



Illustrated Guide to Doors

How to design
frame-and-panel doors
that will swing sweetly
for years to come

BY ANDY RAE

Doors are what we see when we look at a cabinet. Thanks to their relatively large surface area, they're the most visible component in many projects, and they will make a lasting impression if you design them carefully and thoughtfully.

In addition to looking good, doors must function properly. A well-made door opens with little resistance, closes without clatter or fuss, and has a comfortable pull that fits the hand.

Begin by choosing the style of door you want: overlay, rabbeted, or flush. After that, it's a design exercise in proportioning components carefully, choosing the appropriate joinery, and understanding wood movement.

The illustrations on the following pages will help you work out the best door design for whatever project you're planning. This guide covers frame-and-panel doors, the most popular type, used in many furniture styles and periods. Some of the design considerations, however, also apply to slab-style plank doors and veneered doors.

*Andy Rae is a woodworker and author of *Building Doors and Drawers* (The Taunton Press, 2007).*

BEGIN WITH GOOD PROPORTIONS

Because doors are the focal point of many pieces, it's important to proportion them so they will work in harmony with each other and with other case components. People frequently make doors and their case openings too wide or, less commonly, too tall. Whenever possible, divide the case opening into reasonable sections and build the doors to suit.

Keep doors 48 in. tall or less. Extra-tall doors are awkward to open and close.

On tall doors, place third hinge closer to upper hinge to offset greater pulling force at top of door.

Keep doors 24 in. wide or less.

Narrow stiles that meet in paired doors reduce visual weight.

Hinges look best if aligned with inner edges of rails (top). For wide rails, space them one hinge-width from the edge (bottom).

Break up tall or wide doors with intermediary rails and stiles.

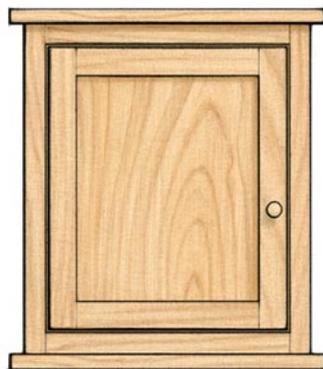
Place knobs low on upper doors and high on lower doors, or within arm's reach.

Wide lower rail adds weight to anchor piece visually to floor.



MOUNTING OPTIONS

For fine furniture and cabinets, there are three main options. Flush and rabbeted doors are seen in contemporary as well as period furniture. Overlay doors are used most often in kitchen and bathroom cabinets. Each style has some pluses and minuses when it comes to fitting and mounting.



FLUSH DOORS

These require the most attention during fitting because the doors hang inside the face of the case. They call for reveals of $\frac{1}{16}$ in. or less between the door and case opening.



RABBETED DOORS

These sit partially proud of the case, and a rabbet on the back allows them to rest slightly inside the case opening. Because the door gap is concealed, this type is generally the easiest to fit.

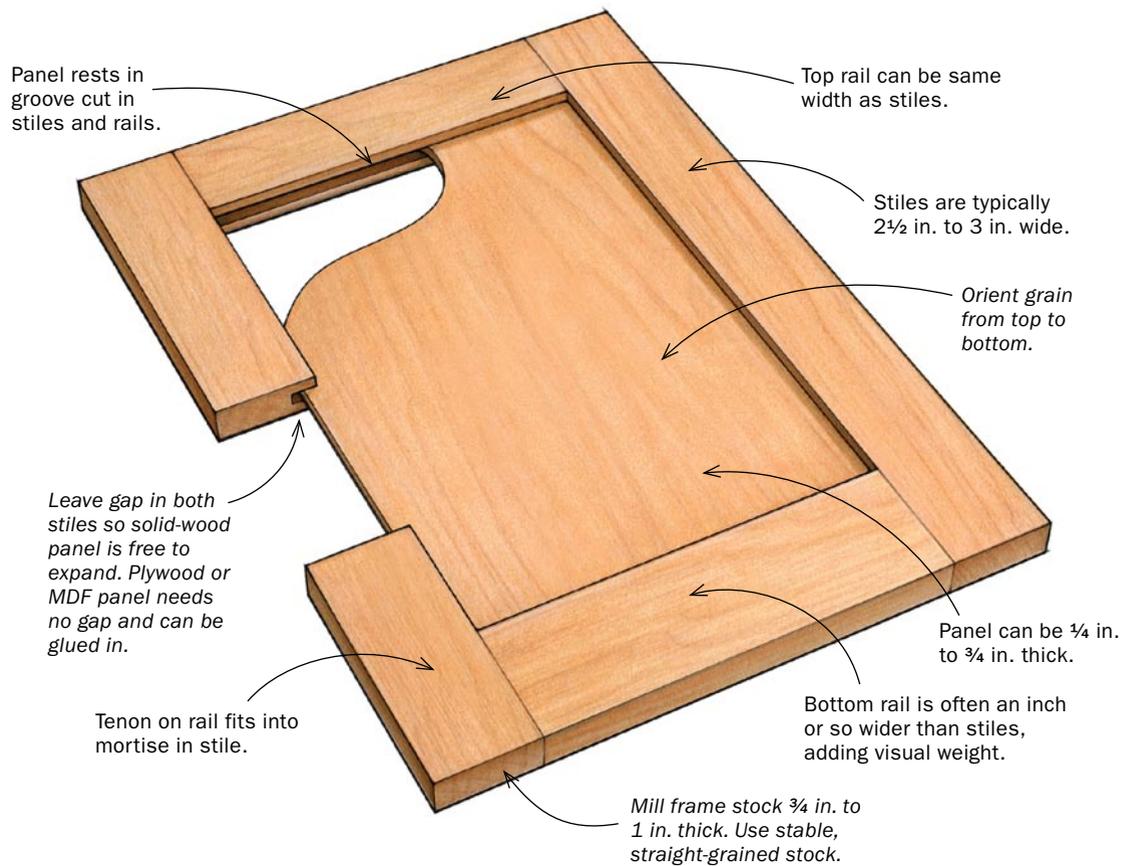


FULL OVERLAY DOORS

These cover the entire face of the cabinets. Avoid unattractive partial-overlay doors, which are used in factory-made cabinets because they require no fitting.

BASIC DOOR ANATOMY

In frame-and-panel door construction, a narrow outer framework surrounds and captures a wide panel. The vertical frame pieces are called stiles; the horizontal pieces, rails. The panel can be made of solid wood, plywood, or medium-density fiberboard (MDF). Typically, stiles run full-length and are mortised for tenons on the rails. But you can reverse that for aesthetic reasons: On paired doors, for example, full-width rails add a visually unifying element. Full-width rails also provide better screw purchase for knife hinges.

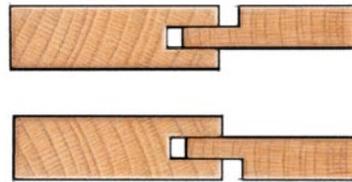


PANEL PROFILES

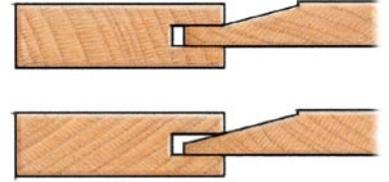
Flat panels offer simplicity and are a hallmark of Shaker work. Raised panels are more traditional. Rabbits or bevels can be positioned on the back to keep the front plain. As a rule, keep the panel flush with or below the surface of the frame.



THIN, FLAT PANEL
Essentially the same thickness as the groove in the frame. Made from plywood or MDF, or glued up from narrower solid stock.



RABBETED PANEL
Profiled on front or back and designed to be flush with the frame. Or, it can be the same thickness as the frame and rabbeted equally front and back.



RAISED PANEL
Panel has a flat tongue made on a router table or shaper (top). Alternatively, you can cut the profile on the tablesaw, or form it with a handplane (bottom).

FRAME EDGE PROFILES

Edges offer a chance for you to be creative by cutting different profiles or applying a molding. This is usually done to the inside edge of the frame, though rabbeted doors typically have a thumbnail or roundover profile on their outside edge.



SQUARE EDGE
Simple in design, simple to make. Smooth the surface with a plane before assembling the frame.



BEAD WITH QUIRK
Make bead ⅛ in. to ¼ in. wide with a ¼-in. quirk. Cut it on the router table or shaper. Requires a mitered frame so the bead is continuous.



THUMBNAIL
Quarter-round, quarter-round with fillet (shown), ogee, or other profiles. Shape on a router table or shaper, or by hand.



APPLIED BEAD
Shape a ⅛-in. to ¼-in. bead. For all applied beads and moldings, miter the ends, then attach with glue and/or brads.



APPLIED MOLDING
Use stock ¾ in. to ½ in. thick, profiled on a router table or shaper. Glue to frame and panel if panel is sheet goods; otherwise, glue only to frame.



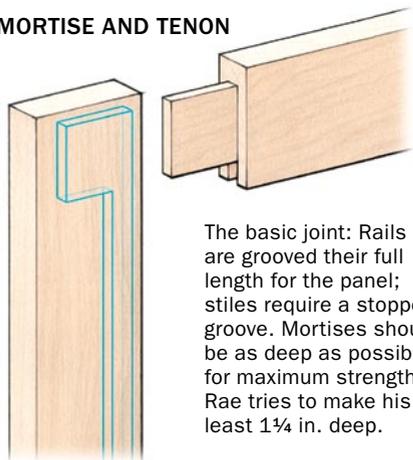
BOLECTION MOLDING
Complex profile with a rabbet that rests over the frame. Glue to frame only, unless panel is made from plywood or MDF.

OPTIONS FOR CORNER JOINTS

Doors with solid-wood panels get their strength mainly from the corner joints in the frame; a glued-in plywood or MDF panel adds considerable rigidity. The time-honored mortise-and-tenon joint is quite

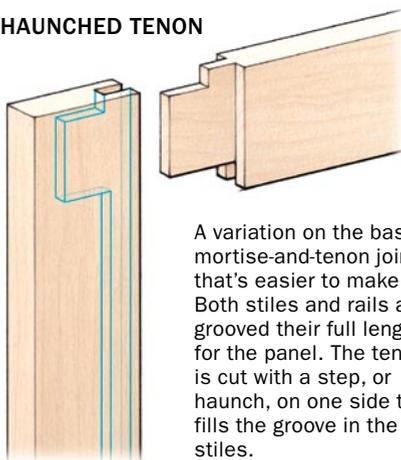
common, but the type of joint you use will depend on the look you want and the strength you need, as well as the ease of construction. Here are nine good options.

MORTISE AND TENON



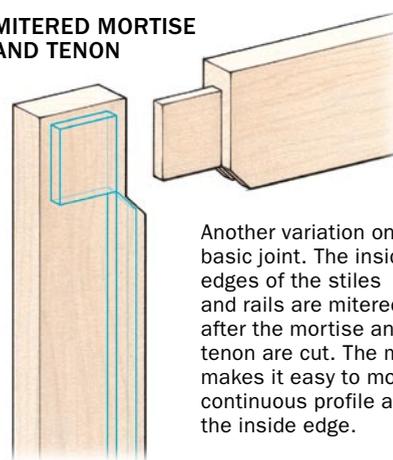
The basic joint: Rails are grooved their full length for the panel; stiles require a stopped groove. Mortises should be as deep as possible for maximum strength; Rae tries to make his at least 1¼ in. deep.

HAUNCHED TENON



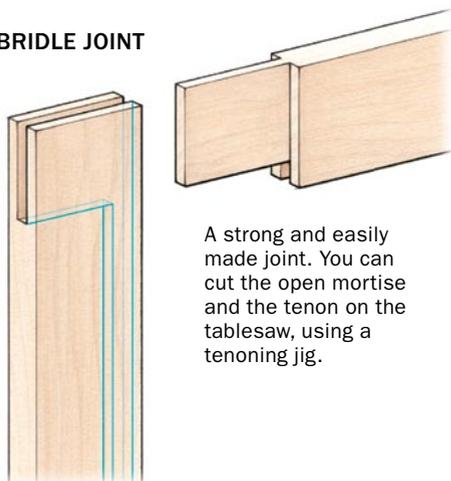
A variation on the basic mortise-and-tenon joint that's easier to make. Both stiles and rails are grooved their full length for the panel. The tenon is cut with a step, or haunch, on one side that fills the groove in the stiles.

MITERED MORTISE AND TENON



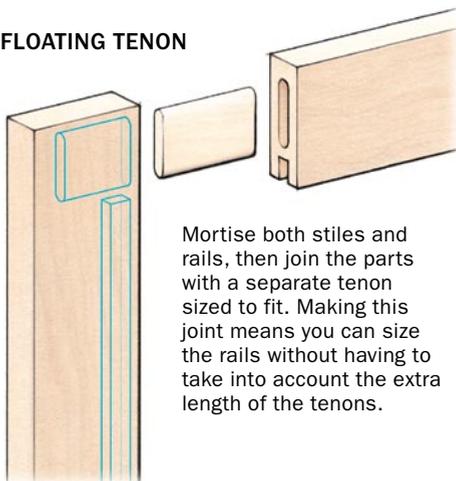
Another variation on the basic joint. The inside edges of the stiles and rails are mitered after the mortise and tenon are cut. The miter makes it easy to mold a continuous profile along the inside edge.

BRIDLE JOINT



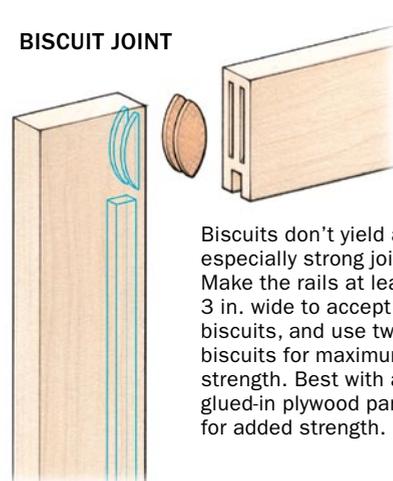
A strong and easily made joint. You can cut the open mortise and the tenon on the tablesaw, using a tenoning jig.

FLOATING TENON



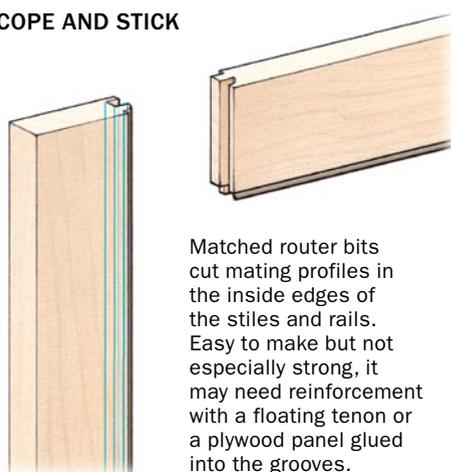
Mortise both stiles and rails, then join the parts with a separate tenon sized to fit. Making this joint means you can size the rails without having to take into account the extra length of the tenons.

BISCUIT JOINT



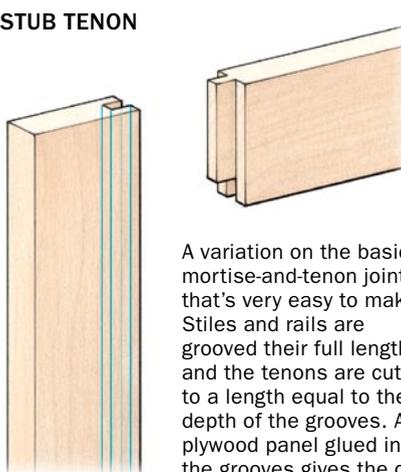
Biscuits don't yield an especially strong joint. Make the rails at least 3 in. wide to accept #20 biscuits, and use two biscuits for maximum strength. Best with a glued-in plywood panel for added strength.

COPE AND STICK



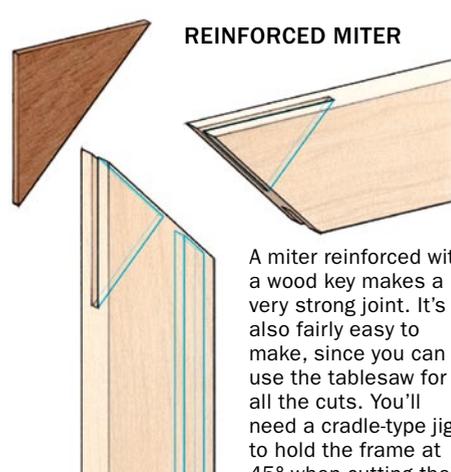
Matched router bits cut mating profiles in the inside edges of the stiles and rails. Easy to make but not especially strong, it may need reinforcement with a floating tenon or a plywood panel glued into the grooves.

STUB TENON



A variation on the basic mortise-and-tenon joint that's very easy to make. Stiles and rails are grooved their full length, and the tenons are cut to a length equal to the depth of the grooves. A plywood panel glued into the grooves gives the door additional strength.

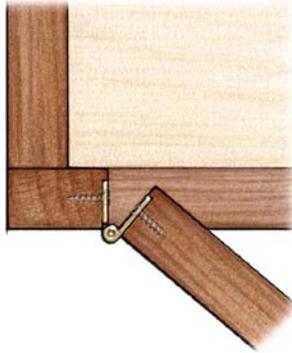
REINFORCED MITER



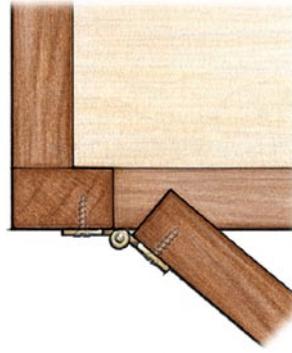
A miter reinforced with a wood key makes a very strong joint. It's also fairly easy to make, since you can use the tablesaw for all the cuts. You'll need a cradle-type jig to hold the frame at 45° when cutting the key slots.

HINGE OPTIONS

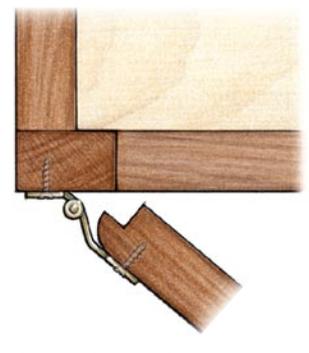
Well-made hinges installed with care will yield a door that swings smoothly and closes easily. Be sure to select the correct type of hinge for the style of door you're hanging. Buy quality hardware: Look for solid castings or extrusions, thick leaves, and knuckles that pivot smoothly without play.



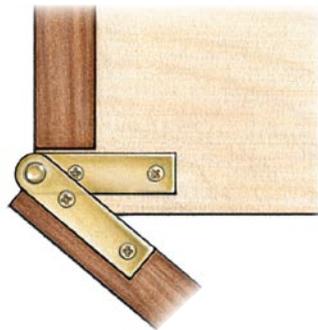
BUTT HINGE
Used for overlay and flush doors. Requires mortising one or both leaves into the case and door.



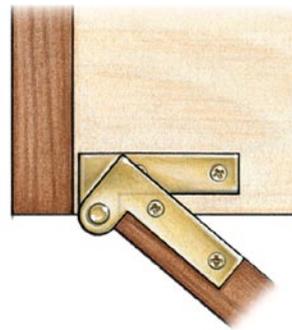
SURFACE HINGE
The easiest type to install. Used for flush and rabbeted (right) doors.



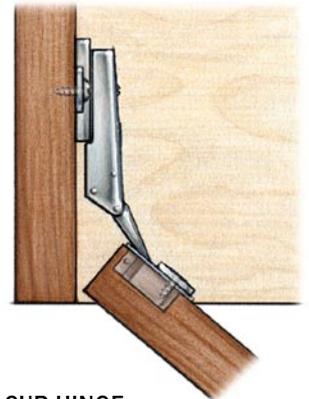
SURFACE HINGE FOR RABBETED DOORS
One leaf is bent to accommodate the offset. Installation is a snap.



STRAIGHT KNIFE HINGE
Used for overlay doors where the case top and bottom extend over the sides. Requires careful mortising of case and door.



OFFSET KNIFE HINGE
Used for flush doors. Requires careful mortising of both case and door.

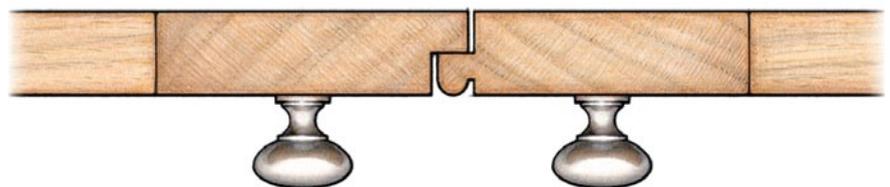
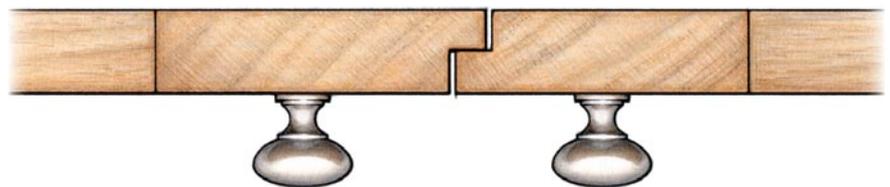


CUP HINGE
Available for all types of doors. Easy to mount in hole drilled in back of door. Lots of adjustability after door is mounted.

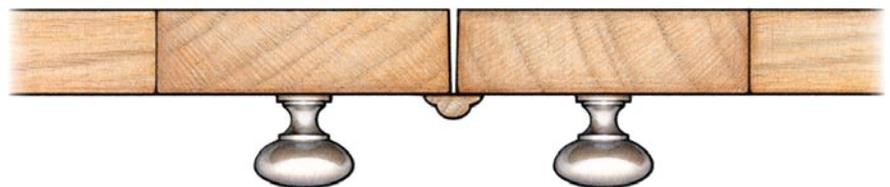
WHEN DOORS MEET

Paired doors are common, offering easier access inside a case. For the tidiest look and one that seals out dust, design the doors with some sort of overlapping element. It's customary to have the right-hand door open first. Also, cut a slight bevel in the side of one door, to keep it from binding.

OPPOSING RABBETS
Close the gap by cutting matching rabbets in the edges of the stiles. Make each rabbet half the thickness of the doors, so they sit flush with each other when closed. When planning the cabinet, you may need to widen the stile of the door rabbeted on its front (top drawing), so that the stiles appear the same width when closed.



ADD AN ASTRAGAL
This is a strip of wood glued either to the face of one door or attached to the back of the captured door. Be sure to cut the astragal a hair short so it won't interfere with the case top or bottom.



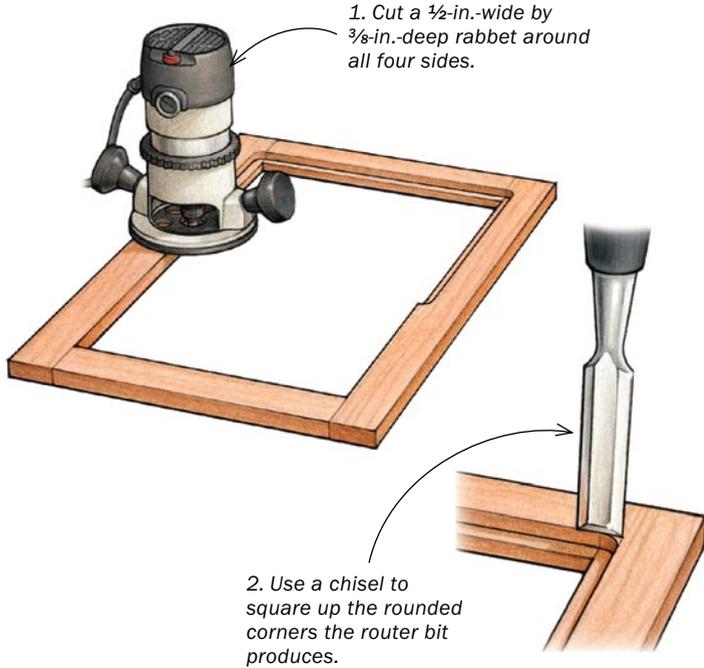
GOOD OPTIONS FOR GLASS DOORS

Glass doors dress up a cabinet and add a practical touch, because you can see what's inside. Use translucent or textured glass if you want to

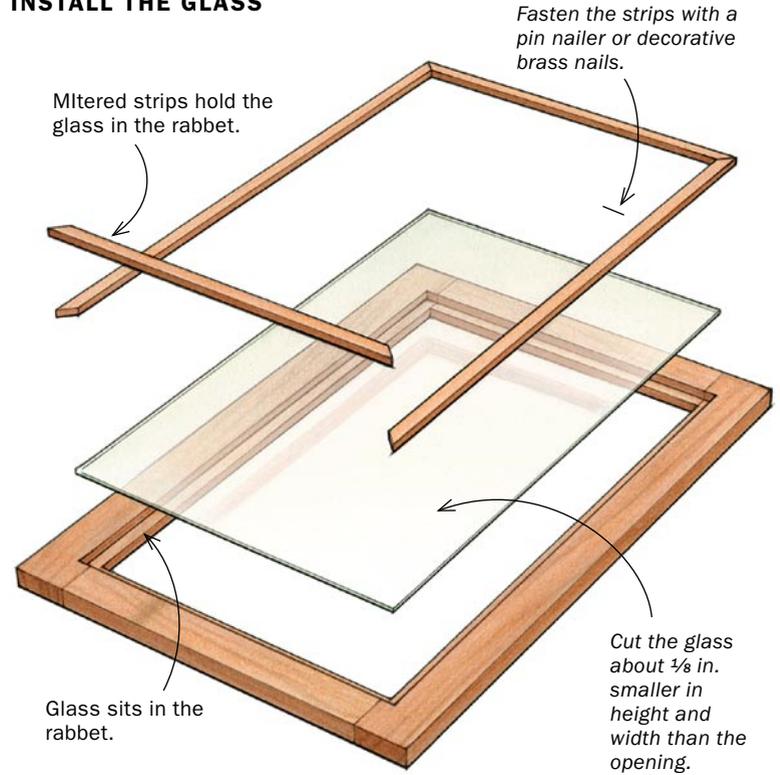
light up the inside without revealing precisely what's there. There are several options when it comes to rabbeting the door to accept the glass.

RABBET THE FRAME AFTER ASSEMBLY

Glue up the door, then use a bearing-guided router bit to cut the rabbet for the glass in the back of the frame.



INSTALL THE GLASS

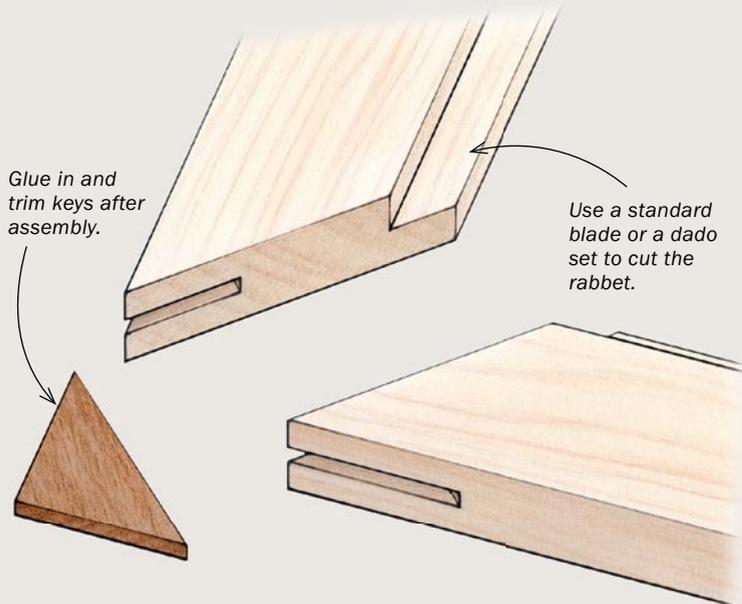


TWO FRAMES THAT CAN BE RABBETED BEFORE ASSEMBLY

It's easier to cut the rabbet before assembly by grooving or rabbeting parts on the tablesaw, but not all frames allow this.

KEYED MITER

Cut the rabbet in the frame stock, then cut the miters, assemble the frame, and add the keys.



MITERED MORTISE AND TENON

When making a batch of doors this way, you can use the same machine setups to create a rabbet for a glass door.

