All-Purpose Sawblades

Designed to rip as well as crosscut, these blades handle a variety of materials

by Michael Standish

***Twenty-three all-purpose tablesaw blades** from 12 manufacturers were evaluated for both crosscuts and ripcuts. The performance difference among them was surprisingly small.*

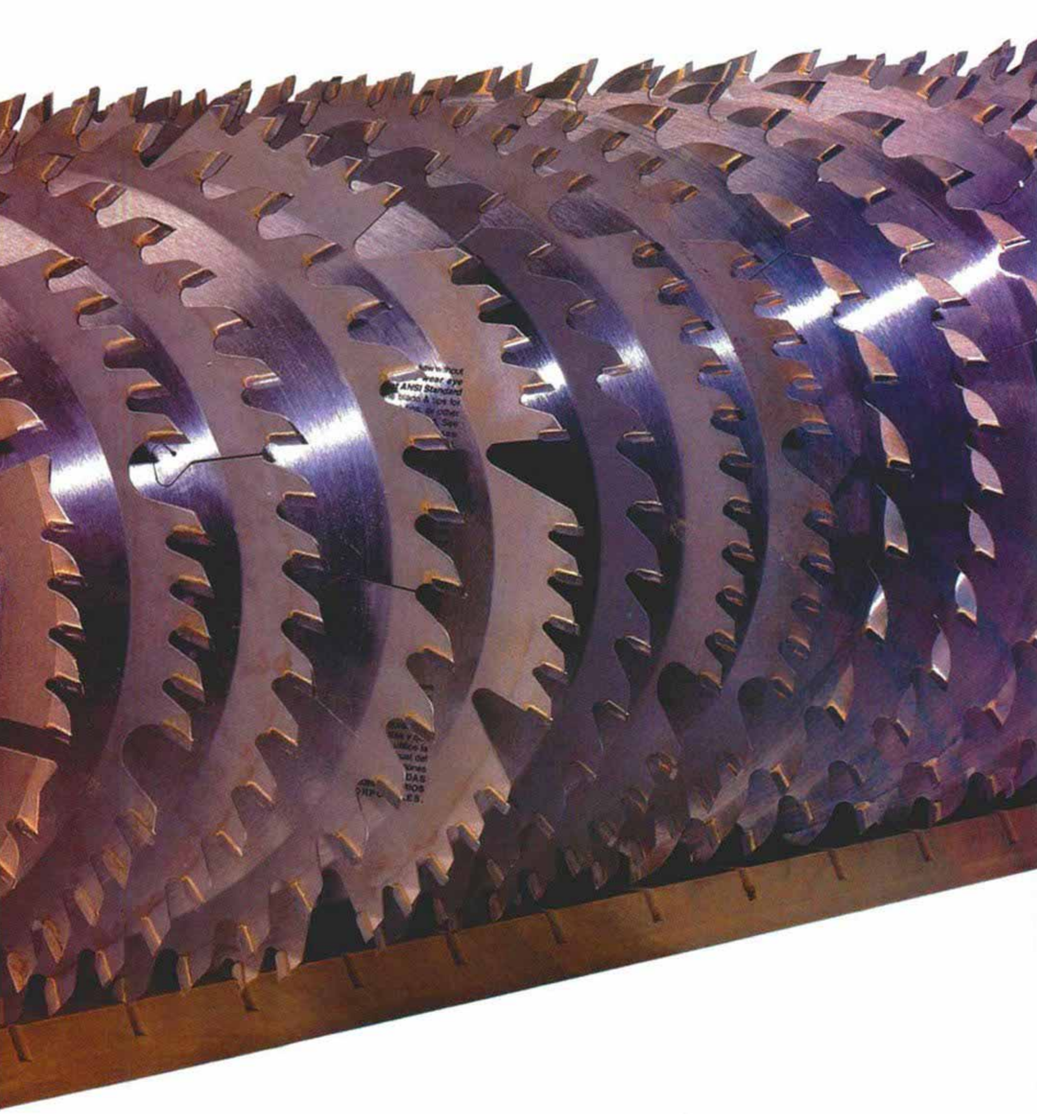
For years, I have used one blade for ripping and another for crosscutting on the tablesaw. Somehow the idea that a single blade could both rip and crosscut seemed a product of aggressive advertising or a reflection of runaway consumer optimism (like the search for the 200-mpg carburetor).

After trying 23 of these industrial-grade, carbide-tipped blades (see the photo above right), I have come to an entirely different point of view. I now think that my best bet may indeed be an all-purpose blade with an identical backup blade to avoid sharpening downtime.

These blades will not rip as quickly as a blade made specifically for that purpose, and they may not produce the smoothest possible crosscut. But if you are making a lot of blade changes on the tablesaw as you switch from crosscutting to ripping operations, these blades are well worth looking at. And your checkbook will like it if you buy one blade that produces acceptable crosscuts and adequate ripcuts rather than two single-purpose blades.

The 10-in. blades I evaluated in the shop came from 12 manufacturers and range in price from $26 to $109. Depending on the manufacturer and the tooth pattern, you might see these blades called combination blades, all-purpose blades or general-purpose blades. But all of them are intended to

Photo at left: Dennis Preston; photos except where noted: Scott Phillips



rip and crosscut. For the sake of simplicity, though, I will refer to them generically as all-purpose sawblades.

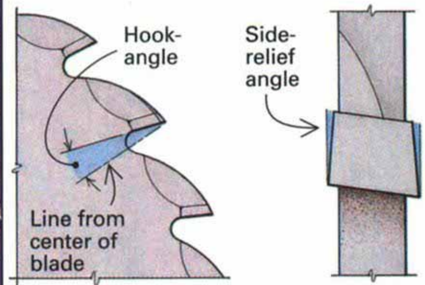
In appearance and in cost, there are obvious differences among these blades. But after cutting dozens of samples of wood, plywood and wood composites, I can tell you that any one of the blades will produce a good cut in a variety of materials (see the chart on pp. 42-43). Although I didn't use the blades long enough to find out which ones perform well over time, over the short run, they're remarkably similar.

Good blades start with a good plate

The plate is the foundation of the sawblade. It supports the cutting tips and clears chips from the cut. Plates are made from annealed (relatively soft) sheet steel, usually a nickel or chrome-vanadium alloy. They're rolled to a thickness of about

BLADE BASICS

Manufacturers adjust hook- and side-relief angles for the best compromise between ripping and crosscutting. Teeth on all-purpose blades may be ground to one of two patterns: alternate top bevel or alternate top bevel and raker.



Alternate top bevel

Points score the wood. *Alternate top bevel (ATB) teeth are ideal for severing wood fibers in crosscutting operations. Feed rates on ripcuts will be slower than with dedicated blades, which have fewer teeth.*

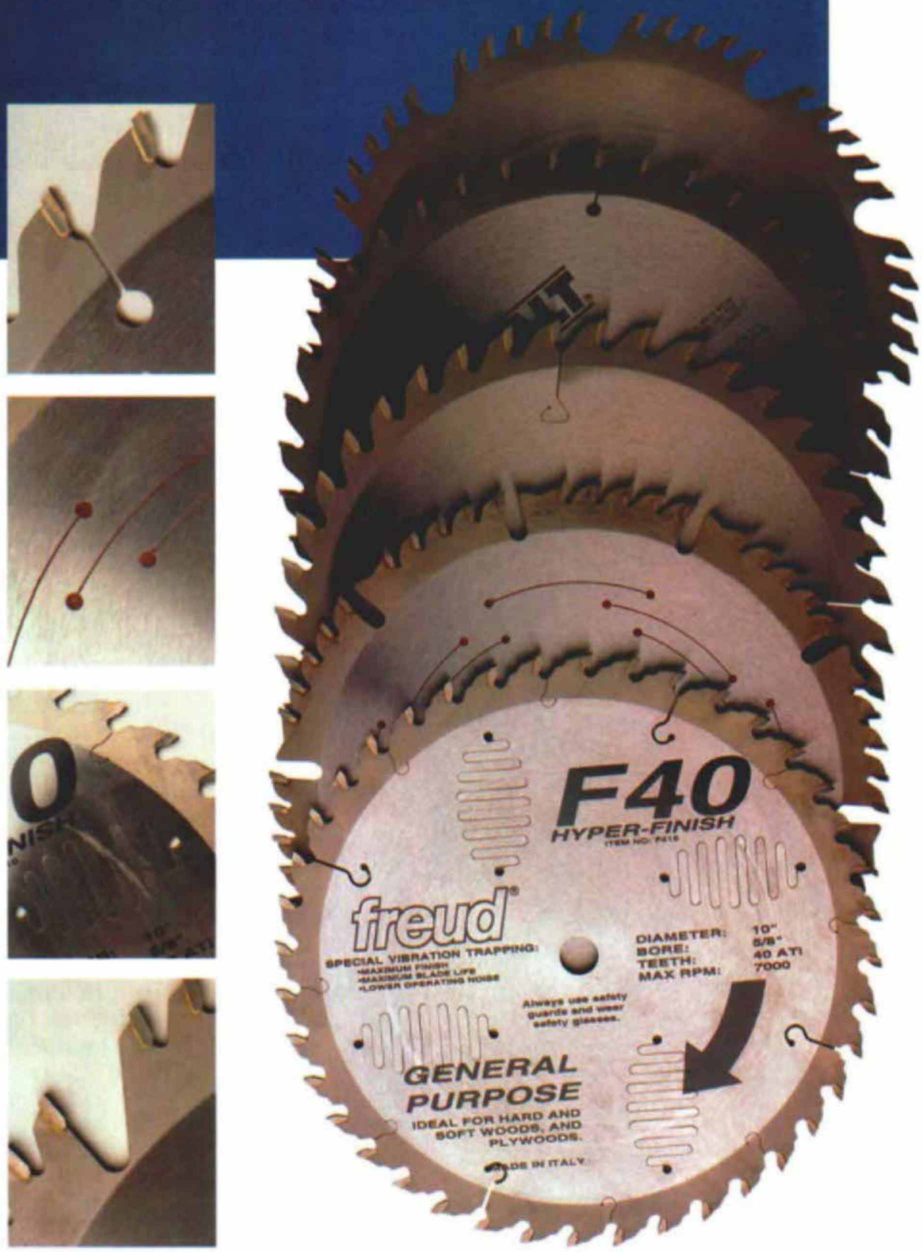
Alternate top bevel and raker

Raker teeth and deep gullets clear *chips for faster ripping. A group of four or 10 alternate top bevel teeth slice wood fibers, followed by a flat-topped raker.*

Drawing: Vince Babak

SLOTS KEEP BLADES FLAT, REDUCE NOISE

Expansion slots (top photo at left) allow the blade to increase in diameter as it heats up, helping the blade stay flat. Sound-suppression slots filled with a rubbery material (second photo) help deaden vibration and reduce noise. Other blades have both types of slots (third photo) or have deep gullets that serve as expansion slots (bottom photo).



.085 in. to .095 in. for regular kerf blades and .075 in. for thin-kerf blades.

Well-made plates, like the ones used in this evaluation, are either milled or laser cut. These techniques induce less stress than stamping, which is an inferior method. At this stage of manufacture, the plate is given the basic configuration: gullets and shoulder shape, tooth pockets, expansion slots, sound-suppression slots (if any) and arbor hole.

After being cut to shape and size, a plate is hardened and tempered. The relative hardness of steel is usually measured in terms of the Rockwell hardness scale (Rc). For normal woodworking applications, plates are hardened and tempered to between Rc38 and Rc44.

Not all plates, or blades, look alike (see the photos above). Some blades have expansion-control slots to minimize warping from heat buildup. Some blades also have sound-suppression slots, which dampen vibration and decrease blade noise. Gaps (gullets) in front of each tooth may vary. They provide a space where chips can accumulate before they are pushed out as the blade exits its cut. A larger gullet will get rid of waste more readily but will increase the noise and shock load on the tooth.

Tensioning helps a blade run true

Selectively applying force by hand or with a machine builds strain into a blade. This is called tensioning, and it counteracts warping caused by thermal expansion. With roll-tensioning, rollers under as much as four tons of force squeeze a small amount of the plate's steel in a concentric pattern. A ⅛-in. ring about 2 in. from the blade's circumference is evidence of this process. Hand-tensioning is accomplished by a saw smith using hammers, an anvil, a dial indicator and straightedges.

Tensioning becomes more critical as a blade's diameter or cutting speed increases and as plate thickness decreases. Because expansion slots or deep gullets will accommodate some deformation, a relatively small blade, carefully ground flat, may deliver adequate cutting results without benefit of tensioning. The need for tensioning plates as small as 10 in. or as thin as .095 in. may be debatable, but the best plates, like the ones in this evaluation, still receive this treatment.

Blades have two possible tooth patterns

Sawblades in this survey have one of two tooth arrangements. One type is the alternate top bevel (ATB). On this blade, the top of each tooth is ground at an angle to the left or right (see the top photo in the box on p. 39). The point of each tooth severs wood fibers at the edge of the kerf and then removes the waste with a slicing action. For crosscutting, this tooth style is ideal. ATB teeth also give a clean cut for ripping, but the feed rate is slower than it is with a dedicated rip blade.

All-purpose blades also may use a tooth arrangement called alternate top bevel and raker (ATB&R). These are often called combination blades. A series of alternately beveled teeth (usually four or 10 in a group) are followed by a rip-style tooth called a raker. The ATB teeth score the stock, and the raker tooth, with its extra-deep gullet, clears dust and chips (see the bottom photo in the box on p. 39). The raker tooth is ground about .01 in. lower than the ATB teeth.

Although they look alike, sound the same and have similar amounts of runout, these all-purpose blades are not quite identical

Blades with an ATB&R pattern are capable of surprisingly crisp crosscuts and permit reasonable feed rates when ripping. As tooth count rises, crosscut quality improves but ripping becomes sluggish. Because the raker gullet takes a large bite of air, the resulting increase in turbulence can also make the blade noisier and may increase the chance of kickback. To lessen this risk, some blade manufacturers add a spur to the back of each shoulder to limit the bite of the following teeth.

Tooth geometry affects the cut

Hook- and side-relief angles are not very apparent to the eye, but they do play a crucial role in blade performance. Increasing the hook angle to 20° improves the feed rate but also increases tearout—the lower the hook angle, the cleaner a blade cuts. Blades in this survey have hook angles that range from 10° to 20°.

Although side-relief angles are hard to spot, they greatly affect cut quality. The more parallel to the plate, the more the tooth scrapes through the cut, resulting in higher operating temperatures. Hot-running blades cause resins in wood and adhesives in man-made materials to bum. The resins are then baked onto the blade, reducing cutting efficiency. A gummed-up blade will never perform as it should.

Thin-kerf blades use less power

Thin blades remove less waste, improve the feed rate and require less horsepower to drive the blade. This is most noticeable when ripping. Removing less waste can also mean better yield from a given amount of material. But except when resawing, the difference between a standard blade and a thin-kerf blade may not be meaningful.

Improved feed rate and yield come at the cost of an increased tendency of the blade to warp or flutter, which results in rougher cuts. The findings of the cut samples from this survey were mixed (see the chart on pp. 42-43). With a 3-hp tablesaw, there was virtually no difference in feed rate when ripping thick stock.

Brazing and carbide

All the blades evaluated in this survey have very hard tungsten-carbide teeth brazed or silver soldered to the plate. The scale used to describe the hardness of carbide includes about 20 classifications; however, only three or four of them are relevant to cutting wood.

Hardness ranges from C1 to C4; the larger number indicates a higher percentage of carbide granules and less binder. But this system is not very precise: one manufacturer produces almost a dozen grades that can be correctly called C2.

Generally speaking, though, as granule size and binder percentage increase, the resulting material is tougher (more shock resistant) but softer and more vulnerable to corrosion. This is important because heat and chemicals are even more destructive to carbide than abrasive materials. High heat can cause the cobalt binder to flow much like solder, which is greatly aggravated by chemical reactions with acids and other components, especially those in man-made materials like medium-density fiberboard (MDF).

Without a supporting binder, carbide granules will fall off like bricks without mortar. The loss of these particles at the cutting edges is the defining feature of a dull tooth.

I didn't cut enough stock to judge long-term durability of the carbide tips—with 23 blades, a huge quantity of material would have to be consumed before any degradation would be noticeable. The objective was to determine the quality of the cut.

Evaluating blades under real-shop conditions

Some materials are just plain difficult to cut cleanly, yet they are very common in the cabinet trade. I chose four of these materials for evaluating the blades: Baltic-birch plywood, melamine-faced particleboard, MDF and 2-in.-thick red oak.

I cut the birch plywood across the grain to maximize the chance of splintering. Melamine-faced particleboard is prone to chipping, especially on the back of the cut where the blade exits. Medium-density fiberboard readily shows sawmarks along the cut edge. And the oak was chosen to evaluate how well the blades ripped heavy stock. With each sawblade, I cut a dozen 24-in. lengths of each material on a General model 350 tablesaw.

Measuring runout indicates flatness. *Blades in this evaluation had runout of between .003 in. and .005 in.*

Blades all produced about the same noise levels, *around 93 decibels.*

Initially, I used a zero-clearance throat plate so that the blades would yield the best results. There was little difference in performance among the blades. I retrenched and used a well-worn throat plate so that the stock was free to splinter with the slightest cutting irregularity.

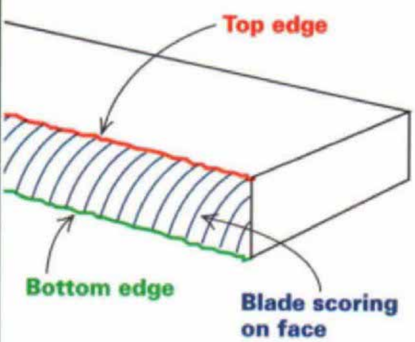
Checking for runout—Blade wobble, called runout, causes scoring on the edge of the cut and chipping on the back face of the stock. A good blade has only a little

Photos this page: Dennis Preston

Blade characteristics and performance

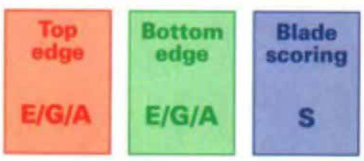
This chart summarizes blade characteristics and performance in solid wood and composites.

How to use this chart



Ratings:

E = Excellent G = Good
A = Acceptable



Use both letters and colors. Letters refer to the quality of cut—the less chipping or splintering, the better the job. Colors show which edge is being graded (see the drawing above). For example, the Arnana blade made an Excellent, chip-free cut on the top edge of plywood and an Acceptable cut on the bottom edge. A blue "S" denotes scoring, or sawmarks.

Manufacturer	Model	Average retail cost	No. teeth	Tooth type
Amana	610504	$65	50	ATB+R
CMT	Maxi-Combination	$58	50	ATB+R
CMT	Maxi-Combo Light	$65	50	ATB+R
Delta	35-614	$55	48	ATB
Delta	35-613	$43	40	ATB
Delta	35-617	$45	50	ATB+R
DML	Planer 74020	$80	50	ATB+R
DeWalt	DW 3213	$53	40	ATB
Eagle America	610-5501	$80	55	ATB+R
Eagle America	610-5001	$60	50	ATB+R
Forrest	Woodworker II	$89	30	ATB
Forrest	Woodworker II	$107	40	ATB
Forrest	Woodworker II	$89	30	ATB
Forrest	Woodworker II	$107	40	ATB
Freud	F 40 Hyper Finish	$60	40	ATB
Freud	LU 72-M010	$45	40	ATB
Freud	LU 84-M011	$50	50	ATB+R
FS Tool	L 55250	$65	50	ATB+R
Oldham	Wizard Elite	$45	40	ATB
Oldham	Tracker	$26	40	ATB
Ridge Carbide	TS 2000	$109	40	ATB
SystiMatic	Budke Combination	$50	50	ATB+R
SystiMatic	Plymaster	$75	55	ATB+R

runout. Using a dial indicator, I measured runout with the probe 4 in. from the arbor center (see the top photo on p. 41), over two or three revolutions of each blade. The blade was then repositioned on the arbor and the reading taken again. I did this in four 90° increments to see whether the arbor flange and blade runout might negate each other. The runout measured between .003 in. and .005 in. for all the blades.

Although this method is not particularly sophisticated, it does represent real shop conditions. The numbers I recorded may not be too meaningful by themselves (it's certainly possible that a speck of sawdust was trapped between blade and arbor flange), but the relative numbers are useful for comparing the blades. My findings are tabulated in the chart above, which gives the average of several measurements on each blade.

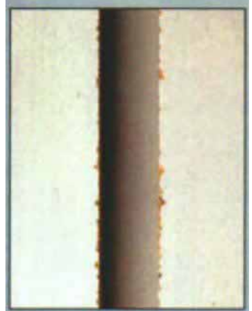
Measuring noise—I measured the noise the blades produced while cutting with a Radio Shack sound meter. It was clamped to a stand next to the saw at roughly ear height (see the bottom photo on p. 41).

Predictably enough, a 2-lb. blade with a rim speed of about 100 mph makes a lot of noise; it is pushing a lot of air. The intensity of the sound waves is measured in decibels (dB). This scale is non-linear, so an increase of 3 dB represents a doubling of the intensity.

All the blades measured 93 dB, spiking 1 dB higher and lower when cutting the oak. I attribute the relative quiet and uniform readings of these blades to two main factors. First, the high-quality saw I used has lots of sound-dampening cast iron, and second, these blades all have been manufactured to extremely high standards.

	Kerf	Runout	Plywood (crosscut)	Melamine	MDF	Oak (ripcut)
	regular	.005	E A	E E	E E S	G
	regular	.005	E G	E G	E G S	G
	thin	.003	E G	E E	E E	G
	regular	.005	G A	E G	E E S	G
	regular	.005	E G	E G	E E	G
	regular	.005	E A	E G	E E S	G
	regular	.004	E E	E A	E G S	E
	regular	.005	E E	E E	E E S	G
	regular	.005	E E	E E	E E S	G
	regular	.004	E E	E E	E E S	G
	regular	.004	E E	E G	E E S	E
	regular	.004	E G	E G	E E	E
	thin	.004	E E	E E	E E	E
	thin	.005	E G	E G	E E	E
	thin	.005	E G	E E	E E S	G
	regular	.005	E G	E G	E E S	G
	regular	.005	E E	E G	E E S	A
	regular	.005	E G	E G	E E S	G
	regular	.004	E G	E G	E E	E
	thin	.005	E G	E G	E E S	G
	regular	.003	E G	E G	E E	E
	regular	.004	E G	E E	E E S	G
	regular	.004	E G	E E	E E S	G

The bottom edge of the plywood shows the difference. *The crosscut sample at left is representative of the best blade performance. The sample at right is an example of blades that made acceptable cuts.*



Chipping on the bottom edge of the melamine. *Excellent-cutting blades produced samples like the one at left. Acceptable cuts look like the one on the right.*

Medium-density fiberboard cuts smoothly. *Differences in blade performance were not significant when it came to scoring, or sawmarks, left behind by blades in the sawn face of MDF (photo at left). That is also the case in how blades performed on the bottom edges of MDF samples (bottom photo).*

Finish quality—All the blades displayed a high level of finish, reflected in crisp arbor holes, uniform brazing cleaned by sandblasting (except Forrest, which is cleaned by grinding), fine and concentric plate grinding, and nicely honed teeth with well-defined edges. And with the exception of Oldham's garish graphics, these blades present a handsome, well-made appearance.

Looking at the cut—Although they look alike, sound the same and have similar amounts of runout, these all-purpose blades are not quite identical.

All the blades produced a crisp cut at the top edge of plywood cut across the face grain. The most noticeable difference was on the bottom edge where tearout varied from hardly noticeable to splintering from ⅛ in. to ⅜ in. back from the edge (see the top photo above).

It is difficult to eliminate chipping in melamine. Each blade in the survey produced a crisp, chip-free cut on the top surface. There was little difference between the best and the worst on the bottom edge (see the second photo above).

There was a more noticeable difference between the best and worst cuts in MDF, but they didn't seem significant to me. The best cuts showed no scoring along the sawn face, and the worst showed only slight scoring (see the third photo above). There was hardly any difference on the bottom edges (see the bottom photo above).

All the blades easily handled deep cuts when ripping hardwood. The best left a crisp, smooth edge that didn't need further jointing; the poorest had slight scoring. ☐

Michael Standish is a trim carpenter and woodworker from Jamaica Plain, Mass.