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Dave Campbell
Editorial Content Chief, *WOOD* magazine



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Design and Install Built-In Bookcases

If you can make a freestanding bookcase, you can handle built-ins.
We'll guide you from planning through installation.

Built-ins add so much pizzazz to a room, you may forget they offer lots of practical storage, too. In this article, you'll learn how to plan, build, and install two bookcases and a window seat, but you can customize the arrangement to suit your needs.

If you're building around a fireplace, for example, omit the window seat. Or lengthen the shelving units and do without the base cabinet for more display space. Our modular system makes it easy to mix and match the components.

Plumb beautiful bookcases

Floors tilt, walls lean and bow, and room corners meet at less-than-square angles. So begin with careful room measure-

ments [**Photo A**] before making plans to fit your combined built-ins within the shortest dimensions.

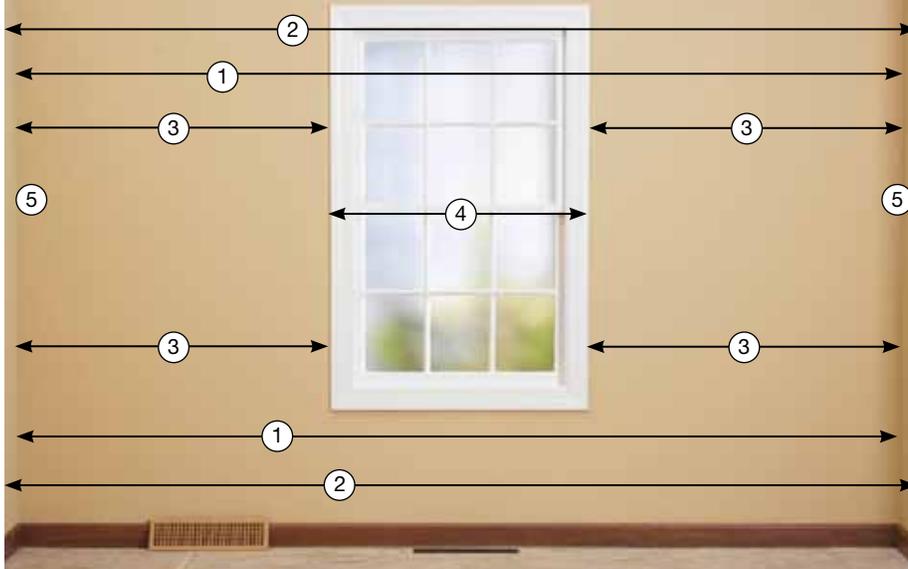
Next check wall corners for right angles using a framing square. For corners that are out-of-square or off from vertical by more than a couple of degrees, plan to widen by $\frac{1}{2}$ " the face-frame stile butting against the sidewalls to compensate. Measure to any obstacles, such as floor registers, cold-air returns, outlets, windows, doors, or a fireplace.

Now work up a design

You're not just fitting built-ins *within* a room, you're fitting them *around* objects such as windows, doors, and fireplaces. Start with a critical dimension, such as

the width of a window. For a window, measure its width (including the trim) and add enough space on both sides to accept your curtains or drapes. Otherwise, leave a 2–4" gap to help built-ins slide into place. Mark this gap on the wall on both sides of the window. Measure between marks for the window-seat length, in this case 48" to work around a 42"-wide window.

Now measure from your marks beside the window to the adjacent wall. Check several locations for the shortest distance and subtract $\frac{1}{2}$ " from that dimension on each side of the window to determine the width of cabinets flanking the window seat. (Oversize stiles or moldings will eliminate this gap.)



A MAKE MULTIPLE MEASUREMENTS

Measure between walls at the ceiling and floor in two places, ① and ②. Then measure between walls and a window ③, and the window width ④. Finally check the corner angles ⑤ for square.

If your built-in will fit underneath a window, measure from the floor to the bottom of the trim (22" in this case) to determine the maximum height of a window seat. We made this window seat 19" high to leave a gap below the window frame for a seat cushion or pillows. Because window seats are made for stretching out, they can be taller than the standard 16¾" height of most chairs. For deciding other dimensions, consider these standards:

- Typical base cabinets measure 24" deep, but you can shrink this some to conserve floor space. (The ones shown measure 20½" deep.)

- Make upper shelves at least 12" deep. Add depth to suit larger contents.

- The maximum comfortable shelf height for upper bookcases is 68".

- To avoid shelves that bow, consider the size and weight of objects they'll hold before deciding their length (and the bookcase width). Use the chart *below right* for an idea of what to expect from different materials. For bookcases wider than the 42½" ones shown, reinforce the shelves to prevent sagging. (We used ¾×1¾" solid-wood edging.)

Both bookcases and the window seat rest on a ladder-frame base designed to be 17½" deep—3" shallower than the depth of the lower cabinet and window seat—to allow for a toekick. The ladder frame makes it easier to level your built-ins and slide them into position.

We'll show how to modify the ladder frame two ways to accommodate either a baseboard- or floor-mounted air vent. To channel air from a baseboard register, split the ladder frame to create a channel

above the floor. The ladder-frame base shown measures 4¼" tall, ½" higher than the baseboard molding.

As you're making plans, include details such as lighting, decorative molding, and trim elements. Trim goes beyond being decorative. The hardwood side frames on portions of the bookcases cover screw holes in the plywood carcass not hidden by walls or adjoining cases.

To divide this project into manageable chunks, first build the window seat [Drawing 1] on page 32 to fit your window width. Build bookcases as separate lower cabinets and upper shelves, and then the ladder-frame base.

First make a window seat

For the window-seat carcass, subtract ¾" (the ½"-thick face frame plus a ¼"-thick front panel) from the finished window-seat depth for the width of the ¾"-thick plywood carcass sides (A) and bottom (B). Then rip those parts to width.

Materials List

Use this list to record the part sizes for your built-ins. Part quantities reflect the number of parts required to assemble one built-in of each type. Parts such as the side frames and moldings vary by installation and are not included.

Part	FINISHED SIZE			L	Matl.	Qty.	Total
	T	W	H				
A sides	¾"	"	"	Ply	2		
B bottom	¾"	"	"	Ply	1		
C stiles	½"	3"	"	H	2		
D rails	½"	3"	"	H	2		
E center stiles	½"	2"	"	H	2		
F front panel	¼"	"	"	Ply	1		
G panel trim	¼"	¾"	"	H	1		
H top back	¾"	8"	"	H	1		
I top sides	¾"	3¼"	"	H	2		
J lid	¾"	"	"	Ply	1		
K top trim	¾"	1½"	"	H	1		
L back	¼"	"	"	Ply	1		

Materials key: H—hardwood of your choice, Ply—hardwood veneer plywood to match hardwood.

The window-seat face frame measures 1" longer on each end than the plywood carcass, so subtract 1" from your finished window-seat length for the length of the plywood carcass, and cut the bottom to length. For the carcass sides, subtract the ladder-frame height plus ¾" for the top from the finished seat height and crosscut the case sides to this length.

Cut and assemble the face frame (C/D/E) to allow a ½" overhang on the bottom and both sides. Finally, from ¼"-thick plywood, rip the front panel (F) 1½" narrower than the length of the carcass sides, and crosscut to the length of the bottom panel. Finish-sand the front panel and frame.

Before assembling the window seat, check whether you need to channel air from a floor register through the seat.

Shelf Material Selection Guide

The shelf material, edging, and shelf length determine whether or how much a shelf will sag. Even if you're not storing a 64-lb set of encyclopedias, err on the side of caution.

Shelving Material	Shelf Length				
	24"	32"	36"	42"	48"
	Amount of Sag Under a 64-lb Load				
¾" oak-veneer plywood/ ¾×1¼" oak edge	0"	¾"	5/6"	7/6"	7/6"
¾" Baltic birch plywood/ ¾×1¼" poplar edge	0"	0"	0"	0"	6/6"
¾" solid oak	1/64"	1/64"	3/64"	9/64"	20/64"
¾" solid pine	1/64"	5/64"	9/64"	15/64"	20/64"

Numbers in red indicate sagging greater than a visually acceptable 2/64" per running foot. (Results are in 64ths of an inch for easy comparison.) Shelves without edges measure 11" wide; edging widens them to 12¼".



B Double-faced tape the hinge with the barrel centered between the window-seat lid and the top back and screw the hinge in place.

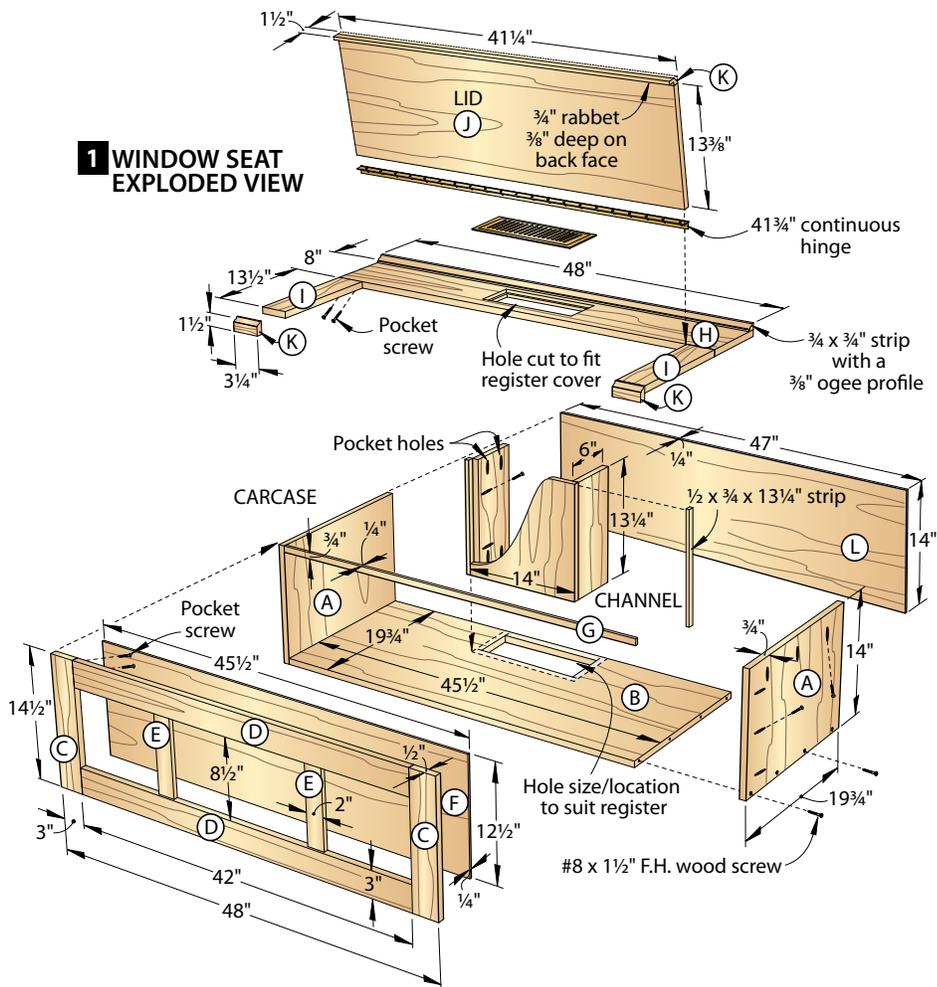
(See "Move air through the seat or a gap in the base" below for how to do this.)

To assemble the case, drill pocket holes in the sides [Drawing 1] and screw the sides to the bottom. Then screw the front panel and face frame to the sides.

Note: Use fine-thread pocket-hole screws to avoid splitting the narrow hardwood frame parts. Add a trim piece (G) to hide the plywood panel edge.

To make the window-seat top frame and lid, first cut an 8"-wide top back (H) that's 1" longer than the case. Then cut two 3/4"-wide top sides (I) long enough to reach from the top back to the front of the face frame. Drill and screw the top sides to the top back and screw that assembly to the case sides. If the window-seat sides will be exposed, build a frame from 1/2x3" hardwood to hide the pocket holes and fill the face-frame overhang.

From 3/4" plywood, cut the window seat lid (J) 1/4" shorter than the opening



between the top sides and wide enough for the front edge to rest flush with the face-frame surface. Cut and rout a top trim piece (K) blank 1" longer than the face frame. From that, cut two top-trim pieces for the ends of the top sides and glue them in place. Rabbet the rest of

the blank and cut it to the lid length. Glue and clamp the trim to the seat lid. Now attach the lid to the top frame with a continuous hinge [Photo B]. Finally cut a back (L) to fit over the edges of the bottom and sides. Then screw it to the case and top frame.

Move air through the seat or a gap in the base

If you have an air register where the window seat will rest, you'll need to channel air into the room one of two ways. To route air through the window seat, first mark the register location on the window-seat bottom.

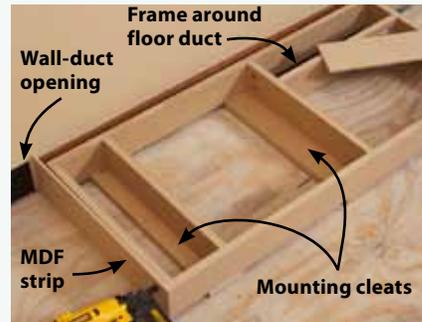
Next cut and screw together a channel sized on its inside to surround the opening plus 1" on both sides and the front. Position the channel on the window-seat bottom with the side edges flush with the back edge of the bottom. Mark around the inside edges of the channel and in from the back edge of the bottom as needed. Drill 1/4" holes at the corners and jigsaw between the holes to create the opening, as shown above right. Then drill pocket holes and screw the channel to the carcass bottom.

When you're ready to attach the window-seat top, jigsaw an opening in



the top back (H) centered above the channel and 1/2" narrower and shorter than a hardwood grille you can buy at most home centers in the hardwood flooring section. Then rabbet the opening to accept the grille.

For baseboard registers or floor registers beneath a bookcase, redirect air out through a gap in the ladder-frame base, as shown above right.



After leveling and anchoring both parts of the base to the floor and with each other, seal the sides of the chase with 1/4"-thick MDF strips that reach from the wall beside the register opening to the front of the base. (You'll cover the ends of these strips with base trim.) The addition of the cabinet will complete the chase. Just add a metal or wood register to cover the opening.

Next, the lower cabinets

Subtract 1" from the finished cabinet width determined earlier to find the lower-cabinet carcass width. Cut the carcass sides (M) and bottom (N) to size as you did for the window seat. Next cut two stretchers (O) and a fixed shelf (P) the same length as the bottom panel. Rip the fixed shelf width 4" less than the bottom. Glue and clamp the hardwood trim (Q) to the front plywood edge. Then drill and screw the lower-cabinet sides to the bottom, shelf, and top-mounting cleats [Drawing 2, Photo C].

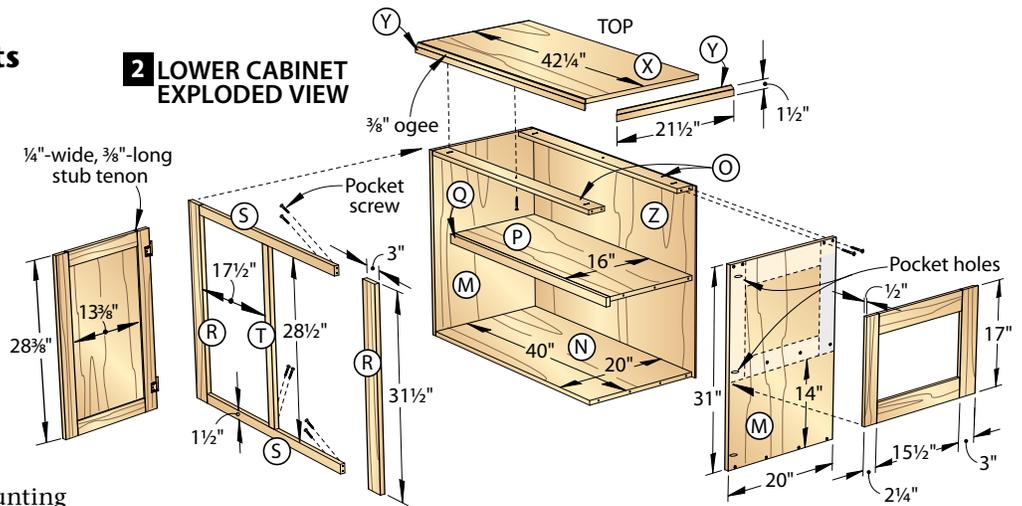
Size the lower-cabinet face frame (R/S/T) to overlap 1/2" on both case sides and at the bottom. To attach the frame to the case, drill pocket holes in the carcass sides where they'll be concealed by trim pieces or an adjoining built-in—the window seat in this case. Then clamp and screw the frame to the case.

If you need a full or partial frame for one or both sides [Photo D], add an extra 1/2" to the width of the stile closest to the wall and cut a 3/4" rabbet 1/4" deep on the inside face of this piece. Scribe and cope the rabbeted stiles to fit the wall.

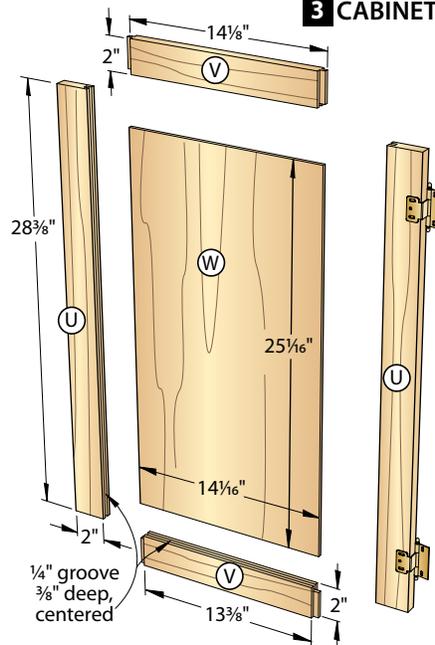
Measure the face-frame opening and cut door stiles (U) 1/8" shorter than the opening height [Drawing 3]. Cut the rails (V) 5/8" oversize for two 3/8" stub tenons [Drawing 3a] minus two 1/16" reveals. Cut centered grooves on one edge of each rail and stile. Cut panels (W) to fit the frame and assemble the doors. (For more about these doors, see **More Resources**.)

Finally, from plywood and 3/4" hardwood edging, build a lower-cabinet top (X/Y) [Drawing 2] that hangs 1" over the

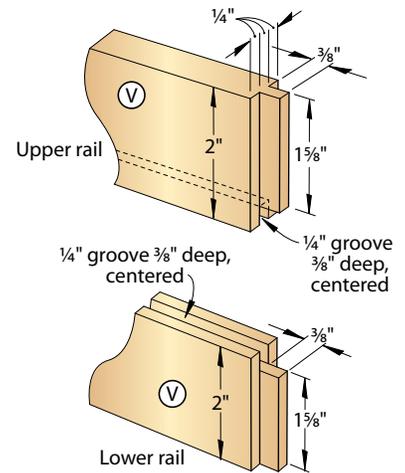
2 LOWER CABINET EXPLODED VIEW



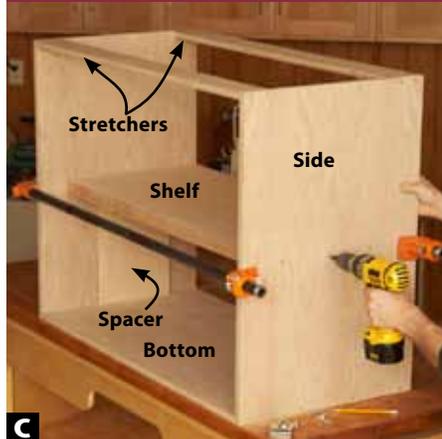
3 CABINET DOOR



3a DOOR-RAIL DETAILS

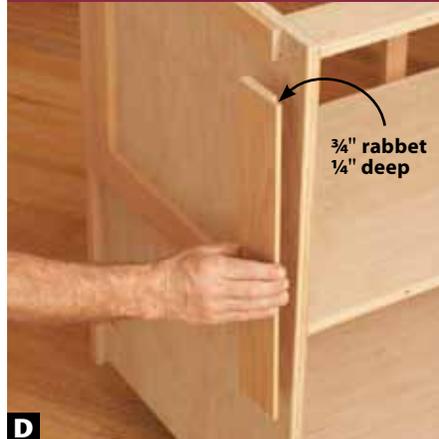


SPACERS SUPPORT THE SHELF



Insert spacers to help center the shelf and hold it in position while you drill and screw it to the lower-case sides.

TRIM ADDS A FAUX-PANEL LOOK



Trim on the upper half of the cabinet portion of this bookcase hides shelf and stretcher screws. The window seat hides the lower half.

Lower cabinet and top

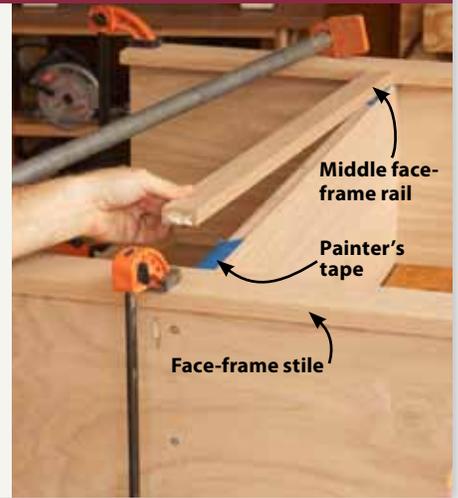
Part	FINISHED SIZE			Matl.	Qty.	Total
	T	W	L			
M sides	3/4"	"	"	Ply	2	
N bottom	3/4"	"	"	Ply	1	
O stretchers	3/4"	4"	"	Ply	2	
P shelf	3/4"	"	"	Ply	1	
Q shelf trim	3/4"	1 3/8"	"	H	1	
R stiles	3/4"	3"	"	H	2	
S rails	3/4"	1 1/2"	"	H	2	
T center stile	3/4"	1 1/2"	"	H	1	
U door stiles	3/4"	2"	"	H	4	
V door rails	3/4"	2"	"	H	4	
W door panels	1/4"	"	"	Ply	2	
X top	3/4"	"	"	Ply	1	
Y top trim	3/4"	1 1/2"	"	H	1	
Z back	1/4"	"	"	Ply	1	

Materials key: H—hardwood of your choice, Ply—hardwood veneer plywood to match hardwood.

SHOP TIP

Add a middle rail to hide a fixed-shelf edge

To position a middle face-frame rail (HH) accurately along a shelf, first apply painter's tape to the plywood carcase edges and shelf where the shelf meets the sides. Clamp the face frame to the carcase and drill pocket holes at each end of the rail. Glue and clamp the rail between the face-frame stiles with the rail edge flush with the top of the shelf. After the glue dries, remove the frame and tape, and drive pocket-hole screws to reinforce the glue joints. Screw the face frame to the carcase and sand the middle-rail top edge flush with the shelf.



Add open shelving on top

The upper-shelf carcase goes together much like the lower-cabinet carcase. Rip the carcase sides (AA), top (BB), and fixed shelf (CC) 11½" wide. Cut the sides to length to fit your room height. Then cut the top and fixed shelf to the same length as the lower-cabinet bottom (N). Drill shelf-pin holes in both sides. (See **More Resources** for information on drilling shelf-pin holes.)

Next rip the adjustable shelf (DD) ⅞" narrower than the sides and ⅜" shorter than the fixed shelf. Glue on the front trim (EE) and sand it flush with the plywood. Drill and screw the sides to the top and fixed shelf [Drawing 4].

Size the upper-shelf face frame (FF/GG/HH) so that the stiles overlap ½" on both case sides but are flush with the top and bottom of the sides. (The extra overlap helps you scribe and cut the stiles to fit a wall or mate with a side frame.) Drill pocket holes and screw the top rail (GG) to the face-frame sides (FF). To accurately align a middle rail (HH) with the fixed shelf (CC), see the **Shop Tip** above right.

Next cut, rout, and screw the hardwood trim pieces (II) to the sides just below the top and at the bottom. (You'll use these later to help attach the back.)

For the visible sides of the upper shelf, add a ½"-thick face frame to the sides to hide the screw holes. Use the same widths as for the lower-cabinet side frames and rabbet the 3" side-frame stiles where shown [Drawing 4].

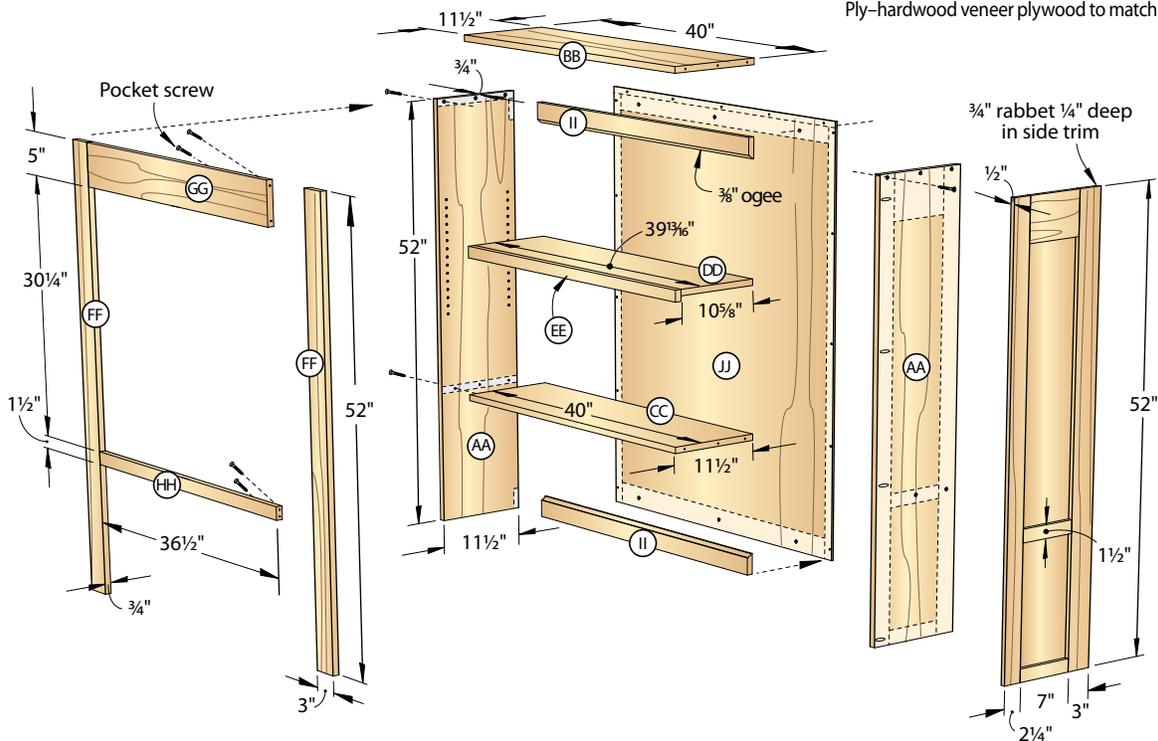
Finally cut a back (JJ) to fit the upper shelf. Finish-sand the window seat, base cabinet, upper shelves, top, and backs. Stain and apply three coats of clear finish. Afterward screw the back to the shelf at the top, sides, and bottom.

Upper shelf

Part	FINISHED SIZE			Matl.	Qty.	Total
	T	W	L			
AA sides	¾"	11½"	"	Ply	2	
BB top	¾"	11½"	"	Ply	1	
CC fixed shelf	¾"	11½"	"	Ply	1	
DD adjustable shelf	¾"	"	"	Ply	1	
EE adjustable-shelf trim	¾"	1⅜"	"	H	1	
FF face-frame stiles	¾"	3"	"	H	2	
GG top face-frame rail	¾"	5"	"	H	1	
HH middle face-frame rail	¾"	1½"	"	H	1	
II back trim	¾"	1⅜"	"	H	2	
JJ back	¼"	"	"	Ply	1	

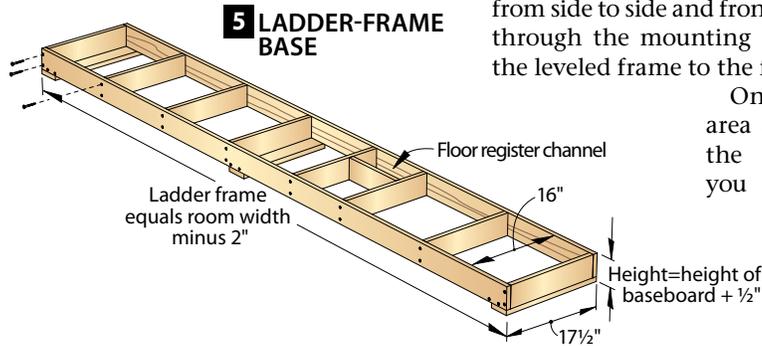
Materials key: H—hardwood of your choice, Ply—hardwood veneer plywood to match hardwood.

4 UPPER SHELF EXPLODED VIEW



Make and install the base

From $\frac{3}{4}$ " MDF, cut blanks for the ladder-frame base $\frac{1}{2}$ " wider than the room's baseboard width ($4\frac{1}{4}$ " in this case). For wall-to-wall built-ins, cut the long front and back strips of the ladder frame 2" shorter than the distance between the room baseboards [Drawing 5]. If a built-in has one side open to the room, cut these strips an additional 3" shorter.



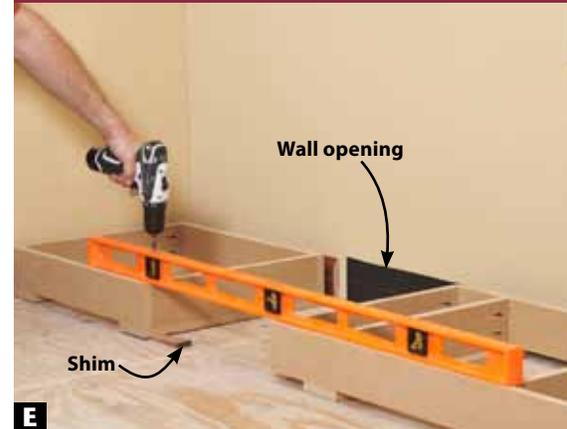
Then cut cross braces to length for a 3" cabinet overhang in front and a 1" gap between the back of the completed frame and the wall. Screw the cross braces to both long strips. Cut mounting cleats to the frame width and screw them to the long strips and cross braces.

Lay the ladder frame on the floor with 1" gaps between the ends and back and the walls. Then shim the frame level from side to side and front to back. Screw through the mounting cleats to fasten the leveled frame to the floor [Photo E].

On the toekick area at the front of the ladder frame, you can nail on

baseboard to match the rest of the room, or use trim cut from $\frac{1}{4}$ "-thick plywood and stained to match the cabinets.

LEVEL THE CABINET BASES



E For a divided ladder frame, shim the sections level from front to back, side to side, and with each other. Then screw the frame to the floor.

Install the window seat and cabinets

Place the window seat on the leveled ladder frame and measure to center under the window. Then check that the window seat evenly overhangs the ladder frame in front from one side to the other, adding shims to the back as needed. Press the back of the window seat against the wall and screw it in place [Photo F]. Later, you can add quarter-round molding to hide any small gaps between the window seat and the wall. Before adding additional built-ins, trim the excess shims flush with the window-seat sides using a sharp utility knife.

Next apply painter's tape to the entire back stile of a lower cabinet. Temporarily position the cabinet on the base with its face frame parallel to the base and the face-frame stile $\frac{1}{2}$ " proud of the window-seat frame. With a compass, scribe the taped back stile [Photo G] where it will touch the wall. Jigsaw the stile and sand to the scribed line [Photo H]. Then repeat this for the remaining lower cabinets.

Reinstall the lower cabinets and clamp them together. Drill and screw through the cabinet side and into the top frame of the window seat [Photo I]. For a cabinet side facing a wall, add shims between the wall and carcass to keep the side from bowing. Drill and screw the cabinet to the wall at the studs.

Now scribe and cut the tops to follow the shape of the front and side walls. Check that each top overhangs equal distances on the front and side, and drill and screw the tops to the cabinets.

MOUNT THE WINDOW SEAT



F Marked painter's tape shows stud locations where you'll drive mounting screws through the window-seat back and into the wall.

SET A COMPASS FOR SCRIBING



G The difference between the lower cabinet and window-seat depth (inset) equals what you'll remove from the lower-cabinet stile.

SAW ALONG THE SCRIBE LINE



H By angling the jigsaw cut slightly, it's easier to sand or plane the stile to your scribe line. Tape protects the wood finish.

DRILL FOR CONNECTING SCREWS



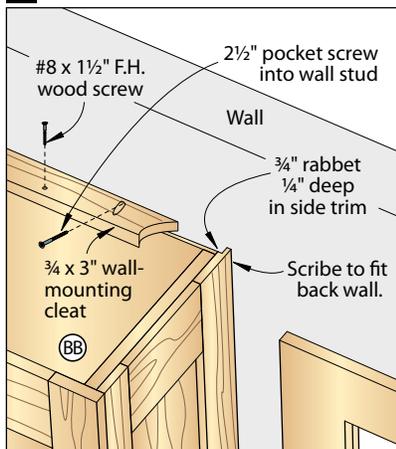
I Pull the bookshelf cabinet and window seat tightly together using clamps before drilling pilot holes. Doors will help hide the screws.

Top cabinets with shelves

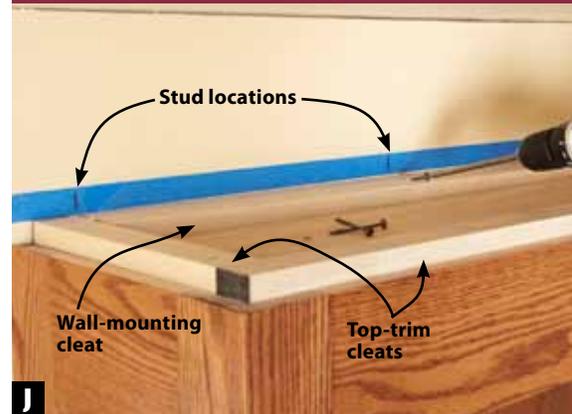
Place the upper shelf assembly on the lower-cabinet top with the shelf face frame parallel to the front edge of the top, and the back side-trim stiles about 1/2" from the wall. Tape, scribe, and jig-saw the side-trim stiles to follow your walls as you did on the lower cabinets.

Before mounting the shelf, drill and screw a wall-mounting cleat and trim cleats to the shelf top [Drawings 6 and 7]. Add pocket holes where you'll screw into wall studs. Rest the shelf on the lower-cabinet top and screw the shelf to the lower-case top from underneath. Screw the shelf to the back at the studs using the wall-mounting cleat [Photo J].

6 WALL-MOUNTING CLEAT



KEEP THE TOP FROM TIPPING



By screwing into the wall-mounting cleats to stabilize the upper shelves, you avoid using screws visible from inside the shelves.

Build up a crowning touch

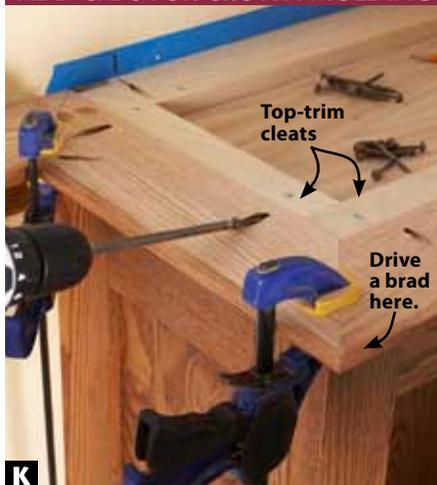
To anchor the crown molding, cut and rout a 3/4x3" filler strip to fit between the tops of the bookshelves. Rout a 3/8"-ogee profile on it where shown [Drawing 7]. Next cut and rout crown-cap blanks to reach around and between your bookcases. Finish-sand the filler strip and crown-cap blanks to 220 grit and finish them to match the built-ins. Then screw the filler strip to the wall studs.

Miter-cut a crown cap to reach between the bookshelves over the window seat and screw it to the filler strip. Measure and miter-cut crown caps for the shelf tops, and drive pocket screws into the trim cleats [Photo K].

Finish-sand the crown moldings to 220 grit and stain them. Miter-cut crown molding to fit between the bookcases and nail it to the crown cap and filler strip [Photo L]. Then cut and nail the remaining crown [Drawing 7].

Mount doors in the lower cabinets using no-mortise hinges. Then install the heat-duct grilles in the window seat or toekick and the loose shelves in the bookcases. Now you're ready to step back and admire this great new addition to your home. 🌳

ADD CAPS FOR CROWN MOLDING



Clamps hold the crown caps flush while you fasten them to the top-trim cleats. If necessary, add brads to the outside corners.

BEGIN ADDING CROWN MOLDING



Cut crown molding to fit between the bookcases so that the upper edge of the miters matches the crown-cap miters.

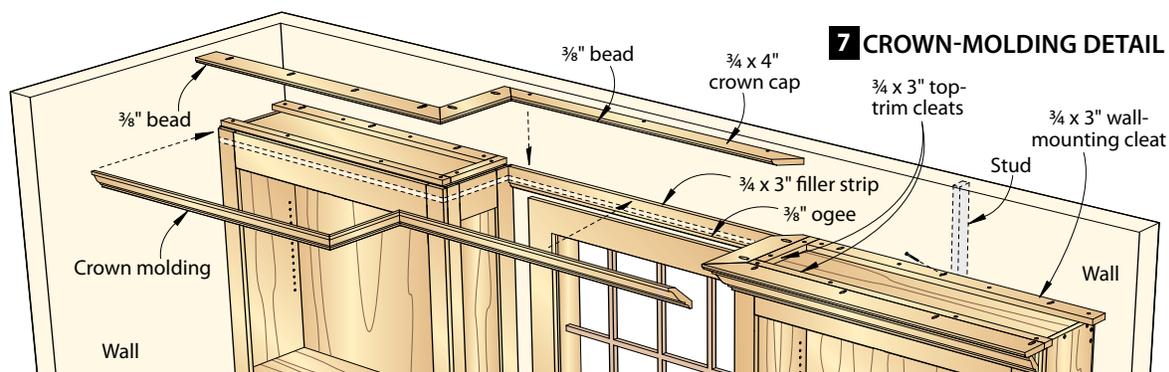
MORE RESOURCES

FREE VIDEOS

- "Drilling Shelf-Support Holes" woodmagazine.com/shelfholes
- "Cutting Crown Molding" woodmagazine.com/crownmldg

RELATED ARTICLES

- "The Shelf Maker's Complete Guide" Issue 154 (March 2004) or at woodstore.net. (Type in "shelf maker.") \$
 - "Simple Frame-and-Panel Doors in 30 Minutes" Issue 182 (March 2008) or at woodstore.net. (Type in "simple doors.") \$
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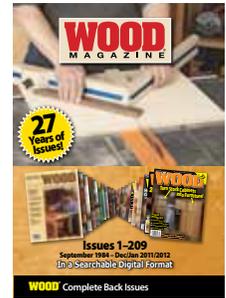
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