

2017

TOOL GUIDE



An inside look at what the pros use



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Over
160
tools
tested



Jack planes, p. 88

Best tools
of the year



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TOOL GUIDE



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VIDEO

How to hold work for routing

When it comes to routing, securing your workpiece is the key to safety and accuracy. But how do you clamp a workpiece while leaving a top or edge unobstructed for the router's path? This video shows you a few ways.



VIDEO

Try a track saw

Fine Homebuilding associate editor Patrick McCombe gives you the rundown on how to use a track saw and shows you why you should think twice before you write them off.



VIDEO

Saw like a pro

Like any hand tool, backsaws require skill to use well. You can buy a great saw, but you can't buy the skill to use it. With these exercises, you'll saw like a pro in no time.



VIDEO

Stuck on you

Super glue is a great at adhering things together, especially fingers. *Fine Woodworking* web producer Ben Strano shows you what to do next time you find yourself in a sticky situation.

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VIDEO WORKSHOP

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■ a textured two-walled box



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The Internet has given shoppers the upper hand. You can find better prices than ever, buy what you need without leaving home—any time of the day or night—and read dozens of reviews by other buyers. We believe in user reviews, too. That's why we survey thousands of our expert readers every year about the tools they own, and tabulate that into a rating on almost every product in this guide. But individual users can only get you so far.

What makes this annual *Tool Guide* special is the head-to-head tool tests. Even the most dedicated users can't do that. And our tool testers aren't just any users.

The tool reviews in this guide are unlike anything else available. They are culled from the pages of *Fine Woodworking* and *Fine Homebuilding* magazines, which conduct the toughest tests out there. Our expert, hand-picked writers range from professional contractors who use the tools on real job sites to passionate woodworkers who do the same in the shop. We understand what DIYers need, too. These real-world tests are designed to produce data that can be measured and compared, such as power, run time, and accuracy.

If you plan to buy a tool this year for woodworking, carpentry, construction, remodeling, or all-around home use, the 2017 *Tool Guide* will pay you back many times over. The right tool makes all the difference, and we have the real story.

—Asa Christiana, editor, *Taunton's 2017 Tool Guide*



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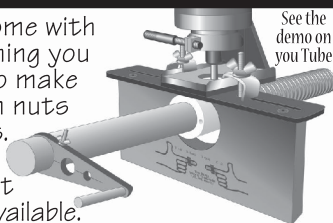


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Best Tools

The experts at *Fine Woodworking* and *Fine Homebuilding* test hundreds of new tools each year. Here are our favorites from this year.

SawStop offers its technology in a more compact package

Although it's designed for the construction industry, SawStop's new job-site tablesaw is strong and precise enough for furniture making. If you are looking for SawStop's skin-sensing safety technology, this compact saw is your most affordable option.

The saw can be folded up and set against a wall, where it takes up very little space. The collapsible stand is outfitted with wheels, making it easy to move. The saw has convenient onboard storage for the fence, miter gauge, spare blade, spare brake cartridge, and wrenches—it even has a spot for a tape measure.

The 15-amp universal motor had ample power. It handled $\frac{3}{4}$ -in.-wide dadoes without any trouble, and was able to rip $\frac{8}{4}$ hard maple (although we did have to slow the feed rate). The cabinet has a $2\frac{1}{2}$ -in.-dia. dust port connected to a shroud around the blade. Hooked to a shop vacuum, the saw did a very good job capturing chips and dust, especially with the blade guard in place.

Blade adjustments were easy and fast. One turn of the height-adjustment wheel takes the blade from below the table to full height. Angling the blade was just as fast. A quick release on the height-adjustment wheel allows you to tilt the blade in 1° increments, and there is a separate wheel for microadjustments of the angle.

We did have a few complaints. The motor is loud. We measured the noise level at 100 db. from 3 ft. in front



of the saw, and slightly higher from behind it. The saw's table is small. There is only 6 in. of table in front of the blade, which makes crosscutting with a miter gauge tricky. And speaking of the miter gauge, we'd replace it with a larger and more sturdy aftermarket one.

Overall, despite the minor complaints, it's a solid little saw, with SawStop's unmatched safety technology providing valuable peace of mind.

JOB-SITE TABLESAW BY SAWSTOP

- JSS-MCA
- \$1,299



Plenty of power for a dado set. With a $\frac{3}{4}$ -in.-wide dado stack on the arbor, the saw easily cut dadoes and tenons.



Super-fast height adjustment. One turn of the handle brings the blade to full height, but there is still enough finesse in the mechanism to fine-tune the height for precise work.



Great dust collection. With a shop vacuum hooked up and the blade guard in place, the saw collected just about all of the dust and chips created.

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Best Tools continued

Compact cyclone devours dust and chips

Cyclones are the most efficient dust collectors on the market, allowing super-fine filtration without sacrificing power. Oneida's Mini-Gorilla brings that engineering to a more compact machine, designed to be connected to one tool at a time.

Its small footprint (30 in. by 36 in.) is great for home shops, and its low height (63 in.) and swiveling, lockable 3-in. rubber casters make it stable and mobile. The 15-ft. power cord means you won't need an extension cord. Just add a short 5-in. or 4-in. flexible hose and a quick disconnect and you're ready to go.

We hooked up the Mini-Gorilla to a 16-in. jointer and aggressively jointed a 10-in.-wide white pine board. It had no trouble keeping up with the big chips that were coming at it fast and furiously. We also used it with a 13-in. benchtop planer. Again, it performed flawlessly. In addition to the cyclone separator, there is a HEPA-rated filter, which means it can trap 99.97% of particles down to 0.3 microns in size.

Dust collectors can be messy to empty and clean, but this one makes the job neat and fast. The dust level in the 36-in.-dia. clear bag can be seen through the window in the cover. Cleaning the filter is a breeze. Simply connect a shop vacuum to a port at the bottom of the filter, reverse-blow the filter pleats from the outside with compressed air, and the shop vacuum captures the dust.

With all of its features, this dust collector leaves nothing to be desired.

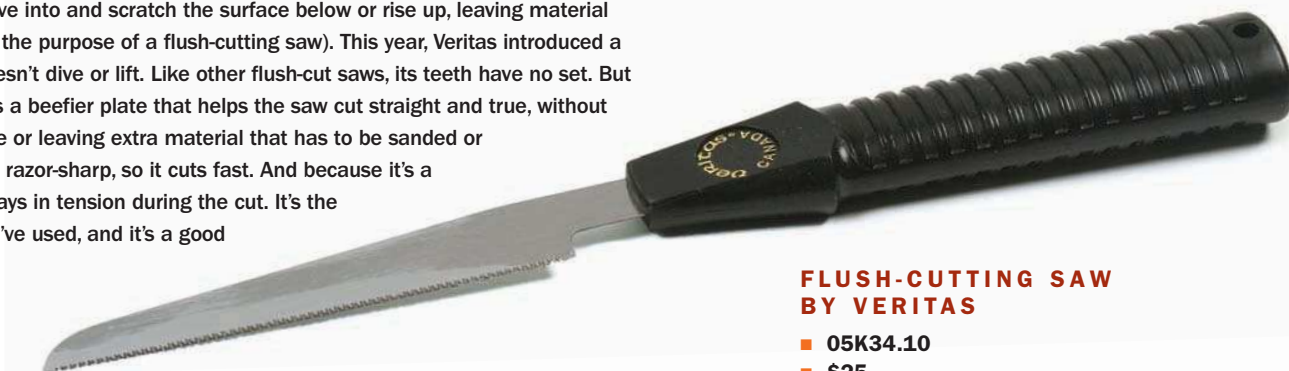


MOBILE DUST COLLECTOR BY ONEIDA

- Mini Gorilla
- \$1,049

Flush-cut saw won't leave scratches

A flush-cut saw is a must-have in any shop. They're great for trimming pegs and exposed joinery. The problem with these tools, though, is that they have a thin saw plate that can flex and either dive into and scratch the surface below or rise up, leaving material proud (and defeating the purpose of a flush-cutting saw). This year, Veritas introduced a flush-cut saw that doesn't dive or lift. Like other flush-cut saws, its teeth have no set. But the Veritas model has a beefier plate that helps the saw cut straight and true, without scratching the surface or leaving extra material that has to be sanded or planed. The teeth are razor-sharp, so it cuts fast. And because it's a pull saw, the blade stays in tension during the cut. It's the best flush-cut saw we've used, and it's a good value, too.



FLUSH-CUTTING SAW BY VERITAS

- 05K34.10
- \$25

Miter saw adds capacity without losing precision

SLIDING COMPOUND-MITER SAW BY MAKITA

- LS1018
- \$382

If you're looking to upgrade from a regular miter saw to a sliding model, take a look at the Makita LS1018 10-in. dual-bevel sliding compound-miter saw. It has the precision needed to make an accurate crosscut for a piece of furniture, and also easily handles jobs like rough-cutting a piece or trimming a long part to length.

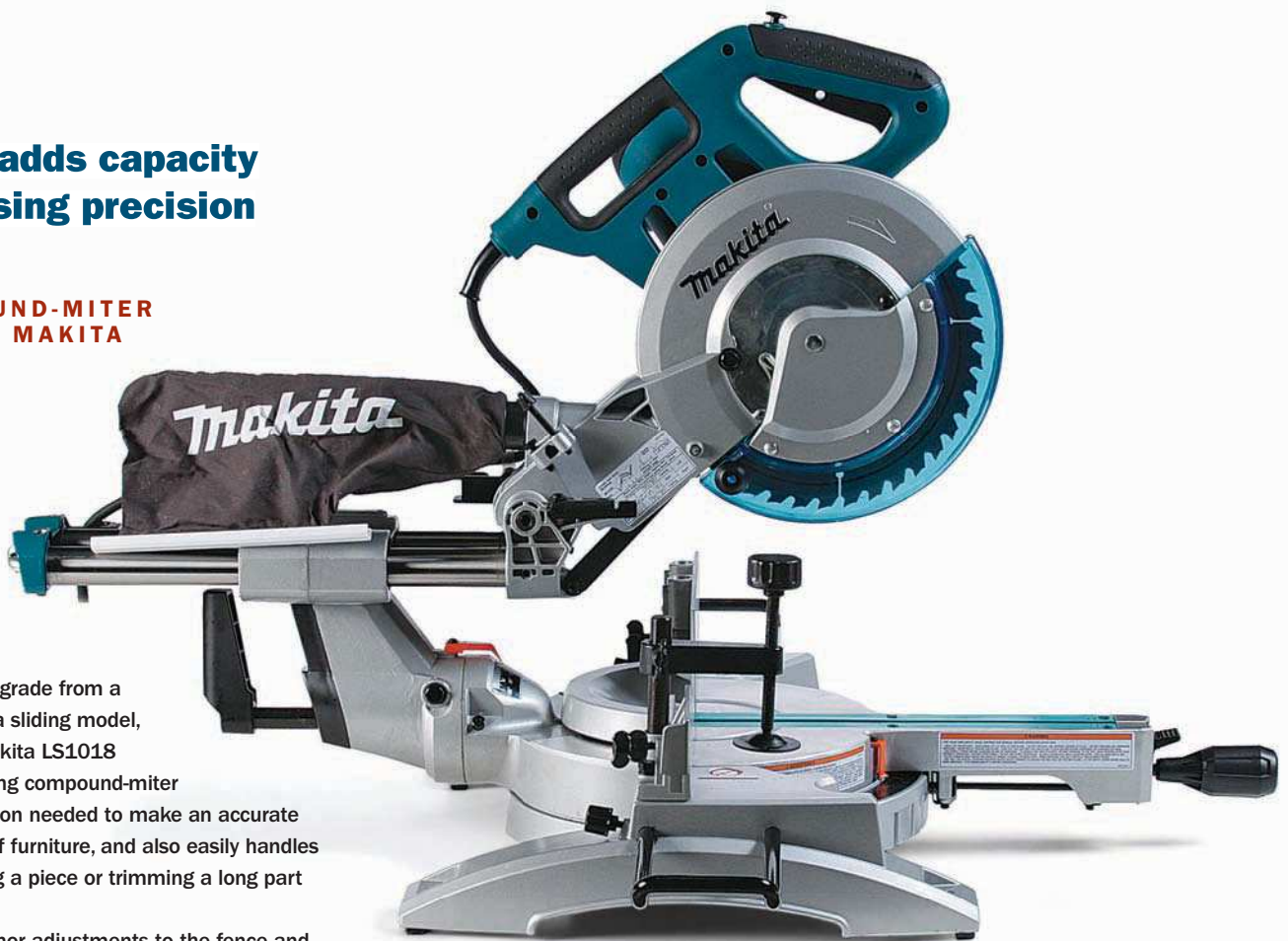
With only some minor adjustments to the fence and bevel stops, we used this saw to make cuts that any finish carpenter would envy. Soon, though, we had the saw dialed in even more precisely and were making furniture-quality cuts. From day one, the saw was pleasing to use. The sliding and chopping actions are very smooth and precise. The grip is comfortable and is oriented on the housing so you can use it with either hand with no trouble.

Changing the miter and bevel angles is intuitive and easy. The miter controls are at the front, while the bevel lock is at the back. Stops for 90° and 45° held the head assembly securely.

The supplied dust bag works well but fills up quickly (after about 20 to 30 cuts through wide boards). Dust collection was even better with a shop

vacuum hooked up to the port (1¼ in. inside diameter) on the back of the head assembly, collecting about 90% of the chips.

When set up for a 90° cut, the saw can handle boards up to 12 in. wide. At 45°, it can still crosscut an 8½-in.-wide board. That capacity is thanks to the sliding rails, but those rails have a downside, too: This saw takes up a lot of space. To put the saw on a countertop against a wall, you'll need a surface that's at least 33 in. deep, and another 10 in. of clearance in front of the saw for the miter control handle. Still, we like this saw and would be willing to find the space it needs.



Wide boards are no problem. You can cut clear through boards up to 12 in. wide with the blade set for a 90° cut. Angled for a 45° miter, the saw can still get through boards 8½ in. wide.



Convenient adjustments. Located on the front of the table, the miter lock is never far from your hand, and provides plenty of leverage to swing the saw for miter cuts in either direction.



Right for lefties, too. Oriented vertically and clear of the blade housing, the handle is just as easy to operate with your left hand as it is with your right.

Best Tools continued



HAND SANDER BY TIME SHAVER TOOLS

- Preppin' Weapon
- \$20

Smooth sander

The Preppin' Weapon by Time Shaver Tools is a sanding block in a league of its own. Originally developed for auto-body work, it's light, durable, and very effective at removing material.

The tool's contoured ABS plastic hand grip is comfortable and allows you to apply even and consistent pressure. The black rubber pad is perfectly flat and has just enough give to ease sharp edges when needed. The block takes quarter-sheets of sandpaper and is available in four colors, so you can dedicate a specific grit to each color.

The block's stainless-steel clips and levers, which were engineered for wet sanding, may seem unnecessary for dry sanding, but their smooth action makes it easy to load paper. The tool can hold up to four sheets of paper at a time, which protects the pad if you tear through a sheet by accident and gives you access to a fresh sheet in a few seconds.

When paired with quality sandpaper, the Preppin' Weapon will change your relationship with sanding. Using the tool is fast and satisfying, and we like that you don't need a battery or cord to get great results. Each block costs \$20. However, given the sturdy construction and stainless-steel hardware, the price seems fair.



CAMERA BY INFRARED DIAGNOSTIC

- Flir C2
- \$699

Thermal camera is a great value

Contractors use thermal cameras to diagnose problems in buildings such as leaks in roofing and flashing, insulation voids, air leaks, leaky ductwork, and faulty electrical components. A good thermal camera suitable for these tasks used to cost thousands of dollars, making it inaccessible to most of us. But now there's the Flir C2.

About the size of a typical smartphone, the C2 is compact, is easy to use, and has excellent image quality for an entry-level thermal camera. It also has what Flir calls MSX. With MSX turned on, an outline of the visual image is overlaid onto the infrared image. The combined image makes it much easier to tell exactly what you're looking at.

The C2 comes with 165MB of storage. At the camera's thermal resolution of 4,800 pixels, this is enough space for 500 paired (visual and thermal) images. You can download the images for project files and customer reports using the provided USB cable. Images also can be postprocessed using Flir Tools software. Other features include an adjustable color pallet, emissivity and distance settings, onboard flash, and auto orientation.

We wish the C2 had a removable memory card and built-in WiFi or Bluetooth connectivity, but considering the affordable cost, we won't complain. Plumbers, electricians, HVAC contractors, builders, and remodelers interested in expanding their diagnostic and troubleshooting capabilities should add a C2 to their toolbox.



Photos, left: courtesy of Andrew Young

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Best Tools continued

Pneumatic nailer is versatile and comfortable

If you're going to have only one nail gun in the shop, it ought to be an 18-gauge brad nailer. Delicate enough for small moldings but robust enough for more demanding woodworking jobs like assembling jigs and fixtures and installing crown molding, it strikes a great balance for a furniture shop.

Senco's new FinishPro 18BMg, which fires nails $\frac{5}{8}$ in. to $2\frac{1}{4}$ in. long, is lightweight (2.8 lb.) but solidly built with a magnesium body. It's compact and comfortable in the hand, thanks to a textured rubber hand grip. It's easy to load and has a depth adjustment and a swivel air connector. Other useful features include a belt hook and an LED headlight. These are great if you install cabinetry or woodwork. When nailing face frames onto $\frac{3}{4}$ -in.-thick cabinet parts, hitting dead center is critical, and the headlight helps focus on the target. The belt hook is useful when working on a ladder installing crown molding.

You can buy similar brad nailers for less money, but if reliability and comfort make a difference, the Senco is a smart choice.



18-GAUGE NAILER BY SENCO

- FinishPro 18BMg
- \$100

Snappy spring clamps are great for edge-banding



Pressure where you need it. Stretched over an edge-banding, Bandy Clamps spread clamping pressure evenly, ensuring a tight glue line.

There's a wide variety of techniques and clamps used to glue edge-banding to veneered panels. But Rockler's new Bandy Clamps change the game.

At the heart of the clamp is a strong and glue-resistant elastic band mounted in the mouth of a spring clamp. The spring clamp has extralarge swivel pads that grip the surface of the panel while the elastic band stretches tight over the edging. We've used them to glue edging to all manner of panels, from MDF to plywood to panels with melamine faces, and the clamp pads held tight to all of them. One caveat: Dust on the surface can cause the pads to slip, so make sure you clean the surface.

The elastic band applies pressure where it is needed most—along the outside edge of the banding. We have used the clamps extensively and so far the band has withstood the sharp corners of square edge-banding.

Bandy Clamps handle edging up to $1\frac{1}{4}$ in. thick, but still work great on thin banding if you use a caul to spread the pressure over a larger area. All in all, Bandy Clamps are very well designed, useful, and a great solution for gluing on edge-banding.



EDGE CLAMPS BY ROCKLER

- Bandy Clamps
- \$20 for two medium-size clamps, \$50 for combo pack (6 medium, 2 small)



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SPECIFICATIONS:

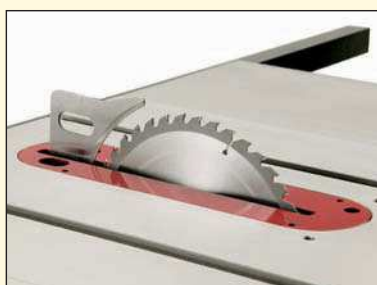
- Motor: 2 HP, 110V/220V, single-phase, prewired to 220V
- Amps: 16A at 110V, 8A at 220V
- Precision-ground cast-iron table w/wings
- Table size: 27"D x 40"W
- Floor-to-table height: 34"
- Footprint: 20"L x 21½"W
- Arbor: 5/8"
- Arbor speed: 3850 RPM
- Rip capacity: 30" right, 12" left
- Overall size: 60"W x 36"D x 40"H
- Approximate shipping weight: 416 lbs.

FEATURES:

- White powder-coated finish on cabinet
- Cast-iron trunnions
- T-slot miter gauge
- 4" Dust port
- Camlock T-shaped fence with HDPE face
- Easy-glide fence system
- Quick-release riving knife and blade guard assembly
- Knurled knobs for adjusting fence
- Includes regular and dado table inserts
- Poly-V serpentine belt drive
- CSA certified



★★★★★ **Five-Star Review**



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Best Tools continued



A less expensive platform ladder

About 18 months ago, Werner introduced the Podium ladder. At the time, it was available only in a Type 1A version with a 300-lb. capacity. Type 1A ladders are great for builders, but they're overkill for DIYers and tradespeople who use a ladder infrequently. Werner now offers a 250-lb.-capacity, 5-ft., Type 1 Podium ladder that allows users to reach a 9-ft. ceiling. The guardrail is molded to accept a number of useful accessories, including tool holders, a paint pail, and a fluorescent-lightbulb holder.

PODIUM LADDER BY WERNER

- PDFS100 series
- \$99



USB charger on the go

Having to walk to the truck to charge a dying phone or missing calls because of a dead phone can be a big hit to your efficiency, but you can keep your phone or tablet charged with DeWalt's DCB090 USB power source. This great little device slides onto a DeWalt 20-volt battery pack. It has a fuel gauge for monitoring the pack's remaining life and two USB ports that can provide up to 1.5 amps of charging power. When two USB devices are connected, it splits the 1.5 amps between the two devices. In addition to charging, it keeps a phone functioning in frigid weather.

USB CHARGER BY DEWALT

- DCB090
- \$29

Dust-collection hose fits small power tools



Perfect connection.

Rockler's new dust hose not only fits snugly onto many small tools, but it also pivots during use, making dust collection hassle-free.



It's a great idea to connect a shop vacuum to your random-orbit sander. With today's perforated sanding disks, the vacuum pulls the dust right off the wood, keeping the sandpaper and, more importantly, your nose and lungs clear. What's not so great is the combination of duct tape and hose adapter that many of us use to connect the vacuum to the back of the sander. It is hard to put the adapter on in the first place, and then it pops off in use.

Rockler solved this problem with its Universal Small Port Hose Kit, part of the Dust Right system. We were already fans of the Dust Right collapsible hoses, and the one on this accessory expands from 3 ft. to 15 ft. At one end is the standard 2¼-in. (outside diameter) fitting that plugs into all shop vacuums except the Festool. At the other end, you thread on one of two rubber ports, one at 1-in. inside diameter and the other at 1½ in. Each is flexible and ribbed inside for a firm grip. The larger port seamlessly fits two Porter-Cable sanders. The smaller one fits a Festool Domino perfectly, meaning it will fit the whole Festool family of tools. While neither port was perfect for the Ryobi and Ridgid sanders in our shop, the larger one worked great with a few wraps of duct tape over each tool's port. It might be a good idea to measure the ports on your tools to see if they are close to a 1 in. or 1½ in. outside diameter.

DUST-RIGHT SMALL PORT HOSE KIT BY ROCKLER

- 48212
- \$40

Ultracompact framer

A framing nailer is one of the most vital tools in a carpenter's arsenal. These nailers are typically bulky and heavy, though, so carpenters often resort to hand nailing or using a palm nailer when working in close quarters. That may all change with Paslode's most recent entry in the framing-nailer market. The new F325R compact framing nailer was designed with remodelers in mind.

The first thing you'll notice about this new tool is how light it is. The F325R weighs just under 6 lb. There's a tradeoff for reduced weight, however: reduced capacity. The F325R holds only one stick of nails, or about 42 shots. That can be a nuisance at first in production-style framing such as rolling trusses or nailing sheathing. But after a few hours of use, the frequent reloading becomes routine and the lightness of the tool makes up for any tedium.

Of course, our crew had to give the F325R the standard test of framing-nailer power: nailing laminated veneer lumber (LVL). Out of the 42 nails we shot, not one was left proud, an indication that Paslode did not compromise power in reducing size. We also used the tool to nail blocking and studs in a shower bay during a bathroom remodel. Here, closer to



FRAMING NAILER BY PASLODE

- F325R
- \$269

its intended purpose, the F325R really started to shine. At just 13 in. long, it fit in every bay, box, or hole we could think to stick it in. It easily toenailed the blocking in the 12-in. on-center stud bays, as well as the studs themselves. As we expected, the reduced weight made overhead nailing much more tolerable than it would have been with a conventional framing nailer.

The F325R does have a few downsides. Although it can be switched from sequential fire to bump fire, you have to remove a near microscopic O-ring to do that. The odds of finding and reinstalling this O-ring on a dusty, dirty job site are not good, so we didn't even attempt it. Paslode touts the tool as having a "quick two-step nail strip reload," but we found the process to be less than intuitive at first. Also, as with all Paslode nailers, an air fitting is not included. We would gladly pay \$5 more to have it ready to go straight from the box.

For remodelers and DIYers who don't do production framing, the F325R is all the framing nailer you will need. Your arm will thank you for the light weight and good balance of this tool.

Frustration-free hammer tacker

If you've ever used a hammer tacker to fasten felt paper to a roof, you're probably familiar with the sound of its spring-loaded follower skittering down the roof toward the ground. This is not a good sound, because it means a trip down the ladder in search of the follower while leaving the partially fastened felt paper to flap in the breeze.

And never mind the fussy process of aligning sticks of staples to fit in a hammer tacker's magazine, particularly when it's cold. Either you have to try to handle the fragile staples while wearing gloves, or you freeze your bare hands to the cold metal sides of the tool. It's even worse when you're trying to clear a jam in those conditions by removing a couple of tiny cotter pins that always seem to break or snap rings that require a tool to remove. We've used tackers from several manufacturers over the years and have found these problems to be endemic to the tool—until now.

We recently tried a Milwaukee tacker, which accepts readily available T50 staples in lengths from $\frac{5}{16}$ in. to $\frac{1}{2}$ in. The first thing we noticed is that the follower never leaves the tool, so you can't drop it. Loading it requires no alignment of staples and guides; you hold the tacker upside

down, withdraw the follower, and drop a stick of staples into the tool's bottom-loading magazine. Push the follower back in place, and you're ready to go. The housing above the driver end is reinforced with a steel plate that you can use to hammer staples flat, and there's a staple puller on the front. We've run a few thousand staples through the thing, and it hasn't jammed yet.

HAMMER TACKER BY MILWAUKEE

- 48-22-1020
- \$40



Get a Drill and Impact Driver for Less

These compact
12-volt tools
boast big power



Cordless technology has changed significantly in the past few years. With the combination of lithium-ion batteries and impact action, smaller 12-volt cordless tools are capable of performing tasks that required 14.4- or even 18-volt models 10 years ago.

There are many tools that fit this 12-volt category, but we focused on the two that are most valuable in a woodshop or on the job site, an impact driver and a standard drill, available as a kit with two batteries and a charger. Having both tools close at hand, one set up to drill holes and the other to drive fasteners, is a real advantage.

The batteries in this test are marketed as 12-volt, which is what they produce with



User-friendly features

As with any tools, performance is about more than power. Conveniences make a big difference.

Easy bit changes. The chucks on our favorite impact drivers allow bits to simply slip in (left) without a sleeve being pulled out. The chucks on our favorite drills lock when the trigger is released, letting you tighten them with one hand (below).



a fresh charge and the drill spinning freely, but all produce 10.8 volts in actual use. As you'll see, these compact workhorses boast a lot of power. And at prices between \$130 and \$170 (with one big exception), these two-tool kits are the best buy in cordless.

Impact driver is the star

The impact driver is an amazing invention. When the going gets tough, it applies a series of rotational blows to the drive shaft, creating a vibrating action that makes screws almost melt into the wood. Impact drivers require almost no pressure to stay



Light in the darkness. The Bosch and DeWalt drivers have three LED work lights on the extreme end of the tool. The others have single LEDs, which can be blocked by the user's hand.

How the kits stacked up



MILWAUKEE FUEL 2594-22

Price: \$260

Batteries: (1) 2 amp/hours,
(1) 4 amp/hours

With high-tech brushless motors, bigger batteries, and a higher price tag, Milwaukee's "Fuel" system doesn't quite fit the mix. But the batteries are rated at 10.8 volts, so we included them. The larger of the batteries adds power and run time. The drill has a larger-capacity, metal chuck (which locks for tightening) and a selector ring to switch between drilling and driving modes. The driver is the only one with two modes. It also has a handy, push-in chuck. Both tools have belt hooks and battery indicators.



BOSCH CLPK22-120

Price: \$130

Batteries: 2 amp/hours

The Bosch tools performed with the best of the more affordable kits yet are the smallest of the lot. The impact driver is especially tiny, allowing it to fit easily in a tool belt or shop apron. The driver also has three LEDs and a battery indicator. The drill sports a locking chuck. The only drawbacks to the Bosch tools are the fatter handles that come with stick-style batteries, and a chuck on the driver that requires you to slide a sleeve forward to change bits.



DeWALT DCK211S2

Price: \$150

Batteries: 1.1 amp/hours

The DeWalt tools also tested at or near the top (behind the Fuel), and we enjoyed using them around the shop and on the job. The pod-style batteries allow thinner handles, which are more comfortable. This comes at the cost of being bulkier overall than the Bosch, though not by much. The drill has a locking chuck, and the impact driver is quite compact, features three LED lights, and has a slip-in chuck. The DeWalt tools also have the most user-friendly belt hooks.

READERS' RATINGS: DRILL/DRIVER KITS

★★★★★	4.66	MILWAUKEE FUEL 2594-22
★★★★★	4.51	MAKITA LCT209W
★★★★★	4.49	BOSCH CLPK22-120
★★★★★	4.48	MILWAUKEE M12 2494-22
★★★★★	4.46	DeWALT DCK211S2
★★★★★	4.25	HITACHI KC10DFL

engaged, and are very easy on the hands and wrists. The only disadvantage of an impact driver is the noise: Ear protection is a must.

While the drills all have a standard chuck and will use any type of bit you own, the impact drivers accept only 1/4-in. hex-shanked bits. You probably already have some drill and driver bits like this, but if not, they are affordable enough.

Notes on the drills—The standard drills in these kits have a 3/8-in. chuck, except the Fuel, which will take shanks up to 1/2 in. dia.

We like drills with a chuck that locks when you release the trigger, letting you ratchet the chuck closed with one hand. All of the drills have a clutch, handy when you do happen to use them as a driver, and all have a variable speed trigger con-

trolled with a switch on top that determines the maximum rpm. For example, the DeWalt drill will run from 0 to 400 rpm on low, and 0 to 1,500 rpm on high.

Tough tests

To test these kits, we developed a range of tasks that would push the tools as far as a typical user would, and beyond. All the tests were performed with freshly charged batteries. To get an overall feel for each tool, we also took them to job sites and used them to bore hundreds of pilot holes, drive boxes of screws, and perform any other tasks that came along in the work of a finish carpenter and cabinet maker.

We developed different tests for the drills and the impact drivers. First, we compared the power and endurance of the drills. We



HITACHI KC10DFL

Price: \$125

Batteries: 1.5 amp/hours

The Hitachi tools were middle-of-the-road performers. We found the chuck on the drill to be rough on the hands, and it was the only one that required two hands to tighten. The tools have the same slim, comfortable handle as the DeWalts, but the batteries are bulkier.



MAKITA LCT209W

Price: \$140

Batteries: 1.3 amp/hours

The Makita tools' appeal lies in their compact design, second only to the Bosch. They slip easily into a tool belt, and the drill has a locking chuck. The tools also have a battery-level indicator.



MILWAUKEE M12 2494-22

Price: \$170

Batteries: 1.5 amp/hours

Identical to the Bosch and DeWalt in performance and features, the Milwaukee M12 tools missed out on a Best Value pick because of their added size and weight, and the single LED on the driver. Like its big brother (Fuel), the M12 drill has a metal chuck, an industrial feature that promises more durability.

chucked a $\frac{3}{8}$ -in.-dia. brad-point bit into each drill and bored as many holes as possible through a piece of 2-in.-thick hard maple. Milwaukee's Fuel drill blew everyone away here, with the DeWalt drill coming in second.

Next, we drilled as many holes as we could all the way through a hard, massive, old-growth fir beam, using a $\frac{3}{4}$ -in. Irwin Speedbor auger bit. We like this test because the lead screw on the bit pulls it into the work, helping to ensure that all the drills are pushed in the same way. Again the Milwaukee Fuel drill was the winner by far, with the DeWalt, the Bosch, and the other Milwaukee drill leading the rest of the pack.

Finally, we drove some #4 brass wood screws into a piece of hardwood (with pi-

lot holes) to test the range and sensitivity of each drill's clutch settings. All of the drills performed well in this test: It was easy to find a "just-right" number to countersink the screws correctly without stripping them.

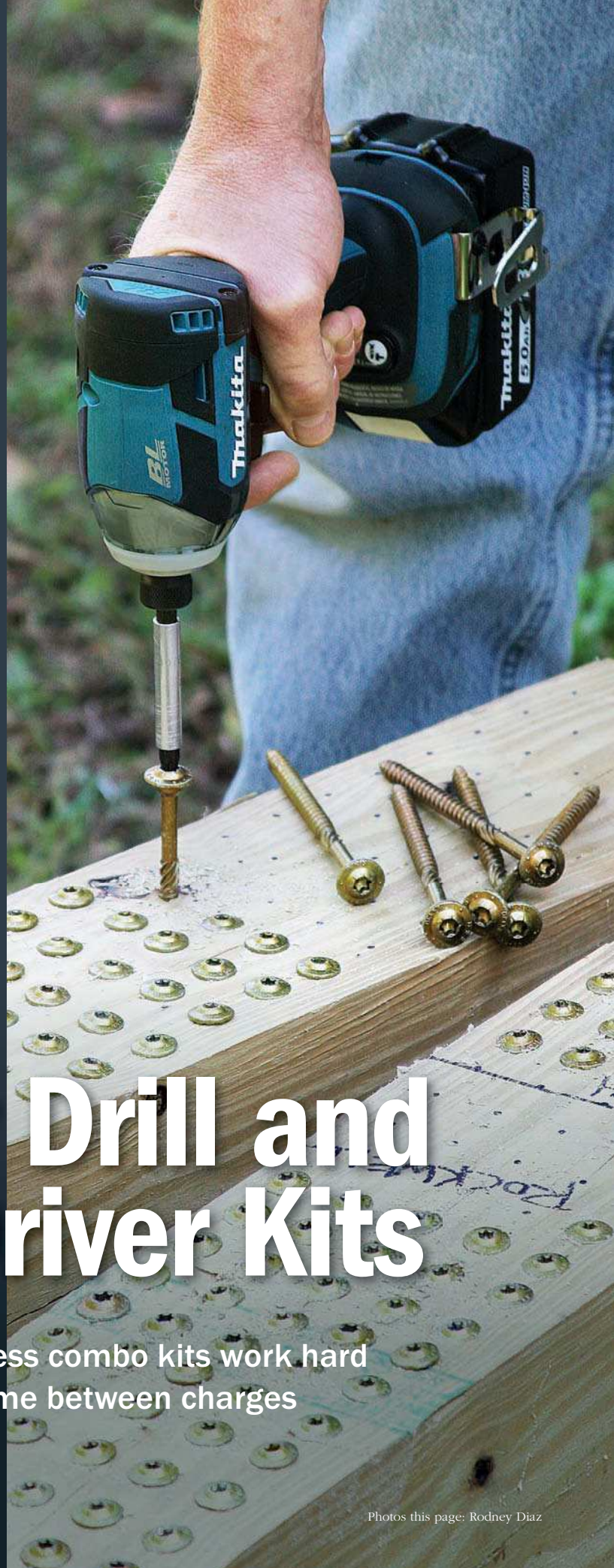
Then we moved on to the impact drivers, using the same old-growth fir beams, driving as many 3-in.-long, Torx-head screws as possible on a single battery charge, with no pilot hole. This should be a brutal test for a 10.8-volt tool, but all of the impact drivers were great performers here. We repeated this test a second time and averaged the results. The Milwaukee Fuel impact driver was an arm-wrecking beast again, driving almost four times as many screws as the Bosch, which came in second.

Last, we attempted to drive 4-in.-long screws into undersize pilot holes in very dense, tropical hardwood. This was too much to ask of these drivers, but all managed to drive the screws at least partially.

Plenty of winners

Milwaukee's Fuel kit ran away with the Best Overall award. At a much lower price than the Fuel, our Best Value picks, the DeWalt and Bosch kits, are the best choice for most woodworkers. And just behind the Bosch and DeWalt was the other Milwaukee, just as powerful in all of the tests, but edged out for being larger and heavier. □

Kit Camp, a shop teacher and finish carpenter in Portland, Ore., contributed to this article.



Hammer Drill and Impact Driver Kits

The tools in these brushless combo kits work hard and run for a long time between charges

MAKITA has more than 100 tools in its 18-volt Li-ion lineup, and the 5-amp/hour packs included in this kit are the largest-capacity batteries the company offers. The impact driver was the smallest of all the drivers in the test, which is great for hanging cabinets and working in other confined areas. The driver features three speeds plus a setting for driving self-drilling sheet-metal screws like those used for steel framing and installing ductwork. In this setting, the driver spins a screw at the optimal speed for drilling and then reduces the speed once the impacting starts. The single LED light produces a shadow if you use your free hand to guide a screw. Although the hammer drill was the heaviest of the bunch, it was comfortable to use. Unfortunately, the battery has to be on the tool to register the level of charge remaining. Other than that, this kit is almost perfect.



Makita XT252T

PRICE \$459

BATTERIES 5 amp/hour

WARRANTY

3 years (tools)

1 year (batteries)



Holes drilled: 64
Holes per amp/hour: 13
Time per hole: 32 seconds
Screws driven: 126
Screws per amp/hour: 25
Time per screw: 4.5 seconds

MILWAUKEE has several battery options, including 9 amp/hour—the industry's largest—and there are more than 40 tools in its 18-volt Li-ion lineup. The impact driver's chuck allows you to lock in a bit without pulling a collar. The LED light above the trigger provides plenty of illumination, but like all lights located in this position, shadowing can be an issue. There are three speed/impact settings, and the grip is comfortable, even during extended use. The hammer drill is heavier than most of the others but is well balanced and comfortable to use. This kit is one of our favorites in the test. The only problem is the blow-molded case, which, despite its size, lacks any real storage space for bits and accessories.



Milwaukee 2797-22

PRICE \$350

BATTERIES 4 amp/hour

WARRANTY

5 years (tools)

3 years (batteries)



Holes drilled: 62
Holes per amp/hour: 16
Time per hole: 23 seconds
Screws driven: 103
Screws per amp/hour: 26
Time per screw: 5.2 seconds

Cordless drills and impact drivers are as common on the job site as tape measures and hammers. Manufacturers are continually improving their tools and batteries in an attempt to build the cordless package that weighs the least, runs the longest, and stands up best to the rigors of job-site use. The latest improvement in this progression is brushless motors. We recently took a look at six brushless hammer-drill and impact-driver combo kits to evaluate their features and their performance in real-world tasks.

All of the kits come with two batteries and a charger and can be purchased as the base for a cordless-tool arsenal. Un-

fortunately, Rockwell offers only two other compatible tools: an oscillating saw and an impact wrench. But the other kits offer a larger selection of additional tools, ranging from circular saws and reciprocating saws to specialty metalworking tools and nailers. Manufacturers try to entice purchasers with low prices on these two-tool kits, hoping they'll buy additional tools and batteries later. This hope is justified, since most users want to stick with one battery platform.

Brushed vs. brushless motors

In a typical tool motor, the carbon brushes slowly wear away until they need replace-

READERS' RATINGS: 18-VOLT HAMMER DRILL/IMPACT DRIVER KITS

★★★★★	4.50	MILWAUKEE 2797-22
★★★★★	4.40	MAKITA XT252T
★★★★★	4.29	DEWALT DCK286D2
★★★★★	4.20	BOSCH CLPK250-181L
★★★★★	3.85	HITACHI KC18DBFL
★★★★★	3.83	ROCKWELL RK1807K2

BOSCH has more than 50 tools in its 18-volt Li-ion system and offers batteries rated up to 6 amp/hour. Three lights surrounding the chuck on the impact driver provide ample light with the workpiece in any position. An unusual chuck accepts both ½-in. mechanics sockets and ¼-in. hex-shaped driver bits. We found two drawbacks to this design: First, the tool is larger than the others; second, some bit holders don't fully lock into place. However, it was convenient not to need socket adapters when installing lags or tightening foundation bolts. Installing a driver bit takes two hands—one to pull out on the collar and one to insert the bit. Although it's not a major issue, two-handed bit changes are a little annoying. The light on the hammer drill is located above the battery and works well.



**Bosch
CLPK250-181L**

PRICE \$377
BATTERIES 2 amp/hour
WARRANTY
 3 years (tools)
 2 years (batteries)

Holes drilled: 24
 Holes per amp/hour: 12
 Time per hole: 47 seconds
 Screws driven: 40
 Screws per amp/hour: 20
 Time per screw: 9.5 seconds

DeWALT has more than 75 tools in its 20-volt Li-ion system and offers batteries rated up to 5 amp/hour. Three LEDs on the impact driver offer ample light around the driver bit, and the chuck allows you to push bits in without lifting the collar, making bit changes a one-handed operation. Along with the Rockwell, the DeWalt is the only impact driver that doesn't have adjustments for maximum speed and torque. This isn't an issue for most users, but it's something to consider for electricians and finish carpenters. The hammer drill is well balanced, is easy to use in any position, and has minimal vibration, making it comfortable during extended drilling of concrete. The single LED light located above the battery does a good job of illuminating the drill bit.



**DeWalt
DCK286D2**

PRICE \$300
BATTERIES 2 amp/hour
WARRANTY
 3 years (tools and
 batteries)

Holes drilled: 24
 Holes per amp/hour: 12
 Time per hole: 24 seconds
 Screws driven: 61
 Screws per amp/hour: 31
 Time per screw: 7.75 seconds

ment. Even worse, they create drag that steals from the motor's useful power.

Instead of brushes, brushless motors have electronic circuitry that alternates the current to the motor's magnets to make the motor rotate. The absence of brushes eliminates the efficiency-robbing friction and also allows for a more compact design for the motor and the tool.

Batteries vary

While all kits in this test contained lithium-ion (Li-ion) batteries, not all batteries had the same amp-hour rating. The higher the amp-hour rating, the more fuel the battery can hold. A higher amp-hour rating doesn't

make the motor more powerful or increase performance; it simply means the battery has a longer run time.

For each kit, we compared the number of holes drilled and fasteners driven to its batteries' amp-hour rating. This allowed us to evaluate performance on a more level playing field. We also included the gross numbers because they matter, too, especially since batteries are a large part of a cordless platform's overall cost.

Shared features

The tools in all six kits in this test share many features. They come with some configuration of LED worklights, although the

positioning and the number of lights vary, and some work better than others. All of the tools have a metal belt clip that can be mounted on either side of the tool.

Impact drivers are great for installing large screws and bolts and for tightening nuts. At full power, though, they're not well suited for smaller screws and tightening up delicate hardware, so all of the drivers except the DeWalt and the Rockwell have controls that slow the motors for greater precision when needed. This feature allows the same impact driver to go from installing ledger bolts for a deck to tightening canopy screws for a ceiling fan.

HITACHI has 30 tools in its 18-volt Li-ion lineup. The 3-amp/hour packs included in this kit are the largest-capacity batteries the company offers. A single LED light above the trigger illuminates the lower side of the bit, creating a shadow, especially when you're holding a screw to start it. The impact-driver housing is among the largest in the test, and the small trigger's shape makes it uncomfortable to use the tool for extended periods. Changing bits requires two hands. The hammer drill also has a large housing, but the tool is well balanced and comfortable to use. A single LED light above the battery illuminates the work area well. There are two features of this kit that we would change. The light is turned on and off with a button rather than the trigger, and the fuel gauge is on the tool instead of on the battery. Having the gauge on the battery is far more useful.



Hitachi KC18D-BFL

PRICE \$280
BATTERIES 3 amp/hour
WARRANTY
 lifetime (tools)
 2 years
 (batteries)

Holes drilled: 52
 Holes per amp/hour: 17
 Time per hole: 39 seconds
 Screws driven: 64
 Screws per amp/hour: 21
 Time per screw: 10 seconds

ROCKWELL has 2-amp/hour batteries and offers just two other tools in its 20-volt Li-ion lineup: an oscillating multitool and an impact wrench. This is the kit's biggest downside, as both the impact driver and the hammer drill offer performance and run time on par with better-known brands. The impact driver feels a little top heavy and is slightly larger than the other impact drivers. The single LED above the trigger provides decent light, but it doesn't have the beam spread of the tools with multiple LEDs. The chuck requires two hands to insert a bit. The hammer drill is well balanced and comfortable to use, and its single LED above the battery illuminates the work area well. This kit is best suited for someone who needs only an impact driver and a hammer drill. One huge perk: If you register the tool, Rockwell offers a 20-year warranty, including batteries.



Rockwell RK1807K2

PRICE \$275
BATTERIES 2 amp/hour
WARRANTY
 20 years (tools and
 batteries)

Holes drilled: 37
 Holes per amp/hour: 19
 Time per hole: 28 seconds
 Screws driven: 51
 Screws per amp/hour: 26
 Time per screw: 4.5 seconds

Hammer drills can drill and drive normally, but also power through masonry when you activate the hammer function. All have two speeds and multiposition clutches.

Top picks

The two kits that we reached for the most were the Makita and the Milwaukee. The Makita impact driver fastens more screws faster than any other driver tested, so its kit is our pick for Best Overall. Because the Milwaukee kit costs \$109 less than the Makita, we made it our Best Value. □

Jeremy Hess, a remodeler in Elizabethtown, Pa., contributed to this article.

How we tested

In addition to using the kits on our own job sites for several weeks and loaning them to friends in the trades for their input, we did some standardized tests to check battery life and drilling/driving speed. To test the impact drivers, we drove $\frac{3}{8}$ -in. by $\frac{5}{8}$ -in. GRK structural screws into a pressure-treated 6x6 post. Starting with a fully charged battery, we ran the big screws one after another until the battery's electronic circuitry cut power to the motor. We did three trials of each tool and averaged the results.

To test the efficiency of the hammer drills, we drilled $\frac{1}{2}$ -in. holes into 4-in. solid concrete blocks until the batteries died. In this case, we did two trials and averaged the results.

Rotary Hammers

We test the handiest size of these masonry masters

Home-improvement contractors use rotary hammers all the time. For starters, it's the perfect tool to drill holes for fastening all kinds of things to concrete and masonry—everything from bottom plates and 2x nailers to storage shelves and hose reels. They also use them for chain-drilling a ring of small holes when they need to make a really big hole, such as one for running a 4-in. duct through a stone or block wall for a dryer or bathroom vent.

Rotary hammers are also great for chipping. In fact, a rotary hammer equipped with a 1-in. chisel is the ideal setup for separating tile from a mud-bed or wood subfloor. It's also great for widening an existing hole in concrete, such as for a basement sump pit. And it is beyond handy for digging holes, breaking up and prying out stones for deck footings, and for breaking concrete and digging when working on plumbing under a slab foundation.

We recently tested seven rotary hammers head-to-head. We chose the SDS-plus 1-in. size because for a remodeler, it's a perfect fit for most tasks. Although too small for major demolition, these tools will drill small-diameter holes and chip tile all day long. They are also surprisingly affordable.

This class of rotary hammer is sold in two styles: pistol grip and D-handle. Some prefer the pistol-grip style because it's more compact and more comfortable to use one-handed. Bosch, DeWalt, Hilti, Makita, and Metabo submitted pistol-grip models for the test. Milwaukee doesn't offer a 1-in. pistol-grip model, so they sent their D-handle equivalent.

Fast concrete drilling

Once you use a rotary hammer for drilling small holes in concrete and masonry, you'll be hard-pressed to go back to the howling whine of a hammer drill. Although there are notable differences among the models in this test, there really isn't a bad tool in the bunch. All drill holes in concrete like they're supposed to. They are also nicely balanced

READERS' RATINGS: ROTARY HAMMERS

★★★★★	4.51	BOSCH 11253VSR
★★★★★	4.41	HILTI TE2
★★★★★	4.36	METABO KHE 2444
★★★★★	4.32	MILWAUKEE 5262-21
★★★★☆	4.10	MAKITA HR2611F
★★★★☆	4.06	DeWALT D25133K





Three classes of rotary hammer

Choosing a rotary hammer can be confusing. In addition to the three basic classes of the tool, there are several models within each class. Class is based on the size of bits and chisels. More specifically, it's the size of the shank that fits into the hammer's quick-release chuck. The smallest and most common size for residential work is SDS-plus. Made for chipping and drilling relatively small holes, SDS-plus tools are inexpensive.

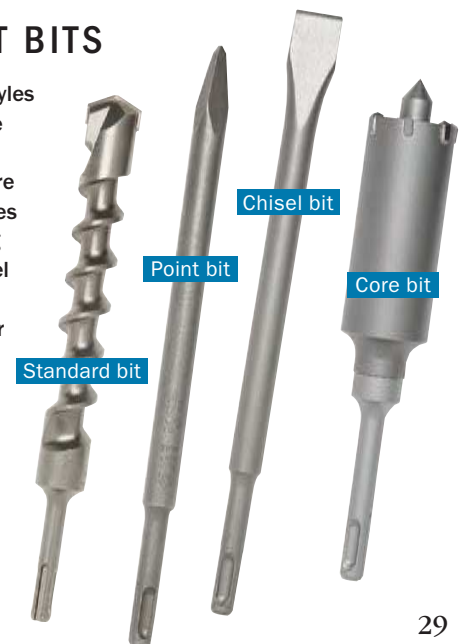
The next class is SDS-max, which includes considerably larger tools that can drill holes more than 2 in. wide with a twist-style bit and up to several inches wide with a core bit (essentially a hole saw for concrete). In addition, SDS-max hammers can run larger chisels and other useful accessories ranging from ground-rod drivers to small tampers.

The largest class of rotary hammer is the spline style. Tools in this class are used in commercial work and offer the largest hole sizes and chisels.

Within the three classes, there is an even greater breakdown in the size of tools and the size of holes they can drill. In the case of a 1-in. rotary hammer, **1-in.** refers to the maximum size hole the hammer can drill with a conventional twist-style bit. Rotary hammers are also rated by their optimal hole size. In the case of the 1-in. tools tested here, most have an optimal hole size of $\frac{3}{16}$ in. to $\frac{5}{8}$ in. When you're considering a rotary hammer, choose a model that's rated for the holes you regularly drill. Keep in mind that all types of rotary hammers can be found at rental yards.

A BIT ABOUT BITS

The many sizes and styles of bits and chisels give a rotary hammer its versatility. Point bits are meant for starting holes in concrete or creating spots for a larger chisel to get a good bite. Chisel bits are used for breaking up concrete and masonry and for removing tile. Core bits can drill the largest holes.



HOW WE TESTED

To test these rotary hammers, we drilled hundreds of holes into concrete—both straight down and out front, simulating what it's like to attach a deck ledger to a concrete wall. For consistency, we included a speed test using a 10-lb. weight instead of muscle power. And just to be mean, we installed a 1-in. bit and repeatedly buried it in 4 in. of concrete. We also spent hours chipping concrete at a low angle and then straight down like when you're enlarging a sump pit.

Online Extra

To see a rotary hammer drill in action, go to FineWoodworking.com/TG2017.

and feel good when held in both typical and awkward positions. After drilling, our testers drove concrete screws into the holes to see if there was any bit of wobble that might enlarge the holes and affect the screws' grip. Every screw held tight.

As a speed test, we weighted each tool with a 10-lb. sandbag, then used it to drill two $\frac{5}{32}$ -in. holes in a factory-made concrete paver. The Milwaukee stood out with a nearly 2.5-second lead over the slowest tool, the DeWalt. However, a speed test is not indicative of a rotary hammer's overall performance. The reality of most projects is that you drill a few holes at a time, then put the tool down; you're not building a stadium with a million holes to drill for seating. Our aim with the speed test was to see if there was an underperformer in the lineup. There was not.

It is rare in remodeling jobs to drill much larger than a $\frac{3}{4}$ -in. hole through a wall. But a 1-in. hole for a new gas pipe or conduit is necessary on occasion, so we chucked up 1-in. bits and went for broke. The Bosch and the Makita punched hard, delivering smooth operation with little torque transferred back to the user. They also had minimal vibration, which kept our hands from buzzing afterward. The Metabo seemed to labor during this test, and the Hilti, which admittedly is the smallest tool of the bunch, was a middle-of-the-road performer. The Milwaukee vibrated more than the others but also delivered fast, consistent drilling.

MAKITA HR2611F

Seconds to drill a $\frac{5}{32}$ -in. hole in concrete: 4.7

Warranty: 1 year

Price: \$180

The Makita is sufficiently balanced and agile to hold out front for mounting everything from a TV bracket to deck ledgers, but it still has enough mass for effective chipping straight down and at low angles. It also has plenty of power for drilling larger holes. Its cord is 160 in. long, and its function dial is easy to adjust and to read. The forward-reverse switch requires you to manipulate it intentionally, making an accidental direction switch nearly impossible. The solidly built kit box has sensible compartments that separate the bits from the tool, making it easy to coil the cord and latch the lid. The trigger lock doesn't engage accidentally, and it works easily when needed. The chisel adjustment setting is a valuable addition to the tool.



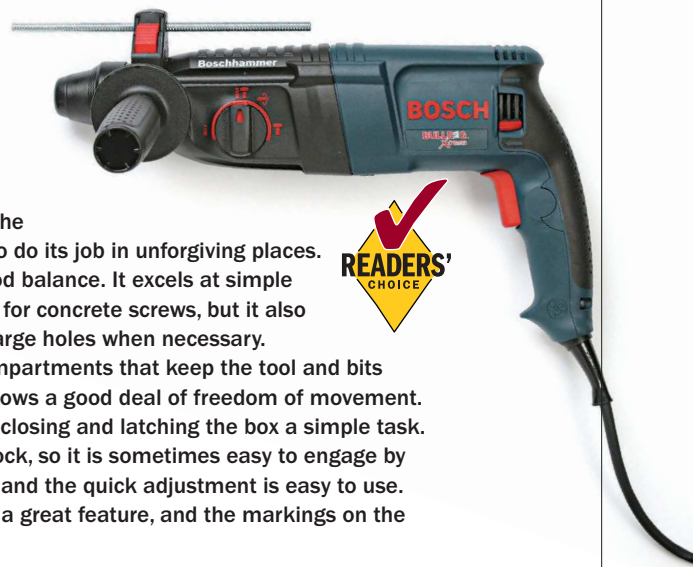
BOSCH 11253VSR

Seconds to drill a $\frac{5}{32}$ -in. hole in concrete: 5.6

Warranty: 1 year

Price: \$215

This tool is a sweet blend of all the things a rotary hammer needs to do its job in unforgiving places. It has minimal vibration and good balance. It excels at simple tasks such as drilling pilot holes for concrete screws, but it also can chip concrete and hog out large holes when necessary. Its well-designed kit box has compartments that keep the tool and bits separate. At 101 in., the cord allows a good deal of freedom of movement. It also coils easily, which makes closing and latching the box a simple task. The tool doesn't have a trigger lock, so it is sometimes easy to engage by accident. The depth rod is steel, and the quick adjustment is easy to use. The chisel adjustment setting is a great feature, and the markings on the function dial are easy to read.



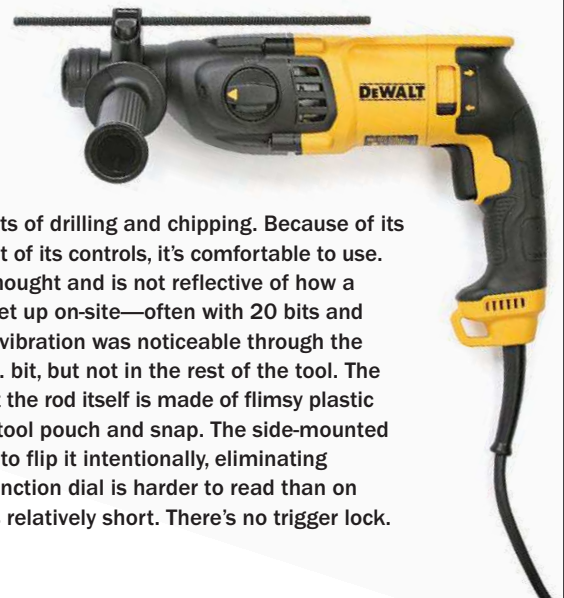
DEWALT D25133K

Seconds to drill a $\frac{5}{32}$ -in. hole in concrete: 5.9

Warranty: 3 years

Price: \$175

This tool performed well in all aspects of drilling and chipping. Because of its good balance and the sensible layout of its controls, it's comfortable to use. Its box, however, feels like an afterthought and is not reflective of how a rotary hammer is transported and set up on-site—often with 20 bits and some grease rattling around. Some vibration was noticeable through the side handle while drilling with a 1-in. bit, but not in the rest of the tool. The depth-rod adjustment works fine, but the rod itself is made of flimsy plastic and is likely to catch on a ladder or tool pouch and snap. The side-mounted forward-reverse button requires you to flip it intentionally, eliminating accidental direction changes. The function dial is harder to read than on other tools, and at 93 in., the cord is relatively short. There's no trigger lock.



HILTI TE2

Seconds to drill a 5/8-in. hole in concrete: 4.5

Warranty: Lifetime

Price: \$326

If all you do is drill and hammer, this is a comfortable, low-vibration tool. But it doesn't chip. For a premium cost, it's hard to justify losing an important function. While the tool drilled well with small and large bits and is well balanced for driving holes laterally or straight down, its performance isn't as good as its price tag is high. The function icons are easy to read, and the side-mounted function dial makes it easy to change settings. The depth rod is steel and adjusts with a twist of the side handle. The trigger lock is easy to engage but is still flush with the pistol handle, so it's hard to activate accidentally. The forward-reverse switch requires you to change it intentionally. At 152 in., the Hilti's cord is among the longest. The tool itself drills great, but at \$100 more than its nearest competitor and without a chipping function, it's overpriced.



METABO KHE 2444

Seconds to drill a 5/8-in. hole in concrete: 5.5

Warranty: 3 years

Price: \$200

The most compact of all the tools tested, the Metabo's comparative lack of mass showed up in various degrees of vibration across all tasks. Still, the tool worked hungrily, taking on the big-bit test serviceably. Its box, however, is a miss. The blow-molded plastic takes up room that should be reserved for bits, precious few of which can be stored with the tool. The hammer's steel depth rod, operated by turning the side handle, works easily. The forward-reverse switch is like that on a drywall gun. It's easy to engage, but you have to be intentional about it. The function dial's black-on-black markings can be difficult to see. Still, the knob works easily. The trigger lock can't be engaged accidentally, and the 148-in. cord is reasonably long. The Metabo is compact and performs well, but it did labor a bit under duress, and its kit box doesn't sync up with how users organize bits.



MILWAUKEE 5262-21

Seconds to drill a 5/8-in. hole in concrete: 3.6

Warranty: 5 years

Price: \$180

This D-handle unit produces a lot of vibration when chipping and drilling with large bits, but it easily accomplishes what rotary hammers need to do. The fit and finish are nice, and the power is abundant. The tool's blow-molded box has robust buckles but room for only a few bits. If you prefer a D-handle rotary hammer, this model is worth considering. One small annoyance was the forward-reverse switch, which is mounted on the trigger handle. We found that it's a little too easy to knock the tool into reverse inadvertently. Also, at 91 in., the cord is the shortest of the bunch. On the plus side, there is no trigger lock, the chisel adjustment setting is great, and the depth rod is much better than that on any of the other tools.



Chipping and breaking

Whether it's separating tile from whatever's underneath it or pounding off the edge of a rock that won't clear out of a post hole any other way, chipping is an important task for a rotary hammer. The Bosch and the Makita performed the smoothest, and we were able to take surprisingly large chunks off the edge of a sidewalk slab. The Milwaukee exhibited the most vibration from the tool body right on through the side handle. The DeWalt seemed to vibrate only through the side handle, which was peculiar, but it otherwise was a good performer. The Hilti has no chipping function, so it sat out this test.

Controls and kit boxes

Except for the Hilti, all the tools have at least three settings: drill only, drill and hammer, hammer only. The Bosch, the Makita, and the Milwaukee also have a fourth setting that enables you to position the chipping iron. Pulling the trigger causes the iron to rotate slowly to whatever position you want. This lets you get the chisel in the right position without resorting to bumping the tool's trigger several times.

We think a functional kit box for carrying all the bits and chisels is a key component of a rotary hammer, so we considered those too when testing.

The bottom line

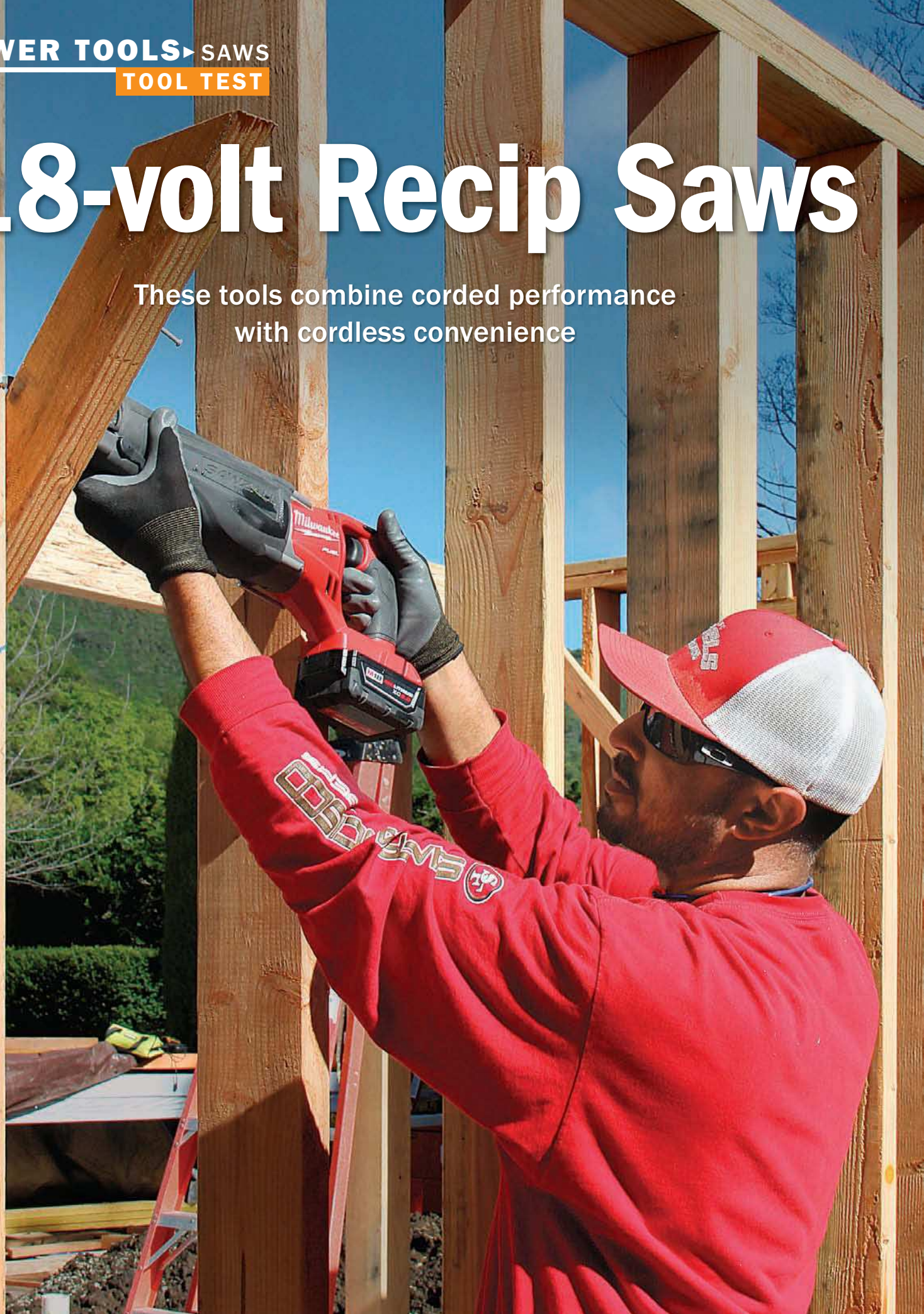
For some tasks—such as working directly over a hole or for repeated straight-down drilling—the longer body of the D-handle Milwaukee hammer is an advantage. Generally speaking, though, the pistol-grip tools ran smoother and were more comfortable to use. They're also more compact, which comes in handy when you're working in tight spaces. The pistol arrangement also worked better at a low angle, which is the way you would use a rotary hammer for chipping up tile.

Its well-designed box, smooth power delivery in all functions, good balance, intelligent controls, long cord, and affordable price make the Makita our choice as Best Overall and Best Value. Bosch is a close second for all the same reasons. □

Professional contractors Mark Clement, Andy Doyle, Matthias Lowjewski, and Derek Schroeder contributed to this article, as did Fine Homebuilding associate editor Patrick McCombe. Irwin provided new bits for the test.

18-volt Recip Saws

These tools combine corded performance
with cordless convenience



SPECS VS. REAL-WORLD PERFORMANCE

Most saws have a 1½-in. stroke and produce around 3,000 strokes per minute, so their performance should be nearly equal. Yet testing reveals that their cutting speeds vary greatly.

SPEED TEST

With the material mounted in a sturdy stand and a weight hung from the front of each saw (10 lb. for metal; 20 lb. for wood), we made 12 cuts in a Douglas-fir 2x12

and in ¾-in. black pipe to test cutting speed. After throwing out the two fastest and the two slowest times, we averaged the remaining eight times.

RUN-TIME TEST

To determine run-time for each saw, we used the same test rig to make as many cuts in a Douglas-fir 2x12 as possible. To prevent overheating, we switched blades after

every five cuts. Because batteries vary, we divided the number of cuts by the respective battery's amp-hour rating. All of these saws are 18-volt models except for the Hilti, which is 21.6 volts.

MODEL	SPEED TEST (SECONDS)		RUN-TIME TEST		
	2x12 Douglas fir	¾-in. black pipe	Total cuts	Amp/hour of battery	Cuts per amp/hour
Bosch CRS180	12.8	8.6	29	6	4.8
DeWalt DCS380	11.9	7.5	27	5	5.4
Hilti WSR 18-A	14.4	17.2	36	5.2	6.9
Hitachi CR18DGLP4	15.7	10.3	13	3	4.3
Makita XRJ03	14.5	9.6	18	5	3.6
Metabo ASE 18 LTX	13.4	12.4	28	5.5	5.1
Milwaukee M18 Fuel 2720	8.8	5.3	38	5	7.6
Ridgid Gen5X R8642	10.4	6.7	27	5	5.4



Cordless reciprocating saws allow you to make cuts with less setup and free you from the weight and hassle of extension cords. We tested eight of the most popular 18-volt lithium-ion (Li-ion) models. Although some of the saws are available in kits that include a battery and a charger, many are sold only as bare tools. For the sake of testing, we asked each manufacturer to provide the highest amp/hour battery it currently offers. This allowed us to determine each saw's maximum capability, which for the best of them is on par with corded recip saws.

In addition to using the saws for general remodeling, we ran each one through a series of tests to gauge cutting speed and run-time (see chart, above). Before each test, we put fully charged batteries and new blades into the tools: Lenox Gold Power Arc blades for wood and Diablo Steel Demon carbide-tipped blades for metal. To avoid overheating, we switched tools after every five cuts.

Improved features

Toolless blade clamps are now the norm. With the DeWalt, Hitachi, Metabo, and Milwaukee saws, you remove and install blades by retracting a spring-loaded lever on the side of the housing. We like these mechanisms because they're easy to get to,

even when you're wearing gloves. The rest of the saws require you to twist a spring-loaded ring on the blade holder. All the saws have two-way blade clamps that allow blades to be installed right side up or upside down. The DeWalt goes one step further with a four-way clamp that also allows blades to be installed facing left or right for easier flush cutting.

The shoes on most of the saws can be adjusted in and out from the housing, allowing you to extend the life of blades by shifting to a fresh set of teeth. The Hitachi, Milwaukee, and Ridgid saws have built-in LED lights aimed at the blade. The Milwaukee is the only tool with a rafter hook.

For light or intermittent use, any of the saws tested would do the job, but for everyday use and long bouts of heavy cutting, the Milwaukee saw is our choice for Best Overall. It's comfortable to use, cuts faster, and has a longer run-time than every other model.

The Ridgid saw is nearly as comfortable as the Milwaukee and came in a close second in cutting speed. At about \$60 less than the Milwaukee (bare tool), it's an easy pick for Best Value.

David Frane, a carpenter in Alamo, Calif., contributed to this article.

READERS' RATINGS: CORDLESS RECIP SAWS

★★★★★	4.39	MILWAUKEE FUEL 2720
★★★★☆	4.19	BOSCH CRS180
★★★★☆	4.16	DEWALT DCS380
★★★★☆	4.14	MAKITA XRJ03
★★★★☆	3.97	HILTI WSR 18-A
★★★★☆	3.81	HITACHI CR18DGLP4
★★★★☆	3.81	RIDGID R8642
★★★★☆	3.79	METABO ASE 18 LTX



MILWAUKEE M18 FUEL SAWZALL 2720

\$179 (bare tool); \$299 with one 4.0-amp/hour battery and a charger; \$129 for one 5.0-amp/hour battery

This saw cuts about as fast as corded models and faster than the other tools tested—in most cases by a significant margin. The only tool with a brushless motor, this saw made more cuts per charge with a 5.0-amp/hour battery than saws equipped with higher-rated batteries, and it made more cuts per amp hour than any other saw tested. Features include an LED light and a handy folding rafter hook. The blade clamp and adjustable shoe are both controlled by levers. The only bad thing we can say about this saw is at 9.1 lb., it's the heaviest tool in the test. It's available as a bare tool and in a kit with one or two 4.0-amp/hour batteries.



RIDGID GEN5X R8642

\$119 (bare tool); \$499 for a five-tool combo kit with two 4.0-amp/hour batteries and a charger; \$119 for a 5.0-amp/hour battery

The Gen5X recip saw was surprisingly fast, cutting 2x12s and black pipe faster than all but the Milwaukee. The run-time was average, but the saw cut smoothly and with minimal vibration. Features include a ring-style blade clamp, an adjustable shoe, and an LED activated by the trigger or a separate switch below. It's the only model with two cutting modes: straight and orbital. But don't let this sway your decision; orbital action greatly increases vibration. Most companies dropped this feature long ago, when wood-cutting blades designed to mimic orbital action rendered it unnecessary. This is a very nice saw; perhaps the only downside is the limited number of tools in Ridgid's cordless system.



BOSCH CRS180

\$119 (bare tool); \$177 with one 4.0-amp/hour battery and a charger; \$129 for one 6.0-amp/hour battery

Lighter than average, this saw has good power but vibrates during heavy cutting. The housing tapers heavily in front and is easy to grip, and a lever above the handle locks the trigger and selects either high or low speed. The blade clamp is better than average; spent blades are ejected with the twist of a ring, and the clamp remains open until a new blade is inserted. The saw is available in combo kits, as a one-battery (4.0 amp/hour) kit in a bag, or as a bare tool with or without a carrying case.



DeWALT DCS380

\$119 (bare tool); \$259 with one 3.0-amp/hour battery and a charger

The best thing about this saw is how little it weighs (6.6 lb.). The worst thing is that it vibrates at all speeds. The saw is fine for intermittent use, but it's uncomfortable for long bouts of heavy cutting. Features include a shoe that adjusts with the push of a button, a lever-activated blade clamp, and a unique four-way blade holder that allows you to install blades with the teeth facing up, down, left, or right. The saw is available in combo kits, as a bare tool, and in a kit with a 3.0-amp/hour battery.



HILTI WSR 18-A

\$209 (bare tool); \$489 with two 5.2-amp/hour batteries and a charger

Hilti's battery packs contain two extra cells, boosting the power to 21.6 volts. Despite its higher-voltage batteries, this tool is a slower-than-average cutter and tends to vibrate during heavy cutting. It has an AVR (Active Vibration Reduction) shoe that allows it to flex in and out while the saw is cutting. We found that it actually increased vibration to the point where the saw was unpleasant to use, especially for cutting metal. The tool is available bare and in a two-battery kit.



HITACHI CR18DGLP4

\$89 (bare tool); \$97 for two 3.0-amp/hour batteries; \$97 for one 5.0-amp/hour battery; \$39 for charger

This saw was tested with 3.0-amp/hour batteries because the anticipated 5.0-amp/hour packs were not yet available. Smaller and lighter than most other saws, the Hitachi is pleasant to handle because it vibrates less than expected for a tool of its weight. However, it cuts about half as fast as the Milwaukee and employs an aggravating safety switch that requires you to hit a button before every cut. We much prefer the sliding on/off lock found on most other saws. The Hitachi is sold as a bare tool only.



MAKITA XRJ03

\$119 (bare tool); \$129 for one 5.0-amp/hour battery; \$99 for charger

The Makita's shoe adjusts with the push of a button, and the saw has a superior blade clamp that ejects hot blades and remains open until a fresh blade is loaded. Weight and cutting speed are about average. Run-time per amp hour is the lowest of the saws tested, though this could be offset by Makita's charging time (45 min. for a 5-amp/hour pack). The tool cuts smoothly and is comfortable to use. The XRJ03 is Makita's lightest full-size reciprocating saw and is available as a bare tool and in combo kits.



METABO ASE 18 LTX

\$210 (bare tool); \$95 for one 5.5-amp/hour battery; \$169 for one 6.2-amp/hour battery; \$57 for charger

Sold as a bare tool only, the Metabo is the second-heaviest saw tested. It cuts smoothly and with little vibration. Features include a lever-activated clamp and an adjustable shoe that requires a hex wrench, which stores in the handle. The biggest downside is the automatic safety on the trigger, which requires you to shift your grip to hit the button before every cut. Cutting speed is about average in wood and slower than average in metal. Run-time is about average.

18-volt Cordless Circular Saws

Modern cordless saws cut fast
and run for a long time





Years ago, cordless circular saws had weak cutting ability and short run-times. But with lithium-ion (Li-ion) technology, 4-amp/hour batteries, and brushless motors, today's new saws are superior to their predecessors. We tested seven 6½-in. 18-volt models, looking only at saws that could cut through 2x stock at a 45° bevel. When possible, we ordered saw kits, but many of these saws are also sold as bare tools. This is important because most builders and many DIYers already have multiple 18-volt batteries for their other cordless tools, so a nice cordless saw doesn't have to be a huge investment.

The strengths of a cordless saw are fast set-up and total mobility, especially where outlets can be hard to find. Climbing staging to trim a rafter tail becomes a quick task—and with one less extension cord, it's also a safer one. And cordless saws weigh a pound or two less than comparable corded saws.

Doug Mahoney, a remodeler in Harvard, Mass., contributed to this article.

How we tested

To get a sense of how the tools would perform, we ran tests for power and run-time. To gauge the overall strength of each saw, we timed 10 crosscuts through a 2x12. To level the playing field, we equipped each saw with a new 6½-in. Irwin Marathon 20-tooth blade (\$14) before testing. To test run-time, we charged all of the batteries fully, used each saw to cut 1-in. strips from a sheet of ¾-in. plywood, and totaled the amount of linear feet cut before the battery went dead. We ran both tests twice and used the better of the two numbers to rank the seven saws.

In addition to the structured tests, we used the saws on job sites and in the shop for cutting everything from iuan plywood to PVC trim. Most of the time was spent making ripcuts and crosscuts in all kinds of dimensional lumber. While doing this, we paid close attention to ergonomics, ease of adjustments, and the success or failure of all the other features.

READERS' RATINGS: CORDLESS CIRCULAR SAWS

★★★★★	4.54	MILWAUKEE M18 FUEL 2730-22
★★★★★	4.30	MILWAUKEE M18 2630-22
★★★★★	4.23	MAKITA XSS01
★★★★★	4.06	BOSCH CCS180
★★★★★	4.03	DeWALT DCS391P1
★★★★★	3.89	HITACHI C18DSLP4

MILWAUKEE M18 FUEL 2730-22

Price: \$400 with two 4-amp/hour batteries, a charger, and a duffel; also available with one battery (2730-21, \$300) or as a bare tool (2730-20, \$200)

Weight: 8 lb. 9 oz.

Max bevel: 50°

Max depth: 2 $\frac{3}{16}$ in.

RPM: 5,000

Light: LED

10 cuts through

2x12: 34 seconds (1st)

Linear ft. of plywood: 159 (1st)

FEATURES This is the only saw in the test with a brushless motor, which apparently made all the difference. The M18 Fuel cut with the ease of a corded saw, and the battery held up for almost 40 cuts across $\frac{3}{4}$ -in. plywood before finally running out. Features include a magnesium baseplate and blade guard for durability, LED lights that illuminate the cut line, and a well-designed rafter hook. It was one of the heaviest saws tested, but it's well balanced, and the handle is comfortable with or without gloves. The saw can get closer to vertical surfaces because its brushless motor is more compact than a regular motor. The Fuel is at least 1 in. narrower than most of the other saws.

FLAWS The narrow baseplate makes the saw a little less stable than the others, and the depth-of-cut gauge faces the handle, which makes it somewhat difficult to read. These are just minor quibbles, though; there's hardly anything to complain about with this saw.

BOTTOM LINE If you're looking for corded power in a cordless saw, this is the one to get. Its good ergonomics, stellar run-time, and terrific cutting performance make it the Best Overall.



FEATURES The DeWalt is an excellent combination of comfort and power. It's not the lightest saw tested, but because of its perfect balance, it felt like it. In addition, its fast-spinning motor produces very little vibration, which leads to smoother cuts.

FLAWS The only ergonomic oversight is that the handle rides on the top of the saw rather than behind it, so when the saw is set to make shallow cuts, the tool is more difficult to push. Also, the indicator line on the depth-of-cut gauge is small and tough to see, and the location of the battery-fuel gauge requires flipping the tool over to read it.

BOTTOM LINE The DeWalt has ample power and sports-car handling, and it's the most comfortable saw we tested. It also costs \$40 less than the single-battery Milwaukee Fuel kit.

DEWALT DCS391P1

Price: \$260 with one 5-amp/hour battery, a charger, and a case; also available as a bare tool (DCS391B, \$111)

Weight: 8 lb. 5 oz.

Max bevel: 50°

Max depth: 2 $\frac{1}{4}$ in.

RPM: 5,250

Light: None

10 cuts through

2x12: 42 seconds (2nd)

Linear ft. of plywood: 142 (3rd)

BOSCH CCS180

Price: \$150 with case; a 4-amp/hour battery with charger sells for \$70

Weight: 8 lb. 5 oz.

Max bevel: 50°

Max depth: 2 in.

RPM: 3,900

Light: None

10 cuts through

2x12: 48 seconds (4th)

Linear ft. of plywood: 147 (2nd)

FEATURES The Bosch is a big saw with big cutting power. The motor is smooth and produced the least amount of vibration when compared to the rest of the saws. Its large baseplate gives the tool great stability. The depth-of-cut gauge is easy to read and allows you to adjust the depth without having to twist and turn the tool to see the setting.

FLAWS Although the Bosch is not the heaviest in the group, it feels heavy because it is unbalanced and the ergonomics are poor. On the more comfortable saws, the handle gets thinner at the bottom, but the Bosch's gets thicker, making it awkward to grip, especially while wearing gloves. The safety switch is tricky to use because it's a button that you have to press into the tool and not a paddle that you press down. This saw does not have a battery-fuel gauge.

BOTTOM LINE This is a quality saw, but it's big and bulky compared to the rest. The poor design of the handle and safety switch makes the tool frustrating to use.





FEATURES The Hitachi is comfortable to hold and comes with a rip fence. Because it's so light, it's easy to use for extended periods of time.

FLAWS We found a number of red flags in the durability department. The metal baseplate is very thin, and the rail for the depth-of-cut adjustment sits behind the blade, vulnerable to damage. While all of the other tools use a hex wrench for changing out the blade, the Hitachi uses a T-handle nut driver that's too big for onboard storage.

BOTTOM LINE This saw ranked last in the power test and next-to-last in the run-time test, and it suffers further from weak overall construction.

HITACHI C18DSL4

Price: \$130 (bare tool), tested with a 3-amp/hour battery (\$72) and a charger (\$40)

Weight: 7 lb. 10 oz.

Max bevel: 50°

Max depth: 2¼ in.

RPM: 3,400

Light: Incandescent

10 cuts through 2x12: 90 seconds (8th)

Linear ft. of plywood: 75 (7th)

MAKITA XSS01

Price: \$340 with two 3-amp/hour batteries, a charger, and a case; also available as a bare tool (\$165)

Weight: 7 lb. 12 oz.

Max bevel: 50°

Max depth: 2¼ in.

RPM: 3,700

Light: LED

10 cuts through 2x12: 66 seconds (5th)

Linear ft. of plywood: 71 (8th)

FEATURES The Makita is a solid little tool with a good feel. The bright LED lights up the cut line, and the handle is nearly as comfortable as the DeWalt's. We like the easy lever adjustments, and the connection between the body of the tool and the baseplate is nice and solid. The Makita fell toward the middle of the pack in power, but it didn't bind up while cutting the 2x12.

FLAWS This saw was at the bottom of our battery test, and it could use a better depth-of-cut gauge. In use, it has enough vibration to affect the quality of cuts.

BOTTOM LINE The high-quality look and feel of the Makita isn't enough to offset its last-place finish in the run-time test and fifth-place performance in the power test.



FEATURES We like how the baseplate of the M18 has straight and 45° kerf marks at the front and rear of the blade. It also has rulers along the side and front that are useful for quick repetitive cuts. It is the only saw where the locking lever for the depth-of-cut tightens on the upswing, so it won't get in the way of the baseplate even if it loosens over time. The M18 comes with a rip fence, and like the Fuel, it has a sturdy and lightweight magnesium blade guard.

FLAWS The M18 was the heaviest saw tested. Even with the nice handle and balanced weight, there's no denying that at more than 9 lb., this is a heavy tool. We also expected the battery life to be better.

BOTTOM LINE There are a lot of nice features on this tool, but other saws have more power and stamina.

MILWAUKEE M18 2630-22

Price: \$360 with two 3-amp/hour batteries, a charger, and a duffel; also available as a bare tool (2630-20, \$119)

Weight: 9 lb. 3 oz.

Max bevel: 50°

Max depth: 2½ in.

RPM: 3,500

Light: None

10 cuts through 2x12: 44 seconds (3rd)

Linear ft. of plywood: 113 (5th)



Track Saws

These versatile tools make fast, precise cuts and weigh a lot less than your tablesaw



Clamp-free cutting. High-friction tape on the underside prevents the aluminum track from moving during straight and angled cuts. All track-saw manufacturers offer clamps for their tracks, but they're unnecessary for most materials.

Combining a plunge-cutting circular saw with an aluminum guide rail, track saws have gone from obscure woodworking tools to common job-site problem solvers and woodshop favorites. Their unsurpassed accuracy, ease of use, and clean cuts make them perfect for cutting everything from veneer plywood for cabinets and built-ins to plywood and OSB for wall and floor sheathing. Track saws are also great for trimming doors to perfect size and cutting off overhanging deck boards.

A lot of people use a regular circular saw along with a clamped

straightedge when they need straight cuts. But after you try a track saw, you'll find that method sloppy and tedious. On a conventional circular saw, the blade is seldom parallel to the edge of the base, so cuts are rough and sometimes burned. Track saws are built so that the track and the blade are parallel, resulting in accurate cuts free of burning and saw marks. In addition, the aluminum tracks have flexible edges that prevent splinters, so the cuts are smooth with little or no chipping. The improved quality of cut is especially noticeable on materials prone to chipping, such

ALL THE SAWS SHARE THE SAME BASIC DESIGN AND OPERATION

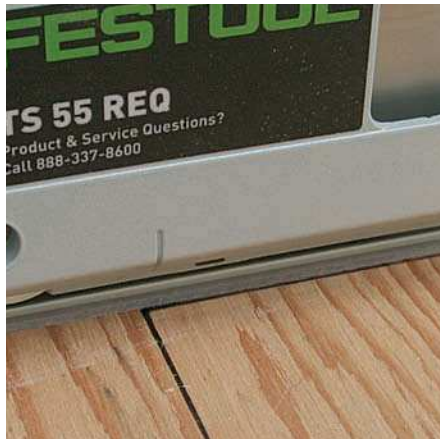
Track saws have two components: a plunge-cutting circular saw and a track that's available in various lengths. The track has a flexible edge that aligns with the path of the blade to aid setup and to prevent splintering.



Cuts are precise. The track's flexible splinter guard follows the cut line exactly, so you just line up the track with your marks and cut, instead of compensating for the width of the saw's base.



Bevel cuts are easy. Amazingly, the path of the blade isn't altered when a track saw is set to make a beveled cut. This makes a track saw the perfect tool for mitered corners on columns, cabinets, and more.



Plunge cuts are accurate. All the saws plunge by way of a spring-loaded hinge, so you have to push down on the handle to make a cut. This makes stopped cuts easy and accurate. Marks on the blade housing show where the blade will enter the wood.



as melamine. Track saws also can plunge cut—meaning you can stop and start a cut wherever you want—which is difficult and less accurate with a traditional circular saw.

We recently tested track saws from DeWalt, Grizzly, Festool, Mafell, Makita, and Triton. Most track-saw kits come with a single length of track that's long enough for a 4-ft. cut, designed to be able to cut a sheet of plywood in half. But if you want to make longer cuts down the length of the sheet, you'll need 8 ft. of track. Although a few manufacturers offer a single 8-ft. track, those are

hard to store and handle without damaging them. Instead, we prefer to make 8-ft. rips by joining two 4-ft. tracks with a connector provided by the manufacturer. When offered by the manufacturer, this is the setup we requested.

Blade sizes vary slightly in diameter from model to model, so you should stick with blades made by the saw manufacturer or confirm that a replacement is exactly the right size. It's a good idea to have extra blades on hand before you need them because track-saw blades can be hard to find at home centers and lumberyards.

THE BEST SAWS STAND OUT FOR THEIR USER-FRIENDLY CONTROLS

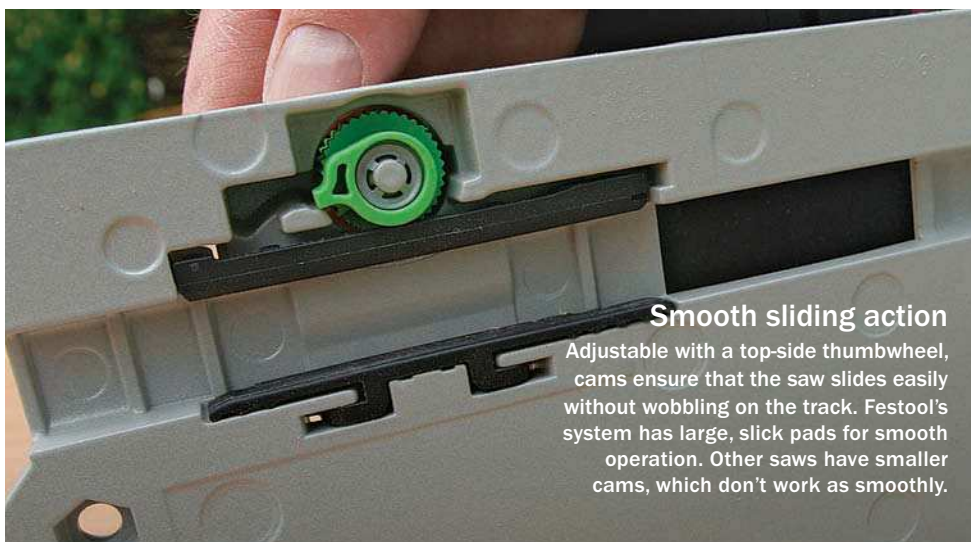


Enclosed blades, riving knives

The DeWalt, Festool, and Grizzly saws have riving knives to prevent kickback. All of the blades are fully enclosed for effective dust collection when connected to a vacuum.

 **Online Extra**

To see a track saw in action, go to FineWoodworking.com/TG2017.



Smooth sliding action

Adjustable with a top-side thumbwheel, cams ensure that the saw slides easily without wobbling on the track. Festool's system has large, slick pads for smooth operation. Other saws have smaller cams, which don't work as smoothly.



How we tested these saws

In addition to using the saws in our own shops and on job sites for a variety of tasks, we put them through a number of tests using the supplied manufacturers' blades. We ran each tool through $\frac{3}{4}$ -in. melamine to judge the quality of cut through the material's brittle plastic-coated surface. As a power test designed to simulate how the saws would perform when trimming an exterior door, we cut through 2 ft. of 2-in.-thick oak. Finally, to assess the gripping power of each track, we ripped a $\frac{3}{4}$ -in.-thick piece of plywood

at a 45° angle without using clamps. During all of these tests, we had the saws hooked up to a Festool CT 26 vacuum so we could assess their dust collection.

Standard features

The six saws we tested all share a few features. Each baseplate has a set of cams that snug the saw to the track, eliminating any side-to-side movement, and every saw has a thumb-operated safety trigger that needs to be engaged before the sawblade will



Score-setting for veneer

The Mafell, Makita, and Triton saws have a one-touch scoring feature that sets the blade to take a very shallow pass for clean cuts in difficult materials such as veneer plywood and melamine. The scoring feature is more convenient than setting the blade depth manually.



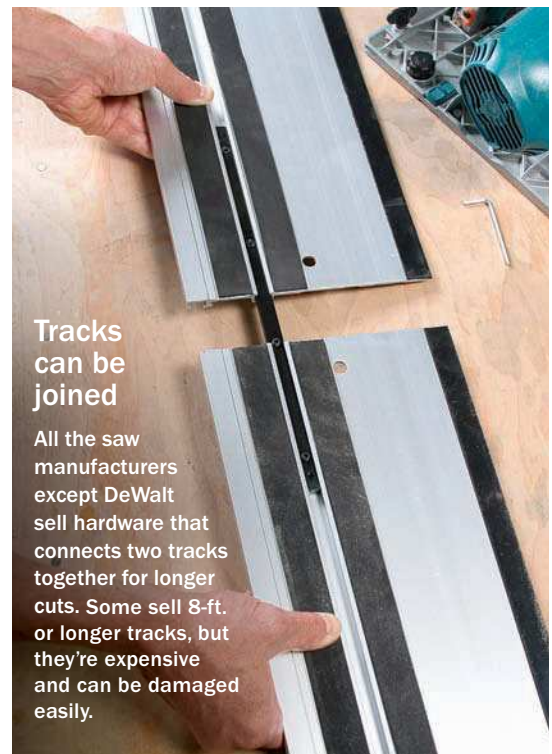
Safety brake

Festool, Grizzly, and Mafell have stop blocks that clamp to the track to prevent the saw from moving backward during plunge cuts. The blocks are preferable to Triton's and DeWalt's systems, which prevent the saw from moving backward at all times. DeWalt's can be turned off, but Triton's requires an override every time you reverse.



Easy blade changes

Pull the lever on the top of the Mafell, and it opens the blade cover and locks the arbor for easy blade changes. By the way, you'll need to buy replacement blades made for track saws. They have a 20-mm arbor, which is larger than the hole on conventional circular-saw blades.



Tracks can be joined

All the saw manufacturers except DeWalt sell hardware that connects two tracks together for longer cuts. Some sell 8-ft. or longer tracks, but they're expensive and can be damaged easily.

spin and the housing will plunge. Bevel adjustments are similar to those on a regular circular saw, but the baseplates are engineered so that the track always aligns with the blade regardless of the bevel angle. Beyond these consistencies, we were surprised how the features and safety mechanisms varied from saw to saw. For example, many of the saws have some means of preventing kick-back during plunge cuts. The DeWalt and the Triton have a setting on the base that allows the tool to move forward on the track but not backward. Festool's stop block prevents the saw from moving

backward during plunge cuts. Grizzly includes a similar device in its accessory kit, and Mafell sells a similar device as an accessory (\$23). The DeWalt, Festool, and Grizzly saws have a riving knife to keep the blade from binding while cutting. The knife deploys when the blade is plunged into the material.

Depth-of-cut adjustments

With all of the saws, the depth-of-cut adjustment is more precise than you'll find on a regular circular saw. On the high-end track



Festool TS 55 REQ

This tool is the complete package of power, precise cutting, and easy adjustments. In a single pass (without scoring), it left a nearly perfect edge when cutting melamine. In the power test, the motor maintained a constant speed while slicing through the thick oak. The depth-of-cut adjustment is excellent, and the track has a thick and effective splinter guard. The Festool also has great dust collection. The depth scale is in metric, but Festool includes a sticker with Imperial measurements to place over the millimeter scale. Power, ease of use, and overall cut quality made this tool stand out above the rest.



Makita SP600J

The Makita's handles are comfortable, and the plunge spring offers just the right amount of resistance. The thumb safety switch is the easiest to use, and the saw's base locks into the track for added stability during beveled cuts. With its scoring setting, the Makita made an almost flawless cut in the melamine. The dust collection was also very good. The Makita weighs at least ½ lb. less than the other saws and easily plowed through ¾-in. plywood; however, it struggled a little with the thick oak, leaving burn marks as it cut. The depth-of-cut scale is in millimeters. Because it was so comfortable and easy to use, though, the Makita was our favorite midpriced saw.



DeWalt DWS520CK

The DeWalt's track is the only one with a splinter guard on both sides, so we didn't need to constantly flip the track, an advantage when working in tight quarters. But DeWalt does not sell a track connector, so for cuts longer than 4 ft., you must get a 102-in. track. The DeWalt is also the only saw that uses a linkage connection rather than a single pivot point for the saw's plunge mechanism. This means you have to push the handle forward as well as down to make a cut, a tricky motion with one hand. In addition, the depth-of-cut dial is too small and is difficult to operate with gloves on. The DeWalt is built tough, but ergonomically, it's not the strongest of the bunch.

MODEL	PRICE	WHAT YOU GET	WEIGHT	RIVING KNIFE	ANTI-KICKBACK
DeWalt DWS520CK	\$613	Saw, 59-in. track, 102-in. track	11 lb., 8 oz.	Yes	Yes
Festool TS 55 REQ	\$640	Saw, 55-in. track	10 lb., 1 oz.	Yes	Yes
Grizzly T25552	\$258	Saw, 55-in. track, clamps, connector	10 lb., 9 oz.	Yes	Yes
Mafell MT55cc	\$836	Saw only	10 lb., 2 oz.	No	Yes
Makita SP600J	\$406	Saw, 55-in. track	9 lb., 6 oz.	No	No
Triton TTS1400	\$300	Saw only	11 lb., 9 oz.	No	Yes

saws (Festool and Mafell), the adjustment is made by squeezing the depth stop and sliding it up and down the gauge. The rest of the saws use locking dials. The squeeze adjustment is more ergonomic and more precise. The dials can be tricky, especially when the depth of cut is bottomed out and the dial is hard up against the saw's baseplate and bevel gauge, leaving little room for fingers.

One feature we especially like—which can be found on the Mafell, Makita, and Triton saws—is the setting for making a shallow scoring cut. Using the scoring setting before making a full-

depth pass creates a much cleaner edge on finicky surfaces such as melamine or veneer plywood. While all of the saws can be set manually to scoring depth and then reset to the cutting depth, the ability to toggle between the two settings saves time.

The bottom line

The saws are priced at three levels. At the top (about \$800 and up for a setup for 8-ft. rips) are Festool and Mafell. These two saws stood apart from the rest due to the smoothness of their motors, excellent dust collection, and overall build quality.



Grizzly T25552

The least expensive track saw we tested, the Grizzly has enough power and ability to get basic tasks done at a decent level of quality. The tool is easy to use, but it has the smallest motor of all the saws and lacks both variable speed and a soft start. It's also not a very comfortable saw to use. The safety switch is tough to reach with your thumb, and the plunge mechanism has a very strong spring that makes cutting tiring. Also, when we tried to dial in a specific angle, we found the bevel markings to be unclear. The dust collection was good. For occasional use, this tool will get the job done, but if you plan to use your track saw often, it's worth stepping up to one of the other tools.



Mafell MT55cc

The Mafell backs up its high price tag with precise adjustments, easy-to-read gauges, and the simplest blade change we've seen on any circular saw: Pull a lever, and the entire blade shroud pops open. The Mafell track is only 5 in. wide—over 1½ in. narrower than the rest—so it's easy to work with narrow material. Using the scoring feature, the Mafell made a perfect cut through the melamine and, like the Festool, kept constant power while cutting the thick oak. Overall, the Mafell is a nice tool with superior dust collection, but we wish it had a front handle for better control, especially when cutting at an angle.



Triton TTS1400

The Triton toggles easily between cutting, scoring, and blade-change mode. It also has an anti-kickback mechanism and can lock into the track with the turn of a dial. Unfortunately, when using the scoring function, we could never get the second cut to line up perfectly with the first. We also didn't like how the kickback stop needed to be manually overridden every time we slid the saw backward. It's especially tedious because the knob is located in a hard-to-reach spot under the motor. The Triton has a good selection of features, but its overall design makes it a difficult and frustrating saw to use. On the plus side, it's the second-least-expensive saw in the test.

DEPTH OF CUT	AMPS	BEVEL	SCORING FEATURE	SETUP FOR 8-FT. RIPS	CONNECTORS	AVAILABLE TRACK LENGTHS (IN.)
2¼ in.	12	0° to 47°	No	\$613	Not offered	59, 102
2 in.	10	-1° to 47°	No	\$787	\$18	32, 42, 55, 75, 106, 118, 197
11⅝ in.	9	0° to 45°	No	\$295	Included in kit	55
2 in.	10	-1° to 48°	Yes	\$1,211	\$76	32, 43, 63
2⅝ in.	12	-1° to 48°	Yes	\$520	\$27	55, 118
2⅜ in.	12	0° to 48°	Yes	\$400	In optional \$100 kit	59, 27.5

The middle range (about \$400 to \$620) includes saws by Makita, DeWalt, and Triton. We had some issues with the Triton, but even though the DeWalt and Makita are missing some of the finer points found on the upper-tier tools, they would both perform admirably on a job site.

The Grizzly costs roughly a quarter of the most expensive saw, yet it would be OK for occasional use. However, it lacks the features of the other saws and isn't as comfortable to use. □

Doug Mahoney, a carpenter in Harvard, Mass., contributed to this article.

READERS' RATINGS: TRACK SAWS		
★★★★★	4.82	FESTOOL TS 5S 55 REQ
★★★★☆	4.19	MAKITA SP600J
★★★★☆	4.00	TRITON TTS1400
★★★★☆	3.97	DEWALT DWS520CK
★★★★☆	3.91	MAFELL MT55CC
★★★☆☆	3.52	GRIZZLY T25552

Midsize Fixed-Base Routers

Great combination of power and control



A midsize fixed-base router is an invaluable tool for woodworkers of every skill level. On its own or teamed up with shopmade jigs, this elegantly simple tool can drill, shape, size, plane, and cut wood similar to the way big stationary equipment can.

Rated between 11 and 15 amps, midsize models (larger than a trim router, which can be held in one hand, but smaller and lighter than a heavy, industrial 3¼-hp router) are plenty powerful for common tasks yet are still relatively compact.

We tested eight midsize fixed-base routers, rated between 1¼ and 2¾ hp, with electronic speed control, and including both ¼- and ½-in.-dia. collets, so you can use the full range of router bits. The speed ranges are similar, from 8,000 to 10,000 rpm up to 23,000 to 25,000 rpm.

Electronic motor control is a recent innovation, which helps the router maintain its rpm under load. It also allows soft start, which is a must-have. Without it a router goes instantly from 0 to 20,000-plus rpm, jumping in your hands. With soft start, the router comes up to speed gradually.

All of the routers will work in a router table, but the Bosch, Ridgid, Porter-Cable, and Milwaukee routers offer through-the-base depth adjustment for that purpose.

We evaluated the routers in 30 different ways, but boiled it all down to five ratings: cut quality, router accuracy, control and handling, bit changing, and visibility of cut.

Tough tests for cut quality

We started with the most important question: Can the router make smooth cuts in the toughest situations?

Our first test was for runout (wobble), which could come from either the motor

Online Extra

For video tips on how to secure your work for routing, go to FineWoodworking.com/TG2017.

Performance tests

We used three tests to evaluate smoothness of cut.
We also evaluated control and handling during two of them.



RUNOUT RESULTS

With a dial indicator touching the shank of a good router bit, we turned the collet by hand to check for wobble, or runout. The Bosch MRF23EVS had the least, just 0.001 in., but most of the others had less than 0.003 in., an acceptable amount.

or collet and create chatter and a bumpy cut. Initially we checked by hand.

To check for real-world runout, we did two cutting tests, on long grain and end grain, using 1/2-in.-shank bits.

We also ran an up-spiral, bearing-guided, flush-trimming bit against a pattern, trimming 3/16 in. off the edge of a workpiece. All of the routers made smooth cuts in this test. The Milwaukee's cut was a standout.

The second test was tougher. We made a full-depth molding cut along the edges of a hard-maple workpiece, using a large, bearing-guided ogee bit. Even with this heavy cut, most of the routers were able to deliver a smooth cut without struggling.

We blended all of these tests into a single rating for cut quality.

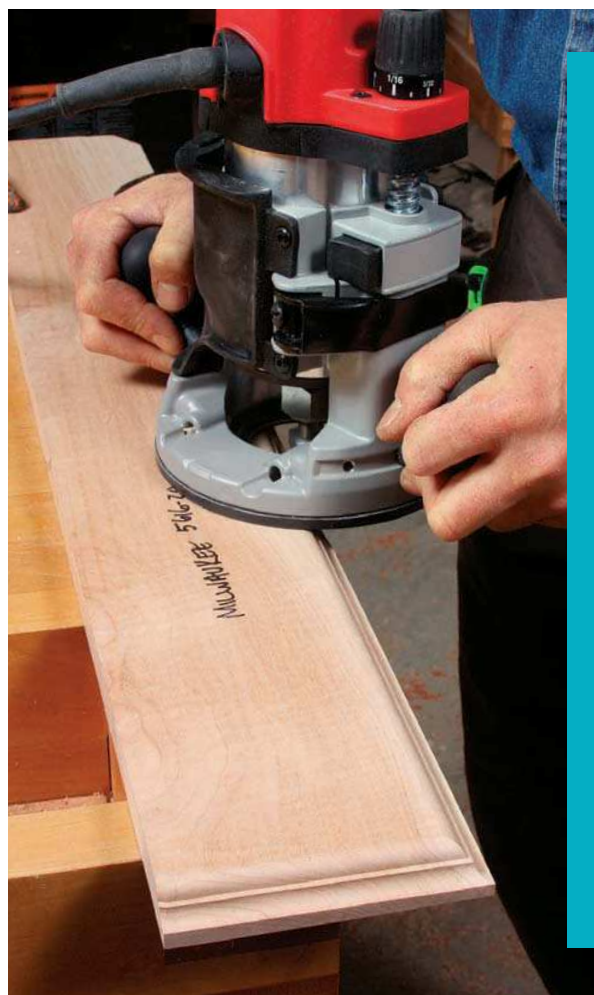
Accuracy is important, too

A fixed-base router has only a couple of adjustments, the most important and frequent being the depth setting. Some routers employ a rack-and-pinion; on others you twist the base to move it up and down. Both systems allow fine, precise movements. All of the routers then lock the base with a cam device. All of the cam locks shifted the bases the tiniest bit, but not enough to worry about. We factored those tiny amounts into the accuracy rating, too.



TEMPLATE TEST

After roughing eight workpieces to the same shape, we loaded them all into this fixture, designed to remove about 3/16 in. of material along a series of curves and straight lines. The Bosch MRF23EVS stood out again.



BIG BITES

We used a new, high-quality router bit to make deep molding cuts along both long grain and end grain.



Harsh light. A raking light showed how smooth the cuts were. The Milwaukee (top) cut the smoothest, while the Hitachi's sample (bottom) was one of the bumpier ones.

How they stacked up



BOSCH MRF23EVS

Power: 15 amps
Price: \$220

This is the heaviest and most powerful router in the test. With rack-and-pinion adjustment, it has good balance and control, with shaped handles that fit the hand. It was one of the smoothest cutters. A built-in work light is always on when the tool is plugged in, which helps with setups. On the downside, the base was a little tricky to remove for bit changes and the on/off trigger in the handle was awkward to use for those with large hands.



MILWAUKEE 5616-20

Power: 13 amps
Price: \$180

This rack-and-pinion model made the smoothest cuts in our tests, and uses two hefty wrenches and collet nuts for the easiest bit changes. It is well-balanced and comes with a unique hand strap and rubber grip on the motor, which offers better control for some tasks. The control score was hurt a little by the Milwaukee's soft start, which was jumpier than some. The depth scale was inaccurate, but not everyone uses these.



DeWALT DW618

Power: 12 amps
Price: \$150

This simple, twist-to-adjust router has a lot going for it. Its depth scale is accurate. It has a gentle soft start, made smooth cuts, and is a very well-balanced machine with a low center of gravity. The grips give excellent control and the switch can be set up for left- and right-handers. The single-wrench/spindle-lock system makes bit changing more cumbersome, and you may need to drill out the 1 1/4-in. base opening to accommodate larger bits.



BOSCH 1617EVS

Power: 12 amps
Price: \$170

This router has a great soft start, is very well balanced, made very smooth cuts, and has an accurate micro-adjust scale on its rack-and-pinion depth system. It has two wrenches, and the base comes off easily for bit changes. On the other hand, the ball-shaped grips are slippery and the baseplate is black, which can hamper visibility.

All of them also have some sort of scale to keep track of the depth. Most of the scales were very accurate, but the Milwaukee was 0.025 in. off (almost 1/32 in.).

When you run the baseplate of the router against a fence, the precision of the cut can be affected by how concentric the base is with the collet. While none turned out to be perfectly accurate, all but the Hitachi are easily adjustable.

Control affects safety and accuracy

We evaluated how easy it was to control the router in a variety of situations: when picking it up and turning it on, when turning it off and setting it down, and most importantly, while making cuts.

We also factored in the switch locations, and whether they can be reached without removing one hand from the handles.

Creature comforts

One thing you'll do often is change router bits. The easiest way is with two wrenches.

Some tool designers have adopted single-wrench bit-changing systems, which force you to hold down the router and a spindle-lock button with one hand while pulling hard with a single wrench. We favor routers that still use two wrenches: the two Bosches, the Hitachi, the Makita, and the Milwaukee.

Although you can keep some of the bases on the router while changing the bit, it is much easier to do it with the bases off and out of the way. So we gave extra points to bases that are easy to remove.

Most routers come with transparent baseplates, an improvement over the old-school black ones. Large openings in the base also help. We factored all that into a visibility rating, and gave a bump to the routers with an effective work light.

READERS' RATINGS: FIXED-BASE ROUTERS

★★★★★	4.46	BOSCH 1617EVS
★★★★★	4.42	MILWAUKEE 5616-20
★★★★★	4.39	BOSCH MRF23EVS
★★★★★	4.33	PORTER-CABLE 892
★★★★★	4.32	DeWALT 618
★★★★★	4.20	HITACHI M12VC
★★★★★	4.20	MAKITA RF1101
★★★★★	4.15	RIDGID R22002

Most were solid performers

In the end there was no one perfect router, and seven out of the eight are certainly usable tools. We would be quickest to buy the Bosch MRF23EVS or Milwaukee 5616-20, so those are our Best Overall choices. The DeWalt was our pick for Best Value, edging out the Ridgid solely on price. □

Marc Adams, Doug Dale, Mark Hedin, and Zane Powell contributed to this article.



HITACHI M12VC

Power: 11 amps
Price: \$120

This twist-to-adjust router was the quietest in the test, and is the lowest priced. Other than that it had the most pitfalls of the lot. The soft start was jerky, the motor had a lot of vibration, and the grips were slippery. We also struggled to remove the router base and to get the bit to release from the collet. Last, the baseplate was significantly off center, and its countersunk screw holes made it impossible to adjust. We can't recommend this router.



MAKITA RF1101

Power: 11 amps
Price: \$190

The Makita had very little runout and produced very smooth cuts. The twist-style base is very easy to attach and detach for bit changes, and the collet is tightened with two wrenches. However, the 1½-in. hole in the baseplate will need to be enlarged for bigger bits. Also, the router felt slightly top heavy, the grips were on the slippery side, and we had to let go of one handle to reach the on/off switch.



PORTER-CABLE 892

Power: 12 amps
Price: \$180

The Porter-Cable's soft start works well, and the scale on its rack-and-pinion micro-adjuster is very accurate. Its variable-speed dial is the only one to list actual rpm, making it the most accurate. The base is easy to remove for bit changing, but the single-wrench system makes bit changes a little awkward. Also, this router had the most bit runout.



RIDGID R22002

Power: 11 amps
Price: \$160

The rack-and-pinion-type base on the Ridgid was easy to remove, the micro-adjustment scale was the most accurate, and the grips offer good control. Also, it has a work light, its variable-speed dial lists actual rpm, and it comes with a handy cone for centering the base. However, with one wrench and a spindle lock, removing the bit was a little awkward. And while it made good cuts, the motor had more vibration than we would like.

MODEL	CUT QUALITY	ROUTER ACCURACY	CONTROL AND HANDLING	CUT VISIBILITY	EASE OF BIT CHANGES
 Bosch 1617EVS	Excellent	Very good	Good	Good	Good
 Bosch MRF23EVS	Excellent	Excellent	Very good	Excellent	Good
 DeWalt DW618	Very good	Very good	Very good	Very good	Fair
Hitachi M12VC	Good	Fair	Fair	Good	Fair
Makita RF1101	Excellent	Good	Fair	Good	Good
 Milwaukee 5616-20	Excellent	Good*	Very good	Very good	Excellent
Porter-Cable 892	Good	Excellent	Very good	Very good	Very good
Ridgid R22002	Very good	Very good	Very good	Very good	Fair

*Excellent if you don't rely on scale for depth adjustment

Benchtop



WHAT MATTERS MOST

When it comes to a planer, the most important evaluations are whether it makes smooth cuts with both faces of the board parallel to one another. After that, it's all about features, including dust collection.



FINISH QUALITY

The curly maple challenge. All of the planers we tested handled white oak and white pine without trouble, but only the two DeWalt machines and the Ridgid planer produced usable surfaces on curly maple.

Parallelism and snipe. A planer's job is to make two faces parallel to one another, and any machine that leaves surfaces more than 0.01 in. out of parallel is to be avoided. As for overcuts near the ends, called "snipe," more than 0.01 in. is too much.



KNIFE CHANGES

Make it fast. Changing knives should be easy so that you can quickly get back to work. DeWalt embedded magnets into the handle of its wrench (above), making it a snap to lift old knives and put new ones in place.

Planers

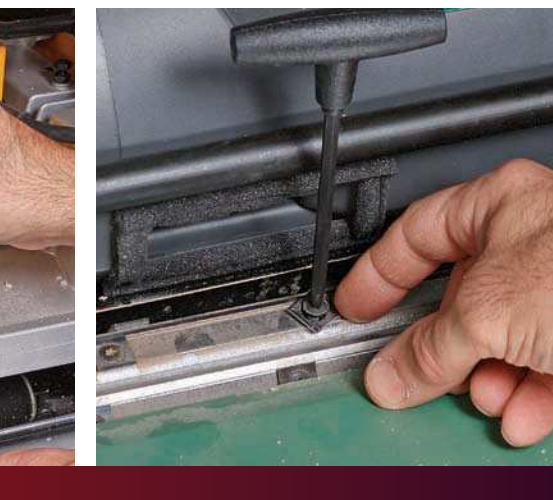
The best machines produce smooth, parallel surfaces on your lumber

A benchtop planer is an essential tool for carpenters and furniture makers alike. Portable yet powerful, these machines shave boards down in thickness, taking anything from a whisker to more than $\frac{1}{16}$ in. at a time, leaving a perfectly smooth surface behind. Benchtop models handle stock $12\frac{1}{2}$ in. to 13 in. wide and 5 in. to 6 in. thick, so you can mill the beefiest boards. These planers also run on a 120-volt circuit, so they can be used in any home shop.

There are a lot of benchtop models on the market, but we limited our selection to the 11 models that have what we consider to be essential features: dust collection and indexed knives. Planers without a dust port will create a huge mess and flood the air with dust. Indexed knives have pins that guarantee that all of the knives project the same amount, which ensures smooth planing. This feature takes the hassle out of knife

READERS' RATINGS: BENCHTOP PLANERS

★★★★★	4.57	DEWALT 735X
★★★★☆	4.21	DEWALT 734
★★★★☆	4.09	TRITON TPT125
★★★★☆	3.99	MAKITA 2012NB
★★★★☆	3.96	RIDGID R4331
★★★★☆	3.94	DELTA 22-555
★★★★☆	3.92	RIKON 25-130H
★★★★☆	3.85	GRIZZLY G0790
★★★★☆	3.82	GENERAL INTL. 30-060HC
★★★★☆	3.66	CRAFTSMAN 21758
★★★★☆	3.56	RIKON 25-131



Give it a twist. The insert cutters on the General International and Rikon segmented cutterheads can be turned to a fresh edge without completely removing the screw that holds them in place.



DEPTH-OF-CUT ADJUSTMENTS

Convenience is king. A depth-of-cut adjustment wheel on the side is easy to reach. Three of the machines have side-mounted wheels, but this convenience doesn't trump surface quality.



Depth stops simplify repeat milling. Stops for common thicknesses make it a snap to mill parts to the same thickness, a handy feature when you need to remake a part. All the stops tested were accurate.



BEST OVERALL DEWALT DW735X

Price: \$649

Warranty: 3 years

Knives: 3

Size: 13 in.

Depth stops: 6

Snipe: 0.003 in.

Out of parallel: 0.000 in.

Dust collection: Excellent

Noise level: 102 db.

Surface quality

White pine: Excellent

White oak: Excellent

Curly maple: Very good



The DeWalt 735X produced two faces perfectly parallel to one another, with surfaces far superior to what the other machines produced, thanks to its two feed speeds. At high speed, the planer works fast and leaves a smooth surface. But the slower, finish speed produces an almost glass-smooth surface. Knife changes are easy, with spacious access to the cutterhead from the top and a gib screw wrench that doubles as a magnetic lift to remove the knives. The 735X also has great dust collection, thanks to an internal blower that helps evacuate chips. The dust port has a 2½-in.-dia. opening, but has a built-in adapter for 4-in.-dia. hoses. Our only complaint is the location of the port. It's on the outfeed side of the machine and exits straight



back. If you don't pull the hose to the side, it interferes with material as it leaves the machine. The top is large and flat, so it's a great place to set material in between passes through the machine.



BEST VALUE RIDGID R4331

Price: \$369

Warranty: 3 years

Knives: 3

Size: 13 in.

Depth stops: 8

Snipe: 0.003 in.

Out of parallel: 0.005 in.

Dust collection: Good

Noise level: 100 db.

Surface quality

White pine: Excellent

White oak: Excellent

Curly maple: Good

Priced nearly \$300 less than the DeWalt 735X, the Ridgid R4331 is an excellent value. Its three-knife cutterhead left wonderfully clean surfaces on plainsawn white oak and white pine. It did not perform nearly as well on curly maple as the 735X, but it created less tearout than all but one of the other machines (the DeWalt 734 was its equal). Knife changes were quick and easy with the provided T-handle wrench. Dust collection was good, assisted by an internal fan. The 2½-in.-dia. port on the outfeed side of the machine is directed to the side, so the hose is out of the way. The planer's top is flat and provides a good surface for holding stock between passes.



changes, greatly speeding up the process.

To test the planers, we looked at what matters most to woodworkers. We ran a wide board through each one to determine if it planed the surface parallel to the opposite face. We measured for snipe, a planer's tendency to cut a bit deeper at the leading and trailing ends of board than in the middle. We also evaluated the quality of the surface each machine produced.

Our tests showed that all of the machines were suitable for woodworking, but the machines with three knives produced the

best surfaces. Also, the two machines with segmented cutterheads performed about as well as those with two knives. This is probably because the cutters enter the wood straight on, just like straight knives. One important thing to remember is that all of the machines are loud. You'll need hearing protection when using any of them.

However, the planers were not all equal, and three were better than the rest. The DeWalt 735X clearly was the Best Overall. With a three-knife cutterhead and two planing speeds, it produced nearly glass-

smooth surfaces, even on curly maple. It left very little snipe and had outstanding dust collection, and the knives were dead-on parallel to the bed. Two other machines did very well, the DeWalt 734 and the Ridgid R4331. Both have three-knife cutterheads and produced very good surfaces, but with some tearout on figured woods. The Ridgid costs \$30 less than the DeWalt 734, so it's our pick for Best Value.

Kelly J. Dunton of Terryville, Conn., contributed to this article.

CRAFTSMAN 21758

Price: \$303

Warranty: 1 year

Knives: 2

Size: 12½ in.

Depth stops: None

Snipe: 0.012 in.

Out of parallel: 0.019 in.

Dust collection: Good

Noise level: 96 db.

Surface quality

White pine: Good

White oak: Good

Curly maple: Poor

The knives on this planer were easy to access, and springs underneath the gib lift it up so that you can remove the knife without removing the screws. The 2½-in.-dia. dust port can be oriented to exit on either side of the machine. This planer's cutterhead was significantly out of parallel and the snipe was bad. The top of the machine has a single stock roller, so you can't rest boards there between passes. Because of a little tab molded into the cutterhead's housing, you cannot take off more than ¼ in. with a single pass unless your stock is narrow enough to pass through on either side of the tab. The Craftsman also is one of four planers without a gauge that indicates how much material is about to be removed.



DELTA 22-555

Price: \$360

Warranty: 5 years

Knives: 2

Size: 13 in.

Depth stops: None

Snipe: 0.006 in.

Out of parallel: 0.008 in.

Dust collection: Good

Noise level: 98 db.

Surface quality

White pine: Good

White oak: Good

Curly maple: Poor

Knife changes on this planer were easy enough, except that you need an Allen wrench to open the dust cover and gain access to the knives, and it's not the same size as the wrench used to loosen the screws that secure the knives. The 2½-in.-dia. dust port can be reversed for use on either side of the machine. Two material rollers on top of the machine aid with transferring stock from the outfeed side back to the infeed side. Finally, there is no gauge that indicates how much material you're about to remove, a convenience that three other planers also lack.



DEWALT DW734

Price: \$399

Warranty: 3 years

Knives: 3

Size: 12½ in.

Depth stops: 4

Snipe: 0.002 in.

Out of parallel: 0.000 in.

Dust collection: Excellent

Noise level: 102 db.

Surface quality

White pine: Excellent

White oak: Excellent

Curly maple: Good

One of only two machines with a cutterhead perfectly parallel to its beds, the DeWalt 734 is a very good planer. Knife changes overall were straightforward, but access is difficult because you must remove a Phillips-head screw from under the dust shroud—not an easy task. The dust port on the back of the machine has a 2½-in.-dia. opening but can be hooked up to a 4-in.-dia. hose. Connected to a dust collector, it did an excellent job gathering chips. And because the port exits to the left of the machine, the hose is never in the way of exiting boards. The top of the machine is flat, making it a good place to stack boards between passes.



GENERAL INTL. 30-060HC

Price: \$700

Warranty: 3 years

Cutters: 26

Size: 13 in.

Depth stops: 8

Snipe: 0.002

Out of parallel: 0.008

Dust collection: Good

Noise level: 101 db.

Surface quality

White pine: Good

White oak: Good

Curly maple: Poor

The General International is one of two planers in the test with a segmented cutterhead (the Rikon 25-130H is the other). The 26 cutters, arranged in six rows, enter the wood straight on. Each cutter has two cutting edges, and can be rotated to get a fresh edge. However, rotating and changing out the cutters is a bit tricky because there is no cutterhead lock, so it tends to move as you loosen and tighten the screw for a cutter. A dust chute on the outfeed side of the machine has both a 2½-in. and 4-in.-dia. port, one exiting to each side. The top of the machine is large and flat, a great place to rest boards between passes.



GRIZZLY G0790

Price: \$290

Warranty: 1 year

Knives: 2

Size: 12½ in.

Depth stops: None

Snipe: 0.004 in.

Out of parallel: 0.013 in.

Dust collection: Fair

Noise level: 99 db

Surface quality

White pine: Good

White oak: Good

Curly maple: Poor

Knife changes on the Grizzly planer were tricky, because access was tight, the screws were small, and the Allen wrench provided was hard to use. The machine has a single dust port that's not a standard size, and we needed tape to connect a hose to it. Two rollers on the top of the machine make returning material to the infeed side easy, and they're stable enough that you can stack boards on them. The Grizzly is one of four planers that do not have a gauge indicating how much material is about to be removed on the next pass through the machine.



MAKITA 2012NB

Price: \$546

Warranty: 1 year

Knives: 2

Size: 12 in.

Depth stops:

One, but it's adjustable

Snipe: 0.003 in.

Out of parallel: 0.002 in.

Dust collection: Fair

Noise level: 98 db.

Surface quality

White pine: Very good

White oak: Very good

Curly maple: Fair

Of the planers with two-knife cutterheads, the Makita produced the best surface quality. The knives are very narrow and a bit tricky to change, but Makita provides two magnets for lifting them off the cutterhead, and these make it easier. The machine's dust port is an odd size, with an outside diameter of approximately 27⁄8 in. Using an adapter to connect it to a 4-in.-dia. hose, dust collection was only fair. Finally, a full revolution of the height-adjustment wheel moves the cutterhead 3⁄32 in. The other machines move 1⁄16 in. with a complete revolution of the handle, a dimension that's much easier to work with because the most common thicknesses for furniture are in multiples of 1⁄16 in.



RIKON 25-130H

Price: \$650

Warranty: 5 years

Cutters: 26

Size: 13 in.

Depth stops: 8

Snipe: 0.003 in.

Out of parallel: 0.001 in.

Dust collection: Good

Noise level: 99 db.

Surface quality

White pine: Good

White oak: Good

Curly maple: Poor

The Rikon 25-130H, like the General International 30-060HC, has a segmented cutterhead with 26 cutters, arranged in six straight rows, that enter the wood straight on. Rotating and changing the cutters was easier on the Rikon than on the General International, because it has an automatic cutterhead lock. There is a flat top that is a good staging area for boards between runs through the machine. There are two dust ports on the back of the machine (2½ in. and 4 in. dia.), with one exiting on either side of the planer. Dust collection was good with the planer connected to a 4-in.-dia. hose and dust collector.



RIKON 25-131

Price: \$450

Warranty: 5 years

Knives: 2

Size: 13 in.

Depth stops: None

Snipe: 0.002 in.

Out of parallel: 0.008 in.

Dust collection: Good

Noise level: 98 db.

Surface quality

White pine: Good

White oak: Good

Curly maple: Poor

The Rikon 25-131 has an open top, but two material rollers make it easy to pass boards back to the infeed side, and they're stable enough for stacking. Access to the knives was difficult, requiring you to remove the dust shroud and a metal hood beneath it, and making knife changes tedious. However, once you get to the knives, you don't need to pull the screws all the way out. After loosening them, the gib is pushed up by springs and the knife can be pulled out. Dust collection was good, with a port that exits to the right of the machine. You can hook up either a 4-in. or 2½-in.-dia. hose to the port. Connected to a 4-in.-dia. hose and dust collector, chip collection was good.



TRITON TPT125

Price: \$426

Warranty: 1 year

Knives: 2

Size: 12½ in.

Depth stops: None

Snipe: 0.101 in.

Out of parallel: 0.01 in.

Dust collection: Good

Noise level: 102 db.

Surface quality

White pine: Good

White oak: Good

Curly maple: Poor

Accessing the knives on the Triton was not difficult, but getting the knives out to change them was tricky because no magnetized handles were provided to lift the knives off the cutterhead. There is a 2½-in.-dia. dust port, and chip collection was good when hooked up to a shop vacuum. The housing has an open top with just one return roller, making it impossible to stack boards there in between passes through the machine. Also, there is no gauge that indicates how much material you are removing in a pass, making it one of four planers that don't offer this feature.



Cabinet Saws for the Home Shop

Compact models give you the power and accuracy of a full-size saw for less

It would be nice to have a full-size cabinet saw in your home shop—one that can handle the toughest timbers or a full sheet of plywood—but there are a few roadblocks. Because they can cost more than \$3,000, it can be difficult to fit a cabinet saw into your tool budget. They also require a 240-volt circuit, which many of us don't have in our garage and basement shops. Finally, they take up a lot of space.

Fortunately, there's a new class of cabinet saws that give you all of the benefits of their bigger brothers—power, good dust collection, vibration-dampening mass, and

easy adjustments—for less money. And they all can run on a 110-volt circuit.

In our head-to-head comparison of these new saws, we checked them for blade wobble (runout) and whether the blade was parallel to the miter slot. We also looked at the sturdiness and accuracy of the rip fence, the saw's ability to hold settings for tilt and height, the placement of the power switch, and the ease of changing blades. To gauge power, we ripped 8/4 hard maple and timed each rip.

After the tests, it was clear that the Sawstop PCS175 was the Best Overall. It was dead accurate, has a top-quality fit

READERS' RATINGS: CABINET SAWS

★★★★★	4.39	SAWSTOP PCS175
★★★★★	4.24	POWERMATIC PM1000
★★★★★	4.12	GRIZZLY G0715P
★★★★★	4.08	LAGUNA FUSION
★★★★★	3.50	BAILEIGH TS-1044H

and finish, is the most user-friendly saw, and has SawStop's flesh-sensing technology and blade brake. The Best Value among the saws is the Grizzly G0715P. It's heavy, accurate, has good power, and costs just \$825.

Roland Johnson contributed to this article.



“It’s excellent. Throw in its safety device, and it’s tremendous.”

SAWSTOP PCS175

Price: \$2,299

Motor: 1¾ hp, 110v

Table size: 27 in. by 44 in.

Rip capacity: 30 in.

Arbor-flange runout: 0.000 in.

Blade-to-slot parallelism at 0°: 0.000 in.
at 45°: 0.001 in.

Warranty: 2 years



Even without its well-known blade brake, the SawStop is a great saw. It has very good ripping power. The dust collection was good, especially considering that the blade is enclosed only on one side to make room for the blade-brake cartridge. A 4-in. hose connects the blade shroud to a port in the cabinet. Everything else about the PCS175 is smooth. The fence locked tightly and glided like skates on ice, at least in part due to two small wheels on the underside of the fence at the end opposite the handle. You can move the fence with one finger. The tilt and elevation wheels had no backlash, and turned beautifully.

Switching from the riving knife to the blade guard took no time at all. And the guard is very good. There are three independent,

but connected, leaves on each side of the blade. Their light weight made it easy to push thin or light stock under the guard, and the leaves fall sequentially back into position. There is no locking device for holding the leaves off the table, but it was easy to lift the leaves manually above the fence for ripping narrow stock. When making a replacement insert plate, you have to do some extra work to make way for the safety gear, a small inconvenience that doesn't outweigh the safety aspect. Overall, the SawStop PCS175 is excellent. Throw in its safety device, and it's tremendous.



Quick exchange from riving knife to guard. A big, easy-to-reach lever is all you need to free them on the SawStop.



Slick fence. Sturdy and deflection-free, the SawStop's fence locks down tight (above). It also glides over the table as if it were floating on air, thanks to a pair of small wheels at the end (left).



“You get a lot of saw for well under \$1,000.”

GRIZZLY G0715P

Price: \$825

Motor: 2 hp, 220v

Table size: 27 in. by 40 in.

Rip capacity: 30 in.

Arbor-flange runout: 0.000 in.

Blade-to-slot parallelism at 0°: 0.009 in.
at 45°: 0.004 in.

Warranty: 1 year



With the Grizzly you get a lot of saw for well under \$1,000. Powered by a 2-hp motor, the G0715P has plenty of muscle and did very well in the ripping test. (It comes wired for 220 volts, but can be rewired for 110.) The T-square style fence is stout and locked down square with no deflection. Even though there is no blade shroud, dust collection was still quite good, and a big hinged door over the motor makes it easy to vacuum out any dust that falls to the bottom of the cabinet.

The release mechanism for the riving knife and blade guard was easily the most convenient in the test. You don't have to remove

the throat plate to switch between the knife and guard. Just slide a thumbwheel back and to the side, and the riving knife is released. Slide in the guard, push the thumbwheel to the side and forward, and it locks the knife into place. Wonderful! The blade guard is good, with a leaf on each side of the blade. The leaves pivot up as wood is fed under them, and rise independently so that you can raise just one for thin rips. The arbor lock worked well and was easy to access, making single-wrench blade changes convenient. A minor downside is that the throat plate is very thin, which complicates making a zero-clearance insert for it.



Power switch is hard to miss. The Grizzly's switch is easy to find while you keep your eyes on the blade and workpiece, making for safer transitions at the start and end of a cut.



Awesome riving knife removal. There's no need to remove the throat plate, and all you have to do is move a small thumbwheel to free the knife or guard.



Guard works for thin rips. One side can be rotated up above the fence, while the other side stays down to cover the blade.



“The only fence in the test that comes with a digital readout.”

BAILEIGH TS-1044H

Price: \$1,595

Motor: 1¾ hp, 110v

Table size: 27 in. by 44 in.

Rip capacity: 36 in.

Arbor-flange runout: 0.000 in.

Blade-to-slot parallelism at 0°: 0.006 in.
at 45°: 0.026 in.

Warranty: 1 year

Cabinet saws are heavy and difficult to move by yourself, which is something you might need to do in a home shop that doubles as a garage. Baileigh addressed the problem by mounting four wheels inside the TS-1044H's cabinet. They allow you to roll the saw forward and back, but not side to side. To make turns, you can lift up on the fence rails and rotate the saw. When you don't need the mobility, the wheels lock with thumbscrews.

The saw's fence is T-square style and worked very well. It's the only fence in the test that comes with a digital readout that displays the distance between the fence and blade down to

thousandths of an inch. It's easy to zero out when you change blades and we found it to be accurate. Dust collection was fair.

The Baileigh did very well in the ripping test, but its miter slot was significantly out of parallel to the blade with the blade tilted to 45°. Fortunately, the trunnions are mounted to the cabinet, which makes it easy to fix. The power switch is very low on the cabinet, making it hard to reach with your hand or knee. Also, the riving knife and blade guard lock in place with the spin of a star knob. It's not difficult, but it is less convenient than the locking mechanisms on the Grizzly, SawStop, and Powermatic saws.



Digital fence readout. The distance from the blade to the fence is displayed to a thousandth of an inch, and it's accurate.



Built-in mobile base. Four wheels in the cabinet allow you to move the saw forward and back. The wheels lock with a few turns of a thumbwheel.



Long reach for the power switch. Located beneath the height adjustment wheel, the switch requires you to lean over too far.



“Plenty of power, and the fence slid easily and locked securely.”

LAGUNA FUSION

Price: \$1,300

Motor: 1¾ hp, 110v

Table size: 27 in. by 44 in.

Rip capacity: 36 in.

Arbor-flange runout: 0.000 in.

Blade-to-slot parallelism at 0°: 0.020 in.
at 45°: 0.019 in.

Warranty: 1 year

If you have a garage shop that doubles as a place to park your cars, then the Fusion's built-in mobile base will come in handy. You can move the saw with ease and store it neatly against a wall when not in use. The saw has two casters. Pick up the fence rails like a wheelbarrow and the saw is ready to roll into action or back into storage. Thumbscrews lock the wheels so that it doesn't roll during use.

The motor provides plenty of power, and the T-square-style fence slid easily, locked securely, and resisted deflection. The magnifying curser makes the fence's scale easy to read. The

power switch attaches to the front fence rail with two T-bolts, and can be positioned anywhere along the fence that's convenient, so you can get it in the exact right place for easy and safe use.

Although there was no arbor flange runout, the miter slot was significantly out of parallel to the blade at both 90° and 45°. Because the trunnions are mounted to the cabinet, it is an easy fix. Although it's not exactly difficult to switch between the riving knife and blade guard (just spin a star knob a few times), the process took longer compared with the Grizzly, SawStop, and Powermatic. Dust collection was fair.

Lift and roll. The novel design of the Laguna's mobile base (it works like a wheelbarrow) made the saw very easy to move around the shop.



Power where you want it. The paddle switch can be positioned anywhere along the front rail, so no matter how tall you are or how long your arms are, it can always be within close reach.



Fence scale is easy to read. The large red line in the magnifying curser is perfectly sized to line up accurately with the lines on the scale.



“An excellent saw. The fit and finish were as neat as a pin.”

POWERMATIC PM1000

Price: \$2,000

Motor: 1¾ hp, 115v

Table size: 27 in. by 40 in.

Rip capacity: 30 in.

Arbor-flange runout: 0.001 in.

Blade-to-slot parallelism at 0°: 0.000 in.
at 45°: 0.002 in.

Warranty: 5 years

This is an excellent saw. It seems like a slightly smaller, but no less impressive, version of the PM2000, a proven winner over the past couple of decades. The fit and finish were as neat as a pin. Equipped with a 1¾-hp motor, the PM1000 did very well in the ripping test. It's massive, too, weighed down by big cast-iron trunnions and a stout motor and arbor assembly. The T-square-style fence was solid, had the least amount of deflection, and was simply bigger and beefier than the other fences.

The riving knife and blade guard are locked in place by a cam clamp, making switches from one to the other quick and painless. There is a single leaf on each side of the blade guard, and they operate independently, so it's no problem to raise one above the fence for thin rips. A detent holds the leaf up. Blade changes are a breeze, too, thanks to an easy-to-use plunge lock on the arbor. The power switch is another great convenience, as it's perfectly positioned at hip height and easy to find with your hand or hip. Dust collection was good, too.

As good as the PM1000 is, it's a microscopically close second to the SawStop, only because it doesn't have a safety system that's equal to that on the SawStop.



Adjustment wheels roll easily. A few fingers on the knob is all it takes to spin the height and tilt wheels. The action is smooth with no lash in the gears.



Cam lever simplifies riving knife. The lever is within easy reach and can be opened and closed with just two fingers.



A great arbor lock. There's plenty of room for your thumb and it takes little effort to depress the lock.

Spindle Sanders

The best tool for sanding curved work



Oscillating spindle sanders are a go-to tool for sanding the edges of curved wood parts while keeping them square to the surface. They're also helpful when smoothing curved router templates. The oscillating action of the spindle and sanding drum mounted to it removes stock quickly and efficiently. Some models even offer a tilting table if you want the edge at a consistent angle. There are both floor models and benchtop models available. The most economical option for a home shop is a benchtop unit, so we looked at those.

Big table is better

The table on an oscillating spindle sander, usually cast metal, supports the work. To get consistent results, the table must be flat and perpendicular to the spindle. A bigger table is better because there's more area to help support your work. It's important to also think about spindle placement because the more table there is in front of the spindle, the more room there is to work.

Some tables tilt so that you can sand at an angle along a curve. The tables on the Delta and Jet sanders tilt around the

READERS' RATINGS: SPINDLE SANDERS

★★★★★	4.27	RIDGID EB 44242
★★★★★	4.13	TRITON TSPS450
★★★★★	4.09	GRIZZLY G0739
★★★★★	4.08	JET JBOS-5
★★★★★	4.07	POWERTEC OS-1000
★★★★★	3.99	DELTA 31-483
★★★★★	3.93	WOOD RIVER 157889
★★★★★	3.73	SHOP FOX W1831

Features that matter

TABLE SIZE



Small tables can be problematic. With a small table, there is very little real estate in front of the spindle where the action happens. Large workpieces are difficult to handle.



Support where you need it. A larger table can handle stock of any size and makes it easier to sand wide or long boards.

THROAT INSERTS



Poorly sized inserts leave a gap. The inserts on most of the tested models sat slightly below the tabletop, an average of 0.013 in. This gap can cause the workpiece to dip, throwing it out of square or causing it to bind.



Close up the gap. The Wood River and Ridgid sanders were the only models with adjustable throat inserts. A flush insert offers solid support along the entire top and allows smooth passes for better results.



Tool free is hassle free. The Powertec and Ridgid models have thumbscrews for quick and easy drum changes. The thumbscrew applies pressure to tighten the sanding sleeve.

SPINDLE CHANGES



Tools in tight places. The Delta and Jet sanders have separate spindles for each diameter that thread directly into the motor. This design is strong and works well, but to change them you must reach under the table and use two wrenches.

Testing the sanders



Sanding squarely. To check that each sander removes material consistently from top to bottom, we marked a board's edge and made one pass. We then used a square to check down the length of the board.



Dust pickup. Most models captured more than 90% of the dust, leaving barely a sign of dust on the table (top). A few sanders, though, didn't fare so well in the dust test, collecting less than 50% of it (bottom). See chart on next page for specific results.

Oscillating spindle sanders



WINNER AND STILL CHAMPION

An earlier Ridgid model won Best Overall the last time we reviewed oscillating spindle sanders. This time was no different. The EB 44242 is the most versatile of the bunch, with a big table and great dust collection.



Two tools in one. The Ridgid's belt-sander attachment stores behind the unit, and attaches as easily as a standard spindle.



Last shop sander you'll need. With the belt sander, the Ridgid lets you accurately sand both curved and flat surfaces.



DELTA
31-483



GRIZZLY
G0739

MODEL	PRICE	TABLE SIZE	MOTOR RATING	SPINDLE/ DRUM SIZES	SPINDLE STROKE	OSCILLATIONS PER MIN.
Delta 31-483	\$400	14 ³ / ₄ in. by 14 ³ / ₄ in., tilting	7.5 amps	¹ / ₄ in., ¹ / ₂ in., ⁵ / ₈ in., 1 ¹ / ₂ in., and 2 in.	¹⁵ / ₁₆ in.	29
Grizzly G0739	\$150	11 ¹ / ₂ in. by 15 in.	3.5 amps	¹ / ₂ in., ³ / ₄ in., 1 in., 1 ¹ / ₂ in., 2 in., and 3 in.	⁵ / ₈ in.	60
Jet JB0S-5	\$490	14 ³ / ₄ in. by 14 ³ / ₄ in., tilting	7.5 amps	¹ / ₄ in., ¹ / ₂ in., ⁵ / ₈ in., 1 ¹ / ₂ in., and 2 in.	¹⁵ / ₁₆ in.	29
Powertec OS-1000	\$270	18 in. dia.	2.6 amps	¹ / ₂ in., ³ / ₄ in., 1 in., 1 ¹ / ₂ in., 2 in., and 3 in.	1 in.	30
Ridgid EB 44242	\$200	14 in. by 19 in., tilting	5 amps	¹ / ₂ in., ³ / ₄ in., 1 in., 1 ¹ / ₂ in., and 2 in.	³ / ₄ in.	60
Shop Fox W1831	\$153	11 ¹ / ₂ in. by 15 in.	3.5 amps	¹ / ₂ in., ³ / ₄ in., 1 in., 1 ¹ / ₂ in., 2 in., and 3 in.	⁵ / ₈ in.	58
Triton TSPS450	\$180	11 ¹ / ₂ in. by 15 in.	3.5 amps	¹ / ₂ in., ³ / ₄ in., 1 in., 1 ¹ / ₂ in., 2 in., and 3 in.	⁵ / ₈ in.	58
Wood River 157889	\$170	11 ¹ / ₂ in. by 15 in.	3.5 amps	¹ / ₂ in., ³ / ₄ in., 1 in., 1 ¹ / ₂ in., 2 in., and 3 in.	⁵ / ₈ in.	58



JET
JBOS-5



POWERTEC
OS-1000

DUST COLLECTION	COMMENTS
Poor	Metal case and throat inserts. No 3-in. spindle. Includes 4-in. dust collection adapter, which didn't improve performance during testing, onboard storage for spindles with sleeves, inserts. No tool storage.
Very good	The noisiest machine, tested at 94 db. Includes onboard storage for drums with sleeves, inserts, and tools. Workspace in front of drum limited to 4 in. wide by 9 in. long.
Poor	Metal case construction and throat inserts. Includes a 1/4-in. spindle but no 3 in., and onboard storage for spindles with sleeves, inserts. No tool storage.
Excellent	Motor stalled under heavy load. Includes onboard storage for drums with sleeves, inserts, and tools.
Good	Includes a 4-in. by 24-in. oscillating belt sander, adjustable throat for flush-mounted inserts, and onboard storage for drums with sleeves, inserts, and tools.
Very good	Includes onboard storage for drums with sleeves, inserts, and tools. Workspace in front of spindle limited to 4 in. wide by 9 in. long.
Very good	Includes onboard storage for drums with sleeves, inserts, and tools. Workspace in front of spindle limited to 4 in. wide by 9 in. long.
Very good	Adjustable throat for flush-mounted inserts. Table machining was rougher than similar units. Includes storage for drums with sleeves, inserts, and tools. Workspace in front limited to 4 in. wide by 9 in. long.



SHOP FOX
W1831



TRITON
TSPS450



WOOD RIVER
157889

spindle, where the Ridgid tilts on the portion of the table in front of the spindle.

Dust is the enemy

These units make a lot of fine dust, so dust collection is a concern. When hooked up to a Bosch VAC090A vacuum, most of the units tested collected at least 90% of the dust.

Dust collection was poor on a few machines because the space below the table is open. This provides access when attaching the spindles, but significantly reduces the airflow. As a result, less than 50% of the dust was captured.

Easy spindle changes are a plus

What's great about these sanders is that you can change out the drum sizes to sand different-size curves. There are two ways to make this change. Most of these sanders have a single, permanently mounted spindle shaft that holds different-size sanding drums. The drums slip over the shaft and a nut and washer on top are tightened to compress the drum so that it holds the sanding sleeve tightly. Other units, such as the Delta and Jet sanders, use different size spindle shafts for each drum size—a less convenient system.

Because of the various size spindle attachments, inserts, and tools required to replace the drum or spindle, it's helpful if the machine has onboard tool storage.

The choice is easy

Overall, it's hard not to like the versatility of the Ridgid unit. It has the largest table and the spindle is mounted toward the rear, providing a huge amount of usable space. The real icing on the cake is the oscillating belt sander, which stores neatly in the sturdy plastic housing. Because of all this, the Ridgid is Best Overall and Best Value. □

Fine Woodworking shop manager

William Peck contributed to this article.

Drill Presses



Floor-standing models have more power, capacity, and convenience than benchtop models

While a benchtop drill press will be adequate for the majority of holes you drill, there will be times you'll want the power and capacity of a full-size machine. On average, floor-mounted drill presses offer more power, larger tables, and more swing (the distance between the post and the chuck). Most importantly, many of today's machines have 4-in.-plus of quill travel (the distance they can plunge a drill bit), which not only makes deeper holes possible but also means you won't have to adjust the table height as often.

Drill presses haven't evolved far from their machine-shop roots, so we focused on models with two woodworker-friendly features: quill travel of at least 4 in. and a table that tilts 45° in both directions. That narrowed an enormous field to 10 machines from six manufacturers. (Jet, Powermatic, and Shop Fox had machines that fit our criteria, but they declined to participate.) Chucks ranged from $\frac{5}{8}$ in. to $\frac{3}{4}$ in., all plenty big for woodworking bits. All came prewired for 120 volts, so they'll work in any shop.

Clean, consistent holes of any size

The main reasons to choose a drill press over a handheld drill are power and precision. To test power, we used a 2-in.-dia. Forstner bit to drill through 2 in. of hard maple. We ran the bit as close to the recommended 400 rpm as each model allowed, and drilled with a very heavy hand.

None of the motors stalled, but we did make the belts slip on a few—the

Stand-out machines



EDITORS' CHOICE
BEST OVERALL

DELTA
18-900L

The Delta 18-900L was a no-brainer for the Best Overall award. It has the most quill travel, a big table that tilts in both directions, the fastest and easiest speed changes, a quick-adjust depth stop and quill lock, an effective head-mounted laser pointer, and plenty of power and accuracy.

A Delta bonus.

The Delta is the only machine with a usable table insert. It is leveled via set screws, and you can screw into it from below to hold it down.



EDITORS' CHOICE
BEST VALUE

PORTER-CABLE
PCB660DP

At one-third the price of the Delta, the Porter-Cable PCB660DP is the most affordable machine in the test and an easy pick for Best Value. It offers a quick-adjust depth stop and quill lock, a good laser pointer, and easy speed changes. The table is small, with a rim that is ¼ in. below the center section (making it hard to clamp at the edges), so you will definitely want to add an auxiliary table. But at \$320, this machine is a steal.



READERS' CHOICE

GRIZZLY
G7948

READERS' RATINGS: DRILL PRESSES

★★★★★	4.04	GRIZZLY G7948
★★★★☆	3.97	DELTA 18-900L
★★★★☆	3.94	PORTER-CABLE PCB660DP
★★★★☆	3.92	RIKON 30-240
★★★★☆	3.88	GRIZZLY G7947
★★★★☆	3.80	GENERAL INTERNATIONAL 75-500
★★★★☆	3.79	GENERAL INTERNATIONAL 75-700 M1 VS
★★★★☆	3.70	GENERAL INTERNATIONAL 75-260 M1
★★★★☆	3.39	CENTRAL MACHINERY 39955



**Central Machinery
39955**



EDITORS' CHOICE
BEST OVERALL
**Delta
18-900L**



**General
International
75-260 M1**



**General
International
75-500**



**General
International
75-700 M1 VS**

MODEL	PRICE/ WARRANTY*	MOTOR	SPEEDS/RANGE	SWING	QUILL STROKE	TABLE SQUARENESS (FRONT TO REAR)
Central Machinery 39955	\$580/ 90 days	1½ hp	12/ 180–3,865 rpm	20 in.	4¾ in.	Fair
EDITORS' CHOICE Delta 18-900L	\$1,000/ 5 years	¾ hp	16/ 170–3,000 rpm	18 in.	6 in.	Adjustable
General International 75-260 M1	\$760/ Lifetime	1 hp	12/ 255–2,750 rpm	17 in.	6 in.	Excellent
General International 75-500	\$960/ Lifetime	1 hp	12/ 120–2,270 rpm	17 in.	4½ in.	Excellent
General International 75-700 M1 VS	\$2,100/ Lifetime	1 hp	VS/280–1,140 and 800–3,200 rpm	22 in.	5⅞ in.	Excellent
Grizzly G7947	\$575/ 1 year	1 hp	12/ 210–3,300 rpm	17 in.	4¾ in.	Very good
READERS' CHOICE Grizzly G7948	\$695/ 1 year	1½ hp	12/ 210–3,300 rpm	20 in.	4¾ in.	Excellent
EDITORS' CHOICE Porter-Cable PCB660DP	\$320/ 3 years	¾ hp	12/ 300–3,100 rpm	15 in.	4 in.	Very good
Rikon 30-240	\$975/ 5 years	1 hp	12/ 180–3,865 rpm	20 in.	4¾ in.	Excellent

* Check with manufacturers for limitations.

Porter-Cable and the General International 75-700—even after pulling the belts extra tight. That meant we couldn't push this big bit quite as hard on these machines. However, that would only be a problem if you were drilling scores of big holes a day. All of the machines produced very clean holes.

To test runout and accuracy, we tightened ¼-in.-dia. and ½-in.-dia. drill rod (precisely

ground lengths of drill steel) in the chuck, placed a dial indicator against the rod, and turned the chuck slowly by hand, letting go before taking each reading.

To see how this test would be reflected in actual performance, we drilled ¼-in.-dia. and ½-in.-dia. holes in soft pine, plunging the bits slowly to allow any runout to affect the hole diameter. Then we removed the drill bit from the chuck and inserted

the shank end into the hole, looking for looseness.

Convenience matters too

The time needed to make speed changes varied considerably among machines. In theory the variable-speed unit would shine here, but the General International 75-700 still requires a belt change to get from a lower speed range to an upper one, and



RUNOUT	AVERAGE SPEED CHANGE	POWER TEST**	QUILL LOCK	WORK LIGHT	COMMENTS
Good	1 min.	10 sec.	Yes	Poor	Weak work light, too much table sag front to back.
Excellent	30 sec.	11.5 sec.	Yes	Good	Best table, easiest belt changes, quick-release depth stop, only machine with front-to-back table adjustment.
Good	2 min., 50 sec.	11 sec.	No	None	Good accuracy but tedious process for changing speeds.
Good	2 min.	11 sec.	No	Very good	Good accuracy, very good work light, useful low-end speed, but difficult belt changes.
Good	Variable, 2 min. range change	12 sec.	No	None	Accurate, but two variable-speed ranges require troublesome belt change.
Fair	1 min., 5 sec.	8 sec.	No	Very good	Tied for most power, very good work light.
Very good	1 min., 10 sec.	8 sec.	No	Very good	Tied for most power, very good work light.
Good	53 sec.	19 sec.	Yes	Very good	Good accuracy, great conveniences, low price.
Very good	1 min.	13 sec.	Yes	Very good	Very accurate, with quick-adjust depth stop and very good work light.

** Average time needed to drill 2-in.-dia. hole through 2 in. of hard maple.

that belt change is tedious, thanks to set screws that require an Allen wrench, and a long motor-cover screw that must be completely unthreaded.

The other eight machines require a belt change for each speed setting, but on most, this took only a minute or less.

While laser pointers are not necessary, we preferred those on the Delta and Porter-Cable machines, which are wired

to the machine and mounted on the head. The others are battery-operated and mounted on the post, so if the head of the machine shifts you'll have to re-align the lasers.

The variously sized cast-iron tables were not a concern, as most people will place a plywood or MDF auxiliary table on top of theirs to offer better workpiece support. However, with its large overall size, flat

edges for clamping, and unique table insert, the Delta's table works fine on its own, giving that machine an edge. For those reasons, we chose the Delta as Best Overall and the affordable Porter-Cable as Best Value. □

William Peck, Fine Woodworking's shop manager and a retired engineer, contributed to this article.

Choosing a Lathe

**More money gets you
more capacity and power, but
great values exist at every level**

If you're new to wood turning, you may be trying to decide what size lathe will fit your shop, your budget, and your capabilities. This brief guide will help you sort things out and get the most for your money.

All lathes share a basic design (see top photo, opposite). At one end is the headstock, where power from a motor spins the work. The headstock spindle is threaded to hold chucks and faceplates, and bored with a Morse taper to hold a drive center and other accessories. At the other end is the tailstock, which is also bored with a Morse taper. In between is the banjo, a piece that slides along the lathe bed and holds the tool rest.

Mini-lathes: A good first choice

Products in this category are low-priced and lightweight, yet large and powerful enough to satisfy a range of needs. Many come with the same handy features as their larger cousins, including variable speed control and a spindle lock.



Ample capacity. Most mini-lathes will let you turn a bowl 10 in. to 12 in. dia. Just be sure the lathe is mounted on a heavy, stable stand or bolted to a bench to dampen vibration and to prevent everything from wobbling when you begin to turn an irregular bowl blank.



Small pieces are a snap. A mini-lathe is tailor-made for turning pens, bottle-stoppers, ornaments, furniture knobs, toy components, and other small pieces.

Features that matter

Though all lathes share a common anatomy, features differ among models based on their size and capacity. To get the best value when you're shopping for a lathe, be sure it will give you some flexibility—the size and power to let you turn new things as your interests change. It's also important to get a tool with as much mass as possible. Mass dampens vibration, which makes turning worlds easier.

When deciding on the right size for you, note the swing and the distance between centers. The swing is the largest diameter you can turn on that lathe. The distance between centers tells

you the length of the longest spindle you can turn. A small lathe is ideal if you plan to turn only pens, bottle-stoppers, and other small things. You'll need a bigger lathe to turn wide, deep vessels or long spindles.

Aside from size, you should consider other features:

Tool rest—In general, a longer tool rest is more useful. It's especially efficient for spindle turning, because it lets you work a larger area before having to move it. The size of a stock rest depends on the size of the lathe—mini-lathes (above) have rests that are only 4 in. to 6 in. long while full-size models may have rests that are 12 in. to 14 in. long. Length is a plus, but so is a rest that is smooth, with

Full-size: Bowls and beyond



With a good full-size lathe, you can turn just about anything—from a small lidded box to a banquet-size serving platter. A larger spindle and greater mass make it easier to work with heavy, rough chunks of wood.



Versatile machines.

Larger full-size lathes have enough horsepower and torque to let you take heavy cuts in a large blank without stalling (above). Some also have a movable headstock assembly and an outboard tool rest (right), so you can turn very large bowls and platters without the bed getting in the way.



no bumps that could interfere with your turning tools. If your lathe is good but you're unhappy with the tool rest, you can replace it with an accessory one.

Electronic variable speed control—Although not essential, electronic speed control is quite handy. It lets you safely start turning an irregular blank at a very slow speed, then run faster as the bowl takes shape.

Headstock spindle lock—The lock makes it a bit easier to thread on a chuck or faceplate. Some mini-lathes and inexpensive full-size lathes lack this feature.

Indexing head—This feature lets you lock the headstock at any one of numerous positions. Most full-size and heavy-duty lathes (opposite page) have an indexing head, but some mini-lathes don't. If you use the lathe and a router to cut flutes or reeds in a period table leg, an indexing head is essential.

Forward and reverse—Being able to run a lathe in reverse is useful when sanding or applying finish. Many full-size and heavy-duty lathes have reverse; it's rare on mini-lathes.

Beefy drive belt—This isn't a factor with mini-lathes, which work fine with a narrow poly-V belt. Bigger lathes need wide belts that hold up under heavy use.

Sturdy stand—To avoid excess vibration, a lathe needs solid support. A universal stand for mini-lathes, about \$180, will hold them steady. Many full-size lathes come with a good wide-body stand or well-designed legs. If your stand is too light, you can weigh it down with bags of play sand to prevent rocking or shaking.

Now let's look at the common sizes of lathes. What size you choose will depend on what you plan to turn, whether it's parts for furniture or vessels and bowls.

Mini-lathes

These are the smallest, least expensive lathes on the market. Despite their name, most have the capacity to let you turn spindles 16 in. to 24 in. long and bowls or vessels up to 10 in. to 12 in. dia. A mini-lathe usually makes a good first choice and is great for learning the basics of wood turning.

If you are a furniture maker, a mini-lathe might be all you need for making knobs, legs, and spindles. A bolt-on bed extension, about \$80 to \$160, gives a mini-lathe the capacity to handle long table legs.

A ½-hp motor is typical on mini-lathes, but some of the newer models come with a ¾-hp or 1-hp motor. Typically, you change speeds by moving a belt to a different pair of stepped pulleys, but electronic variable speed control is a common option.

Mini-lathes have a headstock spindle that's 1 in. dia. with 8 threads per inch (abbreviated 1x8 tpi). The headstock and tailstock are bored with a No. 2 Morse taper, the most widely used size.

Most mini-lathes cost between \$250 and \$600. There are many that weigh less than 100 lb., making them portable, but you'll trade some performance for that

portability. Better to buy a heavier model and put it on a very solid stand or benchtop.

Full-size lathes

Lathes in this category are suitable for just about any kind of turning, from big vessels and long posts down to pens or bottle-stoppers.

At one end of the spectrum are lathes that resemble elongated versions of a mini-lathe; these generally deliver not much more bowl-turning capacity than their smaller counterparts, with a swing of 12 in. or 14 in. They can handle spindles up to 40 in. long and have a $\frac{3}{4}$ -hp or 1-hp motor. As with mini-lathes, you change speeds by moving a belt on stepped pulleys, but variable speed control is a handy option.

At the other end of the full-size spectrum are larger, heavier machines with plenty of power. These models can turn 42-in. spindles and bowls or platters up to 24 in. across. Some have a sliding or pivoting headstock and an auxiliary tool rest, so you can turn even larger pieces off the side or the end of the lathe.

Motors deliver $1\frac{1}{2}$ hp to 2 hp and deliver constant torque even at slow speeds; variable speed control is standard.

Some less-expensive full-size lathes have a 1x8 tpi spindle, but most in this category have a $1\frac{1}{4}$ x8 tpi spindle. The larger diameter makes the headstock spindle stiffer and better able to resist flexing. Headstocks and tailstocks have a No. 2 Morse taper.

Although a few full-size lathes cost less than \$1,000, most are in the \$1,200 to \$5,000 range. All are too big for a bench and need either bolt-on legs or a stand.

Heavy-duty lathes

These large, expensive lathes are meant for professionals and very dedicated hobbyists who want silky-smooth, vibration-free performance even on the largest bowls and vessels. If all you turn is spindles and small furniture parts, a heavy-duty lathe is overkill.

Some of these lathes weigh 900 lb. A 3-hp, 240-volt motor and some sort of electronic speed control are standard. Prices start at about \$5,000 and go up from there. Most have a $1\frac{1}{4}$ x8 tpi headstock. Some heavy-duty lathes have a larger No. 3 Morse taper in the tailstock to handle bigger work.

Try before you buy

If you're really unsure how much lathe you need, seek out a nearby wood turning club. You can find clubs in your area through the American Association of Woodturners (woodturner.org). Visiting members' shops gives you a chance to try different lathes, and club members will almost certainly offer their own buying advice. Many will be happy to give you some free turning lessons, too. □

Wood turner David Heim contributed to this article.

Heavy-duty: For serious turners

These are the largest, heaviest, most expensive lathes on the market. They perform extremely well, but are more lathe than most people need.



Size and power to spare. Heavy-duty lathes are meant for turning bowls, vessels, and sculptures that would tax smaller machines. Here, award-winning wood turner David Ellsworth shapes a blank that will become a hollow vessel.

Portable Compressors

The best models are quiet, durable, and easy to operate

With a big pump and two air tanks, a twin-stack compressor is a mainstay on modern job sites. Capable of powering nail guns from the tiniest pin nailers to roofing and framing nailers, twin stacks are the most versatile hand-carry compressors. That means they are great for DIYers and woodworkers, too. Although portable, these workhorses weigh between 60 lb. and 70 lb., so you should give some extra thought to how you want to hoist and carry them.

A newer group of twin-stack compressors promised much-improved performance and ergonomics, so we decided to test them. We

READERS' RATINGS: COMPRESSORS

★★★★★	4.40	CA AIR TOOLS CAT-4620A
★★★★★	4.31	JENNY AM780-HC4V
★★★★★	4.30	SENCO PC1131
★★★★★	4.29	ROLAIR VT20ST
★★★★★	4.26	MAKITA MAC2400
★★★★★	4.01	DeWALT D55153
★★★★★	3.92	GRIP RITE GR254CTS
★★★★★	3.72	CENTRAL PNEUMATIC 60567



Photo this page: Rodney Diaz



MAKITA MAC2400 \$300

The Makita's roll cage protects the pump, the motor, and most of the components, and it provides the structure supporting the intelligently designed forward-facing gauges, regulator, and hose couplings. The arrangement makes it easy to connect hoses one-handed and to adjust pressure. The Makita is also quiet, second only to the California Air Tools model. It has a single two-way ball valve for draining both tanks, which is our preferred arrangement. Our only complaint about this compressor is its 71-lb. weight, which makes it the heaviest model in the test.



SENCO PC1131 \$212

Aside from its darker paint job, the Senco appears identical to the Grip-Rite. They share the same components, pump, and even the same painful plastic handle. Like its Grip-Rite brother, the Senco has two screw-style tank drains, which we find inconvenient. On the plus side, it's reasonably quiet and is tied with Grip-Rite for second-highest cfm rating in the test. Given its good air delivery, quality components, and reasonable price (second lowest in the lineup), it gets our vote for Best Value.

TWIN-STACK COMPRESSORS WHAT WORKS? WHAT DOESN'T?



Hose connections. Panel-mounted hose couplings on the California Air Tools and Makita compressors allow the connection of two tools and are easier to access than the single hose couplings found on most of the other compressors. Unfortunately, the DeWalt and Jenny compressors don't include a hose coupling, so one had to be added for testing.



Drain valves. The best drain-valve setup is a single quarter-turn ball valve that drains both tanks. The California Air Tools, Central Pneumatic, DeWalt, Makita, and Rol-Air compressors all have this. The Hitachi has a ball valve for each tank. Less reliable are the screw-type drain valves found on the Grip-Rite, the Jenny, and the Senco. Screw-type valves are tough to turn and prone to leaks.



CALIFORNIA AIR TOOLS CAT-4620A \$299

At 70 db., California Air Tool's compressor is the quietest in the test. It also has forward-facing couplings and gauges, making it easy to connect hoses and to read both the tank and the regulated pressure. Because it has two air pumps and a large motor, this compressor is the second heaviest in the test. Its oilless design allowed it to start easily after a deep freeze, but we were disappointed that the cold caused the pressure switch to malfunction, which prevented the motor from shutting off when the tanks were filled.



DeWALT D55153 \$234

The DeWalt is a simple, smartly designed machine. All the parts and gauges are tucked between the tanks and the pump, protecting them from damage and eliminating the bruises that come from carrying a compressor with protruding parts. The high-quality regulator, pressure switch, and gauges can be replaced with off-the-shelf components. Despite its motor having the smallest horsepower rating, this compressor has a very fast recovery time. We like the single easily accessible ball valve for draining the tanks, but wish the compressor came with a hose coupling.



Air filters. To prevent damage, a compressor's air filter should be tucked between the pump and the tanks, an arrangement found on the DeWalt, the Grip-Rite, the Jenny, and the Senco. Alternatively, it should have robust construction as on the Makita and the Rol-Air. California Air Tools' and Central Pneumatic's filters stick out enough to be damaged easily.



Gauges. The compressors from California Air Tools and Makita have 2-in. gauges mounted in an instrument panel that protects them from damage and makes it easy to check both tank and regulated pressure. Central Pneumatic's comparatively small 1½-in. regulated-pressure gauge is mounted just in front of the hose connection, where it could easily be broken.



stuck to compressors with the conventional design of a pair of 2-gal. (approximate) tanks and a piston air pump powered by an electric motor.

All but one of these have oil-splash pumps, which is the traditional choice for a compressor that gets a daily workout. The exception is the oilless model from California Air Tools. Its design is similar to that of a former contractor favorite, the Thomas Air Pac, which went out of production in 2009.

How we tested

One of the most common complaints about twin stacks is that their large motors and oil-splash pumps trip breakers because they require a large surge of electricity to get turning, especially in cold weather when pump oil is more viscous. To measure the propensity of the tested models to trip breakers, we used a clamp-on multimeter to measure their amperage draw at startup and at their maximum, a point usually reached just before the tanks are full. We did the same test at low temperature by putting them in a walk-in freezer (at -10°F) for about 18 hours.

The low-temperature test was revealing. Only three of the nine compressors would even start up after their deep freeze: the California Air Tools, the Rol-Air, and the Makita. The Rol-Air and Makita models were completely trouble free. The California Air Tools compressor started just fine, but then it wouldn't shut off un-

til the blow-off valve released the excess pressure. We wondered if the manufacturer had received complaints like this before, so we called marketing manager Larry Ceruka. He told us that he'd never heard of the problem and that the company sells a lot of compressors in Canada because the oilless pumps are very reliable in cold weather. The unit worked fine once it warmed up again. All of the other compressors that wouldn't start also worked fine once they had thawed.

To check the accuracy of regulators and gauges, we connected a high-quality pressure gauge and compared its reading to that of the compressors' gauges. We found all the gauges to be within a pound or two of their stated pressure. To judge ergonomics, our experts repeatedly carried the compressors from their shops to their trucks, negotiating long walks, entry doors, and slippery stairs. We found that all of the compressors are heavy and hard to carry. Because the differences in ergonomics were so slight, we put less emphasis on weight and ergonomics when choosing our two favorites.

In addition to our testing, we also gave a critical eye to the location and quality of components. We looked for parts that could be broken off or damaged when loading the rig into a truck or carrying it through a door opening. We paid special attention to the drain valves because we find the simplicity and reliability of a ball valve to be a significant upgrade over the screw-type valve,



CENTRAL PNEUMATIC 60567 \$130

Harbor Freight's Central Pneumatic compressor is the lightest in the test and, therefore, the easiest to carry. It's also the loudest and has the second-lowest cfm rating, trailed only by the Hitachi. The regulator is accurate, but adjustments lack precision, especially at higher pressures, and the gauges are small with hard-to-read numbers. The air filter and the coupling are positioned where they could easily be broken. A cross-threaded machine screw securing the motor shroud left us concerned about the company's quality-control department. We'd choose another model.



GRIP-RITE GR254CTS \$249

The Grip-Rite is tied for second in air delivery, and it's priced reasonably. As on the nearly identical Senco, the components are tucked between the tanks and the pump, protecting them from damage. Unfortunately, the arrangement has the gauges facing away from the coupling, making them harder to read than the gauges on most of the other units. Another downside is that both tanks include screw-type drain valves, which is the style we find most uncomfortable to use and the least reliable. Also, the hard-plastic handle has square ribs that dig into your hand.

which is tough on fingers and more prone to leaking. A leaky drain causes the pump to run more often, and one that's tough to open and close sees little use, which can lead to a buildup of water that accelerates tank rusting.

And because there are few things more annoying than a deafening compressor, we measured loudness with a decibel meter placed about 3 ft. away.

To test air delivery, we connected each compressor to a brand-new Max CN 890F coil framing nailer. We used this setup to drive 3¼-in. nails into Douglas-fir lumber and stacks of ¾-in. fir plywood. All of the compressors had enough pressure to fully set the nails.

Nailing speed was dependent on the compressors' respective cfm rating. Not surprisingly, compressors with higher cfm ratings could nail a little faster than those with lower cfm ratings, but none of the compressors were dogs. We also timed how long it took for each compressor to fill its tanks completely when starting from empty (see chart, opposite page).

The verdict

The Makita MAC 2400 compressor is our overall favorite. It's a quiet machine and has excellent performance, and the instrument panel makes it easy to connect hoses, adjust pressure, and see the gauges. This compressor only has one downside: At 71 lb., it's the heaviest twin stack in the lot. Of course, a heavy compressor is a drag, but far worse is a compressor that won't work because of a broken component. The Makita's sturdy roll cage adds weight, but more importantly, it protects the compressor's vital components.

With its quiet operation, intelligent design, and cold-weather reliability, the Rol-Air is also an excellent compressor. It weighs in at a more manageable 61 lb., and at \$330, it is priced only a little higher than the Makita.

Our Best Value pick is the Senco. It has quality components, good air delivery, and a selling price of just over \$200. □

Patrick McCombe, associate editor at Fine Homebuilding magazine, contributed to this article.



JENNY AM780-HC4V \$549

The Jenny and the DeWalt have nearly identical designs, but some components are different. The Jenny's pressure switch is easier to operate and looks especially sturdy. Unlike the DeWalt's single ball valve, the Jenny has two screw-type drain valves. Sturdy pressure gauges have a low-profile design that makes them less likely to snag cords and hoses. Likely because it's built in western Pennsylvania, includes long-life synthetic oil, and has some upgraded components, the Jenny is the most expensive compressor in the test, even though it (like the DeWalt) doesn't include a hose coupling.



ROLAIR VT20ST \$330

At only 1 db. louder than the Makita, Rolair's compressor is extremely quiet. The heavy-duty components are located in protected spots between the tanks and the pump. A single two-way ball valve drains both tanks, and the regulator is precise and easy to adjust. The regulated-pressure gauge is smaller than the tank-pressure gauge, but it's easy enough to read. Rolair's good air delivery, cold-weather reliability, and quiet operation make it our second favorite.

	MANUFACTURER	MODEL	HP	PRICE	STANDARD CFM	WARRANTY	WEIGHT (LB.)	DB. AT 3 FT.	AMPS AT START	MAX AMPS	TANK FILL TIME
	California Air Tools	CAT-4620A	2	\$299	5.3 at 90 psi	1 year	66	70	8.8	13.2	1:15
	Central Pneumatic	60567	2	\$130	3.5 at 90 psi	90 days	54	86	9.9	10.6	0:57
	DeWalt	D55153	1.1	\$234	3.8 at 100 psi	1 year	60	84	10.8	14.2	0:58
	Grip-Rite	GR254CTS	2	\$249	4 at 100 psi	1 year	63	83	12.8	14.3	1:04
	Jenny	AM780-HC4V	2	\$549	4 at 100 psi	1 year	61	82	11.8	14.7	1:06
	Makita	MAC2400	2.5	\$300	4.2 at 90 psi	1 year	71	77	9.1	13.1	1:22
	Rolair	VT20ST	2	\$330	4.2 at 90 psi	1 year	61	78	11.1	13.2	1:19
	Senco	PC1131	2.5	\$212	4.4 at 90 psi	1 year	58	82	13.7	14.3	1:11

18-Gauge Brad Nailers

Now able to shoot 2-in. nails, these small tools are more versatile than ever

New carpenters used to be told to purchase a 15-ga. or 16-ga. model as their first finish nailer, but now that most 18-ga. models can shoot a 2-in. nail, the smaller and less-expensive brad nailer has become a great all-around choice for trim. Short of hanging doors, many carpenters use brad nailers for nearly every finish-carpentry task. Besides being versatile, 18-ga. nailers leave a much smaller hole than 15-ga. and 16-ga. nailers, which is better for stain-grade work and will have the painters that follow you singing your praises (even if that painter is you). For woodworkers and DIYers, this versatile tool is definitely the first nail gun to buy.

For this review, we focused on 12 tools that accept 2-in.-long nails. Using 2-in. nails is standard for a lot of common tasks, such as nailing the outer edges of casing, and fastening baseboard and crown molding. We tested these nailers by using them daily in ways a finish carpenter



CADEX CB18.50A

Price: \$170

Weight: 3.4 lb.

Despite its awkward appearance, this tool was our favorite of the test. It operates smoothly and quietly, is relatively compact, and has a feature we love: a built-in air blower. The blower, which is on the front of the housing, is useful for clearing drywall dust and debris when installing base trim. It's also useful for dusting off tools and cleaning up at the end of the day. This nailer has a solid feel, and its performance was excellent. Its front safety, with a wraparound rubber nose, handled funky angles deftly. The only thing missing is a belt hook.

FEATURES air blower, dry-fire lockout, rear exhaust, quick-release nose, swivel air fitting



Let the air out. The built-in blower on Cadex's brad nailer is handy for clearing drywall dust and sawdust from corners and trim. The flow is controlled by a metal trigger you push with your thumb.



BOSTITCH BT1855

Price: \$85

Weight: 2.6 lb.

This tool was a pleasant surprise. It left very small holes even in the hardest wood, demonstrated excellent power, and was able to shoot 2 1/8-in. nails. It is also an oilless model, which many carpenters who work primarily with stain-grade materials prefer. Its very small front safety provided excellent visibility, but the tool was harder to get engaged at odd angles.

FEATURES

dry-fire lockout, rear exhaust, belt hook with pencil sharpener, swivel air fitting



Better belt hook. Bostitch's belt hook has a built-in pencil sharpener, and it holds the hex wrench used for clearing jams and making repairs. No tools are required for mounting the hook, which fits on either side of the nailer.



MAKITA AF505

Price: \$80

Weight: 3.2 lb.

This nailer feels and shoots like a \$200 tool, but it costs just \$80. Everything about it is refined: It has the smoothest magazine operation of any of the nailers, and it is quiet and comfortably heavy. While it's very capable at odd angles, its chunky nose and lack of a dry-fire lockout kept it from being our favorite model. In addition, the removable safety can fall to the ground when you open the driver housing; it could easily disappear into a pile of shavings.

FEATURES directable exhaust, belt hook, quick-release nose



Red means stop. The Makita doesn't have a dry-fire lockout, but it does have red indicators that show when the magazine is empty.

would. We loaded all the tools into a milk crate and pulled two or three out at the beginning of each day, connecting them to a small trim compressor set at 100 psi.

We used these tools for jobs that are pretty typical for 18-ga. nailers: installing door and window casing, baseboard, and cabinet crown. We also tested them in the shop, firing rack after rack of 2-in. and 1½-in. nails into salvaged, old-growth fir offcuts. To test power, we fired 2-in. nails into blocks made from three layers of ¾-in. Baltic-birch plywood. All of the tools performed well. Interestingly, we didn't have a single jam during the entire testing period, which speaks well to the overall quality of this group of tools.

The nailers we tested have a host of features that weren't common eight or 10 years ago. Many now have rear exhaust. Those that don't instead have rotating, top-mounted exhausts, so you can direct the blast of air away from your face and from accumulated drywall dust. Almost



GREX 1850GB

Price: \$200

Weight: 3.0 lb.

The Green Buddy is heavy-duty and quiet. The only feature it's missing is a quick-release nose for clearing jams. It has a nice swivel air fitting and a cutaway at the back of the magazine that helps it fit into corners. This tool did make larger holes than some of the other nailers in the hardest of the test materials.

FEATURES dry-fire lockout, rear exhaust, belt hook, swivel air fitting

All of the tools performed well. We didn't have

all of the nailers have a belt hook so that they can be hung from your tool belt or ladder when you need two hands to position the work. Many models also have a quick-release nose, which allows you to clear jams quickly without tools. All feature depth-of-drive adjustment to keep hole size to a minimum. We found that all of the depth-of-drive adjustments work pretty well, but some get smoother and easier to adjust with time.

Some of these tools have the ability to go from single-shot firing to bounce firing. In single-shot (sequential-trip) mode, the tool fires one nail when the contact is depressed. To fire another, the contact must be released and depressed again, then the trigger pulled. This can be a pain when you're working in awkward spaces. This feature is designed to enhance safety, but a little convenience is a tradeoff.

Our favorite feature, found in many of the nicer tools, is a dry-fire lockout, which means that the nailer will not fire when the magazine is empty.

Generally, many carpenters have a preference for the position of the safety contact on their nailers. Some models have a plunger behind where the nail exits; others have it in front. Either way, your view is blocked half the time.

Neither the position of the safety nor the size of the nose affected the performance of these tools much in regular use. Only once, with the giant nose on the Makita, were we not able to place a nail where we wanted in an awkward corner. Removing the plastic no-mar tip solved that problem. We discovered that the larger, wraparound-style safeties like Makita's work better at odd angles.

With a couple of exceptions, we would be happy to use any of these nailers daily. If backed against a wall, we would choose the Cadex as Best Overall. Best Value is tougher, as most nailers are priced similarly. Again, if forced, we would choose the Bostitch or the Makita. □

Kit Camp, a shop teacher and finish carpenter in Portland, Ore., contributed to this article.

READERS' RATINGS: 18-GA. BRAD NAILERS

★★★★★	4.59	GREX 1850GB
★★★★☆	4.33	CADEX CB18.50A
★★★★☆	4.33	UFFY TH-T-1825XP
★★★★☆	4.30	SENCO FINISHPRO 25XP
★★★★☆	4.21	RIDGID R213BNE
★★★★☆	4.19	DeWALT DWFP12231
★★★★☆	4.19	HITACHI NT50AE2
★★★★☆	4.19	PORTER-CABLE BN200C
★★★★☆	4.18	MAKITA AF505
★★★★☆	4.14	BOSTITCH BT1855
★★★★☆	4.04	MAX NF255FA/18
★★★★☆	3.71	GRIP-RITE GRTBN200



DEWALT DWFP12231

Price: \$75 **Weight:** 2.6 lb.

DeWalt and Porter-Cable (below) are both owned by Stanley Black & Decker, so it should be no surprise that their 18-ga. nailers are nearly identical. The only difference is that the DeWalt model has rubber bumpers on the housing. Both nailers are light and oilless, and they have excellent depth adjustment and ample power.

FEATURES rear exhaust, belt hook, quick-release nose



GRIP-RITE GRTBN200

Price: \$90 **Weight:** 3.0 lb.

Nearly identical in appearance to the Uffy model, the Grip-Rite has a smooth feel and is a solid performer. The rear safety with its large wraparound rubber tip worked well when nailing at funky angles. This tool also has a short magazine that allows good maneuverability.

FEATURES directable exhaust, belt hook, quick-release nose, swivel air fitting



HITACHI NT50AE2

Price: \$60 **Weight:** 2.0 lb.

Simply put, this model didn't work very well. It's louder than any other tool, left the largest nail holes, and felt too light to be stable.

FEATURES directable exhaust, cutaway magazine, quick-release nose



MAX NF255FA/18

Price: \$110 **Weight:** 2.4 lb.

We really like this tool. The nail holes it left were among the smallest, and it fired extremely consistently in our tests. It also shoots 2 $\frac{1}{8}$ -in. nails. The tool had a different feel depending on which firing mode was selected. If it had dry-fire lockout and came with an air fitting, this tool would be nearly perfect.

FEATURES rear exhaust, belt hook, quick-release nose

a single jam during the entire testing period.



PORTER-CABLE BN200C

Price: \$80 **Weight:** 2.4 lb.

This nailer and the DeWalt model are identical except that there are no rubber bumpers on the Porter-Cable's housing. Both are highly capable, with sensitive depth adjustments and excellent power. They are light and oilless, and they have a full range of modern features.

FEATURES rear exhaust, belt hook, quick-release nose



RIDGID R213BNE

Price: \$98 **Weight:** 2.4 lb.

We've heard good buzz about Ridgid's brad nailer over the years, and it proved itself a top performer. It's quiet and it shoots nails up to 2 $\frac{1}{8}$ in. long. Moreover, it has every feature found on a modern brad nailer. It has an oilless design, is lightweight, has plenty of power, and has a transparent magazine that allows you to see the nail supply.

FEATURES dry-fire lockout, rear exhaust, belt hook, quick-release nose, swivel air fitting



SENCO FINISHPRO 25XP

Price: \$160 **Weight:** 2.6 lb.

Though not one of our favorites, the Senco nailer was a standout in the power category. It easily sank nails into the hardest test materials. Carpenters or woodworkers who routinely fire nails into thick, hard materials should take a close look at this tool. It does not have a belt hook or an air fitting.

FEATURES directable exhaust, oilless operation, 2 $\frac{1}{8}$ -in. capacity, 5-year warranty



UFFY TH-T-1825XP

Price: \$198 **Weight:** 2.4 lb.

A relative newcomer to the retail market, Uffy has supplied industrial users for some time and claims that its nailers are made for industrial use. We found this tool to be a no-frills, capable performer. Externally, its look and features are very similar to those of the Grip-Rite. It performed well at odd angles, while shooting quietly and with little recoil.

FEATURES belt hook, rear exhaust, rear wraparound safety

 Online Extra

Keep your handsaw skills up to snuff with a series of exercises. See the video at FineWoodworking.com/TG2017.

TENON CHEEKS

The all-purpose saw

If you are a hard-core woodworker, it's nice to have several backsaws—a small dovetail saw and a pair of larger saws (one rip, one crosscut) for tenons and other joinery. But it's not necessary, because you can easily cut every furniture joint with just one carcass saw. It's big enough to cut case dovetails, as well as apron and frame tenons, but nimble enough for drawer dovetails. It doesn't matter if the teeth are filed for a ripcut, crosscut, or somewhere between, as long as they are sharpened so that the saw cuts quickly and tracks straight.

SHOULDERS, TOO



Backsaws

**The versatile carcass saw
will cut most joinery—choose from
the best of a bumper crop**

Dovetail saws are a popular choice for a first joinery saw, but because of the blade's length and shallow depth, they are only suitable for cutting dovetails in thin parts like drawer sides. To cut carcass dovetails, and tenons for door-frame rails and table aprons, you need a carcass saw. With a 12-in.-long blade that has 2 in. or more of cutting depth, the saw is big enough for these joints yet small enough for drawer dovetails. Because it's so versatile, the carcass saw is what we recommend as a first saw to new woodworkers.

During the past 10 years, there has been an explosion of new saw makers and saws, so we took a look at the carcass saws now available. Except for one (the Lie-Nielsen tapered crosscut saw), they all had 12-in.-long saw plates, and between 11 and 15 points per inch (ppi). We tested saws with teeth filed for ripcuts as well as saws filed for crosscuts. One saw, the Bad Axe hybrid, has teeth filed between rip and crosscut.

We tested how quickly they cut, and how easy they were to start. We used them to cut dovetails and tenons. We judged how well they tracked for ripcuts, but not crosscuts. With some ripcuts (such as the tail cuts for dovetails) a cut that goes awry can't be corrected, but a wonky crosscut often can be fixed with a handplane.

A saw's performance hinges on one thing: how well its teeth have been sharpened. Over all, these saws reinforced that theory: The best performers had the best sharpening jobs. Although most hobbyist woodworkers won't need to resharpen a saw very often (every few years at most), some of the makers offer sharpening service. Check their websites for this information.

After weeks of using all these saws every which way, we realized that there are a lot of very good saws on the market. However, three were a bit better than the rest, and one was an exceptional value. Keep in mind that several makers are individuals who make each saw every step of the way. The nature of this work means that if you buy a saw from one of them, you might wait weeks or months before it's in your hands. Their saws can often be customized, so the price will vary depending on the options.

Furniture maker Chris Gochnour contributed to this article.



DOVETAILS BIG AND SMALL

Four great saws

With the tests completed, it was clear that most of the carcass saws tested are great, and the difference between them is very small. However, three saws were just a bit better than the rest because they were sharpened extremely well, so they started easily, cut fast, and tracked perfectly. They also performed well on both rip- and crosscuts. We noticed some difference in comfort among these saws, but comfort is subjective and doesn't affect performance. Any of them would be a great do-it-all saw. The Veritas crosscut saw was a solid performer and costs just \$79. It's easily the Best Value.

READERS' RATINGS: BACKSAWS

★★★★★	4.74	LIE-NIELSEN TAPERED CROSSCUT
★★★★★	4.74	BAD AXE RIP
★★★★★	4.70	COSMAN SAWS TENON
★★★★★	4.69	BAD AXE HYBRID
★★★★★	4.69	LIE-NIELSEN CROSSCUT
★★★★★	4.56	GRAMERCY RIP
★★★★★	4.52	VERITAS RIP
★★★★★	4.50	VERITAS CROSSCUT
★★★★★	4.33	GRAMERCY CROSSCUT
★★★★★	4.32	PAX 1776 TENON RIP
★★★★★	4.09	BLACKBURN RIP
★★★★★	4.03	WINSOR RIP
★★★★★	4.00	LYNX TENON CROSSCUT
★★★★★	3.89	BONTZ RIP
★★★★★	3.83	CROWN TENON RIP
★★★★★	3.83	PAX TENON RIP



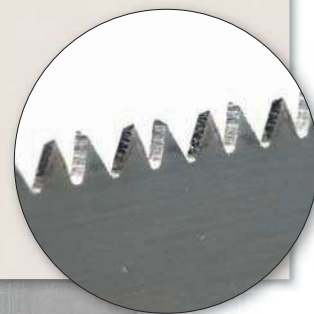
BAD AXE RIP



LIE-NIELSEN TAPERED CROSSCUT

\$140

At 14 in. long, this saw is 2 in. longer than the other saws and had the thinnest saw plate. Its kerf was tied for the narrowest. All of this makes a big difference in how fast the saw cuts. It took the top spot in the ripcut test and tied for first in the crosscut speed test.

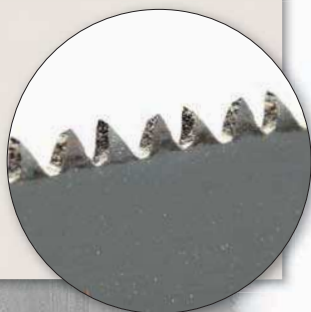




BAD AXE HYBRID

\$255 and up

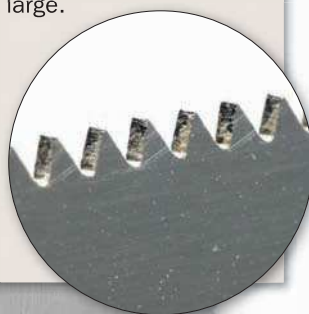
This saw is like a combination tablesaw blade, with a tooth profile designed to rip and crosscut. It wasn't the fastest at either cut, but it did both equally well. Because of the hybrid file, the saw started smoothly in both rip- and crosscuts. We liked the handle on this one the best.



COSMAN SAWS TENON

\$325

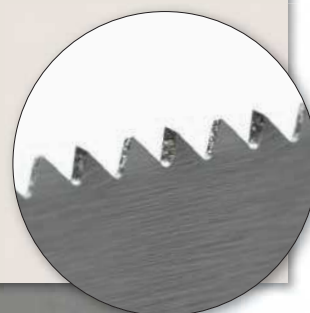
This saw was very easy to start, and it cut smoothly. The teeth cut without binding despite having very little set. It has the heaviest spine, and a molded resin handle with finger grips. The handle comes in standard and extra-large.



VERITAS CROSSCUT

\$79

This saw did very well in all of the tests. It ripped extremely fast and tracked great during ripcuts. Crosscuts were quick, too. It started smoothly in both rip- and crosscuts. Overall, this is a very good saw and a fantastic value.



Jack Planes

From flattening to smoothing, the No. 5 handplane can do it all

If you are comfortable with traditional woodworking hand tools, the jack plane can be the workhorse of your shop, and the go-to tool for a variety of tasks. It smooths boards as well as the shorter No. 2-, 3-, or 4-size handplanes, but it also can be used for the flattening and straightening tasks often reserved for the longer planes: the No. 6, 7, or 8. As its name suggests, this plane is a jack of all trades.

A jack plane should be capable of taking very fine shavings and leaving a great finish, and yet be able to remove lots of wood in a hurry when set for a deeper cut. It should also be adept at jointing edges prior to gluing up a panel. With all of these important attributes in mind, we put 12 jack planes through their paces.

A close look at the critical parts

After unpacking and degreasing the planes, we checked the soles for flatness, and looked to see if the sides were ground square to the sole, critical if you're going

ONE PLANE, MANY TALENTS

A jack plane set up for a fine cut is a perfect smoother for most projects. With a few adjustments, the plane can transition to heavy cuts, flattening rough surfaces—even a workbench. Its added length over the No. 4 makes it adept at jointing edges as well.

FLATTEN



SMOOTH



JOINT

to use the jack for shooting (squaring edges while lying on its side). All but a few planes needed some work to flatten the soles, and some needed work on the frogs. The least expensive planes in the test needed a lot of work.

Blade and chipbreaker—All planes need sharpening out of the box, a straightforward job. But if the back of the blade isn't ground flat at the factory, you have some labor to do. We flattened and polished the blade backs and sharpened all the blades. The amount of work required varied among the different models.

We also looked at the chipbreakers to see if they made solid contact with the plane iron, and if they were stamped or machined. Without perfect contact, the blade will vibrate and chatter, and any gap can cause chips to clog the plane. The stamped type are thinner and generally need more attention to ensure they contact the back of the blade properly. Because they're thin, they don't dampen vibration at the tip of the blade as well as the thicker, machined chipbreakers. But even the machined chipbreakers will occasionally need fine-tuning to be sure that they seat well and that the machined contact face is smooth and flat.

Blade adjustments—An easy-to-use blade-adjustment mechanism—one that holds its settings—is incredibly important. Jack planes come with one of two types, the Bailey-style mechanism (Stanley, Footprint, Wood River, Clifton, and Lie-Nielsen) or the Norris-style adjuster (Kunz and both Veritas planes). You can probably get used to either type, but there was great variation in how well the mechanisms were designed and machined. Most worked well, but a few had more slop and backlash.

Mouth adjustments—You typically set the mouth opening tight to the blade for fine work and more open to keep the mouth from clogging when removing heavier shavings. The jack plane is one of the few planes where you'll regularly use this adjustment,

Features to consider

FAST AND PRECISE BLADE ADJUSTMENTS



Split adjustments. Planes with Bailey-type adjusters use a wheel to set the blade depth (top) and a lever for lateral changes (bottom).



Two in one. Planes with Norris-type adjusters, like the Veritas 5¼ W, combine depth and lateral adjustment into one mechanism. Turning the knob changes the depth and swinging the lever makes lateral adjustments.

CONVENIENT MOUTH ADJUSTMENTS



You shouldn't have to remove the blade. Mouth adjustments are made by moving the frog or by sliding a toe, or shoe, at the front of the plane. Planes with a Bedrock-style frog (or similar) let you move the frog with the blade in place by turning screws at the back of the frog. With planes that use a sliding toe to adjust the mouth opening, like the Veritas Custom No. 5, you never have to remove the blade for mouth adjustments.

Bevel-up jack planes: In a category of their own



The bevel-down jack planes are truly the grab-and-go tool for a multitude of shop tasks. But the bevel-up (low-angle) jack planes—originally designed to plane end grain—are versatile tools as well, especially considering that simply regrounding the blade's bevel gives you the ability to have a low cutting angle for end grain or a high cutting angle for difficult grain. So we tested each type separately, awarding a winner for each. The bevel-up models are featured on pp. 92–93.

since it tends to be used for a wide range of tasks. On the planes we tested, you can adjust the mouth either by moving the frog (with the blade in place or out), or by sliding a toe, or shoe, at the front of the plane. Planes with a sliding toe let you keep the blade in place for mouth adjustments.

The Veritas planes have additional convenient features. They employ set screws in the plane body to restrict any side-to-side movement of the blade. And the Veritas Custom No. 5 has a stop to prevent the toe from smacking into the blade when you close up the mouth.

Put to the test

For the real-world tests, we set up two jobs at opposite ends of the spectrum. First, we did some finish smoothing on straight-grained walnut, curly maple, and finally teak. Once the smoothing tests were done, we reflat-tened a couple of heavily used workbenches (a brutal task for a plane). We cycled through the planes on both tasks, evaluating how they held up under fine work and then under hard work, resharp- ening as needed. We noted how the planes felt in use—which seemed to make the task easier or harder, and which seemed the most responsive.

Conclusions

We were able to tune up each plane, but the Lie-Nielsen No. 5 stood out for overall quality, ease in getting it to work perfectly, and good, solid adjustments. It had tight machining, the most positive feedback, and could do any job from finish smoothing to rough flattening, or shooting end grain. The Veritas No. 5¼ W was close behind the leader and priced well below it, making it the Best Value.

Chicago furniture maker Jeff Miller contributed to this article.

READERS' RATINGS: JACK PLANES, BEVEL-DOWN

★★★★★	4.84	LIE-NIELSEN NO. 5
★★★★☆	4.56	VERITAS CUSTOM NO. 5
★★★★☆	4.51	VERITAS 5-1/4 W
★★★★☆	4.17	CLIFTON NO. 5
★★★★☆	3.96	WOOD RIVER NO. 5
★★★★☆	3.94	STANLEY NO. 5
★★★★☆	3.13	FOOTPRINT NO. 5
★★★☆☆	2.64	KUNZ 5PLUS

LIE-NIELSEN NO. 5

Price: \$325

Blade material: A-2

Chipbreaker: Machined



The Lie-Nielsen No. 5 was very well-machined overall, with lateral and depth adjustments that had the least backlash of any of the Bailey-style planes. The back of the blade was perfectly flat, and the chipbreaker seated fully against the blade. The toe was flat and the sides were square. The Bedrock-style frog made adjustments to the mouth quick and easy without the need to remove the blade. With a quick honing of the blade, this plane cut very well and adjusted easily between fine smoothing and heavier flattening.

VERITAS 5¼ W

Price: \$258

Blade material: PM-V11

Chipbreaker: Stamped



The Veritas 5¼ W had a great overall fit and finish. The Norris-style adjuster was tight and precise. The blade was flat, easy to sharpen, and withstood the bench-flattening test with barely any dulling, unlike some of the other blades. The stamped chipbreaker set up well and mated tightly to the blade. The 5¼ W has a handful of useful features at an affordable price, such as toolless mouth adjustment via a sliding toe and screws in the plane body that prevent lateral movement of the blade during adjustment. Choosing this as Best Value was an easy call.

CLIFTON NO. 5

Price: \$320



Blade material: Cryogenically treated high-carbon steel

Chipbreaker: Machined, two-piece

This is a well-machined plane with only a small amount of backlash in the Bailey-style adjustment mechanisms. The blade was ground slightly unevenly and had to be flattened, but the unique, two-piece chipbreaker worked well and contacted the blade solidly. The sole was flat, but the sides were slightly out of square, which limits the plane's use with a shooting board. A Bedrock-style frog allows the mouth to be adjusted without removing the blade, a great time-saver.

FOOTPRINT NO. 5

Price: \$60



Blade material: Carbon steel

Chipbreaker: Stamped

This plane required a lot of work. The stamped chipbreaker initially had very little contact and the back of the blade was convex, with a high spot in the middle. The frog was poorly machined and neither flat nor smooth. The sole needed the most work—we spent at least 30 minutes flattening it. After all of this work and a careful sharpening, the plane cut fairly well but excessive slop in the Bailey-style blade adjustments and overall poor machining hindered its performance. The frog was a rudimentary Bailey type that required blade removal for mouth adjustments.

KUNZ 5PLUS

Price: \$240



Blade material: High-carbon steel

Chipbreaker: Machined

The cap-iron screw on the Kunz 5Plus was very fussy in use and while the back of the blade was very close to flat, it was ground coarsely, and it took a while to remove the scratches from it. The plane needed a lot of work to get the sole flat as well, although the sides were square to the sole. The Norris-style adjuster had a lot of slop, which translated to unpredictable cuts and settings that didn't quite keep. The mouth adjustment requires blade removal, which slows down setup.

STANLEY NO. 5

Price: \$75



Blade material: Carbon steel

Chipbreaker: Stamped

Out of the box, the Stanley's stamped chipbreaker was easy to tune up, but the blade suffered from a high spot in the center that was hard to remove. The plane iron did not sit flat on the frog and we discovered a significant hollow area (almost $\frac{1}{32}$ in.) on the frog. The sole of the plane was seriously out of flat and took 45 minutes to flatten. Despite all of our efforts, the plane still cut poorly, mostly due to poor machining. The Bailey-style frog worked decently but required removing the blade for mouth adjustments.

VERITAS CUSTOM NO. 5

Price: \$330



Blade material: PM-V11

Chipbreaker: Machined

The Veritas Custom No. 5 was well-machined and its Norris-style adjuster was tight and precise. It has a unique system for setting the chipbreaker with two small Allen-head bolts: one sets the location of the chipbreaker and one attaches the blade to the chipbreaker. This system is cool in that it retains your chipbreaker location setting perfectly, but the button-head bolt is very small and not easy to get a hand on. The back of the blade required only minimal work to flatten. The sole was flat and the sides were square to the sole. Adjusting the mouth was easy and quick via an adjustable toe.

WOOD RIVER NO. 5

Price: \$170



Blade material: High-carbon steel

Chipbreaker: Machined

The thick blade on this plane is a nice feature but its back was high in the center, making it difficult to flatten. The chipbreaker fit well and was also thick, but its machined edge needed a little refining for optimal contact. The sole needed flattening, but the sides were square to the sole. The Bedrock-style frog worked well and made mouth adjustments easy. After a small amount of work, the Wood River planed fairly well but the Bailey-style depth and lateral adjusters both had a significant amount of backlash.

The best of the bevel-ups

When compared with bevel-up models, standard jack planes are a better choice for first-time buyers because they leave a slightly better surface when doing fine work and they adjust more easily, characteristics that are beneficial, especially for someone relatively new to planing. That doesn't mean bevel-up planes don't have a place in the shop. Four planes in the test are bevel-up models. With the blade bedded at a low angle, these planes were originally designed for surfacing end-grain butcher-block tops, but they have gained popularity as a general jack plane alternative. The likely reason is their versatility.

Out of the box, a bevel-up plane is typically sharpened for a 37° cutting angle, which is the bed angle plus a 25° bevel on the blade. That's great for end grain and wood with highly cooperative grain, but they tend to tear out with more challenging grain. In these situations, you need to increase the effective cutting angle by sharpening the blade's bevel at a steeper angle. For instance, to match the 45° cutting angle of a standard jack plane, the blade needs a 33° microbevel (or a completely reground bevel, if you want to go through all that work). And you can go steeper. For example, you can keep two extra blades on hand: one for a 45° cutting angle and another for a 75° cutting angle. The steepest blade basically turns the plane into a very effective scraper plane. Keep in mind that these steeper angles aren't as durable and will dull more quickly than a blade sharpened at 25° to 30°; that's an optimal angle taking into account smoothness of cut and durability of the edge.

These planes can be a good replacement for the bevel-down jack planes, as long as you're willing to spend the time resharpening the blade for different tasks or have the budget to invest in extra blades to have at the ready. But that's not for everyone.

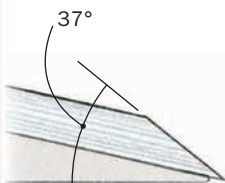
Of the bevel-up planes, the Lie-Nielsen and Veritas models stand out due to the quality of their machining and precise adjustments.

READERS' RATINGS: JACK PLANES, BEVEL-UP

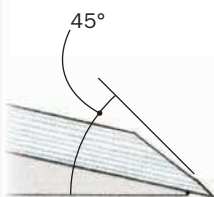
★★★★★	4.80	LIE-NIELSEN NO. 62
★★★★☆	4.70	VERITAS NO. 62-1/2
★★★★☆	3.94	STANLEY SWEETHEART NO. 62
★★★★☆	3.84	WOOD RIVER NO. 62

CHANGE THE BLADE TO SUIT THE TASK

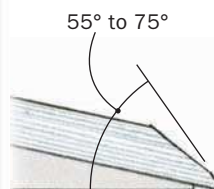
The bevel-up jack plane's effective cutting angle can be changed with ease just by regrounding the bevel or adding a microbevel. Switching the angles (or entire blades) lets a single plane tackle many tasks other planes cannot.



Low angle for end grain. A blade ground at 25° results in a cutting angle of 37°, which is perfect for cleanly slicing end grain. That's why a low-angle plane is ideal for use with a shooting board.



Most useful angle. A 33° grind will turn your bevel-up plane into a standard jack plane, making easy work of smoothing and flattening tasks.



High angle for difficult woods. With a blade ground to an even steeper angle, bevel-up jacks can tackle heavily figured or wild wood with ease.



LIE-NIELSEN NO. 62

Price: \$245

Blade material: A-2

EDITORS' CHOICE
BEST OVERALL

READERS' CHOICE



This plane was very well machined, with a flat blade back, a flat sole, and square sides, and it cut very well. Mouth adjustments were precise. Blade-depth adjustments were precise and easy, but using a hammer for lateral adjustments takes getting used to. Once made, the adjustments held. An accessory handle (\$60) is also available for use with a shooting board.



Tap to square it up. The Lie-Nielsen and Wood River No. 62 (below) have no mechanism for lateral blade adjustment, so it is done with a small hammer after the blade depth has been set.

VERITAS NO. 62½

Price: \$257

Blade material: PM-V11

EDITORS' CHOICE
BEST OVERALL



This plane was machined well, and the Norris-style adjuster was spot-on. It's wider and heavier than the rest of the bevel-up jacks, which means it takes a wider cut and has the momentum to power through some heavy flattening. On the other hand, the added width also meant the plane was a bit hard on the user and could be a bear to push through heavy cuts. The sole was flat, the sides were square, and the PM-V11 blade sharpened easily and took a beating without flinching.

STANLEY SWEETHEART NO. 62

Price: \$140

Blade material: A-2



The back of the blade was mounded in the middle, but we were able to flatten it. The adjustment mechanism had a lot of slop and backlash, and allowed very limited movement. We had to file the bed of the plane a little to allow the blade to sit square. The sole of the plane needed a fair amount of work to get flat and the sides were not square with the sole. Once tuned up the plane cut well, but it suffered because of the poor machining and a cast aluminum cap-iron screw that was not easy to grip.

WOOD RIVER NO. 62

Price: \$200

Blade material: High-carbon steel



One corner of the blade did not clean up even after 10 minutes of flattening. The small front knob was noticeably less comfortable than those found on the other planes. The sole needed a fair amount of flattening, but the sides came square and the unit planed well after this work. The depth adjuster had a small amount of backlash. Lateral adjustments are made with a light hammer, but the blade shape makes that difficult.

Essential Bandsaw Blades

With this basic kit, your bandsaw can tackle any task



BASIC BLADE ANATOMY

Once you understand how the anatomy of a bandsaw blade affects the work, choosing the correct one for a specific task is easy. Consider the size of the blade and the number and size of the teeth.

WIDE VS. NARROW

The width of the blade plays a strong role in its performance.

A **wide blade** won't deflect during heavy cuts, making it ideal for thick rips and resawing, but it can only navigate shallow curves.

A **narrow blade** can handle those tighter curves without binding, but it will tend to wander on large, gentle-radius curves and circles. It also doesn't have the strength to cut thick material without deflecting or binding.

COARSE VS. FINE

The number of teeth per inch (often called the pitch) affects the speed and smoothness of the cut. The basic rule is three teeth in the wood at all times, which prevents the blade from cutting too aggressively for the wood's thickness.

A **coarse-pitch** blade has fewer teeth, but they're large and cut extremely fast.

A **fine-pitch** blade has more teeth. Their small size makes for cleaner cuts, but they tend to clog with pitch in thick material.

Bandsaws are the most versatile power tool in most woodworking shops. They can rip (cut along the grain), crosscut (cut across the grain), resaw (slice thick boards into thin ones), and cut circles and curves without the tablesaw's risk of dangerous kickback. The key is picking the right blade for each job. The choices can be confusing. You must

3 blades that do it all

While the number of combinations possible with different tooth pitch, tooth profile, and blade size are endless, a set of three blades gives you enough versatility and performance to get any job done well. A $\frac{3}{8}$ -in.-wide, 6-tpi hook-tooth blade, a $\frac{1}{4}$ -in., 10-tpi regular-tooth blade, and a $\frac{1}{2}$ -in., 3-tpi hook-tooth blade are all you need in the shop.

understand how the blade width, the number of teeth per inch (tpi), and the tooth geometry all affect the cut you want to make. And you have to consider the wood's thickness. To help you choose, here's a basic set of blades that can perform all of the typical cutting chores. Turns out, three blades are all you really need.

— Roland Johnson, author of Taunton's Complete Illustrated Guide to Bandsaws (The Taunton Press, 2010), contributed to this article.



One for general purpose



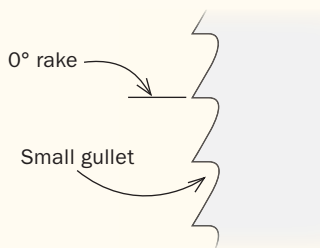
One for curves and thin stock



One for heavy ripping and resawing

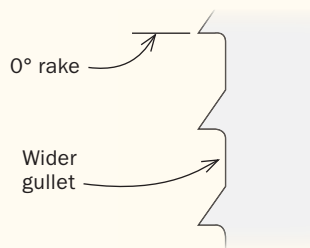
TOOTH GEOMETRY

The shape of a bandsaw blade's teeth are the most critical factor in how it will cut. Understanding these different shapes and when each is most effective will give you better performance from your saw and extend the blade life.



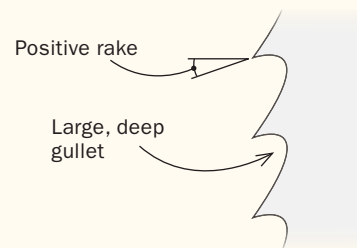
REGULAR TOOTH

A regular-tooth blade has evenly spaced teeth with a 0° rake angle. This tooth shape provides clean cuts, but the small gullets clog quickly when moving a lot of dust, so they are not really suited for heavy ripping or resawing.



SKIP TOOTH

A skip-tooth blade has a 0° rake angle, like a regular-tooth blade, but every other tooth is essentially skipped. The bigger gullets help clear away dust more effectively.



HOOK TOOTH

A hook-tooth blade has a positive rake angle and very large gullets. The teeth cut aggressively and the large gullets evacuate material quickly and effectively. The downside is that the cut surface is rough.

1 The all-around blade

Width: $\frac{3}{8}$ in.

Teeth per inch: 6

Tooth type: Hook

Uses: Rip stock $\frac{1}{2}$ in. to 2 in. thick and cut curves down to a $1\frac{1}{2}$ -in. radius.

While there isn't a single bandsaw blade that does it all, having one that's well suited for a variety of tasks will not only make your day-to-day tasks easier, but will also speed up your work. If any blade could be considered all-purpose, a $\frac{3}{8}$ -in., 6-tpi, hook-tooth, high-carbon-steel blade would be it. This blade has enough width to handle most ripcuts in material up to 2 in. thick without deflecting, but is narrow enough to cut mild curves. It's also good for quick crosscuts. Following the rule of three teeth in the wood at all times, the 6-tpi blade is best suited for material $\frac{1}{2}$ in. thick or thicker.



Everyday ripping. The $\frac{3}{8}$ -in.-wide blade can rip stock from $\frac{1}{2}$ in. to 2 in. thick, depending on the species of the wood.



The rule of three. With the 6-tpi all-purpose blade, $\frac{1}{2}$ in. is the thinnest stock you should cut.



Handles curves and straight cuts. The moderate-width blade can work its way around $1\frac{1}{2}$ -in. radius curves (above), while still tracking straight lines well (right).



2 Blade for thin stock and tight curves

Width: ¼ in.

Teeth per inch: 10

Tooth type: Regular

Uses: Rip stock ¼ in. to ⅝ in. thick and cut curves down to a ⅝-in. radius.

While the all-purpose blade is great to keep in the saw for general use, it's too wide to cut truly tight curves and too coarse, or aggressive, for thin stock. The go-to blade for these jobs is a ¼-in., 10-tpi regular-tooth blade.

With this blade, tight curves as small as ⅝-in. radius are a piece of cake. And the fine teeth provide a clean cut, especially in thinner material—you'll be able to cut ¼-in.-thick stock without it splintering or tearing out. Sawing curves, especially circles, is more about crosscutting than ripping, which results in fine, short-grained sawdust. Despite the small size of the gullets, they adequately clear that dust.

MATCH THE BLADE TO THE CURVE

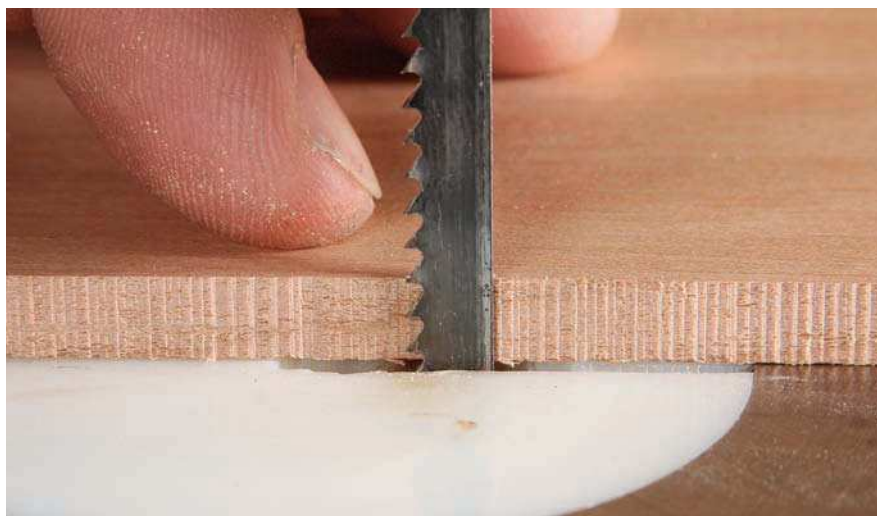
A ⅜-in.-wide blade can tackle most curves, but a ¼-in.-wide blade can go tighter still.

A ⅜-in. blade can cut a 1½-in. radius curve.

A ¼-in. blade can cut a ⅝-in. radius curve.



Ripping thin. The narrow cross-section of this blade and the regular tooth profile make it ideal for ripping thin stock and leaving a clean cut in its wake.



Thin, but not too thin. In keeping with the “three-in-the-cut” rule, ¼-in. stock is the thinnest you'll want to go for best results.



Makes the turn. This blade's narrow cross-section allows it to take turns as tight as a ⅝-in. radius cleanly and without shuddering.

3 Blade for thick stock and resawing

Width:
½ in. to ⅝ in.

Teeth per inch:
3 to 4

Tooth type: Hook

Uses: Rip stock at least 1 in. thick and resaw up to 6 in. (½-in. blade)
Resaw up to 12 in. (⅝-in. dedicated resaw blade)



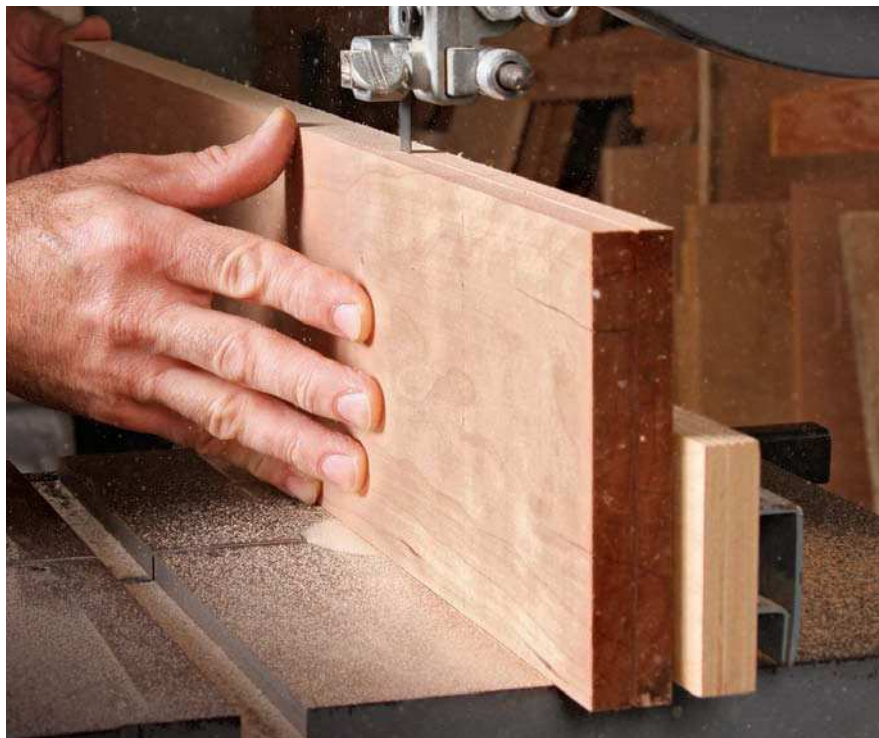
Handling a heavy cut. This blade's big gullets and coarse teeth mean that ripping thick stock is fast and easy.

Another task at which bandsaws excel is resawing and ripping thick stock. The thin blade has a smaller kerf than a tablesaw and there's no danger of kickback. Ripping wood creates lots of stringy sawdust that easily packs the small gullets of an all-purpose blade, robbing the saw of power and keeping the teeth from easily cutting into fresh wood. The best choice for ripping is a ½-in., 3-tpi hook-tooth blade. The aggressive teeth and big gullets of this blade cut fast and evacuate a lot of dust quickly. Because of the low number of teeth per inch, 1-in. stock is the thinnest stock you should cut with this blade. For heavy cuts, a blade must have sufficient beam strength to resist deflection when force is applied to its cutting edge. The ½-in.-wide blade works well for cutting stock from 1 in. to 6 in. thick (or wide for resawing).

For those who do a lot of resawing of stock or veneers, a dedicated resaw blade can be a great addition to this set. A ⅝-in., 3- to 4-tpi



Three's plenty. This blade is best used with stock 1 in. and thicker, to keep three teeth in the cut and get the best performance from the blade.



Ready to resaw. In addition to the fast-working teeth, the ½-in.-wide blade is strong enough to handle most resaw jobs without deflecting, such as resawing a board for drawer fronts.

variable-pitch blade is perfect for clean, accurate cuts in thick or wide material (up to 12 in.). A variable-pitch blade's fluctuating tpi count helps eliminate the vibration that is often produced when working with thick stock.

Standard carbon-steel blades will work for all materials, but some woodworkers invest in better metals for certain tasks: bi-metal for abrasive woods, and carbide for really nasty stuff like jatoba. For resawing, some prefer a true carbide-tipped blade like the Laguna Resaw King (\$150). If that's out of your price range, the carbide-impregnated SuperCut Wood Saver Plus (\$70) is a great option.



Master big resaws. If you do a lot of resawing, a carbide-impregnated or carbide-toothed blade can provide superior longevity and a better-quality cut in extrathick stock.



Make your blades last

You'll get poor results with a blade that's dirty or dull. When the gullets get lined with pitch, the blade has an increasingly hard time evacuating dust. As a result, you need to use excessive force when feeding the wood, causing the blade to wander or the thrust bearings to lose their setting. Scrub dirty blades with a brass brush (left). Make sure to turn the wheel counterclockwise by hand as you clean. And thoroughly clean roughsawn boards before cutting them (below). A dull blade will also cause problems. If you need to push harder to make cuts, if the blade starts to drift consistently in one direction or wander, or if you notice increased burning or smoking, your blade is dull.



Tablesaw Blades for

Go beyond the basic blade for better woodworking



DADO

The tablesaw is one of the most useful power tools in a woodworking shop, perfect for ripping, crosscutting, and a variety of joinery tasks. Most woodworkers can keep a high-quality 50-tooth combination blade in their tablesaws 90% of the time and use it for most ripping and crosscutting operations. But when it comes to joinery, blades that are designed for specific operations usually do a better job because they increase your speed and accuracy. From basic rabbets and dados to finicky box joints and fine-fitting dovetails, a set of four blades makes many joints quickly and precisely.

The most essential joinery blades are an 8-in. stacked dado set, a box-joint set, a specially ground flat-top rip blade, and a blade specially ground to cut dovetails. To get all the benefits, though, you need to buy high-quality blades.

Here's how to take advantage of these specialty blades to increase the speed and precision of your furniture joints.

Bob Van Dyke, director of the Connecticut Valley School of Woodworking, contributed to this article.



FLAT-TOP RIP

Joinery



DOVETAIL

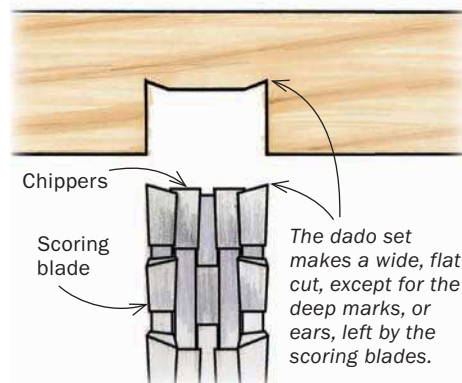


BOX-JOINT



Dado set

A dado set is a stack of blades that can be adjusted to cut wide, flat-bottomed notches (generally from $\frac{1}{4}$ in. to $\frac{3}{4}$ in. wide), ideal for grooves and dados. Two scoring blades go on the outside of the stack to score the edges and cut them cleanly. Flat-topped chipper blades are stacked between the scoring blades to hog out the majority of the waste. Most sets include shims for slight changes in the width of cut.



Many people already own an 8-in. stacked dado blade set. It's the most versatile joinery blade, making jobs such as cutting tenons, rabbets, dados, and grooves simple and straightforward. You change the width of a cut by stacking different combinations of blades and shims.

To cut a groove or a dado, simply load the number of blades and shims needed to make a specific width, and use the rip fence or miter gauge to make the cut. Make sure the scoring blades are on either end, with the high point of the angled teeth on the outside (see above).

To cut a rabbet, use a sacrificial fence and bury the blade in it. The width and height of the exposed section of blade determines the rabbet size. After dialing in the cut, run the board against the fence to create the rabbet.

Cutting tenons is quick and straightforward with this blade. With the dado set sized narrower than the tenon's length, use an accurate miter gauge or a push block to guide the workpiece and use the rip fence as a stop to set the length of the tenon. The narrower dado set doesn't have to be buried in the fence, and the smaller cuts are more accurate. While this is a very direct method, you'll sometimes encounter inconsistencies in tenon thickness. The easiest way around this is to set the saw to leave the tenon just a little fat and then fit each one with a shoulder plane.



Easy grooves and dados. To cut grooves and dados, stack the blades and set the depth of cut.



Rabbets, too. To cut rabbets, clamp a sacrificial fence to the rip fence and position it over the blade. Set the depth of cut and run the stock against the fence.



Tenons made simple. Cutting tenons with a dado set is fast and easy. Use a miter gauge to hold the workpiece and the rip fence to set the tenon's length. A few passes on each cheek will produce tenons ready to be fitted by hand with a shoulder plane.



Box-joint set

The box-joint set includes two 8-in.-dia. blades that have flat-topped teeth. So they cut flat-bottomed kerfs, which is important when the front of the groove will show. You can buy a set that cuts $\frac{3}{16}$ -in. and $\frac{5}{16}$ -in. slots or one that cuts $\frac{1}{4}$ -in. and $\frac{3}{8}$ -in. slots.

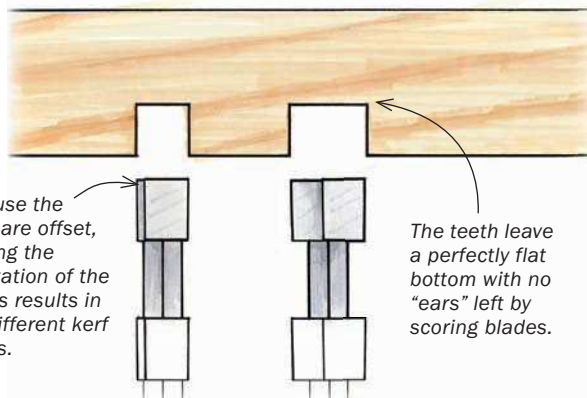
A box-joint blade set is similar to the dado set, but has just two blades. It's used for cutting box joints, also known as finger joints. The blades have offset teeth so that when they are stacked one way, they cut a narrower kerf and when their order is reversed, the cut is wider. Box-joint sets are designed to cut a perfectly flat bottom, so the joint fits together with no gaps visible along the front of the joint.

To cut box joints you must hold the stock vertically in a dedicated jig, where an indexing pin sized to the exact width of the kerf registers how much the stock is moved to create the fingers. The position of the pin controls the fit of the joint.

Even if you rarely make box joints, you'll find the box-joint set to be great for other joinery applications. If the bottom of a groove or dado is exposed, the flat surface of this blade allows through-dadoes and grooves to fit the mating portions of the joint perfectly. In other cases where joinery is visible, such as through-tenons and bridle joints, where the scoring teeth of a dado blade would noticeably affect the appearance of the joint, box-joint blades make tenons that are perfectly flat and fit into the mortise with no gaps.

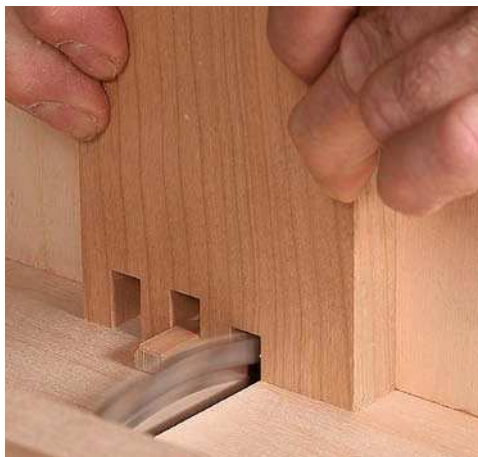
Online Extra

For a video on cutting perfect box joints, go to FineWoodworking.com/TG2017.

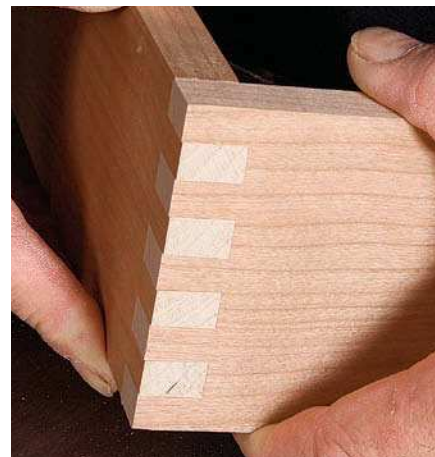


Because the teeth are offset, altering the orientation of the blades results in two different kerf widths.

The teeth leave a perfectly flat bottom with no "ears" left by scoring blades.



Box-joint basics. A jig holds the workpiece upright while an indexing pin sized to match the blade spaces out the joint precisely.



A perfect fit. When the jig is set up correctly, the cut is flawless and the joint is tight and free of gaps.

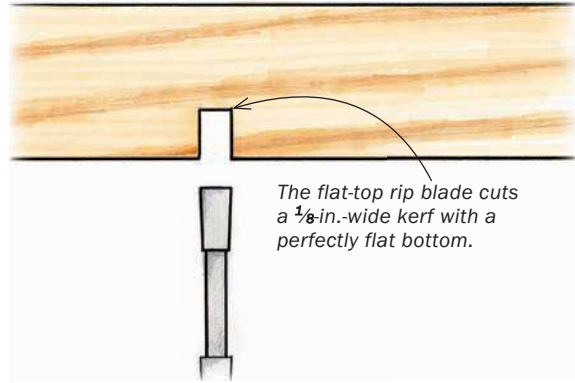


Flat-bottomed grooves and dados. The box-joint blade is also perfect for making narrow grooves and dados with perfectly flat bottoms.



Flat-top rip blade

The flat-top rip blade has its teeth ground flat. These blades can be ground by a saw sharpener or bought new from companies such as Freud, Amana, and Forrest. They also come in heavy-duty versions for a slightly wider kerf.



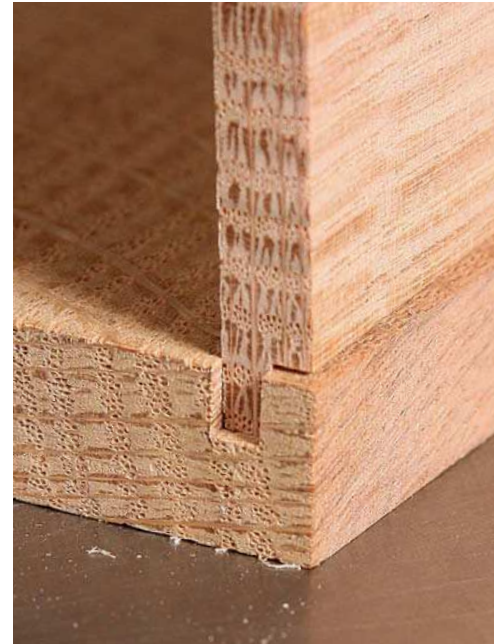
The flat-top rip blade cuts a $\frac{1}{8}$ -in.-wide kerf with a perfectly flat bottom.

A specially ground flat-top rip blade leaves a perfectly flat-bottomed kerf. Most easily found in a $\frac{1}{8}$ -in. size, this blade is useful when cutting narrow exposed grooves, dadoes, or rabbets, such as for fitting dividers or a bottom in a small box or cabinet.

It's an excellent choice for cutting splines in the corner of a miter joint, where the flat-bottomed kerf can form a crisp line with the spline being inserted. Here the miter joint is typically held in a fixture, which is then passed over the blade.



Flat-bottom grooves. The flat-top rip blade is perfect for making thin, perfectly squared grooves in small projects like boxes. The rabbeted portion of the box bottom fits into the flat groove of the side without gaps.

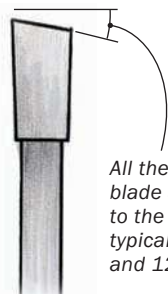


The secret to perfect splines. The spline jig (left) rides on the tablesaw fence and holds a mitered case or frame. Used in conjunction with the flat-top rip blade, it allows splines to fit all the way into the slots (above) without any gaps.

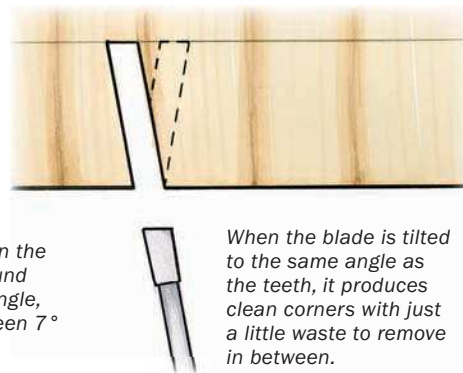


Dovetail blade

The dovetail blade is a modified rip blade that has had all the teeth ground to a set angle that matches the angle of the tails. Saw sharpeners can grind rip blades down to these specifications, and companies like Forrest sell blades that are ready to use.



All the teeth on the blade are ground to the same angle, typically between 7° and 12°.



When the blade is tilted to the same angle as the teeth, it produces clean corners with just a little waste to remove in between.

A dovetail blade makes cutting dovetails on the tablesaw almost a no-brainer. Almost any blade can be reground by a good saw-sharpening service so that all the teeth are at a consistent angle. It's up to you, but something around 10° looks and works great. The tails are cut on the tablesaw with the blade tilted to match the slope of the dovetail and angled teeth. The pins are cut by hand. Because you are just cutting to a line, you can use any spacing, including asymmetrical. While you can use any tablesaw blade to cut dovetails this way, the specially ground blade cuts right up to the baseline and leaves a flat, clean surface all the way into the corner with barely any cleanup between.

To use a 10° blade, set the angle of the blade to 10° and raise the blade until it just touches the baseline of the dovetail layout. If you have set the blade correctly, there's very little paring to do with a chisel afterward. The real advantage of this system, aside from speed, is that each of the tails will come out dead straight and exactly square to the face of the board, which is critical when you transfer the tail layout to the pin board.



Angle the blade. Because the dovetail blade's teeth are ground to match the angle of the tails, tilting the blade to that angle results in a flat cut at the base of the tail.



One side first. A jig with an oversize fence holds the piece upright. With the tails laid out, make all the cuts on one side of the tails. At the end, make passes to remove the waste.



Online Extra

To watch a video on this technique, go to FineWoodworking.com/TG2017.

Flip and finish. Flip the piece edge for edge and make the cuts for the other side of the tails. All that's left after this is to chop out the small amount of waste and cut the pins to match.

Miter Gauges

We compare eight models to see which are the most accurate and easy to use



A great tablesaw setup needs a great miter gauge. This accessory ensures safe, accurate crosscuts on boards and small panels and is great for joinery cuts, too. Unfortunately, the gauges provided with most tablesaws often are less than ideal. That's where a high-quality, aftermarket gauge comes in. We put eight fully equipped gauges (with extruded aluminum fences) through the gauntlet.

What makes a good miter gauge

A tablesaw's miter gauge has three main parts that must work well together to en-

sure accuracy as you work: a bar, a head, and a fence.

Miter bar keeps the gauge on track—If the miter bar that guides the gauge doesn't fit in the tablesaw's miter slot, any play will throw it out of line with the sawblade. This gives you inaccurate angles and joints that fit poorly. To remedy this, most gauges feature a way to adjust the fit of the bar so that it slides smoothly in the track.

Head ensures accurate angles—The head is the key to accurate square or angled cuts. Its scale must be precise and easy to read. Positive stops, or detents, at

common angles are a plus. Adjustments should be quick and easy, yet solid enough to avoid being bumped from a setting.

Sturdy fence that's versatile—Easily adjustable fences are a necessary component of a quality aftermarket gauge, both for safety and for increased accuracy and repeatability. Fences support the stock during the cut, so they should be solid and not slippery to ensure the stock doesn't drift.

Putting the gauges to the test

A straight-cut test ensured the 0° setting on the head was perpendicular to the blade.



A CUT ABOVE THE REST

JDS ACCU-MITER

Price: \$270



The traditional, protractor-style head on this robust gauge registers angle detents solidly with a spring-loaded pin. The sturdy telescoping fence holds stock well, and it comes with a micro-adjustable flip-stop and a flip-down stop on the end of the telescoping section. The rigidity of the fence and the weight of the head ensured extra-smooth action.



KREG MITER GAUGE

Price: \$140

This all-aluminum gauge has the features of a great unit with a price that's hard to beat. The nylon adjustment screws keep the gauge tracking well in the miter slot. The fence has a flip-stop that's curved to let work slide under it for quick repeat cuts. The head quickly registers common angles via a brass pin. The vernier scale is a nice feature.

We used each gauge to cut a piece of poplar in half, then placed the halves edge-down on the tablesaw and flipped one over. Flipping the piece doubles any error and exaggerates how off the gauge is.

For the second test, we used each gauge to make an 11-in. by 14-in. picture frame. This tested the gauge's accuracy at one of the most common angles used, a 45° miter, and also gave us the chance to use the flip-stops to make repeat cuts.

We also made an octagon with 7-in. sides using the 22.5° setting on the gauges and the flip-stops once again. This tested the

head's accuracy and how easy it was to use the gauge with smaller stock. The octagon shape exaggerated any inaccuracies in the angles, making even a small error more obvious.

Finally, for a long stock test, we crosscut a piece of poplar, 1¼ in. thick by 6 in. wide by 60 in. long, and checked whether the fence deflected, if the board slipped on the fence face, and whether the fence helped "hold" the stock during the cut.

Furniture maker Chris Gochnour contributed to this article.

READERS' RATINGS: MITER GAUGES

★★★★★	4.50	INCR 3000 SE
★★★★★	4.47	INCR 1000 HD
★★★★★	4.37	INCR 1000 SE
★★★★★	4.35	JDS ACCU-MITER
★★★★★	4.30	OSBORNE EB-3
★★★★★	4.26	KREG
★★★★★	4.23	WOODHAVEN 4911
★★★★★	4.02	RIDGID DIGITAL MITER GAUGE

MITER GAUGES PUT TO THE TEST

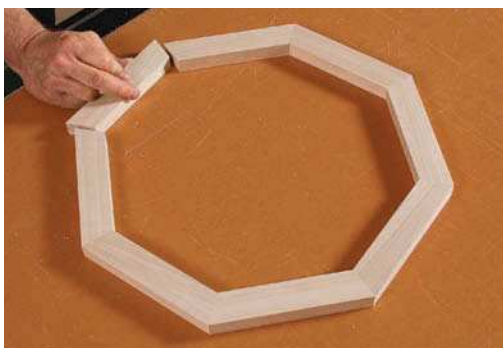
Straight cuts. To test the gauges' 0° setting, we made simple crosscuts. The good news is that every gauge tested made a perfectly straight cut at 0°.



Miter test. To test the accuracy of miter cuts, flip-stops, and head settings, we made picture frames. An accurate gauge will cut equal-length pieces.

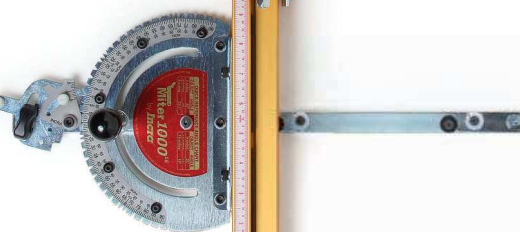
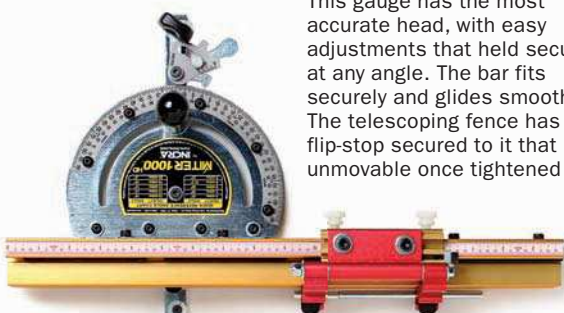


The octagon test. To make octagonal frames we used the 22.5° detent and the stops. This tested the accuracy of the detent system and the stops as well as each gauge's ability to handle smaller stock. If everything works as it should, the result will be geometrically perfect with gap-free joints.



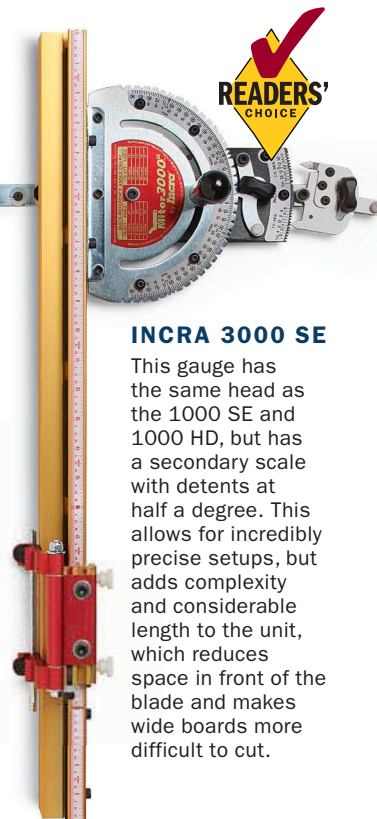
INCRA 1000 HD

This gauge has the most accurate head, with easy adjustments that held securely at any angle. The bar fits securely and glides smoothly. The telescoping fence has a dual flip-stop secured to it that is unmovable once tightened down.



INCRA 1000 SE

The gauge has the same miter bar, fence, and flip-stop as the other Incra gauges, but the 1000 SE's head only has detents every 5°. While this gauge performed well, it lacks the ease of fine adjustment, down to individual degree, that the 1000 HD has.



INCRA 3000 SE

This gauge has the same head as the 1000 SE and 1000 HD, but has a secondary scale with detents at half a degree. This allows for incredibly precise setups, but adds complexity and considerable length to the unit, which reduces space in front of the blade and makes wide boards more difficult to cut.

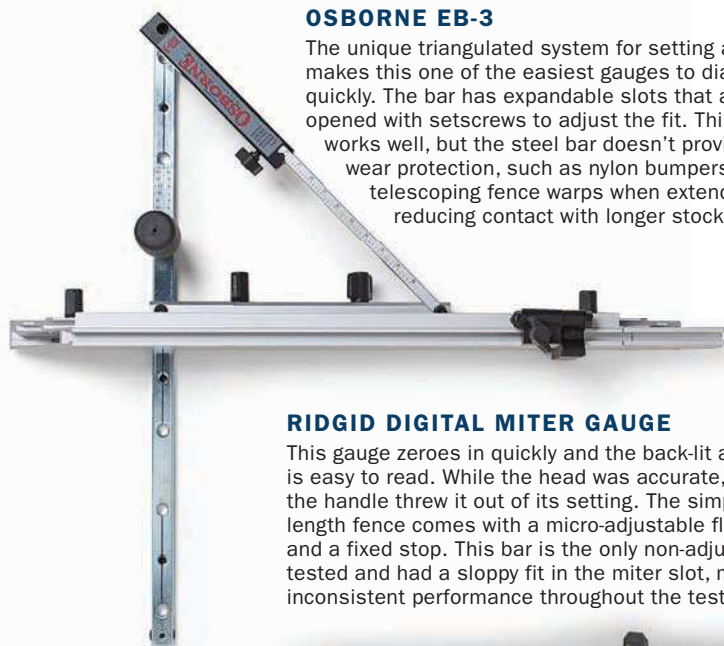
MODEL	PRICE	BAR ADJUSTMENT
Incra 1000 HD	\$190	Good
Incra 1000 SE	\$150	Good
Incra 3000 SE	\$290	Good
JDS Accu-Miter	\$270	Very good
Kreg	\$140	Excellent
Osborne EB-3	\$140	Very good
Ridgid Digital Miter Gauge	\$90	Fair
Woodhaven 4911	\$165	Excellent



DETENT USABILITY AND RANGE	FENCE QUALITY/RANGE	FLIP-STOP QUALITY	MITER TEST	LONG STOCK TEST	OCTAGON TEST
Excellent, 0°–90° in 1° increments	Good 18 to 31 in.	Very good	Very good	Good	Excellent
Very good, 0°–90° in 5° increments	Good 18 to 21 in.	Very good	Very good	Good	Excellent
Very good, 0°–90° in ½° increments	Good 27 to 49 in.	Very good	Excellent	Good	Excellent
Very good, detents at 0°, 15°, 22.5°, 30°, 45°	Excellent 18 to 34 in.	Excellent	Excellent	Good (excellent with optional clamp)	Excellent
Good, detents at 0°, 10°, 22.5°, 30°, 45°	Good 24 in.	Good	Very good	Good	Very good
Very good, 0°–45° in 5° increments, and 22.5°	Fair 24 to 42 in.	Fair	Good	Good	Excellent
Digital, in increments of ¼°	Fair 24 in.	Fair	Fair	Very good	Fair
Fair, detents at 0°, 10°, 15°, 22.5°, 30°, 45°, 60°, 90°	Good 24 in.	Excellent	Excellent	Good	Excellent

OSBORNE EB-3

The unique triangulated system for setting angles makes this one of the easiest gauges to dial in quickly. The bar has expandable slots that are opened with setscrews to adjust the fit. This works well, but the steel bar doesn't provide any wear protection, such as nylon bumpers. The telescoping fence warps when extended, reducing contact with longer stock.



RIDGID DIGITAL MITER GAUGE

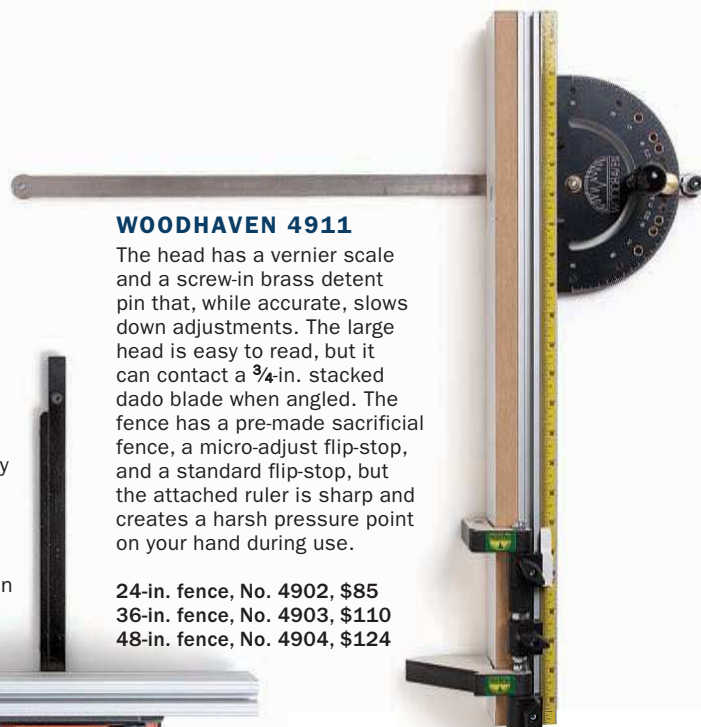
This gauge zeroes in quickly and the back-lit angle display is easy to read. While the head was accurate, tightening the handle threw it out of its setting. The simple, fixed-length fence comes with a micro-adjustable flip-stop and a fixed stop. This bar is the only non-adjustable one tested and had a sloppy fit in the miter slot, making for an inconsistent performance throughout the tests.



WOODHAVEN 4911

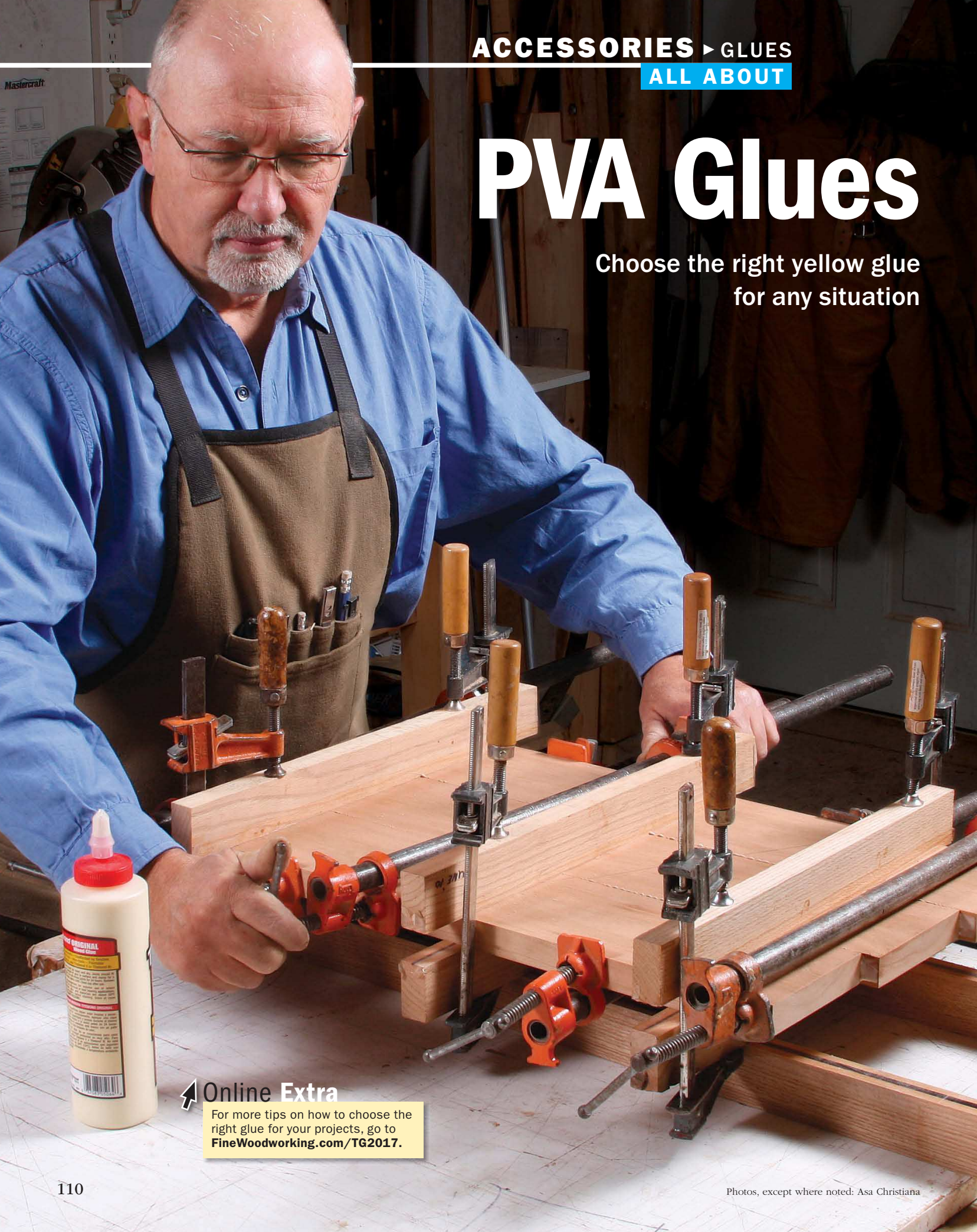
The head has a vernier scale and a screw-in brass detent pin that, while accurate, slows down adjustments. The large head is easy to read, but it can contact a ¾-in. stacked dado blade when angled. The fence has a pre-made sacrificial fence, a micro-adjust flip-stop, and a standard flip-stop, but the attached ruler is sharp and creates a harsh pressure point on your hand during use.

24-in. fence, No. 4902, \$85
36-in. fence, No. 4903, \$110
48-in. fence, No. 4904, \$124



PVA Glues

Choose the right yellow glue
for any situation



Online Extra

For more tips on how to choose the right glue for your projects, go to FineWoodworking.com/TG2017.

Woodworking isn't cheap, but glue isn't the problem. That's because our most common adhesive, yellow glue, is inexpensive and works for many tasks. We all know it and love it, but a better understanding of how this glue works, and the wide array of formulations available, will help you get the most from it.

Officially called polyvinyl acetate (PVA), this adhesive came into wide use after World War II. Its predecessor, animal-hide glue, reigned for centuries, going back to the furniture in King Tut's tomb. PVA came with a number of advantages: longer shelf life, more working-time, and no need for a heated pot. Also, PVAs could be formulated for different jobs and characteristics, such as water resistance and working-time.

PVA glues will bond all types of joinery, many bent laminations, and most veneered panels. And they work well on almost all woods, including plywood and MDF. But it's a good idea to avoid using PVAs on most tropical woods, which contain oils that will interfere with the glue's bond.

PVAs prefer fresh surfaces and tight joints

To get the most strength from PVA glue, you need to know how it works. One critical factor is absorption. Suspended in water, the glue particles are absorbed into the surrounding wood fibers. When the moisture dissipates and the glue hardens, the two adjacent pieces of wood are bonded. That's why joints should be glued right after cutting, sanding, or planing them. If a week or more has passed, surface contaminants can rise from inside the wood and stop the water from penetrating.

The other key to a strong bond is having a very thin, continuous film of glue in the joint. PVA glue is not a good gap-filler. That means good mating surfaces, and powerful clamping force when possible. When you can't clamp the faces of a joint together directly—as is the case with dovetails and mortise-and-tenon joints, for example—the joinery must be snug to ensure success.

Apply the right amount

It doesn't really matter what you use to apply PVA glue, as long as you spread it evenly and thinly over the entire surface of the joint.

If all of the surfaces are freshly cut, scraped, or sanded, you don't have to spread PVA on both mating surfaces to get it to soak in. That means you can apply glue to only one face of each joint—whether an edge joint, dovetail, mortise, or lamination—and achieve unqualified success.

Miters are basically end grain, so glue tends to soak into their fibers, starving the joint. There are a variety of approaches to solve this problem. Some woodworkers recommend applying a thin, preliminary layer of glue, and letting it set up and

Conditions for success

PVAs LIKE FRESH WOOD ...



Proper prep. If more than a day or two has passed since you cut the joints, you should scrape or sand the surfaces to remove oil and other contaminants that can rise from within to prevent absorption.



Absorption test. For full strength, a PVA glue needs to soak into the wood. You can test the joint's readiness with water. It beads on a surface that was cut a year ago (left), but soaks quickly into a freshly scraped area (right).

... AND WARM TEMPS



Too cold. PVAs only work down to certain temperatures, usually around 50°. If the wood, glue, or air is colder than that, the glue will turn chalky, rendering it useless.



Tools for applying a thin, even coat

Aside from absorption, the other key to achieving full strength with PVA glue is having a thin, continuous glue line.

THE FINGER METHOD



Apply glue straight from the bottle when possible. If the joints are freshly cut, you only have to apply glue to one of the mating surfaces in each joint.



The simplest spreader. Try using your finger to spread the glue on edge joints, bending it a bit to get more glue in the middle than along the edges.

BRUSH GOES WHERE FINGERS CAN'T



Doctor it first. Trim the bristles on cheap flux brushes to make them stiffer, and hammer the ferrule to keep the bristles from falling out.



Reach into mortises. Squeeze glue into the mortise, and then spread it with the brush. Glue is not necessary on tight-fitting tenons.



Biscuits and miters, too. The brush reaches into biscuit slots and spreads glue on small surfaces like these miter joints.

SMALL STICKS FOR TIGHT SPACES



Dovetail trick. Thin sticks reach between tails to apply a thin, even coat. You don't need glue on the pins, but a little on the shoulders doesn't hurt.

NOTCHED SPREADER FOR BIG AREAS



Trowel is better than a roller. A spreader with $\frac{1}{32}$ -in. V-notches will deposit the perfect amount of PVA glue for veneering and laminations.



Easy fixes for squeeze-out

PVA glues will show up under almost all finishes, so don't leave any behind. Here is how to make the job as easy as possible.



Don't apply too much. On clamped joints like panels (left) and miters (above), you should see a small continuous line of squeeze-out. Big beads or drips will be harder to deal with afterward.

seal the grain before adding more glue, a process called “sizing” the joint. But joint failure is possible with this technique. That's because glue does not stick well to glue that has already skinned over and begun to cure. So instead move more quickly than usual, touching up dry spots before assembling.

Working-time: The clock is ticking

The most important attributes of any glue are open and closed assembly time. Open assembly time, or open time, is the amount of time you have between spreading the glue and assembling the joint (but not necessarily clamping it yet). Once the glue is spread, the water begins to evaporate and the glue starts to skin over.

Closed assembly time starts after the surfaces are touching, and tells you how long you have to get the pieces aligned and the clamps tightened before the glue starts to fully cure. Adding open and closed time together tells you the working-time—how long you have to complete the glue-up without the joints starting to freeze in place.

A warmer, dryer shop speeds up the clock—Keep in mind that manufacturers' specs are based on an environment where the humidity is mid-range and the temperature is about 72°. In general, a colder or more humid shop will slow down the clock, and a warmer or dryer shop will speed it up.

Clamp time is pretty universal—Clamp time—how long you need to wait before you can remove the clamp pressure—varies based on wood species, humidity, and temperature. Clamps force surfaces and joints together, overcoming all sorts of resistance in the workpieces, from warping to unevenness. The moisture needs to evaporate and the glue has to harden, at least partially, before you can trust workpieces not to shift or move when clamp pressure is released.

If you take off the clamps too soon and a joint opens up, it might be too late to reclamp it without compromising the strength of the joint. Worse, you might not notice the gap,



Scrape it off in stages. When the glue starts to gel, after half hour or so, remove as much as you can with a flexible scraper (top). After about an hour, remove the clamps and get the rest of the gummy squeeze-out with a cheap, steel-bladed paint scraper (bottom). Grind a fresh edge on each tool for best results, and ease the corners so they don't dig in.



TIP

DON'T LEAVE ANY BEHIND

The big blotch was a gluey fingerprint. The haze in the corner came from removing glue with a wet rag, which is a no-no.

The right PVA for your project

Standard PVA glues are a shop staple, but there are many reasons to pay more or go online for a special formula.

STANDARD PVA IS CHEAP AND VERSATILE

These have a shorter working-time and are less expensive than other varieties, but just as strong.

Price: \$4-\$5 for 16 oz.
Open time: 5-10 min.
Total working-time: 15 min.
Chalk temperature: 50°-55°
Dried color:
Translucent yellow



TITEBOND
ORIGINAL
WOOD GLUE

ELMER'S
CARPENTER'S
WOOD GLUE

TYPE I OFFERS MORE OPEN TIME

Type I PVA glues are very water-resistant, so they work well for outdoor furniture. They also offer significantly longer working-time.

Price: \$7-\$8 for 16 oz.
Open time: 10-15 min.
Total working-time: 25 min.
Chalk temperature: 47°-55°
Dried color: Translucent brown



TITEBOND
III ULTIMATE
WOOD GLUE

ELMER'S
CARPENTER'S
WOOD GLUE
MAX

WHY PAY MORE FOR TYPE II?

These varieties cost roughly \$1 more than standard PVA glues, but offer the same amount of working-time and only moderate water-resistance.

Price: \$5-\$6 for 16 oz.
Open time: 5-10 min.
Total working-time: 15 min.
Chalk temperature: 50°-55°
Dried color: Translucent orange



TITEBOND
II PREMIUM
WOOD GLUE

GORILLA
WOOD GLUE



Got 15 minutes? Standard PVA glue has a relatively short working-time, but it's more than enough for many glue-ups. Always do a dry run to get everything set before spreading glue.



More time makes a big difference. For complicated glue-ups like this big lamination, a Type I PVA (here Titebond III) allows more time for spreading, positioning, and clamping.

A few specialists are worth tracking down

You might have to go online to find these products, but they can be lifesavers.

SLOW AND CLEAR

Titebond Extend has the same 25 minutes of working-time as Titebond III but a lighter glue-line, making it better for whiter woods.

Price: \$7 for 16 oz.
Open time: 15 min.
Total working-time: 20-25 min.
Chalk temperature: 40°
Dried color: Translucent white

NO SQUEEZE-THROUGH

This PVA contains a filler that stops it from squeezing through porous veneers. It should be used for veneering only.

Price: \$10.50 for 1 qt.
Open time: 15 min.
Total working-time: 20 min.
Chalk temperature: 50°
Dried color: Brown

GREAT ON END GRAIN

This PVA is thicker so it won't soak as quickly into miter joints. It also grabs quickly, making it great for rub joints.

Price: \$8 for 16 oz.
Open time: 35 min.
Total working-time: 10-15 min.
Chalk temperature: 50°
Dried color: Translucent tan



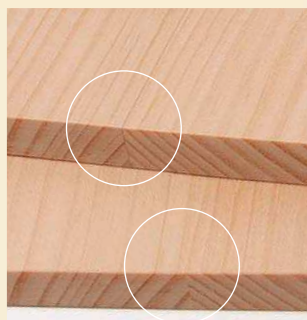
TITEBOND EXTEND WOOD GLUE



TITEBOND COLD PRESS FOR VENEER



TITEBOND NO-RUN, NO-DRIP WOOD GLUE



Perfect for pine. The glue-line is dark (top) using Titebond III, but invisible (bottom) using Titebond Extend.



Stir it up. The filler in this PVA tends to settle. So stir it up with a mixing attachment before use.



Miter master. On end grain, this glue stays on the surface longer, giving you more time to complete the glue-up.

and then let the workpieces freeze permanently in that position. On the other hand, if you wait too long, you won't be able to remove all the glue squeeze-out before it hardens completely. Usually one hour to 90 minutes is about right.

Freshness matters, too

The shelf life of PVA ranges from one year to two, so for most hobbyists, the ubiquitous 16-oz. bottle is the right amount to buy. But if you plan to do laminations or veneering, you can safely buy a gallon or more without much going to waste. If there is no obvious manufacturing date on the bottle, write the date of purchase on it.

Shelf life is shortened if the glue is stored in extreme temperatures: higher than 85° or lower than 55°.

Special situations

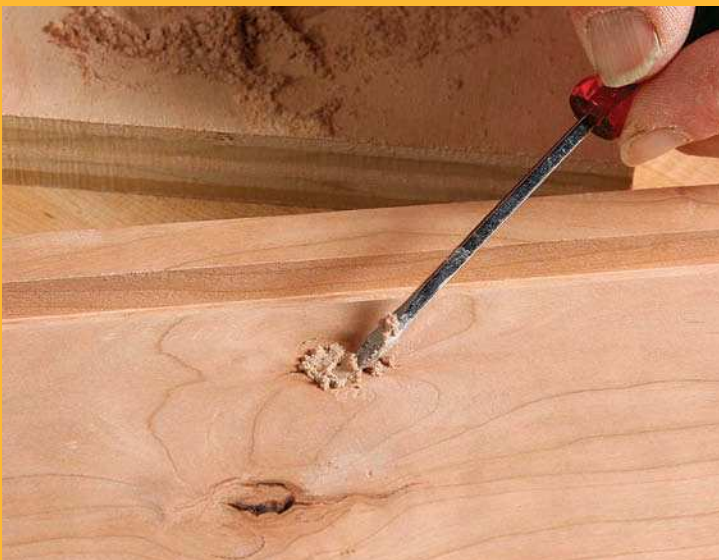
Although PVAs get used a lot, even for laminations and veneering, it's not always appropriate. For laminations, go with Titebond III or Titebond Extend, depending on the color of the wood. The extra open time is invaluable for spreading glue and applying clamps. However, if the lamination will be unsupported for more than 4 ft. and will carry a lot of weight, choose System 3 G2 epoxy, which is much more rigid and offers even more open time.

We also use PVA glues for veneering. If the wood is tight-grained, like cherry or maple, we'll use a normal PVA glue. But for open-grained, ring-porous woods like ash and oak, or for burls, which have small voids in them, we love Titebond Cold Press for Veneer glue.

However, if the veneer has a lot of patternwork or marquetry on it, PVA is a bad choice. The water in the glue will expand the veneer and distort the pattern. It's also a good idea to avoid PVA for areas over roughly 4 ft. by 4 ft., because you can run out of working-time. In these cases, we recommend that you turn to Unibond 800. □

Furniture maker Michael Fortune and freelance editor Asa Christiana contributed to this article.

Super Glue



to the Rescue

We've all been there. You chip a plate in the kitchen or break off a vital section of wood you are working on. If you want an invisible repair, the area is hard to clamp, or you don't want to wait for the glue to set, the answer is Super Glue.

Speed is the main advantage of Super Glue, whose technical name is cyanoacrylate (CA) glue. A repair or a joint made with CA glue can be shaped,

sanded, or finished within about five minutes.

Another advantage is that CA glue doesn't add moisture to the wood, so there is no problem with wood swelling. If you sand a joint too soon after it was made with a polyvinyl acetate (PVA) glue, you can end up with a depression after the moisture has evaporated and the wood shrinks.

We decided to take a close look at this special family of

glues to find out how woodworkers use it in their shops. While researching this article, we picked up great tips for its everyday uses in woodworking. We think it's time woodworkers gave CA glue a second look.

A unique glue

CA glue is an acrylic resin that does not dry, but rather reacts or polymerizes in the presence of water, either in the form of

vapor in the air or moisture in the wood. Unfortunately it is this reaction with moisture that causes CA glue to have such a short shelf life; the moisture in a half-used container will cause the remaining glue to harden. CA glue will not work properly on a highly acidic surface such as tannin-rich oak. In a case like this you need to use an accelerator (also called an initiator), either applying it to one surface and glue to the other,

From repairs to assembly to finishing, how to get the most from this versatile shop helper

Many brands and types

Cyanoacrylate glues are available in a variety of sizes, brands, and viscosities for different tasks, and there are accelerators to hasten curing. Thin CA glue's low viscosity can go places other glues can't, such as hairline cracks. Medium-thickness CA glues are better for bigger repairs or even as a wood finish. And the thickest types can be used for building entire projects. *Editor's note:* DAP has purchased the Nexabond formulas and is selling the product under the name RapidFuse.



Repairs are a breeze

FILL AND CLAMP CRACKS



Low viscosity is ideal for hairline cracks. Forcing a too-tight tenon into a mortise cracked the wood.



Open wide. Use a flat screwdriver or other narrow blade to pry open the crack so that glue flows down into it.



Clamp and wait. Just a few minutes of pressure and the part is ready to go.

REPLACE SMALL CHIPS IN A JIFFY

No clamps needed. With the addition of an accelerator, CA glue is great for repairing chipped surfaces. Apply the glue and hold the chip in place (right). While applying pressure to the repair, liberally spray accelerator to speed up curing time (below).



or applying accelerator around the joint after the two parts are joined. An accelerator is also handy for repairs, eliminating the need for clamps.

Be extra careful when handling CA glues. Read the directions about what to do if you get some in your eye or if you glue your skin together. In the latter case, some glue manufacturers tell you to apply acetone, others to hold the skin under water, but in either case gently rub the bonded area back and forth until the glue dissolves. Don't try to pull the "joint" apart, because you risk tearing the skin.

While most generic CA glues have a low viscosity, meaning they are thin and runny, you can also buy medium and thick varieties designed specifically for woodworking.

Make fast, strong repairs

CA glues with a low viscosity easily flow into hairline cracks and checks to produce an invisible repair.

Torn-out chips can be fixed quickly. For small repairs, use low-viscosity CA glue with an accelerator. For bigger repairs, say if a piece of a carv-

ing breaks off, use medium CA glue with an accelerator. The accelerator eliminates the need for clamps—a lifesaver for an intricate piece—and gets you back to work faster.

Use it as a clamp

Woodworking instructor Bob Van Dyke uses CA glue as a clamp while making jigs as well as to reinforce the edges of MDF templates in those jigs.

Medium CA glue also can be used as a kind of clamp in conjunction with PVA glue. For example, instead of struggling to clamp the odd shapes and angles on a piece of crown molding, you can instead apply sections of CA glue in between longer stretches of PVA glue. Hold the molding in place for a minute until the CA glue sets, and the CA glue will then act as a clamp until the slower drying but stronger PVA glue sets.

Because of CA glue's low shear strength, one of the first uses for the glue was as a thread locker, which stops nuts from vibrating off bolts but still allows them to be removed if the force of a wrench is applied. In the same vein,

REPLACE BIG CHUNKS WITHOUT CLAMPS



A carver's friend. If you accidentally break off a chunk while carving a detailed piece, medium CA glue is your savior. Apply a generous amount, fit the piece in place, and hold it down.



Speed the cure. Spray on accelerator and return to carving again in five minutes.

FILL DEFECTS IN A FLASH



Pack it, glue it, and spray. Fill the void with wood dust, add glue, and then spray on accelerator. Repeat until the filler is just proud of the surface.



turners sometimes use thick CA glue to temporarily attach a small blank or partly completed turning to a wooden glue block, usually applying glue to the block and accelerator to the turning. You should use this only for blanks that won't be subject to extreme force when being turned. To remove the block, you just cut into it on the glue line and pop off the bowl.

Fortify vulnerable areas

CA glue is also useful for stabilizing and reinforcing areas

of spalted wood, whether they are being turned, planed, or sanded. Similarly, it can be used to stiffen wood fibers prior to the insertion of threaded inserts.

Furniture maker Will Neptune uses CA glue to harden and preserve the edges of mat-board templates and to reinforce screw holes.

A fast-drying, stable filler for cracks and voids

If you are advanced enough to do wood inlay, a high-gloss finish can highlight slight gaps



Sand it flush. CA filler dries more quickly than oil-based fillers. And unlike water-based fillers, it won't shrink as it dries, so you end up with a repair that can be leveled with a sanding block after just a few minutes.

It works as a clamp

PAIR IT WITH PVA GLUE

Help hold odd shapes. Apply sections of CA glue in between longer stretches of PVA (yellow) glue. Hold the piece in place for a minute until the CA glue sets. It will then act as a clamp until the slower-drying but stronger PVA glue sets.



SECURE BEFORE SCREWS



Mark your place. To keep parts like the alignment blocks on this woodworking jig from shifting while being screwed down, apply a thin bead of glue around the edges first (left). Use accelerator to lock it in place (center), and finish up with screws (right). The block is more than secure enough to be screwed in place from the bottom.

TEMPORARY GRIP

Wood turner's friend. Use thick CA glue to attach a small blank or partly completed turning to a wooden glue block. Apply glue to the block and accelerator to the turning before holding them together.



between the inlay and the surface of the substrate. Trying to fill them with finish is a slow process. CA glue is fast, and you can sand away any that is proud.

Thick CA glue is great for gluing loose knots and, when mixed with sawdust, excels at filling small voids. This CA filler dries more quickly than oil-based ones and unlike water-based fillers, it won't shrink as it dries.

A super finish

Any brand of CA glue that comes in a medium consisten-

It also adds strength

cy can be used as an acrylic finish by pen turners. Apply it in multiple thin coats while the blank is turning, and then sand and polish to leave a very durable, high-gloss finish.

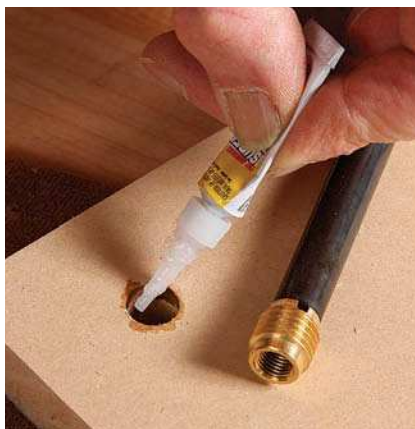
Extend the life of your glue

An unopened container of regular CA glue should be viable for about a year at around 70°F, but if you store it in the refrigerator you can probably double that time, and in the freezer it will keep almost indefinitely. Just don't let the glue freeze, which it does at -8°F (most home freezers operate at around 0°F). Nexabond has a shelf life of 12 months from the date of manufacture at 72°F and at least 18 months if kept in a refrigerator, whether or not it has been opened. Do not store Nexabond in the freezer as it shouldn't be allowed to go below 32°F.

Once the glue has been opened, hot and humid storage will cause it to harden in a month or two, whereas in cool, dry conditions it should be good for at least six months. You can try storing glue in a sealed container with a bag of silica gel (the kind that often gets shipped with electronic goods). If you use a container of regular CA glue straight from the freezer, be sure to let it warm up to match the temperature of the workpiece.

To prevent the narrow dispensing tube from getting blocked, always clear it after use by holding the container upright and tapping it on the work surface before screwing on the cap. Some suppliers sell extra tubes, or you can soak a blocked tube in acetone. □

Finishing expert Mark Schofield contributed to this article.



Lock in a threaded insert. Line the hole with CA glue before installing the insert.



Reinforce screw holes. Neptune uses CA glue in softer woods where he has to insert shallow screws, such as for hinges.



Harden edges of templates. Will Neptune uses mat board to make templates for chair back splats, cabriole legs, etc. He lets thin CA glue soak into the edges and after it dries "as hard as laminate," he can refine the profile by filing or sanding.



Fortify soft areas. Spalted wood that has been softened by fungi can be hardened with CA glue.

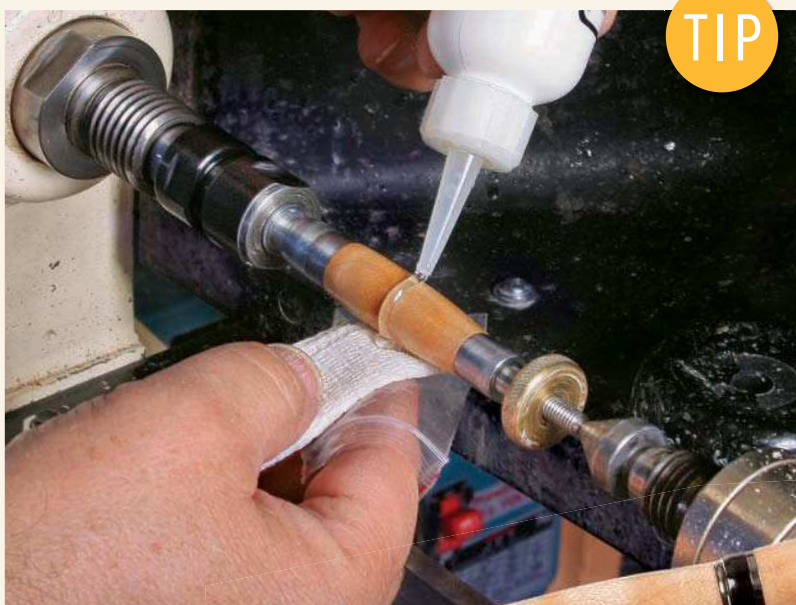
Online Extra

To see a video on how to get your fingers unstuck, go to FineWoodworking.com/TG2017.

TIP

IT WORKS AS A WOOD FINISH, TOO

Apply medium CA glue to a turning blank as you spread it with a paper towel. Wear a disposable glove or wrap your finger in a plastic bag. Spray on accelerator to cure the finish instantly.



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