Woodsmith PLANS

DADO BLADES: WHAT YOU NEED TO KNOW

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If I had to make a short list of shop accessories that I wouldn't want to be without, my dado blade would be near the top. In my shop, it seems like every other step (or more) in a project involves the dado blade. And it's not just for cutting dadoes and grooves. It's more like a one-stop joinery station. I use it to cut tenons, tongue and groove joints, box joints, half-laps, rabbets, moldings, and more. It can be a really versatile tool.

I'm currently working on a classic console with frame and panel construction, for example. I put the dado blade to work right off the bat; cutting the centered grooves in all the stiles and rails. A couple passes for each groove, and I was done. Now what about the tenons? Just a little bit wider setup with an auxiliary fence, and they were cut in pretty short order. And then came the rabbets that join the frames — again with the dado blade. Finally I needed to cut some half-laps to join the front frame pieces. And how do you suppose I did it? Just one guess.

But don't get the impression that I just use a dado blade because I'm lazy. I use it because it allows me to do a high-quality job with the least amount of effort.

Basically, all a dado blade does is cut an extra wide kerf. This seems pretty simple, but there's more to it than you might think. All dado blades aren't the same, and if you've never used one or are new to them, you probably have a few questions. What type of dado blade should I own? How much should I pay? And how do I set it up to use it? These are all good questions and deserve some good answers.

TYPES OF DADO BLADES. There are really just two basic types of dado blades — the adjustable type and the stacking type. Both have been around for a long time and have their advantages and shortcomings.

ADJUSTABLE OR STACK

The adjustable dado (left) is quick and easy to use, but the stacking dado (right) can do more and do it better.

Adjustable Dado

At some time in the past, the adjustable dado picked up the nickname "wobble" dado (also called the drunken blade). If you've ever used one, you probably understand why.

HOW IT WORKS. An adjustable dado is just a single blade mounted on a beveled hub. As the tilted blade spins on the arbor, it looks like it's wobbling. And instead of each tooth cutting one behind the other, each tooth traces a different path and cuts at a different spot. So what you end up with is a wide cut. You can adjust the width of the cut (the amount of "wobble") by turning the blade on the hub to change the tilt. It's really pretty simple.

PLUSES. And for me that's the main attraction of the adjustable dado — simple setup and adjustment. You can fine-tune it to make any width cut within the blade's limits (usually ¼" to about ⅞"), without taking it off the saw. And a second plus is that, compared to a good stacking dado, they're pretty inexpensive ($20 to $60 for a 7" blade).

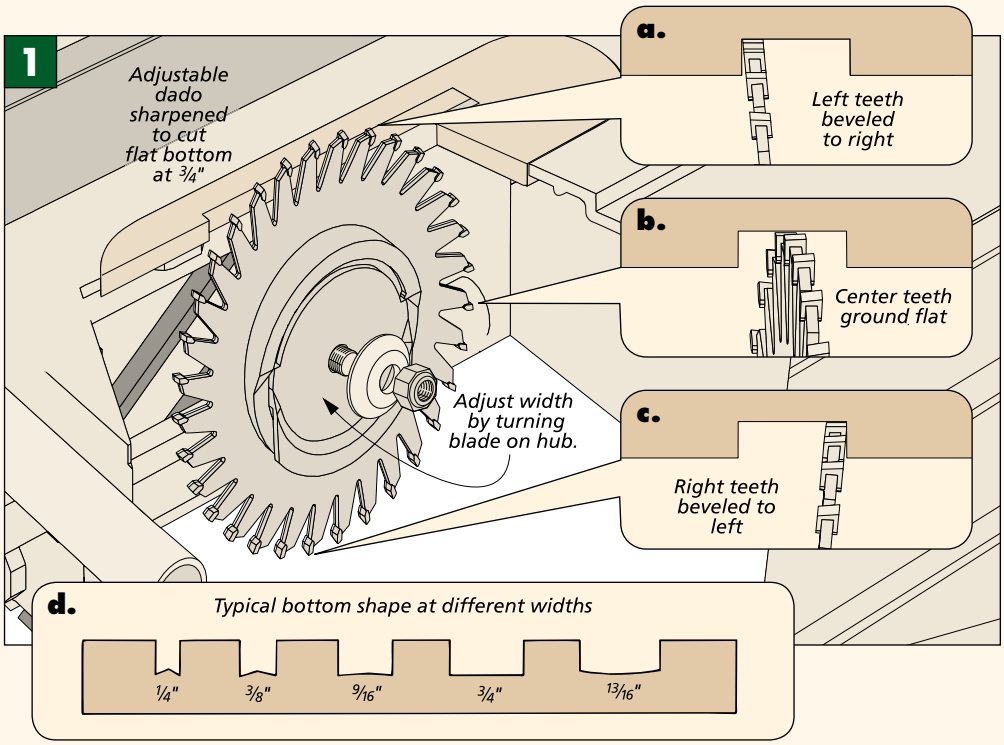
MINUSES. But before you run out to buy one, let's look at the down side. My main complaint with adjustable dadoes is that at most settings they don't cut a flat bottom. The better ones are specially sharpened (Fig. 1) to cut flat at a specific width (usually ½" or ¾"), but at any other width you're out of luck. In Fig. 1d, you can see how the shape of the bottom changes with the width of the cut.

Another drawback can be chipout along the shoulders of the cut. Working with the grain, this won't be a problem. But getting a really clean cut across the grain in hardwoods and "chippy" plywoods (like the oak plywood in the margin) can be next to impossible. This is really going to be a problem with an inexpensive blade.

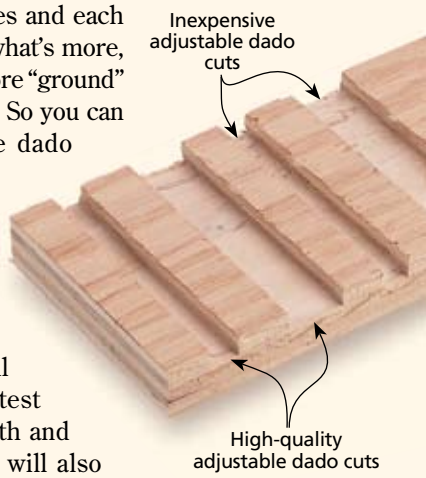
Basically, you've only got one or two teeth that are responsible for cutting at the outside edges and each point in between. And what's more, the wider the cut, the more "ground" each tooth has to cover. So you can see why an adjustable dado might cut a little rough.

A GOOD CUT. Setting up an adjustable dado is as easy as putting the blade on the saw and "dialing" in a width. Then you'll always want to run a test piece to check the width and depth of the cut. This will also help you fine-tune the fence setting. With an adjustable dado, it can be hard to tell where the outside edges of the cut will be.

For the best results, just make shallow passes with a slow feed rate. And if you're using an adjustable dado to cut joinery (tenons, half-laps), use the width setting where the blade will cut flat and square.



▼ *A good quality adjustable dado makes a slightly cleaner cut, but still chips in hard-to-handle oak plywood. And the wider the cut, the poorer the result.*

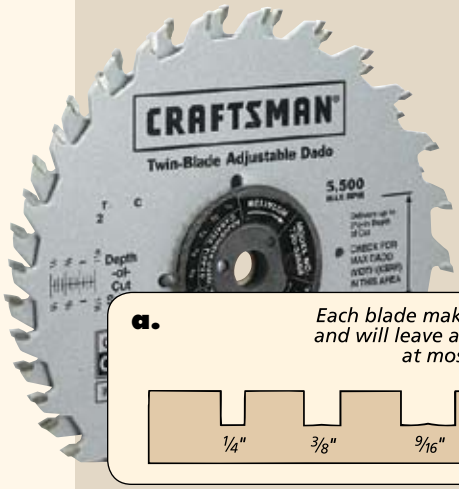


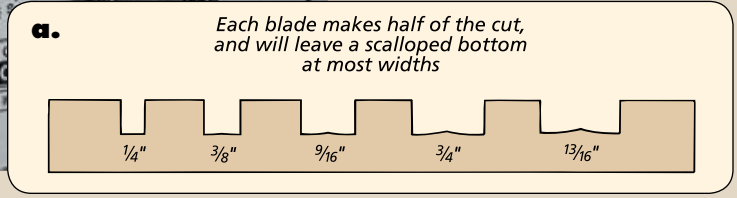
TWIN-BLADE ADJUSTABLE DADO

A couple of companies offer a twin-blade adjustable dado (sometimes called a V-wobble). The two blades are connected in a "V" shape and move in and out as the hub is turned. This changes the shape of the V and the width of the cut.

The idea is that it will make a cleaner, flatter-bottomed cut than a standard adjustable dado. And it does. But it's not a great improvement because you still get a "scalloped" bottom at most widths (drawing below).

But this blade is available in an 8" size, so it's a bit more versatile than the 7" adjustable dado.





Stacking Dado

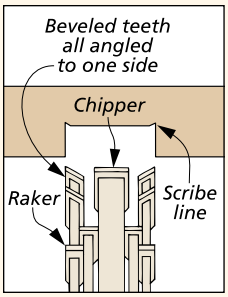
Adjustable dadoes are easy to use and are fine for an occasional task. But if you want a blade you can rely on to cut clean, accurate joinery day in and day out, a good quality stacking dado is a better choice.

CUTTERS AND CHIPPERS. The idea behind the stacking dado is pretty simple. There are two scoring blades that define the outside edges or shoulders of the cut, with a "stack" of chipper blades in between that clean out the waste (Fig. 2).

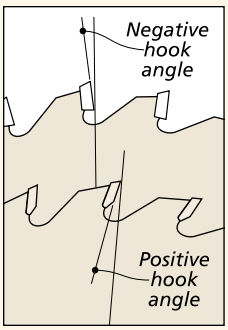
The cuts made by the scoring blades and chippers overlap to give you a flat-bottomed cut. The chippers come in different thicknesses ($\frac{1}{8}$", $\frac{1}{16}$", and $\frac{3}{32}$"). So by putting different combinations together, you can cut a variety of widths. Thin shims can be inserted between the blades to fine-tune the width.

CARBIDE SETS. All-steel stacking sets are still available, but today, carbide-toothed sets are the way to go. But they're not all the same. You can buy a carbide stacking set for as little as $20, and basically you'll get what you pay for. But some of the more expensive sets sell for over $300, which is pretty steep. I'd settle somewhere in the middle. The *Freud* set shown in the photo on page 1 proved itself in my shop and retails for about $100.

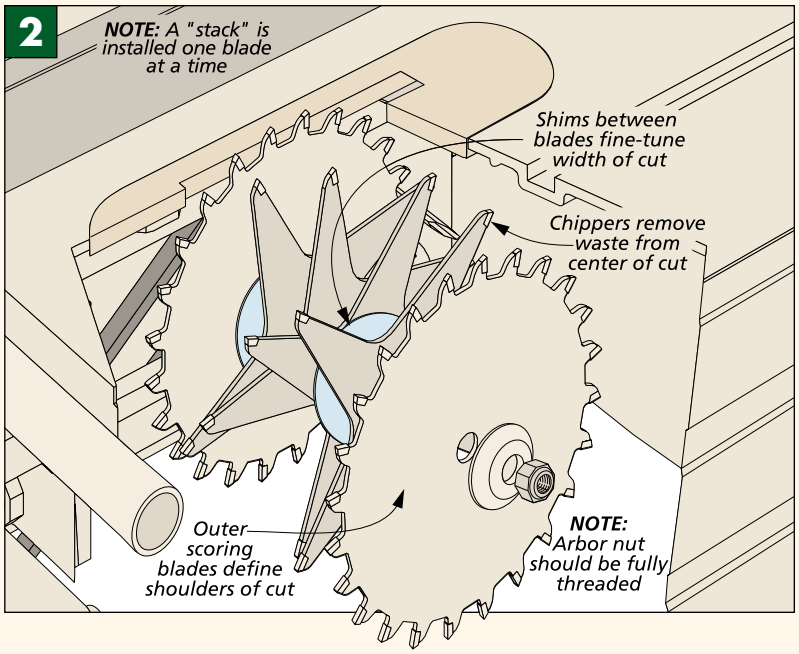
Where you'll really see the difference between sets is in the quality of the cut in hard-to-work materials, like veneered plywoods. Less expensive blades will do a tolerable job in solid wood, but they can't handle dadoes in plywood without serious chipping, as you can see in the photo below.



▲ *The scribe lines at the edges of the cut help prevent chipout as the blade exits the cut.*



▲ *A tooth with a negative hook angle cuts less aggressively and leaves a cleaner shoulder.*



SCORING BLADES. The outer scoring blades account for a lot of the difference in quality between sets. These blades should cut clean (no chipout), square, and flat, with an almost invisible "scribe line" at the edges of the cut (upper drawing in margin).

All scoring blades use a combination of beveled teeth and flat-topped rakers. The beveled teeth all angle to one side and the two blades are mirror images (a left and right), as shown in the upper margin drawing.

The number of teeth on the scoring blades can vary quite a bit (as many as 42 to as few as 12), but this doesn't seem too important to the quality of cut. Since all the beveled teeth angle to one side, a 24-tooth scoring blade should cut as smooth a shoulder as a standard blade with twice as many teeth.

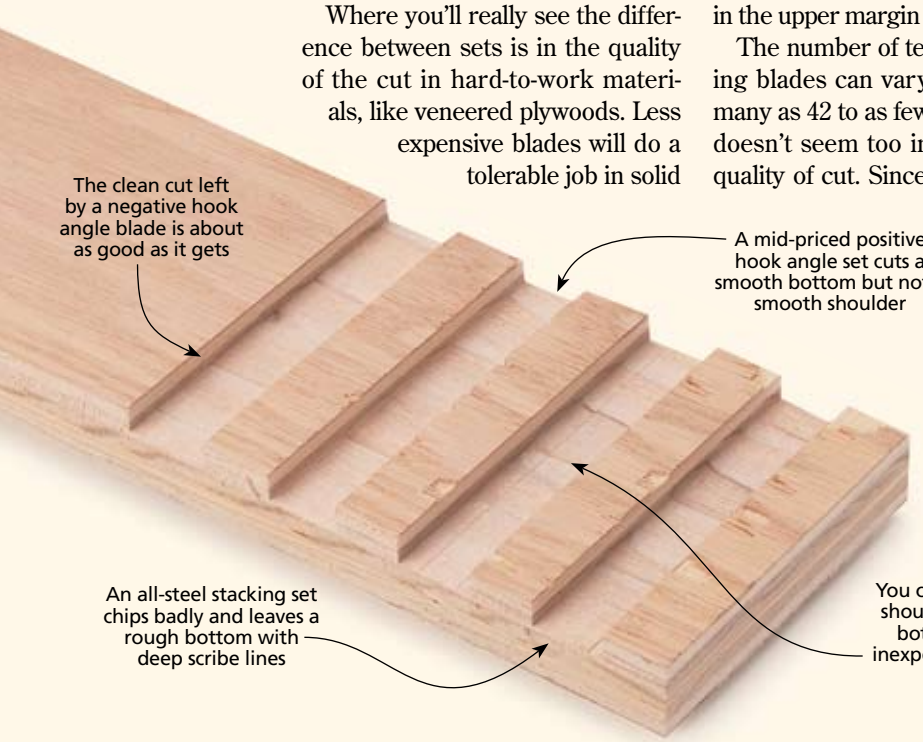
But I've found that the tooth feature that leads to a really clean, chip-free cut in all types of material is a *negative* hook angle. As you can see in the lower margin drawing, this tooth looks flatter and less aggressive.

What this translates to is a slower feed rate and a more upward cutting action. The blade I use in my shop has a negative hook angle, and I highly recommend this feature. (It's great for dadoes in plywood.)

CHIPPERS. The chippers are what create a smooth, flat bottom, so it follows that they all use a flat-ground tooth. The less expensive blades have two-tooth chippers, while the better ones have chippers with four or six teeth. But the really important thing is that they're accurately sized so you end up with a flat bottom.

6" OR 8"? Stack sets come in 6" or 8" diameters. What you need is a blade that's at least 2" smaller than the capacity of your saw (an 8" blade for a 10" saw). The reason for this is fairly simple. The teeth of a smaller blade will be moving slower, but they'll have more cutting force (torque) behind them.

But even a 6" blade will still cut over 1" deep, so if you have a low-powered 10" saw, you might be better off with a 6" blade.



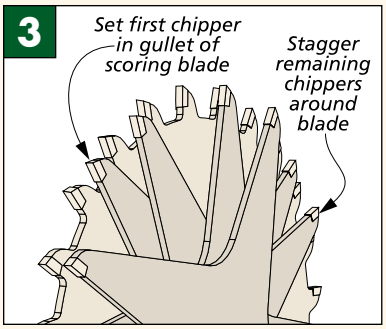
Setting Up

Before you make that first satisfying cut, you need to get set up. And there are just a few simple tricks to do this.

ONTO THE SAW. A stack dado goes onto the saw one piece at a time. I've tried to put a "pre-built" stack on the saw, but I can say it doesn't work.

When you put the first scoring blade on the arbor, just make sure you've got the correct blade (left or right) with the teeth pointing in the right direction (Fig. 2, page 3).

Next comes a chipper. But before you add it to the stack, make sure it's clean. You don't want any sawdust "shimming" the stack. The important thing when setting a chipper is to place the teeth in the gullets of the scoring blade (Fig. 3).



Now as more chippers are added, they should be staggered to balance the blade (Fig. 3). Then after the outer scoring blade is added, I make sure that nothing shifts when I tighten down the arbor nut.

After the dado insert is installed, just give the blade a turn to make sure it spins free. A test cut will tell you if the setup is accurate.

SIZING THE BLADE. The stack set I use came with four $\frac{1}{8}$" and two $\frac{1}{16}$" chippers, but the number and sizes vary with different sets. Some manufacturers have caught on to the problem of undersized plywood and are now including a $\frac{3}{32}$" chipper.

Once you know how to set up your blade, getting the right size stack is just a matter of arithmetic. With different combinations of the scoring blades (never use just one scoring blade) and chippers, you can cut from $\frac{1}{4}$" to about $\frac{13}{16}$" wide. This maximum width is pretty standard, since most arbors won't hold a wider stack. (Note: The nut should always thread fully onto the arbor.)

SHIMMING. I've found that even the more expensive stack sets usually need to be shimmed to get exact standard widths like $\frac{1}{2}$" or $\frac{3}{4}$".

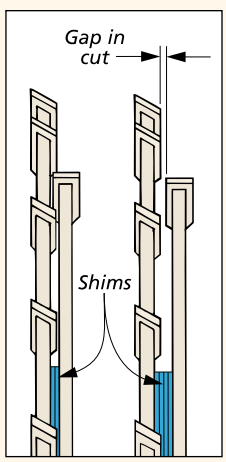
Shimming can be a trial and error process. But as you get to know your blade better, it gets easier. Shims are made from a lot of different materials, and a good set has different thicknesses (5, 10, 15, and 20 thousandths). I like to use the magnetic type, since you can stick them right to a blade. The thing to remember about shimming is to spread them out across the stack so you don't create a gap (see margin).

A GOOD CUT. The final ingredient for a clean, accurate cut is the right technique. And this is pretty simple.

First, I always make a test cut to check the setup. And then I sneak up on the cut with slow, shallow passes — never more than about $\frac{1}{4}$" at a time. When you're cutting cross-grain in "chippy" material, take an initial, light scoring pass.

If chipout at the end of the cut is going to be problem, back up the workpiece with a scrap piece.

And finally, since you often can't see the blade, always be aware of where it's going to exit the cut. W



Too many shims at one spot (right) will result in a gap in the cut.

Shims can be magnetic (top) brass (middle), plastic (bottom), or even paper.

ZERO-CLEARANCE INSERT

A zero-clearance insert can make your dado blade a little more user-friendly.

An "accessory" dado insert for your table saw won't cost you much ($15 to $20). But a shop-made zero clearance insert can give you a cleaner cut, and it's also safer when you're working with narrow pieces.

Start with a piece of wood (plywood works great) that's the same thickness as your insert (usually about $\frac{1}{2}$"). Then you can just use the insert as a pattern to make a new insert blank (Fig. 1).

Now the next steps take a little care. With the dado blade lowered beneath the table and the blank in place, position the fence over the side of the insert (Fig. 2). Just make sure it's not over the blade. Next, tighten down the insert with a couple of thin shims between the fence and the blank. On some saws, the back of the fence might need to be clamped (Fig. 2a).

When everything is in place, turn on the saw and slowly raise the blade through the insert (Fig. 2). Adding a finger hole to the insert makes it easier to remove.