

Fine Woodworking & Fine Homebuilding's

2014 TOOL GUIDE



**Best tools
of the year**



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tools tested**



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Tool Guide – Fall 2013

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TOOL GUIDE



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on the web

free extras at FineWoodworking.com/TG2014



VIDEO

Supercharge Your Jointer

Today's new breed of segmented cutterheads offers woodworkers a cleaner cut with less noise and much longer life. Learn how to upgrade a conventional straight-knived cutterhead from start to finish.



VIDEO

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VIDEO

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Unlock your tablesaw's full potential with furniture maker and teacher Marc Adams. In our latest series, Adams walks you through a variety of essential techniques, including how to:

- Build your own splitters and zero-clearance throat plates
- Construct a custom crosscut sled
- Cut precise joinery



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For 11 years now, the *Tool Guide* has been bringing readers unbiased tool reviews from a team of experts—the woodworkers, carpenters, and other craftsmen who write for *Fine Woodworking* and *Fine Homebuilding* magazines. Once again, we've compiled all of the reviews from recent issues of these two magazines. We've also added new articles to make sure the guide is as complete as you need it to be.

Oh, and we've also included opinions from another very important expert—you. This year's guide again includes results from the annual survey of our readers, all dedicated tool users. You'll see their picks alongside our editors' choices.

The result is a buyer's companion that represents thousands of hours of real-world experience with hundreds of tools. Thank you for picking it up, and happier hunting.

Steve Scott, editor
Taunton's 2014 Tool Guide



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Best Tools

The editors and writers at *Fine Woodworking* and *Fine Homebuilding* test hundreds of new tools each year. Here are our favorites from this year's crop.

First-rate features on a precise chopsaw

12-IN. MITER SAW BY BOSCH

- Model No. CM-12
- [amazon.com](https://www.amazon.com)
- Street price: \$340



A simple 12-in. chopsaw offers the best combination of accuracy and capacity. The new single-bevel, 12-in. miter saw from Bosch stands out from the crowd in a number of ways. The miter detent override button, superb sliding fence, and integral extension wings have been successfully incorporated from earlier Bosch designs. New features include a large, readily accessible bevel-lock lever that's a pleasure to use. The new trigger lock is also a big improvement. The lock buttons are located on the underside of the D-handle, which yields a more natural grip and much improved control over the saw head.

The CM-12 arrived in perfect alignment and it cut smoothly and accurately throughout our testing. It has excellent capacity for a fixed-head saw: an 8-in. maximum crosscut and a vertical reach of 6¾ in. for cutting stock on edge. Dust collection is so-so, but that's not a surprise on a miter saw.

Space for blade changes is a bit tight, and it's challenging to remove and install the blade, in particular standard-kerf models. But the problem is easily solved by removing the outer chip deflector before you change blades.

The Bosch CM-12 offers great accuracy, big capacity, and convenient features, making it a solid buy for the home shop.



Make way for the blade. To change the blade, remove the outer chip deflector. Don't forget to put it back on when you're done.

Innovative stud finder works at a glance

The new ProSensor 710 from Franklin Sensors is proof that stud finders, like mousetraps, can always be improved. Unlike other basic models that require endless back-and-forth scanning to find the edges of a stud, the ProSensor 710 can display the full width of a hidden object—or multiple objects—the moment it's placed on a surface. Inside the 3-in. by 7-in. unit, multiple sensors eliminate the need to initialize the tool over a hollow portion of a wall. Once an object is detected, 13 evenly spaced LEDs illuminate individually to display its location. The tool scored above average for accuracy and detection depth. We also appreciated its silence; there's no annoying beep. Despite its strengths, the 710 is still a basic stud finder. It cannot detect live AC wiring, and it can't tell the difference between studs, copper pipe, and electrical conduit.



FRANKLIN SENSORS

- ProSensor 710
- [franklinsensors.com](https://www.franklinsensors.com)
- Street price: \$50

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BOSCH ROUTER COMBO KIT

- Model No. MRC23EVSK
- homedepot.com
- Street price: \$320

Router kit revamped

The biggest difference between this kit and other router combo kits is that the on/off trigger is located on the hand grip of both the fixed base and the plunge base. A small electric strip that mates between the tool and the bases means there's no hard wiring needed between the two, and the bases are swapped out just as with any other kit. The design is great, because even with the soft-start motor, you can have both hands holding the router when you turn it on, and you can hit the off switch quickly if need be.

Two small LEDs next to the shaft light the work surface. The router's baseplate is clear plastic, allowing for great sight lines to the workpiece, especially in conjunction with the lights. The

10-ft. power cord is unique in that it connects to the tool with a ball-and-socket end, reducing the chances of its getting twisted or snagged.

The plunge base has a full 3-in. travel, the deepest of any comparable router we're aware of. One nice feature is that the plunge lever locks automatically when released. To set the depth, simply hold down the lever, adjust the depth, and then release the lever. Accuracy for this tool was right on the money.

When mounted in a table, the router's height can be adjusted conveniently through the table with a hex key that works with the router's fixed base.



Better blades for the budget conscious

Guhdo, a German tool maker, recently entered the U.S. tool market with a new sawblade line called the Gmaxx series that boasts high quality, priced for high value.

The 10-in. general-purpose blade (No. 2400.100A50), which has 50 teeth with a combination grind and 15° hook, is a great combo blade. We used it to make some very clean ripcuts in a bunch of hickory boards with no signs of bogging down. The blade also yielded tearout-free cuts in Baltic-birch plywood. The Gmaxx crosscut blade (No. 2400.100A40), has 40 teeth and an ATB grind with an 18° hook. It also did a superb job on a variety of wood, from pine to koa, gonzalo alves to rock maple. And the carbide tips are beefy, which means they can be resharpened a number of times.

GMAXX A SERIES SAWBLADES BY GUHDO

- Model No. 2400.100A40 & 2400.100A50
- amazon.com
- Street price: \$66

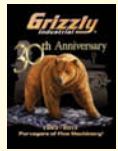


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- Table size: 14" x 14"
- Table tilt: 45° right, 15° left
- Floor to table height: 43"
- Deluxe extruded aluminum fence
- Cutting capacity/throat: 13 1/2"
- Maximum cutting height: 6"
- Blade size: 93 1/2" (1/8" to 3/4" wide)
- Blade speeds: 1500 & 3200 FPM
- 4" dust port
- Cast iron frame
- Computer balanced cast iron wheels with rubber tires
- Overall size: 27" W x 67 1/2" H x 30" D
- Approximate shipping weight: 205 lbs.

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G0555LANV \$545⁰⁰

LIMITED TIME INTRODUCTORY PRICING **\$445⁰⁰**



New!

19" HEAVY-DUTY BANDSAW WITH MOTOR BRAKE



- Motor: 2 HP, 110V/220V, single-phase, TEFC capacitor start induction, 60 Hz, prewired 220V
- Amps: 20A at 110V, 10A at 220V
- RPM: 1725
- Precision-ground cast iron table
- Table size: 17" x 17" x 1 1/2" thick
- Table tilt: 10° left, 45° right
- Floor to table height: 37 1/2"
- Cutting capacity/throat: 16 1/4" left of blade
- Maximum cutting height: 12 1/8"
- Blade size: 131 1/2" long
- Blade sizes available: 1/8"-1" wide
- 2 blade speeds: 1700 & 3500 FPM
- Wheels: fully balanced cast aluminum with polyurethane tires
- Wheel covers: pre-formed steel
- Overall size: 32" W x 73" H x 32" D
- Approximate shipping weight: 342 lbs.

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G0513ANV \$895⁰⁰

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- Motor: 3 HP, 220V, single-phase
- Solid cast iron table size: 48"W x 27"D
- Arbor: 5/8"
- Cutting capacity: 8" left & 25 5/8" right of blade
- Max. depth of cut: @ 90° 3", @ 45° 2 1/8"
- Approx. shipping weight: 547 lbs.



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12" PLANER/JOINTER



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- Motor: 5 HP, 220V, single-phase, 25A
- Jointer table size: 14" x 59 1/2"
- Cutterhead: Spiral, 32 inserts
- Cutterhead insert size: 15 x 15 x 2.5mm
- Cutterhead diameter: 3 1/8"
- Bevel jointing: 0° - 45°
- Switch: Magnetic with thermal protection
- Power transfer: Twin V-belts
- Planer feed rate: 22 FPM
- Planer table size: 12 1/4" x 23 1/8"
- Overall size: 67 1/2" W x 24" D x 41 1/2" H
- Approximate shipping weight: 704 lbs.



G0634XP W/ SPIRAL CUTTERHEAD ONLY \$2295⁰⁰

12 SPEED HEAVY-DUTY 14" FLOOR DRILL PRESS

- Motor: 3/4 HP, 110V, single-phase
- Swing: 14"
- Drill chuck: 1/4"-5/8"
- Spindle taper: MT #2
- Spindle travel: 3 1/4"
- Speeds: 140, 260, 320, 380, 480, 540, 980, 1160, 1510, 1650, 2180, 3050 RPM
- Precision-ground cast iron table
- Table tilts: 90° left & right
- Overall height: 64"
- Approximate shipping weight: 171 lbs.



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G7944 ONLY \$355⁰⁰

2 HP DUST COLLECTOR WITH 2.5 MICRON BAG

MADE IN TAIWAN

- Motor: 2 HP, 240V, single-phase, 3450 RPM, 9A
- 6" inlet with removable "Y" fitting with (2) 4" openings
- Impeller: 12 3/4" balanced steel
- Height (with bags inflated): 78"
- Air suction capacity: 1550 CFM
- Maximum static pressure: 11"
- Standard bag filtration: 2.5 Micron
- Approximate shipping weight: 126 lbs.

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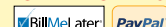
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VERITAS BENCH CHISELS

- Model No. 05S20
- leevalley.com
- Street price: \$295
for the set (¼ in., ⅜ in.,
½ in., ¾ in., and 1 in.).

New woodworker's chisels offer top quality and value

This year, woodworking retailer Veritas started making its own bench chisels, and we were happy to take a set for a test drive.

The chisels were flawless out of the box. The blades are made from O1 tool steel, and they are stout, registering ⅝ in. thick at the ferrules and tapering to ⅜ in. at the bevel, or tip. Their side edges have bevels that extend all the way to the chisel face, and the backs are lapped dead flat, also rare. The blade is secured to the handle with a barbed tang. A tapered stainless-steel ferrule enhances the blade-to-handle connection. The usable blade length ranges from 4⅝ in. (¼-in. chisel) to 5⅝ in. (1-in. chisel).

The maple handles have subtle flats that help make them comfortable to grasp and keep them from rolling off the bench.

We used the chisels to chop and pare dovetails in white oak. They have a very solid feel. Mallet blows are directly transferred to the workpiece with no flex or give. The beveled side edges make it easy to clean up dovetail corners. The O1 steel was easy to sharpen to a keen edge, which held up well in our tests.

A remodeler's favorite recip saw

At just 6.8 lb. and 14½ in. long, this saw was designed to get into some awkward places. It has all the bells and whistles any reciprocating saw should. The overmolded soft grips on both the main handle and front-boot area make it a comfortable tool to use while also helping to limit vibration; the variable-speed trigger lets you control the 1½-in. blade stroke without having to think about it; and the four-position toolless blade clamp lets you configure the saw to get into just about anywhere. Anyone who has done much remodeling work has surely found themselves in a joist bay looking like they're auditioning for the construction sequence of a Cirque du Soleil show with the butt end of a reciprocating saw one bound blade away from a broken nose and—worse—a bruised ego. This saw gets you out of there with the job done and your dignity intact.

The first project our reviewer tackled with this tool was trimming the ends of joists that once sat on a bearing wall but would now be flush-framed into a new beam. The saw also came out of the truck when the reviewer's crew had to remove some ornate railings that were to be restored and reinstalled at the end of the project.

Encouraged by how comfortable the saw was to use, our reviewer decided to try using it for some heavier tasks that really called for a larger, 15-amp reciprocating saw. What we discovered was that, with its 10-amp motor, this saw is not right for heavy demolition work, but it doesn't claim to be. If full-size reciprocating saws are meat cleavers, then the DWE-357 is a paring knife. It is made for quick, clean cuts in tight situations, not for hogging out large amounts of heavy framing lumber.

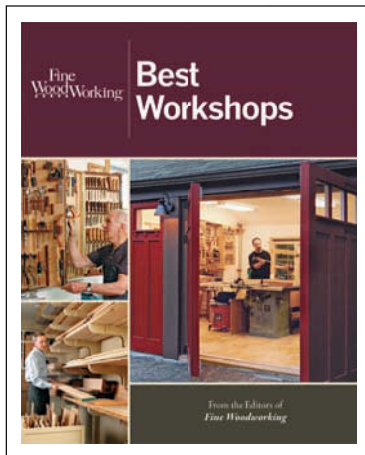


DEWALT RECIPROCATING SAW

- Model No. DWE-357
- northerntool.com
- Street price: \$130

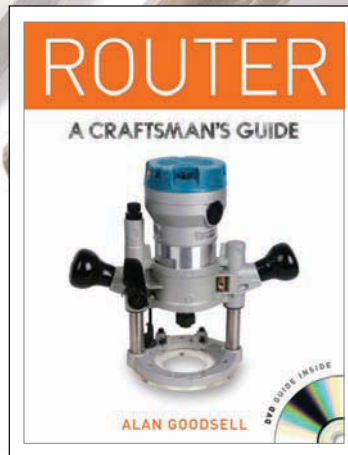
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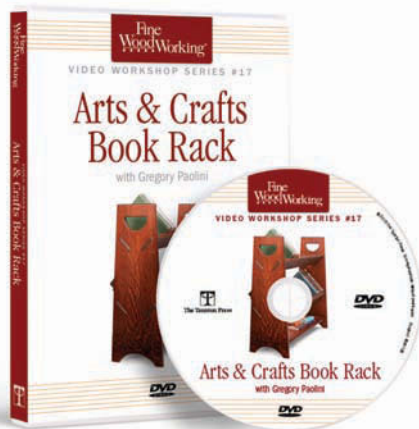
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On the Horizon

So new we haven't tested them yet, but they look like winners

These tools are so new, we haven't had a chance to put them through their paces; in fact, some were not due for release until after the *Tool Guide* went to press. But if you are shopping for something in these categories, give these innovations a close look. Note that some prices may change.



LAGUNA 14-IN. BANDSAW

- lagunatools.com
- Price: \$1,100

Laguna bandsaw: Serious capacity for less

At \$1,100 and available October 1, Laguna's new 14-in. bandsaw looks like a powerful combination of performance and value. The 14 Twelve (refers to its resaw capacity) is designed as a price-conscious cousin to Laguna's premium 14-in. saw, the \$1,700 SUV. Powered by a 1¾-hp motor (110v), the new saw features the same top-notch ceramic guides as the SUV and just 2 fewer inches of resaw capacity (12 in. to the SUV's 14 in.) The saw is beefy enough to allow tensioning of a ¾-in. blade; Laguna designers point to the saw's especially stiff frame. Fit and finish are top-notch. Other features include a magnetic safety switch that you must pull to turn on, a 6-in.-tall, two-position fence, and a table that tilts both ways.

Shelf-pin jig is a solid bet



BENCH DOG SHELF-PIN JIG

- rockler.com
- Price: \$20

If you're serious about making furniture but only occasionally need to drill holes for shelf pins, you can't beat Bench Dog's system, sold by Rockler. The jig provides a reliable, accurate setup for five equally spaced holes. An included indexing pin lets you extend any row of holes indefinitely. Smart features include slots that let you see your layout lines, for aligning holes at the front of a cabinet with those at the back. The jig comes with Rockler's self-centering drill bit.

We've seen plenty of similar jigs, but the combination of features and price make this one look like a sure bet for hobbyists.

Festool's new jigsaws go brushless

Brushless motors keep finding their way into more handheld power tools and now Festool's newest jigsaws have joined the list. Both the corded and cordless version of the new Carvex saws feature the brushless technology (for a description of brushless motors, see p. 24). The result is a more efficient motor that wrings greater run time from batteries on cordless units and is generally longer lasting and quieter. The new saws also feature carbide blade guides to control blade drift and deflection and a full-featured set of interchangeable baseplates for use with a full range of wood, engineered wood products, plastics, and metals. A separately sold accessory base helps make precise angled cuts.



FESTOOL CARVEX JIGSAWS

- festoolusa.com
- Price: \$350

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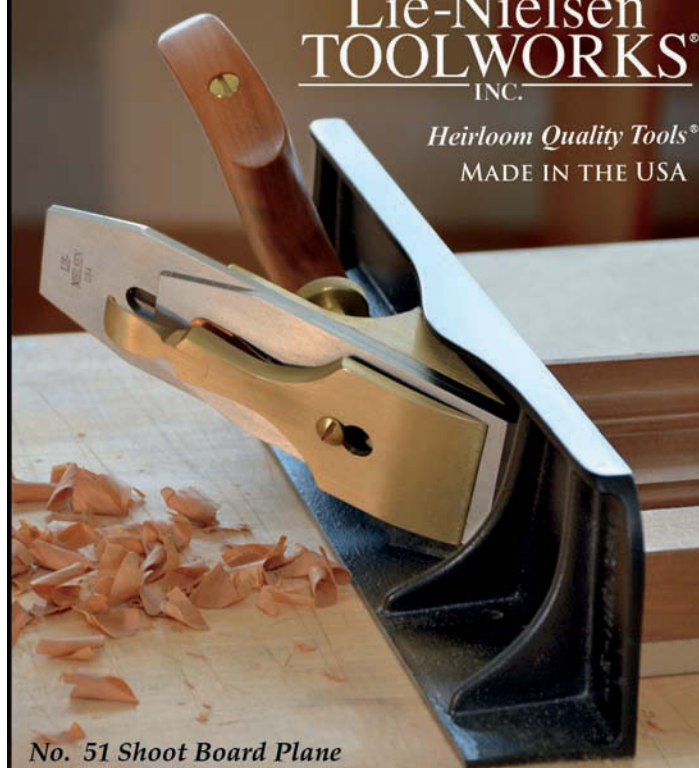
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Tile saw features sliding table

With a 1½-hp motor and a generously sized sliding table, Husqvarna's new TS 60 tile saw allows for 24-in. ripcuts and diagonal cuts on tiles up to 20 in. square. The adjustable cutting head raises and lowers for plunge cuts, and tilts for miters from 22.5° to 45°. A large pan and splash guards keep floors dry, so the saw can be used indoors, the company says. Filters keep tile slurry out of the water pump. The saw comes with soft start and LED technology that Husqvarna calls Elgard, which warns the user when the machine is in danger of being overloaded, preventing motor damage and tripped circuit breakers.

At 80 lb., the saw's portability is boosted by a set of built-in wheels.



HUSQVARNA TILE SAW

- Model No. TS 60
- husqvarna.com
- Price: \$1,200

APOLLO ECO-SERIES HVLP SPRAYERS

- hvp.com
- Starting at \$649

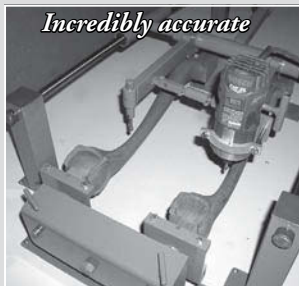


HVLP on a budget

Apollo's new ECO-Series HVLP finish sprayer is aimed at the serious amateur woodworker or small-shop cabinet pro. Starting at \$649, the series offers 3-, 4-, and 5-stage turbines that will handle solvent finishes as well as most of the thicker waterborne finishes. Apollo credits a new fan design with boosting atomizing pressure by 12% to 22%. These sprayers aren't designed for continuous heavy-duty use, but the unit we saw appeared solidly built. It featured a durable metal casing, the same turbine motor as its higher-priced brethren, and even the same hose.

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Beefy router table bolts to your tablesaw

General has launched a tablesaw-extension version of its excellent Excalibur cast-iron router table (see "Router Tables," pp. 52-55).

Compared to the stand-alone table (40-200C), the extension version (40-070EK) is 8 in. shorter in each direction, measuring 16 in. by 27 in. It's designed to replace one of your cast-iron tablesaw wings so as not to take up additional shop space. The \$400 price is roughly half that of the stand-alone model.

The extension fits seamlessly on General cabinet saws, but will also work on other saws with a few extra holes drilled in it. Its two outboard legs adjust to any table height.

The 40-070EK boasts all of its big brother's key features: a flat, sag-proof cast-iron top for accuracy, a convenient insert-ring system around the bit, plus a full-featured fence with easy adjustment, sliding faces, T-track for attaching stop blocks and featherboards, and a dust port. The basic setup comes with a phenolic insert plate for mounting your router. General also offers an excellent Excalibur router lift.



EXCALIBUR EXTENSION ROUTER TABLE

- general.ca
- Price: \$400

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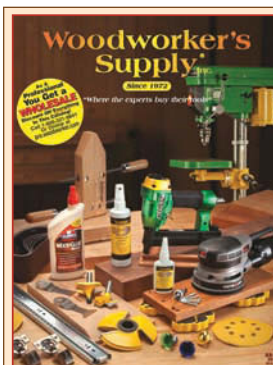
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What's New in Cordless Drills

Run times surge as smart circuitry joins brushless motors and lithium-ion batteries

BY SCOTT GIBSON



Pick a pack

Different batteries for different jobs. For woodworking and other light-duty applications, a small battery pack (above) makes for easier lifting. Larger batteries with long run times are ideal for a full day's work on a job site (left) without convenient access to power. Some manufacturers make it possible to use different packs with the same tool.

Cordless drills are benefitting from a variety of innovations, including more efficient motors that run longer between charges, higher-capacity batteries, and features that make the tools more versatile.

Some manufacturers are further along than others, but just about everyone seems headed in the same direction. Product managers tell a remarkably similar story of what improvements they've made recently and what they hope to accomplish in the near future.

Battery chemistry is improving, with lithium-ion technology ratcheting up how long the tools can run between charges.

High-end product lines are coming, with brushless motors that deliver power more efficiently and last much longer, requiring little or no maintenance.

Onboard electronics in tools, battery packs, and chargers are getting more sophisticated, protecting batteries from damage and improving the efficiency of motors.

Newest batteries are stronger and lighter

Instead of gradually fading to flat, as other batteries do, lithium-ion cells stop running the tool suddenly. That is, the tool drives one screw normally but has zero power the next time you pull the trigger.

It's a small price to pay, though, for much better performance. Lithium-ion cells have a better power-to-weight ratio than older style nickel-cadmium (Ni-Cd) batteries. This means battery packs can be both smaller and lighter.

And they last longer.

The amp-hour rating of a battery indicates how long the tool will run before it must be recharged. "When you increase the amp-hours it's basically like putting a bigger fuel tank on your car," says Festool product manager Rick Bush, "and it can make a bigger difference than voltage." Tests at Festool found much higher performance as amp-hours increased. A 12-volt, 1.3-amp-hour battery could drive 450 #8 by 2-in. screws before it ran down. A 2.4-amp-hour battery could drive 540 screws, and a 3-amp-hour battery sank nearly 700 screws, Bush said.

Companies disagree about the long-term advantages of extended run times. Some manufacturers say their tests link higher amp-hour ratings—particularly those over 4—to shorter overall

Weighty matters

A cordless-tool battery pack is basically a protective case that contains a series of small, cylindrical cells. Each cell holds the same amount of voltage, and they work together as a unit. To achieve higher voltages, a battery pack needs more cells—and by adding more cells, you also add weight. But the beauty of lithium-ion is that a cell of the same size can produce three times the voltage output with no appreciable weight penalty.



NI-CD/NI-MH

Nickel-based battery cells each produce about 1.2 volts, so a battery pack needs to link 15 individual 1.2-volt cells to produce 18 volts.

LITHIUM-ION

Lithium-ion cells produce about 3.6 volts each—three times the voltage—so the same 18 volts can be created with five cells and less weight.

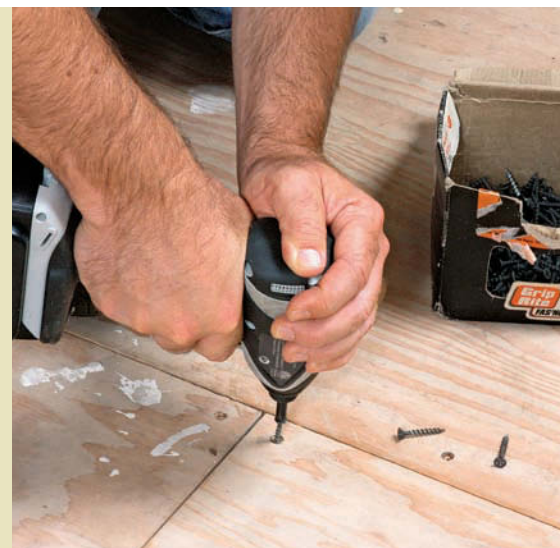
Impact drivers

While drill/drivers have long been staples for professionals and amateurs alike, impact drivers are quickly catching up as more people embrace their compact size and increased torque.

"We've definitely seen the impact-driver category grow quite a bit over the last five years," says Milwaukee group product manager Tom Simeone. "It's one of the fastest-growing categories in cordless power tools."

As popularity grows, manufacturers are offering new features that make the drivers easier and more convenient to use. Hitachi's 18-volt impact driver, for example, has four power settings so you can lower speed when working in softer materials or with smaller fasteners. Another switch dials back the impact function. DeWalt's XR impact driver comes with three speed/torque settings. And Milwaukee's FUEL products have three different fastening modes, each with a different speed and torque. These features make a high-power impact driver much easier to control for everything from drilling to driving.

For more on impact drivers, see pp. 26-29.



How brushless is different

A conventional motor relies on a pair of carbon brushes to deliver current by rubbing on spinning electromagnets. In a brushless motor, fixed electromagnets surround conventional magnets. Because the electromagnets don't move, the power can be supplied directly without the use of brushes. There is no friction or arcing, so the motor is more efficient. What makes the motor more complicated, and adds to the cost, is a microcontroller that reverses the direction of the current every fraction of a second.

Although first invented in the 1960s, brushless motors didn't become commercially viable until the 1990s with the growth of sophisticated and cheap electronic controls. If you like radio-controlled cars, you'll already appreciate brushless motors for their compact size, lack of friction at high rpm, and greater battery range. Cooling fans in computers almost all use brushless motors because they run cooler and don't interfere with electronics.

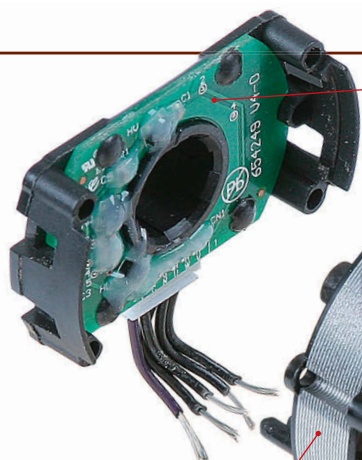
The delay in getting brushless motors into woodworking tools has been a combination of scaling up their size, dealing with the high peak loads these tools need to handle, and seeing if the market will pay more for a workhorse tool.

Online Extra

To see a video animation of how brushless motors work, go to FineWoodworking.com/TG2014.

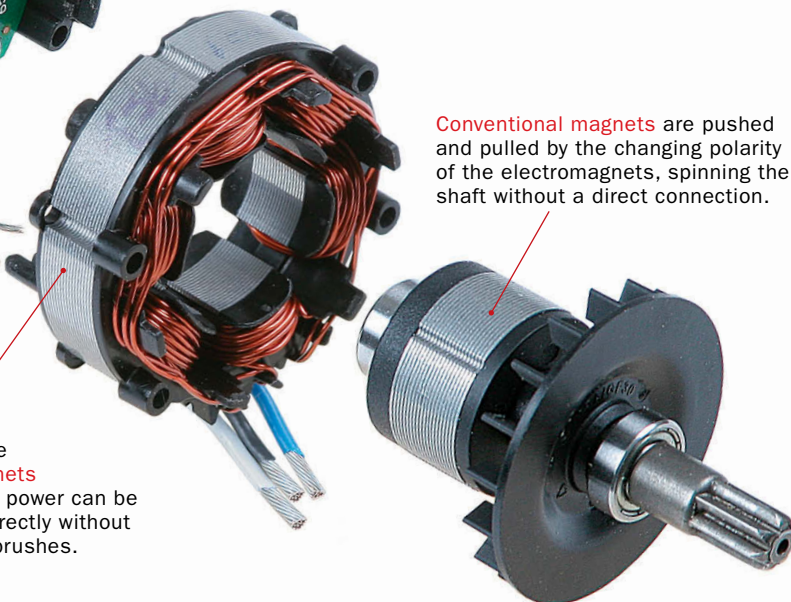
The battery has a chip, too. With their own circuit board that protects the battery and ensures long run times, lithium-ion packs pair nicely with brushless motors.

INSIDE THE TECHNOLOGY



Computer circuitry delivers alternating power to fixed electromagnets.

Because the electromagnets don't move, power can be delivered directly without the use of brushes.



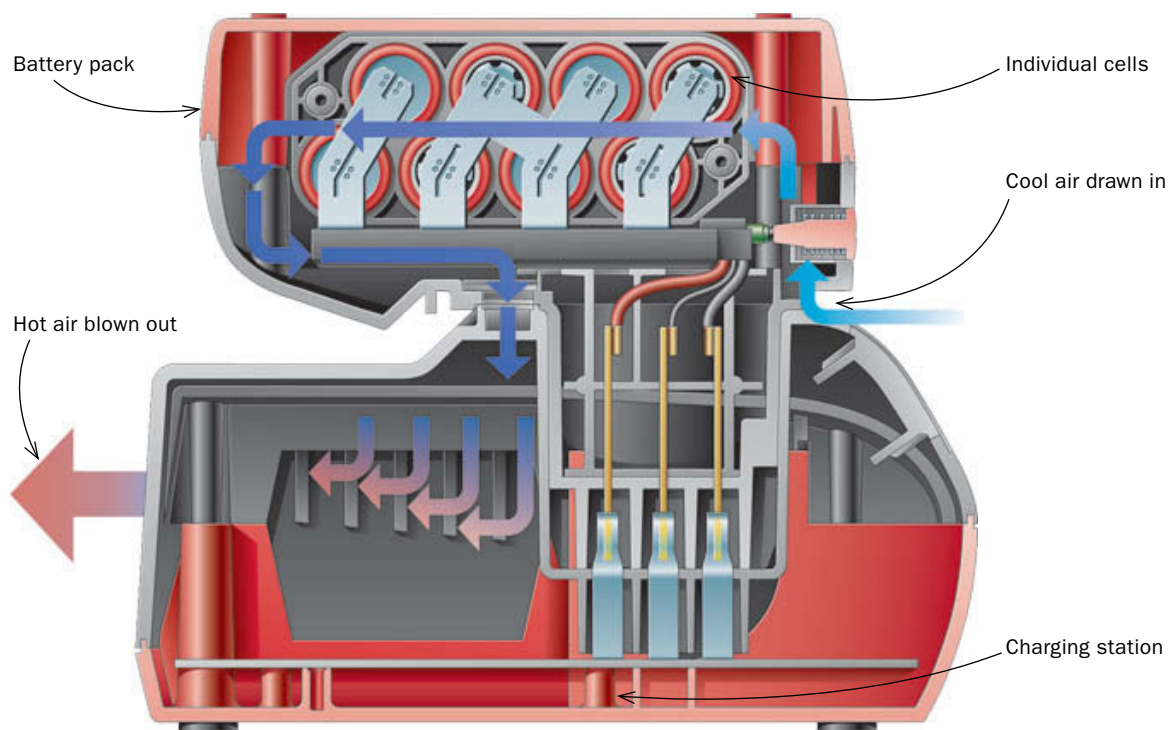
Conventional magnets are pushed and pulled by the changing polarity of the electromagnets, spinning the shaft without a direct connection.



No touching parts. The shaft on a brushless motor spins more freely, unhindered by the drag of brushes.

Heat-monitoring technology

More sensitive chargers and battery packs can prevent over-discharging and manage destructive heat. Some charging stations use fans to cool the battery cells (right) as they recharge. Others use electronic circuitry to protect batteries from damage. Panasonic's charger, for example, monitors each cell in a battery pack, charging all of them for the first 30 minutes and then taking another 25 minutes to balance them.



cell life. Others question those findings and are forging ahead. Batteries with a 3-amp-hour rating are common. Several manufacturers have reached the 4-amp-hour plateau, and Panasonic now has a 4.2-amp-hour battery, which it says is the highest in the industry. These batteries haven't gotten bigger or taken on weight, but they do take longer to charge.

Drills are also getting more flexible in the way they use batteries. Panasonic's new drill/driver can use either a 14.4-volt or an 18-volt battery, allowing users to switch the battery to match the job—a lighter battery for overhead work, for example, or more voltage for heavy-duty work. Festool's "multi-platform" drills can accept older Ni-Cd or nickel-metal hydride (Ni-Mh) batteries as well as newer lithium-ion batteries, and some drills can take either 12-volt or 18-volt batteries. Milwaukee tools can run on different-size battery packs, larger ones for extended run times and smaller ones for lighter duty. DeWalt's chargers can handle both older batteries and new high-capacity battery packs.

Smarter motors and batteries

Another big innovation is the ongoing switch from conventional cordless motors to brushless motors. Several companies—including Hitachi, Makita, Milwaukee, Festool, DeWalt, and Panasonic—have upgraded at least some of their tools. Bosch plans to introduce brushless motors in these tools next year.

Here's why this change is good news: In a conventional motor, a pair of spring-loaded carbon brushes carries current from the tool's battery to a rotating commutator, producing friction and heat. A brushless motor reduces this internal friction and heat by replacing the brushes with electronic circuitry. The result is a more power-efficient drill that runs longer between charges. DeWalt product manager Phil Lalle says the company's recently

launched XR brushless line averages 57% more work per charge than tools with brushed motors.

When it comes to batteries, one reason that lithium-ion cells are seeing wider use is that manufacturers have found ways to overcome the battery's weaknesses: overheating, overcharging, and over-discharging. A cell can be ruined if it gets too much of a charge, or if the battery is run down too much before recharging. Manufacturers have approached the problem in several ways. Panasonic has switched to lithium-cobalt cells from the more common lithium-manganese chemistry, said John Olson, the company's industrial sales manager. That's made it easier to control damaging internal heat, he said. Bosch has developed a battery housing that helps dissipate heat, claiming that its "cool-pack technology" doubles battery life. □

Scott Gibson, a former editor of Fine Woodworking and contributor to Fine Homebuilding, is a freelance writer in Maine.



Shine a light. Porter-Cable and other manufacturers are now equipping their cordless drills with front-mounted LEDs to illuminate the work.

18v Brushless Impact Drivers

Pound for pound, no cordless drill packs more punch

Impact drivers have been widely adopted by home-builders and contractors, and more recently by woodworkers too. They have two major advantages over traditional drill/drivers: lighter weight and much higher torque. And the impact action makes big screws seem to melt into the wood, seldom stripping their heads in the process.

A new wave of impact drivers has taken those advantages to another level. Boasting brushless motors, the new tools promise even more power and battery life in the same compact package. We decided to test these claims in the laboratory to see if these high-tech drills are worth their higher prices.

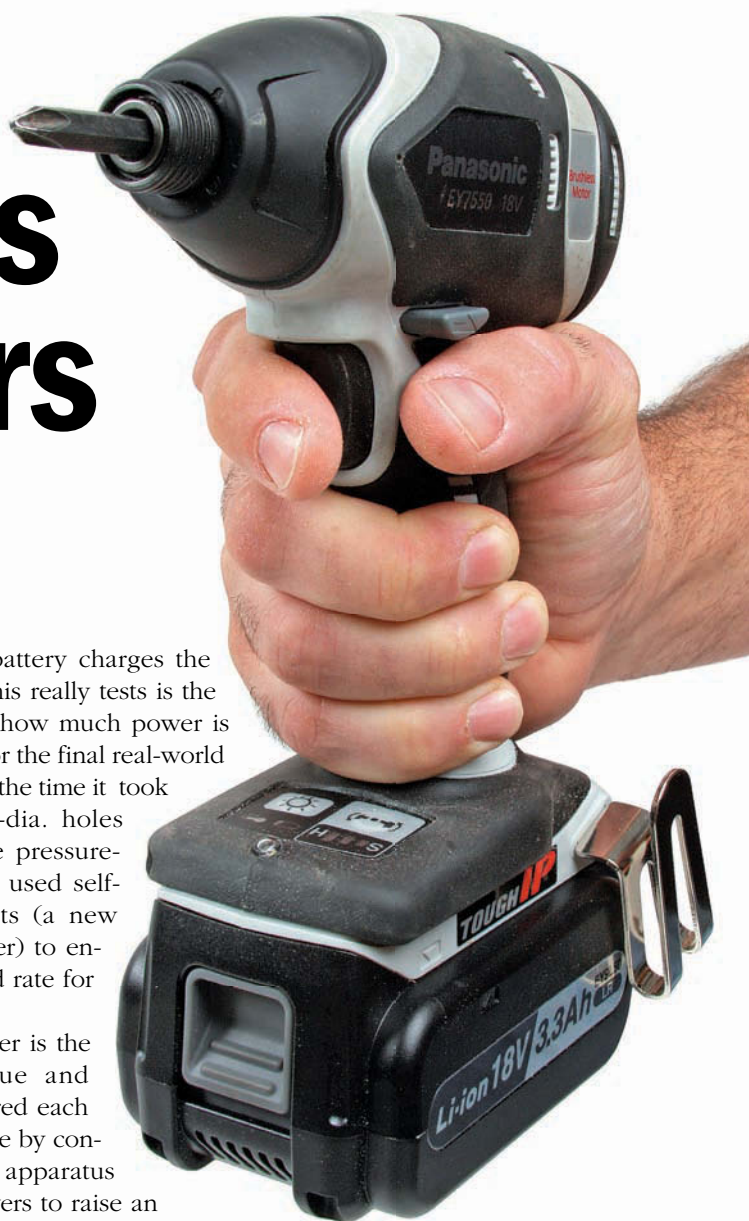
Four torture tests

Working with the head of a college mechanical engineering department and his students, we came up with a good combination of practical tests and laboratory experiments. First, to test the power and control of each driver, our testers used it to sink 50 deck screws into pressure-treated 4x4 pine posts. Each tester was told to work as quickly as possible but to leave each 3-in. screw flush with the surface. We measured the time required.

Next we counted how many 3-in. deck screws could be sunk on a single battery charge. Obviously the

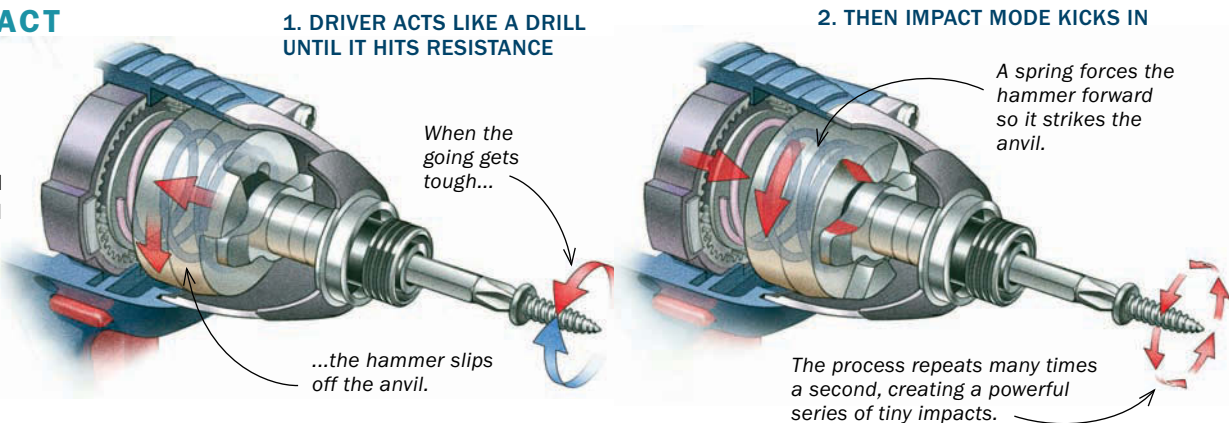
longer between battery charges the better, but what this really tests is the drill's efficiency—how much power is used per screw. For the final real-world test, we measured the time it took to drill ten 1-in.-dia. holes through the same pressure-treated posts. We used self-feeding spade bits (a new one for each driver) to ensure an equal feed rate for each test.

Mechanical power is the product of torque and speed. We measured each drill's steady torque by constructing a winch apparatus and using the drivers to raise an adjustable load to a height of 10 ft. The apparatus has a built-in tachometer, which we used to measure speed. It bore a slight resemblance to a guillotine and generated quite a few comments from students and faculty. In fact, it is a primitive dynamometer—a device used for measuring the power output of a motor.



BEHIND THE IMPACT

With its internal hammer striking an anvil up to 3,000 times per minute, the impact driver creates much more torque than a standard driver, yet is easier to control and won't strip the head of a screw (it can break it though). It's much noisier than a standard drill, so ear protection is a good idea.





THE ULTIMATE DRIVING EXPERIENCE



An 18-volt impact driver can handle any driving task you throw at it. It has fine control for driving smaller screws into a shop jig (far left), enough punch to drive big lag bolts deep into wall studs when hanging a lumber rack (left), and enough run time to drive scores of screws in a major remodeling job (below).

As a final test, we measured the peak torque of the drivers by tightening a ½-in.-13 nut onto a bolt through a steel plate and observing the setting on a torque wrench required to loosen the nut, which adjusts in 60-in./lb. increments.

Amazing stamina and strength

Our testing revealed just how powerful impact drivers can be. When we started the nut/bolt tightening torque tests, we used an aluminum plate instead of steel. After a few tests, we found that the heads of the bolts had been pulled into the plate, creating their own hexagonal holes in the process. When we used a washer under the bolt heads, the plate itself began mushrooming out around the washers. Maybe that's why our gearhead friends say that



IT DRILLS HOLES BIG AND SMALL

An impact driver's quick-change chuck only works with hex-shank drill bits (right), but adapter chucks (below right) will handle the rest of your bit collection. We recommend the type designed for impact drivers. They held all types of bits securely in our tests, even huge Forstners in hardwood. Big bits activated the impact mode, which was a little

rough but very powerful.





Up she rises. To gauge each drill's sustained torque, Eric Constans and his students built the "guillotine" and used it to see how much weight the tool could lift.

good mechanics never tighten nuts with an impact driver—only loosen them.

In the stamina test of screws driven on a single battery charge (which also tests efficiency), the Panasonic was the most efficient, sinking 129.4 screws per amp-hour. It also sank 50 screws in the shortest time.

All of the impact drivers took approximately the same time to drill 10 1-in.-dia. holes. This is perhaps to be expected, since the torque requirement was relatively low and all of the drivers spin at similar speeds.

In terms of sustained torque, the Panasonic was able to lift the heaviest weight on the "guillotine." When tightening the

nut onto a bolt through a steel plate, the Makita driver produced the most peak torque—a jaw-dropping 1,260 in.-lb. In reality, each driver generated more than enough torque to overtighten the nuts, more than enough for any woodworking or carpentry task.

Which impact driver is best?

We chose the Panasonic EY7550 as Best Overall. It sank enough screws on a single charge to build a very large deck, or to assemble an absurd number of cabinets using pocket screws. It had the highest sustained torque of any of the drivers, and was also the quickest at driving screws.

HOW ENGINEERS HAVE FUN

Working with mechanical-engineering students, we devised a brutal series of tests. Not shown here is the test for peak torque, which involved driving large bolts into steel and then loosening them with a torque wrench.



Drive till you drop. To gauge battery life, students measured how many 3-in. screws each driver could sink into pressure-treated pine on a single charge.



Speed drills. In two other tests, they recorded how fast each tool could drill 10 1-in.-dia. holes through a 4x4 post, and drive 50 more of the 3-in. screws.

The DeWalt DCF895 is actually a 20-volt tool, and had the second-highest efficiency of the bunch, right behind the Panasonic. Also, it is the only driver offered with a 1.5 amp-hour battery. The DCF895C2 has almost all the power of its 3.0-amp-hour brother, in a more compact, lower-priced package, and plenty of run-time for woodworking, making it our Best Value choice.

Also worth mentioning is the Makita LXDT08. Its fit and finish were superb, and it generated the highest peak torque. □

Eric Constans, chair of mechanical engineering at Rowan University in Glassboro, N.J., contributed to this article.



Model	Street price	Battery amp-hours	Screws driven	Time for 50 screws (min.)	Time for 10 holes (min.)	Sustained torque (in.-lb.)*	Peak torque (in.-lb.)
EDITORS' CHOICE BEST VALUE DeWALT DCF895C2	\$250	1.5	185.5	5:27	2:23	68.04	1,140
DeWALT DCF895L2 (Same except battery)	\$350	3.0	375	3:43	2:17	68.04	1,020
HITACHI WH18DBDL	\$250	3.0	291	6:25	2:20	68.04	1,080
MAKITA LXDT08	\$290	3.0	290	5:36	2:29	45.78	1,260
EDITORS' CHOICE BEST OVERALL READERS' CHOICE PANASONIC EY7550	\$390	3.3	427	4:14	2:06	73.60	1,080

*The only way to measure was in broad increments, hence the identical numbers in some cases.

READERS' RATINGS: 18V IMPACT DRIVERS

Readers and editors agreed on the Panasonic driver, giving it high marks. But readers gave an edge to the Makita, with its high torque and superb fit and finish, over our Best Value DeWalt.

★★★★★	4.50	PANASONIC EY7550
★★★★☆	4.39	MAKITA LXDT08
★★★★☆	4.23	DeWALT DCF895C2
★★★★☆	4.19	HITACHI WH18DBDL
★★★★☆	4.14	DeWALT DCF895L2

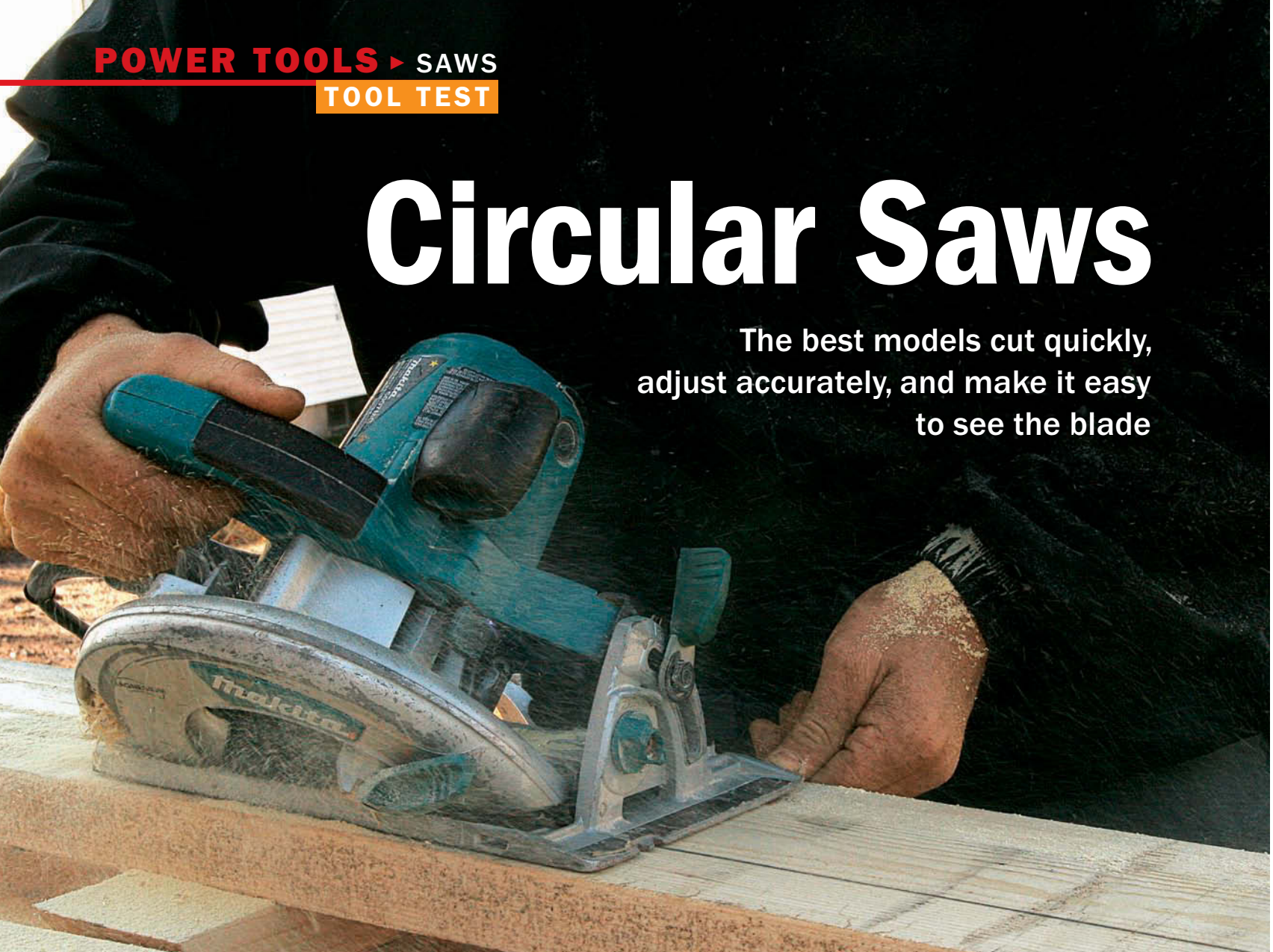


The brushless advantage

To see whether brushless impact drivers are really stronger and run longer, we tested brushed impact drivers from DeWalt and Makita that were nearly identical to their brushless cousins. The DeWalt brushed drill's run time was 12% shorter, its sustained torque 33% less, and its peak torque was the same. The figures for the Makita were 24%, the same, and 10%.

Circular Saws

The best models cut quickly, adjust accurately, and make it easy to see the blade



The circular saw is arguably the most common power tool on a builder's or remodeler's job site, and it is one of the first a homeowner buys. There are two types: the sidewinder type, which has a side-mounted direct-drive motor, and the worm-drive saw, which has an in-line, gear-driven motor. Worm drives, in general, are more powerful, but they are pricier and heavier than sidewinders, making one-handed use a chore. Because sidewinders are less expensive, lightweight, and easy to use with one hand, they are preferred by many builders and DIY-ers alike.

We tested 14 sidewinder saws for this review, opting to include the most full-featured model(s) from each brand. The saws are standard 7¼-in.-blade framing saws, with the exception of a lone 6½-in.

model designed to compete in the same market. Street prices for these popular tools vary from about \$70 to more than \$170, but for a tool that will be as close a companion as a circular saw, consider spending the dough for one of the best and most comfortable models.

We outfitted each tool with a new Irwin Marathon blade to eliminate performance differences caused by stock blades. Then we put the saws through a battery of tests to gauge relative power, measure cut-line accuracy, and assess features like baseplate sturdiness and the saw-to-baseplate connection. We also evaluated each saw's general build quality, ease of adjustments, convenience of features, and feel. □

Michael Springer contributed to this article.

READERS' RATINGS: CIRCULAR SAWS

Readers preferred the Milwaukee over our Best Overall (Makita) and Best Value (Ridgid).

★★★★★	4.48	MILWAUKEE 6394-21
★★★★★	4.27	PORTER-CABLE PC15TCSMK
★★★★★	4.25	MAKITA 5007MGA
★★★★★	4.22	SKIL HD5687M-01
★★★★★	4.19	RIDGID R32021
★★★★★	3.96	HITACHI C7BMR

Online Extra

To watch a video on worm drive vs. sidewinder circular saws, go to FineWoodworking.com/TG2014.



EDITORS' **BEST OVERALL** CHOICE

MAKITA 5007MGA

Street price: \$175 Weight: 10.9 lb.

FEATURES This deluxe saw has rubber-covered everything for comfort, as well as other thoughtful touches like a dual LED headlight to illuminate the cut line. This feature is really handy when cutting indoors, and it also provides valuable fill light outdoors when the blade is casting a shadow on your line. Despite the spindle lock blocking sightlines a bit, visibility on this saw is good. The magnesium baseplate was flat in both directions, and the saw was stable, despite a bit of flex in the baseplate.

FLAWS A few factors tarnished our otherwise stellar experience with this premium saw. The lower guard hung up more than on other top saws during some specific test cuts. At least Makita's rubber-tipped guard-opening lever is easier to grip with just the tip of your thumb or forefinger than slicker levers when you have to hold the guard open. We wish the 56° bevel scale had markings at every degree rather than every 5° and that the angle stops had a bit less slop.

BOTTOM LINE In the top three, this is the Cadillac version of Makita's popular model 5007 line. Although undeniably pricey, this saw is a top performer and a leader in comfort.



EDITORS' **BEST VALUE** CHOICE

RIDGID R32021

Street price: \$100 Weight: 10.2 lb.

FEATURES The depth-adjustment arm on this saw has a nice, stiff rolled edge and ratcheting plastic outboard lever. Bevel angles up to 56° are set with a similar lever, engraved numbers mark every degree, and beveling beyond 45° is done with the push of a button. The cast-magnesium baseplate is nearly flat in both directions, and it has a convenient 1½-in. offset distance from the right edge of the baseplate to the blade.

FLAWS The cut-line markers at 90° were excellent, but when making bevel cuts at 45°, cut-line accuracy plummeted. Resetting the saw's bevel angle to 90° required use of a square.

BOTTOM LINE This high-performance saw posted the third-fastest times in the power test. It also has overall high marks in the features department. If your budget tops out at around \$100, this is the saw to buy.



READERS' **CHOICE**

MILWAUKEE 639421

Street price: \$170 Weight: 11.4 lb.

FEATURES Adjustments on this saw are excellent. Blade depth is set with an extrawide outboard plastic lever, and bevels rely on a long steel lever that locks with barely any force. There are no detents on the bevel scale, but engraved numbers at each degree combined with the scale's generous size and accurate adjustable pointer allow for precise settings. Cut-line markers are good at both 90° and 45°, and blade visibility is great. Stability is top-notch, and the rear handle can be rotated into eight positions, allowing you the option of lowering your grip into a pushing position for shallow cuts.

FLAWS Roof cutters may find the 50° maximum bevel too limiting. Also, despite the functionality of the adjustable rear grip, its rectangular design is too flat and blocky.

BOTTOM LINE The fastest-cutting saw in the power test, the Milwaukee combines top power with fine precision and superb control, and is one of the top three tools.

Miter Saws

Bigger may not be better; it depends on what you'll be cutting

For fast, accurate miters and precision crosscuts, few tools can compete with a miter saw. Thirty years ago, these tools were simply called chopsaws, and they handled rudimentary crosscuts and straightforward miters. But the family of saws has evolved to handle compound miters (angled in two directions) in all manner of trim. Also available are sliding saws that not only make all sorts of angled cuts but also have increased capacity to cut wider boards flat on the saw's table. Both styles are commonly available with either 10-in. or 12-in. blades.

There's no shortage of models to choose from, with prices ranging from about \$100 to more than \$1,200. Given the size and the price range, how do you know which saw is right for you? The answer starts with deciding how you'll use the saw and whether you'll need to take it to a job site.

Cutting capacity rules the day

Although there are smaller and larger examples, most miter saws have either 10-in. or 12-in. blades, which obviously have a major say in the cutting capacity of the saw (see chart, below). Given

What size do you need?

Miter-saw blades vary from 8½ in. to 15 in. For many years, a 15-in. chopsaw was a favorite of trim carpenters because it could cut 7-in. molding leaning against the fence. But many 12-in. saws now exceed this capacity while costing and weighing less. To get the most for your money, limit your search to 10-in. and 12-in. models. This chart will give you a general idea of the cutting capacity of these saws, but specs vary widely among manufacturers, so check them before you buy.



TWO WAYS TO CUT CROWN MOLDING

Vertical. The easiest way to cut crown molding is to lean it against the saw's fence upside down, but at the same angle it will be installed. Some saws have optional crown stops that keep the molding at the right angle.



On the flat. If your saw does not have the capacity to cut tall molding in the vertical position, you must lay the molding on the saw's table, and then make a compound-angle cut employing both the miter and bevel settings.

GUIDE TO MITER-SAW CUTTING CAPACITIES				
SAW SIZE AND TYPE	MAX. HEIGHT OF STANDING MOLDING	MAX. CROSSCUT AT 90°	MAX. CROSSCUT AT 45°	MAX. CROSSCUT WITH BLADE AT 45°
10-in. compound-miter	4 in.	2½ in. by 6 in.	2 in. by 4 in.	2 in. by 6 in.
12-in. compound-miter	6 in.	2½ in. by 8 in.	2¼ in. by 6 in.	2 in. by 8 in.
10-in. sliding compound-miter	3⅝ in.	3⅝ in. by 12 in.	2 in. by 8 in.	2 in. by 12 in.
12-in. sliding compound-miter	4 in.	4½ in. by 12½ in.	4½ in. by 8½ in.	3 in. by 12 in.

COMPOUND-MITER SAW

This type of saw is more portable and less expensive than sliding models, but won't cut through extrawide boards in a single pass.

SLIDING COMPOUND-MITER SAW

The sliding feature extends the saw's crosscutting capacity and makes this saw well-suited for cutting wide boards.

COMPOUND OR SLIDING COMPOUND?

A compound-miter saw blade moves in three directions: up and down in a chopping motion; about 45° left and right to cut miters; and leaning left (single bevel) or left and right (double bevel) to make compound cuts. A sliding compound-miter saw does all of the above, but the blade and motor assembly also can slide back and forth on one or two tubes to enable crosscutting wider boards.

Features to look for



The bevel-angle setting is on the back of most saws. It's a time-tested design, but it can be quite a stretch when making frequent adjustments.



Up-front bevel controls. Rather than a knob or lever at the back of the saw, Bosch's miter saws have the bevel lock at the front. The setup is more convenient and more ergonomic than rear-mounted controls.



Some saws have slide-out extension wings to help support longer boards. The wings should operate smoothly and be in perfect alignment with the table. Misalignment of extension wings and the fence is a common problem with inexpensive saws.

Setting up a new saw

It may sound crazy, but read the owner's manual first! Unpack the saw by grasping its base or carrying handle(s) and not the saw head, which can cause damage. Check the depth stop to ensure that the blade cannot hit the tool base when the saw head is fully lowered. If your saw has adjustable kerf inserts, leave them spaced wide open; you can move them closer to the blade later, after the blade angle is dialed in. Because most saws will arrive out of alignment, expect to refer to the owner's manual for corrective action. Get the saw to the point where all of the detents for common angles (0°, 45°) yield perfect results.

Attach the machine to its permanent worktable with screws or bolts through the mounting holes in the base. These are large tools, so even with the miter-control knob and part of the turntable overhanging the front of the worktable, you'll still need about 30 in. of working depth.



the relatively narrow width of cut inherent to conventional miter saws, manufacturers came up with the sliding miter saw in the mid 1980s. In addition to the chopping motion of a conventional miter saw, these saws have a motor that slides back and forth, usually on bearing-guided metal rails, for a much wider crosscut capacity.

Unfortunately, this extra capacity adds weight and comes at additional cost. Brand-name sliders start at \$400 or \$450 and go up to \$1,300. They also weigh 50 lb. or more. In addition, these saws, with their precision rails, are more easily damaged if dropped or mishandled.

The increased crosscutting capacity comes with another trade-off. Because the motor typically slides on tubes built into the saw table, the saw requires more open space in back for it to reach its full capacity. That's not an issue if you are on a job site or using the saw outside, but the additional space requirement could be problematic in a small shop, where floor space is at a premium. Fortunately, two saw manufacturers—Bosch and Makita—have designed new sliding compound-miter saws that don't require as much room in the rear.

One bevel or two?

With a board flat on the saw table, all miter saws can cut angles to the left or right, usually from 0° (really a 90° crosscut) to about to 45° or 50°. The angle is adjusted by rotating the table, which typically has

Slider innovations



Motor on top. Some saws have the motor mounted above the blade, which allows the saw to bevel through thick stock without the motor getting in the way. It also provides better visibility.



Arms replace tubes. Bosch's newest saw has folding arms instead of tubes. The design saves space and is more accurate than tubes, claims the maker.



Dual slides. Pairs of top and bottom slides give the 10-in. Makita LS1016L nearly the capacity of a 12-in. sliding model. The maker says the design also improves rigidity for more accurate cuts.

stops, often called detents, for common cutting angles such as 0° and 45°.

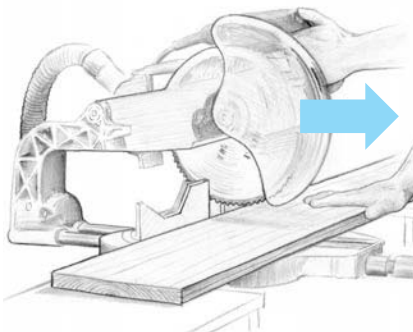
The real difference among miter saws involves how they bevel (cuts made with the saw's head tilted one way, or both ways). Tilting the head for bevel cuts often involves a compound-miter cut, where the miter and bevel cuts are made at the same time by rotating the table and tilting

the head. This is a common cut for crown molding in a room.

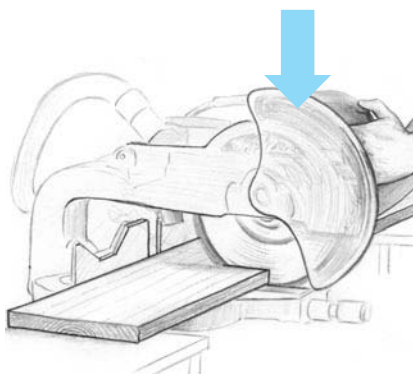
Generally speaking, the least expensive saws bevel in only one direction. If you want the bevel cut to be angled in the other direction, you have to flip over the stock or rotate it end for end, which can be a pain to do. A better option is a dual- or double-bevel miter saw. With this

Always push a slider

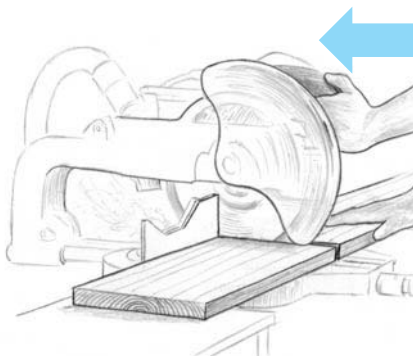
Sliding miter saws cut on the push stroke. Pulling a miter saw through the cut could cause the blade to rise up out of the wood and chase after you.



1. Pull the blade over the workpiece.



2. Turn on the saw and plunge the blade into the wood.



3. Push the blade through the wood. Let the blade stop before moving it.

type of saw, you can tilt the saw motor both left and right rather than having to rotate the stock. However, you'll pay for the added capacity—about \$50 to \$100 more than a similarly featured single-bevel design. □

Patrick McCombe, Gary M. Katz, and Andy Beasley contributed to this article.

Biscuit Joiners, Head to Head

The best of these build cabinets in a hurry

READERS' RATINGS: BISCUIT JOINERS

Readers agreed with our editors on the top picks, but chose the Porter-Cable over the Best Value DeWalt.

★★★★★	4.59	LAMELLO TOP 21
★★★★★	4.30	LAMELLO CLASSIC X
★★★★★	4.16	PORTER-CABLE 557
★★★★★	4.03	DEWALT DW682K
★★★★★	3.92	MAKITA PJ7000
★★★★★	3.82	MAKITA LXJP02
★★★★★	3.47	CRAFTSMAN 17539
★★★★★	3.40	RYOBI JM82K



Once considered a newcomer, the biscuit joiner nowadays is almost as common as the portable drill in professional and hobbyist woodshops alike. With good reason. It's a versatile and easy-to-use tool for numerous applications, from assembling and attaching face frames to reinforcing miters, and it's also great for building cabinet and drawer boxes.

A biscuit joiner is a pretty simple machine. It has a motor and blade, a spring-loaded plunge mechanism that guides the blade, and a baseplate and fence that locate biscuit slots in the work.

Using the tool is a two-handed operation: One hand pushes at the back of the machine to plunge it into the workpiece while the other holds it down at the front end.

We worked with eight machines over several weeks to find out which models performed best. We evaluated all the key components to gauge their accuracy, and we used all of the machines to cut slots for face frames, miters (standing and flat), and cases. The most important test was to check the accuracy of the slot-cutting.

Vertical slot alignment is most important

For a biscuit joiner to perform well, it has to cut slots without excessive slop, so the store-bought biscuits fit snugly for a good glue joint. One of the keys to getting an accurate slot and good fit from joint to joint is a precise plunge mechanism that slides without play or wobble. You also have to hook up the machine to a vacuum because any debris can interfere with the tool's alignment and give you sloppy results. Finally, you need a high-quality fence that holds its settings while you cut slots. Problems with any of these can cause serious alignment issues.

Although the slots and biscuits are designed with sideways play built in—it doesn't affect strength and actually comes in handy



How big a biscuit?

Almost all biscuit joiner work involves commonly available and standard-size biscuits (#0, #10, and #20). But Lamello and Porter-Cable offer different sizes that could come in handy. All of the machines have turret-like adjusters that change the slot size for these different biscuits. In general, you should use the largest biscuit the workpiece can accommodate. By the way, there are also a number of specialty joints and options for biscuit joiners, such as duplex hinges (the D setting) and simplex connectors (S setting), as well as options for making knockdown furniture, such as Lamello's Clamex S system.



"FF" MEANS FACE FRAME

The Porter-Cable 557 has a special FF setting for small biscuits. You need to buy a smaller, 2-in. blade, though, to get the job done (\$50; amazon.com).



LAMELLO GOES BIG—AND SMALL

Both Lamello machines can cut slots for extralarge biscuits (the S6) using the standard blade at the Max setting. They also can cut smaller slots for face-frame biscuits, but you'll need a smaller blade (\$99; csaw.com).

Two types of fences

One type can be adjusted for angles and height. The other can be angled but is set at a fixed height to center slots in $\frac{3}{4}$ -in. stock, so height adjustments require an auxiliary fence.

ALL IN ONE

A single fence that adjusts for both angles and height is convenient. It can handle stock of any thickness and be used for miters, too.



Dial in the height. The DeWalt fence is easy to adjust with a thumbscrew (left), with scales that are easy to read.



Online Extra

To get more from your biscuit joiner, check out the free video at FineWoodworking.com/TG2014.



Two ways to slot a miter. The DeWalt fence doesn't adjust past 90° , so to biscuit a standing miter, you angle the fence to 45° and cut the slot with the workpiece clamped flat (left). But workpieces can shift, so it makes sense to slot these parts while they're clamped in a vise (right). The material won't move, and there are no clamps to get in the way, but you need a fence that adjusts to 135° , like that on the Porter-Cable (shown at right).

when assembling parts—slots that are out of parallel will give you headaches.

We tested all the machines using a shop-made hardwood “biscuit” that wouldn't be as affected as normal biscuits are by moisture changes. We cut slots both with the fence and with the base as the reference surface. Then we inserted the test piece into each slot and measured from end to end with a dial indicator to be sure each slot was parallel with the faces of the board. Except for the Craftsman, all of the machines did well here.

Fence should keep settings locked in

To locate slots vertically in a workpiece, you can use the base or the fence. But because the base is always solid, and guaranteed to center a slot in $\frac{3}{4}$ -in. material, it's more accurate to use it as the reference surface whenever possible. When you need to offset a slot or to cut slots in stock thicker than $\frac{3}{4}$ in., you can use a shim to raise the machine.

But some people prefer to use the fence, and there are times when it's more practical. Some like to use the fence on large cabinet parts, where it's just easier to move the biscuiter around the parts than it is to move the parts. It also makes sense to use the fence on stock that's thinner than $\frac{3}{4}$ in., and it's a must for cutting slots in beveled edges for a standing miter joint.

To be reliable and accurate, the fence must be easy to adjust and remain parallel to the base. And it must hold its settings (you can read about each fence in the individual writeups on pp. 40-41).

Some models have a single fence (see photos, left) that adjusts for both angles and height (DeWalt, Porter-Cable, Craftsman, and Ryobi). The Lamello and Makita machines feature a fixed-height fence that uses an auxiliary fence for height adjustments (see opposite page).

The winners

After putting the machines through a few weeks of work, it was pretty clear that the Lamello biscuit machines were the winners. They are extremely well made—and priced accordingly. Professional woodworkers who build a lot of cabinets and don't mind spending top dollar for frequently used

DIVIDE AND CONQUER

Fixed-height fences take the guesswork out of setting the fence to center slots in $\frac{3}{4}$ -in. material. For height adjustments, they have an auxiliary fence. It's less convenient, but it works very well.

Fence finds center.

The Makita and Lamello machines feature fixed-height fences that center slots automatically in $\frac{3}{4}$ -in. stock, at any angle. The Lamello Classic X is shown.



Auxiliary help. These machines use an auxiliary fence for height adjustments. It mounts to the fixed fence in front (left), so you can center slots in thick stock (right) or offset workpieces. We preferred the Lamello system, which attaches via dovetailed ways and has no play.



Distinct advantage. The auxiliary fence for the Lamello machines can be mounted to the base, which makes it easier to hold the tool vertically.

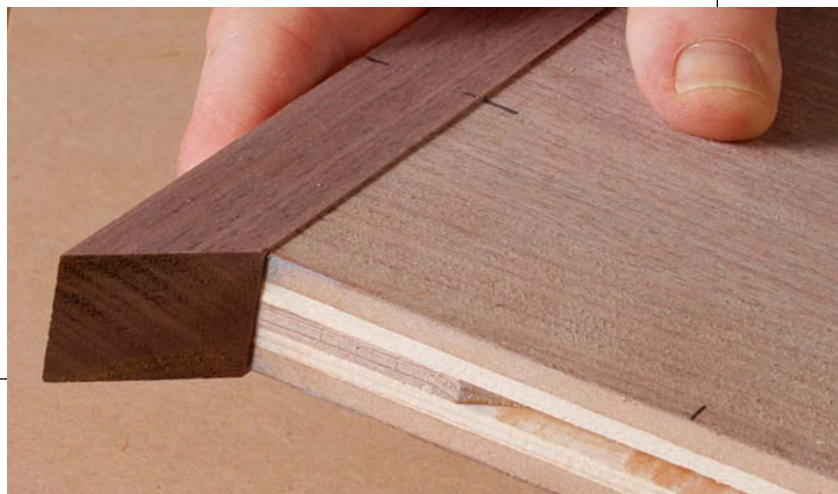
tools should consider buying the Top 21 when it comes time to replace their current model. The Lamello Classic X is half the cost with most of the same features, so that would be a more sensible purchase for the serious hobbyist looking for the best machine he or she could afford.

Picking the Best Value was more difficult, as three closely priced tools performed similarly (DeWalt, Makita PJ7000, and Porter-Cable). In the end we picked the DeWalt, because it has a great fence that adjusts easily and holds its adjustments in any position, it's light and comfortable to use, and it's less expensive than the other two. If you don't use a biscuit joiner every day, any of the three would be an excellent choice.

Tony O'Malley contributed to this article.

CUTTING-EDGE ADJUSTER

Adjust the blade height. With the Lamello Top 21, you can move the blade up or down by turning a wheel on the top of the machine (top). The blade moves in 0.1mm steps, allowing you to dial in a desired offset. This feature comes in handy when you are attaching solid-wood edging to plywood and want the edging to sit just proud for flush trimming later (bottom).



Head to head



LAMELLO TOP 21

Price: \$1,195

csaw.com

**Fence-angle
detents:**

22.5, 45, 67.5, 90

**Cutting-depth
indexes:**

0, 10, 20, S, D, Max

Weight: 7.2 lb.



This machine is the cream of the crop in every aspect. The Top 21 has a one-of-a-kind blade-height adjustment feature that makes it easy to offset slots, with the fence or the base as a reference. The adjuster also allows you to cut the wider slots for the Clamex S knockdown system without the need for a specialty blade. The fence setup is the same as the Classic X. The machine is twice as expensive as the classic, and five to six times as much as the other machines. But if you use a biscuiter daily, or would benefit from all the various joinery attachments available, the tool is worth the investment.



LAMELLO Classic X

Price: \$600

csaw.com

**Fence-angle
detents:**

22.5, 45, 67.5, 90

**Cutting-depth
indexes:**

0, 10, 20, S, D, Max

Weight: 6.2 lb.

This machine is top-notch, made to high tolerances with a plunge mechanism that slides without play. The fixed-height main fence, which centers slots in $\frac{3}{4}$ in. material, locks solidly at 90° and other angles. To handle other stock thicknesses, the Classic X uses an auxiliary fence that attaches to the main fence via well-machined dovetailed ways. The auxiliary fence also attaches to the base of the machine, making it easier to use the machine vertically. The Classic X is versatile and can use a number of Lamello joinery options, such as the knockdown Clamex S system (requires a special blade). The depth stop is clearly visible on the front of the machine, and adjustments are easy to make. The tool is well-balanced and a joy to use.



DeWalt DW682K

Price: \$170

homedepot.com

**Fence-angle
detents:** 90

**Cutting-depth
indexes:** 0, 10,
20, Max

Weight: 6.2 lb.

We picked the DeWalt as Best Value. The fence is simple, reliable, and comfortable to use, even for long sessions. It features a rack-and-pinion height adjustment that keeps it parallel, and a height gauge that's easy to read. The fence has solid, accurate stops at 0° and 90°. But it's the only fence in the group that doesn't have angle detents beyond that, a minor inconvenience that's easy to overlook because the fence locks solidly at any angle. The barrel grip is very comfortable, with a conveniently positioned lock-on trigger switch on the bottom.



CRAFTSMAN 315.175390

Price: \$90
sears.com

Fence-angle detents:
45, 90, 135

Cutting-depth
indexes: 0, 10, 20

Weight: 7.8 lb.

The plunge mechanism in this machine has a lot of play, and the machine cut very loose slots that didn't allow me to get an accurate reading during the parallel test. It's heavy but well balanced, and features a comfortable pistol grip; however, the grip makes the tool harder to use in the vertical orientation. The fence is large and has an easy-to-grip handle in front that we like. But it was hard to keep the fence parallel when locking it after adjustments.



MAKITA PJ7000

Price: \$200
homedepot.com

Fence-angle detents:
45, 90

Cutting-depth
indexes: 0, 10, 20,
S, D, Max

Weight: 5.8 lb.

The Makita is the lightest of the machines reviewed. Its plunge mechanism is tight and smooth with zero play. Like the Lamellos and the other Makita, it uses a fixed-height main fence, with an auxiliary fence that adjusts in height. The 90° stop on the fixed fence is inexact, and it's easy to lock it a degree or two past 90°. When attached, the auxiliary fence had a bit of lateral play in it, so you have to be careful to check that the fence remains parallel to the base.



MAKITA LXJP02

Price: \$410
amazon.com

Fence-angle detents:
45, 90

Cutting-depth
indexes: 0, 10, 20,
S, D, Max

Weight: 6.8 lb.

This is the same machine as the Makita PJ7000, with the overall fit and finish about the same. It is powered by an 18-volt lithium-ion battery (two batteries are included, along with a charger) that can be shared with other 18-volt lithium-ion tools made by Makita, but the battery pack makes the machine a bit back-heavy. It has sufficient power, but it bogs down more easily if you plunge too quickly. This tool is quieter than any other machine tested.



PORTER-CABLE 557

Price: \$225
woodcraft.com

Fence-angle detents:
90, 135

Cutting-depth
indexes: FF, 0, 10, 20, S, D, Max

Weight: 7.2 lb.

This machine has the largest fence of this group, which is an advantage for general use. But the large opening near the blade makes the tool unwieldy on small workpieces. Fence-height adjustments are slow, but the fence remains parallel and holds its settings. The plunge mechanism is smooth and solid. A unique feature is that the top handle is attached to the front of the machine—not to the moving barrel—which gives you better control as you plunge.



RYOBI JM 82

Price: \$100
homedepot.com

Fence-angle detents:
45, 90, 135

Cutting-depth
indexes: 0, 10, 20

Weight: 7.6 lb.

The Ryobi is well balanced and features a comfortable pistol grip; however, the pistol grip makes the tool harder to use in the vertical orientation. The fence is large and easy to grasp. Its height adjusts on tongue-and-groove ways and is guided by a double rack-and-pinion, but the fence tended to shift up or down when it was locked. The plunge mechanism has too much play, which resulted in sloppy slots and loose biscuits.



Bench Grinders for Woodworking

Slow-speed units cut quickly and won't burn; a good tool rest is key

Bench grinders are vital tools for woodworkers, for shaping plane irons, chisels, and gouges before they are honed to a polished edge. They also excel at reshaping tools, such as scratch stocks and scrapers.

For this review, we narrowed the field to 8-in. variable- or slow-speed machines. The slow speed is less likely to burn hardened steel (removing its temper). We capped the price at \$200, a point we thought made sense for such a one-dimensional tool. That left us with four grinders, from Craftsman, General International, Penn State Industries, and Porter-Cable. To evaluate each, we considered the usefulness of the stock tool rest and the quality of the grinding wheels. We also judged their performance in the basic tasks of shaping plane irons and bench chisels.

We found that none of the grinders was perfect for woodworking tools, though each would be fine for general shop tasks. Each has flaws with its tool rests, leading us to recommend adding an aftermarket rest to any of these grinders. Because of that shared, critical flaw, we chose only a Best Value, the Porter-Cable. It has one usable tool rest, and comes with a dresser and work light. It also was the least expensive, making an aftermarket tool rest easier to afford. □

Chris Gochnour contributed to this article.

READERS' RATINGS: BENCH GRINDERS

The readers' top choice is the same as our Best Value pick, the Porter-Cable.

★★★★★	4.12	PORTER-CABLE PCB575BG
★★★★☆	3.83	GENERAL INTERNATIONAL 15-825 M1
★★★★☆	3.81	PENN STATE INDUSTRIES GRIND2X
★★★★☆	3.64	CRAFTSMAN 21162



PORTER-CABLE PCB575BG

Street price: \$119

Source: Lowes, lowes.com

Speed: Variable,
from 2,000 to 3,400 rpm

Wheels: 1 in. wide;
120 grit, 36 grit

Runout: 0.005 in.
(after flange adjustment)

Tool rest: 2³/₄ in. by 1³/₄ in.

The Porter-Cable has one flat tool rest; the other has a drill trough cast into the platform, making it useless for narrow chisels. That's too bad, because the rests are easy to adjust. Although we had to override the detents with a washer, once set, the platforms held their settings. The grinder ran with very little vibration and comes with a diamond wheel dresser and a work light.



CRAFTSMAN 21162

Street price: \$153

Source: craftsman.com

Speed: Variable,
from 1,745 to 3,450 rpm

Wheels: 1 in. wide;
60-grit, brass wire

Runout: 0.005 in.

Tool rest: 4¹/₄ in. by 1⁷/₈ in.

This grinder has the biggest tool-rest platforms of all the grinders, and they were flat. Angle adjustments were easy via a thumbscrew, but detents in the mechanism had to be overridden by a washer spacer. Depth adjustments, needed whenever the rest angle is changed, require a wrench, which is a hassle.



GENERAL INT'L 15-825 M1

Street price: \$190

Source: general.ca

Speed: 1,725 rpm

Wheels: ³/₄ in. wide;
60 grit, 34 grit

Runout: 0.014 in.
(after flange adjustment)

Tool rest: 2⁵/₈ in. by 1¹/₄ in.

The General International grinder is the only machine with a ³/₄-in.-wide wheel. The tool rests can move in or out by loosening and tightening two bolts with a wrench, but they are cast roughly and can't be angled in any way, making them almost useless. On the other hand, the General is a very smooth-running grinder, with very little vibration (after adjusting the flange).



PENN STATE INDUSTRIES GRIND2X

Street price: \$160

Source: pennstateind.com

Speed: 1,720 or 3,450 rpm

Wheels: 1 in. wide;
120 grit, 60 grit

Runout: 0.007 in.

Tool rest: 2³/₈ in. by 1¹/₄ in.

Like those on the General International, the tool rests on the Grind2X are not a bright spot. Each is a one-piece casting that can move in and out, but lacks an adjustable platform. Because they can't be angled, grinding a chisel or plane iron evenly is a big challenge. The plastic shields had a hard time staying put while the machine was running.

Choosing an Emergency Generator

The right one will provide days of convenient power

These days it seems you read about power outages almost daily, whether from weather-related trauma, overloaded grids, or even a pole being felled by a vehicle. In the case of an accident, power restoration is usually pretty quick. But if it's due to a natural disaster or weather catastrophe, you could be without power for days, darkening a home office, spoiling refrigerated or frozen goods, shutting down heating or air conditioning, or preventing power to needed medical equipment. For many homeowners, the solution is a backup generator, allowing their lives to go on without major disruption. But how do you choose?

There are three broad categories of generator: small, portable types for running a limited number of items (up to 3,000 watts); larger, wheeled models capable of running a job site or a house's essential appliances (4,000w to 17,500w); and large, permanently installed models that can power a house's essentials or provide whole-house backup (7,000w to 100,000w).

Three emergency-power strategies

Plugging appliances and lights directly into a portable generator is the most basic power-backup strategy. This type must be outside and away from windows (i.e., not in the garage) and requires you to run extension cords from it to the appliance. Also, you're limited in the number of items you can run both by the output rating of the generator and by the number of outlets. Finally, small fuel capacity means that you need to have a large quantity of gasoline on hand for anything but the briefest power interruption.

The next step in backup power relies on a larger portable generator that energizes the house's circuits through the

electrical service panel. This scenario requires a manual transfer switch (see "Two ways to transfer power," p. 47) to disconnect the service panel from the grid and to connect it to the generator. These wheelbarrow-style portable units come in sizes large enough to power an HVAC system, critical appliances, and lights.

For bigger loads, say, to power a central air conditioning unit and larger appliances, you can opt for a pad-mounted, permanently installed outdoor generator. Depending on the output size, a standby system can be configured to power ei-

ther essential circuits or the entire house. These systems utilize an automatic transfer switch, which senses when to disconnect the service panel from the grid and shift to generator power. When power is restored, the transfer switch reconnects the panel to the exterior line and shuts down the generator.

To decide what size generator and type of backup system will serve your needs best, walk around your house and envision it during a blackout. What damage would occur if the sump pump didn't work? Would pipes freeze without heat? How much food

POWER IN A PINCH

Small portable generators up to 3,000 watts are emergency generators in the most basic sense of the word. Because they have just two or three outlets, you're limited in what you can power by both connections and output size. You might be able to power your refrigerator, a small space heater, a light, and a laptop. However, in some cases multiple portable generators can be wired in series for greater power. You are limited to 120-volt outlets, so ranges, dryers, sump pumps, and furnaces can't be connected.



Small and quiet. Honda's \$2,300 EU3000i Handi is just 19 in. tall, 25 in. long, and 78 lb. It's a quiet machine—even at the rated load of 2,600w (maximum 3,000w), it's only 65 db., which is a bit louder than a conversation. The variable-speed engine stretches the capacity of the 1.56-gal. gas tank by reducing rpm as the load decreases.

HOME POWER FROM A JOB-SITE WORKHORSE



Low-cost protection. Briggs & Stratton's Elite Series top-of-the-line portable residential generator (model 0304710) is a no-frills workhorse at a reasonable price of just \$1,200. The 8,000w-rated output (10,000w maximum) is enough to power the absolute bare essentials and keep food from spoiling, pipes from freezing, and the sump pump running.

Large portable generators can meet all the electrical needs of small homes, but they are typically used for powering essential circuits. Although the backup protection is not automatic, generators starting in the 5,000w to 6,000w range are typically equipped with a twist-lock 120v/240v, 30-amp outlet that will connect the generator to a manual transfer switch. This eliminates the need to run extension cords through the house. These units, like their smaller cousins, still require fueling and periodic maintenance, including testing the engine monthly.



User-friendly features add to the price. An illuminated control panel on Generac's \$2,000 XG 10000E (10,000w rated; 12,500w maximum) helps when setting up or fiddling with the generator at night. There are plenty of connection options: A 120v/240v 50-amp circuit-breaker-protected twist-lock outlet can feed a transfer switch while four covered 120v outlets with GFCI protection and two covered 120v/240v 30-amp outlets offer direct plug-in options.

YOU'LL NEVER KNOW THE POWER WENT OUT



Backyard power plant. Powered by an eight-cylinder GM Vortec engine, Briggs & Stratton's 45kw liquid-cooled generator (\$15,000), with a surge capacity of 56kw, is large enough to replace grid-supplied power in all but the largest houses. Despite its size, it runs very quietly (65 db., or slightly louder than normal conversation)

Paired with an automatic transfer switch, standby generators kick in during a blackout or brownout even if a house is unoccupied. All you'll notice is a flicker in the lights before you're back up and running. The controller also automatically exercises the generator to test the engine and to prevent the oil seals from drying out. These generators range from small 7kw units designed for running only the most essential items to enormous power plants in the 50kw to 100kw range that easily power the largest residence. Engine size and type determine the cost of these generators. Units up to and including 20kw typically rely on air-cooled engines, which are cheaper than liquid-cooled engines. Unlike their portable cousins, standby generators are fueled by natural gas or propane



A balance of cost and size. Kohler's 20kw model 20ES (about \$5,000) includes a mounting pad, fuel line, and 200-amp transfer switch, which accepts up to 24 circuits to ensure that all essentials are backed up.

Small generator that pulls its weight. Air-cooled versions of Generac's Guardian Series, from 8kw to 20kw, retail from \$2,300 to \$4,600, including a transfer switch. Generac's \$3,000 10kw model with a Nexus transfer switch can digitally manage two central air conditioners and have the ability to include four additional load-management modules, increasing the effective size of the generator.



Five ways to manage the load

To size a generator, you need to know the load of the things you want to power. You can find the power requirements for an appliance on the body of the device, the nameplate, or the data tag on the electric motor. If the draw is listed in amps, you can convert to watts with this formula: watts = amps x volts. Most items run on 120v, but dryers, furnaces, and some other appliances run on 240v. Once you know the loads, add them up.

Don't forget to account for start-up loads. Electric motors need more energy to start than they do when running. For example, a refrigerator might consume 540w running, but will draw 1,200w for a few seconds after the compressor has started. You don't typically run all those loads at the same time, so you don't need to meet the total starting load. Instead, either build in extra capacity for these starting loads, or manage them by turning off other circuits when large

electric motors start. This can be done manually by switching circuit breakers or with a transfer switch programmed to direct power to some circuits and shunt other circuits based on the total load.

Why not install a larger generator instead of using load-managing transfer switches to keep demand under the generator's output? The answer is cost. For standby generators between 10kw and 20kw, the cost at the margin for each increase of 1,000w is relatively small. Once you exceed 20kw, however, generators require a liquid-cooled engine rather than an air-cooled engine. This upgrade—like jumping from a lawn-mower engine to a car engine—doubles or triples the price.

The prices listed here are a starting point. The actual cost will vary greatly depending on house size, load size, and specific transfer switch used. Also, installation costs are not included and can easily rival the cost of the generator and transfer switch.



THE POWER AND PRICE CONTINUUM

5,000W

PORTABLE GENERATORS

10KW

STANDBY GENERATORS

1 LOWEST COST, LEAST CONVENIENCE

Based on the typical load of a 2,500-sq.-ft. house, a 5,500w or larger portable generator offering 240v electricity and paired with a manual transfer switch can power critical loads. A good rule of thumb is to have one circuit for each kilowatt of generator power (excluding electric heat and AC loads). A 6,000w generator with a six-circuit transfer switch could back up a sump pump, a freezer, and a refrigerator, with two or three circuits left for lights and a TV, and possibly another kitchen circuit for a microwave. It's unlikely that all these devices would be on at once, so with care, you could connect additional circuits and power them intermittently by manually turning circuits on and off.

\$1,000

2 AUTOMATIC ESSENTIAL POWER

For the same home in option 1, a permanently installed 10kw generator and 12-circuit subpanel-type automatic transfer switch mean you don't have to connect and start the generator manually, or refuel it during use. The 12 circuits are the only circuits powered, but you'll be able to add a well pump, an electric water heater, and possibly a small (3-ton) air conditioner to the load.

\$3,000

3 DOING MORE WITH LESS CAPACITY

The largest air-cooled generator (20kw) might back up the whole house in the 2,500-sq.-ft. scenario as long as the central air-conditioning compressor isn't more than 5 tons and the house doesn't have electric heat. However, even a slightly larger house could have two AC compressors. They might use 7,800w running together, but their combined start-up draw would be 22,800w—enough to overload a larger generator. Generac's load-managing Nexus Smart Switch (about \$700) has two dedicated circuits for air conditioners that stagger their starts. This reduces the required size of the generator and saves you from spending two to three times more for a liquid-cooled model to handle the unmanaged start-up load of two AC units. You also can add up to four modules—\$60 devices installed along the circuit's wiring—that will monitor the load and, if necessary, delay and stagger the demands of additional energy hogs like well pumps, sump pumps, and electric ranges.

\$5,000

TWO WAYS TO TRANSFER POWER FROM GRID TO GENERATOR

Except for light-duty portable generators, all of the units require a transfer switch to connect to a home's wiring. The switch, installed between the generator-powered circuits and the meter, prevents back-feed—sending electricity from the generator out into the grid that can injure or kill utility workers, cause a fire, or simply fry your generator.



Depending on the generator, the switch operates manually or automatically. Either way, it must be rated for the generator's output.

- ◀ **Manual:** Typically found with larger portable generators, these switches are used to disconnect the service panel manually from the grid and connect it to the generator, often via an exterior inlet.



Automatic: Limited to permanently installed standby generators

- ◀ with dedicated fuel hookups, an automatic transfer switch and controller monitors the house's incoming electricity. If voltage from the grid drops, the generator turns on, and the electrical panel automatically switches over to generator power. This system also monitors the electrical grid and automatically switches back to normal utility power when power is restored.

20KW

50KW



4 PRIORITIZING CIRCUITS

Large homes with big but still undersize generators that need to manage the load of more than six appliances can use a load-shedding transfer switch. One example of these expensive switches—Generac's \$1,500 Nexus LTS—has 16 circuits for powering priority items. The transfer switch will also power the remaining circuits in the main panel and monitor the frequency (Hz.) of the current, which in North America is supplied at 60 Hz. If current falls below 57 Hz. (typically caused by high start-up loads), the switch will shut off all nonessential circuits to keep the priority items running. After a delay, the nonessential circuits are brought back online.

GE's Symphony II (\$1,200) is intended to back up the whole service panel by having you prioritize appliances. When the generator approaches maximum load, it sheds the lowest priority circuits one at a time until there's capacity available to power the highest priority circuit. Once demand falls, lower priority circuits are brought back online.

\$6,000

5 WORRY FREE

Switches for whole-house protection are relatively basic, but they require a generator large enough to handle all the loads in the house, including their respective start-up loads. These service-rated transfer switches (\$600 to \$1,000) shift the entire service panel over to generator power. It may still make sense to use a switch with dedicated AC-load management to reduce stress on the generator.

\$12,000

would spoil? Do you have powered medical equipment? Would your work in a home office be disrupted significantly? Is the house unoccupied for days or weeks at a time?

After that, calculate the load of the electrical devices you plan to power (see opposite page) to determine the generator size. The number of branch circuits you plan to power, the types of appliances you will back up, and your inconvenience threshold determine how you'll connect the generator to the house's electrical system.

Do it yourself, or not?

Should you tie your generator into the electrical system yourself, or should you call a professional to do the installation? It depends.

Pad-installed generators and automatic transfer switches are often packaged together and sold by big-box retailers at reasonable prices, with the implication that the owner can install them. But plenty of people who set out to install a transfer switch probably shouldn't. To help you decide if you're ready to tackle this task, the first consideration is the condition of your service panel and the type of transfer switch you want to install.

- Installing a manual transfer switch is a DIY project if you have experience, and the empty spaces for a generator circuit.

- If you buy a service-rated transfer switch, which installs between the meter and the main panel, it's a job for a pro.

- A prewired subpanel-type switch is fairly simple, and one electrician told us that if you can wire a three-way switch, you can install one of these. But you can get in serious trouble, especially if you can't recognize a multiwire circuit and keep the shared neutral properly balanced. With a subpanel-type transfer switch, you have to pull the existing circuits that you want to back up and then splice the leads from the transfer switch into that slot. If there's not much space in your service panel and/or the wiring inside is a rat's nest and/or the length of the prewired leads isn't quite long enough, you're in for a long, frustrating day. In other words, call a pro. □

Sean Groom contributed to this article.

Portable Tablesaws

Latest job-site tools combine muscle and mobility

BY SCOTT GIBSON



The cabinet saw is an amazing tool. With its beefy induction motor, heavy cast-iron components, and generous work surface, it is perfectly suited to all kinds of carpentry and furniture making.

But just try getting one up the stairs.

As a solution, trim carpenters, flooring installers, and other contractors have turned for decades to the portable or “job-site” tablesaw mounted on a collapsible stand. These marvels of convenience and utility are light and compact enough to move easily through doorways or in and out of a truck bed.

Portable tablesaws don’t match the power of their sturdier cousins, but that hasn’t made them less popular in the trades or with do-it-yourselfers. Today, at least a half-dozen manufacturers make portable saws in varying sizes, most for less than \$600. Some are large enough to handle sheet goods.

And, in recent years, the saws have improved in ways that make them more versatile. There are obvious limits, but manufacturers are giving these tools as many “full-size” functions as they can at a smaller size and price.

Manufacturers make a stand

Setting up a portable tablesaw used to mean setting up the stand where you intended to work, placing the saw on it, and then bolting the saw in place.

“If you look back four or five years ago, many of the saws either did not come with a stand or came with a stationary stand with no mobility whatsoever,” says Jason Swanson of Ridgid. “Obviously, the biggest thing has been collapsible stands and the addition of the wheels, which make it very portable from job site to job site.”

Although stationary scissor-style stands are still available, more manufacturers now offer stands with wheels. They also are combining saw and stand into one, and they’re making setup and breakdown as easy as pulling a single lever.

Bosch started the trend 12 years ago with the introduction of its wheeled “gravity-rise stand.” “You can set it up literally by pulling one lever,” says Craig Wilson, the company’s tablesaw project manager, adding that the stand “sets itself up in a matter of seconds.”

Other manufacturers continue to follow suit. Early next year, for instance, Porter-Cable plans to introduce a collapsible stand with

Up to the job



one-step setup on the portable saws it sells at Lowe's, a company spokesperson says.

Say good-bye to the old guard

Though designed to protect the user, blade guards are famously unpopular with many carpenters and woodworkers.

A large number of tablesaw users "still have the bias that guards are terrible," says DeWalt product engineer Ross Billings. "They think of the old guard, which is what we're trying to improve."

DeWalt and other manufacturers have introduced a range of designs to make guards more palatable to end users. Perhaps the biggest change has been in kickback prevention, replacing the old-style fixed splitter with a riving knife in the guard that moves up and down with the blade and can be set at different heights.

Other innovations include modular designs that allow different parts of the system to be removed easily, and shields on each side of the blade that operate independently.

Manufacturers also are making it easier to adjust or remove the guards without the need for special tools. The Bosch guard, for



POWER

Modern muscle. Today's portable saws boast increased cutting power derived from 15-amp motors that spin the blade at 4,500 to 5,000 rpm.



CAPACITY

Small saws, big rips. Although the table surfaces are small, the fences on most saws extend far enough to make ripcuts in wide sheet goods.



VERSATILITY

Dado-ready. The new saws are accurate and capable of tackling a variety of joinery operations, including handling a stacked dado set.

Guards



Smart guards. Newer blade guards attach and detach much more conveniently than older models.



Riving knives. This improved version of the standard splitter helps prevent kickback and is available on all portable saws. Without a splitter or riving knife, a board can pivot sideways, catch the blade's back teeth, and be propelled toward the user.

instance, pops up and holds itself out of the way so users can check the fence-to-blade distance with a tape before making a cut.

Universal motors, compact designs

Part of the appeal of job-site tablesaws is that they don't need 240-volt electrical circuits. The tradeoff is that they're still powered by lighter but noisy universal motors that don't have as much power as the induction motors on bigger cabinet saws.

"We're trying to give them the same feel and give [users] the sense they can cut those bigger things they would have cut on the bigger saws," says Billings.

Fences



Precise adjustments. Rip fences on portable saws have improved all around. Ridgid's offers a micro-adjust feature that allows changing the fence location in $\frac{1}{64}$ -in. increments.



Solid mechanics. DeWalt's fence locks in place atop a pair of extension arms whose movement is synchronized through a rack-and-pinion adjustment system.

One way of accomplishing this is to increase blade speed, from the 4,000 rpm that would have been common five years ago to between 4,500 to 5,000 rpm today, Billings says.

Increasing the energy at the blade tip allows users to cut material more easily. Theoretically, saws running at a higher rpm should lose torque, but it doesn't feel that way to users, he says.

Mason says the lower available power on job-site saws makes it important to choose the right blade. He suggests investing in both a rip and a crosscut blade.

Many job-site tablesaws have rip capacities of 24 in. or more to the right of the blade, making it possible to break down sheet

Storage

Smart storage.

Many saws incorporate storage for fences and miter gauges so that these crucial accessories stay with the saw in transit.



goods like plywood or oriented strand board (OSB). But some manufacturers also offer compact models for those who typically work with smaller pieces of stock.

DeWalt's Model DW745, for example, and the Bosch GTS1031 both use 10-in. blades, but have rip capacities of less than 24 in. These saws are lighter than corresponding full-size models. The DW745 weighs 45 lb., vs. the 57 lb. for DeWalt's DW744 model with its 24½-in. rip capacity.

Bosch introduced the GTS1031 two years ago after instructing engineers to come up with a "very robust, very portable" design to augment its existing saw offerings. Installers who don't need huge cutting capacity and may need to lug the saws up and down stairs are the likely target audience.

Coincidentally, Makita's research led it to believe that most contractors aren't interested in having more than one table saw. They want one saw that suits all of their needs. Even floor installers occasionally need to cut sheet goods, says Makita residential construction product manager Joe Soto, so at least for now the company doesn't have plans for expanding its line beyond the current model 2705.

Other features that save time or hassle

Several other features that add convenience or utility have been introduced by one or more manufacturers. For example, carefully planned onboard storage keeps accessories within easy reach. Another benefit is that when the accessories—including the fence—are stowed, the tool becomes more compact and can be set against a wall without fear of damaging anything.

Adjustable stock supports, such as the one on the back of the Jet saw, provide extra support for larger pieces of material. The support can extend an extra 12 in. from the back of the table, providing a total of 18 in. of surface.

Enough blade height to cut a 4x4 in a single pass is available on some models, too. The Makita 2705 is one. Some saws also are able to handle stack-dado sets.

More robust fence designs do a better job of staying parallel to the blade than earlier models. DeWalt offers a rack-and-pinion adjustment it says will stay in proper alignment under a load. Ridgid's saw has a micro-adjust feature that moves the fence in increments of 1/64 in. Fences that clamp front and back are becoming more common as manufacturers in general look for beefier designs. □

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Smaller units. For contractors and other users who don't need to break down sheet goods, manufacturers offer smaller, lighter saws with a rip capacity of less than 24 in. The rip capacity on this DeWalt is 16 in.

Router Tables

The best offer flat tables, great fences, and good dust collection

There seems to be no limit to what the router can do. That's why just about every woodworker has one—and why some of us have more than that. But if you are using the router only as a handheld tool and not mounted in a table, too, then you're not taking full advantage of its versatility. Mounted in a table, the router becomes a super-accurate joinery machine that can spin out perfect sliding dovetails, and tenons that fit their mortises straight from the table. You can also rout more consistent edge profiles because you don't have to worry about the router tipping. And it becomes possible to rout small parts, something that's too dangerous with a handheld router.

It's not hard to make a router table in your shop. All you need is a piece of plywood or MDF for the top, and a straight piece of wood for the fence. Bolt the router to the top and you're good to go. Woodworkers have been using router tables like this for a long time, and many still do.

But there are problems with shopmade router tables. If you go the simplest route and bolt a fixed-base router to the table, you're stuck having to reach under the table to adjust the bit height. And you'll have to remove the router altogether to change bits. Even if you have a router that makes above-the-table adjustments possible, you probably won't be able to change the bit that way because the table will be too thick to allow the collet to get



above it. And a simple fence will be hard to adjust. Do you really want to spend your money and shop time making a tool that will never be as good as one you can buy?

So, if you are looking to add a router table to your shop (or upgrade the one you already have), it makes sense to buy a manufactured one. You'll get a smooth and durable top and a rigid fence that's easy to adjust and mount accessories to. You'll also get dust collection built into the fence, and perhaps even dust collection under the table. The top will accommodate a router lift, which makes it

a snap to change bits and bit height from above the table. Add one of those (see pp. 56-59) and a powerful router, and you have a router table that has the same types of adjustment as a shaper, setting up precisely for any task in just a minute or two. It's very difficult to get there with a shopmade table.

With this in mind, we reviewed the manufactured router tables currently available. For accurate work, the table's flatness is critical. So we eliminated laminate tops with MDF cores from the test because past testing has shown that this material

Features to look for



Quick and precise fence adjustments. You shouldn't need tools to move the fence; they only slow things down. A scale on the Excalibur's mounting bracket helps to locate the fence faster.



Adjustable fence faces. The opening between fence faces gets changed often to accommodate different-size bits. Look for a fence, like this one on the Rockler table, that lets you make the adjustments without tools.

is prone to sagging. That left only tables made from cast iron, solid phenolic, and aluminum—nine tables in all (but one has two fence options). We'll explain how we tested them, and tell you which router table came out on top, and which one proved itself to be the Best Value.

How the tables were tested

A router table should be flat when weighed down by your router (and a lift, possibly), because one that dips can result in uneven edge profiles and hard-to-fit joinery. So, we mounted a router in the tables and checked their flatness with a straightedge and feeler gauges.

How much dip is too much? In practice, a top that dips more than 0.030 in. (just less than $\frac{1}{32}$ in.) would create problems for edge profiles and joinery. But of course, the less it dips the better. All of the tables dipped, except for the two cast-iron ones. None of the tables exceeded the limit, but a few came close: the Woodhaven 8243K and the JessEm Mast-R-Top with Mast-R-Fence. Both cast-iron tops actually had a crown, which is better than a dip, because as long as you keep downward pressure on the workpiece right at the bit, you'll get accurate profiles and joinery.

Every router table needs a fence, preferably one that adjusts easily and



T-tracks make the table more versatile. Use them to attach stops as on the Excalibur (left) and featherboards like on the JessEm (right), which allow you to work more accurately and safely.



Dust port keeps the table clean. Clearing chips and dust is crucial to a clean, safe cut. All the tables, including this Woodhaven unit, have a port on the fence. Some also have a port on the router enclosure.

Router tables, head to head



EXCALIBUR 40-200C



Street price: \$760

Source: general.ca

Flatness with plate and router: 0.008-in. crown

Flatness with lift and router: 0.008-in. crown

This table has it all: a cast-iron top that doesn't sag, a versatile and stout fence, a remote power switch, and the best dust collection. The fence is easily positioned with adjustable scales on the mounting brackets. The fence faces are quickly adjusted and simple to replace with shopmade sacrificial fences. A scale on the top of the fence can be set for any bit application, and there are plenty of T-tracks for stops and featherboards. A single 4-in. dust port collects from both the router enclosure and the fence. The router plugs into a push-button switch that can be mounted on either front leg, easily reached by knee or knuckle. Rounding out the assembly is a three-wheeled mobility kit that keeps all four legs firmly on the floor when the single steering wheel is raised.

accommodates featherboards, auxiliary fence faces, stops, and other accessories. Like the table, the fence needs to be flat (no bow) along its length and the fence face should be square to the table when locked in place.

We used a long straightedge to check the fences for flatness. All of them were flat. We also tested the fences to determine if they were square to the table, and every one of them was.

All of the fences have a dust-collection port, which did a good job of keeping the tabletop clear of chips and dust. However,

by itself this port can't catch everything, and all but three of the tables allowed piles of chips to form under the tables. The two tables from Excalibur and the Bench Dog have router enclosures with dust ports, and they did a great job of collecting the falling chips, too.

A clear winner, and a great value

After all of the testing was completed, it wasn't hard to pick the Best Overall router table: the Excalibur 40-200C. Its cast-iron top has a slight crown, which is preferable to a slight dip. The fence is versatile, stout,



JESSEM MAST-R-TOP WITH ROUT-R-FENCE AND ROUT-R-STAND



Street price: \$560

Source: jessemdirect.com

Flatness with plate and router: 0.010-in. dip

Flatness with lift and router: 0.015-in. dip

Although this table has a good stand and a solid top, it's really all about the fence. It has T-tracks on the front, top, and back, which makes it a snap to attach accessories like featherboards and stops. Edge-banded MDF faces can be adjusted quickly and easily replaced with wood or MDF when sacrificial faces are needed. Mounting brackets on the table's edge eliminate slots in the tabletop. However, there are no scales on the fence mounts or on the fence. There is a dust-collection port in the fence, but not beneath the table. These missing conveniences can be overlooked when you get such a strong performer at a great price.

and easy to adjust. Add excellent dust collection to the mix and you have a table that can't be beat.

The JessEm Mast-R-Top paired with JessEm's Rout-R-Fence and Rout-R-Stand is the Best Value. The stand is strong and makes a nice base for the solid phenolic top, which was nearly dead-flat—it dipped just 0.010 in. But what really makes this table stand out is the fence, which has plenty of T-tracks for attaching accessories and is easy to set up. □

Roland Johnson contributed to this article.

BENCH DOG CAST-IRON ROUTER TABLE WITH STEEL CABINET



Street price: \$1,000

Source: rockler.com

Flatness with plate and router:
0.005-in. crown

Flatness with lift and router:
0.005-in. crown

The enclosed base offers great storage and good dust collection. The fence is solid. However, to get the most from this table you need a few accessories (an external power switch and a dust-port connector to join the fence and cabinet hoses). The opening for the plate fits only Rockler and Bench Dog plates and lifts, but a plate is included in the price.

EXCALIBUR 40-200P



Street price: \$695

Source: general.ca

Flatness with plate and router:
0.021-in. dip

Flatness with lift and router:
0.022-in. dip

This table is identical to the 40-200C, but has a solid phenolic top, rather than a cast-iron one. The phenolic top had a slight dip. Our Best Overall choice, the version with the cast-iron top, costs only \$65 more and has the slightest crown rather than a dip, so choose it rather than this one.

JESSEM MAST-R-TOP WITH MAST-R-FENCE II AND ROUT-R-STAND



Street price: \$630

Source: jessemdirect.com

Flatness with plate and router:
0.025-in. dip

Flatness with lift and router:
0.0028-in. dip

This table is identical to the one chosen as Best Value, but with an even nicer fence. There are scales on the mounting brackets, which make it easier to set the fence's distance from the bit and to keep the fence parallel to the miter slot. The fence also has T-tracks for mounting accessories. The fence's dust port kept the table clean.

JESSEM MAST-R-LIFT EXCEL II



Street price: \$1,050

Source: jessemdirect.com

Flatness with small motor:
0.002-in. dip

Flatness with large motor:
0.008-in. dip

This table is unique because it has a router lift built into it. Height adjustments are wrench-free and instant using a wheel that attaches to the right side of the base. The under-table dust port did not collect enough falling chips to prevent a pile from forming on the floor. The fence port did its job and kept the table clean.

ROCKLER PRO PHENOLIC TABLE WITH STEEL STAND



Street price: \$500

Source: rockler.com

Flatness with plate and router:
0.020-in. dip

Flatness with lift and router:
0.021-in. dip

This table is light but strong, with a sturdy base. The fence is solid, with plenty of T-tracks for accessories, faces that were easy to move, lock down, and adjust. The dust collection did a good job of keeping the table clear. The opening fits only Rockler or Bench Dog plates or lift (a plate is included in the price).

WOODHAVEN 8243K



Street price: \$596

Source: woodhaven.com

Flatness with plate and router:
0.026-in. dip

Flatness with lift and router:
0.029-in. dip

A sturdy fence with T-track and rulers highlights this affordable table. The fence clamps easily and securely to the table. Unfortunately, the base is made from flat aluminum extrusions (for the legs) and MDF (for the aprons), making it unstable during heavy use. (Street price includes router plate.)

FESTOOL CMS GE BASIC



Street price: \$1,200

Source: festoolusa.com

Flatness with Festool router:
0.002-in. dip

This is a compact router table, a great option for the job site, but probably too small for the shop. The fence design is similar to a shaper fence, which allows you to easily offset the infeed and outfeed tables with the turn of a dial. This table fits only Festool routers—the OF 1010 and OF 1400. They're plunge routers that offer above-the-table height changes.

SOMMERFELD TOOLS ROUTER TABLE



Street price: \$670

Source: sommerfeldtools.com

Flatness with Triton router:
0.018-in. dip

This table's top is made from three pieces of aluminum that are bolted together. The piece of aluminum in the middle of the table is pre-drilled for two routers: the Triton TRC001 and the Milwaukee 5625-20, both of which are designed so that you can change the bit and adjust the bit's height from above the table.

Router Lifts

Above-table adjustments and bit changes make setup a pleasure



No matter what jobs you use your router table for—profiling edges, cutting rabbets and dadoes, or routing dovetails and box joints—there are two things that you end up doing a lot: changing bits and adjusting the bit's height. Both tasks can be exercises in frustration if your router table is nothing more than a router bolted to a flat surface (whether that surface is a router plate or a piece of plywood). To change the bit, you'll have to pull the router out from under the table and then put it back. And changing the bit's height can be even more aggravating, as it can involve a series of hit-or-miss adjustments as you reach under the table to unlock, raise or lower, and then re-lock the motor. The bit always seems to drop or climb just a hair when you lock the motor!

Even if you have a router designed for table use—which allows for above-the-table height adjustments—you still have to reach under the table to unlock the motor to make changes and then reach back under to relock it. And changing the bit can still require you to take the motor completely out of the table.

The solution to these problems is a router lift to hold your router's motor. With a lift, you can raise and lower the motor from above the table. Changing bit height is a snap, and you don't have to reach under the table to unlock and lock the motor. In fact, most lifts are so solid there is no need for a separate locking step. There is also enough vertical movement to get the collet above the table so you can change bits without removing the motor.

If you don't have a router lift, you should consider getting one. To save you from having to wade through discussion forums, YouTube videos, Amazon reviews, and countless pages of Google search results, we tested the lifts currently available on the market. We got seven lifts into the shop and examined them side-by-side. We checked to see if they held their vertical alignment and kept the router square to the table, and how securely they held height adjustments during use. We also looked at a whole host of convenience features, such as how easy it is to adjust the bit's height and how quickly the lift plate's insert rings can be taken in and out (they need to be easy to remove and replace because it has to be done every time you change the bit—not only to gain wrench access to the collet, but also because bits are different sizes, so you'll need to switch out the insert rings to match.) All of

Accuracy and convenience



Router lifts are all about convenience. The two things you do most when using a router table are changing bits (above) and adjusting the bit's height (left). Router lifts make your life easier, because they make it possible to do both jobs from above the table.

Setup is a snap

Unlike router plates, which must be bolted to the router base, router lifts have a carriage that holds the motor (right), a faster and more convenient way to mount the router. And look for insert rings that are easy to install and remove, like those that twist in with a spanner wrench (far right).



Router lifts, head to head



EXCALIBUR 40-125



Street price: \$370

Source: general.ca

The Excalibur is a rock-solid lift that's easy to adjust. The lift mechanism comprises four posts connected by a chain and sprockets. Height adjustments were precise, and the system stayed aligned and held its height settings perfectly. The insert rings twist and lock into place with a spanner wrench, a simple and effective system. They were level with the plate and easy to use. The lift is designed for large routers, but can accommodate smaller ones with the addition of a reducer sleeve that fits around the router's housing.



JESSEM ROUT-R-LIFT IIV



Street price: \$180

Source:
jessemdirect.com

Designed for medium-size routers with 3½-in.-dia. motors, this lift has all of the features and accuracy of its bigger brethren, but in a slighter package. It's easy to install the motor, adjust bit height, and change bits. The insert rings were level with the lift plate, and twist into place with a spanner wrench. Once set, height and alignment were very stable. If you never plan to get a big router for your table, this is the lift to have.

the router lifts performed well, but one of these lifts proved itself better than the rest, and another is the best option for those on a tight budget.

Excalibur is a cut above the rest

After completing all the tests, we determined that the Excalibur 40-125 is the Best Overall lift. It stayed aligned, held its height settings, and made height adjustments and bit changes a snap. The lift mechanism itself is stout, more than sturdy enough to handle the weight and power of a big 3-hp router. But it is also the most expensive lift in the test.

If you're looking for a more affordable lift that still does a great job, the Best Value JessEm Rout-R-Lift is for you. It's the least expensive lift we tested, but it held its vertical alignment especially well. However, the JessEm fits only medium-size router motors, like the Porter Cable 690, the Bosch 1617, and the DeWalt 610. □

Roland Johnson contributed to this article.

BENCH DOG 40-150



Street price: \$350

Source: rockler.com

A cast-iron plate, accurate height adjustments, and a stout lift mechanism make this a great router lift. The crank handle is actually a speed wrench, which is nicer than the handles on the other lifts. However, it engages the lead screw by means of a shallow socket that slips over a nut on the screw. The fit between them allowed the wrench to wobble during use.

JESSEM MAST-R-LIFT II



Street price: \$350

Source: jessemdirect.com

This lift would be a great choice for someone with a medium-size router who is looking to upgrade to a big one later, because the clamping mechanism adjusts to fit just about any router motor on the market. Height adjustments are easy. The plate is easy to level and has adjustable "snuggers" to ensure that it fits tightly in the opening.

ROCKLER ROUTER LIFT FX



Street price: \$207

Source: rockler.com

This is the lift for anyone who has just one router motor and plans to use it in both handheld and table modes. A nifty cam lock made quick work of taking the motor in and out. However, the lift fits only medium-size routers. Height adjustments were no problem. However, the throat insert is held in place by screws, and that's a hassle on a tool that is supposed to be all about convenience.

WOODHAVEN EZ LIFT



Street price: \$237

Source: woodhaven.com

The Woodhaven lift is constructed from aluminum track, phenolic parts, and screws. This means that you can adjust the vertical alignment, but that adjustability can also allow some inaccuracy to creep into the lift. Out of the box, there was too much vertical misalignment. The throat inserts were easy to use, as they snap into the opening and are held in place by an O-ring.

WOODPECKER PRL-V2



Street price: \$350

Source: woodpeck.com

A unique thumbwheel for fine height adjustments combined with a spring-loaded lift handle for quick and big changes results in a lift that's easy and quick to set up. The thumbwheel, which changes the bit's height $\frac{1}{32}$ in. with every full rotation, allows for finer adjustments than all the others, which adjust the height by $\frac{1}{16}$ in. with each rotation. And bit changes are lightning-fast. The throat insert twists and locks into place.

Go for the gusto: Buy the total package

Making a router table seems to be a rite of passage for woodworkers. But for many of us there is no good reason to do it. You might save some money, but you're going to spend a lot of time making it. Wouldn't you rather be building furniture than shop tools? And, to be blunt, it's tough to beat the factory when it comes to quality and features. So, if you're looking for your first router table or want to replace an existing one, consider getting a lift and manufactured table for the ultimate in speed and convenience.

We tested 10 router tables at the same time as these lifts (see pp. 52-55). You could mix and match many of these lifts with the tables, but there is no need. The Best Overall table and lift combination is the Excalibur 40-200C table paired with the Excalibur 40-125 lift. The cast-iron table has no sag, great dust collection, a fantastic fence, and a top-performing lift.

If that package is outside your budget, then you'll find a great value in the JessEm Rout-R-Lift II complete table system, which



Excalibur 40-200C table paired with the Excalibur 40-125 lift
\$1,099, general.ca



JessEm Rout-R-Lift II complete table system
\$650, jessemdirect.com



includes the lift, the Mast-R-Top, Rout-R-Fence, a sturdy stand, a power switch, and even some featherboards. You'll even save money on the router, because the lift fits only medium-size routers, like the Porter Cable 690, Bosch 1617, and DeWalt 610. Not only are they less expensive than routers with more horsepower, there's also a good chance you already have one and can use it in the table.

Shop Vacuums

With better filters and features, these vacs are must-have companions for power tools



As part of our research for “Better Air for Every Shop” (see pp. 62-65), we brought in the best shop vacuums we could find. We used them in our filter testing, and planned to show just a few as part of a whole-shop guide to dust management. But somewhere along the line, we realized, “Duh, we’ve got a full tool test of shop vacs on our hands.” So here is your guide to the most effective and user-friendly shop vacuums on the market.

Three indispensable features

We selected only vacs that come standard with HEPA filters, the finest available. To keep things more affordable, we opted for the smallest such vac in each maker’s line. We did look at one vacuum that doesn’t offer HEPA as a standard item—the 12-gal. DeWalt D27904—because it has a self-cleaning feature. We ordered the accessory HEPA replacement filter for it.

Two features that have become state-of-the-art for shop vacuums are variable suction and an onboard power outlet. These features are related: If you have a tool plugged into the vacuum, the combined amp draw might trip your breaker. So it’s nice to be able to dial back the suction a bit to draw less power. Also, with some sanders, full suction will pull the tool against the wood, making it harder to move it.

And of course, onboard power is wonderful. Plug in your router, sander, or whatever, and when you turn it on, it triggers the vac. The vacuum keeps running for a few seconds after you switch off the tool, grabbing the last few chips.

The problem with filter bags

Because of their HEPA filters, all of these vacs also have some kind of bag inside as a



Photos: Michael Pekovich

pre-filter, which keeps the superfine filters from clogging and cutting suction in half.

The bags do their jobs well, keeping airflow close to its initial high, but most woodworkers probably won't use them in the long run. They reduce the capacity of the vacuum canister—drastically in most cases—and they fill quickly. Unfortunately, they can't be emptied and re-used, and at an average of \$5 each, we don't think you'll go on replacing them for long. Without them, however, the HEPA filter clogs quickly. At that point, for most of the vacuums, you'll have two choices. You can bang them out over a trash can, filling your head with a cloud of the very dust you are trying to avoid, or you can add a dust separator (see p. 63). The best will catch 99% of the chips and dust, keeping your HEPA filter remarkably clean. But a separator is another expense, and another thing to drag around at the end of the vacuum hose.

Bosch is the exception

Two of the vacuums, the Bosch Airsweep and the DeWalt D27904, have automatic filter shakers, designed to unpack the

pleats and get the air flowing freely again. So in theory at least, you should be able to run both of these vacs without a separator. With the Bosch, when you turn off a tool that is plugged into the onboard power outlet, the vac automatically shuts off after 7 extra seconds of run time, and then the cleaner switches on, shaking the dust off the filter. If you don't have a tool plugged in, you can activate the cleaning function with a push-button. The DeWalt filter vibrator turns on much more often: once every 15 seconds while the vac is running.

Of the two, the Bosch Airsweep worked best in our tests, restoring the airflow almost to full power so you don't need to attach a separator to the vacuum or shake its filter over a trash can. Its working airflow was the highest in the group, no matter how much dust we fed into it. It also has the second-highest canister capacity. So the Bosch was an easy choice for Best Overall.

Dustless Technologies looks like the bargain of the lot, but it lacks an onboard tool outlet and you'll need to buy either a pile of bags or a dust separator to keep its HEPA filter clean and flowing freely, and then it won't be any cheaper than the

Bosch. So we went in a different direction with our Best Value award. Based on our testing, the least expensive way to get a shop vacuum with good filtration and powerful airflow is to keep the vacuum you have and add an aftermarket HEPA filter and a separator (below). □

Asa Christiana and Bill Peck contributed to this article.

READERS' RATINGS: SHOP VACUUMS

Our Best Overall, the Bosch Airsweep, was the third choice among readers surveyed. They preferred the Festool and Fein vacs.

★★★★★	4.76	FESTOOL CLEANTECH CT 26
★★★★☆	4.59	FEIN HEPA TURBO III
★★★★☆	4.37	BOSCH AIRSWEEP 3931A-PBH
★★★★☆	4.32	DUSTLESS TECHNOLOGIES HEPA VACUUM
Not surveyed		DeWALT DWV012
★★★☆☆	3.87	DeWALT D27904
Not surveyed		MAKITA VC4710

MODEL/SOURCE	STREET PRICE	POWER	CANISTER CAPACITY	BAG CAPACITY	NOISE	INITIAL AIRFLOW	WORKING AIRFLOW
Bosch Airsweep 3931A-PBH boschtools.com	\$650	11 amps	13 gal.	8 gal.	91 db	86 cfm	77 cfm
DeWalt D27904 dewalt.com	\$530*	9 amps	12 gal.	6 gal.	85 db	77 cfm	58 cfm
DeWalt DWV012 dewalt.com	\$460	10 amps	10 gal.	7 gal.	Not tested	Not tested	65 cfm
Dustless Technologies HEPA Vacuumv dustlesstechnologies.com	\$440	10.6 amps	16 gal.	6 gal.	78 db	79 cfm	60 cfm
Fein HEPA Turbo III fein.com	\$560	11 amps	15 gal.	4 gal.	74 db	90 cfm	59 cfm
Festool Cleantex CT 26 festoolusa.com	\$595	10 amps	7 gal.	6 gal.	73 db	61 cfm	31 cfm
Makita VC4710 makitausa.com	\$550**	8 amps	10 gal.	Not tested	72 db	70 cfm	56 cfm

* plus \$120 HEPA accessory filter

** plus \$140 HEPA filter

YOUR VAC HERE

BEST VALUE CHOICE

Best Value is the vac you already own.

Outfit it with an aftermarket HEPA filter and a dust separator, and you'll have a safer, more powerful shop vacuum for under \$100.



Better Air

Improved technology offers better choices, whether your needs are small, medium, or large

In 2002, wood dust went from being a shop nuisance to an official health risk. That's when the U.S. government put it on their list of known carcinogens, linking it to a variety of nose, throat, and lung cancers. And the trouble with wood dust is that the most dangerous particles, that is, the very fine ones, are the hardest



SMALL CYCLONES, TINY CYCLONES

One of the breakthroughs in dust collection involves downsizing. There is no doubt that the cyclone is the best way to collect dust. New portable models (above) are a more affordable option for small shops, while even smaller versions work wonders as dust separators for shop vacuums (right) and single-stage dust collectors.



for Every Shop

to collect. Under 10 microns in size, these particles hang longest in the air, penetrate deepest into the lungs, and are the hardest for the body to eject.

The strategy for fighting the problem is simple: Bring the right amount of suction to the source and put the finest filtration you can buy at the other end. Your primary source of suction for woodworking machinery should be a dust collector, not a shop vacuum alone. In recent years, the best collector designs have gotten more affordable and portable. A 2-hp dust collector (either cyclone or single-stage) with a 12-in. impeller is probably right for a basement or garage shop.

Also, the modern pleated dust filter, which packs hundreds of square feet of surface area into a small canister, is a major upgrade from the felt-bag filters of the past. But for any collector short of a cyclone, there is a problem: The filters can only get so fine before they start clogging and killing airflow. On single-stage dust collectors (and most shop vacuums), most of the fine dust reaches the filter, so the very finest pleated filters will quickly pack with dust and start killing suction. The good news is that there's a way around that, too.

Boost performance of shop vacs and small collectors

No matter what type of dust collector you get, you also need a shop vacuum. If you're buying a new vac, look for one that comes with a HEPA filter. Otherwise, add a HEPA filter to your existing vac and, in either case, add a dust separator to keep it from clogging. Dust separators are made for both shop vacuums and single-stage dust collectors. The common type is simply an inlet and outlet that attach to the top of a barrel. Dust reaches the barrel first, where the larger particles settle out before the air passes into the dust collector itself. In our tests, separators helped keep the shop-vac HEPA filters clean and flowing free.

We also tested a number of single-stage collectors, trying them without a separator in place, and the results were sobering: Airflow dropped by an average of 40% af-

SHOP VACUUMS TWO AFFORDABLE UPGRADES MAKE A BIG DIFFERENCE



Faithful companion. A dust separator tags along with your shop vacuum, capturing 99% of the dust before it can clog the filter.



Add a HEPA filter. Certified HEPA aftermarket filters are inexpensive and widely available for most shop vacuums. Go to cleanstream.com for more information. However, without a dust separator (left), a HEPA filter will clog more quickly than a standard one, reducing airflow significantly.



DUST RIGHT SEPARATOR

Price: \$80

Rockler.com

Dust captured: 99%



We tested three dust separators designed for shop vacuums, and two were extremely efficient. The Oneida Dust Deputy stopped a few more grams of the finest dust before it reached the vacuum filter, but the Rockler Dust Right Separator (left) has more capacity.

SINGLE-STAGERS CLEAN FREQUENTLY OR ADD A SEPARATOR



Use a dust separator to keep the filter clean. This Veritas Cyclone Lid is an affordable upgrade for any single-stage dust collector. Separators are also easier to empty than bags are.



Or clean the filter yourself—frequently. Spinning the internal flappers or blowing with compressed air will return the airflow to normal, but you must do it after each wood-working session.

EDITORS'
BEST OVERALL
CHOICE

SUPER DUST DEPUTY

Price: \$170
(requires container)
Oneida-Air.com
Dust captured: 99%

TRASH CAN CYCLONE LID

Price: \$33 (requires
container) Woodcraft.com
Dust captured: 90%

EDITORS'
BEST VALUE
CHOICE



ter filling the bags just once. Then we picked a typical performer, the Jet DC1100CK, and tried it with various dust separators. With the best separators, the airflow hardly budged! By the way, Jet makes a vortex-type of single-stage collector, called the Vortex Cone, which keeps the filter clean without the need for a separator.

We also tested the effectiveness of the internal flappers that manufacturers have included on their cartridge filters. They worked great,



Grizzly T23916
Cartridge Filter
Price: \$330
Grizzly.com



Oneida HEPA Media
Filter Conversion Kit
Price: \$268
Oneida-Air.com



Wynn C-1425C
Price: \$168
Wynnen.com

AFTERMARKET FILTERS ARE A STEP UP

There are three aftermarket filters that will catch finer particles, each one a big improvement over the stock filters on today's single-stage dust collectors.

CYCLONES GO PORTABLE AND CHOOSE WISELY

Find a cyclone with a fine filter.

Grizzly, Oneida, and Penn State are three companies whose cyclone filters are third-party rated to capture at least 85% of the finest dust particles. Oneida's HEPA filters are the highest rated.

too. A few spins of the handles unpacked the pleats and brought airflow back to normal. Blowing compressed air through the pleats also worked, and won't abrade the filter media the way flappers might. We found that a full bag drives the dust swirl higher, clogging the filter more quickly, so empty the bag when it is half full or so.

If a single-stage collector is a better fit for your budget, or if you already own one, consider the upgraded filters from Grizzly and Oneida. Most collectors have similar dimensions and designs, so there should be an aftermarket filter that will fit yours. After upgrading, consider adding a dust separator to keep the filter clean and the airflow powerful.

Cyclones—the biggest and the best

Cyclone dust collectors are still the best choice if you can afford them. While the first cyclones for small shops were big, expensive, stationary machines, requiring long hose or rigid-duct runs to reach all four corners of a shop, almost every cyclone manufacturer now makes compact, roll-around models, and many are under \$1,000.

Cyclone collectors can have state-of-the-art filters that capture particles as small as 0.3 microns. While the airflow on the other collectors and vacs dipped up to 40% as their filters clogged, the filters on the cyclones stayed clean and the airflow barely wavered. □

Asa Christiana and Bill Peck contributed to this article.



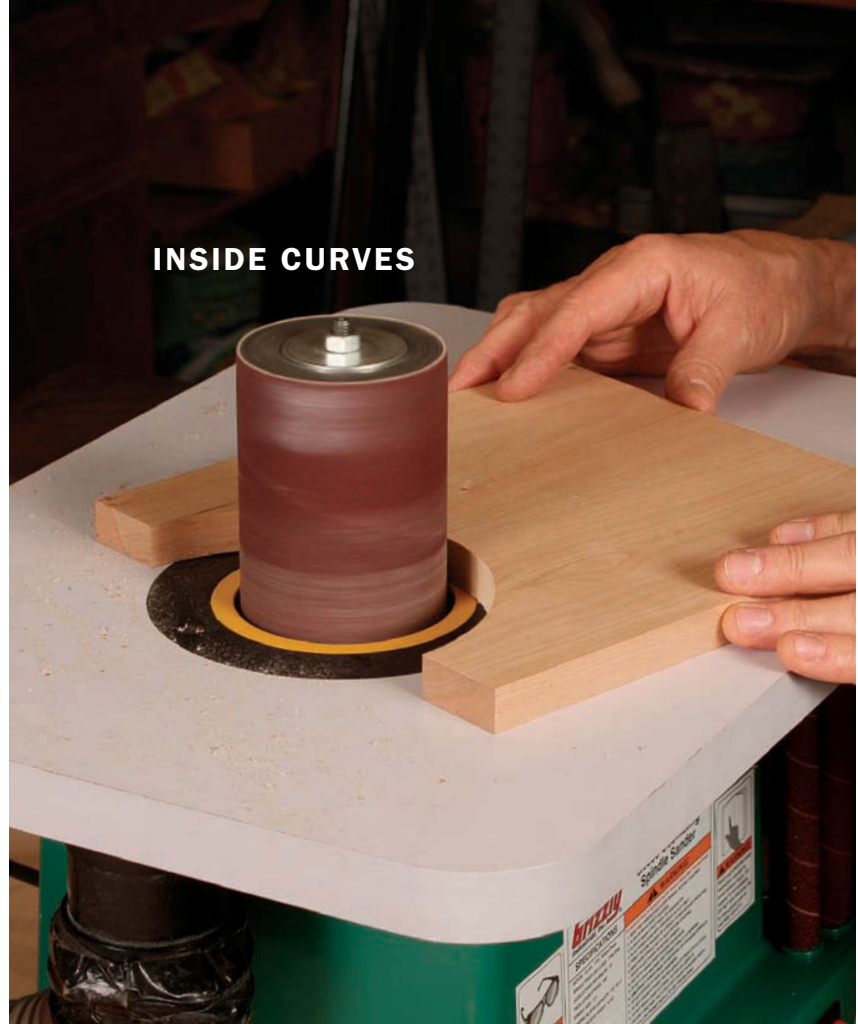
OR UPGRADE THE CYCLONE YOU HAVE

Grizzly, Oneida, and Penn State also sell their filters as accessories.

Get your shop a Benchtop Sander

You'll find a hundred
uses for these
compact machines

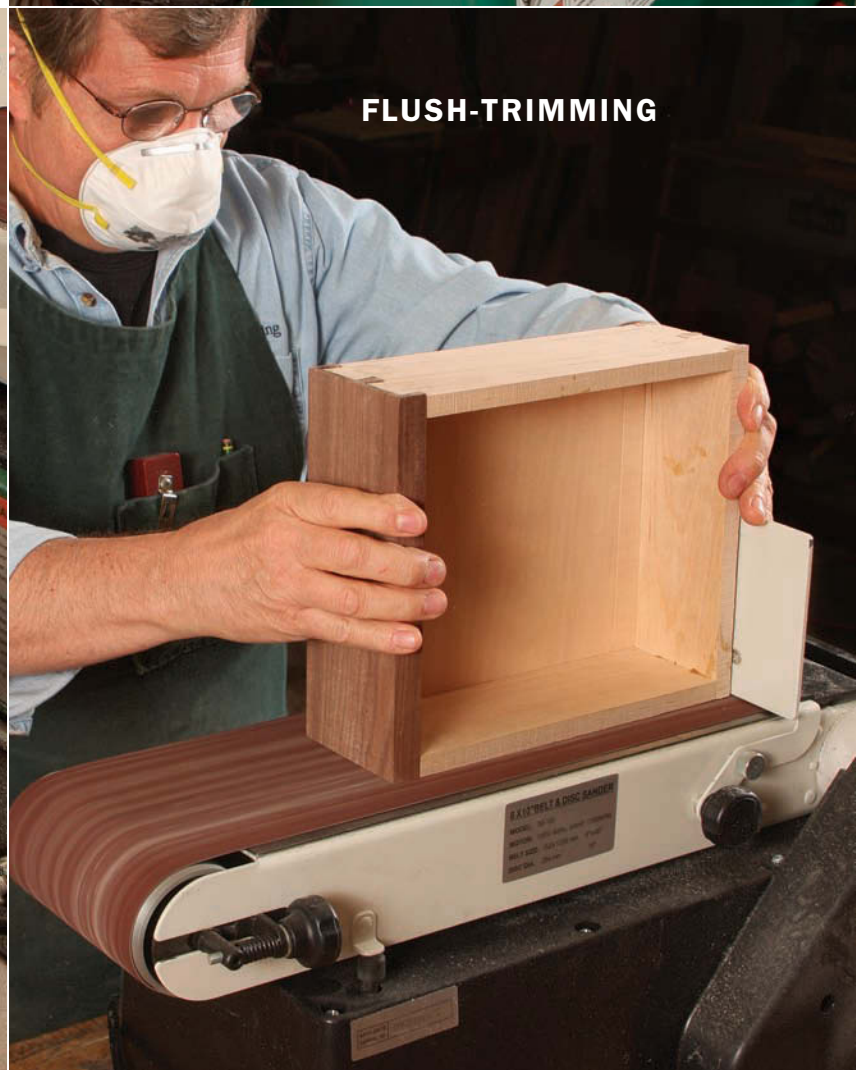
INSIDE CURVES



OUTSIDE CURVES



FLUSH-TRIMMING



There are a handful of jobs that a benchtop sander handles better than any other tool. We'll reveal a few of these tasks here, but once you have a disk, belt, or spindle sander, you'll discover many more odd jobs for it—and soon you'll wonder how you got along without one or more of these units. What's more, many of these versatile machines can be had for around \$100 to \$450.

There are a lot of benchtop sanding machines out there, but we'll focus on the types best suited to serious woodworkers: disk sanders, combination belt-disk sanders, and oscillating spindle sanders. These tools will have even more appeal to those who favor power tools over hand tools, as the sanders can step in to do jobs normally reserved for rasps, files, spokeshaves, and handplanes.

But remember that these machines are not the last word on surface prep. They all are very aggressive, and any surface that will be visible will require some random-orbit and/or final hand-sanding to perfect it. Also, these sanders require a light touch, or you risk sanding over the line—quickly and deeply.

Last, these sanders spew lots of fine dust, even when connected to a dust collector or shop vacuum. That means you need to wear a high-quality dust mask when using these machines.

Now let's take a look at the most basic of the bunch, disk sanders.

Disk sanders: Useful, but limited

Most disk sanders come with a 12-in.-dia. disk, a table to support the workpiece, and a miter gauge. This sander is very adept at shaping or trimming end grain, like when you need to take a bit off the end of a tenon—a job normally reserved for a sharp handplane—or when you need to quickly chamfer the ends of a tenon or dowel.

Disk sanders can be used to clean up and fair convex curves on templates to create a perfect path for a router to follow. You also can use this machine to smooth convex curves, but because the disk cuts across the workpiece, you'll have obvious scratch marks to remove with a hand-sanding block.

The disk sander has its limits. It cannot sand inside a concave curve. Also, it's not great for sanding long, straight edges because the disk's rotation makes it hard to control the workpiece and to use the full face of the disk. Disk changes can be a bear, because they all use PSA (pressure sensitive adhesive)-backed disks, which can be tough to remove. The disks also cannot be reused.

If you're interested in this type of machine, look for a model that has a 12-in. disk and a large table to support different-size



Disk sander ROUGH AND READY

Disk sanders are capable of trimming parts and smoothing templates in a jiffy. But their PSA-backed disks can be tough to remove, so it's best to keep a coarse grit on the disk and dedicate the tool to aggressive jobs.



Quick trim. A disk sander trims tenons quickly. Use the miter gauge to keep the workpiece square to the disk.



Different approach. With the miter gauge angled, you can chamfer dowels and through-tenons. Just use a light touch.

GETTING UNSTUCK



The PSA-backed sanding disks often require a fair amount of scraping to get the paper off, and leave a bit of residue behind. You can remove any adhesive residue with a solvent, such as naphtha.



Belt sander WHO NEEDS A HANDPLANE?

With a combination belt-disk machine, you can keep an aggressive grit on the disk and use the belt sander for jobs that require you to sand through various grits, from 60 up to 220. With this tool you can handle almost any flush-trimming job, and more.



TIP

With the belt at an angle, you can use the nose as a spindle sander to smooth inside curves.



workpieces. Expect to spend anywhere from \$150 to nearly \$400. A more economical and versatile approach may be to buy a combination belt-disk sander.

Belt-disk sanders: A versatile combination

A combination belt-disk sander gives you two machines for the price of one. These sanders typically have either 6-in.- or 10-in.-dia. disks, with 4-in. by 36-in. or 6-in. by 48-in. belts, respectively, and come in a wide range of prices (from about \$150 to more than \$500), depending on the size of the belt and disk.

The belt increases the tool's versatility. It will flush-trim door and drawer parts quickly. It's also handy for boxmakers, making it easy to trim miter splines or dovetails flush. And it will chamfer dowels,



refine door and drawer pulls, and facet the ends of through-tenons in a flash. It can be used on outside, convex curves of course, but it can also reach into concave curves. Again, these machines are aggressive, so use a light touch. And you'll still need to remove the sanding marks by hand, using finer grits.

The 6-in. belt width provides a 6-in. by 16-in. sanding surface at the platen; the sanding surface for the 4-in. belt is about 4 in. by 12 in. at the platen. Among these combination machines, we recommend buying the bigger belt and disk, which offers more sanding area and typically has larger tables and more mass, helping to reduce vibration.

Spindle sanders: Not just for curves

Of all the power sanders in a typical shop, the oscillating spindle sander is the most versatile. Ranging in price from around \$130 to \$450, a dedicated oscillating spindle sander is the best tool for smoothing the concave areas on router templates, and you can always find another way to smooth outside curves: block plane, spokeshave, or sanding block. You also can use this sander to smooth ornamental brackets, pulls, bandsawn boxes, and all sorts of curved parts. The oscillating action helps keep the abrasive cool and clean and allows use of a larger area of the drum, extending the life of the abrasive. It also makes for smoother results, with no deep, continuous scratch marks.

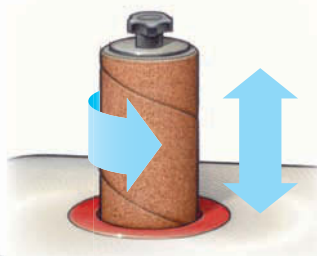
The drums are available in a wide variety of diameters, typically from ¼ in. to 2 in., depending on the machine. Swapping out the drums is easy, allowing you to match the drum size to the curve. Also, changing abrasive sleeves is a breeze, so you can sand from rough to finer grits. But, as with all the other benchtop sanders mentioned here, you'll need to fine-tune the surface with hand-sanding to remove deep scratches before finishing. □

Roland Johnson contributed to this article.

Spindle sander INSIDE CURVES AND MORE



Oscillating spindle sanders offer plenty of versatility in a small package. This is the best sander for inside curves and, if you add a shopmade fence, it works like a belt sander for straight runs.



Drum moves up and down as it spins.



Match the spindle to the curve. Use larger spindles for smoother results on wide curves, like that on the base of this Shaker step stool (above). Narrower spindles fit tighter curves, like the finger pull on this shop drawer (right).



Outside curves, too. To avoid a lumpy surface on outside curves, pass the work across the spindle quickly with light pressure and long strokes, and have a definite line to sand to. With a tilting table, you can handle beveled edges, too.

TIP

You can extend the life of abrasives and get better performance with any of the sanders in this article by using a sanding-belt cleaning stick (\$5 to \$15).



Only sander you need?

The Ridgid benchtop sander is both spindle sander and belt sander. It oscillates in both modes, which makes sanding more efficient and lets you use almost the entire width of the paper. It's available at The Home Depot for \$200, making it a great value.



QUICK CHANGEOVER, TOO



Switching from belt to spindle mode, or vice versa, takes less than a minute. The sanding drums fit over the spindle shaft and are held in place with a thumbscrew.

Jointer/Planers for Less

These tools put two powerful milling machines in one cabinet to save both money and shop space

Jointer-planer combination machines save space and money. They offer a wide jointer and an industrial-strength planer in one small footprint, for close to the price of the big jointer alone. We tested five machines, milling a variety of exotic, domestic, and figured wood. We also measured how long it took to convert each machine between jointing and planing modes. The fastest took just over 20 seconds; the slowest took more than a minute.

All the machines delivered excellent planing cuts with minimal snipe. Differences in dust collection and general performance also were minimal. The biggest differences were in conversion time and the ease with which fences and settings can be adjusted or changed.

The Jet JJP-12 was easy to use and quickest to convert, while the Grizzly G0634XP came with a segmented cutterhead, giving it a substantial cutting advantage. We named them both Best Overall. For Best Value we chose the Rikon 25-200, which changes over almost as quickly as the Jet, for more than \$500 less. □

Roland Johnson contributed to this article.



WIDE JOINTER

Despite shorter tables, jointer/planer combination machines still allow woodworkers to comfortably face-joint 12-in.-wide stock that is up to 8 ft. long.

POWERFUL PLANER

These heavy-duty planers can handle a heavier cut than benchtop models.



READERS' RATINGS: JOINTER/PLANNER COMBOS

The Rikon 25-200 is the readers' favorite and our Best Value machine.

★★★★★	4.44	RIKON 25-200
★★★★☆	4.28	GRIZZLY G0675
★★★★☆	4.06	GRIZZLY G0634XP
★★★★☆	4.05	JET JJP-12
★★★★☆	3.88	RIKON 25-010



Segmented cutterhead tips the scales

This machine combines a powerful motor with a segmented cutterhead that ensures good cuts, longer edge life, and easy maintenance. We liked the Grizzly's American-style cutterhead guard, which swings away to let push pads go by. Some quibbles: Adjusting the height of the jointer's infeed table is tricky because the scale is on the opposite side of the machine from the adjustment handle. The fence calls for extra care to ensure it is seated properly. Otherwise, the angle between the fence and tables can be inaccurate. And it has to go on or off for each changeover. Still, these quirks don't detract from the high quality of this Grizzly's cutterhead at a price the other machines can't beat.

GRIZZLY **BEST OVERALL CHOICE**
G0634XP

Street price: \$2,295

Power: 220v, 5 hp

Jointer bed length: 59½ in.

Weight: 610 lb.

Changeover: 49 seconds jointer to planer, 59 seconds planer to jointer

Cutterhead: Segmented, 32 carbide cutters



Fast and friendly changeovers

It takes just 21 seconds for the Jet to go from jointer to planer—fast enough that the task no longer feels like a nuisance or momentum-killer. The main reason is that the jointer fence can stay attached when you raise the tables. Plus, the infeed and outfeed tables move as a single piece, making this machine the simplest of all five to use. Although its motor is smaller than the 12-in. Grizzly's, the Jet produced very good results without bogging down. The Jet's three-knife cutterhead is similar to the others, with blades that can be resharpened and are held in place with gibs and jack screw overall ease

JET **BEST OVERALL CHOICE**
JJP-12

Street price: \$2,245

Power: 3 hp, 230v

Jointer bed length: 55⅝ in.

Weight: 500 lb.

Changeover: 21 seconds jointer to planer, 25 seconds planer to jointer

Cutterhead: 3-knife, HSS



Big, but budget-conscious

The Rikon 25-200 performs almost as well as the Jet, and produces 12-in.-wide cuts of similar quality. It has the same size motor and a similar, three-knife cutterhead. The Rikon's fence stays on the machine during changeover, but must be moved to its rearmost position. The Rikon also has a single-table changeover, but that is because only the jointer's outfeed table moves. The drawback is that the fixed jointer infeed table covers the outfeed end of the planer, making it difficult to remove short parts after planing. A set of outfeed rollers helps support longer stock. The Rikon nearly matched the performance of the best machines in the test, and factoring in the cost, it's an excellent value.

RIKON **BEST VALUE CHOICE**
25-200

Street price: \$1,700

Power: 3 hp, 220v

Jointer bed length: 49 in.

Weight: 386 lb.

Changeover: 31 seconds jointer to planer, 25 seconds planer to jointer

Cutterhead: 3-knife, HSS

Segmented Cutterheads

Plane hundreds of feet of lumber with no tearout and no knife changes

Segmented cutterheads for jointers and planers are one of the few truly new developments in woodworking. The multi-sided, (usually) carbide teeth hold an edge many times longer than traditional steel knives, and pivot quickly and accurately when they finally do need a fresh edge. Users also report much less tearout than they get with straight knives.

Today's higher-end machines come equipped with a wide variety of these innovative cutterheads, and there are at least two that can be retrofit into your old jointer or planer. But there is debate about which types leave the cleanest surfaces, those with forward-facing teeth (a bit less expensive to manufacture) or those with angled, shear-cutting teeth (see drawings, opposite).

To find out if all the claims about segmented cutterheads are true, and see if any of the types have an edge on the competition, we ran hundreds of feet of lumber through most of the models on the market.

Apples to apples

A head-to-head comparison of the technologies is a bit difficult because the

Big benefits

One project's worth of rough lumber is enough to nick and dull the straight, steel knives on your jointer and planer. Not so for segmented cutterheads, spelling the end of tedious blade changes.

CLEANER CUTS

The perfectly indexed, long-lasting carbide teeth leave fewer ridges and less tearout in all types of woods.

Change the Game

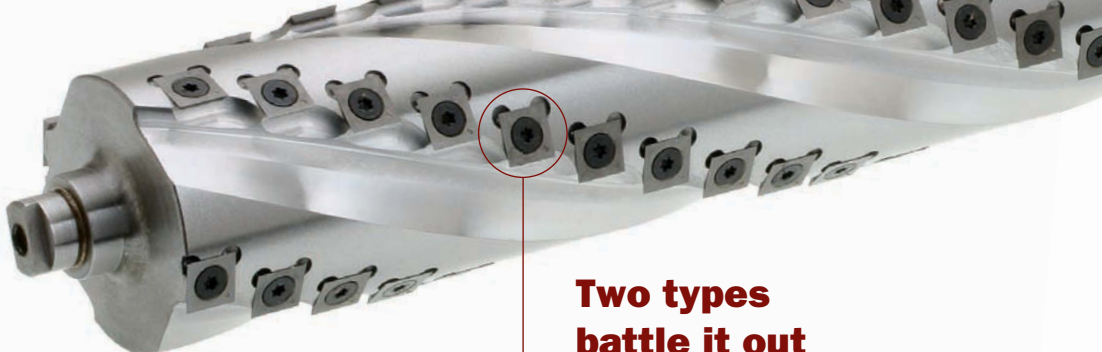
machines they are installed in play a role in cut quality. So we tried them in a wide array of machine types and sizes.

But we did manage a limited head-to-head test, using the two cutterheads that can be retrofitted, the Accu-Head and the Byrd Shelix, putting each into a DeWalt DW735 benchtop planer, with a third DW735 planer tested with its original straight knives.

That let us measure amperage draw and decibel levels on a level playing field. Surprisingly, the straight knives consumed the lowest power, the 26-cutter Accu-Head was next in line, and the Shelix required considerably more power. The constant power demand won't wear out your motor any faster, but the additional amp draw could trip the breaker on an undersize circuit.

The big test

To test surface quality in real-world situations, we started all of our machines and cutterheads with several $\frac{1}{16}$ -in. passes on cherry and oak boards. Then we put 120 linear feet of 12-in.-wide MDF (very unkind to cutting edges) through each one to put some additional wear on the edges.



Two types battle it out

New segmented cutterheads are emerging all the time, but they shake out into two main approaches, each with its own passionate advocates.

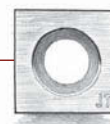
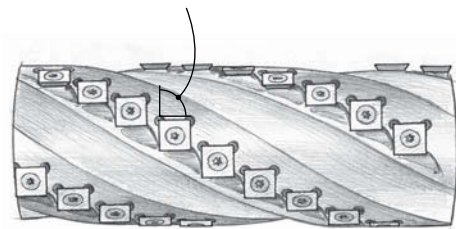
And then we ran three types of woods through all of them. We ran cherry, oak, and maple as examples of domestic hardwoods; and then cumaru, jatoba, hickory, and tiger maple to test the cutterheads on the toughest interlocked and alternating grain. Last, we ran some white pine, since softwoods present their own challenges.

After the tests, we can unequivocally say that insert-cutter technology for jointers and planers is worth every penny. The fact that each carbide edge will last 10 times longer than a steel one, conservatively, and that most teeth have four sharp edges, is enough to repay your investment.

Roland Johnson and Bill Peck contributed to this article.

STRAIGHT STYLE IS LESS EXPENSIVE

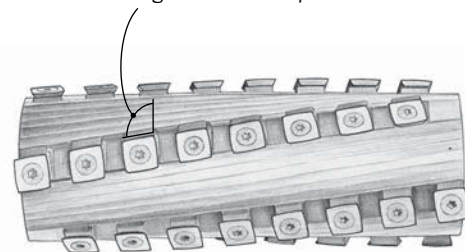
Teeth are set along a spiral, but they face forward.



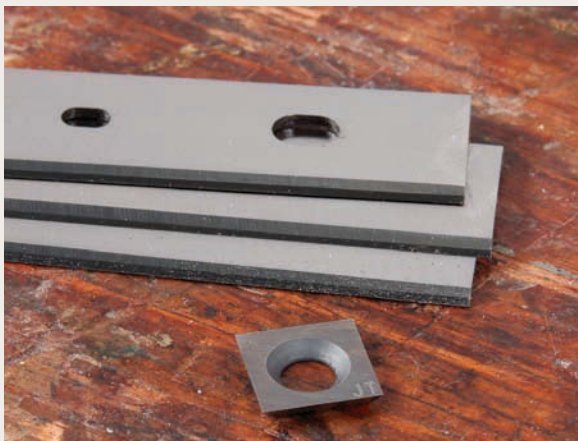
Teeth are straight on all four sides.

SHEAR CUT IS MORE COMPLEX

The teeth are not only arrayed in a spiral, but their edges follow the spiral too.

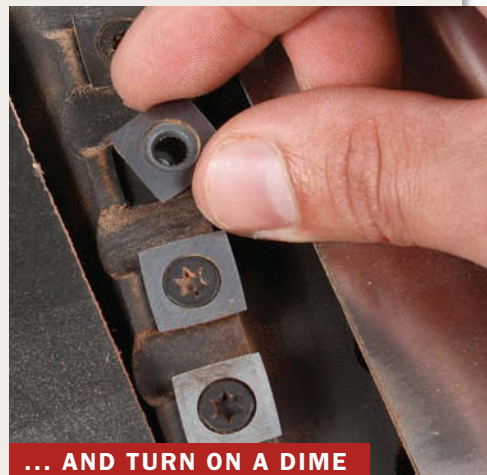


Teeth are slightly curved on the edges to follow the shear angle.



TEETH LAST 20 TIMES LONGER ...

The typical insert cutter has four sharp edges vs. one or two on high-speed-steel knives, and is made of carbide, making each edge much more durable.



... AND TURN ON A DIME

When you do finally need a fresh edge, the teeth are simple to loosen and turn, and they go right back into perfect position. Say goodbye to tedious knife changes.

Head to head

We tested five types of segmented cutterheads both as standard equipment in new machines and retrofit into DeWalt DW735 12-in. benchtop planers. Our control group was another DW735 and a Jet JJP-12 Jointer/Planer, each outfitted with the straight knives. We ran MDF through each machine to accelerate wear, and then closely examined cut quality on a wide variety of woods, from tiger maple and exotic woods to common domestic hardwoods and soft white pine. We think that straight knives will fare a bit worse in the real world than they did in our tests because people tend to avoid changing straight knives, keeping them in place long after they are dull and causing serious tearout. Also, our MDF wear cycle only simulated 200-or-so feet of lumber passing by the blades. We would have listed prices in the chart, but there are too many factors (machine type, bearings, cutterhead dia.) to lock down specific ranges. In general, Accu-Head is the least expensive and shear-cutting heads cost the most.



ACCU-HEAD



BYRD SHELIX



GRIZZLY SPIRAL CUTTERHEAD



LAGUNA SHEARTEC II



POWERMATIC/JET HELICAL CUTTERHEAD



CUTTERHEAD	AVAILABLE ON	TOOTH ORIENTATION	TEETH PER INCH	PERFORMANCE		
				HARDWOODS	SOFTWOODS	DIFFICULT HARDWOODS
Straight knives	All machines	Straight	n/a	Good	Very good	Good
Accu-Head	General International's 13-in planer, many of Steel City's jointers and planers, and as retrofits for dozens of other machines (check Accu-Head.com)	Straight	2 $\frac{1}{4}$ *	Good	Good	Good
Byrd Shelix	Available on some new machines (check with the manufacturers), and as retrofits for many more (check byrdtool.com)	Shear	5	Excellent	Good	Excellent
Grizzly spiral cutterhead	Grizzly planers, jointers, and planer/jointers	Straight	5	Very good	Good	Very good
Laguna ShearTec II	Laguna planers, jointers, and planer/jointers	Shear	6 $\frac{3}{4}$	Excellent	Very good	Very good
Powermatic/Jet helical cutterhead	Jet planers, jointers, and planer/jointers, and a few Powermatic jointers	Shear	4 $\frac{3}{4}$	Excellent	Very good	Excellent

*Accu-Head teeth are high-speed steel and have two sharp edges. All others are carbide, with four sharp edges.

Upgrade the machine you have

PLANER

For both retrofittable cutterheads, the Accu-Head and Byrd Shelix, installation in the DeWalt DW735 planer is straightforward, if you follow the detailed instructions provided with both. You'll need a good set of internal and external snap-ring pliers, some other standard tools, and about two hours to do it. But this is not a job for the mechanically challenged. Some patience and attention to detail will make the installation go smoothly.

When reassembling the Shelix unit, we found the key slot in the cutterhead shaft was slightly undersize and would not accept the DeWalt key. Byrd quickly provided a new key, which solved the problem.

At right are a few highlights of the job, with tips for success.

START BY REMOVING THE OLD CUTTERHEAD

Tip for removing the belt. Neither set of instructions tells you to remove the idler pulley from the feed roll chain, but doing so eases the removal of the drive belt, and it's easy to do.

Knock out the original head. Heavy taps with a dead-blow hammer and a block of hardwood unseat the bearing, and then it slides out easily. Fasten the planer securely when removing the old cutterhead and reinstalling the new one.



JOINTER

Installation varies with the cutterhead and the machine, but in general the only special tool required is a \$25 bearing puller (amazon.com) and a piece of PVC pipe.

You'll start by removing the old cutterhead and pulling the bearings. Then you'll stand the new cutterhead on end and tap on the bearings with the PVC. If you're worried about this step, a machine shop, mechanic, or anyone with an arbor press can do it. Then it's just a matter of reinstalling the new cutterhead, reattaching the pulleys, and adjusting the outfeed table.

TRADE UP FOR A CUTTING-EDGE CUTTERHEAD



1 Easy to install. Out with the old, in with the new. The cutterhead and bearing housing should come out as a single piece (1). Start by pulling the housing (2) and bearings off the old

cutterhead. Tape the new head to avoid cutting your hand, and then tap on the bearings (3). A PVC pipe helps spread out the force from the hammer blows when reattaching the bearing housing (4).



Online Extra

To watch Johnson install a segmented cutterhead in an 8-in. jointer, go to FineWoodworking.com/TG2014.

Compact Compressors

These quiet and lightweight compressors are perfect for pros and do-it-yourselfers alike



GRIP-RITE GR152CM

Street price: \$180

Weight: 39 lb.

Capacity: 2 gal.

Power: 2 hp

Output: 2.6 cfm at 90 psi

Draw: 8 amps

Lubrication: oil free



FEATURES The GR152CM has a welded roll cage that keeps the components well protected. There are two ways to carry the compressor, either with two handles at the top of the unit or a handle at the bottom that allows the tool to be carried like a suitcase. We found that the compressor was light enough to carry by one of the handles at the top, and that seemed to be the most ergonomic way. A small tray bolted to the top of the roll cage was useful for holding nails and other small things, and the compressor has a low-enough vibration that it doesn't rattle the contents of the tray. It's a bit louder than its little brother, the Grip-Rite GR100, but still quieter than most compressors, and the tone of the motor is not offensive.

FLAWS The dials and gauges on both Grip-Rite tools are recessed behind the metal faceplate, so the user needs to bend down a bit to read them. This is also the only compressor that has two drain valves—not a huge issue, but necessary due to the construction of the unit. Still, it's one more thing to remember to do at the end of the day.

BOTTOM LINE We chose this tool as Best Overall because of its quietness, tank capacity, quick recovery, and sturdiness. It would have no trouble functioning as either a dedicated small-shop or job-site compressor.

When you're standing at the front door looking up a three-story staircase leading to a small bathroom remodel, there's no better feeling than knowing that you won't have to lug a 75-lb. twin-stack air compressor up and down every day. Many builders are supplementing their large compressors with compact models designed for small trim jobs, punch-list work, and even light framing. For the average do-it-yourselfer, these offer an affordable way to get into air-nailing, in a compact package that stows and totes just as easily.

We cycled through 14 of these compressors—each 2 gal. or less—and picked the eight best for those times when you don't want to bring in the big guns.

The challenge in picking out the best small compressor is that every user has a different idea of what features are most important. Some people favor light weight and a low noise level over tank



SENCO PC1010

Street price: \$125
Weight: 20 lb.
Capacity: 1 gal.
Power: 1 hp
Output: 0.7 cfm
 at 90 psi
Draw: 4 amps
Lubrication: oil free



FEATURES This is the lightest and quietest of all the compressors tested. The handle is well placed and has a foam sleeve to help make carrying the tool easy. The drain valve is easy to open and close without having to tilt the compressor. There's also a plastic baffle to shield the top of the motor, which gets pretty hot because this compressor runs for quite a while under heavy use.

FLAWS The light weight and quiet presence come with a cost. The small motor can't keep up with any sort of production nailing. At 31 seconds to refill the tank pressure, expect this little compressor to be running fairly often while in use. Another trade-off for lighter weight: The absence of a larger roll cage leaves the gauges somewhat exposed to damage.

BOTTOM LINE The PC1010 is the compressor we see most often on job sites when someone is doing punch-list work, small trim projects, and even tasks that don't need it for fastening purposes. If the output demand is fairly small or sporadic, you can't do any better than this compressor. If it had just a little more capacity, we would easily name it Best Overall, but as is, it heartily earns the Best Value title.



JENNY AM780-HC2

Street price: \$450
Weight: 49 lb.
Capacity: 1.5 gal.
Power: 2 hp
Output: 4.1 cfm
 at 100 psi
Draw: Not listed
Lubrication: oil



FEATURES The Jenny is the heaviest of this batch of compressors. While the weight is a downside for portability, it makes for a stable compressor when it's sitting on the ground. Even though it doesn't have the convenience of being oilless, its stout shape ensures that it won't be knocked over accidentally and spill oil. This model beat out the competition for fastest fill and recovery times.

FLAWS Although its offset handle makes this heavy tool a bit easier to move around, it still tends to bang against your leg as you walk. The copper tube that delivers air to the tank is coiled up a few times and is exposed to the surroundings, making it an easy target for dropped lumber or nailers. Also, the carrying handle is perilously close to the hot surface of the motor.

BOTTOM LINE This is the most expensive model in the group, and you get a stout tool for the money. Unfortunately, we think if you're bringing a compressor of this size and weight to a job site, it should have more capacity.

capacity and output. Others want compressors that have high volume and output but are still portable.

We focused on a healthy mix of compactness, portability, quietness, and output. In the end, we chose the best compressors based on how a remodeling contractor would use them. After all, if the compressor can handle the job site, it can handle the homestead.

Our pick for Best Value was a no-brainer: The Senco model achieves a time-tested balance between cost and quality. The pick for Best Overall was much harder and came close to a three-way tie. In the end, though, we found that the larger Grip-Rite model had the greatest number of features that we consider desirable for everyday use. □

Paul Johnson contributed to this article.

READERS' RATINGS: COMPRESSORS

The higher-priced Jenny AM780-HC2 was favored slightly by readers over our Best Overall, the Grip-Rite GR152CM.

★★★★★	4.44	JENNY AM780-HC2
★★★★★	4.28	ROLAIR FC1500HBP2
★★★★★	4.19	GRIP-RITE GR152CM
★★★★★	4.04	SENCO PC1010
★★★★★	3.94	GRIP-RITE GR100
★★★★★	3.88	DeWALT D55140
★★★★★	3.84	PORTER-CABLE C1010
★★★★★	3.77	BOSTITCH CAP1512-OF

Three Small Nailers

Pin, brad, or finish—which one is right for you?

BY ROLAND JOHNSON

Small pneumatic nailers are great time and material savers for just about any task that you'd trust to a hammer and many others that you wouldn't, from split-free pinning of tiny moldings to securing millwork.

Pin nailers and brad nailers make terrific substitutes for clamps and are a great way to attach glue blocks, case backs, and other parts where the nails won't show. Woodworkers who don't use them on their furniture find nailers invaluable for building jigs and shop fixtures. These nailers, and the larger finish nailers, are also great tools to have around the house for trimwork and improvement projects.

Here's a look at what these tools can do and some of their key features:

A narrow nose is more accurate

As convenient as pneumatic nailers are, if you can't accurately position the nail, especially when fastening fussy moldings, you'll quickly return to using a hammer. With some nailers the protective rubber nose cover needs to be removed to place nails accurately. But without the cover, the concussion of the plunger can bounce the nailer, causing the metal tip to dig in and leaving a dent or

scar on the surface. Small nose covers with alignment marks cast into all four sides are the best.

Depth adjustment

With brad and finish nailers, adjustable depth of drive is essential. Moving between hardwood, softwood, and composite products creates a wide variety of material density, and an easy-to-adjust depth drive makes adjusting to the changes seamless. The goal is to get the



PIN NAILERS

Pin nailers drive 23-gauge fasteners so narrow that the nail holes often don't need to be filled. The pins are headless and don't offer much structural strength on their own, but they are great for holding moldings in place while glue dries, fastening small glass stop, or applying tiny moldings. Some pin nailers can handle pins up to 2 in. long, but applications calling for more than 1 in. or 1½ in. are rare.



Precise placement. Small applied moldings are tough to glue and clamp, but a pin nailer, with its tiny nosepiece, makes it easy to hold and fasten even the smallest moldings.





BRAD NAILERS

Brad nailers fire an 18-gauge fastener with a head on it for more holding power. It works well for securing smaller trim and face frames. The fastener offers moderate structural strength and leaves a small but visible nail hole that will likely need filling. The gun is still small and light enough to use in tight spaces.

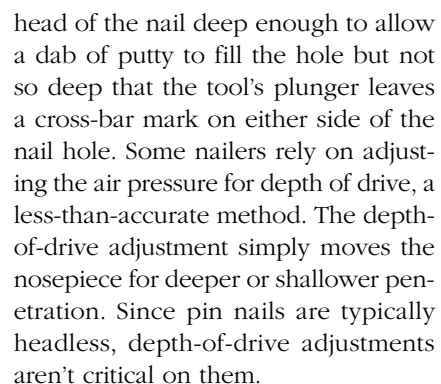
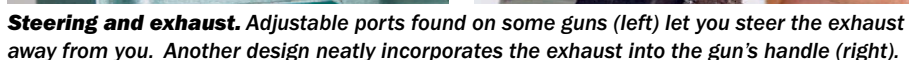
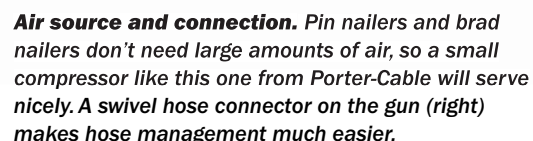


FINISH NAILERS



These nailers handle 15-gauge and 16-gauge finish nails and are commonly used for installing baseboard, chair rail, door and window casings, crown molding, door frames, and more. The large nail holes definitely require filling, and the gun can get heavy with extended use. One option is to ditch the compressor and hose by using a cordless model.

AIR HANDLING



SAFETY



Bounce fire is a setting that allows the user to keep the trigger depressed and simply bounce the nose on the surface of the wood to deliver a nail. This is really useful when doing production nailing or when nailing in cupboard backs or putting together jigs where super-accurate placement isn't essential.

It is convenient to use a bounce-fire nail delivery when putting together jigs or installing trim pieces so you can rapidly fire the nails into place. What's not so convenient is accidentally double-firing a nail because you couldn't hold the gun solidly and the resulting bounce caused another nail to be fired. Some nailers offer a simple switch on the gun for moving from bounce-fire to single-fire, others require a mechanical change. I have an older finish nailer that requires a mechanical change that I performed once, to single fire, and there are many times I wish I had the bounce-fire option, if only for a few nails.

Dry fire

Dry-fire prevention is a helpful feature, particularly in pin nailers where it's often difficult to tell when the gun is shooting blanks (tiny head, little rebound). Most nailers have view ports on the side of the nail carriage with a bright color on the inside of the carriage that becomes visible through ports when the nail supply runs low. Still, if you forget to check the ammo supply, the result can be a few dry-fire nail holes. Having a dry-fire lockout is a huge advantage, particularly with pin nailers where adding more nail holes without any holding power is cosmetically undesirable.

MANAGING NAILS



A deep subject. All nailers are capable of driving their fasteners completely beneath the surface. It used to be that adjusting the depth of this “set” was a matter of adjusting air pressure at the compressor. Recent models let you adjust this at the tool, often with a simple thumbwheel like the one shown here.

Nail carriages

Angled nail carriages (sometimes called magazines) not only allow easier nail placement when dealing with tight confines but also provide a better line of sight because the bulky power head is not centered in the field of view.

Side loading carriages are the ticket for 18-gauge nails. They are easy to load, especially with short sticks of nails, and it's easy to identify the length of nail (simply open the carriage). Rear loading is the norm for finish nails (15 and 16 gauge) where the nail sticks are sturdier, but identifying the nail length can be a hassle (pull the spring-plunger, slide the nails to the back of the carriage to check the length, then reverse the procedure). □

Roland Johnson is a contributing editor to Fine Woodworking.



Time to reload? Nail carriages on all types of guns typically feature a view port to let the user see whether the onboard nail supply is running low. Styles range from small holes to longer slots and mostly open designs.

Going cordless



Get untethered. Cordless nailers have been around for a while but recent advances in battery technologies have made battery-powered nailers smaller and more efficient (far left). In some models, the battery works in conjunction with a gas cartridge (left). In others, it powers an internal flywheel or compressed air cylinder which fires the nail.

Choosing the Right Framing Nailer

The choices are many, so start by deciding which nails you'll be shooting

Readers often ask for tool tests of framing nailers, but all the variations on the market make that a tall order to fill. There are stick nailers with 20°, 28°, and 30° magazine angles, not to mention coil nailers. Some tools max out at 3¼-in. nails, some at 3½-in. nails, and some at 4-in. nails or longer. Some tools shoot full round-head nails, clipped-head nails, or both. With the variety of models available from the major pneumatic brands, power-tool companies, and lower-cost clone and private-label manufacturers, the framing-nailer category must represent 100 or more tools.

Our goal here is to condense all the relevant information about these nailers into a brief guide, helping you target the latest and greatest tool that fits your needs.

It all starts with the nails

Picking a framing nailer starts with knowing the nails you'll be shooting. You want a tool that you can keep supplied with nails easily and affordably. Regional preferences and sometimes even building codes dictate which fasteners—and therefore which tools—are common in your area.

California and other Western states have adopted full round-head nailers, while most of the rest of the country relies on clipped-head models. Specific code requirements have driven some of the divide, but these geographic tool preferences can be traced back to the regional markets where distribution was originally focused for the big nailer companies. Think Bostitch in New England, Hitachi in the West, and Paslode and Senco in between.

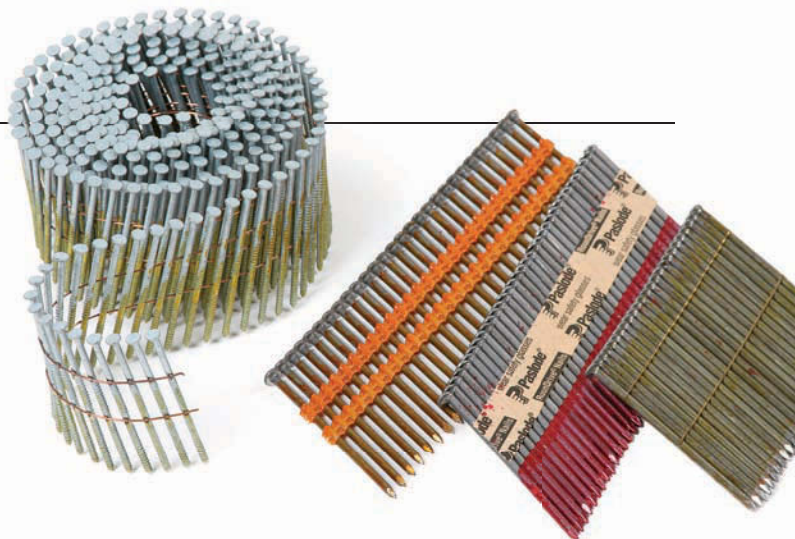
Regardless of nail type, follow the nailing schedule for each material, component, and assembly you construct as specified by the building code covering your area. Model building codes were written for hand-driven nails, so they specify only the size, spacing, and number of nails used for specific connections and applications, not the type of head. The International Code Council's ESR-1539 report—which is free and widely available online—is written with an awareness of pneumatic nailers and is a good place to find the details of nailed connections (and equivalent connections) required to meet all the model building codes.

Michael Springer contributed to this article.

Know your nails

NAIL COLLATION

Framing nailers come in two styles: coil or stick. Coil nailers have an adjustable canister that accepts a coil of nails strung together by two rows of thin wire welded to the shanks. These nails have a full round head. Stick nailers fit two angled sticks of 25 to 40 nails held together with wire, paper, or plastic. The style of nail head is usually based on the collation angle.

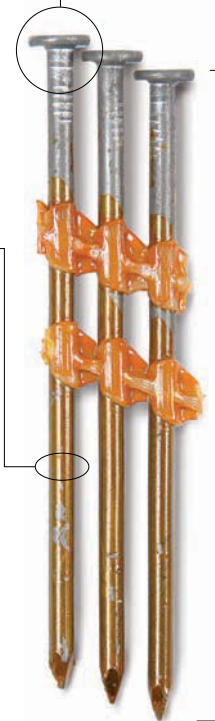


NAIL HEADS

Full round-head nails are acceptable everywhere in the United States and for every type of framing connection. They are also typically available in thicker shank diameters. The downside is that nail heads take up space in a magazine, so you get fewer nails per stick.

MAXIMUM NAIL DIAMETER

Nailers also have limitations to the maximum diameter of compatible fasteners they can accept. The minimum nail thickness for wall sheathing isn't typically the same as the minimum nail thickness for rafters. This varies by region, though, and also can change based on what the architect or engineer has specified in the building plans. We know a framer in the Southwest who is allowed to use 3-in. by 0.131-in. (10d) nails for everything—an easy task for any framing nailer.



MAXIMUM NAIL LENGTH

Some brands have created a new compact-framer category, designed to be lighter and to fit more easily between 16-in.-on-center framing layouts. The dividing line for this category is typically maximum nail length—3 $\frac{1}{4}$ in. for compact models, 3 $\frac{1}{2}$ in. for full size—but the maximum shank thickness also may differ by collation angle and brand.

The maximum size is often referenced in a nailer's model number. For instance, a domestic model number may express maximum nail lengths of 3 $\frac{1}{4}$ in. and 3 $\frac{1}{2}$ in. as 325 and 350. Foreign models may use 83 and 90, which are the lengths in millimeters.

It's worth noting that some compact nailers don't have the guts to shoot into dense engineered lumber well. Even if the longest nails you shoot are 3 $\frac{1}{4}$ in., you may be better off with a full-size nailer because of its superior power.

TWO HEAD-STYLE OPTIONS FOR PAPER-COLLATED STICK NAILS

Depending on your region and applicable codes, the type of head on your nails is a big deal, and the head style is usually tied to the collation angle. There are a few variations.



CLIPPED HEAD

At steeper collation angles (28° and 30°), manufacturers pack nails closer together by clipping off one side of the head. The resulting D-shape is smaller than round heads of the same diameter, so these nails aren't allowed for some applications. Some of the nails are called notched instead of clipped because the chunk removed from their heads is rounded instead of straight.



OFFSET ROUND HEAD

Available in both 28° and 30° angles, these nails provide the code compliance of a full round-head nail with the tight spacing common to a stick of clipped-head nails.

Framing nailers: coil or stick?

COIL NAILERS

Coil nailers have an adjustable canister that accepts a coil of nails—up to 200 framing nails or 300 sheathing nails at a time—angled at 15° and strung together by two rows of thin wire welded to the shanks. In most areas of the United States, these nailers are far less popular than stick nailers, but they are common in areas of the Northeast and in a few pockets of Louisiana, Missouri, and Texas. Interestingly, this is what the rest of the world considers a framing nailer.

PROS

- These tools shoot a lot of nails between reloading, potentially saving time.
- The tools' compact size provides some accessibility advantages.
- If a model fits shorter nails and has a protective nosepiece, it can double as a high-volume siding or trim nailer.

CONS

- When fully loaded with hundreds of nails, these tools can be heavy and unwieldy.
- Dropping or bending a coil of nails often renders it unusable and creates expensive waste.



NOTABLE BRANDS

Bostitch, DeWalt, Grip-Rite, Hitachi, Makita, Max, Pneu-Tools, Senco

Must-have features for a quality framing nailer

Even an occasional user needs a competent tool. Here are some important features to consider when choosing a nailer.

- Balance and feel are important to your overall comfort and the control of the tool. Before you plunk down cash, be sure to fill the tool with nails and hang a hose off the back to evaluate how it really feels.
- A selective-fire setting lets you switch the tool from sequential-fire (single-shot) mode to bump-fire mode. The best designs are tool free, but because most users never switch back to sequential fire, replacing or adjusting the trigger assembly once is not a big deal. If you plan to switch back and forth, opt for a nailer that has a toggle switch.
- Top-load versus rear-load magazines is a decision you will have to make. Our tester and



his peers are unanimously in favor of rear load (see photo, below). Hanging the tool down with one hand lets you load in a more comfortable position; the spring-loaded follower can't accidentally slam into the nails and damage the collation strip; the remaining nails can't fall out as soon as you release the follower; and

having the follower engaged when loading new nails keeps the last few remaining nails tightly in place so that they won't cause a jam.

- Depth-of-drive adjustment (see photo, above right) is important for meeting building codes, and the best setups work without the need for tools. Without this feature, you have to adjust the regulator on the air compressor when you switch from LVL headers to nailing off sheathing. It's not worth compromising on this feature.

HANDY UPGRADES

Whether you're framing on a regular basis or just looking for some extra perks, try these features.

- A few manufacturers use nose magnets to hold the last few nails in a stick in place when reloading the magazine. This helps make the reloading process goofproof.
- Built-in air filters keep unwanted gunk out of a nailer's innards. Pads of filter media are useful enough, but the best filters are self-cleaning cartridges that cough out any trapped particles every time you unplug the air hose.
- A nonmarring nose cap lets your framing nailer become a siding, trim, or deck nailer. Without a cap, the teeth on the nose turn cedar or redwood into hamburger.



STICK NAILERS



Plastic-collated nailers fit round-head nails collated between 20° and 22°. A stiff collating strip—typically plastic but also available in rigid paper—allows enough space for full-size heads with the nails side-by-side. Two sticks fit in the magazine for a load of about 60 nails. These tools are particularly big on the West Coast and in much of the West.

PROS

- Round-head nails are allowed for every connection type, so these tools can be used anywhere in the United States with their standard fasteners.
- Round-head nails are typically available in larger shank sizes than other types.
- Plastic-collated nails cost less than the paper- or wire-collated nails used in other nailers.

CONS

- Nails of the standard plastic-collated variety spew out bits of plastic shrapnel, which is a nuisance when they ricochet off the wall into your face or leave the floor dotted with scattered shards.
- The long, low magazine keeps the nose of the tool from fitting into tight spots as easily as higher-angle stick nailers.



Wire-weld-collated nailers have their own specific collation angle and their own specific homegrown market. These tools started strong in the Northeast and have stayed strong, with 80% of their sales in New England. Overall, the 28° tools are similar to the 30° type, but 28° clipped-head nails are typically collated with thin wires tack-welded to the side of the nails.

Plastic-collated and paper-tape versions of 28° nails can be found, even some with round heads. These tools are largely unknown in much of the country, and their fasteners may be hard to find.



Paper-collated nailers have magazine angles anywhere from 30° to 35°, but the fasteners they fit are usually referred to as 30° nails. These tools are known generically as clipped-head nailers or paper-tape nailers. Their standard nails are collated with paper tape and packed shank to shank. Magazines typically fit two sticks, providing about 80 nails.

PROS

- The steep magazine angle of the tool affords its nose the deepest reach into corners.
- Tighter packed sticks of nails hold significantly more fasteners per load than the sticks in full round-head nailers.

CONS

- Clipped-head nails are not approved for structural connections in some areas, so more specialized offset round-head nails may be needed.
- These tools require more expensive fasteners than full round-head nailers.



NOTABLE BRANDS

PLASTIC-COLLATED

Bosch, Bostitch, DeWalt, Duo-Fast, Grip-Rite, Hitachi, Makita, Max, Pneu-Tools, Senco

WIRE-WELD-COLLATED

Bostitch, Grip-Rite, Hitachi, Max

PAPER-COLLATED

Bosch, Bostitch, DeWalt, Grip-Rite, Hitachi, Max, Paslode, Pneu-Tools, Senco

Features for production framers

- A rafter hook for keeping your nailer close at hand is a must if you don't want your tool to slow you down. The lack of a hook is not a deal breaker, however. Aftermarket hooks that connect at the air fitting are available and may be preferable to a factory-installed hook that is clumsy or too small.



- Toenailing spikes that really grab are the key to fast, accurate toenailing (left). Look for a nose with very sharp spikes protruding well out from the sides.

- Real-world durability and

longevity are hard to test. Many top brands have legacy tools that have been in production for decades, so talk to other folks in the field. Check local tool-repair shops, too. They might not know which nailer will last, but they sure can tell you which ones break.

Handheld Sprayers

New generation makes the job easier and more affordable

BY JEFFERSON KOLLE

It used to be that if you wanted to spray a finish with anything larger than a rattle can from the hardware store, you needed a dedicated air compressor or pump, lengthy hoses, and often finicky spray guns. Commercial finishing contractors still use these rigs, but for less-frequent users such as homeowners or small cabinet-shop owners, a new generation of self-contained handheld sprayers offers the perfect solution.

Early handheld units, many of which sneezed out a horrible finish, were often sworn at by their owners and then chucked in the trash. They have been replaced with models that spray perfectly

smooth coats of a variety of finishes, then clean up easily. Prices vary, but the least-expensive models don't cost much more than a set of high-quality paintbrushes.

Sprayer types

Like larger sprayers, handheld units move liquid finish onto a surface in one of two ways: airless spraying or HVLP.

Airless sprayers use high pressure to pump finish through a small hole at the gun's nozzle, causing the finish to speed up and break into smaller particles. On an HVLP (high volume low



Airless sprayers for paint. These sprayers use a pump to force large volumes of finish through the nozzle. Graco's backpack version allows the user to carry a large reservoir of paint, minimizing refill stops.



**AIRLESS
SPRAYERS
HANDLE
BIG JOBS**

With cord or without.
A lithium-ion battery pack makes the sprayer even more portable.

Photos, this page (top and bottom left): courtesy of Graco

HVLP SPRAYERS DELIVER A FINER FINISH



HVLP for stains and clear finishes. Units like the Wagner Flexio 590 (above) use an on-board turbine to mix the finish with forced air as it exits the nozzle, making a finer spray and the smoother finish needed for furniture and other projects (below).

pressure) sprayer, the pump pushes just enough air into a cup filled with finish or paint to force it out through the gun. Most of the air exits through the gun, too, from an array of holes that surround the center spray hole. This atomizes the finish into superfine particles.

An airless sprayer moves a lot more finish, but HVLP guns offer better control and greater transfer efficiency—a measurement of how much finish actually adheres to the surface. HVLP is best for interiors and finer work. Typically, airless sprayers are used for outdoor work, where you want to apply a lot of finish fast and don't mind getting some on the shrubbery. Higher pressure and larger output make airless sprayers better with thicker coatings like latex paints, but they also mean that an airless sprayer might not put down as fine a finish as an HVLP. Clear finishes like varnishes and sealers are easy to spray with any handheld.

Cups, cleaning, and noise

Handheld sprayers typically hold paint in a cup underneath the nozzle. A large cup needs fewer refills but weighs more. A lighter cup can make it easier to hold the gun parallel to the surface for the best finish. As to maintenance, it takes a little longer to clean an airless model, most of which also need occasional lubrication.

Some older handheld airless sprayers are not-so-fondly called “buzzguns” for the racket they make. Ryobi marketing manager Jason Swanson says newer guns use a piston pump instead of a diaphragm type, producing “half the noise of our older models.” Still, an airless unit's buzz will be louder than an HVLP's rattling hiss. No matter which sprayer you use, you probably want to wear hearing protection, if only to keep paint out of your ears. □

Jefferson Kolle is a freelance writer in Bethel, Conn., who writes frequently for Fine Homebuilding. He is a former carpenter and contractor.



Woodworking Squares

Look for precision and clear markings

A good square is an essential tool for any woodworker or carpenter, whether it's used to set up machinery, lay out joinery, or check for squareness. There are dozens of 12-in. combination squares and a number of 4-in. double squares for sale in catalogs and online, so how do you choose?

To narrow the field of 12-in. squares, we chose models with features we think are important. For woodworking, the best models have "4R" graduations ($\frac{1}{8}$ in., $\frac{1}{16}$ in., $\frac{1}{32}$ in., and $\frac{1}{64}$ in.), which American woodworkers use almost exclusively. Also, rules with acid-etched markings are easier to read than the less-expensive, stamped-steel versions. We eliminated models that come with more than just a rule and a head, because centering and protractor heads aren't really necessary for most woodworking tasks. And for squares where both hardened steel and cast-iron heads were available, we opted for iron, which is more than strong enough for woodworking, and less expensive. For the double squares, we looked all 11 models but list only four in the chart, because a few models are identical.

We graded each square for fit, feel, finish, and the intangibles of how it performed in a shop setting. We eliminated any model that didn't hold up during the testing.



After putting each combination square through its paces, the L.S. Starrett 12-in. model with a satin chrome blade was a clear Best Overall pick. The fit, finish, and machining were excellent. For Best Value, we picked the 12-in. square from Products Engineering Corp. (PEC Tools). It performed well, and at \$54, it costs about half as much as the Starrett. For double squares, we picked the Starrett as Best

Overall. The $\frac{5}{8}$ -in.-wide Starrett blade is narrower than the others, making it slightly better for fitting into tight spaces, an important consideration for small squares. The PEC Tools double square earns Best Value. It has an easy-to-read satin chrome blade, performed well, stayed square, and costs much less than the Starrett. □

Philip C. Lowe contributed to this article.

12-IN. COMBO SQUARES

HEAD TO HEAD

Subtle details make a big difference in performance. Key components are a secure lockbolt, which holds the head in place, and a rule that is easy to read under ceiling lights. Satin chrome is the way to go.



STARRETT
Satin chrome



PEC

THE WHOLE FIELD AT A GLANCE

MODEL/SOURCE	STREET PRICE	BLADE	EASE OF REPLACING RULER	EASE OF READING RULER	MACHINING AND FINISH	COMMENTS
12-IN. COMBINATION SQUARES						
General 812 amazon.com	\$35	Stainless steel	Good	Good	Good	Good overall product; comfortable to use all around; looks like a PEC but without the satin-chrome-finish rule.
iGaging rockler.com	\$30	Satin chrome	Fair	Excellent	Good	Performed well; accurate and legible; loose lockbolt made for difficult re-assembly; nearly identical to models from Westward and Highland Woodworking.
Johnson 440 amazon.com	\$29	Hardened steel	Fair	Good	Good	Locknut a bit small in relation to the head; graduations are not clear, and only go down to $\frac{1}{32}$ in.; lockbolt loose in hole; some sharp edges.
Mitutoyo grainger.com	\$135	Satin chrome	Good	Excellent	Good	Excellent tool, but the knurling could be a little coarser; head and blade sold separately.
Products Engineering Corp. (PEC) amazon.com	\$54	Satin chrome	Good	Excellent	Good	Excellent product; nearly identical to models from McMaster-Carr and Brown & Sharpe.
Starrett woodcraft.com	\$100	Satin chrome	Excellent	Excellent	Excellent	Superior lockbolt design made head easy to remove, replace, and lock down; well machined, easy to read, and an excellent all-around performer.
Starrett leevalley.com	\$77	Hardened steel	Excellent	Good	Excellent	Performed as well as the Starrett satin-chrome model with the same basic design; however, the hardened steel rule was tough to read under lights.
Swiss Precision Instruments (SPI) mscdirect.com	\$65	Satin chrome	Fair	Poor	Good	Good tool but the graduations were difficult to read because lines are nearly identical lengths.
4-IN. DOUBLE SQUARES						
iGaging grizzly.com	\$10	Satin chrome	Fair	Excellent	Fair	Poor locknut action makes it difficult to replace the rule; nearly identical to models from Highland Woodworking and Rockler.
PEC wttool.com	\$23	Satin chrome	Good	Excellent	Good	Good fit and feel and comfortable to use, but locknut occasionally needed extra tightening to keep blade in place; least expensive of the PEC-made models.
Starrett leevalley.com	\$67	Hardened steel	Excellent	Good	Excellent	Head is easy to remove, replace, and lock down; narrowest blade, at $\frac{5}{8}$ in., made it easier to fit into tight places; hard to read under lights.
SPI mscdirect.com	\$37	Satin chrome	Fair	Poor	Fair	Difficult to distinguish lines on ruler.

4-IN. DOUBLE SQUARES



READERS' RATINGS: COMBINATION SQUARES

Editors and readers agree that Starrett still makes the best 12-in. combo square. We didn't ask readers about the double squares.

★★★★★	4.78	STARRETT
★★★★★	4.76	MITUTOYO
★★★★☆	4.50	PEC
★★★★☆	3.82	JOHNSON
★★★★☆	3.75	iGAGING
★★★★☆	3.57	GENERAL TOOLS
NOT SURVEYED		SPI

Builder's Squares

Get the right angle on these useful layout and measuring tools

BY JEFFERSON KOLLE

Right angles are the reference point for most of what we build. Even circles and curves are calculated using them. And most measurements and layouts begin at a square corner. That's why the edges of most builder's squares are delineated in inches. In fact, in everyday use, most squares are used less to check corners and more as tools for layout and measurement. Some are even used as saw guides to ensure the cutting of perfectly square corners.

Taking true measure

Companies use lasers or a stable granite machinist's block to check their squares for accuracy during and again after manufacturing. All abide by a standard, whether it's a self-imposed in-house one or one from a standards laboratory. But keep in mind that the standard is an indication of

what's acceptable as a deviation from perfect, which suggests that perfection is unattainable.

That's what Richard Hummel thinks. The owner of Woodpeckers Inc. (woodpeck.com), a manufacturer of high-quality woodworking tools including several squares, he says "true square doesn't exist." But that doesn't mean companies don't strive for it. Hummel's standard is to use a 0.0015-in. feeler gauge to check his squares before they leave the factory. "That's something that just can't happen in a factory that makes a quarter of a million squares every year," he adds.

Stanley's (stanleytools.com) Premium Aluminum Rafter Squares are stamped with a die and require no milling afterward. Tom Chang, Stanley's global product manager for measurement and layout tools, says the company uses a laser gauge to check random tools in each manufacturing lot. If a sample tool is substandard, the die can be adjusted and the defective batch of squares is recycled. "Our job is to produce tools that are accurate while maintaining a price in the market and allowing us to stay in business," Chang says.

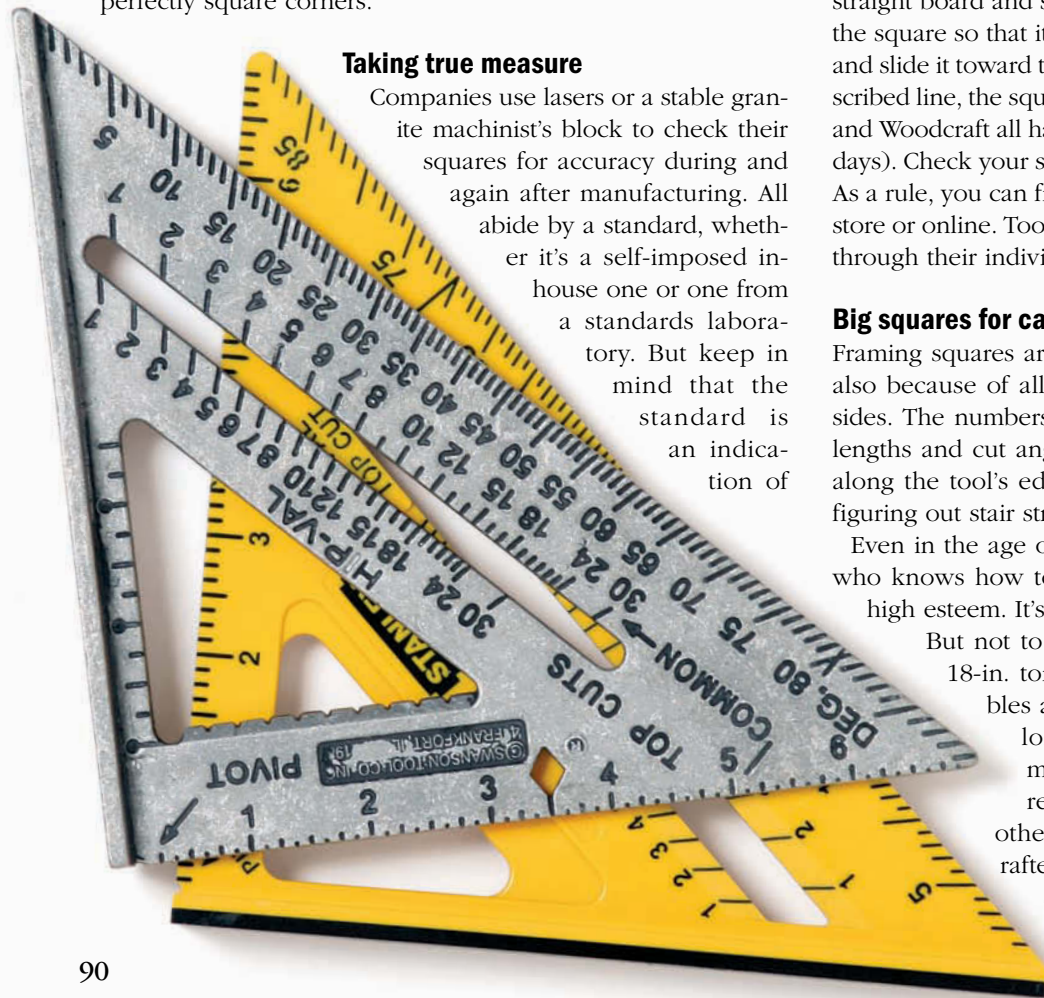
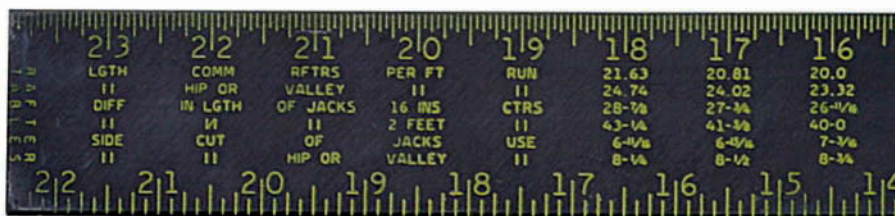
The easiest way to check a square yourself is to hold it against a straight board and scribe a line across the board's face. Then flip the square so that it rests against the board in the other direction and slide it toward the line. If the edge of the tool is parallel to the scribed line, the square is square. Rockler, Swanson, Garrett Wade, and Woodcraft all have a 90-day return policy (Woodpecker's is 30 days). Check your square when you get it, and return it if it's bad. As a rule, you can find a good variety of squares at any hardware store or online. Tools from specialty makers may be easier to find through their individual company websites.

Big squares for carpenters

Framing squares are daunting, not only for their sheer size, but also because of all the numbers and tables etched along both sides. The numbers are multipliers and degree-readings for the lengths and cut angles of rafters and blocking. The inch scales along the tool's edges are also used for simple layout and for figuring out stair stringers.

Even in the age of electronic builder's calculators, a carpenter who knows how to calculate with a framing square is held in high esteem. It's getting to be a lost craft.

But not to everyone. Chappell's Master Framer has an 18-in. tongue that provides room for even more tables and works as a 3-4-5 triangle with the 24-in.-long blade. You can download the 48-page manual at chappellsquare.com. Stanley, Starrett, Johnson Level and Tool, Irwin tools, and others also make framing squares, replete with rafter tables. With some exceptions, expect to pay \$15 to \$20.



Framing square

This square combines a 16-in. by 1½-in. tongue and a 24-in. by 2-in. blade with plenty of room for scales. The reverse side includes a scale that divides inches into twelfths to simplify equations in feet and inches.

Rafter table

Six lines of figures aimed at helping roofers determine the length of rafters for various roof pitches, and the angles of the cuts needed to create them.

Blade

Heel

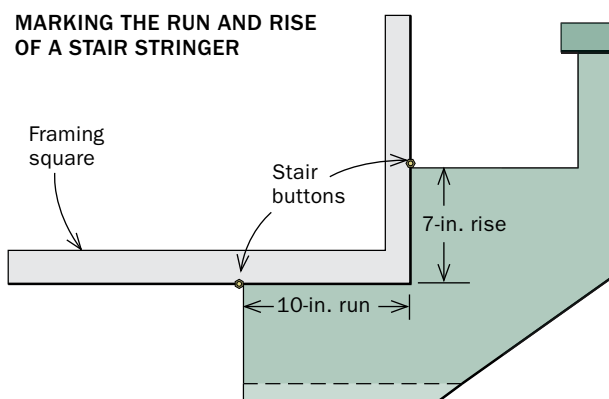
Tongue

Octagon scale

Used to lay out cuts on the end of a square timber to make it octagonal.



MARKING THE RUN AND RISE OF A STAIR STRINGER



Simple stair layout. One common use for a framing square is laying out cuts for stair stringers. The settings for rise and run can be maintained with commercially made clamps called stair buttons.



The home-grown approach. A straight board and a pair of spring clamps can do the same job as store-bought buttons.



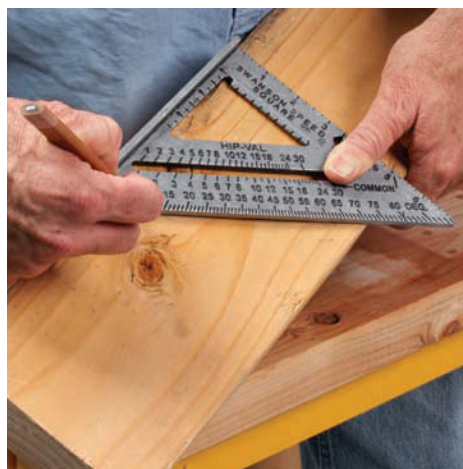
Useful in the shop, too. The framing square's size makes it useful for laying out cuts on panels or checking case assemblies for square during glue-up.

High-end square. The U.S.-made Chappell Master Framers (model No. 1824,) is made from 304 stainless steel. It is cut with a laser, milled on a CNC machine and by hand. The tool is guaranteed to be square within 0.003 in. along its 18-in. length. It costs \$118 (chappellsquare.com).



Speed square

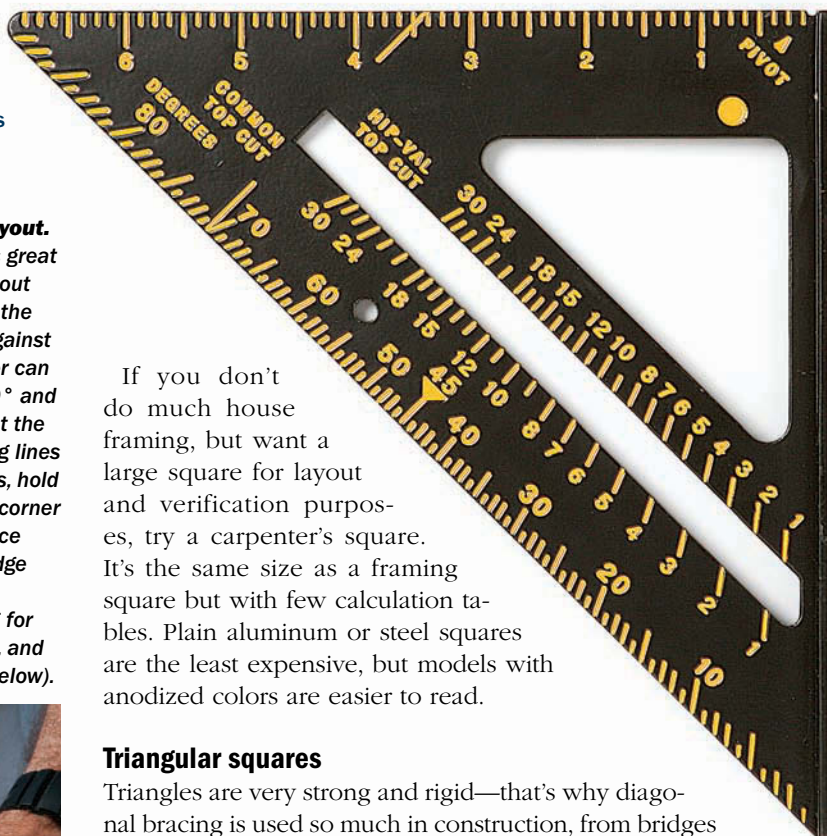
This triangular square is in tool belts across the country due to its compact size and indestructible utility. It's graduated in inches with other delineations for figuring out rafter cuts.



Speedy angle layout. A speed square is great for quickly laying out angled cuts. With the reference edge against the stock, the user can quickly lay out 90° and 45° cuts. To orient the square for scribing lines at different angles, hold the square's 90° corner as a fixed reference point along the edge of the stock. Then align the marking for the desired angle, and strike your line (below).



Saw guide. The speed square's easy handling and positive reference make it an ideal straightedge for guiding a circular saw for short crosscuts.



If you don't do much house framing, but want a large square for layout and verification purposes, try a carpenter's square. It's the same size as a framing square but with few calculation tables. Plain aluminum or steel squares are the least expensive, but models with anodized colors are easier to read.

Triangular squares

Triangles are very strong and rigid—that's why diagonal bracing is used so much in construction, from bridges to bridge tables. Drop any two-armed square on a scaffolding enough times and it's going to get knocked out of square, but a triangular square will stay true forever. Albert J. Swanson, a Chicago carpenter, knew this, and that's what led him in 1928 to make his triangular square. The Swanson Speed Square is made from 1/8-in.-thick die-cast aluminum. The edges are machined and then the tools go through a mechanical tumbling process to clean up any casting flash. The tool forms a right triangle with 7-in. legs. The hypotenuse can be used for marking 45° angles.

Along with their use as layout tools, triangular squares get used a lot as guides for circular saws. The tool is comfortable to hold one-handed against a board's edge.

Swanson makes variations of the original Speed Square, including a 12-in.-long model and plastic composite models that won't mar softer materials, such as vinyl siding. Stanley makes a version of the Speed Square, called the Quick Square, from black metal with bright yellow markings, as well as several plastic versions.

Triangular squares are used mainly for carpentry work and don't often find their way into a cabinet shop, except for rough preliminary work. Expect to pay around \$10.

Tri squares are not triangular

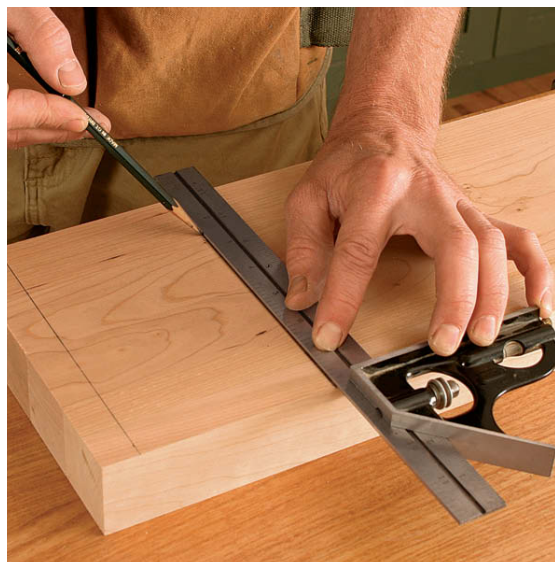
The story goes that the tri square was originally called a try square, used to "try" or test an angle for squareness. Tri squares have two parts: the thicker stock and the thinner blade, mounted at the end of the stock and forming a 90° angle.

Traditionally, a tri-square stock is made from wood, often a fine, stable hardwood and often banded or edged with steel or brass. Some tri squares have layout graduations marked on the blade, but traditional tools have unadorned surfaces.

A machinist's or engineer's square is similar to a tri square, except that the stock is made from metal. While it can be used for lay-

Other squares

A handful of other squares are also useful to builders and woodworkers alike as tools for reference and layout.



COMBO SQUARE

A 12-in. combination square can be used as a long- or short-bladed tri square as well as a miter square. Used with a pencil, it can scribe lines parallel to a board's edge.

out work, machinist squares are just as often used for setting tools and jigs and verifying, for instance, that a saw fence is square to its table. Machinist squares are sold in a huge variety of sizes. Garrett Wade offers a set of engineer's squares (with 2-, 3-, 4-, and 6-in. blades) in a wooden box. And Woodpecker's sells all-metal stock-and-blade squares in sizes from the smallest with its 2 $\frac{5}{8}$ -in. blade all the way up to its giant 16-by-24-in. Precision Woodworking Square.

Where to draw the line

If you spend more money on a square, you're more likely to find one that is true to its name, but then again, you could find an inexpensive tool at the hardware store that is just as correct.

Hummel's advice is to consider the work you do and make a one-time tool purchase. That's what he does. And whether it's the work he's doing or the tool he's buying, his guiding principle is that both should be a "smidge better than they need to be." □

Jefferson Kolle is a freelance writer in Bethel, Conn., who writes frequently for Fine Homebuilding. He is a former carpenter and contractor.



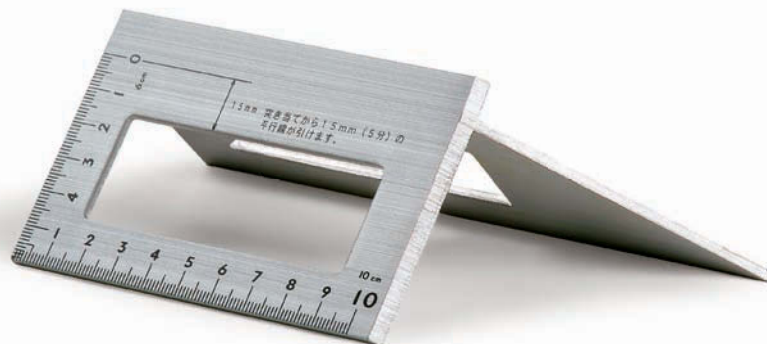
ENGINEER'S SQUARE

Similar to a tri square, this square is great for layout, and for setting up or checking machinery blades, fences, and tables for accuracy.



SADDLE SQUARE

This design from Shinwa (shinwa-measuring.com) provides broad references on two adjacent surfaces, letting the user easily carry a layout line from one surface to another.



Block Planes

For woodworkers, a high-end model makes good sense

Woodworkers and trim carpenters know the value of a good block plane. It's used for many jobs, from fitting drawers to chamfering edges, tuning up miters in trimwork and removing machine marks.

We gathered 23 of the most popular block planes (both standard- and low-angle models), to compare performance and quality. In the end we determined that a low-angle plane is all you need, so we focused on those models. After honing the blades, we tested the planes on an array of tasks, from removing mill marks to fairing curves. The winners excelled not only in performance on a range of woods, but also in comfort, build, and ease of adjustments. That said, if all you do is carpentry, working on softwoods like pine and fir, you might also want to consider the Stanley 60½, a bargain at \$47. □

Mario Rodriguez contributed to this article.

READERS' RATINGS: BLOCK PLANES

Readers agreed with our editors on the Lie-Nielsen planes, scoring them in the top two. Readers and editors also gave high marks to the Veritas planes.

★★★★★	4.88	LIE-NIELSEN 60½
★★★★★	4.85	LIE-NIELSEN 102
★★★★★	4.74	VERITAS LOW-ANGLE
★★★★★	4.71	VERITAS DX60
★★★★★	4.71	VERITAS NX60
★★★★☆	4.25	RIDER 60½
★★★★☆	4.18	WOOD RIVER
★★★★☆	4.08	STANLEY SWEETHEART 60½ 12-139
★★★★☆	3.81	STANLEY 60½ MODEL 12-960
★★★★☆	3.75	ANANT 60½
★★★☆☆	3.35	GROZ

LIE-NIELSEN 102

\$115 lie-nielsen.com

The 102 is small and spare but very nicely crafted. The compact size will fit any hand, and the simple design makes it easy to set up and adjust. The 102 will deftly handle any job a block plane is meant to perform, although its narrow blade will require more passes to handle wider surfaces. It doesn't have any bells and whistles, but there's not a better block plane available for the money.



LIE-NIELSEN 60½

\$165 lie-nielsen.com

The 60½ is a step up from its cousin, the 102. It's bigger, which means more weight and a bigger blade, making the plane more efficient at tackling wider surfaces. An adjustable mouth allows you to dial in the opening for different situations (wider for coarse work; narrow for tricky grain). All adjustments were smooth and precise, and the tool is very well-balanced and comfortable to hold.



VERITAS DX60

\$185 leevalley.com

With the DX60 (and its pricier nickel counterpart, the NX60), Veritas tossed aside traditional lines and engineering. Both are extremely well made and very comfortable to hold and use. Both feature adjustable mouths, smooth-operating Norris-style adjusters, and set screws on the side of the body to help hold the settings. But these are a bit narrower than the other Veritas model (below), giving them a slightly more comfortable grip. The NX60's high pricetag took it out of contention for Best Overall, but you might opt for its high style and corrosion-resistance.



VERITAS LOW-ANGLE

\$140 leevalley.com

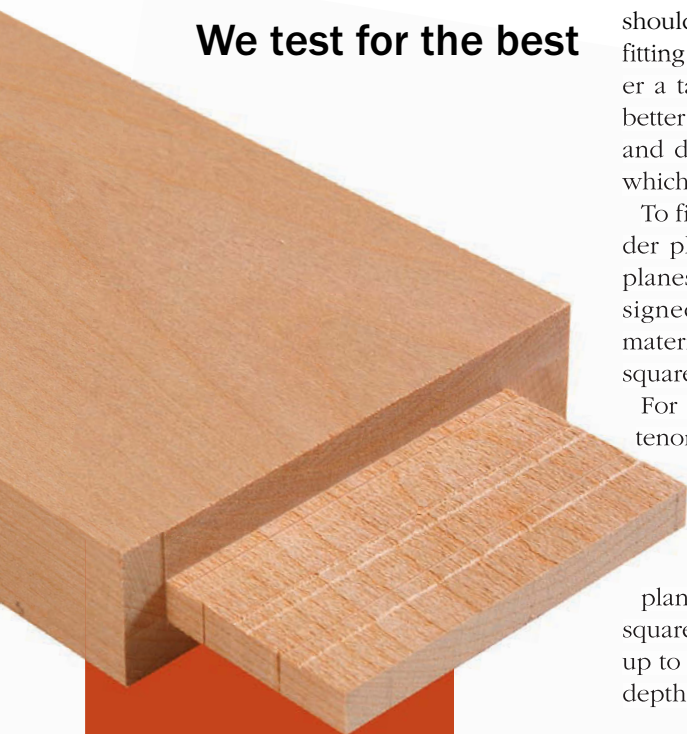
This is the largest and heaviest plane among the winners, making it the best for broad surfaces. Despite its size, the plane is comfortable to hold, with detents in the body that put your fingers in the right spots. The plane has a smooth-operating Norris-style adjuster, which handles depth and lateral adjustments, and set screws in the body to hold the lateral settings. Mouth adjustments are smooth and responsive.



	MODEL/ SOURCE	STREET PRICE	SIZE/WEIGHT	BLADE	PERFORMANCE	EASE OF ADJUSTMENTS	COMMENTS
	Anant 60½ No. 8952500 rlarson.com	\$42	1 ¹³ / ₁₆ in. wide by 6 ⁷ / ₈ in. long; 1 lb. 8.3 oz.	⁵ / ₆₄ in. thick by 1 ¹ / ₈ in. wide	Fair	Depth: poor Lateral: poor Mouth: good	Low silhouette should make it comfortable to hold, but sharp edges and rough machining spoil the grip; blade deflection caused lots of chatter; sole was flat.
	Groz Low-Angle Block Plane amazon.com	\$37	1 ³ / ₄ in. wide by 6 ³ / ₄ in. long; 1 lb. 7.3 oz.	⁵ / ₆₄ in. thick by 1 ¹ / ₈ in. wide	Fair	Depth: poor Lateral: poor Mouth: good	Blade is not adequately supported, causing chatter, edge of blade was not square and had to be reground to work; adjustments were difficult and didn't hold; sole was flat.
 BEST OVERALL  READERS' CHOICE	Lie-Nielsen 60½ lie-nielsen.com	\$165	1 ³ / ₄ in. wide by 6 ³ / ₄ in. long; 1 lb. 9.8 oz.	³ / ₈ in. thick by 1 ¹ / ₈ in. wide	Excellent	Depth: excellent Lateral: excellent Mouth: excellent	Top-notch tool; well-made and well-balanced, comfortable to hold; sole was flat.
 BEST OVERALL  BEST VALUE	Lie-Nielsen 102 lie-nielsen.com	\$115	1 ⁵ / ₈ in. wide by 5 ³ / ₄ in. long; 1 lb. 0.07 oz.	³ / ₈ in. thick by 1 ³ / ₁₆ in. wide	Excellent	Depth: excellent Lateral: excellent Mouth: none	A pleasure to use; very comfortable and well-balanced; compact design; simple to set up; lack of adjustable mouth did not hinder performance; sole was flat.
	Rider 60½ No. 4-260600 traditional-woodworker.com	\$80	1 ³ / ₄ in. wide by 6 ⁷ / ₈ in. long; 1 lb. 12.3 oz.	³ / ₃₂ in. thick by 1 ¹ / ₈ in. wide	Very good	Depth: good Lateral: good Mouth: good	A good-value plane; low profile is a little hard to grip but overall balance is good; responsive to blade adjustments; sole was flat.
	Stanley 60½ woodcraft.com	\$47	2 in. wide by 6 ⁷ / ₈ in. long; 1 lb. 13 oz.	³ / ₃₂ in. thick by 1 ¹ / ₈ in. wide	Good	Depth: fair Lateral: fair Mouth: good	Was fairly comfortable to hold; well-balanced; blade adjustments were stiff; fit and finish was fair, with chipping paint and mill marks; sole was flat.
	Stanley Sweet Heart 60½ highlandwoodworking.com	\$105	2 ¹ / ₈ in. wide by 6 ⁷ / ₈ in. long; 2 lb. 0.06 oz.	³ / ₈ in. thick by 1 ¹ / ₈ in. wide	Excellent	Depth: good Lateral: good Mouth: good	Aluminum lever cap is difficult to engage and easy to overtighten; hard corners left scratches in wide stock; sharp edges needed work; sole was flat.
 BEST OVERALL	Veritas DX60 leevalley.com	\$185	1 ¹³ / ₁₆ in. wide by 6 ⁷ / ₈ in. long; 1 lb. 11.6 oz.	⁵ / ₆₄ in. thick by 1 ¹ / ₈ in. wide	Excellent	Depth: excellent Lateral: excellent Mouth: excellent	Impeccable manufacturing; very comfortable; well-balanced; adjustments very responsive; set screws near mouth help hold lateral adjustments; sole was flat.
	Veritas NX60 leevalley.com	\$295	1 ¹³ / ₁₆ in. wide by 6 ⁷ / ₈ in. long; 1 lb. 11.6 oz.	⁵ / ₆₄ in. thick by 1 ¹ / ₈ in. wide	Excellent	Depth: excellent Lateral: excellent Mouth: excellent	Same basic design as DX60, but made from corrosion-resistant nickel instead of ductile iron. Retro tool styling really shines, but you'll pay a premium for it.
 BEST OVERALL	Veritas Low-Angle Block Plane leevalley.com	\$140	2 ³ / ₁₆ in. wide by 6 ¹ / ₂ in. long; 1 lb. 13.1 oz.	³ / ₈ in. thick by 1 ¹ / ₈ in. wide	Excellent	Depth: excellent Lateral: good Mouth: excellent	A bit heavier than the other winners, but well-balanced and comfortable; very responsive to adjustments; set screws near mouth help hold lateral adjustments; sole was flat.
	Wood River woodcraft.com	\$100	2 in. wide by 7 in. long; 1 lb. 14 oz.	³ / ₈ in. thick by 1 ¹ / ₈ in. wide	Excellent	Depth: difficult Lateral: good Mouth: good	A big tool, but well-balanced and easy to control; sole was flat, but blade adjustments were extremely stiff.

Shoulder and Rabbet Block Planes

These tools trim tenons for a piston fit that machines can't match. We test for the best



A lot of woodworkers choose to cut tenons with a tablesaw, thinking it will be fast and dead-on, only to get frustrated when their “precise” setup results in ill-fitting cheeks or misaligned shoulders. Truth is, it's hard to cut perfect-fitting tenons using just machinery, whether a tablesaw, a router, or a bandsaw. A better approach is to cut the tenon close and dial in the fit using hand tools. But which is best for the job?

To find the answer, we compared shoulder planes, rabbet block planes, fillister planes, and bullnose planes. All are designed to cut into corners, removing material methodically and leaving crisp, square edges.

For a plane to be effective at trimming tenon cheeks and shoulders in standard hardwoods, it must have some basic characteristics. It should have a low cutting angle for making cross-grain and end-grain cuts. The plane's sole should be flat and perfectly square to the sides. The blade should hold up to the rigors of end-grain planing. The depth and lateral adjustments should be

easy and should hold. Finally, since these planes may be used in multiple positions, the body should be comfortable to grip with one or two hands.

The right planes for the job

We used all of the planes on tablesawn tenons to fine-tune the shoulders and cheeks, a job that involves tricky end-grain and cross-grain work. The stock was cherry, and the tenons were $\frac{1}{4}$ in. thick by 4 in. wide by $1\frac{1}{4}$ in. long. We judged the planes based on the test, as well as on their fit and finish and ergonomics.

After the tests, the bullnose and fillister planes fell out of contention while shoulder and rabbet block planes rose to the fore. With their low cutting angle, these planes handle end-grain and cross-grain cuts. And they're made for use with one or two hands; you can hold them in a number of positions to handle any trimming job.

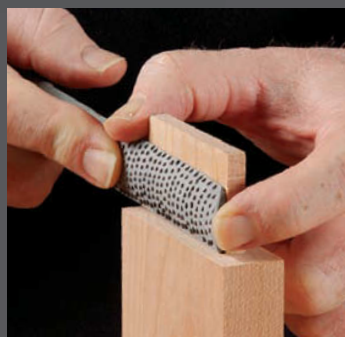
We recommend buying a shoulder plane first, and adding a rabbet block plane later (see “Which ones to buy ...” p. 99).

Chris Gochmour contributed to this report.

MACHINE-CUT TENONS NEED A HELPING HAND

Using a tablesaw, router, or bandsaw to cut tenons certainly makes the job faster and more efficient. But even with a careful setup, there are bound to be slight inconsistencies in the cuts, such as a shoulder that has a step. The path to a piston fit is to cut the tenons close, and then trim them using handplanes.

Wrong tools are hard to handle



You may be tempted to file, sand, or chisel your way to perfect tenons. But these methods are inconsistent. Files and sandpaper tend to round over the work, especially in the corner, and it's difficult to control a chisel over a longer surface without creating a taper.



READERS' RATINGS: SHOULDER PLANES

Readers and editors gave high marks to the Veritas Large plane, with the Lie-Nielsen running a close second in the ratings.

★★★★★	4.70	VERITAS LARGE
★★★★★	4.68	LIE-NIELSEN LARGE
★★★★☆	4.29	GORDON GIDGEE
★★★★☆	4.13	CLIFTON 3110
★★★★☆	4.11	CLIFTON 420
★★★★☆	3.73	STANLEY SWEET HEART 92
★★★☆☆	3.15	SHOP FOX D3752
★★★☆☆	3.08	SHOP FOX D3751

READERS' RATINGS: RABBET BLOCK PLANES

This category was incredibly close, with the Lie-Nielsen 60½ R edging into first place with readers and editors.

★★★★★	4.70	LIE-NIELSEN 60½ R
★★★★★	4.58	LIE-NIELSEN SKEW
★★★★☆	4.54	VERITAS SKEW



Why planes work better

Shoulder planes and rabbet block planes reach into corners and remove material methodically in a way that power tools cannot, and they're more precise than files, sandpaper, or chisels. With each one, the blade should project slightly beyond the side (about 0.002 in.—the thickness of a sheet of paper) for best performance. If it doesn't project enough, the plane is pushed away from the corner and won't remove stock evenly.

Shoulder planes: The first choice for tenons



Shoulder planes excel at trimming the shoulders of tenons. But they also are great for sizing tenon cheeks. These planes range in width from $\frac{1}{2}$ in. to $1\frac{1}{4}$ in. For furniture making, the larger models, $\frac{3}{4}$ in. or bigger, are more efficient. They cover more ground while still handling narrow shoulders well.

If a manufacturer offered different sizes of the same tool, we tested the largest one offered. We judged the planes based on how well they worked at trimming the shoulders and cheeks of tenons, as well as their fit and finish (flat sole, with sides perfectly square to the sole). We also evaluated the ergonomics of each one, and whether it is comfortable to hold with one or two hands.

Among this group, the Veritas model stood out, and we picked it as Best Overall and Best Value.

MODEL/SOURCE	WIDTH	EASE OF BLADE ADJUSTMENTS	FIT AND FINISH	PERFORMANCE	COMMENTS
Clifton 420 toolsforworkingwood.com \$290	$\frac{3}{4}$ in.	Good	Very good	Good	Blade needed lapping out of the box; mouth not adjustable; blade shifted laterally during depth adjustments.
Clifton 3110 (3-in-1) toolsforworkingwood.com \$290	$1\frac{1}{16}$ in.	Good	Very good	Good	Blade needed lapping out of the box; mouth adjustments, made via shims, were difficult; blade shifted laterally during depth adjustments.
Gordon Gidgee hntgordon.com.au \$185	1 in.	Good	Excellent	Good	Blade adjusted with a hammer, which takes practice; blade projection on top made plane hard to grip; mouth not adjustable.
Lie-Nielsen Large lie-nielsen.com \$250	$1\frac{1}{4}$ in.	Good	Very good	Very good	Solid performer; casting recesses have sharp edges; blade shifted laterally as depth was adjusted; mouth easy to adjust.
Shop Fox D3752 (3-in-1) woodstockint.com \$75	$1\frac{3}{32}$ in.	Good	Good	Fair	Blade was poorly prepped and failed on end grain; mouth adjustments, made via shims, were difficult; sole not flat.
Shop Fox D3751 woodstockint.com \$55	$\frac{3}{4}$ in.	Very good	Fair	Fair	Blade needed lapping out of the box and needed reshaping to make it parallel to sole; blade failed on end grain, mouth easy to adjust.
Stanley Sweet Heart 92 woodcraft.com \$125	$\frac{3}{4}$ in.	Excellent	Good	Fair	Sharp edges on body made tool uncomfortable to grip; blade projection was inadequate, making for inconsistent results; mouth easy to adjust.
Veritas Large leevalley.com \$225	$1\frac{1}{4}$ in.	Excellent	Excellent	Excellent	Flawless tool; very comfortable to grip with one hand or two; blade lapped dead flat; mouth easy to adjust.



Rabbet block planes: Better for cheeks



LIE-NIELSEN
60½ R



LIE-NIELSEN
SKEW BLOCK



VERITAS
SKEW BLOCK



Skew is the best. The blade on the skew rabbet block plane (above) is angled, which pulls it against the shoulder and leaves no tearout at the back of the cut. A normal rabbet block plane (right) cuts in both directions, making it more versatile.



With its wider blade, bedded at a low angle, a rabbet block plane is well suited to trimming the cheeks of a tenon efficiently. It can work on shoulders, but it's not as easy to use on its side as a shoulder plane. These planes are versatile, also working well as conventional block planes.

After putting all the planes through the same tenon-trimming tests as the shoulder planes, we picked the Veritas skew block plane as the Best Overall. Its skewed blade rabbets on only one side but cuts with less resistance and produces a flawless surface with no tearout. Buy the version that suits your favored hand and cutting direction.

One caveat: there's a learning curve associated with sharpening the angled blade, and perhaps some extra honing accessories to buy. For folks who don't want to deal with those issues, we recommend the Lie-Nielsen 60½ R as a Best Value buy.

Online Extra

For tips on sharpening a skew blade, go to FineWoodworking.com/TG2014.

MODEL/SOURCE	EASE OF BLADE ADJUSTMENTS	FIT AND FINISH	PERFORMANCE	COMMENTS
BEST VALUE Lie-Nielsen 60½ R lie-nielsen.com \$175	Good	Very good	Very good	Cut quality is good; square, full-width blade rabbets on both sides; depth adjuster tended to shift blade laterally, so you must be careful.
Lie-Nielsen Skew Block Plane lie-nielsen.com \$225 (left or right handed)	Good	Excellent	Very good	Cut quality is very good; bronze body increases mass and heft, won't rust; depth adjuster tended to shift blade laterally, so you must be careful.
BEST OVERALL Veritas Skew Block Plane leevalley.com \$215 (left or right handed)	Excellent	Excellent	Excellent	Cut quality is excellent; easy to set up and holds settings with the help of setscrews on side of body to align blade; extremely comfortable to hold.

Which ones to buy, and in what order

With its tall body, a shoulder plane is ideal for trimming tenon shoulders, offering great control while keeping your hands away from the work. It also can be used to trim tenon cheeks. Buy the biggest one you can (see recommendations, opposite page), which can handle any size shoulder and any tenon cheek.

The problem with a shoulder plane, even a large one, is that it's not the most efficient tool for cheeks. It requires multiple overlapping passes to tackle long tenons, which could

result in a tapered tenon if you're not careful. That job is best handled by a rabbet block plane, which has a wider blade (see recommendations, above). Though it can be used on a shoulder, its short body is a bit harder to hold on its side.

Out of both, the first one we'd recommend is the large shoulder plane, because it can do both shoulders and tenons pretty easily. Ideally, though, if you can afford it, add a rabbet block plane for cheeks. With both tools you'll be set up to trim perfect tenons every time, quickly and efficiently.

Waterstones

**They're the best choice
for honing woodworking tools**

Waterstones are the best choice for honing chisels and handplane blades for woodworking. They produce a finer polish than both oil and diamond stones, and are more durable and less expensive (in the long run) than sandpaper.

The supply of natural waterstones has diminished, but synthetic stones are widely available and more affordable. There are so many choices, in fact, that it's not easy to know which one to buy.

Waterstones are best used for honing a small, secondary bevel, not grinding the primary one. So, we looked at the three grits suitable for honing: 1,000, 4,000, and 8,000. Some manufacturers don't make stones in those exact grits, so we used an equivalent grit in those cases.

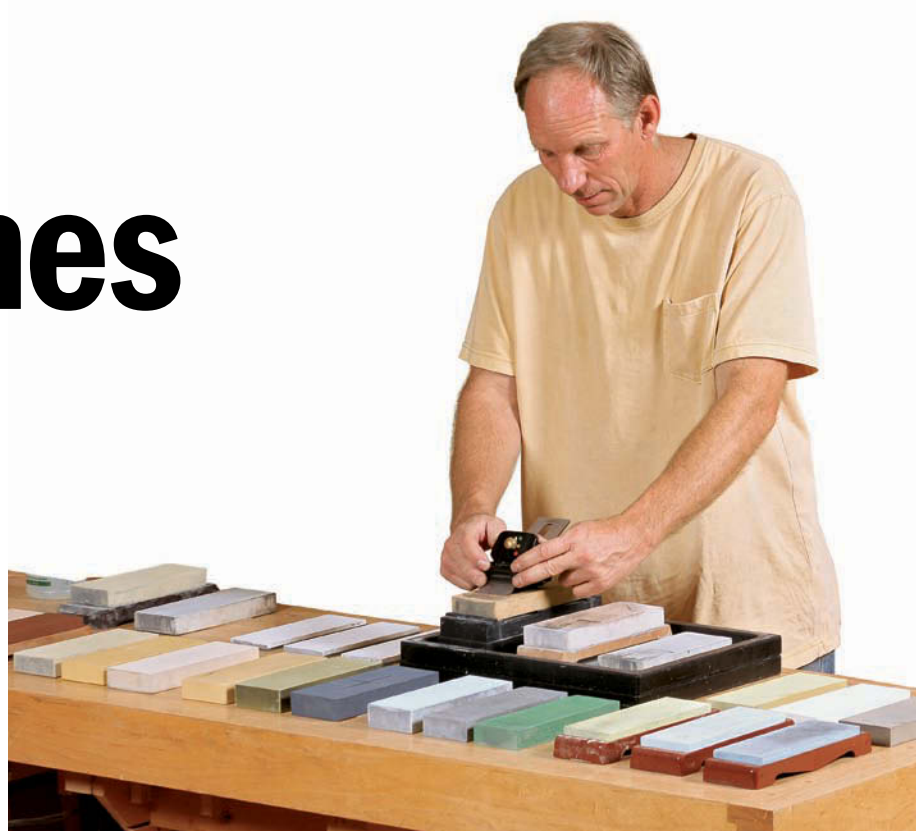
Performance testing

Synthetic waterstones have a reputation for dishing quickly. We tested for this and gauged how fast we could re-flatten them. We then tested how quickly they sharpened both O1 (standard high-carbon tool steel) and A2 (a tougher alloy) blades. Finally, we used them to sharpen plane and chisel blades, and used those tools to take shavings from end and edge grain, as the ultimate real-world test. To sharpen each blade, we used the 1,000-grit stone until a burr formed on the back, we refined the edge with the 4,000-grit stone, and then we polished the edge and removed the burr with the 8,000-grit stone.

The bottom line

Every set of stones we tested can produce a cutting edge good enough for the finest woodworking, but three impressed us equally as the best overall: Naniwa Chosera, Shapton GlassStone, and Sigma Power. Our choice for Best Value is the two-stone set from Japan Woodworker. It produced an edge that competed with the three-stone sets but cost just \$169. If you want to add an 8,000-grit to an existing set of stones, we recommend the Naniwa Chosera, Shapton, or Sigma Power. A fourth choice is the Naniwa Super Stone 8,000-grit. It performed very well as a polishing stone, and is a great value at \$70. □

Chris Gochnour contributed to this article.



NAME	STONES TESTED	STREET PRICE	DISHING
Bester/Imanishi leevalley.com	1,000, 4,000, 8,000	\$49, \$61, \$76	0.006 in.
Bester/Kitayama japanwoodworker.com	1,200, 8,000*	\$65, \$104*	0.002 in.
King leevalley.com	1,000, 4,000, 8,000	\$29, \$29, \$62	0.002 in.
Naniwa Chosera toolsforworkingwood.com	1,000, 5,000, 10,000	\$87, \$140, \$266	0.002 in.
Naniwa Super Stone toolsforworkingwood.com	1,000, 5,000, 8,000	\$36, \$60, \$70	**
Norton woodcraft.com	1,000, 4,000, 8,000	\$48, \$65, \$97	0.002 in.
Shapton craftsmanstudio.com	1,000, 4,000, 10,000	\$57, \$72, \$172	0.001 in.
Sigma Power toolsfromjapan.com	1,000, 6,000, 13,000	\$36, \$50, \$85	0.001 in.
Sigma Power Select II leevalley.com	1,000, 3,000, 10,000	\$69, \$75, \$96	0.007 in.

*Japan Woodworker recommended only a coarse and fine stone.



READERS' RATINGS: WATERSTONES		
Readers closely agree with our Best Overall choices; however they rated the Sigma Power Select II higher than our fourth choice, the Bester/Kitayama stones.		
★★★★★	4.50	SHAPTON
★★★★★	4.46	SIGMA POWER
★★★★★	4.45	NANIWA CHOSERA
★★★★★	4.40	SIGMA POWER SELECT II
★★★★★	4.39	BESTER/IMANISHI
★★★★★	4.36	BESTER/KITAYAMA
★★★★★	4.16	KING
★★★★★	4.16	NORTON
Not surveyed		NANIWA SUPER STONE

THE FINAL CUT

All of the waterstones produced an edge suitable for fine woodworking, leaving smooth surfaces with no tearout. None of the 1,000-grit stones were a burden to flatten. Even the most dished ones can be done in less than a minute. The highest-grit stones dished so little that we couldn't measure it. So, you'll hardly ever need to flatten those. All that being said, our tests discovered significant differences among stones.

1,000-GRIT STONES			8,000-GRIT STONES					COMMENTS
FLATTENING (strokes needed)	HONING SPEED (rated 1-10)		HONING SPEED (rated 1-10)		PERFORMANCE (rated 1-10)			
	O1	A2	O1	A2	End-grain paring	End-grain planing	Edge-grain planing	
14	8	6	8	4	8	8	9	These moderately hard stones have a good feel during use.
15	10	8	9	3	7	8	8	Great results from just two stones, but remove the wooden base on the 8,000-grit stone—it warps after getting wet.
10	8	7	4	3	5	6	5	Grits are not marked on the stones. Use a Sharpie to tell them apart.
8	8	7	7	4	9	8	9	The Chosera have the smoothest cutting action of all the stones tested and create a nice slurry during use.
**	4	1	4	3	9	9	8	The 8,000-grit stone produced an excellent polish, but the stones are not well-mounted on their plastic bases.
15	9	8	7	5	6	7	6	Honed A2 steel the quickest.
9	9	6	6	4	9	8	9	These stones are very hard and blades occasionally chattered across the surface.
11	9	7	8	4	8	8	9	Excellent value at \$317 for a full set that includes a 400-grit diamond plate for flattening.
27	9	7	7	3	6	6	7	1,000-grit stone dished so quickly that it created a cambered blade, which the finer stones were not able to correct easily.

**1,000-grit Superstone tended to bow upward during our dishing test, making it impossible to measure wear.

Toolbox Evolution

Tool storage gets a remake with custom-fit boxes that stack

Whether you're a finish carpenter, a woodworker, or a do-it-yourselfer, storing your tools so they are protected and easy to access is an important part of the job. Small wonder that a lot of folks like to hang onto those blow-molded plastic cases the tools come in. After all, the cases fit the tools, keeping them protected and, in appearance at least, well organized. Unfortunately, this strategy takes up a lot of space. All those cases can fill your shop shelves or truck bed to overflowing.

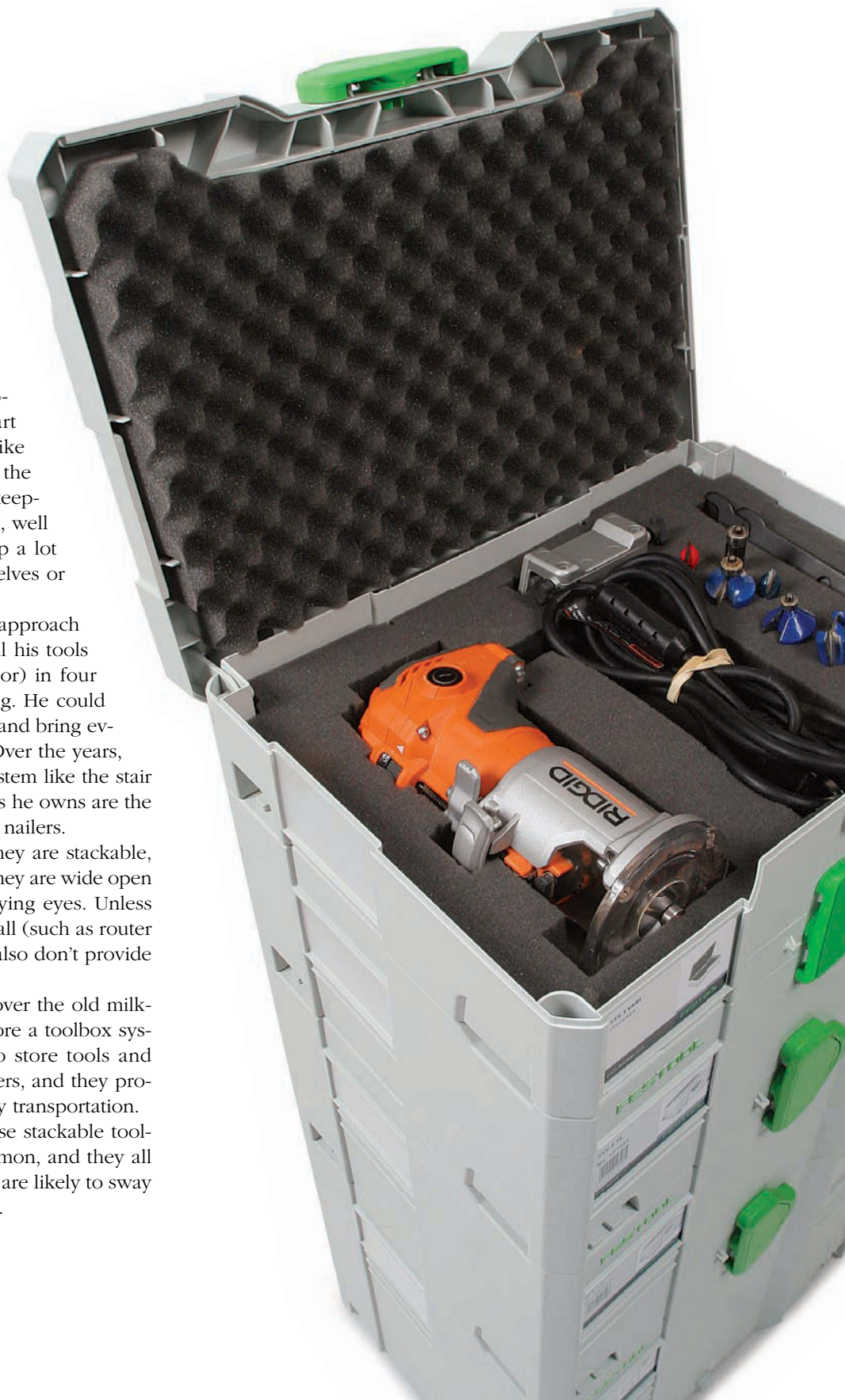
One carpenter we know learned a different approach from a stair-building contractor who carried all his tools (other than a miter saw and an air compressor) in four rectangular milk crates and a single canvas bag. He could stack two crates, throw the canvas bag on top, and bring every tool he needed onto the job in two trips. Over the years, our carpenter has moved closer to a simple system like the stair guy's. At this point, the only blow-molded cases he owns are the tiny ones that came with a couple of small pin nailers.

So, why not just use milk crates? Although they are stackable, nearly indestructible, and handy as step stools, they are wide open and exposed to dust, planer shavings, and prying eyes. Unless modified, they are not suitable for anything small (such as router bits) or thin and sharp (such as chisels). They also don't provide protection from dirt and moisture.

Today's toolboxes have specific advantages over the old milk-crate system. Less individual toolboxes and more a toolbox system, these stackable units can be outfitted to store tools and materials from finish nails to 3-hp plunge routers, and they provide protection, organization, security, and easy transportation.

We recently looked at three examples of these stackable tool-storage devices. They have some traits in common, and they all accomplish the same job. The details, however, are likely to sway your decision about which one is right for you.

Kit Camp contributed to this article.





A SYSTEMS APPROACH

A new concept in the United States, stackable toolboxes have a longer track record in Europe. The concept is simple: Boxes are available in several heights but share the same footprint, allowing them to latch together into an easily movable stack. Because they are often sold empty, you can customize the interiors either with proprietary

inserts or with aftermarket accessories, such as pick-and-pluck foam (FastCap.com), or homemade inserts.

We recommend keeping the interiors of each box simple, wasting the least amount of space with bins or thick foam. This way, you can either get more tools into the box or fit a tool and all its related accessories.

Where it makes sense, you might also arrange tools in groups—for example, a dedicated box for finish nailers—rather than individually.

Unlike storing blow-molded cases of all different sizes, packing tools in containers of a standard size makes it easier to store them in drawers in your truck, on shelves in your van, or in cubbies in your shop.

Toolboxes à la carte



- 1: \$50
- 2: \$60
- 3: \$65
- 4: \$70

BOSCH L-BOXX

Bosch has started importing the L-Boxx, a European product made by Sortimo. The footprint and interior volume of each L-Boxx is slightly larger than the equivalent Systainer (see below), but Bosch has four sizes instead of Festool's five.

At the moment, these boxes don't have as many stock variations and options as you can get from the Festool lineup, but the Sortimo website shows a wide selection of drawers, colors, inserts, and carts. Time will tell how many of these products Bosch will import, but

the company has started packaging some tools into these cases, an encouraging start. In the meantime, tool-specific inlays and generic L-Boxx accessories can be purchased from European sites such as RAldiy.co.uk.

We also really like the color-coded bins in the L-Boxx1A, designed for sorting small parts or fasteners. The two smallest boxes have a front (briefcase-style) handle, and all four also can be carried by a top handle or with two hands on side handles. One of our testers left a box to slam around in a truck bed for a month, and



- 1: \$33
- 2: \$27
- 3: \$33
- 4: \$44

DeWALT TSTAK

To compete with the boxes from Festool and Bosch, DeWalt has built its TSTAK system from scratch. Although the boxes are stackable and somewhat customizable, they don't quite compare directly to the Bosch and Festool systems.

One of the boxes has a longer metal handle and can be placed only at the top of a stack. It has a lid compartment perfect for holding drill bits or similarly sized tools, and a main compartment that we found would just fit an 18-volt drill, two batteries, and the charger. The next box's outside dimensions are about the same, but it has a single compartment

roughly equivalent to the Bosch/Festool #2, about 5 in. deep. This box has a top and front handle, and it easily swallows jigsaws, drills, or random-orbit sanders. The next two boxes feature drawers with full-extension ball-bearing slides. One has a single deep drawer filled with smaller lidded boxes; the other has two shallow drawers with numerous dividers. All the boxes have a small label window, a nice touch for the truly meticulous.

The only big strike against the TSTAK as a do-all system is that no larger sizes are available. These boxes simply won't accommodate routers, circular saws, power planes, or other



- 1: \$63
- 2: \$68
- 3: \$76
- 4: \$80
- 5: \$86

FESTOOL SYSTAINERS

Festool products have always come packaged in plastic boxes called Systainers, made by a company called Tanos. These boxes include a molded insert designed to hold the tool and its optional accessories securely. Systainers are available separately in five sizes. One version, called Sortainers, sports small, medium, and large drawers. Festool also has Mini and Maxi Systainers, for really tiny or really big tools. To tie the system together, the company also offers a small dolly and a hand truck for wheeling stacks of Systainers around and cabinets designed for your shop. The boxes are designed to latch to vacuums as well.

These units evolved from an older model of Systainer, now referred to as a Classic

Systainer. We liked everything about this old style except the small latches used to join boxes together and secure their lids, which proved time and again to be fingernail breakers. Classic Systainers are still available from Festool—and also in a variety of fits and finishes from other woodworking outlets, such as Japan Woodworker (JapanWoodworker.com)—but the new T-Loc models are a huge improvement.

Our tester has used Systainers for the past eight years and has yet to break one despite dropping them, leaving them in his truck bed, checking them as luggage, using them as boxes to ship tools, and occasionally using them as step stools.

it held up well, despite our worries about the L-Boxx's comparatively thin sidewalls and the latches' flexibility.

PROS: Larger footprint and interior volume than comparable Systainer, and about 20% less expensive; 1-Click system makes for fast, secure stacking and unstacking.

CONS: Far fewer generic customization accessories and inserts; boxes require two hands to unlatch from a stack; thin sidewalls allow for a lot of flex, especially in larger boxes.



One click, but two hands. Bosch's 1-Click system allows the boxes to clip together simply by stacking them; there are no latches to operate. To separate the boxes, press a release button on each side of the box and lift. Unlike the others, these boxes require two hands to unclip and cannot be opened while in a stack.

large tools. We hope DeWalt will start offering some of its smaller tools for sale in these cases, and also expand the line to include larger sizes and more accessories. One big selling point for these cases is their low cost. They range in price from about \$30 to about \$40.

PROS: Plastic, heavy-duty latches inspire confidence in longevity; lids can be opened without unstacking boxes from above; each box includes a window for labels; lowest-cost option.

CONS: Less customizable than other systems; largest box is still too small for certain tools.



Rugged and simple. The DeWalt boxes require two hands to latch and unlatch, but unlike the Bosch boxes, they can be opened while stacked. The boxes also share some features with the familiar cases DeWalt has packaged its tools in for many years, notably the thick plastic sidewalls and heavy-duty metal latches.

This beautifully thought-out system isn't cheap. Prices start at \$63 for an empty Systainer 1, which is about 3½ in. deep—good for jigsaws, drills, and the like. Festool/Tanos offers the most stock accessories (inserts, foams, colored and locking latches, dollies) to customize the boxes.

Systainers are an expensive but excellent quality platform for an infinitely customizable and addictive storage system.

PROS: A single latch secures the lids and joins the boxes together; new T-Loc Systainers are backward compatible with Classic Systainer boxes; has the most inserts and accessories.

CONS: Expensive.



One latch does it all. Festool's improved T-Loc boxes latch together with a simple twist of the same large knob that secures the lid, and they can be stacked atop the Classic boxes as well. Unlike other systems, the T-Loc boxes can be opened while stacked, an attractive selling point.

Sanding



DISK TYPE	AVG. PRICE PER DISK
Gator gatorfinishing.com	\$0.80
Grizzly grizzly.com	\$1.09
Klingspor VD900 klingspor.com	\$0.50
Klingspor VD980 klingspor.com	\$0.70
Mirka Abranet mirka.com	\$1.07
Mirka Gold mirka.com	\$0.32
Norton 3X nortonabrasives.com	\$1.14
3M 236U solutions.3m.com	\$0.62

BEST OVERALL
CHOICE

BEST VALUE
CHOICE

BEST OVERALL
CHOICE



Whether you work wood in a commercial shop or in your basement, you probably use a random-orbit sander. For any type of wood or grain, it can convert a surface from rough to finish-ready, without requiring a lot of skill. Therefore, we all go through tons of hook-and-loop disks, which are not cheap.

So it makes sense to ask: Which sanding disk works the fastest? Which offers the most

Disks

Our top picks let you work fast and save cash

ENDURANCE (MINUTES)				TOTAL REMOVED (GRAMS)				FASTEST REMOVAL				MOST ECONOMICAL			
								GRAMS PER MINUTE				GRAMS PER PENNY			
80	120	180	220*	80	120	180	220*	80	120	180	220*	80	120	180	220*
15	10	10	10	5	5	3	3	0.33	0.50	0.30	0.30	0.06	0.06	0.04	0.04
15	25	10	5	9	9	3	1	0.60	0.36	0.30	0.20	0.08	0.08	0.03	0.01
40	40	20	25	17	19	10	8	0.43	0.48	0.50	0.32	0.34	0.38	0.20	0.16
20	30	20	10	13	16	9	3	0.65	0.53	0.45	0.30	0.19	0.23	0.13	0.04
15	10	15	10	10	3	5	3	0.67	0.30	0.33	0.30	0.09	0.03	0.05	0.03
20	25	10	10	8	11	5	3	0.40	0.44	0.50	0.30	0.25	0.34	0.16	0.09
35	10	5	20	15	7	3	9	0.43	0.70	0.60	0.45	0.13	0.06	0.03	0.08
15	10	5	15	5	5	3	5	0.33	0.50	0.60	0.33	0.08	0.08	0.05	0.08

*Grizzly uses 240 grit.

bang for the buck? And most importantly, which yields the most finish-ready surface?

Four grits, six brands, eight types of disk

We tested eight widely available varieties of 5-in.-dia. hook-and-loop sanding disks: one each from Gator, Grizzly, Norton, and 3M, and two each from Klingspor and Mirka.

Except for Norton's ceramic alumina blend, all the disks use aluminum oxide as their primary abrasive. Most feature the common "C" weight paper backing, although the 80- and 120-grit Mirka Gold disks rely on the slightly heavier "D" weight, and Klingspor's VD980 line boasts the very stiff "F" backing. Mirka's Abranet uses an extremely light and porous polyamide fabric. Three product lines—Klingspor's VD900, Mirka Gold, and Norton—have a stearate coating meant to reduce loading and extend their life.

We tested each disk by establishing an initial rate of stock removal and stopping when this rate had dropped by 50%.

Our tests showed that, with careful sanding technique and a steady progres-



sion through the grits, all these products work well. If you want to work fast and cost doesn't scare you, search the chart for the disk with the highest grams-per-minute total. If your focus is on value for money, use the disk that scores highest on the grams per penny scale. The Norton disks proved fastest, while Klingspor's VD900 series was the most cost-effective. We awarded them both Best Overall and gave Best Value to the Klingspor. □

Andy Beasley contributed to this article.

What to Look for in a Level

Bubble or digital, the best models deliver accuracy and durability



Buying any tool takes a certain leap of faith, but buying a level may require the biggest. Most tools have at least some physical considerations—handle comfort, trigger action, overall quality of construction—but how do you judge a box-beam level?

Levels are tricky to assess because you're taking a gamble on long-term durability. Your level will inevitably be dropped, take a beating in the back of your truck, or slide down a wall and land on the floor. It's crucial to get a level that starts out accurate and stays that way. That's a hard thing to see, but it's far more difficult to achieve. In speaking with five manufacturers about how they make their levels, we learned that the quality and durability of a box-beam level are determined by the aluminum extrusion, the vial, and the way that vial is mounted.

The frame is the backbone

The frame of a box-beam level serves as an extension of the vials it holds and protects. That means the aluminum extrusion must start out straight, flat, and strong, and remain that way no matter how many times you drop the level or drop something on it.

ARROW-STRAIGHT EXTRUSIONS

Level makers design the frame but hire outside companies, such as manufacturers of aluminum ladders, to extrude aluminum to their specs.



1. RIDGED FOR STRENGTH
Box-beam levels often have ridges that run the length of the extrusion. The ridges add stiffness to the assembly, allowing makers to keep the frames thin and light.



2. THE BEVEL ANNOYANCE
Heavily beveled or rounded corners make it difficult to mark an accurate line. Sharp corners, on the other hand, are easily dented and deformed from impact, making it difficult to get a correct reading.

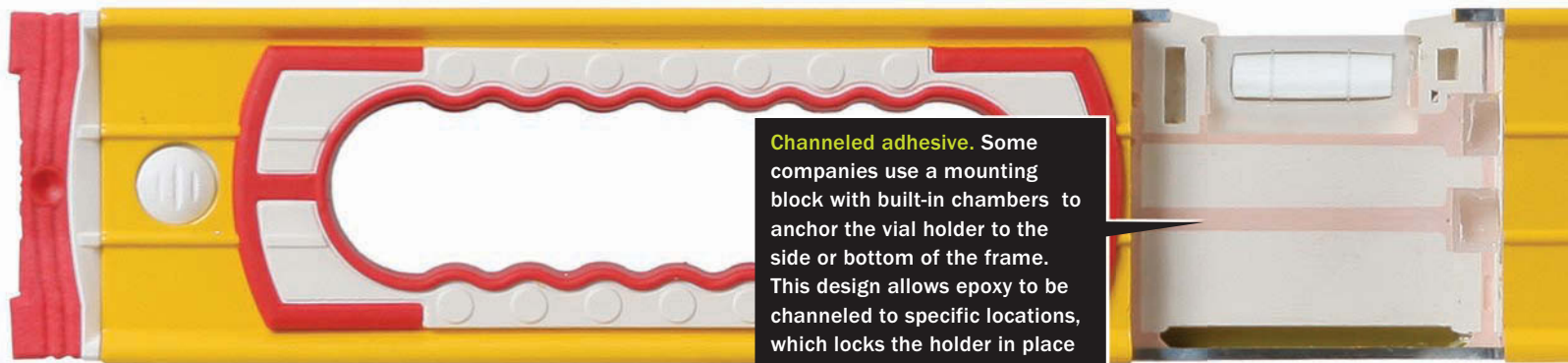


3. DEAD-FLAT EDGES
For accuracy, the edges of a box beam must be dead flat. Old levels used to be machined flat, but today's makers can create perfectly flat edges during the extrusion process. U.S. makers have kept the machine marks as a sign of quality.

4

**IRWIN
2500
SERIES,
24 IN., \$58**

4. CAPS ARE LIKE AIR BAGS
Protective end caps are made from impact-resistant materials and covered with rubber. Some caps are removable so that the level can be slid into a corner for accurate marking.



STABILA TYPE 196, 24 IN., \$70

Channeled adhesive. Some companies use a mounting block with built-in chambers to anchor the vial holder to the side or bottom of the frame. This design allows epoxy to be channeled to specific locations, which locks the holder in place inside the aluminum frame.

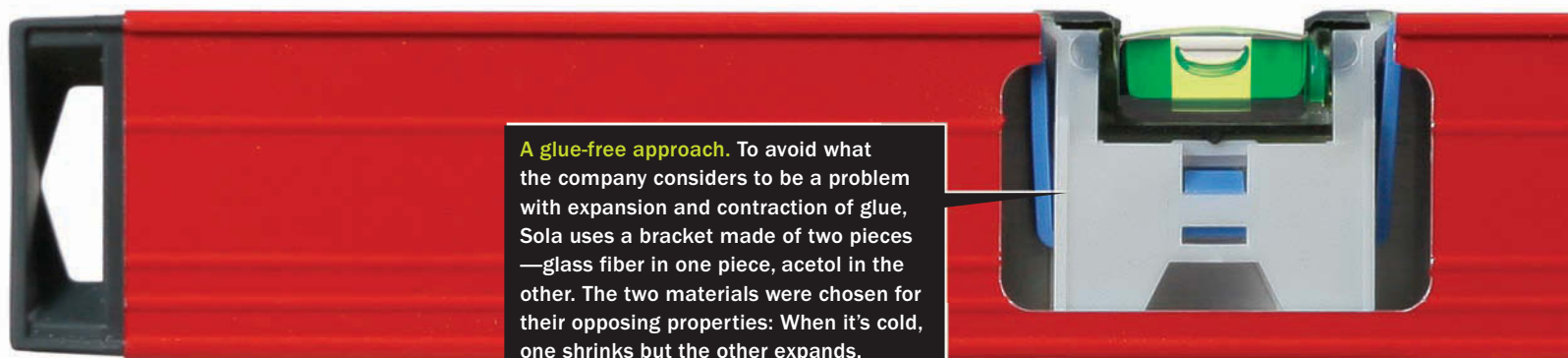


STANLEY FATMAX, 24 IN., \$23

Good old glue. Most levels rely on industrial-strength adhesives to secure the vial holder to the frame. Some are anchored to the rim of the cutout, others to the sides or bottom of the aluminum extrusion.

MOUNTING THE VIAL

A peek inside the frame of several box-beam levels shows that not all mounting systems are the same. Some vial holders are glued to the top of the frame, others to the sides or bottom. The process ranges from a blob of adhesive to more complicated holders that have channels to shuttle injections of adhesive to key positions.



SOLA BIG RED, 24 IN., \$65

A glue-free approach. To avoid what the company considers to be a problem with expansion and contraction of glue, Sola uses a bracket made of two pieces—glass fiber in one piece, acetol in the other. The two materials were chosen for their opposing properties: When it's cold, one shrinks but the other expands, so the vial stays in position.

If you cut a stack of box-beam levels in half and look at the profile of each, you can see differences: the size and shape, the size of the bevels on the edges, and the number and placement of holes for vials and handles. Other differences, such as the type of aluminum and slight differences in wall thickness, you can't see. All of these factors combine to strike a balance in cost, weight, strength, and long-term durability.

According to Mike Fraser, president of Stabila, the number-one failure in levels is bending, and that typically happens right over the center vial. The second-most-common failure is what he calls

“tip-overs and fall-ons,” when the level either falls onto something or something falls onto it. This is a big deal because not only will the level no longer read accurately after being bent, but a bent frame is also the only thing that will void the tool's warranty.

According to John Dwyer, vice president of sales and marketing at Johnson Level, “There isn't a level maker in the world that extrudes their own aluminum.” Instead, they farm out the extrusion process to dedicated manufacturers, where frames are built to each company's specs (see photos, opposite page).

Alan Karraker, president of Sola USA, says, “Getting a decent extrusion with the holes in the right place isn't that tough. The hard part is making the vial.”

Performance comes down to sensitivity and accuracy

Two types of vials are used in box-beam levels: tubular vials and block vials (see photos, p. 110). Regardless of the type of vial, there are two factors to consider: sensitivity and accuracy. The two are often confused, but they are very different.

Sensitivity is the relationship between the tilt angle of the level and the movement of



IN SEARCH OF THE PERFECT VIAL

Old levels had pairs of bent-glass vials, one for each reading position. Nowadays, a single vial replaces the pair and is designed to be read in both standard and inverted positions. Regardless of the type of vial or the way it's shaped on the outside, the curve inside the vial is cigar-shaped: tapered on both ends and wider in the middle (left).



TUBULAR VIAL

By its nature, a properly built tubular vial is an accurate level on its own. If you

were to roll the vial across a level table, the bubble would stay centered. This type of vial is often set into puck-shaped blanks that prevent the indicator lines, which are applied to the outside of these vials, from wearing off.



BLOCK VIAL

Most box-beam levels now use block vials made from a hollowed-out blank of acrylic. A block vial must be calibrated level after it's mounted in the frame. The indicator lines are applied

to the inside of the vial rather than the outside. This places the lines closer to the actual bubble, reducing the chance of the lines and bubble appearing askew of one another (called parallax error).



KAPRO ZEUS, 24 IN., \$44

0.029°

0.029°



ACCURACY EXPLAINED

The most commonly promoted standard is 0.029°, which means that to center the bubble, neither end of the level should have to be raised more than 0.029° from a level surface.

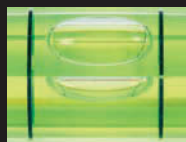
Room to grow. As temperature drops, bubble size increases, so level makers have to size the bubble so that it will never expand to the point of being wider than the indicator lines. A good vial will have in the neighborhood of one to two indicator-line thicknesses of space on each side of the bubble

Just the right radius. By playing with the curvature inside the vial, manufacturers can tweak the sensitivity of the level. The larger the radius (more flat), the more sensitive the level.

A bubble through thick or thin. If the liquid inside a vial is too thin, the bubble will dance all over, making it hard to get a sure reading. Too thick, and the bubble will separate when you tap on the level, a common situation for masons who tap on the tool with a trowel to set stones level with one another.



Vial shape matters, too. Any level can introduce parallax error, which can make the bubble and lines appear askew from certain angles. Block vials with crisp outer edges tend to have less parallax than rounded vials designed to magnify the bubble.



Easy on the eyes. Black indicator lines are still the norm, but on some levels, bands of color are used to cast a colored shadow on the bubble, helping to highlight its edges. Some vials even have glow-in-the-dark backgrounds to help in low-light situations.



the bubble. In other words, the higher the sensitivity, the faster the bubble will move. The two big factors that influence a vial's sensitivity are the viscosity of its fluid and the curvature of its inner walls.

Most level manufacturers keep the exact formulation of the liquid in their vials a secret, but according to Dwyer, mineral spirits is the foundation for the magic fluid. "It has a very extreme temperature range—so it won't boil and won't freeze—and it's slippery enough and has the right amount of surface tension so that the bubble will move but won't race around erratically."

According to Dave Ripplinger, vice president of sales and marketing for Empire, some level makers also create a smaller radius (steeper curve) on the inside of the vial, which makes it easier to keep the bubble in the center. "Imagine a marble rolling around inside a cereal bowl," explains Ripplinger. "It's pretty easy to keep that marble in the bowl, right? Now, put the marble on a sheet of glass and try to keep the marble from rolling off the edges."

In terms of a box-beam level, accuracy is a broad term that refers to the size and positioning of the bubble in the center of the vial. Small inaccuracies can translate into large inaccuracies over a long distance.

A level's accuracy is often listed as 0.029°, 0.5 mm/m, or 0.0005 in./in. (see center photos, facing page). Dwyer says that although the 0.029° measure has become the industry standard, "you're not going to find a board that's straight enough to even allow you to take advantage of that."

Fraser agrees: "We've found that when you go tighter than 0.029° accuracy, the user has not bargained for the consequence of the higher sensitivity that comes with it."

Many users also gripe about too big of a gap between the bubble and the vial's reading lines (see bottom photo, opposite page). To fill the vial, explains Dwyer, Johnson Level relies on the same type of machine used to fill capsules in pharmaceutical work. "It puts a precise amount of fluid in the vial, just enough to leave an air bubble that's almost, but not quite, touching the lines."

The reason the bubble can't be sized to fit exactly between the lines, explains Fraser, has to do with temperature. "The bubble expands with cold weather, so we have to size it to ensure that it will

never be larger than the space between the lines."

Vials should be easy on the eyes

The bubble inside a vial is just clear air. It's easier to see clear air when viewed against a darker background, so most manufacturers color the liquid in the vial. "What color is the most visible to the human eye?" asks Dwyer. "That's not something a marketing company determines. It's physics, and that color is green." Shades of yellow and green are most popular, but some manufacturers opt for an unconventional color to help them stand out against the competition.

Empire, for instance, uses blue liquid in its True Blue line of levels. The company, though, has received some complaints



For you, blue. Empire uses blue liquid in its vials.



All lit up. Stabila offers an optional onboard light pack that illuminates the vial in low-light conditions.

about the blue liquid turning to clear over time. "It's not that Empire can't use blue correctly," says Sola's Alan Karraker. "It's that nobody can. Blue liquid just doesn't work."

Mounted for the long haul

Years ago, glass vials were set into a level's wooden frame using plaster. Nowadays, manufacturers mount the vial to a holder, which is placed into the aluminum extrusion, tweaked to be level, and then secured in place. According to Fraser, durable vial mounting is a big part of what drives the price of a premium level. He says, "Imag-

ine a 12-ft. plate level. Your 1½-in. vial has to be calibrated to the very ends of that frame. That process is incredibly expensive and very tedious."

Karraker believes that "Stabila has unquestionably the best gluing system on the market." He acknowledges, however, that there's an inherent trade-off with gluing the vial holder to the frame. "The bad part of the glue is temperature. When it's cold, the glue shrinks. When it's hot, the glue expands. Over time, this expansion and contraction cycling can slowly move the vial out of alignment." Instead, Sola relies on a two-piece plastic holder designed to cancel out movement from expansion and contraction.

How do you choose?

The box-beam-level market is huge, and the price spread is wide, with a 48-in. level selling for anywhere from \$40 to \$100. In addition to the familiar brand names, house brands and private-label levels from major-brand tool companies are on the rise. "Distributors are punch drunk with level options," says Fraser, "and now you have multibillion-dollar shock-and-awe power-tool companies crashing the category." How do you choose? You can't see the inside of every level at the store, but you can use the information here as a guide when you're shopping.

Long-term use is the best indicator of quality, so it's also a good idea to ask around. Every carpenter you see at the store has a level in the truck and an opinion to go along with it.

Also, consider how often you will use the level. For occasional use, say for a do-it-yourselfer, a lower-priced level will do the job. If you're a professional who relies daily on the consistent accuracy of a level, the durability of a higher-priced model makes far more sense, and the extra cost is easy to justify.

Is digital worth the price?

Another option to consider when evaluating levels is going digital. The option is a pricey one but, depending on the type of

Online Extra

To see a video on choosing a box-beam level, go to FineWoodworking.com/TG2014.

Digital levels: Is a brain better than a bubble?_____

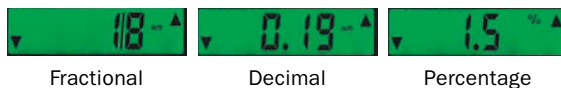
GOING BEYOND THE BUBBLE

PRECISE RESULTS

Digital models aren't more accurate than standard bubble levels; it's just that their accuracy is easier to take advantage of. Besides being kinder to aging eyes, a digital display means that you know exactly how level or plumb you are in inches or millimeters, and which way to move the tool if needed.

CUSTOMIZED OUTPUT

Digital levels allow you to read an angle or a slope as a fraction, decimal, or percentage. For example, the fractional mode allows you to lay a level across the floor of a doorway and know how much to remove from one jamb leg or the other on a prehung door; no homemade shim gauge is necessary.



FIELD CALIBRATION

It's easy to test a standard box-beam level for accuracy, but fixing a problem means returning the tool to the manufacturer. Digital levels can be field-calibrated.

FALSE ZERO

Digital levels can be zeroed at any setting, essentially establishing a benchmark angle so that you can easily repeat it. This is great for consistently pitching the framing on a deck or porch, setting concrete forms, pitching indoor and outdoor drainpipes, or finding cut angles for handrails and other sloped work.

AUDIO

The icing on the cake is an audio feature that beeps to indicate proximity to level or plumb, a true blessing when working in dim light or awkward positions where bubble visibility is compromised.

work you do, you may find digital worth the extra cost. If you compare professional-grade models, Stabila's accurate, durable, top-of-the-line 48-in. box-beam level costs just less than \$100. The digital version of that level sells for \$230. Why would you want to pay more than double the price? To answer that question, we ordered eight digital levels and put them to daily work.

After a few months of use, we concluded that for the simple plumb-and-level operations done by most tradesmen on a day-to-day basis, a digital level is far from a must-have. But we also really wanted to keep one. When you're working with levels day in and day out, a little bit more speed and accuracy can go a long way toward improving the quality of your work.

Bottom line: Digital levels cost much more than their bubble-vial companions; to some, that will be the end of the story. But in some circumstances, the added cost is in balance with the added functionality of these tools. They are extraordinarily easy (and fun) to use, mostly foolproof, and super accurate. At the end of the day, they not only enhance the functions of a standard box-beam level, but they also add features that aren't possible with a bubble vial. □

Justin Fink and Kit Camp contributed to this article.

Bandsaw Fences

An aftermarket model can work wonders



Tapping a bandsaw's fullest potential means using a high-quality fence, but some manufacturers treat this accessory as an afterthought. If your stock fence doesn't do all the things that the winning aftermarket fences shown here can do, think about upgrading.

We tested systems that fit 14-in. saws, but many also work on 16- or 18-in. saws. Resawing asks the most of a fence. For an accurate cut, you'll need a fence at least half as tall as the board you are slicing. If your 14-in. bandsaw has a riser block, it will make a 12-in. resaw cut, so for all these fences except the 6-in.-tall Grizzly, you'll need an easy way to attach an auxiliary fence.

Of course, the fence must be parallel to the blade horizontally so the blade doesn't wander, and vertically so you get an even slice. And you need the fence to stay put, with no movement and very little flex as you press against it.

When you need it, though, the fence should come off easily, either to make a cut that uses the full throat depth, or to move to the right of the blade to align it with the miter slot. It's also nice to have an accurate measuring system on the guide rail, with an adjustable, easy-to-read cursor. The best fences do two other cool things. One is switching to a low-profile orientation, which lets you fit a push stick between the blade and fence when making thin rips. Another is sliding toward you so the fence ends at the

blade. This is great for ripping boards to rough size, where the two halves sometimes bow and bind against a full-length fence.

There were two clear winners: The Best Value Kreg Precision Bandsaw Fence does everything you need, and the Grizzly Resaw Fence Complete adds a measure of convenience, making it Best Overall.

Asa Christiana contributed to this article.

READERS' RATINGS: BANDSAW FENCES

Readers liked Carter's Magfence and Laguna's Driftmaster better than our editors did, but agreed with editors on the Kreg fence.

- ★★★★★ 4.10 CARTER MAGFENCE II
- ★★★★★ 4.05 LAGUNA DRIFTMASTER BANDSAW FENCE
- ★★★★★ 4.02 KREG KMS 7200
- ★★★★★ 3.95 MAGSWITCH DUAL-ROLLER GUIDE W/STARTER KIT
- ★★★★★ 3.83 EXCALIBUR 90-075
- ★★★★★ 3.81 GRIZZLY H7587
- ★★★★★ 3.72 WOODHAVEN 7280 BANDSAW FENCE
- ★★★★★ 3.60 ACCUSQUARE 415688MB BANDSAW FENCE
- ★★★★★ 3.50 EZ SQUARE BANDSAW FENCE



GRIZZLY RESAW FENCE COMPLETE FOR 14-IN. BANDSAWS (H7587)

Street price: \$140
grizzly.com

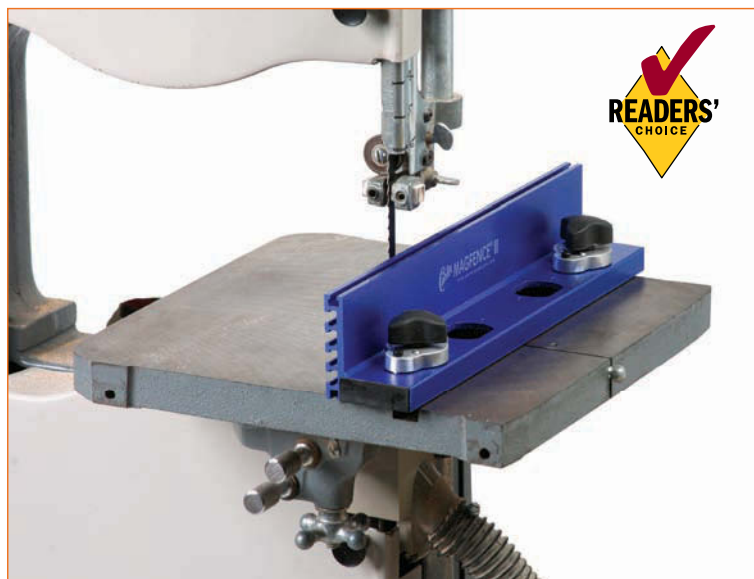
This Grizzly fence system is easily the best in the lot. It does everything the Kreg does (below), but it one-ups the Kreg with even smoother sliding action and an even better fence. The extrusion switches more easily from tall to low-profile, and its tall side is much taller, nearly 6 in., meaning you won't have to bother adding an auxiliary fence for resawing. And the extrusion can be taken off completely, leaving only the narrow cast-iron part of the fence for added ripping capacity. Our only quibble is the location of the lock lever, which made our tester's hand bump into long workpieces sometimes. Companion models H5788 and H5789 fit larger saws and tables, but you might have to do some DIY on the back rail for in-between sizes.



KREG PRECISION BANDSAW FENCE (KMS 7200)

Street price: \$107
rockler.com

The Kreg fence system is an excellent value. It goes on any saw easily, even saws bigger than 14 in. It adjusts nicely in every direction, moves well, locks securely at the same angle every time, and has a very accurate and readable rule system. Its extruded aluminum fence is a clever right-angle design, strong yet thin, so it doesn't steal as much throat capacity as some others. It has two T-slots for solid attachment of a tall fence, and a low-profile position. It can also be slid backward for rough ripping.



CARTER MAGFENCE II

Street price: \$100
carterproducts.com

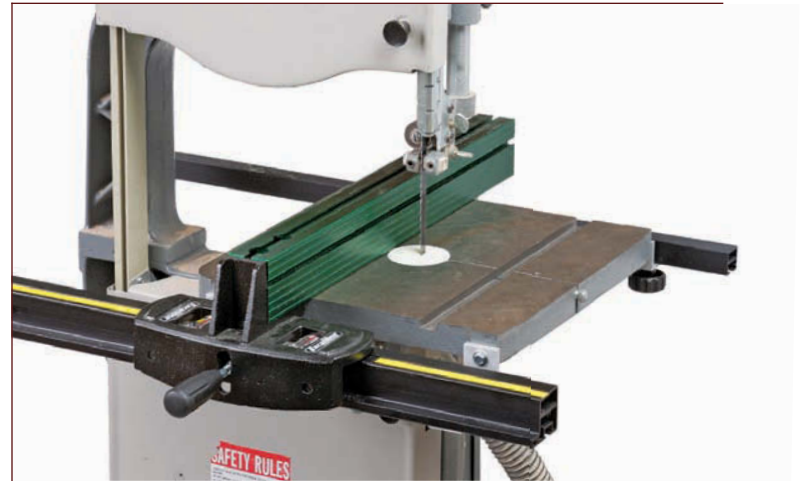
When it came to the Magfence, readers differed dramatically with our editors. We saw the Magfence's main asset—powerful magnets that lock it to the saw table with the turn of a knob—as also being its undoing. With no way to keep the fence in proper alignment, you are forced to put a square on the front edge of the saw table each time you adjust the fence, or measure to the miter slot in two places.



ACCUSQUARE MB BANDSAW FENCE (415688)

Street price: \$150
woodcraft.com

With a design very similar to the EZ Square (below), this is a solid fence with a few design flaws. If the fence is to the left of the blade, it is impossible to take it off the saw without removing its guide rail completely, which is tedious. We could live with that, but we also found it difficult to lock the fence reliably in a vertical square position. This is because the center clamping bolt is set too low so the fence rocks on it rather than sitting solidly on its plastic guide disks.



EXCALIBUR UNIVERSAL BANDSAW RIP FENCE SYSTEM (90075)

Street price: \$150
acmetools.com

The Excalibur, made by General International, is a very solid fence with some unique advantages. It is among the easiest to attach and adjust, comes in three sizes, and will fit any saw on the market. Also, its ball-bearing rollers give it the slickest sliding action. But the guide mechanism has too much slack, and the fence pivots up to $\frac{3}{8}$ in. as you lock it in place, making it hard at times to align the blade with a mark on a workpiece or measuring tape.



EZ SQUARE

Street price: \$150
ptreusa.com

This fence locks solidly but, like the Accusquare (above), is difficult to remove from the saw. You have to loosen the nuts that hold the guide rails in place in order to slide them over. Another problem is the low-friction plastic strip built into the fence. It sticks out a bit from the aluminum extrusion, lowering its effective height to 2 in., and at the same time making it difficult to add a tall fence. Also, the self-adhesive rule was printed in the wrong direction.



WOODHAVEN 7280 BANDSAW FENCE

Street price: \$150
woodhaven.com

The Woodhaven's fence is the only one that locks in the back and front. This makes it the most solid of all, but is also the source of its main drawback: It does not lock at the same angle each time. Its movement is also herky-jerky as you adjust it, and depending on which way you happen to be pushing, the fence can lock down crooked enough to make the blade wander, ruining the cut. It also lacks a ruler system.



MAGSWITCH DUAL-ROLLER GUIDE ATTACHMENT, PLUS STARTER KIT

Street price: \$100
mag-tools.com

The Magswitch resaw system is assembled from components while the Carter (see p. 114) is ready to go as is, but the two fences are very similar in design, with the Magswitch sharing the Carter's main drawback—an inability to stay aligned during adjustments.



LAGUNA DRIFTMASTER

Street price: \$395
lagunatools.com

Laguna launched its first Driftmaster bandsaw fence five years ago. We tested an updated version that has improved components and features—easier attachment and setup, a beefier lead screw (acme threads), and no interference with a bandsaw's lower door. It is a big, industrial tool, with a large dial that swings the tall fence quickly to any drift angle and a long screw that micro-adjusts the fence (a knob disengages it for big fence moves). Many woodworkers change blades when they dull and begin to drift,

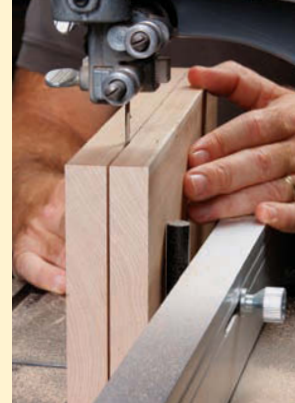
but if you had an industrial shop, with a big bandsaw dedicated to resawing, the Driftmaster would let you run big blades longer even when the drift angle changes.



Dial in the drift. No other fence makes it easier to adjust for blade drift, even to an extreme angle.

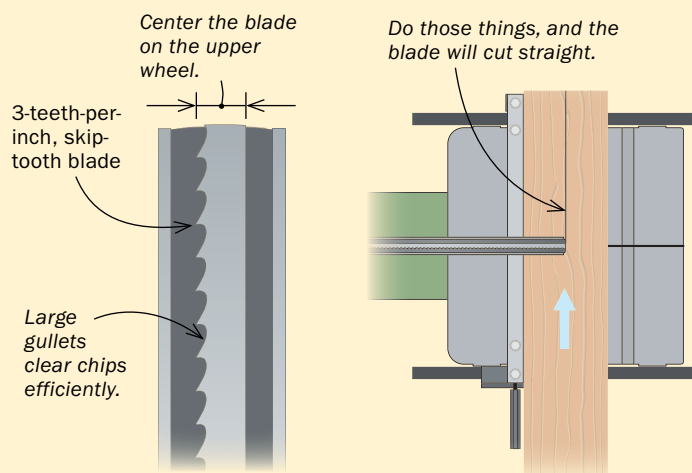
The best way to beat drift

The hot item on bandsaw fences these days is a single-point attachment for resawing. This pivot point lets you adjust a board's angle on the fly to match the blade's "drift." It is a bad fix for a series of misunderstandings about bandsaw setup. You don't want to have to guess at the drift angle, and you won't be able to get consistent cuts by constantly pivoting against a single point. The fact is, a bandsaw blade doesn't have to drift at all. Here's why so many do. For one, they have too many teeth, and therefore smaller gullets that can't effectively clear the chips from a tall resaw cut. Also, when blades dull, they tend to cut more on one side than the other. And last, the upper wheel on a bandsaw is crowned, so the key is to have the blade centered on it. We learned these tips from Michael Fortune, a furniture maker and *Fine Woodworking* contributing editor. Try them and you'll be amazed. By the way, you won't need that super-high blade tension that is so popular.



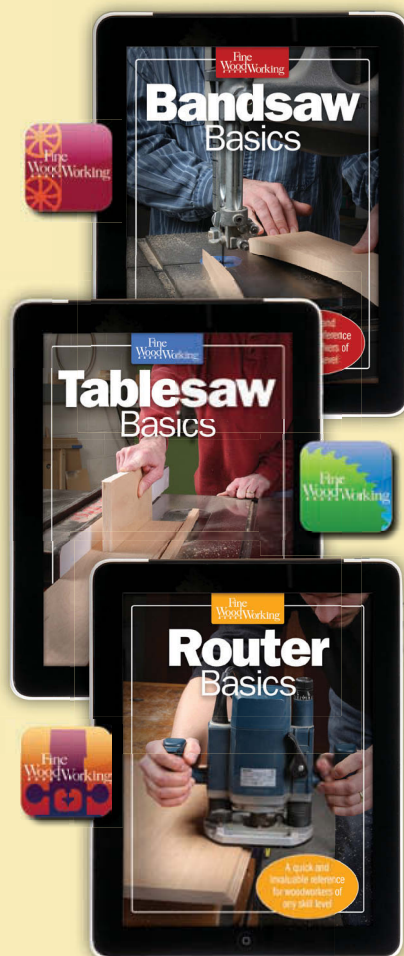
Single-point fence is a bad fix. It allows for drift adjustment on the fly, but cuts are inconsistent.

USE A COARSE BLADE AND CENTER IT



Alignment is easy. With the right blade and setup, you can just adjust the fence once, lining it up with the saw's miter slot, and leave it like that.

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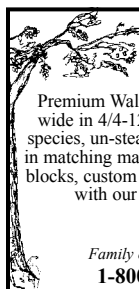
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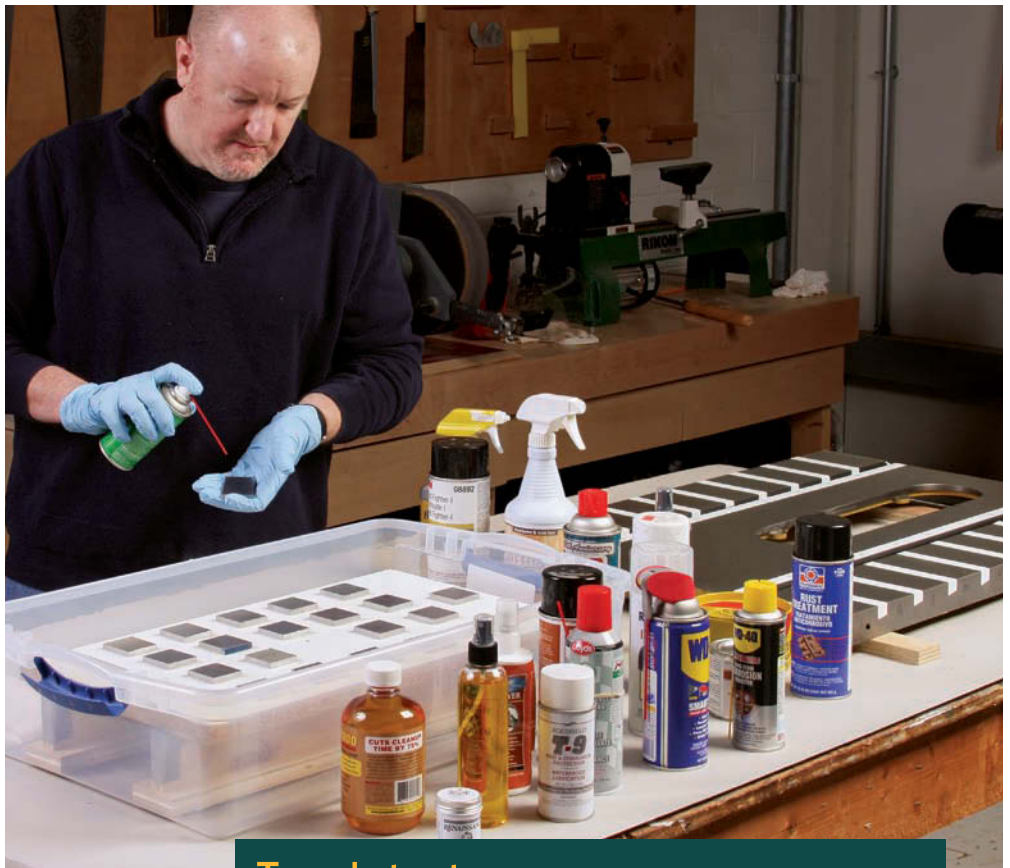
New products thrashed old favorites in our tests

If you live in a humid area of the country, you are more than likely familiar with the menacing presence of rust, especially if you work in an unheated basement or garage shop. To help protect your expensive woodworking tools, you need to take steps to prevent rust. One way is to coat iron and steel surfaces with a rust inhibitor. But which one?

Look on any woodworking forum or website, and you'll see a lot of recommendations about which products to use. To end the debate, we put 20 of these commonly available preventers—from waxes to natural oils to petroleum-based products—through a torture test to see which ones work best. Here we'll share the test results, along with some basic strategies for fighting rust. Before you can go to battle, however, it's important to understand how rust forms.

Water is the instigator

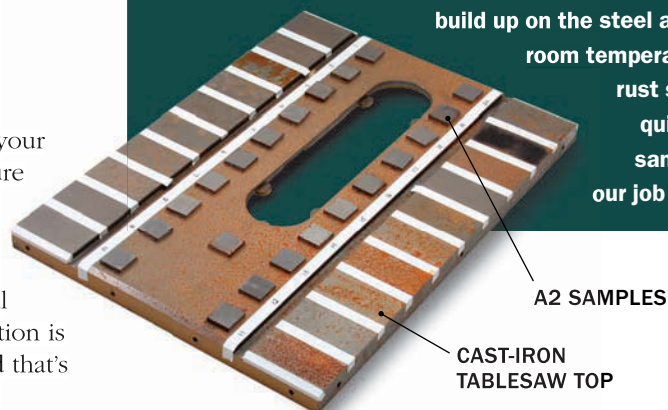
Rust (iron oxide) is a form of corrosion that occurs when both iron and oxygen are exposed to moisture, whether in the air or on the surface. That moisture is the medium through which the players that chemically cause corrosion travel. Rust formation can be accelerated with the addition of a stronger oxide or acid—the salt in sea air, for instance, or the moisture from your fingertips (ever see prints on your hand tools?). The process also speeds up with temperature variations that cause condensation. The corrosion starts on the surface and spreads like a rash. As corroded metal flakes away, fresh iron surfaces are exposed to the oxygen and water, and the process begins anew until the metal disintegrates. The key to stopping the degradation is to prevent water from mixing with iron and oxygen. And that's



Tough test

To test the rust preventers, we applied them to a cast-iron tablesaw top, leaving the center portion untreated to serve as the control. We spritzed water on the top, put it outside under an overhang, and waited. Our goal was to accelerate what happens over an extended period in some unheated garage spaces, where the top would be subject to the extreme temperature ranges of the outside air that would cause condensation.

We also applied the coatings to A2 steel samples. We placed the samples in a freezer for a few hours, removed them, and put them in a lidded plastic container. We repeated the freeze-thaw process once daily, to allow condensation to build up on the steel as it reached room temperature. The rust showed up quickly on some samples, making our job pretty easy.



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THE BEST OF THE BEST

We picked CRC Industrial 3-36 from the top seven performers as the Best Overall because it worked well on both cast iron and tool steel and did not leave an objectionable sticky or slick residue on the chisel. However, it does have a petroleum odor. Though the smell dissipates, some may find the spray offensive to use on hand tools. For those people, we recommend using the CRC for machines and Moovit for hand tools.



what these various coatings are meant to do.

10 days of hell

We tried the rust preventers on a cast-iron tablesaw top and some samples of A2 tool steel (an iron alloy) and subjected them to extreme environments. The rust came on strong. We started seeing it on the tablesaw top after only one night, and on the tool steel within 48 hours. After 10 days, it was clear which products were working.

The top seven performers were CRC Industrial 3-36, LPS 3, Moovit, Rust Block, WD-40, WD-40 Long-Term Corrosion Inhibitor, and 3M Rust Fighter 1. However, a rust preventer is useless if it interferes with your work. So we did further tests so see if any of the top picks would discolor wood, or interfere with finishes or glue adhesion. We applied the top six products to A2 steel samples, rubbed them across some sample boards, and applied oil- and water-based finishes on top of the boards. None showed any discoloration of the wood,

UNTREATED SAMPLES 	BOESHIELD T9 \$10 (4 oz.) rockler.com	CAMELLIA OIL \$12 (8 oz.) amazon.com
PERMATEX RUST TREATMENT \$10 (10.25 oz.) amazon.com	PROGOLD PG2000 \$11 (16 oz.) amazon.com	RENAISSANCE WAX \$23 (65 ml) rockler.com
SLIPIT \$10.25 (12 oz.) grizzly.com	TOPCOTE BY BOSTIK \$19 (10.75 oz.) woodcraft.com	TOPSAVER \$28 (8 oz.) amazon.com

FAMILIAR PRODUCTS FADED FAST

Waxes and natural oil-based products have often been touted as rust preventers on machines and hand tools. But they didn't fare well in our testing.



WAXES WANED

Waxes work well as lubricants, especially on the bottoms of planes and on machine tops, but they don't offer much protection against rust.

OILS SLIPPED UP

Camellia and Jojoba oils are natural products (made from vegetable oil), so they have a pleasant odor. That quality is partially why they are used often by hand-tool aficionados as a protectant. But in our tests, the products were marginal performers.



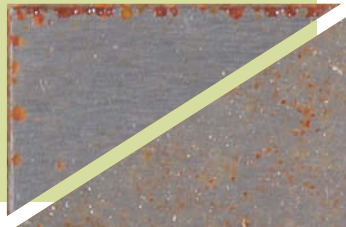
CRC INDUSTRIAL 3-36

\$6 (11 oz.)
amazon.com



JOJOBA OIL

\$12 (8 oz.)
lie-nielsen.com



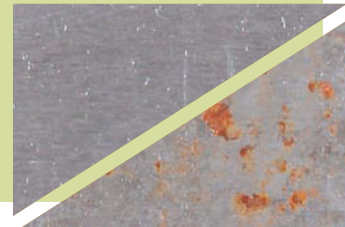
LPS 3

\$15 (11 oz.)
jdindustrialsupply.com



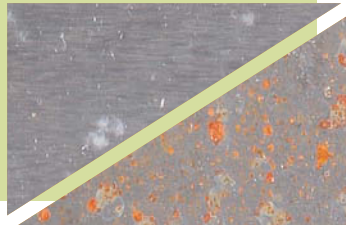
MOOVIT

\$10 (10 oz.)
leevalley.com



RUST BLOCK BY EVAPO-RUST

\$9 (16 oz.) gemplers.com



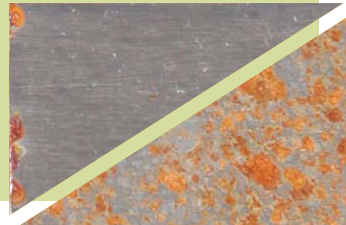
RUSTERIZER ARMOR

\$16 (32 oz.)
amazon.com



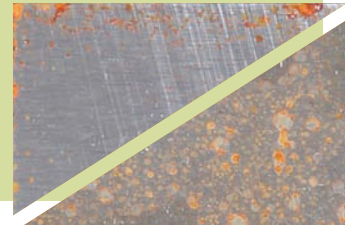
RUST-OLEUM STOPS RUST RUST INHIBITOR

\$7 (10.25 oz.) amazon.com



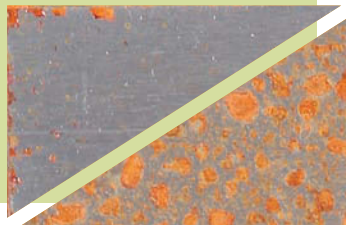
SC JOHNSON PASTE WAX

\$7 (16 oz.) The Home Depot



WAXILIT

\$16 (7 oz.) Johnson's
Workbench, 800-292-5937



WD-40

\$5.50
Most hardware stores



WD-40 LONG-TERM CORROSION INHIBITOR

\$16 (6.5 oz.) amazon.com



3M RUST FIGHTER-1

\$21 (18 oz.)
amazon.com



Other ways to manage moisture

and there were no problems with finish adhesion.

Last, to find out if any products left an objectionable residue on hand tools, we applied them to some chisels and then basically felt them, comparing an untreated chisel with the treated ones. The CRC Industrial 3-36 and Moovit were the favorites here. Each of these products were very close in feel to the untreated chisel. We also applied the products to a jointer table and gave them a feel for any objectionable residue. Most of the products left a slick surface on the cast iron, a plus for machine tables. The only two that left a visible and tactile residue were 3M Rust Fighter 1 and LPS 3.

The best defense

Two products, 3M Rust Fighter 1 and LPS 3, performed perfectly in both torture tests, but we didn't like the sticky feel of the coating that both left behind. Other products did well on one steel but showed kinks in the other. In the end we picked CRC Industrial 3-36 as Best Overall. If you prefer a non-petroleum product for your hand tools, we recommend Moovit.

But the best defense against rust has multiple prongs. Aside from weatherproofing and heating the shop, we also recommend using a dehumidifier to help control moisture. And because none of the products we tested can be applied to the inside of power tools (rust can degrade motor components), we recommend keeping desiccants or corrosion inhibitors in tool cases. □

Thomas McKenna contributed to this article.



Solutions for enclosed spaces. Volatile corrosion inhibitors (VCIs) and desiccants help prevent rust in drawers, tool cases, and cabinets. VCIs form a protective coating on tools while desiccants draw moisture from the air.



VCIs

DESSICANTS

The wipe-on or spray products we tested aren't the only weapons available in the battle against rust. Aside from heating the shop or using a dehumidifier, two other options are desiccants and volatile corrosion inhibitors (VCIs). These products prevent corrosion of critical components in contained spaces, such as boxes, drawers, and cabinets. Each does the job differently.

Desiccants are made from a number of porous minerals, including calcium and silica, as well as manmade

compounds. They help prevent rust by removing moisture from the air via the process of *adsorption* (vs. absorption). When a substance is adsorbed, it remains separate from its host, which essentially works as a storage drum. And that storage area is limited. A desiccant compound can become saturated, or full.

Some desiccants, such as

silica and a few calcium-based products, can be recharged, or reactivated, with heat to remove the stored moisture and used again.

VCIs emit molecules that settle on metal surfaces, forming a protective layer that repels moisture. VCIs are made by a number of manufacturers from proprietary chemicals and often are infused into a porous carrier material, such as foam. They are disposable and cannot be recharged—some last six months, others work for up to five years.

Desiccants and VCIs both are designed to work in enclosed spaces, and you purchase them based on the square footage of that space. To get the most protection from both products, the storage space needs to be as airtight as possible. If a drawer is left open, the protective tool coating emitted by a VCI will dissipate, while a desiccant will become saturated quickly.

Dry the air. You also can curb moisture with a dehumidifier—just remember to empty it regularly. For basement shops, a masonry waterproofing paint keeps moisture from migrating through the porous concrete walls. Garage floors should be sealed as well.





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