

Mortise and Tenon on the PantoRouter™

Basic mortise and tenon is fast and easy on the PantoRouter™ using the factory-made templates or templates of your own design. For mortise and tenon (M&T) on the PantoRouter™, always cut the mortise first then size the tenon to fit as snugly as you wish.

All of the Standard and Segmented race-track-shaped templates use the 10mm guide bearing in the mortising slot and there are three steps in each end of the slot to make three different widths with each size template. The lowest (closest to the template holder) step will make a perfect fitting mortise and tenon (top M&T in the photo to the right), which is especially useful for through-mortise and tenon. If you prefer a mortise slightly wider than the tenon, the second or third step can be used. This additional room side-to-side is sometimes useful for adjustability during glue-up or for wedging the tenon to strengthen and visually enhance the joinery. M&T templates are supplied in two styles, Standard and Segmented, and they use different sizing schemes.



Standard Mortise and Tenon Templates. The standard set of seven M&T templates are “optimized” for ½” thick M&T. Using the ½” bit to make ½” thick M&T, the width will be equal to the size molded into the template; 1”, 1½”, 2”, 2½” & 3”. For each size template, the guide bearing in the mortise slot always follows the same path side-to-side, so if a smaller bit is used for the mortise, the mortise will be both thinner and narrower. Using a larger diameter bit will make a thicker and wider mortise than the number molded into the template. The numbers on the set of seven standard M&T templates act as a guide but are only accurate for ½” thick mortises. The following chart shows the actual widths using different bit diameters for the mortises.



Standard Mortise and Tenon Template Identification															
Mortise Bit Diameter	A (1")			B (1-1/2")			C (2")			D (2-1/2")			E (3")		
	Fraction	0.01"	mm	Fraction	0.01"	mm	Fraction	0.01"	mm	Fraction	0.01"	mm	Fraction	0.01"	mm
1/4"	3/4	0.70	17.8	1 1/4	1.22	31.4	1 3/4	1.73	44.0	2 1/4	2.24	56.9	2 3/4	2.73	69.4
5/16"	3/4	0.78	19.7	1 1/4	1.28	32.6	1 3/4	1.78	45.3	2 1/4	2.30	58.4	2 3/4	2.80	71.0
3/8"	7/8	0.83	21.0	1 3/8	1.34	34.1	1 7/8	1.84	46.8	2 3/8	2.36	59.9	2 7/8	2.85	72.4
1/2"	1	0.96	24.3	1 1/2	1.47	37.3	2	1.98	50.3	2 1/2	2.49	63.1	3	2.99	75.9
3/4"	1 1/4	1.21	30.8	1 3/4	1.72	43.7	2 1/4	2.24	56.9	2 3/4	2.75	69.8	3 1/4	3.24	82.2
1"	1 1/2	1.47	37.3	2	1.98	50.4	2 1/2	2.49	63.2	3	2.99	75.8	3 1/2	3.48	88.5

Notes:

Fractions are rounded to the nearest 1/8"

Templates marked B-V and D-V are for vertical M&T and are the same dimension as B and D above

Segmented Mortise and Tenon. The segmented M&T templates are “optimized” for a 3/8” diameter bit, which is used more frequently than 1/2” for furniture. The chart shows 154 different sizes of mortise and tenon possible with the segmented template set and all but two segment combinations will have a centering hole to quickly align the template to the center of the template holder. The same rule applies to these templates, when a smaller diameter bit is used for the mortise, the mortise will be narrower than the even numbers possible with the 3/8” bit. Larger diameter bits will make thicker and wider mortises as shown on the chart.

Segmented Mortise and Tenon Templates for the PantoRouter™

Mortise Bit Size	1/8" M&T	1/4" M&T	5/16" M&T	3/8" M&T	1/2" M&T	3/4" M&T	1" M&T	Segment Combinations									
Guide Bearing	6mm	10mm	12mm	15mm	22mm	35mm	48mm	All tenons use the 1/2" bit and guide bearings listed to left									
Mortise and Tenon Width (Rounded to 1/16")	3/4	7/8	15/16	1	1 1/8	1 3/8	1 5/8	●	●	Circle marked round-end pieces only							
	1	1 1/8	1 3/16	1 1/4	1 3/8	1 5/8	1 7/8	▲	▲	Triangle marked round-end pieces only							
	1 1/4	1 3/8	1 7/16	1 1/2	1 5/8	1 7/8	2 1/8	●	1/2"	●	End pieces with segments of various combinations						
	1 1/2	1 5/8	1 11/16	1 3/4	1 7/8	2 1/8	2 3/8	▲	1/2"	▲							
	1 3/4	1 7/8	1 15/16	2	2 1/8	2 3/8	2 5/8	●	1"	●							
	2	2 1/8	2 3/16	2 1/4	2 3/8	2 5/8	2 7/8	▲	1"	▲							
	2 1/4	2 3/8	2 7/16	2 1/2	2 5/8	2 7/8	3 1/8	●	1 1/2"	●							
	2 1/2	2 5/8	2 11/16	2 3/4	2 7/8	3 1/8	3 3/8	▲	1 1/2"	▲							
	2 3/4	2 7/8	2 15/16	3	3 1/8	3 3/8	3 5/8	●	1"	1"	●						
	3	3 1/8	3 3/16	3 1/4	3 1/2	3 3/8	3 5/8	3 7/8	▲	1"	1"	▲					
	3 1/4	3 3/8	3 7/16	3 1/2	3 5/8	3 7/8	4 1/8	4 1/8	●	1"	1/2"	1"	●				
	3 1/2	3 5/8	3 11/16	3 3/4	3 7/8	4 1/8	4 3/8	4 3/8	▲	1"	1/2"	1"	▲				
	3 3/4	3 7/8	3 15/16	4	4 1/8	4 3/8	4 5/8	4 5/8	●	1"	1"	1"	●				
	4	4 1/8	4 3/16	4 1/4	4 1/2	4 3/8	4 5/8	4 7/8	▲	1"	1"	1"	▲				
	4 1/4	4 3/8	4 7/16	4 1/2	4 5/8	4 7/8	5 1/8	5 1/8	●	1"	1 1/2"	1"	●				
	4 1/2	4 5/8	4 11/16	4 3/4	4 7/8	5 1/8	5 3/8	5 3/8	▲	1"	1 1/2"	1"	▲				
	4 3/4	4 7/8	4 15/16	5	5 1/8	5 3/8	5 5/8	5 5/8	●	1 1/2"	1"	1"	1/2"	●			
	5	5 1/8	5 3/16	5 1/4	5 1/2	5 3/8	5 5/8	5 7/8	▲	1 1/2"	1"	1"	1"	1/2"	▲		
	5 1/4	5 3/8	5 7/16	5 1/2	5 5/8	5 7/8	6 1/8	6 1/8	●	1 1/2"	1"	1"	1"	1"	●	*	
	5 1/2	5 5/8	5 11/16	5 3/4	5 7/8	6 1/8	6 3/8	6 3/8	▲	1 1/2"	1"	1"	1"	1"	▲	*	
5 3/4	5 7/8	5 15/16	6	6 1/8	6 3/8	6 5/8	6 5/8	●	1 1/2"	1"	1"	1/2"	1"	●			
6	6 1/8	6 3/16	6 1/4	6 3/8	6 5/8	6 7/8	6 7/8	▲	1 1/2"	1"	1"	1/2"	1"	▲			

Mortise and Tenon Width (Rounded to 1/16")	3/4	7/8	15/16	1	1 1/8	1 3/8	1 5/8	■	■	Square-end pieces only						
	1 1/4	1 3/8	1 7/16	1 1/2	1 5/8	1 7/8	2 1/8	■	1/2"	■	End pieces with segments of various combinations					
	1 3/4	1 7/8	1 15/16	2	2 1/8	2 3/8	2 5/8	■	1"	■						
	2 1/4	2 3/8	2 7/16	2 1/2	2 5/8	2 7/8	3 1/8	■	1 1/2"	■						
	2 3/4	2 7/8	2 15/16	3	3 1/8	3 3/8	3 5/8	■	1"	1"						
	3 1/4	3 3/8	3 7/16	3 1/2	3 5/8	3 7/8	4 1/8	■	1"	1/2"	1"	■				
	3 3/4	3 7/8	3 15/16	4	4 1/8	4 3/8	4 5/8	■	1"	1"	1"	■				
	4 1/4	4 3/8	4 7/16	4 1/2	4 5/8	4 7/8	5 1/8	■	1"	1 1/2"	1"	■				
	4 3/4	4 7/8	4 15/16	5	5 1/8	5 3/8	5 5/8	■	1 1/2"	1"	1"	1/2"	■			
	5 1/4	5 3/8	5 7/16	5 1/2	5 5/8	5 7/8	6 1/8	■	1 1/2"	1"	1"	1"	■	*		
	5 3/4	5 7/8	5 15/16	6	6 1/8	6 3/8	6 5/8	■	1 1/2"	1"	1"	1/2"	1"	■		

*Note: On the 5 1/2" and 5 3/4" round-end M&T and the 5 1/2" square end M&T, there is not a centering hole. Align the ends to be equidistant from center using a square for these sizes.

- Indicates the round-end pieces with the circle mark. Using these together makes a 1" wide M&T x 3/8" thick (other sizes according to the chart above)
- ▲ Indicates the round-end pieces with the triangle mark. Using these together makes a 1 1/4" M&T x 3/8" thick (other sizes according to the chart above)
- Indicates the square-end pieces. Using these together makes a 1" M&T x 3/8" thick. The tenon will have square ends.

The square-end templates do not have steps in the mortise slot since these will always be through M&T and the ends of the mortise will need to be squared with a chisel

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A complete How-To Guide for the segmented mortise and tenon template system is included with each set.

Cutting the Tenons. Once the desired template is selected and the mortise is cut, there are choices for cutting the tenon. The 1/2" bit is preferred for all tenons. It's large enough to cut efficiently and the spiral upcut effectively brings shavings to the dust hood. The standard PantoRouter™ guide bearings are 10mm, 12mm, 15mm & 22mm, plus 35mm and 48mm included in the Monster M&T set. Using the 1/2" router bit, the following tenons can be cut with any of the Standard or Segmented M&T templates simply by changing the guide bearing.

Tenon thickness using the 1/2" diameter bit with different diameter guide bearings:

1/4" thick tenon = 10mm guide bearing with 1/2" bit

5/16" thick tenon = 12mm guide bearing with 1/2" bit

3/8" thick tenon = 15mm guide bearing with 1/2" bit

1/2" thick tenon = 22mm guide bearing with 1/2" bit

3/4" thick tenon = 35mm guide bearing with 1/2" bit

1" thick tenon = 48mm guide bearing with 1/2" bit

Other combinations are possible using different guide bearings and bits, but the 1/2" bit works so well and takes so little time to change, it's preferred for all tenon sizes. Additional bit and guide bearing combinations are shown on page-4 of this guide.

Dowel Templates. The dowel templates have the same 10mm mortise pocket and the same outer tapered template profile as the mortise and tenon templates, so the same combinations of bit and guide bearing work. The only difference with the dowel templates is when mortising with the 3/4" and 1" bits supplied in the Monster M&T set. These two bits are not made for plunge-cutting without a side-to-side motion because they have no center blade to remove the center of the cut. Use a 1/2" bit to first remove the center, then plunge-cut your final hole using the 3/4" or 1" bit. There are 3/4" and 1" center-cutting plunge bits available from other sources on the internet if you plan to make these large holes (mortises) often.




Diamond and Bow Tie. The Diamond and Bow Tie templates use a different offset between the mortise pocket and the outer profile used to cut the tenons. These templates require the 3/8" bit and 10mm guide bearing for both mortise and tenon.



Alternate Bit and Bearing Combinations: This chart is published in our How-To Guide, and it offers more options than the list of sizes at the top of page-3 of this guide. It's rare that tenons would need to be cut with a bit other than 1/2" diameter, but in case a different combination is desired, this chart shows the possibilities. See the example below.

		GB	Bit	
Tenon Size	1/8"	6	1/2	
	1/4"	10	1/2	
		22	3/4	
	3/8"	35	1	
		10	3/8	
	1/2"	15	1/2	
		10	1/4	
		15	3/8	
		22	1/2	
	3/4"	35	3/4	
		48	1	
		22	1/4	
	1"	35	1/2	
		48	3/4	
		35	1/4	
	48			



It's best to use larger guide bearings and bits where possible.
The 1/2"spiral upcut bit works with every size.

The 35mm (yellow) and 48mm (orange) guide bearings come with the Monster Set along with 3/4" and 1" straight cut bits.

Example: For a 1/4" thick mortise and tenon, the chart above shows three different combinations that can make the correctly-sized tenon. Since it's a 1/4" mortise and tenon, the mortise is cut with the 1/4" bit, then the bit and guide bearing are changed to make the tenon cut. The 1/2" bit with 10mm guide bearing is preferred, but the chart above also shows the 3/4" bit with the 22mm guide bearing or the 1" bit with the 35mm guide bearing will make the same 1/4" thick tenon.

The colors in the chart and on the guide bearing shafts in the photo are for clarifying the sizes, but we do not color-code the guide bearings for the PantoRouter™.

March 2021 Update. We recently introduced a 12mm guide bearing to our packages, which is used to make 5/16" tenons using the 1/2" bit. The mortise is made using a 5/16 bit.

Guide Bearing Collars. The guide bearing collars supplied with the PantoRouter are useful for repeating tenon size setup. Once you find the sweet spot on the taper for the tenon size, slide the collar against the handle and lock the hex screw. The next time you make the same size tenon using the same size bit, this setting should get you very close to a perfect fit without having to start at the top and work your way down the taper.



Keep these charts handy for reference to exact sizes for mortise and tenon. If there's a need to create a different size, the standard templates can be cut-down to make smaller sizes, or custom templates can be designed and 3D printed.

Happy PantoRouting!