

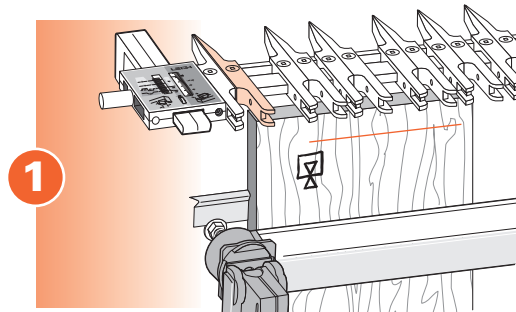
## Box Joints

### IMPORTANT: "Actual" Joint Sizes

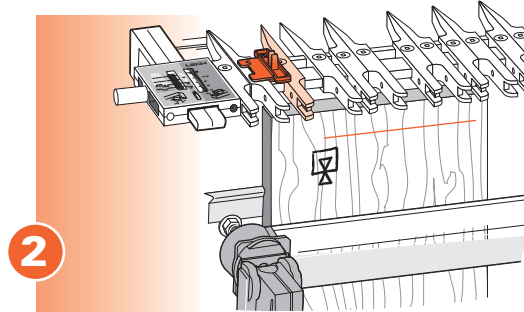
The D4R Pro finger assembly was originally designed solely for dovetailing. Adapting the assembly for box jointing was a serendipitous combination of luck (existing guides approximately the correct dimension) and clever design; the e7-Bush and Spacer. As a result, the nominal  $\frac{3}{8}$ " and  $\frac{3}{4}$ " [9,5 and 19mm] box joint sizes are closer to  $\frac{25}{64}$ " and  $\frac{49}{64}$ " [9,8 and 19,6mm] respectively.

### Concept of Operation

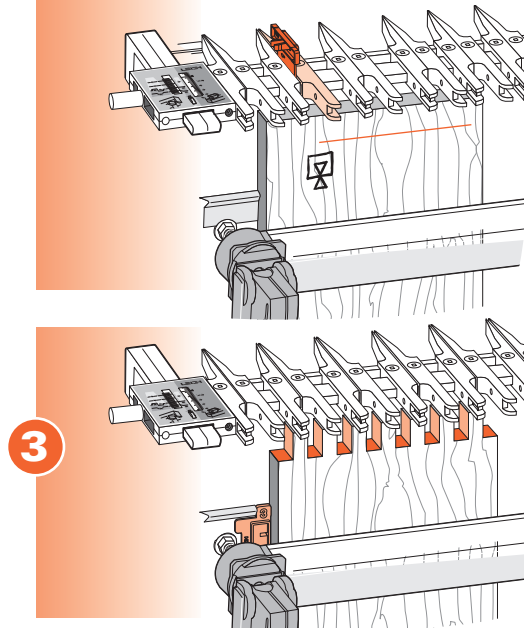
The first board is set against the side stop ①.



The Spacer is used to space the guide fingers ②.



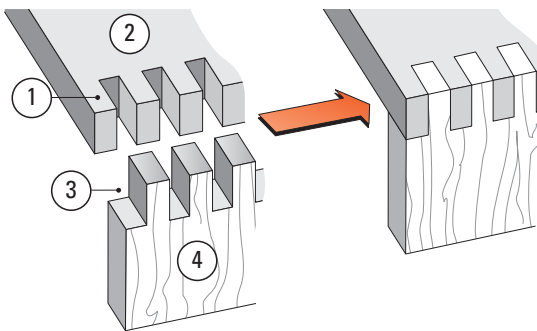
The Spacer is also used against the side stop ③ to accurately offset mating workpieces for correct board to board joint alignment.



### Box Joints Terminology

- ① Pin
- ② Pin board
- ③ Socket
- ④ Socket board

The pins fit in the sockets.



### Board Width Selection

Choose a joint size in the chart below:  $\frac{3}{8}$ " [9,5mm] or  $\frac{3}{4}$ " [19mm]. Board width is determined by the total number of pins and sockets in the joint design and whether the joint is symmetrical or asymmetrical. Use this chart to determine board widths up to  $16\frac{7}{32}$  [412mm] (limited by the number of guide fingers).



**Symmetrical joints** have a pin on each board edge. Total pins and sockets is always an odd number.



**Asymmetrical joints** have a pin on one board edge, and a socket on the other edge. Total pins and sockets is always an even number.

**EXAMPLE**  
 $\frac{3}{8}$ " joint size  
 Symmetrical layout  
 11 sockets and pins  
 =  $4\frac{7}{32}$ " board width

**EXAMPLE**  
 $\frac{3}{8}$ " joint size  
 Asymmetrical layout  
 10 sockets and pins  
 =  $3\frac{27}{32}$ " board width

### Board Width - INCHES

#### $\frac{3}{8}$ "

	Symmetrical	Asymmetrical
1		
2		
3	$1\frac{1}{8}$	
4		$1\frac{1}{2}$
5	$1\frac{29}{32}$	
6		$2\frac{9}{32}$
7	$2\frac{11}{16}$	
8		$3\frac{1}{16}$
9	$3\frac{15}{32}$	
10		$3\frac{27}{32}$
11	$4\frac{7}{32}$	
12		$4\frac{5}{8}$
13	5	
14		$5\frac{3}{8}$
15	$5\frac{3}{4}$	
16		$6\frac{5}{32}$
17	$6\frac{17}{32}$	
18		$6\frac{15}{16}$
19	$7\frac{5}{16}$	
20		$7\frac{23}{32}$
21	$8\frac{3}{32}$	
22		$8\frac{17}{32}$
23	$8\frac{7}{8}$	
24		$9\frac{1}{4}$
25	$9\frac{19}{32}$	
26		$10\frac{1}{32}$
27	$10\frac{13}{32}$	
28		$10\frac{13}{16}$
29	$11\frac{3}{16}$	
30		$11\frac{9}{16}$
31	$11\frac{31}{32}$	
32		$12\frac{11}{32}$
33	$12\frac{3}{4}$	
34		$13\frac{1}{8}$
35	$13\frac{1}{2}$	
36		$13\frac{29}{32}$
37	$14\frac{9}{32}$	
38		$14\frac{11}{16}$
39	$15\frac{1}{16}$	
40		$15\frac{7}{16}$
41	$15\frac{27}{32}$	
		$16\frac{7}{32}$

#### $\frac{3}{4}$ "

	Symmetrical	Asymmetrical
1		
2		
3	$2\frac{9}{32}$	
4		$3\frac{1}{16}$
5	$3\frac{27}{32}$	
6		$4\frac{5}{8}$
7	$5\frac{3}{8}$	
8		$6\frac{5}{32}$
9	$6\frac{15}{16}$	
10		$7\frac{23}{32}$
11	$8\frac{17}{32}$	
12		$9\frac{1}{4}$
13	$10\frac{1}{32}$	
14		$10\frac{13}{16}$
15	$11\frac{9}{16}$	
16		$12\frac{11}{32}$
17	$13\frac{1}{8}$	
18		$13\frac{29}{32}$
19	$14\frac{11}{16}$	
20		$15\frac{7}{16}$
21	$16\frac{7}{32}$	

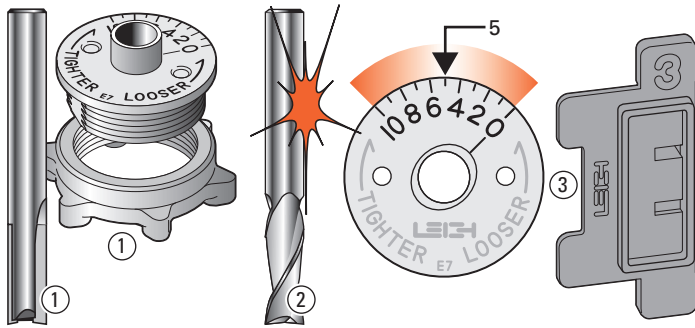
### Board Width - MILLIMETERS

#### 9,5mm

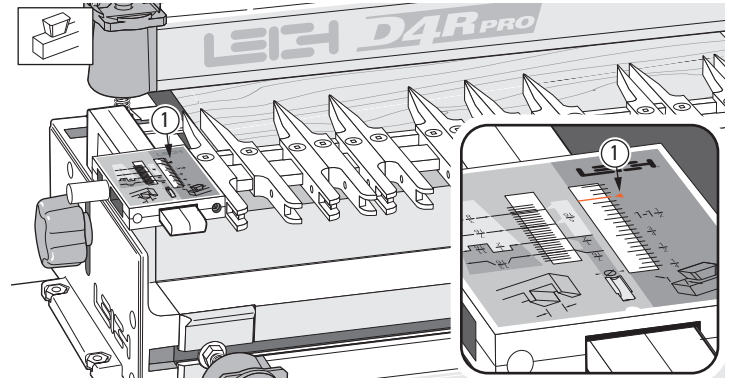
	Symmetrical	Asymmetrical
1		
2		
3	29	
4		39
5	49	
6		59
7	68	
8		78
9	88	
10		98
11	107	
12		117
13	127	
14		137
15	147	
16		157
17	167	
18		176
19	186	
20		196
21	206	
22		216
23	225	
24		235
25	245	
26		255
27	265	
28		275
29	284	
30		294
31	304	
32		314
33	324	
34		334
35	343	
36		353
37	363	
38		373
39	383	
40		393
41	402	
		412

#### 19mm

	Symmetrical	Asymmetrical
1		
2		
3	59	
4		78
5	98	
6		117
7	137	
8		157
9	176	
10		196
11	216	
12		235
13	255	
14		275
15	294	
16		314
17	334	
18		353
19	373	
20		393
21	412	

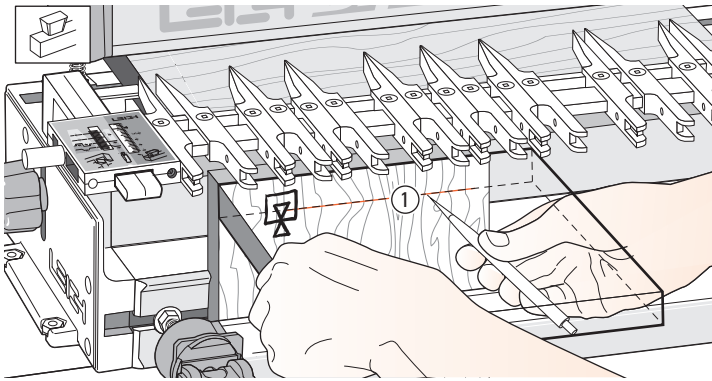


**15-1 Bit and Guidebush selection** Only the e7-Bush and the  $\frac{5}{16}$ " bit ① that came with the D4R Pro are required for box joints. Spiral upcut router bits ② will cut cleaner than straight flute. Where metric size bits are available an 8mm straight or spiral bit may be substituted for the  $\frac{5}{16}$ ". Always start test routing with the e7-Bush set on "5". Note: the box joint Spacer ③ has a square notch.

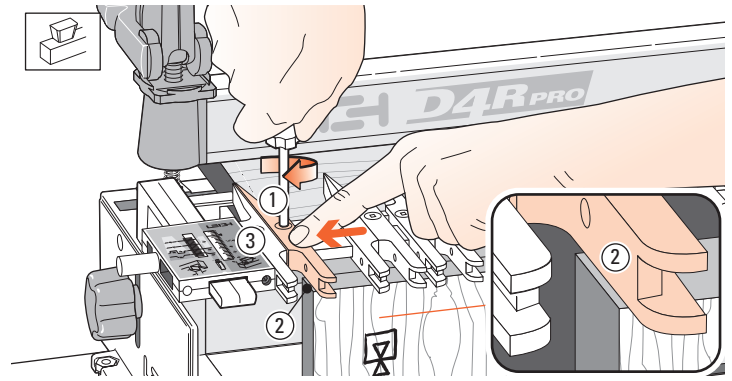


### 15-2 $\frac{3}{8}$ " [9,5mm] Box Joints

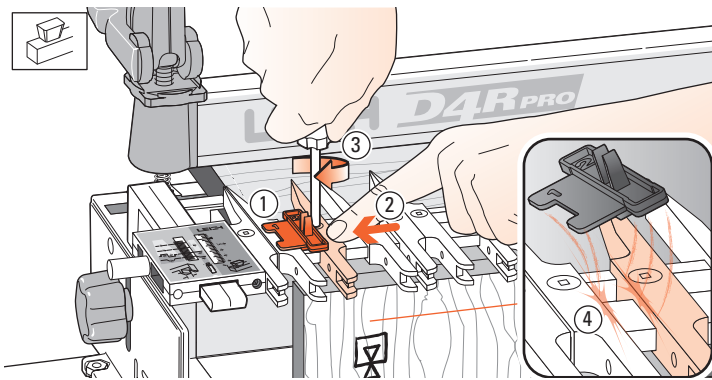
Place the finger assembly on the support brackets in the HB TAILS mode, set the scales on the **small triangular arrow** ① and lower the assembly onto the spacer board. All box joints are routed in this position. Note: maximum board thickness is 1" [25mm].



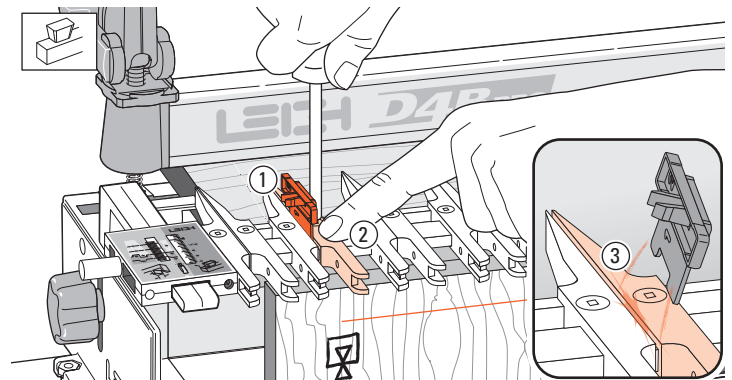
**15-3** Clamp a test board in the front left clamp, against the side stop with the top edge flush under the guide fingers. The board may be clamped face side in or out. Mark and adjust the depth of cut to suit the thickness of the mating boards ①.



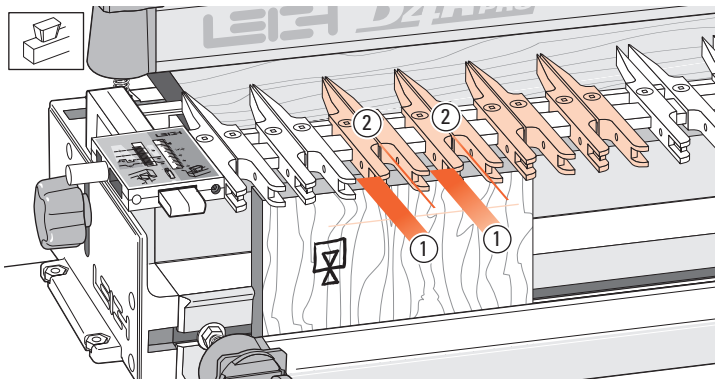
**15-4** Raise the finger assembly about  $\frac{1}{8}$ " [3mm] to allow ease of guide finger adjustment ①. Position the second guide finger  $\frac{1}{32}$ " [1,0mm] in from the board edge ② and tighten the finger. The first finger stays against the scale block as a router support ③. *Note: Square ended boards are essential to achieve flush joint alignment.*



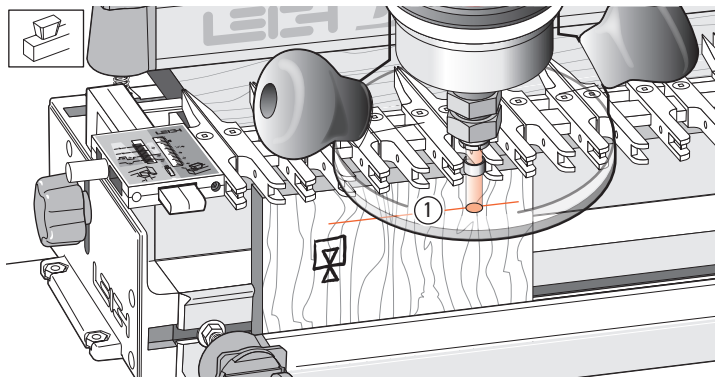
**15-5** Place the Spacer on the finger bar to the right of the second finger, numeral 1 on top overlapping the locked finger ①. Move the next finger in to touch the Spacer ②. Hold the guide finger firmly against the Spacer and tighten the second finger screw ③. As you remove the Spacer you should feel some friction; this indicates that the guide finger is correctly spaced ④.



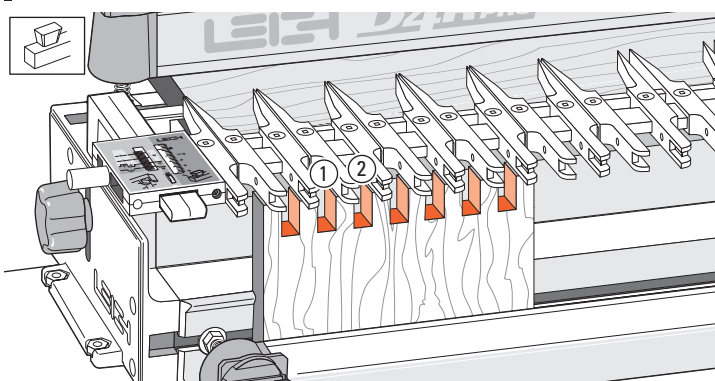
**15-6** Now place the spacer vertically on the right hand side of the third finger; the prongs to the left ①. Hold the guide finger firmly against the Spacer and tighten the second finger screw ②. As you remove the Spacer you should feel some friction ③; this indicates that the guide finger is correctly spaced.



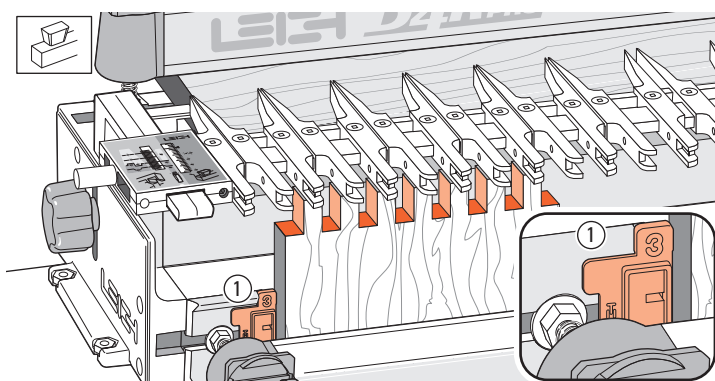
**15-7** Repeat this procedure across the jig until there is at least one guide finger spaced past the right hand side of the work piece. Finger pairs should have a uniform  $\frac{1}{2}$ " [12,7mm] space between them ①, and .054" [1,37mm] gap ② between fingers of the same pair. Tighten the unused guides.



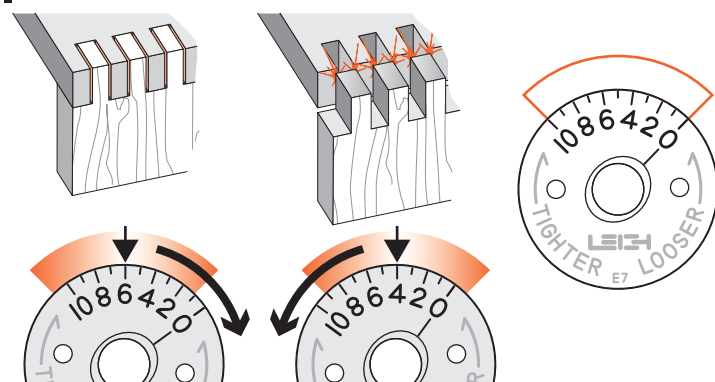
**15-8** Lower the finger assembly onto the spacer board and double-check that the bit depth is down to the center of the pencil line ①. Make sure the collet does not rub on the guidebush.



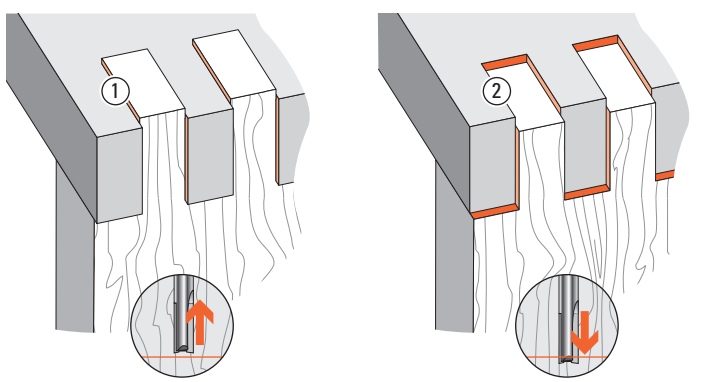
**15-9** Rout one end of the scrap board. Rout into each finger opening ① and between each finger ②. Make sure to run the guidebush on both sides of each opening.



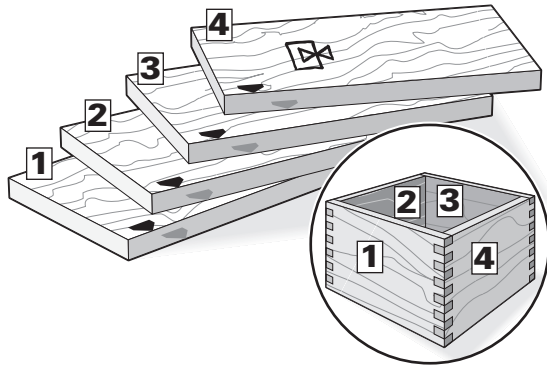
**15-10** Remove the board and fit the box joint Spacer against the front side stop with the **number 3** showing ①. Make sure it is fully home. Clamp the second test board with its side edge against the Spacer and its top edge touching the guide fingers. Rout this board. *Note: Square ended boards are essential to achieve flush joint alignment.*



**15-11** Test the boards for fit and flushness. If the joint is loose, turn the e7-Bush to a higher number and rout two more boards. If the joint is too tight, turn the e7-Bush to a lower number. Trial-and-error establishes the best e7-Bush setting. Record it on this bush drawing for a good result the next time. *Note: each increment adjusts glue line fit by 0.002" [0,05mm]. Retighten the eBush nut after each adjustment.*

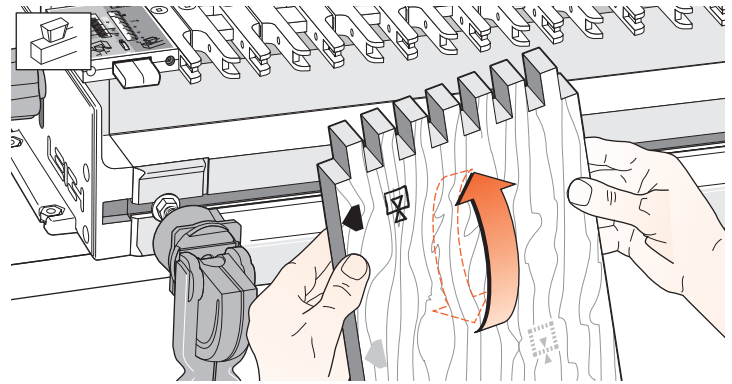




**15-12** If the joint is over flush ①, raise the bit slightly. If it is under flush ②, lower the bit.

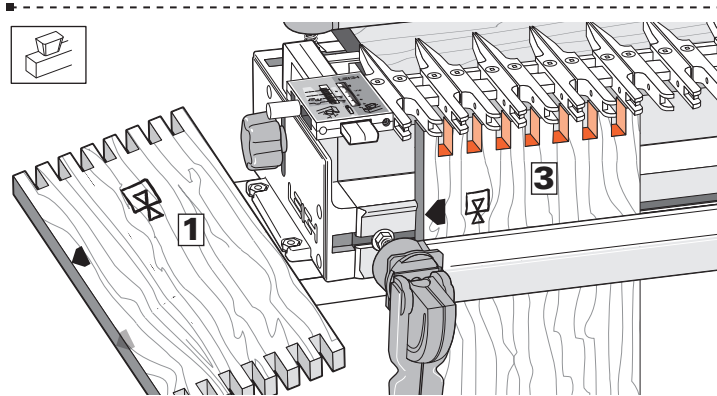


**15-13 Lets make a box with 3/8" box joints..**

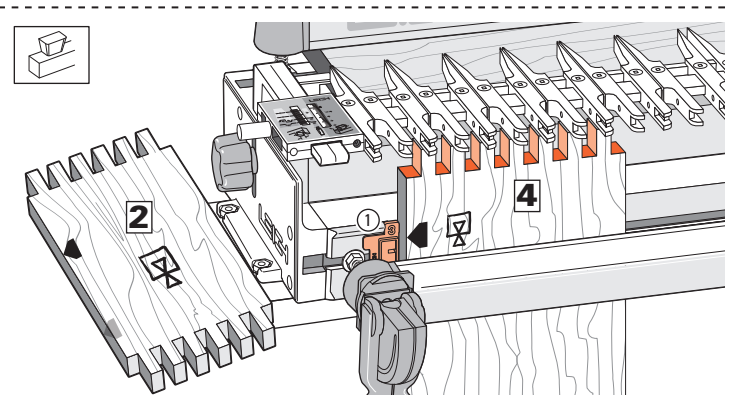
Prepare four boards and number them **1** to **4**. Then select the grain alignment and mark the common top (or bottom) edge. Don't worry about face side selection; this can be done after routing.



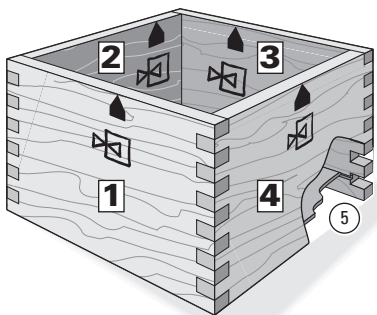
**15-14** All box joint boards are clamped alternating face side in  and face side out  always with the same side edge against the side stop (or Spacer).



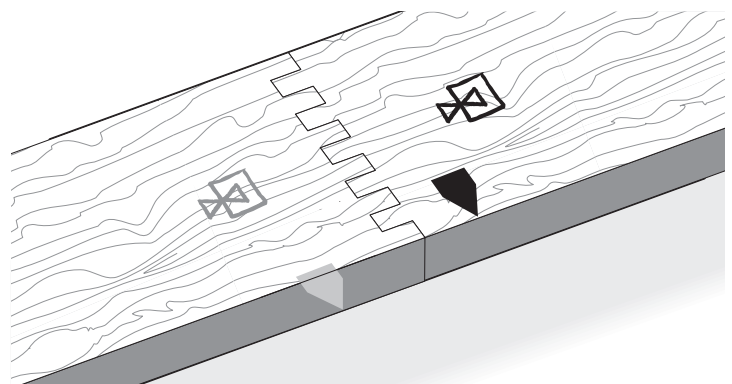
**15-15** Rout both ends of boards **1** and **3** with their edges against the side stop. Be sure to keep the same edge to the stop.



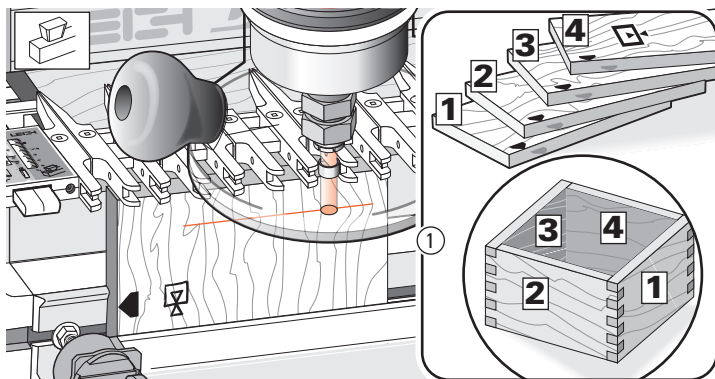
**15-16** Rout both ends of boards **2** and **4** with their edges against the Spacer and the Spacer in the No.3 position. Keep the same edges to the Spacer.



**15-17** Keeping the marked side stop edges of all boards toward the top (or all to the bottom) of the box, select the preferred outside faces before routing the grooves ⑤ for the bottom.

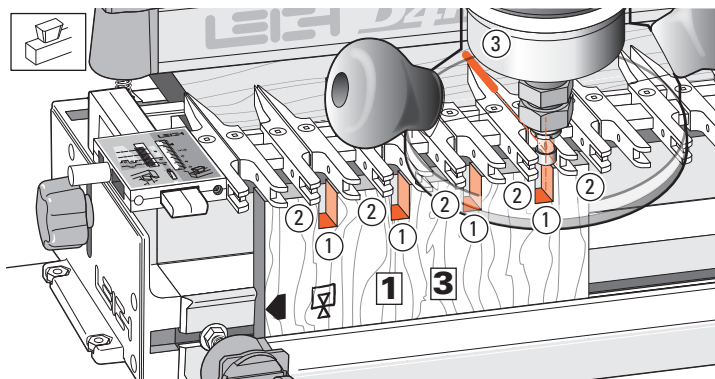


**15-18** The same method will produce end-on-end joints.



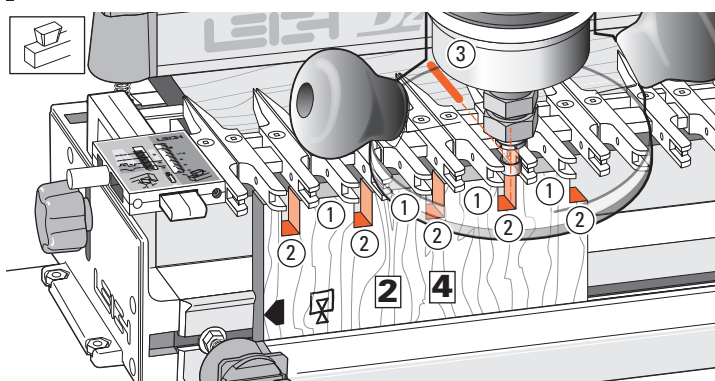
**15-19 3/4" [19mm] Box Joints** Set-up and space the guide fingers exactly as for 3/8" [9mm] joints. Start with the same e7-Bush setting. See 15-2 thru 15-9.

Prepare four boards using the board width chart for 3/4" [19mm] joints and number them **1** to **4** around the box **1** with the common edges marked.



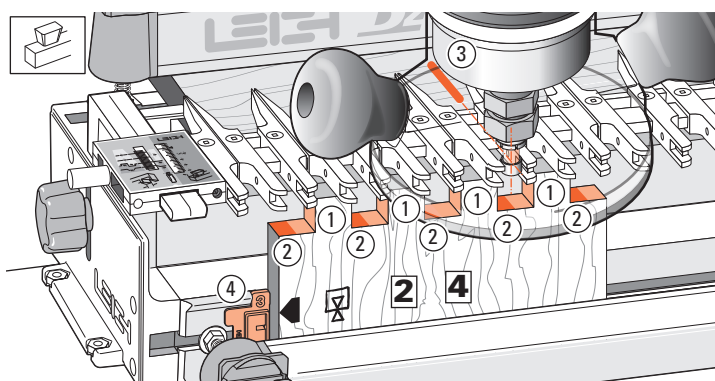
**15-20** Rout both ends of boards **1** and **3** but **only rout between the guide finger openings** **1** not between the finger sides **2**. Keep the common edge against the side stop.

*Hint:* Mark the router base at the 12 o'clock position **3** and steer this mark along the **pointed ends of the fingers** at the rear of the assembly.

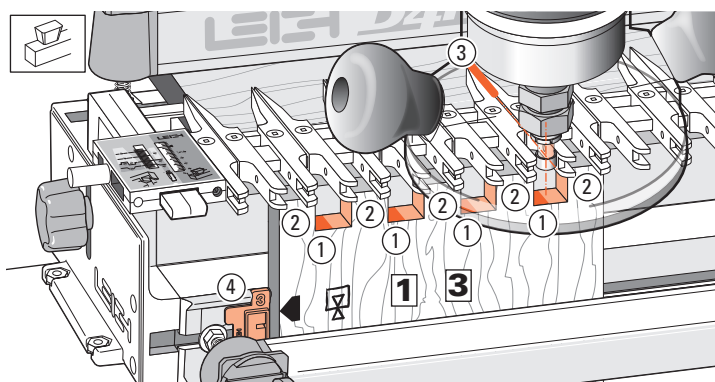


**15-21** Now rout both ends of boards **2** and **4**, with the common edge against the side stop but **only rout between the finger sides** **2** not between the finger openings **1**.

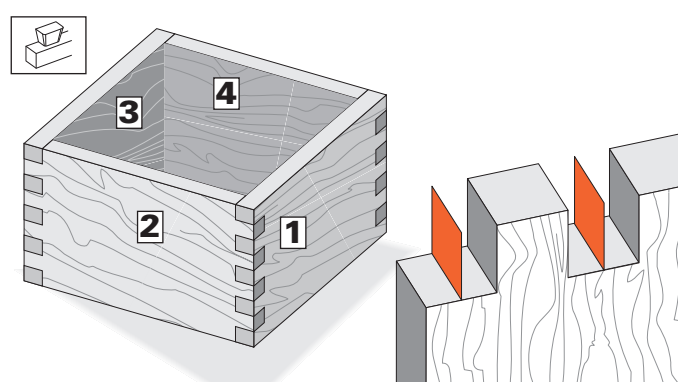
*Hint:* Now steer the base 12 o'clock mark **between the pairs of finger points** **3**.



**15-22** Remove the board and fit the Spacer to the side stop with number **3** showing **4**. Now rout both ends of boards **2** and **4** again, with the common edge against the Spacer and **again ... only rout between the finger sides** **2**, not between the finger openings **1**, steering the router mark **between the pairs of finger points** **3**.



**15-23** With the Spacer still in position rout both ends of boards **1** and **3**, with the common edge against the Spacer and **only rout between the finger openings** **1**, steering the router mark along the **finger points** **3**.



**15-24 Joint fit** Check for joint fit as usual, and repeat testing if required. Theoretically, there will be nothing in the 3/4" [19mm] sockets, literally a zero thickness wall, where the bit has passed by twice. However, routing tolerances can leave a very thin "wall" uncleared by routing. This can be quickly removed with a chisel or sandpaper. ■