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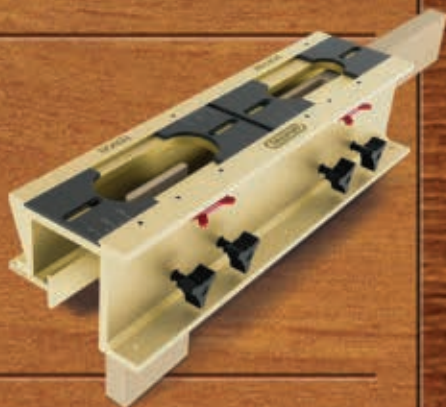
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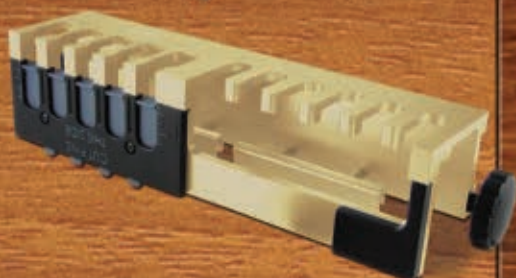
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I'm not big on celebrities. I can't understand why some people waste their time watching drivel like "The Kardashians," a family of airheads whose only discernible claim to fame seems to be that they're famous. I've never been impressed by a person's status or class, but occasionally I'm impressed by what people accomplish, and that's why I like Mike Rowe. He's a TV personality who not only spotlights hardworking Americans but also spreads the word of how average people can earn a fine living through skilled labor.

You might know Mike Rowe from his television programs "Dirty Jobs" or "Somebody's Gotta Do It," where he profiles normally unsung Americans and shows how their dedicated labor fulfills them personally, supports their families and often keeps the country afloat. Not only has Mr. Rowe accomplished great things in television entertainment, he uses his fame to shine a light on the accomplishments of others, and I feel like that's something worth praising here in *Extreme How-To*.

Furthermore, Mike Rowe has established a foundation to further his cause. Inspired by what he sees as a "profound disconnection" in today's labor force, he explains that the Country is facing a trillion dollars in student loans while experiencing record high unemployment. Many college graduates can't find jobs to pay off their mountain of debt. Meanwhile, American industry has roughly three million skilled-labor jobs that no one seems to want.

The mikeroweWORKS Foundation seeks to close that skills gap. The foundation promotes hard work and supports the skilled trades in a variety of areas by awarding scholarships to men and women who have demonstrated an interest in and an aptitude for mastering a specific trade.

This 501(c)(3) nonprofit organization has participated in more than \$2.5 million of awarded scholarships to schools around the

country, including Midwest Technical Institute, Tulsa Welding School, The Refrigeration School and Universal Technical Institute.

It sounds like a worthy cause to me, and I suggest you take a look at what he's put together at [profoundlydisconnected.com](http://profoundlydisconnected.com).



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**Q:** We installed a new tile floor in the bathroom, but the toilet drain is now too low for the toilet flange. How can we fix this?

**A:** The toilet flange seals the toilet to the drain so it needs to be at floor level or slightly above to work properly. You can correct the problem by installing a toilet drain extension. Look for a "closet drain extension

kit" that includes polyurethane spacer rings with built-in gaskets. Some kits even include all the necessary hardware for installation (T-bolts, nuts, etc.). The polyurethane rings stack over the opening to extend the drain even with or above the floor tile. You can then add a wax ring on top and mount the toilet.

**Q:** What is the advantage of a wireless light switch?

**A:** These battery-powered switches control the new home lighting options that are controlled by radio frequency. The advantage is that you can place the light switch anywhere in the home without the need to wire it into the electrical system, which can save a lot of time and work. Mount it to any wall surface or even hold the device in your hand. Some of the new switches can wirelessly control up to five light sources simultaneously from anywhere in the home. Once the switch is installed, it searches for installable devices and synchronizes itself with them, granting remote control capability. Using Z-wave wireless technology, the switch operates on a dedicated radio frequency so it doesn't interfere with Wi-Fi or other wireless communications in the house.

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**Q:** Why are some saw blades "carbide-tipped"?

**A:** Carbide (specifically tungsten carbide and titanium carbide) is a common material used for cutting tools such as saw blades, drill bits, router bits and lathe bits. Carbide is used for the cutting edge because it stays sharper longer than most other materials and can hold an edge ten to twenty times longer than steel. With a carbide-tipped saw blade, the main body of the blade is made of steel, and the carbide tips are brazed onto the body. The blades aren't made entirely of carbide because it would be very expensive, but also because the body would be very brittle, and steel is less likely to crack or shatter.

**Q:** I'd like to replace a 2-prong receptacle with a 3-prong receptacle but was told I could only do this if the outlet box was grounded so that I could ground the new receptacle. How can I tell if the box is grounded?

**A:** To check for ground, insert one prong of a circuit tester into the shorter slot (the "hot" one) of the outlet. Touch the other to one of the screws securing the plastic cover plate. The tester should light up to indicate a proper ground. If the box is not grounded, then you need to consult an electrician to make the change to a 3-prong receptacle. **EHT**

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# Sorting Things Out

The Right Storage Options to Organize Your Workshop



*Manufactured cabinets offer a sleek design, smooth drawer operation, caster wheels and locking doors. Photo credit: Gladiator Garageworks*

Small magnetic lamps or LED rope lighting are good options for illuminating dark corners or shadows beneath cabinets.

## SMART STORAGE

Every garage or workshop has a limited amount of floor space for storage, but you can add significant square footage of elevated storage space using shelves and cabinets. Manufactured garage storage cabinets are sold by companies such as Gladiator GarageWorks and Sears/Craftsman. Tool cabinets are excellent options for serious DIY'ers who have a lot of equipment that needs to be sorted by type and application. The number of drawers varies, and many versions include caster wheels to easily roll the cabinet around the shop. They offer a sleek design and nice amenities like ball-bearing drawer slides and locking doors.

Wall-storage systems are popular because they make use of otherwise unused wall space to organize tools and supplies. Many of these systems consist of slat-wall panels fastened to the wall, which



By Michael Morris

I shudder to think how much of my lifespan has been spent searching for missing tools. I try to be organized, but I'm often juggling multiple projects and end up making a mess of my work area. Periodically, I dedicate an entire Saturday just to put my cluttered workshop back together in an orderly fashion.

There's no doubt about it: To work efficiently, all your necessary tools and supplies should be where you need them, when you need them. From easy visibility to convenient accessibility, there's a lot to consider when organizing a workshop. Here are some pointers

for the next time you reorganize your mounting pile of equipment.

## LIGHT IT UP

Poor visibility is counterproductive to any kind of work. If you're giving your garage or workshop a complete remodel, a good place to start might be the walls. Painting the walls of the workshop white or another bright color helps reflect interior light, enhancing visibility and making it easier to find your tools.

Overhead fluorescent lighting is a popular option because it supplies bright, ample light without contributing heat to the workshop.





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hold various hooks, shelves and straps to keep items off the floor.

Some wall-mounted storage solutions are configured as heavy-duty racks with impressive load capacities. When mounted solidly to stud framing, wall-mounted racks can be used to store bulky items such as ladders, lumber, car tires and more.



*Heavy-duty racks hold tires, ladders, lumber and more.*

Pegboard panels mounted to the wall have long been popular for storing small items such as wrenches and screwdrivers. Various hooks and holders can mount to the pegboard holes with almost limitless versatility to keep your hand tools handy. Consider a metal or high-density plastic pegboard for a durable tool holder that won't swell and blister if exposed to moisture.

From rolling tool boxes to wall-mounted systems and pegboards, store-bought storage solutions have a lot to offer but can cost a lot, too.

A less expensive alternative for a DIY'er is to custom-build shelving for the workspace. Wall-mounted shelves can be hung with store-bought brackets screwed into the framing studs. Two-tiered shelves

can be built from simple legs and rails made of 2x4 with shelving made of 2x6, 2x8 or plywood. Screw or nail the shelves together and use diagonal bracing to keep the structure square. Another type of workshop shelves utilizes 2x2 ladder brackets with three-tiered plywood shelving. Styles vary, but most shop shelves are built with simple construction from inexpensive materials.



## TOOLBOXES

Handheld toolboxes certainly need no introduction, but a couple of new spins on the old standbys are worth noting. Some major tool manufacturers offer the modular hard-shell power tool cases that fit on top of one another and interlock to form an easy-to-cart stack.

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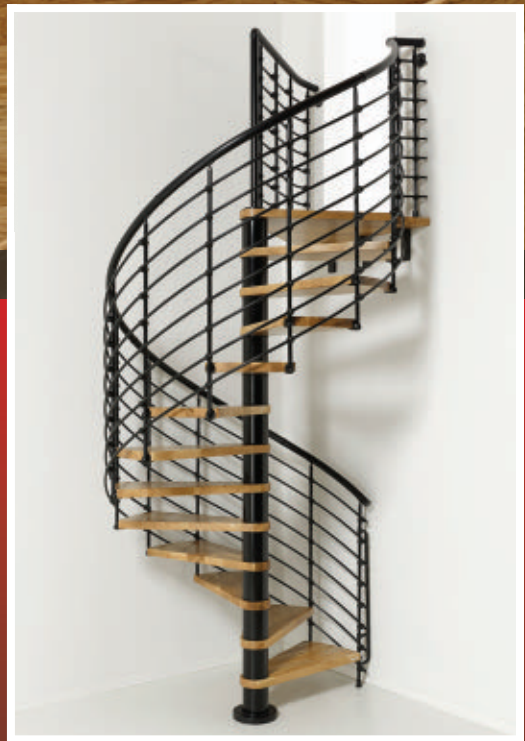
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The new Jobsite Organizer from Milwaukee Tool includes (8) small and (2) large removable bins that can be mounted on common jobsite materials by utilizing the integrated screw slots. A seal around the perimeter of each bin prevents small items from migrating from one bin to the other.



Screws, nails and other fasteners need a home as well. Toolboxes with transparent tops and adjustable dividers offer easy-to-see visibility for the wide array of fasteners and accessories that need to be sorted by type and size.

### THINK OUTSIDE THE SHOP

Need more storage space? What if you don't have a whole garage or spare room to make into a workshop? Although you can optimize interior spaces with shelves, cabinets and wall storage, you're ultimately limited by the size of the house. Consider overlooked areas of the home that can be modified to provide extra storage space. Convert the space beneath a staircase into a closet, or build a plywood bin in the unused space beneath your deck. Install a sub-floor in the attic to create storage space above the joists, or construct an outdoor storage shed to keep your long-handle lawn and landscape tools. With a little creative thinking, you can find a number of storage options outside the typical workspace. **EHT**



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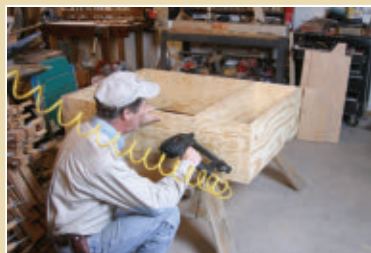
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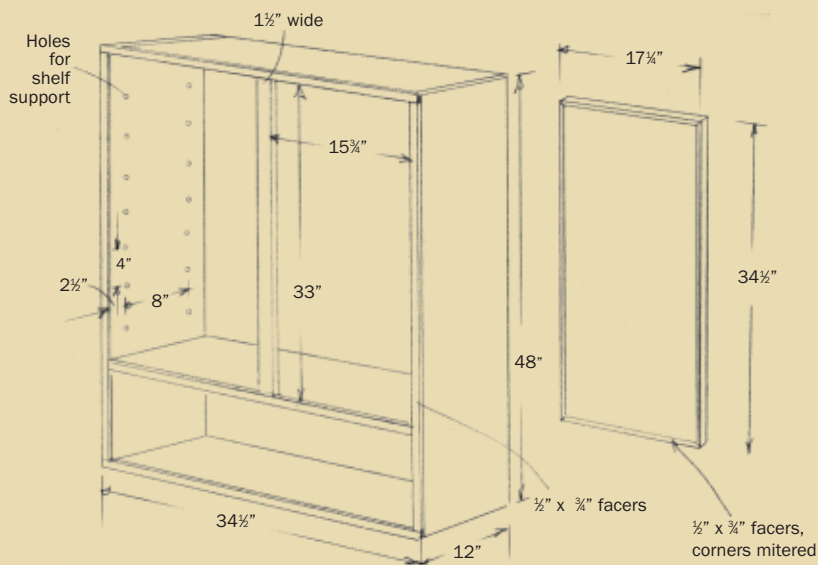
A locking tool cabinet can secure your tools from thieves and protect them from the elements. The cabinet shown is made of 3/4-in. plywood and has an open shelf below the locking cabinet for chargers for cordless tools, or for less valuable gear. The cabinet shown is used in a garage and the plywood is economical "good one-side" (C/D) fir plywood. You may prefer to utilize a pine, birch or other more decorative plywood if your shop or garage is more upscale.



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# Sealing Tile and Grout

*Keep it Clean Longer*



By Rob Robillard

I'm a remodeling contractor in the Northeast and can tell you that most bathroom remodelers do not take the time to seal tile grout for their customers.

I could speculate why, and I'd probably point to a missing level of professionalism, ignorance, communication and cost—but that's for a different article. This article will focus on the proper techniques for sealing tile and grout.

## WHY SEAL IT?

The primary reason for sealing non-glazed tile and grout (especially grout) is to keep it looking fresh and clean. Non-sealed tile and grout gets grimy and stained over time, requiring a lot of scrubbing

and sometimes even replacement to look good again.

Sealing tile and grout provides water and oil-based stain resistance and delays grout discoloration. Sealed tiles and grout are much easier to clean and stay clean longer.

Not all tile and grout require sealing. Glazed tiles are coated with a liquid glass, which is baked into the surface of the tile by the manufacturer. The glaze fills in the tile's microscopic imperfections, protects from stains and creates an extremely durable surface.

You should only seal cement-based grout, which is extremely porous and can harbor dirt, mold, mildew and bacteria. However,

epoxy, urethane and other types of synthetic grouts do not need to be sealed.

All unglazed tile and any cement-based grout should be protected with a penetrating sealer. Much like the porous grout, unglazed tile has microscopic imperfections that will, over time, accumulate gunk and cause your floor to always look dirty.

Sealing the tile and grout is not a one-time event. Unfortunately, the sealant is a maintenance issue and needs to be reapplied every two years, and sometimes sooner.

The best time to apply the first coat of sealer is 72 hours after the grout is installed.



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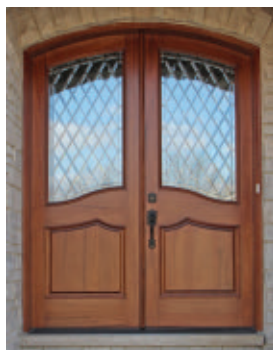
If you or your contractor did not seal your tile when it was installed, it is never too late. The tile and especially the grout will need to be thoroughly cleaned, because

applying sealer will lock in any stains or discoloration. In most situations, cleaning grout can be accomplished by using a stiff bristle brush and simple dish soap.

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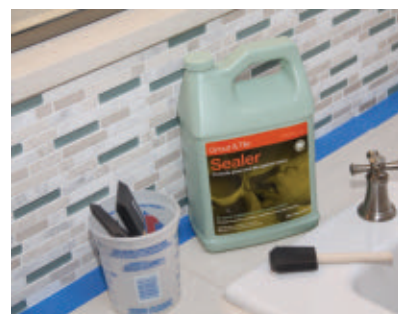
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*Clean the tile and grout thoroughly.*



*Assemble all materials and mask off the work area.*



*Apply sealer to the tile first using a foam brush.*

Badly stained grout may require a stronger cleaner or even grout replacement.

### SIMPLE STEPS TO APPLY SEALER

1. Clean tile and grout thoroughly.
2. Ensure tile and grout are completely dry.
3. Mask off any areas you do not want to get sealer on.



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## QUICK FIX

4. Liberally apply a quality fluorochemical-based sealer to unglazed tile and non-epoxy grout. Applying with a foam brush can eliminate bristle marks, and the narrow tip can access grout lines.

5. Allow the sealer to penetrate for the duration of time recommended by the manufacturer, and then apply a second coat. If sealer has dried on the tile and streaking is present, use a "sealer dampened"

towel to remove and then a dry towel to wipe clean.

6. Wipe off excess sealer with a clean, dry towel.

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Here are some useful tips to ensure your footings are installed properly and the integrity of your project is maintained:

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- Select a footing form that can carry the weight of your new construction and has met the proper building codes.
- Select a footing form made of environmentally friendly, sturdy materials.
- Ensure you are placing the footing form on solid ground. The more solid the ground the less likely movement will occur.
- Install your footings 4-6 inches below the frost line to avoid potential movement. If you are in an area without frost, then the form should be back filled 2 feet to hold it in place when it is being filled with concrete.
- Should rebar be required pour concrete into the system first. Insert three or four number 4 or 5 rebar rods into the tube. To determine the length of rebar, measure the distance from the top of the tube to the air holes located on the Bigfoot Systems® Footing Form before you place the system in the excavation and backfill.
- Purchase the amount of concrete stated on the form label. You will use all of it.
- Use a Bigfoot Systems® Footing Form as a funnel to pour concrete into the system by placing an inverted Bigfoot on top of the construction tube.
- For a marine application, such as constructing a wharf, pour the concrete into the footing and tube on shore and have an excavator set them in place in the water. The other option will entail using a diver and pumper truck.
- Footing forms should always be used when installing footings as they provide added stability, strength and safety to your new construction.
- Don't risk having to redo the job, do it right the first time!

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Use the the narrow tip to apply sealer to the grout lines.



Allow to dry according to the manufacturer's instructions before applying second coat. Wipe away excess with a clean towel.





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The secret is a proprietary caulk blend that actually bonds to the paint rather than repelling it like standard caulks. Included in each kit is a Standard Caulk Mixer; two tubes of specially formulated Create-A-Color Caulk, a syringe for injecting the paint and an easy-to-follow instruction guide. The sys-



tem works in minutes to create the perfect color and the mixer is very easy to clean and re-use for future projects. (Note: The mixer is not a caulk gun and is for mixing only).

Red Devil's Create-A-Color Caulk is a quality formulation that has excellent adhesion, mildew resistance, interior and exterior performance, low odor and water clean-up. Learn more at 1(800) 423-3845 or visit [www.reddevil.com](http://www.reddevil.com).

7. Follow the manufacturer's directions for drying and usage.

8. Mark your calendar for a maintenance coat in 1-2 years.

Sealing tile and grout will prolong the clean look and beauty of your tile installation. It provides a natural looking protective coating on interior and some exterior surfaces, and protects against water and oil-based stains. **EHT**

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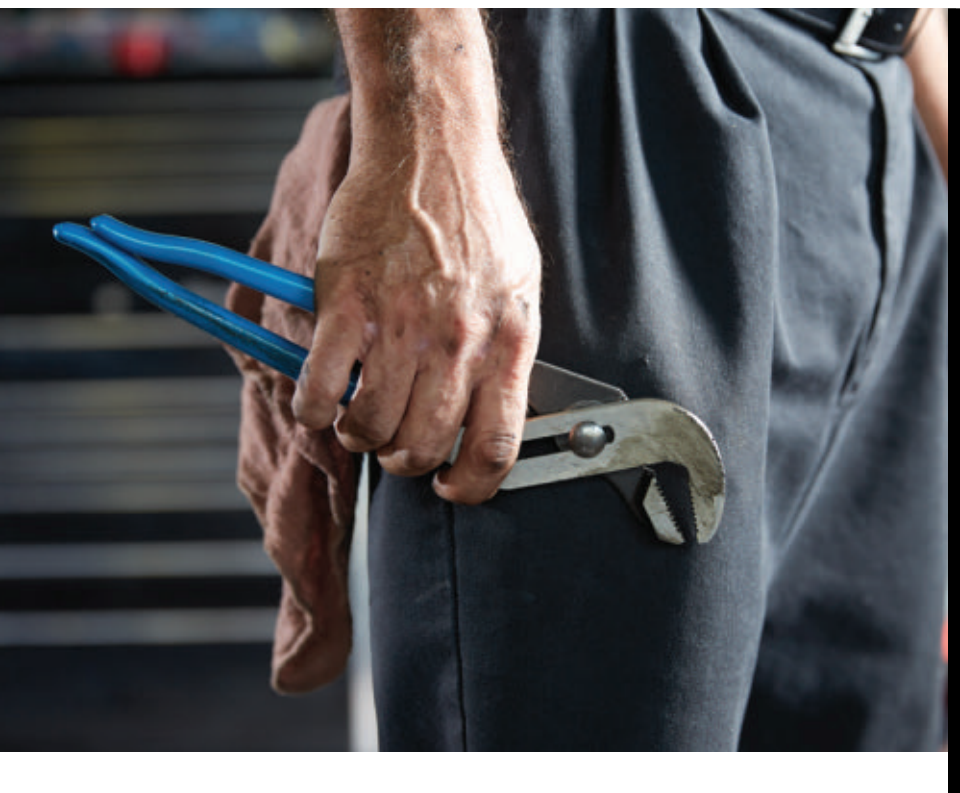
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# Top Tips for the Care of Your Tools



- **Keep your tools organized.**

A tool box or chest is a great way to store tools as well as keep them organized, clean and easy to find. When you can't find the tool you're looking for, you end up using the wrong tool for the job.

- **Don't expose your tools to excessive heat and cold.** Extreme temperatures can have adverse effects on metal tools.

- **Don't carelessly or intentionally drop your tools onto hard or paved surfaces.** Even though they're made of steel or metal, they still can break.

- **Keep tools clean.** Dust, dirt or grime can build up on tools and prevent them from working properly.

- **And, finally, choose quality over quantity.** While it may seem that sometimes saving a few dollars in the short term might be a good idea, often it is not. The higher the quality of a tool, the better it will perform and the longer it will last. Over time you will have fewer tools to replace and ultimately will save money and trips to the local retailer. Simply put, it makes more sense to invest in quality tools once, rather than to purchase lower-quality tools again and again.

All tools will get dirty and they should. The only way to keep tools perfectly clean is to never use them. But with proper care and maintenance, your tools will work every time and will last a lot longer. **EHT**

Anyone who has spoken to a professional tradesman or woman has undoubtedly heard the phrase, "Take good care of your tools and they'll take good care of you." No matter what kind of tools you have, it's the single best piece of advice one can follow. After all, no matter how well-built a tool is, it won't last long if it's carelessly used.

But how do you make sure you're taking good care of your tools? Here are several tips from CHANNELLOCK®, which has been the maker of quality tools, like its original tongue and groove pliers, for 129 years. Apply these tips to your own workshop and chances are you will be able to pass down your trusted hammers and CHANNELLOCK® tools to the next generation.

- **Always use the right tool for the job.** Using the wrong tool, or using tools inappropriately, is a danger to yourself and others.

- **Dust attracts moisture.** To avoid rust, store tools in a dry place. If they get wet or you have to use them in the rain, wipe them dry and spray with a product like WD-40® afterward to make sure they stay rust-free. If there are signs of rust, apply WD-40® and then scrub the tools with a heavy-duty scouring pad or steel wool. Avoid using sandpaper, which can scratch the metal and any protective layers it may have.

- **Don't use damaged or dull tools.** Worn or broken tools are a safety hazard and should be thrown away or recycled.



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# BRIGHT BUILDING BLOCKS

By Larry Walton  
Photos by Mark Walton

When I was making plans to remove a set of sliding patio doors in our master bedroom and replace them with a single, half-lite door, my wife was concerned that it would be too dark in the room. After she refused to wear the provided headlamp, I had to admit she was right and started making plans for Phase 2 of the project.

Of course I had little idea what Phase 2 might be, but I talked about it with the same air of confidence you hear from guys you see on viral video montages before doing permanent damage to themselves.

I considered various forms of lighting, which were vetoed by my life-long companion as she groped her way through a maze of bed-

room furniture. She missed the brilliance of the natural light.

Not wanting to start another major remodel project, I relied on one of my go-to fixes: Glass block. When done right, a pair of glass block windows would lighten the mood in the room while providing minimally invasive access to the abundant natural light on the other side of the wall.

## GLASS BLOCK FEATURES

There are some pretty cool advantages to using glass block. First of all, their double-pane construction makes them naturally (see what I did there?) energy efficient and a good sound barrier.

*Glass block windows let in more light.*











You can put glass blocks together to make a variety of rectangular shapes, which for some projects means you can decide on size as you go. In our case, we wanted to keep the openings between stud bays to avoid the need for headers and concerns about structural support for the second floor above.

The obscure glass also gives you built-in privacy. There's no need for window coverings, but window coverings can certainly be employed for room darkening or for decorating purposes.

The primary disadvantage to a glass block window is that it can't be opened unless you order it custom-built from the manufacturer. If you install a fixed window as shown in this article, it won't provide ventilation or egress in the event of an emergency. You'll still need a second door or an active window to provide these in a bedroom.

## INSTALLATION OPTIONS

Techniques for installing glass block can vary quite a bit from what we did for this project. You

can use mortar to build glass block walls or special spacers to help lock blocks together when the structure involves several rows and columns.

Since we used a single column of blocks for each window, we did not need to be concerned about the horizontal block-to-block connections. Each block would be thoroughly held in place with the vertical window stops. Weather-tight seals were the only concern at the joints. These we sealed with clear silicone caulk.

On this project, the installation process was pretty straightforward. We planned to make the window surround/frames with boards that were about one inch wider than the thickness of the wall. The idea was to be precise enough in cutting the openings to eliminate the need for casing. The extra 1/2 inch protruding through the wall provided a shoulder so the surrounds could be sealed to the wall surfaces with caulk.

One of the things that made this job quicker was the pre-primed pine boards we found for the window frames. These were

primed on both sides with white primer, which helped provide added reflective characteristics to the inside of the window opening and ensured minimal moisture penetration to guard against warping.

The plan was to build boxes to house the glass blocks, use the boxes to mark the openings, cut through the wall, nail in the boxes, stop in the blocks, seal with caulk and paint.

The project went well, the room is brighter and in the end I was right. Remember, when a project leaves you in the dark, tell your people, "That will be handled in Phase 2."

## HERE'S HOW WE GOT IT DONE:

The most common glass blocks are square with obscure glass and generous pockets of sound- and temperature-insulating air between the walls.



I started the installation with plans to build the surround boxes and use them as templates to lay out the openings in the wall. First step is to measure the set of blocks laid end to end. I chose to use three blocks per window on this project.

Next, cut four pieces of primed pine about 1/8 in. longer than the set of blocks to allow wiggle room to fit the blocks in the box.

Put the blocks between the vertical boards and measure to get the length for the horizontal boards, which overlap the thickness of the verticals.



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# BRIGHT BUILDING BLOCKS



Cut all of the horizontal and vertical surround boards before assembly.

Nail the surround boards for each window together to form a box.



Test the set of three blocks in the surround to check the fit.

Take measurements both inside and outside the house to find the right location for the windows.

Use one of the boxes to lay out the location of the first window.



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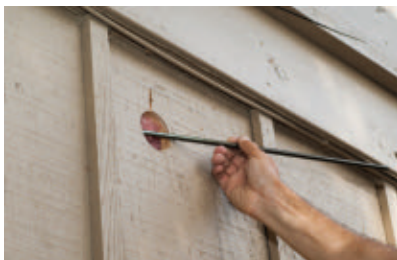
Drill a hole with a long bit all the way through the wall to indicate the elevation of the top surround board.



I used the drill bit to determine elevation and one of the battening boards as a stud location to get the location of the first window.



The surround box serves as a template to mark the exterior opening for the window.



Before cutting the exterior siding, I made a large hole in the planned opening and used an arrow shaft to probe the interior of the wall. I wanted to make sure of the exact stud location and double-check for wires and pipes before proceeding.



I made some of the siding cuts with a circular saw and finished the cuts in the corners with a Porter Cable cordless jigsaw.



Cutting out the siding revealed the wall insulation, which needed to be cut and removed.



With the surround box partially in place on the exterior, mark the exact location of each inside corner through the drywall with a long drill bit.

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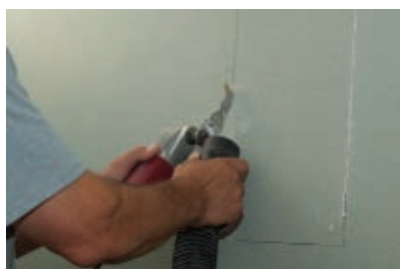
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# BRIGHT BUILDING BLOCKS



With the corners determined, again use the box as a template and mark the outside of the box on the interior wall. Be precise to eliminate the need for trim boards. Use a utility knife to score the dry-wall face at the layout line.

I used a multi-tool with a saw blade to cut the drywall, and used a shop vac to catch most of the dust during the cutting process.

*And there was light.* All that remained was to cut out a layer of vapor barrier to complete the opening for the surround box.

I put the first surround in place and set the blocks in it for reference because I wanted the offset to be about 1/3 of the window height. This would put the top of the lower window at the joint between the top two blocks of the higher window. I then measured



from the first window to the surround of the second to position it for marking the opening.

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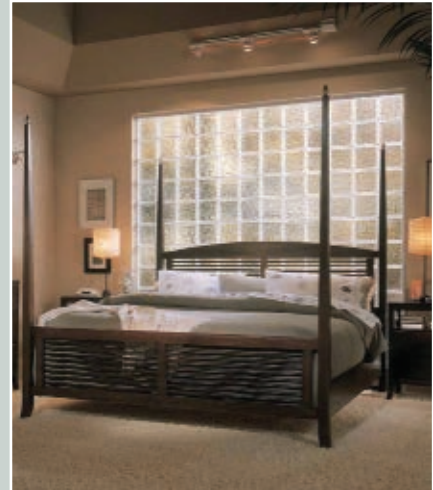
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# BRIGHT BUILDING BLOCKS

After cutting out the interior opening for the second window, I marked the corner locations by drilling from the inside and then using the surround to mark the siding for the cut-out.

I used a 3/8-by-3/8-in. wood gauge block to set the amount of surround extending beyond the interior wall.

With the surrounds gauged for an even reveal, and after double-



checking for level, I nailed the surrounds into the siding with 2-in. 18-gauge finish brads.



I cut 7/16-by-7/16-in. wood strips as window stops from the same primed pine material I used for the surrounds.



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# BRIGHT BUILDING BLOCKS

The gauge block helps to position the exterior stops inside the surrounds. I nailed them into place with a micro-pinner.



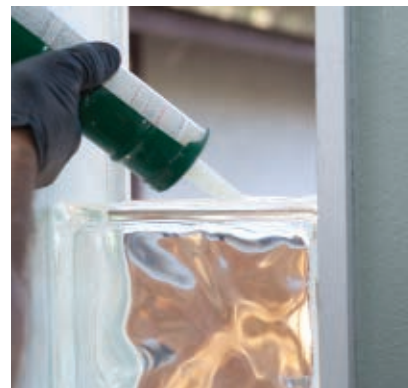
I installed the stops with the primed side to the glass block side because the reachable parts could be painted later.



Apply clear silicone caulk on the inside of the stops and between the glass blocks and then put the glass blocks in place from the interior side.

I pinned a second set of window stops against the glass blocks on the interior side of each window.

I then used my favorite white paintable caulk at the surround-to-wall transitions and at the surround-to-stop transitions. I used a paintable clear caulk at the stop-to-glass transitions and clear silicone caulk to fill the seams between blocks. **EHT**







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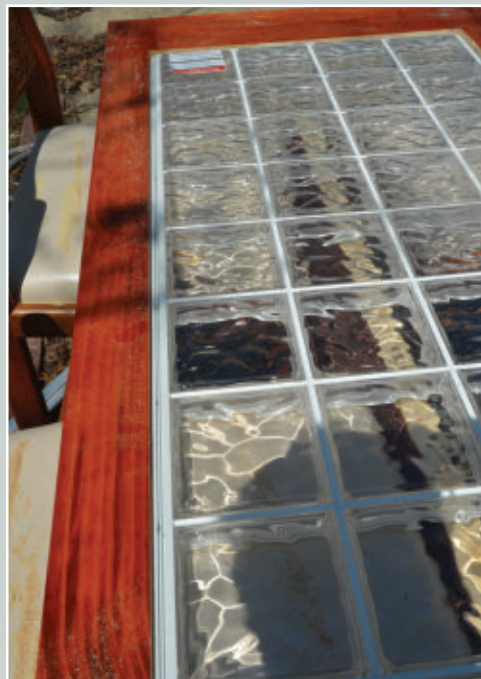
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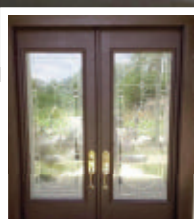
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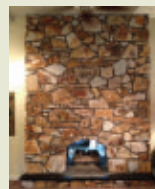
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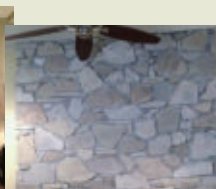


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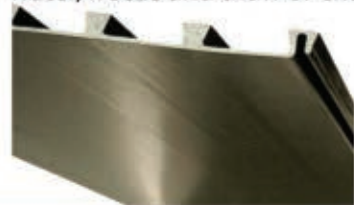
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# DECK BUILDING

By Rob Robillard

# BREAKDO

**T**here are approximately 40 million decks in the United States, and only half of those are code-compliant.

Deck safety is a real problem. Every year we hear about decks that collapse under the weight of people or snow load. Improperly built decks can be dangerous. Local codes were created to keep us safe, and many existing decks do not meet current safety codes.

If you've always dreamed of building your own deck but were

hesitant to tackle such a large, complicated construction project, well I'm here to tell you it's not that difficult. In this article we demonstrate the proper techniques for building a small, simple, low-to-ground deck.

## BASIC DESIGN

Layout of a deck sometimes starts on that proverbial napkin drawing and needs to be transformed into reality. Whether you're building off a napkin

sketch or a detailed architectural drawing, you need to transfer the deck design onto the ground to get started.

I lay out the deck using 12-in. ground spikes at each corner of the deck. For better visualization you can join the spikes with string to show the perimeter of the deck. This is often helpful for decisions on size, spacing, etc. I sometimes leave the strings up for a few days and ask the client to walk around, place furniture,





## *Pro Tips on Building a Code-Compliant Deck*

etc., to make sure they like the size or shape of the deck.

### **JOIST SIZE**

When planning a deck, one begins with the sizes of the framing material. This often is determined by the joist span needed. Joists typically extend from the ledger-board connected to the house. To reduce cost and material waste I always try to work with readily available pressure-treated lumber lengths, such as 8-

10-, 12-, 14- and 16-ft. long boards. It helps to know what size material you can get; for example, I know that my lumberyard carries 20 foot boards but only in the 2x10 sizes. Any longer than that and you're dealing with special orders or adding additional footings or beams to support joists that span the distance.

### **JOIST SPAN**

When choosing deck lumber based on joist span, I use the

following easy-to-remember rule of thumb that works for most of the treated wood species that I use for building. This rule is not a substitute for a proper table of spans and sizes of framing lumber, but is helpful in over-designing my joists during the early phase.

#### **Rule of thumb for joist span:**

Take the "depth of the framing member" and add half that number to determine a rough footage estimate for the deck's joist span



# DECK BUILDING BREAKDOWN

Most decks begin with a ledger board connected to the house rim joist.



limit. For example, on a 2x10 take 10 and add half of that (5) to equal 15. The rule of thumb says that 15 feet is your maximum allowable span for a generic 2x10 deck joist.

In my experience this rule of thumb always comes in shorter than the building codes allow—which is a good thing! This rule also assumes you are spacing your joists 16 inches on center.

Once you have determined your joist size, use this size lumber for all components of the deck frame, ledger, perimeter rim joists and blocking. For exterior use, we always use pressure-treated lumber for our framing.

The deck we build in this article is approximately 20 inches off the ground and as a result is not required by code to have a railing system on the steps or deck. The owner preferred an open, no-railing look.

If your deck is more than 30 inches off the ground it requires guardrails or handrails.

## LEDGER BOARD

I start all of my decks by determining the length of the ledger board. A ledger board is the part that attaches the deck to the

house. It is the first board to be installed because it sets the base for the rest of the deck.

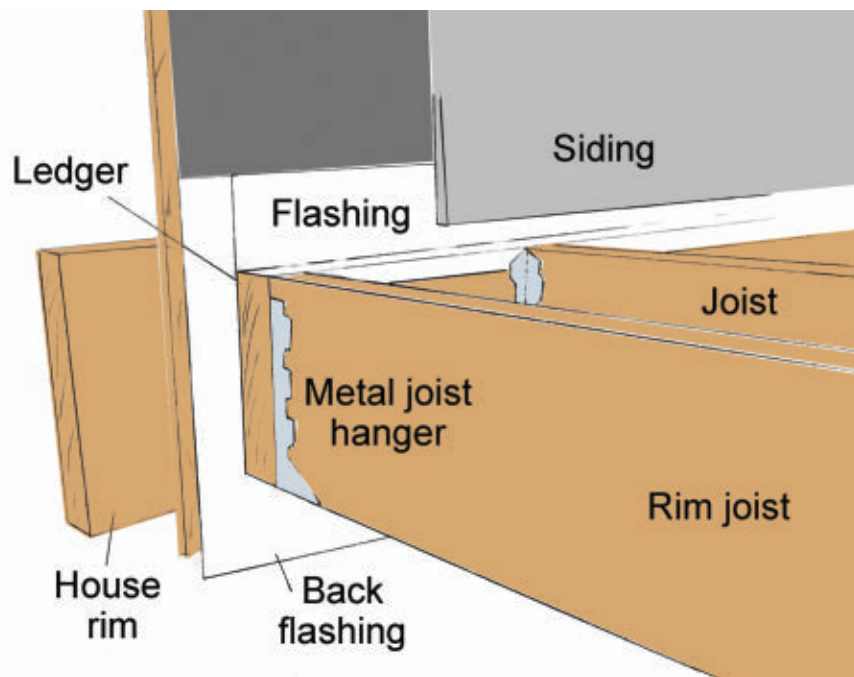
The ledger board attachment supports one end of the deck and bears about half the weight of the deck, the other half borne by the posts and footings. This means that proper attachment to the

house is extremely important.

In my neck of the woods I always try to install my ledger board so my finished deck height is 7 inches below the house interior floor. Stepping down 7 inches onto the deck reduces snow buildup and rain splashing and getting in under the house door. It also allows for me to install ledger flashing. The ledger board must be located 4 to 7-3/4 inches below the door sill. Snap a level line for quick reference (but don't put away the level!).

Prior to installing a ledger board you first need to remove existing house siding and trim from the house to expose the sheathing. After ensuring that the sheathing is structurally sound, we cover the area above and below the ledger board location with self-adhering rubber.

If there is space I will run rubber 10 inches up and as far down as necessary to keep water from



The ledger board requires continuous flashing against the house and over the ledger to prevent water intrusion. The flashing should lap up the house behind the siding.



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# DECK BUILDING BREAKDOWN

getting into the house. Sometimes the area below an elevated deck has siding, so I install the rubber to overlap a siding course and then cover with the last siding course or trim.

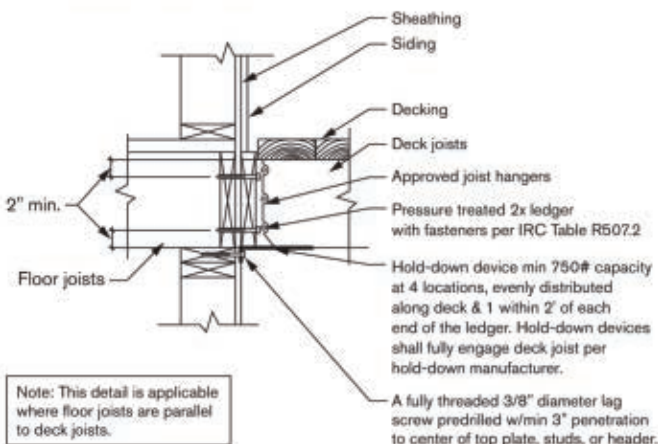
I prefer to cut our ledger board 3 inches shorter than our final frame width, which allows us to nail rim joists directly to the ledger board's end grain.

Once we locate the ledger board height, we level it and temporarily fasten it to the house with 16d galvanized nails.

After the ledger is temporarily fastened to the house, we go back and install permanent fasteners. Check your local building code to confirm fastener spacing in your area.

If at all possible I install through-bolts through the ledger and house

2015 IRC Lateral Load Detail



The International Residential Code requires decks supported by an adjacent house to be built with a "positive attachment" to resist lateral loads. The latest permitted lateral-load connection detail requires hardware that connects the bottom of a joist back to the wall plates, foundation, studs, or window or door headers. Check local codes for requirements in your area. (See sidebar for the latest technique to make the necessary connection.)

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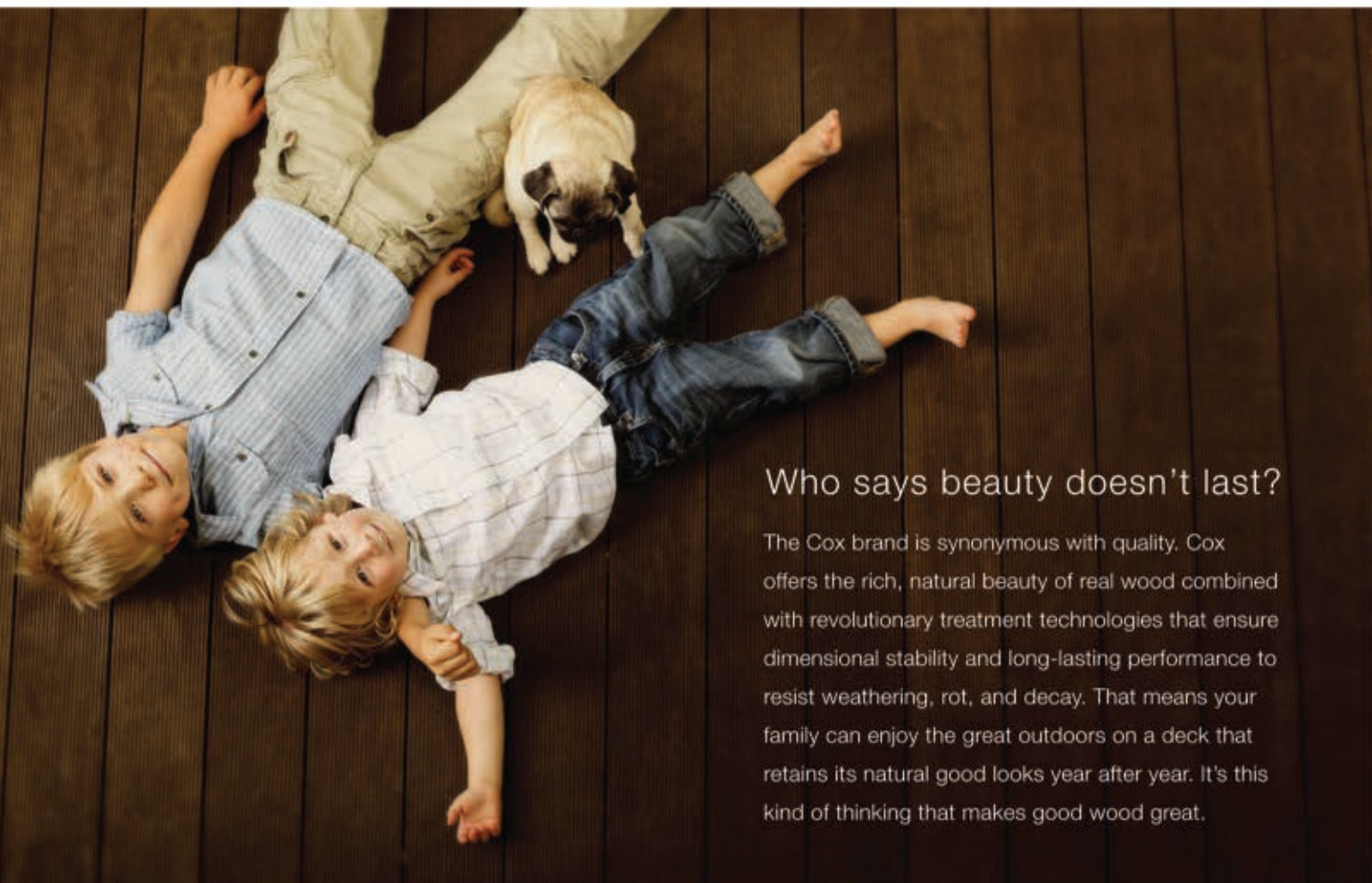
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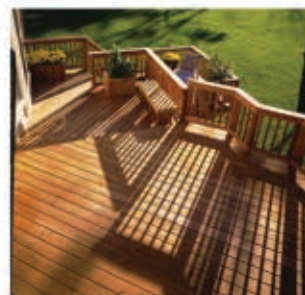


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# DECK BUILDING BREAKDOWN

rim board. This requires accessing the basement rim joist area. I use 1/2-in. diameter galvanized bolts and washers for which I drill 17/32- to 9/16-in. pilot holes. Use washers at the carriage-bolt head and the bolt nut.

I also like using structural screws because they don't require pre-drilling, are corrosion-resistant and are designed to be used with pressure-treated lumber. Follow the manufacturers' recommendations for fastener length and placement.

Once the ledger board is level and permanently installed, we run additional rubber down the side wall and over the ledger board. This area will later also receive a copper, galvanized or PVC ledger flashing cap.

**NOTE** – The latest building codes require decks supported by a



Once the ledger is attached to the house we install a rim joist on each side and a rim or beam opposite the ledger. We use scrap lumber as “legs” to hold the two rim joists level while attaching the outer joist to complete the perimeter frame. Diagonal bracing will hold the structure square while you add permanent supports and joists.

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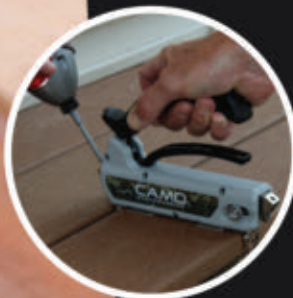
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# DECK BUILDING BREAKDOWN

house to be built with a “positive attachment” to resist lateral loads. This is accomplished using hardware connectors that tie the deck into the house to protect against lateral stresses from wind, seismic or people on the deck. Check your local codes to see if this is required in your area.

Follow the metal connector manufacturer’s recommendations for fastening any metal connector in your deck. My general rule is to use 16d galvanized nails everywhere I can.

## RIM JOISTS

Once the ledger is attached to the house we install a rim joist on either side and one rim or beam opposite the ledger. We use scrap lumber as “legs” to hold the two rim joists level and then attach and outer rim joist (opposite the ledger board) to complete the perimeter frame.

You’re probably saying, wait what about the footings? I’m a bit unconventional with my footings. I prefer to build the outer perimeter or the “sandbox frame” as we joke



We dig concrete footings to support all deck posts.

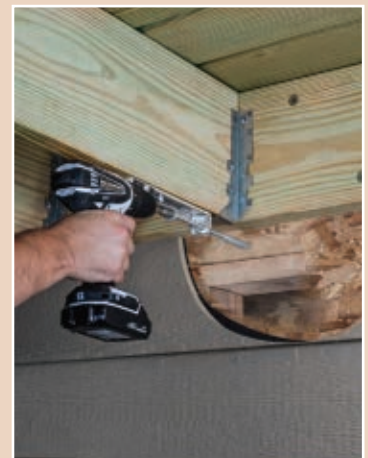


The depth of the deck footings will be determined by your local frost line and building codes.

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Simpson Strong-Tie introduces a new deck tension tie for attaching a deck to a home that meets newly updated code standards. The DTT1Z deck tension tie is a safe and time-saving alternative that eliminates the need to access floor joists from inside the house. Instead, it is fastened from outside the house. The DTT1Z addresses a new 2015 International Residential Code provision (section R507.2.4) that allows four 750-lb. lateral connectors to be fastened to structural framing joists members in the house. This provision is an alternative to using two 1,500-lb. lateral connections from the deck to the floor joists within the house.

The DTT1Z fastens to the narrow or wide face of a single 2x with Strong-Drive SD Connector screws. The new Strong-Drive SDWH Timber-Hex HDG screw with an integral washer attaches the tension tie to the supporting structure with a minimum of 3 inches of penetration. Learn more at [www.strongtie.com](http://www.strongtie.com).





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# DECK BUILDING BREAKDOWN



Tube-shaped cardboard forms can be cut to length and placed in the holes to pour the concrete footings.

on the jobsite. Once this frame is built we take diagonal measurements and use the 3-4-5 method to square the frame. Fastening two lengths of strapping from the outer rim joist's center diagonally to the side rim joists helps to hold the deck square.

We then add additional “temporary” support legs and start digging the footings.

## FOOTINGS

I like this method because it allows me to place my footings exactly where I want them and eliminates all the layout work with strings and batter boards that's otherwise required to locate the footings.

A concrete “footing” helps support the weight of the deck by spreading out the loads created by each post

over a wider area. The wider base also helps prevent frost heave from lifting the deck.

Deck posts are supposed to rest securely and centered on these footings with a threaded anchor or J-bolt holding it down. Anchor bolts are designed to resist post



Deck support posts should be mechanically fastened both to the footing in the ground and the deck frame or beam. Metal brackets make a strong connection while raising the wood post away from standing water.

## REIMAGINE OUTDOOR SPACES WITH THE 3D IPAD APP FROM AZEK

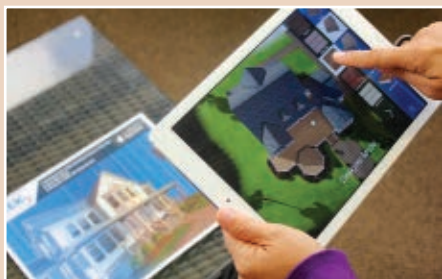
AZEK Building Products is making it easier than ever to visualize new deck, railing, paver and trim products on a home. A free new app, the AZEK iPad App, provides the power to reimagine home and outdoor living spaces in realistic 2D and 3D renderings.

With the new app, it's easy to turn dreams of outdoor living spaces into visual reality with a simple tap or swipe using five different product scenarios. From inspired deck and railing designs, trim and molding applications, porch colors and paver layouts, the app places the power of creative outdoor visualization in any user's hands.

Starting out in the 2D section, an iPad user can choose any of five home scenes, and mix and match products, designs and colors to customize the scenes. After exploring the two-dimensional visualization and customizing the product color schemes, the user can then take the design to the level of cutting-edge 3D technology to bring an entire house to life.

In the 3D experience, a user will scan what is known as a “visualization marker”, such as the cover of any AZEK catalog or a downloadable image from [www.azek.com/iPad](http://www.azek.com/iPad), to enter the exciting world of Augmented Reality (AR). In the AR experience, a 3D home appears and the user can personalize the house, rotate it 360 degrees, change product colors and then zoom in to make sure it's perfectly designed. If a visualization marker isn't available, Virtual Reality (VR) mode can be used to view and customize the AZEK home in 3D.

Once the home has been customized, it will be easy to imagine how a family might enjoy their outdoor spaces. And, after completion, the dream design can be saved, adding notes or tags, and then shared with friends. A user can even invite others to experience it. To learn more about the app, visit [www.azek.com](http://www.azek.com).





movement and deck uplift from high winds.

Most deck footings these days are either poured in place or pre-cast. When poured in place most folks use footing forms from Bigfoot Systems, Sonotube or an equivalent concrete form. These tube-shaped forms are simple to use, easy to install, resist settling, and prevent uplift caused by frost to result in a stronger deck foundation.

For this reason it's always important to install deck and porch footings below the frost line for your area as well as to make sure the installed footing is on soil that will support the footing's load.

The frost line depth is not consistent around the nation because there is such a dramatic difference in climate from state to



Rule of thumb for joist span: Take the "depth of the framing member" and add half that number to determine a rough footage estimate for the deck's joist span limit. For example, on a 2x10 take 10 and add half of that (5) to equal 15. The rule of thumb says that 15 feet is your maximum allowable span for a generic 2x10 joist (16" on center).



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# DECK BUILDING BREAKDOWN

state. The frost line in southern Florida is less than a foot, while in northern Minnesota it approaches 6 feet. The average frost line in Massachusetts is between 30

and 35 inches. My inspector wants to see deck footings 48 inches deep. The best source of information regarding your frost-line depth is your local building department.

## FOOTING DIAMETER

The diameter of the holes for your footings especially large ones, create significant concentrated loads within the soil. If you calculate the weight of the entire deck, the furniture placed on it and the combined weight of a large group of people who might be standing on it, you will be shocked at the number. Even a small deck might weigh in at 10,000 or more pounds.

If your deck has wood support posts and a ledger board that is bolted to the house, the deck posts holds up approximately 50 percent of the total weight. In this situation, the soil under each deck footing may be called upon to support 3,000 plus pounds.

Depending on the porch load, the diameter of the hole will probably range between 8 and 24



Use metal joist hangers to connect all joist ends.



Small sections of joist material can be installed between the joists as mid-span blocking to help prevent deck bounce and strengthen through-the-deck rail post attachments.

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inches. Larger diameter footings spread the weight out over more soil area. We used 12-in. diameter footings on this deck.

Footings tubes come in different lengths from 4 to 10 feet. The tubes are cardboard and are easy to cut with a hand saw.

Fill them with concrete, using a shovel to work out air pockets. Apply the J-bolt and allow the concrete to cure for one week. Once the footing is cured we install support posts. Depending on where we are on the project, I might install the joists before pouring the footing or vice versa. Either way, the temporary supports will hold the deck in place until we install and connect the deck posts to the footings.

## SUPPORT POSTS

Deck support posts should be mechanically fastened both to

the footing in the ground and the deck frame or beam. You want to ensure that your deck support posts resist lateral and uplift movement. Deck posts should be 4×6 pressure-treated lumber and have galvanized or stainless steel connectors attaching them to the rim joist.

If your posts are notched to hold a beam they should be a minimum of 6×6 (nominal) and have a corrosion-resistant post-to-footing and post-to-beam connector. There are a few retrofit options available to accomplish the post to beam. These connections are needed to resist lateral and uplift loads.

Adding diagonal bracing to both the parallel and perpendicular side of the deck post is also a good idea to reduce lateral motion and racking of the deck.

Diagonal braces should be installed at a 45-degree angles 24 in. down from the beam and 24 in. out from the post.

## JOIST INSTALLATION

Next, it's time to install the joists. We start left to right and mark out the ledger and outside rim joist 16-inches on center in a square line.

We cut all our joists at the same time, toe-nail them to the ledger and direct-nail them through our single outside rim joist. Toe-nailing or direct nailing of joists is no longer an acceptable way to secure joists without additional support, so we add metal joist hangers afterward.

TIP: If the joist has a crown—a slight arc along its edge—install it crown-side up.



Decks can be built with all sorts of designs. Here, we're doubling up the rim of a small alcove before applying joist hangers. This small area was designed to store a gas grill.

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# DECK BUILDING BREAKDOWN



To guide our 3/4" decking overhang, we temporarily face-nail a 3/4" board around the rim to use as a gauge. Once installation is complete, remove the board and paint/stain the rim.

## JOIST HANGERS

Joist hangers must meet IBC and IRC code of downward capacity. You can determine this by using an approved manufacturer's product data based on the dimensions of your joists or header.

Use the recommended nails and fasteners for the metal connector you're installing. Roofing nails, screws and box nails have no place in any metal connector system and should be avoided and replaced at all costs.

Also, make sure to install a properly sized nail or fastener into every metal connector hole provided.

Since we did not design a beam in this deck, the outside rim joist is then tripled, and is supported by the deck posts.

## MID-SPAN SUPPORT

Mid-span blocking can be used for a variety of purposes in deck building. Probably the most commonly used technique is to install small pieces of material in between the joists to help prevent deck bounce and also to increase the strength of the rail post attachment.

Often times scrap materials from your framing lumber may be

used for blocking; we often use joist cut-offs.

We snap a chalk line across the joists to lay out blocking. Install blocking in each joist bay, alternating the block along the chalk line to allow direct nailing. Install the blocking flush with the top of the deck frame.

## FLASHING AND TRIM

We install a metal or PVC flashing cap over the ledger board using roofing nails, and only place fasteners high up on the flashing.

We also like to install protective flashing to the joist tops. We accomplish this by using tar paper and staples on the joist tops, or a rubber membrane.

We then install all of our perimeter trim on the rim boards prior to applying decking.

## DECKING

A deck should complement its environment, your landscape, and enhance your outdoor living space. Your deck, therefore, should ideally complement you and your lifestyle. Whatever your reason for building a deck—for entertaining, relaxing or outdoor

living, you will need to consider materials for your decking.

On some of our decks we use composite deck boards. Composite decking has the beauty of wood without the concerns of splintering, rotting, maintenance or weather damage. Composite decking is simple to maintain and offers superior stain, fade, scratch and mold resistance. The decking surface is also easier to clean, which equates to less maintenance.

Some brands come with matching, colored plugs to conceal fasteners. Once installed the plugs almost disappear. Also available are colored screws to match the decking, as well as various hidden-fastener systems that are concealed beneath the deck boards.

To achieve a 3/4-in. overhang on the deck surface, we first temporarily face-nail a 3/4-in. board flush to one side rim joist. We then square one end of the first deck board and install it flush over the 3/4-in. temporary board. The temporary board gauges our 3/4-in. overhang. We let the end of the decking run long, off the deck, and cut it later with a track saw. This is faster than trying to



Granite steps provide access to the finished deck.



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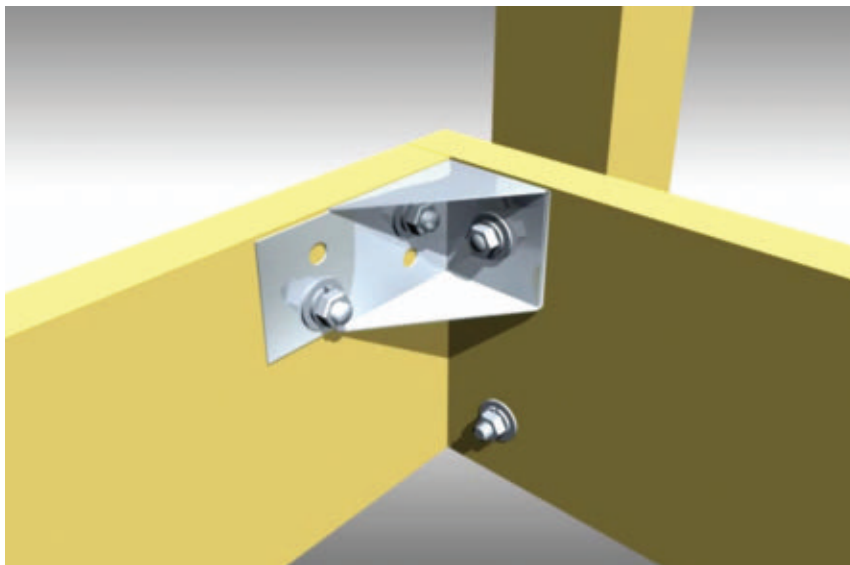


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# DECK BUILDING BREAKDOWN



Although the deck shown in this article was low to the ground, any deck higher than 30 inches requires a handrail/guardrail system. The posts of the railing system should be connected to the rim and joists or blocking using through-bolts and metal tension ties, such as the Advanced Lateral Anchor System available from DeckLok ([www.deck-lok.com](http://www.deck-lok.com)).

measure each board and get the ends to match up.

If you built your deck smaller than the longest available decking board length, you can install the decking without any joints.

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When we get to the last few deck boards next to the house, we measure and to determine the width of the very last board. In a perfect world a full-width board would drop into place, and the deck would be complete. The reality is that the last board usually gets ripped to size, and we hate installing a 1- to 2-in. ripped board. To avoid this, we rip the final three or four boards down 3/4 to an

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inch and install them. This method gives the appearance of all full boards at the house.

After the decking is complete, it's time to reinstall the siding. Some carpenters will put trim on the deck and side to that trim, or simply keep the siding off the decking 1/2 to 1 inch.

Now is the time to clean up your tools and celebrate. You've just built your first deck and you might as well start enjoying it.

## RAILING SYSTEMS

For decks more than 30 inches off the ground, railings are critical safety features. The posts should be a minimum 4×4 size and be solidly anchored to the deck joist and rim joist of the structure. Use two through-bolts and a metal tension tie for the upper bolt connection.

If a deck's guard-posts anchoring does not have a minimum allowable tension load of 1,800 lbs. for a 36-in. maximum railing height, they should be replaced. They can be retrofitted with a tension tie, through-bolts and or blocking as needed. Follow IRC code requirements when installing fasteners into guard posts.

Guard rails can be either 36 to 42 inches high (refer to your local code for guidance). Balusters in the railing system should also be installed so a 4-in. sphere can not pass between them.

## STAIRS

Stairs, stair stringers and stair guards must meet the IRC design and strength requirements for tread height and opening/spacing requirements. The steps you

should have a consistent tread depth with a 7-3/4-in. maximum riser height. A 3/8-in. deviation from one another is allowed by code but should be avoided.

If the stairs have an open riser they should not allow a 4-in. diameter sphere to pass through. Like the maximum spacing for balusters, this is intended to prevent small children from getting stuck or falling through.

Additional metal connectors can be used to connect stair stringers to the deck frame. **EHT**

*Editor's Note: Robert Robillard is a remodeling contractor based in Concord, MA. He is also the editor of a [www.AConcordCarpenter.com](http://www.AConcordCarpenter.com).*

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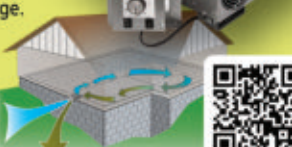


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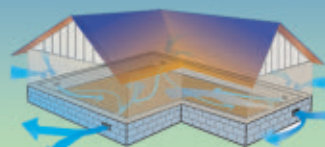
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# METAL PANELS FOR A LASTING ROOF

By Matt Weber

Corrugated roofing panels are made of metal, fiberglass or polycarbonate and typically install over a system of purlins. They're popular for workshops, sheds, boathouses and other outbuildings due to their long-lasting durability and easy installation. The panels come in standard widths and lengths and are fastened using screws with flexible washers.

## MATERIAL ADVANTAGE

The *EHT* staff chose the metal version of the panels in basic black to roof a boathouse last summer. Depending on the roofing product, a metal roof can last 40 years or more. Metal roofing easily sheds snow and ice and doesn't absorb water. It won't rot, split or crack, and can't be damaged by termites and pests.

And, unlike any other type of roofing, the color of pre-painted metal roofing can be changed to match new exterior color schemes. In fact, repainting will lengthen the overall life of the roof while eliminating the cost of replacement.

*How to Install  
Corrugated  
Roofing*



# METAL PANELS FOR A LASTING ROOF



*One trick to separating panels from a bundle is to "whip" the panel to force air beneath it (so they don't stick together).*

*On this construction crew, one man delivers the panels to the two installers on the roof.*



The light weight of a corrugated metal panel is another advantage. Compared to asphalt shingles that weigh an average of 2.5 lbs. per square foot, metal roofing panels only weigh .7 to 1.3 pounds per square foot, which allows the panels to be installed over existing roofing materials. This saves costly disposal and removal charges, and makes the panels easier to lift and install. (Ultimately, local building codes and the condition of your roof's substructure will determine if you can install metal panels over your existing roof.)

Metal roofing can reflect as much as 70 percent of the sun's radiant energy. This minimizes heat retention so less heat is transferred into the building.

Plus, metal roofing is the preferred roofing choice in hail-prone areas. Hail causes conventional roofing materials to break and split. Hail will not penetrate a metal roof.

## **SAFETY**

In general, fall-restraint harnesses and safety lines should be used by anyone working on roof.

It's also smart to wear goggles when cutting, and gloves when installing or handling the sheets to prevent cuts from the metal. Wear flexible rubber shoes that grip the metal when stepping on it. Never install metal roofing in the rain, because the slick, wet surface of the panels can virtually guarantee you'll slip and fall. And never work with metal panels in high winds, because the wind can carry an unfastened panel airborne, in which case it becomes a large flying blade and very dangerous.

The installers in this article did not wear the appropriate safety harness, assuming that if they fell they'd simply splash into the water. Do not follow their lead! If you fall off a roof and land on the ground, you could break your neck. Always wear the appropriate safety gear.



*Fasten the panels with a 2" overhang.*



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# METAL PANELS FOR A LASTING ROOF

## STORAGE

If the bundles of metal panels are stored outdoors on the ground, use plastic sheeting beneath the bundle to minimize condensation of water from the ground onto the

panels. The bundles must be raised off the plastic to avoid contact with water puddles and allow air to circulate around the bundles to dry condensed water. Store the panels at an angle to promote

drainage off the bundle. Protect the stored panels with a loose-fitting tarp to protect from rain or snow but also allow air circulation.

## CUTTING

Tin snips, powered shears or an electric nibbler tool are recommended to cut the panels. Cutting the steel generates slivers and metal chips that should be removed to avoid scratching the painted finish.

For cutting miscellaneous panels, trim and flashing, compound snips are required. You'll find it useful to have three pair, for left edge, right edge and centerline cuts.

## FASTENING

A variable-speed cordless drill/driver is all you need to drive the screws.

For fastening the metal to wood framing, use sharp-pointed, color-coated screws that easily penetrate

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*To help gauge the overhang, attach a layout string parallel to the eave as a guide.*

## ROOFING AN ENCLOSED BUILDING

For enclosed buildings, you can apply roofing felt before adding the panels by stapling every 3 inches on the outside of the felt and about 5 to 7 inches on the interior. Foil-backed single bubble insulation can also be used under metal roofing. Foil-backed bubble insulation has an R-value of approx. 9.2 and blocks 97 percent of radiant heat energy.



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# METAL FOR A LASTING PANELS ROOF

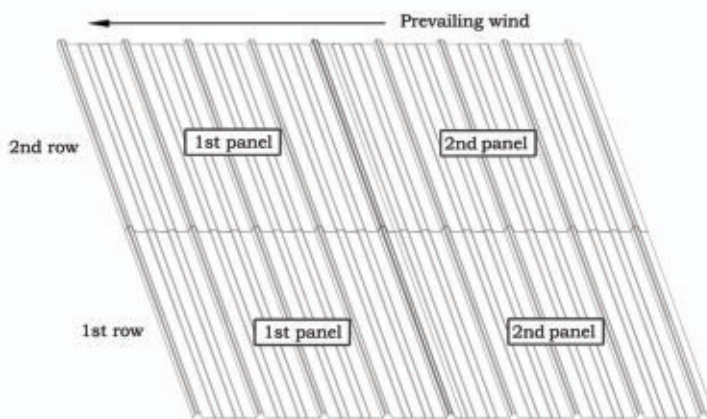


Fastener pattern at eaves, ridge and end laps



Fastener pattern at intermediate supports

*Suggested fastening pattern*



the metal to engage the wood. Color-coated screws protect against corrosion and blend with the roofing for an almost invisible appearance. Hex-head screws help hold the fasteners stable while driving them. All screws should include an EPDM vulcanized, bonded washer to prevent leaks and damage to the panels during installation.

Drive the fasteners through the metal roofing so they penetrate solidly into the framing. Whenever possible, nail in the valley between the ridges, where the roofing is closest to the wood.

*Side laps should face away from the prevailing wind. If you're not able to use full panels on your roof, follow the installation sequence (left) for proper construction.*

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*The fasteners of choice are color-coated screws with sharp points and EPDM vulcanized bonded washers to seal out water.*

## INSTALLATION

**Gable roofs.** For gable roofs, place the metal sheet at one corner of the roof, overhanging the edge by 2 inches. It may help to attach a string along the eaves to serve as a layout guideline for the overhang.



*Work toward the sides of the roof deck, cutting panels to fit as necessary.*



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# METAL FOR A LASTING PANELS ROOF



*This crew builds a lot hip roofs to a common pitch, and they made a wood jig to guide the matching panels cuts.*

Fasten with about 20 screws per sheet.

Place a second corrugated sheet next to the first with the ridge of the panel overlapping. For a more secure roof, apply caulk/sealant between the two overlapping sheets. Screw the second sheet through the first and into the framing. Finish fastening the second



*Install of corrugated panels on gable roofs usually begins on one side of the roof, working in the opposite direction of the prevailing wind. On hip roofs, this crew prefers to begin at the center and work outward. Side laps should still face away from the wind.*



*After marking the angle with the jig, the panels are cut to shape. Tin snips, powered shears or an electric nibbler tool are recommended to cut the panels.*

sheet and then repeat the procedure to complete the bottom row.

For the second row, place the first sheet above the first sheet of the first row. The upper sheet should overlap the first by 6 inches. Fasten the sheet and complete the second row in the same manner as the first. Each sheet should overlap both the sheet below it and the sheet to the side.

**Hip roofs.** For hip roofs, like the boathouse in the photos, determine the center line of the roof

and start panel installation in the middle, working outward to the sides of the roof deck and cutting the angled hip panels to fit. Snap a vertical chalk line to guide placement of the first center panel. The panels should still be installed so the side laps face away from the prevailing wind.

Metal roofing is typically sold with matching metal trim pieces, including ridge caps, drip edges, W-valley, rake trim and more. Consult the manufacturer's



*After completing the roof panels, the ridge seams at the adjoining sections of roof deck must be covered.*



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# METAL PANELS FOR A LASTING ROOF



The metal roof supplier should supply instruction for trim details. The ends of these ridge caps are measured for folding angles.



A pair of flat-jawed pliers are used to make straight bends along the cut angles.



The folded ends of the ridge cap will conceal the corners of the roof for a more finished appearance.

instructions for recommended fastener locations for the trim. The roof shown had no valleys, but the installers capped the seams of each ridge with matching black trim.

Once completed, the sleek-looking new metal roof greatly enhanced the décor of the boat-house, and will shade the sun and block the rain for many years to come. **EHT**



Beginning at the bottom, fasten the ridge cap over the exposed ridge seam to prevent water penetration and complete the roof. Roofing suppliers also offer drip edges, W-valley, end caps and various other trim pieces to complete virtually any common roof design.

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According to the Copper Development Association, laboratory testing shows that,

when cleaned regularly, antimicrobial copper surfaces kill greater than 99.9 percent of the following bacteria within two hours of exposure: MRSA, VRE, Staphylococcus aureus, Enterobacter aerogenes, Pseudomonas aeruginosa, and E. coli O157:H7.

Antimicrobial copper surfaces are a supplement to standard infection control practices and have been shown to reduce microbial contamination.

The mechanism by which Antimicrobial Copper kills bacteria is complex by nature, but the effect is simple. Science suggests

that copper surfaces affect bacteria in two sequential steps. The first step is a direct interaction between the surface and the bacterial outer membrane, causing the membrane to rupture. The second is related to the holes in the outer membrane, through which the cell loses vital nutrients and water, causing a general weakening of the cell.

## HOW CAN COPPER PUNCH HOLES IN A BACTERIUM?

Every cell's outer membrane, including that of a single cell organism like a bacterium, is





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characterized by a stable electrical micro-current. This is often called "transmembrane potential", and is, literally, a voltage difference between the inside and the outside of a cell. It is strongly suspected that when a bacterium comes in contact with a copper surface, a short circuiting of the current in the cell membrane can occur. This weakens the membrane and creates holes.

Another way to make a hole in a membrane is by localized oxidation or "rusting." This happens when a single copper molecule, or copper ion, is released from the copper surface and hits a building block of the cell membrane (either a protein or a fatty acid). If the "hit" occurs in the presence of oxygen, we speak of "oxidative damage", or "rust." An analogy is rust weakening and making holes in a piece of metal.

## AFTER PUNCHING HOLES, HOW DO COPPER IONS FURTHER DAMAGE THE CELL?

Now that the cell's main defense (its outer envelope) has been breached, there is an unopposed stream of copper ions entering the cell. This puts several vital processes inside the cell in danger. Copper literally overwhelms the inside of the cell and obstructs cell metabolism (i.e., the biochemical reactions needed for life). These reactions are accomplished and catalyzed

by enzymes. When excess copper binds to these enzymes, their activity grinds to a halt. The bacterium can no longer "breathe", "eat", "digest" or "create energy."

## HOW CAN COPPER'S EFFECT BE SO FAST, AND AFFECT SUCH A WIDE RANGE OF MICROORGANISMS?

Experts explain the speed with which bacteria perish on copper surfaces by the multi-targeted nature of copper's effects. After membrane perforation, copper can inhibit any given enzyme that stands in its way, and stop the cell from transporting or digesting nutrients, from repairing its damaged membrane, from breathing or multiplying.

It is also thought that this is why such a wide range of microorganisms are susceptible to contact action by copper.

## HOW IS ANTIMICROBIAL COPPER BEING USED?

In August of 2014, Chick-Fil-A of Morganton, North Carolina, installed antimicrobial copper push plates and door handles on its restroom doors. The owner, Dallas Stoudamire, cited interest in creating the cleanest environment possible for his customers and employees as his main driver for the installation.

In November, a level IV trauma center in Washington State installed copper components throughout its facility to create a cleaner environment for patients and reduce the bacteria that cause hospital infections. Pullman Regional Hospital installed the following copper hardware throughout the 95,000-square foot facility: faucet levers on 40 sinks in the public restrooms found in patient rooms and hallway basins, handles for







the IV poles used in the Birthplace, ICU and Medical Surgery Unit, and handicapped-access buttons for double-doors.

## DID YOU KNOW BRASS AND BRONZE ARE ACTUALLY ANTIMICROBIAL COPPER ALLOYS?

Copper can be combined with other metals to create alloys such as brass and bronze, which have different aesthetic and engineering properties. More than 400 copper alloys are registered by the EPA. A wide array of color, form and finish options are available.

With its antimicrobial properties and its wide range of alloys and applications, you now have a compelling new reason to consider copper for the hardware in your home and business. **EHT**

**Editor's Note:** Information and artwork were provided by Copper Development Association. Learn more about antimicrobial copper at [www.antimicrobialcopper.com](http://www.antimicrobialcopper.com).



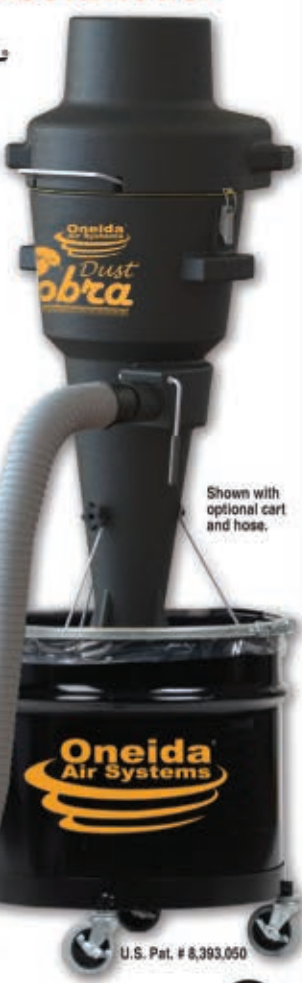
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# Big Oil

Save more by changing your truck's oil



By Tim Walton

I don't always work on trucks, but when I do, some things are actually easier. It's true that engine bay work often requires a stepladder to reach inside, but there is usually plenty of room compared to the import cars I see. For the DIY mechanic some maintenance tasks like oil changes can be easier because there is more room underneath a truck.

Oil is the life-blood of any engine, and big pickups are no exception. While their larger stature can be a bit intimidating, they're virtually the same as a car for basic maintenance such

as oil changes. In fact, their higher oil capacity means a greater opportunity to save money on an oil change when you do it yourself.

There are some differences when it comes to doing an oil drain, filter change and refill on a large vehicle. For example, you need to make sure the drain pan you're going to use has enough capacity so you're not fighting with an overflowing, sloshing container of oil.

## TOOLS

There are also a few tools that will make the job easier. Depending on the clearance

underneath your truck, you might be lucky enough to access all you need by crawling under or, better yet, rolling under with the aid of a creeper—something which is almost never true of an oil change on a car or lower vehicle. If you do need extra clearance you can utilize a jack and jack stands or wheel ramps. Be sure that jacks or ramps are heavy-duty and rated for the weight of your truck. Follow all safety precautions listed with the jacks and ramps.

Whichever method you use, set the parking brake and use chock blocks to ensure nothing moves.

Depending on how tight the oil



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filter is, having a filter wrench to assist with removing it can be key. Filter wrenches come in a variety of designs. Filter cap wrenches are designed for a specific filter. Plier and gear style wrenches tighten down to fit different size filters using a metal band, rubber strap or chain to cinch down on the filter. They all have their different applications that work well, but take into account how much room you have to access the filter.

In a pinch, you can drive a screwdriver through the walls of the filter near the bottom to gain more mechanical advantage to spin the filter off. This method almost always proves to be messy, and if you're going to continue to perform your own oil changes, investing in an oil-filter wrench is well worth it.

## FILTER FIND

It is very important that you get the proper fitment of oil filter for your vehicle. Just because a filter screws on doesn't mean it's correct. Make sure you're purchasing a filter that is specific for your vehicle. There are other thread pitches and sizes that are close enough that the filter will thread on and feel like it's tight but could come loose once the full oil pressure of the engine is applied to it, especially combined with the heat and vibration of a running engine.

Tightening the new oil filter shouldn't take a specialty tool. In fact you risk breaking the oil filter or the mounting post if you over-tighten it. Each filter has specific instructions based on the gasket construction. Instructions often say something like "screw until gasket contacts mounting surface and tighten an additional quarter of a turn."

Replacing the crush washer is cheap insurance for avoiding an oil leak at the drain plug. You

should be able to buy a replacement washer for your truck at an automotive parts store. Tightening the drain plug itself is important and you want to crush the washer to ensure a seal. However, over-tightening can potentially strip the threads in the oil pan, which could be a big hassle to repair so be careful when tightening the plug.

While you're at the store picking up supplies, a funnel isn't a bad idea to add to your cart. The one I have actually threads into the filler neck where the cap goes. It also has a rubber seal to ensure you're not going to lose oil from the funnel while you're refilling.

My Ford F-250 Super Duty has a 7.3 Liter Diesel Engine that takes 15 quarts of oil, and taking care of the oil changes myself has saved me a ton of money. Here's how I get it done on my truck.



I start by removing the oil fill cap so the oil drains faster. Once you're underneath the pickup, start by loosening the oil pan's drain plug using a wrench.



Once the drain plug is loose, you can screw it the rest of the way out by hand, applying some upward force to minimize oil leakage.



Quickly remove the plug once it's unthreaded to avoid pouring an oily mess down your arm. Once it's removed, allow as much oil to drain as you can.



If your oil drain pan is large enough, you can move it to cover the drainage from both the oil pan and the filter at the same time. Loosen the oil filter with a filter wrench



The oil filter is full of oil so be careful to pour it out it into the oil pan, which is probably the messiest part of the job.



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Once the oil filter is removed you can see where it mounts to the engine. I take this opportunity to clean it as well as check that the O-ring/rubber seal on the top of the oil filter isn't still stuck to the engine; if doubled up on accident you're almost always ensured a nasty oil leak.



With oil filters in a vertical configuration, such as this one, I like to add some oil to the filter itself before installing. This makes sure there is less of the engine without oil on the first start after the oil change. Also take this opportunity to add some oil to the O-ring/rubber seal on the filter before installing it.



After you have the filter ready and have cleaned up the area, you can reinstall the filter. I generally put them on as tight as I can by hand.



Replace the crush washer on the drain plug and screw it back into the engine oil pan. Make sure it threads in easily and take care not to cross-thread the plug. The fitment of the washer to the thread is more important than the material of the washer.



Tighten the drain plug so it crushes the washer for a good seal but don't go overboard unless you want an entirely new project of fixing the oil pan threads.



This handy thread-in-funnel is specifically designed to help avoid spills when refilling.



Refer to your owner's manual for capacity and grade of oil to use. I like to use a quality synthetic oil which is more expensive but offers better protection for my diesel engine. The larger gallon or 5-quart containers of oil are handy for engines with large oil capacity.

I check the level with the dipstick once it's near capacity to avoid overfilling the engine. You're almost never going to get all the oil out when you drain it so the refill capacities aren't exact. Once it's close, run the engine for a short period of time and recheck to get a true level of oil. Add more if needed. If the front of the vehicle is elevated you may have to lower it back down to be level to get a true reading.



Make sure to replace your oil filler cap and tighten it. If it's equipped with a rubber seal, make sure it's in place and not damaged. The oil filler drains to the crankcase, which can be connected to emission-related systems on the vehicle. **EHT**



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# HOT PRODUCTS

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Kameleon Screws have a unique design featuring fiber-trapping rings that keep material from splintering and eliminate any mushrooming effect.

Kameleon screws are available in #9 gauge diameters in lengths of 2-1/2 and 3 inches, and are also sold in colors that match today's most popular composite decking, including Redwood, Brown, Grey, Sand and Tan. Visit [www.grkfasteners.com](http://www.grkfasteners.com).

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Channellock Inc. introduces a brand new line of Xtra Slim Jaw adjustable wrenches. in two different wrench sizes with a variety of features to help the professional or serious DIY'er get the job done. The line includes 6- and 8-in. wrench sizes, and the Xtra Slim 3/16-in. Jaws are 40 percent thinner than a regular wrench of the same size for extra reach and maximum accessibility. The four-thread knurl and non-protruding jaws offer up to 20 percent greater jaw capacity for larger nuts and bolts. Signature CODE BLUE, grips are designed for durability and comfort. The wrench is properly balanced to avoid weak points in the tool, and the jaws are imprinted with standard and metric measurement scales. Visit [channellock.com](http://channellock.com).



## TORCHSCOPE VIDEO RECORDING FLASHLIGHT

The new TorchScope Video Recording Flashlight (DCF1) from General Tools & Instruments is ideal for construction, renovation, security, maintenance projects and tasks involving line-of-sight inspections. The instrument combines a powerful LED flashlight with a camera that can record and store high-definition video and photos. These media files can be date- and time-stamped to document or create a timeline of projects or events. Audio is captured simultaneously with video clips, allowing the user to record ambient sound, comments and explanations. The TorchScope is ruggedly constructed with anodized military-grade aerospace aluminum and features a non-slip knurled grip. The entire unit is 1m drop-resistant and IP68 waterproof, making it operable under water up to 10m (33 ft.) deep. Four buttons on the handle control menu access, brightness and illumination-mode, photo and video capture, and zoom (up to 4X). The flashlight can be used independently or in conjunction with the integral camera. The brightness and illumination-mode selections include 50-, 75-, 100-percent, fast strobe and S-O-S Morse Code transmission. At 100-percent (1,000 lumens), the illumination distance is 328 ft. (100m). Visit [www.generaltools.com](http://www.generaltools.com).







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# HOT PRODUCTS

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## 3-IN-ONE LOCK DRY LUBE

The new 3-In-One Lock Dry Lube from WD-40 helps to loosen and lubricate stuck locks and protect them from corrosion without attracting the dirt and debris that often plague lock lubricants. Some lock lubricants, like graphite formulas, leave a dirty, hard-to-clean mess on locks, doors and equipment, but 3-In-One Lock Dry Lube's clear formula dries within minutes so it won't attract dirt, which can gunk up lock mechanisms. The attachable straw easily delivers the formula into narrow lock mechanisms to penetrate stuck locks quickly and deeply. Lock Dry Lube can also be used without the straw for a wider spray pattern to refurbish and protect the entire lock. The quick-drying formula is safe to use on metal, wood and most plastic surfaces. It comes in a 2.5-ounce size so it easily fits in small spaces like toolboxes and glove compartments. Visit [www.WD40Company.com](http://www.WD40Company.com).

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# HOT PRODUCTS



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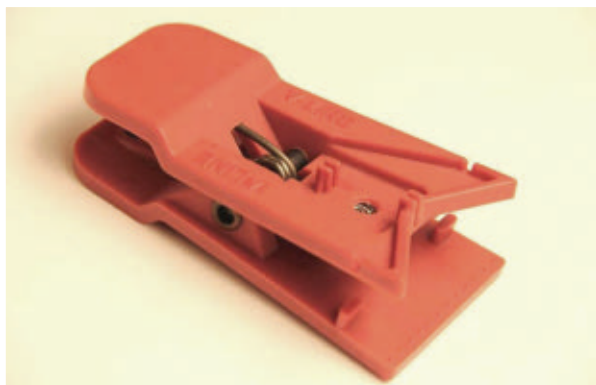
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The Wide Slide CFL/LED dimmer adds CFL/LED single pole and 3-way preset versions. The new dimmer line features wattage ratings of 450W for CFL/LED lamps and 700W for incandescent loads. The dimmers are available in three interchangeable face colors. Visit [www.legrand.com](http://www.legrand.com)



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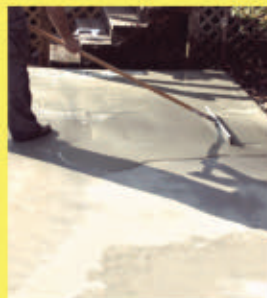
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