

## How to build a climbing wall

For photo ideas, copy and paste the following link to see our Customer Photo Gallery in our Project Ideas tab.  
<http://www.atomikclimbingholds.com/Projects/customerPhotos.htm>

Feel free to email our climbing expert for questions about your project to [Kenny@atomikclimbingholds.com](mailto:Kenny@atomikclimbingholds.com)

**Have us bid your project! We would love to choose a custom set of holds specifically for your wall. You can have us do this by emailing the above address with total wall dimensions, shipping zip code, indoor or outdoor wall, thickness of wall surface and who will be climbing on your wall. We will promptly calculate your needed holds to your specifications and get you our best prices possible in the industry.**

Every wall is different! Feel free to email us for specific advice on your wall even if you are not buying holds from us. We can help! It's hard these days to get the answers you need for free but at Atomik, holds are for sale, not advice. Our leader, Kenny Matys has been a pro-climber, rigger and route setter for over 15 years and he simply wants to help other people enjoy this sport at an affordable price. Our number is 801-404-0280. 5 days a week! 8am to 8pm MST. If we don't answer, we will by the end of the business day. I understand that people are building walls all through the week so if you find yourself in need on the weekend, give us a call. We can't promise we will answer the phone but we will try. Just leave us a message.

### General Materials

3/4-inch plywood is the industry standard. Preferably good one side Birch plywood. It costs about \$5 extra a panel but worth it.

3/8 t-nuts spaced 72 t-nuts per 4 foot by 8-foot panel (so the bolt-on holds can attach to the wall) **(12 t-nut x 6 t-nut pattern on a 4 x 8 sheet of plywood. See below or in Instructional Steps in Project Ideas for diagram)**

2 x 6 studs on 16-inch centers or 2 x 4 studs laid flat when attaching to a concrete wall  
 you can attach holds directly to a concrete wall using 2 types of anchors. See below for details.

1 5/8 screws to attach panels to frame

**7/16" spaded wood drill bit (to drill the holes for the t-nuts)**

**1/2" concrete bit for drop in concrete anchors 5/8" drill bit for hollow set anchors**

Paint and sand (to make textured wall paint) (see below for recipes)

### Wood Walls

Below is a photo essay of how t-nuts work and the proper installation of them.

#1. Drill a grid of 6 high by 12 wide 7/16" holes on a 4-foot by 8-foot sheet of 3/4 inch plywood. Birch good one side is recommended. Drill the holes from the front of the panel through to the back so when or if the wood splinters ( aka blows out ) on the back side of the panel, you will not see the splinters on the front. The below diagram is an example of 72 t-nuts on a 4-foot by 8-foot sheet of plywood. You will have the t-nuts 8 inches apart with this set up. You have 2 options for patterns to drill. The easier choice of the two is the "grid pattern" . You end up having holds in one line which can be boring. The "staggered" pattern takes a little more time to set up but worth it. It is my choice by far.



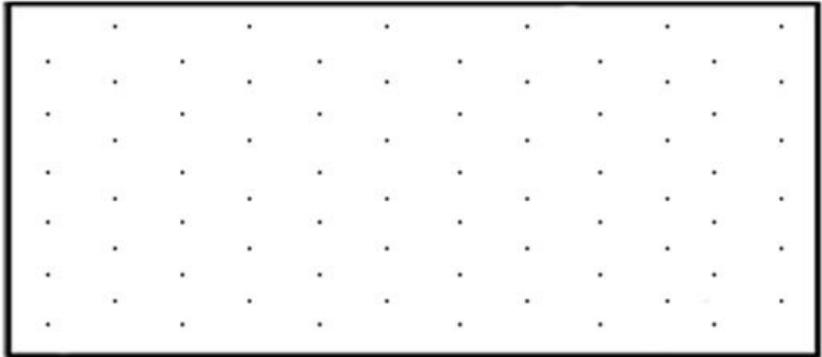
6 x 12 t-nut layout **grid** pattern. 72 t-nuts per panel. Easy to figure out but your holds will end up in straight lines on your wall.



#2. Turn panel over and hammer in the t-nuts.



The below **staggered** pattern layout gives you a more natural feel when route setting. Simply offset each row from the previous row.



#3. Attach panel to the wall frame. Your wall studs should be built on 16-inch centers. That means, if you measure from the middle of one 2 x 6 to the other, you would measure 16 inches. (On a vertical wall, it is okay to bolt 2 x 4s to a structural wall and lay the 2 x 4 flat. That is it would stick out 1.5 inches off of the wall. 2 x 4s really measure 1.5 inch by 3.5 inches). Your wall is now ready to attach the holds to the panel.



### School Walls/Concrete Cinder Block Walls

We have equipped hundreds of schools and churches over the years and they have approached wall building with cost in mind. Many have used a 2 x 4 frame on 24-inch centers and fastened it to their cinder-block wall. They then put the standard, 4 x 8 foot panels 3/4 inch thick, on the frame. **Lay the 2 x 4s on the flat side so it sticks out an inch and a half from the wall.** They stud the wall out this way because it is easy to anchor a flat lying 2 x 4 to the concrete wall with either Tapcon concrete screws or expansion bolts. I prefer using the hex head variety of Tapcon screws over the Phillips head since the 1/4 inch/5/8 inch driver rarely slips while tightening down the screw. The Phillips head tends to slip. These screws are available in the “Hardware Aisle” at your local Lowes or Home Depot.

To attach a 2 x 4 to a concrete wall, I prefer using 1/4” x 3 1/4” hex head Tapcon screws. Below is a link for full Tapcon Specs.

### Tapcon® Concrete Screw - Technical Information:

The Tapcon® brand concrete screw cuts threads in a predrilled hole in concrete, brick or block. The screw has alternating raised and lowered threads with diamond cut notches which provide exceptional holding power and stability. The Tapcon® brand concrete screw is available in both 3/16" or 1/4" diameters with either a flat phillips #3 countersunk or a 5/16" hex washer head. All screws are plated using the Stalgard coating which provides extended life and additional lubricity for ease of installation. Tapcon® screws are also available in 410 stainless steel finished with a silver Stalgard. The stainless steel screws have shown no red rust in salt spray test performed at a certified A2LA laboratory per ASTM B117 specifications.

### Tapcon® Concrete Screw - Applications:

Light to medium duty in concrete, brick and block.

### Tapcon® Concrete Screw - Installation:

(1) Drill hole into base material using the drill bit provided with the screws. The depth of the hole must be at least 1/4" deeper than the Tapcon embedment. (2) Place object to be fastened over hole. (3) Insert point of Tapcon into hole and drive screw in using a nut drive or #3 bit tip. Do not over torque the screw.

## Tapcon® Concrete Screw - Screw Length:

The length of the Tapcon® fastener to be used is determined by combining the thickness of the material to be attached with the desired depth of embedment in the base material. It is recommended that a minimum of 1" and a maximum of 1-3/4" embedment be used in determining fastener length. The diameter of the fastener and the depth of embedment affect pullout strengths. A carbide-tipped drill bit is supplied with each box of Tapcon® fasteners. The correct hole must be drilled for the screw to obtain holding values. In all cases the hole must be at least 1/4" deeper than the depth of the fastener embedment.

## Tapcon® Concrete Screw - Technical Data:

### Pull-Out Values

Size	Embedment	Concrete 3725 psi	Hollow Block
1/4"	1-3/4"	2100 lb.	801 lb.

### Shear Values

Size	Embedment	Concrete 3725 psi	Hollow Block
1/4"	1-3/4"	1924 lb.	1059 lb.

All pullout values are based on close-tolerance holes drilled with Elco carbide tipped drill bits. Designated holding power depends on the quality of the masonry material, depth of embedment, and proper hole size. These figures are offered only as a guide and are not guaranteed by Elco Textron. The figures indicate average pullout and shear failure values. A safety factor of 4:1, or 25% of ultimate pullout value, is generally accepted as a safe working load, however, reference should always be made to applicable codes for the specific safe working ration.

If you have an even tighter budget, some schools are attaching the holds directly to the cinder block wall using concrete drop-in anchors. See our "Project Ideas" link on the bottom of our webpage and click "Customer Photo Gallery". There you will see a couple fine example of a painted concrete wall.

### Outdoor Walls

Moving your wall outdoors brings up the problem of weather. Most people don't care if their bolts rust but some do. Stainless steel bolts is the way to go if you do not want any rust but the price is approximately 3 to 4 times the cost of our steel ones. The other obstacle is wood. It weathers easily and plywood hates water. There are types of marine grade plywood available for outdoors but many are using 2x 6s or the new 5/4" composite decking. These are great ideas because no texture or additional paint is needed to stop weather damage or slippage of holds. You can see photo examples on our Project Ideas tab <http://www.atomikclimbingholds.com/Projects/customerPhotos.htm>. If you do choose to use plywood, keep water off the wood by using outdoor paint or some other method to protect it from delaminating.

## Installing Concrete Anchors

**Concrete Drop-in Anchor** – This anchor is a little more sensitive to install but at a quarter of the cost of the next option, many builders choose this option because of budget concerns. This anchor can only be used in solid concrete.



Copy and paste this link to get details of specifications and installation on the **Concrete Drop-in Anchor**. Click “View Product Specs” once you arrive at the link.

[http://www.powers.com/product\\_06308.html](http://www.powers.com/product_06308.html)

**Hollow Set Concrete Anchors** – A very versatile anchor. It only needs 1.5 inches of material to set itself making it perfect for cinder block walls. They work on hollow cell cinder blocks as well as solid cell.



Copy and paste this link to get details of specifications and installation on the **Hollow Set Concrete Anchor**. Click “View Product Specs” once you arrive at the link.

[http://www.powers.com/product\\_09340.html](http://www.powers.com/product_09340.html)

## **Wall Surface (The mystery of textured paint is solved!)**

Many hard-core climbers leave their walls bare plywood. The disadvantage to this is that holds tend to spin easily. That is why we recommend using a texture. If you simply paint, holds will stick to your wall leaving unsightly damage when the hold rips a layer off when you try to move it. You can buy this texture or make your own. All it really consists of is a water-based acrylic paint with silica sand. I have used #70 silica sand, which is a fine grain. The sand grain only matters because the finer grain is easier to apply and looks better. Playground sand does work just fine but the finer the better. You mix 1 to 4 cups of sand to one gallon of paint in a bucket with a paint-mixing spinner or paint stick found at your local hardware store. Some Home Depots carry a 200-grain (also known as Shark Grip) in their paint section. Shark Grip

is found near the floor paint. It is an additive that puts texture on floors to offer an anti-skid surface. Works great for walls. If they don't have any fine sand in stock, use whatever sand is locally available. **For your convenience, we now carry #70 silica sand for sale! We sell a one-pound bag for \$1.95, which is the amount to mix with one gallon of paint.** The next step is to throw on a coat of primer/sealer and then roll the paint/sand mix on un-drilled panels and then sprinkle another layer of dry sand on the top. The sprinkling is only necessary if your paint does not have enough sand in it. This is to leave an additional layer of sand ensuring holds won't stick. I prefer mixing in the 4 cups per gallon and calling it good. Once the panel is dry, sweep off the excess sand, drill the holes using a 7/16 drill bit for the t-nut from the front through to the back and then hammer in your t-nut from the back. You can fill in cracks with paint-able silicone or use a caulking tube of concrete crack filler. You can also use Vinyl Spackle found in the paint section at your local hardware store. **If you have skipped the steps of drilling and painting you don't have to worry. You can paint the wall once it is up. You just have to be careful not to roll paint into the t-nuts. It does work. Use a 1/2 inch thick roller and evenly coat the already built wall. Paint a primer coat first, then with the paint/sand mixture.**

Want to get even crazier? Many of the new high-end gym textures are made out of dyed concrete. They use rebar and lath to create a rock-like look then trowel on concrete. Another way is to attach wafer board to a frame, roll on concrete adhesive and the trowel on a quarter inch or thicker layer of concrete. Many of them boast a higher strength concrete than the normal consumer can get and they are right. We just finished a project that boasted a 6000-pound per square inch test. Home Depot carries one that tests at 3000 pounds. While the concrete is wet but carve-able, they use their tools to add rock-like features. It is difficult, time-consuming and an artistic craft. The downside to concrete is that you should use a specialized screw-on t-nut (weld nut) instead of the pound-in 4-prong that are easily found. The reason is because the hammering of a normal t-nut can knock off the concrete layer.

## Hold

The general rule of thumb is **1 hold per 2 square feet** of climbing surface. **You should put at a minimum 50 t-nuts per panel but 72 are recommended. That is 12 wide by 6 pattern on a 4 x 8 sheet of plywood. The reason you want more t-nuts than holds is because it gives you the option to move your holds around at a later date.** So if you have three 4-foot by 8-foot sheets of plywood, you have 96 square feet and need approximately 48 holds. **Don't fall into the idea that more is better in terms of number of holds.** You can buy 100 small screw-ons and have a terrible time on your wall or you could buy 20 medium/large holds and have a blast! Let us help you choose the right holds for the climbers that will be on your wall and the angles you are climbing on.

If you are building a bouldering wall (not very tall with no ropes) the density of holds will increase.

## Bolt-on holds versus Screw-on holds

Bolt-on holds attach with 3/8 Allen head bolts. They attach from the front of the wall into a t-nut that is hammered in from the back. This system is nice because you can easily move or rotate holds quickly.

Screw-on holds attach using drywall or decks screws. We use #6 Gold Phillips head screws for indoor use. This system is nice because you are not limited to where you can put a hold.

## Attaching Screw ons to a Concrete wall

If you want to attach our screw on holds to a concrete wall, simply purchase the holds online and then run to Lowes or Home Depot and get 3/16 x 2 inch long Tapcon Phillips head concrete screws. They are the blue ones.

## How and where to put up your holds

(Louie Anderson recently wrote a book called *The Art Of Coursesetting*. To obtain a copy, his email address is [socalbolter@cox.net](mailto:socalbolter@cox.net) or simply do a search for the title and author on the internet.

(Also, another book of note is *The Way of The Rock Warrior* by Arno Ilgner. This book is a mental training book.)

In terms of placing the holds on the wall, I recommend evenly spacing the size of holds over the wall. To better visualize what I am saying, take a normal 8.5-inch x 11-inch piece of paper with some pennies, dimes, nickels and quarters. If you spread the coins out using the smaller ones at the bottom, you will see where your density of holds is less in some areas and more in others. At this point, simply adjust the coins to even out the area. This same principle works for holds on your wall except that the scale is larger.

For application on your wall, take all the largest holds and evenly space them from the 4-½ foot level up, then the mediums and then the small. You only need smaller sized holds on the lower 3 to 3 ½ feet because you will only be standing on them. Once you climb on a wall that has been equipped this way, you will be able to adjust the areas that need more or less holds.

Once you have set your wall up this way and you have even spacing, you might find that some sections are too easy or too difficult. If the section is too easy, then switch some of your larger holds for smaller ones. If the section is too difficult, then switch out some of the smaller sized holds for larger ones. If at this point things are still not the way you want them, you most likely will need to eliminate holds to make it harder or add more holds to make it easier.

The size of hold at this point matters. Having lots of holds is nice but it is very important to have the right size. If you want to make your wall easier, think larger holds. If you want a more difficult wall, think smaller holds, NOT less holds. It is bad form to just space the holds out farther to make it harder. It is much better to have the holds within reaching distance of your target climber and challenge their hand strength rather than superhero stretching distances. Below is an example of *how to set a boulder problem*...

1. Sit your butt down on the far left or far right of the wall.
2. Bolt on 2 holds that you can reach from the sit position.
3. Now put your feet on the wall, while sitting. A position that feels comfortable. Don't just choose where you already have holds. Put your foot against the wall where your leg feels comfortable and then put a hold there.
4. Pull onto the wall and reach with the hand that feels the most comfortable. Actually do a move into thin air and touch the wall. The more dynamic the reach and size of holds will determine the difficulty. Once you have the spot, bolt on new hold.
5. Now you probably should be in the standing position. Now put your hand on the last hold you just bolted on and get on the problem. If you don't yet have enough feet, add some.
6. This technique is called "dogging" the problem. It is starting the problem from midway through each time rather than from the beginning.
7. Starting from the last hold, get on the problem and do another move into thin air up or across the wall and touch the wall. That is where you will place the next hold.
8. This process is done over and over again for both feet and handholds until it reaches a finish.
9. Tape your 2 starting holds and finishing hold each with a ">" and each single hold with an "I" piece of tape. For feet and hands, keep the tape long enough to see while on the problem while still out of the way so you don't scrape the tape off with your feet.

### ***Setting a route***

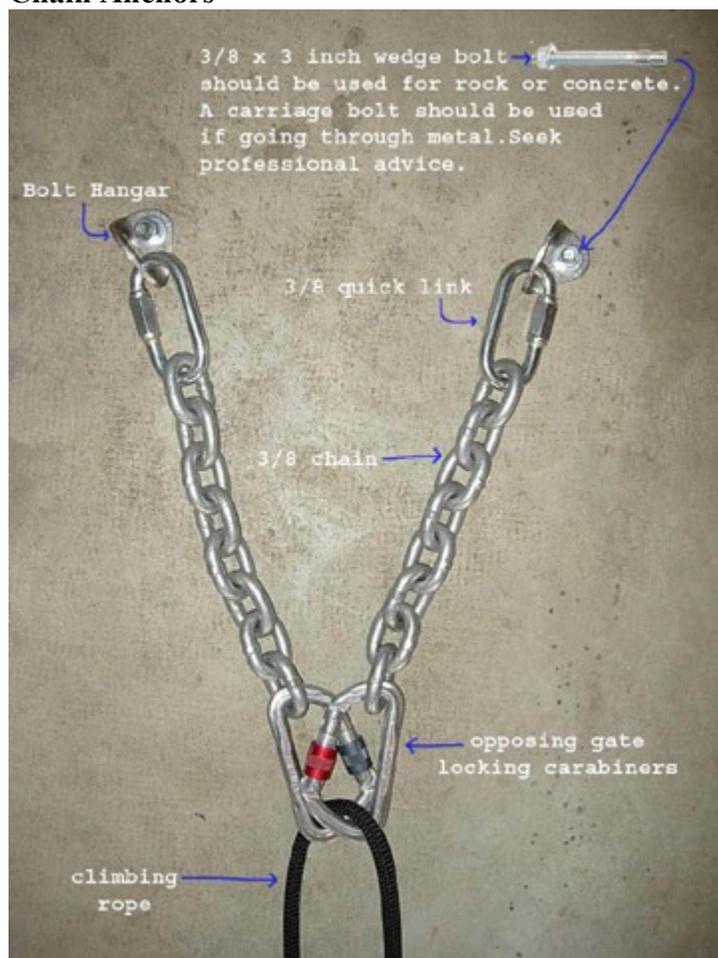
Setting a route is a little more time consuming with planning. The proper rigging is essential as well proper training. Above all, be safe. #1 rule is to keep yourself and the ones below safe. For this reason, never have people below you while route setting.

Starting off...

1. Set the first part of your route just like a boulder problem using a ladder remembering to clip your self in so you don't fall off the ladder.
2. Now the tough part. You can self-belay your self up or rappel down. Either way demands proper training.
3. As you go up, bring a haul bag with you and ideally have a "Ground Crew" who can put things in your bag and send items up, as you need them. Make sure your Ground Crew is out of the wall when you are working.
4. Finish you route with a double taped ">" inverted V. Lower to the ground, shed your setting gear, take a small bag of footholds and a wrench. Climb your route with the help of your partner belaying you. Stop each time you think you need to add an extra hold and add it as well as taping it. Re-climb that section making adjustments until you like the way it feels. Continue on to the top. Remember that tall setters almost always make the last move too far at the end. You are usually too tired to bother but you should. You can ruin a perfect route by making the last move to the finishing jug too difficult. Take the time and set the last move.
5. Now that you are done setting the route, it is time to forerun it. That means climb it again. If you are satisfied with it, get a couple of friends preferably ones that can easily climb that grade and of different heights.
6. Have your "forerunners" climb your route and don't tell them what to do. Just watch how they do your route. At the beginning you will see that the forerunner will do a move you never intended them to and even do your route nothing like what you wanted. In time, you will learn how to force the intended move.
7. ***Remember, nothing written should ever be in place of proper training. Route setting is a profession by very skilled athletes. Seek professional guidance before ever attempting to rope up and set your own routes.***

## Anchor Systems

### Chain Anchors



Chain anchors are a preferred material. Webbing is not preferred because it wears out quickly. 3/8 chains are awesome for anchors. In the bottom link you can clip one locking carabiner on each end and oppose the gates then clipping the rope into that. We do have a faxable drawing of this right now if you would like to see it. You should consult a certified Guide for this type of set as with any other set up.

## Belay Bars



A Belay Bar is usually a 4-inch in diameter bar that is anywhere from 4 feet to 8 feet long welded securely at the top of the wall. You could also bolt it to the structure. A rope is then wrapped around the bar **TWICE** which creates a coefficient of friction for the belay.

## Auto Belays



Auto belays are really nice for gyms that want to allow members/clients to be able to climb on their own without the need of a belayer. It is still crucial to have skilled staff checking the climber's harnesses and attaching method to the cable or webbing from the auto belay. This anchor option comes with a price. They cost in the \$1700 range. We recommend contacting Jim at [www.americanrockclimbing.com](http://www.americanrockclimbing.com) 1-888-922-9255 or direct cell phone 1-352-516-8618.

### \*Note on Auto Belays\*

If you decide you want auto belays on your wall, maintain them. Many of the manufacturers recommend that you ship them back to them on a yearly basis for maintenance. This may cost \$300 to \$600 plus shipping per unit. Never push a unit beyond what the manufacturer recommends.

## Safety and Wall Guidelines

1. Every wall should have crash pads as a landing surface. [www.promats.com](http://www.promats.com) can evaluate your wall height and recommend a thickness of pad.
2. If you do not want kids climbing on the wall unattended, then you should get the pads that have the Velcro straps so that they can cover the wall when not in use.
3. Holds on the wall should be tightened as soon as it has come to the operator's attention.
4. Spotting - Climbing magazine wrote an article many years ago on How to Spot a Climber. I haven't found the photos yet but for now, read on. For a vertical wall, you will only utilize one method. That method is to keep the climber's head off of the ground. This is accomplished by holding out both hands thumbs up. When the climber falls, the "spotters" job is helping the climber to stay upright. The spotter's job is not to catch the climber, simply to keep the climber upright to avoid the climber's head from hitting the floor even though it is padded.
5. Bare feet - climbing barefoot is a bad idea because foot fungus can be transferred from foot, to hold, to hand, to mouth.
6. Make signs - make some signs that clearly state the walls rules. An example of a sign could be **No climbing without teacher supervision**. You can have these kind of rules screened on to the mats from [www.promats.com](http://www.promats.com)
7. For the home wall builder that is looking to go LOW TECH, old foam mattresses with carpet on top works nicely. The carpet is to displace the climber's weight more evenly. On a wall 10 to 12 feet tall, 2 mattresses thick with carpet on top will work.
8. Insurance – Most schools don't have a problem adding a wall to their school, however some do. Check with your schools insurance policy to make sure the wall is compliant. What this usually means is that you have to have a certain thickness of pad.

## Short Cuts

Though it is tempting to just attach a 3/4-inch panel to a concrete wall, it will not work. The length of the bolts that come out of the back of the wall varies. They will push out your panel from the wall. For this reason, you should put up a frame to allow the bolts to fully pass through the t-nut. See “School Walls/Concrete Cinder Block Walls” above for specific details.

**Another short cut is to buy slightly thinner plywood. This is a bad idea because the shaft of the t-nut is about 9/16 long. When attaching a hold to thinner plywood, the tightening action will pull the t-nut slightly to the front of the panel. This movement of the t-nut will force the shaft out bottoming on the hold being tightened which will cause the hold to spin. 3/4 inch plywood or thicker should be the only plywood used.**

**There is always more to follow at a later date...if you have questions that have not been answered, please email us and we will update this list. Remember, we are climbers at heart and want you to have fun with your project. We are happy to answer your questions whether or not you are buying from us. Good luck!**

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