitable base materials include normal-weight concrete, sand-lightweight concrete and concrete over steel deck. The anchor is manufactured with a zinc plated carbon steel body and stainless steel expansion clip for premium performance.

GENERAL APPLICATIONS AND USES

- Structural connections, i.e., beam and column anchorage
- Utility and safety-related attachments
- Interior applications / low level corrosion environment
- Tension zone applications, i.e., cable trays and strut, pipe supports, fire sprinklers
- Seismic and wind loading
- Medium to heavy duty purposes

FEATURES AND BENEFITS

+ Consistent performance in high and low strength concrete
+ Nominal drill bit size is the same as the anchor diameter
+ Anchor can be installed through standard fixture holes
+ Length ID code and identifying marking stamped on head of each anchor
+ Anchor design allows for follow-up expansion after setting under tensile loading

APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES), ESR-2502 for cracked and uncracked concrete
- Code Compliant with the 2015, IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, and 2009 IRC
- Tested in accordance with ACI 355.2 and ICC-ES AC193 for use in structural concrete under the design provisions of ACI 318-14 Chapter 17 or ACI 318-11/08 Appendix D
- Evaluated and qualified by an accredited independent testing laboratory for recognition in cracked and uncracked concrete including seismic and wind loading (Category 1 anchors)
- FM Global (Factory Mutual) - File No. 3033795, 3/8" and 1/2" diameters
  Pipe hanger components for automatic sprinkler systems
- Underwriters Laboratories (UL Listed) - File No. EX1289 - See listing

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 09 - Post-Installed Concrete Anchors. Expansion anchors shall be Power-Stud+ SD2 as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

MATERIAL SPECIFICATIONS

Anchor component	Specification
Anchor Body	Medium carbon steel
Hex nut	Carbon steel, ASTM A 563, Grade A
Washer	Carbon Steel, ASTM F 844; meets dimensional requirements of ANSI B18.22.2. Type A Plain
Expansion wedge (clip)	Type 316 Stainless Steel
Plating (anchor body, nut and washer)	Zinc plating according to ASTM B 633, SC1 Type III (Fe/Zn 5). Minimum plating requirements for Mild Service Condition.

SECTION CONTENTS

POWER-STUD+ SD2 ASSEMBLY

THREAD VERSION

- UNC threaded stud

ANCHOR MATERIALS

- Zinc plated carbon steel body with stainless steel expansion clip, zinc plated carbon steel nut and washer

ANCHOR SIZE RANGE (TYP.)

- 3/8" diameter through 3/4" diameter

SUITABLE BASE MATERIALS

- Normal-weight concrete
- Sand-lightweight concrete
- Concrete over steel deck
- Grouted-filled concrete masonry (CMU)

CODE LISTED
ICC-ES ESR-2502
CONCRETE

INSTALLATION SPECIFICATIONS

Installation Table for Power-Stud+ SD2[4]

Anchor Property/ Setting Information	Notation	Units	Nominal Anchor Size									
			3/8"	1/2"				5/8"			3/4"	
Anchor diameter	d_a	in. (mm)	0.375 (9.5)	0.500 (12.7)				0.625 (15.9)			0.750 (19.1)	
Minimum diameter of hole clearance in fixture	d_h	in. (mm)	7/16 (11.1)	9/16 (14.3)				11/16 (17.5)			13/16 (20.6)	
Nominal drill bit diameter	d_{bit}	in.	3/8 ANSI	1/2 ANSI				5/8 ANSI			3/4 ANSI	
Minimum nominal embedment depth[1]	h_{nom}	in. (mm)	2-3/8 (60)	2-1/2 (64)		3-3/4 (95)		3-7/8 (98)	4-7/8 (124)		4-1/2 (114)	5-3/4 (146)
Effective embedment	h_{ef}	in. (mm)	2 (51)	2 (51)		3-1/4 (83)		3-1/4 (83)	4-1/4 (108)		3-3/4 (95)	5 (127)
Minimum hole depth[2]	h_o	in. (mm)	2-5/8 (67)	2-3/4 (70)		4 (102)		4-1/4 (108)	5-1/4 (133)		5 (127)	6-1/4 (159)
Minimum concrete member thickness	h_{min}	in. (mm)	4 (102)	4-1/2 (114)	6 (152)	5-3/4 (146)	5-3/4 (146)	5-3/4 (146)	6-1/2 (165)	8 (203)	7 (178)	10 (254)
Minimum overall anchor length[3]	ℓ_{anch}	in. (mm)	3 (76.2)	3-3/4 (95)		4-1/2 (114)		4-3/4 (121)	6 (152)		5-1/2 (140)	7 (178)
Minimum edge distance[2]	c_{min}	in. (mm)	2-1/2 (63.5)	4 (102)	2-3/4 (70)	4 (102)	2-3/4 (70)	4-1/4 (108)	4-1/4 (108)		5 (127)	4-1/2 (114)
Minimum spacing distance[2]	s_{min}	in. (mm)	3-1/2 (88.9)	6 (152)	6 (152)	4 (102)	6 (152)	4-1/4 (108)	4-1/4 (108)		6 (152)	6 (152)
Critical edge distance[2]	c_{ac}	in. (mm)	6-1/2 (165.1)	8 (203)		10 (254)		8 (203)	15-3/4 (400)	10 (254)	12 (305)	12 (305)
Installation torque	T_{inst}	ft.-lb. (N-m)	20 (27)	40 (54)				60 (81)			110 (149)	
Torque wrench socket size	-	in.	9/16	3/4				15/16			1-1/8	
Nut height	-	in.	21/64	7/16				35/64			41/64	

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

1. The embedment depth, h_{nom}, is measured from the outside surface of the concrete member to the embedded end of the anchor prior to tightening.
2. For installations through the soffit of steel deck into concrete see the installation details in Figure A, B, and C. In addition, anchors shall have an axial spacing along the flute equal to the greater of $3h_{ef}$ or 1.5 times the flute width. The hole diameter in the steel deck must not exceed the hole diameter in the concrete by more than 1/8-inch (3.2 mm).
3. The listed minimum overall anchor length is based on anchor sizes commercially available at the time of publication compared with the requirements to achieve the minimum nominal embedment depth and possible fixture attachment.
4. The anchors may be installed in the topside of concrete-filled steel deck floor and roof assemblies in accordance with the installation specifications and design information provided the concrete thickness above the upper flute meets the minimum thicknesses specified in the tables; see Setting Information for Installation on the Top of Concrete-Filled Steel Deck Assemblies table and installation detail D.

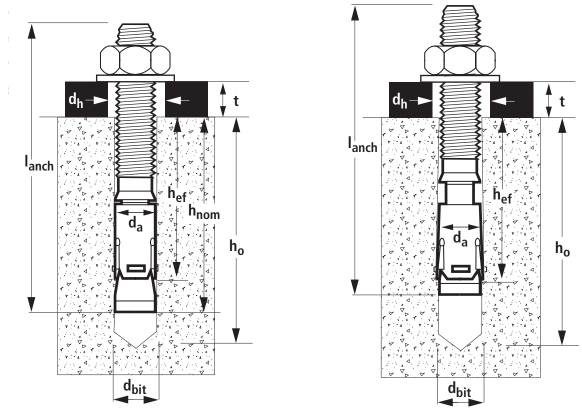
Anchor Setting Information for Installation on the Top of Concrete-Filled Steel Deck Assemblies[3,4]

Anchor Property/ Setting Information	Notation	Units	Nominal Anchor Size (inch)			
			3/8"		1/2"	
Nominal drill bit diameter	d_{bit}	in.	3/8 ANSI		1/2 ANSI	
Minimum nominal embedment depth[1]	h_{nom}	in. (mm)	2-3/8 (60)		2-1/2 (64)	
Effective embedment	h_{ef}	in. (mm)	2.00 (51)		2.00 (51)	
Minimum concrete member thickness[2]	$h_{min,deck}$	in. (mm)	2-1/2 (64)		2-1/2 (64)	
Critical edge distance	$c_{ac,deck,top}$	in. (mm)	8 (203)		9 (229)	
Minimum edge distance	$c_{min,deck,top}$	in. (mm)	4 (102)	2-3/4 (70)	4 (102)	8 (203
Minimum spacing distance	$s_{min,deck,top}$	in. (mm)	3-1/2 (89)	6 (152)	8 (203)	4 (102)
Minimum hole depth	h_o	in. (mm)	2-1/2 (64)		2-1/2 (64)	
Installation torque	T_{inst}	ft.-lb. (N-m)	20 (27)		40 (54)	
Torque wrench socket size	-	in.	9/16		3/4	
Nut height	-	in.	21/64		7/16	

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

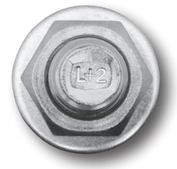
1. The embedment depth, h_{nom}, is measured from the outside surface of the concrete member to the embedded end of the anchor prior to tightening.
2. The anchors may be installed in the topside of concrete-filled steel deck floor and roof assemblies provided the concrete thickness above the upper flute meets the minimum thicknesses specified in this table. Minimum concrete member thickness refers to the concrete thickness above the upper flute (topping thickness). See Installation Detail D.
3. For all other anchor diameters and embedment depths, refer to the installation table for applicable values of h_{min}, c_{min} and s_{min}.
4. Design capacities shall be based on calculations according to values in Tension and Shear Design Information for Anchors in Concrete tables.

Power-Stud+ SD2 Anchor Detail



Before After

Head Marking



Legend

Letter Code = Length Identification Mark

'+' Symbol = Strength Design Compliant Anchor

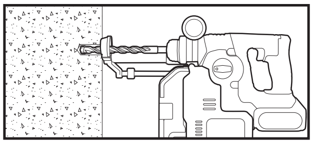
Number Code 2 = Carbon Steel Body and Stainless Steel Expansion Clip

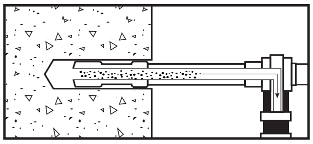
Length Identification

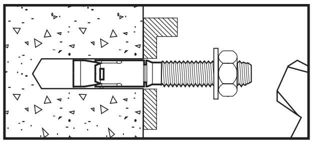
Mark	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
From	1-1/2"	2"	2-1/2"	3"	3-1/2"	4"	4-1/2"	5"	5-1/2"	6"	6-1/2"	7"	7-1/2"	8"	8-1/2"	9"
Up to but not including	2"	2-1/2"	3"	3-1/2"	4"	4-1/2"	5"	5-1/2"	6"	6-1/2"	7"	7-1/2"	8"	8-1/2"	9"	9-1/2"
Length identification mark indicates overall length of anchor.																

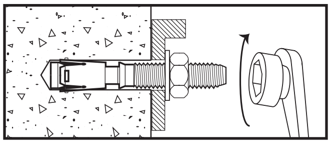
INSTALLATION INSTRUCTIONS

Installation Instructions for Power-Stud+ SD2









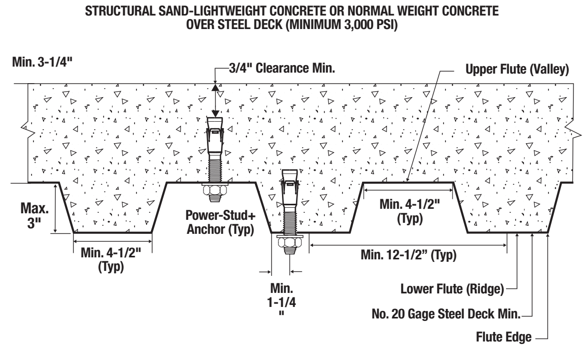
Step 1
Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.

Step 2
Remove dust and debris from the hole during drilling, (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.

Step 3
Position the washer on the anchor and thread on the nut. If installing through a fixture, drive the anchor through the fixture into the hole. Be sure the anchor is driven to the minimum required embedment depth, h_{nom}.

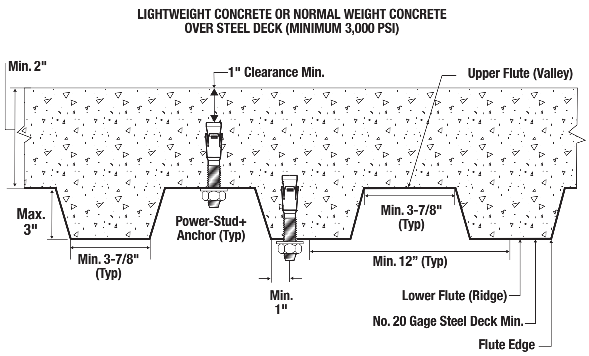
Step 4
Tighten the anchor with a torque wrench by applying the required installation torque, $T_{inst.}$

Installation Detail A: Power-Stud+ SD2 Installed in the Soffit of Concrete over Steel Deck Floor and Roof Assemblies (see dimensional profile requirements)[1]



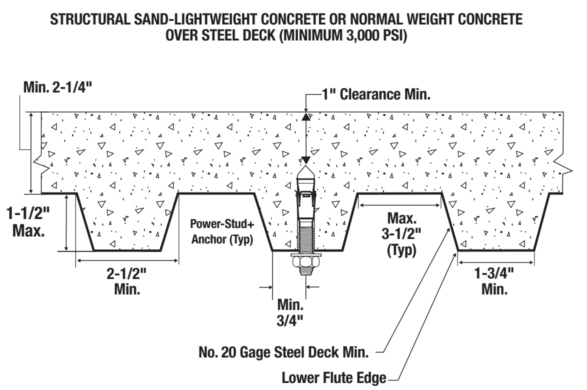
1. Anchors may be placed in the upper flute or lower flute of the steel deck profiles in accordance with installation Detail A provided the minimum hole clearance is satisfied. Anchors in the lower flute of installation Detail A profiles may be installed with a maximum 1-inch offset in either direction from the center of the flute. The offset distance may be increased proportionally for profiles with lower flute widths greater than those shown provided the minimum lower flute edge distance is also satisfied.

Installation Detail B: Power-Stud+ SD2 Installed in the Soffit of Concrete Over Steel Deck Floor and Roof Assemblies (see dimensional profile requirements)[1]



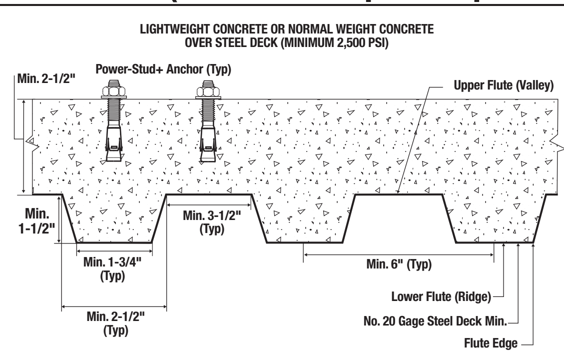
1. Anchors may be placed in the upper flute or lower flute of the steel deck profiles in accordance with Detail B provided the minimum hole clearance is satisfied. Anchors in the lower flute of Detail B profiles may be installed with a maximum 15/16 -inch offset in either direction from the center of the flute. The offset distance may be increased proportionally for profiles with lower flute widths greater than those shown provided the minimum lower flute edge distance is also satisfied.

Installation Detail C: Power-Stud+ SD2 Installed in the Soffit of Concrete over Steel Deck Floor and Roof Assemblies (See Dimensional Profile Requirements)[1,2]



1. Anchors may be placed in the lower flute of the steel deck profiles in accordance with installation Detail C provided the minimum hole clearance is satisfied. Anchors in the lower flute of installation Detail C profiles may be installed with a maximum 1/8-inch offset in either direction from the center of the flute. The offset distance may be increased proportionally for profiles with lower flute widths greater than those shown provided the minimum lower flute edge distance is also satisfied.
2. Anchors may be placed in the upper flute of the steel deck profiles in accordance with installation Detail C provided the concrete thickness above the upper flute is minimum 3-1/4-inch and a minimum hole clearance of 3/4-inch is satisfied.

Installation Detail D: Installation Detail for Anchors in the Top of Concrete Over Steel Deck Floor and Roof Assemblies (see dimensional profile requirements)[1,2]



1. Anchors may be placed in the top side of concrete over steel deck profiles in accordance with Detail D provided the minimum concrete thickness above the upper flute (topping thickness) is as illustrated and the minimum spacing distance and minimum edge distances are satisfied as given in Setting Information for Installation on the Top of Concrete-Filled Steel Deck Assemblies Table.
2. For anchors installed in the top of concrete over steel deck profiles with concrete thickness above the upper flute (topping thickness) greater than or equal to the minimum concrete member thicknesses specified in Installation Table for the Power-Stud+ SD2, the minimum spacing distance and minimum edge distances may be used from this table, as applicable.

PERFORMANCE DATA

Tension Design Information[1,2,12]

CODE LISTED ICC-ES ESR-2502

STRENGTH DESIGN TABLES SD

Design Characteristic	Notation	Units	Nominal Anchor Diameter (inch)						
			3/8	1/2		5/8		3/4	
Anchor category	1,2 or 3	-	1	1		1		1	
STEEL STRENGTH IN TENSION (ACI 318-14 17.4.1 or ACI 318-11 D.5.1)[4]									
Minimum specified yield strength (neck)	f_y	ksi (N/mm²)	96.0 (662)	85.0 (586)		85.0 (586)		70.0 (483)	
Minimum specified ultimate tensile strength (neck)	f_{uta}	ksi (N/mm²)	120.0 (827)	106.0 (731)		106.0 (731)		90.0 (620)	
Effective tensile stress area (neck)	$A_{se,N}$	in² (mm²)	0.0552 (35.6)	0.1007 (65.0)		0.1619 (104.5)		0.2359 (153.2)	
Steel strength in tension[5]	N_{sa}	lb (kN)	6,625 (29.4)	10,445 (46.5)		13,080 (58.2)		21,230 (94.4)	
Reduction factor for steel strength[3]	ϕ	-	0.75						
CONCRETE BREAKOUT STRENGTH IN TENSION (ACI 318-14 17.4.2 or ACI 318-11 D.5.2)[8]									
Effective embedment	h_{ef}	in. (mm)	2.00 (51)	2.00 (51)	3.25 (83)	3.25 (83)	4.25 (108)	3.75 (95)	5.00 (127)
Effectiveness factor for uncracked concrete	k_{ucr}	-	24	24		24		24	
Effectiveness factor for cracked concrete	k_{cr}	-	17	17		17		17	
Modification factor for cracked and uncracked concrete[6]	$\psi_{c,N}$	-	1.0 See note 5	1.0 See note 6		1.0 See note 6		1.0 See note 6	
Critical edge distance	c_{ac}	in. (mm)	See Installation Table						
Reduction factor for concrete breakout strength[3]	ϕ	-	0.65 (Condition B)						
PULLOUT STRENGTH IN TENSION (ACI 318-14 17.4.3 or ACI 318-11 D.5.3)[9]									
Characteristic pullout strength, uncracked concrete (2,500 psi)[7]	$N_{p,uncr}$	lb (kN)	2,775 (12.3)	See note 8	6,615 (29.4)	See note 8	See note 8	See note 8	See note 8
Characteristic pullout strength, cracked concrete (2,500 psi)[7]	$N_{p,cr}$	lb (kN)	2,165 (9.6)	See note 8	4,375 (19.5)	See note 8	See note 8	See note 8	7,795 (35.1)
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)						
PULLOUT STRENGTH IN TENSION FOR SEISMIC APPLICATIONS (ACI 318-14 17.2.3.3 or ACI 318-11 D.5.3.3.3)[9]									
Characteristic pullout strength, seismic (2,500 psi)[7,10]	$N_{p,eq}$	lb (kN)	2,165 (9.6)	See note 8	4,375 (19.5)	See note 8	See note 8	See note 8	7,795 (35.1)
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)						
Mean axial stiffness values service load range[11] — Uncracked concrete	β	lbf/in (kN/mm)	865,000 (151)	717,00 (126)		569,000 (100)		420,000 (74)	
Mean axial stiffness values service load range[11] — Cracked concrete	β	lbf/in (kN/mm)	49,500 (9)	57,000 (10)		64,500 (11)		72,000 (13)	

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318 D.3.3, as applicable, shall apply.
2. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable. If the load combinations of ACI 318-11 Appendix C are used, then the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4. For reinforcement that meets ACI 318-14 Chapter 17 or ACI 318 Appendix D, as applicable, requirements for Condition A, see ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, for the appropriate ϕ factor when the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used.
4. The Power-Stud+ SD2 is considered a ductile steel element in tension as defined by ACI 318-14 2.3 or ACI 318 D.1, as applicable.
5. Tabulated values for steel strength in tension are based on test results per ACI 355.2 and must be used for design in lieu of calculation.
6. For all design cases use $\psi_{c,N}$ = 1.0. Select appropriate effectiveness factor for cracked concrete (k_{cr}) or uncracked concrete (k_{uncr}).
7. For all design cases use $\psi_{c,P}$ = 1.0. For concrete compressive strength greater than 2,500 psi, N_{pn} = (pullout strength value from table)*(specified concrete compressive strength/2500)^n. For concrete over steel deck the value of 2500 must be replaced with the value of 3000.
For all anchors n = 1/2 with the exception of the 3/8" anchor size for cracked concrete where n = 1/3.
8. Pullout strength does not control design of indicated anchors. Do not calculate pullout strength for indicated anchor size and embedment.
9. Anchors are permitted to be used in sand-lightweight concrete provided the modification factor λ_a equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n and V_n. λ shall be determined in accordance with the corresponding version of ACI 318.
10. Tabulated values for characteristic pullout strength in tension for seismic applications are based on test results per ACI 355.2, Section 9.5.
11. Mean values shown; actual stiffness varies considerable depending on concrete strength, loading and geometry of application.
12. Anchors are permitted for use in concrete-filled steel deck floor and roof assemblies; see installation details A, B, C and D.

CODE LISTED ICC-ES ESR-2502

Shear Design Information[1,2,8]

Design Characteristic	Notation	Units	Nominal Anchor Diameter (inch)						
			3/8	1/2		5/8		3/4	
Anchor category	1,2 or 3	-	1	1		1		1	
STEEL STRENGTH IN SHEAR (ACI 318-14 17.5.1 or ACI 318-11 D.6.1)[4]									
Minimum specified yield strength (threads)	f_y	ksi (N/mm²)	76.8 (530)	68.0 (469)		68.0 (469)		56.0 (386)	
Minimum specified ultimate tensile strength (threads)	f_{uta}	ksi (N/mm²)	100.0 (690)	88.0 (607)		88.0 (607)		80.0 (551)	
Effective tensile stress area (threads)	$A_{se, V}$	in² (mm²)	0.0775 (50.0)	0.1419 (65.7)		0.2260 (104.9)		0.3345 (215.8)	
Steel strength in shear[5]	V_{sa}	lb (kN)	3,115 (13.9)	4,815 (21.4)		10,170 (45.2)		12,610 (56.1)	
Reduction factor for steel strength[3]	ϕ	-	0.65						
CONCRETE BREAKOUT STRENGTH IN SHEAR (ACI 318-14 17.5.2 or ACI 318-11 D.6.2)[6]									
Load bearing length of anchor (h_{ef} or $8d_o$, whichever is less)	ℓ_e	in. (mm)	2.00 (51)	2.00 (51)	3.25 (83)	3.25 (83)	4.25 (108)	3.75 (95)	5.00 (127)
Reduction factor for concrete breakout strength[3]	ϕ	-	0.70 (Condition B)						
PRYOUT STRENGTH IN SHEAR (ACI 318-14 17.5.3 or ACI 318-11 D.6.3)[6]									
Coefficient for pryout strength 1.0 for h_{ef} < 2.5 in., 2.0 for $h_{ef} \geq 2.5$ in.	k_{cp}	-	1.0	1.0	2.0	2.0	2.0	2.0	2.0
Effective Embedment	h_{ef}	in. (mm)	2.00 (51)	2.00 (51)	3.25 (83)	3.25 (83)	4.25 (108)	3.75 (95)	5.00 (127)
Reduction factor for pullout strength[3]	ϕ	-	0.70 (Condition B)						
STEEL STRENGTH IN SHEAR FOR SEISMIC APPLICATIONS (ACI 318-14 17.2.3.3 or ACI 318-11 D.3.3.3)									
Steel Strength in shear, seismic[7]	$V_{sa, eq}$	lb (kN)	2,460 (11.0)	4,815 (21.4)		6,770 (30.1)		8,060 (35.9)	
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)						

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318 D.3.3 shall apply, as applicable.
2. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318 Section 9.2. If the load combinations of ACI 318-11 Appendix C are used, then the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4. For reinforcement that meets ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable, requirements for Condition A, see ACI 318-14 17.3.3 or ACI 318-11 D.4.3, for the appropriate ϕ factor when the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318 Section 9.2 are used.
4. The Power-Stud+ SD2 is considered a ductile steel element as defined by ACI 318-14 2.3 or ACI 318-11 D.1, as applicable.
5. Reported values for steel strength in shear are based on test results per ACI 355.2, Section 9.4 and shall be used for design.
6. Anchors are permitted to be used in sand-lightweight concrete provided the modification factor λ_a equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n and V_n. λ shall be determined in accordance with the corresponding version of ACI 318.
7. Reported values for steel strength in shear for seismic applications are based on test results per ACI 355.2, Section 9.6.
8. Anchors are permitted for use in concrete-filled steel deck floor and roof assemblies; see installation details A, B, C and D.

Tension and Shear Design Data for Power-Stud+ SD2 Anchors in the Soffit of Concrete-Filled Steel Deck Assemblies[1,2,7]

CODE LISTED ICC-ES ESR-2502

STRENGTH DESIGN TABLES SD

Design Characteristics		Notation	Units	Nominal Anchor Size (inch)					
				0.375	0.5		0.625		0.75
Anchor Category		1, 2 or 3	-	1	1		1		1
Effective Embedment		h_{ef}	in. (mm)	2.00 (51)	2.00 (51)	3.25 (83)	3.25 (83)	4.25 (108)	3.75 (95)
Minimum Nominal Embedment Depth		h_{nom}	in. (mm)	2-3/8 (60)	2-1/2 (64)	3-3/4 (83)	3-7/8 (98)	4-7/8 (124)	4-1/2 (114)
Minimum Hole Depth		h_o	in. (mm)	2-5/8 (67)	2-3/4 (70)	4 (102)	4-1/4 (108)	5-1/4 (133)	5 (27)
PULLOUT STRENGTH IN TENSION FOR ANCHORS IN SOFFIT OF SAND LIGHTWEIGHT AND NORMAL-WEIGHT CONCRETE OVER STEEL DECK[1]									
According to Detail A 4-1/2-inch-wide deck flute	Characteristic pullout strength, uncracked concrete over steel deck[2]	$N_{p,deck,uncr}$	lbf (kN)	1,855 (8.3)	2,065 (9.2)	3,930 (17.5)	4,665 (20.8)	7,365 (32.8)	4,900 (21.8)
	Characteristic pullout strength, cracked concrete over steel deck[2,3]	$N_{p,deck,cr}$	lbf (kN)	1,445 (6.4)	1,465 (6.5)	2,600 (11.6)	3,305 (14.7)	5,215 (23.2)	3,470 (15.4)
According to Detail B 3-7/8-inch-wide deck flute	Characteristic pullout strength, uncracked concrete over steel deck[2]	$N_{p,deck,uncr}$	lbf (kN)	2,235 (9.9)	2,785 (12.4)	5,600 (24.9)	4,480 (19.9)	7,265 (32.3)	Not Applicable
	Characteristic pullout strength, cracked concrete over steel deck[2,3]	$N_{p,deck,cr}$	lbf (kN)	1,745 (7.8)	1,975 (8.8)	3,695 (16.4)	3,175 (14.1)	5,145 (22.9)	Not Applicable
According to Detail C 1-3/4-inch-wide deck flute	Characteristic pullout strength, uncracked concrete over steel deck[2]	$N_{p,deck,uncr}$	lbf (kN)	1,600 (7.1)	2,025 (9.0)	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Characteristic pullout strength, cracked concrete over steel deck[2,3]	$N_{p,deck,cr}$	lbf (kN)	1,250 (5.6)	1,435 (6.4)	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Reduction factor for pullout strength[6]		ϕ	-	0.65					
STEEL STRENGTH IN SHEAR FOR ANCHORS IN SOFFIT OF SAND-LIGHTWEIGHT AND NORMAL WEIGHT CONCRETE OVER STEEL DECK[4,5]									
According to Detail A 4-1/2-inch-wide deck flute	Steel strength in shear, concrete over steel deck	$V_{sa,deck}$	lbf (kN)	2,170 (9.7)	3,815 (17.0)	5,040 (22.4)	4,015 (17.9)	6,670 (29.7)	4,325 (19.2)
	Steel strength in shear, seismic, concrete over steel deck	$V_{sa,deck,eq}$	lbf (kN)	1,715 (7.6)	3,815 (17.0)	5,040 (22.4)	2,675 (11.9)	4,445 (19.8)	2,820 (12.5)
According to Detail B 3-7/8-inch-wide deck flute	Steel strength in shear, concrete over steel deck	$V_{sa,deck}$	lbf (kN)	3,040 (13.5)	2,675 (11.9)	4,930 (21.9)	Not Applicable	Not Applicable	Not Applicable
	Steel strength in shear, seismic, concrete over steel deck	$V_{sa,deck,eq}$	lbf (kN)	2,400 (10.6)	2,675 (11.9)	4,930 (21.9)	Not Applicable	Not Applicable	Not Applicable
According to Detail C 1-3/4-inch-wide deck flute	Steel strength in shear, concrete over steel deck	$V_{sa,deck}$	lbf (kN)	2,170 (9.7)	2,880 (12.8)	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Steel strength in shear, seismic, concrete over steel deck	$V_{sa,deck,eq}$	lbf (kN)	1,715 (7.6)	2,880 (12.8)	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Reduction factor for steel strength in shear, concrete over steel deck[6]		ϕ	-	0.65					

1. For all design cases $\Psi_{c,P}$ = 1.0. For concrete compressive strength greater than 3,000 psi, N_{pn}=(pullout strength value from table) * (specified concrete compressive strength/2500)^n. For all anchors n=1/2 with exception of the 3/8-inch-diameter anchor size, where n=1/3.
2. Values for $N_{p,deck}$ are for sand-lightweight concrete ($f'_{c,\,min}$ = 3,000 psi) and additional lightweight concrete reduction factors need not be applied. In addition, evaluation for the concrete breakout capacity in accordance with ACI 318-14 17.4.2 or ACI 318 D.5.2, as applicable, is not required for anchors installed in the deck soffit (flute).
3. Values for $N_{p,deck,cr}$ are applicable for seismic loading.
4. Shear loads for anchors installed through steel deck into concrete may be applied in any direction.
5. Values for $V_{sa,deck}$ and $V_{sa,deck,eq}$ are for sand-lightweight concrete ($f'_{c,\,min}$ = 3,000 psi) and additional lightweight concrete reduction factors need not be applied. In addition, evaluation for the concrete breakout capacity in accordance with ACI 318-14 17.5.2 or ACI 318 D.6.2, as applicable and the pryout capacity in accordance with ACI 318-14 17.5.3 or ACI 318-11 D.6.3, as applicable, is not required for anchors installed in the deck soffit (flute).
6. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable. If the load combinations of ACI 318-11 Appendix C are used, then the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4.
7. Anchors shall have an axial spacing along the flute soffit equal to the greater of $3h_{ef}$ or 1.5 times the flute width.

Factored Design Strength (ϕN_n and ϕV_n) Calculated in Accordance with ACI 318-14 Chapter 17:

1- Tabular values are provided for illustration and are applicable for single anchors installed in normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
- c_{a1} is greater than or equal to the critical edge distance, c_{ac} (table values based on $c_{a1} = c_{ac}$).
- c_{a2} is greater than or equal to 1.5 times c_{a1}.

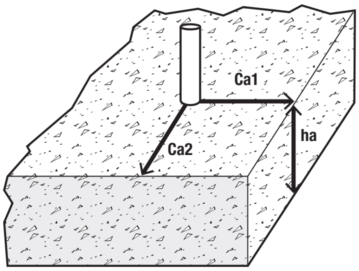
2- Calculations were performed according to ACI 318-18 Chapter 17. The load level corresponding to the controlling failure mode is listed. (e.g. For tension: steel, concrete breakout and pullout; For shear: steel, concrete breakout and pryout). Furthermore, the capacities for concrete breakout strength in tension and pryout strength in shear are calculated using the effective embedment values, h_{ef}, for the selected anchors as noted in the design information tables. Please also reference the installation specifications for more information.

3- Strength reduction factors (ø) were based on ACI 318-14 Section 5.3 for load combinations. Condition B is assumed.

4- Tabular values are permitted for static loads only, seismic loading is not considered with these tables.

5- For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Chapter 17.

6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318-14 Chapter 17. For other design conditions including seismic considerations please see ACI 318-14 Chapter 17.



Tension and Shear Design Strengths for Power-Stud+ SD2 in Cracked Concrete

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)
3/8	2-3/8	1,405	1,685	1,495	1,845	1,645	2,025	1,885	2,025	2,075	2,025
1/2	2-1/2	1,565	1,685	1,710	1,845	1,975	2,130	2,420	2,605	2,795	3,010
	3-3/4	2,845	3,130	3,115	3,130	3,595	3,130	4,405	3,130	5,085	3,130
5/8	3-7/8	3,235	4,220	3,545	4,620	4,095	5,335	5,015	6,535	5,790	6,610
	4-7/8	4,840	6,610	5,305	6,610	6,125	6,610	7,500	6,610	8,660	6,610
3/4	4-1/2	4,010	7,590	4,395	8,195	5,075	8,195	6,215	8,195	7,175	8,195
	5-3/4	5,065	8,195	5,550	8,195	6,410	8,195	7,850	8,195	9,065	8,195

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

Tension and Shear Design Strengths for Power-Stud+ SD2 in Uncracked Concrete

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)
3/8	2-3/8	1,805	2,025	1,975	2,025	2,280	2,025	2,795	2,025	3,225	2,025
1/2	2-1/2	2,205	2,375	2,415	2,605	2,790	3,005	3,420	3,130	3,945	3,130
	3-3/4	4,300	3,130	4,710	3,130	5,440	3,130	6,660	3,130	7,690	3,130
5/8	3-7/8	4,570	5,905	5,005	6,470	5,780	6,610	7,080	6,610	8,175	6,610
	4-7/8	6,835	6,610	7,485	6,610	8,645	6,610	9,810	6,610	9,810	6,610
3/4	4-1/2	5,665	8,195	6,205	8,195	7,165	8,195	8,775	8,195	10,130	8,195
	5-3/4	8,720	8,195	9,555	8,195	11,030	8,195	13,510	8,195	15,600	8,195

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

Factored design strengths may be converted to allowable loads using an appropriate conversion factor, α, for the controlling load combination.
See ICC-ES ESR-2502 or contact DEWALT for more information regarding the procedure to convert factored design strengths to allowable loads.

Converted Allowable Loads for Power-Stud+ SD2 in Cracked Concrete[1,2]

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)
3/8	2-3/8	1,005	1,205	1,070	1,320	1,175	1,445	1,345	1,445	1,480	1,445
1/2	2-1/2	1,120	1,205	1,220	1,320	1,410	1,520	1,730	1,860	1,995	2,150
	3-3/4	2,030	2,235	2,225	2,235	2,570	2,235	3,145	2,235	3,630	2,235
5/8	3-7/8	2,310	3,015	2,530	3,300	2,925	3,810	3,580	4,670	4,135	4,720
	4-7/8	3,455	4,720	3,790	4,720	4,375	4,720	5,355	4,720	6,185	4,720
3/4	4-1/2	2,865	5,420	3,140	5,855	3,625	5,855	4,440	5,855	5,125	5,855
	5-3/4	3,620	5,855	3,965	5,855	4,580	5,855	5,605	5,855	6,475	5,855

1. Allowable load values are calculated using a conversion factor, α, from Factored Design Strengths and conditions shown on the previous page.
2. Tabulated allowable load values assume 50% dead load and 50% live load, with controlling load combination 1.2D + 1.6L. Calculated weighted average for the conversion factor, α : 1.2(0.5) + 1.6(0.5) = 1.4.

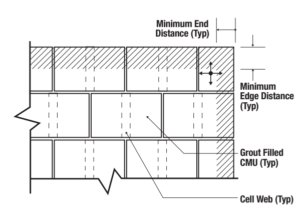
Converted Allowable Loads for Power-Stud+ SD2 in Uncracked Concrete[1,2]

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)
3/8	2-3/8	1,290	1,445	1,410	1,445	1,630	1,445	1,995	1,445	2,305	1,445
1/2	2-1/2	1,575	1,695	1,725	1,860	1,995	2,145	2,445	2,235	2,820	2,235
	3-3/4	3,070	2,235	3,365	2,235	3,885	2,235	4,755	2,235	5,495	2,235
5/8	3-7/8	3,265	4,220	3,575	4,620	4,130	4,720	5,055	4,720	5,840	4,720
	4-7/8	4,880	4,720	5,345	4,720	6,175	4,720	7,005	4,720	7,005	4,720
3/4	4-1/2	4,045	5,855	4,430	5,855	5,120	5,855	6,270	5,855	7,235	5,855
	5-3/4	6,230	5,855	6,825	5,855	7,880	5,855	9,650	5,855	11,145	5,855

1. Allowable load values are calculated using a conversion factor, α, from Factored Design Strengths and conditions shown on the previous page.
2. Tabulated allowable load values assume 50% dead load and 50% live load, with controlling load combination 1.2D + 1.6L. Calculated weighted average for the conversion factor, α : 1.2(0.5) + 1.6(0.5) = 1.4.

Ultimate and Allowable Load Capacities for Power-Stud+ SD2 in Grouted Filled Concrete Masonry[1,2,3]

Nominal Anchor Size in. (mm)	Minimum Embedment Depth (mm)	Installation Location[3]	Minimum Masonry Compressive Strength, f'm = 1,500 psi (10.4 MPa)			
			Ultimate Load Tension lbs. (kN)	Allowable Load Tension lbs. (kN)	Ultimate Load Shear lbs. (kN)	Allowable Load Shear lbs. (kN)
3/8 (9.5)	2-1/2 (50.8)	Wall Face/End Min. 2-1/2" Edge and End Distances	1,670 (7.4)	335 (1.5)	2,075 (9.2)	415 (1.8)
1/2 (12.7)	2-1/2 (50.8)	Wall Face/End Min. 3" Edge and End Distances	2,295 (10.2)	460 (2.0)	1,310 (5.8)	260 (1.2)
	3-3/4 (95.3)	Top of Wall Min. 1-3/4" Edge and 4" Edge Distances	3,320 (14.8)	665 (3.0)	1,140 (5.1)	230 (1.0)



Face Shell Permissible Anchor Locations
(Un-hatched Area / Through Face Shell)

1. Tabulated load values are for anchors installed in minimum 6-inch wide, minimum Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety.
3. Anchor installations into grouted masonry walls are limited to one per masonry cell.

ORDERING INFORMATION

Power-Stud+ SD2 (Carbon Steel Body with Stainless Steel Expansion Clip)

Cat. No.	Anchor Size	Thread Length	Box Qty.	Carton Qty.	Wt./100 (lbs.)	Suggested ANSI Carbide Drill Bit Cat. No.				
						Full Head SDS-Plus	SDS-Plus	SDS-Max	Hollow Bit SDS-Plus	Hollow Bit SDS-Max
7413SD2	3/8" x 3"	1-3/4"	50	300	10	DW5527	DW5427	-	-	-
7414SD2	3/8" x 3-1/2"	2-1/4"	50	300	12	DW5527	DW5427	-	-	-
7415SD2	3/8" x 3-3/4"	2-1/2"	50	300	13	DW5527	DW5427	-	-	-
7416SD2	3/8" x 5"	3-3/4"	50	300	16	DW55300	DW5429	-	-	-
7422SD2	1/2" x 3-3/4"	2-1/8"	50	200	23	DW5537	DW5437	DW5803	DWA54012	-
7423SD2	1/2" x 4-1/2"	2-7/8"	50	200	28	DW5539	DW5438	DW5803	DWA54012	-
7424SD2	1/2" x 5-1/2"	3-7/8"	50	150	32	DW5539	DW5438	DW5803	DWA54012	-
7426SD2	1/2" x 7"	5-3/8"	25	100	44	DW5539	DW5438	DW5803	DWA54012	-
7427SD2	1/2" x 8-1/2"	6-7/8"	25	100	46	DW5539	DW5439	DW5804	DWA54012	-
7435SD2	5/8" x 4-3/4"	2-7/8"	25	100	52	-	DW5446	DW5806	DWA54058	DWA58058
7433SD2	5/8" x 5"	3-1/8"	25	50	57	-	DW5446	DW5806	DWA54058	DWA58001
7434SD2	5/8" x 6"	4-1/8"	25	75	64	-	DW5446	DW5806	DWA54058	DWA58001
7436SD2	5/8" x 7"	5-1/8"	25	75	72	-	DW5447	DW5806	DWA54058	DWA58001
7438SD2	5/8" x 8-1/2"	6-5/8"	25	75	84	-	DW5447	DW5809	DWA54058	DWA58001
7442SD2	3/4" x 5-1/2"	3-1/4"	20	60	88	-	DW5453	DW5810	DWA54074	DWA58034
7444SD2	3/4" x 6-1/4"	4"	20	60	90	-	DW5455	DW5810	DWA54074	DWA58034
7446SD2	3/4" x 7"	4-3/4"	20	60	95	-	DW5455	DW5810	DWA54074	DWA58034
7448SD2	3/4" x 8-1/2"	6-1/4"	10	40	95	-	DW5455	DW5812	DWA54074	DWA58034

The published size includes the diameter and the overall length of the anchor.
All anchors are packaged with nuts and washers.
A manual hand pump is available (Cat. No. 08280).
Hollow drill bits must be used with a dust extraction vacuum (Cat. No. DW012).

GENERAL INFORMATION

POWER-STUD®+ SD4/SD6

Stainless Steel Wedge Expansion Anchors

PRODUCT DESCRIPTION

The Power-Stud+ SD4 and Power-Stud+ SD6 anchors are fully threaded, torque-controlled, stainless steel wedge expansion anchors which are designed for consistent performance in cracked and uncracked concrete. Suitable base materials are normal-weight, sand-lightweight concrete, and grouted concrete masonry (CMU). The anchor is manufactured with a stainless steel body and expansion clip. Nut and washer are included.

GENERAL APPLICATIONS AND USES

- Structural connections, i.e., beam and column anchorage
- Safety-related and common attachments
- Interior and exterior applications
- Tension zone applications, i.e., cable trays and strut, pipe supports, fire sprinklers

FEATURES AND BENEFITS

+ Knurled mandrel design provides consistent performance in cracked concrete and helps prevent galling during service life.
+ Nominal drill bit size is the same as the anchor diameter
+ Anchor can be installed through standard clearance fixture holes
+ Length ID code and identifying marking stamped on head of each anchor
+ Anchor design allows for follow-up expansion after setting under tensile loading
+ Corrosion resistant stainless steel anchors
+ Domestically manufactured by request, call for details

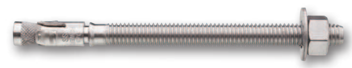
APPROVALS AND LISTINGS

- International Code Council Evaluation Service (ICC-ES), ESR-2502 for cracked and uncracked concrete
- Code compliant with the 2015 IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, and 2009 IRC
- Tested in accordance with ACI 355.2/ASTM E 488 and ICC-ES AC193 for use in structural concrete under the design provisions of ACI 318-14 Chapter 17 or ACI 318-11/08 Appendix D
- Evaluated and qualified by an accredited independent testing laboratory for recognition in cracked and uncracked concrete including seismic and wind loading (Category 1 anchors)

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00-Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 Post-Installed Concrete Anchors. Expansion anchors shall be Power-Stud+ SD4 and Power-Stud+ SD6 as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS



POWER-STUD+ STAINLESS STEEL ASSEMBLY

THREAD VERSION

- UNC threaded stud

ANCHOR MATERIALS

- Stainless steel body and expansion clip, nut and washer

ANCHOR SIZE RANGE (TYP.)

- 1/4" diameter through 3/4" diameter

SUITABLE BASE MATERIALS

- Normal-weight concrete
- Sand-lightweight concrete
- Grouted Concrete Masonry (CMU)

TENSION ZONE CRACKED CONCRETE

SEISMIC REGION QUALIFICATION

CODE LISTED ICC-ES ESR-2502 CONCRETE

DDA DEWALT DESIGN ASSIST™

DUSTX+™ ANCHOR INSTALLATION SYSTEM

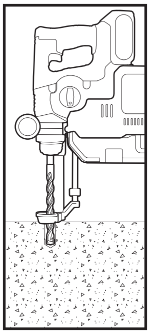
MATERIAL SPECIFICATIONS

Anchor component	Specification	
	SD4[1]	SD6[1]
Anchor body	Type 304 Stainless Steel	Type 316 Stainless Steel
Washer	300 Series Stainless Steel	Type 316 Stainless Steel
Hex Nut	Type 316 Stainless Steel	
Expansion wedge (clip)	Type 316 Stainless Steel	

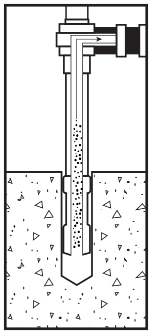
1. Domestically manufactured anchors are available upon request (see ordering information for details).

INSTALLATION INSTRUCTIONS

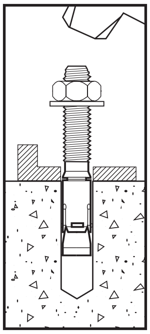
Installation Instructions for Power-Stud+ SD4 and Power-Stud+ SD6



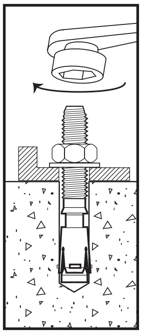
Step 1
Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



Step 2
Remove dust and debris from the hole during drilling, (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



Step 3
Position the supplied washer on the anchor and thread on the supplied nut. If installing through a fixture, drive the anchor through the fixture into the hole. Be sure the anchor is driven to the minimum required embedment depth.

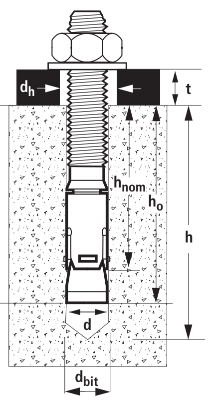


Step 4
Tighten the anchor with a torque wrench by applying the required installation torque, T_{inst}.

Length Identification

Mark	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
From	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"	10"
Up to but not including	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"	10"	11"
Length identification mark indicates overall length of anchor.																		

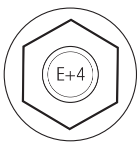
Anchor Detail



Nomenclature

d = Diameter of anchor
d_{bit} = Diameter of drill bit
d_h = Diameter of fixture clearance hole
h = Base material thickness
The minimum value of h should be $1.5h_{nom}$ or 3" whichever is greater
h_{nom} = Minimum embedment depth

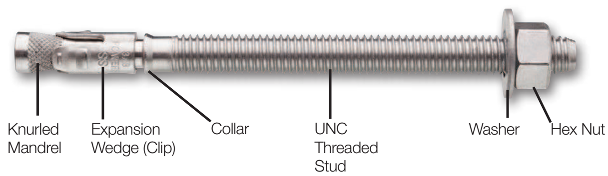
Head Marking



Legend

Letter Code = Length Identification Mark
'+' Symbol = Strength Design Compliant Anchor (see ordering information, symbol not on 1/4" diameter anchors)
Number Code = Stainless Steel Body Type (4 or 6)

Anchor Assembly



REFERENCE DATA (ASD)

Installation Specifications Table for Power-Stud+ SD4 and Power-Stud+ SD6 in Concrete

Anchor Property/Setting Information	Notation	Units	Nominal Anchor Diameter (inch)				
			1/4	3/8	1/2	5/8	3/4
Anchor outside diameter	d	in. (mm)	0.250 (6.4)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)
Nominal drill bit diameter	d_{bit}	in.	1/4 ANSI	3/8 ANSI	1/2 ANSI	5/8 ANSI	3/4 ANSI
Minimum diameter of hole clearance in fixture	d_h	in. (mm)	5/16 (7.9)	7/16 (11.1)	9/16 (14.3)	11/16 (17.5)	13/16 (20.6)
Minimum embedment depth	h_{nom}	in. (mm)	1-1/8 (29)	1-3/8 (41)	1-7/8 (48)	2-1/2 (64)	3-3/8 (86)
Minimum hole depth	h_o	in. (mm)	1-1/4 (32)	1-1/2 (38)	2 (51)	2-5/8 (67)	3-1/2 (89)
Installation torque	T_{inst}	ft.-lbf. (N-m)	6 (8)	25 (34)	40 (54)	60 (81)	110 (149)
Torque wrench/socket size	-	in.	7/16	9/16	3/4	15/16	1-1/8
Nut height	-	in.	7/32	21/64	7/16	35/64	41/64
For SI: 1 inch = 25.4 mm, 1 ft-lbf = 1.356 N-m.							

Ultimate Load Capacities for Power-Stud+ SD4 and Power-Stud+ SD6 in Normal-Weight Concrete[1,2]

Nominal Anchor Diameter in.	Minimum Embedment Depth h_{nom} in. (mm)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi (17.3 MPa)		f'c = 3,000 psi (20.7 MPa)		f'c = 4,000 psi (27.6 MPa)		f'c = 6,000 psi (41.4 MPa)		f'c = 8,000 psi (55.2 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)
1/4	1-1/8 (29)	1,095 (4.9)	2,135 (9.5)	1,200 (5.3)	2,135 (9.5)	1,390 (6.2)	2,135 (9.5)	1,455 (6.5)	2,135 (9.5)	1,680 (7.5)	2,135 (9.5)
	1-3/4 (44)	1,890 (8.4)	2,135 (9.5)	2,070 (9.2)	2,135 (9.5)	2,390 (10.6)	2,135 (9.5)	2,480 (11.0)	2,135 (9.5)	2,480 (11.0)	2,135 (9.5)
3/8	1-3/8 (41)	1,530 (6.8)	2,745 (12.2)	1,680 (7.5)	2,745 (12.2)	1,940 (8.6)	2,745 (12.2)	2,520 (11.2)	2,745 (12.2)	2,910 (12.9)	2,745 (12.2)
	1-7/8 (48)	2,790 (12.4)	2,745 (12.2)	3,060 (13.6)	2,745 (12.2)	3,530 (15.7)	2,745 (12.2)	4,195 (18.7)	2,745 (12.2)	4,840 (21.5)	2,745 (12.2)
	3 (76)	4,700 (20.9)	2,745 (12.2)	4,895 (21.8)	2,745 (12.2)	4,895 (21.8)	2,745 (12.2)	4,895 (21.8)	2,745 (12.2)	4,895 (21.8)	2,745 (12.2)
1/2	1-7/8 (48)	2,745 (12.2)	5,090 (22.6)	3,010 (13.4)	5,090 (22.6)	3,475 (15.5)	5,090 (22.6)	4,525 (20.1)	5,090 (22.6)	5,230 (23.3)	5,090 (22.6)
	2-3/8 (60)	5,370 (23.9)	5,090 (22.6)	5,880 (26.2)	5,090 (22.6)	6,790 (30.2)	5,090 (22.6)	6,790 (30.2)	5,090 (22.6)	7,845 (34.9)	5,090 (22.6)
	3-3/4 (95)	8,840 (39.3)	5,090 (22.6)	9,300 (41.4)	5,090 (22.6)	9,300 (41.4)	5,090 (22.6)	9,300 (41.4)	5,090 (22.6)	9,300 (41.4)	5,090 (22.6)
5/8	2-1/2 (64)	5,015 (22.3)	9,230 (41.1)	5,495 (24.4)	9,230 (41.1)	6,345 (28.2)	9,230 (41.1)	7,250 (32.2)	9,230 (41.1)	8,370 (37.2)	9,230 (41.1)
	3-1/4 (83)	6,760 (30.1)	9,230 (41.1)	7,405 (32.9)	9,230 (41.1)	8,560 (38.1)	9,230 (41.1)	9,615 (42.8)	9,230 (41.1)	11,105 (49.4)	9,230 (41.1)
	4-3/4 (121)	10,550 (46.9)	9,230 (41.1)	11,555 (51.4)	9,230 (41.1)	13,345 (59.4)	9,230 (41.1)	14,560 (64.8)	9,230 (41.1)	14,560 (64.8)	9,230 (41.1)
3/4	3-3/8 (86)	6,695 (29.8)	11,255 (50.1)	7,330 (32.6)	12,625 (56.2)	8,465 (37.7)	14,580 (64.9)	9,705 (43.2)	15,440 (68.7)	11,210 (49.9)	15,440 (68.7)
	4-1/2 (114)	10,800 (48.0)	15,440 (68.7)	11,830 (52.6)	15,440 (68.7)	13,575 (60.4)	15,440 (68.7)	17,110 (76.1)	15,440 (68.7)	19,760 (87.9)	15,440 (68.7)
	5-5/8 (143)	11,730 (52.2)	15,440 (68.7)	12,850 (57.2)	15,440 (68.7)	13,575 (60.4)	15,440 (68.7)	19,710 (87.7)	15,440 (68.7)	21,705 (96.5)	15,440 (68.7)

1. Tabulated load values are for anchors installed in uncracked concrete with no edge or spacing considerations. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working loads.

Allowable Load Capacities for Power-Stud+ SD4 and Power-Stud+ SD6 in Normal-Weight Concrete[1,2,3,4]

Nominal Anchor Diameter in.	Minimum Embedment Depth h_{nom} in. (mm)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi (17.3 MPa)		f'c = 3,000 psi (20.7 MPa)		f'c = 4,000 psi (27.6 MPa)		f'c = 6,000 psi (41.4 MPa)		f'c = 8,000 psi (55.2 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)
1/4	1-1/8 (28)	275 (1.2)	535 (2.4)	300 (1.3)	535 (2.4)	350 (1.6)	535 (2.4)	365 (1.6)	535 (2.4)	420 (1.9)	535 (2.4)
	1-3/4 (44)	475 (2.1)	535 (2.4)	520 (2.3)	535 (2.4)	600 (2.7)	535 (2.4)	620 (2.8)	535 (2.4)	620 (2.8)	535 (2.4)
3/8	1-3/8 (41)	385 (1.7)	685 (3.0)	420 (1.9)	685 (3.0)	485 (2.2)	685 (3.0)	630 (2.8)	685 (3.0)	730 (3.2)	685 (3.0)
	1-7/8 (60)	700 (3.1)	685 (3.0)	765 (3.4)	685 (3.0)	885 (3.9)	685 (3.0)	1,050 (4.7)	685 (3.0)	1,210 (5.4)	685 (3.0)
	3 (60)	1,175 (5.2)	685 (3.0)	1,225 (5.4)	685 (3.0)	1,225 (5.4)	685 (3.0)	1,225 (5.4)	685 (3.0)	1,225 (5.4)	685 (3.0)
1/2	1-7/8 (57)	685 (3.0)	1,275 (5.7)	755 (3.4)	1,275 (5.7)	870 (3.9)	1,275 (5.7)	1,130 (5.0)	1,275 (5.7)	1,310 (5.8)	1,275 (5.7)
	2-3/8 (64)	1,345 (6.0)	1,275 (5.7)	1,470 (6.5)	1,275 (5.7)	1,700 (7.6)	1,275 (5.7)	1,700 (7.6)	1,275 (5.7)	1,960 (8.7)	1,275 (5.7)
	3-3/4 (95)	2,210 (9.8)	1,275 (5.7)	2,325 (10.3)	1,275 (5.7)	2,325 (10.3)	1,275 (5.7)	2,325 (10.3)	1,275 (5.7)	2,325 (10.3)	1,275 (5.7)
5/8	2-1/2 (70)	1,255 (5.6)	2,310 (10.3)	1,375 (6.1)	2,310 (10.3)	1,585 (7.1)	2,310 (10.3)	1,815 (8.1)	2,310 (10.3)	2,095 (9.3)	2,310 (10.3)
	3-1/4 (86)	1,690 (7.5)	2,310 (10.3)	1,850 (8.2)	2,310 (10.3)	2,140 (9.5)	2,310 (10.3)	2,405 (10.7)	2,310 (10.3)	2,775 (12.3)	2,310 (10.3)
	4-3/4 (117)	2,640 (11.7)	2,310 (10.3)	2,890 (12.9)	2,310 (10.3)	3,335 (14.8)	2,310 (10.3)	3,640 (16.2)	2,310 (10.3)	3,640 (16.2)	2,310 (10.3)
3/4	3-3/8 (86)	1,675 (7.5)	2,815 (12.5)	1,835 (8.2)	3,155 (14.0)	2,115 (9.4)	3,645 (16.2)	2,425 (10.8)	3,860 (17.2)	2,805 (12.5)	3,860 (17.2)
	4-1/2 (114)	2,700 (12.0)	3,860 (17.2)	2,960 (13.2)	3,860 (17.2)	3,395 (15.1)	3,860 (17.2)	4,280 (19.0)	3,860 (17.2)	4,940 (22.0)	3,860 (17.2)
	5-5/8 (143)	2,935 (13.1)	3,860 (17.2)	3,215 (14.3)	3,860 (17.2)	3,395 (15.1)	3,860 (17.2)	4,930 (21.9)	3,860 (17.2)	5,425 (24.1)	3,860 (17.2)

1. Tabulated load values are for anchors installed in uncracked concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities listed are calculated using and applied safety factor of 4.0.
3. Allowable load capacities must be multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.
4. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.

SPACING DISTANCE AND EDGE DISTANCE ADJUSTMENT FACTORS FOR NORMAL WEIGHT CONCRETE - TENSION (F_{NS}, F_{NC})

Spacing Reduction Factors - Tension (F_{NS})

	Diameter (in)	1/4	3/8	1/2	5/8	3/4
	Nominal Embed. h_{nom} (in)	1-3/4	1-7/8	2-1/2	3-1/4	4-1/2
	Minimum Spacing, s_{min} (in)	2	3	3	5	5
Spacing Distance (inches)	1-3/4	-	-	-	-	-
	2	0.79	-	-	-	-
	2-1/4	0.81	-	-	-	-
	2-1/2	0.83	-	-	-	-
	2-3/4	0.85	-	-	-	-
	3	0.87	0.87	0.82	-	-
	3-1/2	0.91	0.91	0.85	-	-
	4	0.96	0.96	0.88	-	-
	4-1/2	1.00	1.00	0.91	-	-
	5	1.00	1.00	0.94	0.85	0.76
	5-1/2	1.00	1.00	0.97	0.87	0.78
	6	1.00	1.00	1.00	0.90	0.80
	6-1/2	1.00	1.00	1.00	0.92	0.82
	7	1.00	1.00	1.00	0.94	0.84
	7-1/2	1.00	1.00	1.00	0.97	0.86
	8	1.00	1.00	1.00	0.99	0.87
	8-1/4	1.00	1.00	1.00	1.00	0.88
	8-1/2	1.00	1.00	1.00	1.00	0.89
	9	1.00	1.00	1.00	1.00	0.91
	9-1/2	1.00	1.00	1.00	1.00	0.93
	10	1.00	1.00	1.00	1.00	0.95
	10-1/2	1.00	1.00	1.00	1.00	0.97
	11	1.00	1.00	1.00	1.00	0.99
	11-1/4	1.00	1.00	1.00	1.00	1.00

Edge Distance Reduction Factors- Tension (F_{NC})

	Diameter (in)	1/4	3/8	1/2	5/8	3/4
	Nominal Embed. h_{nom} (in)	1-3/4	1-7/8	2-1/2	3-1/4	4-1/2
	Critical Edge Distance, c_{ac} (in)	5	5	7-1/2	9-1/2	9
	Min. Edge Distance, c_{min} (in)	1-3/4	3	3	4-1/2	5
Edge Distance (inches)	1-1/2	-	-	-	-	-
	1-3/4	0.35	-	-	-	-
	2	0.40	-	-	-	-
	2-1/4	0.45	-	-	-	-
	2-1/2	0.50	-	-	-	-
	2-3/4	0.55	-	-	-	-
	3	0.60	0.60	0.40	-	-
	3-1/2	0.70	0.70	0.47	-	-
	4	0.80	0.80	0.53	-	-
	4-1/2	0.90	0.90	0.60	0.47	-
	5	1.00	1.00	0.67	0.53	0.56
	5-1/2	1.00	1.00	0.73	0.58	0.61
	6	1.00	1.00	0.80	0.63	0.67
	6-1/2	1.00	1.00	0.87	0.68	0.72
	7	1.00	1.00	0.93	0.74	0.78
	7-1/2	1.00	1.00	1.00	0.79	0.83
	8	1.00	1.00	1.00	0.84	0.89
	8-1/2	1.00	1.00	1.00	0.89	0.94
	9	1.00	1.00	1.00	0.95	1.00
	9-1/2	1.00	1.00	1.00	1.00	1.00

SPACING DISTANCE AND EDGE DISTANCE ADJUSTMENT FACTORS FOR NORMAL WEIGHT CONCRETE - SHEAR (F_{VS}, F_{VC})

Spacing Reduction Factors - Shear (F_{VS})

	Diameter (in)	1/4	3/8	1/2	5/8	3/4
	Nominal Embed. h_{nom} (in)	1-3/4	1-7/8	2-1/2	3-1/4	4-1/2
	Minimum Spacing, s_{min} (in)	2	3	3	5	5
Spacing Distance (inches)	1-3/4	-	-	-	-	-
	2	0.87	-	-	-	-
	2-1/4	0.88	-	-	-	-
	2-1/2	0.90	-	-	-	-
	2-3/4	0.91	-	-	-	-
	3	0.92	0.92	0.89	-	-
	3-1/2	0.95	0.95	0.91	-	-
	4	0.97	0.97	0.93	-	-
	4-1/2	1.00	1.00	0.95	-	-
	5	1.00	1.00	0.96	0.91	0.84
	5-1/2	1.00	1.00	0.98	0.93	0.85
	6	1.00	1.00	1.00	0.94	0.86
	6-1/2	1.00	1.00	1.00	0.95	0.88
	7	1.00	1.00	1.00	0.97	0.89
	7-1/2	1.00	1.00	1.00	0.98	0.90
	8	1.00	1.00	1.00	0.99	0.92
	8-1/4	1.00	1.00	1.00	1.00	0.92
	8-1/2	1.00	1.00	1.00	1.00	0.93
	9	1.00	1.00	1.00	1.00	0.94
	9-1/2	1.00	1.00	1.00	1.00	0.95
	10	1.00	1.00	1.00	1.00	0.97
	10-1/2	1.00	1.00	1.00	1.00	0.98
	11	1.00	1.00	1.00	1.00	0.99
	11-1/4	1.00	1.00	1.00	1.00	1.00

Edge Distance Reduction Factors - Shear (F_{VC})

	Diameter (in)	1/4	3/8	1/2	5/8	3/4
	Nominal Embed. h_{nom} (in)	1-3/4	1-7/8	2-1/2	3-1/4	4-1/2
	Min. Edge Distance, c_{min} (in)	1-3/4	3	3	4-1/2	5
Edge Distance (inches)	1-1/2	-	-	-	-	-
	1-3/4	0.39	-	-	-	-
	2	0.44	-	-	-	-
	2-1/4	0.50	-	-	-	-
	2-1/2	0.56	-	-	-	-
	2-3/4	0.61	-	-	-	-
	3	0.67	0.67	0.50	-	-
	3-1/2	0.78	0.78	0.58	-	-
	4	0.89	0.89	0.67	-	-
	4-1/2	1.00	1.00	0.75	0.55	-
	5	1.00	1.00	0.83	0.61	0.44
	5-1/2	1.00	1.00	0.92	0.67	0.49
	6	1.00	1.00	1.00	0.73	0.53
	6-1/2	1.00	1.00	1.00	0.79	0.58
	7	1.00	1.00	1.00	0.85	0.62
	7-1/2	1.00	1.00	1.00	0.91	0.67
	8	1.00	1.00	1.00	0.97	0.71
	8-1/4	1.00	1.00	1.00	1.00	0.73
	8-1/2	1.00	1.00	1.00	1.00	0.76
	9	1.00	1.00	1.00	1.00	0.80
	9-1/2	1.00	1.00	1.00	1.00	0.84
	10	1.00	1.00	1.00	1.00	0.89
	10-1/2	1.00	1.00	1.00	1.00	0.93
	11	1.00	1.00	1.00	1.00	0.98
	11-1/4	1.00	1.00	1.00	1.00	1.00

PERFORMANCE DATA

Ultimate Load Capacities for Power-Stud+ SD4 and Power-Stud+ SD6 installed into the Face of Grout Filled Concrete Masonry[1,2]

Nominal Anchor Diameter in.	Minimum Embedment h_{nom} in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Ultimate Tension Load lb (kN)	Direction of Shear Loading	Ultimate Shear Load lb (kN)
1/2	2-3/8 (60)	3 (76.2)	3 (76.2)	1,695 (7.5)	Any	2,080 (9.3)
		12 (304.8)	12 (304.8)	2,425 (10.8)	Any	4,905 (21.8)
5/8	3-1/4 (83)	12 (304.8)	12 (304.8)	5,565 (24.8)	Any	7,944 (35.3)

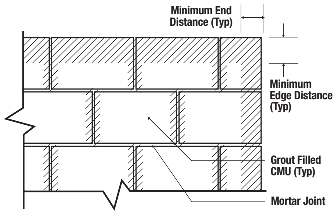
1. Tabulated load values are for anchors installed in minimum 8 inch wide, minimum Grade N, Type II, normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 5.0 or greater to determine allowable working loads.

Allowable Load Capacities for Power-Stud+ SD4 and Power-Stud+ SD6 installed into the Face of Grout Filled Concrete Masonry[1,2,3,4,5]

ALLOWABLE STRESS DESIGN ASD

Nominal Anchor Diameter in.	Minimum Embedment h_{nom} in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Allowable Tension Load lb (kN)	Direction of Shear Loading	Allowable Shear Load lb (kN)
1/2	2-3/8 (60)	3 (76.2)	3 (76.2)	340 (1.5)	Any	415 (1.8)
		12 (304.8)	12 (304.8)	485 (2.2)	Any	980 (4.4)
5/8	3-1/4 (83)	12 (304.8)	12 (304.8)	1,115 (5.0)	Any	1,590 (7.1)

1. Tabulated load values are for anchors installed in minimum 8 inch wide, minimum Grade N, Type II, normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities listed are calculated using an applied safety factor of 5.0. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety.
3. The tabulated values are applicable for anchors installed in grouted masonry wall faces at a critical spacing distance, s_{cr}, between anchors of 16 times the anchor diameter. The spacing distance between two anchors may be reduced to a minimum distance, s_{min}, of 8 times the anchor diameter provided the allowable tension loads are multiplied a reduction factor of 0.80 and allowable shear loads are multiplied by a reduction factor of 0.90. Linear interpolation for calculation of allowable loads may be used for intermediate anchor spacing distances.
4. Anchors may be installed in the grouted cells and in cell webs and bed joints not closer than 1-3/8" from head joints. The minimum edge and end distances must also be maintained.
5. Allowable tension values for anchors installed into bed joints of grouted masonry wall faces with a minimum of 12" edge and end distance may be increased by 20 percent for the 1/2-inch diameter and 10 percent for the 5/8-inch diameter.



Wall Face
Permissible Anchor Locations
(Un-hatched Area)

STRENGTH DESIGN (SD)

Strength Design Installation Table for Power-Stud+ SD4 and Power-Stud+ SD6[1,4]

CODE LISTED ICC-ES ESR-2502

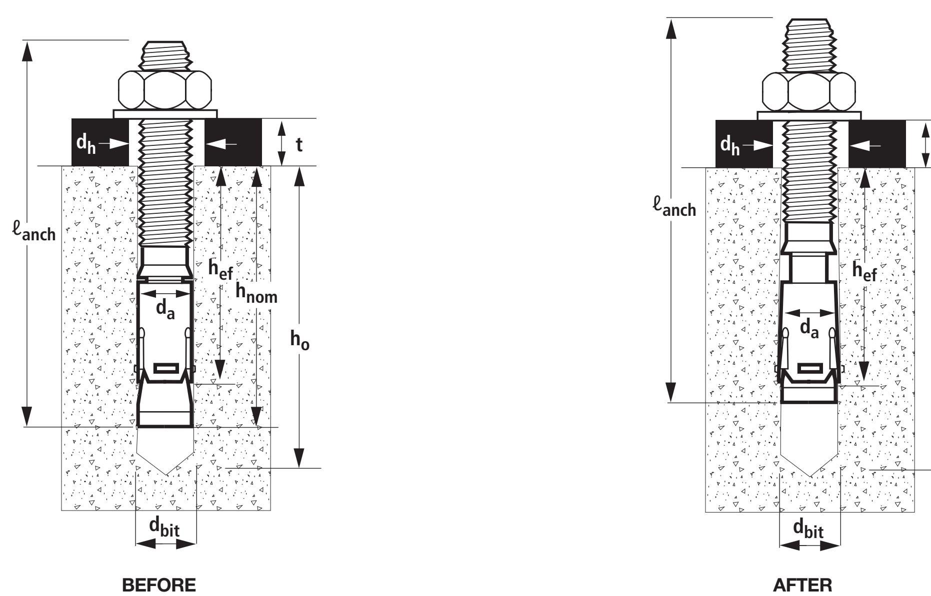
STRENGTH DESIGN SD TABLES

Anchor Property/Setting Information	Notation	Units	Nominal Anchor Diameter								
			1/4	3/8		1/2		5/8		3/4	
Anchor outside diameter	d_a	in. (mm)	0.250 (6.4)	0.375 (9.5)		0.500 (12.7)		0.625 (15.9)		0.750 (19.1)	
Minimum diameter of hole clearance in fixture	d_h	in. (mm)	5/16 (7.9)	7/16 (11.1)		9/16 (14.3)		11/16 (17.5)		13/16 (20.6)	
Nominal drill bit diameter	d_{bit}	in.	1/4 ANSI	3/8 ANSI		1/2 ANSI		5/8 ANSI		3/4 ANSI	
Minimum nominal embedment depth[2]	h_{nom}	in. (mm)	1-3/4 (44)	1-7/8 (48)		2-1/2 (64)		3-1/4 (83)		4-1/2 (114)	
Effective embedment	h_{ef}	in. (mm)	1.50 (38)	1.50 (38)		2.00 (51)		2.75 (70)		3-3/4 (95)	
Minimum hole depth	h_o	in. (mm)	1-7/8 (48)	2 (51)		2-5/8 (67)		3-1/2 (89)		4-3/4 (121)	
Minimum member thickness	h_{min}	in. (mm)	3-1/4 (83)	3-1/4 (83)	4 (102)	4 (102)		5 (127)		6 (152)	
Minimum overall anchor length[3]	ℓ_{anch}	in. (mm)	2-1/4 (57)	2-3/4 (70)		3-3/4 (95)		4-1/2 (114)		5-1/2 (140)	
Minimum edge distance	c_{min}	in. (mm)	1-3/4 (44)	3 (76)	3-1/2 (89)	6 (152)	3 (76)	4-1/2 (114)	8-1/2 (216)	5 (127)	9 (229)
Minimum spacing distance	s_{min}	in. (mm)	2 (51)	5-1/2 (140)	3 (76)	3 (76)	6 (152)	8-1/2 (216)	5 (127)	9 (229)	5 (127)
Critical edge distance	c_{ac}	in. (mm)	5 (127)	5 (127)		7-1/2 (191)		9-1/2 (241)		9 (229)	
Installation torque	T_{inst}	ft.-lbf. (N-m)	6 (8)	25 (34)		40 (54)		60 (81)		110 (149)	
Torque wrench/socket size	-	in.	7/16	9/16		3/4		15/16		1-1/8	
Nut height	-	in.	7/32	21/64		7/16		35/64		41/64	

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

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable.
2. The embedment depth, h_{nom}, is measured from the outside surface of the concrete member to the embedded end of the anchor prior to tightening.
3. The listed minimum overall anchor length is based on anchor sizes commercially available at the time of publication compared with the requirements to achieve the minimum nominal embedment depth and possible fixture attachment.
4. The anchors may be installed in the topside of concrete-filled steel deck floor and roof assemblies in accordance with the following: the 1/4-inch diameter anchors must be installed in uncracked normal-weight or sand-lightweight concrete; 3/8-inch to 3/4-inch diameter anchors must be installed in cracked and uncracked normal-weight or sand-lightweight concrete over steel deck having a minimum specified compressive strength, f'c, of 3,000 psi (20.7 MPa) provided the concrete thickness above the upper flute meets the minimum thickness specified in this table.

Power-Stud+ SD4 and Power-Stud+ SD6 Anchor Detail



Application of Installation Torque

Tension Design Information for Power-Stud+ SD4 and Power-Stud+ SD6 Anchors in Concrete (For use with load combinations taken from ACI 318-14, Section 5.3 or ACI 318-11, Section 9.2)[1,8]

CODE LISTED ICC-ES ESR-2502

Design Characteristic		Notation	Units	Nominal Anchor Diameter				
				1/4	3/8	1/2	5/8	3/4
Anchor category		1,2 or 3	-	1	1	1	1	1
Nominal embedment depth		h_{nom}	in.	1-3/4	1-7/8	2-3/8	3-1/4	4-1/2
STEEL STRENGTH IN TENSION (ACI 318-14 17.4.1 or ACI 318-11 D.5.1)								
Minimum specified yield strength (neck		f_y	ksi (N/mm^2)	60 (414)	60 (414)	60 (414)	60 (414)	60 (414)
Minimum specified ultimate tensile strength (neck)		f_{uta}	ksi (N/mm^2)	90 (621)	90 (621)	90 (621)	90 (621)	90 (621)
Effective tensile stress area (neck)		$A_{se,N}$	in^2 (mm^2)	0.0249 (16.1)	0.0530 (34.2)	0.1020 (65.8)	0.1630 (105.2)	0.2380 (151)
Steel strength in tension		N_{sa}	lb (kN)	2,240 (10.0)	4,780 (21.3)	9,160 (40.8)	14,635 (65.1)	21,380 (95.1)
Reduction factor for steel strength[2,3]		ϕ	-	0.75				
CONCRETE BREAKOUT STRENGTH IN TENSION (ACI 318-14 17.4.2 or ACI 318-11 D.5.2)[8]								
Effective embedment		h_{ef}	in. (mm)	1.50 (38)	1.50 (38)	2.00 (51)	2.75 (70)	3.75 (95)
Effectiveness factor for uncracked concrete		k_{uncr}	-	24	24	24	24	24
Effectiveness factor for cracked concrete		k_{cr}	-	Not Applicable	17	21	21	21
Modification factor for cracked and uncracked concrete		$\psi_{c,N}$	-	1.0 See Note 5	1.0 See Note 5	1.0 See Note 5	1.0 See Note 5	1.0 See Note 5
Critical edge distance (uncracked concrete only)		c_{ac}	in. (mm)	5 (127)	5 (127)	7-1/2 (191)	9-1/2 (241)	9 (229)
Reduction factor for concrete breakout strength[4]		ϕ	-	0.65 (Condition B)				
PULLOUT STRENGTH IN TENSION (ACI 318-14 17.4.3 or ACI 318-11 D.5.3)[8]								
Characteristic pullout strength, uncracked concrete (2,500 psi)[5]		$N_{p,uncr}$	lb (kN)	1,510 (6.7)	See Note 7	See Note 7	See Note 7	8,520 (37.8)
Characteristic pullout strength, cracked concrete (2,500 psi)[5]		$N_{p,cr}$	lb (kN)	Not Applicable	See Note 7	See Note 7	See Note 7	See Note 7
Reduction factor for pullout strength[3]		ϕ	-	0.65 (Condition B)				
PULLOUT STRENGTH IN TENSION FOR SEISMIC APPLICATIONS (ACI 318-14 17.2.3.3 or ACI 318-11 D.3.3.3)[8]								
Characteristic pullout strength, seismic (2,500 psi)[6,9]		$N_{p,eq}$	lb (kN)	Not Applicable	1,645 (7.3)	See Note 7	See Note 7	See Note 7
Reduction factor for pullout strength[4]		ϕ	-	0.65 (Condition B)				
Mean axial stiffnes values for service load range	Uncracked concrete	β	lbf/in (kN/mm)	171,400 (30,060)	490,000 (86,000)	459,000 (80,500)	234,000 (41,000)	395,000 (69,300)
	Cracked concrete	β	lbf/in (kN/mm)	Not Applicable	228,000 (40,000)	392,000 (68,800)	193,000 (33,800)	76,600 (13,400)

For SI: 1 inch = 25.4 mm; 1 ft-lbf = 1.356 N-m; 1 ksi = 6.894 N/mm^2; 1 lb = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable, shall apply.
2. The tabulated value of ϕ for steel strength applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ for steel strength must be determined in accordance with ACI 318-11 D.4.4.
3. The anchors are ductile steel elements as defined in ACI 318-14 2.3 or ACI 318-11 D.1, as applicable.
4. The tabulated value of ϕ for concrete breakout strength and pullout strength applies when both the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3, for Condition B are satisfied. If the load combinations of Section 1605.2 of the IBC ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3, for Condition A are satisfied, the appropriate value of ϕ for concrete breakout strength and pullout strength must be determined in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ for concrete breakout strength and pullout strength must be determined in accordance with ACI 318-11 D.4.4.
5. For all design cases $\psi_{c,N}$ =1.0. The appropriate effectiveness factor for cracked concrete (k_{cr}) or uncracked concrete (k_{uncr}) must be used.
6. For all design cases $\psi_{c,P}$ =1.0. For concrete compressive strength greater than 2,500 psi, N_{pn} = (pullout strength value from table)*(specified concrete compressive strength/2,500)$^{0.5}$.
7. Pullout strength does not control design of indicated anchors. Do not calculate pullout strength for indicated anchor size and embedment.
8. Anchors are permitted to be used in lightweight concrete provided the modification factor λ_a equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n and V_n. λ shall be determined in accordance with the corresponding version of ACI 318.
9. Tabulated values for characteristic pullout strength in tension are for seismic applications and are based on test results per ACI 355.2, Section 9.5.
10. Actual stiffness of the mean value varies depending on concrete strength, loading and geometry of application.

Shear Design Information for Power-Stud+ SD4 and Power-Stud+ SD6 Anchors in Concrete (For use with load combinations taken from ACI 318-14, Section 5.3 or ACI 318-11, Section 9.2)[1,7]

CODE LISTED
ICC-ES ESR-2502

STRENGTH DESIGN SD TABLES

Design Characteristic	Notation	Units	Nominal Anchor Diameter				
			1/4	3/8	1/2	5/8	3/4
Anchor category	1, 2 or 3	-	1	1	1	1	1
Nominal embedment depth	h_{nom}	in.	1-3/4	1-7/8	2-3/8	3-1/4	4-1/2
STEEL STRENGTH IN SHEAR (ACI 318-14 17.5.1 or ACI 318-11 D.6.1)[4]							
Minimum specified yield strength (threads)	f_y	ksi (N/mm²)	60 (414)	60 (414)	60 (414)	60 (414)	60 (414)
Minimum specified ultimate strength (threads)	f_{uta}	ksi (N/mm²)	90 (621)	90 (621)	90 (621)	90 (621)	90 (621)
Effective tensile stress area (threads)	$A_{se,V}$ [A_{se}][8]	in² (mm²)	0.0318 (20.5)	0.078 (50.3)	0.142 (91.6)	0.226 (145.8)	0.334 (212)
Steel strength in shear[6]	V_{sa}	lb (kN)	1,115 (5.0)	1,470 (6.6)	3,170 (14.3)	7,455 (33.6)	11,955 (53.2)
Reduction factor for steel strength[2,3]	ϕ	-	0.65				
CONCRETE BREAKOUT STRENGTH IN SHEAR (ACI 318-14 17.5.2 or ACI 318-11 D.6.2)							
Load bearing length of anchor (h_{ef} or $8d_a$, whichever is less)	ℓ_e	in. (mm)	1.50 (38.1)	1.50 (38.1)	2.00 (50.8)	2.75 (69.9)	3.75 (95)
Nominal anchor diameter	d_a	in. (mm)	0.250 (6.4)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)
Reduction factor for concrete breakout[4]	ϕ	-	0.70 (Condition B)				
CONCRETE PRYOUT STRENGTH IN SHEAR (ACI 318-14 17.2.3.3 or ACI 318-11 D.6.3)							
Coefficient for pryout strength (1.0 for $h_{ef} < 2.5$ in., 2.0 for $h_{ef} \geq 2.5$ in.)	k_{cp}	-	1.0	1.0	1.0	2.0	2.0
Effective embedment	h_{ef}	in. (mm)	1.50 (38.1)	1.50 (38.1)	2.00 (50.8)	2.75 (69.9)	3.75 (95)
Reduction factor for pryout strength[5]	ϕ	-	0.70 (Condition B)				
STEEL STRENGTH IN SHEAR FOR SEISMIC APPLICATIONS (ACI 318-14 17.2.3.3 or ACI 318-11 D.3.3.3)							
Steel strength in shear, seismic[8]	$V_{sa,eq}$	lb (kN)	Not Applicable	1,305 (5.9)	2,765 (12.3)	5,240 (23.3)	7,745 (34.5)
Reduction factor for steel strength in shear for seismic[2]	ϕ	-	0.65				

For SI: 1 inch = 25.4 mm; 1 ft-lbf = 1.356 N-m; 1 ksi = 6.894 N/mm²; 1 lb = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable, shall apply.
2. The tabulated value of ϕ for steel strength applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11Section 9.2, as applicable, are used. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ for steel strength must be determined in accordance with ACI 318-11 D.4.4.
3. The anchors are ductile steel elements as defined in ACI 318-14 2.3 or ACI 318-11 D.1, as applicable.
4. The tabulated value of ϕ for concrete breakout strength applies when both the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3, for Condition B are satisfied. If the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used and the requirements of ACI 318-14 14.3.3 or ACI 318-11 D.4.3, for Condition A are satisfied, the appropriate value of ϕ for concrete breakout strength must be determined in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ for concrete breakout strength must be determined in accordance with ACI 318-11 D.4.4.
5. The tabulated value of for pryout strength applies if the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ for pryout strength must be determined in accordance with ACI 318-11 D.4.4, Condition B.
6. Tabulated values for steel strength in shear must be used for design.
7. Anchors are permitted to be used in lightweight concrete provided the modification factor λ_a equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n and V_n. λ shall be determined in accordance with the corresponding version of ACI 318.
8. Tabulated values for steel strength in shear are for seismic applications are based on test results per ACI 355.2, Section 9.6.

STRENGTH DESIGN PERFORMANCE DATA

Factored design strength ϕN_n and ϕV_n
Calculated in accordance with ACI 318-14 Chapter 17
Compliant with the International Building Code

Tension and Shear Design Strengths Installed in Cracked Concrete[1-6]

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)
1/4	-	-	-	-	-	-	-	-	-	-	-
3/8	1-7/8	1,015	955	1,110	955	1,285	955	1,570	955	1,815	955
1/2	2-1/2	1,930	2,060	2,115	2,060	2,440	2,060	2,990	2,060	3,455	2,060
5/8	3-1/4	3,110	4,520	3,410	4,845	3,935	4,845	4,820	4,845	5,570	4,845
3/4	4-1/2	4,955	5,270	5,430	5,770	6,270	6,665	7,680	7,770	8,865	7,770

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

Tension and Shear Design Strengths Installed in Uncracked Concrete[1-6]

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)
1/4	1-3/4	980	725	1,075	725	1,240	725	1,520	725	1,680	725
3/8	1-7/8	1,435	955	1,570	955	1,815	955	2,220	955	2,565	955
1/2	2-1/2	2,205	2,060	2,415	2,060	2,790	2,060	3,420	2,060	3,945	2,060
5/8	3-1/4	3,555	4,845	3,895	4,845	4,500	4,845	5,510	4,845	6,365	4,845
3/4	4-1/2	5,540	7,375	6,065	7,770	7,005	7,770	8,580	7,770	9,905	7,770

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

1- Tabular values are provided for illustration and are applicable for single anchors installed in normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac} (table values based on $c_{a1} = c_{ac}$).
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.

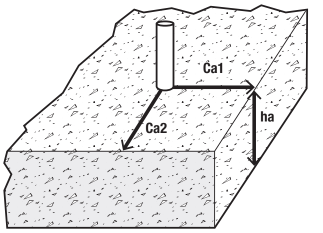
2- Calculations were performed according to ACI 318-14 Chapter 17. The load level corresponding to the controlling failure mode is listed. (e.g. For tension: steel, concrete breakout and pullout; For shear: steel, concrete breakout and pryout). Furthermore, the capacities for concrete breakout strength in tension and pryout strength in shear are calculated using the effective embedment values, h_{ef}, for the selected anchors as noted in the design information tables. Please also reference the installation specifications for more information.

3- Strength reduction factors (ø) were based on ACI 318-14 Section 5.3 for load combinations. Condition B is assumed.

4- Tabular values are permitted for static loads only, seismic loading is not considered with these tables.

5- For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Chapter 17.

6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318-14 Chapter 17. For other design conditions including seismic considerations please see ACI 318-14 Chapter 17.



ORDERING INFORMATION

Power-Stud+ SD4 (Type 304 Stainless Steel Body) and Power-Stud+ SD6 (Type 316 Stainless Steel Body)

Cat. No.		Anchor Size	Thread Length	Box Qty.	Carton Qty.	Suggested ANSI Carbide Drill Bit Cat. No.				
Type 304 SS	Type 316 SS					Full Head SDS-Plus	SDS-Plus	SDS-Max	Hollow Bit SDS-Plus	Hollow Bit SDS-Max
7300SD4	7600SD6	1/4" x 1-3/4"	3/4"	100	600	DW5517	DW5416	-	-	-
7302SD4	7602SD6	1/4" x 2-1/4"	1-1/4"	100	600	DW5517	DW5417	-	-	-
7304SD4	7604SD6	1/4" x 3-1/4"	2-1/4"	100	600	DW5517	DW5417	-	-	-
-	7610SD6	3/8" x 2-1/4"	7/8"	50	300	DW5527	DW5427	-	-	-
-	7612SD6	3/8" x 2-3/4"	1-3/8"	50	300	DW5527	DW5427	-	-	-
7313SD4	7613SD6	3/8" x 3"	1-5/8"	50	300	DW5527	DW5427	-		
-	7614SD6	3/8" x 3-1/2"	2-1/8"	50	300	DW5527	DW5427	-	-	-
7315SD4	7615SD6	3/8" x 3-3/4"	2-3/8"	50	300	DW5527	DW5427	-	-	-
7316SD4	7616SD6	3/8" x 5"	3-5/8"	50	300	DW55300	DW5429	-	-	-
-	7617SD6	3/8" x 7"	5-5/8"	50	200	DW55300	DW5429	-	-	-
-	7620SD6	1/2" x 2-3/4"	1"	50	200	DW5537	DW5437	DW5803	DWA54012	-
7322SD4	7622SD6	1/2" x 3-3/4"	2"	50	200	DW5537	DW5437	DW5803	DWA54012	-
7323SD4	7623SD6	1/2" x 4-1/2"	2-3/4"	50	200	DW5539	DW5438	DW5803	DWA54012	-
7324SD4	7624SD6	1/2" x 5-1/2"	3-3/4"	50	100	DW5539	DW5438	DW5803	DWA54012	-
7326SD4	7626SD6	1/2" x 7"	5-1/4"	25	100	DW5539	DW5438	DW5803	DWA54012	-
-	7630SD6	5/8" x 3-1/2"	1-1/2"	25	100	-	DW5446	DW5806	DWA54058	DWA54058
-	7632SD6	5/8" x 4-1/2"	2-1/2"	25	100	-	DW5446	DW5806	DWA54058	DWA54058
7333SD4	7633SD6	5/8" x 5"	3"	25	100	-	DW5446	DW5806	DWA54058	DWA54058
7334SD4	7634SD6	5/8" x 6"	4"	25	75	-	DW5446	DW5806	DWA54058	DWA54058
-	7636SD6	5/8" x 7"	5"	25	75	-	DW5447	DW5806	DWA54058	DWA54058
7338SD4	7638SD6	5/8" x 8-1/2"	6-1/2"	25	50	-	DW5447	DW5809	DWA54058	DWA54058
-	7640SD6	3/4" X 4-1/4"	1-7/8"	20	60	-	DW5453	DW5810	DWA54034	DWA54034
-	7641SD6	3/4" X 4-3/4"	2-3/8"	20	60	-	DW5453	DW5810	DWA54034	DWA54034
7342SD4	7642SD6	3/4" X 5-1/2"	3-1/8"	20	60	-	DW5453	DW5810	DWA54034	DWA54034
-	7644SD6	3/4" X 6-1/4"	3-7/8"	20	60	-	DW5455	DW5810	DWA54034	DWA54034
-	7646SD6	3/4" X 7"	4-5/8"	20	60	-	DW5455	DW5810	DWA54034	DWA54034
7348SD4	7648SD6	3/4" X 8-1/2"	6-1/8"	10	40	-	DW5455	DW5812	DWA54034	DWA54034

Power-Stud+ SD4 and Power-Stud+ SD6 anchors can be domestically manufactured (assembled in the USA with foreign and domestic components) and are available for special order only. Call for details.

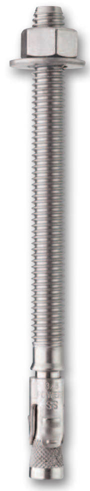
Shaded catalog numbers denote sizes which are less than the minimum standard anchor length for strength design.

The published size includes the diameter and the overall length of the anchor.

All anchors are packaged with nuts and washers.

A manual hand pump is available (Cat. No. 08280).

Hollow drill bits must be used with a dust extraction vacuum (Cat. No. DW012).



GENERAL INFORMATION

POWER-STUD® HD5

Hot-Dip Galvanized Wedge Expansion Anchor

PRODUCT DESCRIPTION

The Power-Stud HD5 anchor is a fully threaded, torque-controlled, wedge expansion anchor. Suitable base materials include normal-weight concrete, sand-lightweight concrete and grouted concrete masonry. The anchor is manufactured with a hot-dip galvanized carbon steel body and stainless steel expansion clip. Nut and washer are included.

GENERAL APPLICATIONS AND USES

- Racking and Shelving
- Material Handling
- Support Ledgers
- Storage Facilities
- Fencing
- Repairs
- Maintenance
- Retrofits

FEATURES AND BENEFITS

+ Consistent performance in high and low strength concrete
+ Nominal drill bit size is the same as the anchor diameter
+ Anchor can be installed through standard fixture holes
+ Length ID code and identifying marking stamped on head of each anchor

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 Post - Installed Concrete Anchors. Expansion Anchors shall be Power-Stud HD5 as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

MATERIAL SPECIFICATIONS

Anchor Component	Specification
Anchor body	Medium carbon steel
Hex Nut	Carbon steel, ASTM A 563, Grade A
Washer	Carbon steel ASTM F 844; meets dimensional requirements of ANSI B18.22.2, Type A plain
Expansion wedge (clip)	Type 304 Stainless Steel
Plating (anchor, body, nut, washer)	Zinc Galvanized According to ASTM A 153 Class C or D

SECTION CONTENTS

POWER-STUD HD5 ASSEMBLY

THREAD VERSION

- UNC Threaded Stud

ANCHOR MATERIALS

- Hot-dip galvanized carbon steel body, stainless steel expansion clip, hot-dip galvanized nut and washer

ROD/ANCHOR SIZE RANGE (TYP.)

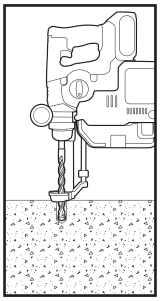
- 3/8" diameter through 3/4" diameter

SUITABLE BASE MATERIALS

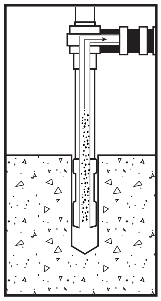
- Normal-weight concrete
- Sand-lightweight concrete
- Grouted concrete masonry (CMU)

INSTALLATION INSTRUCTIONS

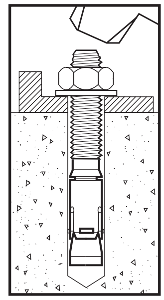
Installation Instructions for Power-Stud HD5



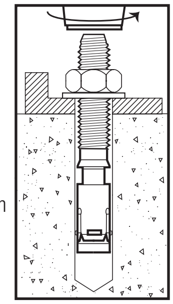
Step 1
Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



Step 2
Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.

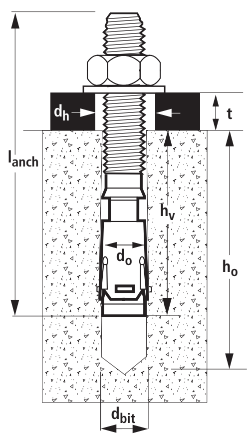


Step 3
Position the washer on the anchor and thread on the nut. If installing through a fixture, drive the anchor through the fixture into the hole. Be sure the anchor is driven to the minimum required embedment depth, h_v.



Step 4
Tighten the anchor with a torque wrench by applying the required installation torque, T_{inst}.

Anchor Specifications



Length Identification

Mark	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
From	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"
Up to but not including	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"

Length identification mark indicates overall length of anchor.

REFERENCE DATA (ASD)

Installation Specification for Power-Stud HD5 in Concrete

Anchor Property/ Setting Information	Notation	Units	Nominal Anchor Diameter (inch)									
			3/8		1/2			5/8			3/4	
Anchor outside diameter	d	in. (mm)	0.375 (9.525)		0.500 (12.7)			0.625 (15.9)			0.750 (19.05)	
Minimum diameter of hole clearance in fixture	d_h	in. (mm)	7/16 (11.1)		9/16 (14.3)			11/16 (17.5)			13/16 (20.6)	
Nominal drill bit diameter	d_{bit}	in. (mm)	3/8 ANSI		1/2 ANSI			5/8 ANSI			3/4 ANSI	
Minimum nominal embedment depth	h_v	in. (mm)	1-3/4 (44)	2-3/8 (60)	2 (51)	2-1/2 (64)	3-3/4 (95)	2-3/8 (60)	3-3/8 (86)	4-5/8 (117)	3-3/8 (66)	5 (127)
Minimum hole depth	h_o	in. (mm)	2 (51)	2-5/8 (67)	2-1/2 (64)	3 (76)	4-1/4 (108)	2-7/8 (73)	3-7/8 (98)	5-1/8 (130)	3-7/8 (98)	5-1/2 (140)
Minimum member thickness	h_{min}	in. (mm)	3-1/4 (83)	4 (102)	4 (102)	5 (127)	6 (152)	5 (127)	6 (152)	7 (178)	6 (152)	10 (254)
Minimum overall anchor length[1]	ℓ_{anch}	in. (mm)	3 (76)	3 (76)	2-3/4 (70)	3-3/4 (95)	4-1/2 (114)	3-1/2 (89)	5 (127)	6 (152)	4-3/4 (121)	5-1/2 (140)
Minimum edge distance	c_{min}	in. (mm)	3 (76)	2-1/4 (57)	4 (102)	5-1/4 (133)	4 (102)	4-1/4 (108)	5-1/2 (140)	4-1/4 (108)	5 (127)	4-1/2 (114)
Minimum spacing distance	s_{min}	in. (mm)	5-1/4 (133)	3-3/4 (95)	6 (152)	7-1/4 (184)	5 (127)	7-1/8 (181)	10-1/8 (257)	4-1/4 (108)	9 (229)	6 (152)
Critical edge distance	c_{ac}	in. (mm)	5 (127)	6-1/2 (165)	8 (203)	8-1/2 (216)	8 (203)	8 (203)	6 (152)	10 (254)	5 (127)	12 (305)
Installation torque (Normal-weight concrete)	T_{inst}	ft.-lbf. (N-m)	20 (27)		40 (54)			60 (81)			110 (149)	
Installation torque (Grout Filled CMU)	T_{inst}	ft.-lbf. (N-m)	20 (27)		40 (54)			50 (68)			80 (108)	
Torque wrench/socket size	-	in.	9/16		3/4			15/16			1-1/8	
Nut height	-	in.	21/64		7/16			35/64			41/64	

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

1. The listed minimum overall anchor length is based on anchor sizes available at the time of publication compared with the requirements for the minimum nominal embedment depth and fixture attachment.

Ultimate Load Capacities for Power-Stud HD5 in Normal-Weight Concrete[1,2]

Nominal Anchor Diameter (in.)	Minimum Embedment Depth (in.)	Minimum Concrete Compressive Strength - f'c (psi)									
		2,500 psi		3,000 psi		4,000 psi		6,000 psi		8,000 psi	
		Tension (lbs)	Shear (lbs)	Tension (lbs)	Shear (lbs)	Tension (lbs)	Shear (lbs)	Tension (lbs)	Shear (lbs)	Tension (lbs)	Shear (lbs)
3/8	1-3/4	2,470	3,925	2,710	3,925	3,130	3,925	3,220	3,925	3,715	3,925
	2-3/8	3,620	3,925	3,965	3,925	4,580	3,925	5,470	3,925	6,320	3,925
1/2	2	2,690	4,195	2,950	4,195	3,405	4,195	4,170	4,195	4,815	4,195
	2-1/2	4,140	4,195	4,540	4,195	5,240	4,195	6,415	4,195	7,410	4,195
	3-3/4	8,580	4,195	9,400	4,195	10,300	4,195	10,300	4,195	10,300	4,195
5/8	2-1/2	4,115	6,815	4,505	6,815	5,200	6,815	6,370	6,815	7,355	6,815
	3-3/8	7,305	6,815	8,000	6,815	9,240	6,815	11,315	6,815	13,065	6,815
	4-5/8	11,715	6,815	12,830	6,815	14,815	6,815	16,400	6,815	16,400	6,815
3/4	3-3/8	7,080	11,570	7,750	11,570	8,955	11,570	12,125	11,570	14,000	11,570
	5	16,965	11,570	18,580	11,570	21,330	11,570	21,330	11,570	21,330	11,570

1. Tabulated load values are applicable to single anchors installed in uncracked concrete with no edge or spacing considerations. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load.

Allowable Load Capacities for Power-Stud HD5 in Normal-Weight Concrete[1]

Nominal Anchor Diameter (in.)	Minimum Embedment Depth (in.)	Minimum Concrete Compressive Strength - f'c (psi)									
		2,500 psi		3,000 psi		4,000 psi		6,000 psi		8,000 psi	
		Tension (lbs)	Shear (lbs)	Tension (lbs)	Shear (lbs)	Tension (lbs)	Shear (lbs)	Tension (lbs)	Shear (lbs)	Tension (lbs)	Shear (lbs)
3/8	1-3/4	620	980	680	980	785	980	805	980	930	980
	2-3/8	905	980	990	980	1,145	980	1,370	980	1,580	980
1/2	2	675	1,050	740	1,050	850	1,050	1,045	1,050	1,205	1,050
	2-1/2	1,035	1,050	1,135	1,050	1,310	1,050	1,605	1,050	1,855	1,050
	3-3/4	2,145	1,050	2,350	1,050	2,575	1,050	2,575	1,050	2,575	1,050
5/8	2-1/2	1,030	1,705	1,125	1,705	1,300	1,705	1,595	1,705	1,840	1,705
	3-3/8	1,825	1,705	2,000	1,705	2,310	1,705	2,830	1,705	3,265	1,705
	4-5/8	2,930	1,705	3,210	1,705	3,705	1,705	4,100	1,705	4,100	1,705
3/4	3-3/8	1,770	2,895	1,940	2,895	2,240	2,895	3,030	2,895	3,500	2,895
	5	4,240	2,895	4,645	2,895	5,335	2,895	5,335	2,895	5,335	2,895

1. Allowable load capacities listed are calculated using and applied safety factor of 4.0.
2. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.

Spacing Distance and Edge Distance Tension (F_{NS}, F_{NC}) Adjustment Factors for Normal-Weight Concrete

Spacing Distance -Tension (F_{NS})											
Diameter, d (in)		3/8	3/8	1/2	1/2	1/2	5/8	5/8	5/8	3/4	3/4
Minimum Embedment, h_v (in)		1-3/4	2-3/8	2	2-1/2	3-3/4	2-3/8	3-3/8	4-5/8	3-3/8	5
Minimum Spacing, s_{min} (in)		5-1/4	3-3/4	6	7-1/4	5	7-1/8	10-1/8	4-1/4	9	6
Spacing Distance (inches)	3-3/4	-	0.80	-	-	-	-	-	-	-	-
	4	-	0.82	-	-	-	-	-	-	-	-
	4-1/4	-	0.83	-	-	-	-	-	0.69	-	-
	4-1/2	-	0.85	-	-	-	-	-	0.70	-	-
	5	-	0.88	-	-	0.75	-	-	0.71	-	-
	5-1/2	1.00	0.91	-	-	0.77	-	-	0.73	-	-
	6	1.00	0.93	1.00	-	0.79	-	-	0.74	-	0.74
	6-1/2	1.00	0.96	1.00	-	0.81	-	-	0.76	-	0.75
	7	1.00	0.99	1.00	-	0.83	-	-	0.78	-	0.77
	7-1/4	1.00	1.00	1.00	0.99	0.84	-	-	0.78	-	0.78
	7-1/2	1.00	1.00	1.00	1.00	0.85	1.00	-	0.79	-	0.78
	8	1.00	1.00	1.00	1.00	0.87	1.00	-	0.81	-	0.80
	8-1/2	1.00	1.00	1.00	1.00	0.89	1.00	-	0.83	-	0.81
	9	1.00	1.00	1.00	1.00	0.91	1.00	-	0.84	0.94	0.83
	9-1/2	1.00	1.00	1.00	1.00	0.93	1.00	-	0.86	0.97	0.84
	10	1.00	1.00	1.00	1.00	0.95	1.00	-	0.87	0.99	0.86
	10-1/2	1.00	1.00	1.00	1.00	0.97	1.00	1.00	0.89	1.00	0.87
	11	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.91	1.00	0.88
	11-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	1.00	0.90
	12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	1.00	0.91
	12-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	1.00	0.93
	13	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	0.94
	13-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	0.96
	14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97
	14-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99
	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Edge Distance - Tension (F_{NC})											
Diameter, d (in)		3/8	3/8	1/2	1/2	1/2	5/8	5/8	5/8	3/4	3/4
Minimum Embedmend, h_v (in)		1-3/4	2-3/8	2	2-1/2	3-3/4	2-3/8	3-3/8	4-5/8	3-3/8	5
Minimum Edge Distance, c_{min} (in)		3	2-1/4	4	5-1/4	4	4-1/4	5-1/2	4-1/4	5	4-1/2
Edge Distance (inches)	2-1/4	-	0.35	-	-	-	-	-	-	-	-
	2-1/2	-	0.38	-	-	-	-	-	-	-	-
	3	0.60	0.46	-	-	-	-	-	-	-	-
	3-1/2	0.70	0.54	-	-	-	-	-	-	-	-
	4	0.80	0.62	0.50	-	0.50	-	-	-	-	-
	4-1/4	0.85	0.65	0.53	-	0.53	0.53	-	0.43	-	-
	4-1/2	0.90	0.69	0.56	-	0.56	0.56	-	0.45	-	0.38
	5	1.00	0.77	0.63	-	0.63	0.63	-	0.50	1.00	0.42
	5-1/4	1.00	0.81	0.66	0.62	0.66	0.66	-	0.53	1.00	0.44
	5-1/2	1.00	0.85	0.69	0.65	0.69	0.69	0.92	0.55	1.00	0.46
	6	1.00	0.92	0.75	0.71	0.75	0.75	1.00	0.60	1.00	0.50
	6-1/2	1.00	1.00	0.81	0.76	0.81	0.81	1.00	0.65	1.00	0.54
	7	1.00	1.00	0.88	0.82	0.88	0.88	1.00	0.70	1.00	0.58
	7-1/2	1.00	1.00	0.94	0.88	0.94	0.94	1.00	0.75	1.00	0.63
	8	1.00	1.00	1.00	0.94	1.00	1.00	1.00	0.80	1.00	0.67
	8-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.85	1.00	0.71
	9	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	1.00	0.75
	9-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	0.79
	10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.83
	10-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88
	11	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92
	11-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96
	12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Spacing Distance Shear (F_{VS}) Adjustment Factors for Normal-Weight Concrete

Spacing Distance - Shear (F_{VS})											
Diameter, d (in)		3/8	3/8	1/2	1/2	1/2	5/8	5/8	5/8	3/4	3/4
Minimum Embedment, h_v (in)		1-3/4	2-3/8	2	2-1/2	3-3/4	2-3/8	3-3/8	4-5/8	3-3/8	5
Minimum Spacing, s_{min} (in)		5-1/4	3-3/4	6	7-1/4	5	7-1/8	11	4-1/4	9	6
Spacing Distance (inches)	3-3/4	-	0.87	-	-	-	-	-	-	-	-
	4	-	0.88	-	-	-	-	-	-	-	-
	4-1/4	-	0.89	-	-	-	-	-	0.78	-	-
	4-1/2	-	0.90	-	-	-	-	-	0.79	-	-
	5	-	0.92	-	-	0.82	-	-	0.80	-	-
	5-1/2	1.00	0.94	-	-	0.84	-	-	0.81	-	-
	6	1.00	0.96	1.00	-	0.85	-	-	0.82	-	0.82
	6-1/2	1.00	0.98	1.00	-	0.87	-	-	0.83	-	0.83
	7	1.00	1.00	1.00	-	0.88	-	-	0.84	-	0.84
	7-1/2	1.00	1.00	1.00	1.00	0.89	1.00	-	0.85	-	0.85
	8	1.00	1.00	1.00	1.00	0.91	1.00	-	0.87	-	0.86
	8-1/2	1.00	1.00	1.00	1.00	0.92	1.00	-	0.88	-	0.87
	9	1.00	1.00	1.00	1.00	0.94	1.00	-	0.89	0.96	0.88
	9-1/2	1.00	1.00	1.00	1.00	0.95	1.00	-	0.90	0.98	0.89
	10	1.00	1.00	1.00	1.00	0.96	1.00	-	0.91	1.00	0.90
	10-1/2	1.00	1.00	1.00	1.00	0.98	1.00	-	0.92	1.00	0.91
	11	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.93	1.00	0.92
	11-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	0.93
	12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	1.00	0.94
	12-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	0.95
	13	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.96
	13-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	0.97
	14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98
	14-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99
	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Edge Distance Shear (F_{VC}) Adjustment Factors for Normal-Weight Concrete

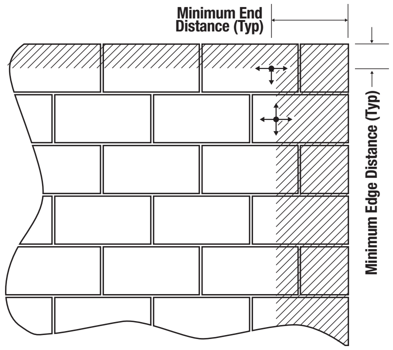
Edge Distance - Shear (F_{VC})											
Diameter, d (in)		3/8	3/8	1/2	1/2	1/2	5/8	5/8	5/8	3/4	3/4
Minimum Embedment, h_v (in)		1-3/4	2-3/8	2	2-1/2	3-3/4	2-3/8	3-3/8	4-5/8	3-3/8	5
Minimum Edge Distance, c_{min} (in)		5	6-1/2	6	8-1/2	8	7-1/8	6	10	5	12
Edge Distance (inches)	5	0.95	-	-	-	-	-	-	-	0.49	-
	5-1/2	1.00	-	-	-	-	-	-	-	0.54	-
	6	1.00	-	1.00	-	-	-	0.59	-	0.59	-
	6-1/2	1.00	0.91	1.00	-	-	-	0.64	-	0.64	-
	7	1.00	0.98	1.00	-	-	-	0.69	-	0.69	-
	7-1/2	1.00	1.00	1.00	-	-	1.00	0.74	-	0.74	-
	8	1.00	1.00	1.00	-	0.71	1.00	0.79	-	0.79	-
	8-1/2	1.00	1.00	1.00	1.00	0.76	1.00	0.84	-	0.84	-
	9	1.00	1.00	1.00	1.00	0.80	1.00	0.89	-	0.89	-
	9-1/2	1.00	1.00	1.00	1.00	0.84	1.00	0.94	-	0.94	-
	10	1.00	1.00	1.00	1.00	0.89	1.00	0.99	0.72	0.99	-
	10-1/2	1.00	1.00	1.00	1.00	0.93	1.00	1.00	0.76	1.00	-
	11	1.00	1.00	1.00	1.00	0.98	1.00	1.00	0.79	1.00	-
	11-1/4	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.81	1.00	-
	11-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.83	1.00	-
	12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	1.00	0.80
	12-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	1.00	0.83
	13	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	1.00	0.87
	13-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	0.90
	14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93
	14-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97
	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

MASONRY PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Power-Stud HD5 in Grout-filled Concrete Masonry[1,2,3]

Anchor Diameter d in.	Minimum Embed. h_v in. (mm)	Nominal Drill Bit Diameter in.	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Ultimate Loads: Tension lbs. (kN)	Ultimate Loads: Shear lbs. (kN)	Allowable Loads: Tension lbs. (kN)	Allowable Loads: Shear lbs. (kN)
3/8	1-1/2 (38.1)	3/8 ANSI	4 (102)	4 (102)	1,185 (5.3)	1,340 (6.0)	235 (1.0)	270 (1.2)
1/2	2 (50.8)	1/2 ANSI	4 (102)	4 (102)	1,670 (7.4)	2,110 (9.4)	335 (1.5)	420 (1.9)
			12 (305)	12 (305)	1,860 (8.3)	2,560 (11.4)	370 (1.6)	510 (2.3)
5/8	2-3/8 (60.3)	5/8 ANSI	4 (102)	4 (102)	2,155 (9.6)	2,110 (9.4)	430 (1.9)	420 (1.9)
			12 (305)	12 (305)	2,850 (12.7)	5,225 (23.2)	570 (2.5)	1,045 (4.6)
3/4	3-3/8 (85.7)	3/4 ANSI	12 (305)	12 (305)	5,660 (25.2)	8,115 (36.1)	1,130 (5.0)	1,625 (7.2)
			20 (508)	20 (508)	5,660 (25.2)	9,360 (41.6)	1,130 (5.0)	1,870 (8.3)

1. Tabulated load values are for anchors installed in minimum 6-inch wide, Grade N, Type II, lightweight concrete masonry units conforming to ASTM C 90 that have reached the minimum designated ultimate compressive strength at the time of installation (*f'm* ≥ 1,500 psi).
2. Allowable load capacities listed are calculated using an applied safety factor of 5.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety.
3. The tabulated values are for anchors installed at a minimum spacing 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. Anchors with 3/4-inch diameter are limited to one anchor per cell.



ORDERING INFORMATION

Power-Stud HD5 (Carbon Steel Body and Stainless Steel Expansion Clip)

Cat. No.	Anchor Size	Thread Length	Box Qty.	Carton Qty.	Wt/100 (lbs.)	Suggested ANSI Carbide Drill Bit Cat. No.				
						Full Head SDS-Plus	SDS-Plus	SDS-Max	Hollow Bit SDS-Plus	Hollow Bit SDS-Max
7713HD5	3/8" x 3"	1-1/2"	50	300	10	DW5527	DW5427	-	-	-
7715HD5	3/8" x 3-3/4"	2-3/8"	50	300	13	DW5527	DW5427	-	-	-
7716HD5	3/8" x 5"	3-1/2"	50	300	15	DW55300	DW5429	-	-	-
7717HD5	3/8" x 7"	5-1/2"	50	200	21	DW55300	DW5429	-	-	-
7720HD5	1/2" x 2-3/4"	1"	50	200	21	DW5537	DW5437	DW5803	DWA54012	-
7722HD5	1/2" x 3-3/4"	2"	50	200	19	DW5537	DW5437	DW5803	DWA54012	-
7723HD5	1/2" x 4-1/2"	2-3/4"	50	200	23	DW5539	DW5438	DW5803	DWA54012	-
7724HD5	1/2" x 5-1/2"	3-3/4"	50	150	27	DW5539	DW5438	DW5803	DWA54012	-
7726HD5	1/2" x 7"	5-1/4"	25	100	30	DW5539	DW5438	DW5803	DWA54012	-
7730HD5	5/8" x 3-1/2"	1-1/2"	25	100	44	-	DW5446	DW5806	DWA54058	DWA58058
7733HD5	5/8" x 5"	3"	25	100	43	-	DW5446	DW5806	DWA54058	DWA58058
7734HD5	5/8" x 6"	4"	25	75	47	-	DW5446	DW5806	DWA54058	DWA58058
7738HD5	5/8" x 8-1/2"	6-1/2"	25	50	60	-	DW5447	DW5809	DWA54058	DWA58058
7741HD5	3/4" x 4-3/4"	2-1/4"	20	60	68	-	DW5453	DW5810	DWA54034	DWA58034
7742HD5	3/4" x 5-1/2"	3"	20	60	76	-	DW5453	DW5810	DWA54034	DWA58034
7746HD5	3/4" x 7"	4-1/2"	20	60	92	-	DW5455	DW5810	DWA54034	DWA58034
7748HD5	3/4" x 8-1/2"	6"	10	40	107	-	DW5455	DW5812	DWA54034	DWA58034

The published size includes the diameter and the overall length of the anchor.
All anchors are packaged with nuts and washers.
A manual hand pump is available (Cat. No. 08280).
Hollow drill bits must be used with a dust extraction vacuum (Cat. No. DW012).

MECHANICAL ANCHORS

POWER-STUD® HD5
Hot-Dip Galvanized Wedge Expansion Anchor

MECHANICAL ANCHORS

POWER-STUD®
Stainless Steel Wedge Expansion Anchor

GENERAL INFORMATION

POWER-STUD®

Stainless Steel Wedge Expansion Anchor

PRODUCT DESCRIPTION

The Power-Stud anchor, is a fully threaded, torque-controlled, wedge expansion anchor. It is available in a threaded version suitable for applications in solid concrete and grout-filled concrete masonry. The threaded version is produced in Type 304 and Type 316 stainless steel.

GENERAL APPLICATIONS AND USES

- Lighting Standards and Base Plates
- Sills and Support Ledgers
- Retrofit Projects and Machinery Anchorage
- Food and Beverage Facilities
- Water Treatment Plants and Marine Applications

FEATURE AND BENEFITS

+ Fully threaded, medium duty all-purpose anchor
+ Length ID stamped on each threaded anchor
+ Anchors can be installed through the fixture for hole spotting not required
+ Chamfered impact section prevents damage to threads
+ Clip design prevents spinning during installation
+ Nominal drill bit diameter same as anchor diameter

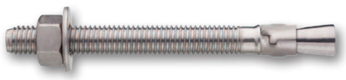
APPROVALS AND LISTINGS

- Tested in accordance with ASTM E488
- Underwriters Laboratory (UL Listed) – File No. EX1289 (see listing)
- Federal GSA Specification
  Meets the descriptive and proof load requirements of CID A-A-1923A, Type 4

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Expansion anchors shall be Power-Stud as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS



THREADED POWER-STUD ASSEMBLY

HEAD STYLES

- Threaded Stud

ANCHOR MATERIALS

- Type 304 Stainless Steel
- Type 316 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

- 1/4" diameter through 1" diameter

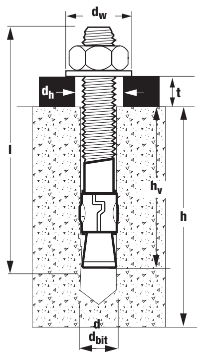
SUITABLE BASE MATERIALS

- Normal-weight Concrete
- Structural Lightweight Concrete
- Grouted Concrete Masonry (CMU)

INSTALLATION SPECIFICATIONS

Type 304 and Type 316 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
Tightening Torque, T_{inst} (ft-lbs)	8	28	60	90	175	250	300
Tightening torque is listed for anchors installed in normal-weight concrete. Consult performance data tables for other base materials.							

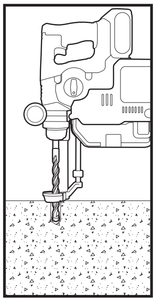


Nomenclature

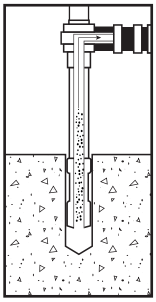
- d = Diameter of anchor
- d_{bit} = Diameter of drill bit
- d_h = Diameter of fixture clearance hole
- d_w = Diameter of washer
- h = Base material thickness. The minimum value of h should be $1.5h_v$ or 3" whichever is greater
- h_v = Minimum embedment depth
- l = Overall length of anchor
- t = Fixture thickness

INSTALLATION PROCEDURE

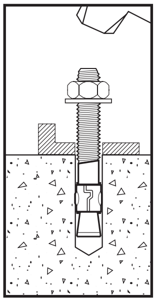
Threaded Stud Version



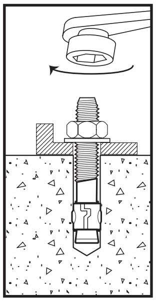
Step 1
Using the proper diameter bit, drill a hole into the base material to a depth of at least 1/2" or one anchor diameter deeper than the embedment required. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15



Step 2
Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



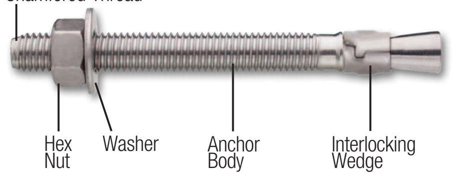
Step 3
Position the washer on the anchor and thread on the nut. Drive the anchor through the fixture into the anchor hole until the nut and washer are firmly seated against the fixture. Be sure the anchor is driven to the required embedment depth.



Step 4
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.

MATERIAL SPECIFICATIONS

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 304 (7/8"– 1", lengths up to 7")	Type 316 Stainless Steel
Nut	Type 18-8 (300 Series) Stainless Steel	Type 316 Stainless Steel
Washer	Type 18-8 (300 Series) Stainless Steel	Type 316 Stainless Steel
Expansion Wedge	Type 18-8 (300 Series) Stainless Steel	Type 316 Stainless Steel
Stainless steel anchor components are passivated.		



Length Identification (Threaded Version)

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 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)
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)	4,200 (18.7)	3,760 (16.9)	4,200 (18.7)	3,760 (16.9)
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)	6,540 (29.4)	6,800 (30.6)	6,540 (29.4)	6,800 (30.6)
	4 (101.6)	5,700 (25.7)	6,540 (29.4)	6,540 (29.4)	6,800 (30.6)	6,540 (29.4)	6,800 (30.6)
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)	7,125 (31.7)	9,280 (41.8)	9,000 (40.0)	11,900 (53.6)	9,000 (40.0)	11,900 (53.6)
3/4 (19.1)	3-3/8 (85.7)	7,420 (33.0)	12,380 (55.7)	9,500 (42.3)	15,060 (67.8)	10,250 (45.6)	15,060 (67.8)
	5 (127.0)	10,640 (47.3)	12,380 (55.7)	10,640 (47.3)	15,060 (67.8)	10,640 (47.3)	15,060 (67.8)
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)	12,500 (55.6)	24,160 (108.7)
	4-1/2 (114.3)	9,600 (43.2)	17,960 (80.8)	12,500 (55.6)	24,160 (108.7)	12,500 (55.6)	24,160 (108.7)
	5-3/4 (146.1)	10,640 (47.3)	17,960 (80.8)	12,500 (55.6)	24,160 (108.7)	12,500 (55.6)	24,160 (108.7)
1 (25.4)	4-1/2 (114.3)	8,740 (39.3)	26,420 (118.9)	13,820 (62.2)	31,100 (140.0)	17,125 (76.2)	31,100 (140.0)
	5-1/2 (139.7)	12,770 (57.5)	26,420 (118.9)	17,125 (76.2)	31,100 (140.0)	17,125 (76.2)	31,100 (140.0)
	6-1/2 (165.1)	16,605 (74.7)	26,420 (118.9)	17,125 (76.2)	31,100 (140.0)	17,125 (76.2)	31,100 (140.0)

1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.

Allowable Load Capacities for Stainless Steel Power-Stud 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)	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)
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)	1,050 (4.7)	940 (4.2)	1,050 (4.7)	940 (4.2)
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)	1,635 (7.3)	1,700 (7.7)	1,635 (7.3)	1,700 (7.7)
	4 (101.6)	1,425 (6.4)	1,635 (7.4)	1,635 (7.3)	1,700 (7.7)	1,635 (7.3)	1,700 (7.7)
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)	2,215 (9.9)	2,975 (13.4)
	4 (101.6)	1,780 (7.9)	2,320 (10.4)	2,250 (10.0)	2,975 (13.4)	2,250 (10.0)	2,975 (13.4)
3/4 (19.1)	3-3/8 (85.7)	1,855 (8.3)	3,095 (13.9)	2,375 (10.6)	3,765 (16.9)	2,560 (11.4)	3,765 (16.9)
	5 (127.0)	2,660 (11.8)	3,095 (13.9)	2,660 (11.8)	3,765 (16.9)	2,660 (11.8)	3,765 (16.9)
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)	3,125 (13.9)	6,040 (27.2)
	4-1/2 (114.3)	2,400 (10.8)	4,490 (20.2)	3,125 (13.9)	6,040 (27.2)	3,125 (13.9)	6,040 (27.2)
	5-3/4 (146.1)	2,660 (11.8)	4,490 (20.2)	3,125 (13.9)	6,040 (27.2)	3,125 (13.9)	6,040 (27.2)
1 (25.4)	4-1/2 (114.3)	2,185 (9.8)	6,605 (29.7)	3,455 (15.5)	7,775 (35.0)	4,280 (19.0)	7,775 (35.0)
	5-1/2 (139.7)	3,195 (14.4)	6,605 (29.7)	4,280 (19.0)	7,775 (35.0)	4,280 (19.0)	7,775 (35.0)
	6-1/2 (165.1)	4,150 (18.7)	6,605 (29.7)	4,280 (19.0)	7,775 (35.0)	4,280 (19.0)	7,775 (35.0)

1. Allowable load capacities listed are calculated using and applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.
2. Allowable load capacities are multiplied by reduction factors found in the Design Criteria section when anchor spacing or edge distances are less than critical distances.
3. Linear interpolation may be used to determine allowable loads for intermediate embedments and concrete compressive strength.

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

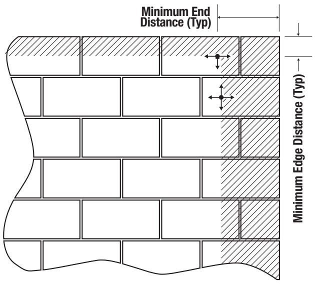
Anchor Diameter d in. (mm)	Install Torque T_{inst} ft.-lbs.	Min. Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f´c) Tension, lbs (kN)						Shear, lbs (kN)	
			3,000 psi (20.7 MPa)		4,000 psi (27.6 MPa)		5,000 psi (34.5 MPa)		f´c ≥ 3,000 psi (20.7 MPa)	
			Ultimate Load	Allowable Load	Ultimate Load	Allowable Load	Ultimate Load	Allowable Load	Ultimate Load	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)
		4 (101.6)	-	-	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)
		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)
		5 (127.0)	-	-	9,300 (41.9)	2,325 (10.5)	-	-	9,880 (44.5)	2,470 (11.1)

1. Tabulated load values are for anchors installed in sand-lightweight concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities listed are calculated using and applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.
3. Allowable load capacities are multiplied by reduction factors found in the Design Criteria section when anchor spacing or edge distances are less than critical distances.

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

Anchor Dia. d in. (mm)	Install Torque T_{inst} 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 ≥ 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)	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 8-inch wide, minimum Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry cells may be grouted. Masonry compressive strength must be at the specified minimum at the time of installation (f'm ≥ 1,500 psi).
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.
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 (ALLOWABLE STRESS DESIGN)

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[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	$s_{cr} = 2.0h_v$	$F_{NS} = F_{VS} = 1.0$	$s_{min} = h_v$	$F_{NS} = F_{VS} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_{NC} = 1.0$	$c_{min} = 5d$	$F_{NC} = 0.75$
	Shear	$c_{cr} = 12d$	$F_{VC} = 1.0$	$c_{min} = 5d$	$F_{VC} = 0.75$

Anchor Installed in Structural 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	$s_{cr} = 2.0h_v$	$F_{NS} = F_{VS} = 1.0$	$s_{min} = h_V$	$F_{NS} = F_{VS} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_{NC} = 1.0$	$c_{min} = 5d$	$F_{NC} = 0.95$
	Shear	$c_{cr} = 12d$	$F_{VC} = 1.0$	$c_{min} = 5d$	$F_{VC} = 0.30$

1. Allowable load values found in the performance data tables are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances. Linear interpolation is allowed for intermediate anchor spacing and edge distances between critical and minimum distances. When an anchor is affected by both reduced spacing and edge distance, the spacing and edge reduction factors must be combined (multiplied). Multiple reduction factors for anchor spacing and edge distance may be required depending on the anchor group configuration.

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

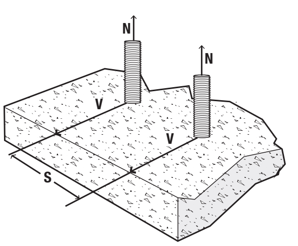
	Dia. (in.)	1/4				3/8				1/2					5/8				
	h_v (in.)	1-1/8	1-1/2	2	2-3/4	1-5/8	2	3	4-1/4	2-1/4	3	4	5	6	2-3/4	3-1/2	4	5	7
	s_{cr} (in.)	2-1/4	3	4	5-1/2	3-1/4	4	6	8-1/2	4-1/2	6	8	10	12	5-1/2	7	8	10	14
	s_{min} (in.)	1-1/8	1-1/2	2	2-3/4	1-5/8	2	3	4-1/4	2-1/4	3	4	5	6	2-3/4	3-1/2	4	5	7
Spacing, s (inches)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

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

	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	1.00	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	1.00	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	1.00	0.80	0.67	0.50	1.00	0.89	0.70	0.57	0.50	0.89	0.73	0.62	0.50	-	0.73	0.57	-
	9	1.00	1.00	0.90	0.75	0.56	1.00	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	1.00	1.00	0.83	0.63	1.00	1.00	0.87	0.71	0.63	1.00	0.91	0.77	0.63	0.56	0.91	0.71	0.50
	11	1.00	1.00	1.00	0.92	0.69	1.00	1.00	0.96	0.79	0.69	1.00	1.00	0.85	0.69	0.61	1.00	0.79	0.55
	11-1/2	1.00	1.00	1.00	0.96	0.72	1.00	1.00	1.00	0.82	0.72	1.00	1.00	0.88	0.72	0.64	1.00	0.82	0.58
	12	1.00	1.00	1.00	1.00	0.75	1.00	1.00	1.00	0.86	0.75	1.00	1.00	0.92	0.75	0.67	1.00	0.86	0.60
	13	1.00	1.00	1.00	1.00	0.81	1.00	1.00	1.00	0.93	0.81	1.00	1.00	1.00	0.81	0.72	1.00	0.93	0.65
	14	1.00	1.00	1.00	1.00	0.88	1.00	1.00	1.00	1.00	0.88	1.00	1.00	1.00	0.88	0.78	1.00	1.00	0.70
	16	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89	1.00	1.00	0.80
	18	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90
	20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	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.

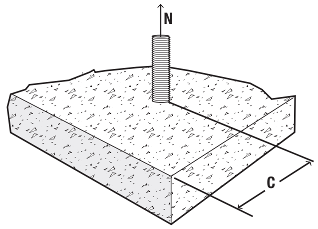


Edge Distance Load Adjustment Factors for Normal-Weight Concrete

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

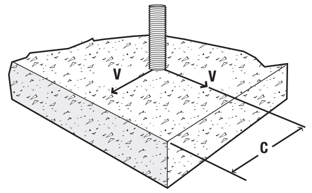
Minimum edge distance (c_{min}) is equal to 5 anchor diameters (5d) at which the anchor achieves 75% of load.



Edge Distance, Shear (F_{VC})								
Diameter (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.)		1-1/4	1-7/8	2-1/2	3-1/8	3-3/4	4-3/8	5
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	1.00	0.66	0.47	0.35	-	-	-
	3-3/4	1.00	0.81	0.58	0.44	0.35	-	-
	4	1.00	0.88	0.63	0.48	0.38	-	-
	4-3/8	1.00	0.97	0.70	0.54	0.43	0.35	-
	4-1/2	1.00	1.00	0.72	0.55	0.44	0.36	-
	5	1.00	1.00	0.81	0.63	0.50	0.42	0.35
	6	1.00	1.00	1.00	0.78	0.63	0.52	0.44
	6-1/4	1.00	1.00	1.00	0.81	0.66	0.55	0.47
	7	1.00	1.00	1.00	0.93	0.75	0.63	0.54
	7-1/2	1.00	1.00	1.00	1.00	0.81	0.68	0.58
	8	1.00	1.00	1.00	1.00	0.88	0.73	0.63
	9	1.00	1.00	1.00	1.00	1.00	0.84	0.72
	10-1/2	1.00	1.00	1.00	1.00	1.00	1.00	0.86
	12	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	15	1.00	1.00	1.00	1.00	1.00	1.00	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 35% of load.

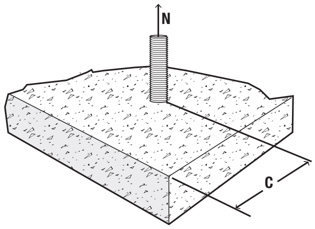


Edge Distance Load Adjustment Factors for Lightweight Concrete

Edge Distance, Tension (F_{NC})							
Diameter (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.)	1-1/4	1-7/8	2-1/2	3-1/8	3-3/4	4-3/8	5
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	1.00	0.97	0.96	0.95	-	-	-
3-3/4	1.00	0.99	0.97	0.96	0.95	-	-
4	1.00	0.99	0.97	0.96	0.95	-	-
4-3/8	1.00	1.00	0.98	0.96	0.96	0.95	-
4-1/2	1.00	1.00	0.98	0.97	0.96	0.95	-
5	1.00	1.00	0.99	0.97	0.96	0.96	0.95
6	1.00	1.00	1.00	0.98	0.97	0.96	0.96
6-1/4	1.00	1.00	1.00	0.99	0.97	0.97	0.96
7	1.00	1.00	1.00	0.99	0.98	0.97	0.96
7-1/2	1.00	1.00	1.00	1.00	0.99	0.98	0.97
8	1.00	1.00	1.00	1.00	0.99	0.98	0.97
9	1.00	1.00	1.00	1.00	1.00	0.99	0.98
10-1/2	1.00	1.00	1.00	1.00	1.00	1.00	0.99
12	1.00	1.00	1.00	1.00	1.00	1.00	1.00
15	1.00	1.00	1.00	1.00	1.00	1.00	1.00

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

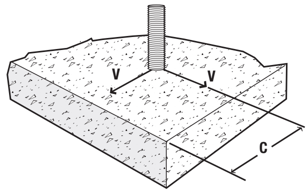
Minimum edge distance (cmin) is equal to 5 anchor diameters (5d) at which the anchor achieves 95% of load.



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

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

Minimum edge distance (cmin) is equal to 5 anchor diameters (5d) at which the anchor achieves 30% of load.



ORDERING INFORMATION

Stainless Steel Power-Stud

Cat. No.		Anchor Size	Min.-Embed.	Thread-Length	Std. Box	Std. Carton	Wt./100
Type 304 SS	Type 316 SS						
7300	7600	1/4" x 1-3/4"	1-1/8"	3/4"	100	500	3
7302	7602	1/4" x 2-1/4"	1-1/8"	1-1/4"	100	500	3-1/2
7304	7604	1/4" x 3-1/4"	1-1/8"	2-1/4"	100	500	4-3/4
7310	7610	3/8" x 2-1/4"	1-5/8"	1-1/4"	50	250	8-3/4
7312	7612	3/8" x 2-3/4"	1-5/8"	1-5/8"	50	250	9-1/2
7313	7613	3/8" x 3"	1-5/8"	1-7/8"	50	250	10-3/4
7314	7614	3/8" x 3-1/2"	1-5/8"	2-3/8"	50	250	12
7315	7615	3/8" x 3-3/4"	1-5/8"	2-5/8"	50	250	12-3/4
7316	7616	3/8" x 5"	1-5/8"	3-1/8"	50	250	15-1/2
7320	7620	1/2" x 2-3/4"	2-1/4"	1-3/8"	50	200	18
7322	7622	1/2" x 3-3/4"	2-1/4"	2-3/8"	50	200	23
7323	7623	1/2" x 4-1/2"	2-1/4"	3-1/8"	50	200	30
7324	7624	1/2" x 5-1/2"	2-1/4"	4-1/8"	50	150	34
7326	7626	1/2" x 7"	2-1/4"	5-5/8"	25	100	44
7330	7630	5/8" x 3-1/2"	2-3/4"	2"	25	100	40
7332	7632	5/8" x 4-1/2"	2-3/4"	3"	25	100	54
7333	7633	5/8" x 5"	2-3/4"	3-1/2"	25	100	57
7334	7634	5/8" x 6"	2-3/4"	4-1/2"	25	75	64
7336	7636	5/8" x 7"	2-3/4"	5-1/2"	25	75	72
7338	7638	5/8" x 8 1/2"	2-3/4"	7"	25	75	84
7340	7640	3/4" x 4 1/4"	3-3/8"	2-3/8"	20	60	70
7341	7641	3/4" x 4 3/4"	3-3/8"	2-7/8"	20	60	76
7342	7642	3/4" x 5 1/2"	3-3/8"	3-5/8"	20	60	85
7344	7644	3/4" x 6-1/4"	3-3/8"	4-3/8"	20	60	95
7346	7646	3/4" x 7"	3-3/8"	5-1/8"	20	60	105
7348	7648	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.

GENERAL INFORMATION

DOMESTIC WEDGE ANCHOR

Carbon Steel and Stainless Steel Wedge Expansion Anchors

Anchor produced in the U.S.A., nut and washer made in Taiwan or China*

PRODUCT DESCRIPTION

The Domestic Wedge Anchor is a threaded, torque-controlled, carbon steel or stainless steel wedge expansion anchor which is designed for consistent performance in concrete. Suitable base materials are normal-weight and sand-lightweight concrete. The anchor is manufactured with carbon steel body and expansion clip or a stainless steel body and expansion clip. Nut and washer are included.

GENERAL APPLICATIONS AND USES

- Steel fixtures
- Support connections
- Equipment and railing

FEATURES AND BENEFITS

+ Anchors made in the U.S.A., nut and washer made in Taiwan or China, domestic nut and washer available upon request.
+ Nominal drill bit size is the same as the anchor diameter
+ Anchor can be installed through standard size fixture clearance holes
+ Length ID code and identifying marking stamped on head of each anchor
+ Corrosion resistant stainless steel anchors available

APPROVALS AND LISTINGS

- Tested in accordance with ASTM E 488

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Expansion anchors shall be Domestic Wedge Anchor as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

MATERIAL SPECIFICATIONS

Anchor component	Specification		
	Carbon Steel[1]	Type 303	Type 316
Anchor body	AISI C12L14	Type 303 Stainless Steel	Type 316 Stainless Steel
Washer	AISI C1010-1018	300 Series Stainless Steel	Type 316 Stainless Steel
Hex Nut	Low Carbon Steel, ASTM A563, Grade A	Type 18-8	Type 316 Stainless Steel
Expansion wedge (clip)	AISI C1010-1018 1037	Type 18-8	Type 316 Stainless Steel

1. Plated with Zinc in accordance with ASTM B 633, SC1 Type III.

* Domestic nut and washer available upon request.

SECTION CONTENTS

DOMESTIC WEDGE ANCHOR ASSEMBLY

THREAD VERSION

- UNC threaded stud

ANCHOR MATERIALS

- Carbon Steel Type 303 Stainless Steel, or Type 316 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

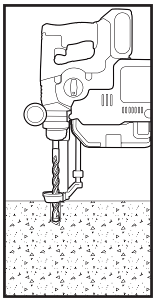
- 1/4" diameter through 1-1/4" diameter

SUITABLE BASE MATERIALS

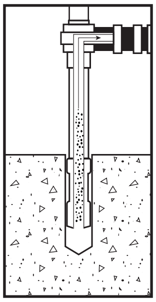
- Normal-weight Concrete
- Lightweight Concrete

INSTALLATION INSTRUCTIONS

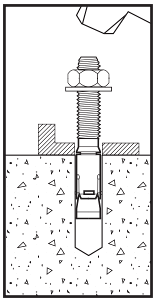
Installation Instructions for Domestic Wedge Anchor



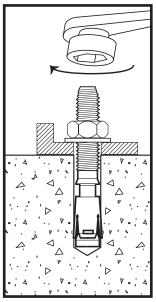
Step 1
Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



Step 2
Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



Step 3
Position the washer on the anchor and thread on the nut. If installing through a fixture, drive the anchor through the fixture into the hole. Be sure the anchor is driven to the minimum required embedment depth.



Step 4
Tighten the anchor with a torque wrench by applying the required installation torque, T_{inst}.

Installation Table for Domestic Wedge Anchor

Anchor Property/ Setting Information	Notation	Units	Nominal Anchor Diameter (inch)							
			1/4	3/8	1/2	5/8	3/4	7/8	1	1-1/4
Anchor outside diameter	d	in.	0.25	0.375	0.500	0.625	0.750	0.875	1.000	1.250
Nominal drill bit diameter	d_{bit}	in.	1/4 ANSI	3/8 ANSI	1/2 ANSI	5/8 ANSI	3/4 ANSI	7/8 ANSI	1 ANSI	1-1/4 ANSI
Minimum diameter of hole clearance in fixture	d_h	in.	5/16	7/16	9/16	11/16	13/16	15/16	1-1/8	1-3/8
Minimum nominal embedment depth	h_{nom}	in.	1-1/8	1-1/2	2-1/4	2-3/4	3-1/4	3-7/8	4-1/2	5-1/2
Minimum hole depth	h_o	in.	1-3/8	1-7/8	2-3/4	3-1/4	3-3/4	4-3/8	5	6
Minimum member thickness	h_{min}	in.	3	3	3-3/8	4-1/8	4-7/8	5-13/16	6-3/4	8-1/4
Installation torque	T_{inst}	ft.-lbf.	5-10	25-30	50-60	75-90	150-175	200-250	250-300	400-450
Torque wrench/socket size	-	in.	7/16	9/16	3/4	15/16	1-1/8	1-5/16	1-1/2	1-7/8
Nut height	-	in.	7/32	21/64	7/16	35/64	41/64	3/4	55/64	1-1/16

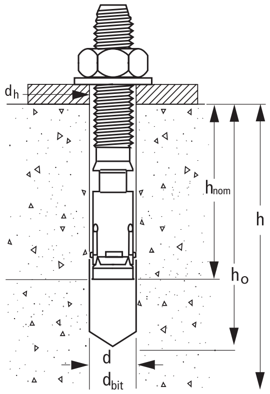
For SI: 1 inch = 25.4 mm, 1 ft-lbf = 1.356 N-m.

Length Identification

Mark	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
From	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	10"	11"
Up to but not including	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	10"	11"	12"

Length identification mark indicates overall length of anchor.

Installation Detail



Nomenclature
d = Diameter of anchor
d_{bit} = Diameter of drill bit
d_h = Diameter of fixture clearance hole
h = Base material thickness
The minimum value of h should be $1.5h_{nom}$ or 3” whichever is greater
h_{nom} = Minimum embedment depth

MECHANICAL ANCHORS

DOMESTIC WEDGE ANCHOR
Carbon Steel and Stainless Steel Wedge Expansion Anchors

MECHANICAL ANCHORS

DOMESTIC WEDGE ANCHOR
Carbon Steel and Stainless Steel Wedge Expansion Anchors

REFERENCE PERFORMANCE DATA

Ultimate Load Capacities for Domestic Wedge Anchor in Normal-Weight Concrete[1,2]

Nominal Anchor Diameter (in.)	Minimum Embedment Depth (in.)	Concrete Compressive Strength, f'c					
		2,000 psi		4,000 psi		6,000 psi	
		Ultimate Tension Load Capacity (lbs.)	Ultimate Shear Load Capacity (lbs.)	Ultimate Tension Load Capacity (lbs.)	Ultimate Shear Load Capacity (lbs.)	Ultimate Tension Load Capacity (lbs.)	Ultimate Shear Load Capacity (lbs.)
1/4	1-1/8	1,170	1,445	1,770	1,815	2,775	2,635
	1-3/4	1,840		2,410		2,775	
	2-3/4	1,975		2,750		2,830	
3/8	1-1/2	1,630	4,320	3,640	5,120	4,450	6,235
	3	3,230		5,655		5,975	
	5	4,075		6,330		6,360	
1/2	2-1/4	4,000	7,420	6,715	9,380	9,615	9,890
	4	6,335		8,945		10,190	
	6	6,900		10,175		12,065	
5/8	2-3/4	5,000	8,265	8,750	12,930	9,760	16,375
	5	8,855		15,590		16,800	
	7	9,380		16,710		17,735	
3/4	3-1/4	6,640	12,505	11,315	17,050	16,230	22,965
	6	10,085		18,410		21,095	
	8	11,170		19,805		22,525	
7/8	3-7/8	8,395	18,250	16,355	20,235	16,800	23,980
	5-3/4	12,065		18,250		23,405	
1	4-1/2	9,775	23,620	18,250	27,605	27,460	28,910
	7-1/2	11,890		26,725		34,960	
	10	15,590		30,490		37,840	
1-1/4	5-1/2	17,550	32,275	22,970	42,690	32,370	55,565
	7	21,050		27,845		48,365	
	10	27,895		34,790		61,270	

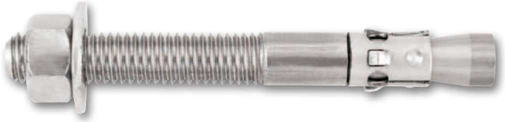
1. Tabulated load values are for anchors installed in uncracked concrete with no edge or spacing considerations. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working loads.

Allowable Load Capacities for Carbon Steel and Stainless Steel Domestic Wedge Anchor in Normal-Weight Concrete[1,2,3]

Nominal Anchor Diameter (in.)	Minimum Embedment Depth (in.)	Concrete Compressive Strength, f'c					
		2,000 psi		4,000 psi		6,000 psi	
		Allowable Tension Load Capacity (lbs.)	Allowable Shear Load Capacity (lbs.)	Allowable Tension Load Capacity (lbs.)	Allowable Shear Load Capacity (lbs.)	Allowable Tension Load Capacity (lbs.)	Allowable Shear Load Capacity (lbs.)
	1-1/8	295		445		695	
1/4	1-3/4	460	360	600	455	695	660
	2-3/4	495		690		710	
	1-1/2	410		910		1,115	
3/8	3	810	1,080	1,415	1,280	1,495	1,560
	5	1,020		1,580		1,590	
	2-1/4	1,000		1,680		2,405	
1/2	4	1,585	1,855	2,235	2,345	2,550	2,475
	6	1,725		2,545		3,015	
	2-3/4	1,250		2,190		2,440	
5/8	5	2,215	2,065	3,900	3,235	4,200	4,095
	7	2,345		4,180		4,435	
	3-1/4	1,660		2,830		4,060	
3/4	6	2,520	3,125	4,600	4,265	5,275	5,740
	8	2,795		4,950		5,630	
7/8	3-7/8	2,100	4,565	4,090	5,060	4,200	5,995
	5-3/4	3,015		4,565		5,850	
	4-1/2	2,445		4,565		6,865	
1	7-1/2	2,975	5,905	6,685	6,900	8,740	7,230
	10	3,900		7,625		9,460	
	5-1/2	4,390		5,745		8,095	
1-1/4	7	5,265	8,070	6,960	10,675	12,095	13,890
	10	6,975		8,700		15,320	

1. Tabulated load values are for anchors installed in uncracked concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities listed are calculated using and applied safety factor of 4.0.
3. Allowable loads for lightweight concrete may be determined by multiplying the tabulated allowable load capacities for normal weight concrete by 0.60.

ORDERING INFORMATION



*Domestic Wedge Anchor (Carbon Steel)

Cat. No.	Size	Min. Embed.	Thread Length	Std. Box	Std. Ctn.
7400USA	1/4" x 1-3/4"	1-1/8"	3/4"	100	500
7402USA	1/4" x 2-1/4"	1-1/8"	3/4"	100	500
7404USA	1/4" x 3-1/4"	1-1/8"	3/4"	100	500
7410USA	3/8" x 2-1/4"	1-1/2"	7/8"	50	250
7412USA	3/8" x 2-3/4"	1-1/2"	1-1/8"	50	250
7413USA	3/8" x 3"	1-1/2"	1-1/8"	50	250
7415USA	3/8" x 3-3/4"	1-1/2"	1-1/8"	50	250
7416USA	3/8" x 5"	1-1/2"	1-1/8"	50	250
7417USA	3/8" x 6-1/2"	1-1/2"	1-1/8"	50	200
7420USA	1/2" x 2-3/4"	2-1/4"	1-1/4"	50	200
7422USA	1/2" x 3-3/4"	2-1/4"	1-1/4"	50	200
7423USA	1/2" x 4-1/2"	2-1/4"	1-1/4"	50	200
7424USA	1/2" x 5-1/2"	2-1/4"	1-1/4"	50	150
7428USA	1/2" x 10"	2-1/4"	1-1/4"	25	100
7430USA	5/8" x 3-1/2"	2-3/4"	2"	25	100
7432USA	5/8" x 4-1/2"	2-3/4"	2"	25	100
7433USA	5/8" x 5"	2-3/4"	2"	25	100
7434USA	5/8" x 6"	2-3/4"	2"	25	75
7436USA	5/8" x 7"	2-3/4"	2"	25	75
7440USA	3/4" x 4-1/4"	3-1/4"	2"	20	60
7441USA	3/4" x 4-3/4"	3-1/4"	2"	20	60
7442USA	3/4" x 5-1/2"	3-1/4"	2"	20	60
7444USA	3/4" x 6-1/4"	3-1/4"	2"	20	60
7446USA	3/4" x 7"	3-1/4"	2"	20	60
7449USA	3/4" x 10"	3-1/4"	2"	10	30
7461USA	1" x 6"	4-1/2"	2-1/4"	10	40
7475USA	1-1/4" x 12"	5-1/2"	3-1/4"	5	15

Installation Accessories

Cat. No.	Description	Box Qty
08466	Adjustable torque wrench with 1/2" square drive (25 to 250 ft.-lbs.)	1
08280	Hand pump / dust blower	1

*Domestic Wedge Anchor (Type 303 Stainless Steel)

Cat. No.	Size	Min. Embed.	Thread Length	Std. Box	Std. Ctn.
7300USA	1/4" x 1-3/4"	1-1/8"	3/4"	100	500
7304USA	1/4" x 3-1/4"	1-1/8"	3/4"	100	500
7312USA	3/8" x 2-3/4"	1-1/2"	1-1/8"	50	250
7313USA	3/8" x 3"	1-1/2"	1-1/8"	50	250
7314USA	3/8" x 3-1/2"	1-1/2"	1-1/8"	50	250
7315USA	3/8" x 3-3/4"	1-1/2"	1-1/8"	50	250
7316USA	3/8" x 5"	1-1/2"	1-1/8"	50	250
7320USA	1/2" x 2-3/4"	2-1/4"	1-1/4"	50	200
7323USA	1/2" x 4-1/2"	2-1/4"	1-1/4"	50	200
7324USA	1/2" x 5-1/2"	2-1/4"	1-1/4"	50	150
7326USA	1/2" x 7"	2-1/4"	1-1/4"	25	100
7332USA	5/8" x 4-1/2"	2-3/4"	2"	25	100
7341USA	3/4" x 4-3/4"	3-1/4"	2"	20	60
7348USA	3/4" x 8-1/2"	3-1/4"	2"	10	40
7349USA	3/4" x 10"	3-1/4"	2"	10	30

*Domestic Wedge Anchor (Type 316 Stainless Steel)

Cat. No.	Size	Min. Embed.	Thread Length	Std. Box	Std. Ctn.
7600USA	1/4" x 1-3/4"	1-1/8"	3/4"	100	500
7602USA	1/4" x 2-1/4"	1-1/8"	3/4"	100	500
7610USA	3/8" x 2-1/4"	1-1/2"	7/8"	50	250
7612USA	3/8" x 2-3/4"	1-1/2"	1-1/8"	50	250
7613USA	3/8" x 3"	1-1/2"	1-1/8"	50	250
7614USA	3/8" x 3-1/2"	1-1/2"	1-1/8"	50	250
7615USA	3/8" x 3-3/4"	1-1/2"	1-1/8"	50	250
7616USA	3/8" x 5"	1-1/2"	1-1/8"	50	250
7626USA	1/2" x 7"	2-1/4"	1-1/4"	25	100
7632USA	5/8" x 4-1/2"	2-3/4"	2"	25	100
7633USA	5/8" x 5"	2-3/4"	2"	25	100
7634USA	5/8" x 6"	2-3/4"	2"	25	75
7636USA	5/8" x 7"	2-3/4"	2"	25	75
7638USA	5/8" x 8-1/2"	2-3/4"	2"	25	75
7642USA	3/4" x 5-1/2"	3-1/4"	2"	20	60
7646USA	3/4" x 7"	3-1/4"	2"	20	60

*Made to Order

The published size includes the diameter and the overall length of the carbon and stainless steel anchors.

All anchors are packaged with nuts and washers.

GENERAL INFORMATION

POWER-BOLT®+

Heavy Duty Sleeve Anchor

PRODUCT DESCRIPTION

The Power-Bolt+ anchor is a torque controlled, heavy duty sleeve style anchor which is designed for consistent performance in cracked and uncracked concrete. Suitable base materials include normal-weight concrete and sand-lightweight concrete. The anchor is manufactured with a zinc plated carbon steel bolt, sleeve, cone and expansion clip. The Power-Bolt+ has a low profile finished hex head.

GENERAL APPLICATIONS AND USES

- Structural connections, i.e., beam and column anchorage
- Safety-related attachments and tension zone applications
- Interior applications / low level corrosion environment
- Heavy duty applications

FEATURES AND BENEFITS

+ Consistent performance in high and low strength concrete
+ Nominal drill bit size is the same as the anchor diameter
+ Anchor can be installed through standard fixture holes
+ Length ID code and identifying marking stamped on head of each anchor
+ Anchor design allows for follow-up expansion after setting under tensile loading
+ High shear load capacity

APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES), ESR-3260 for cracked and uncracked concrete - 1/2", 5/8" and 3/4" diameters
- Code compliant with 2015 IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, and 2009 IRC
- Tested in accordance with ACI 355.2 and ICC-ES AC193 (including ASTM E 488) for use in structural concrete under the design provisions of ACI 318-14 Chapter 17 or ACI 318-11/08 (Appendix D)
- Evaluated and qualified by an accredited independent testing laboratory for recognition in cracked and uncracked concrete including seismic and wind loading (Category 1 anchors): 1/2", 5/8" and 3/4" diameters

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchoring and 05 05 19 - Post-Installed Concrete Anchors Expansion anchors shall be Power-Bolt+ as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

POWER-BOLT+ ASSEMBLY

HEAD STYLES

- Finished Hex Head

ANCHOR MATERIALS

- Zinc plated carbon steel bolt, washer, cone, sleeve, and expansion clip; assembled with a plastic compression ring and retainer nut

ANCHOR SIZE RANGE (TYP.)

- 1/4" diameter through 3/4" diameter

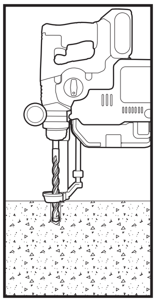
SUITABLE BASE MATERIALS

- Normal-weight concrete
- Sand-lightweight concrete

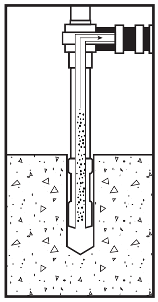
TENSION ZONE CRACKED CONCRETE
SEISMIC REGION QUALIFICATION
CODE LISTED ICC-ES ESR-3260 CONCRETE
DDA DEWALT DESIGN ASSIST™
DUSTX+™ ANCHOR INSTALLATION SYSTEM

INSTALLATION INSTRUCTIONS

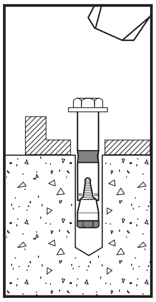
Installation Instructions for Power-Bolt+ Anchor



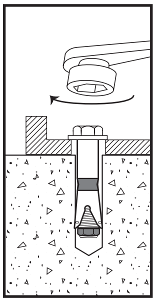
Step 1
Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



Step 2
Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.. Ensure the cone is snug and uniformly under the expansion wedge (clip) with the clip fingers overlapping the anchor cone, prior to installation using the retention nut (see photo below).



Step 3
Drive anchor through the fixture into the hole. Be sure the anchor is driven to the minimum required embedment depth, h_{nom} .



Step 4
Tighten the anchor with a torque wrench by applying the required installation torque, T_{inst}.

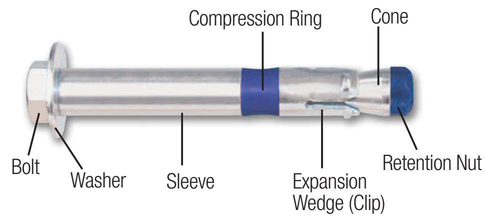
Head Marking

Legend

'PB+' Symbol = Power-Bolt+ Strength Design Compliant (see ordering information)

Letter Code = Length Identification Mark

Power-Bolt+ Anchor Assembly



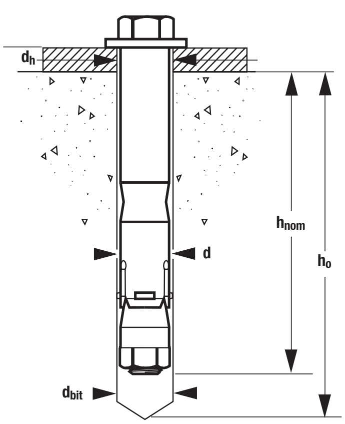
Length Identification

Mark	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
From	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"	10"
Up to but not including	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"	10"	11"
Length identification mark indicates overall length of anchor.																		

INSTALLATION SPECIFICATIONS

Power-Bolt+ Anchor Installation Specifications

Anchor Property/Setting Information	Notation	Units	Nominal Anchor Diameter (in.)				
			1/4	3/8	1/2	5/8	3/4
Anchor outside diameter	d	in. (mm)	0.250 (6.4)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)
Internal Bolt Diameter (UNC)	-	in. (mm)	#8 (4)	1/4 (6.4)	3/8 (9.5)	7/16 (11.1)	9/16 (14.3)
Nominal drill bit diameter	d_{bit}	in. (mm)	1/4 ANSI	3/8 ANSI	1/2 ANSI	5/8 ANSI	3/4 ANSI
Minimum diameter of hole clearance in fixture	d_h	in. (mm)	5/16 (8)	7/16 (11)	9/16 (14)	11/16 (17)	13/16 (21)
Minimum nominal embedment depth	h_{nom}	in. (mm)	1-1/4 (32)	1-5/8 (41)	2-1/2 (64)	2-3/4 (70)	3 (76.2)
Minimum hole depth	h_o	in. (mm)	1-1/2 (38)	1-7/8 (48)	3 (76)	3-1/4 (83)	3-5/8 (92)
Minimum member thickness	h_{min}	in. (mm)	3-1/2 (89)	4-1/2 (114)	5 (127)	6-1/2 (165)	7 (178)
Minimum edge distance	c_{min}	in. (mm)	1-3/4 (44)	2-3/4 (70)	3-1/4 (83)	4-1/2 (114)	6 (152)
Minimum spacing distance	s_{min}	in. (mm)	2 (51)	3-1/2 (89)	4-1/2 (114)	6 (152)	6 (152)
Installation torque	T_{inst}	ft.-lbf. (N-m)	4 (5)	20 (27)	40 (54)	60 (81)	110 (149)
Torque wrench/socket size	-	in.	3/8	1/2	5/8	3/4	15/16
Bolt Head Height	-	in. (mm)	1/8 (3)	13/64 (5)	9/32 (7)	5/16 (8)	3/8 (10)



REFERENCE PERFORMANCE DATA

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

Nominal Anchor Diameter d in.	Minimum Embed. Depth in. (mm) h_{nom}	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi (17.3 MPa)		f'c = 3,000 psi (20.7 MPa)		f'c = 4,000 psi (27.6 MPa)		f'c = 6,000 psi (41.4 MPa)		f'c = 8,000 psi (55.2 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)
1/4	1-1/4 (32)	1,245 (5.5)	1,670 (7.4)	1,260 (5.6)	1,670 (7.4)	1,290 (5.7)	1,670 (7.4)	1,345 (6.0)	1,670 (7.4)	1,397 (6.2)	1,670 (7.4)
	1-3/4 (44)	1,740 (7.7)	1,670 (7.4)	1,905 (8.5)	1,670 (7.4)	1,945 (8.7)	1,670 (7.4)	1,945 (8.7)	1,670 (7.4)	1,945 (8.7)	1,670 (7.4)
3/8	1-5/8 (41)	1,420 (6.3)	2,420 (10.8)	1,555 (6.9)	2,460 (10.9)	1,795 (8.0)	2,460 (10.9)	2,105 (9.4)	2,470 (11.0)	2,430 (10.8)	2,810 (12.5)
	2 (51)	2,740 (12.2)	3,990 (17.7)	3,000 (13.3)	3,990 (17.7)	3,465 (15.4)	3,990 (17.7)	4,140 (18.4)	3,990 (17.7)	4,425 (19.7)	3,990 (17.7)
	2-3/4 (70)	4,130 (18.4)	3,990 (17.7)	4,425 (19.7)	3,990 (17.7)	4,425 (19.7)	3,990 (17.7)	4,425 (19.7)	3,990 (17.7)	4,425 (19.7)	3,990 (17.7)
1/2	2-1/2 (64)	3,880 (17.3)	7,420 (33.0)	4,250 (18.9)	8,030 (35.7)	4,905 (21.8)	8,030 (35.7)	5,150 (22.9)	8,030 (35.7)	5,518 (24.5)	8,030 (35.7)
	3 (76)	5,190 (23.1)	8,030 (35.7)	5,685 (25.3)	8,030 (35.7)	6,560 (29.2)	8,030 (35.7)	7,985 (35.5)	8,030 (35.7)	9,065 (40.3)	8,030 (35.7)
	3-1/4 (83)	7,120 (31.7)	8,030 (35.7)	7,660 (34.1)	8,030 (35.7)	8,645 (38.5)	8,030 (35.7)	9,400 (41.8)	8,030 (35.7)	10,835 (48.2)	8,030 (35.7)
5/8	2-3/4 (70)	4,745 (21.1)	9,975 (44.4)	5,195 (23.1)	10,930 (48.6)	6,000 (26.7)	12,620 (56.1)	6,845 (30.4)	13,155 (58.5)	7,200 (32.0)	13,155 (58.5)
	3-1/2 (89)	6,995 (31.1)	9,975 (44.4)	7,660 (34.1)	10,930 (48.6)	8,845 (39.3)	12,620 (56.1)	11,325 (50.4)	13,155 (58.5)	12,900 (57.4)	13,155 (58.5)
	3-3/4 (95)	8,710 (38.7)	12,015 (53.4)	9,545 (42.5)	14,320 (63.7)	11,020 (49.0)	16,535 (73.6)	12,820 (57.0)	18,250 (81.2)	14,800 (65.8)	18,250 (81.2)
3/4	3 (76)	5,655 (25.2)	10,950 (48.7)	6,195 (27.6)	11,995 (53.4)	7,155 (31.8)	13,850 (61.6)	8,385 (37.3)	18,510 (82.3)	9,685 (43.1)	21,370 (95.1)
	4-3/8 (111)	10,870 (48.4)	18,635 (82.9)	11,910 (53.0)	20,415 (90.8)	13,750 (61.2)	23,575 (104.9)	14,705 (65.4)	23,575 (104.9)	16,975 (75.5)	23,575 (104.9)
	7 (178)	18,145 (80.7)	24,290 (108.0)	19,880 (88.4)	24,290 (108.0)	22,955 (102.1)	24,290 (108.0)	28,445 (126.5)	24,290 (108.0)	29,863 (132.8)	24,290 (108.0)

1. The tabulated load values are applicable to single anchors installed in uncracked concrete with no edge or spacing considerations. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must reduced by a minimum safety factor of 4.0 or greater to determine allowable working loads.

Allowable Load Capacities for Power-Bolt+ in Normal-Weight Concrete[1,2,3]

Nominal Anchor Diameter d in.	Minimum Embed. Depth in. (mm) h_{nom}	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi (17.3 MPa)		f'c = 3,000 psi (20.7 MPa)		f'c = 4,000 psi (27.6 MPa)		f'c = 6,000 psi (41.4 MPa)		f'c = 8,000 psi (55.2 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)
1/4	1-1/4 (32)	310 (1.4)	420 (1.9)	315 (1.4)	420 (1.9)	325 (1.4)	420 (1.9)	335 (1.5)	420 (1.9)	350 (1.6)	420 (1.9)
	1-3/4 (44)	435 (1.9)	420 (1.9)	475 (2.1)	420 (1.9)	485 (2.2)	420 (1.9)	485 (2.2)	420 (1.9)	485 (2.2)	420 (1.9)
3/8	1-5/8 (41)	355 (1.6)	605 (2.7)	390 (1.7)	615 (2.7)	450 (2.0)	615 (2.7)	525 (2.3)	620 (2.8)	610 (2.7)	705 (3.1)
	2 (51)	685 (3.0)	1,000 (4.4)	750 (3.3)	1,000 (4.4)	865 (3.8)	1,000 (4.4)	1,035 (4.6)	1,000 (4.4)	1,105 (4.9)	1,000 (4.4)
	2-3/4 (70)	1,035 (4.6)	1,000 (4.4)	1,105 (4.9)	1,000 (4.4)	1,105 (4.9)	1,000 (4.4)	1,105 (4.9)	1,000 (4.4)	1,105 (4.9)	1,000 (4.4)
1/2	2-1/2 (64)	970 (4.3)	1,855 (8.3)	1,065 (4.7)	2,010 (8.9)	1,225 (5.4)	2,010 (8.9)	1,290 (5.7)	2,010 (8.9)	1,380 (6.1)	2,010 (8.9)
	3 (76)	1,300 (5.8)	2,010 (8.9)	1,420 (6.3)	2,010 (8.9)	1,640 (7.3)	2,010 (8.9)	1,995 (8.9)	2,010 (8.9)	2,265 (10.1)	2,010 (8.9)
	3-1/4 (83)	1,780 (7.9)	2,010 (8.9)	1,915 (8.5)	2,010 (8.9)	2,160 (9.6)	2,010 (8.9)	2,350 (10.5)	2,010 (8.9)	2,710 (12.1)	2,010 (8.9)
5/8	2-3/4 (70)	1,185 (5.3)	2,495 (11.1)	1,300 (5.8)	2,735 (12.2)	1,500 (6.7)	3,155 (14.0)	1,710 (7.6)	3,290 (14.6)	1,800 (8.0)	3,290 (14.6)
	3-1/2 (89)	1,750 (7.8)	2,495 (11.1)	1,915 (8.5)	2,735 (12.2)	2,210 (9.8)	3,155 (14.0)	2,830 (12.6)	3,290 (14.6)	3,225 (14.3)	3,290 (14.6)
	3-3/4 (95)	2,180 (9.7)	3,005 (13.4)	2,385 (10.6)	3,580 (15.9)	2,755 (12.3)	4,135 (18.4)	3,205 (14.3)	4,565 (20.3)	3,700 (16.5)	4,565 (20.3)
3/4	3 (76)	1,415 (6.3)	2,740 (12.2)	1,550 (6.9)	3,000 (13.3)	1,790 (8.0)	3,465 (15.4)	2,095 (9.3)	4,630 (20.6)	2,420 (10.8)	5,345 (23.8)
	4-3/8 (111)	2,720 (12.1)	4,660 (20.7)	2,980 (13.3)	5,105 (22.7)	3,440 (15.3)	5,895 (26.2)	3,675 (16.3)	5,895 (26.2)	4,245 (18.9)	5,895 (26.2)
	7 (178)	4,535 (20.2)	6,075 (27.0)	4,970 (22.1)	6,075 (27.0)	5,740 (25.5)	6,075 (27.0)	7,110 (31.6)	6,075 (27.0)	7,465 (33.2)	6,075 (27.0)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the applications, such as life safety or overhead.
2. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
3. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.

ALLOWABLE STRESS DESIGN (ASD) DESIGN CRITERIA

Spacing Reduction Factors - Tension (F_{NS})

Diameter (in)		1/4	3/8	1/2	5/8	3/4
Nominal Embedment h_{nom} (in)		1-1/4	2	2-1/2	2-3/4	3
Minimum Spacing s_{min} (in)		2	3-1/2	4-1/2	6	5
Spacing Distance (inches)	2	0.78	-	-	-	-
	2-1/2	0.82	-	-	-	-
	3	0.87	-	-	-	-
	3-1/2	0.91	0.80	-	-	-
	4	0.96	0.83	-	-	-
	4-1/2	1.00	0.86	0.83	-	-
	5	1.00	0.89	0.85	-	0.77
	5-1/2	1.00	0.92	0.88	-	0.79
	6	1.00	0.95	0.91	0.85	0.81
	6-1/2	1.00	0.98	0.93	0.87	0.83
	7	1.00	1.00	0.96	0.90	0.85
	7-1/2	1.00	1.00	0.98	0.92	0.87
	8	1.00	1.00	1.00	0.95	0.89
	8-1/2	1.00	1.00	1.00	0.97	0.92
	9	1.00	1.00	1.00	1.00	0.94
	9-1/2	1.00	1.00	1.00	1.00	0.96
	10	1.00	1.00	1.00	1.00	0.98
	10-1/2	1.00	1.00	1.00	1.00	1.00

Edge Distance Reduction Factors - Tension (F_{NC})

Diameter (in)		1/4	3/8	1/2	5/8	3/4
Nominal Embedment h_{nom} (in)		1-1/4	2	2-1/2	2-3/4	3
Minimum Edge Distance c_{min} (in)		1-3/4	2-3/4	3-1/4	4-1/2	6
Edge Distance (inches)	1-3/4	0.39	-	-	-	-
	2	0.44	-	-	-	-
	2-1/2	0.56	-	-	-	-
	3	0.67	0.46	-	-	-
	3-1/4	0.72	0.50	0.41	-	-
	3-1/2	0.78	0.54	0.44	-	-
	4	0.89	0.62	0.50	-	-
	4-1/2	1.00	0.69	0.56	0.75	-
	5	1.00	0.77	0.63	0.83	-
	5-1/2	1.00	0.85	0.69	0.92	-
	6	1.00	0.92	0.75	1.00	0.75
	6-1/2	1.00	1.00	0.81	1.00	0.81
	7	1.00	1.00	0.88	1.00	0.88
	7-1/2	1.00	1.00	0.94	1.00	0.94
	8	1.00	1.00	1.00	1.00	1.00

Spacing Reduction Factors - Shear (F_{VS})

Diameter (in)		1/4	3/8	1/2	5/8	3/4
Nominal Embedment h_{nom} (in)		1-1/4	2	2-1/2	2-3/4	3
Minimum Spacing s_{min} (in)		2	3-1/2	4-1/2	6	5
Spacing Distance (inches)	2	0.86	-	-	-	-
	2-1/2	0.89	-	-	-	-
	3	0.92	-	-	-	-
	3-1/2	0.94	0.88	-	-	-
	4	0.97	0.90	-	-	-
	4-1/2	1.00	0.91	0.89	-	-
	5	1.00	0.93	0.91	-	0.84
	5-1/2	1.00	0.95	0.93	-	0.86
	6	1.00	0.97	0.94	0.89	0.87
	6-1/2	1.00	0.99	0.96	0.91	0.88
	7	1.00	1.00	0.97	0.93	0.90
	7-1/2	1.00	1.00	0.99	0.94	0.91
	8	1.00	1.00	1.00	0.96	0.93
	8-1/2	1.00	1.00	1.00	0.98	0.94
	9	1.00	1.00	1.00	1.00	0.96
	9-1/2	1.00	1.00	1.00	1.00	0.97
	10	1.00	1.00	1.00	1.00	0.99
	10-1/2	1.00	1.00	1.00	1.00	1.00

Edge Distance Reduction Factors - Shear (F_{VC})

Diameter (in)		1/4	3/8	1/2	5/8	3/4
Nominal Embedment h_{nom} (in)		1-1/4	2	2-1/2	2-3/4	3
Minimum Edge Distance c_{min} (in)		1-3/4	2-3/4	3-1/4	4-1/2	6
Edge Distance (inches)	1-3/4	0.39	-	-	-	-
	2	0.44	-	-	-	-
	2-1/2	0.56	-	-	-	-
	3	0.67	0.44	-	-	-
	3-1/4	0.72	0.48	0.41	-	-
	3-1/2	0.78	0.52	0.44	-	-
	4	0.89	0.59	0.51	-	-
	4-1/2	1.00	0.67	0.57	0.50	-
	5	1.00	0.74	0.63	0.56	-
	5-1/2	1.00	0.81	0.70	0.61	-
	6	1.00	0.89	0.76	0.67	0.57
	6-1/2	1.00	0.96	0.83	0.72	0.62
	7	1.00	1.00	0.89	0.78	0.67
	7-1/2	1.00	1.00	0.95	0.83	0.71
	8	1.00	1.00	1.00	0.89	0.76
	8-1/2	1.00	1.00	1.00	0.94	0.81
	9	1.00	1.00	1.00	1.00	0.86
	9-1/2	1.00	1.00	1.00	1.00	0.90
	10	1.00	1.00	1.00	1.00	0.95
	10-1/2	1.00	1.00	1.00	1.00	1.00

STRENGTH DESIGN INFORMATION

CODE LISTED
ICC-ES ESR-3260

STRENGTH DESIGN TABLES

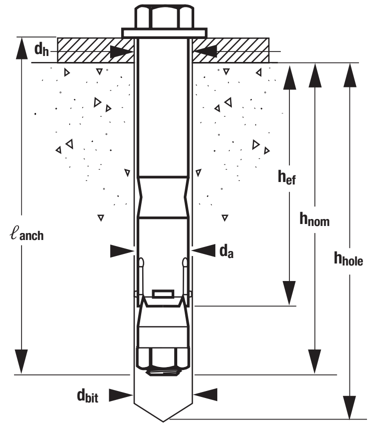
Power-Bolt+ Anchor Installation Specifications[1]

Anchor Property/Setting Information	Notation	Units	Norminal Anchor Diameter (in.)		
			1/2	5/8	3/4
Anchor outside diameter	d_a	in. (mm)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)
Internal bolt diameter (UNC)	-	in. (mm)	3/8 (9.5)	7/16 (11.1)	9/16 (14.3)
Minimum diameter of hole clearance in fixture	d_h	in. (mm)	9/16 (14.3)	11/16 (17.5)	13/16 (21.6)
Nominal drill bit diameter	d_{bit}	in.	1/2 ANSI	5/8 ANSI	3/4 ANSI
Minimum nominal embedment depth	h_{nom}	in. (mm)	3-1/4 (83)	3-3/4 (95)	4-3/8 (111)
Effective embedment	h_{ef}	in. (mm)	2-5/8 (67)	3 (76)	3-1/2 (89)
Minimum hole depth	h_{hole}	in. (mm)	3-3/4 (95)	4-1/4 (108)	5 (127)
Minimum member thickness	h_{min}	in. (mm)	5 (127)	6-1/2 (165)	7 (178)
Minimum overall anchor length[2]	ℓ_{anch}	in. (mm)	3-1/2 (89)	4 (102)	5-1/4 (133)
Minimum edge distance	c_{min}	in. (mm)	3-1/4 (83)	4-1/2 (114)	6 (152) / 8 (203)
Minimum spacing distance	s_{min}	in. (mm)	4-1/2 (114)	6 (152)	6 (152) / 5 (127)
Critical edge distance	c_{ac}	in. (mm)	8 (203)	6 (152)	8 (203)
Installation torque	T_{inst}	ft.-lbf. (N-m)	40 (54)	60 (81)	110 (149)
Bolt Head Height	-	in. (mm)	9/32 (7.1)	5/16 (7.9)	3/8 (9.6)
Torque wrench/socket size	-	in.	5/8	3/4	15/16

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

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D.
2. The listed minimum overall anchor length is based on anchor sizes available at the time of publication compared with the requirements for the minimum nominal embedment depth and fixture attachment.

Power-Bolt+ Anchor Detail



MECHANICAL ANCHORS

POWER-BOLT®+
Heavy Duty Sleeve Anchor

Tension Design information for Power-Bolt+ Anchor in Concrete (for use with load combinations taken form ACI 318-14, Section 5.3 or ACI 318-11, Section 9.2)[1,2]

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Design Characteristic	Notation	Units	Nominal Anchor Diameter		
			1/2	5/8	3/4
Anchor category	1,2 or 3	-	1	1	1
Nominal embedment depth	h_{nom}	in. (mm)	3-1/4 (83)	3-3/4 (95)	4-3/8 (111)
STEEL STRENGTH IN TENSION[4]					
Minimum specified yield strength	f_y	ksi (N/mm²)	130 (896)	130 (896)	130 (896)
Minimum specified ultimate tensile strength[8]	f_{uta}	ksi (N/mm²)	150 (1,034)	150 (1,034)	150 (1,034)
Effective tensile stress area (threads)	$A_{se,N}$	in² (mm²)	0.0775 (50)	0.1063 (68.6)	0.1820 (117.4)
Steel strength in tension	N_{sa}	lb (kN)	9,685 (43.1)	13,285 (59.1)	27,300 (121.4)
Reduction factor for steel strength[3]	ϕ	-	0.75		0.65
CONCRETE BREAKOUT STRENGTH IN TENSION[7]					
Effective embedment	h_{ef}	in. (mm)	2.625 (67)	3.000 (76)	3.500 (89)
Effectiveness factor for uncracked concrete	k_{ucr}	-	27 (11.3)	27 (11.3)	24 (10.0)
Effectiveness factor for cracked concrete	k_{cr}	-	17 (7.1)	17 (7.1)	17 (7.1)
Modification factor for cracked and uncracked concrete[5]	$\psi_{c,N}$	-	1.0	1.0	1.0
Critical edge distance (uncracked concrete)	c_{ac}	in. (mm)	8 (203)	6 (152)	8 (203)
Reduction factor for concrete breakout strength[4]	ϕ	-	0.65 (Condition B)		
PULLOUT STRENGTH IN TENSION (NON-SEISMIC APPLICATIONS)[7]					
Characteristic pullout strength, uncracked concrete (2,500 psi)	$N_{p,uncr}$	lb (kN)	Not Applicable[6]	Not Applicable[6]	Not Applicable[6]
Characteristic pullout strength, cracked concrete (2,500 psi)	$N_{p,cr}$	lb (kN)	Not Applicable[6]	Not Applicable[6]	Not Applicable[6]
Reduction factor for pullout strength	ϕ	-	0.65 (Condition B)		
PULLOUT STRENGTH IN TENSION FOR SEISMIC APPLICATIONS[7]					
Characteristic pullout strength, seismic (2,500 psi)	$N_{p,eq}$	lb (kN)	Not Applicable[6]	Not Applicable[6]	Not Applicable[6]
Reduction factor for pullout strength	ϕ	-	0.65 (Condition B)		

For SI: 1 inch = 25.4 mm; 1 ksi = 6.894 N/mm²; 1 lbf = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable, shall apply.
2. Installation must comply with the manufacturer's published installation instructions.
3. The tabulated value of ϕ for steel strength applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ for steel strength must be determined in accordance with ACI 318-11 D.4.3. The anchors are ductile steel elements as defined in ACI 318-14 2.3 or ACI 318-11 D.1, as applicable, except for the 3/4-inch-diameter, which is considered a brittle steel element for the purposes of design.
4. The tabulated value of ϕ for concrete breakout strength applies when both the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, for Condition B are satisfied. If the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3,, as applicable, for Condition A are satisfied, the appropriate value of ϕ for concrete breakout strength must be determined in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ for concrete breakout strength must be determined in accordance with ACI 318-11 D.4.4.
5. For all design cases use $\Psi_{c,N}$ = 1.0. The appropriate effectiveness factor for cracked concrete (k_{cr}) or uncracked concrete (k_{uncr}) must be used.
6. Pullout strength does not control design.
7. Anchors are permitted to be used in lightweight concrete provided the modification factor λ_a equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n and V_n. λ shall be determined in accordance with the corresponding version of ACI 318.
8. In accordance with ACI 318-14 17.4.1.2 and Eq. 17.4.1.2 or ACI 318-11 D.5.1.2 and Eq. D-2, as applicable, the nominal steel strength in tension is calculated using a limited value of f_{uta} of 125 ksi.

Mean Axial Stiffness Values, β, for Power-Bolt+ Anchors in Normal-Weight Concrete[1]

Concrete State	Units	Nominal Anchor Diameter		
		1/2 inch	5/8 inch	3/4 inch
Uncracked concrete	10^3 lbf/in. (kN/mm)	366 (63)	871 (150)	256 (44)
Cracked concrete	10^3 lbf/in. (kN/mm)	64 (11)	94 (16)	27 (5)

1. Mean values shown; actual stiffness varies considerably depending on concrete strength, loading and geometry of application.

Shear Design information for Power-Bolt+ Anchor in Concrete (For use with load combinations taken from ACI 318-14, Section 5.3 or ACI 318-11, Section 9.2)[1,2]

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STRENGTH DESIGN TABLES

Design Characteristic	Notation	Units	Nominal Anchor Diameter		
			1/2	5/8	3/4
Anchor category	1, 2 or 3	-	1	1	1
Nominal embedment depth	h_{nom}	in. (mm)	3-1/4 (83)	3-3/4 (95)	4-3/8 (111)
STEEL STRENGTH IN SHEAR					
Minimum specified yield strength	f_y	ksi (N/mm²)	130 (896)	130 (896)	130 (896)
Minimum specified ultimate strength	f_{uta}	ksi (N/mm²)	150 (1,034)	150 (1,034)	150 (1,034)
Effective shear stress area	$A_{se,v}$	in² (mm²)	0.1069 (69.0)	0.1452 (93.7)	0.2410 (153)
Steel strength in shear[6]	V_{sa}	lb (kN)	6,005 (26.7)	13,415 (59.7)	14,820 (65.9)
Reduction factor for steel strength[3]	ϕ	-	0.65		0.60
CONCRETE BREAKOUT STRENGTH IN SHEAR[7]					
Load bearing length of anchor	ℓ_e	in (mm)	1.00 (25)	1.25 (32)	1.50 (51)
Nominal anchor diameter	d_a	in (mm)	0.500 (12.7)	0.625 (15.9)	0.750 (19.05)
Reduction factor for concrete breakout[4]	ϕ	-	0.70 (Condition B)		
PRYOUT STRENGTH IN SHEAR[7]					
Coefficient for pryout strength (1.0 for $h_{ef} < 2.5$ in., 2.0 for $h_{ef} \geq 2.5$ in.)	k_{cp}	-	2.0	2.0	2.0
Effective embedment	h_{ef}	in (mm)	2.625 (675)	3.000 (76)	3.500 (89)
Reduction factor for pryout strength[5]	ϕ	-	0.70 (Condition B)		
STEEL STRENGTH IN SHEAR FOR SEISMIC APPLICATIONS					
Steel strength in shear, seismic[8]	$V_{sa, eq}$	lb (kN)	4,565 (20.3)	7,425 (33.0)	14,820 (65.9)
Reduction factor for steel strength in shear for seismic[3]	ϕ	-	0.65		0.60

For SI: 1 inch = 25.4 mm; 1 ksi = 6.894 N/mm²; 1 lbf = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable, shall apply.
2. Installation must comply with the manufacturer's published installation instructions.
3. The tabulated value of ϕ for steel strength applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ for steel strength must be determined in accordance with ACI 318-11 D.4.3. The anchors are ductile steel elements as defined in ACI 318-14 2.3 or ACI 318-11 D.1, as applicable, except for the 3/4-inch-diameter which is considered a brittle steel element for the purposes of design.
4. The tabulated value of ϕ for concrete breakout strength applies when both the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, for Condition B are satisfied. If the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, for Condition A are satisfied, the appropriate value of ϕ for concrete breakout strength must be determined in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ for concrete breakout strength must be determined in accordance with ACI 318-11 D.4.4.
5. The tabulated value of for pryout strength applies if the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ for pryout strength must be determined in accordance with ACI 318-11 D.4.4, for condition B.
6. Tabulated values for steel strength in shear must be used for design. The tabulated values for the shear stress area are listed conservatively and the results for the steel strength will be more conservative when using ACI 318-14 Eq. 17.5.1.2b or ACI 318-11 Eq. D-29, as applicable.
7. Anchors are permitted to be used in lightweight concrete provided the modification factor λ_a equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n and V_n. λ shall be determined in accordance with the corresponding version of ACI 318.
8. Tabulated values for steel strength in shear are for seismic applications and based on test results in accordance with ACI 355.2, Section 9.6.

STRENGTH DESIGN PERFORMANCE DATA

Factored design strength ΦNn and ΦVn
Calculated in accordance with ACI 318-14 Chapter 17
Tested to the International Building Code

STRENGTH DESIGN SD TABLES

Tension and Shear Design Strengths for Power-Bolt+ in Cracked Concrete[1,2,3,4,5,6]

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ΦNn Tension (lbs.)	ΦVn Shear (lbs.)	ΦNn Tension (lbs.)	ΦVn Shear (lbs.)	ΦNn Tension (lbs.)	ΦVn Shear (lbs.)	ΦNn Tension (lbs.)	ΦVn Shear (lbs.)	ΦNn Tension (lbs.)	ΦVn Shear (lbs.)
1/2	3-1/4	2,350	2,905	2,575	3,185	2,970	3,675	3,640	3,905	4,205	3,905
5/8	3-3/4	2,870	2,780	3,145	3,045	3,630	3,515	4,450	4,305	5,135	4,970
3/4	4-3/8	3,620	4,210	3,965	4,615	4,575	5,330	5,605	6,525	6,470	7,535

□ - Concrete Breakout Strength Controls ■ - Steel Strength Controls

Tension and Shear Design Strengths for Power-Bolt+ in Uncracked Concrete[1,2,3,4,5,6]

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength, f'c (psi)									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ΦNn Tension (lbs.)	ΦVn Shear (lbs.)	ΦNn Tension (lbs.)	ΦVn Shear (lbs.)	ΦNn Tension (lbs.)	ΦVn Shear (lbs.)	ΦNn Tension (lbs.)	ΦVn Shear (lbs.)	ΦNn Tension (lbs.)	ΦVn Shear (lbs.)
1/2	3-1/4	3,730	3,905	4,090	3,905	4,720	3,905	5,780	3,905	6,675	3,905
5/8	3-3/4	4,560	3,890	4,995	4,260	5,770	4,920	7,065	6,025	8,155	6,960
3/4	4-3/8	5,105	5,895	5,595	6,460	6,460	7,460	7,910	8,690	9,135	8,690

□ - Concrete Breakout Strength Controls ■ - Steel Strength Controls

1- Tabular values are provided for illustration and are applicable for single anchors installed in normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
  - c_{a1} is greater than or equal to the critical edge distance, c_{ac} (table values based on $c_{a1} = c_{ac}$).
  - c_{a2} is greater than or equal to 1.5 times c_{a1}.

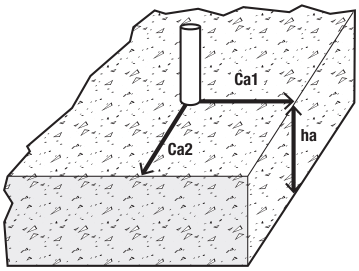
2- Calculations were performed according to ACI 318-14- Chapter 17. The load level corresponding to the controlling failure mode is listed. (e.g. For tension: steel, concrete breakout and pullout; For shear: steel, concrete breakout and pryout). Furthermore, the capacities for concrete breakout strength in tension and pryout strength in shear are calculated using the effective embedment values, h_{ef}, for the selected anchors as noted in the design information tables. Please also reference the installation specifications for more information.

3- Strength reduction factors (ø) were based on ACI 318-14 Section 5.3 for load combinations. Condition B is assumed.

4- Tabular values are permitted for static loads only, seismic loading is not considered with these tables.

5- For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14- Chapter 17.

6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318-14- Chapter 17. For other design conditions including seismic considerations please see ACI 318-14- Chapter 17.



ORDERING INFORMATION

Power-Bolt+ (Carbon Steel Finished Hex Head)

Cat. No.	Anchor Size	Maximum Fixture Thickness	Box Qty.	Carton Qty.	Suggested ANSI Carbide Drill Bit Cat. No.				
					Full Head SDS-Plus	SDS-Plus	SDS-Max	Hollow Bit SDS-Plus	Hollow Bit SDS-Max
6902SD	1/4" X 1-3/4"	1/2"	100	600	-	-	-	-	-
6906SD	1/4" X 3"	1-3/4"	100	600	-	-	-	-	-
6911SD	3/8" x 1-7/8"	1/4"	50	300	DW5527	DW5427	-	-	-
6910SD	3/8" X 2-1/4"	1/4"	50	300	DW5527	DW5427	-	-	-
6913SD	3/8" X 3"	1"	50	300	DW5527	DW5427	-	-	-
6914SD	3/8" X 3-1/2"	1-1/2"	50	300	DW5527	DW5427	-	-	-
6916SD	3/8" X 4"	2"	50	300	DW5527	DW5427	-	-	-
6930SD	1/2" x 2-3/4"	1/4"	50	200	DW5537	DW5429	DW5803	DWA54012	-
6932SD	1/2" x 3-1/2"	1/4"	50	200	DW5537	DW5429	DW5803	DWA54012	-
6934SD	1/2" x 4-3/4"	1-1/2"	25	150	DW5537	DW5429	DW5803	DWA54012	-
6936SD	1/2" x 5-3/4"	2-1/2"	25	150	DW5537	DW5429	DW5803	DWA54012	-
6940SD	5/8" x 3"	1/4"	20	120	-	DW5446	DW5806	DWA54058	DWA54058
6942SD	5/8" x 4"	1/4"	15	90	-	DW5446	DW5806	DWA54058	DWA54058
6944SD	5/8" x 5"	1-1/4"	15	90	-	DW5446	DW5806	DWA54058	DWA58058
6945SD	5/8" x 6"	2-1/4"	15	90	-	DW5446	DW5806	DWA54058	DWA58058
6947SD	5/8" x 8-1/2"	4-3/4"	10	40	-	DW5447	DW5809	DWA54058	DWA58058
6950SD	3/4" x 3-1/4"	1/4"	15	90	-	DW5453	DW5809	DWA54034	DWA54034
6952SD	3/4" x 4-1/2"	1-1/2"	10	60	-	DW5453	DW5809	DWA54034	DWA54034
6954SD	3/4" x 5-1/4"	7/8"	10	60	-	DW5453	DW5809	DWA54034	DWA54034
6956SD	3/4" x 7-1/4"	2-7/8"	10	40	-	DW5453	DW5809	DWA54034	DWA54034
6957SD	3/4" x 8-1/4"	3-7/8"	10	40	-	DW5455	DW5809	DWA54034	DWA54034

Shaded catalog numbers denote sizes which are less than the minimum standard anchor length for strength design.
The published size includes the diameter and the length which is measured from below the washer to the end of the anchor.
A manual hand pump is available (Cat. No. 08280)
Hollow drill bits must be used with a dust extraction vacuum (Cat. No. DW012)

GENERAL INFORMATION

POWER-BOLT®

Heavy-Duty Sleeve Anchor

PRODUCT DESCRIPTION

The Power-Bolt anchor, 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 engages the base material deep in the anchor hole. The bolt and cone remain locked together which resists loosening under 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 sleeve making it suitable 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

- Column Base Plates and Mechanical Equipment
- Dock Bumpers and Support Ledgers
- Racking and Railing Attachments

FEATURE AND BENEFITS

+ High load capacity
+ Two-level expansion mechanism
+ Internal high strength bolt is removable and reusable
+ Compression zone in sleeve clamps fixture to the base material
+ Low profile finished head design

APPROVALS AND LISTINGS

- Tested in accordance with ASTM E488

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors, and 05 05 19 - Post-Installed Concrete Anchors. Expansion anchors shall be Power-Bolt as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

HEX HEAD
POWER-BOLT ASSEMBLY

FLAT HEAD
POWER-BOLT ASSEMBLY

HEAD STYLES

- Finished Hex Head
- Flat Head

ANCHOR MATERIALS

- Type 304 Stainless Steel (Hex Head)
- Zinc Plated Carbon Steel (Flat Head)

ANCHOR SIZE RANGE (TYP.)

- 1/4" diameter through 5/8" diameter

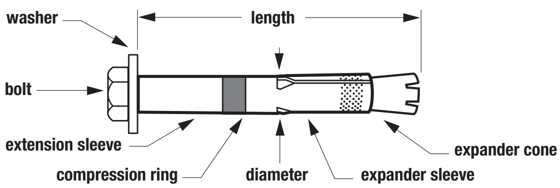
SUITABLE BASE MATERIALS

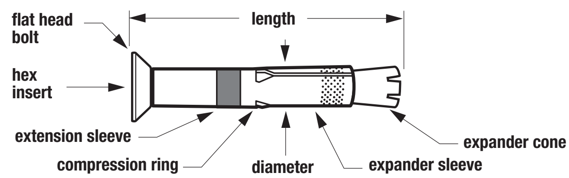
- Normal-weight concrete
- Lightweight concrete
- Grouted Concrete Masonry (CMU)
- Hollow CMU
- Brick Masonry
- Stone

MATERIAL SPECIFICATIONS

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

** Manufactured with a minimum yield strength of 65,000 psi. Stainless steel anchor components are passivated. The stainless steel expander cone is zinc plated.





INSTALLATION SPECIFICATIONS

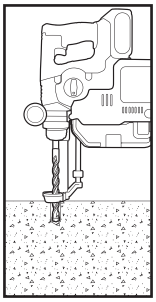
Carbon Steel Flat Head Power-Bolt (80°– 82° head)

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 Bolt Torque, T_{max} (ft-lbs)	25	45	100

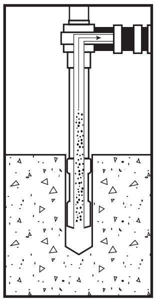
Stainless Steel Hex Head Power-Bolt

Dimension	Anchor Diameter, d		
	1/4"	3/8"	1/2"
ANSI Drill Bit Size, d_{bit} (in.)	1/4	3/8	1/2
Fixture Clearance Hole, d_h (in.)	5/16	7/16	9/16
Internal Bolt Size (UNC)	10-24	5/16-18	3/8-16
Head Height (in.)	7/64	13/64	15/64
Washer O.D., d_w (in.)	1/2	13/16	1
Wrench Size (in.)	5/16	1/2	9/16
Max Bolt Torque, T_{max} (ft-lbs)	3	12	25

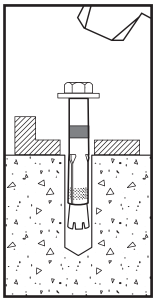
Installation Procedure



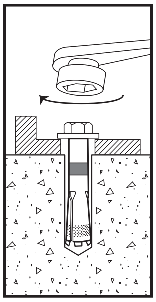
Using the proper diameter bit, drill a hole into the base material to a depth of at least 1/2" or one anchor diameter deeper than the embedment required. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15.



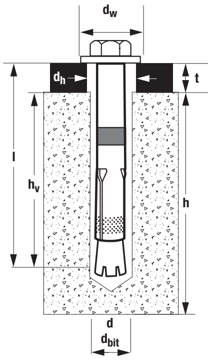
Step 2
Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling. Do not modify the anchor or advance the bolt in the anchor assembly prior to installation.

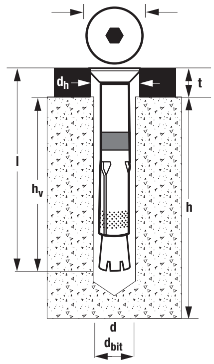


Step 3
Drive the anchor through the fixture into the anchor hole until the bolt head is firmly seated against the fixture. Be sure the anchor is driven to the required embedment depth.



Step 4
Tighten the anchor by turning the head 3 to 4 turns past finger tight.





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 $1.5h_v$ or 3" whichever is greater
h_v = Minimum embedment depth
l = Overall length of anchor
t = Fixture thickness

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"

PERFORMANCE DATA

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

Anchor Diameter d 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)		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	1-1/4 (31.8)	945 (4.2)	1655 (7.4)	1105 (4.9)	1680 (7.5)	1265 (5.6)	1705 (7.6)	1330 (5.9)	1705 (7.6)
	1-3/4 (44.5)	1120 (5.0)	1655 (7.4)	1240 (5.5)	1845 (8.2)	1360 (6.0)	2030 (9.0)	1490 (6.6)	2030 (9.0)
	2-1/2 (63.5)	1505 (6.7)	1655 (7.4)	1550 (6.9)	2185 (9.7)	1600 (7.1)	2710 (12.1)	1680 (7.5)	2710 (12.1)
3/8	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	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	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)

1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.

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

Anchor Diameter d 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)		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	1-1/4 (31.8)	235 (1.0)	415 (1.8)	275 (1.2)	420 (1.9)	315 (1.4)	425 (1.9)	335 (1.5)	425 (1.9)
	1-3/4 (44.5)	280 (1.2)	415 (1.8)	310 (1.4)	460 (2.0)	340 (1.5)	510 (2.3)	375 (1.7)	510 (2.3)
	2-1/2 (63.5)	375 (1.7)	415 (1.8)	390 (1.7)	545 (2.4)	400 (1.8)	680 (3.0)	420 (1.9)	680 (3.0)
3/8	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	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	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)

1. Allowable load capacities listed are calculated using and applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.
2. Allowable load capacities are multiplied by reduction when anchor spacing or edge distances are less than critical distances.
3. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.

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

Anchor Diameter d in.	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f´c)							
		3,000 psi (20.7 MPa)				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	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	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	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	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)

1. Tabulated load values are for anchors installed in sand-lightweight concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities listed are calculated using and applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.
3. Linear interpolation may be used to determine ultimate and allowable loads for intermediate embedments and compressive strengths.

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

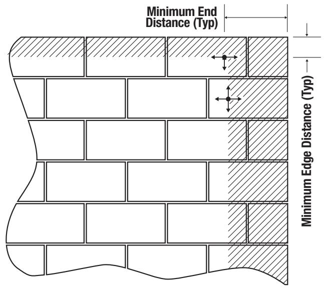
Anchor Diameter d in.	Minimum Embedment Depth h_v in. (mm)	Lightweight Concrete over minimum 20 Gage Metal Deck, f´c ≥ 3,000 (20.7 MPa)							
		Minimum 1-1/2" Wide Deck				Minimum 4-1/2" Wide Deck			
		Ultimate Load		Allowable Load		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4	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	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	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	2-3/4 (88.9)	-	-	-	-	2,000 (9.0)	4,440 (20.0)	500 (2.3)	1,110 (5.0)

1. Tabulated load values are for anchors installed in sand-lightweight concrete over steel deck. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities listed are calculated using and applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.
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.
4. Anchors are permitted to be installed in the lower or upper flute of the steel deck provided the proper installation procedures are maintained.

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

Anchor Diameter d in.	Minimum Embed. Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	f´m ≥ 1,500 psi (10.4 MPa)			
				Ultimate Load		Allowable Load	
				Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4	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	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	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	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)

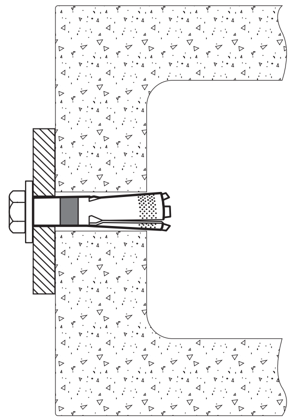
1. Tabulated load values are for carbon steel and stainless steel anchors installed in minimum 6-inch wide, minimum Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry cells may be grouted. Masonry compressive strength must be at the specified minimum at the time of installation (f'm ≥ 1,500 psi).
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.
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 d in.	Minimum Embed. Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	f´m ≥ 1,500 psi (10.4 MPa)			
				Ultimate Load		Allowable Load	
				Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4	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	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	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)

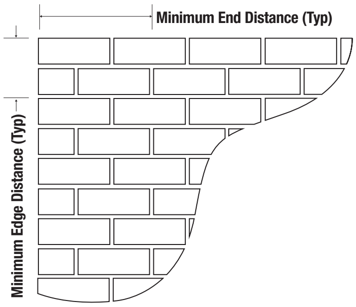
1. Tabulated load values are for carbon steel and stainless steel anchors installed in minimum 6-inch wide, minimum Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry cells may be grouted. Masonry compressive strength must be at the specified minimum at the time of installation (f'm ≥ 1,500 psi).
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.
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 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.
5. A suitable anchor length must be selected which included consideration of fixture to engage the base material at the minimum embedment depth when anchoring into hollow concrete masonry.
(e.g. attachment thickness + embedment + one half inch = suitable anchor length)



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

Anchor Dia. d in.	Min. Embed. Depth h_v in. (mm)	Min. Edge Distance	Min. End Distance	Min. Spacing Distance	Structural Brick Masonry f´m ≥ 1,500 psi (10.4 MPa)			
					Ultimate Load		Allowable Load	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4	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	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	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	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)

1. Tabulated load values are for anchors installed in multiple wythe, minimum Grade SW, solid clay brick masonry walls conforming to ASTM C 62. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation (f'm ≥ 1,500 psi).
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.
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 (ALLOWABLE STRESS DESIGN)

Combined Loading

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

$$\left(\frac{Nu}{Nn}\right) + \left(\frac{Vu}{Vn}\right) \leq 1$$

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	$S_{cr} = 2.0h_v$	$F_{NS} = F_{VS} = 1.0$	$S_{min} = h_v$	$F_{NS} = F_{VS} = 0.50$
Edge Distance (c)	Tension	$C_{cr} = 12d$	$F_{NC} = 1.0$	$C_{min} = 5d$	$F_{NC} = 0.70$
	Shear	$C_{cr} = 12d$	$F_{VC} = 1.0$	$C_{min} = 5d$	$F_{VC} = 0.35$

Anchor Installed in Structural 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	$S_{cr} = 2.0h_v$	$F_{NS} = F_{VS} = 1.0$	$S_{min} = h_v$	$F_{NS} = F_{VS} = 0.50$
Edge Distance (c)	Tension	$C_{cr} = 12d$	$F_{NC} = 1.0$	$C_{min} = 5d$	$F_{NC} = 0.80$
	Shear	$C_{cr} = 12d$	$F_{VC} = 1.0$	$C_{min} = 5d$	$F_{VC} = 0.40$

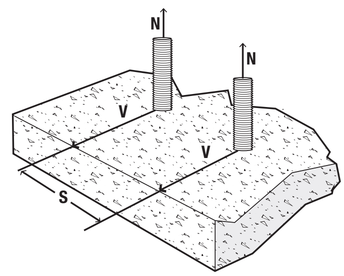
1. Allowable load values found in the performance data tables are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances. Linear interpolation is allowed for intermediate anchor spacing and edge distances between critical and minimum distances. When an anchor is affected by both reduced spacing and edge distance, the spacing and edge reduction factors must be combined (multiplied). Multiple reduction factors for anchor spacing and edge distance may be required depending on the anchor group configuration.

Load Adjustment Factors for Normal-Weight Concrete

Spacing, Tension (F_{NS}) & Shear (F_{VS})												
Dia. (in.)	**1/4**			**3/8**			**1/2**			**5/8**		
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**
s_{cr} (in.)	**2-1/2**	**3-1/2**	**5**	**4**	**5**	**7**	**5**	**7**	**10**	**5-1/2**	**8**	**12**
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**
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	1.00	0.79	0.55	0.69	0.55	-	0.55	-	-	0.50	-	-
3	1.00	0.86	0.60	0.75	0.60	-	0.60	-	-	0.55	-	-
3-1/2	1.00	1.00	0.70	0.88	0.70	0.50	0.70	0.50	-	0.64	-	-
4	1.00	1.00	0.80	1.00	0.80	0.57	0.80	0.57	-	0.73	0.50	-
4-1/2	1.00	1.00	0.90	1.00	0.90	0.64	0.90	0.64	-	0.82	0.56	-
5	1.00	1.00	1.00	1.00	1.00	0.71	1.00	0.71	0.50	0.91	0.63	-
5-1/2	1.00	1.00	1.00	1.00	1.00	0.79	1.00	0.79	0.55	1.00	0.69	-
6	1.00	1.00	1.00	1.00	1.00	0.86	1.00	0.86	0.60	1.00	0.75	0.50
7	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.70	1.00	0.88	0.58
8	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.80	1.00	1.00	0.67
9	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	1.00	1.00	0.75
10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.83
12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	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.

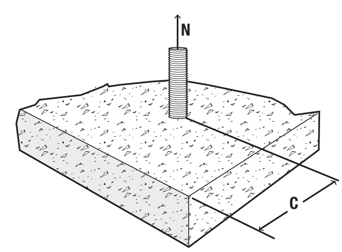
Minimum spacing (s_{min}) is equal to 1 embedment depth (h_v) at which the anchor achieves 50% of load.



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

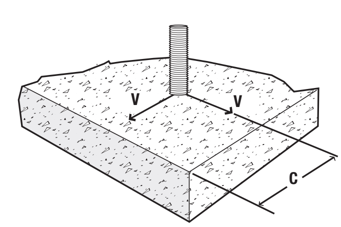
Minimum edge distance (c_{min}) is equal to 5 anchor diameters (5d) at which the anchor achieves 70% of load.



Edge Distance, Shear (F_{VC})				
Dia. (in.)	**1/4**	**3/8**	**1/2**	**5/8**
c_{cr} (in.)	**3**	**4-1/2**	**6**	**7-1/2**
c_{min} (in.)	**1-1/4**	**1-7/8**	**2-1/2**	**3-1/8**
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	1.00	0.66	0.47	0.35
3-3/4	1.00	0.81	0.58	0.44
4	1.00	0.88	0.63	0.48
4-1/2	1.00	1.00	0.72	0.55
5	1.00	1.00	0.81	0.63
6	1.00	1.00	1.00	0.78
6-1/4	1.00	1.00	1.00	0.81
7	1.00	1.00	1.00	0.93
7-1/2	1.00	1.00	1.00	1.00
8	1.00	1.00	1.00	1.00
9	1.00	1.00	1.00	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 35% of load.

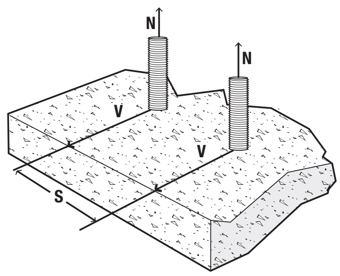


Load Adjustment Factors for Lightweight Concrete

Spacing, Tension (F_{NS}) & Shear (F_{VS})												
Dia. (in.)	**1/4**			**3/8**			**1/2**			**5/8**		
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**
s_{cr} (in.)	**2-1/2**	**3-1/2**	**5**	**4**	**5**	**7**	**5**	**7**	**10**	**5-1/2**	**8**	**12**
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**
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	1.00	0.79	0.55	0.69	0.55	-	0.55	-	-	0.50	-	-
3	1.00	0.86	0.60	0.75	0.60	-	0.60	-	-	0.55	-	-
3-1/2	1.00	1.00	0.70	0.88	0.70	0.50	0.70	0.50	-	0.64	-	-
4	1.00	1.00	0.80	1.00	0.80	0.57	0.80	0.57	-	0.73	0.50	-
4-1/2	1.00	1.00	0.90	1.00	0.90	0.64	0.90	0.64	-	0.82	0.56	-
5	1.00	1.00	1.00	1.00	1.00	0.71	1.00	0.71	0.50	0.91	0.63	-
5-1/2	1.00	1.00	1.00	1.00	1.00	0.79	1.00	0.79	0.55	1.00	0.69	-
6	1.00	1.00	1.00	1.00	1.00	0.86	1.00	0.86	0.60	1.00	0.75	0.50
7	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.70	1.00	0.88	0.58
8	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.80	1.00	1.00	0.67
9	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	1.00	1.00	0.75
10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.83
12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	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.

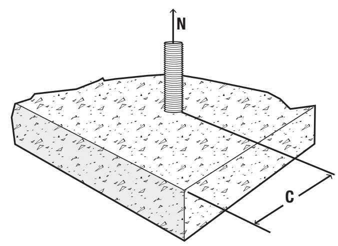
Minimum spacing (s_{min}) is equal to 1 embedment depth (h_v) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_{NC})				
Dia. (in.)	**1/4**	**3/8**	**1/2**	**5/8**
c_{cr} (in.)	**3**	**4-1/2**	**6**	**7-1/2**
c_{min} (in.)	**1-1/4**	**1-7/8**	**2-1/2**	**3-1/8**
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	1.00	0.90	0.84	0.80
3-3/4	1.00	0.94	0.87	0.83
4	1.00	0.96	0.89	0.84
4-1/2	1.00	1.00	0.91	0.86
5	1.00	1.00	0.94	0.89
6	1.00	1.00	1.00	0.93
6-1/4	1.00	1.00	1.00	0.94
7	1.00	1.00	1.00	0.98
7-1/2	1.00	1.00	1.00	1.00
8	1.00	1.00	1.00	1.00
9	1.00	1.00	1.00	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.

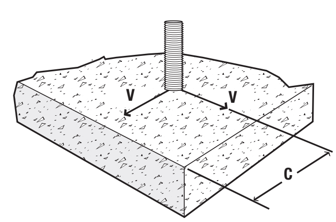
Minimum edge distance (c_{min}) is equal to 5 anchor diameters (5d) at which the anchor achieves 80% of load.



Edge Distance, Shear (F_{VC})				
Dia. (in.)	**1/4**	**3/8**	**1/2**	**5/8**
c_{cr} (in.)	**3**	**4-1/2**	**6**	**7-1/2**
c_{min} (in.)	**1-1/4**	**1-7/8**	**2-1/2**	**3-1/8**
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	1.00	0.69	0.51	0.40
3-3/4	1.00	0.83	0.61	0.49
4	1.00	0.89	0.66	0.52
4-1/2	1.00	1.00	0.74	0.59
5	1.00	1.00	0.83	0.66
6	1.00	1.00	1.00	0.79
6-1/4	1.00	1.00	1.00	0.83
7	1.00	1.00	1.00	0.93
7-1/2	1.00	1.00	1.00	1.00
8	1.00	1.00	1.00	1.00
9	1.00	1.00	1.00	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

Stainless Steel Hex Head Power-Bolt

Cat.No.	Anchor Size	Drill Dia.	Min. Embed.	Std. Box	Std. Carton	Wt./100
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

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

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.

GENERAL INFORMATION

PB-PRO™

Heavy Duty Sleeve Anchor

PRODUCT DESCRIPTION

The PB-PRO is a large diameter torque controlled, heavy duty sleeve anchor designed for concrete applications. Suitable base materials included normal-weight concrete. The anchor is manufactured with a zinc plated carbon steel bolt, sleeve, cone and expansion clip and plastic compression ring. The PB-PRO has a low profile finished hex head.

GENERAL APPLICATIONS AND USES

- Structural connections, i.e., beam and column anchorage
- Safety-related attachments and tension zone applications
- Interior applications / low level corrosion environment
- Heavy duty applications

FEATURES AND BENEFITS

+ Consistent performance in high and low strength concrete
+ High shear load capacity
+ Patented plastic retainer nut prevents loosening components during transport as well as spinning in the drill hole
+ Compression zone in sleeve clamps fixture to the base material

APPROVALS AND LISTINGS

- Tested in accordance with ASTM E488

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchoring and 05 05 19 - Post Installed Concrete Anchors
Expansion anchors shall be PB-PRO as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

PB-PRO ASSEMBLY

HEAD STYLES

- Finished Hex Head

ANCHOR MATERIALS

- Zinc plated carbon steel bolt, washer, cone, sleeve, and expansion clip; assembled with a plastic compression ring and retainer nut

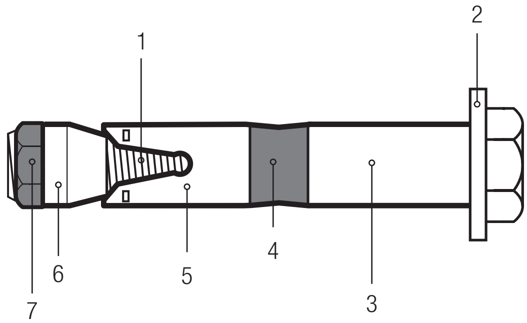
ANCHOR SIZE RANGE (TYP.)

- 16mm through 20mm

SUITABLE BASE MATERIALS

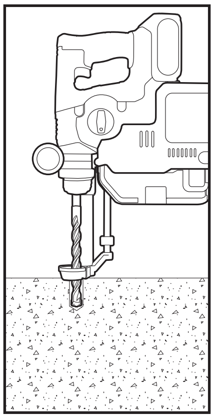
- Normal-weight concrete

MATERIAL SPECIFICATION

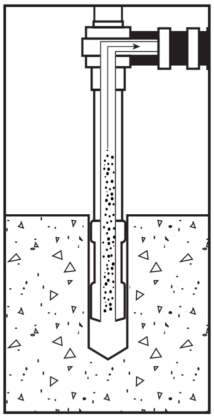


Part No.	Designation	Material	Protection
1	Threaded bolt	Medium Carbon Steel (Grade 8.8)	Zinc plated (5 μm)
2	Washer	Steel Property class 8.8 acc. to EN ISO 7093	Zinc plated (5 μm)
3	Distance sleeve	Medium Carbon Steel	Zinc plated (5 μm)
4	Compression ring	Plastic (HDPE)	-
5	Expansion sleeve	Medium Carbon Steel	Zinc plated (5 μm)
6	Cone nut	Medium Carbon Steel	Zinc plated (5 μm)
7	Retainer nut	Plastic (HDPE)	-

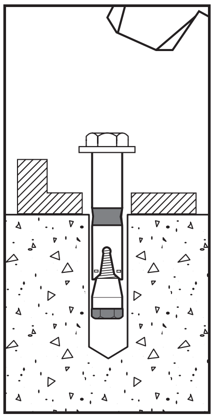
INSTALLATION INSTRUCTIONS



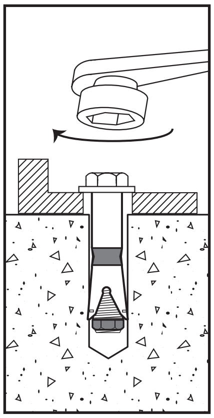
1. Using the proper drill bit size, drill a hole into the base material to the required depth.



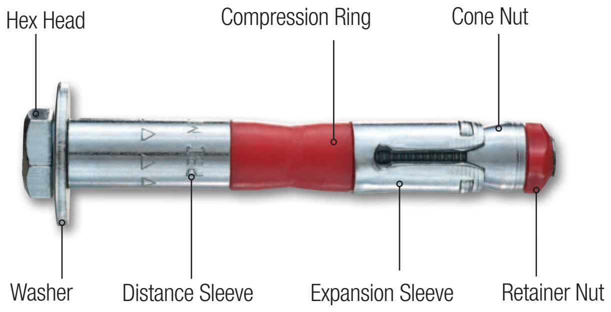
2. Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



3. Drive the anchor into the hole through the fixture at least to the minimum required embedment depth.



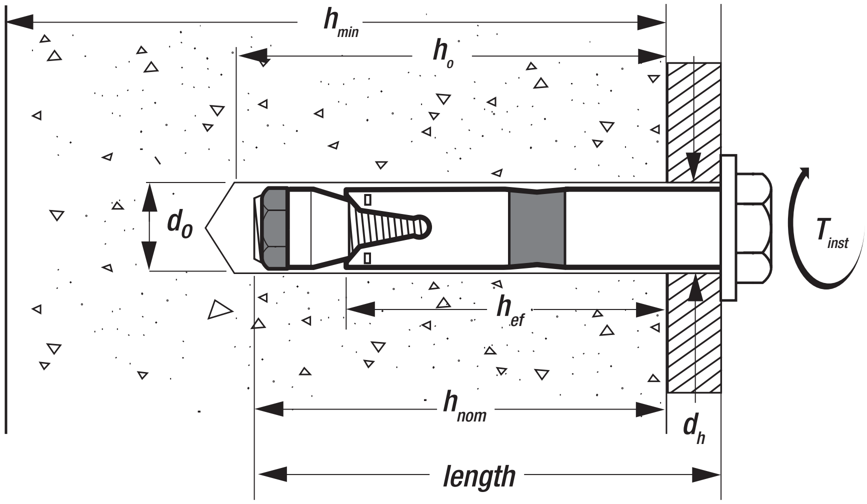
4. Tighten the anchor with a torque wrench by applying the required installation torque Tinst.



INSTALLATION INFORMATION

INSTALLATION DATA

Description	Notation	Unit	PB-PRO	
			M16	M20
Anchor diameter	d	mm (in)	24 (0.94)	28 (1.10)
Head height	-	mm (in)	10.0 (0.39)	12.5 (0.49)
Washer outside diameter	-	mm (in)	50 (1.97)	60 (236)
Internal bolt diameter	-	mm (in)	16 (0.63)	20 (0.79)
Minimum specified yield strength	f_y	MPa (ksi)	640 (92.8)	640 (92.8)
Minimum specified ultimate steel strength	f_{uta}	MPa (ksi)	800 (116)	800 (116)
Nominal drill bit diameter	d_{bit}	mm (in)	24 (0.94)	28 (1.10)
Diameter of hole clearance in fixture	d_h	mm (in)	26 (1.02)	31 (1.22)
Minimum nominal embedment depth	h_{nom}	mm (in)	128 (5.04)	160 (6.30)
Effective embedment depth	h_{ef}	mm (in)	100 (3.94)	125 (4.92)
Minimum hole depth	h_o	mm (in)	155 (6.10)	180 (7.09)
Minimum member thickness	h_{min}	mm (in)	200 (7.87)	250 (9.84)
Minimum spacing	s_{min}	mm (in)	130 (5.12)	140 (5.51)
Corresponding edge distance at s_{min}	for $c \geq$	mm (in)	240 (9.45)	300 (11.81)
Minimum edge distance	c_{min}	mm (in)	140 (5.51)	140 (5.51)
Corresponding spacing at c_{min}	for $s \geq$	mm (in)	230 (9.06)	300 (11.81)
Installation torque	T_{inst}	Nm (ft-lb)	130 (96)	200 (148)
Torque wrench socket size	-	mm	24	28



PERFORMANCE DATA

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

Nominal Anchor Diameter d mm	Minimum Nominal Embed. Depth mm (in)	Minimum Concrete Compressive Strength									
		2,500 psi		3,000 psi		4,000 psi		6,000 psi		8,000 psi	
		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)
M16	128 (5.04)	9,135 (40.9)	16,505 (74.0)	10,005 (44.8)	18,080 (81.0)	11,555 (51.8)	20,880 (93.6)	14,145 (63.4)	24,600 (110.3)	16,337 (73.2)	24,600 (110.3)
M20	160 (6.30)	11,515 (51.6)	21,780 (97.6)	12,615 (56.5)	23,860 (106.9)	14,565 (65.3)	27,555 (123.5)	17,840 (80.0)	31,280 (140.2)	20,600 (92.3)	31,280 (140.2)

1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.

Allowable Load Capacities for PB-PRO in Normal-Weight Concrete[1,2,3]

ALLOWABLE STRESS DESIGN ASD

Nominal Anchor Diameter d mm	Minimum Nominal Embed. Depth mm (in)	Minimum Concrete Compressive Strength									
		2,500 psi		3,000 psi		4,000 psi		6,000 psi		8,000 psi	
		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)
M16	128 (5.04)	2,285 (10.2)	4,125 (18.5)	2,500 (11.2)	4,520 (20.3)	2,890 (13.0)	5,220 (23.4)	3,535 (15.8)	6,150 (27.6)	4,085 (18.3)	6,150 (27.6)
M20	160 (6.30)	2,880 (12.9)	5,445 (24.4)	3,155 (14.1)	5,965 (26.7)	3,640 (16.3)	6,890 (30.9)	4,460 (20.0)	7,820 (35.1)	5,150 (23.1)	7,820 (35.1)

1. Allowable load capacities listed are calculated using and applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.
2. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.
3. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.

Spacing Reduction Factors - Tension (F_{NS})

Nominal Anchor Size		M16	M20
Minimum Spacing s_{min} (mm)		130	140
Nominal Embedment h_{nom} (mm)		128	160
Spacing Distance (mm)	130	0.84	-
	140	0.85	0.80
	150	0.87	0.81
	175	0.91	0.84
	200	0.95	0.87
	225	0.99	0.90
	250	1.00	0.94
	275	1.00	0.97
	300	1.00	1.00

Edge Distance Reduction Factors - Tension (F_{NC})

Nominal Anchor Size		M16	M20
Minimum Edge Distance c_{min} (mm)		140	140
Nominal Embedment h_{nom} (mm)		128	160
Edge Distance (mm)	140	0.58	-
	150	0.63	0.50
	160	0.67	0.53
	175	0.73	0.58
	200	0.83	0.67
	225	0.94	0.75
	250	1.00	0.83
	275	1.00	0.92
	300	1.00	1.00

Spacing Reduction Factors - Shear (F_{VS})

Nominal Anchor Size		M16	M20
Minimum Spacing s_{min} (mm)		130	140
Nominal Embedment h_{nom} (mm)		128	160
Spacing Distance (mm)	130	0.86	-
	140	0.87	0.84
	150	0.88	0.85
	175	0.90	0.87
	200	0.92	0.88
	225	0.94	0.90
	250	0.96	0.92
	275	0.98	0.93
	300	1.00	0.95
	325	1.00	0.97
	350	1.00	0.98
	375	1.00	1.00

Edge Distance Reduction Factors - Shear (F_{VC})

Nominal Anchor Size		M16	M20
Minimum Edge Distance c_{min} (mm)		140	140
Nominal Embedment h_{nom} (mm)		128	160
Edge Distance (mm)	140	0.47	0.37
	150	0.50	0.40
	160	0.53	0.43
	175	0.58	0.47
	200	0.67	0.53
	225	0.75	0.60
	250	0.83	0.67
	275	0.92	0.73
	300	1.00	0.80
	325	1.00	0.87
	350	1.00	0.93
	375	1.00	1.00

ORDERING INFORMATION

Carbon Steel Hex Head PB-PRO

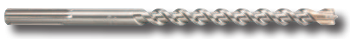
Cat No.	Size (Diameter x Length)	Drill Dia	Length*	Std Box	Std Ctn
PFM1220650	PB-PRO 24-M16 x 148mm	24mm	148mm	5	20
PFM1220700	PB-PRO 24-M16 x 178mm	24mm	178mm	5	20
PFM1220750	PB-PRO 28-M20 x 170mm	28mm	170mm	5	15
PFM1220800	PB-PRO 28-M20 x 190mm	28mm	190mm	5	10
PFM1220850	PB-PRO 28-M20 x 220mm	28mm	220mm	5	10

*Length measured from underneath the washer to the end of the anchor.

PB-PRO ACCESSORIES

Metric Drill Bits
SDS-MAX Carbide Drill Bits – 4 Cutter

Cat No.	Size	Drill Dia	Length	Useable Length	Std. Tube
PPA1330220	M24x340x200	24mm	340mm	200mm	1
PPA1330290	M28x380x250	28mm	380mm	250mm	1



Installation Accessories

Cat. No.	Description	Box Qty
08280	Hand pump / dust blower	1

GENERAL INFORMATION

LOK-BOLT AS®

Sleeve Anchor

PRODUCT DESCRIPTION

The Lok-Bolt AS is an all-steel pre-assembled single unit sleeve anchor which is designed for use in concrete or masonry base materials. The anchors are available in multiple head styles for multiple applications and a finished appearance. Anchor extender sleeves can be added to create longer lengths.

GENERAL APPLICATIONS AND USES

- Door and window frame installations
- Masonry applications
- Electrical / Mechanical applications
- Mounting fixtures on walls
- General purpose anchoring

FEATURES AND BENEFITS

+ Variety of head styles, lengths and sizes
+ All steel component design
+ Preassembled anchor for immediate installation
+ Sleeve design keeps anchor centered in hole
+ Sleeve has 360° contact area for even stress distribution
+ Versatile – can be used for solid and hollow concrete or masonry applications
+ Designed to allow fixture to draw snug against the base material during tightening

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors, and 05 05 19 - Post-Installed Concrete Anchors Expansion anchors shall be Lok-Bolt AS as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

LOK-BOLT AS
ASSEMBLY

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 through 3/4" diameter

SUITABLE BASE MATERIALS

- Normal-Weight Concrete
- Grouted Concrete Masonry (CMU)
- Hollow Concrete Masonry (CMU)
- Brick Masonry

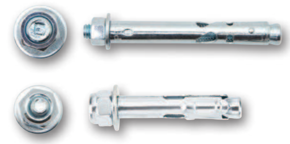
MATERIAL SPECIFICATIONS

Anchor Component	Carbon Steel Version	Stainless Steel Version
Plow-Bolt	AISI 1010/1018	Type 304 Stainless Steel
Expansion Sleeve	AISI 1010	Type 304 Stainless Steel
Extender	AISI 1010	N/A
Zinc Plating	ASTM B 633, SC1, Type III (Fe/Zn5)	N/A

INSTALLATION SPECIFICATIONS

Acorn Nut and Hex Head Lok-Bolt AS

Dimension	Nominal 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	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 AS

Dimension	Nominal Anchor Diameter, 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
Phillips Driver Size	#3	#3	#4

Combo Flat Head Lok-Bolt AS

Dimension	Nominal Anchor Diameter, 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
Phillips Driver Size	#2	#3	#4

Rod Hanger Lok-Bolt AS

Dimension	Nominal Anchor Diameter, d		
	1/4"	5/16"	3/8"
ANSI Drill Bit Size, d_{bit} (in.)	5/16	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.)	3/8	1/2	11/16

Threshold Lok-Bolt AS

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

Tie-Wire Lok-Bolt AS

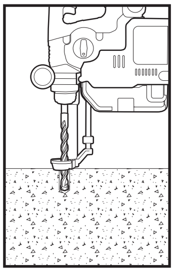
Dimension	Anchor Size, d
	5/16"
ANSI Drill Bit Size, d_{bit} (in.)	5/16
Fixture Clearance Hole, d_h (in.)	3/8
Plow Bolt Size (UNC)	1/4-20
Head Height (in.)	1-9/16
Head Width, d_{hd} (in.)	31/64

INSTALLATION INSTRUCTIONS

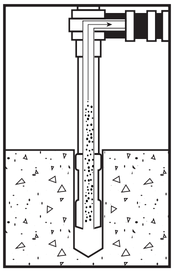
Hex/Acorn/Flat Head Round Versions

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 must meet the requirements of ANSI Standard B212.15

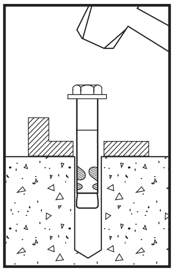


Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.

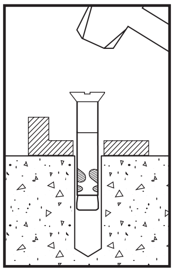


Hex Head/Acorn Nut
Position the washer on the anchor and thread on the nut.

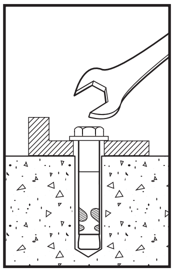
Drive the anchor through the fixture into the anchor hole until the nut and washer are firmly seated against the fixture. Be sure the anchor is driven to the required embedment depth.



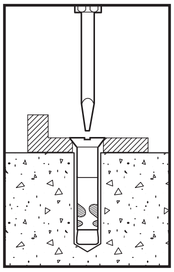
Flat Head/Round Head
Drive the anchor through the fixture until the anchor is firmly seated. Be sure the anchor is driven to the required embedment depth.



Hex Head/Acorn Nut
Tighten the anchor by turning the nut or head 3 to 5 turns past finger tight or by applying the guide installation torque from the finger tight position.



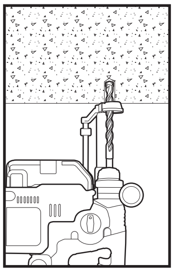
Flat Head/Round Head
Tighten the anchor by turning the head 3 to 5 turns past finger tight.



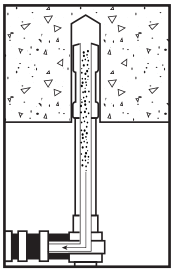
Rod Hanger Version

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.

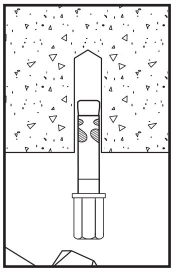
The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15



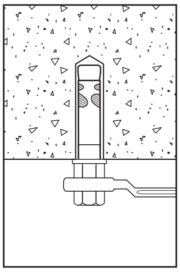
Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



Drive the anchor into the hole until the anchor is at the required embedment depth.



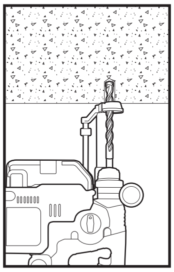
Tighten the coupler nut and washer up to the concrete surface and tighten the anchor by turning the nut 3 to 5 turns past finger tight or by applying the guide installation torque from the finger tight position.



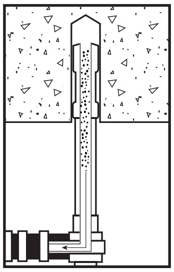
Tie-Wire Version

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.

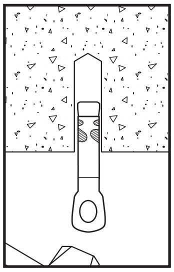
The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15



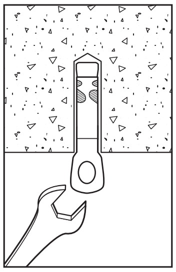
Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



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.



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



PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Carbon and Stainless Steel Lok-Bolt AS Anchors in Normal Weight Concrete[1,2,3,4]

Nominal Anchor Diameter d in.	Min. Embed. Depth h_v in.	Guide Installation Torque ft.-lbs.		Minimum Concrete Compressive Strength, f'c											
				3,000 psi				3,500 psi				4,000 psi			
				Ultimate		Allowable		Ultimate		Allowable		Ultimate		Allowable	
		Carbon	Stainless	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
1/4	1/2	2	-	225	1,000	55	250	240	1,000	60	250	260	1,000	65	250
	1	6	4	910	1,120	230	280	980	1,120	245	280	1,050	1,120	265	280
5/16	1	12	-	1,205	2,360	300	590	1,300	2,360	325	590	1,390	2,360	350	590
3/8	1-1/4	18	18	1,875	4,110	470	1,030	2,040	4,110	510	1,030	2,165	4,110	540	1,030
1/2	1-1/2	26	26	2,235	4,860	560	1,215	2,420	4,860	605	1,215	2,580	4,860	645	1,215
5/8	2	50	40	4,870	4,860	1,220	1,215	5,260	4,860	1,315	1,215	5,625	4,860	1,405	1,215
3/4	2-1/4	90	60	5,045	11,040	1,260	2,760	5,450	11,040	1,365	2,760	5,825	11,040	1,455	2,760

1. The ultimate load values listed above must be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
2. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
3. Tabulated load values are for anchors installed at a minimum spacing distance between anchors and an edge distance of 12 times the anchor diameters.
4. The embedment depth is measured from the outside surface of the concrete member to the embedded end of the anchor prior to tightening.

Ultimate and Allowable Load Capacities for Carbon and Stainless Steel Lok-Bolt AS Anchors in Hollow or Solid Concrete Masonry[1,2,3,4,5,6]

Nominal Anchor Diameter d in.	Minimum Embed. Depth h_v in.	Guide Installation Torque ft.-lbs.	Minimum Edge Dist. in.	Minimum End Dist. in.	Ultimate Loads		Allowable Loads	
					Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
1/4	1	4	3-3/4	4	800	1,140	160	225
5/16	1	8			905	1,570	180	310
3/8	1-1/4	15			1,100	1,570	220	310
1/2	1-1/2	18			1,525	1,570	305	310
5/8	1-1/2	30			2,250	1,770	450	355

1. Tabulated load values are for anchors installed in minimum 6 inch wide, Grade N, Type II, normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N, S, or M. Masonry prism compressive strength must be 1,500 psi minimum at time of installation.
2. Allowable load capacities listed are calculated using an applied safety factor of 5.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
3. A suitable anchor length must be selected which includes consideration of a fixture to engage the base material at the minimum embedment depth when anchoring into hollow concrete masonry. (e.g. attachment thickness + face shell thickness embedment + one half inch = suitable anchor length)
4. The consistence of hollow concrete block masonry base material can vary greatly. Consideration of job site testing should be given to verify conformance of base materials and anchor performance in actual conditions.
5. Tabulated load values are for anchors installed at a minimum spacing distance between anchors and an edge distance of 16 times the anchor diameters.
6. The embedment depth is measured from the outside surface of the masonry member to the embedded end of the anchor prior to tightening.

Ultimate and Allowable Load Capacties for Carbon or Stainless Steel Lok-Bolt AS Anchors in Solid Clay Brick Masonry[1,2,3,4]

Nominal Anchor Diameter d in.	Minimum Embed. Depth h_v in.	Guide Installation Torque ft.-lbs.	Minimum Edge Dist. in.	Minimum End Dist. in.	f'm ≥ 1,500 psi (10.4 MPa)			
					Ultimate		Allowable	
					Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
1/4	1	4	4	1-1/2	800	950	160	190
3/8	1-1/4	15	8	8	1,100	3,000	220	600
1/2	1-1/2	26	8	8	1,560	3,150	310	630
5/8	2	40	8	8	2,470	5,250	495	1,050

1. Tabulated load values are for anchors installed in Grade SW, multiple wythe solid clay brick masonry conforming to ASTM C 62.
2. Allowable load capacities listed are calculated using a safety factor of 5.0 or greater. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
3. Tabulated load values are for anchors installed at a minimum spacing distance between anchors and an edge distance of 16 times the anchor diameters.
4. The embedment depth is measured from the outside surface of the brick masonry member to the embedded end of the anchor prior to tightening.

ORDERING INFORMATION

Hex Nut Lok-Bolt AS

Catalog Number		Size	Drill Dia.	Std. Box	Std. Ctn.
Carbon Steel	Stainless Steel				
5005S	-	5/16" x 1-1/2"	5/16"	100	1000
5010S	-	5/16" x 2-3/8"	5/16"	100	500
5015S	6152S	3/8" x 1-7/8"	3/8"	50	500
5020S	6153S	3/8" x 3"	3/8"	50	500
5022S	-	3/8" x 4"	3/8"	50	250
5025S	6156S	1/2" x 2-1/2"	1/2"	25	250
5030S	6157S	1/2" x 3"	1/2"	25	250
5034S	6160S	1/2" x 3-3/4"	1/2"	25	125
5033S	-	1/2" x 5-1/4"	1/2"	25	125
5032S	-	1/2" x 6"	1/2"	10	100
5035S	-	5/8" x 2-1/2"	5/8"	25	125
5038S	-	5/8" x 3"	5/8"	25	125
5040S	6164S	5/8" x 4-1/4"	5/8"	10	100
5045S	-	5/8" x 5-3/4"	5/8"	10	100
5050S	-	3/4" x 2-3/4"	3/4"	10	100
5055S	-	3/4" x 4-1/4"	3/4"	10	40
5060S	-	3/4" x 6-1/4"	3/4"	10	30
5065S	-	3/4" x 8-1/4"	3/4"	10	30
The published length is measured from below the washer to the end of the anchor					

Acorn Nut Lok-Bolt AS

Catalog Number		Size	Drill Dia.	Std. Box	Std. Ctn.
Carbon Steel	Stainless Steel				
5125S	-	1/4" x 5/8"	1/4"	100	1000
5150S	6150S	1/4" x 1-3/8"	1/4"	100	1000
5175S	-	1/4" x 2-1/4"	1/4"	100	1000
The published length is measured from below the washer to the end of the anchor					

Round Head Lok-Bolt AS, Slotted

Catalog Number		Size	Drill Dia.	Std. Box	Std. Ctn.
Carbon Steel	Stainless Steel				
5205S	-	1/4" x 1-3/8"	1/4"	100	1000
5210S	6180S	1/4" x 2-1/4"	1/4"	100	1000
5215S	-	1/4" x 3"	1/4"	100	1000
5220S	-	1/4" x 3-3/4"	1/4"	100	1000
5225S	-	5/16" x 2-3/8"	5/16"	100	1000
5230S	-	5/16" x 3-3/8"	5/16"	100	500
5235S	-	3/8" x 2-3/4"	3/8"	50	500
5240S	-	3/8" x 3-3/4"	3/8"	50	250
The published length is measured from below the head to the end of the anchor					

Combo Flat Head Lok-Bolt AS

Catalog Number		Size	Drill Dia.	Std. Box	Std. Ctn.
Carbon Steel	Stainless Steel				
5305S	-	1/4" x 1-1/2"	1/4"	100	1000
5310S	6170S	1/4" x 2-1/4"	1/4"	100	1000
5315S	6172S	1/4" x 3"	1/4"	100	1000
5320S	-	1/4" x 4"	1/4"	100	500
5325S	-	1/4" x 5-1/4"	1/4"	100	500
5330S	-	5/16" x 2-1/2"	5/16"	100	1000
5340S	-	3/8" x 2-3/4"	3/8"	50	500
5345S	6174S	3/8" x 4"	3/8"	50	250
5350S	6175S	3/8" x 5"	3/8"	50	250
5360S	6176S	3/8" x 6"	3/8"	50	250
The published length is the overall length of the anchor					

Threshold Flat Head Lok-Bolt AS

Cat #	Size	Drill Dia.	Std. Box	Std. Ctn.
5500S	1/4" x 2"	1/4"	100	1000
The published length is the overall length of the anchor				

Rod Hanger Lok-Bolt AS

Cat #	Size	Drill Dia.	Std. Box	Std. Ctn.
5810S	1/4" x 1-1/2"	5/16"	50	250
5815S	3/8" x 1-7/8"	3/8"	50	250
5825S	1/2" x 2-1/4"	1/2"	25	125
The published length is measured from below the washer to the end of the anchor				

Tie-Wire Lok-Bolt AS

Cat #	Size	Drill Dia.	Std. Box	Std. Ctn.
5700S	5/16" x 2-3/8"	5/16"	100	1000
The published length is measured from below the head to the end of the anchor				

Lok-Bolt AS Extenders

Cat #	Size	Drill Dia.	Std. Box	Std. Ctn.
5684S	3/8" x 1-1/4"	3/8"	50	500

GENERAL INFORMATION

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

FEATURES AND BENEFITS

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

APPROVALS AND LISTINGS

- 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.DEWALT.com, including CalTrans listing for "Stud Mechanical Expansion Anchors"

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors and 05 05 19 - Post-Installed Concrete Anchors. Expansion Anchors shall be Set-Bolt as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

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

MECHANICAL ANCHORS

SET-BOLT™ Displacement-Controlled Expansion Anchor

INSTALLATION AND MATERIAL SPECIFICATIONS

Installation Specification

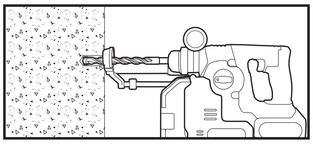
Dimension	Anchor Size, d		
	1/4"	3/8"	1/2"
ANSI Drill Bit Size, (in.)	1/4	3/8	1/2
Max. Tightening Torque, T_{max} (ft.-lbs)	5-7	15-20	22-30
Fixture Clearance Hole, (in.)	5/16	7/16	9/16
Thread Size (UNC)	1/4-20	3/8-16	1/2-13

Material Specification

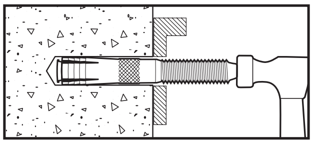
Anchor Component	Component Material
Anchor Body	AISI 12L14
Cone	AISI 12L14
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn 5)

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. Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



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.	Minimum Embedment in.	Minimum Concrete Compressive Strength (f´c)					
		2,000 psi		4,000 psi		6,000 psi	
		Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
1/4	1-3/8	1,150	1,780	1,935	2,070	2,320	2,070
3/8	1-5/8	2,605	3,705	3,600	4,185	3,850	4,185
1/2	1-7/8	3,595	5,140	5,000	6,000	5,265	6,000

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[1,2,3]

Anchor Diameter d in.	Minimum Embedment in.	Minimum Concrete Compressive Strength (f´c)					
		2,000 psi		4,000 psi		6,000 psi	
		Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
1/4	1-3/8	290	445	485	520	580	520
3/8	1-5/8	650	925	900	1,045	965	1,045
1/2	1-7/8	900	1,285	1,250	1,500	1,315	1,500

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. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Combined Loading

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

$$\left(\frac{Nu}{Nn}\right) + \left(\frac{Vu}{Vn}\right) \leq 1$$

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

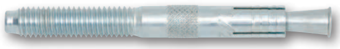
Load Adjustment Factors for Spacing and Edge Distances

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	$C_{cr} = 12d$	$F_V = 1.0$	$C_{min} = 5d$	$F_V = 0.50$

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
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
7151	1/2" x 4-1/4"	1-7/8"	1-7/8"	25	125	24



GENERAL INFORMATION

SCREW-BOLT+™

High Performance Screw Anchor

PRODUCT DESCRIPTION

The Screw-Bolt+ anchor is a one piece, heavy duty screw anchor with a finished hex head. It is simple to install, easy to identify and fully removable. The patented thread design, designed for use with standard ANSI drill bits, reduces installation torque and enhances productivity. The steel threads along the anchor body tap into the hole during installation to provide keyed engagement and allow for reduced edge and spacing distances. The Screw-Bolt+ finish is available in bright zinc-plated and mechanically galvanized. Suitable base materials include normal-weight concrete, sand-lightweight concrete, concrete over steel deck, concrete masonry and solid clay brick.

GENERAL APPLICATIONS AND USES

- Racking, shelving and material handling
- Support ledgers and sill plate attachments
- Temporary attachments
- Glazing and window attachments
- Retrofits, repairs and maintenance
- Fencing and railing
- Cracked and uncracked concrete
- Seismic and wind loading

FEATURES AND BENEFITS

+ Designed for standard ANSI tolerance drill bits
+ Patented thread design offers toughened threads for tapping high strength concrete
+ Low installation torque in concrete and masonry
+ Universal product for concrete and grouted/solid masonry
+ Ratchet teeth on underside of hex washer head lock against the fixture
+ Can be installed closer to the edge than traditional expansion anchors
+ Fully removable and reinstallable in same hole
+ Fast installation with powered impact wrench, can also be installed manually
+ Diameter, length and identifying marking stamped on head of each anchor
+ One-piece, finished head design

APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES), ESR-3889 for concrete. Code compliant with 2015 IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, and 2009 IRC.
- International Code Council, Evaluation Service (ICC-ES), ESR-4042 for masonry. Code compliant with 2015 IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, and 2009 IRC.
- Tested in accordance with ACI 355.2 and ICC-ES AC193 for use in structural applications in concrete under the design provisions of ACI 318 (Strength Design Method)
- Evaluated and qualified by an accredited independent testing laboratory for recognition in cracked and uncracked concrete including seismic and wind loading (Category 1 anchors)
- Evaluated and qualified by an accredited independent testing laboratory for reliability against brittle failure, e.g. hydrogen embrittlement

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Screw anchors shall be Screw-Bolt+ as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

MATERIAL SPECIFICATIONS

Anchor component		Specification
Anchor Body and hex washer head		Case hardened low carbon steel (see minimum strength properties on the next page)
Plating	Standard zinc plated version	Zinc plating according to ASTM B 633, SC1 Type III (Fe/Zn 5). Minimum plating requirements for Mild Service Condition.
	Mechanically galvanized version	Mechanically Galvanized Zinc plating according to ASTM B 695, Class 55

SECTION CONTENTS

SCREW-BOLT+

HEAD STYLES

- Hex Washer Head

ANCHOR MATERIALS

- Zinc plated carbon steel or mechanically galvanized

ANCHOR SIZE RANGE (TYP.)

- 1/4" diameter through 3/4" diameter (see ordering information)

SUITABLE BASE MATERIALS

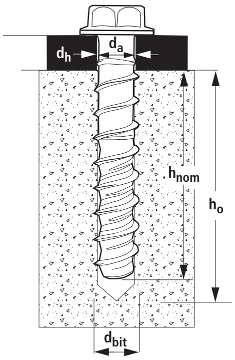
- Normal-weight concrete
- Lightweight concrete
- Concrete over steel deck
- Grouted Concrete Masonry (CMU)
- Brick Masonry

CODE LISTED ICC-ES ESR-3889 CONCRETE

CODE LISTED ICC-ES ESR-4042 MASONRY

INSTALLATION SPECIFICATIONS (ASD)

Screw-Bolt+ Anchor Detail



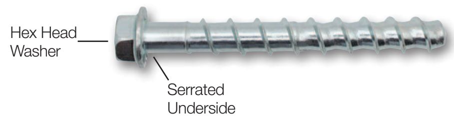
Nomenclature

d_a = Diameter of Anchor
d_{bit} = Diameter of Drill Bit
d_h = Diameter of Clearance Hole
h = Base Material Thickness. The value of h should be $1.5h_{nom}$ or 3", whichever is greater
h_{nom} = Minimum Nominal Embedment
h_o = Minimum Hole Depth

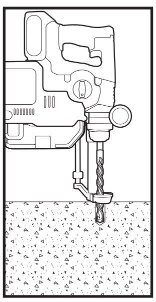
Hex Head Marking

Legend

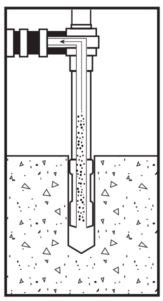
Diameter and Length Identification Mark



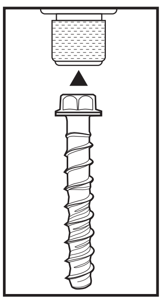
Installation Instructions for Screw-Bolt+



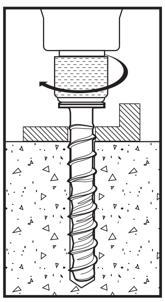
Step 1
Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI standard B212.15



Step 2
Remove dust and debris from hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created during drilling.



Step 3
Select a torque wrench or powered impact wrench and do not exceed the maximum torque, $T_{inst,max}$ or $T_{impact,max}$ respectively for the selected anchor diameter and embedment. Attach an appropriate sized hex socket/driver to the impact wrench. Mount the screw anchor head into the socket.



Step 4
Drive the anchor into the hole until the head of the anchor comes into contact with the fixture. The anchor must be snug after installation. Do not spin the hex socket off the anchor to disengage.

REFERENCE DATA (ASD)

Installation Specifications for Screw-Bolt+ in Concrete and Supplemental Information

Anchor Property/Setting Information	Notation	Units	Nominal Anchor Diameter (inch)				
			1/4	3/8	1/2	5/8	3/4
Anchor outside diameter	d	in. (mm)	0.250 (6.35)	0.375 (9.53)	0.500 (12.70)	0.625 (15.88)	0.750 (19.05)
Nominal drill bit diameter	d_{bit}	in.	1/4 ANSI	3/8 ANSI	1/2 ANSI	5/8 ANSI	3/4 ANSI
Minimum diameter of hole clearance in fixture	d_h	in. (mm)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)	7/8 (22.2)
Minimum embedment depth[2]	h_{nom}	in. (mm)	1 (25)	1-1/2 (38)	1-3/4 (44)	2-1/2 (64)	2-1/2 (64)
Minimum hole depth	h_o	in. (mm)	1-3/8 (35)	1-7/8 (48)	2-1/8 (54)	2-7/8 (73)	2-7/8 (73)
Minimum member thickness[1]	h_{min}	in. (mm)	3 (76)	3 (76)	3 (76)	3-3/4 (95)	3-3/4 (95)
Minimum edge distance	c_{min}	in. (mm)	1-1/2 (38)	1-1/2 (38)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)
Minimum spacing	s_{min}	in. (mm)	1-1/2 (38)	2 (51)	2-3/4 (70)	2-3/4 (70)	3 (76)
Max Installation torque	$T_{inst,max}$	ft.-lbf. (N-m)	19 (26)	25 (34)	45 (61)	60 (81)	70 (95)
Max impact wrench power (torque)	$T_{impact,max}$	ft.-lbf. (N-m)	150 (203)	300 (407)	300 (407)	700 (950)	700 (950)
Impact wrench socket size	-	in.	7/16	9/16	3/4	15/16	1-1/8
Maximum head height	-	in.	21/64	3/8	31/64	37/64	43/64
Maximum washer diameter	-	in.	37/64	3/4	1-1/16	1-1/8	1-13/32
Effective tensile stress area (screw anchor body)	A_{se}	in² (mm²)	0.045 (29.0)	0.094 (60.6)	0.176 (113.5)	0.274 (176.8)	0.399 (257.4)
Minimum specified ultimate strength	f_{uta}	ksi (N/mm²)	100 (690)	92.5 (638)	115 (794)	95 (656)	95 (656)
Minimum specified yield strength	f_y	ksi (N/mm²)	80 (552)	74 (511)	92 (635)	76 (524)	76 (524)

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

1. The minimum base material thickness shall be the greater of $1.5 \bullet h_{nom}$ or 3 inches.
2. See load capacities in normal weight concrete for additional embedment depths.

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

Nominal Anchor Diameter in.	Minimum Nominal Embedment Depth in. (mm)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi (17.3 MPa)		f'c = 3,000 psi (20.7 MPa)		f'c = 4,000 psi (27.6 MPa)		f'c = 6,000 psi (41.4 MPa)		f'c = 8,000 psi (55.2 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)
1/4	1 (25)	1,325 (5.9)	1,660 (7.4)	1,400 (6.2)	1,755 (7.8)	1,530 (6.8)	1,910 (8.5)	1,725 (7.7)	2,080 (9.3)	1,725 (7.7)	2,080 (9.3)
	1-5/8 (41)	2,835 (12.6)	1,660 (7.4)	2,995 (13.3)	1,755 (7.8)	3,265 (14.5)	1,910 (8.5)	3,265 (14.5)	2,080 (9.3)	3,265 (14.5)	2,080 (9.3)
	2-1/2 (64)	3,650 (16.2)	2,025 (9.0)	3,855 (17.1)	2,140 (9.5)	4,200 (18.7)	2,335 (10.4)	4,270 (19.0)	2,545 (11.3)	4,270 (19.0)	2,545 (11.3)
3/8	1-1/2 (38)	2,630 (11.7)	3,550 (15.8)	2,880 (12.8)	3,890 (17.3)	3,330 (14.8)	4,490 (20.0)	4,075 (18.1)	5,500 (24.5)	4,075 (18.1)	6,355 (28.3)
	2 (51)	3,670 (16.3)	4,320 (19.2)	4,020 (17.9)	4,735 (21.1)	4,645 (20.7)	5,465 (24.3)	4,725 (21.0)	6,345 (28.2)	5,455 (24.3)	6,345 (28.2)
	3-1/4 (83)	7,420 (33.0)	6,325 (28.1)	8,130 (36.2)	6,930 (30.8)	9,065 (40.3)	8,000 (35.6)	9,065 (40.3)	8,565 (38.1)	10,350 (46.0)	8,565 (38.1)
	4-1/2 (114)	10,905 (48.5)	6,325 (28.1)	11,945 (53.1)	6,930 (30.8)	13,795 (61.4)	8,000 (35.6)	15,075 (67.1)	8,565 (38.1)	15,075 (67.1)	8,565 (38.1)
1/2	1-3/4 (44)	2,840 (12.6)	5,985 (26.6)	3,115 (13.9)	6,555 (29.2)	3,595 (16.0)	7,570 (33.7)	4,400 (19.6)	9,270 (41.2)	4,400 (19.6)	10,705 (47.6)
	2-1/2 (64)	6,680 (29.7)	8,035 (35.7)	7,320 (32.6)	8,800 (39.1)	8,450 (37.6)	10,160 (45.2)	8,450 (37.6)	11,545 (51.4)	8,450 (37.6)	11,545 (51.4)
	4-1/4 (108)	13,260 (59.0)	9,395 (41.8)	14,525 (64.6)	10,290 (45.8)	16,480 (73.3)	11,885 (52.9)	16,480 (73.3)	13,520 (60.1)	16,480 (73.3)	13,520 (60.1)
	5-1/2 (140)	15,730 (70.0)	9,395 (41.8)	17,235 (76.7)	10,290 (45.8)	19,900 (88.5)	11,885 (52.9)	21,310 (94.8)	13,520 (60.1)	21,310 (94.8)	13,520 (60.1)
5/8	2-1/2 (64)	5,735 (25.5)	10,615 (47.2)	6,285 (28.0)	11,630 (51.7)	7,255 (32.3)	13,425 (59.7)	8,885 (39.5)	16,445 (73.2)	8,885 (39.5)	17,170 (76.4)
	3-1/4 (83)	9,755 (43.4)	12,065 (53.7)	10,685 (47.5)	13,220 (58.8)	12,340 (54.9)	15,265 (67.9)	12,340 (54.9)	17,170 (76.4)	12,340 (54.9)	17,170 (76.4)
	5 (127)	14,455 (64.3)	13,675 (60.8)	15,830 (70.4)	14,980 (66.6)	18,280 (81.3)	17,295 (76.9)	19,295 (85.8)	19,485 (86.7)	22,280 (99.1)	19,485 (86.7)
	6-1/4 (159)	20,520 (91.3)	13,675 (60.8)	22,475 (100.0)	14,980 (66.6)	25,955 (115.5)	17,295 (76.9)	31,785 (141.4)	19,485 (86.7)	31,785 (141.4)	19,485 (86.7)
3/4	2-1/2 (64)	6,035 (26.8)	11,615 (51.7)	6,610 (29.4)	12,725 (56.6)	7,635 (34.0)	14,690 (65.3)	9,350 (41.6)	17,995 (80.0)	9,350 (41.6)	20,775 (92.4)
	4-1/4 (108)	11,900 (52.9)	17,055 (75.9)	13,035 (58.0)	18,685 (83.1)	15,050 (66.9)	21,575 (96.0)	17,745 (78.9)	24,270 (108.0)	20,490 (91.1)	24,270 (108.0)
	5 (127)	19,020 (84.6)	17,055 (75.9)	20,835 (92.7)	18,685 (83.1)	24,055 (107.0)	21,575 (96.0)	29,460 (131.0)	24,270 (108.0)	29,460 (131.0)	24,270 (108.0)
	6-1/4 (159)	20,495 (91.2)	17,055 (75.9)	22,450 (99.9)	18,685 (83.1)	25,920 (115.3)	21,575 (96.0)	31,750 (141.2)	24,270 (108.0)	31,750 (141.2)	24,270 (108.0)

1. Tabulated load values are for anchors installed in uncracked concrete with no edge or spacing considerations. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load.

Allowable Load Capacities for Screw-Bolt+ in Normal-Weight Concrete[1,2,3,4,5]

ALLOWABLE STRESS DESIGN ASD

Nominal Anchor Diameter in.	Minimum Nominal Embedment Depth in. (mm)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi (17.3 MPa)		f'c = 3,000 psi (20.7 MPa)		f'c = 4,000 psi (27.6 MPa)		f'c = 6,000 psi (41.4 MPa)		f'c = 8,000 psi (55.2 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)
1/4	1 (25)	330 (1.5)	415 (1.8)	350 (1.6)	440 (2.0)	385 (1.7)	480 (2.1)	430 (1.9)	520 (2.3)	430 (1.9)	520 (2.3)
	1-5/8 (41)	710 (3.2)	415 (1.8)	750 (3.3)	440 (2.0)	815 (3.6)	480 (2.1)	815 (3.6)	520 (2.3)	815 (3.6)	520 (2.3)
	2-1/2 (64)	915 (4.1)	505 (2.2)	965 (4.3)	535 (2.4)	1,050 (4.7)	585 (2.6)	1,070 (4.8)	635 (2.8)	1,070 (4.8)	635 (2.8)
3/8	1-1/2 (38)	660 (2.9)	890 (4.0)	720 (3.2)	975 (4.3)	835 (3.7)	1,125 (5.0)	1,020 (4.5)	1,375 (6.1)	1,020 (4.5)	1,590 (7.1)
	2 (51)	920 (4.1)	1,080 (4.8)	1,005 (4.5)	1,185 (5.3)	1,160 (5.2)	1,365 (6.1)	1,180 (5.2)	1,585 (7.1)	1,365 (6.1)	1,585 (7.1)
	3-1/4 (83)	1,855 (8.3)	1,580 (7.0)	2,035 (9.1)	1,735 (7.7)	2,265 (10.1)	2,000 (8.9)	2,265 (10.1)	2,140 (9.5)	2,590 (11.5)	2,140 (9.5)
	4-1/2 (114)	2,725 (12.1)	1,580 (7.0)	2,985 (13.3)	1,735 (7.7)	3,450 (15.3)	2,000 (8.9)	3,770 (16.8)	2,140 (9.5)	3,770 (16.8)	2,140 (9.5)
1/2	1-3/4 (44)	710 (3.2)	1,495 (6.7)	780 (3.5)	1,640 (7.3)	900 (4.0)	1,895 (8.4)	1,100 (4.9)	2,320 (10.3)	1,100 (4.9)	2,675 (11.9)
	2-1/2 (64)	1,670 (7.4)	2,010 (8.9)	1,830 (8.1)	2,200 (9.8)	2,115 (9.4)	2,540 (11.3)	2,115 (9.4)	2,885 (12.8)	2,115 (9.4)	2,885 (12.8)
	4-1/4 (108)	3,315 (14.7)	2,350 (10.5)	3,630 (16.1)	2,575 (11.5)	4,120 (18.3)	2,970 (13.2)	4,120 (18.3)	3,380 (15.0)	4,120 (18.3)	3,380 (15.0)
	5-1/2 (140)	3,935 (17.5)	2,350 (10.5)	4,310 (19.2)	2,575 (11.5)	4,975 (22.1)	2,970 (13.2)	5,330 (23.7)	3,380 (15.0)	5,330 (23.7)	3,380 (15.0)
5/8	2-1/2 (64)	1,435 (6.4)	2,655 (11.8)	1,570 (7.0)	2,910 (12.9)	1,815 (8.1)	3,355 (14.9)	2,220 (9.9)	4,110 (18.3)	2,220 (9.9)	4,295 (19.1)
	3-1/4 (83)	2,440 (10.9)	3,015 (13.4)	2,670 (11.9)	3,305 (14.7)	3,085 (13.7)	3,815 (17.0)	3,085 (13.7)	4,295 (19.1)	3,085 (13.7)	4,295 (19.1)
	5 (127)	3,615 (16.1)	3,420 (15.2)	3,960 (17.6)	3,745 (16.7)	4,570 (20.3)	4,325 (19.2)	4,825 (21.5)	4,870 (21.7)	5,570 (24.8)	4,870 (21.7)
	6-1/4 (159)	5,130 (22.8)	3,420 (15.2)	5,620 (25.0)	3,745 (16.7)	6,490 (28.9)	4,325 (19.2)	7,945 (35.3)	4,870 (21.7)	7,945 (35.3)	4,870 (21.7)
3/4	2-1/2 (64)	1,510 (6.7)	2,905 (12.9)	1,655 (7.4)	3,180 (14.1)	1,910 (8.5)	3,675 (16.3)	2,340 (10.4)	4,500 (20.0)	2,340 (10.4)	5,195 (23.1)
	4-1/4 (108)	2,975 (13.2)	4,265 (19.0)	3,260 (14.5)	4,670 (20.8)	3,765 (16.7)	5,395 (24.0)	4,435 (19.7)	6,070 (27.0)	5,125 (22.8)	6,070 (27.0)
	5 (127)	4,755 (21.2)	4,265 (19.0)	5,210 (23.2)	4,670 (20.8)	6,015 (26.8)	5,395 (24.0)	7,365 (32.8)	6,070 (27.0)	7,365 (32.8)	6,070 (27.0)
	6-1/4 (159)	5,125 (22.8)	4,265 (19.0)	5,615 (25.0)	4,670 (20.8)	6,480 (28.8)	5,395 (24.0)	7,940 (35.3)	6,070 (27.0)	7,940 (35.3)	6,070 (27.0)

1. Tabulated load values are for anchors installed in uncracked concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities are calculated using an applied safety factor 4.0.
3. Allowable load capacities must be multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.
4. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
5. Anchors may be used in lightweight concrete provided the allowable load capacities are multiplied by a reduction factor of 0.60.

LOAD ADJUSTMENT FACTORS FOR NORMAL-WEIGHT CONCRETE

Edge Distance Reduction Factors - Tension (F_{NC})

	Diameter (in)	1/4			3/8				1/2				5/8				3/4			
	Nominal Embedment h_{nom} (in)	1	1-5/8	2-1/2	1-1/2	2	3-1/4	4-1/2	1-3/4	2-1/2	4-1/4	5-1/2	2-1/2	3-1/4	5	6-1/4	2-1/2	4-1/4	5	6-1/4
	Min. Edge Distance c_{min} (in)	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4
Edge Distance (inches)	1-1/2	1.00	0.77	0.64	0.85	0.74	0.59	0.55	-	-	-	-	-	-	-	-	-	-	-	-
	1-3/4	1.00	0.83	0.67	0.93	0.79	0.62	0.57	0.87	0.71	0.58	0.54	0.73	0.65	0.56	0.53	0.73	0.59	0.56	0.53
	2	1.00	0.88	0.71	1.00	0.84	0.65	0.59	0.94	0.76	0.60	0.56	0.78	0.68	0.58	0.54	0.78	0.61	0.58	0.54
	2-1/4	1.00	0.94	0.75	1.00	0.89	0.68	0.61	1.00	0.80	0.63	0.57	0.82	0.71	0.60	0.56	0.82	0.63	0.60	0.56
	2-1/2	1.00	1.00	0.78	1.00	0.95	0.71	0.63	1.00	0.84	0.65	0.59	0.87	0.75	0.62	0.57	0.87	0.66	0.62	0.57
	2-3/4	1.00	1.00	0.82	1.00	1.00	0.74	0.65	1.00	0.88	0.67	0.61	0.91	0.78	0.64	0.59	0.91	0.68	0.64	0.59
	3	1.00	1.00	0.86	1.00	1.00	0.77	0.67	1.00	0.92	0.69	0.62	0.96	0.81	0.66	0.60	0.96	0.70	0.66	0.60
	3-1/2	1.00	1.00	0.93	1.00	1.00	0.83	0.71	1.00	1.00	0.74	0.65	1.00	0.87	0.69	0.63	1.00	0.75	0.69	0.63
	4	1.00	1.00	1.00	1.00	1.00	0.88	0.75	1.00	1.00	0.78	0.69	1.00	0.94	0.73	0.66	1.00	0.79	0.73	0.66
	4-1/2	1.00	1.00	1.00	1.00	1.00	0.94	0.79	1.00	1.00	0.82	0.72	1.00	1.00	0.77	0.69	1.00	0.84	0.77	0.69
	5	1.00	1.00	1.00	1.00	1.00	1.00	0.84	1.00	1.00	0.87	0.75	1.00	1.00	0.81	0.72	1.00	0.89	0.81	0.72
	5-1/2	1.00	1.00	1.00	1.00	1.00	1.00	0.88	1.00	1.00	0.91	0.79	1.00	1.00	0.85	0.75	1.00	0.93	0.85	0.75
	6	1.00	1.00	1.00	1.00	1.00	1.00	0.92	1.00	1.00	0.96	0.82	1.00	1.00	0.89	0.78	1.00	0.98	0.89	0.78
	6-1/2	1.00	1.00	1.00	1.00	1.00	1.00	0.96	1.00	1.00	1.00	0.85	1.00	1.00	0.92	0.81	1.00	1.00	0.92	0.81
	7	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88	1.00	1.00	0.96	0.84	1.00	1.00	0.96	0.84
	7-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	1.00	1.00	1.00	0.87	1.00	1.00	1.00	0.87
	8	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	0.90	1.00	1.00	1.00	0.90
	8-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.93	1.00	1.00	1.00	0.93
	9	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	1.00	1.00	1.00	0.96
	9-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00	0.99
	10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Spacing Reduction Factors - Tension (F_{NS})

	Diameter (in)	1/4			3/8				1/2				5/8				3/4			
	Nominal Embedment h_{nom} (in)	1	1-5/8	2-1/2	1-1/2	2	3-1/4	4-1/2	1-3/4	2-1/2	4-1/4	5-1/2	2-1/2	3-1/4	5	6-1/4	2-1/2	4-1/4	5	6-1/4
	Minimum Spacing s_{min} (in)	1-1/2	1-1/2	1-1/2	2	2	2	2	2-3/4	2-3/4	2-3/4	2-3/4	2-3/4	2-3/4	2-3/4	2-3/4	3	3	3	3
Spacing Distance (inches)	1-1/2	0.89	0.73	0.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1-3/4	0.94	0.77	0.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	1.00	0.80	0.70	0.88	0.77	0.67	0.63	-	-	-	-	-	-	-	-	-	-	-	-
	2-1/4	1.00	0.83	0.72	0.93	0.80	0.69	0.64	-	-	-	-	-	-	-	-	-	-	-	-
	2-1/2	1.00	0.86	0.74	0.97	0.83	0.70	0.65	-	-	-	-	-	-	-	-	-	-	-	-
	2-3/4	1.00	0.89	0.76	1.00	0.86	0.72	0.66	0.92	0.78	0.67	0.64	0.80	0.73	0.65	0.63	-	-	-	-
	3	1.00	0.92	0.78	1.00	0.89	0.74	0.67	0.95	0.80	0.68	0.65	0.83	0.74	0.66	0.64	0.83	0.69	0.66	0.64
	3-1/2	1.00	0.99	0.82	1.00	0.94	0.77	0.70	1.00	0.85	0.71	0.67	0.88	0.78	0.68	0.65	0.88	0.71	0.68	0.65
	4	1.00	1.00	0.86	1.00	1.00	0.80	0.72	1.00	0.89	0.73	0.68	0.92	0.81	0.70	0.67	0.93	0.74	0.71	0.67
	4-1/2	1.00	1.00	0.90	1.00	1.00	0.83	0.74	1.00	0.93	0.75	0.70	0.97	0.85	0.72	0.68	0.97	0.76	0.73	0.69
	5	1.00	1.00	0.94	1.00	1.00	0.86	0.76	1.00	0.98	0.78	0.72	1.00	0.88	0.75	0.70	1.00	0.79	0.75	0.70
	5-1/2	1.00	1.00	0.97	1.00	1.00	0.89	0.78	1.00	1.00	0.80	0.74	1.00	0.92	0.77	0.72	1.00	0.81	0.77	0.72
	6	1.00	1.00	1.00	1.00	1.00	0.93	0.81	1.00	1.00	0.82	0.75	1.00	0.95	0.79	0.73	1.00	0.84	0.79	0.73
	6-1/2	1.00	1.00	1.00	1.00	1.00	0.96	0.83	1.00	1.00	0.85	0.77	1.00	0.98	0.81	0.75	1.00	0.86	0.81	0.75
	7	1.00	1.00	1.00	1.00	1.00	0.99	0.85	1.00	1.00	0.87	0.79	1.00	1.00	0.83	0.76	1.00	0.89	0.83	0.77
	7-1/2	1.00	1.00	1.00	1.00	1.00	1.00	0.87	1.00	1.00	0.90	0.81	1.00	1.00	0.85	0.78	1.00	0.91	0.85	0.78
	8	1.00	1.00	1.00	1.00	1.00	1.00	0.90	1.00	1.00	0.92	0.83	1.00	1.00	0.87	0.80	1.00	0.94	0.87	0.80
	8-1/2	1.00	1.00	1.00	1.00	1.00	1.00	0.92	1.00	1.00	0.94	0.84	1.00	1.00	0.89	0.81	1.00	0.96	0.89	0.81
	9	1.00	1.00	1.00	1.00	1.00	1.00	0.94	1.00	1.00	0.97	0.86	1.00	1.00	0.91	0.83	1.00	0.99	0.91	0.83
	9-1/2	1.00	1.00	1.00	1.00	1.00	1.00	0.96	1.00	1.00	0.99	0.88	1.00	1.00	0.93	0.84	1.00	1.00	0.93	0.85
	10	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.90	1.00	1.00	0.95	0.86	1.00	1.00	0.95	0.86
	10-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	1.00	0.97	0.88	1.00	1.00	0.97	0.88
	11	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93	1.00	1.00	0.99	0.89	1.00	1.00	0.99	0.89
	11-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	0.91	1.00	1.00	1.00	0.91
	12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.92	1.00	1.00	1.00	0.93
	13	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	1.00	1.00	1.00	0.96
	14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00	0.99
	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Edge Distance Reduction Factors - Shear (F_{VC})

Diameter (in)		1/4			3/8				1/2				5/8				3/4			
Nominal Embedment h_{nom} (in)		1	1-5/8	2-1/2	1-1/2	2	3-1/4	4-1/2	1-3/4	2-1/2	4-1/4	5-1/2	2-1/2	3-1/4	5	6-1/4	2-1/2	4-1/4	5	6-1/4
Min. Edge Distance c_{min}(in)		1-1/2	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4
Edge Distance (inches)	1-1/2	0.58	0.63	0.59	0.40	0.37	0.31	0.32	-	-	-	-	-	-	-	-	-	-	-	-
	1-3/4	0.68	0.73	0.69	0.46	0.43	0.36	0.38	0.35	0.31	0.30	0.31	0.27	0.26	0.25	0.26	0.26	0.22	0.22	0.23
	2	0.78	0.84	0.78	0.53	0.49	0.41	0.43	0.41	0.35	0.35	0.36	0.30	0.29	0.29	0.30	0.30	0.25	0.26	0.27
	2-1/4	0.87	0.94	0.88	0.59	0.55	0.46	0.48	0.46	0.40	0.39	0.40	0.34	0.33	0.32	0.33	0.33	0.28	0.29	0.30
	2-1/2	0.97	1.00	0.98	0.66	0.61	0.51	0.54	0.51	0.44	0.43	0.45	0.38	0.36	0.36	0.37	0.37	0.31	0.32	0.33
	2-3/4	1.00	1.00	1.00	0.73	0.67	0.56	0.59	0.56	0.49	0.48	0.49	0.42	0.40	0.40	0.41	0.41	0.34	0.35	0.37
	3	1.00	1.00	1.00	0.79	0.73	0.61	0.64	0.61	0.53	0.52	0.54	0.46	0.44	0.43	0.45	0.44	0.38	0.39	0.40
	3-1/2	1.00	1.00	1.00	0.92	0.85	0.72	0.75	0.71	0.62	0.61	0.63	0.53	0.51	0.50	0.52	0.52	0.44	0.45	0.47
	4	1.00	1.00	1.00	1.00	0.97	0.82	0.86	0.81	0.71	0.69	0.72	0.61	0.58	0.57	0.59	0.59	0.50	0.51	0.53
	4-1/2	1.00	1.00	1.00	1.00	1.00	0.92	0.97	0.91	0.80	0.78	0.81	0.68	0.66	0.65	0.67	0.67	0.56	0.58	0.60
	5	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89	0.87	0.90	0.76	0.73	0.72	0.74	0.74	0.63	0.64	0.66
	5-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.95	0.99	0.84	0.80	0.79	0.82	0.82	0.69	0.71	0.73
	6	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.88	0.86	0.89	0.89	0.75	0.77	0.80
	6-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.95	0.93	0.97	0.96	0.81	0.84	0.86
	7	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88	0.90	0.93
	7-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	0.96	1.00
	8	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Spacing Reduction Factors - Shear (F_{VS})

Diameter (in)		1/4			3/8				1/2				5/8				3/4			
Nominal Embedment h_{nom} (in)		1	1-5/8	2-1/2	1-1/2	2	3-1/4	4-1/2	1-3/4	2-1/2	4-1/4	5-1/2	2-1/2	3-1/4	5	6-1/4	2-1/2	4-1/4	5	6-1/4
Minimum Spacing s_{min} (in)		1-1/2	1-1/2	1-1/2	2	2	2	2	2-3/4	2-3/4	2-3/4	2-3/4	2-3/4	2-3/4	2-3/4	2-3/4	3	3	3	3
Spacing Distance (inches)	1-1/2	0.60	0.60	0.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1-3/4	0.61	0.62	0.61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	0.63	0.64	0.63	0.59	0.58	0.57	0.57	-	-	-	-	-	-	-	-	-	-	-	-
	2-1/4	0.65	0.66	0.65	0.60	0.59	0.58	0.58	-	-	-	-	-	-	-	-	-	-	-	-
	2-1/2	0.66	0.67	0.66	0.61	0.60	0.59	0.59	-	-	-	-	-	-	-	-	-	-	-	-
	2-3/4	0.68	0.69	0.68	0.62	0.61	0.59	0.60	0.59	0.58	0.58	0.58	0.57	0.57	0.57	0.57	-	-	-	-
	3	0.69	0.71	0.70	0.63	0.62	0.60	0.61	0.60	0.59	0.59	0.59	0.58	0.57	0.57	0.57	0.57	0.56	0.56	0.57
	3-1/2	0.73	0.74	0.73	0.65	0.64	0.62	0.63	0.62	0.60	0.60	0.60	0.59	0.59	0.58	0.59	0.59	0.57	0.57	0.58
	4	0.76	0.78	0.76	0.68	0.66	0.64	0.64	0.64	0.62	0.62	0.62	0.60	0.60	0.60	0.60	0.60	0.58	0.59	0.59
	4-1/2	0.79	0.81	0.79	0.70	0.68	0.65	0.66	0.65	0.63	0.63	0.63	0.61	0.61	0.61	0.61	0.61	0.59	0.60	0.60
	5	0.82	0.85	0.83	0.72	0.70	0.67	0.68	0.67	0.65	0.64	0.65	0.63	0.62	0.62	0.62	0.62	0.60	0.61	0.61
	5-1/2	0.86	0.88	0.86	0.74	0.72	0.69	0.70	0.69	0.66	0.66	0.66	0.64	0.63	0.63	0.64	0.64	0.61	0.62	0.62
	6	0.89	0.92	0.89	0.76	0.74	0.70	0.71	0.70	0.68	0.67	0.68	0.65	0.65	0.64	0.65	0.65	0.63	0.63	0.63
	6-1/2	0.92	0.95	0.92	0.79	0.76	0.72	0.73	0.72	0.69	0.69	0.69	0.66	0.66	0.66	0.66	0.66	0.64	0.64	0.64
	7	0.95	0.99	0.96	0.81	0.78	0.74	0.75	0.74	0.71	0.70	0.71	0.68	0.67	0.67	0.67	0.67	0.65	0.65	0.66
	7-1/2	0.99	1.00	0.99	0.83	0.80	0.76	0.77	0.75	0.72	0.72	0.72	0.69	0.68	0.68	0.69	0.69	0.66	0.66	0.67
	8	1.00	1.00	1.00	0.85	0.82	0.77	0.79	0.77	0.74	0.73	0.74	0.70	0.69	0.69	0.70	0.70	0.67	0.67	0.68
	9	1.00	1.00	1.00	0.90	0.87	0.81	0.82	0.80	0.77	0.76	0.77	0.73	0.72	0.72	0.72	0.72	0.69	0.69	0.70
	10	1.00	1.00	1.00	0.94	0.91	0.84	0.86	0.84	0.80	0.79	0.80	0.75	0.74	0.74	0.75	0.75	0.71	0.71	0.72
	11	1.00	1.00	1.00	0.98	0.95	0.87	0.89	0.87	0.82	0.82	0.83	0.78	0.77	0.76	0.77	0.77	0.73	0.74	0.74
	12	1.00	1.00	1.00	1.00	0.99	0.91	0.93	0.91	0.85	0.85	0.86	0.80	0.79	0.79	0.80	0.80	0.75	0.76	0.77
	13	1.00	1.00	1.00	1.00	1.00	0.94	0.96	0.94	0.88	0.88	0.89	0.83	0.82	0.81	0.82	0.82	0.77	0.78	0.79
	14	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.97	0.91	0.90	0.92	0.85	0.84	0.84	0.85	0.85	0.79	0.80	0.81
	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	0.93	0.95	0.88	0.86	0.86	0.87	0.87	0.81	0.82	0.83
	16	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.96	0.98	0.91	0.89	0.88	0.90	0.90	0.83	0.84	0.85
	17	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	0.93	0.91	0.91	0.92	0.92	0.86	0.86	0.88
	18	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.94	0.93	0.95	0.94	0.88	0.89	0.90
	19	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.96	0.95	0.97	0.97	0.90	0.91	0.92
	20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.98	1.00	0.99	0.92	0.93	0.94
	21	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	0.95	0.97
	22	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.97	0.99
	23	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.99	1.00
	24	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Ultimate Load Capacities for Screw-Bolt+ in Normal-Weight Concrete at Minimum Edge[1,2]

Nominal Anchor Diameter d in.	Minimum Nominal Embedment Depth in. (mm)	Minimum Edge Distance in. (mm)	Minimum Concrete Compressive Strength					
			f'c = 2,500 psi (17.3 MPa)		f'c = 3,000 psi (20.7 MPa)		f'c = 4,000 psi (27.6 MPa)	
			Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)
1/4	1-5/8 (41)	1-1/2 (38)	2,060 (9.2)	1,300 (5.8)	2,260 (10.1)	1,420 (6.3)	2,600 (11.6)	1,640 (7.3)
	2-1/2 (64)		3,380 (15.0)	1,580 (7.0)	3,700 (16.5)	1,740 (7.7)	4,280 (19.0)	2,000 (8.9)
3/8	1-1/2 (38)	1-1/2 (38)	2,120 (9.4)	1,060 (4.7)	2,320 (10.3)	1,160 (5.2)	2,680 (11.9)	1,340 (6.0)
	2 (51)		2,600 (11.6)	1,560 (6.9)	2,840 (12.6)	1,700 (7.6)	3,280 (14.6)	1,960 (8.7)
	3-1/4 (83)		4,460 (19.8)	2,080 (9.3)	4,880 (21.7)	2,280 (10.1)	5,640 (25.1)	2,640 (11.7)
	4-1/2 (114)		7,680 (34.2)	2,080 (9.3)	8,420 (37.5)	2,280 (10.1)	9,720 (43.2)	2,640 (11.7)
1/2	1-3/4 (44)	1-3/4 (38)	2,840 (12.6)	2,040 (9.1)	3,115 (13.9)	2,220 (9.9)	3,595 (16.0)	2,580 (11.5)
	2-1/2 (64)		3,820 (17.0)	2,360 (10.5)	4,180 (18.6)	2,580 (11.5)	4,820 (21.4)	2,980 (13.3)
	4-1/4 (108)		6,860 (30.5)	3,280 (14.6)	7,520 (33.5)	3,580 (15.9)	8,680 (38.6)	4,140 (18.4)
	5-1/2 (140)		12,600 (56.0)	3,280 (14.6)	13,800 (61.4)	3,580 (15.9)	15,940 (70.9)	4,140 (18.4)
5/8	3-1/4 (83)	1-3/4 (44)	5,260 (23.4)	2,800 (12.5)	5,760 (25.6)	3,060 (13.6)	6,640 (29.5)	3,540 (15.7)
	5 (127)		8,360 (37.2)	3,660 (16.3)	9,160 (40.7)	4,020 (17.9)	10,580 (47.1)	4,640 (20.6)
	6-1/4 (159)		10,240 (45.5)	3,660 (16.3)	11,200 (49.8)	4,020 (17.9)	12,940 (57.6)	4,640 (20.6)
3/4	4-1/4 (108)	1-3/4 (44)	7,240 (32.2)	3,460 (15.4)	7,920 (35.2)	3,780 (16.8)	9,160 (40.7)	4,360 (19.4)
	5 (127)		9,140 (40.7)	3,460 (15.4)	10,020 (44.6)	3,780 (16.8)	11,560 (51.4)	4,360 (19.4)
	6-1/4 (159)		14,420 (64.1)	3,460 (15.4)	15,800 (70.3)	3,780 (16.8)	18,240 (81.1)	4,360 (19.4)

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

Allowable Load Capacities for Screw-Bolt+ in Normal-Weight Concrete at Minimum Edge[1,2,3,4,5]

Nominal Anchor Diameter d in.	Minimum Nominal Embedment Depth in. (mm)	Minimum Edge Distance in. (mm)	Minimum Concrete Compressive Strength					
			f'c = 2,500 psi (17.3 MPa)		f'c = 3,000 psi (20.7 MPa)		f'c = 4,000 psi (27.6 MPa)	
			Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)
1/4	1-5/8 (41)	1-1/2 (38)	515 (2.3)	325 (1.4)	565 (2.5)	355 (1.6)	650 (2.9)	410 (1.8)
	2-1/2 (64)		845 (3.8)	395 (1.8)	925 (4.1)	435 (1.9)	1,070 (4.8)	500 (2.2)
3/8	1-1/2 (38)	1-1/2 (38)	530 (2.4)	265 (1.2)	580 (2.6)	290 (1.3)	670 (3.0)	335 (1.5)
	2 (51)		650 (2.9)	390 (1.7)	710 (3.2)	425 (1.9)	820 (3.6)	490 (2.2)
	3-1/4 (83)		1,115 (5.0)	520 (2.3)	1,220 (5.4)	570 (2.5)	1,410 (6.3)	660 (2.9)
	4-1/2 (114)		1,920 (8.5)	520 (2.3)	2,105 (9.4)	570 (2.5)	2,430 (10.8)	660 (2.9)
1/2	1-3/4 (44)	1-3/4 (38)	710 (3.2)	510 (2.3)	780 (3.5)	555 (2.5)	900 (4.0)	645 (2.9)
	2-1/2 (64)		955 (4.2)	590 (2.6)	1,045 (4.6)	645 (2.9)	1,205 (5.4)	745 (3.3)
	4-1/4 (108)		1,715 (7.6)	820 (3.6)	1,880 (8.4)	895 (4.0)	2,170 (9.7)	1,035 (4.6)
	5-1/2 (140)		3,150 (14.0)	820 (3.6)	3,450 (15.3)	895 (4.0)	3,985 (17.7)	1,035 (4.6)
5/8	3-1/4 (83)	1-3/4 (44)	1,315 (5.8)	700 (3.1)	1,440 (6.4)	765 (3.4)	1,660 (7.4)	885 (3.9)
	5 (127)		2,090 (9.3)	915 (4.1)	2,290 (10.2)	1,005 (4.5)	2,645 (11.8)	1,160 (5.2)
	6-1/4 (159)		2,560 (11.4)	915 (4.1)	2,800 (12.5)	1,005 (4.5)	3,235 (14.4)	1,160 (5.2)
3/4	4-1/4 (108)	1-3/4 (44)	1,810 (8.1)	865 (3.8)	1,980 (8.8)	945 (4.2)	2,290 (10.2)	1,090 (4.8)
	5 (127)		2,285 (10.2)	865 (3.8)	2,505 (11.1)	945 (4.2)	2,890 (12.9)	1,090 (4.8)
	6-1/4 (159)		3,605 (16.0)	865 (3.8)	3,950 (17.6)	945 (4.2)	4,560 (20.3)	1,090 (4.8)

1. Tabulated load values are for anchors installed in uncracked concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities are calculated using an applied safety factor 4.0.
3. Allowable load capacities must be multiplied by reduction factors when anchor spacing or edge distances are less that critical distances.
4. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
5. Anchors may be used in sand-lightweight concrete provided the allowable load capacities are multiplied by a reduction factor of 0.60.

Allowable Screw-Bolt+ Tension and Shear Load Capacities Installed into the face of Grout-Filled Concrete Masonry Units[1,2,3,4,5,6,7,8,9]

CODE LISTED
ICC-ES ESR-4042

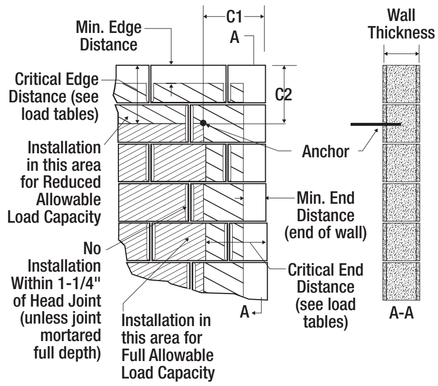
ALLOWABLE STRESS DESIGN ASD

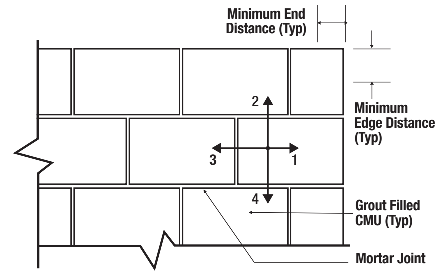
Tension Load								
Anchor Diameter, d in.	Minimum Embedment h_{nom} in. (mm)	Allowable Load at c_{cr} and s_{cr} lbs (kN)	Spacing Distance, s			Edge or End Distance, c_2 or c_1 (see Illustration of Screw-Bolt+ Installed into Grouted Concrete Masonry Wall detail)		
			Critical Distance, s_{cr} in. (mm)	Minimum Distance, s_{min} in. (mm)	Allowable Load Factor at s_{min}	Critical Distance, c_{cr} in. (mm)	Minimum Distance, c_{min} in. (mm)	Allowable Load Factor at c_{min}
1/4	1-5/8 (41.3)	315 (1.4)	4 (101.6)	2 (50.8)	1.00	3-3/4 (95.3)	1-1/4 (31.8)	0.60
	2-1/2 (63.5)	605 (2.7)						
3/8	2 (50.8)	450 (2.0)	6 (152.4)	3 (76.2)	1.00	6 (152.4)	1-1/2 (38.1)	0.70
	3-1/4 (82.6)	1,085 (4.8)						
1/2	2-1/2 (63.5)	610 (2.7)	8 (203.2)	4 (101.6)	1.00	8 (203.2)	2-5/8 (66.7)	0.75
	4-1/4 (108.0)	1,190 (5.3)						
5/8	3-1/4 (82.6)	880 (3.9)	10 (254.0)	4 (101.6)	1.00	10 (254.0)	3-3/8 (85.7)	0.90
	5 (127.0)	1,270 (5.6)						
3/4	4 (101.6)	1,150 (5.1)	12 (304.8)	4 (101.6)	1.00	12 (304.8)	4 (101.6)	1.00
	6-1/4 (158.8)	1,355 (6.0)						

Shear Load										
Anchor Diameter, d in.	Minimum Embedment h_{nom} in. (mm)	Allowable Load at c_{cr} and s_{cr} Direction 1 & 2 lbs[9] (kN)	Allowable Load at c_{cr} and s_{cr} Direction 3 & 4 lbs[9] (kN)	Spacing Distance, s			Edge or End Distance, c_2 or c_1 (see Illustration of Screw-Bolt+ Installed into Grouted Concrete Masonry Wall detail)			
				Critical Distance, s_{cr} in. (mm)	Minimum Distance, s_{min} in. (mm)	Allowable Load Factor at s_{min}	Critical Distance, c_{cr} in. (mm)	Minimum Distance, c_{min} in. (mm)	Allowable Load Factor at c_{min}	
									Load Perpendicular to Edge or End (Direction 1 & 2)[9]	Load Perpendicular to Edge or End (Direction 3 & 4)[9]
1/4	1-5/8 (41.3)	400 (1.8)	400 (1.8)	4 (101.6)	2 (50.8)	1.00	3-3/4 (95.3)	1-1/4 (31.8)	0.35	1.00
	2-1/2 (63.5)	505 (2.2)	505 (2.2)							
3/8	2 (50.8)	815 (3.6)	815 (3.6)	6 (152.4)	3 (76.2)	1.00	6 (152.4)	1-1/2 (38.1)	0.27	1.00
	3-1/4 (82.6)	935 (4.2)	935 (4.2)							
1/2	2-1/2 (63.5)	1,380 (6.1)	1,380 (6.1)	8 (203.2)	4 (101.6)	1.00	8 (203.2)	2-5/8 (66.7)	0.20	1.00
	4-1/4 (108.0)	2,180 (9.7)	2,180 (9.7)							
5/8	3-1/4 (82.6)	2,090 (9.3)	2,225 (9.9)	10 (254.0)	4 (101.6)	1.00	10 (254.0)	3-3/8 (85.7)	0.23	1.00
	5 (127.0)	2,640 (11.7)	2,640 (11.7)							
3/4	4 (101.6)	2,800 (12.5)	3,330 (14.8)	12 (304.8)	4 (101.6)	1.00	12 (304.8)	4 (101.6)	0.25	1.00
	6-1/4 (158.8)	3,100 (13.8)	3,685 (16.4)							

For SI: 1 inch = 25.4 mm; 1 lbs = 0.0044 kN, 1 psi = 0.006894 MPa.

1. All values are for anchors installed in fully grouted concrete masonry wall construction with materials meeting minimum compressive strength, f'm, of 1,500 psi (10.3 MPa). Concrete masonry units must be light-, medium, or normal-weight conforming to ASTM C90. Allowable loads are based on a safety factor of 5.0.
2. Anchors may be installed in any location in the face of the masonry wall (cell, web, bed joint) except within 1-1/4-inch from the of the vertical mortar joint (head joint), center-to-center, provided the minimum edge and end distances are maintained. Anchors may not be placed in the head joint unless the vertical joint is mortared full-depth.
3. A maximum of two anchors may be installed in a single masonry cell in accordance with the spacing and edge or end distance requirements. Embedment is measured from the outside surface of the concrete masonry unit to the embedded end of the anchor. See the Illustration of Screw-Bolt+ Anchors Installed into Grouted Concrete Masonry Wall figure.
4. The critical spacing distance, s_{cr}, is the anchor spacing where full load values in the table may be used. The minimum spacing distance, s_{min}, is the minimum anchor spacing for which values are available and installation is permitted. Spacing distance is measured from the centerline to centerline between two anchors.
5. The critical edge or end distance, c_{cr}, is the distance where full load values in the table may be used. The minimum edge or end distance, c_{min}, is the minimum distance for which values are available and installation is permitted. Edge or end distance is measured from anchor centerline to the closest unrestrained edge.
6. The tabulated values are applicable for anchors installed into the ends of grout-filled concrete masonry units (e.g. wall opening) where minimum edge distances are maintained.
7. Load values for anchors installed less than s_{cr} and c_{cr} must be multiplied by the appropriate load reduction factor based on actual spacing (s) or edge distance (c). Load factors are multiplicative; both spacing and edge reduction factors must be considered.
8. Linear interpolation of load values between minimum spacing (s_{min}) and critical spacing (s_{cr}) and between minimum edge or end distance (c_{min}) and critical edge or end distance (c_{cr}) is permitted.
9. See the Direction of Shear Loading in Relation to Edge and End of Masonry Wall figure for illustration of shear load directions.





1. Shear load perpendicular to End and parallel to Edge
2. Shear load perpendicular to Edge and parallel to End
3. Shear load parallel to Edge and perpendicular away from End
4. Shear load parallel to End and perpendicular to bottom of wall

Allowable Screw-Bolt+ Tension and Shear Load Capacities Installed into the Tops of Grout-Filled Concrete Masonry Units[1,2,3,4,5,6,7,8,9,10]

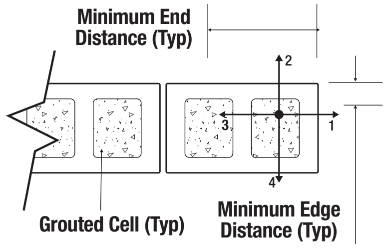
CODE LISTED ICC-ES ESR-4042

ALLOWABLE STRESS DESIGN ASD

Anchor Diameter d in.	Minimum Embedment h_{nom} in. (mm)	Minimum Spacing Distance in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Tension Load lbs (kN)	Shear Load, lb (kN)	
						Load Perpendicular to Edge of Masonry Wall (II to end)	Load Parallel to Edge of Masonry Wall (⊥ to end)
1/4	2-1/2 (63.5)	1-1/2 (38.1)	1-1/2 (38.1)	4 (101.6)	410 (1.8)	185 (0.8)	185 (0.8)
		1-1/2 (38.1)	3-1/2 (88.9)	4 (101.6)	485 (2.2)	215 (1.0)	215 (1.0)
3/8	3-1/4 (82.6)	2 (50.8)	1-1/2 (38.1)	4 (101.6)	625 (2.8)	505 (2.2)	505 (2.2)
		2 (50.8)	3-1/2 (88.9)	6 (152.4)	625 (2.8)	560 (2.5)	560 (2.5)
1/2	4-1/4 (108.0)	8 (203.2) (see Note 4 for reduced minimum spacing distances)	1-3/4 (44.5)	8 (203.2)	810 (3.6)	255 (1.1)	580 (2.6)
			3-3/4 (95.3)		1,210 (5.4)	255 (1.1)	580 (2.6)
5/8	5 (127.0)	10 (254.0)	1-3/4 (44.5)	10 (254.0)	900 (4.0)	260 (1.2)	950 (4.2)
3/4	6-1/4 (158.8)	12 (304.8)	1-3/4 (44.5)	12 (304.8)	1,215 (5.4)	260 (1.2)	990 (4.4)

For SI: 1 inch = 25.4 mm; 1 lbs = 0.0044 kN, 1 psi = 0.006894 MPa.

1. All values are for anchors installed in fully grouted concrete masonry wall construction with materials meeting minimum compressive strength, f'm, of 1,500 psi (10.3 MPa). Concrete masonry units must be light-, medium, or normal-weight conforming to ASTM C90. Allowable loads are based on a safety factor of 5.0.
2. Anchors may be installed in any location in the top of the masonry wall except within 1-1/4-inch from the of the mortar joint (head joint), provided the minimum edge and end distances are maintained.
3. A maximum of two anchors may be installed in a single masonry cell in accordance with the spacing and edge or end distance requirements. Embedment is measured from the outside surface of the concrete masonry unit to the embedded end of the anchor. See Screw-Bolt+ Anchors Installed into the Top of Grouted Concrete Masonry Wall figure.
4. Minimum spacing distance for 1/2-inch-diameter anchors shall be 8 inches and may be reduced to 2 inches provided the allowable load reduction factor of 0.40 is applied. Linear interpolation may be used to determine the reduction factor for intermediate anchor spacing distances between 8 inches and 2 inches.
5. Spacing distance is measured from the centerline to centerline between two anchors.
6. Linear interpolation may be used to for 1/4-inch and 3/8-inch-diameter anchors to determine allowable loads for edge distances between 3-1/2-inches and 1-1/2-inches.
7. Linear interpolation may be used to for 1/2-inch-diameter anchors to determine allowable loads for edge distances between 3-3/4-inches and 1-3/4-inches.
8. The edge and end distance is measured from the anchor centerline to the closest unrestrained edge and end of the CMU block, respectively. See Screw-Bolt+ Anchors Installed into the Top of Grouted Concrete Masonry Wall figure.
9. Spacing distance is measured from the centerline to centerline between two anchors.
10. Allowable shear loads parallel and perpendicular to the edge of a masonry wall may be applied in or out of plane, respectively. See Screw-Bolt+ Anchors Installed into the Top of Grouted Concrete Masonry Wall figure.



1. Shear load perpendicular to End and parallel to Edge
2. Shear load perpendicular to Edge and parallel to End
3. Shear load parallel to Edge and perpendicular away from End
4. Shear load parallel to End and perpendicular to bottom of wall

Allowable Screw-Bolt+ Tension and Shear Load Capacities Installed into the Face of Brick Masonry Walls[1,2,3,4,5,6,7,8]

Tension Load

Anchor Diameter, d in.	Minimum Embedment, h_{nom} in. (mm)	Allowable Load at c_{cr} and s_{cr} lbs (kN)	Spacing Distance, s			Edge or End Distance		
			Critical Distance, s_{cr} in. (mm)	Minimum Distance, s_{min} in. (mm)	Allowable Load Factor at s_{min} in. (mm)	Critical Distance, c_{cr} in. (mm)	Minimum Distance, c_{min} in. (mm)	Allowable Load Factor at c_{min}
1/4	1-5/8 (41.3)	550 (2.4)	4 (101.6)	2 (50.8)	0.60	3-3/4 (95.3)	1-1/4 (31.8)	0.25
	2-1/2 (63.5)	830 (3.7)						
3/8	2 (50.8)	905 (4.0)	6 (152.4)	3 (76.2)	0.60	6 (152.4)	1-1/2 (38.1)	0.50
	3-1/4 (82.6)	1,115 (5.0)						
1/2	2-1/2 (63.5)	1,015 (4.5)	8 (203.2)	4 (101.6)	0.60	8 (203.2)	2-5/8 (66.7)	0.50
	4-1/4 (108.0)	1,495 (6.7)						
5/8	3-1/4 (82.6)	1025 (4.6)	10 (254.0)	5 (127.0)	0.50	10 (254.0)	3-3/8 (85.7)	0.50
	5 (127.0)	2,015 (9.0)						
3/4	4 (101.6)	1,815 (8.1)	12 (304.8)	6 (152.4)	0.50	12 (304.8)	4 (101.6)	0.50
	6-1/4 (158.8)	2,400 (10.7)						

Shear Load

Anchor Diameter, d in.	Minimum Embedment, h_{nom} in. (mm)	Allowable Load at c_{cr} and s_{cr} lbs (kN)	Spacing Distance, s			Edge or End Distance		
			Critical Distance, s_{cr} in. (mm)	Minimum Distance, s_{min} in. (mm)	Allowable Load Factor at s_{min} in. (mm)	Critical Distance, c_{cr} in. (mm)	Minimum Distance, c_{min} in. (mm)	Allowable Load Factor at c_{min} Load Perpendicular to Edge or End
1/4	1-5/8 (41.3)	405 (1.8)	4 (101.6)	2 (50.8)	0.70	3-3/4 (95.3)	1-1/4 (31.8)	0.20
	2-1/2 (63.5)	520 (2.3)						
3/8	2 (50.8)	930 (4.1)	6 (152.4)	3 (76.2)	0.70	6 (152.4)	1-1/2 (38.1)	0.20
	3-1/4 (82.6)	1,030 (4.6)						
1/2	2-1/2 (63.5)	1,055 (4.7)	8 (203.2)	4 (101.6)	0.65	8 (203.2)	2-5/8 (66.7)	0.25
	4-1/4 (108.0)	1,075 (4.8)						
5/8	3-1/4 (82.6)	1,700 (7.6)	10 (254.0)	5 (127.0)	0.50	10 (254.0)	3-3/8 (85.7)	0.40
	5 (127.0)	1,980 (8.8)						
3/4	4 (101.6)	1,700 (7.6)	12 (304.8)	6 (152.4)	0.50	12 (304.8)	4 (101.6)	0.55
	6-1/4 (158.8)	2,030 (9.0)						

For SI: 1 inch = 25.4 mm; 1 lbs = 0.0044 kN, 1 psi = 0.006894 MPa.

1. All values are for anchors installed in minimum two-wythe, solid clay brick masonry walls conforming to ASTM C62, grade SW minimum. Mortar must be type N, S or M. The base material must have a minimum compressive strength, f'm, of 2,000 psi (13.8 MPa). Allowable loads are based on a safety factor of 5.0.
2. Anchors may be installed in any location in the face of the masonry wall, provided the minimum edge and end distances are maintained.
3. Embedment is measured from the outside surface of the concrete masonry unit to the embedded end of the anchor.
4. The critical spacing distance, s_{cr}, is the anchor spacing where full load values in the table may be used. The minimum spacing distance, s_{min}, is the minimum anchor spacing for which values are available and installation is permitted. Spacing distance is measured from the centerline to centerline between two anchors.
5. The critical edge or end distance, c_{cr}, is the distance where full load values in the table may be used. The minimum edge or end distance, c_{min}, is the minimum distance for which values are available and installation is permitted. Edge or end distance is measured from anchor centerline to the closest unrestrained edge.
6. The tabulated values are applicable for anchors installed into wall openings where minimum edge distances are maintained.
7. Load values for anchors installed less than s_{cr} and c_{cr} must be multiplied by the appropriate load reduction factor based on actual spacing (s) or edge distance (c). Load factors are multiplicative; both spacing and edge reduction factors must be considered.
8. Linear interpolation of load values between minimum spacing (s_{min}) and critical spacing (s_{cr}) and between minimum edge or end distance (c_{min}) and critical edge or end distance (c_{cr}) is permitted.

INSTALLATION SPECIFICATIONS (SD)

Screw-Bolt+ Installation Specifications in Concrete and Supplemental Information[1,2,3,4]

CODE LISTED ICC-ES ESR-3889

STRENGTH DESIGN SD TABLES

Anchor Property/ Setting Information	Notation	Units	Nominal Anchor Diameter (inch)											
			1/4		3/8			1/2			5/8			3/4
Nominal anchor diameter	d_a	in. (mm)	0.250 (6.35)		0.375 (9.525)			0.500 (12.7)			0.625 (15.9)			0.750 (19.05)
Minimum diameter of hole clearance in fixture	d_h	in. (mm)	3/8 (9.5)		1/2 (12.7)			5/8 (15.9)			3/4 (19.1)			7/8 (22.2)
Nominal drill bit diameter	d_{bit}	in.	1/4 ANSI		3/8 ANSI			1/2 ANSI			5/8 ANSI			3/4 ANSI
Minimum nominal embedment depth[5]	h_{nom}	in. (mm)	1-5/8 (41)	2-1/2 (64)	2 (51)	2-1/2 (64)	3-1/4 (83)	2-1/2 (64)	3 (76)	4-1/4 (108)	3-1/4 (64)	4 (64)	5 (127)	4-1/4 (108)
Effective Embedment	h_{ef}	in. (mm)	1.20 (30)	1.94 (49)	1.33 (34)	1.75 (44)	2.39 (61)	1.75 (44)	2.17 (55)	3.23 (82)	2.24 (57)	2.88 (73)	3.73 (95)	3.08 (78)
Minimum hole depth	h_{hole}	in. (mm)	2 (51)	2-7/8 (73)	2-3/8 (60)	2-7/8 (73)	3-5/8 (92)	2-7/8 (73)	3-3/8 (86)	4-5/8 (117)	3-5/8 (92)	4-3/8 (111)	5-3/8 (137)	4-5/8 (117)
Minimum concrete member thickness	h_{min}	in. (mm)	3-1/4 (83)	4 (102)	3-1/2 (89)	4 (102)	5 (127)	4-1/2 (114)	5-1/4 (133)	6-3/4 (171)	5 (127)	6 (152)	7 (178)	6 (152)
Minimum edge distance[6]	c_{min}	in. (mm)	1-1/2 (38)		c_{min} = 1-1/2 (38) for $s_{min} \geq$ 3 (76)			1-3/4 (44)			1-3/4 (44)			1-3/4 (44)
Minimum spacing distance[6]	s_{min}	in. (mm)	1-1/2 (38)		s_{min} = 2 (51) for $c_{min} \geq$ 2 (51)			2-3/4 (70)			2-3/4 (70)			3 (76)
Critical edge distance	c_{ac}	in. (mm)	4.30 (109)	6.10 (155)	5.00 (127)	6.30 (160)	7.80 (198)	3.30 (84)	5.90 (150)	8.10 (206)	6.30 (160)	7.90 (201)	10.10 (257)	10.90 (277)
Minimum overall anchor length[7]	ℓ_{anch}	in. (mm)	1-3/4 (44)	3 (76)	2-1/2 (64)	3 (76)	4 (102)	3 (76)	4 (102)	5 (127)	4 (102)	5 (127)	6 (152)	5 (127)
Maximum Installation torque	$T_{inst,max}$	ft.-lbf. (N-m)	19 (26)	25 (34)	25 (34)	25 (34)	40 (54)	45 (61)	45 (61)	60 (81)	60 (81)			70 (95)
Maximum impact wrench power (torque)	$T_{impact,max}$	ft.-lbf (N-m).	150 (203)		300 (407)			300 (407)			700 (950)			700 (950)
Impact wrench socket size	-	in.	7/16		9/16			3/4			15/16			1-1/8
Maximum head height	-	in.	21/64		3/8			31/64			37/64			43/64
Maximum washer diameter	-	in.	37/64		3/4			1-1/16			1-1/8			1-13/32
Effective tensile stress area (screw anchor body)	A_{se}	in² (mm²)	0.045 (29.0)		0.094 (60.6)			0.176 (113.5)			0.274 (176.8)			0.399 (257.4)
Minimum specified ultimate strength	f_{uta}	ksi (N/mm²)	100 (690)		92.5 (638)			115 (794)			95 (656)			95 (656)
Minimum specified yield strength	f_y	ksi (N/mm²)	80 (552)		74 (511)			92 (635)			76 (524)			76 (524)
Mean axial stiffness[8] – Uncracked concrete	β_{uncr}	lbf/in (kN/mm)	1,252,000 (211)		1,157,000 (195)			1,014,000 (171)			919,000 (155)			1,028,000 (173)
Mean axial stiffness[8] – Cracked concrete	β_{cr}	lbf/in (kN/mm)	355,000 (60)		330,000 (56)			349,000 (59)			378,000 (64)			419,000 (71)

For SI: 1 inch = 25.4 mm; 1 ksi = 6.894 N/mm²; 1 ft-lb = 1.356 N-m; 1 lb = 0.0044 kN.

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable.
2. For installations in the topside of concrete-filled steel deck assemblies with minimum concrete member thickness, $h_{min,deck}$, of 2.5 inches above the upper flute (topping thickness). See the table for anchor setting information for installation on the top of concrete-filled steel deck assemblies and the top of concrete over steel deck installation detail.
3. For installations in the topside of concrete-filled steel deck assemblies with sand-lightweight concrete fill, the maximum installation torque, $T_{inst,max}$, is 18 ft.-lb.
4. For installations through the soffit of steel deck assemblies into concrete, see the design information table for installation in the soffit of concrete-filled steel deck assemblies and the installation details in the soffit of concrete over steel deck for the applicable steel deck profile. Tabulated minimum spacing values are based on anchors installed along the flute with axial spacing equal to the greater of $3h_{ef}$ or 1.5 times the flute width.
5. The embedment depth, h_{nom}, is measured from the outside surface of the concrete member to the embedded end of the anchor.
6. Additional combinations for minimum edge distance, c_{min}, and minimum spacing distance, s_{min}, may be derived by linear interpolation between the given boundary values for the 3/8-inch diameter anchors.
7. The listed minimum overall anchor length is based on the anchor sizes commercially available at the time of publication compared with the requirements to achieve the minimum nominal embedment depth, including consideration of a fixture attachment. The minimum nominal anchor length is measured from under the head to the tip of the anchor.
8. Mean values shown, actual stiffness varies considerably depending on concrete strength, loading and geometry of application.

Anchor Setting Information for Installation on the Top of Concrete-Filled Steel Deck Assemblies with Minimum Topping Thickness[1,2,3,4]

CODE LISTED
ICC-ES ESR-3889

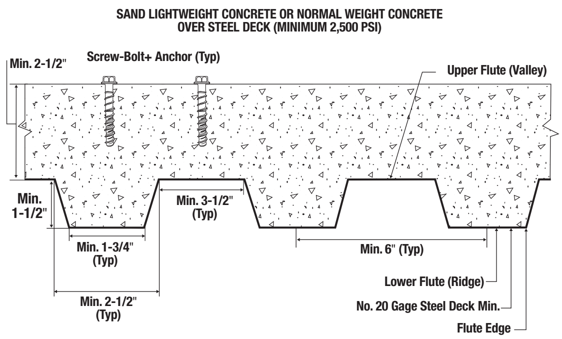
STRENGTH DESIGN TABLES

Anchor Property / Setting Information	Notation	Units	Nominal Anchor Size (inch)			
			1/4		3/8	1/2
Nominal anchor diameter	d_a	in. (mm)	0.250 (6.4)		0.375 (9.5)	0.500 (12.7)
Minimum diameter of hole clearance in fixture	d_h	in. (mm)	3/8 (9.5)		1/2 (12.7)	5/8 (15.9)
Nominal drill bit diameter	d_{bit}	in.	1/4 ANSI		3/8 ANSI	1/2 ANSI
Minimum nominal embedment depth[5]	h_{nom}	in. (mm)	1-5/8 (41)	2-1/2 (64)	2 (51)	2-1/2 (64)
Effective embedment	h_{ef}	in. (mm)	1.20 (30)	1.94 (49)	1.33 (33)	1.75 (44)
Minimum hole depth	h_o	in. (mm)	2 (51)	2-1/2 (64)	2-3/8 (60)	2-1/2 (64)
Minimum concrete member thickness (topping thickness)	$h_{min,deck}$	in. (mm)	2-1/2 (64)	2-1/2 (64)	2-1/2 (64)	2-1/2 (64)
Minimum edge distance	$c_{min,deck,top}$	in. (mm)	1-1/2 (38)		2 (51)	2-1/2 (64)
Minimum spacing distance	$s_{min,deck,top}$	in. (mm)	1-1/2 (38)		2 (51)	2-1/2 (64)
Critical edge distance	$c_{ac,deck,top}$	in. (mm)	3 (76)	4 (102)	3.5 (89)	6 (152)
Minimum nominal anchor length[6]	ℓ_{anch}	in. (mm)	1-3/4 (44)	3 (76)	2-1/2 (64)	3 (76)
Maximum impact wrench power (torque)	$T_{impact,max}$	ft.-lb. (N-m)	150 (203)		300 (407)	300 (407)
Max. installation torque	$T_{inst,max}$	ft.-lb. (N-m)	18[7] (26)	25 (34)	25 (34)	45 (61)
Wrench socket size	-	in.	7/16		9/16	3/4
Max. head height	-	in.	21/64		3/8	31/64
Max. washer diameter	-	in.	37/64		3/4	1-1/16

For SI: 1 inch = 25.4 mm; 1 ksi = 6.894 N/mm²; 1 ft-lb = 1.356 N-m; 1 lb = 0.0044 kN.

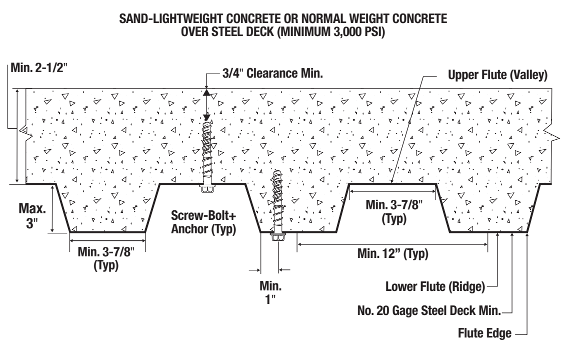
1. The anchors may be installed in the topside of concrete-filled steel deck floor and roof assemblies in accordance with this table, the anchor installation specifications in concrete table and the top of concrete over steel deck installation detail provided the concrete thickness above the upper flute meets the minimum thicknesses specified in this table. Minimum concrete member thickness, $h_{min,deck}$, refers to the concrete thickness above the upper flute (topping thickness). See the top of concrete over steel deck installation detail.
2. Applicable to the following conditions:
   For 1/4-inch-diameter anchors with 1-5/8-inch nominal embedment, 2-1/2-inch $\leq h_{min,deck} <$ 3-1/4-inch.
   For 1/4-inch-diameter anchors with 2-1/2-inch nominal embedment, 2-1/2-inch $\leq h_{min,deck} <$ 4-inch.
   For 3/8-inch-diameter anchors with 2-inch nominal embedment, 2-1/2-inch $\leq h_{min,deck} <$ 3-1/2-inch.
   For 1/2-inch-diameter anchors with 2-1/2-inch nominal embedment, 2-1/2-inch $\leq h_{min,deck} <$ 4-1/2-inch.
3. For all other anchor diameters and embedment depths, refer to the anchor installation specifications in concrete table for applicable values of h_{min}, c_{min} and s_{min}, which can be substituted for $h_{min,deck}$, $c_{min,deck,top}$ and $s_{min,deck,top}$, respectively.
4. Design capacities shall be based on calculations according to values in Tension Design Information and the Shear Design Information tables.
5. The embedment depth, h_{nom}, is measured from the outside surface of the concrete member to the embedded end of the anchor.
6. The listed minimum overall anchor length is based on the anchor sizes commercially available at the time of publication compared with the requirements to achieve the minimum nominal embedment depth, including consideration of a fixture attachment for hex head anchors. The minimum nominal anchor length is measured from under the head to the tip of the anchor.
7. For installations in the topside of concrete-filled steel deck assemblies with normal-weight concrete fill, a maximum installation torque, $T_{inst,max}$, of 19 ft.-lb is allowed.

Installation Detail for Anchors in the Top of Concrete Over Steel Deck Floor and Roof Assemblies with Minimum Topping Thickness (See Dimensional Profile Requirements)[1,2]



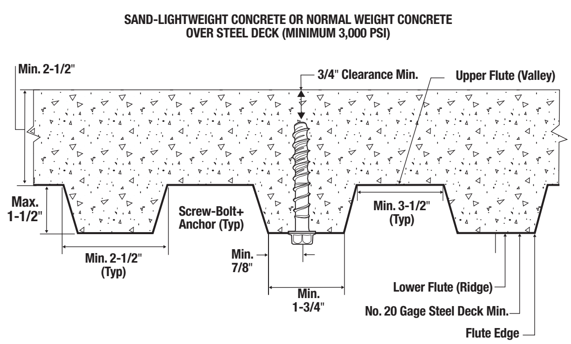
1. Anchors may be placed in the top side of concrete over steel deck profiles provided the minimum concrete thickness above the upper flute (topping thickness), minimum spacing distance and minimum edge distances are satisfied as given in Anchor Setting Information for Installation on the Top of Concrete-Filled Steel Deck Assemblies with Minimum Topping Thickness table.
2. For all other anchor diameters and embedment depths installed in the top of concrete over steel deck profiles with topping thickness greater than or equal to the minimum concrete member thicknesses given in the Installation Specifications in Concrete table, the minimum spacing distances and minimum edge distances must be used from the Installation Specifications in Concrete table, as applicable.

Screw-Bolt+ Installation Detail for Anchors in the Soffit of Concrete Over Steel Deck Floor and Roof Assemblies (See Dimensional Profile Requirements)[1,2,3]



1. Anchors may be placed in the upper flute or lower flute of concrete-filled steel deck profiles provided the minimum hole clearance of 3/4-inch is satisfied for the selected anchor. See the Tension and Shear Design information for Anchors Installed in the Soffit of Concrete-Filled Steel Deck Assemblies table.
2. Anchors in the lower flute may be installed with a maximum 15/16 -inch offset in either direction from the center of the flute. The offset distance may be increased proportionally for profiles with lower flute widths greater than those shown provided the minimum lower flute edge distance is also satisfied (e.g. 1-1/4 -inch offset for 4-1/2-inch wide flute).
3. See the Tension and Shear Design information for Anchors Installed in the Soffit of Concrete-Filled Steel Deck Assemblies table for design data.

Screw-Bolt+ Installation Detail for Anchors in the Soffit of Concrete Over Steel Deck Floor and Roof Assemblies (See Dimensional Profile Requirements)[1,2,3]



1. Anchors may be placed in the upper flute or lower flute of the concrete-filled steel deck profiles provided the minimum hole clearance of 3/4-inch is satisfied for the selected anchor. See the Tension and Shear Design information for Anchors Installed in the Soffit of Concrete-Filled Steel Deck Assemblies table.
2. Anchors in the lower flute may be installed in the center of the flute. An offset distance may be given proportionally for profiles with flute widths greater than those shown provided the minimum lower flute edge distance is also satisfied.
3. See the Tension and Shear Design information for Anchors Installed in the Soffit of Concrete-Filled Steel Deck Assemblies table for design data.

STRENGTH DESIGN (SD)

Tension Design Information For Screw-Bolt+ Anchor In Concrete[1,2]

CODE LISTED
ICC-ES ESR-3889

Design Characteristic	Notation	Units	Nominal Anchor Diameter											
			1/4		3/8			1/2			5/8			3/4
Anchor category	1, 2 or 3	-	1		1			1			1			1
Minimum nominal embedment depth	h_{nom}	in. (mm)	1-5/8 (41)	2-1/2 (64)	2 (51)	2-1/2 (64)	3-1/4 (83)	2-1/2 (64)	3 (76)	4-1/4 (108)	3-1/4 (64)	4 (64)	5 (127)	4-1/4 (108)
Steel Strength in Tension (ACI 318-14 17.4.1 or ACI 318-11 D.5.1)														
Steel strength in tension	N_{sa}[10]	lb (kN)	4,535 (20.2)		8,730 (38.8)			20,475 (91.1)			26,260 (116.8)			38,165 (169.8)
Reduction factor for steel strength[3,4]	ϕ	-	0.65											
Concrete Breakout Strength in Tension (ACI 318-14 17.4.2 or ACI 318-11 D.5.2)														
Effective embedment	h_{ef}	in. (mm)	1.20 (30)	1.94 (49)	1.33 (34)	1.75 (44)	2.39 (61)	1.75 (44)	2.17 (55)	3.23 (82)	2.24 (57)	2.88 (73)	3.73 (95)	3.08 (78)
Critical edge distance	c_{ac}	in. (mm)	4.30 (109)	6.10 (155)	5.00 (127)	6.30 (160)	7.80 (198)	3.30 (84)	5.90 (150)	8.10 (206)	6.30 (160)	7.90 (201)	10.10 (257)	10.90 (277)
Critical edge distance, topside of concrete-filled steel decks with minimum topping thickness[9]	$c_{ac,deck,top}$	in. (mm)	3.00 (76)	4.00 (102)	3.50 (89)	-[11]	-[11]	6.00 (152)	-[11]	-[11]	-[11]	-[11]	-[11]	-[11]
Effectiveness factor for uncracked concrete	k_{uncr}	-	27	24	30	24	24	30	24	24	30	24	24	27
Effectiveness factor for cracked concrete	k_{cr}	-	17		17			17			21			17
Modification factor for cracked and uncracked concrete[5]	$\Psi_{c,N}$	-	1.0		1.0			1.0			1.0			1.0
Reduction factor for concrete breakout strength[3]	ϕ	-	0.65 (Condition B)											
Pullout Strength in Tension (Non-Seismic Applications) (ACI 318-14 17.4.3 or ACI 318-11 D.5.3)														
Characteristic pullout strength, uncracked concrete (2,500 psi)[6,10]	$N_{p,uncr}$	lb (kN)	See Note 7		See Note 7			See Note 7			See Note 7			See Note 7
Characteristic pullout strength, cracked concrete (2,500 psi)[6,10]	$N_{p,cr}$	lb (kN)	765 (3.4)	1,415 (6.3)	See Note 7			1,645 (7.3)	2,515 (11.2)	4,700 (20.9)	3,080 (13.7)	4,720 (21.0)	6,900 (30.7)	See Note 7
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)											
Pullout Strength in Tension for Seismic Applications (ACI 318-14 17.2.3.3 or ACI 318-11 D.3.3.3)														
Characteristic pullout strength, seismic (2,500 psi)[6,8,10]	N_{eq}	lb	360 (1.6)	1,170 (5.2)	900 (4.0)	1,645 (7.3)	2,765 (12.3)	1,645 (7.3)	2,515 (11.2)	4,700 (20.9)	1,910 (8.5)	2,445 (10.9)	3,370 (15.0)	4,085 (18.2)
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)											

For SI: 1 inch = 25.4 mm; 1 ksi = 6.894 N/mm²; 1 ft-lb = 1.356 N-m; 1 lb = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable, shall apply.
2. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3, or ACI 318-11 Section 9.2. If the load combinations of ACI 318-11 Appendix C are used, then the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4. For reinforcement that complies with ACI 318-14 Chapter 17 or ACI 318-11 Appendix D requirements for Condition A, see ACI 318-14 17.3.3(c) or ACI 318-11 Section D.4.3(c), as applicable for the appropriate ϕ factor when the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used.
4. The anchors are considered a brittle steel elements as defined by ACI 318-14 2.3 or ACI 318-11 D.1, as applicable.
5. Select the appropriate effectiveness factor for cracked concrete (k_{cr}) or uncracked concrete (k_{uncr}) and use $\Psi_{c,N} = 1.0$.
6. For all design cases $\Psi_{c,P} = 1.0$. The characteristic pullout strength, N_{pn}, for concrete compressive strengths greater than 2,500 psi for 1/4-inch-diameter anchors may be increased by multiplying the value in the table by $(f'c / 2{,}500)^{0.3}$ for psi or $(f'c / 17.2)^{0.3}$ for MPa. The characteristic pullout strength, N_{pn}, for concrete compressive strengths greater than 2,500 psi for 3/8-inch- to 3/4-inch-diameter anchors may be increased by multiplying the value in the table by $(f'c / 2{,}500)^{0.5}$ for psi or $(f'c / 17.2)^{0.5}$ for MPa.
7. Pullout strength does not control design of indicated anchors and does not need to be calculated for indicated anchor size and embedment.
8. Reported values for characteristic pullout strength in tension for seismic applications are based on test results per ACI 355.2, Section 9.5.Y
9. Anchors are permitted in the topside of concrete-filled steel deck assemblies in accordance with the Installation Detail for Anchors in the Top of Concrete Over Steel Deck Floor and Roof Assemblies with Minimum Topping Thickness.
10. Anchors are permitted to be used in lightweight concrete provided the modification factor λa equal to 0.8λ is applied to all values of f'c affecting N_n.
11. Tabulated critical edge distance values, $c_{ac,deck,top}$, are for anchors installed in the top of concrete over steel deck profiles with a minimum concrete thickness, $h_{min,deck}$, of 2.5 inches above the upper flute (topping thickness). For minimum topping thickness greater than or equal to the minimum concrete member thicknesses, h_{min}, given in the Installation Specifications table, the associated critical edge distance, c_{ac}, for indicated anchor diameters and embedment depths may be used in the calculation of $\Psi_{cp,N}$ as applicable.

Shear Design Information for Screw-Bolt+ Anchor in Concrete[1,2,7,8]

CODE LISTED ICC-ES ESR-3889

STRENGTH DESIGN SD TABLES

Design Characteristic	Notation	Units	Nominal Anchor Diameter											
			1/4		3/8			1/2			5/8			3/4
Anchor category	1, 2 or 3	-	1		1			1			1			1
Minimum nominal embedment depth	h_{nom}	in. (mm)	1-5/8 (41)	2-1/2 (64)	2 (51)	2-1/2 (64)	3-1/4 (83)	2-1/2 (64)	3 (76)	4-1/4 (108)	3-1/4 (64)	4 (64)	5 (127)	4-1/4 (108)
Steel Strength in Shear (ACI 318-14 17.5.1 or ACI 318-11 D.6.1)														
Steel strength in shear[5]	V_{sa}	lb (kN)	1,635 (7.3)	2,040 (9.1)	3,465 (15.4)	3,465 (15.4)	4,345 (19.3)	8,860 (39.4)	8,860 (39.4)	11,175 (49.7)	12,310 (54.8)	12,310 (54.8)	15,585 (69.3)	19,260 (85.7)
Reduction factor for steel strength[3,4]	ϕ	-	0.60											
Steel Strength in Shear for Seismic Applications (ACI 318-14 17.2.3.3 or ACI 318-11 D.3.3.3)														
Steel strength in shear, seismic[6]	V_{eq}	lb (kN)	1,360 (6.1)	1,700 (7.7)	2,415 (10.9)	2,415 (10.9)	3,030 (13.6)	7,090 (31.9)	7,090 (31.9)	8,940 (40.2)	9,845 (44.3)	9,845 (44.3)	12,465 (56.1)	15,405 (69.3)
Reduction factor for steel strength in shear for seismic[3,4]	ϕ	-	0.60											
Concrete Breakout Strength in Shear (ACI 318-14 17.5.2 or ACI 318-11 D.6.2)														
Nominal anchor diameter	d_a	in. (mm)	0.250 (6.4)		0.375 (9.5)			0.500 (12.7)			0.625 (15.9)			0.750 (19.1)
Load bearing length of anchor	ℓ_e	in. (mm)	1.20 (30)	1.94 (49)	1.33 (34)	1.75 (44)	2.39 (61)	1.75 (44)	2.17 (55)	3.23 (82)	2.24 (57)	2.88 (73)	3.73 (95)	3.08 (78)
Reduction factor for concrete breakout[3]	ϕ	-	0.70 (Condition B)											
Pryout Strength in Shear (ACI 318-14 17.5.3 or ACI 318-11 D.6.3)														
Coefficient for pryout strength	k_{cp}	-	1	1	1	1	1	1	1	2	1	2	2	2
Effective embedment	h_{ef}	in. (mm)	1.20 (30)	1.94 (49)	1.33 (34)	1.75 (44)	2.39 (61)	1.75 (44)	2.17 (55)	3.23 (82)	2.24 (57)	2.88 (73)	3.73 (95)	3.08 (78)
Reduction factor for pryout strength[3]	ϕ	-	0.70 (Condition B)											

For SI: 1 inch = 25.4 mm; 1 ksi = 6.894 N/mm²; 1 ft-lb = 1.356 N-m; 1 lb = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-17 17.2.3 or ACI 318-11 D.3.3, as applicable shall apply.
2. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3, or ACI 318-11 Section 9.2. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 Section D.4.4. For reinforcement that complies with ACI 318-14 Chapter 17 or ACI 318-11 Appendix D requirements for Condition A, see ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c), as applicable, for the appropriate ϕ factor when the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3, or ACI 318-11 Section 9.2 are used.
4. The anchors are considered a brittle steel elements as defined by ACI 318-14 2.3 or ACI 318-11 D.1.
5. Reported values for steel strength in shear are based on test results per ACI 355.2, Section 9.4 and must be used for design in lieu of the calculated results using equation 17.5.1.2(b) of ACI 318-14 or equation D-29 in ACI 318-11 D.6.1.2.
6. Reported values for steel strength in shear are for seismic applications and based on test results in accordance with ACI 355.2, Section 9.6 and must be used for design.
7. Anchors are permitted in the topside of concrete-filled steel deck assemblies in accordance with the Installation Detail for Anchors in the Top of Concrete Over Steel Deck Floor and Roof Assemblies with Minimum Topping Thickness.
8. Anchors are permitted to be used in lightweight concrete in provided the modification factor λa equal to 0.8λ is applied to all values of f'c affecting N_n.

Tension and Shear Design Information for Screw-Bolt+ Anchor in the Soffit (Through the Underside) of Concrete-Filled Steel Deck Assemblies[1,2,3,4,5,6]

CODE LISTED
ICC-ES ESR-3889

STRENGTH DESIGN SD TABLES

Anchor Property/Setting Information	Notation	Units	Nominal Anchor Diameter (inch)											
			1/4		3/8			1/2			5/8			3/4
Minimum nominal embedment depth	h_{nom}	in. (mm)	1-5/8 (41)	2-1/2 (64)	2 (51)	2-1/2 (64)	3-1/4 (83)	2-1/2 (64)	3 (76)	4-1/4 (108)	3-1/4 (64)	4 (64)	5 (127)	4-1/4 (108)
Effective Embedment	h_{ef}	in. (mm)	1.20 (30)	1.94 (49)	1.33 (34)	1.75 (44)	2.39 (61)	1.75 (44)	2.17 (55)	3.23 (82)	2.24 (57)	2.88 (73)	3.73 (95)	3.08 (78)
Minimum hole depth	h_o	in. (mm)	1-3/4 (44)	2-5/8 (67)	2-1/8 (54)	2-5/8 (67)	3-3/8 (86)	2-5/8 (67)	3-1/8 (79)	4-3/8 (111)	3-3/8 (86)	4-1/8 (10.5)	5-1/8 (130)	4-3/8 (111)
Anchors Installed Through the Soffit of Steel Deck Assemblies into Concrete (Minimum 3-7/8-inch-wide deck flute)														
Minimum concrete member thickness[7]	$h_{min,deck,total}$	in. (mm)	5-1/2 (140)	5-1/2 (140)	5-1/2 (140)	5-1/2 (140)	5-1/2 (140)	5-1/2 (140)	5-1/2 (140)	5-1/2 (140)	5-1/2 (140)	5-1/2 (140)	6-1/4 (159)	6-1/4 (159)
Characteristic pullout strength, uncracked concrete over steel deck, (3,000 psi)	$N_{p,deck,uncr}$	lb (kN)	1,430 (6.4)	2,555 (11.4)	2,275 (10.1)	2,655 (11.8)	3,235 (14.4)	2,600 (11.6)	3,555 (15.8)	5,975 (26.6)	2,610 (11.6)	4,150 (18.5)	6,195 (27.6)	6,085 (27.1)
Characteristic pullout strength, cracked concrete over steel deck, (3,000 psi)	$N_{p,deck,cr}$	lb (kN)	615 (2.7)	1,115 (5.0)	1,290 (5.7)	1,880 (8.4)	2,290 (10.2)	1,230 (5.5)	2,330 (10.4)	4,030 (17.9)	1,600 (7.1)	3,340 (14.9)	4,945 (22.0)	3,835 (17.1)
Characteristic pullout strength, cracked concrete over steel deck,seismic, (3,000 psi)	$N_{p,deck,eq}$	lb (kN)	290 (1.3)	920 (4.1)	890 (4.0)	1,570 (7.0)	2,015 (9.0)	1,230 (5.5)	2,330 (10.4)	4,030 (17.9)	990 (4.4)	1,730 (7.7)	2,415 (10.7)	3,410 (15.2)
Reduction factor for pullout strength[8]	ϕ	-	0.65											
Steel strength in shear, concrete over steel deck	$V_{sa,deck}$	lb (kN)	1,155 (5.1)	2,595 (11.5)	2,470 (11.0)	2,470 (11.0)	3,225 (14.3)	2,435 (10.8)	2,435 (10.8)	5,845 (26.0)	2,650 (11.8)	2,650 (11.8)	6,325 (28.1)	5,175 (23.0)
Steel strength in shear, concrete over steel deck, seismic	$V_{sa,deck,eq}$	lb (kN)	960 (4.3)	2,165 (9.6)	1,725 (7.7)	1,900 (8.5)	2,250 (10.0)	1,950 (8.7)	2,095 (9.3)	4,675 (20.8)	2,120 (9.4)	2,325 (10.3)	5,060 (22.5)	4,140 (18.4)
Reduction factor for steel strength in shear for concrete over steel deck[8]	ϕ	-	0.60											
Anchors Installed Through the Soffit of Steel Deck Assemblies into Concrete (Minimum 1-3/4-inch-wide deck flute)														
Minimum concrete member thickness[7]	$h_{min,deck,total}$	in. (mm)	4 (102)	4 (102)	4 (102)	4 (102)	4 (102)	4 (102)	N/A		N/A			N/A
Characteristic pullout strength, uncracked concrete over steel deck, (3,000 psi)	$N_{p,deck,uncr}$	lb (kN)	1,760 (7.8)	2,075 (9.2)	1,440 (6.4)	2,135 (9.5)	3,190 (14.2)	1,720 (7.7)	N/A		N/A			N/A
Characteristic pullout strength, cracked concrete over steel deck, (3,000 psi)	$N_{p,deck,cr}$	lb (kN)	760 (3.4)	910 (4.0)	815 (3.6)	1,510 (6.7)	2,260 (10.1)	1,280 (5.7)	N/A		N/A			N/A
Characteristic pullout strength, cracked concrete over steel deck,seismic, (3,000 psi)	$N_{p,deck,eq}$	lb (kN)	355 (1.6)	750 (3.3)	565 (2.5)	1,260 (5.6)	1,985 (8.8)	1,280 (5.7)	N/A		N/A			N/A
Reduction factor for pullout strength[8]	ϕ	-	0.65						N/A		N/A			N/A
Steel strength in shear, concrete over steel deck	$V_{sa,deck}$	lb (kN)	1,880 (8.4)	2,315 (10.3)	2,115 (9.4)	2,115 (9.4)	2,820 (12.5)	2,095 (9.3)	N/A		N/A			N/A
Steel strength in shear, concrete over steel deck, seismic	$V_{sa,deck,eq}$	lb (kN)	1,565 (7.0)	1,930 (8.6)	1,475 (6.6)	1,625 (7.2)	1,965 (8.7)	1,675 (7.5)	N/A		N/A			N/A
Reduction factor for steel strength in shear for concrete over steel deck[8]	ϕ	-	0.60		0.60			0.60	N/A		N/A			N/A

For SI: 1 inch = 25.4 mm; 1 ksi = 6.894 N/mm²; 1 ft-lb = 1.356 N-m; 1 lb = 0.0044 kN.

1. Installation must comply with published instructions and details.
2. Values for $N_{p,deck}$ and $N_{p,deck,cr}$ are for sand-lightweight concrete (f'c, min = 3,000 psi) and additional lightweight concrete reduction factors need not be applied. In addition, evaluation for the concrete breakout capacity in accordance with ACI 318-14 17.4.2 or ACI 318 D.5.2, as applicable, is not required for anchors installed in the deck soffit (through underside).
3. Values for $N_{p,deck,eq}$ are applicable for seismic loading and must be used in lieu of $N_{p,deck,cr}$.
4. For all design cases $\Psi_{c,P}$ = 1.0. The characteristic pullout strength, N_{pn}, for concrete compressive strengths greater than 3,000 psi for 1/4-inch-diameter anchors may be increased by multiplying the value in the table by $(f'c / 3{,}000)^{0.3}$ for psi or $(f'c / 17.2)^{0.3}$ for MPa. The characteristic pullout strength, N_{pn}, for concrete compressive strengths greater than 3,000 psi for 3/8-inch- to 3/4-inch-diameter anchors may be increased by multiplying the value in the table by $(f'c / 3{,}000)^{0.5}$ for psi or $(f'c / 17.2)^{0.5}$ for MPa.
5. Shear loads for anchors installed through steel deck into concrete may be applied in any direction.
6. Values of $V_{sa,deck}$ and $V_{sa,deck,eq}$ are for sand-lightweight concrete and additional lightweight concrete reduction factors need not be applied. In addition, evaluation for the concrete breakout capacity in accordance with ACI 318-14 17.5.2 or ACI 318-11 D.6.2, as applicable, and the pryout capacity in accordance with ACI 318-14 17.5.3 or ACI 318-11 D.6.3, as applicable, are not required for anchors installed in the soffit (through underside).
7. The minimum concrete member thickness, $h_{min,deck,total}$, is the minimum overall thickness of the concrete-filled steel deck (depth and topping thickness).
8. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318 Section 9.2. If the load combinations of ACI 318 Appendix C are used, then the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4 (ACI 318-08).

FACTORED RESISTANCE STRENGTH (ϕN_n AND ϕV_n) CALCULATED IN ACCORDANCE WITH ACI 318-14 CHAPTER 17:

1- Tabular values are provided for illustration and are applicable for single anchors installed in normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac} (table values based on $c_{a1} = c_{ac}$).
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.

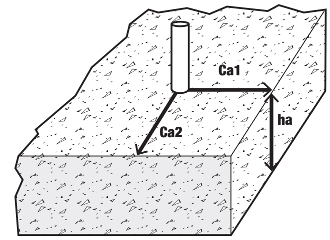
2- Calculations were performed according to ACI 318-14, Chapter 17. The load level corresponding to the controlling failure mode is listed. (e.g. For tension: steel, concrete breakout and pullout; For shear: steel, concrete breakout and pryout). Furthermore, the capacities for concrete breakout strength in tension and pryout strength in shear are calculated using the effective embedment values, h_{ef}, for the selected anchors as noted in the design information tables. Please also reference the installation specifications for more information.

3- Strength reduction factors (ø) were based on ACI 318-14 Section 5.3 for load combinations. Condition B is assumed.

4- Tabular values are permitted for static loads only, seismic loading is not considered with these tables.

5- For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14, Chapter 17.

6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318-14, Chapter 17. For other design conditions including seismic considerations please see ACI 318-14, Chapter 17.



Tension and Shear Design Strength Installed in Cracked Concrete

Nominal Anchor Diameter (in.)	Nominal Embed. Depth h_{nom} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)
1/4	1-5/8	495	780	525	855	575	980	645	980	705	980
	2-1/2	920	1,225	970	1,225	1,060	1,225	1,195	1,225	1,305	1,225
3/8	2	845	915	930	1,000	1,070	1,155	1,315	1,415	1,515	1,635
	2-1/2	1,280	1,375	1,400	1,510	1,620	1,740	1,980	2,080	2,290	2,080
	3-1/4	2,040	2,200	2,235	2,410	2,580	2,605	3,165	2,605	3,650	2,605
1/2	2-1/2	1,070	1,270	1,170	1,395	1,355	1,610	1,655	1,970	1,915	2,275
	3	1,635	1,900	1,790	2,085	2,070	2,405	2,535	2,945	2,925	3,400
	4-1/4	3,055	4,325	3,345	4,735	3,865	5,470	4,735	6,695	5,465	6,705
5/8	3-1/4	1,850	1,995	2,030	2,185	2,345	2,525	2,870	3,090	3,315	3,570
	4	2,700	4,155	2,960	4,550	3,415	5,255	4,185	6,435	4,830	7,385
	5	3,980	6,040	4,360	6,615	5,035	7,640	6,165	9,350	7,120	9,350
3/4	4-1/4	2,985	6,135	3,270	6,720	3,780	7,760	4,625	9,505	5,340	10,975

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

Tension and Shear Design Strength Installed in Uncracked Concrete

Nominal Anchor Diameter (in.)	Nominal Embed. Depth h_{nom} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)
1/4	1-5/8	1,155	980	1,265	980	1,460	980	1,785	980	2,065	980
	2-1/2	2,110	1,225	2,310	1,225	2,665	1,225	2,950	1,225	2,950	1,225
3/8	2	1,495	1,610	1,640	1,765	1,890	2,035	2,315	2,080	2,675	2,080
	2-1/2	1,805	1,945	1,980	2,080	2,285	2,080	2,795	2,080	3,230	2,080
	3-1/4	2,880	2,605	3,155	2,605	3,645	2,605	4,465	2,605	5,155	2,605
1/2	2-1/2	2,255	1,780	2,475	1,950	2,855	2,255	3,495	2,760	4,040	3,185
	3	2,495	2,685	2,730	2,940	3,155	3,395	3,865	4,160	4,460	4,805
	4-1/4	4,530	6,050	4,960	6,630	5,725	6,705	7,015	6,705	8,100	6,705
5/8	3-1/4	3,270	3,520	3,580	3,855	4,135	4,455	5,065	5,455	5,845	6,295
	4	3,810	5,815	4,175	6,370	4,820	7,355	5,905	7,385	6,820	7,385
	5	5,620	8,455	6,155	9,265	7,110	9,350	8,705	9,350	10,050	9,350
3/4	4-1/4	4,745	8,590	5,195	9,410	6,000	10,865	7,350	11,555	8,485	11,555

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

FACTORED RESISTANCE STRENGTH ($ØN_n$ AND $ØV_n$) CALCULATED IN ACCORDANCE WITH ACI 318-14, CHAPTER 17:

1- Tabular values are provided for illustration and are applicable for single anchors installed in normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
 - c_{a1} is greater than or equal to the minimum edge distance, c_{min} (table values based on $c_{a1} = c_{min}$).
 - c_{a2} is greater than or equal to 1.5 times c_{a1}.

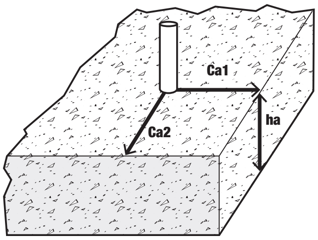
2- Calculations were performed according to ACI 318-14, Chapter 17. The load level corresponding to the controlling failure mode is listed. (e.g. For tension: steel, concrete breakout and pullout; For shear: steel, concrete breakout and pryout). Furthermore, the capacities for concrete breakout strength in tension and pryout strength in shear are calculated using the effective embedment values, h_{ef}, for the selected anchors as noted in the design information tables. Please also reference the installation specifications for more information.

3- Strength reduction factors (ø) were based on ACI 318-14 Section 5.3 for load combinations. Condition B is assumed.

4- Tabular values are permitted for static loads only, seismic loading is not considered with these tables.

5- For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14, Chapter 17.

6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318-14, Chapter 17. For other design conditions including seismic considerations please see ACI 318-14, Chapter 17.



Tension and Shear Design Strength at Minimum Edge Distance, c_{min} for Screw-Bolt+ in Cracked Concrete

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ϕN_n Tension (lbs.)	ϕV_{sn} Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_{sn} Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_{sn} Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_{sn} Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_{sn} Shear (lbs.)
1/4	1-5/8	495	370	525	405	575	470	645	575	705	660
	2-1/2	920	450	970	495	1,060	570	1,195	700	1,305	810
3/8	2	785	445	860	485	990	560	1,215	685	1,405	790
	2-1/2	1,115	500	1,220	550	1,410	635	1,725	775	1,995	895
	3-1/4	1,685	595	1,845	650	2,130	755	2,610	920	3,015	1,065
1/2	2-1/2	1,070	675	1,170	740	1,355	855	1,655	1,045	1,915	1,205
	3	1,520	760	1,665	835	1,925	960	2,355	1,180	2,720	1,360
	4-1/4	2,595	935	2,840	1,025	3,280	1,180	4,015	1,445	4,640	1,670
5/8	3-1/4	1,585	800	1,735	875	2,005	1,010	2,455	1,240	2,835	1,430
	4	2,220	920	2,430	1,010	2,805	1,165	3,435	1,425	3,970	1,645
	5	3,160	1,045	3,460	1,145	3,995	1,325	4,895	1,620	5,650	1,870
3/4	4-1/4	2,430	985	2,660	1,080	3,075	1,245	3,765	1,525	4,345	1,760

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

Tension and Shear Design Strength at Minimum Edge Distance, c_{min} for Screw-Bolt+ in Uncracked Concrete

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ϕN_n Tension (lbs.)	ϕV_{sn} Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_{sn} Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_{sn} Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_{sn} Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_{sn} Shear (lbs.)
1/4	1-5/8	460	495	505	540	580	625	710	765	820	885
	2-1/2	860	635	940	695	1,085	800	1,330	980	1,535	1,130
3/8	2	550	595	605	650	700	750	855	920	990	1,065
	2-1/2	655	700	720	765	830	885	1,015	1,085	1,175	1,250
	3-1/4	1,095	835	1,200	915	1,385	1,055	1,695	1,290	1,955	1,490
1/2	2-1/2	1,615	945	1,770	1,035	2,045	1,195	2,505	1,465	2,890	1,690
	3	1,185	1,065	1,300	1,165	1,500	1,345	1,835	1,650	2,120	1,905
	4-1/4	2,190	1,310	2,400	1,430	2,770	1,655	3,390	2,025	3,915	2,340
5/8	3-1/4	1,495	1,120	1,635	1,225	1,890	1,415	2,310	1,735	2,670	2,000
	4	1,715	1,290	1,875	1,410	2,165	1,630	2,655	1,995	3,065	2,305
	5	2,470	1,465	2,705	1,605	3,125	1,855	3,830	2,270	4,420	2,620
3/4	4-1/4	1,635	1,380	1,790	1,510	2,070	1,745	2,535	2,135	2,925	2,465

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

ORDERING INFORMATION

Screw-Bolt+

Cat. No.		Anchor Size	Box Qty.	Ctn. Qty.	20V Max* SDS Plus Rotary Hammers			Flexvolt SDS Max
					DCH273P2DH 1" L-Shape	DCH133M2 1" D-Handle	DCH293R2 1-1/8" L-Shape w/ E-Clutch	DCH481X2 1-9/16" w/ E-Clutch
Zinc Plated	Galvanized				Carbide Bits			
PFM1411000	-	1/4" x 1-1/4"	100	600	DW5517	DW5417	DW5417	-
PFM1411020	-	1/4" x 1-3/4"	100	600	DW5517	DW5417	DW5417	-
PFM1411060	-	1/4" x 2-1/4"	100	600	DW5517	DW5417	DW5417	-
PFM1411080	-	1/4" x 2-5/8"	100	500	DW5517	DW5417	DW5417	-
PFM1411100	-	1/4" x 3"	100	500	DW5517	DW5417	DW5417	-
PFM1411160	-	3/8" x 1-3/4"	50	300	DW5527	DW5427	DW5427	-
PFM1411220	-	3/8" x 2-1/2"	50	300	DW5527	DW5427	DW5427	-
PFM1411240	PFM1461240	3/8" x 3"	50	250	DW5527	DW5427	DW5427	-
PFM1411280	PFM1461280	3/8" x 4"	50	250	DW5527	DW5427	DW5427	-
PFM1411300	PFM1461300	3/8" x 5"	50	250	DW5529	DW5429	DW5429	-
PFM1411320	PFM1461320	3/8" x 6"	50	150	DW5529	DW5429	DW5429	-
PFM1411340	-	1/2" x 2"	50	200	DW5537	DW5437	DW5437	-
PFM1411360	-	1/2" x 2-1/2"	50	200	DW5537	DW5437	DW5437	-
PFM1411380	-	1/2" x 3"	50	150	DW5537	DW5437	DW5437	-
PFM1411420	PFM1461420	1/2" x 4"	50	150	DW5537	DW5437	DW5437	-
PFM1411460	PFM1461460	1/2" x 5"	25	100	DW5538	DW5438	DW5438	-
PFM1411480	PFM1461480	1/2" x 6"	25	75	DW5538	DW5438	DW5438	-
PFM1411520	PFM1461520	1/2" x 8"	25	100	DW5538	DW5438	DW5438	-
PFM1411540	-	5/8" x 3"	25	100	DW5471	DW5446	DW5471	DW5806
PFM1411580	-	5/8" x 4"	25	100	DW5471	DW5446	DW5471	DW5806
PFM1411600	PFM1461600	5/8" x 5"	25	75	DW5471	DW5446	DW5471	DW5806
PFM1411640	PFM1461640	5/8" x 6"	25	75	DW5471	DW5446	DW5471	DW5806
PFM1411680	PFM1461680	5/8" x 8"	25	50	DW5471	DW5447	DW5471	DW5806
PFM1411700	-	3/4" x 3"	20	60	DW5474	DW5453	DW5474	DW5810
PFM1411720	-	3/4" x 4"	20	60	DW5474	DW5453	DW5474	DW5810
PFM1411760	-	3/4" x 5"	20	60	DW5474	DW5453	DW5474	DW5810
PFM1411800	PFM1461800	3/4" x 6"	20	60	DW5474	DW5453	DW5474	DW5810
PFM1411840	PFM1461850	3/4" x 8"	10	40	DW5474	DW5455	DW5474	DW5810
PFM1411880	-	3/4" x 10"	10	20	DW5475	DW5455	DW5475	DW5812

Shaded catalog numbers denote sizes which are less than the minimum standard anchor length for Strength Design.

The published size includes the diameter and length of the anchor measured from under the head.

- Optimum Tool Match
- Maximum Tool Match
- Not Recommended

Suggested Impact Wrench and Socket

Nominal Anchor Size	Socket Size	Impact Rated Socket		20V Max* Impact Wrenches	
1/4	7/16	DWMT74479B		DCF890M2 3/8" Impact Wrench	
3/8	9/16	DWMT75122B		DCF894HP2 1/2" Impact Wrench	
1/2	3/4	DWMT75113B			
5/8	15/16	DWMT75104B		DCF899HP2 High Torque 1/2" (Use In Speed Setting #3)	
3/4	1-1/8	DWMT75125B			

GENERAL INFORMATION

316 STAINLESS STEEL WEDGE-BOLT™

Screw Anchor

PRODUCT DESCRIPTION

The 316 Stainless Steel Wedge-Bolt anchor is a one piece, heavy duty screw anchor with a finished hex head. It is simple to install, easy to identify, a fully removable.

The 316 Stainless Steel Wedge-Bolt has many unique features and benefits that make it well suited for many applications, both indoors and out. 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 316 Stainless Steel Wedge-Bolt can be installed with either a powered impact wrench or conventional hand socket.

316 Stainless Steel 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.

316 Stainless Steel Wedge-Bolt screw anchors are not recommended for immersion in or long term exposure to chloride/chlorine environments.

GENERAL APPLICATIONS AND USES

- Interior and Exterior Applications
- Support Ledgers and Windows
- Railing and Fencing
- Storage Facilities
- Repairs & Retrofits
- Maintenance

FEATURES AND BENEFITS

+ High corrosion resistance of Type 316 stainless steel
+ Consistent performance in high and low strength concrete
+ Anchor can be installed through standard size fixture holes in steel
+ Diameter, length and identifying marking stamped on head of each anchor
+ Can be installed with an impact wrench or conventional hand socket
+ Fast installation and immediate loading minimizes downtime
+ Finished hex head provides attractive appearance and minimizes tripping hazard
+ Can be installed closer to the edge than traditional expansion anchors
+ Ratchet teeth on underside of hex washer head contact against the fixture
+ Removable

APPROVALS AND LISTINGS

- Tested in accordance with ASTM E488

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Screw anchors shall be 316 Stainless Steel Wedge-Bolt as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

316 STAINLESS STEEL WEDGE-BOLT

HEAD STYLES

- Hex washer head

ANCHOR MATERIALS

- Type 316 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

- 1/4" diameter through 1/2" diameter

SUITABLE BASE MATERIALS

- Normal-weight Concrete
- Lightweight Concrete
- Grouted Concrete Masonry (CMU)
- Brick Masonry

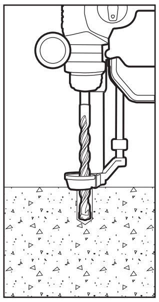
MATERIAL SPECIFICATIONS

Anchor component	Specification
Anchor Body and hex washer head	Type 316 Stainless Steel[1]

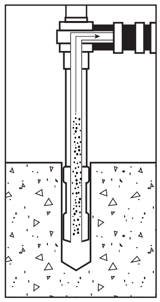
1. With sacrificial carbon steel drive tip and tapping threads.

INSTALLATION INSTRUCTIONS

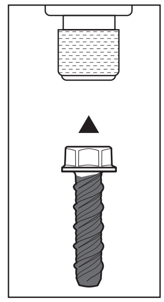
Installation Instructions for 316 Stainless Steel Wedge-Bolt



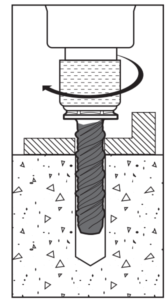
Step 1
Using the proper Wedge-bit size, drill a hole into the base material to the required depth. The tolerances of the Wedge-bit used must meet the requirements of the published Wedge-bit range.



Step 2
Remove dust and debris from the hole during drilling (e.g. dust extractor) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.

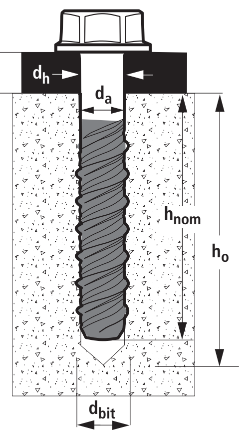


Step 3
Select a powered impact wrench that does not exceed the maximum torque, $T_{inst,max}$ or $T_{impact,max}$, for the selected anchor diameter. Attach an appropriate sized hex socket/driver to the impact wrench. Mount the screw anchor head into the socket.



Step 4
Drive the anchor through the fixture and into the hole until the head of the anchor comes into contact with the fixture. The anchor should be snug after installation. Do not spin the hex socket off the anchor to disengage.

316 Stainless Steel Wedge-Bolt Anchor Detail

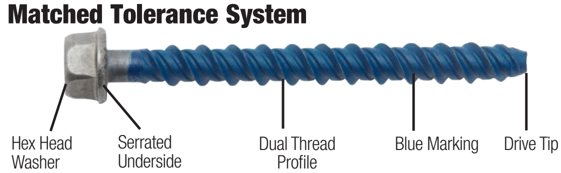


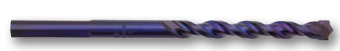
Nomenclature
d_a = Diameter of Anchor
d_{bit} = Diameter of Drill Bit
d_h = Diameter of Clearance Hole
h = Base Material Thickness. The value of h should be $1.5h_{nom}$ or 3", whichever is greater
h_{nom} = Minimum Nominal Embedment
h_o = Minimum Hole Depth

Hex Head Marking

Legend
Diameter, material, and length identification mark

Matched Tolerance System





BLUE WEDGE-BIT

Designed and tested as a system for consistency and reliability

REFERENCE DATA (ASD)

Installation Specifications for 316 Stainless Steel Wedge-Bolt in Concrete

Anchor Property / Setting Information	Notation	Units	Nominal Anchor Diameter		
			1/4	3/8	1/2
Anchor diameter	d_o	in. (mm)	0.250 (6.4)	0.375 (9.5)	0.500 (12.7)
Minimum diameter of hole clearance in fixture	d_h	in. (mm)	5/16 (7.9)	7/16 (11.1)	9/16 (14.3)
Nominal drill bit diameter	d_{bit}	in.	1/4 Wedge-Bit	3/8 Wedge-Bit	1/2 Wedge-Bit
Minimum nominal embedment depth	h_{nom}	in. (mm)	1-3/4 (44)	2 (51)	2-3/4 (70)
Minimum hole depth	h_o	in. (mm)	2 (51)	2-1/4 (57)	3 (77)
Minimum overall anchor length	ℓ_{anch}	in. (mm)	2 (51)	2-1/2 (64)	3 (76)
Max installation torque	$T_{inst,max}$	in. (mm)	15 (20)	35 (47)	60 (81)
Max impact wrench power (torque)	$T_{impact,max}$	ft.-lbf. (N-m)	115 (156)	245 (332)	300 (407)
Torque wrench/socket size	-	in.	7/16	9/16	3/4
Head height	-	in.	7/32	21/64	7/16
Ultimate tensile strength	(UTS)	ksi	80	100	100
Approximate yield strength	(YS)	ksi	64	80	80

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

Ultimate Load Capacities for 316 Stainless Steel Wedge-Bolt in Normal-Weight Concrete[1,2]

Nominal Anchor Diameter in.	Minimum Embedment Depth, h_{nom} in. (mm)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi (17.3 MPa)		f'c = 3,000 psi (20.7 MPa)		f'c = 4,000 psi (27.6 MPa)		f'c = 6,000 psi (41.4 MPa)		f'c = 8,000 psi (55.2 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)
1/4	1-3/4 (44)	890 (4.0)	1,385 (6.2)	975 (4.3)	1,520 (6.8)	1,130 (5.0)	1,755 (7.8)	1,440 (6.4)	2,560 (11.4)	1,440 (6.4)	2,850 (12.7)
	2-1/2 (64)	2,485 (11.1)	1,385 (6.2)	2,720 (12.1)	1,520 (6.8)	3,145 (14.0)	1,755 (7.8)	3,150 (14.0)	2,560 (11.4)	3,150 (14.0)	2,850 (12.7)
3/8	2 (51)	735 (3.3)	1,675 (7.5)	805 (3.6)	1,833 (8.2)	930 (4.1)	2,115 (9.4)	1,180 (5.2)	2,710 (12.1)	1,210 (5.4)	3,295 (14.7)
	2-1/2 (64)	1,515 (6.7)	1,675 (7.5)	1,655 (7.4)	1,833 (8.2)	1,915 (8.5)	2,115 (9.4)	2,130 (9.5)	2,710 (12.1)	2,180 (9.7)	3,295 (14.7)
	3-1/2 (89)	3,525 (15.7)	1,675 (7.5)	3,860 (17.2)	1,833 (8.2)	4,455 (19.8)	2,115 (9.4)	4,570 (20.3)	2,710 (12.1)	4,680 (20.8)	3,295 (14.7)
1/2	2-3/4 (70)	3,000 (13.3)	4,675 (20.8)	3,285 (14.6)	5,120 (22.8)	3,790 (16.9)	5,915 (26.3)	5,975 (26.6)	7,560 (33.6)	6,900 (30.7)	9,205 (40.9)
	3-1/2 (89)	3,830 (17.0)	5,205 (23.2)	4,195 (18.7)	5,700 (25.4)	4,845 (21.6)	6,590 (29.3)	6,800 (30.2)	7,390 (32.9)	7,855 (34.9)	8,995 (40.0)
	4-1/2 (114)	5,680 (25.3)	5,205 (23.2)	6,220 (27.7)	5,700 (25.4)	7,180 (31.9)	6,590 (29.3)	9,760 (43.4)	7,390 (32.9)	11,265 (50.1)	8,995 (40.0)

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

Allowable Load Capacities for 316 Stainless Steel Wedge-Bolt in Normal-Weight Concrete[1,2,3,4,5]

Nominal Anchor Diameter in.	Minimum Embedment Depth, h_{nom} in. (mm)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi (17.3 MPa)		f'c = 3,000 psi (20.7 MPa)		f'c = 4,000 psi (27.6 MPa)		f'c = 6,000 psi (41.4 MPa)		f'c = 8,000 psi (55.2 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)
1/4	1-3/4 (44)	225 (1.0)	345 (1.5)	245 (1.1)	380 (1.7)	285 (1.3)	440 (2.0)	360 (1.6)	640 (2.8)	360 (1.6)	715 (3.2)
	2-1/2 (64)	620 (2.8)	345 (1.5)	680 (3.0)	380 (1.7)	785 (3.5)	440 (2.0)	790 (3.5)	640 (2.8)	790 (3.5)	715 (3.2)
3/8	2 (51)	185 (0.8)	420 (1.9)	200 (0.9)	460 (2.0)	235 (1.0)	530 (2.4)	295 (1.3)	680 (3.0)	305 (1.4)	825 (3.7)
	2-1/2 (64)	380 (1.7)	420 (1.9)	415 (1.8)	460 (2.0)	480 (2.1)	530 (2.4)	535 (2.4)	680 (3.0)	545 (2.4)	825 (3.7)
	3-1/2 (89)	880 (3.9)	420 (1.9)	965 (4.3)	460 (2.0)	1,115 (5.0)	530 (2.4)	1,145 (5.1)	680 (3.0)	1,170 (5.2)	825 (3.7)
1/2	2-3/4 (70)	750 (3.3)	1,170 (5.2)	820 (3.6)	1,280 (5.7)	950 (4.2)	1,480 (6.6)	1,495 (6.7)	1,890 (8.4)	1,725 (7.7)	2,300 (10.2)
	3-1/2 (89)	960 (4.3)	1,300 (5.8)	1,050 (4.7)	1,425 (6.3)	1,210 (5.4)	1,650 (7.3)	1,700 (7.6)	1,850 (8.2)	1,965 (8.7)	2,250 (10.0)
	4-1/2 (114)	1,420 (6.3)	1,300 (5.8)	1,555 (6.9)	1,425 (6.3)	1,795 (8.0)	1,650 (7.3)	2,440 (10.9)	1,850 (8.2)	2,815 (12.5)	2,250 (10.0)

1. Tabulated load values are for anchors installed in normal weight concrete. Concrete compressive strength must be at a minimum at the time of installation.
2. Allowable load capacities are calculated using an applied safety factor of 4.0.
3. Allowable load capacities must be multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.
4. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
5. Allowable loads for lightweight concrete may be determined by multiplying the tabulated allowable load capacities for normal weight concrete by 0.60.

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Combined Loading

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

$$\left(\frac{Nu}{Nn}\right) + \left(\frac{Vu}{Vn}\right) \leq 1$$

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

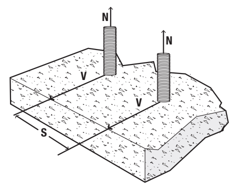
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (s)	Tension	s_{cr} = 12d	F_{NS} = 1.0	s_{min} = 4d	F_{NS} = 0.50
	Shear	s_{cr} = 12d	F_{VS} = 1.0	s_{min} = 4d	F_{VS} = 0.75
Edge Distance (c)	Tension	c_{cr} = 8d	F_{NC} = 1.0	c_{min} = 3d	F_{NC} = 0.70
	Shear	c_{cr} = 12d	F_{VC} = 1.0	c_{min} = 3d	F_{VC} = 0.15

1. Allowable load values found in the performance data tables are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances. Linear interpolation is allowed for intermediate anchor spacing and edge distances between critical and minimum distances. When an anchor is affected by both reduced spacing and edge distance, the spacing and edge reduction factors must be combined (multiplied). Multiple reduction factors for anchor spacing and edge distance may be required depending on the anchor group configuration.

LOAD ADJUSTMENT FACTORS FOR NORMAL-WEIGHT CONCRETE

Spacing, Tension (F_{NS})

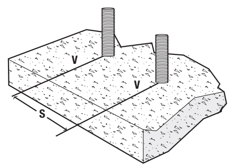
	Dia. (in.)	1/4	3/8	1/2
	s_{cr} (in.)	3	4-1/2	6
	s_{min} (in.)	1	1-1/2	2
Spacing, s (inches)	1	0.50	-	-
	1-1/2	0.63	0.50	-
	2	0.75	0.58	0.50
	2-1/2	0.88	0.67	0.56
	3	1.00	0.75	0.63
	4-1/2	1.00	1.00	0.81
	6	1.00	1.00	1.00



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_{VS})

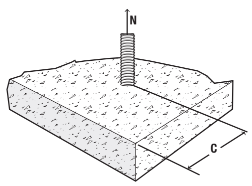
	Dia. (in.)	1/4	3/8	1/2
	s_{cr} (in.)	3	4-1/2	6
	s_{min} (in.)	1	1-1/2	2
Spacing, s (inches)	1	0.75	-	-
	1-1/2	0.81	0.75	-
	2	0.88	0.79	0.75
	2-1/2	0.91	0.83	0.78
	3	1.00	0.88	0.81
	4-1/2	1.00	1.00	0.91
	6	1.00	1.00	1.00



Notes: For anchors loaded in shear, 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_{NC})

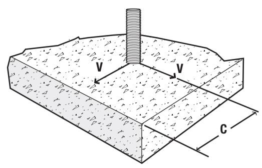
	Dia. (in.)	1/4	3/8	1/2
	c_{cr} (in.)	2	3	4
	c_{min} (in.)	3/4	1-1/8	1-1/2
Edge Distance, c (in.)	3/4	0.70	-	-
	1-1/8	0.79	0.70	-
	1-1/2	0.88	0.76	0.70
	1-7/8	0.97	0.82	0.75
	2	1.00	0.84	0.76
	2-1/4	1.00	0.88	0.79
	3	1.00	1.00	0.88
	4	1.00	1.00	1.00



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_{VC})

	Dia. (in.)	1/4	3/8	1/2
	c_{cr} (in.)	3	4-1/2	6
	c_{min} (in.)	3/4	1-1/8	1-1/2
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
	2-1/4	0.72	0.43	0.29
	3	1.00	0.62	0.43
	4-1/2	1.00	1.00	0.72
	6	1.00	1.00	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 3 anchor diameters (3d) at which the anchor achieves 15% of load

MASONRY PERFORMANCE DATA

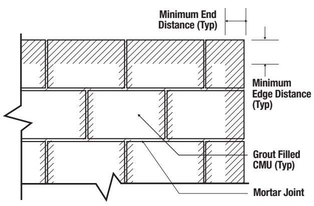
Ultimate Load Capacities for 316 Stainless Steel Wedge-Bolt installed into the Face or End of Grout Filled Concrete Masonry[1,2,3]

Nominal Anchor Diameter d in.	Minimum Embed. h_{nom} in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Tension lbs. (kN)		Shear lbs. (kN)		
				f'm = 1,500 psi	f'm = 2,000 psi	Loading Direction	f'm = 1,500 psi	f'm = 2,000 psi
1/4	1-3/4 (44)	3-3/4 (95)	1-1/2 (38)	570 (2.5)	660 (2.9)	Perpendicular or parallel to wall edge or end	645 (2.9)	745 (3.3)
	2-1/4 (57)	3-3/4 (95)	1-1/2 (38)	1,145 (5.1)	1,325 (5.9)		910 (4.0)	1,050 (4.7)
3/8	2 (51)	3-3/4 (95)	1-1/2 (38)	1,535 (6.8)	1,775 (7.9)	Perpendicular or parallel to wall edge or end	775 (3.4)	895 (4.0)
	3 (76)	3-3/4 (95)	3-3/4 (95)	2,300 (10.2)	2,655 (11.8)	Perpendicular or parallel to wall edge or end	3,110 (13.8)	3,585 (15.9)
	3 (76)	3-3/4 (95)	11-1/4 (286)			Parallel to wall edge	3,325 (14.8)	3,835 (17.1)
1/2	2-3/4 (70)	3-3/4 (95)	1-3/4 (44)	1,330 (5.9)	1,535 (6.8)	Perpendicular or parallel to wall edge or end	2,050 (9.1)	2,365 (10.5)
	2-3/4 (70)	3-3/4 (95)	3-3/4 (95)				2,630 (11.7)	3,040 (13.5)
	4-1/2 (114)	3-3/4 (95)	11-1/4 (286)	4,680 (20.8)	5,400 (24.0)		2,630 (11.7)	3,040 (13.5)
	4-1/2 (114)	11-1/4 (286)	11-1/4 (286)				7,290 (32.4)	8,415 (37.4)

1. Tabulated load values are for anchors installed in minimum 8-inch wide, Grade N, Type II, normal-weight concrete masonry units conforming to ASTM C 90 that have reached the minimum designated ultimate strength at the time of installation (f'm ≥ 1,500 psi).
2. Ultimate load capacities must be reduced by a minimum safety factor of 5.0 or greater to determine allowable working load.
3. The tabulated load values are applicable for screw anchors installed at a critical spacing between screw anchors of 16 times the screws anchor diameter. Reduce the tabulated load capacities by 50 percent when anchors are installed at a minimum spacing between screw anchors of 8 times the screw anchor diameter. Linear interpolation may be used for intermediate spacing distances.

Allowable Load Capacities for 316 Stainless Steel Wedge-Bolt installed into the Face or End of Grout Filled Concrete Masonry[1,2,3,4,5]

Nominal Anchor Diameter d in.	Minimum Embed. h_{nom} in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Tension lbs. (kN)		Shear lbs. (kN)		
				f'm = 1,500 psi	f'm = 2,000 psi	Loading Direction	f'm = 1,500 psi	f'm = 2,000 psi
1/4	1-3/4 (44)	3-3/4 (95)	1-1/2 (38)	115 (0.5)	130 (0.6)	Perpendicular or parallel to wall edge or end	130 (0.6)	150 (0.7)
	2-1/4 (57)	3-3/4 (95)	1-1/2 (38)	230 (1.0)	265 (1.2)		180 (0.8)	210 (0.9)
3/8	2 (51)	3-3/4 (95)	1-1/2 (38)	305 (1.4)	355 (1.6)	Perpendicular or parallel to wall edge or end	155 (0.7)	180 (0.8)
	3 (76)	3-3/4 (95)	3-3/4 (95)	460 (2.0)	530 (2.4)	Perpendicular or parallel to wall edge or end	620 (2.8)	715 (3.2)
	3 (76)	3-3/4 (95)	11-1/4 (286)			Parallel to wall edge	665 (3.0)	765 (3.4)
1/2	2-3/4 (70)	3-3/4 (95)	1-3/4 (44)	265 (1.2)	305 (1.4)	Perpendicular or parallel to wall edge or end	410 (1.8)	475 (2.1)
	2-3/4 (70)	3-3/4 (95)	3-3/4 (95)				525 (2.3)	610 (2.7)
	4-1/2 (114)	3-3/4 (95)	11-1/4 (286)	935 (4.2)	1,080 (4.8)		525 (2.3)	610 (2.7)
	4-1/2 (114)	11-1/4 (286)	11-1/4 (286)				1,460 (6.5)	1,685 (7.5)

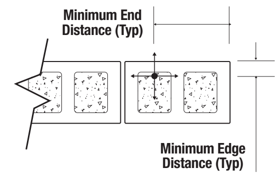


Wall Face Permissible Anchor Locations
(Un-hatched Area)

1. Tabulated load values are for anchors installed in minimum 8-inch wide, Grade N, Type II, normal-weight concrete masonry units conforming to ASTM C 90 that have reached the minimum designated ultimate strength at the time of installation (f'm ≥ 1,500 psi).
2. Allowable load capacities are calculated using an applied safety factor of 5.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety.
3. Linear interpolation for allowable loads for anchors at intermediate embedment depths may be used.
4. For installation in 3,000 psi grout filled concrete masonry (f'm = 3,000 psi) the load capacity in 1,500 psi grout filled concrete masonry (f'm = 1,500) may be increased by 40% and the load capacity in 2,000 psi grout concrete masonry (f'm = 2,000 psi) may be increased by 22%.
5. The tabulated load values are applicable for screw anchors installed at a critical spacing between screw anchors of 16 times the screws anchor diameter. Reduce the tabulated load capacities by 50 percent when anchors are installed at a minimum spacing between screw anchors of 8 times the screw anchor diameter. Linear interpolation may be used for intermediate spacing distances.

Ultimate and Allowable Load Capacities for 316 Stainless Steel Wedge-Bolt Installed in Grout Filled Concrete Masonry Wall Tops[1,2,3,4,5,6]

Nominal Anchor Diameter d in.	Minimum Nominal Embed. Depth h_{nom} in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Minimum Spacing Distance in. (mm)	Ultimate Load		Allowable Load	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4	2-1/2 (64)	1-1/2 (38)	3 (76)	4 (102)	1,025 (4.6)	625 (2.8)	205 (0.9)	125 (0.6)
3/8	3 (76)	1-1/2 (38)	4 (102)	6 (152)	1,675 (7.5)	1,075 (4.8)	335 (1.5)	215 (1.0)
1/2	4-1/2 (114)	1-3/4 (44)	6 (152)	8 (203)	2,475 (11.0)	1,075 (4.8)	495 (2.2)	215 (1.0)

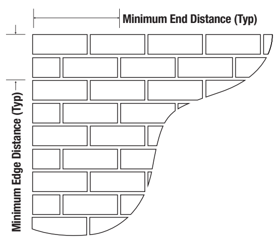


Top of Wall

1. All values are for anchors installed in fully grouted concrete masonry wall construction with materials meeting minimum compressive strength, f'm, of 1,500 psi (10.3 MPa). Concrete masonry units must be light-, medium, or normal-weight conforming to ASTM C90. Allowable loads are based on a safety factor of 5.0.
2. Anchors may be installed in any location in the top of the masonry wall except within 1-1/4-inch from the of the mortar joint (head joint), provided the minimum edge and end distances are maintained.
3. A maximum of two anchors may be installed in a single masonry cell in accordance with the spacing and edge or end distance requirements. Embedment is measured from the outside surface of the concrete masonry unit to the embedded end of the anchor.
4. Spacing distance is measured from the centerline to centerline between two anchors.
5. The edge and end distance is measured from the anchor centerline to the closest unrestrained edge and end of the CMU block, respectively.
6. Allowable shear loads may be applied in any direction.

Ultimate and Allowable Load Capacities for 316 Stainless Steel Wedge-Bolt Installed into Multiple Wythe Solid Clay Brick Masonry[1,2,3]

Nominal Anchor Diameter d in.	Minimum Nominal Embed. Depth h_{nom} in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Minimum Spacing Distance in. (mm)	Ultimate Load		Allowable Load	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4	2-1/2 (64)	3-1/2 (89)	2-1/2 (64)	4 (102)	1,170 (5.2)	1,380 (6.1)	235 (1.0)	275 (1.2)
3/8	2-3/4 (70)	6 (152)	6 (152)	6 (152)	1,435 (6.4)	2,875 (12.8)	285 (1.3)	575 (2.6)
1/2	3-1/4 (83)	9-1/2 (241)	9-1/2 (241)	8 (203)	1,840 (8.2)	7,655 (34.1)	370 (1.6)	1,530 (6.8)



1. Tabulated load values are for anchors installed in multiple wythe, minimum Grade SW, solid clay brick masonry walls conforming to ASTM C 62. Mortar must be minimum Type N. Masonry compressive strength must be as the specified minimum at the time of installation (f'm ≥ 1,500 psi).
2. Ultimate load capacities must be reduced by a minimum safety factor of 5.0 or greater to determine allowable working load.
3. Allowable load capacities listed are calculated using an applied safety factor of 5.0. Consideration of safety factors of 10 or higher may be used depending on the application, such as life safety.

ORDERING INFORMATION

316 Stainless Steel Wedge-Bolt

Cat. No.	Anchor Size	Thread Length (inc)	Box Qty.	Ctn. Qty.	Wt./100 (lbs)	Suggested Wedge-Bit Cat. No.			
						SDS-Plus	SDS-Max	Spline	Straight Shank
07870	1/4 x 2	1-3/4	100	600	3.94	01312	-	-	01370
07872	1/4 x 3	2-3/4	100	500	5.16	01314	-	-	01372
07876	1/4 x 4	2-3/4	100	500	6.56	01314	-	-	01372
07878	1/4 x 5	2-3/4	100	500	7.20	01315	-	-	-
07880	3/8 x 2-1/2	2-1/4	50	300	10.42	01316	-	-	01380
07882	3/8 x 3	2-1/4	50	250	11.96	01316	-	-	01380
07884	3/8 x 4	3-1/2	50	250	15.06	01316	-	-	01380
07886	3/8 x 5	3-1/2	50	250	17.92	01318	-	-	01384
07888	1/2 x 3	2-3/4	50	150	21.17	01320	01354	01340	01390
07890	1/2 x 4	2-3/4	50	150	25.87	01320	01354	01340	01390
07892	1/2 x 5	3-3/4	25	100	31.70	01322	01354	01340	01394
07894	1/2 x 6	3-3/4	25	75	36.73	01322	01354	01340	01394

The published size includes the diameter and length of the anchor measured from under the head to the tip.
*316 Stainless Steel Wedge-Bolt has a blue marking and must be installed with a matched tolerance Wedge-Bit.

Wedge-Bit

Cat. No.	Wedge-Bit Description	Usable Length	Tube Qty.	Ctn. Qty.
01312	SDS 1/4" x 4"	2"	1	250
01314	SDS 1/4" x 6"	4"	1	100
01315	SDS 1/4" x 8"	6"	1	-
01316	SDS 3/8" x 6"	4"	1	200
01318	SDS 3/8" x 8"	6"	1	100
01332	SDS 3/8" x 12"	10"	1	50
01319	SDS 3/8" x 18"	16"	1	50
01320	SDS 1/2" x 6"	4"	1	150
01322	SDS 1/2" x 10"	8"	1	50
01334	SDS 1/2" x 12"	10"	1	50
01335	SDS 1/2" x 18"	16"	1	50
01340	Spline 1/2" x 13"	8"	1	20
01342	Spline 1/2" x 16"	11"	1	-
01354	SDS-Max 1/2" x 13"	8"	1	20
01370	HD Straight Shank 1/4" x 4"	2-3/4"	1	100
01372	HD Straight Shank 1/4" x 6"	4"	1	-
01380	HD Straight Shank 3/8" x 6"	4"	1	-
01384	HD Straight Shank 3/8" x 13"	11"	1	-
01390	HD Straight Shank 1/2" x 6"	4"	1	-
01394	HD Straight Shank 1/2" x 13"	11"	1	50

Suggested Impact Wrench and Socket

Nominal Anchor Size	Socket Size	Impact Rated Socket		20V Max* Impact Wrenches	
1/4	7/16	DWMT74479B		DCF883M2 3/8" Impact Wrench	
3/8	9/16	DWMT75122B		DCF880M2 1/2" Impact Wrench	
1/2	3/4	DWMT75113B		DCF894HP2 High Torque 1/2"	

GENERAL INFORMATION

SNAKE+®

Internally Threaded Screw Anchor

PRODUCT DESCRIPTION

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

GENERAL APPLICATIONS AND USES

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

FEATURE AND BENEFITS

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

APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES), ESR-2272 for concrete. Code compliant with the 2015 IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, 2009 IRC, 2006 IBC, and 2006 IRC.
- Tested in accordance with ACI 355.2 and ICC-ES AC193 for use in structural concrete under the design provisions of ACI 318-14 Chapter 17 or ACI 318-11/08 (Appendix D)
- Evaluated and qualified by an accredited independent testing laboratory for recognition in cracked and uncracked concrete including seismic and wind loading (Category 1 anchor)
- Evaluated and qualified by an accredited independent testing laboratory for reliability against brittle failure, e.g. hydrogen embrittlement
- Evaluated and qualified by an accredited independent testing laboratory for supplemental recognition in redundant fastening applications
- FM Global (Factory Mutual) - File No. 3038104 (see report for sizes) www.approvalguide.com - Pipe hanger components for automatic sprinkler systems

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors and 05 05 09 - Post-Installed Concrete Anchors. Internally threaded anchors shall be Snake+ as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

MATERIAL SPECIFICATIONS

Anchor Component	Specification
Anchor Body	Case hardened carbon steel
Plating	Zinc plating according to ASTM B633, SC1, Type III (Fe/Zn 5) Minimum plating requirements for Mild Service Condition

SECTION CONTENTS

SNAKE+

INTERNAL THREAD VERSION

- Unified coarse thread (UNC)

ANCHOR MATERIALS

- Zinc plated carbon steel body

ANCHOR SIZE RANGE (TYP.)

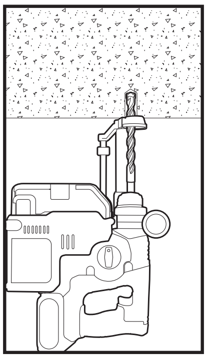
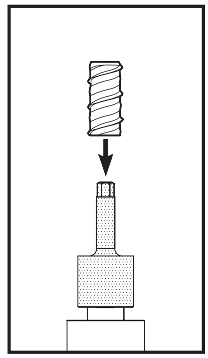
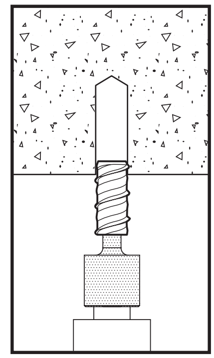
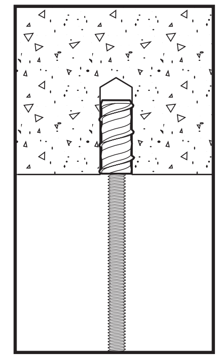
- 1/4", 3/8" and 1/2" diameters

SUITABLE BASE MATERIALS

- Normal-weight concrete
- Sand-lightweight concrete
- Concrete over steel deck

CODE LISTED
ICC-ES ESR-2272
CONCRETE

INSTALLATION INSTRUCTIONS

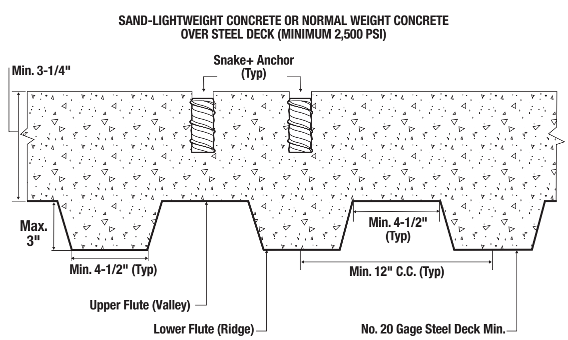
Step 1
Using the proper drill bit size, drill a hole into the base material to the required depth (e.g. dust extractor, hollow bit). The tolerances of the carbide drill bit used should meet the requirements of ANSI Standard B212.15.

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

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

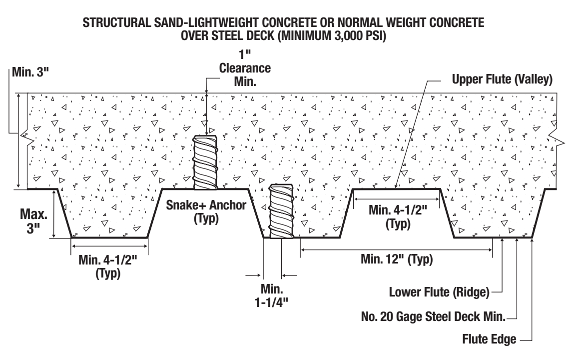
Step 4
Insert threaded rod or a bolt into the Snake+, taking care not to exceed the maximum specified tightening torque of the steel insert element, T_{max}. Minimum thread engagement should be at least one anchor diameter.

Installation Detail for Snake+ in the Topside of Concrete-Filled Steel Deck floor and Roof Assemblies[1]



1. 3/8-inch diameter anchors may be placed in the topside of steel deck profiles provided the minimum topping thickness, minimum spacing distance and minimum edge distance are satisfied as given in the installation information table.

Installation Detail for Snake+ Installed in the Soffit of Concrete over Steel Deck floor and Roof Assemblies[1]



1. Anchors may be placed in the upper flute or lower flute of the steel deck profiles provided in minimum hole clearance is satisfied. Anchors in the lower flute may be installed with a maximum 1-inch offset in either direction from the center of the flute. The offset distance may be increased proportionally for profiles with lower flute widths greater than those shown provided the minimum lower flute edge distance is also satisfied.

STRENGTH DESIGN (SD)

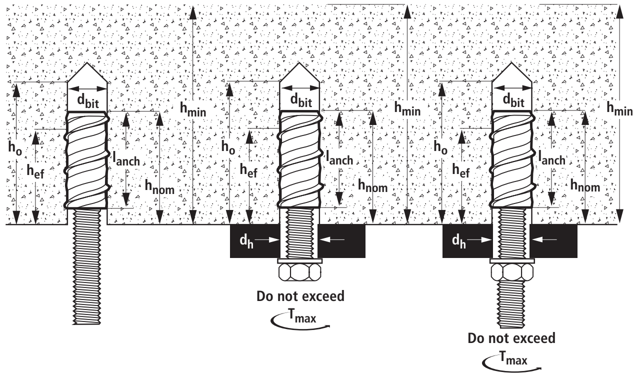
Installation Information for Snake+ Screw Anchor for Single Point Applications[1]

CODE LISTED ICC-ES ESR-2272

Anchor Property/ Setting Information	Notation	Units	Nominal Anchor Size / Threaded Coupler Diameter (inch)		
			1/4	3/8	1/2
Nominal outside anchor diameter	$d_a(d_o)$[3]	in. (mm)	0.375 (9.5)	0.500 (12.7)	0.750 (19.1)
Internal thread diameter (UNC)	d	in. (mm)	0.250 (6.4)	0.375 (9.5)	0.500 (12.7)
Minimum diameter of hole clearance in fixture for steel insert element (following anchor installation)	d_h	in.	5/16	7/16	9/16
Nominal drill bit diameter	d_{bit}	in.	3/8 ANSI	1/2 ANSI	3/4 ANSI
Minimum hole depth	h_o	in. (mm)	2 (51)	2 (51)	2-1/2 (64)
Overall anchor length	ℓ_{anch}	in. (mm)	1-1/4 (32)	1-1/4 (32)	1-11/16 (43)
Minimum nominal embedment depth[2]	h_{nom}	in. (mm)	1-5/8 (41)	1-5/8 (41)	2-3/16 (55)
Effective embedment	h_{ef}	in. (mm)	Not Applicable[4]	1.10 (28)	1.54 (39)
Maximum impact wrench power (torque)	T_{screw}	ft.-lb. (N-m)	120 (163)	345 (468)	345 (468)
Maximum tightening torque of steel insert element (threaded rod or bolt)	T_{max}	ft.-lb. (N-m)	4 (6)	8 (11)	36 (49)
Anchors Installed in Concrete Construction[2]					
Minimum member thickness[2]	h_{min}	in. (mm)	Not Applicable[4]	4 (102)	4 (102)
Critical edge distance[2]	c_{ac}	in. (mm)	Not Applicable[4]	3 (76)	4 (102)
Minimum edge distance[2]	c_{min}	in. (mm)	Not Applicable[4]	3 (76)	4 (102)
Minimum spacing distance[2]	s_{min}	in. (mm)	Not Applicable[4]	3 (76)	4 (102)
Anchors Installed in the Topside of Concrete-Filled Steel Deck Assemblies[5]					
Minimum member topping thickness	$h_{min,deck}$	in. (mm)	Not Applicable[4]	3-1/4 (83)	Not applicable
Critical edge distance	$c_{ac,deck,top}$	in. (mm)	Not Applicable[4]	3 (76)	Not applicable
Minimum edge distance	$c_{min,deck,top}$	in. (mm)	Not Applicable[4]	3 (76)	Not applicable
Minimum spacing distance	$s_{min,deck,top}$	in. (mm)	Not Applicable[4]	3 (76)	Not applicable

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable.
2. For installations through the soffit of steel deck into concrete, see installation detail. Anchors in the lower flute may be installed with a maximum 1-inch offset in either direction from center of the flute. In addition, anchors shall have an axial spacing along the flute equal to the greater of $3h_{ef}$ or 1.5 times the flute width.
3. The notation in parenthesis is for the 2006 IBC.
4. The 1/4-inch diameter anchor is limited to redundant fastening design only.
5. For 3/8-inch diameters installed in the topside of concrete-filled steel deck assemblies, steel installation detail.

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



PERFORMANCE DATA

Tension Design Information (For use with load combinations taken from ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2)[1,2]

CODE LISTED
ICC-ES ESR-2272

Design Characteristic	Notation	Units		Nominal Anchor Diameter 3/8 inch	Nominal Anchor Diameter 1/2 inch
Anchor category	1,2 or 3	-		1	1
Nominal embedment depth	h_{nom}	in. (mm)		1-5/8 (41)	2-3/16 (55)
STEEL STRENGTH IN TENSION[4]					
Minimum specified yield strength of steel insert element	f_y	ksi (N/mm²)	ASTM A36	36.0 (248)	
			ASTM A193, Grade B7	105.0 (724)	-
Minimum specified ultimate strength of steel insert element	f_{uta}	ksi (N/mm²)	ASTM A36	58.0 (400)	
			ASTM A193, Grade B7	125.0 (862)	-
Effective tensile stress area of steel insert element	$A_{se,N}$ (A_{se})[10]	in² (mm²)		0.0775 (50)	0.1419 (92)
Steel strength in tension	N_{sa}	lb (kN)	ASTM A36	4.495 (20.0)	8,230 (37.0)
			ASTM A193, Grade B7	9,685 (43.1)	-
Reduction factor for steel strength[3]	ϕ	-		0.65	
CONCRETE BREAKOUT STRENGTH IN TENSION[8]					
Effective embedment	h_{ef}	in. (mm)		1.10 (28)	1.54 (39)
Effectiveness factor for uncracked concrete	k_{ucr}	-		24	30
Effectiveness factor for cracked concrete	k_{cr}	-		17	24
Modification factor for cracked and uncracked concrete[5]	$\psi_{c,N}$	-		Cracked concrete = 1.0 Uncracked concrete = 1.0	
Critical edge distance	c_{ac}	in. (mm)		3 (76)	4 (102)
Reduction factor for concrete breakout strength[3]	ϕ	-		Condition B = 0.65	
PULLOUT STRENGTH IN TENSION (NON-SEISMIC APPLICATIONS)[8]					
Characteristic pullout strength, uncracked concrete (2,500 psi)[6]	$N_{p,uncr}$	lb (kN)		See note 7	See note 7
Characteristic pullout strength, cracked concrete (2,500 psi)[6]	$N_{p,cr}$	lb (kN)		See note 7	1,665 (7.4)
Reduction factor for pullout strength[3]	ϕ	-		0.65 (Condition B)	
PULLOUT STRENGTH IN TENSION FOR SEISMIC APPLICATIONS[8]					
Characteristic pullout strength, seismic (2,500 psi)[6]	$N_{p,eq}$	lb (kN)		See note 7	1,665 (7.4)
Reduction factor for pullout strength[3]	ϕ	-		Condition B = 0.65	
PULLOUT STRENGTH IN TENSION FOR SOFFIT OF SAND-LIGHT WEIGHT AND NORMAL-WEIGHT CONCRETE OVER STEEL DECK					
Characteristic pullout strength, uncracked concrete over steel deck[6,9]	$N_{p,deck,uncr}$	lb (kN)		1,515 (6.7)	1,625 (7.2)
Characteristic pullout strength, cracked concrete over steel deck[6,9]	$N_{p,deck,cr}$	lb (kN)		1,075 (4.8)	1,300 (5.8)
Characteristic pullout strength, cracked concrete over steel deck, seismic[6,9]	$N_{p,deck,eq}$	lb (kN)		1,075 (4.8)	1,300 (5.8)
Reduction factor for pullout strength, concrete over steel deck[3]	ϕ	-		Condition B = 0.65	

For SI: 1 inch = 25.4 mm, 1 ksi = 6.894 N/mm²; 1 lbf = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable, must apply.
2. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2. If the load combinations ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4. For reinforcement that meets ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable, requirements for Condition A, see ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c), as applicable, for the appropriate ϕ factor.
4. It is assumed that the threaded rod or bolt used with the Snake+ anchor is a ductile steel element with minimum specified properties as listed in the table or an equivalent steel element. The Snake+ anchor is considered a brittle steel element in tension as defined by ACI 318-14 2.3 or ACI 318-11D.1, as applicable. Tabulated values for steel strength in tension must be used for design.
5. For all design cases use $\psi_{c,N} = 1.0$. The appropriate effectiveness factor for cracked concrete (k_{cr}) and uncracked concrete (k_{uncr}) must be used.
6. For all design cases use $\psi_{c,P} = 1.0$. For concrete compressive strength greater than 2,500 psi, N_{pn} = (pullout strength from table)*(specified concrete compressive strength/2,500)$^{0.5}$. For concrete over steel deck the value of 2,500 must be replaced with the value of 3,000.
7. Pullout strength does not control design of indicated anchors. Do not calculate pullout strength for indicated anchor size and embedment.
8. Anchors are permitted to be used in lightweight concrete provided the modification factor λ_a equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n and V_n. λ shall be determined in accordance with the corresponding version of ACI 318. For anchors installed in the soffit of sand-lightweight concrete-filled steel deck and floor and roof assemblies, further reduction of the pullout values provided in not required.
9. Values for $N_{p,deck}$ are for sand-lightweight concrete ($f'c,min$ = 3,000 psi) and additional lightweight concrete reduction factors need not be applied. In addition, evaluation for the concrete breakout capacity in accordance with ACI 318-14 17.4.2 or ACI 318-11 D.5.2, as applicable, is not required for anchors installed in the deck soffit (flute).
10. The notation in parenthesis is for the 2006 IBC.

Shear Design Information (For use with load combinations taken from ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2)[1,2]

CODE LISTED
ICC-ES ESR-2272

STRENGTH DESIGN TABLES SD

Design Characteristic	Notation	Units		Nominal Anchor Diameter	
				3/8 inch	1/2 inch
Anchor category	1,2 or 3	-		1	1
Nominal embedment depth	h_{nom}	in. (mm)		1-5/8 (41)	2-3/16 (55)
STEEL STRENGTH IN SHEAR[4]					
Steel strength in shear[5]	V_{sa}	lb (kN)	ASTM A36	770 (3.4)	1,995 (8.9)
			ASTM A193, Grade B7	1,655 (7.4)	-
Reduction factor for steel strength[3]	ϕ	-		0.60	
CONCRETE BREAKOUT STRENGTH IN SHEAR[6]					
Nominal outside anchor diameter	$d_a(d_o)$[10]	in. (mm)		0.500 (12.7)	0.750 (19.1)
Load bearing length of anchor (h_{ef} or $8d_o$, whichever is less)	ℓ_e	-		1.10 (28)	1.54 (39)
Reduction factor for concrete breakout strength[3]	ϕ	-		Condition B = 0.70	
PRYOUT STRENGTH IN SHEAR[6]					
Coefficient for pryout strength (1.0 for $h_{ef} < 2.5$ in, 2.0 for $h_{ef} \geq 2.5$ in.)	k_{cp}	-		1.0	1.0
Effective embedment	h_{ef}	in. (mm)		1.10 (28)	1.54 (39)
Reduction factor for pullout strength[3]	ϕ	-		Condition B = 0.70	
STEEL STRENGTH IN SHEAR FOR SEISMIC APPLICATIONS					
Steel strength in shear, seismic[7]	$V_{sa,eq}$	lb (kN)	ASTM A36	770 (3.4)	1,995 (8.9)
			ASTM A193, Grade B7	1,655 (7.4)	-
Reduction factor for pullout strength[3]	ϕ	-		Condition B = 0.60	
STEEL STRENGTH IN SHEAR FOR SOFFIT OF SAND-LIGHT WEIGHT AND NORMAL-WEIGHT CONCRETE OVER STEEL DECK[9]					
Steel strength in shear, concrete over steel deck[8]	$V_{sa,deck}$	lb (kN)	ASTM A36	770 (3.4)	1,995 (8.9)
			ASTM A193, Grade B7	1,655 (7.4)	-
Steel strength in shear, concrete over steel deck, seismic[8]	$V_{sa,deck,eq}$	lb (kN)	ASTM A36	770 (3)	1,995 (8.9)
			ASTM A193, Grade B7	1,665 (7.4)	-
Reduction factor for pullout strength[3]	ϕ	-		Condition B = 0.60	

For SI: 1 inch = 25.4 mm, 1 lbf = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318-11 D.3.3 shall apply.
2. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3, or ACI 318-11 Section 9.2, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4. For reinforcement that meets ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable, requirements for Condition A, see ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c), as applicable, for the appropriate ϕ factor.
4. It is assumed that the threaded rod or bolt used with the Snake+ anchor will be a ductile steel element as defined by ACI 318-14 2.3 or ACI 318-11 D.1, as applicable.
5. Tabulated values for steel strength in shear must be used for design. These tabulated values are lower than calculated results using equation 17.5.1.2b in ACI 318-14, D-29 in ACI 318-11, and ACI 318-14 17.5.1.2 or ACI 318-11 D.6.1.2, as applicable.
6. Anchors are permitted to be used in lightweight concrete provided the modification factor λ_a equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n and V_n. λ shall be determined in accordance with the corresponding version of ACI 318. For anchors installed in the soffit of sand-lightweight concrete-filled steel deck and floor and roof assemblies, further reduction of the pullout values provided in not required.
7. Tabulated values for steel strength in shear are for seismic applications and based on test results in accordance with ACI 355.2 Section 9.6.
8. Tabulated values for $V_{sa,deck}$ are for sand-lightweight concrete ($f'c,min = 3{,}000$ psi) and additional lightweight concrete reduction factors need not be applied. In addition, evaluation for the concrete breakout capacity in accordance with ACI 318-14 17.5.2 or ACI 318-11 D.6.2, as applicable, and the pryout capacity in accordance with ACI 318-14 17.5.3 or ACI 318-11 D.6.3 are not required for anchors installed in the deck soffit (flute).
9. Shear loads for anchors installed through steel deck into concrete may be applied in any direction.
10. The notation in parenthesis is for the 2006 IBC.

Factored Design Strength ($ØN_n$ And $ØV_n$) Calculated In Accordance With ACI 318-14 Chapter 17:

1- Tabular values are provided for illustration and are applicable for single anchors installed in normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac} (table values based on $c_{a1} = c_{ac}$).
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.

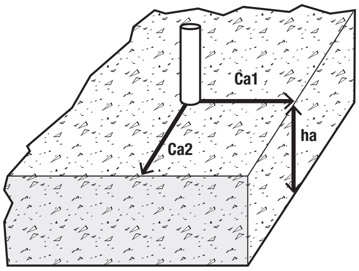
2- Calculations were performed according to ACI 318-14 Chapter 17. The load level corresponding to the controlling failure mode is listed. (e.g. For tension: steel, concrete breakout and pullout; For shear: steel, concrete breakout and pryout). Furthermore, the capacities for concrete breakout strength in tension and pryout strength in shear are calculated using the effective embedment values, hef, for the selected anchors as noted in the design information tables. Please also reference the installation specifications for more information.

3- Strength reduction factors (ø) were based on ACI 318-14 Section 5.3 for load combinations. Condition B is assumed.

4- Tabular values are permitted for static loads only, seismic loading is not considered with these tables.

5- For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Chapter 17.

6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318-14 Chapter 17. For other design conditions including seismic considerations please see ACI 318-14 Chapter 17.



Tension and Shear Design Strengths Installed in Cracked Concrete

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Steel Insert Element (Threaded Rod or Bolt)	Minimum Concrete Compressive Strength, f'c (psi)									
			2,500		3,000		4,000		6,000		8,000	
			ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)
3/8	1-5/8	ASTM A36	635	500	700	500	805	500	985	500	1,140	500
		ASTM A193 Grade B7	635	685	700	750	805	870	985	1,065	1,140	1,075
1/2	2-3/16	ASTM A36	1,080	1,295	1,185	1,295	1,370	1,295	1,675	1,295	1,935	1,295

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

Tension and Shear Design Strengths Installed in Uncracked Concrete

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Steel Insert Element (Threaded Rod or Bolt)	Minimum Concrete Compressive Strength, f'c (psi)									
			2,500		3,000		4,000		6,000		8,000	
			ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)
3/8	1-5/8	ASTM A36	900	500	985	500	1,140	500	1,395	500	1,610	500
		ASTM A193 Grade B7	900	970	985	1,060	1,140	1,075	1,395	1,075	1,610	1,075
1/2	2-3/16	ASTM A36	1,865	1,295	2,040	1,295	2,355	1,295	2,885	1,295	3,335	1,295

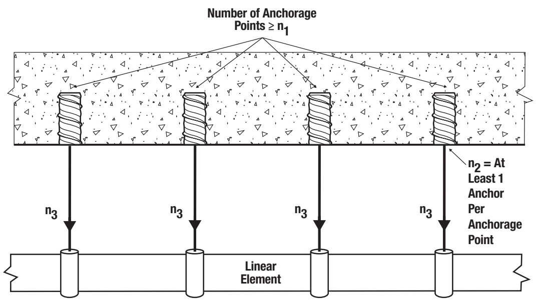
□ - Anchor Pullout/Pryout Strength Controls □ - Concrete Breakout Strength Controls ■ - Steel Strength Controls

REDUNDANT FASTENING APPLICATIONS

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

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

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



Strength Design (Redundant Fastening):

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

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

n_2 = number of anchors per anchorage point

n_3 = factored load at each anchorage point, lbs., using load combinations from IBC Section 1605.2.1 or ACI 318-14 Section 5.3 or ACI 318 (-11,-08,-05) Section 9.2.

Strength Design (SD)

Design values for use with strength design shall be established taking $\phi_{ra} \bullet F_{ra}$.

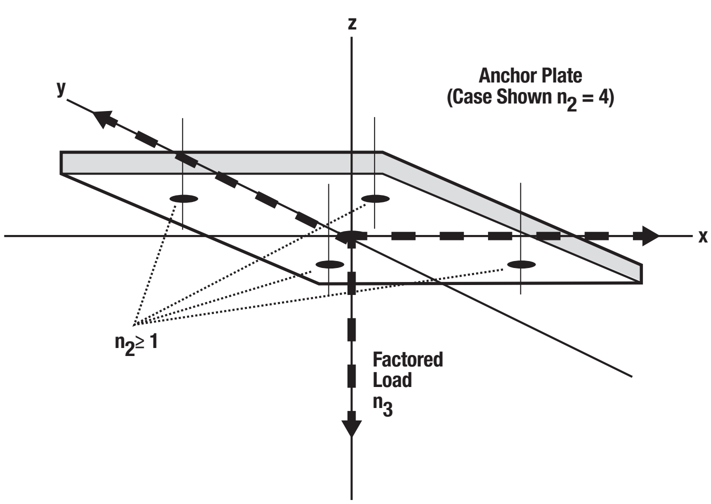
Allowable Stress Design (Redundant Fastening):

Design values for use with allowable stress design shall be established taking

$$R_d, ASD = \frac{\phi_{ra} \bullet F_{ra}}{\alpha}$$

Where α is the conversion factor calculated as the weighted average of the load factors from the controlling load combination. The conversion factor, α is equal to 1.4 assuming all dead load.

See redundant fastening design information table for Snake+ design resistance.



REDUNDANT FASTENING

Installation Information for Snake+ Screw Anchor in Redundant Fastening Applications

Anchor Property/ Setting Information	Notation	Units	Nominal Anchor Size / Threaded Coupler Diameter (inch)		
			1/4	3/8	1/2
Nominal drill bit diameter	d_{bit}	in.	3/8 ANSI	1/2 ANSI	3/4 ANSI
Nominal embedment depth	h_{nom}	in. (mm)	1-5/8 (41)	1-5/8 (41)	2-3/16 (55)
Effective embedment	h_{ef}	in. (mm)	1.10 (28)	1.10 (28)	1.54 (39)
Minimum hole depth	h_o	in. (mm)	2 (51)	2 (51)	2-1/2 (64)
Minimum concrete member thickness	h_{min}	in. (mm)	3 (76.2)	3 (76.2)	3 (76.2)
Overall anchor legnth	ℓ_{anch}	in. (mm)	1-1/4 (32)	1-1/4 (32)	1-11/16 (43)
Minimum edge distance, redundant fastening[1]	$c_{min} = c_{ac}$	in. (mm)	4 (102)	4 (102)	4 (102)
Minimum spacing distance, redundant fastening[1]	s_{min}	in. (mm)	8 (203)	8 (203)	8 (203)
Maximum tightening torque of steel insert element (threaded rod or bolt)	T_{max}	ft.-lb. (N-m)	4 (6)	8 (11)	36 (49)
Maximum impact wrench power (torque)	T_{screw}	ft.-lb. (N-m)	120 (163)	345 (468)	345 (468)

1. Tabulated minimum spacing and edge distances are applicable only for redundant fastening applications.

Redundant Fastening Design Information for Snake+ Anchors[1,2,3]

Anchor Property/ Setting Information	Notation	Units	Nominal Anchor Size					
			1/4"		3/8"		1/2"	
Anchor category	1,2 or 3	-	1		1		1	
Nominal embedment depth	h_{nom}	in. (mm)	1-5/8 (41)		1-5/8 (41)		2-3/16 (55)	
CHARACTERISTIC STRENGTH (RESISTANCE) INSTALLED IN CONCRETE[4,5]								
Resistance, cracked or uncracked concrete (2,500psi)	F_{ra}	lb (kN)	Number of anchorage points		Number of anchorage points		Number of anchorage points	
			$n_1 \geq 4$	$n_1 \geq 3$	$n_1 \geq 4$	$n_1 \geq 3$	$n_1 \geq 4$	$n_1 \geq 3$
			550 (2.5)	360 (1.6)	675 (3.0)	450 (2.0)	675 (3.0)	450 (2.0)
Strength reduction factor[3]	ϕ_{ra}	-	0.65					
CHARACTERISTIC STRENGTH (RESISTANCE) FOR SAND-LIGHTWEIGHT AND NORMAL WEIGHT CONCRETE OVER STEEL DECK[4,6]								
Resistance, cracked or uncracked concrete over steel deck (2,500 psi)	$F_{ra,deck}$	lb (kN)	Number of anchorage points		Number of anchorage points		Number of anchorage points	
			$n_1 \geq 4$	$n_1 \geq 3$	$n_1 \geq 4$	$n_1 \geq 3$	$n_1 \geq 4$	$n_1 \geq 3$
			550 (2.5)	360 (1.6)	675 (3.0)	450 (2.0)	675 (3.0)	450 (2.0)
Strength reduction factor[3]	ϕ_{ra}	-	0.65					

For SI: 1 inch = 25.4 mm, 1 lbf = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of Section 4.3 of this report; loads may be applied in tension, shear or any combination thereof.
2. Installation must comply with published instructions and this report.
3. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318 (-11, -08, -05) Section 9.2, as applicable.
4. It is assumed that the threaded rod or bolt used with the Snake+ anchor has properties as listed in Tension Design Information table.
5. Anchors are permitted to be used in lightweight concrete provided the design strength $\phi_{ra} F_{ra}$ is multiplied by the modification factor λ_a. The modification factor λ_a is equal to 0.8λ, λ shall be determined in accordance with the corresponding version of ACI 318. For anchors installed in the soffit of sand-lightweight concrete-filled steel deck and floor and roof assemblies, further reduction of the pullout values provided in not required.
6. For installations through the soffit of steel deck into concrete see the installation detail. Anchors in the lower flute may be installed with a maximum 1-inch offset in either direction from center of the flute. In addition, anchors shall have an axial spacing along the flute equal to the greater of $3h_{ef}$ or 1.5 times the flute width.

Ultimate Tension Load Capacities for Snake+ in Normal-Weight Uncracked Concrete[1,2,3,4]

Nominal Anchor Diameter in.	Minimum Embedment Depth in. (mm)	Minimum Concrete Compressive Strength					
		f'c = 2,500 psi (17.2 MPa)		f'c = 3,000 psi (20.7 MPa)		f'c = 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	1-5/8 (41)	2,130 (9.5)	1,045 (4.6)	2,335 (10.4)	1,045 (4.6)	-	-
3/8	1-5/8 (41)	2,165 (9.7)	1,045 (4.6)	2,370 (10.6)	1,045 (4.6)	3,190 (14.2)	1,045 (4.6)
1/2	2-3/16 (55)	5,590 (24.9)	2,050 (9.1)	6,125 (27.3)	2,050 (9.1)	7,240 (32.0)	2,050 (9.1)

1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load.
3. The tabulated load values are applicable to single anchors in uncracked concrete installed at critical spacing distance between anchors and at critical edge distance.
4. Ultimate shear capacity is controlled by steel strength of ASTM A36 element (or equivalent).

ORDERING INFORMATION

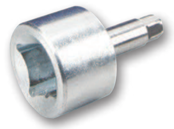
Carbon Steel Snake+ Screw Anchor

Cat. No.	Anchor Size	Embedment	Internal Thread Depth	Std. Box[1]	Std. Ctn.
6400SD	1/4"	1-5/8"	11/32"	100	1,000
6401SD	3/8"	1-5/8"	23/32"	50	500
6403SD	1/2"	2-1/2"	15/16"	50	300

1. Each box comes with one free setting tool

Setting Tool for Snake+ Screw Anchor

Cat. No.	Anchor Size	Std. Ctn.
6402SD	1/4"	1
6407SD	3/8"	1
6404SD	1/2"	1



Suggested Impact Wrench

<table>
<tr><th colspan="3">20V Max* Impact Wrenches</th></tr>
<tr><td>1/4</td><td rowspan="2">DCF880M2
1/2" Impact Wrench</td><td rowspan="2"></td></tr>
<tr><td>3/8</td></tr>
<tr><td>3/8</td><td rowspan="2">DCF894HP2
3/8 and 1/2" Impact Wrench
High Torque</td><td rowspan="2"></td></tr>
<tr><td>1/2</td></tr>
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GENERAL INFORMATION

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.

GENERAL APPLICATIONS AND USES

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

FEATURES AND BENEFITS

+ Internally threaded anchor for easy bolt removability and service work
+ Flanged (lipped) version installs flush for easy inspection and standard embedment
+ 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

TESTING, APPROVALS AND LISTINGS

- Tested in accordance with ASTM 488 and AC01 criteria
- Underwriters Laboratory (UL Listed) – File No. EX1289 (N) (see ordering information)
- FM Approvals (Factory Mutual) – File No. 3059197

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors and 05 05 19 - Post-Installed Concrete Anchors. Dropin anchors shall be Steel Dropin as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

SMOOTH WALL DROPIN

FLANGE (LIPPED) DROPIN

THREAD VERSION

- UNC Coarse Thread
- Coil Thread

ANCHOR MATERIALS

- Zinc Plated Carbon Steel
- 303 Stainless Steel (Domestic)
- 304 Stainless Steel
- 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

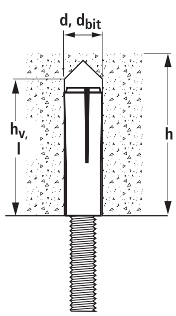
- Normal-weight Concrete
- Lightweight Concrete

MATERIAL SPECIFICATIONS

Anchor Component	Carbon Steel	Type 303 Stainless Steel	Type 316 Stainless Steel
Anchor Body	AISI 1008	Type 303/304 Stainless Steel	Type 316 Stainless Steel
Plug	AISI 1018	Type 303/304 Stainless Steel	Type 316 Stainless Steel
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn 5)	N/A	
Stainless steel anchor components are passivated.			

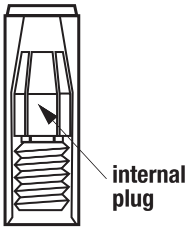
INSTALLATION SPECIFICATIONS

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	3/4-41/2
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



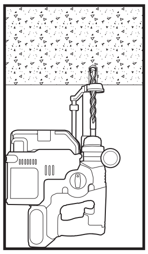
Nomenclature

d = Diameter of anchor
d_{bit} = Diameter of drill bit
h = Base material thickness. The minimum value of h should be 1.5h_v or 3" min. (whichever is greater)
h_v = Minimum embedment depth
l = Overall length of anchor
T_{max} = Maximum tightening torque

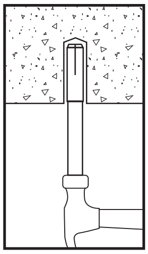


Installation Procedure

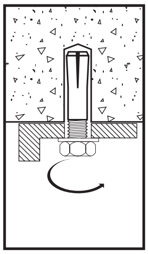
Using the proper drill bit size, drill a hole into the base material to the depth of embedment required. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15. Do not over drill the hole unless the application calls for a subset anchor.



Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling. Insert the anchor into the hole and tap flush with surface. Using a DEWALT 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 DEWALT 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 and Allowable Load Capacities for Steel Dropin in Normal-Weight Concrete[1,2,3]

Rod/Anchor Diameter d in. (mm)	Minimum Embedment Depth in. (mm)	Tension						Shear	
		2,000 psi (13.8 MPa)		4,000 psi (27.6 MPa)		6,000 psi (41.4 MPa)		f'c ≥ 2000 psi (20.7 MPa)	
		Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)
1/4 (6.4)	1 (25.4)	1,140 (5.1)	285 (1.3)	1,985 (8.9)	495 (2.2)	2,080 (9.4)	520 (2.3)	2,120 (9.5)	530 (2.4)
3/8 (9.5)	1-9/16 (39.7)	2,180 (9.8)	545 (2.5)	4,180 (18.8)	1,045 (4.7)	4,950 (22.3)	1,240 (5.6)	4,585 (20.6)	1,145 (5.2)
1/2 (12.7)	2 (50.8)	4,105 (18.5)	1,025 (4.6)	5,760 (25.9)	1,440 (6.5)	6,585 (29.6)	1,645 (7.4)	6,400 (28.8)	1,600 (7.2)
5/8 (15.9)	2-1/2 (63.5)	4,665 (21.0)	1,165 (5.2)	7,440 (33.5)	1,860 (8.4)	10,920 (49.1)	2,730 (12.3)	12,380 (55.7)	3,095 (13.9)
3/4 (19.1)	3-3/16 (81.0)	8,580 (38.6)	2,145 (9.7)	9,405 (41.8)	2,350 (10.5)	11,300 (50.3)	2,825 (12.6)	15,680 (70.6)	3,920 (17.6)

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

Ultimate and Allowable Load Capacities for Steel Dropin in Lightweight Concrete[1,2,3,4]

Rod/Anchor Diameter d in. (mm)	Minimum Embedment Depth in. (mm)	Tension						Shear	
		2,000 psi (13.8 MPa)		4,000 psi (27.6 MPa)		6,000 psi (41.4 MPa)		f'c ≥ 2000 psi (20.7 MPa)	
		Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)
1/4 (6.4)	1 (25.4)	1,060 (4.8)	265 (1.2)	1,360 (6.1)	340 (1.5)	1,660 (7.5)	415 (1.9)	1,920 (8.6)	480 (2.2)
3/8 (9.5)	1-9/16 (39.7)	3,040 (13.7)	760 (3.4)	3,780 (17.0)	945 (4.3)	4,520 (20.3)	1,130 (5.1)	4,120 (18.5)	1,030 (4.6)
1/2 (12.7)	2 (50.8)	4,240 (19.1)	1,060 (4.8)	4,840 (21.8)	1,210 (5.4)	5,460 (24.6)	1,365 (6.1)	5,680 (25.6)	1,420 (6.4)
5/8 (15.9)	2-1/2 (63.5)	6,860 (30.9)	1,715 (7.7)	7,840 (35.3)	1,960 (8.8)	8,840 (39.8)	2,210 (9.9)	9,640 (43.4)	2,410 (10.8)
3/4 (19.1)	3-3/16 (81.0)	10,280 (45.7)	2,570 (11.4)	11,700 (52.7)	2,925 (13.0)	13,120 (59.0)	3,280 (14.6)	15,680 (70.6)	3,920 (17.9)

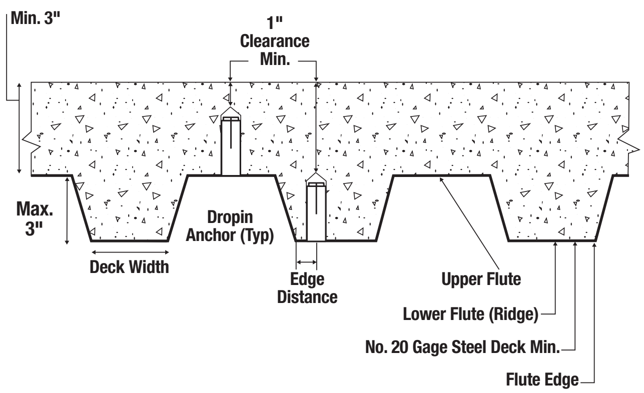
1. Tabulated load values are applicable to carbon and stainless steel anchors.
2. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
3. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load.
4. Allowable load capacities are multiplied by reduction factors found in the Design Criteria section when anchor spacing or edge distances are less than critical distances.

Allowable Load Capacities for Steel Dropin in Lightweight Concrete over Steel Deck[1,2,3,4]

Rod/Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Lightweight Concrete over Steel Deck, f´c ≥ 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)	400 (1.8)	2,040 (9.2)	100 (0.4)	510 (2.3)	760 (3.4)	2,040 (9.2)	190 (0.8)	510 (2.3)
3/8 (9.5)	1-9/16 (39.7)	600 (2.7)	2,760 (12.3)	150 (0.7)	690 (3.1)	960 (4.3)	2,760 (12.3)	240 (1.1)	690 (3.1)
1/2 (12.7)	2 (50.8)	-	-	-	-	2,740 (12.3)	5,560 (25.0)	685 (3.1)	1,390 (6.3)

1. Tabulated load values are for carbon steel and stainless steel anchors installed in sand-lightweight concrete over steel deck. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities listed are calculated using and 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.
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.

SAND-LIGHTWEIGHT CONCRETE OR NORMAL WEIGHT CONCRETE OVER STEEL DECK (MINIMUM 3,000 PSI)



DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

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	$s_{cr} = 3.0h_v$	$F_{NS} = F_{VS} = 1.0$	$s_{min} = 1.5h_v$	$F_{NS} = F_{VS} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 14d$	$F_{NC} = 1.0$	$c_{min} = 7d$	$F_{NC} = 0.90$
	Shear	$c_{cr} = 14d$	$F_{VC} = 1.0$	$c_{min} = 7d$	$F_{VC} = 0.50$

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	$s_{cr} = 3.0h_v$	$F_{NS} = F_{VS} = 1.0$	$s_{min} = 1.5h_v$	$F_{NS} = F_{VS} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 14d$	$F_{NC} = 1.0$	$c_{min} = 7d$	$F_{NC} = 0.80$
	Shear	$c_{cr} = 14d$	$F_{VC} = 1.0$	$c_{min} = 7d$	$F_{VC} = 0.50$

1. Allowable load values found in the performance data tables are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances. Linear interpolation is allowed for intermediate anchor spacing and edge distances between critical and minimum distances. When an anchor is affected by both reduced spacing and edge distance, the spacing and edge reduction factors must be combined (multiplied). Multiple reduction factors for anchor spacing and edge distance may be required depending on the anchor group configuration.

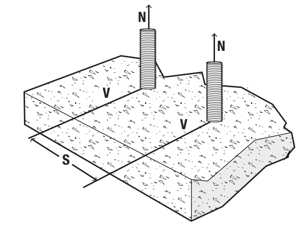
LOAD ADJUSTMENT FACTORS FOR NORMAL-WEIGHT AND LIGHTWEIGHT CONCRETE

Spacing, Tension (F_{NS}) & Shear (F_{VS})

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 Distance (inches)	1-1/2	0.50	-	-	-	-
	2-1/4	0.75	0.50	-	-	-
	3	1.00	0.67	0.50	-	-
	3-3/4	1.00	0.83	0.63	0.50	-
	4	1.00	0.89	0.67	0.53	-
	4-1/2	1.00	1.00	0.75	0.60	0.50
	5	1.00	1.00	0.83	0.67	0.56
	6	1.00	1.00	1.00	0.80	0.67
	7-1/2	1.00	1.00	1.00	1.00	0.83
	9	1.00	1.00	1.00	1.00	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.

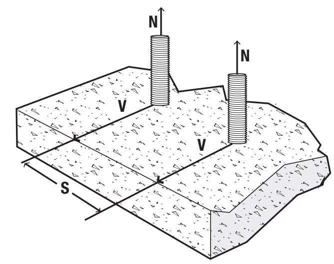


Edge Distance, Tension (F_{NC}) (Normal-Weight concrete only)

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	1.00	0.97	0.93	0.90	-
	5-1/4	1.00	1.00	0.95	0.92	0.90
	6	1.00	1.00	0.97	0.94	0.91
	7	1.00	1.00	1.00	0.96	0.93
	8	1.00	1.00	1.00	0.98	0.95
	8-3/4	1.00	1.00	1.00	1.00	0.97
	10-1/2	1.00	1.00	1.00	1.00	1.00

Notes: For anchors loaded in tension, the critical edge (c_{cr}) is equal to 14 anchors 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 light-weight concrete.



Edge Distance, Tension (F_{NC}) (Lightweight concrete only)

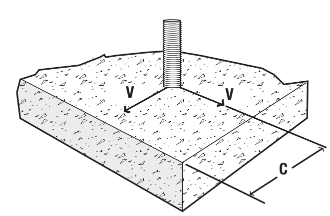
Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		3-1/2	5-1/4	7	8-3/4	10-1/2
c_{min} (in.)		1-3/4	2-5/8	3-1/2	4-3/8	5-1/4
Edge Distance, c (inches)	1-3/4	0.80	-	-	-	-
	2	0.83	-	-	-	-
	2-5/8	0.90	0.80	-	-	-
	3	0.94	0.83	-	-	-
	3-1/2	1.00	0.87	0.80	-	-
	4-3/8	1.00	0.93	0.85	0.80	-
	5-1/4	1.00	1.00	0.90	0.84	0.80
	6	1.00	1.00	0.94	0.87	0.83
	7	1.00	1.00	1.00	0.92	0.87
	8	1.00	1.00	1.00	0.97	0.90
	8-3/4	1.00	1.00	1.00	1.00	0.93
	10-1/2	1.00	1.00	1.00	1.00	1.00

Edge Distance, Shear (F_{VC})

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	1.00	0.83	0.63	0.50	-
	5	1.00	0.95	0.71	0.57	-
	5-1/4	1.00	1.00	0.75	0.60	0.50
	6	1.00	1.00	0.86	0.69	0.57
	7	1.00	1.00	1.00	0.80	0.67
	8	1.00	1.00	1.00	0.91	0.76
	8-3/4	1.00	1.00	1.00	1.00	0.83
	10	1.00	1.00	1.00	1.00	0.95
	10-1/2	1.00	1.00	1.00	1.00	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.



MECHANICAL ANCHORS

STEEL DROPIN™
Internally Threaded Expansion Anchor

ORDERING INFORMATION

Carbon Steel Smooth Wall Dropin

Cat. No.	Domestic Cat. No.	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Carton	Wt./100
6304	6304USA	1/4"	1"	7/16"	100	1000	2
6306	6306USA	3/8"	1-9/16"	5/8"	50	500	6
6308	6308USA	1/2"	2"	13/16"	50	250	12
6320	6320USA	5/8"	2-1/2"	1-3/16"	25	125	32
6312	6312USA	3/4"	3-13/16"	1-3/8"	10	50	48

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

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	300	12

Type 300 Series Stainless Steel Dropin

Cat. No. (Type 304)	Domestic Cat. No. (Type 303)	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Carton	Wt./100
6204	6204USA	1/4"	1"	7/16"	100	1000	2
6206	6206USA	3/8"	1-9/16"	5/8"	50	500	6
6208	6208USA	1/2"	2"	13/16"	50	250	12
6210	6210USA	5/8"	2-1/2"	1-3/16"	25	125	32
6212	6212USA	3/4"	3-13/16"	1-3/8"	10	50	48

Type 316 Stainless Steel Dropin

Cat. No.	Domestic Cat. No.	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Carton	Wt./100
6224	6224USA	1/4"	1"	7/16"	100	1000	2
6226	6226USA	3/8"	1-9/16"	5/8"	50	500	6
6228	6228USA	1/2"	2"	13/16"	50	250	12
6230	6230USA	5/8"	2-1/2"	1-3/16"	25	125	32
6232	6232USA	3/4"	3-13/16"	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	300	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"

Accu-Bit™ Drill Stop for Steel Dropin

Cat. No.	Rod/Anchor Size	Drill Depth	Std. Box
DWA5493	1/2" Accu-Bit for 3/8" Steel Dropin	1-13/16"	1
DWA5495	5/8" Accu-Bit for 1/2" Steel Dropin	2-3/8"	1

GENERAL INFORMATION

SMART DI™

Internally Threaded Expansion Anchor

PRODUCT DESCRIPTION

The Smart DI is an all-steel, machine bolt anchor available in carbon steel. It can be used in solid concrete, hard stone, and solid block base materials. The Smart DI is specifically designed to be easier to fully set during installation as a benefit to the user.

GENERAL APPLICATIONS AND USES

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

FEATURES AND BENEFITS

+ Installs with reduced effort compared to traditional drop in style anchors
+ Can be installed using the manual setting tool or Smart DI system with a hammer-drill
+ Setting indicater makes identification of properly set anchors easy (when installed using the smart tool and smart bit)
+ Internally threaded anchor for easy bolt removability and service work
+ Anchor can be installed through standard fixture holes

TESTING, APPROVALS AND LISTINGS

- FM Global (Factory Mutual) - File No. 3059197 (see ordering information)
- Underwriters Laboratory (UL Listed) – File No. EX1289 (N) (see ordering information)

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors and 05 05 19 - Post-Installed Concrete Anchors. Dropin anchors shall be Smart DI as supplied by DEWALT, Towson, MD.

SECTION CONTENTS

SMART DI (DROP-IN)

THREAD VERSION

Coarse (UNC)

ANCHOR MATERIALS

- Zinc Plated Carbon Steel

ROD/ANCHOR SIZE RANGE (TYP.)

- 1/4", 3/8" and 1/2" diameter (UNC)

SUITABLE BASE MATERIALS

- Normal-Weight Concrete

SMART DI DROP-IN

Anchor prior to installation

When properly set with Smart DI tool (system installation tool), anchor indicator will leave blue paint in recessed cavities. Note: Blue does not have to be removed from all four top surfaces to be fully set.

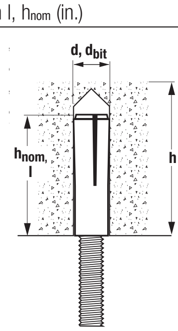
- Easier to Set
- More Expansion
- Expansion Indicator with a Smart DI System

MATERIAL SPECIFICATIONS

Anchor component	Specification
Anchor Body	AISI 1008
Plug	AISI 1008
Zinc Plating	ASTM B 633, SC1 Type III (Fe/Zn 5)

INSTALLATION SPECIFICATIONS

Anchor (Rod) Size	1/4"	3/8"	1/2"
Nominal Outside Diameter d (in.)	0.375	0.500	0.625
ANSI Drill Bit Size, d_{bit} (in.)	3/8	1/2	5/8
Maximum Tightening Torque, T_{max} (ft.-lbs.)	5	10	20
Thread Size (UNC)	1/4-20	3/8-16	1/2-13
Thread Depth (in.)	7/16	5/8	13/16
Anchor Length l, h_{nom} (in.)	1	1-9/16	2

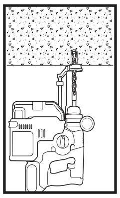


Nomenclature

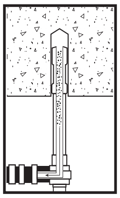
d = Diameter of anchor
d_{bit} = Diameter of drill bit
h = Base material thickness. The minimum value of h should be 3" min. except for 1/2" size where minimum value of h should be 4"
h_{nom} = Minimum embedment depth
l = Overall length of anchor

INSTALLATION SPECIFICATIONS

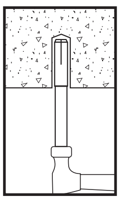
Manual Installation



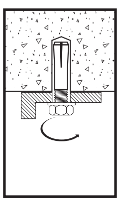
1. Using the proper drill bit size, drill a hole into the base material to the depth of embedment required. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15. Use any ANSI Standard carbide drill bit.



2. Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling. Insert the anchor into the hole and, if necessary tap flush with surface.

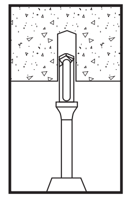


3. Using a DEWALT manual setting tool specifically, set the anchor by driving the tool with a sufficient number of hammer blows until the shoulder of the tool is seated against the anchor. Anchor will not hold allowable loads required if shoulder of DEWALT manual setting tool does not seat against anchor. Proper manual installation may not remove blue indicator paint.

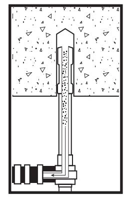


4. If using a fixture, position it, insert bolt and tighten so as not to exceed the maximum tightening torque. Most overhead applications utilize threaded rod. Minimum thread engagement should be at least one anchor diameter.

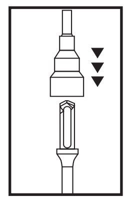
Smart DI System Installation



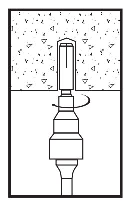
1. Using the proper drill bit size, drill a hole into the base material to the depth of embedment required using the appropriate DEWALT DI Stop Drill Bit. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15. Standard installation with a DI Stop Drill Bit may result in the anchor being slightly subset from the surface. Minimum published embedment depths must be achieved by using the shoulder of the DI Stop Drill Bit as a guide.



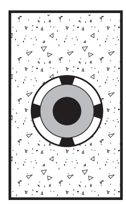
2. Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling. Insert the anchor into the hole and, if necessary, tap flush with the surface.



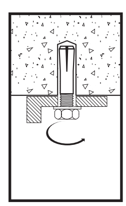
3. Slide the appropriate DEWALT DI Setting Tool over the DI Stop Drill Bit used to drill the hole and twist counterclockwise to lock the setting tool onto the bit. If tool does not fit snug onto bit it may be necessary to replace the internal rubber spring plug in the tool (see ordering information). Replacement kit sold separately.



4. Once attached, insert the tip of the setting tool into the Smart DI anchor and drive the internal plug fully using the rotation with hammer mode of the SDS+ drill (see table below for suggested tools).



5. For proper installation, the shoulder of the setting tool must come briefly in full contact with the Smart DI resulting in the blue indicator paint being removed from the raised top of the anchor. The paint will remain in the recessed portion of the top indicating full expansion.



6. If using a fixture, position it, insert the bolt and tighten so as not to exceed the maximum tightening torque. Most overhead applications utilize threaded rod. Minimum thread engagement should be at least one anchor diameter.

Recommended SDS+ Rotary Hammer Drill Specification for Smart DI Anchor (Drop-In) with Smart DI System Installation

Diameter	Concrete Compressive Strength (psi)	Rated Tool Impact Energy Suggested Range* (ft-lbs)	Recommended Rotary Hammer Tool Part Number
1/4"	2,500	1.3 - 2.6	DCH133M2, D25323K
	6,500	2.0 - 3.5	
3/8"	2,500	1.3 - 4.0	DCH293R2, D25263K
	6,500	2.1 - 4.0	
1/2"	2,500	2.0 - 4.0	DCH293R2, D25413K
	6,500	2.5 - 4.0	

* Local concrete conditions and rotary hammer impact efficiency vary greatly. Please verify that the tool impact energy is sufficient to fully set the internal plug of the Smart DI prior to using the system.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Smart DI Anchor (Drop-In) in Normal-Weight Concrete[1,2,3,4,5]

Nom. Anchor Dia. d in.	Min. Embed. Depth in. (mm)	Minimum Concrete Compressive Strength - f'c (psi)															
		2,500				3,000				4,000				6,000			
		Tension		Shear		Tension		Shear		Tension		Shear		Tension		Shear	
		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)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)
1/4	1 (25)	1,300 (5.8)	325 (1.4)	2,495 (11.1)	625 (2.8)	1,390 (6.2)	350 (1.6)	2,510 (11.2)	630 (2.8)	1,565 (7.0)	390 (1.7)	2,550 (11.3)	640 (2.8)	1,910 (8.5)	480 (2.1)	2,620 (11.7)	655 (2.9)
3/8	1-9/16 (40)	1,985 (8.6)	495 (2.2)	4,160 (18.5)	1,040 (4.6)	2,275 (10.1)	570 (2.5)	4,360 (19.4)	1,090 (4.6)	2,850 (12.7)	715 (3.2)	4,755 (21.2)	1,190 (5.3)	4,000 (17.5)	1,000 (4.4)	5,550 (24.7)	1,390 (5.2)
1/2	2 (51)	3,630 (16.1)	910 (4.0)	7,170 (31.9)	1,795 (8.0)	3,185 (14.2)	795 (3.5)	7,280 (32.4)	1,820 (8.1)	4,190 (18.6)	1,050 (4.7)	7,505 (33.4)	1,875 (8.3)	4,935 (22.0)	1,235 (8.3)	7,955 (35.4)	1,990 (8.9)

1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load.
3. Allowable load capacities listed are calculated using and applied safety factor of 4.0.
4. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.
5. Allowable load capacities are multiplied by reduction factors found in the Design Criteria section when anchor spacing or edge distances are less than critical distances.

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Combined Loading

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

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

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]

NOTE: Allowable load values found in the performance data tables are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances. Linear interpolation is allowed for intermediate anchor spacing and edge distances between critical and minimum distances. When an anchor is affected by both reduced spacing and edge distance, the spacing and edge reduction factors must be combined (multiplied). Multiple reduction factors for anchor spacing and edge distance may be required depending on the anchor group configuration.

LOAD ADJUSTMENT FACTORS FOR NORMAL-WEIGHT CONCRETE

Spacing Distance Adjustment Factors - Tension (F_{NS})

	Dia. (in)	1/4"	3/8"	1/2"
	h_v	1	1-9/16	2
	s_{cr}	3	4-1/2	6
	s_{min}	1-1/2	2-3/8	3
Spacing Distance (inches)	1/2	-	-	-
	1	-	-	-
	1-1/2	0.90	-	-
	2	0.94	-	-
	2-1/2	0.97	0.84	-
	3	1.00	0.87	0.85
	3-1/2	1.00	0.91	0.88
	4	1.00	0.95	0.90
	4-1/2	1.00	1.00	0.93
	5	1.00	1.00	0.95
	5-1/2	1.00	1.00	0.98
	6	1.00	1.00	1.00

Spacing Distance Adjustment Factors - Shear (F_{VS})

	Dia. (in)	1/4"	3/8"	1/2"
	h_v	1	1-9/16	2
	s_{cr}	3	5	6
	s_{min}	1-1/2	2-3/8	3
Spacing Distance (inches)	1/2	-	-	-
	1	-	-	-
	1-1/2	0.62	-	-
	2	0.75	-	-
	2-1/2	0.88	0.65	-
	3	1.00	0.73	0.62
	3-1/2	1.00	0.81	0.69
	4	1.00	0.89	0.75
	4-1/2	1.00	0.97	0.81
	5	1.00	1.00	0.88
	5-1/2	1.00	1.00	0.94
	6	1.00	1.00	1.00

Edge Distance Adjustment Factors - Tension (F_{NC})

	Dia. (in)	1/4"	3/8"	1/2"
	h_v	1	1-9/16	2
	c_{cr}	2	4-11/16	6
	c_{min}	2	3-1/8	4
Edge Distance (inches)	1/2	-	-	-
	1	-	-	-
	1-1/2	-	-	-
	2	1.00	-	-
	2-1/2	1.00	-	-
	3	1.00	-	-
	3-1/2	1.00	0.98	-
	4	1.00	0.99	0.93
	4-1/2	1.00	1.00	0.95
	5	1.00	1.00	0.97
	5-1/2	1.00	1.00	0.98
	6	1.00	1.00	1.00

Edge Distance Adjustment Factors - Shear (F_{VC})

	Dia. (in)	1/4"	3/8"	1/2"
	h_v	1	1-9/16	2
	c_{cr}	3	4-11/16	6
	c_{min}	2	3-1/8	4
Edge Distance (inches)	1/2	-	-	-
	1	-	-	-
	1-1/2	-	-	-
	2	0.87	-	-
	2-1/2	0.94	-	-
	3	1.00	-	-
	3-1/2	1.00	0.96	-
	4	1.00	0.98	0.91
	4-1/2	1.00	1.00	0.93
	5	1.00	1.00	0.95
	5-1/2	1.00	1.00	0.98
	6	1.00	1.00	1.00

ORDERING INFORMATION

Smart DI Anchor (Drop-In) Carbon Steel Smooth Wall Dropin

Cat. No.	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Box	Wt./100	FM or UL
6304SD	1/4"	1"	7/16"	100	1,000	2	-
6306SD	3/8"	1-9/16"	5/8"	50	500	6	FM/UL
6308SD	1/2"	2"	13/16"	50	500	12	FM/UL

DI System Setting Tool

Cat. No.	00425SD	00427SD	00429SD
Rod/Anchor Size	1/4"	3/8"	1/2"
Pin Length	39/64"	61/64"	1-3/16"

DI Tool Replacement Parts

Cat. No.	00426SD	00428SD	00430SD
Kit Contents	2 Guide Screws 1 Rubber Spring Plug	2 Guide Screws 1 Rubber Spring Plug	2 Guide Screws 1 Rubber Spring Plug
Fits Tool No.	00425SD	00427SD	00429SD

DI Stop Drill Bit

Cat. No.	00391SD	00397SD	00410SD
Description	Smart Bit for 1/4"	Smart Bit for 3/8"	Smart Bit for 1/2"
Bit Diameter	3/8"	1/2"	5/8"

Manual Setting Tools for Smart DI Anchor (Drop-In)

Cat. No.	6305	6307	6309
Rod/Anchor Size	1/4"	3/8"	1/2"
Pin Length	39/64"	61/64"	1-3/16"

Recommended Rotary Hammer Drills

Cat. No.	Description
DCH133M2	1" D-Handle SDS+ Brushless Rotary Hammer 20V Max
DCH293R2	1-1/8" SDS+ Brushless Rotary Hammer 3.5J w/ 6Ah Battery 20V Max
D25263K	1-1/8" SDS+ Rotary Hammer
D25323K	1" L-Shape SDS Rotary Hammer
D25413K	1-1/8" SDS Plus Rotary Hammer Kit





GENERAL INFORMATION

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 steel deck.

GENERAL APPLICATIONS AND USES

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

FEATURES AND BENEFITS

+ Internally threaded anchor for easy bolt removability and service work
+ Ideal for precast hollow core plank and post-tensioned concrete slabs
+ Lip provides flush installation and consistent embedment
+ Manual setting tool scores flange when set to verify proper expansion depth

APPROVALS AND LISTINGS

- Tested in accordance with ASTM E488 and AC01 criteria
- Factory Mutual Research Corporation (FM Approvals) – File No. 3059197
  See listing for applicable sizes - www.fmglobal.com

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors and 05 05 19 - Post-Installed Concrete Anchors. Anchors shall be Mini Dropin anchors as supplied by DEWALT, Towson, MD.

SECTION CONTENTS

MINI DROPIN

THREAD VERSION

- UNC Thread

ANCHOR MATERIALS

- Zinc Plated Carbon Steel

ROD/ANCHOR SIZE RANGE (TYP.)

- 1/4" diameter to 1/2" diameter

SUITABLE BASE MATERIALS

- Normal-weight Concrete
- Lightweight Concrete
- Precast Hollow Core Plank
- Concrete Over Steel Deck

MATERIAL AND INSTALLATION SPECIFICATIONS

Material Specification

Anchor Component	Carbon Steel
Anchor Body	SAE 1009
Plug	SAE 1009
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn 5)

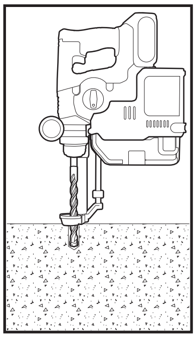
Installation Specification

Dimension	Rod/Anchor Diameter, d		
	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

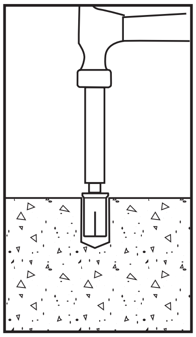
INSTALLATION PROCEDURES

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

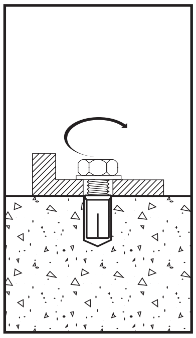
In post-tensioned concrete slabs, take care to avoid drilling into the post-tensioned cables.



Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling. Insert the anchor into the hole and tap flush with surface. Using a DEWALT 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 DEWALT 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)	1,100 (6.3)	1,260 (5.7)	1,150 (5.1)	1,650 (7.4)	1,200 (5.3)	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. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load.

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

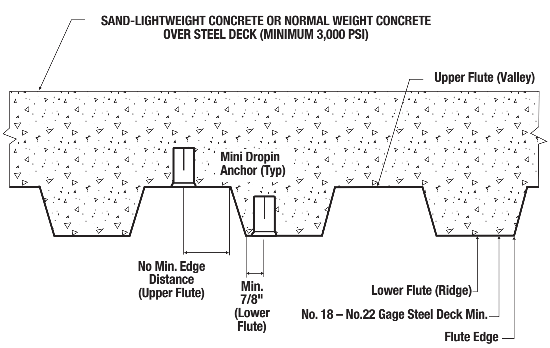
Rod/Anchor Size d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f´c)					
		3,000 psi (20.7 MPa)		4,000 psi (27.6 MPa)		6,000 psi (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	275 (1.2)	315 (1.4)	285 (1.3)	415 (1.9)	300 (1.3)	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 and 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 Mini Dropin Installed Through Steel Deck into Lightweight Concrete[1,2,3]

Rod/Anchor Size d in. (mm)	Minimum Embed. Depth h_v in. (mm)	Lightweight Concrete Over Min. 20 Ga. Steel Deck. f´c ≥ 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)

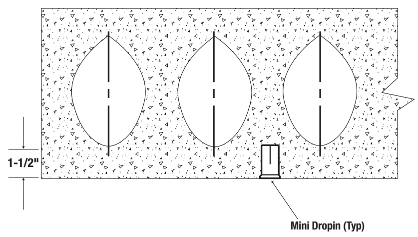
1. The metal deck shall be No. 22 gage to No. 18 gage thick steel [0.030-inch to 0.047-inch base metal thickness (0.75 mm to 1.20 mm)].
2. Allowable load capacities listed are calculated using and applied safety factor of 4.0.
3. Tabulated load values are for anchors installed with a minimum edge distance 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.



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)	Minimum Edge Distance in. (mm)	Min. Concrete Compressive Strength f´c ≥ 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)	1,400 (6.2)	1,840 (8.3)	350 (1.6)	460 (2.1)
3/8 (9.5)	3/4 (19.1)	4-1/2 (114)	4-1/2 (114)	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. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities listed are calculated using and applied safety factor of 4.0.



DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Combined Loading

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

$$\left(\frac{Nu}{Nn}\right) + \left(\frac{Vu}{Vn}\right) \leq 1$$

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 DISTANCE[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	$s_{cr} = 3.0h_v$	$F_{NC} = F_{VC} = 1.0$	$s_{min} = 1.5h_v$	$F_{NS} = F_{VS} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_{NC} = F_{VC} = 1.0$	$c_{min} = 6d$	$F_{NC} = 0.90$
	Shear[1]	$c_{cr} = 12d$	$F_{NC} = F_{VC} = 1.0$	$c_{min} = 6d$	$F_{VC} = 0.75$

1. Allowable loads for anchors loaded in shear parallel to the edge have no load factor $F_{VC} = 1.0$ when installed at minimum edge distances.
2. Allowable load values found in the performance data tables are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances. Linear interpolation is allowed for intermediate anchor spacing and edge distances between critical and minimum distances. When an anchor is affected by both reduced spacing and edge distance, the spacing and edge reduction factors must be combined (multiplied). Multiple reduction factors for anchor spacing and edge distance may be required depending on the anchor group configuration.

Anchor Installed in Through Steel Deck Structural 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	$s_{cr} = 3.0h_v$	$F_{NS} = F_{VS} = 1.0$	$s_{min} = 1.5h_v$	$F_{NS} = F_{VS} = 0.50$

3. Allowable load values found in the performance data tables are multiplied by reduction factors when anchor spacing is less than critical distances. Linear interpolation is allowed for intermediate anchor spacing between critical and minimum distances. Multiple reduction factors for anchor spacing may be required depending on the anchor group configuration.

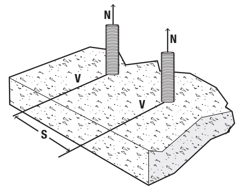
LOAD ADJUSTMENT FACTORS FOR NORMAL-WEIGHT AND LIGHTWEIGHT CONCRETE

Spacing, Tension (F_{NS}) & Shear (F_{VS}) (Normal-weight & Lightweight Concrete over deck)

	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	1.00	0.89	0.67
	2-1/4	1.00	1.00	0.75
	2-1/2	1.00	1.00	0.83
	3	1.00	1.00	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.

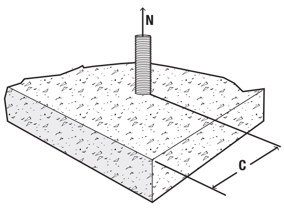


Edge Distance, Tension (F_{NC}) (Normal-weight concrete only)

	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	1.00	0.98	0.93
	4-1/2	1.00	1.00	0.95
	5	1.00	1.00	0.97
	6	1.00	1.00	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.

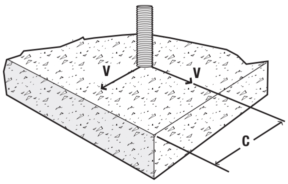


Edge Distance, Shear (F_{VC}) (Normal-weight concrete only)

	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	1.00	0.94	0.83
	4-1/2	1.00	1.00	0.88
	5	1.00	1.00	0.92
	6	1.00	1.00	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"	3/8"	5/8"	100	1,000
6322	3/8"	1/2"	3/4"	100	1,000
6337	1/2"	5/8"	1"	50	250

Setting Tool for Mini Dropin

Cat No.	Mini Dropin Size	Standard Box	Standard Carton
6336	1/4"	1	50
6323	3/8"	1	50
6338	1/2"	1	50

Accu-Bit™ Drill Stop for Mini Dropin

Cat No.	Rod/Anchor Size	Drill Depth	Standard Box
DWA5491	3/8" Accu-Bit for 1/4" Mini Dropin	7/8"	1
DWA5492	1/2" Accu-Bit for 3/8" Mini Dropin	15/16"	1
DWA5494	5/8" Accu-Bit for 1/2" Mini Dropin	1-13/32"	1

GENERAL INFORMATION

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 and precast hollow core plank. It can also be used in solid base materials. 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, where most conventional style anchors will not function properly.

GENERAL APPLICATIONS AND USES

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

FEATURE AND BENEFITS

+ Internally threaded anchor for easy bolt removability and service work
+ Unique expansion design allows for anchoring in thin-walled base materials
+ Versatile setting options allows for hollow or solid base materials
+ Tested in accordance with ASTM E488 and AC01 criteria

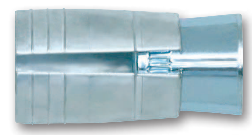
APPROVALS AND LISTINGS

- Underwriters Laboratories (UL) File EX 1289 (Hanger, Pipe): See listing for sizes.

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Dropin anchors shall be Hollow-Set Dropin as supplied by DEWALT, Towson, MD.

SECTION CONTENTS



HOLLOW-SET DROPIN

ANCHOR MATERIALS

- Zamac Alloy Anchor Body with:
  - Carbon Steel Cone or
  - Type 304 Stainless Steel Cone

ROD/ANCHOR SIZE RANGE (TYP.)

- 1/4" through 5/8" diameters

SUITABLE BASE MATERIALS

- Normal-Weight Concrete
- Precast Hollow Core Plank
- Hollow or Grout Filled Concrete Masonry (CMU)
- Brick Masonry

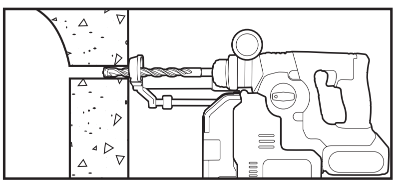
MATERIAL SPECIFICATIONS

Anchor Component	Carbon Steel	Stainless Steel
Anchor Body	Zamac Alloy	Zamac Alloy
Cone	AISI C 1008	Type 304 Stainless Steel
Plating (Cone)	ASTM B633, SC1, Type III (Fe/Zn 5)	N/A

INSTALLATION SPECIFICATIONS

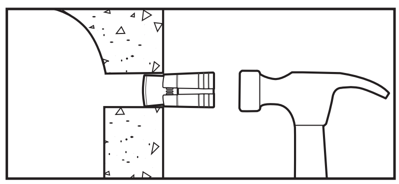
Dimension	Rod/Anchor Diameter, d				
	1/4"	5/16"	3/8"	1/2"	5/8"
ANSI Drill Bit Size, d_{bit} (in.)	3/8	5/8	5/8	3/4	1
Maximum Tightening Torque, T_{max} (ft.-lbs)	3-4	5-7	8-10	15-20	30-40
Thread Size (UNC)	1/4-20	5/16-18	3/8-16	1/2-13	5/8-11
Overall Anchor Length (in.)	7/8	1-5/16	1-5/16	1-3/4	2
Sleeve 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 Instructions for Hollow Base Materials

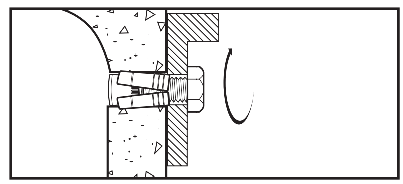


In hollow base materials, drill through into the cell or void. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15.

Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.

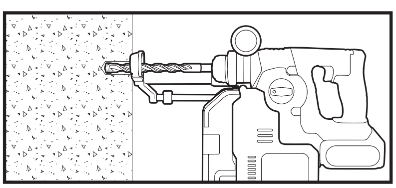


Do not expand the anchor prior to installation. Insert cone end and tap flush to surface.



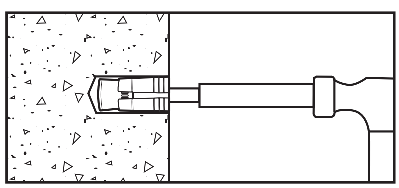
Position fixture, insert bolt and tighten. The bolt should engage a minimum of 2/3 of the anchor threads. The anchor can also be expanded using a Hollow-Set Tool. (If Hollow-Set Tool is used, thread anchor onto tool prior to tapping into anchor hole. When flush with surface, turn tool clockwise to tighten.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

Installation Instructions for Solid Base Materials



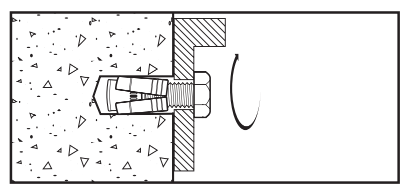
Drill a hole into the base material to the required embedment depth. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15.

Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to ex tract loose particles created by drilling.



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.

PERFORMANCE DATA

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

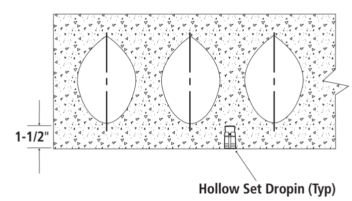
Rod/ Anchor Diameter d in. (mm)	Minimum Embed Depth h_v in. (mm)	Drill Bit Diameter ANSI in.	Minimum Concrete Compressive Strength, f 'c											
			2,000 psi				4,000 psi				6,000 psi			
			Tension		Shear		Tension		Shear		Tension		Shear	
			Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)
1/4 (6.4)	3/4 (19)	3/8	760 (3.4)	150 (0.7)	1,200 (5.3)	240 (1.1)	1,140 (5.1)	230 (1.0)	1,200 (5.3)	240 (1.1)	1,440 (6.4)	290 (1.3)	1,200 (5.3)	240 (1.1)
	7/8 (22)		880 (3.9)	175 (0.8)	1,440 (6.4)	290 (1.3)	1,145 (5.1)	230 (1.0)	1,440 (6.4)	290 (1.3)	2,045 (9.1)	410 (1.8)	1,440 (6.4)	290 (1.3)
5/16 (6.4)	1 (25)	5/8	1,120 (5.0)	225 (1.0)	1,980 (8.8)	395 (1.8)	1,680 (7.5)	335 (1.5)	1,980 (8.8)	395 (1.8)	2,200 (9.8)	440 (2.0)	1,980 (8.8)	395 (1.8)
	1-1/2 (38)		2,205 (9.8)	440 (2.0)	2,740 (12.2)	550 (2.4)	2,775 (12.3)	555 (2.5)	2,740 (12.2)	550 (2.4)	4,825 (21.5)	965 (4.3)	2,740 (12.2)	550 (2.4)
3/8 (9.5)	1 (25)	5/8	1,370 (6.1)	275 (1.2)	2,550 (11.3)	510 (2.3)	2,070 (9.2)	415 (1.8)	2,550 (11.3)	510 (2.3)	2,290 (10.2)	460 (2.0)	2,550 (11.3)	510 (2.3)
	1-1/2 (38)		2,445 (10.9)	490 (2.2)	3,145 (14.0)	630 (2.8)	2,800 (12.5)	560 (2.5)	3,145 (14.0)	630 (2.8)	5,085 (22.6)	1,015 (4.5)	3,145 (14.0)	630 (2.8)
1/2 (12.7)	1-1/2 (38)	3/4	2,140 (9.5)	430 (1.9)	4,020 (17.9)	805 (3.6)	4,025 (17.9)	805 (3.6)	4,020 (17.9)	805 (3.6)	7,285 (32.4)	1,455 (6.5)	4,020 (17.9)	805 (3.6)
	2 (51)		2,780 (12.4)	555 (2.5)	4,020 (17.9)	805 (3.6)	4,375 (19.5)	875 (3.9)	4,020 (17.9)	805 (3.6)	9,455 (42.1)	1,890 (8.4)	4,020 (17.9)	805 (3.6)
5/8 (15.9)	2-1/4 (57)	1	5,725 (25.5)	1,145 (5.1)	6,400 (28.5)	1,280 (5.7)	9,410 (41.9)	1,880 (8.4)	6,400 (28.5)	1,280 (5.7)	10,500 (46.7)	2,100 (9.3)	6,400 (28.5)	1,280 (5.7)

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. Consideration of safety factors of 20 or higher may be necessary depending on the application, such as life safety, overhead and in sustained tensile loading applications.
3. Linear interpolation may be used to determine allowable loads for anchors at intermediate embedment depths and compressive strengths.
4. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.

Ultimate and Allowable Load Capacities for Hollow-Set Dropin in Hollow Core Plank[1,2,3]

Rod/ Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Drill Bit Diameter ANSI in.	Minimum Concrete Compressive Strength f´c ≥ 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	6,560 (29.2)	8,320 (37.4)	1,640 (7.3)	2,080 (9.4)

1. Tabulated load values are applicable to anchors with carbon and stainless steel cones and set with sleeve flush to surface of the plank and with setting tool for solid base materials.
2. Allowable load capacities listed are calculated using and applied safety factor of 4.0. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, overhead and in sustained tensile loading applications.
3. Minimum spacing distance must not be less than eight anchor diameters (8d).



Ultimate and Allowable Load Capacities for Hollow-Set Dropin in Hollow Concrete Masonry[1,2,3,4,5,6,7]

Rod/Anchor Diameter d in.	Minimum Embedment Depth hv in.	Drill Bit Diameter ANSI in.	Min. Edge Distance in. (mm)	Min. End Distance in. (mm)	f'm = 1,500 psi			
					Ultimate Load		Allowable Load	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4	7/8* (22.2)	3/8	3-3/4 (95)	3-3/4 (95)	530 (2.4)	785 (3.5)	105 (0.5)	155 (0.7)
5/16	1* (25.4)	5/8	3-3/4 (95)	3-3/4 (95)	1,035 (4.6)	920 (4.1)	205 (0.9)	185 (0.8)
3/8	1* (25.4)	5/8	3-3/4 (95)	3-3/4 (95)	1,225 (5.4)	1,175 (5.2)	245 (1.1)	235 (1.0)
1/2	1-1/4* (31.8)	3/4	3-3/4 (95)	3-3/4 (95)	1,520 (6.8)	1,240 (5.5)	305 (1.4)	250 (1.1)
	1-1/4* (31.8)	3/4	11-1/4 (286)	11-1/4 (286)	1,520 (6.8)	1,825 (8.1)	305 (1.4)	365 (1.6)
5/8	1-1/2* (38.1)	1	11-1/4 (286)	11-1/4 (286)	1,790 (8.0)	1,870 (8.3)	360 (1.6)	375 (1.7)

1. Tabulated load values are applicable to anchors with carbon and stainless steel cones.
2. Tabulated load values for anchors are installed in minimum 6" wide, minimum Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry cells may be grouted. Masonry compressive strength must be at specified minimum at the time of installation.
3. Allowable load capacities listed are calculated using an applied safety factor of 5.0. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, and in sustained tensile loading applications.
4. Allowable shear load values may be increased by 100% (multiplied by 2.0) provided the applied shear loads are not loaded toward the wall edge and end.
5. The tabulated values are applicable for anchors installed into grouted masonry wall faces or ends of block ends provided minimum edge and end distances are maintained.
6. The tabulated values are applicable to single anchors. Two anchors may be installed in the same cell provided the spacing distance between the anchors is a minimum of six diameters (6d) and the allowable loads are reduced by 50%.
7. Anchors were installed with sleeve flush to block surface and with setting tool for hollow base materials. Embedment is measured from the surface of the base material.

*Minimum face shell thickness must be minimum 1.25-inch-thick for 1/2-inch-diameter anchors and minimum 1.5-inch-thick for 5/8-inch diameter anchors.

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

Rod/ Anchor Diameter d in. (mm)	Minimum Embed. Depth h_v in. (mm)	Drill Bit Diameter ANSI in.	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	f´m ≥ 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	6 (152.4)	8 (203.2)	880 (4.0)	1,640 (7.4)	175 (0.8)	330 (1.5)
5/16 (9.5)	1-1/4 (31.8)	5/8	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)	5/8	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)	3/4	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)	1	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.
2. Tabulated load values are for anchors installed in multiple wythe, minimum Grade SW, solid clay brick masonry walls conforming to ASTM C 62. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation (f'm ≥ 1,500 psi).
3. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, and in sustained tensile loading applications.
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 (ALLOWABLE STRESS DESIGN)

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	$s_{cr} = 3.0h_v$	$F_{NS} = F_{VS} = 1.0$	$s_{min} = 1.5h_v$	$F_{NS} = F_{VS} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 14d$	$F_{NC} = 1.0$	$c_{min} = 8d$	$F_{NC} = 0.80$
	Shear	$c_{cr} = 14d$	$F_{VC} = 1.0$	$c_{min} = 8d$	$F_{VC} = 0.50$

1. Allowable load values found in the performance data tables are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances. Linear interpolation is allowed for intermediate anchor spacing and edge distances between critical and minimum distances. When an anchor is affected by both reduced spacing and edge distance, the spacing and edge reduction factors must be combined (multiplied). Multiple reduction factors for anchor spacing and edge distance may be required depending on the anchor group configuration.

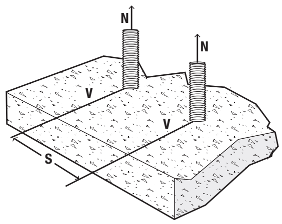
LOAD ADJUSTMENT FACTORS FOR NORMAL-WEIGHT CONCRETE

Spacing, Tension (F_{NS}) & Shear (F_{VS})

	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	1.00	0.67	0.67	0.50	-
	3-3/8	1.00	0.75	0.75	0.56	0.50
	4	1.00	0.89	0.89	0.67	0.59
	4-1/2	1.00	1.00	1.00	0.75	0.67
	5	1.00	1.00	1.00	0.83	0.74
	6	1.00	1.00	1.00	1.00	0.89
	6-3/4	1.00	1.00	1.00	1.00	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.

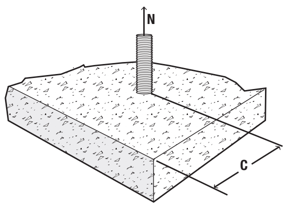


Edge Distance, Tension (F_{NC})

	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	1.00	0.96	0.89	0.80	-
	4-3/8	1.00	1.00	0.92	0.83	-
	5	1.00	1.00	0.98	0.87	0.80
	5-1/4	1.00	1.00	1.00	0.88	0.81
	6	1.00	1.00	1.00	0.93	0.85
	7	1.00	1.00	1.00	1.00	0.91
	8	1.00	1.00	1.00	1.00	0.96
	8-3/4	1.00	1.00	1.00	1.00	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.

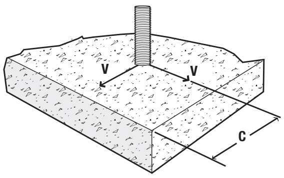


Edge Distance, Shear (F_{VC})

	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	1.00	0.90	0.72	0.50	-
	4-3/8	1.00	1.00	0.81	0.56	-
	5	1.00	1.00	0.94	0.67	0.50
	5-1/4	1.00	1.00	1.00	0.71	0.53
	6	1.00	1.00	1.00	0.83	0.63
	7	1.00	1.00	1.00	1.00	0.77
	8	1.00	1.00	1.00	1.00	0.90
	8-3/4	1.00	1.00	1.00	1.00	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.

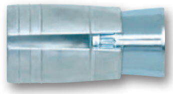
Minimum edge distance (c_{min}) is equal to 8 anchor diameters (8d) at which the anchor achieves 50% of load.



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	300	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	5/16"	1	1
9343	3/8"	1	1
9353	1/2"	1	1
9363	5/8"	1	1

* Hollow set tool for hollow block and clay brick masonry base materials.

GENERAL INFORMATION

CONCRETE HANGERMATE®+

Rod Hanging Anchor

PRODUCT DESCRIPTION

The Hangermate®+ concrete screw is a one piece, steel anchor designed for rod hanging applications such as fire protection systems, ventilation systems, electrical conduit, pipe hanging and cable trays. Tested and qualified for use in cracked concrete and seismic conditions. The concrete Hangermate®+ requires a 1/4" ANSI masonry bit for installation, accepts 1/4" and 3/8" diameter threaded rods and is also available in a 3/8" male thread version.

GENERAL APPLICATIONS AND USES

- Fire Sprinkler Pipes
- Ventilation Systems
- Cable Trays
- Suspended Ceilings
- Overhead Utilities
- Lighting Systems

FEATURES AND BENEFITS

+ Installs with standard ¼-inch ANSI drill bit
+ Faster installation resulting in labor savings
+ Patented thread design offers low installation torque
+ Tough threads for tapping high strength concrete

APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES). ESR-3889 code compliant with the 2015 IBC/IRC, 2012 IBC/IRC, and 2009 IBC/IRC.
- FM Approvals (FM) - (see listing for applicable sizes and types).
- Tested in accordance with ACI 355.2/ASTM E 488 and ICC-ES AC193 for use in structural concrete under the design provisions of ACI 318-14, Chapter 17 and ACI-318-11/08 Appendix D.
- Evaluated and qualified by an accredited independent testing laboratory for recognition in cracked and uncracked concrete including seismic and wind loading (Category 1 anchors)
- Evaluated and qualified by an accredited independent testing laboratory for reliability against brittle failure, e.g. hydrogen embrittlement.

GUIDE SPECIFICATIONS

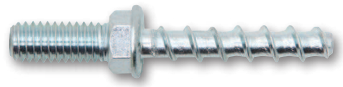
CSI Divisions: 03 16 00 - Concrete Anchors, 05 05 19 - Post-Installed Concrete Anchors. Anchors shall be Concrete Hangermate+ as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instruction and the Authority Having Jurisdiction.

MATERIAL SPECIFICATIONS

Anchor component	Specification
Anchor Body	Case hardened low carbon steel
Plating	Zinc plating according to ASTM B 633, SC1 Type III (Fe/Zn 5). Minimum plating requirements for Mild Service Condition.

SECTION CONTENTS

CONCRETE HANGERMATE+ (INTERNALLY THREADED COUPLER HEAD)



CONCRETE HANGERMATE+ (EXTERNAL THREAD - STUD HEAD)

THREAD VERSION

- Unified Coarse Thread (UNC)

ANCHOR MATERIALS

- Zinc Plated Carbon Steel

ANCHOR SIZE RANGE (TYP.)

- 1/4" and 3/8" diameter (Threaded Heads)

SUITABLE BASE MATERIALS

- Normal-weight concrete
- Sand-lightweight concrete
- Concrete over steel deck

TENSION ZONE CRACKED CONCRETE

SEISMIC REGION QUALIFICATION

CODE LISTED
ICC-ES ESR-3889
CONCRETE

DDA
DEWALT DESIGN ASSIST™

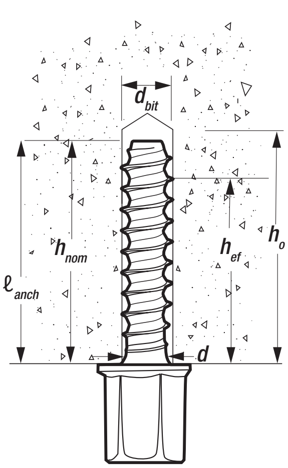
INSTALLATION SPECIFICATIONS

Installation Specifications for Hangermate+ in Concrete and Supplementary Information

Anchor Property/Setting Information		Notation	Units	Nominal Anchor Diameter (inch) 1/4	
Anchor outside diameter		d	in. (mm)	0.250 (6.35)	
Nominal drill bit diameter		d_{bit}	in. (mm)	1/4 ANSI	
Minimum embedment depth		h_{nom}	in. (mm)	1-5/8 (41)	2-1/2 (64)
Minimum hole depth		h_o	in. (mm)	2 (51)	2-7/8 (73)
Minimum member thickness		h_{min}	in. (mm)	3-1/4 (83)	4 (102)
Minimum edge distance		c_{min}	in. (mm)	1-1/2 (38)	
Minimum spacing		s_{min}	in. (mm)	1-1/2 (38)	
Max. Installation torque		$T_{inst,max}$	ft.-lbf. (N-m)	19 (26)	
Max impact wrench power (torque)		$T_{impact,max}$	ft.-lbf. (N-m)	150 (203)	
Internal Threaded Head	Wrench socket size	1/4 thread	in.	3/8	-
		3/8 thread		1/2	
	Maximum head height	1/4 thread	in.	33/64	-
		3/8 thread		43/64	
	Maximum washer diameter	1/4 thread	in.	1/2	-
		3/8 thread		21/32	
Externally Threaded Head	Wrench socket size	3/8 thread	in.	1/2	
	Maximum head height			1-3/16	
	Maximum washer diameter			21/32	
Effective tensile stress area (screw anchor body)		A_{se}	in.² (mm²)	0.045 (29.0)	
Minimum specified ultimate strength		f_{uta}	ksi (N/mm²)	100 (690)	
Minimum specified yield strength		f_y	ksi (N/mm²)	80 (552)	

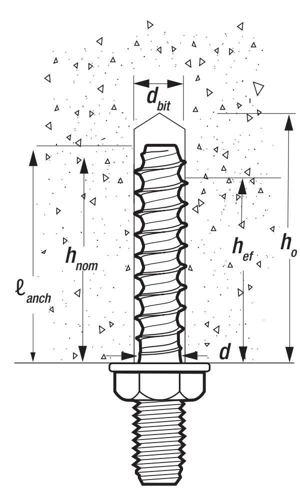
For SI: 1 inch = 25.4 mm; 1 ksi = 6.894 N/mm²; 1 ft-lb = 1.356 N-m; 1 lb = 0.0044 kN.

Hangermate+ Anchor Detail in Concrete



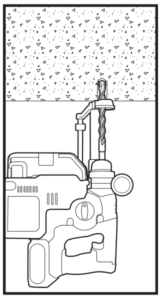
Internally Threaded

Nomenclature
d = Diameter of Anchor
d_{bit} = Diameter of Drill Bit
h_{nom} = Minimum Nominal Embedment
h_{ef} = Effective Embedment
h_o = Minimum Hole Depth
ℓ_{anch} = Nominal Anchor Length

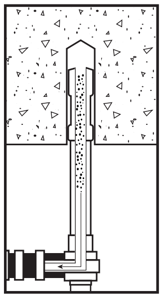


External Thread

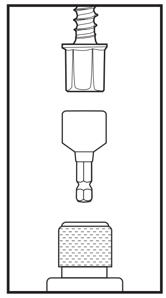
INSTALLATION INSTRUCTIONS



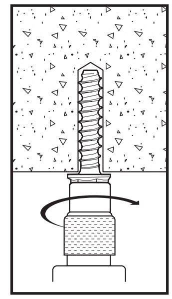
Step 1
Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



Step 2
Remove dust and debris from hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created during drilling.

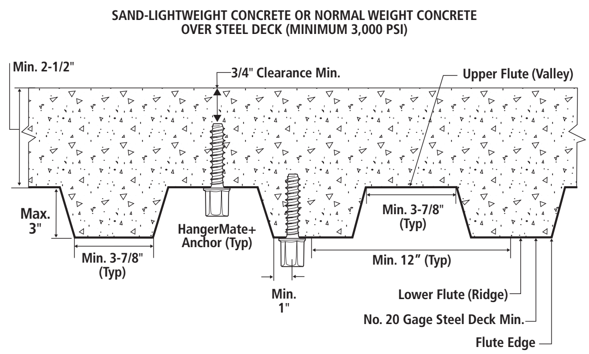


Step 3
Select a powered impact wrench or torque wrench and do not exceed the maximum torque, $T_{impact,max}$ or $T_{inst,max}$, repectively, for the selected anchor diameter and embedment (See Table 1). Attach an appropriate sized hex socket to the wrench. Mount the screw anchor head into the socket.



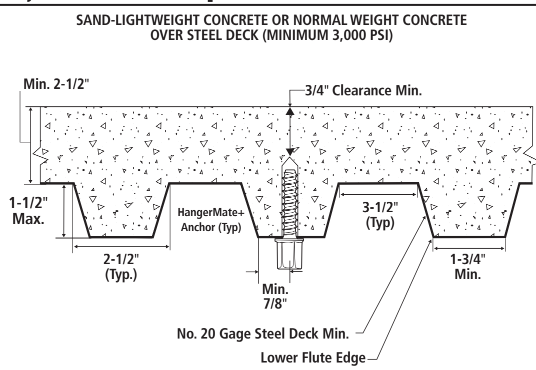
Step 4
Drive the anchor with an impact wrench or torque wrench through the fixture and into the hole until the head of the anchor comes into contact with the member surface. Do not spin the hex socket off the anchor to disengage. Insert threaded rod or threaded bolt element into Hangermate+.

Hangermate+ Installation Detail for Screw Anchors in the Soffit of Concrete over Steel Deck Floor and Roof Assemblies, 3-inch Deep Deck Profile[1,2,3]



1. Anchors may be placed in the upper flute or lower flute of the concrete-filled steel deck profiles provided the minimum hole clearance of 3/4-inch is satisfied for the selected anchor. See the Tension and Shear Design information for Anchors Installed in the Soffit of Concrete-Filled Steel Deck Assemblies table.
2. Anchors in the lower flute may be installed with a maximum 15/16-inch offset in either directions from the center of the flute. The offset distance may be increased proportionally for profiles with lower flute widths greater than those shown provided the minimum lower flute edge distance is also satisfied. (e.g. 1-1/4-inch offset for 4-1/2-inch wide flute).
3. See the Tension and Shear Design information for Anchors Installed in the Soffit of Concrete-Filled Steel Deck Assemblies table for design data.

Hangermate+ Installation Detail for Screw Anchors in the Soffit of Concrete over Steel Deck Floor and Roof Assemblies, 1-1/2-inch Deep Deck Profile[1,2,3]



1. Anchors may be placed in the upper flute or lower flute of the concrete-filled steel deck profiles provided the minimum hole clearance of 3/4-inch is satisfied for the selected anchor. See the Tension and Shear Design information for Anchors Installed in the Soffit of Concrete-Filled Steel Deck Assemblies table.
2. Anchors in the lower flute may be installed in the center of the flute. An offset distance may be given proportionally for profiles with flute widths greater than those shown provided the minimum lower flute edge distance is also satisfied.
3. See the Tension and Shear Design information for Anchors Installed in the Soffit of Concrete-Filled Steel Deck Assemblies table for design data.

REFERENCE DATA (ASD)

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

Nominal Anchor Diameter in.	Minimum Nominal Embedment Depth in. (mm)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi (17.3 MPa)		f'c = 3,000 psi (20.7 MPa)		f'c = 4,000 psi (27.6 MPa)		f'c = 6,000 psi (41.4 MPa)		f'c = 8,000 psi (55.2 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)
1/4 (1/4 Thread)	1-5/8 (41)	2,835 (12.6)	1,485 (6.6)	2,995 (13.3)	1,525 (6.8)	3,265 (14.5)	1,525 (6.8)	3,265 (14.5)	1,525 (6.8)	3,265 (14.5)	1,525 (6.8)
1/4 (3/8 Thread)	1-5/8 (41)	2,835 (12.6)	2,035 (9.1)	2,995 (13.3)	2,090 (9.3)	3,265 (14.5)	2,090 (9.3)	3,265 (14.5)	2,090 (9.3)	3,265 (14.5)	2,090 (9.3)
	2-1/2 (64)	3,650 (16.2)	2,035 (9.1)	3,855 (17.1)	2,090 (9.3)	4,200 (18.7)	2,090 (9.3)	4,270 (19.0)	2,090 (9.3)	4,270 (19.0)	2,090 (9.3)

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

Allowable Load Capacities for Hangermate+ in Normal-Weight Concrete[1,2,3,4]

Nominal Anchor Diameter in.	Minimum Nominal Embedment Depth in. (mm)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi (17.3 MPa)		f'c = 3,000 psi (20.7 MPa)		f'c = 4,000 psi (27.6 MPa)		f'c = 6,000 psi (41.4 MPa)		f'c = 8,000 psi (55.2 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)
1/4 (1/4 Thread)	1-5/8 (41)	710 (3.2)	370 (1.6)	750 (3.3)	380 (1.7)	815 (3.6)	380 (1.7)	815 (3.6)	380 (1.7)	815 (3.6)	380 (1.7)
1/4 (3/8 Thread)	1-5/8 (41)	710 (3.2)	510 (2.3)	750 (3.3)	525 (2.3)	815 (3.6)	525 (2.3)	815 (3.6)	525 (2.3)	815 (3.6)	525 (2.3)
	2-1/2 (64)	915 (4.1)	510 (2.3)	965 (4.3)	525 (2.3)	1,050 (4.7)	525 (2.3)	1,070 (4.8)	525 (2.3)	1,070 (4.8)	525 (2.3)

1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities are calculated using an applied safety factor 4.0.
3. Allowable load capacities must be multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.
4. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.

Edge Distance - Tension (F_{NC})

Diameter (in)		1/4		
Thread Diameter		1/4"	3/8"	3/8"
Nominal Embedment, h_{nom} (in)		1-5/8	1-5/8	2-1/2
Minimum Edge Distance, c_{min} (in)		1-1/2	1-1/2	1-1/2
Edge Distance (inches)	1-1/2	0.77	0.77	0.64
	1-3/4	0.83	0.83	0.67
	2	0.88	0.88	0.71
	2-1/4	0.94	0.94	0.75
	2-1/2	1.00	1.00	0.78
	2-3/4	1.00	1.00	0.82
	3	1.00	1.00	0.86
	3-1/2	1.00	1.00	0.93
	4	1.00	1.00	1.00

Spacing - Tension (F_{NS})

Diameter (in)		1/4		
Thread Diameter		1-5/8	1-5/8	2-1/2
Nominal Embedment, h_{nom} (in)		1-1/5	1-1/5	2
Minimum Spacing, s_{min} (in)		3-3/5	3-3/5	5-5/6
Spacing Distance (inches)	1-1/2	0.77	0.77	0.68
	1-3/4	0.80	0.80	0.70
	2	0.83	0.83	0.72
	2-1/4	0.86	0.86	0.74
	2-1/2	0.89	0.89	0.76
	2-3/4	0.92	0.92	0.78
	3	0.99	0.99	0.82
	3-1/2	1.00	1.00	0.86
	4	1.00	1.00	0.90
	4-1/2	1.00	1.00	0.94
	5	1.00	1.00	0.97
	5-1/2	1.00	1.00	1.00
	6	1.00	1.00	1.00

Edge Distance - Shear (F_{VC})

Diameter (in)		1/4		
Thread Diameter		1/4"	3/8"	3/8"
Nominal Embedment, h_{nom} (in)		1-5/8	1-5/8	2-1/2
Minimum Edge Distance, c_{min} (in)		1-1/2	1-1/2	1-1/2
Edge Distance (inches)	1-1/2	0.68	0.55	0.59
	1-3/4	0.79	0.64	0.68
	2	0.90	0.73	0.78
	2-1/4	1.00	0.82	0.88
	2-1/2	1.00	0.92	0.98
	2-3/4	1.00	1.00	1.00

Spacing - Shear (F_{VS})

Diameter (in)		1/4		
Thread Diameter		1/4"	3/8"	3/8"
Nominal Embedment, h_{nom} (in)		1-5/8	1-5/8	2-1/2
Minimum Spacing, s_{min} (in)		1-1/2	1-1/2	1-1/2
Spacing Distance (inches)	1-1/2	0.61	0.59	0.60
	1-3/4	0.63	0.61	0.61
	2	0.65	0.62	0.63
	2-1/4	0.67	0.64	0.65
	2-1/2	0.69	0.65	0.66
	2-3/4	0.71	0.67	0.68
	3	0.73	0.68	0.70
	3-1/2	0.76	0.71	0.73
	4	0.80	0.74	0.76
	4-1/2	0.84	0.77	0.79
	5	0.88	0.81	0.83
	5-1/2	0.91	0.84	0.86
	6	0.95	0.87	0.89
	6-1/2	0.99	0.90	0.92
	7	1.00	0.93	0.96
	7-1/2	1.00	0.96	0.99
	8	1.00	0.99	1.00
	9	1.00	1.00	1.00

PERFORMANCE DATA (SD)

Hangermate+ Installation Specifications in Concrete and Supplemental Information[1,2]

CODE LISTED
ICC-ES ESR-3889

Anchor Property/Setting Information		Notation	Units	Nominal Anchor Diameter (inch) 1/4	
Nominal anchor diameter		d_a	in. (mm)	0.250 (6.4)	
Nominal drill bit diameter		d_{bit}	in.	1/4 ANSI	
Minimum nominal embedment depth[3]		h_{nom}	in. (mm)	1-5/8 (41)	2-1/2 (64)
Effective Embedment		h_{ef}	in. (mm)	1.20 (30)	1.94 (49)
Minimum hole depth		h_o	in. (mm)	2 (51)	2-7/8 (73)
Minimum concrete member thickness		h_{min}	in. (mm)	3-1/4 (83)	4 (102)
Minimum edge distance		c_{min}	in. (mm)	1-1/2 (38)	
Minimum spacing distance		s_{min}	in. (mm)	1-1/2 (38)	
Critical edge distance		c_{ac}	in. (mm)	4.30 (109)	6.10 (155)
Minimum nominal anchor length[4]		ℓ_{anch}	in. (mm)	1-5/8 (41)	2-1/2 (64)
Max Installation torque		$T_{inst,max}$	ft.-lb. (N-m)	19 (26)	25 (34)
Maximum impact wrench power (torque)		$T_{impact,max}$	ft.-lb. (N-m)	150 (203)	
Internal Threaded Head	Wrench socket size	1/4" thread	in.	3/8	-
		3/8" thread		1/2	
	Maximum head height	1/4" thread	in.	33/64	-
		3/8" thread		43/64	
	Maximum washer diameter	1/4" thread	in.	1/2	-
		3/8" thread		21/32	
Externally Threaded Head	Wrench socket size	3/8" thread	in.	1/2	
	Maximum head height			1-3/16	
	Maximum washer diameter			21/32	
Effective tensile stress area (screw anchor body)		A_{se}	in² (mm²)	0.045 (29.0)	
Minimum specified ultimate strength		f_{uta}	ksi (N/mm²)	100 (690)	
Minimum specified yield strength		f_y	ksi (N/mm²)	80 (552)	
Mean axial stiffness[5]	Uncracked concrete	β_{uncr}	lbf/in (kN/mm)	1,381,000 (242)	
	Cracked concrete	β_{cr}	lbf/in (kN/mm)	318,000 (56)	

For SI: 1 inch = 25.4 mm; 1 ksi = 6.894 N/mm²; 1 ft-lb = 1.356 N-m; 1 lb = 0.0044 kN.

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable.
2. For installations through the soffit of steel deck assemblies into concrete, see the design information table for installation in the soffit of concrete-filled steel deck assemblies and the installation details in the soffit of concrete over steel deck for the applicable steel deck profile. Tabulated minimum spacing values are based on anchors installed along the flute with axial spacing equal to the greater of $3h_{ef}$ or 1.5 times the flute width.
3. The embedment depth, h_{nom}, is measured from the outside surface of the concrete member to the embedded end of the anchor.
4. The listed minimum overall anchor length is based on the anchor sizes commercially available at the time of publication compared with the requirements to achieve the minimum nominal embedment depth, including consideration of a fixture attachment. The minimum nominal anchor length is measured from under the head to the tip of the anchor.
5. Mean values shown, actual stiffness varies considerably depending on concrete strength, loading and geometry of application.

Tension Design Information for Hangermate+ Anchor is in Concrete[1,2]

CODE LISTED
ICC-ES ESR-3889

Design Characteristic	Notation	Units	Nominal Anchor Diameter	
			1/4	
Anchor category	1, 2 or 3	-	1	
Minimum nominal embedment depth	h_{nom}	in. (mm)	1-5/8 (41)	2-1/2 (64)
Steel Strength in Tension (ACI 318-14 17.4.1 or ACI 318-11 D.5.1)				
Steel strength in tension	N_{sa}[10]	lb (kN)	4,535 (20.2)	
Reduction factor for steel strength[3,4]	ϕ	-	0.65	
Concrete Breakout Strength in Tension (ACI 318-14 17.4.2 or ACI 318-11 D.5.2)				
Effective embedment	h_{ef}	in. (mm)	1.20 (30)	1.94 (49)
Critical edge distance	c_{ac}	in. (mm)	4.30 (109)	6.10 (155)
Effectiveness factor for uncracked concrete	k_{uncr}	-	27	24
Effectiveness factor for cracked concrete	k_{cr}	-	17	
Modification factor for cracked and uncracked concrete[5]	$\Psi_{c,N}$	-	1.0	
Reduction factor for concrete breakout strength[3]	ϕ	-	0.65 (Condition B)	
Pullout Strength in Tension (Non-Seismic Applications) (ACI 318-14 17.4.3 or ACI 318-11 D.5.3)				
Characteristic pullout strength, uncracked concrete (2,500 psi)[6,9]	$N_{p,uncr}$	lb (kN)	See Note 7	
Characteristic pullout strength, cracked concrete (2,500 psi)[6,9]	$N_{p,cr}$	lb (kN)	765 (3.4)	1,415 (6.3)
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)	
Pullout Strength in Tension for Seismic Applications (ACI 318-14 17.2.3.3 Or ACI 318-11 D.3.3.3)				
Characteristic pullout strength, seismic (2,500 psi)[6,8,9]	$N_{p,eq}$	lb (kN)	360 (1.6)	1,170 (5.2)
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)	

For SI: 1 inch = 25.4 mm; 1 ksi = 6.894 N/mm²; 1 ft-lb = 1.356 N-m; 1 lb = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable, shall apply.
2. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3, or ACI 318-11 Section 9.2. If the load combinations of ACI 318-11 Appendix C are used, then the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4. For reinforcement that complies with ACI 318-14 Chapter 17 or ACI 318-11 Appendix D requirements for Condition A, see ACI 318-14 17.3.3(c) or ACI 318-11 Section D.4.3(c), as applicable for the appropriate ϕ factor when the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used.
4. The anchors are considered a brittle steel elements as defined by ACI 318-14 2.3 or ACI 318-11 D.1, as applicable.
5. Select the appropriate effectiveness factor for cracked concrete (k_{cr}) or uncracked concrete (k_{uncr}) and use $\Psi_{c,N} = 1.0$.
6. For all design cases $\Psi_{c,P} = 1.0$. The characteristic pullout strength, N_{pn}, for concrete compressive strengths greater than 2,500 psi may be increased by multiplying the value in the table by $(f'c / 2{,}500)^{0.3}$ for psi or $(f'c / 17.2)^{0.3}$ for MPa.
7. Pullout strength does not control design of indicated anchors and does not need to be calculated for indicated anchor size and embedment.
8. Reported values for characteristic pullout strength in tension for seismic applications are based on test results per ACI 355.2, Section 9.5.
9. Anchors are permitted to be used in lightweight concrete provided the modification factor λa equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n.

Shear Design Information for Hangermate+ Anchor in Concrete[1,2,7,8]

CODE LISTED
ICC-ES ESR-3889

STRENGTH DESIGN TABLES SD

Design Characteristic	Notation	Units	Nominal Anchor Diameter		
			1/4		
Anchor category	1, 2 or 3	-	1	1	
Thread diameter	-	in.	1/4	3/8	
Minimum nominal embedment depth	h_{nom}	in. (mm)	1-5/8 (41)	1-5/8 (41)	2-1/2 (64)
Steel Strength in Shear (ACI 318-14 17.5.1 or ACI 318-11 D.6.1)					
Steel strength in shear[5]	V_{sa}	lb (kN)	860 (3.8)	1,545 (6.9)	1,545 (6.9)
Reduction factor for steel strength[3,4]	ϕ	-	0.60		
Steel Strength in Shear for Seismic Applications (ACI 318-14 17.2.3.3 or ACI 318-11 D.3.3.3)					
Steel strength in shear, seismic[6]	V_{eq}	lb (kN)	600 (2.7)	1,390 (6.2)	1,390 (6.2)
Reduction factor for steel strength in shear for seismic[3,4]	ϕ	-	0.60		
Concrete Breakout Strength in Shear (ACI 318-14 17.5.2 or ACI 318-11 D.6.2)					
Nominal anchor diameter	d_a	in. (mm)	0.250 (6.4)	0.250 (6.4)	
Load bearing length of anchor	ℓ_e	in. (mm)	1.20 (30)	1.20 (30)	1.94 (49)
Reduction factor for concrete breakout[3]	ϕ	-	0.70 (Condition B)		
Pryout Strength in Shear (ACI 318-14 17.5.3 or ACI 318-11 D.6.3)					
Coefficient for pryout strength	k_{cp}	-	1	1	1
Effective embedment	h_{ef}	in. (mm)	1.20 (30)	1.20 (30)	1.94 (49)
Reduction factor for pryout strength[3]	ϕ	-	0.70 (Condition B)		

For SI: 1 inch = 25.4 mm; 1 ksi = 6.894 N/mm²; 1 ft-lb = 1.356 N-m; 1 lb = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-17 17.2.3 or ACI 318-11 D.3.3, as applicable shall apply.
2. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3, or ACI 318-11 Section 9.2. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 Section D.4.4. For reinforcement that complies with ACI 318-14 Chapter 17 or ACI 318-11 Appendix D requirements for Condition A, see ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c), as applicable, for the appropriate ϕ factor when the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3, or ACI 318-11 Section 9.2 are used.
4. The anchors are considered a brittle steel elements as defined by ACI 318-14 2.3 or ACI 318-11 D.1.
5. Reported values for steel strength in shear are based on test results per ACI 355.2, Section 9.4 and must be used for design in lieu of the calculated results using equation 17.5.1.2(b) of ACI 318-14 or equation D-29 in ACI 318-11 D.6.1.2.
6. Reported values for steel strength in shear are for seismic applications and based on test results in accordance with ACI 355.2, Section 9.6 and must be used for design.
7. Anchors are permitted to be used in lightweight concrete in provided the modification factor λa equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n.
8. Shear values are for threaded rod or steel inserts with an ultimate strength, $F_u \geq 125$ ksi; threaded rod or steel inserts with an F_u less than 125 ksi are allowed provided the steel strength shear values are multiplied by the ratio of F_u (ksi) of the steel insert and 125 ksi.

Tension and Shear Design Information for Hangermate+ Anchor in the Soffit (Through the Underside) of Concrete-Filled Steel Deck Assemblies[1,2,3,4,5,6,7]

CODE LISTED
ICC-ES ESR-3889

STRENGTH DESIGN TABLES SD

Anchor Property/Setting Information	Notation	Units	Nominal Anchor Size (inch)		
Anchor Category	1, 2 or 3	-	1	1	
Head Style	-	-	Threaded		
Thread Diameter	-	in.	1/4	3/8	
Minimum nominal embedment depth	h_{nom}	in. (mm)	1-5/8 (41)	1-5/8 (41)	2-1/2 (64)
Effective Embedment	h_{ef}	in. (mm)	1.20 (30)	1.20 (30)	1.94 (49)
Minimum hole depth	h_o	in. (mm)	1-3/4 (44)	1-3/4 (44)	2-5/8 (67)
Anchors Installed Through the Soffit of Steel Deck Assemblies into Concrete (Minimum 3-7/8-inch-wide deck flute)					
Minimum concrete member thickness[8]	$h_{min,deck,total}$	in. (mm)	5-1/2 (140)	5-1/2 (140)	
Characteristic pullout strength, uncracked concrete over steel deck, (3,000 psi)	$N_{p,deck,uncr}$	lb (kN)	1,430 (6.4)	1,430 (6.4)	2,555 (11.4)
Characteristic pullout strength, cracked concrete over steel deck, (3,000 psi)	$N_{p,deck,cr}$	lb (kN)	615 (2.7)	615 (2.7)	1,115 (5.0)
Characteristic pullout strength, cracked concrete over steel deck,seismic, (3,000 psi)	$N_{p,deck,eq}$	lb (kN)	290 (1.3)	290 (1.3)	920 (4.1)
Reduction factor for pullout strength[9]	ϕ	-	0.65		
Steel strength in shear, concrete over steel deck	$V_{sa,deck}$	lb (kN)	1,485 (6.6)	2,740 (12.2)	
Steel strength in shear, concrete over steel deck, seismic	$V_{sa,deck,eq}$	lb (kN)	1,040 (4.6)	2,465 (11.0)	
Reduction factor for steel strength in shear for concrete over steel deck[9]	ϕ	-	0.60		
Anchors Installed Through the Soffit of Steel Deck Assemblies into Concrete (Minimum 1-3/4-inch-wide deck flute)					
Minimum concrete member thickness[8]	$h_{min,deck,total}$	in. (mm)	4 (102)	4 (102)	
Characteristic pullout strength, uncracked concrete over steel deck, (3,000 psi)	$N_{p,deck,uncr}$	lb (kN)	1,760 (7.8)	1,760 (7.8)	2,075 (9.2)
Characteristic pullout strength, cracked concrete over steel deck, (3,000 psi)	$N_{p,deck,cr}$	lb (kN)	760 (3.4)	770 (3.4)	910 (4.0)
Characteristic pullout strength, cracked concrete over steel deck,seismic, (3,000 psi)	$N_{p,deck,eq}$	lb (kN)	355 (1.6)	635 (2.8)	750 (3.3)
Reduction factor for pullout strength[8]	ϕ	-	0.65		
Steel strength in shear, concrete over steel deck	$V_{sa,deck}$	lb (kN)	1,680 (7.5)	2,180 (9.7)	
Steel strength in shear, concrete over steel deck, seismic	$V_{sa,deck,eq}$	lb (kN)	1,175 (5.2)	1,960 (8.7)	
Reduction factor for steel strength in shear for concrete over steel deck[9]	ϕ	-	0.60		

For SI: 1 inch = 25.4 mm; 1 ksi = 6.894 N/mm^2; 1 ft-lb = 1.356 N-m; 1 lb = 0.0044 kN.

1. Installation must comply with published instructions and details.
2. Values for $N_{p,deck}$ and $N_{p,deck,cr}$ are for sand-lightweight concrete (f'c, min = 3,000 psi) and additional lightweight concrete reduction factors need not be applied. In addition, evaluation for the concrete breakout capacity in accordance with ACI 318-14 17.4.2 or ACI 318 D.5.2, as applicable, is not required for anchors installed in the deck soffit (through underside).
3. Values for $N_{p,deck,eq}$ are applicable for seismic loading and must be used in lieu of $N_{p,deck,cr}$.
4. For all design cases $\Psi_{c,P}$ = 1.0. The characteristic pullout strength, N_{pn}, for concrete compressive strengths greater than 3,000 psi anchors may be increased by multiplying the value in the table by $(f'c / 3{,}000)^{0.3}$ for psi or $(f'c / 17.2)^{0.3}$ for MPa.
5. Shear loads for anchors installed through steel deck into concrete may be applied in any direction.
6. Values of $V_{sa,deck}$ and $V_{sa,deck,eq}$ are for sand-lightweight concrete and additional lightweight concrete reduction factors need not be applied. In addition, evaluation for the concrete breakout capacity in accordance with ACI 318-14 17.5.2 or ACI 318-11 D.6.2, as applicable, and the pryout capacity in accordance with ACI 318-14 17.5.3 or ACI 318-11 D.6.3, as applicable, are not required for anchors installed in the soffit (through underside).
7. Shear values are for threaded rod or steel inserts with an ultimate strength, $F_u \geq$ 125 ksi; threaded rod or steel inserts with an F_u less than 125 ksi are allowed provided the steel strength shear values are multiplied by the ratio of F_u (ksi) of the steel insert and 125 ksi.
8. The minimum concrete member thickness, $h_{min,deck,total}$, is the minimum overall thickness of the concrete-filled steel deck (depth and topping thickness).
9. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318 Section 9.2. If the load combinations of ACI 318 Appendix C are used, then the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4 (ACI 318-08).

Factored Resistance Strength ($ØN_n$ And $ØV_n$) Calculated In Accordance With ACI 318-14 Chapter 17:

1- Tabular values are provided for illustration and are applicable for single anchors installed in normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
  - c_{a1} is greater than or equal to the critical edge distance, c_{ac} (table values based on $c_{a1} = c_{ac}$).
  - c_{a2} is greater than or equal to 1.5 times c_{a1}.

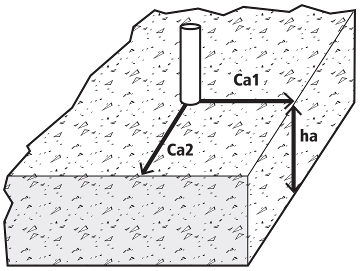
2- Calculations were performed according to ACI 318-14 Chapter 17. The load level corresponding to the controlling failure mode is listed. (e.g. For tension: steel, concrete breakout and pullout; For shear: steel, concrete breakout and pryout). Furthermore, the capacities for concrete breakout strength in tension and pryout strength in shear are calculated using the effective embedment values, hef, for the selected anchors as noted in the design information tables. Please also reference the installation specifications for more information.

3- Strength reduction factors (ø) were based on ACI 318-14 Section 5.3 for load combinations. Condition B is assumed.

4- Tabular values are permitted for static loads only, seismic loading is not considered with these tables.

5- For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Chapter 17.

6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318-14 Chapter 17. For other design conditions including seismic considerations please see ACI 318-14 Chapter 17.



Tension and Shear Design Strength Cracked Concrete

Nominal Anchor Diameter	Nominal Embed. Depth h_{nom} (in.)	f'c = 2,500 psi øNn Tension (lbs.)	f'c = 2,500 psi øVn Shear (lbs.)	f'c = 3,000 psi øNn Tension (lbs.)	f'c = 3,000 psi øVn Shear (lbs.)	f'c = 4,000 psi øNn Tension (lbs.)	f'c = 4,000 psi øVn Shear (lbs.)	f'c = 6,000 psi øNn Tension (lbs.)	f'c = 6,000 psi øVn Shear (lbs.)	f'c = 8,000 psi øNn Tension (lbs.)	f'c = 8,000 psi øVn Shear (lbs.)
1/4" (1/4" thread)	1-5/8	495	515	525	515	575	515	645	515	705	515
1/4" (3/8" thread)	1-5/8	495	780	525	855	575	925	645	925	705	925
	2-1/2	920	925	970	925	1,060	925	1,195	925	1,305	925

Minimum Concrete Compressive Strength

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

STRENGTH DESIGN SD TABLES

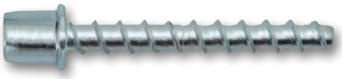
Tension and Shear Design Strength Uncracked Concrete

Nominal Anchor Diameter	Nominal Embed. Depth h_{nom} (in.)	f'c = 2,500 psi øNn Tension (lbs.)	f'c = 2,500 psi øVn Shear (lbs.)	f'c = 3,000 psi øNn Tension (lbs.)	f'c = 3,000 psi øVn Shear (lbs.)	f'c = 4,000 psi øNn Tension (lbs.)	f'c = 4,000 psi øVn Shear (lbs.)	f'c = 6,000 psi øNn Tension (lbs.)	f'c = 6,000 psi øVn Shear (lbs.)	f'c = 8,000 psi øNn Tension (lbs.)	f'c = 8,000 psi øVn Shear (lbs.)
1/4" (1/4" thread)	1-5/8	1,155	515	1,265	515	1,460	515	1,785	515	2,065	515
1/4" (3/8" thread)	1-5/8	1,155	925	1,265	925	1,460	925	1,785	925	2,065	925
	2-1/2	2,110	925	2,310	925	2,665	925	2,950	925	2,950	925

Minimum Concrete Compressive Strength

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

ORDERING INFORMATION

Catalog Number	Screw Size	Hang	Rod Size	Socket Size	Box Qty.	Ctn. Qty.	20V Max* SDS Plus Rotary Hammers			20V Max* Impact Wrench
							 DCH273P2DH 1" L-Shape	 DCH133M2 1" D-Handle	 DCH293R2 1-1/8" L-Shape w/ E-Clutch"	 DCF883L2 3/8" Impact Wrench
							Carbide Bits			Impact Rated Socket
										
Hangermate+ Internal Thread 										
PFM2211100	1/4" x 1-5/8"	Vertical	1/4"	3/8"	25	125	DW5517	DW5417	DW5417	DWMT19051B
PFM2211200	1/4" x 1-5/8"	Vertical	3/8"	1/2"	25	125	DW5517	DW5417	DW5417	DWMT19169B
PFM2211250	1/4" x 2-1/2"	Vertical	3/8"	1/2"	25	125	DW5517	DW5417	DW5417	DWMT19169B
Hangermate+ External Thread 										
PFM1421000	1/4" x 1-5/8"	Vertical	3/8"	1/2"	25	125	DW5517	DW5417	DW5417	DWMT19052B
PFM1421050	1/4" x 2-1/2"	Vertical	3/8"	1/2"	25	125	DW5517	DW5417	DW5417	DWMT19052B
The published size includes the diameter and length of the anchor measured from under the head.							☐ - Optimum Tool Match ☐ - Maximum Tool Match			

Zinc Economy Rod Coupling Nuts

Catalog Number	Coupler Size	Box Qty.	Ctn. Qty.
030007	3/8" - 16 x 1/2" x 1-1/8"	100	1000

Zinc Reducing Rod Coupling Nuts

Catalog Number	Coupler Size	Box Qty.	Ctn. Qty.
030016	3/8"-16 - 1/4"-20	50	1000
030017	1/2"-13 - 3/8"-16	50	500

GENERAL INFORMATION

MINI-UNDERCUT+™

Internally Threaded Undercut Anchor

PRODUCT DESCRIPTION

The Mini-Undercut+ anchor is an internally threaded, self-undercutting anchor designed for performance in cracked and uncracked concrete. Suitable base materials include post-tension concrete (PT slabs), hollow-core precast concrete, normal-weight concrete, sand-lightweight concrete and concrete over steel deck. The Mini-Undercut+ anchor is installed into a pre-drilled hole with a power tool and a setting tool. The result is an anchor which can provide consistent behavior at shallow embedments as low as 3/4 of an inch. After installation a steel element is threaded into the anchor body.

GENERAL APPLICATIONS AND USES

- Tension zones, seismic and wind loading applications
- Suspended Conduit
- Fire Sprinkler & pipe supports
- Cable Trays and Strut
- Suspended Lighting

FEATURE AND BENEFITS

+ Ideal for precast hollow-core plank and post-tensioned concrete slabs
+ Cracked concrete tested alternative to a mini dropin anchor
+ ANSI carbide stop bit with enlarged shoulder for accurate drill depth
+ Anchor design allows for shallow embedment as low as 3/4 of an inch
+ Internally threaded anchor for easy adjustment and removability of threaded rod or bolt
+ Drill and drive the anchor with one tool for fast anchor installation

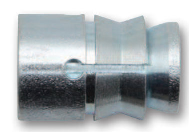
APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES), ESR-3912 for Concrete and Hollow-Core precast slabs, code compliant with the 2015, IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, and 2009 IRC.
- Tested in accordance with ACI 355.2 (including ASTM E 488) and ICC-ES AC193 for use in concrete under the design provisions of ACI 318-14 Chapter 17 or ACI 318-11/08 Appendix D
- Evaluated and qualified by an accredited independent testing laboratory for recognition in cracked and uncracked concrete including seismic and wind loading (Category 1 anchors)
- FM Approvals (Factory Mutual) – File No. J.I. 3059197

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchoring and 05 05 19 - Post Installed Concrete Anchors. Expansion anchors shall be Mini-Undercut+ as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS



MINI-UNDERCUT+

THREAD VERSION

- UNC Thread

ANCHOR MATERIALS

- Zinc plated carbon steel

ANCHOR SIZE RANGE (TYP.)

- 3/8"

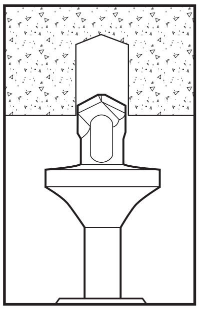
SUITABLE BASE MATERIALS

- Post-Tension Concrete
- Precast Hollow-Core Plank
- Normal-weight concrete

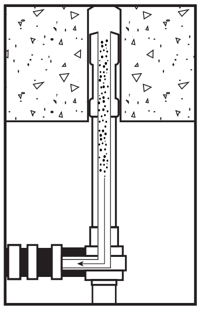
CODE LISTED
ICC-ES ESR-3912
CONCRETE

INSTALLATION INSTRUCTIONS

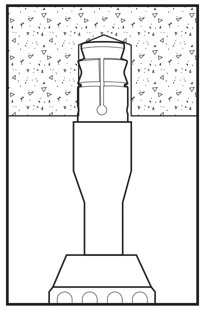
INSTALLATION PROCEDURE (USING SDS PLUS SYSTEM)



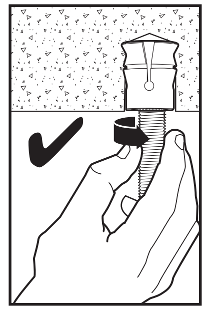
Using the required stop drill bit, drill a hole into the base material to the required depth using the shoulder of the drill bit as a guide. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15.



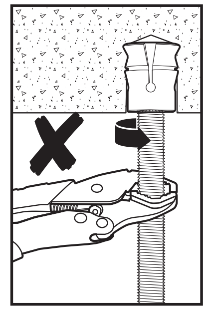
Remove dust and debris from the hole during drilling (e.g. dust extractor) or following drilling (e.g. suction forced air) to extract loose particles created by drilling.



Attach the required SDS setting tool to the hammer-drill. Mount the open end of the anchor onto the setting tool. Drive the anchor into the hole until the shoulder of the anchor is flush with the base material.



Thread the rod or bolt by hand until snug tight (minimum of 4 full rotations).



Do not further tighten with adjustable wrench or similar tool.

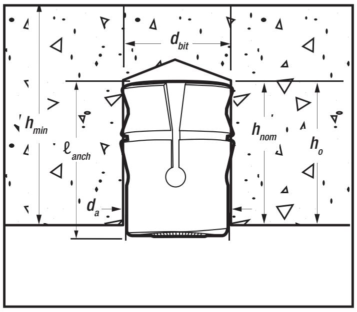
Installation Information for Mini-Undercut+ Anchor[1,2,3]

Anchor Property/Setting Information	Symbol	Units	Nominal Anchor Diameter (inch)
			3/8
Anchor outside diameter	d_a	in. (mm)	0.625 (15.9)
Internal thread diameter (UNC)	d	in. (mm)	3/8 (9.5)
Nominal drill bit diameter	d_{bit}	in. (mm)	5/8 ANSI
Minimum nominal embedment depth	h_{nom}	in. (mm)	3/4 (19)
Effective embedment depth	h_{ef}	in. (mm)	3/4 (19)
Hole depth	h_o	in. (mm)	3/4 (19)
Overall anchor length (before setting)	ℓ_{anch}	in. (mm)	15/16 (24)
Approximate tool impact power (hammer-drill)	-	J	2.1 to 2.8
Minimum diameter of hole clearance in fixture for steel insert element (following anchor installation)	d_h	in.	7/16
Minimum member thickness in normal-weight concrete	h_{min}	in. (mm)	2-1/2 (64)
Minimum cover thickness in hollow core concrete slabs (see Hollow-Core concrete figure)	$h_{min,core}$	in. (mm)	1-1/2 (38)
Critical edge distance	c_{ac}	in. (mm)	2-1/4 (57)
Minimum edge distance	c_{min}	in. (mm)	2-1/2 (64)
Minimum spacing distance	s_{min}	in. (mm)	3 (76)
Maximum installation torque	T_{max}	ft.-lb. (N-m)	5 (7)
Effective tensile stress area (undercut anchor body)	A_{se}	in.^{2} (mm^2)	0.044 (28.4)
Minimum specified ultimate strength	f_{uta}	psi (N/mm^2)	95,000 (655)
Minimum specified yield strength	f_{ya}	psi (N/mm^2)	76,000 (524)
Mean axial stiffness[4] — Uncracked concrete	β_{uncr}	lbf/in.	50,400
Mean axial stiffness[4] — Cracked concrete	β_{cr}	lbf/in.	29,120

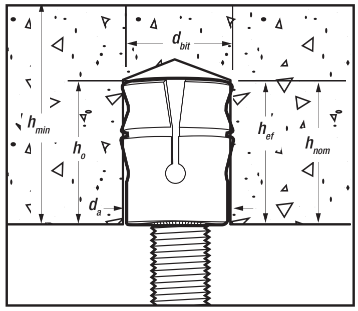
For SI: 1 inch = 25.4 mm, 1 ft-lbf = 1.356 N-m.

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable.
2. For installation detail for anchors in hollow-core concrete slabs, see Hollow-Core concrete figure.
3. The embedment depth, h_{nom}, is measured from the outside surface of the concrete member to the embedded end of the anchor.
4. Mean values shown, actual stiffness varies considerably depending on concrete strength, loading and geometry of application.

Mini-Undercut+ Anchor Detail

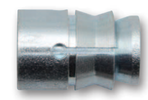


Before



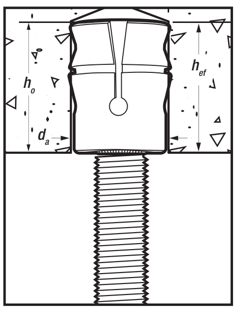
After

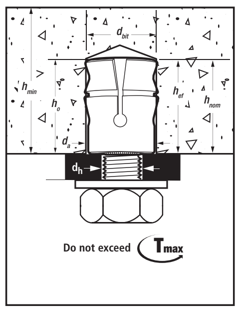

STOP DRILL BIT

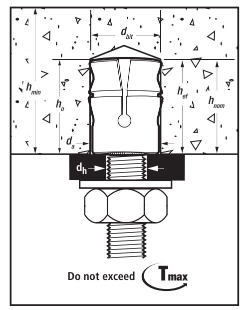

MINI-UNDERCUT+


SETTING TOOL

Mini-Undercut+ Anchor Installed with Steel Insert Element







REFERENCE DATA (ASD)

Ultimate and Allowable Tension Load Capacities for Mini-Undercut+ in Normal-Weight Concrete[1,2,3]

Nominal Rod/ Anchor Diameter d in.	Minimum Nominal Embed. Depth in. (mm)	Minimum Concrete Compressive Strength							
		f'c = 3,000 psi (20.7 MPa)				f'c = 4,000 psi (27.6 MPa)			
		Ultimate		Allowable		Ultimate		Allowable	
		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	3/4 (19)	1,535 (6.8)	1,975 (8.8)	385 (1.7)	495 (2.2)	1,770 (7.9)	2,275 (10.1)	445 (2.0)	570 (2.5)

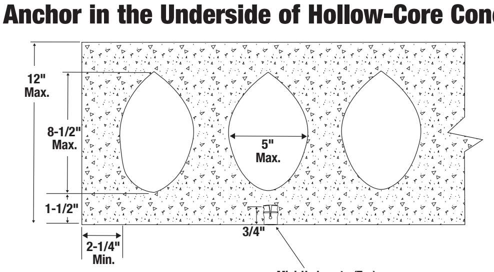
1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities are calculated using an applied safety factor of 4.0.
3. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.

Ultimate and Allowable Tension Load Capacities for Mini-Undercut+ in Hollow-Core Plank[1,2,3]

Nominal Rod/ Anchor Diameter d in.	Minimum Nominal Embed. Depth in. (mm)	Minimum Concrete Compressive Strength											
		f'c = 5,000 psi (34.5 MPa)				f'c = 6,000 psi (41.4 MPa)				f'c = 8,000 psi (55.2 MPa)			
		Ultimate		Allowable		Ultimate		Allowable		Ultimate		Allowable	
		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)
3/8	3/4 (19)	1,855 (8.3)	2,590 (11.5)	465 (2.1)	650 (2.9)	2,035 (9.1)	2,835 (12.6)	510 (2.3)	710 (3.2)	2,345 (10.4)	3,275 (14.6)	585 (2.6)	820 (3.6)

1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities are calculated using an applied safety factor of 4.0.
3. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.

Mini-Undercut+ Installed Detail for Anchor in the Underside of Hollow-Core Concrete slabs



STRENGTH DESIGN (SD)

Tension Design Information for Mini-Undercut+ Anchors in the Underside of Normal-weight Concrete and the Underside of Hollow-Core Concrete Slabs[1,2,3,4,5,6,7]

CODE LISTED
ICC-ES ESR-3912

Design Characteristic	Notation	Units	Nominal Anchor Size / Threaded Rod Diameter (inch)
			3/8
Anchor category	1, 2 or 3	-	1
Nominal embedment depth	h_{nom}	in. (mm)	3/4 (19)
Steel Strength In Tension (ACI 318-14 17.4.1 or ACI 318-11 D.5.1)			
Steel strength in tension	N_{sa}	lb (kN)	4,180 (18.6)
Reduction factor for steel strength	ϕ	-	0.65
Concrete Breakout Strength In Tension (ACI 318-14 17.4.2 or ACI 318-11 D.5.2)			
Effective embedment	h_{ef}	in. (mm)	3/4 (19)
Effectiveness factor for uncracked concrete	k_{uncr}	-	24
Effectiveness factor for cracked concrete	k_{cr}	-	17
Modification factor for cracked and uncracked concrete	$\Psi_{c,N}$	-	1.0 (see note 5)
Critical edge distance	c_{ac}	in. (mm)	2-1/4 (57)
Reduction factor, concrete breakout strength[3]	ϕ	-	0.40
Pullout Strength In Tension (ACI 318-14 17.4.3 or ACI 318-11 D.5.3)			
Pullout strength, uncracked concrete	$N_{p,uncr}$	lb (kN)	See note 7
Pullout strength, cracked concrete	$N_{p,cr}$	lb (kN)	455 (2.0)
Reduction factor, pullout strength	ϕ	-	0.40
Pullout Strength In Tension For Seismic Applications (ACI 318-14 17.2.3.3 or ACI 318-11 D.3.3.3)			
Characteristic pullout strength, seismic	$N_{p,eq}$	lb (kN)	410 (1.82)
Reduction factor, pullout strength, seismic	ϕ	-	0.40

For SI: 1 inch = 25.4 mm, 1 ksi = 6.894 N/mm^2; 1 lbf = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable, shall apply.
2. Installation must comply with manufacturer's published installation instructions and details.
3. All values of ϕ are applicable with the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3, or ACI 318-11 Section 9.2.
4. The threaded rod or bolt strength must also be checked, and the controlling value of ϕN_{sa} between the anchor and rod must be used for design.
5. Select the appropriate effectiveness factor for cracked concrete (k_{cr}) or uncracked concrete (k_{uncr}) and use $\Psi_{c,N}$ = 1.0.
6. The characteristic pullout strength for concrete compressive strengths greater than 2,500 psi for anchors may be increased by multiplying the value in the table by $(f'c / 2{,}500)^{0.5}$ for psi or $(f'c / 17.2)^{0.5}$. For hollow-core concrete slabs the characteristic pullout strength for concrete compressive strengths greater than 6,000 psi for anchors may be increased by multiplying the value in the table by $(f'c / 6{,}000)^{0.5}$ for psi or $(f'c / 41.4)^{0.5}$.
7. Reported values for characteristic pullout strength in tension for seismic applications are based on test results per ACI 355.2, Section 9.5.

Shear Design Information for Mini-Undercut+ Anchors in the Underside of Normal-weight Concrete and the Underside of Hollow-Core Concrete Slabs[1,2,3,4,5,6]

CODE LISTED
ICC-ES ESR-3912

STRENGTH DESIGN TABLES SD

Design Characteristic	Notation	Units	Nominal Anchor Size / Threaded Rod Diameter (inch)
			3/8
Anchor category	1, 2 or 3	-	1
Nominal embedment depth	h_{nom}	in. (mm)	3/4 (19)
Steel Strength in Shear (ACI 318-14 17.5.1 or ACI 318-11 D.6.1)			
Steel strength in shear	V_{sa}	lb (kN)	985 (4.4)
Reduction factor, steel strength	ϕ	-	0.60
Steel Strength in Shear for Seismic (ACI 318-14 17.2.3.3 or ACI 318-11 D.3.3.3)			
Steel strength in shear, seismic	$V_{sa, eq}$	lb (kN)	895 (4.0)
Reduction factor, steel strength in shear, seismic	ϕ	-	0.60
Concrete Breakout Strength in Shear (ACI 318-14 17.5.2 or ACI 318-11 D.6.2)			
Load bearing length of anchor in shear	ℓ_e	in. (mm)	3/4 (19)
Nominal outside anchor diameter	d_a	in. (mm)	0.625 (15.9)
Reduction factor for concrete breakout strength	ϕ	-	0.45
Pryout Strength in Shear (ACI 318-14 17.5.3 or ACI 318-11 D.6.3)			
Coefficient for pryout strength	k_{cp}	-	1.0
Effective embedment	h_{ef}	in. (mm)	3/4 (19)
Reduction factor, pryout strength	ϕ	-	0.45

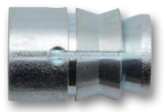
For SI: 1 inch = 25.4 mm, 1 lbf = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-17 17.2.3 or ACI 318-11 D.3.3, as applicable shall apply
2. Installation must comply with manufacturer's published installation instructions and details.
3. All values of ϕ are applicable with the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3, or ACI 318-11 Section 9.2.
4. The strengths shown in the table are for the Mini-Undercut+ anchors only. Design professional is responsible for checking threaded rod strength in tension, shear, and combined tension and shear, as applicable.
5. Reported values for steel strength in shear are based on test results per ACI 355.2, Section 9.4 and must be used for design in lieu of the calculated results using equation 17.5.1.2b of ACI 318-14 or equation D-29 in ACI 318-11 D.6.1.2.
6. Reported values for steel strength in shear for the Mini-Undercut+ anchors are for seismic applications and based on test results in accordance with ACI 355.2, Section 9.6 and must be used for design.

ORDERING INFORMATION

Mini-Undercut+

Cat. No.	Anchor Size	Rod/Anchor Dia.	Drill Diameter	Overall Length	Box Qty.	Ctn. Qty.
PFM2111820	3/8" x 3/4"	3/8"	5/8"	3/4"	100	600



Accu-Bit™ for DEWALT Mini-Undercut+

Cat. No.	Mini-Undercut+ Size	Rod/Anchor Dia.	Drill Diameter	Drill Depth	Std. Pack
PPA2431720	5/8" x 3/4" Stop Drill Bit - PT Anchor	3/8"	5/8"	3/4"	1

SDS Plus Setting Tool for DEWALT Mini-Undercut+

Cat. No.	Mini-Undercut+ Size	Rod/Anchor Dia.	Std. Pack
PFM2101720	3/8" SDS+ Setting Tool - PT Anchor	3/8"	1

Mini-Undercut+ Ordering Matrix

Description	Anchor Cat No.	Accu-Bit™ Cat. No.	SDS Plus Setting Tool Cat. No.	Recommended SDS Hammer-Tools (DEWALT)
3/8" x 3/4" Mini-Undercut+	PFM2111820	PPA2431720	PFM2101720	DCH273, DCH133, D25133, D25262

GENERAL INFORMATION

WOOD-KNOCKER® II+

Concrete Inserts

PRODUCT DESCRIPTION

Wood-Knocker II concrete inserts are specifically designed to provide hangar attachments for mechanical, electrical, plumbing (MEP) and fire protection.

Wood-Knocker II+ 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, including a 3/8-1/2" multi insert. The hex impact plate offers resistance to rotation within the concrete as a steel threaded rod or threaded bolt is being installed.

GENERAL APPLICATIONS AND USES

- Hanging Pipe and Sprinkler Systems
- HVAC Ductwork and Strut Channels
- Suspending Trapeze and Cable Trays
- Mechanical Unit Overhead Utilities
- Conduit and Lighting System
- Seismic Loading and Cracked Concrete

FEATURES AND BENEFITS

+ Fast and simple to install, low installed cost
+ Color coded by size for simple identification
+ Wood-Knocker II+ can be installed in wood form pours only 3.5" thick
+ Hex head does not rotate when set
+ Insert design allows for full thread engagement
+ All sizes suitable for tension and shear loading

APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES), ESR-3657 for concrete - approved for seismic and wind loading
- Code compliant with the 2015 IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, and 2009 IRC
- Tested in accordance with ASTM E488 and ICC-ES AC446 for use in concrete under the design provisions of ACI 318 (Strength Design method)
- Evaluated and qualified by an accredited independent testing laboratory for recognition in cracked and uncracked concrete
- Underwriters Laboratories (UL Listed) - File No. EX1289, see listing for sizes. Also UL listed and recognized for use in air handling spaces.
- FM Approvals (Factory Mutual) – File No. J.I. 3059197

GUIDE SPECIFICATIONS

CSI Divisions: 03 15 19 - Cast-In Concrete Anchors and 03 16 00 - Concrete Anchors. Concrete inserts shall be Wood-Knocker II+ as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

WOOD-KNOCKER II+
WOOD FORM INSERT

ANCHOR MATERIALS

- Carbon Steel and Engineered Plastic

ROD/ANCHOR SIZE RANGE (TYP.)

- 1/4" to 3/4" threaded rod for Wood-Knocker Concrete Inserts

SUITABLE BASE MATERIALS

- Normal-weight Concrete
- Lightweight Concrete

TENSION ZONE CRACKED CONCRETE

SEISMIC REGION QUALIFICATION

CODE LISTED
ICC-ES ESR-3657
CONCRETE

DDA
DEWALT DESIGN ASSIST™

MATERIAL SPECIFICATIONS

Wood-Knocker II+

Anchor Component	Component Material
Insert Body	AISI 1008 Carbon Steel or equivalent
Flange	Engineered Plastic
Zinc Plating	ASTM B 633 (Fe/Zn5) Min. plating requirements for mild service condition

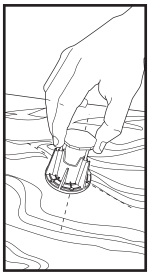
Material Properties for Threaded Rod

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 or A 307, Grade C	1/4 to 3/4	36.0	58.0
High strength carbon rod	A 193, Grade B7	1/4 to 3/4	105.0	125.0

INSTALLATION INSTRUCTIONS

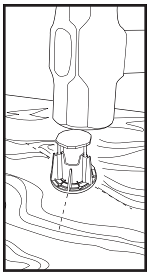
Installation Instructions for Wood-Knocker II+

Position



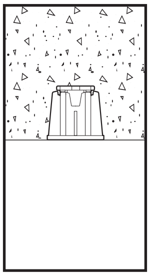
Step 1
Position insert on formwork plastic down.

Drive



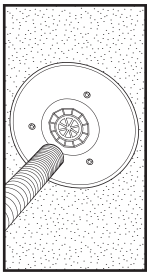
Step 2
Drive insert head down until head contacts plastic.

Prepare



Step 3
After formwork removal, remove nails as necessary (e.g. flush mounted fixtures).

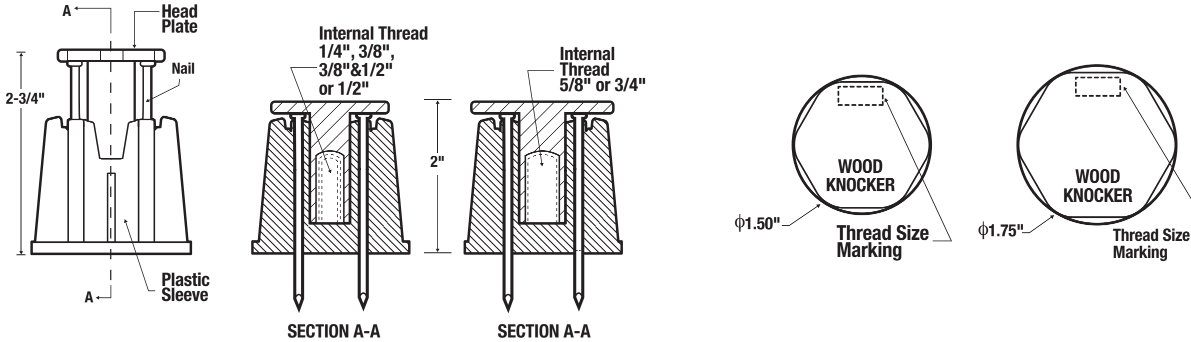
Attach



Step 4
After concrete pour and cure, install threaded steel element (rod/bolt) into the insert by firmly pushing threaded rod through plastic center to puncture thread seal. Attach fixture as applicable (e.g. seismic brace).

INSTALLATION SPECIFICATIONS

Wood-Knocker II+ Cast-In-Place Inserts for Form Pour Concrete

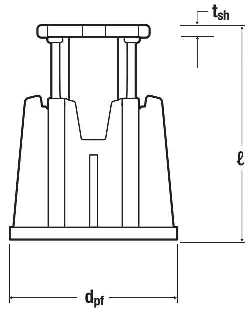


Before Setting

After Setting

Wood-Knocker II+

Dimension	Notation	Nominal Rod/Anchor Size						
		1/4"	3/8"	3/8" & 1/2" Multi		1/2"	5/8"	3/4"
Thread Size, UNC	-	1/4-20	3/8-16	3/8-16	1/2-13	1/2-13	5/8-11	3/4-10
Approx. Internal Thread Length (in.)	-	3/8	5/8	9/16	9/16	11/16	15/16	1-1/8
Approx. Internal Thread Standoff from Plastic Sleeve Bottom, after setting (in.)	-	3/8	3/8	15/16	3/8	3/8	3/8	3/8
Plastic Sleeve Flange Dia. (in.)	d_{pf}	2-3/8	2-3/8	2-3/8		2-3/8	2-3/8	2-3/8
Plastic Sleeve Flange Thickness (in.)	-	3/16	3/16	3/16		3/16	3/16	3/16
Overall Length, after setting (in.)	ℓ	2	2	2		2	2	2
Break-Off Nail Length (in.)	ℓ_n	3/4	3/4	3/4		3/4	3/4	3/4
Steel Head Plate Thickness (in.)	t_{sh}	1/8	1/8	1/8		1/8	1/8	1/8



REFERENCE DATA (ASD)

Ultimate and Allowable Load Capacities for Wood-Knocker II+ Inserts Installed in Normal-Weight Concrete[1,2,3]

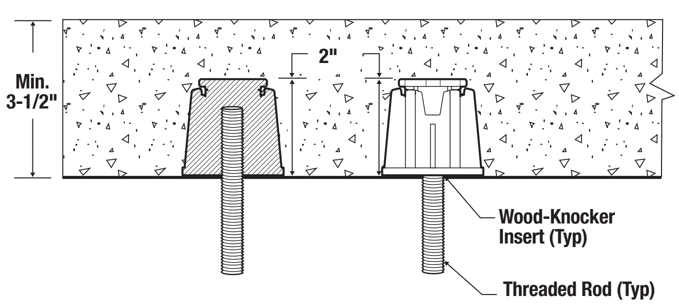
Rod/Insert Diameter d in.	Nominal Embedment Depth h_v in.	Insert Spacing in.	Edge Distance in.	Minimum Concrete Compressive Strength (f´c)							
				3,000 psi				4,500 psi			
				Ultimate Load		Allowable Load		Ultimate Load		Allowable Load	
				Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
1/4	2	6	6	3,720	1,490	1,240	495	4,250	1,610	1,415	535
3/8	2	6	6	4,820	5,330	1,605	1,775	7,190	5,620	2,395	1,875
1/2	2	6	6	4,820	7,400	1,605	2,465	7,190	8,590	2,395	2,865
5/8	2	6	6	4,650	11,360	1,550	3,785	7,350	13,010	2,450	4,335
3/4	2	6	6	4,650	11,360	1,550	3,785	7,350	14,590	2,450	4,865

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.

Ultimate and Allowable Load Capacities for Wood-Knocker II+ Inserts Installed in Sand-lightweight Concrete[1,2]

Rod/Insert Diameter d in.	Nominal Embedment Depth h_v in.	Insert Spacing in.	Edge Distance in.	f´c ≥ 3,000 psi			
				Ultimate Load		Allowable Load	
				Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
1/4	2	6	6	3,570	1,380	1,190	460
3/8	2	6	6	4,270	5,280	1,425	1,760
1/2	2	6	6	4,270	7,180	1,425	2,395
5/8	2	6	6	4,600	7,590	1,535	2,530
3/4	2	6	6	4,600	7,590	1,535	2,530

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. For 1/4", 3/8" and 1/2" diameters: When the inserts are spaced 3" center-to-center the inserts allowable tension capacity must be reduced by 25 percent and the allowable shear capacity reduced by 15 percent. When the inserts have a 3" edge distance the inserts allowable tension capacity does not require a reduction and the allowable shear capacity must be reduced by 40 percent.



Allowable Steel Strength for Threaded Rod

Anchor Diameter d in.	Nominal Area of Rod in.[2]	Allowable Tension			Allowable Shear		
		ASTM A36 lbs.	ASTM A307 Grade C lbs.	ASTM A193 Grade B7 lbs.	ASTM A36 lbs.	ASTM A307 Grade C lbs.	ASTM A193 Grade B7 lbs.
1/4	0.0491	940	940	2,160	485	485	1,030
3/8	0.1104	2,115	2,115	4,375	1,090	1,090	2,255
1/2	0.1963	3,755	3,755	7,775	1,940	1,940	4,055
5/8	0.3068	5,870	5,870	12,150	3,025	3,025	6,260
3/4	0.4418	8,455	8,455	17,495	4,355	4,355	9,010

Allowable tension = f_u (A_{nom}) (0.33); Allowable shear = f_u (A_{nom}) (0.17)

STRENGTH DESIGN (SD)

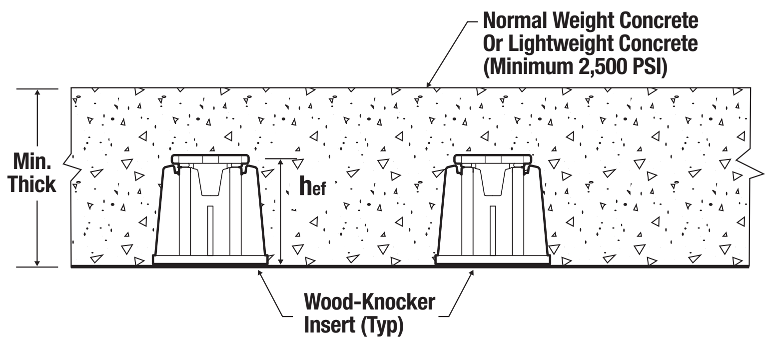
Wood-Knocker II+ Insert Design Information[1,2,3,4,5,6,7,8]

Design Information	Symbol	Units	1/4-inch	3/8-inch	1/2-inch	5/8-inch	3/4-inch
Insert O.D.	d_a (d_o)	in. (mm)	0.7 (18)	0.7 (18)	0.7 (18)	1.0 (25)	1.0 (25)
Insert head net bearing area	A_{brg}	in² (mm²)	1.20 (762)	1.20 (762)	1.20 (762)	1.30 (839)	1.30 (839)
Effective embedment depth	h_{ef}	in. (mm)	1.75 (45)	1.75 (45)	1.75 (45)	1.75 (45)	1.75 (45)
Minimum member thickness	h_{min}	-	3.5 (89)	3.5 (89)	3.5 (89)	3.5 (89)	3.5 (89)
Effectiveness factor for cracked concrete	k_c	- (SI)	24 (10)	24 (10)	24 (10)	24 (10)	24 (10)
Modification factor for tension strength in uncracked concrete	$\Psi_{c,N}$	-	1.25	1.25	1.25	1.25	1.25
Nominal tension strength of single insert as governed by steel strength	$N_{sa,insert}$	lb (kN)	10,270 (45.7)	10,270 (45.7)	9,005 (40.1)	12,685 (56.4)	12,685 (56.4)
Nominal tension strength of single insert as governed by steel strength, for seismic loading	$N_{sa,insert,eq}$	lb (kN)	10,270 (45.7)	10,270 (45.7)	9,005 (40.1)	12,685 (56.4)	12,685 (56.4)
Nominal steel shear strength of single insert	$V_{sa,insert}$	lb (kN)	7,180 (31.9)	7,180 (31.9)	7,180 (31.9)	9,075 (40.4)	9,075 (40.4)
Nominal steel shear strength of single insert, for seismic loading	$V_{sa,insert,eq}$	lb (kN)	7,180 (31.9)	7,180 (31.9)	7,180 (31.9)	9,075 (40.4)	9,075 (40.4)

For SI: 1 inch = 25.4 mm, 1 inch² = 635 mm², 1 pound = 0.00445 kN, 1 psi = 0.006895 MPa. For pound-inch unit: 1 mm = 0.03937 inches.

1. Concrete must have a compressive strength f'c of 2,500 psi minimum.
2. Design of headed cast-in specialty inserts shall be in accordance with the provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D for cast-in headed anchors.
3. Strength reduction factors (ø) for the inserts are based on ACI 318-14 17.3.3 or ACI 318-11 D.4.3 for cast-in headed anchors. Condition B is assumed. Strength reduction factors for load combinations in accordance with ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 governed by steel strength of the insert are taken as 0.65 for tension and 0.60 for shear; values correspond to brittle steel elements. The value of ø applies when the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3. If the load combinations of ACI 318-11 Appendix C are used, then the appropriate value of ø must be determined in accordance with ACI 318-11 D4.4.
4. The concrete tension strength of headed cast-in specialty inserts shall be calculated in accordance with ACI 318-14 Chapter 17 or ACI 318-11 Appendix D.
5. Insert O.D. is the outside diameter of the headed insert body.
6. Only the largest size of threaded rod or bolt for the 3/8 & 1/2 inch multi insert must be used for applications resisting shear loads.
7. Minimum spacing distance between anchors and minimum edge distance for cast-in Wood-Knocker II+ anchors shall be in accordance with ACI 318-14 17.7 or ACI 318-11 D.8.
8. The strengths shown in the table are for inserts only. Design professional is responsible for checking threaded rod or bolt strength in tension, shear, and combined tension and shear, as applicable. See Steel Design Information table for common threaded rod elements.

Wood-Knocker II+ Insert Installed in Soffit of Form Pour Concrete Floor and Roof Assemblies



STRENGTH DESIGN SD TABLES

Specifications And Physical Properties Of Common Carbon Steel Threaded Rod Elements[1]

Threaded Rod Specification		Units	Min. Specified Ultimate Strength, F_{uta}	Min. Specified Yield Strength 0.2 Percent Offset, F_{ya}	$\frac{F_{uta}}{F_{ya}}$	Elongation Minimum Percent[5]	Reduction Of Area Min. Percent	Related Nut Specification[6]
Carbon Steel	ASTM A36/A36M[2] and F1554[3] Grade 36	psi (MPa)	58,000 (400)	36,000 (248)	1.61	23	40 (50 for A36)	ASTM A194 / A563 Grade A
	ASTM F1554[3] Grade 105	psi (MPa)	125,000 (862)	105,000 (724)	1.19	15	45	ASTM A194 / A563 Grade DH
	ASTM A193/A193M[4] Grade B7	psi (MPa)	125,000 (860)	105,000 (720)	1.19	16	50	

For SI: 1 inch = 25.4 mm, 1 psi = 0.006897 MPa. For pound-inch units: 1 mm = 0.03937 inch, 1 MPa = 145.0 psi.

1. Inserts may be used in conjunction with all grades of continuously threaded carbon steels (all-thread) that comply with code reference standards and that have thread characteristics comparable with ANSI B1.1 UNC Coarse Thread Series.
2. Standard Specification for Carbon Structural Steel.
3. Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
4. Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.
5. Based on 2-inch (50 mm) gauge length except ASTM A193, which are based on a gauge length of 4d (d_{rod}).
6. Where nuts are applicable, nuts of other grades and style having specified proof load stress greater than the specified grade and style are also suitable.

STRENGTH DESIGN SD TABLES

Steel Design Information For Common Threaded Rod Elements Used With Concrete Inserts[1,2,3,4]

Design Information	Symbol	Units	1/4-inch	3/8-inch	1/2-inch	5/8-inch	3/4-inch
Threaded rod nominal outside diameter	d_{rod}	in. (mm)	0.250 (6.4)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)
Threaded rod effective cross-sectional area	A_{se}	in² (mm²)	0.032 (21)	0.078 (50)	0.142 (92)	0.226 (146)	0.335 (216)
Nominal tension strength of ASTM A36 threaded rod as governed by steel strength	$N_{sa,rod,A36}$	lb (kN)	1,855 (8.2)	4,525 (20.0)	8,235 (36.6)	13,110 (58.3)	19,430 (86.3)
Nominal seismic tension strength of ASTM A36 threaded rod as governed by steel strength	$N_{sa,rod,A36,eq}$	lb (kN)	1,855 (8.2)	4,525 (20.0)	8,235 (36.6)	13,110 (58.3)	19,430 (86.4)
Nominal tension strength of ASTM A193, Gr. B7 threaded rod as governed by steel strength	$N_{sa,rod,B7}$	lb (kN)	4,000 (17.7)	9,750 (43.1)	17,750 (78.9)	28,250 (125.7)	41,875 (186.0)
Nominal seismic tension strength of ASTM A193, Gr. B7 threaded rod as governed by steel strength	$N_{sa,rod,B7,eq}$	lb (kN)	4,000 (17.7)	9,750 (43.1)	17,750 (78.9)	28,250 (125.7)	41,875 (186.0)
Nominal shear strength of ASTM A36 threaded rod as governed by steel strength	$V_{sa,rod,A36}$	lb (kN)	1,115 (4.9)	2,715 (12.1)	4,940 (22.0)	7,865 (35.0)	11,660 (51.9)
Nominal seismic shear strength of ASTM A36 threaded rod as governed by steel strength	$V_{sa,rod,A36,eq}$	lb (kN)	780 (3.5)	1,900 (8.4)	3,460 (15.4)	5,505 (24.5)	8,160 (36.3)
Nominal shear strength of ASTM A193, Gr. B7 threaded rod as governed by steel strength	$V_{sa,rod,B7}$	lb (kN)	2,385 (10.6)	5,815 (25.9)	10,640 (7.3)	16,950 (75.4)	25,085 (111.6)
Nominal seismic shear strength of ASTM A193, Gr. B7 threaded rod as governed by steel strength	$V_{sa,rod,B7,eq}$	lb (kN)	1,680 (7.5)	4,095 (18.2)	7,455 (34.2)	11,865 (52.8)	17,590 (78.2)

For SI: 1 inch = 25.4 mm, 1 pound = 0.00445 kN, 1 in² = 645.2 mm². For pound-inch unit: 1 mm = 0.03937 inches.

1. Values provided for steel element material types based on minimum specified strengths and calculated in accordance with ACI 318-11 Eq. (D-2) and Eq. (D-29).
2. ϕN_{sa} shall be the lower of the $\phi N_{sa,rod}$ or $\phi N_{sa,insert}$ for static steel strength in tension; for seismic loading $\phi N_{sa,eq}$ shall be the lower of the $\phi N_{sa,rod,eq}$ or $\phi N_{sa,insert,eq}$.
3. ϕV_{sa} shall be the lower of the $\phi V_{sa,rod}$ or $\phi V_{sa,insert}$ for static steel strength in tension; for seismic loading $\phi V_{sa,eq}$ shall be the lower of the $\phi V_{sa,rod,eq}$ or $\phi V_{sa,insert,eq}$.
4. Strength reduction factors shall be taken from ACI 318-14 17.3.3 or ACI 318-11 D.4.3 for steel elements. Condition B is assumed. Strength reduction factors for load combinations in accordance with ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 governed by steel strength of the threaded rod are taken as 0.75 for tension and 0.65 for shear; values correspond to ductile steel elements. The value of ø applies when the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3. If the load combinations of ACI 318-11 Appendix C are used, then the appropriate value of ø must be determined in accordance with ACI 318-11 D4.4.

Tension and Shear Design Strengths for Wood-Knocker II+ Insert Installed in the Soffit of Form Poured Concrete and Roof Assemblies - Uncracked Concrete[1,2,3,4,5,6]

Nominal Anchor Diameter	Embed. Depth h_{ef} (in.)	Minimum Concrete Compressive Strength					
		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi	
		ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)
1/4	1-3/4	2,665	2,420	3,075	2,795	3,765	3,425
3/8	1-3/4	2,665	2,420	3,075	2,795	3,765	3,425
1/2	1-3/4	2,665	2,420	3,075	2,795	3,765	3,425
5/8	1-3/4	2,665	2,665	3,075	3,075	3,765	3,765
3/4	1-3/4	2,665	2,665	3,075	3,075	3,765	3,765

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

Tension and Shear Design Strengths for Wood-Knocker II+ Insert Installed in the Soffit of Form Poured Concrete and Roof Assemblies - Cracked Concrete[1,2,3,4,5,6]

Nominal Anchor Diameter	Embed. Depth h_{ef} (in.)	Minimum Concrete Compressive Strength					
		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi	
		ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)
1/4	1-3/4	2,130	1,730	2,460	2,000	3,015	2,445
3/8	1-3/4	2,130	1,730	2,460	2,000	3,015	2,445
1/2	1-3/4	2,130	1,730	2,460	2,000	3,015	2,445
5/8	1-3/4	2,130	2,130	2,460	2,460	3,015	3,015
3/4	1-3/4	2,130	2,130	2,460	2,460	3,015	3,015

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

1- Tabular values are provided for illustration and are applicable for single anchors installed in normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac}.
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.

2- Calculations were performed following methodology in ACI 318-14 Chapter 17 or ACI 318-11 Appendix D. The load level corresponding to the failure mode listed [steel strength of insert ($N_{sa,insert}$, $V_{sa,insert}$), concrete breakout strength, or pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod type, ($N_{sa,rod}$, $V_{sa,rod}$), the lowest load level controls.

3- Strength reduction factors shall be taken from ACI 318-14 17.3.3 or ACI 318-11 D.4.3 for cast-in headed anchors. Condition B is assumed. Strength reduction factors for load combinations in accordance with ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 governed by steel strength of the insert are taken as 0.70 for tension and 0.60 for shear; values correspond to brittle steel elements.

4- Tabular values are permitted for short-term static loads only, seismic loading is not considered with these tables.

5- For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Chapter 17 or ACI 318-11 Appendix D.

6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318-14 Chapter 17 or ACI 318-11 Appendix D and information contained in this product supplement. For other design conditions including seismic considerations please see ACI 318-14 Chapter 17 or ACI 318-11 Appendix D.

Tension and Shear Design Strength of Steel Elements (Steel Strength)[1,2,3,4]

Nominal Rod Diameter (in. or No.)	Steel Elements - Threaded Rod			
	ASTM A36 and ASTM F1554 Grade 36		ASTM A193 Grade B7 and ASTM F1554 Grade 105	
	$\phi N_{sa,rod}$ Tension (lbs.)	$\phi V_{sa,rod}$ Shear (lbs.)	$\phi N_{sa,rod}$ Tension (lbs.)	$\phi V_{sa,rod}$ Shear (lbs.)
1/4	1,390	720	3,000	1,550
3/8	3,395	1,750	7,315	3,780
1/2	6,175	3,210	13,315	6,915
5/8	9,835	5,115	21,190	11,020
3/4	14,550	7,565	31,405	16,305

■ - Steel Strength Controls

1. Steel tensile design strength according to ACI 318 Appendix D and ACI 318 Chapter 17, $\phi N_{sa} = \phi \bullet A_{se,N} \bullet f_{uta}$
2. The tabulated steel design strength in tension for the threaded rod must be checked against the design strength of the steel insert, concrete breakout and pullout design strength to determine the controlling failure mode, the lowest load level controls.
3. Steel shear design strength according to ACI 318 Appendix D and ACI 318 Chapter 17, $\phi N_{sa} = \phi \bullet 0.60 \bullet A_{se,N} \bullet f_{uta}$
4. The tabulated steel design strength in shear for the threaded rod must be checked against the design strength of the steel insert, concrete breakout and pryout design strength to determine the controlling failure mode, the lowest load level controls

ORDERING INFORMATION

Wood-Knocker®II+ Form Insert (UNC)

Cat No.	Description	Color Code	Std. Box
PFM2521100	1/4" Wood-Knocker II+ Insert	Brown	100
PFM2521150	3/8" Wood-Knocker II+ Insert	Green	100
PFM2521200	1/2" Wood-Knocker II+ Insert	Yellow	100
PFM2521250	5/8" Wood-Knocker II+ Insert	Red	100
PFM2521300	3/4" Wood-Knocker II+ Insert	Purple	100
PFM2521350	3/8"-1/2" Wood-Knocker II+ Multi Insert	Gray	100
Threaded Inserts are color coded to easily identify location and diameter of the internally threaded coupling, allowing multiple trades on the same job to suspend their systems with various size steel threaded rods.			

Wood-Knocker®II+ Form Insert (UNC) with no nails

Cat No.	Description	Color Code	Std. Box
PFM2521100NN	1/4" Wood-Knocker II+ Insert with no nails	Brown	100
PFM2521150NN	3/8" Wood-Knocker II+ Insert with no nails	Green	100
PFM2521200NN	1/2" Wood-Knocker II+ Insert with no nails	Yellow	100
PFM2521250NN	5/8" Wood-Knocker II+ Insert with no nails	Red	100
PFM2521300NN	3/4" Wood-Knocker II+ Insert with no nails	Purple	100
PFM2521350NN	3/8-1/2" Wood-Knocker II+ Multi Insert with no nails	Gray	100
Wood-Knocker II+ Form Inserts with no nails must be screwed to the concrete form work (screws not included).			

GENERAL INFORMATION

BANG-IT®+

Concrete Inserts

PRODUCT DESCRIPTION

Bang-It+ concrete inserts are specifically designed to provide hangar attachments for mechanical, electrical, plumbing (MEP) and fire protection.

Bang-It+ concrete inserts are designed for installation in and through composite steel deck (i.e. "pan-deck") used to support newly poured concrete floors or roof slabs.

After installation, the protective sleeve of the insert protrudes below the surface of the deck. The sleeves are color coded by size and allow overhead attachment of steel threaded rod in sizes ranging from 1/4" to 3/4" in diameter, including a 3/8-1/2" multi insert. 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. A hex impact plate offers resistance to rotation within the concrete as a steel threaded rod is being installed.

GENERAL APPLICATIONS AND USES

- Hanging Pipe and Sprinkler Systems
- HVAC Ductwork and Strut Channels
- Suspending Trapeze and Cable Trays
- Mechanical Unit Overhead Utilities
- Conduit and Lighting System
- Seismic Loading and Cracked Concrete

FEATURES AND BENEFITS

+ Fast and simple to install, low installed cost
+ Color coded by size for simple identification
+ Bang-It+ can be installed in lower flute of steel deck as little as 1.5" topping thickness (see installation details)
+ Hex head does not rotate when set
+ Insert design allows for full thread engagement
+ All sizes suitable for tension and shear loading

APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES), ESR-3657 for concrete - Approved for seismic and wind loading
- Code compliant with the 2015 IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, and 2009 IRC
- Tested in accordance with ASTM E488 and ICC-ES AC446 for use in concrete under the design provisions of ACI 318 (Strength Design method)
- Evaluated and qualified by an accredited independent testing laboratory for recognition in cracked and uncracked concrete
- Underwriters Laboratories (UL Listed) - File No. EX1289, see listing for sizes
  Also UL listed and recognized for use in air handling spaces (i.e. plenum rated locations)
- FM Approvals (Factory Mutual) – File No. J.I. 3015153

GUIDE SPECIFICATIONS

CSI Divisions: 03 15 19 - Cast-In Concrete Anchors and 03 16 00 - Concrete Anchors. Concrete inserts shall be Bang-It+ as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

BANG-IT+
STEEL DECK INSERT

ANCHOR MATERIALS

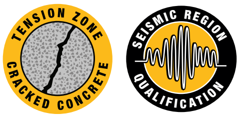
- Carbon Steel and Engineered Plastic

ROD/ANCHOR SIZE RANGE (TYP.)

- 1/4" to 3/4" threaded rod for Bang-It Concrete Inserts

SUITABLE BASE MATERIALS

- Normal-weight Concrete
- Lightweight Concrete



CODE LISTED
ICC-ES ESR-3657
CONCRETE

DDA
DEWALT DESIGN ASSIST

MATERIAL SPECIFICATIONS

Bang-It+

Anchor Component	Component Material
Insert Body	AISI 1008 Carbon Steel or equivalent
Flange	AISI 1008 Carbon Steel or equivalent
Spring	Steel Music Wire
Protective Sleeve	Engineered Plastic
Zinc Plating	ASTM B 633 (Fe/Zn5) Min. Plating requirements for Mild Service Condition

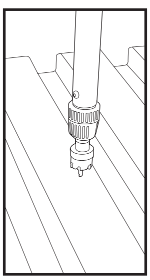
Material Properties for Threaded Rod

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 or A 307, Grade C	1/4 to 3/4	36.0	58.0
High strength carbon rod	A 193, Grade B7	1/4 to 3/4	105.0	125.0

INSTALLATION INSTRUCTIONS

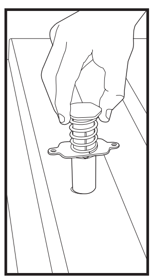
Installation Instructions for Bang-It+

Create Hole



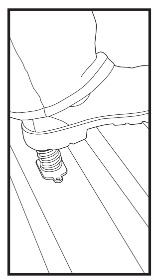
Step 1
Cut (e.g. drill/punch) a hole in the steel deck to the hole size required by the insert.

Position



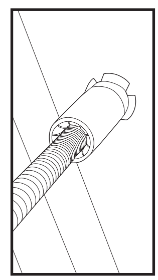
Step 2
Place the plastic sleeve of the insert through hole in steel deck.

Prepare



Step 3
Step on or impact the insert head to engage. Optionally, base plate of insert can also be screwed to steel deck.

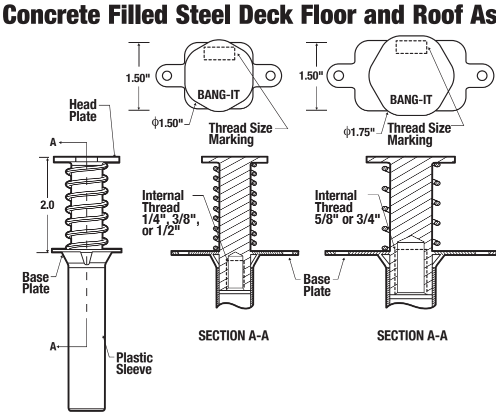
Attach



Step 4
After concrete pour and cure, install threaded steel element (rod/bolt) into the insert. Trim away plastic sleeve as needed for application and attach fixture as applicable (e.g. seismic brace).

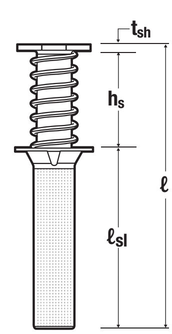
INSTALLATION SPECIFICATIONS

Bang-It+ Cast-In-Place Inserts for Concrete Filled Steel Deck Floor and Roof Assemblies



Bang-It+

Dimension	Notation	Nominal Rod/Anchor Size						
		1/4"	3/8"	3/8" & 1/2" Multi		1/2"	5/8"	3/4"
Metal Hole Saw Diameter (in.)	-	13/16 or 7/8					1-3/16 or 1-1/4	
Metal Hole Saw Drilling Speed (rpm)	-	700-900	700-900	700-900		700-900	500-700	500-700
Steel Head Plate Thickness (in.)	t_{sh}	1/8	1/8	1/8		1/8	1/8	1/8
Approx. Height of Spring (in.)	h_s	1-13/16	1-13/16	1-13/16		1-13/16	1-13/16	1-13/16
Base Plate Thickness (in.)	-	1/16	1/16	1/16		1/16	1/16	1/16
Thread Size, UNC	-	1/4-20	3-3/8	3/8-16	1/2-13	1/2-13	5/8-11	3/4-10
Approx. Internal Thread Length (in.)	-	3/8	5/8	9/16	9/16	11/16	15/16	1-1/8
Approx. Internal Thread Projection throught Deck Soffit, after setting (in.)	-	3/4	3/4	0	3/4	3/4	3/4	3/4
Length of Plastic Sleeve (in.)	ℓ_{sl}	3-3/8	3-3/8	3-3/8		3-3/8	3-3/8	3-3/8
Overall Insert Length (in.)	ℓ	5-7/16	5-7/16	5-7/16		5-7/16	5-7/16	5-7/16



REFERENCE DATA (ASD)

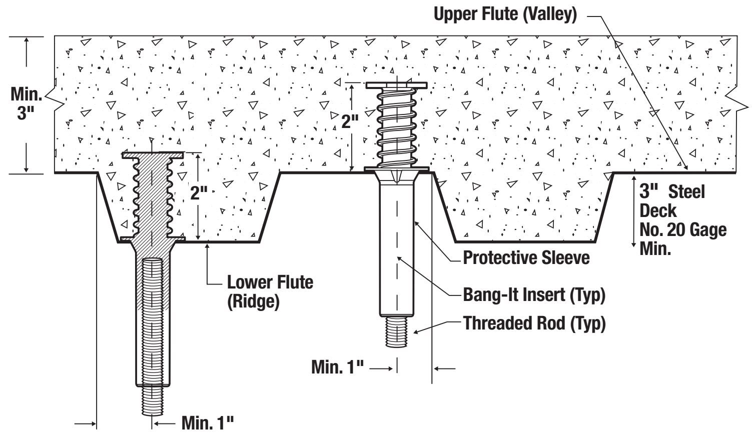
Ultimate and Allowable Load Capacities for Bang-It+ Inserts Installed in Sand-Lightweight Concrete or Normal Weight over Steel Deck[1,2,3]

Rod/Insert Diameter d in.	Nominal Embedment Depth h_v in.	Flute Location in Deck	Insert Spacing in.	End Distance in.	f´c ≥ 3,000 psi			
					Ultimate Load		Allowable Load	
					Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
1/4	2	Upper	6	6	4,450	2,500	1,115	835
		Lower			3,320	2,500	830	625
3/8	2	Upper	6	6	5,750	3,350	1,915	1,115
		Lower			3,320	3,350	830	840
1/2	2	Upper	6	6	7,110	3,350	2,370	1,115
		Lower			3,320	3,350	830	840
5/8	2	Upper	6	6	8,810	3,350	2,935	1,115
		Lower	6		3,960	3,350	990	840
3/4	2	Upper	6	6	8,810	3,350	2,935	1,115
		Lower	6		3,960	3,350	990	840

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. For 1/4", 3/8" and 1/2" Bang-It Inserts:
   The allowable tension load for a single insert installed in the upper flute must be adjusted as follows for spacing less than 6 inches.
   When the insert are spaced 2" center-to-center across the flute the insert tension capacity must be reduced by 40 percent.
   When the insert are spaced 2" center-to-center along the flute the insert tension capacity must be reduced by 50 percent.

   The allowable tension load for a single insert installed into the lower flute must be adjusted as follows for spacing less than 6 inches.
   When the insert are spaced 2" center-to-center across the flute the insert tension capacity must be reduced by 30 percent.
   When the insert are spaced 2" center-to-center along the flute the insert tension capacity must be reduced by 35 percent.

Sand-Lightweight Concrete or Normal Weight Concrete over Steel Deck (Minimum 3,000 psi)



Allowable Steel Strength for Threaded Rod

Anchor Diameter d in.	Nominal Area of Rod in.²	Allowable Tension			Allowable Shear		
		ASTM A36 lbs.	ASTM A307 Grade C lbs.	ASTM A193 Grade B7 lbs.	ASTM A36 lbs.	ASTM A307 Grade C lbs.	ASTM A193 Grade B7 lbs.
1/4	0.0491	940	940	2,160	485	485	1,030
3/8	0.1104	2,115	2,115	4,375	1,090	1,090	2,255
1/2	0.1963	3,755	3,755	7,775	1,940	1,940	4,055
5/8	0.3068	5,870	5,870	12,150	3,025	3,025	6,260
3/4	0.4418	8,455	8,455	17,495	4,355	4,355	9,010

Allowable tension = f_u (A_{nom}) (0.33); Allowable shear = f_u (A_{nom}) (0.17)

STRENGTH DESIGN (SD)

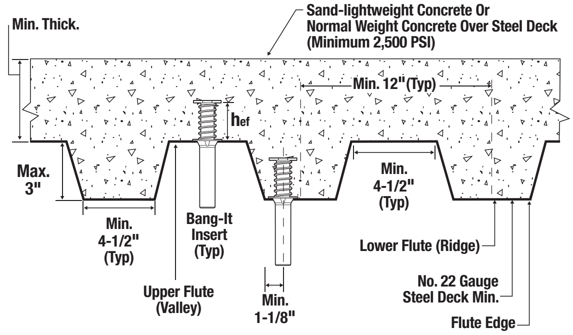
Bang-It+ Insert Design Information[1,2,3,4,5,6,7,8,9]

Design Information		Symbol	Units	1/4-inch	3/8-inch	1/2-inch	5/8-inch	3/4-inch
Insert O.D.		d_a (d_o)	in. (mm)	0.7 (18)	0.7 (18)	0.7 (18)	1.0 (25)	1.0 (25)
Insert head net bearing area		A_{brg}	in² (mm²)	1.20 (762)	1.20 (762)	1.20 (762)	1.30 (839)	1.30 (839)
Effective embedment depth		h_{ef}	in. (mm)	1.75 (45)	1.75 (45)	1.75 (45)	1.75 (45)	1.75 (45)
Minimum member thickness		h_{min}	-	See Deck Figures as applicable				
Minimum spacing and edge distances	Upper flute	s_{min}, c_{min}	-	See ACI 318 Section D.8.1 and D.8.2				
	Lower flute	s_{min}, c_{min}	-	See Deck Figures as applicable				
Effectiveness factor for cracked concrete		k_c	- (SI)	24 (10)	24 (10)	24 (10)	24 (10)	24 (10)
Modification factor for tension strength in uncracked concrete		$\Psi_{c,N}$	-	1.25	1.25	1.25	1.25	1.25
Nominal tension strength of single insert in tension as governed by steel strength (4-1/2" W-Deck, B-Deck, 3-7/8" W-Deck)		$N_{sa,insert}$	lb (kN)	10,440 (46.4)	10,440 (46.4)	8,850 (43.5)	11,985 (53.3)	11,985 (53.3)
Nominal tension strength of single insert in tension as governed by steel strength, for seismic loading (4-1/2" W-Deck, B-Deck, 3-7/8" W-Deck)		$N_{sa,insert,eq}$	lb (kN)	10,440 (46.4)	10,440 (46.4)	8,850 (43.5)	11,985 (53.3)	11,985 (53.3)
Nominal steel shear strength of single insert in the soffit of concrete on steel deck, (4-1/2" W-Deck)		$V_{sa,insert,deck}$	lb (kN)	2,280 (10.2)	2,280 (10.2)	2,280 (10.2)	3,075 (13.7)	3,075 (13.7)
Nominal steel shear strength of single insert in the soffit of concrete on steel deck, for seismic loading, (4-1/2" W-Deck)		$V_{sa,insert,deck,eq}$	lb (kN)	2,280 (10.2)	2,280 (10.2)	2,280 (10.2)	2,695 (12.0)	2,695 (12.0)
Nominal steel shear strength of single insert in the soffit of concrete on steel deck, (B-Deck, 3-7/8" W-Deck)		$V_{sa,insert,deck}$	lb (kN)	2,080 (10.2)	2,080 (10.2)	2,080 (10.2)	2,975 (13.2)	2,975 (13.2)
Nominal steel shear strength of single insert in the soffit of concrete on steel deck, for seismic loading, (B-Deck, 3-7/8" W-Deck)		$V_{sa,insert,deck,eq}$	lb (kN)	2,080 (10.2)	2,080 (10.2)	2,080 (10.2)	2,695 (12.0)	2,695 (12.0)

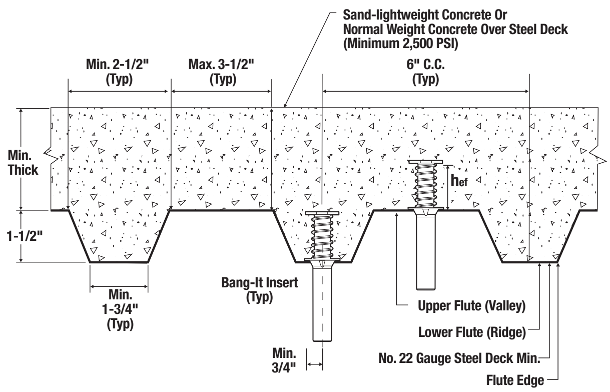
For SI: 1 inch = 25.4 mm, 1 inch² = 635 mm², 1 pound = 4.45 N, 1 psi = 0.006895 MPa. For pound-inch unit: 1 mm = 0.03937 inches.

1. Concrete must have a compressive strength f'c of 2,500 psi minimum.
2. Design of headed cast-in specialty inserts shall be in accordance with the provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D for cast-in headed anchors.
3. Strength reduction factors (ø) for the inserts are based on ACI 318-14 17.3.3 or ACI 318-11 D.4.3 for cast-in headed anchors. Condition B is assumed. Strength reduction factors for load combinations in accordance with ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 governed by steel strength of the insert are taken as 0.65 for tension and 0.60 for shear; values correspond to brittle steel elements. The value of ø applies when the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3. If the load combinations of ACI 318-11 Appendix C are used, then the appropriate value of ø must be determined in accordance with ACI 318-11 D4.4.
4. The concrete tension strength of headed cast-in specialty inserts in concrete filled steel deck assemblies shall be calculated in accordance with ACI 318-14 Chapter 17 or ACI 318-11 Appendix D and Deck Figures.
5. Insert O.D. is the outside diameter of the headed insert body.
6. Minimum spacing distance between anchors and minimum edge distances for cast-in Bang-It+ anchors shall be in accordance with Deck Figures, as applicable, and noted provisions.
7. Only the largest size of threaded rod or bolt for the 3/8 & 1/2 inch multi insert must be used for applications resisting shear loads.
8. The strengths shown in the table are for inserts only. Design professional is responsible for checking threaded rod strength in tension, shear, and combined tension and shear, as applicable. See Steel Design Information table for common threaded rod elements.
9. The tabulated insert strength values are applicable to installations in the lower flute or upper flute of the steel deck profiles; see Deck Figures.

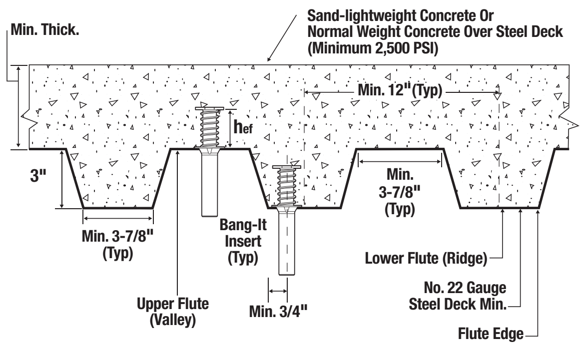
Bang-It+ Inserts Installed in Soffit of Concrete Filled Steel Deck Floor and Roof Assemblies, 4-1/2 -inch W-Deck[1,2,3,4]



Bang-It+ Inserts Installed in Soffit of Concrete Filled Steel Deck Floor and Roof Assemblies, B-Deck[1,2,3,4,5,6,7]



Bang-It+ Inserts Installed in Soffit of Concrete Filled Steel Deck Floor and Roof Assemblies, 3-7/8 -inch W-Deck[1,2,3,8]



1. Inserts may be placed in the upper flute or lower flute of the steel deck assembly. Inserts in the lower flute require a minimum 1.5" of concrete topping thickness (min. thick) from the top of the deck at the location of the installation. Upper flute installations require a minimum 3" topping thickness concrete (min. thick) from the top of the deck at the location of the installation.
2. Axial spacing for Bang-It inserts along the flute length shall be minimum $3h_{ef}$.
3. Upper flute Bang-It+ inserts are not subject to steel deck dimension limitations, or the minimum steel deck gauge limitations.
4. Inserts in the lower flute of 4-1/2-inch W-Deck may be installed with a maximum 1-1/8 -inch offset in either direction from the center of the flute. The offset distance may be increased for flute widths greater than those shown provided the minimum lower flute edge distance of 1-1/8 -inch is also satisfied.
5. Inserts in the lower flute of B-Deck may be installed with a maximum 1/8 -inch offset in either direction from the center of the flute. The offset distance may be increased for flute widths greater than those shown provided the minimum lower flute edge distance of 3/4 -inch is also satisfied.
6. Lower flute installations of B-Deck with flutes widths greater than 1-3/4 -inch are permitted.
7. Lower flute installations of B-Deck in flute depths greater than 1-1/2 -inch are permitted provided the minimum edge distance of 3/4 -inch is met and the minimum lower flute width is increased proportionally (e.g. applicable to a lower flute depth of 2-inch with a minimum lower flute width of 2-1/4 -inch).
8. Inserts in the lower flute of 3-7/8-inch W-Deck may be installed with a maximum 1-3/16 -inch offset in either direction from the center of the flute.

Specifications And Physical Properties Of Common Carbon Steel Threaded Rod Elements[1]

Threaded Rod Specification		Units	Min. Specified Ultimate Strength, F_{uta}	Min. Specified Yield Strength 0.2 Percent Offset, F_{ya}	$\frac{F_{uta}}{F_{ya}}$	Elongation Minimum Percent[5]	Reduction Of Area Min. Percent	Related Nut Specification[6]
Carbon Steel	ASTM A36/A36M[2] and F1554[3] Grade 36	psi (MPa)	58,000 (400)	36,000 (248)	1.61	23	40 (50 for A36)	ASTM A194 / A563 Grade A
	ASTM F1554[3] Grade 105	psi (MPa)	125,000 (862)	105,000 (724)	1.19	15	45	ASTM A194 / A563 Grade DH
	ASTM A193/A193M[4] Grade B7	psi (MPa)	125,000 (860)	105,000 (720)	1.19	16	50	

For SI: 1 inch = 25.4 mm, 1 psi = 0.006897 MPa. For pound-inch units: 1 mm = 0.03937 inch, 1 MPa = 145.0 psi.

1. Inserts may be used in conjunction with all grades of continuously threaded carbon steels (all-thread) that comply with code reference standards and that have thread characteristics comparable with ANSI B1.1 UNC Coarse Thread Series.
2. Standard Specification for Carbon Structural Steel.
3. Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
4. Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.
5. Based on 2-inch (50 mm) gauge length except ASTM A193, which are based on a gauge length of 4d (d_{rod}).
6. Where nuts are applicable, nuts of other grades and style having specified proof load stress greater than the specified grade and style are also suitable.

Steel Design Information For Common Threaded Rod Elements Used With Concrete Inserts[1,2,3,4]

Design Information	Symbol	Units	1/4-inch	3/8-inch	1/2-inch	5/8-inch	3/4-inch
Threaded rod nominal outside diameter	d_{rod}	in. (mm)	0.250 (6.4)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)
Threaded rod effective cross-sectional area	A_{se}	in² (mm²)	0.032 (21)	0.078 (50)	0.142 (92)	0.226 (146)	0.335 (216)
Nominal tension strength of ASTM A36 threaded rod as governed by steel strength	$N_{sa,rod,A36}$	lb (kN)	1,855 (8.2)	4,525 (20.0)	8,235 (36.6)	13,110 (58.3)	19,430 (86.3)
Nominal seismic tension strength of ASTM A36 threaded rod as governed by steel strength	$N_{sa,rod,A36,eq}$	lb (kN)	1,855 (8.2)	4,525 (20.0)	8,235 (36.6)	13,110 (58.3)	19,430 (86.4)
Nominal tension strength of ASTM A193, Gr. B7 threaded rod as governed by steel strength	$N_{sa,rod,B7}$	lb (kN)	4,000 (17.7)	9,750 (43.1)	17,750 (78.9)	28,250 (125.7)	41,875 (186.0)
Nominal seismic tension strength of ASTM A193, Gr. B7 threaded rod as governed by steel strength	$N_{sa,rod,B7,eq}$	lb (kN)	4,000 (17.7)	9,750 (43.1)	17,750 (78.9)	28,250 (125.7)	41,875 (186.0)
Nominal shear strength of ASTM A36 threaded rod as governed by steel strength	$V_{sa,rod,A36}$	lb (kN)	1,115 (4.9)	2,715 (12.1)	4,940 (22.0)	7,865 (35.0)	11,660 (51.9)
Nominal seismic shear strength of ASTM A36 threaded rod as governed by steel strength	$V_{sa,rod,A36,eq}$	lb (kN)	780 (3.5)	1,900 (8.4)	3,460 (15.4)	5,505 (24.5)	8,160 (36.3)
Nominal shear strength of ASTM A193, Gr. B7 threaded rod as governed by steel strength	$V_{sa,rod,B7}$	lb (kN)	2,385 (10.6)	5,815 (25.9)	10,640 (7.3)	16,950 (75.4)	25,085 (111.6)
Nominal seismic shear strength of ASTM A193, Gr. B7 threaded rod as governed by steel strength	$V_{sa,rod,B7,eq}$	lb (kN)	1,680 (7.5)	4,095 (18.2)	7,455 (34.2)	11,865 (52.8)	17,590 (78.2)

For SI: 1 inch = 25.4 mm, 1 pound = 0.00445 kN, 1 in² = 645.2 mm². For pound-inch unit: 1 mm = 0.03937 inches.

1. Values provided for steel element material types based on minimum specified strengths and calculated in accordance with ACI 318-11 Eq. (D-2) and Eq. (D-29).
2. ϕN_{sa} shall be the lower of the $\phi N_{sa,rod}$ or $\phi N_{sa,insert}$ for static steel strength in tension; for seismic loading $\phi N_{sa,eq}$ shall be the lower of the $\phi N_{sa,rod,eq}$ or $\phi N_{sa,insert,eq}$.
3. ϕV_{sa} shall be the lower of the $\phi V_{sa,rod}$ or $\phi V_{sa,insert}$ for static steel strength in tension; for seismic loading $\phi V_{sa,eq}$ shall be the lower of the $\phi V_{sa,rod,eq}$ or $\phi V_{sa,insert,eq}$.
4. Strength reduction factors shall be taken from ACI 318-14 17.3.3 or ACI 318-11 D.4.3 for steel elements. Condition B is assumed. Strength reduction factors for load combinations in accordance with ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 governed by steel strength of the threaded rod are taken as 0.75 for tension and 0.65 for shear; values correspond to ductile steel elements. The value of ø applies when the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3. If the load combinations of ACI 318-11 Appendix C are used, then the appropriate value of ø must be determined in accordance with ACI 318-11 D4.4.

Tension and Shear Design Strengths for Bang-It+ Inserts Installed in the Soffit of Uncracked Concrete Filled Steel Deck Floor and Roof Assemblies[1,2,3,4,5,6]

STRENGTH DESIGN SD TABLES

Nominal Anchor Diameter	Embed. Depth h_{ef} (in.)	Minimum Concrete Compressive Strength											
		f'c = 3,000 psi											
		4-1/2" W-Deck				B-Deck				3-7/8" W-Deck			
		Upper Flute		Lower Flute		Upper Flute		Lower Flute		Upper Flute		Lower Flute	
		ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)
1/4	1-3/4	2,665	1,370	1,340	1,370	2,265	1,250	595	1,250	2,265	1,250	1,145	1,250
3/8	1-3/4	2,665	1,370	1,340	1,370	2,265	1,250	595	1,250	2,265	1,250	1,145	1,250
1/2	1-3/4	2,665	1,370	1,340	1,370	2,265	1,250	595	1,250	2,265	1,250	1,145	1,250
5/8	1-3/4	2,665	1,845	1,340	1,845	2,265	1,785	595	1,785	2,265	1,785	1,145	1,785
3/4	1-3/4	2,665	1,845	1,340	1,845	2,265	1,785	595	1,785	2,265	1,785	1,145	1,785

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

Tension and Shear Design Strengths for Bang-It+ Inserts Installed in the Soffit of Cracked Concrete Filled Steel Deck Floor and Roof Assemblies[1,2,3,4,5,6]

Nominal Anchor Diameter	Embed. Depth h_{ef} (in.)	Minimum Concrete Compressive Strength											
		f'c = 3,000 psi											
		4-1/2" W-Deck				B-Deck				3-7/8" W-Deck			
		Upper Flute		Lower Flute		Upper Flute		Lower Flute		Upper Flute		Lower Flute	
		ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)
1/4	1-3/4	1,810	1,370	1,070	1,370	1,810	1,250	475	1,250	1,810	1,250	915	1,250
3/8	1-3/4	1,810	1,370	1,070	1,370	1,810	1,250	475	1,250	1,810	1,250	915	1,250
1/2	1-3/4	1,810	1,370	1,070	1,370	1,810	1,250	475	1,250	1,810	1,250	915	1,250
5/8	1-3/4	1,810	1,845	1,070	1,845	1,810	1,785	475	1,785	1,810	1,785	915	1,785
3/4	1-3/4	1,810	1,845	1,070	1,845	1,810	1,785	475	1,785	1,810	1,785	915	1,785

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

1- Tabular values are provided for illustration and are applicable for single anchors installed in sand-lightweight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac}.
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.

2- Calculations were performed following methodology in ACI 318-14 Chapter 17 or ACI 318-11 Appendix D. The load level corresponding to the failure mode listed [steel strength of insert ($N_{sa,insert}$, $V_{sa,insert}$), concrete breakout strength, or pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod type, ($N_{sa,rod}$, $V_{sa,rod}$), the lowest load level controls.

3- Strength reduction factors shall be taken from ACI 318-14 17.3.3 or ACI 318-11 D.4.3 for cast-in headed anchors. Condition B is assumed. Strength reduction factors for load combinations in accordance with ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 governed by steel strength of the insert are taken as 0.65 for tension and 0.60 for shear; values correspond to brittle steel elements.Tabular values are permitted for short-term static loads only, seismic loading is not considered with these tables.

4- For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Chapter 17 or ACI 318-11 Appendix D.

5- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318-14 Chapter 17 or ACI 318-11 Appendix D and information contained in this product supplement. For other design conditions including seismic considerations please see ACI 318-14 Chapter 17 or ACI 318-11 Appendix D.

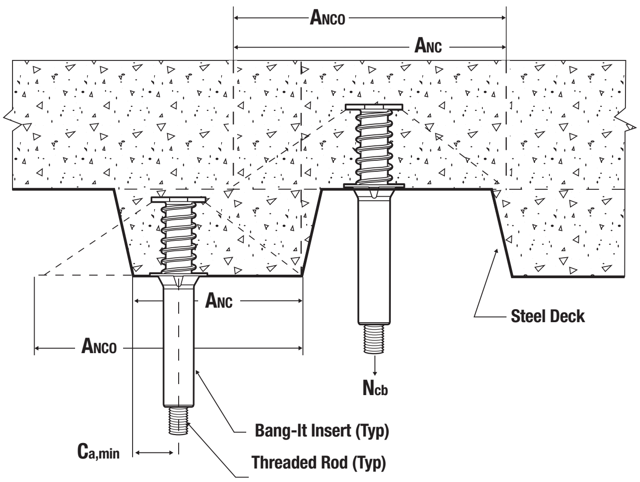
Tension and Shear Design Strength of Steel Elements (Steel Strength)[1,2,3,4]

Nominal Rod Diameter (in.)	Steel Elements - Threaded Rod			
	ASTM A36 and ASTM F1554 Grade 36		ASTM A193 Grade B7 and ASTM F1554 Grade 105	
	$\phi N_{sa,rod}$ Tension (lbs.)	$\phi V_{sa,rod}$ Shear (lbs.)	$\phi N_{sa,rod}$ Tension (lbs.)	$\phi V_{sa,rod}$ Shear (lbs.)
1/4	1,390	720	3,000	1,550
3/8	3,395	1,750	7,315	3,780
1/2	6,175	3,210	13,315	6,915
5/8	9,835	5,115	21,190	11,020
3/4	14,550	7,565	31,405	16,305

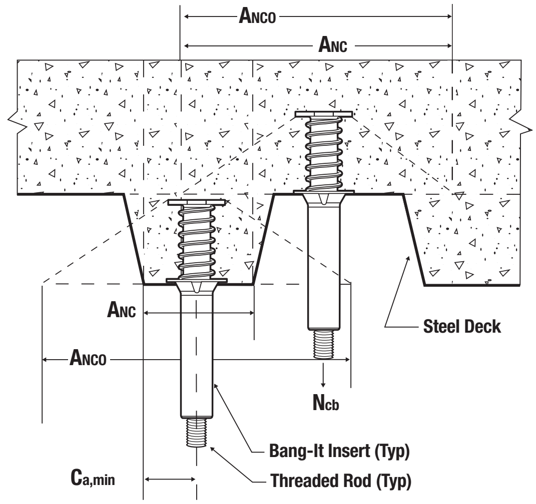
- Steel Strength Controls

1. Steel tensile design strength according to ACI 318 Appendix D and ACI 318 Chapter 17, $\phi N_{sa} = \phi \bullet A_{se,N} \bullet f_{uta}$
2. The tabulated steel design strength in tension for the threaded rod must be checked against the design strength of the steel insert, concrete breakout and pullout design strength to determine the controlling failure mode, the lowest load level controls.
3. Steel shear design strength according to ACI 318 Appendix D and ACI 318 Chapter 17, $\phi N_{sa} = \phi \bullet 0.60 \bullet A_{se,N} \bullet f_{uta}$
4. The tabulated steel design strength in shear for the threaded rod must be checked against the design strength of the steel insert, concrete breakout and pryout design strength to determine the controlling failure mode, the lowest load level controls.

Idealization of Concrete Filled Steel Decks for Determination of Concrete Breakout Strength in Accordance with ACI 318



Idealization of Standard Steel Deck Profiles



Idealization of B Deck Steel Deck Profiles

ORDERING INFORMATION

Bang-It®+ Deck Insert (UNC)

Cat.No.	Description	Color Code	Pre-Drilled Hole	Std. Box	Std. Pallet
7540	1/4" Bang-It+	Brown	13/16" or 7/8"	100	4,000
7542	3/8" Bang-It+	Green	13/16" or 7/8"	100	4,000
7544	1/2" Bang-It+	Yellow	13/16" or 7/8"	100	4,000
7546	5/8" Bang-It+	Red	1-3/16" or 1-1/4"	50	2,400
7548	3/4" Bang-It+	Purple	1-3/16" or 1-1/4"	50	2,400
7543	3/8-1/2" Bang-It+ Multi Insert	Gray	13/16" or 7/8"	100	4,000
Inserts are color coded to easily identify location and diameter of the internally threaded coupling.					

Bang-It®+ Installation Accessories

Cat.No.	Description	Std. 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
D180014IR	7/8" (22mm) Impact Ready® Hole Saw	1
D180020IR	1-1/4" (32mm) Impact Ready® Hole Saw	1
7566	Extra Carbide Hole Saw Center Bit	1
DWA1786IR	3/16" - 7/8" Impact Ready® Step Drill Bit	1
DWA1789IR	7/8" - 1-1/8" Impact Ready® Step Drill Bit	1
DCD980M2	20V Max* Lithium Ion Premium 3-Speed Drill/Driver Kit (4.0 Ah)	1
DWD220	1/2" VSR Pistol Grip Drill With E-Clutch Anti-Lock Control	1

GENERAL INFORMATION

DDI™+ (DECK INSERT)

Threaded Insert for Metal Deck

PRODUCT DESCRIPTION

The DDI+ (Deck Insert) is a concrete insert designed for installation in concrete-filled metal deck assemblies (i.e. "pan-deck", "Q-deck") applications. After installation, the threaded male hanger of the insert protrudes below the surface of the deck. The DDI+ comes in sizes ranging from 3/8" to 7/8" in diameter. The threaded bolt offers adjustability for precise height requirements and guarantees the minimum embedment depth. The longer "T" brace enables a variety of installation locations in across the deck.

GENERAL APPLICATIONS AND USES

- Seismic Loading and Cracked Concrete
- Hanging Pipe and Sprinkler Systems
- HVAC Ductwork and Strut Channels
- Suspending Trapeze and Cable Trays
- Mechanical Unit Overhead Utilities
- Conduit and Lighting System

FEATURE AND BENEFITS

+ Fast and simple to install, low installed cost
+ Pre-mounted self drilling screws for convenient installation
+ Fine-tuned thread length for guaranteed minimum embedment
+ Lengthened "T" brace for more flexible installation positions

APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES), ESR-3958 for concrete. Approved for seismic and wind loading
- Code compliant with the 2015 IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, and 2009 IRC
- Underwriters Laboratories (UL Listed) - File No. EX1289, see listing for sizes.
- FM Approvals (Factory Mutual) – File No. J.I. 3059197

GUIDE SPECIFICATIONS

CSI Divisions: 03 15 19 - Cast-In Concrete Anchors and 03 16 00 - Concrete Anchors. Concrete inserts shall be DDI+ as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

DDI+

THREAD VERSION

- UNC Thread

ANCHOR MATERIALS

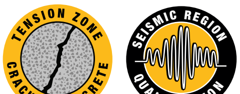
Plain and zinc plated carbon steel

ANCHOR SIZE RANGE

- 3/8" diameter through 7/8" diameter

SUITABLE BASE MATERIALS

- Concrete or lightweight concrete over metal deck

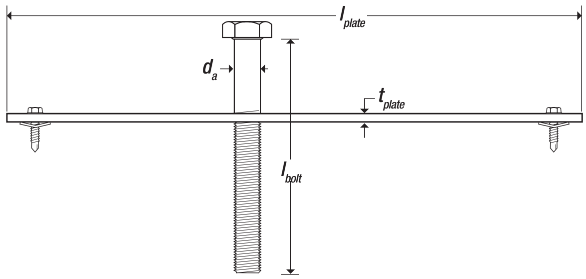


CODE LISTED
ICC-ES ESR-3958
CONCRETE

DDA
DEWALT DESIGN ASSIST™

MATERIAL SPECIFICATIONS

Anchor Component	Component Material
Metal Plate	ASTM A1011 Carbon Steel or equivalent (plain)
Hex Head Bolt	ASTM A307 Grade A (zinc plated)



DDI+ Insert Detail

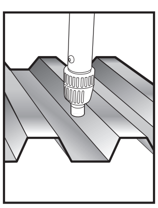
INSTALLATION SPECIFICATIONS

Dimension		Notation	Nominal Anchor Size				
			3/8"	1/2"	5/8"	3/4"	7/8"
Typical Drill Bit Diameter for Deck		in.	7/16 or 1/2	9/16 or 5/8	11/16 or 3/4	13/16 or 7/8	15/16 or 1
Overall Length of Metal Plate		in.	12	12	12	12	12
Approximate Width of Metal Plate		in.	1-1/4	1-1/4	1-1/4	2	2
Approximate Thickness of Metal Plate		in.	3/16	3/16	3/16	3/8	3/8
Bolt Thread Size (UNC)		in.	3/8-16	1/2-13	5/8-11	3/4-10	7/8-9
Length of Hex Head Bolt		in.	8	8	8	8	8
Effective Embedment Depth		in.	1-1/2	1-3/4	2	2-1/8	2-1/16
Nominal Embedment Depth		in.	1-3/4	2	2-3/8	2-5/8	2-5/8
Approx. Thread Projection (through 3-inch-deep deck)	Over Upper Flute	in.	6-1/4	6	5-5/8	5-3/8	5-3/8
	Over Lower Flute		3-1/4	3	2-5/8	2-3/8	2-3/8

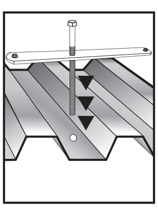
Dimension	Size	Point Style	Drill Range	RPM (Max)
Self-Drilling Screw	8-18	#2	18 Gage Max	2500

INSTALLATION INSTRUCTIONS

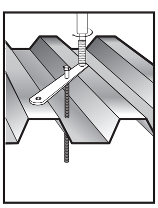
Cut (e.g. drill/punch) a hole in the steel deck to the hole size required by the threaded bolt of the insert.



Place the threaded bolt of the insert through the hole in the steel deck.



The metal plate of the insert must be on the top of the deck flutes. The metal plate can (optionally) be secured to the deck using the pre-assembled size drilling screws.



REFERENCE DATA (ASD)

Ultimate and Allowable Load Capacities for DDI+ (Deck Insert) Installed in the Soffit of Sand-lightweight or Normal Weight Concrete over Metal Deck Floor and Roof Assemblies[1,2,3,4]

Nominal Anchor Diameter in.	Nominal Embed. Depth h_{nom} (in.)	Min. Concrete Topping Thickness (in.)	Min. Insert Spacing (in.)	Min. End Distance (in.)	Normal-weight or Sand-lightweight concrete, f'c ≥ 3,000 psi											
					3-7/8" or 4-1/2" Wide Deck											
					Installed Over Upper Flute				Installed Over Flute Incline				Installed Over Lower Flute			
					Ultimate Load		Allowable Load		Ultimate Load		Allowable Load		Ultimate Load		Allowable Load	
					Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
3/8	1-3/4	2	4-1/2	9	3,420	1,985	1,140	660	5,230	1,985	1,745	660	5,230	2,610	1,745	870
1/2	2	2-1/2	5-1/4	10-1/2	4,310	4,205	1,435	1,400	6,235	4,205	2,080	1,400	6,235	5,155	2,080	1,720
5/8	2-3/8	3-1/4	6	12	5,265	6,450	1,755	2,150	8,630	6,450	2,875	2,150	8,630	6,820	2,875	2,275
3/4	2-5/8	3-1/4	6-3/8	12-3/4	5,770	6,450	1,925	2,150	8,630	6,450	2,875	2,150	8,630	6,820	2,875	2,275
7/8	2-5/8	3-1/4	6-3/8	12-3/4	5,770	6,450	1,925	2,150	8,630	6,450	2,875	2,150	8,630	6,820	2,875	2,275

1. Allowable load capacities listed are calculated using an applied safety factor of 3.0
2. Nominal embedment depth is measured from the bottom of the insert plate to the top of the insert bolt head.
3. Insert spacing and end distances are measured from the centerline of the insert bolt head.
4. Shear loads may be applied in any direction. For inserts installed over the upper flute, if the shear load is parallel to the flute the tabulated allowable load values may be increased by 20 percent (multiplied by 1.2)

STRENGTH DESIGN (SD)

CODE LISTED
ICC-ES ESR-3958

DDI+ Insert Installation Information and Supplemental Information[1,2]

Design Information		Symbol	Units	3/8-inch	1/2-inch	5/8-inch
Nominal bolt diameter		d_a	in. (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)
Length of insert bolt		ℓ_{bolt}	in (mm)	8 (203)	8 (203)	8 (203)
Typical drill bit diameter		d_{bit}	in.	7/16 or 1/2	9/16 or 5/8	11/16 or 3/4
Nominal overall length of insert plate		ℓ_{plate}	in.² (mm²)	12 (305)	12 (305)	12 (305)
Nominal width of insert plate		W_{plate}	in.² (mm²)	1-1/4 (32)	1-1/4 (32)	1-1/4 (32)
Approximate thickness of insert plate		t_{plate}	in. (mm)	3/16 (4.8)	3/16 (4.8)	3/16 (4.8)
Minimum nominal embedment depth	Over upper flute	$h_{nom\ (upperflute)}$	in. (mm)	1-3/4 (45)	2 (51)	2-3/8 (60)
	Over flute incline	$h_{nom\ (upperincline)}$	in. (mm)			
	Over lower flute	$h_{nom\ (lowerflute)}$	in. (mm)			
Minimum effective embedment depth	Over upper flute	$h_{ef\ (upperflute)}$	in. (mm)	1.50 (38)	1.75 (45)	2.00 (51)
	Over flute incline	$h_{ef\ (upperincline)}$	in. (mm)			
	Over lower flute	$h_{ef\ (lowerflute)}$	in. (mm)			
Minimum concrete member thickness (topping thickness)	Over upper flute	$h_{min\ (upperflute)}$	in. (mm)	2 (51)	2-1/2 (64)	3-1/4 (83)
	Over flute incline	$h_{min\ (upperincline)}$	in. (mm)			
	Over lower flute	$h_{min\ (lowerflute)}$	in. (mm)			
Minimum flute edge distance (insert bolt)	Over upper flute	$c_{min,deck\ (upperflute)}$	in. (mm)	N/A	N/A	N/A
	Over flute incline	$c_{min,deck\ (upperincline)}$	in. (mm)			
	Over lower flute	$c_{min,deck\ (lowerflute)}$	in. (mm)	See Figure 3C	See Figure 3C	See Figure 3C
Minimum spacing distance (bolt spacing, center-to-center)	Over upper flute	$s_{min\ (upperflute)}$	in. (mm)	4-1/2 (114)	5-1/4 (133)	6 (152)
	Over flute incline	$s_{min\ (upperincline)}$	in. (mm)			
	Over lower flute	$s_{min\ (lowerflute)}$	in. (mm)			
Minimum deck end distance	Over upper flute	$c_{min\ (upperflute)}$	in. (mm)	Specified cover requirements for reinforcement in accordance with ACI 318-14 17.7.2 or ACI 318-11 7.7, as applicable.		
	Over flute incline	$c_{min\ (upperincline)}$	in. (mm)			
	Over lower flute	$c_{min\ (lowerflute)}$	in. (mm)			
Effective tensile stress area (insert bolt)		A_{se}	in.² (mm²)	0.078 (50)	0.142 (92)	0.226 (146)
Insert head net bearing area		A_{brg}	in.² (mm²)	0.17 (110)	0.28 (181)	0.45 (290)
Minimum specified ultimate strength		f_{uta}	psi (N/mm²)	60,000 (400)		
Minimum specified yield strength		f_{ya}	psi (N/mm²)	36,000 (248)		

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

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable,
2. For installation detail for inserts in concrete-filled steel deck assemblies, see Figures A, B and C (i.e. over upper flute, over flute incline, over lower flute).

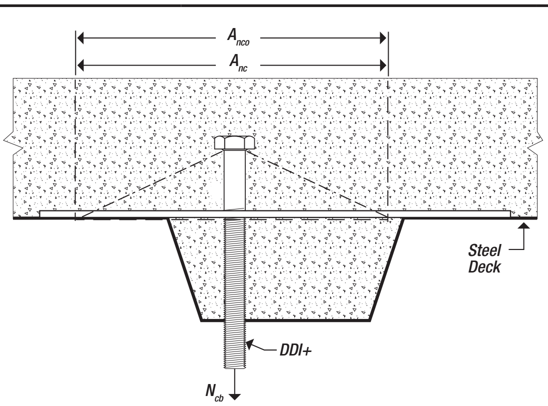
CODE LISTED ICC-ES ESR-3958
STRENGTH DESIGN TABLES SD

DDI+ Insert Design Information[1,2,3,4,5,6]

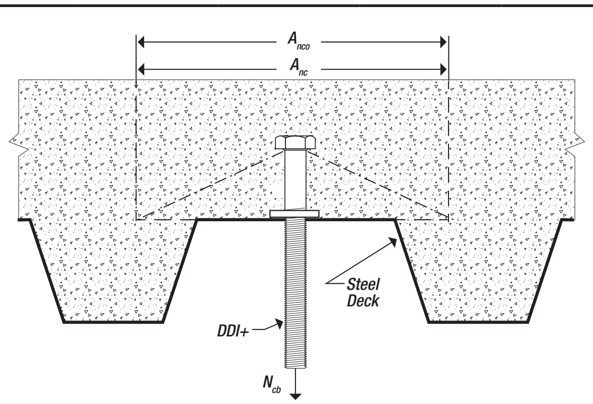
Design Information		Symbol	Units	3/8-inch	1/2-inch	5/8-inch
Insert O.D. (nominal bolt diameter)		d_a	in. (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)
Insert head net bearing area		A_{brg}	in² (mm²)	0.17 (110)	0.28 (181)	0.45 (290)
Effective tensile stress area		A_{se}	in.² (mm²)	0.078 (50)	0.142 (92)	0.226 (146)
Effective embedment depth	Over upper flute	h_{ef} (upperflute)	in. (mm)	1.50 (38)	1.75 (45)	2.00 (51)
	Over flute incline	h_{ef} (fluteincline)	in. (mm)			
	Over lower flute	h_{ef} (lowerflute)	in. (mm)			
Minimum concrete member thickness (topping thickness over upper flute)		h_{min}	in. (mm)	2.00 (51)	2.50 (64)	3.25 (83)
Minimum spacing and edge distance		s_{min}, c_{min}	in. (mm)	See Installation Information Table and Figures A, B and C		
Effectiveness factor for cracked concrete		k_c	- (SI)	24 (10)		
Modification factor for tension strength in uncracked concrete		$\Psi_{C,N}$	-	1.25		
According to Figures A, B or C	Nominal tension strength of single insert as governed by steel strength	$N_{sa,insert}$	lb (kN)	4,650 (20.7)	8,520 (37.9)	13,560 (60.3)
	Nominal tension strength of single insert as governed by steel strength, seismic	$N_{sa,insert,eq}$	lb (kN)			
According to Figure A (over upper flute)	Nominal steel shear strength of single insert in the soffit of concrete on steel deck	$V_{sa,insert,deck}$ (upperflute)	lb (kN)	2,280 (10.1)	4,260 (18.9)	7,245 (32.2)
	Nominal steel shear strength of single insert in the soffit of concrete on steel deck, seismic	$V_{sa,insert,deck,eq}$ (upperflute)	lb (kN)	1,825 (8.1)	3,410 (15.2)	
According to Figure B (over flute incline)	Nominal steel shear strength of single insert in the soffit of concrete on steel deck	$V_{sa,insert,deck}$ (fluteincline)	lb (kN)	1,310 (5.8)	3,410 (15.2)	5,240 (23.3)
	Nominal steel shear strength of single insert in the soffit of concrete on steel deck, seismic	$V_{sa,insert,deck,eq}$ (fluteincline)	lb (kN)	1,045 (4.6)	2,860 (12.7)	
According to Figure C (over lower flute)	Nominal steel shear strength of single insert in the soffit of concrete on steel deck	$V_{sa,insert,deck}$ (lowerflute)	lb (kN)	2,280 (10.1)	4,260 (18.9)	5,735 (25.5)
	Nominal steel shear strength of single insert in the soffit of concrete on steel deck, seismic	$V_{sa,insert,deck,eq}$ (lowerflute)	lb (kN)	2,015 (9.0)	3,410 (15.2)	

For SI: 1 inch = 25.4 mm, 1 pound = 4.45 N, 1 psi = 0.006895 MPa. For pound-inch unit: 1 mm = 0.03937 inches.

1. Concrete must have a compressive strength f 'c of 3,000 psi (20.7 MPa) minimum.
2. Design of headed cast-in specialty inserts shall be in accordance with the provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable, for cast-in headed anchors. Concrete breakout strength must also be in accordance with the Idealization of Concrete Filled Steel Decks Figure.
3. Strength reduction factors for the inserts shall be taken from ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, for cast-in headed anchors. Strength reduction factors for load combinations in accordance with ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, governed by steel strength of the insert shall be taken as 0.75 for tension and 0.65 for shear; values correspond to ductile steel elements. The value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4.
4. Insert O.D. is the nominal bolt diameter of the insert.
5. Minimum spacing distance between anchors and minimum edge distances for cast-in headed DDI+ inserts shall be in accordance with the Installation Information Table, Design Information Table, Figures A, B and C and noted provisions.
6. Shear loads for concrete inserts in concrete-filled steel deck assemblies may be applied in any direction (i.e. over upper flute, over flute incline, over lower flute).



Idealization of Steel Deck Profile (over lower flute or over flute incline)



Idealization of Steel Deck Profile (over upper flute)

Idealization of Concrete Filled Steel Decks for Determination of Concrete Breakout Strength in Accordance with ACI 318

Tension and Shear Design Strengths for DDI+ Inserts Installed in Uncracked Lightweight Concrete Filled Steel Deck Floor and Roof Assemblies[1,2,3,4,5,6]

Insert O.D. (Nominal Bolt Diameter) (in.)	Embed. Depth hef (in.)	Minimum Concrete Compressive Strength					
		f'c = 3,000 psi					
		Upper Flute (Figure A)		Flute Incline (Figure B)		Lower Flute (Figure C)	
		ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)
3/8	1-3/4	1,795	1,480	1,795	850	1,795	1,480
1/2	1-3/4	2,265	2,770	2,265	2,215	2,265	2,770
5/8	1-3/4	2,765	4,710	2,765	3,405	2,765	3,730

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

Tension and Shear Design Strengths for DDI+ Inserts Installed in Cracked Lightweight Concrete Filled Steel Deck Floor and Roof Assemblies[1,2,3,4,5,6]

Insert O.D. (Nominal Bolt Diameter) (in.)	Embed. Depth hef (in.)	Minimum Concrete Compressive Strength					
		f'c = 3,000 psi					
		Upper Flute (Figure A)		Flute Incline (Figure B)		Lower Flute (Figure C)	
		ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)
3/8	1-3/4	1,435	1,480	1,435	850	1,435	1,480
1/2	1-3/4	1,810	2,770	1,810	2,215	1,810	2,770
5/8	1-3/4	2,210	4,710	2,210	3,405	2,210	3,730

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

1- Tabular values are provided for illustration and are applicable for single anchors installed in sand-lightweight concrete with minimum member thickness (topping thickness), $h_a = h_{min}$, and with the following conditions:
- For Upper Flute and Flute Incline: c_{a1} is greater than or equal to the critical edge distance, c_{ac}
- For Lower Flute: c_{a1} is equal to the minimum lower flute edge distance

2- Calculations were performed following methodology in ACI 318-14 Chapter 17. The load level corresponding to the controlling failure mode listed (e.g. For Tension: steel strength, concrete breakout strength, or pullout strength; For Shear: steel strength). Furthermore, the capacities for concrete breakout strength in tension are calculated using the effective embedment values, h_{ef}, for the selected anchors as noted in the design information table. Please also reference the installation specifications for additional information.

3- Strength reduction factors (ø) for the inserts are based on ACI 318-14 17.3.3 for cast-in headed anchors. Condition B is assumed. Strength reduction factors for load combinations in accordance with ACI 318-14 Section 5.3 governed by steel strength of the insert are taken as 0.75 for tension and 0.65 for shear; values correspond to ductile steel elements.

4- Tabular values are permitted for short-term static loads only, seismic loading is not considered with these tables.

5- For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Chapter 17.

6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-14 Chapter 17 and information contained in this product supplement. For other design conditions including seismic considerations please see ACI 318-14 Chapter 17.

Figure A

DDI+ Concrete Inserts Installed Through the Soffit of Concrete-Filled Steel Deck Floor and Roof Assemblies (Over Upper Flute)[1,2,3]

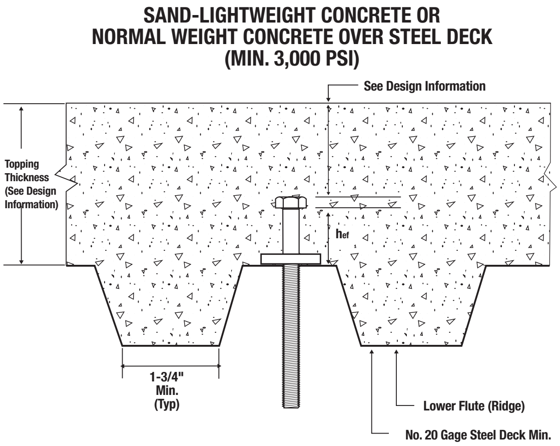


Figure B

DDI+ Concrete Inserts Installed Through the Soffit of Concrete-Filled Steel Deck Floor and Roof Assemblies (Over Flute Incline)[1,2,4]

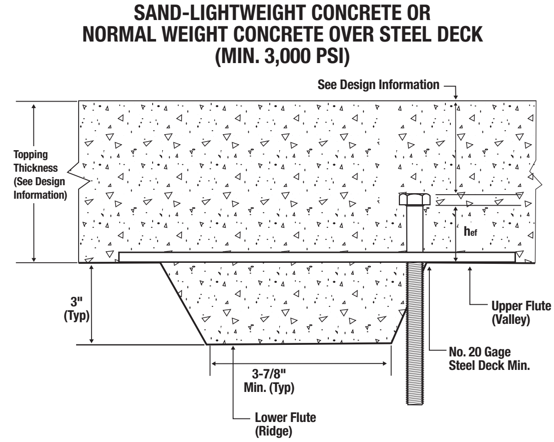
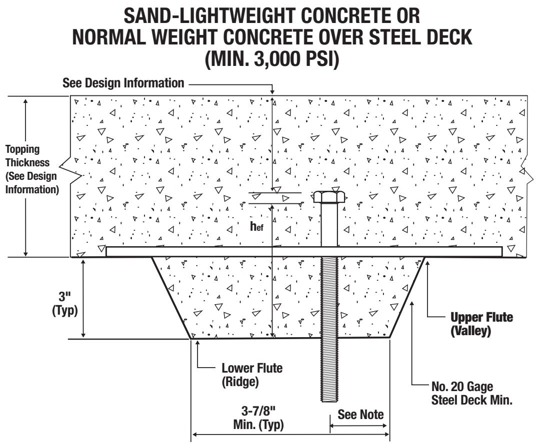


Figure C

DDI+ Concrete Inserts Installed Through the Soffit of Concrete-Filled Steel Deck Floor and Roof Assemblies (Over Lower Flute)[1,2,5]

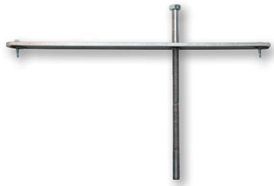


1. Installations require a minimum concrete member topping thickness from the top of the upper flute as given in the Design Information Table.
2. Inserts may be placed on the upper flute of the steel deck assembly; they may be installed anywhere across upper flute as follows:
   (Figure A) - Placed over the upper flute with threaded bolt installed through the upper flute or;
   (Figure B) - Placed over the upper flute spanning the lower flute with threaded bolt installed through the inclined section or;
   (Figure C) - Placed over the upper flute spanning the lower flute with threaded bolt installed through the lower flute.
3. Inserts over the upper flute with threaded bolt installed through the upper flute may be placed in any location and orientation that meets the minimum deck end distance requirements (see Design Information Table). The minimum deck end distance is measured from deck end to the centerline of the insert bolt.
4. Inserts over the upper flute spanning the lower flute with threaded bolt installed through the inclined section may be placed in any location and orientation that meets the minimum deck end distance requirements (see Design Information Table). The minimum deck end distance is measured from deck end to the centerline of the insert bolt.
5. Inserts over the upper flute spanning the lower flute with threaded bolt installed through the lower flute may be placed in any location that meets the minimum deck end distance and minimum lower flute edge distance requirements. The minimum deck end distance is measured from deck end to the centerline of the insert bolt. For lower flute widths of 3-7/8-inch, a maximum 1-inch centerline bolt offset in either direction from the center of the flute. The offset distance may be increased for flute widths greater than those shown provided the minimum lower flute edge distance of 15/16 -inch is also satisfied.

ORDERING INFORMATION

DDI+ (Deck Insert)

Cat. No.	Anchor Size	Rod/Anchor Dia.	Typical Drill Diameter	Box Qty.
PFM2511100	3/8" Metal Deck Insert	3/8"	7/16" or 1/2"	20
PFM2511110	1/2" Metal Deck Insert	1/2"	9/16" or 5/8"	20
PFM2511120	5/8" Metal Deck Insert	5/8"	11/16" or 3/4"	20
PFM2511130	3/4" Metal Deck Insert	3/4"	13/16" or 7/8"	12
PFM2511140	7/8" Metal Deck Insert	7/8"	15/16" or 1"	12



Rod Coupling Nuts - Zinc

Cat. No.	Description	Rod/Anchor Dia.	Hex Diameter	Box Qty.	Ctn. Qty.
030007	3/8"-16 x 1/2" x 1-1/8"	3/8"	1/2"	100	1000
030009	1/2"-13 x 5/8" x 1-1/4"	1/2"	5/8"	50	500
030010	5/8"-13 x 13/16" x 2-1/8"	5/8"	13/16"	25	250
030011	3/4"-13 x 1" x 2-1/4"	3/4"	1"	25	250
030012	7/8"-13 x 1-1/4" x 2-1/2"	7/8"	1-1/4"	10	100

GENERAL INFORMATION

DOUBLE™

Shield Expansion Anchor

PRODUCT DESCRIPTION

The Double is a dual expansion machine bolt anchor particularly suited for materials of questionable strength or consistence such as stone. It can be used in solid concrete, block, brick, and stone. Job site tests are recommended when used in base materials of questionable strength or consistence.

FEATURE AND BENEFITS

- Performs in base material of questionable strength
- Internally threaded anchor for easy removablility and service work
- Corrosion resistant body

APPROVALS AND LISTINGS

- Tested in accordance with ASTM E488
- Federal GSA Specification – Meets descriptive and proof load requirements of CID A-A-1923A, Type 3

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Expansion anchors shall be Double as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

DOUBLE

THREAD VERSION

- UNC Thread

ANCHOR MATERIALS

- Zamac Alloy

ANCHOR SIZE RANGE (TYP.)

- 1/4" to 3/4" diameter

SUITABLE BASE MATERIALS

- Normal-weight Concrete
- Grout-filled Concrete Masonry (CMU)
- Hollow Concrete Masonry (CMU)
- Brick Masonry
- Stone

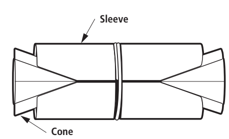
INSTALLATION AND MATERIAL SPECIFICATIONS

Installation Specifications

Dimension	Rod/Anchor Diameter, d					
	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"
ANSI Drill Bit Size (in.)	1/2	5/8	3/4	7/8	1	1-1/4
Max. Tightening Torque, (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
Nominal outside diameter of anchor is the same as the corresponding ANSI drill bit size.						

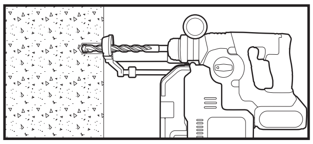
Material Specifications

Anchor Component	Component Material
Anchor Sleeve	Zamac Alloy
Cone	Zamac Alloy

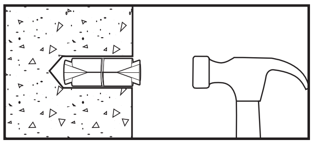


Installation Guidelines

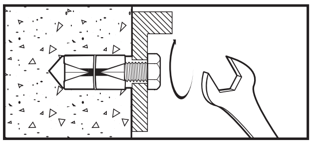
Drill a hole into the base material to the minimum depth required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15. Do not expand the anchor prior to installation. Do not over drill the hole unless the application calls for a subset anchor.



Insert anchor into the hole, threaded cone end first until the outer 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 Size in.	Minimum Embedment Depth 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)	710 (3.2)	1,110 (5.0)	900 (4.0)	1,135 (5.2)	1,220 (5.5)	1,335 (6.0)
5/16 (7.9)	1-1/2 (38.1)	1,130 (5.1)	1,735 (7.8)	1,500 (6.7)	2,020 (9.1)	2,160 (9.7)	2,155 (9.7)
3/8 (9.5)	1-3/4 (44.5)	1,365 (6.1)	2,690 (12.1)	2,000 (9.0)	3,000 (13.5)	3,085 (13.9)	4,030 (18.1)
1/2 (12.7)	2-1/4 (57.2)	2,590 (11.7)	3,740 (16.8)	3,550 (16.0)	4,310 (19.4)	4,645 (20.9)	6,930 (31.2)
5/8 (15.9)	2-1/2 (63.5)	4,290 (19.3)	9,640 (43.4)	6,150 (27.7)	10,270 (46.2)	6,890 (81.0)	11,580 (52.2)
3/4 (19.1)	3-1/2 (88.9)	6,000 (27.0)	10,920 (49.2)	8,150 (36.7)	13,330 (60.0)	11,510 (51.8)	14,480 (65.2)

1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, overhead and in sustained tensile loading applications.

Allowable Load Capacities for Double Expansion Anchor in Normal-Weight Concrete[1,2,3]

Rod/Anchor Size in.	Minimum Embedment Depth 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)	180 (0.8)	280 (1.3)	225 (1.0)	285 (1.3)	305 (1.4)	335 (1.5)
5/16 (7.9)	1-1/2 (38.1)	285 (1.3)	435 (20)	375 (1.7)	505 (2.3)	540 (2.4)	540 (2.4)
3/8 (9.5)	1-3/4 (44.5)	340 (1.5)	675 (3.0)	500 (2.3)	750 (3.4)	770 (3.5)	1,010 (4.5)
1/2 (12.7)	2-1/4 (57.2)	650 (2.9)	935 (4.2)	890 (4.0)	1,080 (4.9)	1,160 (5.2)	1,735 (7.8)
5/8 (15.9)	2-1/2 (63.5)	1,075 (4.8)	2,410 (10.9)	1,540 (6.9)	2,570 (11.6)	1,725 (20.3)	2,895 (13.1)
3/4 (19.1)	3-1/2 (88.9)	1,500 (6.8)	2,730 (12.3)	2,040 (9.2)	3,335 (15.0)	2,880 (13.0)	3,620 (16.3)

1. Allowable load capacities listed are calculated using and applied safety factor of 4.0. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, overhead and in sustained tensile loading applications.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.
3. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.

Ultimate and Allowable Load Capacities for Double Expansion Anchor in Hollow Concrete Masonry[1,2,3]

Rod/Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	f´m ≥ 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, minimum Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry cells may be grouted. Masonry compressive strength must be at the specified minimum at the time of installation (f'm ≥ 1,500 psi).
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, and in sustained tensile loading applications.
3. Anchors with diameters of 3/8" and 1/2" 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)	f´m ≥ 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)	4,460 (19.8)	6,055 (27.2)	890 (4.0)	1,210 (5.4)
3/4 (19.1)	3-1/2 (88.9)	6,000 (26.7)	7,935 (35.7)	1,200 (5.3)	1,585 (7.1)

1. Tabulated load values are for anchors installed in multiple wythe, minimum Grade SW, solid clay brick masonry walls conforming to ASTM C 62. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation (f'm ≥ 1,500 psi).
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, and in sustained tensile loading applications.

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Combined Loading

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

$$\left(\frac{Nu}{Nn}\right) + \left(\frac{Vu}{Vn}\right) \leq 1$$

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	$s_{cr} = 10d$	$F_{NS} = F_{VS} = 1.0$	$s_{min} = 5d$	$F_{NS} = F_{VS} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 8d$	$F_{NC} = 1.0$	$c_{min} = 5d$	$F_{NC} = 0.80$
	Shear	$c_{cr} = 12d$	$F_{VC} = 1.0$	$c_{min} = 5d$	$F_{VC} = 0.50$

1. Allowable load values found in the performance data tables are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances. Linear interpolation is allowed for intermediate anchor spacing and edge distances between critical and minimum distances. When an anchor is affected by both reduced spacing and edge distance, the spacing and edge reduction factors must be combined (multiplied). Multiple reduction factors for anchor spacing and edge distance may be required depending on the anchor group configuration.

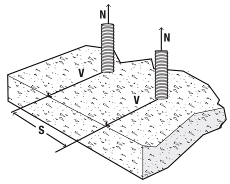
LOAD ADJUSTMENT FACTORS FOR NORMAL-WEIGHT CONCRETE

Spacing Distance, Tension (F_{NS} and F_{VS})

	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
Edge Distance, c (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	1.00	0.83	0.63	0.50	-
	3-3/4	1.00	1.00	1.00	0.75	0.60	0.50
	5	1.00	1.00	1.00	1.00	0.80	0.67
	6-1/4	1.00	1.00	1.00	1.00	1.00	0.83
	7-1/2	1.00	1.00	1.00	1.00	1.00	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.

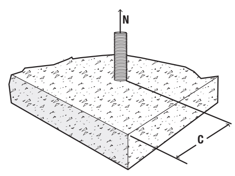


Edge Distance, Tension (F_{NC})

	Dia. (in.)	1/4	5/8	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	1.00	0.90	-	-	-
	4	1.00	1.00	0.93	0.80	-	-
	4-1/2	1.00	1.00	1.00	0.85	-	-
	5	1.00	1.00	1.00	0.90	0.80	-
	6	1.00	1.00	1.00	1.00	0.88	0.80
	7-1/2	1.00	1.00	1.00	1.00	1.00	0.90
	9	1.00	1.00	1.00	1.00	1.00	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.

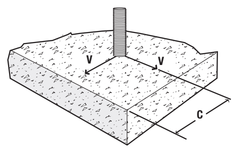


Edge Distance, Shear (F_{VC})

	Dia. (in.)	1/4	5/8	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	1.00	0.75	-	-	-
	4	1.00	1.00	0.83	0.50	-	-
	4-1/2	1.00	1.00	1.00	0.63	-	-
	5	1.00	1.00	1.00	0.75	0.50	-
	6	1.00	1.00	1.00	1.00	0.70	0.50
	7-1/2	1.00	1.00	1.00	1.00	1.00	0.75
	9	1.00	1.00	1.00	1.00	1.00	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.

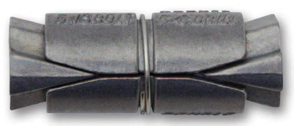
Minimum edge distance (c_{min}) is equal to 8 anchor diameters (8d) at which the anchor achieves 50% of load.



ORDERING INFORMATION

Double 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



GENERAL INFORMATION

SINGLE™

Shield Expansion Anchor

PRODUCT DESCRIPTION

The Single is a machine bolt anchor designed for use in concrete. 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 or life safety applications.

FEATURES AND BENEFITS

+ Readily accepts machine bolts
+ Internally threaded anchor for easy removability and service work
+ Corrosion resistant body

APPROVALS AND LISTINGS

- Tested in accordance with ASTM E488
- Federal GSA Specification – Meets the descriptive and proof load requirements of CID A-A 1923A, Type 2

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors and 05 05 19 - Post-Installed Concrete Anchors. Expansion anchors shall be Single as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

SINGLE

THREAD VERSION

- UNC Thread

ANCHOR MATERIALS

- Zamac Alloy

ANCHOR SIZE RANGE (TYP.)

- 1/4" to 5/8" 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"
ANSI Drill Bit Size, (in.)	1/2	5/8	5/8	7/8	1
Max. Tightening Torque, (ft.-lbs.)	5	7	10	20	30
Thread Size (UNC)	1/4-20	5/16-18	3/8-16	1/2-13	5/8-11
Thread Length In Cone (in.)	5/16	5/16	5/16	7/16	5/8
Overall Anchor Length (in.)	1-5/16	1-1/2	1-1/2	2-1/16	2-5/8

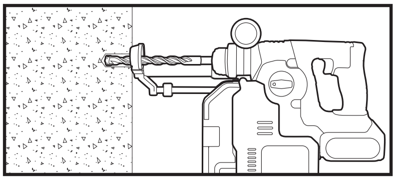
Nominal outside diameter of anchor is the same as the corresponding ANSI drill bit size

Material Specifications

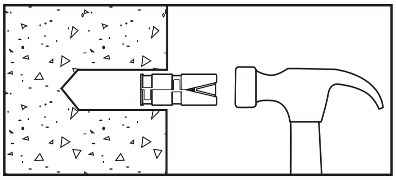
Anchor Component	Component Material
Anchor Sleeve	Zamac Alloy
Cone	Zamac Alloy

Installation Guidelines

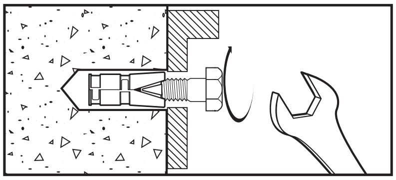
Drill a hole into the base material to the minimum depth required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15. Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



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.



MECHANICAL ANCHORS

SINGLE™
Shield Expansion Anchor

PERFORMANCE DATA

Ultimate Load Capacities for Single Expansion Anchor in Normal-Weight Concrete[1,2,3]

Rod/Anchor Size 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)	175 (0.8)	555 (2.5)	400 (1.8)	565 (2.5)	460 (2.1)	670 (3.0)
5/16 (7.9)	1-5/8 (41.3)	830 (3.7)	1,535 (6.9)	1,260 (5.7)	1,780 (8.0)	1,475 (6.6)	1,900 (8.6)
3/8 (9.5)	1-5/8 (41.3)	1,160 (5.2)	3,050 (13.7)	2,030 (9.1)	3,225 (14.5)	2,360 (10.6)	4,570 (20.6)
1/2 (12.7)	2-1/2 (63.5)	1,495 (6.7)	3,475 (15.7)	2,450 (11.0)	4,000 (18.0)	2,550 (11.5)	6,435 (29.0)
5/8 (15.9)	2-3/4 (69.9)	2,230 (10.0)	6,425 (28.9)	3,690 (16.6)	6,845 (30.8)	3,975 (17.9)	7,720 (34.8)

1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as in sustained tensile loading applications.

Allowable Load Capacities for Single Expansion Anchor in Normal-Weight Concrete[1,2,3]

Rod/Anchor Size 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)	45 (0.2)	140 (0.6)	100 (0.5)	140 (0.6)	115 (0.5)	170 (0.8)
5/16 (7.9)	1-5/8 (41.3)	210 (0.9)	385 (1.7)	315 (1.4)	445 (2.0)	370 (1.7)	475 (2.1)
3/8 (9.5)	1-5/8 (41.3)	290 (1.3)	765 (3.4)	510 (2.3)	805 (3.6)	590 (2.7)	1,145 (5.1)
1/2 (12.7)	2-1/2 (63.5)	375 (1.7)	870 (3.9)	615 (2.8)	1,000 (4.5)	640 (2.9)	1,610 (7.2)
5/8 (15.9)	2-3/4 (69.9)	560 (2.5)	1,605 (7.2)	925 (4.2)	1,710 (7.7)	995 (4.5)	1,930 (8.7)

1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities listed are calculated using and applied safety factor of 4.0. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as in sustained tensile loading applications.
3. Linear interpolation may be used to determine loads for intermediate compressive strengths.

ORDERING INFORMATION

Single 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

GENERAL INFORMATION

CALK-IN™

Mechanical 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 or for life safety.

GENERAL APPLICATIONS AND USES

- Windows
- Screens
- Sliding Doors
- Shutters

FEATURES AND BENEFITS

+ Readily accepts machine bolts
+ Internally threaded anchor for easy removability of attachment and service work
+ Shallow embedment

APPROVALS AND LISTINGS

- Federal GSA Specification – Meets descriptive and proof load requirements of CID A-A-1922A, Type 1

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Machine bolt anchors shall be Calk-In as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

CALK-IN

THREAD VERSION

- UNC Thread

ANCHOR MATERIALS

- Antimonial Lead Alloy Body and Zamac Alloy Cone

ANCHOR SIZE RANGE (TYP.)

- No. 8 Screw to 1/2" diameter

SUITABLE BASE MATERIALS

- Normal-weight concrete
- Grouted-filled Concrete Masonry (CMU)
- Brick Masonry

INSTALLATION AND MATERIAL SPECIFICATIONS

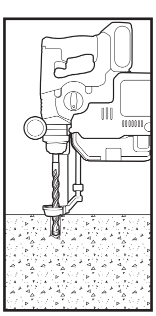
Installation Specifications

Dimension	Nominal Rod/Anchor Size					
	#8-32	#10-24	1/4"	5/16"	3/8"	1/2"
Nominal Length (in.)	1/2	5/8	7/8	1	1-1/4	1-1/2
ANSI Drill Bit Size, (in.)	5/16	3/8	1/2	5/8	3/4	7/8
Nominal Outside Dia. (in.)	5/16	3/8	1/2	5/8	3/4	7/8
Max. Tightening Torque	15 (in.-lbs.)	20 (in.-lbs.)	60 (in.-lbs.)	7 (ft.-lbs.)	10 (ft.-lbs.)	15 (ft.-lbs.)
Threaded Length in Cone (in.)	13/32	15/32	19/32	3/4	1	1-1/8

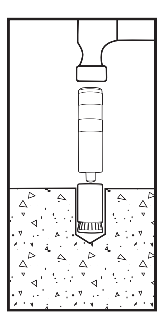
Material Specifications

Anchor Component	Component Material
Anchor Sleeve (Body)	Antimonial Lead Alloy
Cone	Zamac Alloy

Installation Instructions

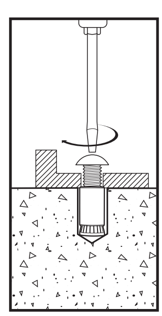


Step 1
Drill a hole into the base material to the required depth. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15. Do not over drill the hole.



Step 2
Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.

Insert the anchor into the hole, cone first. Position the setting tool in the anchor with shoulder in contact with the anchor sleeve. Using the tool, set the anchor by driving the sleeve using several sharp hammer blows.



Step 3
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. Do not exceed the maximum tightening torque.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Calk-In in Normal-Weight Concrete[1,2,3]

Rod / Anchor Size in.	Minimum Embed. Depth in.	Minimum Concrete Compressive Strength, f 'c											
		2,000 psi				4,000 psi				6,000 psi			
		Tension		Shear		Tension		Shear		Tension		Shear	
		Ultimate lbs.	Allowable lbs.	Ultimate lbs.	Allowable lbs.	Ultimate lbs.	Allowable lbs.	Ultimate lbs.	Allowable lbs.	Ultimate lbs.	Allowable lbs.	Ultimate lbs.	Allowable lbs.
#8-32	1/2	335	85	310	75	365	90	360	90	380	95	360	90
#10-24	5/8	765	190	885	220	975	245	940	235	1,105	275	940	235
1/4-20	7/8	1,200	300	1,355	340	1,500	375	1,410	355	1,640	410	1,410	355
5/16-18	1	1,570	390	1,880	470	1,965	490	2,070	520	2,160	540	2,070	520
3/8-16	1-1/4	1,985	495	2,700	675	2,485	620	3,305	825	2,895	725	3,305	825
1/2-13	1-1/2	2,795	700	3,995	1,000	3,495	875	4,545	1,135	3,810	950	4,545	1,135

1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending on the application such as in sustained tensile loading applications.
3. Linear interpolation may be used to determine allowable loads for anchors at intermediate embedment depths and compressive strengths.

Ultimate and Allowable Load Capacities for Calk-In in Grout-Filled Concrete Masonry[1,2]

Rod/Anchor Size in.	Minimum Embedment Depth in.	f´m ≥ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
#8-32	1/2	335	310	65	60
#10-24	5/8	740	885	150	175
1/4-20	7/8	880	1,250	175	250
5/16-18	1	1,470	1,585	295	315
3/8-16	1-1/4	1,700	2,265	340	455
1/2-13	1-1/2	2,360	3,210	470	640

1. Tabulated load values are for anchors installed in minimum 6-inch wide, minimum Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation (f'm ≥ 1,500 psi).
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as in sustained tensile loading applications.

Ultimate and Allowable Load Capacities for Calk-In in Clay Brick Masonry[1,2]

Rod/Anchor Size in.	Minimum Embedment Depth in.	f´m ≥ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
#8-32	1/2	335	310	65	60
#10-24	5/8	765	890	150	180
1/4-20	7/8	1,460	1,480	290	295
5/16-18	1	1,730	1,995	345	400
3/8-16	1-1/4	2,200	3,600	440	720
1/2-13	1-1/2	3,200	4,535	640	905

1. Tabulated load values are for anchors installed in minimum 6-inch wide, minimum Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation (f'm ≥ 1,500 psi).
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as in sustained tensile loading applications.

ORDERING INFORMATION

Calk-In Anchor and Setting Tools (Ordered Separately)

Anchor Cat. No.	Tool Cat. No.	Anchor Size	Drill Diameter	Min. Hole Depth	Std. Box	Std. Carton	Wt./100
9205	9201	#8-32	5/16"	1/2"	100	1,000	1
9210	9211	#10-24	3/8"	5/8"	100	1,000	1-3/4
9220	9221	1/4"-20	1/2"	7/8"	100	1,000	4-1/2
9225	9226	5/16"-18	5/8"	1"	50	250	7-3/4
9230	9231	3/8"-16	3/4"	1-1/4"	50	250	14
9240	9241	1/2"-13	7/8"	1-1/2	50	250	19

GENERAL INFORMATION

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. The Lag Shield is not recommended for overhead or life safety applications.

GENERAL APPLICATIONS AND USES

- Hard and Soft Base Materials
- Shallow Attachments
- Mortar Joints
- Masonry Anchorage

FEATURE AND BENEFITS

+ Ideal for use in masonry materials
+ Internally threaded anchor for easy removability and service work

APPROVALS AND LISTINGS

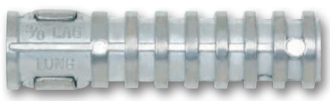
- Federal GSA Specification – Meets the descriptive and proof load requirements of CID A-A 1923A, Type 1
- Tested in accordance with ASTM E 488

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Shell Expansion Anchors shall be Lag Shield as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

LAG SHIELD - SHORT



LAG SHIELD - LONG

THREAD VERSION

- Lag Bolt

ANCHOR MATERIALS

- Zinc alloy

ANCHOR SIZE RANGE (TYP.)

- 1/4" to 3/4" diameter

SUITABLE BASE MATERIALS

- Normal-Weight Concrete
- Hollow Concrete Masonry (CMU)
- Brick Masonry

MECHANICAL ANCHORS

LAG SHIELD™ Shell Expansion Anchor

INSTALLATION AND MATERIAL SPECIFICATIONS

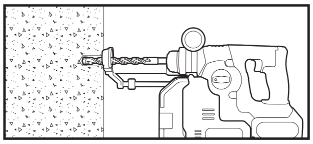
Installation Specifications						
Dimension	Rod/Anchor Diameter, d					
	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"
ANSI Drill Bit Size (in.)	1/2	1/2	5/8	3/4	7/8	1
Max. Tightening Torque, T_{max} (ft.-lbs.)	5	7	10	20	30	60
Lag Bolt Size	1/4-10	5/16-9	3/8-7	1/2-6	5/8-5	3/4-4-1/2

Material Specifications

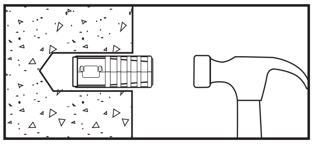
Anchor Component	Component Material
Anchor Sleeve	Zamac Alloy

Installation Guidelines

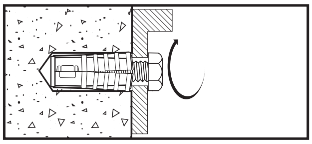
Drill a hole into the base material to the depth of at least 1/2" or one anchor diameter deeper than the embedment required. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15.



Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling. 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)	200 (0.9)	790 (3.5)	280 (1.2)	1,005 (4.1)	370 (1.6)	1,005 (4.5)
1/4 Long (6.4)	1-1/2 (38.1)	300 (1.3)	790 (3.5)	345 (1.5)	1,005 (4.1)	425 (1.9)	1,005 (4.5)
5/16 Short (7.9)	1-1/4 (31.8)	315 (1.4)	995 (4.4)	515 (2.3)	1,115 (4.9)	660 (2.9)	1,115 (4.9)
5/16 Long (7.9)	1-3/4 (44.5)	375 (1.7)	995 (4.4)	550 (2.4)	1,115 (4.9)	570 (2.5)	1,115 (4.9)
3/8 Short (9.5)	1-3/4 (44.5)	590 (2.6)	1,175 (5.2)	855 (3.8)	1,450 (6.4)	910 (4.0)	1,450 (6.4)
3/8 Long (9.5)	2-1/2 (63.5)	740 (3.3)	1,175 (5.2)	1,080 (4.8)	1,450 (6.4)	1,290 (5.7)	1,450 (64)
1/2 Short (12.7)	2 (50.8)	800 (3.6)	1,335 (5.9)	1,190 (5.3)	1,600 (7.1)	1,265 (5.6)	1,600 (7.1)
1/2 Long (12.7)	3 (76.2)	1,460 (6.5)	1,335 (5.9)	2,110 (9.4)	1,600 (7.1)	2,370 (10.5)	1,600 (7.1)
5/8 Short (15.9)	2 (50.8)	855 (3.8)	2,000 (8.9)	1,230 (5.5)	2,250 (10.0)	1,355 (6.0)	2,250 (10.0)
5/8 Long (15.9)	3-1/2 (88.9)	1,730 (7.7)	2,000 (8.9)	2,660 (10.8)	2,250 (10.0)	2,935 (13.0)	2,250 (10.0)
3/4 Short (19.1)	2 (50.8)	930 (4.1)	2,000 (8.9)	1,540 (6.8)	2,400 (10.6)	1,640 (17.3)	2,400 (10.6)
3/4 Long (19.1)	3-1/2 (88.9)	2,045 (9.1)	2,000 (8.9)	2,800 (12.5)	2,400 (10.6)	2,935 (13.0)	2,400 (10.6)

1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as in sustained tensile loading applications.

Allowable 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)	50 (0.2)	200 (0.9)	70 (0.3)	250 (1.1)	90 (0.4)	250 (1.1)
1/4 Long (6.4)	1-1/2 (38.1)	75 (0.3)	200 (0.9)	85 (0.4)	250 (1.1)	105 (0.5)	250 (1.1)
5/16 Short (7.9)	1-1/4 (31.8)	80 (0.3)	245 (1.1)	130 (0.6)	275 (1.2)	165 (0.7)	275 (1.2)
5/16 Long (7.9)	1-3/4 (44.5)	90 (0.4)	245 (1.1)	135 (0.6)	275 (1.2)	140 (0.6)	275 (1.2)
3/8 Short (9.5)	1-3/4 (44.5)	145 (0.6)	290 (1.3)	210 (0.9)	360 (1.6)	225 (1.0)	360 (1.6)
3/8 Long (9.5)	2-1/2 (63.5)	185 (0.8)	290 (1.3)	270 (1.2)	360 (1.6)	320 (1.4)	360 (1.6)
1/2 Short (12.7)	2 (50.8)	200 (1.9)	330 (1.5)	300 (1.3)	400 (1.8)	315 (1.4)	400 (1.8)
1/2 Long (12.7)	3 (76.2)	365 (1.6)	330 (1.5)	525 (2.3)	400 (1.8)	590 (2.6)	400 (1.8)
5/8 Short (15.9)	2 (50.8)	215 (1.9)	500 (2.2)	305 (1.1)	560 (2.5)	335 (1.5)	560 (2.5)
5/8 Long (15.9)	3-1/2 (88.9)	430 (1.9)	500 (2.2)	665 (3.0)	560 (2.5)	730 (3.2)	560 (2.5)
3/4 Short (19.1)	2 (50.8)	230 (1.0)	500 (2.2)	385 (1.7)	600 (2.7)	410 (1.8)	600 (2.7)
3/4 Long (19.1)	3-1/2 (88.9)	510 (2.3)	500 (2.2)	700 (3.1)	600 (2.7)	730 (3.2)	600 (2.7)

1. Allowable load capacities listed are calculated using and applied safety factor of 4.0. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as in sustained tensile loading applications.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.

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 ≥ 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, minimum Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry cells may be grouted. Masonry compressive strength must be at the specified minimum at the time of installation (f'm ≥ 1,500 psi).
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as in sustained tensile loading applications.
3. Anchors with diameters of 3/8" and greater installed in hollow concrete masonry units are limited to one anchor per unit cell.
4. Anchors installed flush with face shell surface. The wall thickness of the masonry unit must be equal to or greater than the embedment depth.

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 ≥ 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)

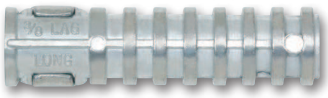
1. Tabulated load values are for anchors installed in multiple wythe, minimum Grade SW, solid clay brick masonry walls conforming to ASTM C 62. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation (f'm ≥ 1,500 psi).
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as in sustained tensile loading applications.

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"	1/2"	50	500	3
1055	1/4" Long	1/2"	1-1/2"	1"	50	500	4
1101	5/16" Short	1/2"	1-1/4"	3/4"	50	500	3
1105	5/16" Long	1/2"	1-3/4"	1"	50	500	4-1/4
1151	3/8" Short	5/8"	1-3/4"	1"	50	500	6-3/4
1155	3/8" Long	5/8"	2-1/2"	1-1/2"	50	250	9-1/2
1201	1/2" Short	3/4"	2"	1-1/8"	50	500	9-1/4
1205	1/2" Long	3/4"	3"	1-7/8"	50	200	14-1/4
1251	5/8" Short	7/8"	2"	1"	25	125	13
1255	5/8" Long	7/8"	3-1/2"	2 1/4"	25	125	22
1301	3/4" Short	1"	2"	1 1/8"	25	125	16
1305	3/4" Long	1"	3-1/2"	2 1/4"	25	100	24-1/2

SHORT


LONG

GENERAL INFORMATION

SPIKE®

Pin Anchor

PRODUCT DESCRIPTION

The Spike is a, one-piece, vibration resistant anchor for use in concrete block or stone. Several head styles, including tamperproof versions, 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-formed, there is no secondary tightening operation required which greatly reduces the overall cost of an anchor installation.

GENERAL APPLICATIONS AND USES

- Tamperproof applications
- Cable trays and strut
- Available in corrosion resistance stainless steel for exterior applications
- Pipe hanging
- Metal track attachments
- Concrete formwork

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 a simple to install alternative to direct fastening (e.g. powder actuated)

APPROVALS AND LISTINGS

- Tested in accordance with ASTM E488 and AC01 criteria

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Pre-expanded anchors shall be Spike as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

MATERIAL SPECIFICATIONS

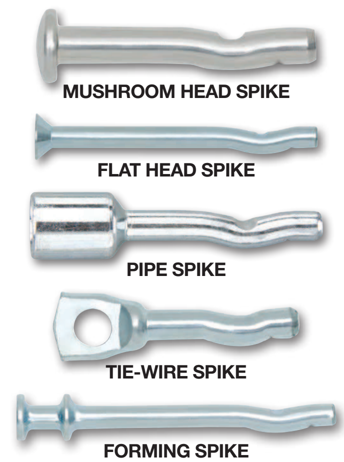
Carbon Steel (Mushroom Head, Flat Head, Pipe, Tie-Wire and Forming Spike)

Anchor Component	Component Material
Anchor Body	AISI 1038 Carbon Steel
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn5)

Stainless Steel (Mushroom Head)

Anchor Component	Component Material
Anchor Body	Type 316L Stainless Steel

SECTION CONTENTS



HEAD STYLE

- Mushroom Head
- Flat Head
- Pipe (Coupler Head)
- Tie-Wire
- Forming

ANCHOR MATERIALS

- Zinc Plated Carbon Steel
- Type 316 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

- 3/16" diameter through 1/2" diameters

SUITABLE BASE MATERIALS

- Normal-Weight Concrete
- Lightweight Concrete
- Grouted Concrete Masonry (CMU)

INSTALLATION SPECIFICATIONS

Mushroom Head Carbon Steel Spike

Dimension	Nominal Anchor Size, d			
	3/16"	1/4"	3/8"	1/2"
ANSI Drill Bit Size (in.)	3/16	1/4	3/8	1/2
Fixture Clearance Hole (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

Mushroom Head Stainless Steel Spike

Dimension	Nominal Anchor Size, d		
	3/16"	1/4"	3/8"
ANSI Drill Bit Size (in.)	3/16	1/4	3/8
Fixture Clearance Hole (in.)	1/4	5/16	7/16
Head Height (in.)	7/64	7/64	7/32
Head Size, O.D. (in.)	7/16	1/2	3/4

Flat Head Spike (80°– 82° Head)

Dimension	Nominal Anchor Size, d	
	3/16"	1/4"
ANSI Drill Bit Size (in.)	3/16	1/4
Fixture Clearance Hole (in.)	1/4	5/16
Head Height (in.)	7/64	9/64
Head Size, O.D. (in.)	3/8	1/2

Pipe Spike

Dimension	Nominal Anchor Size, d	
	1/4"	3/8"
ANSI Drill Bit Size (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	Nominal Anchor Size, d	
	3/16"	1/4"
ANSI Drill Bit Size (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

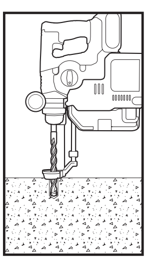
Forming Spike

Dimension	Nominal Anchor Size, d	
	3/16"	1/4"
ANSI Drill Bit Size (in.)	3/16	1/4
Fixture Clearance Hole (in.)	1/4	5/16
Head Height (in.)	9/16	9/16
Head Size, O.D. (in.)	13/32	1/2

INSTALLATION INSTRUCTIONS

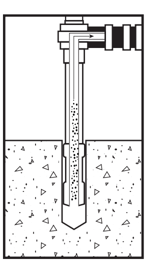
Mushroom/Flat Head Version

Using the proper diameter bit, drill a hole into the base material to a depth of at least one anchor diameter deeper than the embedment required.

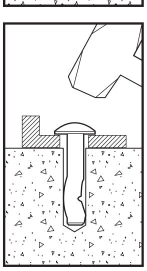


The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15

Remove dust and debris from the hole during drilling (e.g. dust extractor) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.

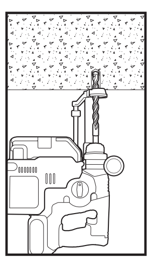


Drive the anchor through the fixture into the anchor hole until the head is firmly seated against the fixture. Be sure the anchor is driven to the required embedment depth.



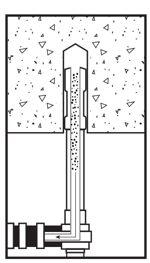
Pipe Spike Version

Using the proper diameter bit, drill a hole into the base material to a depth of at least one anchor diameter deeper than the embedment required.

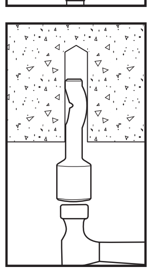


The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15

Remove dust and debris from the hole during drilling (e.g. dust extractor) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.

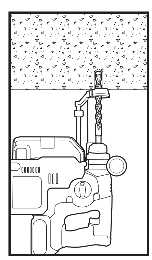


Drive the anchor into the hole until the head is firmly seated against the base material. Be sure the anchor is driven to the required embedment depth.



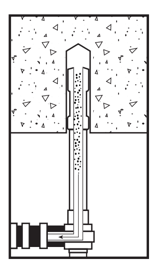
Tie-Wire Version

Using the proper diameter bit, drill a hole into the base material to a depth of at least one anchor diameter deeper than the embedment required.

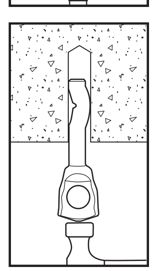


The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15

Remove dust and debris from the hole during drilling (e.g. dust extractor) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.

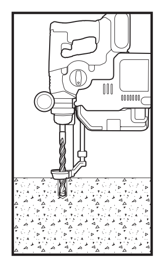


Drive the anchor into the hole until the head is firmly seated against the base material. Be sure the anchor is driven to the required embedment depth.



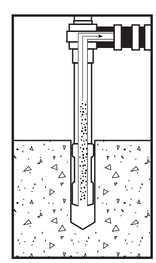
Forming Spike Version

Using the proper diameter bit, drill a hole into the base material to a depth of at least one anchor diameter deeper than the embedment required.

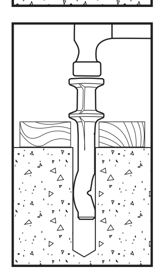


The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15

Remove dust and debris from the hole during drilling (e.g. dust extractor) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



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.



PERFORMANCE DATA

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

Anchor Diameter d in. (mm)	Minimum Embedment Depth 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)	560 (2.5)	1,270 (5.7)	660 (2.9)	1,310 (5.9)	690 (3.1)	1,350 (6.1)
	1 (25.4)	540 (2.4)	1,230 (5.5)	620 (2.8)	1,725 (7.8)	780 (3.5)	1,860 (8.4)	795 (3.5)	1,860 (8.4)
	1-1/4 (31.8)	780 (3.5)	1,800 (8.1)	900 (4.0)	2,000 (9.0)	1,060 (4.7)	2,155 (9.7)	1,120 (5.0)	2,310 (10.4)
1/4 (6.4)	1 (25.4)	620 (2.8)	1,585 (7.1)	775 (3.4)	1,965 (8.8)	835 (3.7)	2,160 (9.7)	885 (3.9)	2,360 (10.6)
	1-1/4 (31.8)	830 (3.7)	1,815 (8.2)	1,100 (4.9)	2,020 (9.1)	1,210 (5.4)	2,220 (10.0)	1,320 (5.9)	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. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.

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

Anchor Diameter d in. (mm)	Minimum Embedment Depth 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)	140 (0.6)	320 (1.4)	165 (0.7)	330 (1.5)	170 (0.8)	340 (1.5)
	1 (25.4)	135 (0.6)	310 (1.4)	155 (0.7)	430 (1.9)	195 (0.9)	465 (2.1)	200 (0.9)	465 (2.1)
	1-1/4 (31.8)	195 (0.9)	450 (2.0)	225 (1.0)	500 (2.3)	265 (1.2)	540 (2.4)	280 (1.2)	580 (2.6)
1/4 (6.4)	1 (25.4)	155 (0.7)	395 (1.8)	195 (0.9)	490 (2.2)	210 (0.9)	540 (2.4)	220 (1.0)	590 (2.7)
	1-1/4 (31.8)	210 (0.9)	455 (2.0)	275 (1.2)	505 (2.3)	300 (1.3)	555 (2.5)	330 (1.5)	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. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
3. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.

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

Anchor Diameter d in. (mm)	Minimum Embedment Depth 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)	560 (2.5)	1,155 (5.2)	660 (2.9)	1,220 (5.5)	690 (3.1)	1,290 (5.8)
	1 (25.4)	500 (2.3)	1,175 (5.3)	620 (2.8)	1,650 (7.4)	780 (3.5)	1,740 (7.8)	795 (3.5)	1,830 (8.2)
	1-1/4 (31.8)	740 (3.3)	1,735 (7.8)	900 (4.0)	1,930 (8.7)	1,060 (4.7)	2,040 (9.2)	1,120 (5.0)	2,150 (9.7)
1/4 (6.4)	1 (25.4)	620 (2.8)	1,565 (7.0)	775 (3.4)	1,845 (8.3)	835 (3.7)	2,095 (9.4)	885 (3.9)	2,250 (10.1)
	1-1/4 (31.8)	795 (3.6)	1,765 (7.9)	1,080 (4.9)	1,965 (8.8)	1,175 (5.2)	2,145 (9.7)	1,280 (5.7)	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. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.

ALLOWABLE STRESS DESIGN ASD

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

Anchor Diameter d in. (mm)	Minimum Embedment Depth 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)	140 (0.6)	290 (1.3)	165 (0.7)	305 (1.4)	170 (0.8)	325 (1.5)
	1 (25.4)	125 (0.6)	295 (1.3)	155 (0.7)	415 (1.9)	195 (0.9)	435 (2.0)	200 (0.9)	460 (2.1)
	1-1/4 (31.8)	185 (0.8)	435 (2.0)	225 (1.0)	485 (2.2)	265 (1.2)	510 (2.3)	280 (1.7)	540 (2.4)
1/4 (6.4)	1 (25.4)	155 (0.7)	390 (1.8)	195 (0.9)	460 (2.1)	210 (0.9)	525 (2.4)	220 (1.0)	565 (2.5)
	1-1/4 (31.8)	200 (0.9)	440 (2.0)	270 (1.2)	490 (2.2)	295 (1.3)	535 (2.4)	320 (1.4)	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. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
3. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.

Ultimate Load Capacities for Carbon Steel Pipe Spike in Normal-Weight Concrete[1,2]

Anchor Diameter d in. (mm)	Drill Bit Diameter in.	Minimum Embedment Depth 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)	2,000 (9.0)	2,180 (9.8)

1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.

ALLOWABLE STRESS DESIGN ASD

Allowable Load Capacities for Carbon Steel Pipe Spike in Normal-Weight Concrete[1,2,3]

Anchor Diameter d in. (mm)	Drill Bit Diameter in.	Minimum Embedment Depth 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)	500 (2.3)	545 (2.5)

1. Allowable load capacities are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.
3. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.

Ultimate Load Capacities for Carbon Steel Tie-Wire Spike in Normal-Weight Concrete[1,2]

Anchor Diameter d in. (mm)	Minimum Embedment Depth 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)	1-1/8 (28.6)	975 (4.4)	950 (4.3)	1,050 (4.7)	950 (4.3)	1,120 (5.0)	950 (4.3)
1/4 (6.4)	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. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.

ALLOWABLE STRESS DESIGN ASD

Allowable Load Capacities for Carbon Steel Tie-Wire Spike in Normal-Weight Concrete[1,2,3]

Anchor Diameter d in. (mm)	Minimum Embedment Depth , 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)	1-1/8 (28.6)	245 (1.1)	240 (1.1)	265 (1.2)	240 (1.1)	280 (1.3)	240 (1.1)
1/4 (6.4)	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. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.
3. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.

Ultimate Load Capacities for Carbon Steel Forming Spike in Normal-Weight Concrete[1,2]

Anchor Diameter d in. (mm)	Minimum Embedment Depth 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)	1,260 (5.7)	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)	1,410 (6.3)	2,585 (11.6)

1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.

Allowable Load Capacities for Carbon Steel Forming Spike in Normal-Weight Concrete[1,2,3]

Anchor Diameter d in. (mm)	Minimum Embedment Depth 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)	315 (1.4)	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)	355 (1.6)	645 (2.9)

1. Allowable load capacities are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.
3. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.

Ultimate Load Capacities for Spike in Lightweight Concrete[1,2,3]

Anchor Diameter d in. (mm)	Minimum Embedment Depth 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)	1-1/8 (28.6)	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)	1-1/8 (28.6)	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. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
3. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.

Allowable Load Capacities for Spike in Lightweight Concrete[1,2,3,4]

Anchor Diameter d in. (mm)	Minimum Embedment Depth 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)	1-1/8 (28.6)	110 (0.5)	320 (1.4)	100 (0.5)	320 (1.4)	95 (0.4)	320 (1.4)
1/4 (6.4)	1-1/8 (28.6)	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. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
3. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.
4. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.

Ultimate and Allowable Load Capacities for Spike Anchors in Concrete Over Steel Deck[1,2]

Anchor Diameter d in. (mm)	Minimum Embedment Depth in. (mm)	Lightweight Concrete Over Steel Deck f´c ≥ 3,000 psi (20.7 MPa)			
		Minimum 1-1/2" Wide Deck, 20 Gage Minimum			
		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. Tabulated load values are for carbon steel and stainless steel anchors installed in sand-lightweight concrete over steel deck. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities are calculated using a safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
3. Spacing distances shall be in accordance with the spacing table for lightweight concrete.
4. Anchors are permitted to be installed in the lower or upper flute of the steel deck provided the proper installation procedures are maintained. Minimum flute edge distance is 7/8-inch.

Ultimate and Allowable Load Capacities for Spike in Grouted Concrete Masonry[1,2,3,4]

Anchor Diameter d in. (mm)	Minimum Embedment Depth in. (mm)	f´m ≥ 1,500 psi (10.4 MPa)							
		Minimum 6" Wide CMU							
		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)	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, minimum Grade N, Type II, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry cells may be grouted. Masonry compressive strength must be at the specified minimum at the time of installation (f'm ≥ 1,500 psi)
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety, and in sustained tensile loading applications.
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 spacing and edge distance of 16 anchor diameters.

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	$s_{cr} = 2.0h_v$	$F_{NS} = F_{VS} = 1.0$	$s_{min} = h_v$	$F_{NS} = F_{VS} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 14d$	$F_{NC} = 1.0$	$c_{min} = 5d$	$F_{NC} = 0.80$
	Shear	$c_{cr} = 14d$	$F_{VC} = 1.0$	$c_{min} = 5d$	$F_{VC} = 0.50$

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	$s_{cr} = 3.0h_v$	$F_{NS} = F_{VS} = 1.0$	$s_{min} = 1.5h_v$	$F_{NS} = F_{VS} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 14d$	$F_{NC} = 1.0$	$c_{min} = 7d$	$F_{NC} = 0.80$
	Shear	$c_{cr} = 14d$	$F_{VC} = 1.0$	$c_{min} = 7d$	$F_{VC} = 0.50$

1. Allowable load values found in the performance data tables are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances. Linear interpolation is allowed for intermediate anchor spacing and edge distances between critical and minimum distances. When an anchor is affected by both reduced spacing and edge distance, the spacing and edge reduction factors must be combined (multiplied). Multiple reduction factors for anchor spacing and edge distance may be required depending on the anchor group configuration.

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

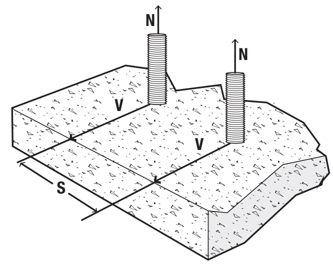
LOAD ADJUSTMENT FACTORS FOR NORMAL-WEIGHT CONCRETE

Spacing, Tension (F_{NS}) & Shear (F_{VS})

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
Distance (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	1.00	0.80	1.00	1.00	0.80	-	-
	2-1/2	1.00	1.00	1.00	1.00	1.00	1.00	0.50	-
	2-3/4	1.00	1.00	1.00	1.00	1.00	1.00	0.55	0.50
	3	1.00	1.00	1.00	1.00	1.00	1.00	0.60	0.55
	4	1.00	1.00	1.00	1.00	1.00	1.00	0.80	0.73
	5	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91
	5-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	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.

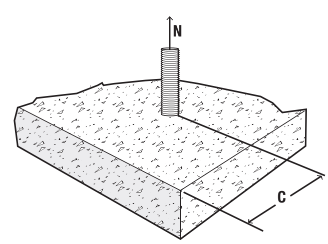


Edge Distance, Tension (F_{NC})

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
Distance (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	1.00	0.89	0.67	0.56
	3-1/2	1.00	1.00	0.74	0.61
	4	1.00	1.00	0.81	0.67
	5	1.00	1.00	0.96	0.78
	5-1/4	1.00	1.00	1.00	0.81
	6	1.00	1.00	1.00	0.89
	7	1.00	1.00	1.00	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.

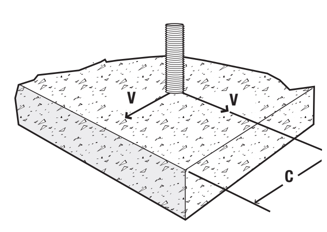


Edge Distance, Shear (F_{VC})

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
Distance (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	1.00	0.83	0.50	0.33
	3-1/2	1.00	1.00	0.61	0.42
	4	1.00	1.00	0.72	0.50
	5	1.00	1.00	0.94	0.67
	5-1/4	1.00	1.00	1.00	0.71
	6	1.00	1.00	1.00	0.83
	7	1.00	1.00	1.00	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.



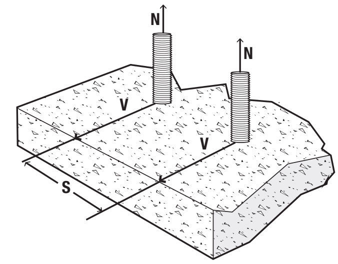
LOAD ADJUSTMENT FACTORS FOR LIGHTWEIGHT CONCRETE

Spacing, Tension (F_{NS}) & Shear (F_{VS})

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
Distance (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	1.00	0.80	1.00	1.00	0.80	-	-
	3-3/4	1.00	1.00	1.00	1.00	1.00	1.00	0.50	-
	4	1.00	1.00	1.00	1.00	1.00	1.00	0.53	-
	4-1/8	1.00	1.00	1.00	1.00	1.00	1.00	0.55	0.50
	5	1.00	1.00	1.00	1.00	1.00	1.00	0.67	0.61
	6	1.00	1.00	1.00	1.00	1.00	1.00	0.80	0.73
	7	1.00	1.00	1.00	1.00	1.00	1.00	0.93	0.85
	7-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91
	8-1/4	1.00	1.00	1.00	1.00	1.00	1.00	1.00	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.

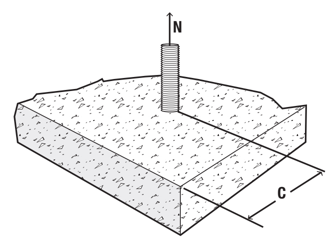


Edge Distance, Tension (F_{NC})

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
Distance (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	1.00	0.86	0.57	-
	3-1/2	1.00	1.00	0.67	0.50
	4	1.00	1.00	0.76	0.57
	5	1.00	1.00	0.95	0.71
	5-1/4	1.00	1.00	1.00	0.75
	6	1.00	1.00	1.00	0.86
	7	1.00	1.00	1.00	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.

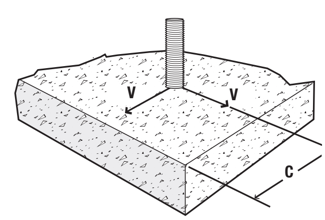


Edge Distance, Shear (F_{VC})

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
Distance (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	1.00	0.83	0.49	-
	3-1/2	1.00	1.00	0.60	0.40
	4	1.00	1.00	0.71	0.49
	5	1.00	1.00	0.94	0.66
	5-1/4	1.00	1.00	1.00	0.70
	6	1.00	1.00	1.00	0.83
	7	1.00	1.00	1.00	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.



MECHANICAL ANCHORS

SPIKE® Pin Anchor

ORDERING INFORMATION

Mushroom Head Spike (Tamperproof)

Carbon Steel Cat. No.	Stainless Steel Cat. No.	Anchor Size	Drill Diameter	Min. Embed.	Std. Box	Std. Carton	Wt./100
5502	6602	3/16" x 1"	3/16"	7/8"	100	1,000	1-1/4
5503	6603	3/16" x 1-1/4"	3/16"	7/8"	100	1,000	1-1/2
5504	6604	3/16" x 1-1/2"	3/16"	1-1/4"	100	1,000	1-3/4
5506	6606	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	600	2
5510	-	3/16" x 3"	3/16"	1-1/4"	100	600	2-1/2
5511	-	3/16" x 3-1/2"	3/16"	1-1/4"	100	600	3-1/2
5512	-	3/16" x 4"	3/16"	1-1/4"	100	600	4
5522	-	1/4" x 1"	1/4"	7/8"	100	1,000	1-1/2
5523	6623	1/4" x 1-1/4"	1/4"	1"	100	1,000	2-1/4
5524	6624	1/4" x 1-1/2"	1/4"	1-1/4"	100	1,000	2-1/2
5526	6626	1/4" x 2"	1/4"	1-1/4"	100	600	3
5528	6628	1/4" x 2-1/2"	1/4"	1-1/4"	100	600	4
5530	6630	1/4" x 3"	1/4"	1-1/4"	100	600	4-1/2
5531	-	1/4" x 3-1/2"	1/4"	1-1/4"	100	600	4-1/2
5532	-	1/4" x 4"	1/4"	1-1/4"	100	600	5-1/2
5546	6646	3/8" x 2"	3/8"	1-3/4"	25	250	7-1/2
5548	6648	3/8" x 2-1/2"	3/8"	1-3/4"	25	150	9
5550	6650	3/8" x 3"	3/8"	1-3/4"	25	150	10
5551	-	3/8" x 3-1/2"	3/8"	1-3/4"	25	150	11
5552	-	3/8" x 4"	3/8"	1-3/4"	25	150	11
5554	-	3/8" x 5"	3/8"	1-3/4"	25	150	11
5556	-	3/8" x 6"	3/8"	1-3/4"	25	125	11
5569	-	1/2" x 2-3/4"	1/2"	2-1/2"	50	200	13
5571	-	1/2" x 3-1/2"	1/2"	2-1/2"	50	150	13
5572	-	1/2" x 4"	1/2"	2-1/2"	25	125	13
5574	-	1/2" x 5"	1/2"	2-1/2"	25	125	13
5577	-	1/2" x 6-1/2"	1/2"	2-1/2"	25	100	13
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	600	2
5610	3/16" x 3"	3/16"	1-1/4"	100	600	2-1/2
5612	3/16" x 4"	3/16"	1-1/4"	100	600	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	600	3
5628	1/4" x 2-1/2"	1/4"	1-1/4"	100	600	3-3/4
5630	1/4" x 3"	1/4"	1-1/4"	100	600	4-1/2
5631	1/4" x 3-1/2"	1/4"	1-1/4"	100	600	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.						

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	600	4
3758	3/8"	1/4"	1-3/4"	50	300	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	600	2
3759	1/4"	1/4"	1-1/8"	9/32"	100	600	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	600	2-1/2
3796	3/16" x 2"	3/16"	1-1/4"	100	600	3
3797	3/16" x 2-3/4"	3/16"	1-1/4"	100	600	4
3794	1/4" x 2-3/4"	1/4"	1-1/4"	100	500	5
Designed for concrete forming. The published length is measured from below the head to the end of the anchor.						

GENERAL INFORMATION

DRIVE®

Pin Anchor

PRODUCT DESCRIPTION

The Drive is a one-piece, tamperproof, pre-formed anchor available in carbon steel for use in concrete. Tie-Wire Drive anchors are designed 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 other applications requiring fast, permanent installations.

GENERAL APPLICATIONS AND USES

- Tamperproof Applications
- Suspended Ceilings

FEATURE AND BENEFITS

- Pre-expanded anchor design allows for easy installation
- Round And Flat Head Anchors Are Tamperproof

APPROVALS AND LISTINGS

- Tested in accordance with ASTM E488
- Underwriters Laboratory (UL Listed) – VFXT. EX1289

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors and 05 05 19 - Post-Installed Concrete Anchors. Pre-expanded anchors shall be Drive as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

MATERIAL SPECIFICATIONS

Anchor Component	Component Material
Anchor Body	Heat Treated Carbon Steel
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn 5)

SECTION CONTENTS

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 to 1/2" diameter

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 (in.)	3/16	1/4	3/8	1/2
Fixture Clearance Hole (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

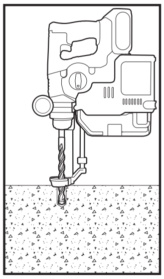
Dimension	Anchor Size, d	
	3/16"	1/4"
ANSI Drill Bit Size (in.)	3/16	1/4
Fixture Clearance Hole (in.)	1/4	5/16
Head Height (in.)	7/64	9/64
Head Width (in.)	3/8	1/2

Tie-Wire Drive

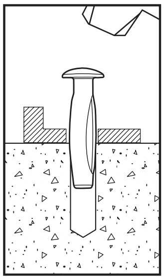
Dimension	Anchor Size, d
	1/4"
ANSI Drill Bit Size (in.)	1/4
Head Height (in.)	5/8
Tie-Wire Hole Diameter (in.)	13/64

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 must meet the requirements of ANSI Standard B212.15. Remove dust and debris from the hole during drilling (e.g. dust extractor) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



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 Mushroom and Flat Head Drive in Normal-Weight Concrete[1,2]

Anchor Diameter d in.	Minimum Embedment Depth in.	Minimum Concrete Compressive Strength (f´c)					
		2,000 psi		4,000 psi		6,000 psi	
		Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
3/16	7/8	700	1,100	1,080	1,365	1,080	1,370
1/4	1-1/8	1,320	1,665	1,760	2,090	1,760	2,090
3/8	1-7/8	2,275	5,580	4,240	7,030	4,240	7,030
1/2	2-5/8	2,560	7,945	4,960	10,205	4,960	10,205

1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.

Allowable Load Capacities for Mushroom and Flat Head Drive in Normal-Weight Concrete[1,2,3]

Anchor Diameter d in.	Minimum Embedment Depth in.	Minimum Concrete Compressive Strength (f´c)					
		2,000 psi		4,000 psi		6,000 psi	
		Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
3/16	7/8	175	275	270	340	270	345
1/4	1-1/8	330	415	440	525	440	525
3/8	1-7/8	570	1,395	1,060	1,760	1,060	1,760
1/2	2-5/8	640	1,985	1,240	2,550	1,240	2,550

1. Allowable load capacities listed are calculated using and applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.
3. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.

Ultimate Load Capacities for Tie-Wire Drive in Normal-Weight Concrete[1,2]

Anchor Diameter d in.	Minimum Embedment Depth in.	Minimum Concrete Compressive Strength (f´c)					
		2,000 psi		4,000 psi		6,000 psi	
		Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
1/4	1-1/8	1,320	1,100	1,760	1,560	1,760	1,560

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

Allowable Load Capacities for Tie-Wire Drive in Normal-Weight Concrete[1,2,3]

Anchor Diameter d in.	Minimum Embedment Depth in.	Minimum Concrete Compressive Strength (f´c)					
		2,000 psi		4,000 psi		6,000 psi	
		Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
1/4	1-1/8	330	275	440	390	440	390

1. Allowable load capacities listed are calculated using and applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.
3. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

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

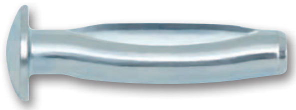
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (s)	Tension and Shear	$s_{cr} = 10d$	$F_{NS} = F_{VS} = 1.0$	$s_{min} = 5d$	$F_{NS} = F_{VS} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_{NC} = 1.0$	$c_{min} = 5d$	$F_{NC} = 0.80$
	Shear	$c_{cr} = 12d$	$F_{VC} = 1.0$	$c_{min} = 5d$	$F_{VC} = 0.50$

1. Allowable load values found in the performance data tables are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances. Linear interpolation is allowed for intermediate anchor spacing and edge distances between critical and minimum distances. When an anchor is affected by both reduced spacing and edge distance, the spacing and edge reduction factors must be combined (multiplied). Multiple reduction factors for anchor spacing and edge distance may be required depending on the anchor group configuration.

ORDERING INFORMATION

Round Head Drive

Cat. No.	Size	Drill Dia.	Min. Embed.	Std. Box	Std. Carton	Wt./100
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

GENERAL INFORMATION

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 zinc plated carbon steel or Perma-Seal™ coated drive screw, this anchor has been developed as an improvement over standard nailin anchors.

The Zamac Hammer-Screw has been designed to provide a removable anchor with higher tension load capacities compared with traditional nailin when installed in concrete. The anchor is not recommended for overhead, life-safety or sustained tensile loading applications (see performance data section).

GENERAL APPLICATIONS AND USES

- Brick ties and masonry anchorage
- Electrical fixtures
- Signage
- Flashing
- Drywall track
- Maintenance
- Surveillance equipment
- Light gage attachments

FEATURES AND BENEFITS

+ General purpose anchoring
+ Installs in a variety of base materials
+ Removable anchor - screw can be backed out with a Phillips head driver

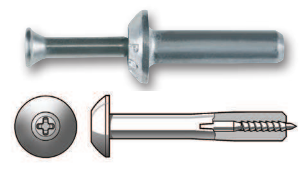
APPROVALS AND LISTINGS

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: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Anchors shall be Zamac Hammer-Screw anchors as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS



ZAMAC HAMMER-SCREW

ANCHOR MATERIALS

- Zamac Alloy body with Carbon Steel Drive Screw or Perma-Seal Coated Carbon Steel Drive Screw

ANCHOR SIZE RANGE (TYP.)

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

SUITABLE BASE MATERIALS

- Normal-Weight Concrete
- Concrete Masonry (CMU)
- Brick Masonry
- Stone

INSTALLATION AND MATERIAL SPECIFICATIONS

Installation Specifications

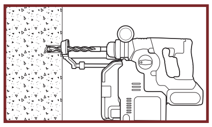
Dimension	Anchor Diameter, d
	1/4
ANSI Drill Bit Size (in.)	1/4
Fixture Clearance Hole (in.)	5/16
Head Height (in.)	9/64
Head Width (in.)	35/64

Material Specifications

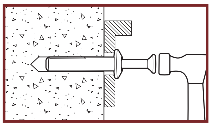
Anchor Component	Mushroom Head Carbon Steel Screw	Mushroom Head Perma-Seal Coated Screw
Anchor Body	Zamac Alloy	Zamac Alloy
Drive Screw	AISI 1018	AISI 1018
Screw Plating/ Coating	ASTM B 633, SC1, Type III (Fe/Zn5)	Perma-Seal™ coating

Installation Guidelines

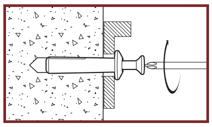
1. Drill a hole into the base material to a depth of at least 1/4" deeper than the required embedment. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15. Remove dust and debris from the hole during drilling (e.g. dust extractor) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



2. 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. Take care not to overdrive the screw. This anchor is not recommended for installations at an angle or for use overhead.



Optional: 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 and Allowable Load Capacities for Zamac Hammer-Screw in Normal-Weight Concrete[1,2,3,4,5]

Rod/ Anchor Diameter d in. (mm)	Min. Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength, f 'c											
		2,000 psi				4,000 psi				6,000 psi			
		Tension		Shear		Tension		Shear		Tension		Shear	
		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)	Ultimate lbs. (kN)	Allowable lbs. (kN)
1/4 (6.4)	5/8 (16)	675 (3.0)	170 (0.8)	650 (2.9)	165 (0.7)	850 (3.8)	215 (1.0)	880 (3.9)	220 (1.0)	890 (4.0)	225 (1.0)	880 (3.9)	220 (1.0)
	3/4 (19)	790 (3.5)	200 (0.9)	805 (3.6)	200 (0.9)	1,135 (5.0)	285 (1.3)	1,115 (5.0)	280 (1.2)	1,190 (5.3)	300 (1.3)	1,115 (5.0)	280 (1.2)
	7/8 (22)	930 (4.1)	235 (1.0)	990 (4.4)	250 (1.1)	1,205 (5.4)	300 (1.3)	1,230 (5.5)	310 (1.4)	1,250 (5.6)	315 (1.4)	1,230 (5.5)	310 (1.4)
	1-1/8 (29)	1,220 (5.4)	305 (1.4)	1,365 (6.1)	340 (1.5)	1,350 (6.0)	340 (1.5)	1,470 (6.5)	370 (1.6)	1,450 (6.4)	365 (1.6)	1,470 (6.5)	370 (1.6)
	1-3/8 (35)	1,325 (5.9)	330 (1.5)	1,555 (6.9)	390 (1.7)	1,450 (6.4)	365 (1.6)	1,645 (7.3)	410 (1.8)	1,530 (6.8)	385 (1.7)	1,645 (7.3)	410 (1.8)
	1-3/4 (44)	1,480 (6.6)	370 (1.6)	1,840 (8.2)	460 (2.0)	1,600 (7.1)	400 (1.8)	1,910 (8.5)	480 (2.1)	1,660 (7.4)	415 (1.8)	1,910 (8.5)	480 (2.1)
	1-7/8 (48)	1,480 (6.6)	370 (1.6)	1,840 (8.2)	460 (2.0)	1,600 (7.1)	400 (1.8)	1,910 (8.5)	480 (2.1)	1,660 (7.4)	415 (1.8)	1,910 (8.5)	480 (2.1)

1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending on the application, such as in sustained tensile loading applications.
3. Linear interpolation may be used to determine allowable loads for anchors at intermediate embedment depths and compressive strengths.
4. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.
5. Anchors installed flush with face or end of concrete surface.

Ultimate and Allowable Load Capacities for Zamac Hammer-Screw in Hollow Concrete Masonry[1,2,3,4]

Nominal Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	f´m ≥ 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 Type N, S or M. Masonry compressive strength must be 1,500 psi minimum at the time of installation. Hollow masonry cells may also be grouted or solid.
2. 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.
3. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as in sustained tensile loading applications.
4. Anchors installed flush with face or end of masonry surface.

Ultimate and Allowable Load Capacities for Zamac-Hammer Screw in Solid Clay Brick Masonry[1,2,3,4]

Nominal Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	f´m ≥ 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)	1,025 (4.6)	135 (0.6)	205 (0.9)
	3/4 (19.1)	930 (4.2)	1,200 (5.3)	185 (0.8)	240 (1.1)
	1 (25.4)	990 (4.5)	1,350 (6.0)	200 (0.9)	270 (1.2)
	1-1/8 (28.6)	1,040 (4.7)	1,350 (6.0)	210 (0.9)	270 (1.2)
	1-3/8 (34.9)	1,150 (5.2)	1,350 (6.0)	230 (1.0)	270 (1.2)
	1-1/2 (38.1)	1,260 (5.7)	1,350 (6.0)	250 (1.1)	270 (1.2)

1. Tabulated load values are for anchors installed in multiple wythe, minimum Grade SW, solid clay brick masonry walls conforming to ASTM C 62. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation (f'm ≥ 1,500 psi).
2. 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.
3. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as in sustained tensile loading applications.
4. Anchors installed flush with face or end of masonry surface.

DESIGN CRITERIA

Combined Loading

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

$$\left(\frac{Nu}{Nn}\right) + \left(\frac{Vu}{Vn}\right) \leq 1$$

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

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

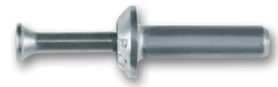
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (s)	Tension and Shear	$s_{cr} = 10d$	$F_{NS} = F_{VS} = 1.0$	$s_{min} = 5d$	$F_{NS} = F_{VS} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_{NC} = 1.0$	$c_{min} = 6d$	$F_{NC} = 0.80$
	Shear	$c_{cr} = 12d$	$F_{VC} = 1.0$	$c_{min} = 6d$	$F_{VC} = 0.50$

1. Allowable load values found in the performance data tables are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances. Linear interpolation is allowed for intermediate anchor spacing and edge distances between critical and minimum distances. When an anchor is affected by both reduced spacing and edge distance, the spacing and edge reduction factors must be combined (multiplied). Multiple reduction factors for anchor spacing and edge distance may be required depending on the anchor group configuration.

ORDERING INFORMATION

Mushroom Head with No. 2 Phillips Head Screw

Catalog Number	Anchor Size	Drill Diameter	Standard Box	Standard Carton	Wt./ 100
2839	1/4" x 3/4"	1/4"	100	500	1-1/2
2840	1/4" x 1"	1/4"	100	500	1-3/4
2842	1/4" x 1-1/4"	1/4"	100	500	2-1/4
2844	1/4" x 1-1/2"	1/4"	100	500	2-1/2
2846	1/4" x 2"	1/4"	100	500	3
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
The published size includes the diameter and length of the anchor measured from under the shoulder of the anchor body.					

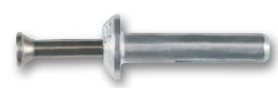


Master Pack

Catalog Number	Anchor Size	Drill Diameter	Standard Box	Standard Carton	Wt./ 100
2939	1/4" x 3/4"	1/4"	-	1,000	1-1/2
2940	1/4" x 1"	1/4"	-	1,000	1-3/4
2942	1/4" x 1-1/4"	1/4"	-	1,000	2-1/4
2944	1/4" x 1-1/2"	1/4"	-	1,000	2-1/2
2946	1/4" x 2"	1/4"	-	1,000	3
2948	1/4" x 2-1/4"	1/4"	-	1,000	3-1/2
2949	1/4" x 3"	1/4"	-	1,000	4-1/4
The published size includes the diameter and length of the anchor measured from under the shoulder of the anchor body.					

Mushroom Head with No. 2 Phillips Head Perma-Seal™ Coated 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	2-1/4
The published size includes the diameter and length of the anchor measured from under the shoulder of the anchor body.					



GENERAL INFORMATION

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. The anchor is not recommend for overhead, life-safety or sustained tensile loading applications (see performance data section).

GENERAL APPLICATIONS AND USES

- Roof Flashing
- Mechanical Attachments
- Brick Ties and Masonry Anchorage
- Furring Strips
- Electrical Fixtures
- Maintenance

FEATURES AND BENEFITS

+ General purpose anchoring
+ Installs in a variety of base materials

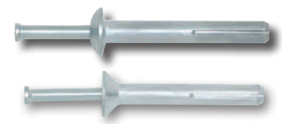
APPROVALS AND LISTINGS

- Federal GSA Specification Meets the proof load requirements of FF-S-325C, Group V, Type 2, Class 3, (superseded) and CID A-A 1925A, Type 1 (mushroom head) & Type 2 (flat head)

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors, and 05 05 19 - Post-Installed Concrete Anchors. Anchors shall be Zamac Nailin anchors as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS



ZAMAC NAILIN

ANCHOR MATERIALS

Zamac Alloy body with Carbon or Stainless Steel Drive Nail

ANCHOR SIZE RANGE (TYP.)

- 3/16" diameter x 7/8" length to 1/4" diameter x 3" diameter

SUITABLE BASE MATERIALS

- Normal-Weight Concrete
- Concrete Masonry (CMU)
- 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 (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 (in.)	13/32	35/64	35/64

MH = Mushroom Head FH = Flat Head

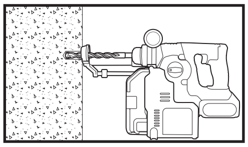
Material Specifications

Anchor Component	Component Material		
	Mushroom Head CS Nail	Flat Head CS Nail	Mushroom Head 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/Zn5)		N/A

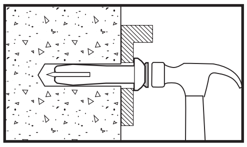
CS = Carbon Steel SS = Stainless Steel

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. Remove dust and debris from the hole during drilling (e.g. dust extractor) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



Insert the anchor through the fixture and into the drilled hole. 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 the nail. This anchor is not recommended for installations at an angle or for use overhead.



PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Zamac Nailin in Normal-Weight Concrete[1,2,3,4,5]

Nominal Anchor Diameter d in.	Min. Embed. Depth in. (mm)	Minimum Concrete Compressive Strength, f 'c											
		2,000 psi				4,000 psi				6,000 psi			
		Tension		Shear		Tension		Shear		Tension		Shear	
		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)	Ultimate lbs. (kN)	Allowable lbs. (kN)
3/16	3/4 (19)	285 (1.3)	70 (0.3)	415 (1.8)	105 (0.5)	400 (1.8)	100 (0.4)	560 (2.5)	140 (0.6)	480 (2.1)	120 (0.5)	560 (2.5)	140 (0.6)
1/4	5/8 (16)	410 (1.8)	105 (0.5)	440 (2.0)	110 (0.5)	580 (2.6)	145 (0.6)	655 (2.9)	165 (0.7)	580 (2.6)	145 (0.6)	655 (2.9)	165 (0.7)
	3/4 (19)	540 (2.4)	135 (0.6)	600 (2.7)	150 (0.7)	765 (3.4)	190 (0.8)	850 (3.8)	215 (1.0)	800 (3.6)	200 (0.9)	850 (3.8)	215 (1.0)
	1 (25)	620 (2.8)	155 (0.7)	640 (2.8)	160 (0.7)	875 (3.9)	220 (1.0)	890 (4.0)	225 (1.0)	895 (4.0)	225 (1.0)	890 (4.0)	225 (1.0)
	1-1/4 (32)	700 (3.1)	175 (0.8)	720 (3.2)	180 (0.8)	990 (4.4)	250 (1.1)	970 (4.3)	245 (1.1)	990 (4.4)	250 (1.1)	990 (4.4)	250 (1.1)

1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities listed are calculated using and applied safety factor of 4.0. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as in sustained tensile loading applications.
3. Linear interpolation may be used to determine allowable loads for anchors at intermediate embedment depths and compressive strengths.
4. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.
5. Anchors installed flush with face or end of concrete surface.

Ultimate and Allowable Load Capacities for Zamac Nailin in Hollow Concrete Masonry[1,2,3]

Nominal Anchor Diameter d in.	Minimum Embedment Depth in. (mm)	f´m ≥ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16	3/4 (19.1)	270 (1.2)	560 (2.5)	55 (0.2)	110 (0.5)
1/4	5/8 (15.9)	360 (1.6)	655 (2.9)	70 (0.3)	130 (0.6)
	3/4 (19.1)	735 (3.3)	850 (3.8)	145 (0.7)	170 (0.8)
	1 (25.4)	835 (3.8)	890 (4.0)	165 (0.7)	180 (0.8)
	1-1/4 (31.7)	990 (4.4)	970 (4.3)	200 (0.9)	195 (0.9)

1. Tabulated load values are for anchors installed in minimum 6-inch wide, minimum Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation (f'm ≥ 1,500 psi). Hollow masonry cells may also be grouted or solid.
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as in sustained tensile loading applications.
3. Anchors installed flush with face or end of masonry surface.

Ultimate and Allowable Load Capacities for Zamac Nailin in Solid or Hollow Clay Brick Masonry[1,2,3]

Nominal Anchor Diameter d in.	Minimum Embedment Depth in. (mm)	f´m ≥ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16	3/4 (19.1)	460 (2.1)	550 (2.5)	90 (0.4)	110 (0.5)
1/4	5/8 (15.9)	570 (2.6)	750 (3.3)	115 (0.5)	150 (0.7)
	3/4 (19.1)	790 (3.6)	840 (3.7)	160 (0.7)	170 (0.8)
	1 (25.4)	820 (3.7)	840 (3.7)	165 (0.7)	170 (0.8)
	1-1/4 (31.7)	865 (3.9)	840 (3.7)	175 (0.8)	170 (0.8)

1. Tabulated load values are for anchors installed in multiple wythe, minimum Grade SW, solid clay brick masonry walls conforming to ASTM C 62. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation (f'm ≥ 1,500 psi).
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as in sustained tensile loading applications.
3. Anchors installed flush with face or end of masonry surface.

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 V_u = Applied Service Shear Load
N_n = Allowable Tension Load V_n = Allowable Shear Load

Load Adjustment Factors for Spacing and Edge Distances 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} = 10d	$F_{NS} = F_{VS}$ = 1.0	s_{min} = 5d	$F_{NS} = F_{VS}$ = 0.50
Edge Distnace (c)	Tension	c_{cr} = 12d	F_{NC} = 1.0	c_{min} = 6d	F_{NC} = 0.80
	Shear	c_{cr} = 12d	F_{VC} = 1.0	c_{min} = 6d	F_{VC} = 0.50

1. Allowable load values found in the performance data tables are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances. Linear interpolation is allowed for intermediate anchor spacing and edge distances between critical and minimum distances. When an anchor is affected by both reduced spacing and edge distance, the spacing and edge reduction factors must be combined (multiplied). Multiple reduction factors for anchor spacing and edge distance may be required depending on the anchor group configuration.

ORDERING INFORMATION

Mushroom Head Zamac Nailin with Carbon Steel Nail

Catalog Number	Anchor Size	Drill Diameter	Standard Box	Standard 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

The published size includes the diameter and length of the anchor measured from under the shoulder of the anchor body.

Master Pack Mushroom Head Zamac Nailin with Carbon Steel Nail

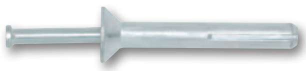
Catalog Number	Anchor Size	Drill Diameter	Standard Box	Standard Carton	Wt./ 100
2803	3/16" x 7/8"	3/16"	–	1,000	3/4
2807	1/4" x 3/4"	1/4"	–	1,000	1-1/2
2809	1/4" x 1"	1/4"	–	1,000	1-3/4
2815	1/4" x 1-1/4"	1/4"	–	1,000	2-1/4
2821	1/4" x 1-1/2"	1/4"	–	1,000	2-1/2
2827	1/4" x 2"	1/4"	–	1,000	3
2805	1/4" x 3"	1/4"	–	1,000	4

The published size includes the diameter and length of the anchor measured from under the shoulder of the anchor body.

Flat Head Zamac Nailin with Carbon Steel Nailin

Catalog Number	Anchor Size	Drill Diameter	Standard Box	Standard 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

The published size includes the diameter and length of the anchor measured from under the shoulder of the anchor body.



Mushroom Head Zamac Nailin with Stainless Steel Nailin

Catalog Number	Anchor Size	Drill Diameter	Standard Box	Standard 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

The published size includes the diameter and length of the anchor measured from under the shoulder of the anchor body.

GENERAL INFORMATION

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 overhead, life-safety or sustained tensile loading applications.

GENERAL APPLICATIONS AND USES

- Brick Ties and Masonry Anchorage
- Furring Strips
- Electrical Fixtures
- Maintenance
- Copper Flashing
- Aluminum Frames

FEATURES AND BENEFITS

+ General purpose anchoring
+ Installs in a variety of base materials

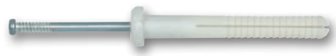
APPROVALS AND LISTINGS

- 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: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Anchors shall be Nylon Nailin anchors as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS



ROUND HEAD NYLON NAILIN

FLAT HEAD NYLON NAILIN

MUSHROOM HEAD NYLON NAILIN

ANCHOR MATERIALS

- Nylon Body 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

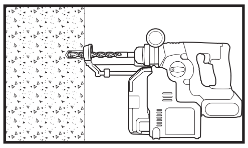
Dimension	Anchor Diameter, d					
	3/16"			1/4"		
	RH	FH	MH	RH	FH	MH
ANSI Drill Bit Size (in.)	3/16	3/16	3/16	1/4	1/4	1/4
Fixture Clearance Hole (in.)	1/4	1/4	1/4	5/16	5/16	5/16
Head Height (in.)	1/8	1/8	1/8	1/8	1/8	1/8
Head Width (in.)	3/8	3/8	9/16	7/16	7/16	9/16

Material Specifications

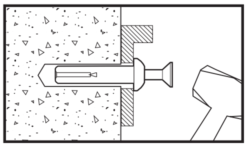
Anchor Component	Component Material			
	Round Head	Flat Head	Mushroom Head	
			Carbon	Stainless
Drive Nail	AISI 1018	AISI 1018	AISI 1018	Type 304 SS
Anchor Body	Nylon	Nylon	Nylon	Nylon
Nail Plating	ASTM B 633, SC1, Type III (Fe/Zn 5)			N/A

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. Remove dust and debris from the hole during (e.g. dust extractor) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



Insert the anchor through the fixture and into the drilled hole. 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 the nail. This anchor is not recommended for installations at an angle or for use overhead.



PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Nylon Nailin in Normal-Weight Concrete[1,2,3]

Anchor Diameter d in.	Minimum Embed. Depth in.	Minimum Concrete Compressive Strength, f 'c											
		2,000 psi				4,000 psi				6,000 psi			
		Tension		Shear		Tension		Shear		Tension		Shear	
		Ultimate lbs.	Allowable lbs.	Ultimate lbs.	Allowable lbs.	Ultimate lbs.	Allowable lbs.	Ultimate lbs.	Allowable lbs.	Ultimate lbs.	Allowable lbs.	Ultimate lbs.	Allowable lbs.
3/16	3/4	180	45	280	70	195	50	320	80	200	50	320	80
	1	200	50	280	70	220	55	320	80	230	60	320	80
1/4	5/8	120	30	320	80	140	35	500	125	180	45	500	125
	3/4	200	50	320	80	220	55	500	125	240	60	500	125
	1	230	60	320	80	250	65	500	125	260	65	500	125
	1-1/2	240	60	320	80	270	70	500	125	280	70	500	125
	2	250	65	320	80	280	70	500	125	280	70	500	125

1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Anchors are not recommended for use overhead or for life safety.
3. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.

Ultimate and Allowable Load Capacities for Nylon Nailin in Hollow Concrete Masonry[1,2]

Anchor Diameter d in.	Minimum Embedment Depth in.	f'm ≥ 1,500 psi			
		Ultimate Load		Allowable Load	
		Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
3/16	3/4	170	280	35	55
	1	180	280	35	55
1/4	5/8	110	320	20	65
	3/4	160	320	30	65
	1	170	320	35	65
	1-1/4	180	320	35	65
	1-1/2	200	320	40	65

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. Anchors are not recommended for use overhead or for life safety.

Ultimate and Allowable Load Capacities for Nylon Nailin in Solid or Hollow Clay Brick Masonry[1,2]

Anchor Diameter d in.	Minimum Embedment Depth in.	f'm ≥ 1,500 psi			
		Ultimate Load		Allowable Load	
		Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
3/16	3/4	155	320	30	65
	1	170	320	35	65
1/4	5/8	150	500	30	100
	3/4	200	500	40	100
	1	220	500	45	100
	1-1/4	240	500	50	100
	1-1/2	250	500	50	100

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. Anchors are not recommended for use overhead or for life safety.

DESIGN CRITERIA

Combined Loading

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

$$\left(\frac{Nu}{Nn}\right) + \left(\frac{Vu}{Vn}\right) \leq 1$$

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

Load Adjustment Factors for Spacing and Edge Distances 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	$s_{cr} = 10d$	$F_N = F_V = 1.0$	$s_{min} = 5d$	$F_N = F_V = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_N = 1.0$	$c_{min} = 5d$	$F_N = 0.80$
	Shear	$c_{cr} = 12d$	$F_V = 1.0$	$c_{min} = 5d$	$F_V = 0.50$

1. Allowable load values found in the performance data tables are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances. Linear interpolation is allowed for intermediate anchor spacing and edge distances between critical and minimum distances. When an anchor is affected by both reduced spacing and edge distance, the spacing and edge reduction factors must be combined (multiplied). Multiple reduction factors for anchor spacing and edge distance may be required depending on the anchor group configuration.

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	Std. Box	Std.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

GENERAL INFORMATION

SAFE-T PIN™

Nail Anchor

PRODUCT DESCRIPTION

The Safe-T Pin is a small-steel nail anchor which is designed for use in a variety of applications and as an improved alternative to traditional zamac nailin anchors where overhead use is not recommended. The Safe-T Pin can be used pre-drilled holes in solid base materials such as concrete, grouted block, and brick.

GENERAL APPLICATIONS AND USES

- Electrical fixtures
- Signage
- Maintenance
- HVAC / Mechanical
- Drywall track
- Interior applications / low level corrosion environment

FEATURES AND BENEFITS

+ General purpose anchoring
+ Installs in a variety of solid base materials
+ Suitable for overhead use where specified
+ All-steel anchor components

APPROVALS AND LISTINGS

- Tested in accordance with ASTM E 488
- Tested in accordance with ICC-ES AC193 for use in structural concrete

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Anchors shall be Safe-T Pin anchors as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

SAFE-T PIN

ANCHOR MATERIALS

- Zinc Plated Carbon Steel

ANCHOR SIZE RANGE (TYP.)

- 1/4" diameter (6mm) x 1-3/8" length
- 1/4" diameter (6mm) x 2-1/2" length

SUITABLE BASE MATERIALS

- Normal-weight Concrete
- Structural Sand-lightweight Concrete
- Grout-filled Concrete Masonry
- Brick Masonry

MATERIAL SPECIFICATIONS

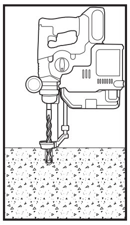
Anchor component	Specification
Anchor body	Low carbon steel (AISI 1008 or equivalent)
Zinc plating according to ASTM B 633 SC1, Type III. Minimum plating requirement for Mild Service Condition	

INSTALLATION SPECIFICATIONS

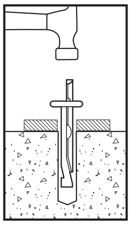
Anchor Property / Setting Information	Notation	Units	Nominal Anchor Size, d (inch)	
			1/4	
Nominal outside anchor diameter	d_o	in.	0.250	
Safe-T Pin drill bit diameter	d_{bit}	mm	6	
Safe-T Pin bit tolerance range	-	mm	5.9 to 6.4	
Nominal Embedment	h_{nom}	in.	1-3/16	2-1/2
Minimum hole depth	h_o	in.	1-1/2	2-3/4
Minimum concrete member thickness	h_{min}	in.	3	4
Minimum edge distance	c_{min}	in.	3-1/2	3-1/2
Minimum spacing distance	s_{min}	in.	3-1/2	3-1/2

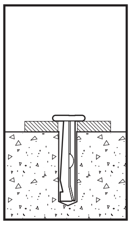
Installation Guidelines

Using the proper Safe-T Pin drill bit size, drill a hole into the base material to the required depth. The tolerances of the Safe-T Pin bit used must meet the requirements of the published range. Remove dust and debris from the hole during drilling (e.g. dust extractor) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



Insert the anchor through the fixture. Drive the anchor pin into the anchor body to expand it. Be sure the head is seated firmly against the fixture and that the anchor is at the minimum required embedment.





PERFORMANCE DATA

Ultimate Load Capacities for Safe-T Pin in Normal-Weight Concrete[1,2,3,4]

Nominal Anchor Diameter in.	Nominal Drill Bit Diameter (mm)	Minimum Embedment Depth in.	Minimum Concrete Compressive Strength f'c = 3,000 psi	
			Tension lbs.	Shear lbs.
1/4	6	1-3/16	1,330	1,745

1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load.
3. The tabulated load values are applicable to single anchors in uncracked concrete.
4. Minimum spacing and edge distances for anchors is 4 inches.

Ultimate Load Capacities for Safe-T Pin in Grouted-filled Concrete Masonry[1,2,3]

Nominal Anchor Diameter in.	Nominal Drill Bit Diameter (mm)	Minimum Embedment Depth in.	Minimum Concrete Compressive Strength f'm = 1,500 psi	
			Tension lbs.	Shear lbs.
1/4	6	1-3/16	920	1,745

1. Tabulated load values are for anchors installed in minimum 6-inch wide, minimum Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 5.0 or greater to determine allowable working load. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety.
3. Minimum spacing and edge distances for anchors is 4 inches.

Ultimate Load Capacities for Safe-T Pin in Solid Clay Brick Masonry[1,2,3]

Nominal Anchor Diameter in.	Nominal Drill Bit Diameter (mm)	Minimum Embedment Depth in.	Minimum Concrete Compressive Strength f'm = 1,500 psi	
			Tension lbs.	Shear lbs.
1/4	6	1-3/16	1,100	1,745

1. Tabulated load values are for anchors installed in multiple wythe, minimum Grade SW, solid clay brick masonry walls conforming to ASTM C 62. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation (f'm ≥ 1,500 psi).
2. Ultimate load capacities must be reduced by a minimum safety factor of 5.0 or greater to determine allowable working load. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety.
3. Minimum spacing and edge distances for anchors is 4 inches.

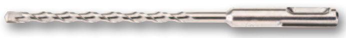
ORDERING INFORMATION

Safe-T Pin

Cat. No.	Size	Std. Box[1]	Std. Ctn.
2800SD	1/4" (6mm) x 1-3/8"	100	600
2801SD	1/4" (6mm) x 2-1/2"	100	600

Drill Bit

Cat. No.	Size	Std. Box[1]	Std. Ctn.
2800	6 mm Drill Bit	1	50



GENERAL INFORMATION

HELI-PIN™

Helical Facade Anchor

PRODUCT DESCRIPTION

The Heli-Pin anchor is a one-piece stainless steel helical wall tie system used for anchoring existing brick veneers to the back-up structural members without exposing hardware. The helical design allows the tie to be driven quickly and easily into a predrilled pilot hole with a Heli-Pin setting tool and a roto-hammer drill (or embedded into mortar joints in new construction) to provide a reliable mechanical connection between a masonry façade and its backup material or between multiple wythes of brick.

Existing façades constructed of various masonry materials can be reattached and reinforced using the Heli-Pin. They are ideal for stabilizing areas with missing or corroded wall ties as well as retrofits to multiple width masonry wall sections. Heli-Pin anchor performs in concrete and masonry as well as wood and steel studs.

GENERAL APPLICATIONS AND USES

- Mechanical connections between a masonry façade and its backup material
- Replace missing or corroded wall ties
- Used in new construction by being embedded into the mortar joint

FEATURES AND BENEFITS

+ Virtually invisible repairs to masonry building facades
+ Ease and speed of installation with a roto-hammer and available setting tool
+ Made of corrosion resistant stainless steel
+ Helical shaped tie is both tension and compression resistant, and provides solid connection with the base material.
+ Variety of lengths and diameters, for a broad range of applications
+ Reinforced central core for high shaft strength

APPROVALS AND LISTINGS

- Tested in accordance with CSA A370

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors and 04 05 19.16 - Masonry Anchors. Anchors shall be Heli-Pin as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

HELI-PIN

ANCHOR MATERIALS

- Type 304 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

- 8mm (5/16") x 6" to 12"

SUITABLE BASE MATERIALS

- Normal-weight Concrete
- Grouted Concrete Masonry (CMU)
- Hollow Concrete Masonry (CMU)
- Brick Masonry
- Wood Studs
- Metal Studs
- Natural Stone

MECHANICAL ANCHORS

HELI-PIN™ Helical Facade Anchor

INSTALLATION AND MATERIAL SPECIFICATIONS

Material Specifications

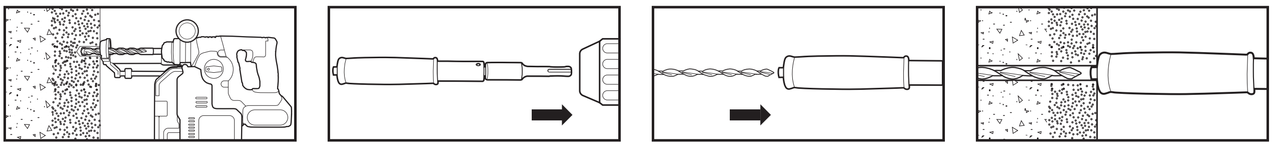
Anchor Component	Component Material
Anchor Body	Type 304 Stainless Steel

Installation Procedure

Using a proper diameter bit drill a pilot hole through façade material into backup base material to a depth at least ¼" deeper than the embedment required.

Mount installation tool on a rotary hammer drill. Position the Heli-Pin in the installation tool and insert into the pilot hole.

Drive the pin until it is about ½" below the surface of the façade material (setting tool should be flush with face of base material). Patch hole with appropriate material.



PERFORMANCE DATA

Typical Performance Characteristics for 8mm Heli-Pin[1]

Material	Minimum Effective Embedment Depth h_{ef} in.	Ultimate Tension/Compression lbs.
Mortar Joint	3	700
Brick (solid)	3-5/8	700
Brick (cavity)	3-5/8	1200
Hollow CMU 6 (normal wt. CMU)	1	800
Grouted CMU (lightweight block)	2	550
Concrete	1-1/4	1200
2x4 Wood Stud	3	520
2x6 Wood Stud	3	520
Metal Stud	16 gauge	300
Granite	1-1/8	500
Travertine	7/8	500
Limestone	3	600

1. The data reflects the results of lab, field and in-house testing and provided as a guideline for the designers. Site testing is suggested for verification of load carrying capacity.

8mm Heli-Pin Masonry Bit Size

Facade Material	Heli-Pin	Back-up Base Material						
		Mortar Joint	Brick	Hollow CMU	Solid CMU	Concrete	Wood Stud	Metal Stud
Mortar Joint	8mm	3/16"	1/4"	3/16"	3/16"	1/4"	3/16"	3/16"
Brick	8mm	1/4"	1/4"	1/4"	1/4"	1/4"	5/16"	1/4"
Hollow CMU	8mm	3/16"	1/4"	3/16"	3/16"	1/4"	3/16"	3/16"
Solid CMU	8mm	3/16"	1/4"	3/16"	3/16"	1/4"	3/16"	3/16"
Precast Concrete	8mm	1/4"	1/4"	1/4"	1/4"	1/4"	1/4"	1/4"

8mm Heli-Pin Length Selection

Nominal length	Minimum Drilled Hole Depth in.	Cavity Range	
		CMU (Hollow or Solid)	Concrete
6"	6-5/8	0 to 1"	0 to 1-1/2"
8"	8-5/8	0 to 3"	1-1/2" to 3-1/2"
10"	10-5/8	0 to 5"	3-1/2" to 5-1/2"

ORDERING INFORMATION

Heli-Pin Anchors

Catalog Number	Description	Standard Box	Standard Carton
08341	Heli-Pin Anchor 8mm (5/16") x 6"	100	1000
08342	Heli-Pin Anchor 8mm (5/16") x 8"	100	1000
08343	Heli-Pin Anchor 8mm (5/16") x 10"	100	1000
08344	Heli-Pin Anchor 8mm (5/16") x 12"	50	500

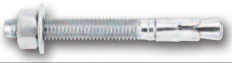
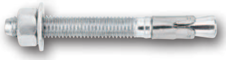
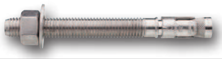
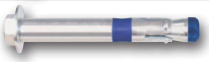
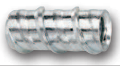
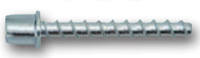
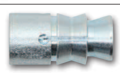
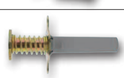
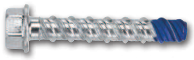
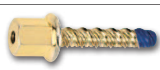
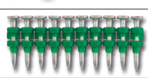
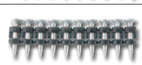
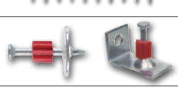
Heli-Pin Setting Tool

Catalog Number	Description	Standard Box	Standard Carton
08345	Heli-Pin Setting Tool	1	12

Essential for correct installation of Heli-Pins. The tool will automatically counter-sink the Heli-Pin, allowing for fast, efficient installation.

NOTES

Building and Residential Code Complaint Product Solutions*

Product Picture	Product	Code Compliant Listing	Reference
	AC200+™	ICC-ES ESR-4027	Page 27
	Pure110+®	ICC-ES ESR-3298	Page 76
	AC100+ Gold®	ICC-ES ESR-2582 & ESR-3200	Page 45
	PE1000+®	ICC-ES ESR-2583	Page 123
	Pure50+®	ICC-ES ESR-3576	Page 101
	Atomic+ Undercut®	ICC-ES ESR-3067	Page 153
	Power-Stud®+ SD1	ICC-ES ESR-2818 & ESR-2966	Page 164
	Power-Stud®+ SD2	ICC-ES ESR-2502	Page 178
	Power-Stud®+ SD4/SD6	ICC-ES ESR-2502	Page 188
	Power-Bolt®+	ICC-ES ESR-3260	Page 221
	Screw-Bolt+™	ICC-ES ESR-3889	Page 251
	Snake+®	ICC-ES ESR-2272	Page 278
	Hangermate®+	ICC-ES ESR-3889	Page 307
	Mini-Undercut+™	ICC-ES ESR-3912	Page 318
	Wood-Knocker® II+	ICC-ES ESR-3657	Page 324
	Bang-It®+	ICC-ES ESR-3657	Page 331
	DDI+™	ICC-ES ESR-3958	Page 339
	Tapper+®	ICC-ES ESR-3068, ESR-3196 ICC-ES ESR-3042, ESR-3213	www.DEWALT.com
	Wedge-Bolt+	ICC-ES ESR-2526	www.DEWALT.com
	Vertigo®+	ICC-ES ESR-2526	www.DEWALT.com
	Trak-It® C4 and C5 Pins	ICC-ES ESR-3275	www.DEWALT.com
	Trak-It® Pins	ICC-ES ESR-2036	www.DEWALT.com
	Power-actuated Fasteners	ICC-ES ESR-2024	www.DEWALT.com
	TriggerFoam™ Pro	ICC-ES ESR-3263	www.DEWALT.com

*Evaluated by ICC-ES for Code Compliance with the 2015, 2012 and 2009 International Building Codes (IBC) and International Residential Codes (IRC)

DEWALT

OSHA COMPLIANT™ 1926.1153

DUST SOLUTIONS

ARE YOU COMPLIANT?

The Occupational Safety and Health Administration (OSHA) rules with the intent to limit workers' exposure to respirable crystalline silica.

+

+

AIR LOCK™

TOOLS

Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.

- Read operator's manual provided with tool and accessories.
- To minimize dust emissions use recommended shroud or cowling and dust extractor

ACCESSORIES AND SHROUDS

Use drill or grinder equipped with commercially available shroud or cowling with dust collection system.

- All DEWALT shrouds and dust collection systems are commercially available.

DUST EXTRACTORS

Dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency. Dust collector must have a cyclonic pre-separator or filter-cleaning mechanism. Cleaning/Drilling holes requires a vacuum with a HEPA filter.

- Both DWV010 and DWV012 provide the necessary airflow for drilling and hammering applications.
- Both DWV010 and DWV012 ship with dual HEPA filters, which have an efficiency of 99.97% of all particles greater than or equal to 0.3 microns.
- Both DWV010 and DWV012 have a timed automatic filter-cleaning mechanism.
- Surfacing, Tuckpointing, and Cutting with grinder requires 25 CFM per inch of wheel diameter, a filter cleaning mechanism, and 99% or greater efficiency.

PERFORM PROTECT™

YOUR FIRST LINE OF DEFENSE.™

DEWALT's Perform & Protect™ line of Power Tools is designed to provide a high level of one or more of the following: control, dust containment, or low vibration, without sacrificing performance.

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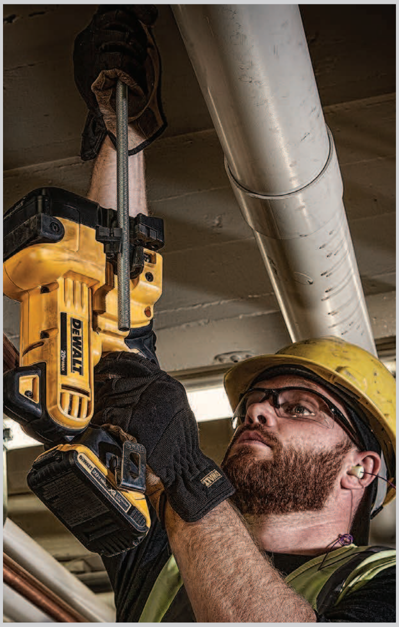

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