



Post Installed Anchors

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Types of Anchors – Visual Overview

Cast-in-Place

Cast-in-Place Anchors



Bolt or stud that is installed prior to pouring concrete

Post-Installed

Adhesive Anchors



Chemical adhesive hardens and bonds between the base material and the anchor

Mechanical Anchors



Creates interlock with the base material through friction or undercutting

Codes

ACI 318

ACI 355.2

ACI 355.4

AC 308 and others

Evaluation reports



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ICC-ES Evaluation Report
ESR-2713

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Revised August 2023

This report is subject to renewal September 2023.



EVALUATION REPORT

Number: 712

Originally Issued: 04/24/2020

Revised: 04/25/2023

Valid Through: 04/30/2024

Qualified Base Materials

Normal-Weight Concrete



Lightweight Concrete



Hollow and Grout-Filled Concrete Block (CMU)



Unreinforced Brick (URM)



Major Components

Chemical Adhesive



Hybrid adhesive



Epoxy adhesive

Insert



Threaded rod

Reinforcing bar

Adhesive Anchor Update – AT-3G

AT-3G – High Performance Cold Weather Adhesive

- Premier bond strength
- Fast-cure
- Approved for Rebar Development Length
- Dry, Saturated, and Water-Filled Hole Tested



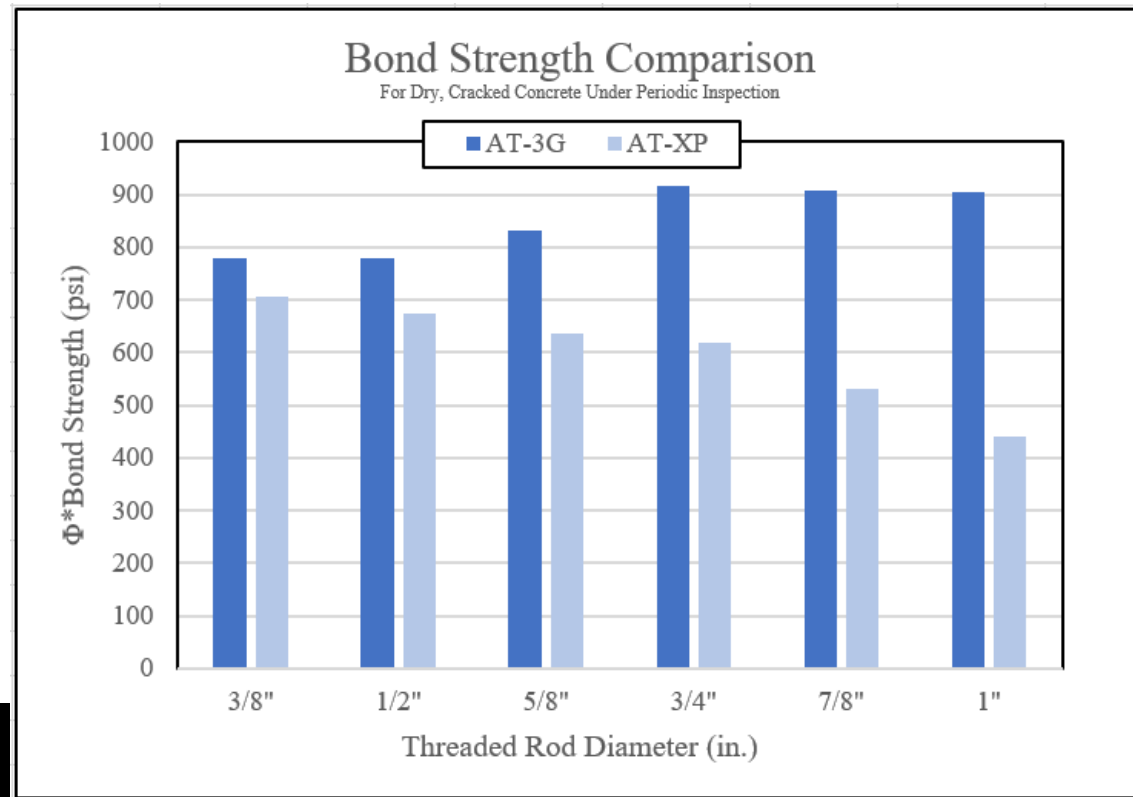
C-A-2023, pg 42

Adhesive Anchor Update – AT-3G

AT-3G – High Performance Cold Weather Adhesive

- Premier Bond Strength
 - Anchor Category 1

Category 1	0.75	0.65
(Low sensitivity to installation and high reliability)			
Category 2	0.65	0.55
(Medium sensitivity to installation and medium reliability)			
Category 3	0.55	0.45
(High sensitivity to installation and lower reliability)			



Adhesive Mixture



A Two-Part System

- A resin + a hardener/initiator are combined and mixed through a multi-element static mixing nozzle
- Once combined, the chemical reaction causes the mixture to harden and bond to base materials



Common Installation Conditions



Dry and Damp Holes



Horizontal and Overhead Applications



Wet and Water-Filled Holes

Reliability Testing per ICC-ES AC308 is defined as:

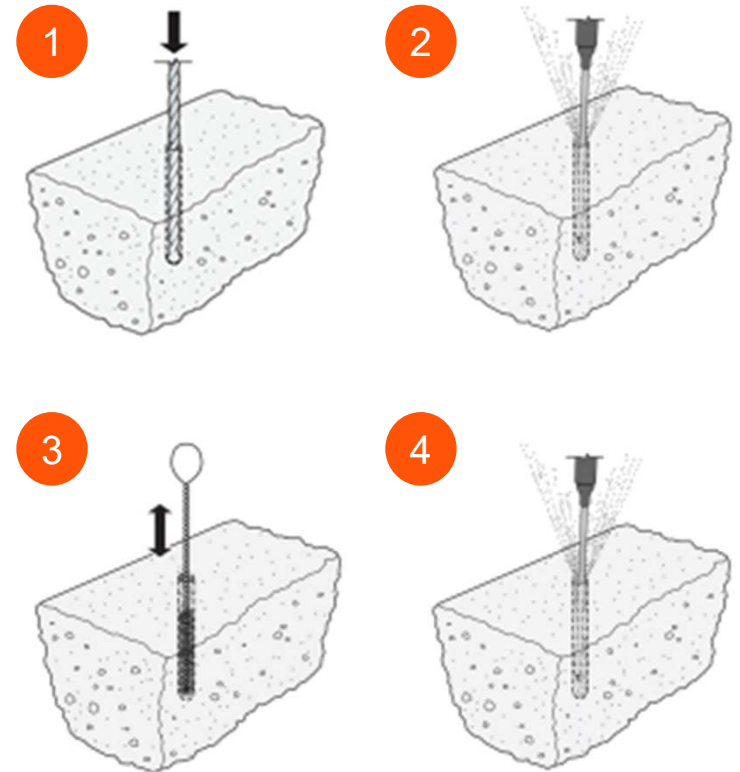
- Dry Concrete — Cured concrete whose moisture content is in equilibrium with surrounding non-precipitate atmospheric conditions.
- Water-Saturated Concrete — Concrete that has been exposed to water over a sufficient length of time to have the maximum possible amount of absorbed water into concrete pores to a depth equal to the anchor embedment.
- Submerged Concrete — Water-saturated concrete that is fully submerged at the time of hole drilling and anchor installation.
- Water-Filled Hole — Drilled hole in water-saturated concrete that is clean yet contains standing water at the time of installation.

Adhesive Anchor Installation



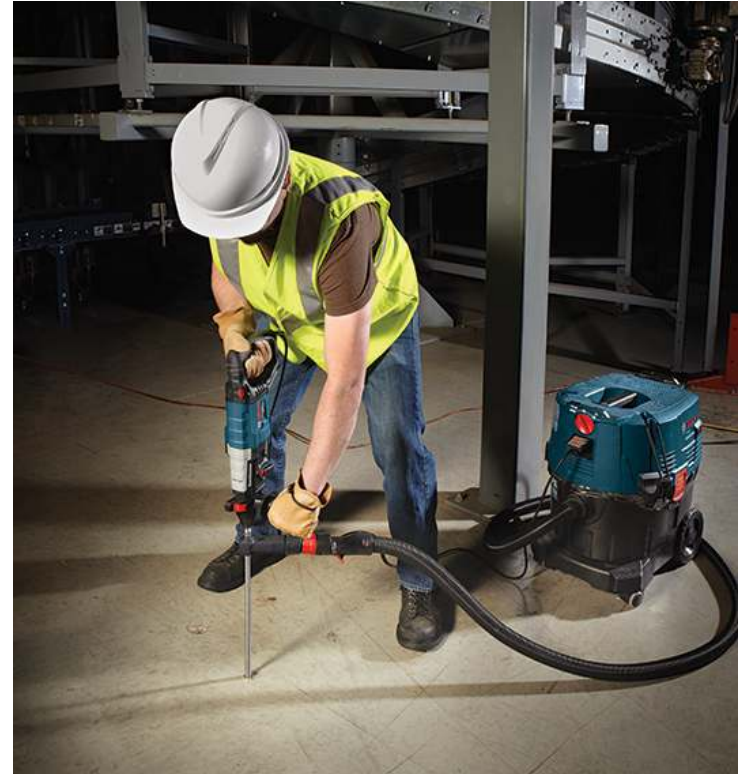
Drilling Overview: Drill, Blow, Brush, Blow

1. A hole is drilled to the specified depth.
2. It is then blown out with oil-free compressed air.
3. It is brushed to remove debris.
4. Finally blown out once again with oil-free compressed air.



Drilling Overview: Vacuum Dust Extraction Systems

- Uses a patented method of vacuuming the dust through the drill tip while the hole is being drilled
- Addresses the concern of ***silica exposure***, providing health and safety benefits to operators and others around the construction site



Cartridge Preparation

Step 1

Step 2

Step 3

Step 4

Step 5

Introduction

The basic procedure is the same for most adhesive formulations. The following instructions cover how to prepare an adhesive cartridge.

Note: Make sure all holes are drilled and prepared before preparing the adhesive.

Cartridge Preparation

Step 1

Step 1 Check

Step 2

DO NOT USED EXPIRED PRODUCT!

Step 3

Check the expiration date on the product label.

Step 4

Step 5



Cartridge Preparation

Step 1

Step 2

Step 3

Step 4

Step 5

Step 2 Open

Open the cartridge per packaging instructions.

This will include either cutting or snapping off the top of the cartridge.



Cartridge Preparation

Step 1

Step 2

Step 3

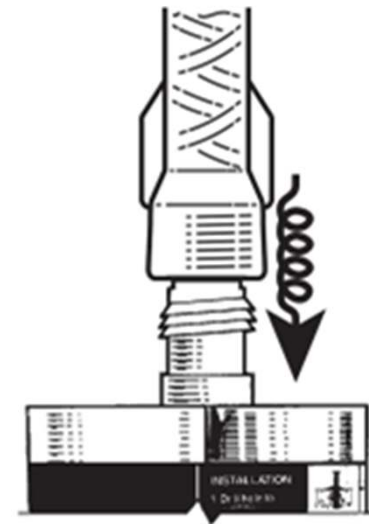
Step 4

Step 5

Step 3 Attach Nozzle

Attach the proper nozzle to the top of the opened cartridge.

DO NOT MODIFY THE NOZZLE!



Cartridge Preparation

Step 1

Step 2

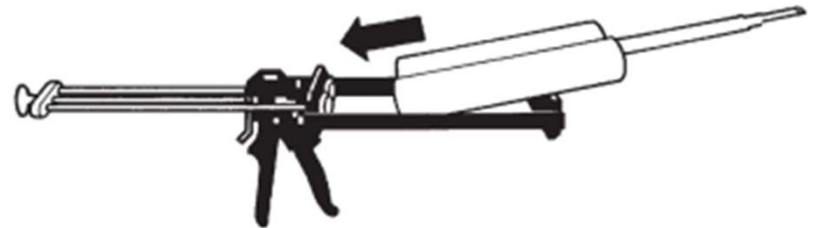
Step 3

Step 4

Step 5

Step 4 Insert

Insert cartridge into the dispensing tool.



Cartridge Preparation

Step 1

Step 2

Step 3

Step 4

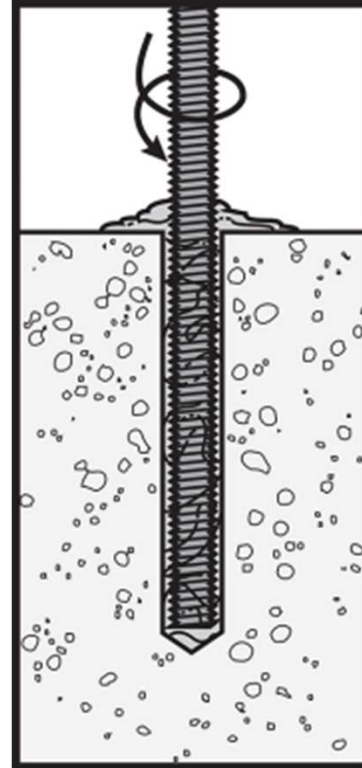
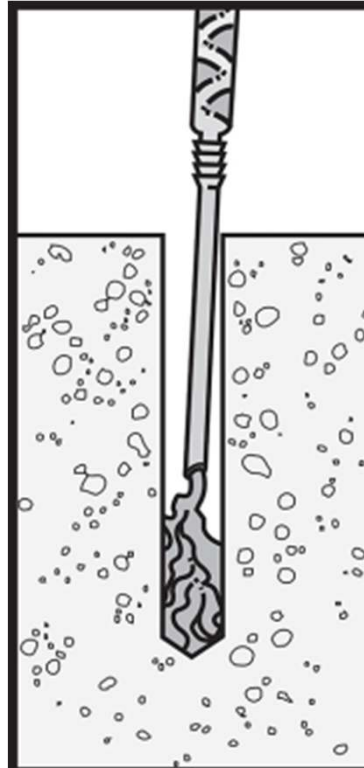
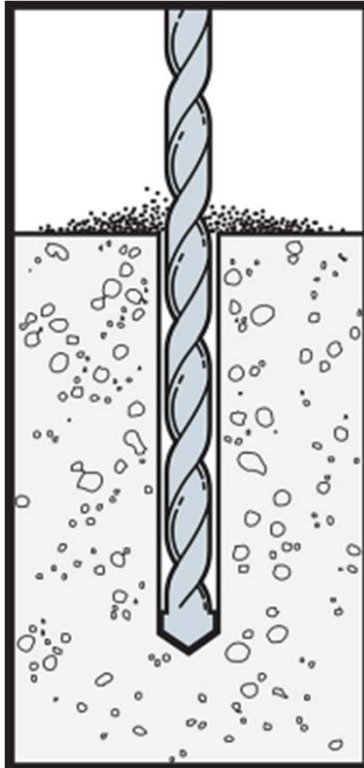
Step 5

Step 5 Dispense

Dispense some adhesive off to the side until the adhesive is properly mixed (uniform color).



Insert Installation



Epoxy-Based Adhesives vs. Acrylic-Based Adhesives



Epoxy Adhesive Anchors

Advantages

- Excellent adhesion to a broad range of substrates
- Low degree of shrinkage during cure
- Good chemical resistance
- Extensive shelf life
- Extended working time
- More flexible hole sizes

The chart to the right shows **long** gel and cure times, which allows for **high jobsite versatility**, since it can be installed over a long period of time, in **dry, water-saturated or water-filled holes**.

Disadvantages

- Minimum base material temperature
- Extended working time
- Slower cure time

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

Long Gel and Cure Times

Hybrid Adhesive Anchors

Advantages

- All-weather formula
- Easy to dispense
- Fast cure time

Disadvantages

- Critical hole size
- Faster gel time in hot temperature may be too fast to work with

AT-3G Cure Schedule

Base Material Temperature		Gel Time (minutes)	Cure Time (hr.)
°F	°C		
23	-5	50	5
32	0	25	3½
41	5	15	2
50	10	10	1
59	15	6	40 min.
68	20	3	30 min.
86	30	2	30 min.
104	40	2	30 min.

1. For water-saturated concrete, the cure times must be doubled.
2. Cartridge temperature must be between 41°F (5°C) and 104°F (40°C) at the time of installation.
3. For installation in temperatures below 23°F (-5°C), see p. 241 (Supplemental Section) for more information.

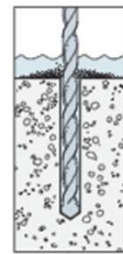
Advantages of Adhesive Anchors

- High loads
- Vibration resistant
- High strength at shallow embedment
- Small anchor spacing and short edge distances
- Precise location of anchors after concrete is cured (avoids mislocated cast-in-place anchors)

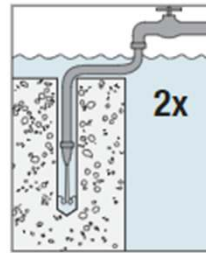


Installation Overview

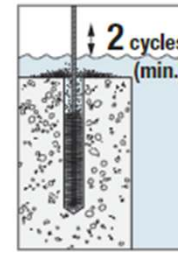
- Cartridge preparation
- Dry and damp holes
- Water-filled holes
- Overhead and horizontal anchorage
- Hollow base materials



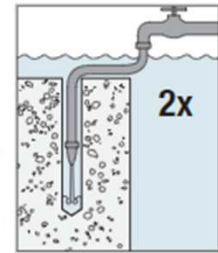
1. Drill.
Drill hole to specified diameter and depth.



2. Flush.
Remove slurry from hole by flushing hole twice with water until water runs clear.



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



4. Flush.
Remove slurry from hole by flushing hole twice with water until water runs clear.

Note: All holes need to be properly drilled and prepared before installation.

Piston Plug Delivery System

- Easy to use and reliable
- Dispenses adhesive into drilled holes for threaded rod and rebar dowel installations in overhead, upwardly inclined and horizontal orientations
- Virtually eliminates formation of voids and air pockets during adhesive dispensing



Screen Tubes

- Screen tubes are designed to contain adhesive around the anchor.
- They are vital to the performance of adhesive anchors in base materials that are hollow or contain voids, such as hollow block and brick.



Post-Installed – Mechanical Anchors



“
... a post-installed anchor that derives its holding strength from either the expansion of an element against the sides of a drilled hole, or a mechanical interlock between a component of the anchor and the base material.”

Edge Distance and Spacing Requirements

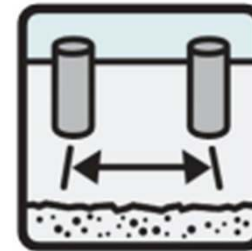
Edge distance

The distance between the anchor centerline and the free edge of the concrete or masonry member.



Spacing

The distance between anchors, centerline-to-centerline.



Critical edge distance

The shortest edge distance at which the anchor capacity is applicable without reductions.

Minimum edge distance

The least edge distance at which the anchors are tested for recognition.

Qualified Base Materials

Normal-Weight
Concrete



Lightweight
Concrete



Concrete Block
(CMU)



Lightweight Concrete
over Metal Deck

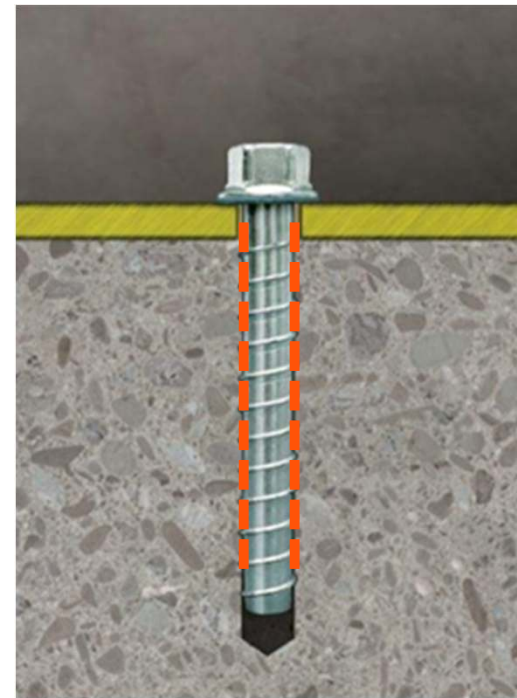


Common Mechanical Anchor Types

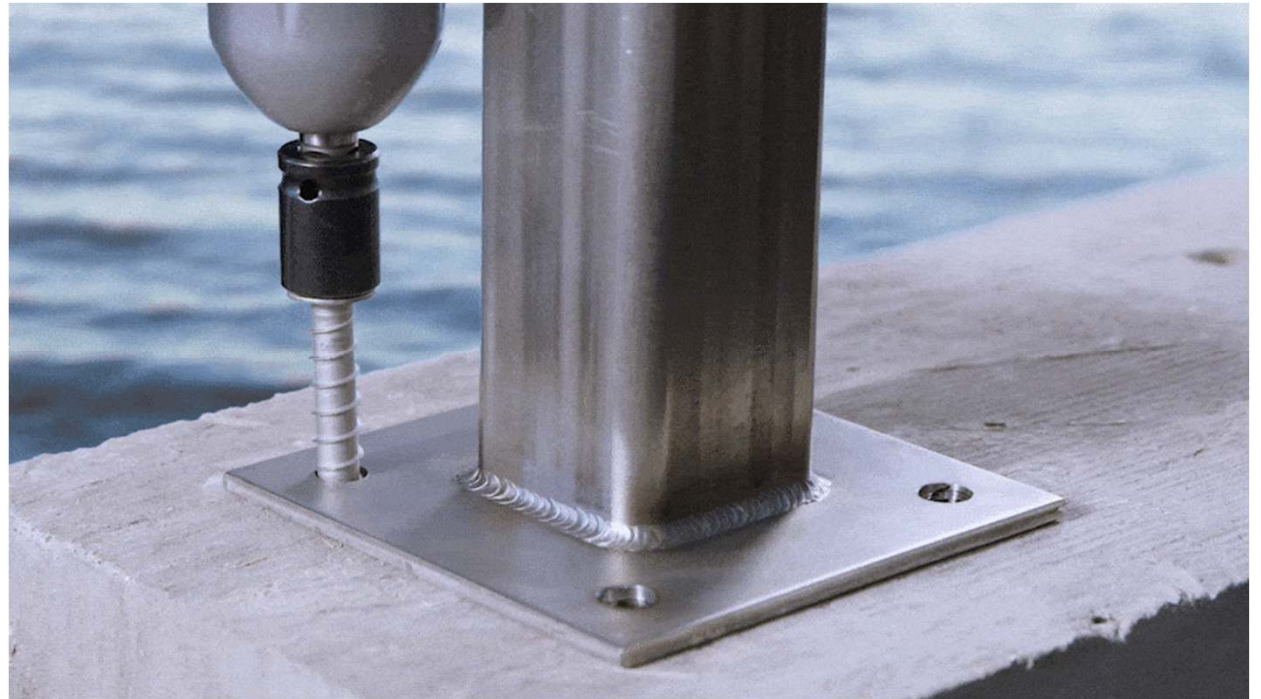
Expansion Anchors



Heavy-Duty Screw Anchor



Heavy-Duty Screw Anchors



Wedge Anchor



Strong-Bolt® 2



Adhesive Anchor Update – Web Apps

Splice Information

Application ?

Development Length ▼

Concrete Information

Concrete Type ? Concrete Compressive Strength, f'_c (psi) ?

NWC ▼ 4,000 ▼

Rebar Information

Rebar Size (#) ? Rebar Yield Strength, f_y (ksi) ?

8 ▼ 60 ▼

Rebar Coating ? Rebar Spacing (Center-to-Center), S ?

Uncoated / Zinc coated ▼ 8 in

Minimum Clear Cover, C_{min} ?

3 in

Excess Reinforcement

Apply reduction of development length due to excess reinforcement ?

$A_{s,required}$? $A_{s,provided}$?

0.79 in² 0.79 in²

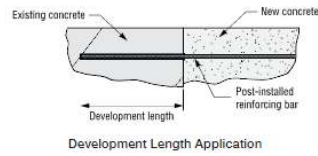
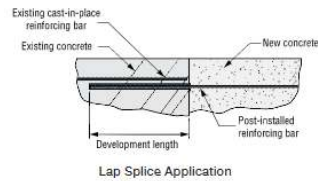
Seismic Design Category

Seismic Design Category ?

Note: For SET-XP in SDC C-F, f'_c is limited to 2500psi for calculation purposes only.

C-F ▼

⏪ RESTART
⚙️ CALCULATE



Results

Model No.	Tension Development Length, l_{dt} (in)	Compression Development Length, l_{dc} (in)	Drill Bit Diameter, d_{hole} (in)
SET-XP®	36.00 Launch ACE	24.00 Launch ACE	1.125
SET-3G™	28.50 Launch ACE	19.00 Launch ACE	1.125
AT-3G™	28.50 Launch ACE	19.00 Launch ACE	1.125

Notes

- For SET-XP® the value of f'_c used to calculate development lengths is limited to 2,500 psi when Seismic Design Category C-F is selected.
- Adhesive installation instructions and parameters can be found at [Anchoring Adhesives Technical and Installation Notes](#).

Development Length Application



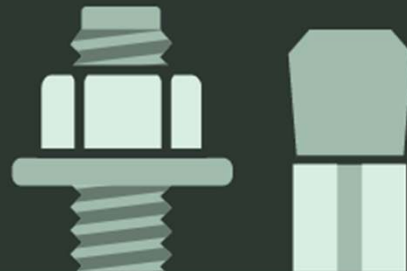
Anchor Designer™

PROFESSIONAL STRENGTH DESIGN SOFTWARE FOR

ACI 318

ETAG

CSA



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←

New

Open

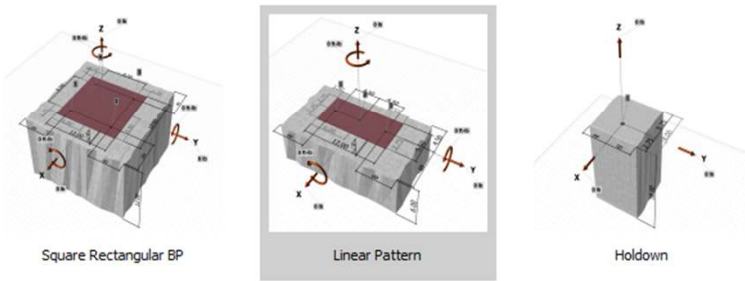
Internet LiveUpdate

AD settings

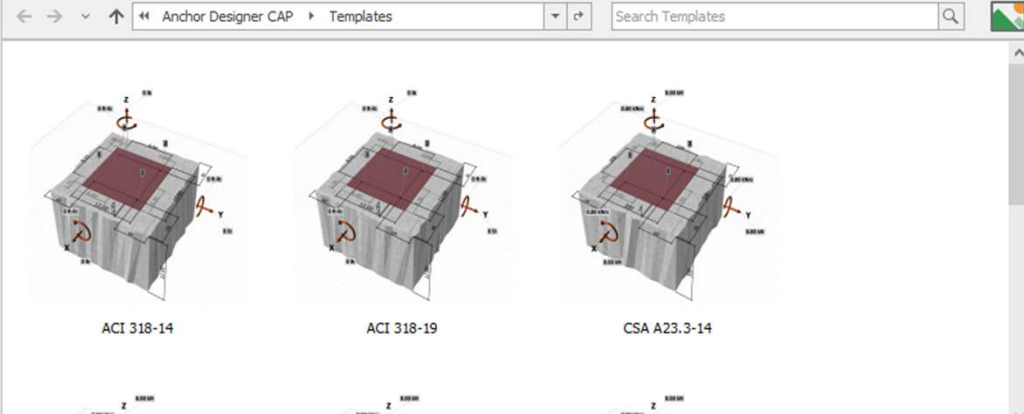
About AD

New project

Design



Template



Recent projects

- WP16A.cap C:\Users\bmaier\Desktop\WP 16A.cap
- SHDU9 anchor bolt.cap C:\Users\bmaier\Desktop\SHDU9 anchor bolt.cap
- Ledger Concentrated Point Load w SET-3G.cap C:\Users\bmaier\Desktop\Ledger Concentrated Point Load...
- Ledger Concentrated Point Load.cap C:\Users\bmaier\Desktop\Ledger Concentrated Point Load...
- JIB10 BM modied.cap C:\Users\bmaier\Desktop\JIB10 BM modied.cap
- JIB10_tilt anchor.cap C:\Users\bmaier\AppData\Local\Microsoft\Windows\IN...
- Curb-Mounted Embed.cap C:\Users\bmaier\AppData\Local\Microsoft\Windows\IN...

Recent folders

- Desktop C:\Users\bmaier\Desktop
- WTBBAQAM C:\Users\bmaier\AppData\Local\Microsoft\Windows\IN...
- Anchor Designer CAP C:\Program Files (x86)\Simpson Strong-Tie\Anchor Design...

-- SIMPSON STRONG-TIE® - Anchor Designer™

File Home View Help

Save project Save as New project

My project

RDLC ACE ART PSG PFD

Web Applications

SIMPSON
Strong-Tie

Build 3.2.2309.3

Inputs

Design method

Base material

Base plate

Anchor layout

Geometry

Concrete [inch]

$C_x (+)$

$C_y (+)$

$C_x (-)$

$C_y (-)$

h

Base plate [inch]

l_x

l_y

Simplified Geometry

Anchor positions [inch]

Equal Spacing

Col. Spacing 1 Row Spacing 1

Loads

Products - 1/2"Ø Titen HD, hnom:3.25" (83mm)

3D-Model Project

Calculation summary

Design Result Copy

No load defined.

Chart

Cmin ≥ 1.75
Smin ≥ 3.00
N = -
V = -
N+V = -
Fail

Thank you!

