Getting the Most From the Festool Domino Machine

Text and Photos by Jerry Work

For many woodworkers the construction of a butterfly leaf dining table like the small one shown here is considered a rite of passage because it is very difficult to do correctly. The table tops slide apart to reveal a self storing leaf that folds in the middle. By pulling up on one half of the leaf both halves rise up to perfectly align with the table top both on the flat top surface as well as along each edge. Then the two halves of the top slide together to engage the butterfly leaf in its deployed position.

Properly executed, this operation is a thing of beauty in and of itself. Most people watching a butterfly leaf table open for the first time seem to be transfixed as they watch everything side so effortlessly into perfect alignment. And, watching the leaf fold down and store below the table top is no less captivating.

I often caution my customers to be prepared for the first dinner party on their new table. If the guests see the butterfly leaf deploy, they usually will stand around opening and closing it time after time just because it is fun and interesting to do.

Using conventional tools and techniques it is very difficult to get all the pivot points in exactly the right places so designing and building such a table can be quite complex and intimidating. But, as we will see while we follow the construction of the table shown here from start to finish, using the innovative Festool Domino machine and the self aligning, self squaring and self locking features of the sliding dovetail joint, building tables such as this one are well within your grasp whether you are a hobbyist just starting out or a seasoned furniture maker with years of experience under your belt.

The Domino machine is the key.

Also in this manual we will follow the construction of a conventional four leg with side skirt style of table, an upright chest with gracefully flaring legs and sliding doors, and a unique “convertible” coffee table that can quickly change look and function.

All of these are easy to build by using the Domino machine and are all within your reach as well.

How should we describe this innovative tool?

Early in the U.S. introduction planning I was asked by Festool USA how I thought the machine should be described. Because I had lots of experience with loose tenon joinery using the three dimensional sliding table on my industrial slot mortising machine, I first described it in those terms. At that time I wrote that I would describe the Domino machine as, “a portable loose tenon jointer with great positional accuracy.” And, as we will discover moving through this manual, it certainly is that.

However, as I used the Domino machine on more and different projects, it evolved in my head to something much more than those words could capture. The Domino machine solves a whole range of woodworking issues from joining two pieces of wood in all six ways one can joint two pieces together, to handling a myriad of wood movement problems that are always a part of building with solid woods, to precisely aligning two or more components during assembly operations, to making hidden latches, stops and door slides, and much more.

As you progress through this manual I think you will enjoy seeing examples of all of these uses and the opportunity to learn more about this truly remarkable and unique woodworking tool.

The author, Jerry Work, designs and hand crafts fine furniture in the 1907 Masonic Temple building in historic Kerby, OR, where visitors are always welcome.

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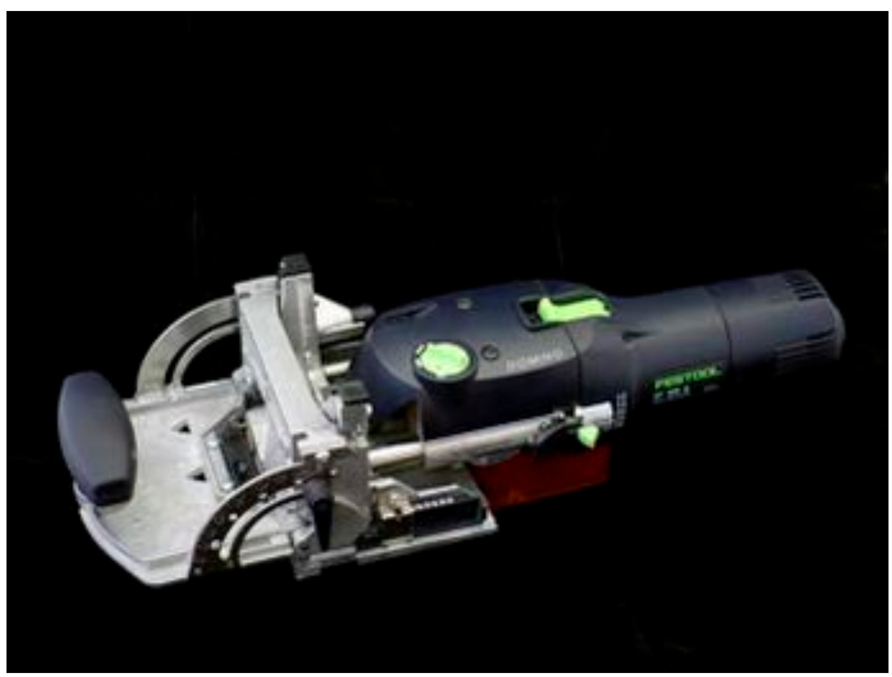
What is a Domino Machine?

Let's begin by exploring the tool itself. It is made up of a body with a unique mechanism that both rotates and oscillates a drill-like cutter bit. The body slides nearly effortlessly on two hardened steel shafts built into the fence section of the tool.

Once aligned where you want the cut to be made, you push the body towards the work piece to produce an elongated slot, most commonly called a "mortise."

The Domino machine fence and positioning systems allow you to center that slot both horizontally and vertically very accurately. Built into the machine are adjustments for the width and the depth of the slot. The cutters can be interchanged easily and quickly and come in 5mm, 6mm, 8mm and 10mm diameters producing slots of those widths.

The pictures on this page show the Domino in broad view. As we come in closer with the detailed photos on the next few pages we will see the many precise adjustments and alignment aids.



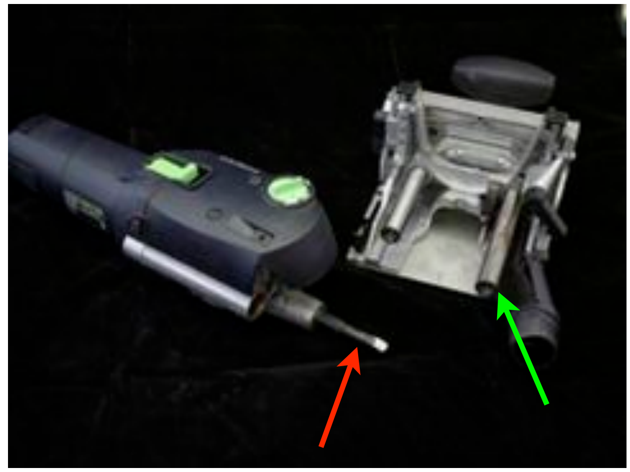
The idea is to cut a mortise slot into which you can insert a premade wooden tenon which Festool calls a "domino," hence the name of the machine.

You can make your own if you want to, but the pre-made Festool tenons are extremely strong, very precisely dimensioned to fit perfectly into the mortise slot cut by the Domino machine and they are quite economical to buy. My recommendation is to simply use the Festool dominos and not try to reinvent that wheel on your own.

The Domino Body

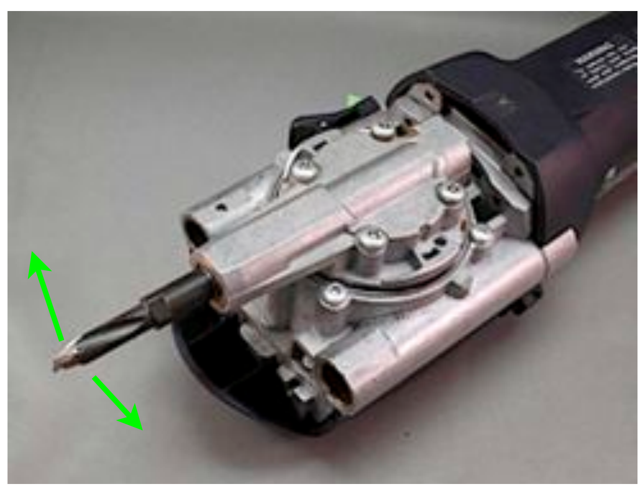
This sequence of photos shows how the body and fence can easily be separated by simply raising the lock tab as shown here. The wrench used to change cutters

is ideal for this. Hook the edge of the wrench beneath the lock tab and lift it up.



The fence will start to slide off the body as shown in the photos left and above exposing the rotating and oscillating cutter (red arrow).

In the photo above you can see the two hardened shafts (green arrow pointing to the right shaft) that the body slides on as you push the body in to cut the mortise slot. They ensure the mortise slot will be exactly parallel to the base of the Domino machine, one of the keys to Domino's impressive accuracy.



Here is a view of the under side of the body. The round housing held by the four screws is gear driven to move the cutter tip back and forth in a horizontal arc while the cutter is also rotated to make the cut.

The cutters can be easily changed as they just screw onto the threaded end of

the gear-driven shaft as shown by these photos.

Above, the wrench is positioned on the flats of the cutter tip. The shaft lock button is on the side of the Domino body right where the thumb on one hand can easily press it while you loosen or tighten the cutter with the wrench held in the

other hand. In the photo above I moved my thumb down so you can see the shaft lock lever (red arrow).

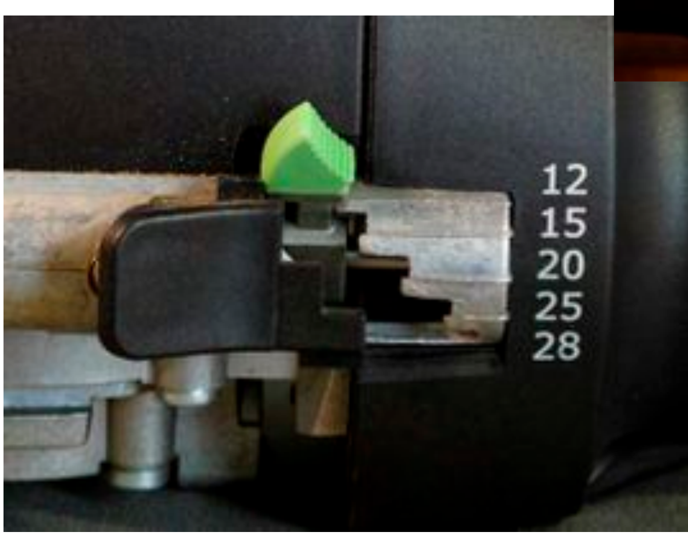
The cutters are available in four different diameters, 5, 6, 8 and 10mm. The 5mm cutter comes standard with the machine itself and the four cutter set shown above

comes with the set of domino tenons.

The photo below shows the cutters with

their respective Domino tenons for size comparison.

Depth of cut is controlled by a lever on the side of the Domino body (red arrow above and in detail below). Settings are for depths of cut of 12, 15, 20, 25 and 28mm. This is the depth measured from the front of the fence to the bottom of the mortise. Lift the black safety catch and move the green depth lever to align with the desired depth of cut. To allow for some glue build up in the bottom of the mortise as the tenon



is inserted, the actual length of the Festool supplied tenons is about 1.5mm shorter than the depth of the corresponding mortise.

The top green knob turns to set the desired width of cut. Three settings are provided. The narrowest width (the setting shown below) matches the supplied domino tenon for each domino (tenon) thickness. The 5mm thick dominons are just under 19mm wide scaling up to the just under 23mm width of the 10mm

thick dominos.

At the minimum width of cut setting (the way the width knob is set in this photo) the cutter bit oscillation is 13.7mm. With a 5mm cutter bit the overall cut mortise slot will be 13.7 + 5 = 18.7mm wide, nominally 19mm.

Move the knob to the intermediate width of cut setting and the oscillation increases from 13.7mm to 19.2mm resulting in a slot 24.5mm wide for the 5mm cutter bit. The tenon still fits tightly into the sides of the mortise slot, but the slot is longer than the width of the tenon allowing some assembly adjustment room side to side. The third width setting increases the oscillation to 23.2mm resulting in a 28.2mm mortise slot which provides close to 10mm side to side adjustment room.

The ability to vary the slot width is key to many of the Domino machine attributes. As indicated, at the narrow setting the domino tenon fits tightly into the slot. At the wider settings the thickness of the domino tenon fits tightly into the mortise slot front to back, but the domino tenon is free to shift side to side.

When you cut a tight mortise (width knob at the narrowest setting) at the same location on two different boards, that one M&T joint will keep the two boards aligned as desired. Placing wider mortise slots along the same face of one of the two boards means the remaining domino mortise slots can be cut with some margin for positional error while still allowing the joint to close properly, a great advantage over dowel joints where the positional accuracy must be dead on or the joint simply will not close up at all.

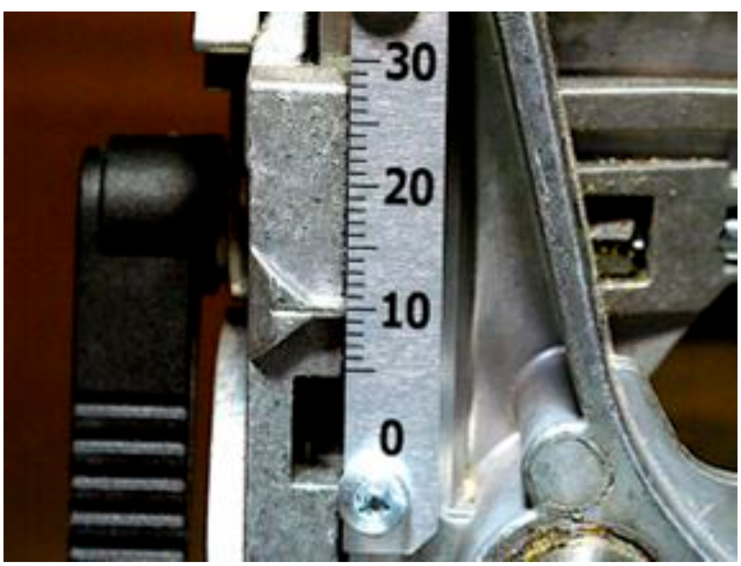
Since the majority of the strength of a loose tenon joint is derived from the fit and glue surface on the faces of the mortise slot and the faces of the tenon, little strength is lost when the width of the mortise is greater than the width of the tenon.

We will see numerous examples of when and where you want to use tight fitting or over-width mortise slots as we progress through the manual and show actual projects in process.

The Domino Fence

Now let's look at the adjustments on the fence part of the Domino machine. In this photo we are looking at the back side of the fence with the body removed. You can see one of the two hardened steel rods that the body slides on as it moves the cutter in and out of the work piece keeping the mortise slot parallel with the base of the fence.

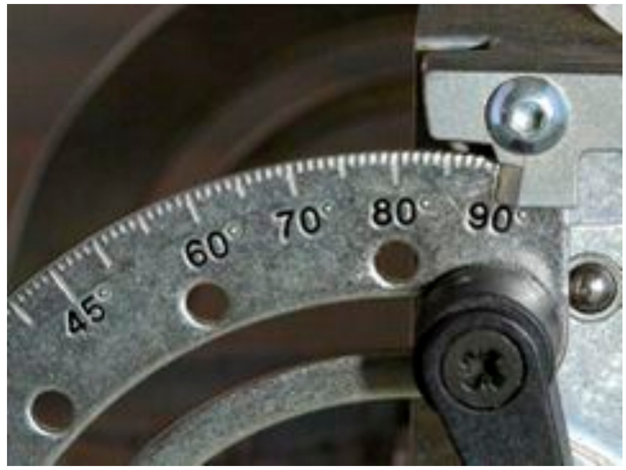
The first adjustment to consider is the height the fence is above the ***horizontal centerline*** of the cutter. That is shown by a scale and pointer. In the close up photo below the fence is set to be exactly 10mm above the centerline of the cutter. A lock lever secures the fence at the desired height. The fence moves up and down on machined ways so it remains exactly parallel with the cutter at all heights.



For rapidly setting the fence to common heights above the horizontal centerline of the bit, a stop block (shown in detail above) is provided that slides back and forth to reveal different step heights. The fence sits on the top of a stop block step, positioning it exactly an indicated distance above the horizontal centerline of the cutter.

The stop block (shown here at a setting of 20mm) is marked in units corresponding to the ***overall thickness of the work piece for which the cutter will be exactly centered***. In this case the stop block is set for a 20mm thick work piece resulting in the pointer (photo left) indicating that the centerline of the cutter will be at 10mm.

The stop block is marked to center the bit on work pieces 16, 20, 22, 25, 28, 36 and 40mm thick.

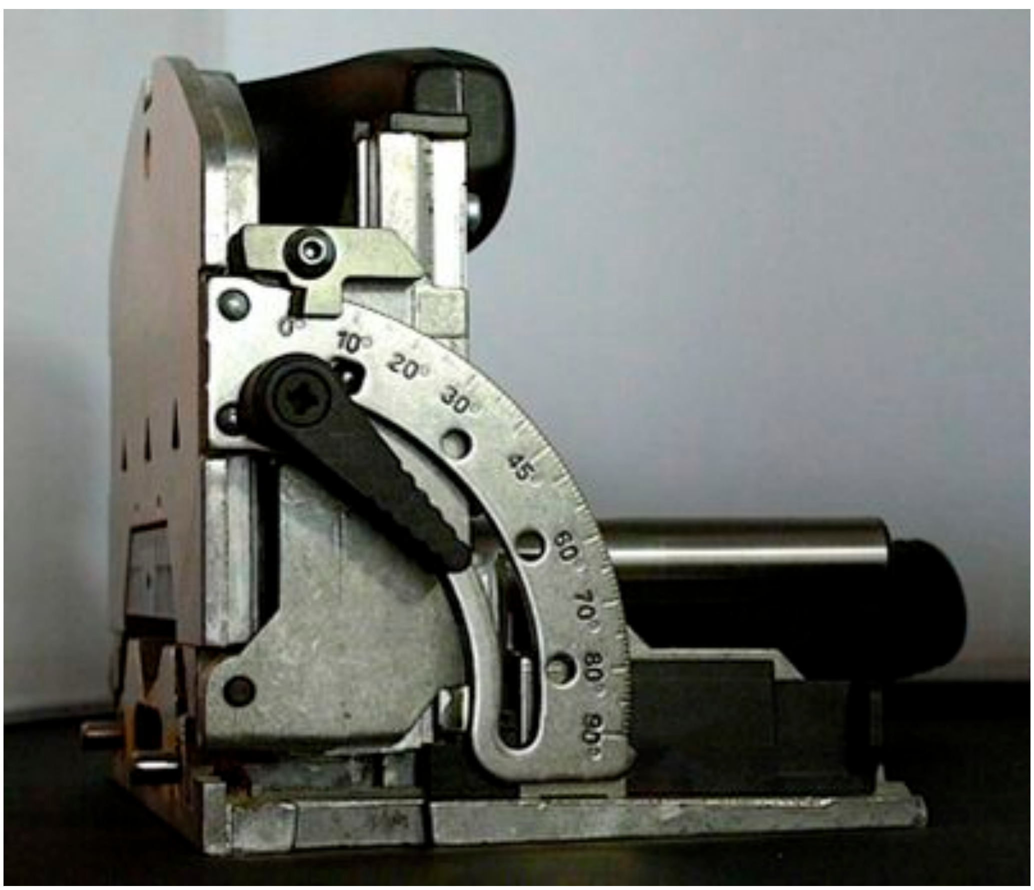


You can also simply use the height scale to set the fence any distance you want it to be above the horizontal centerline of the bit within the range of 7mm to 30mm.

The minimum height of 7mm ensures that a 10mm cutter will leave a minimum of 2mm of wall between the upper side of the mortise slot and the upper side of the work piece so you don't inadvertently drive the cutter into the bottom side of the fence.

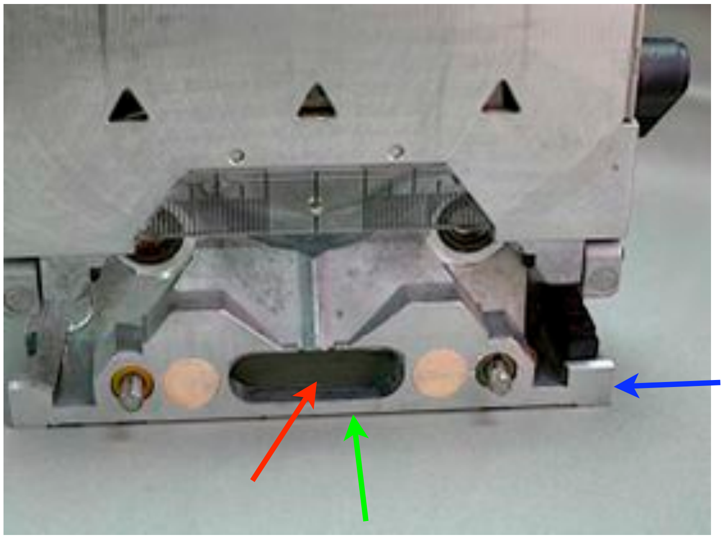
The fence also rotates from 90 degrees angle relative to the edge of the work piece (meaning the fence is parallel with the cutter) to zero degrees relative to the edge of the work piece (meaning the cutter is moving perpendicular to the fence the way it is shown in the photo left).

Ball detent stops are also provided for common intermediate settings, or you can simply set the angle with the protractor scale and pointer. The pointer is adjustable so you can calibrate the angles to be dead on.



Now let's look at the variety of alignment marks to help you place the mortise slots exactly where you want them.

This first photo is looking at the front of the Domino fence with the fence piece raised to the zero degree angle for clarity of view. The slot in the center towards the bottom (red arrow) is where the cutter



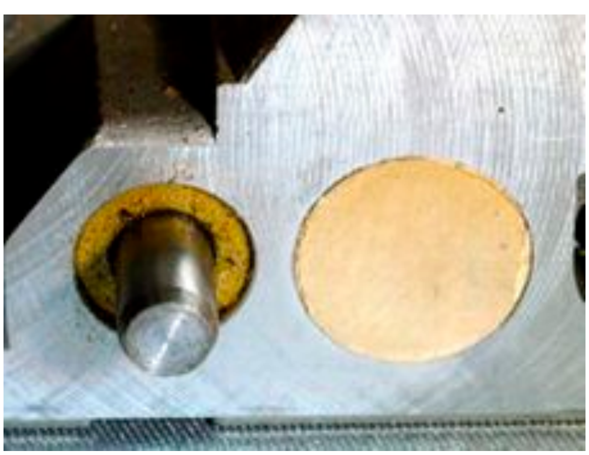
emerges when the body is pushed towards the work piece to make the mortise cut. ***The cutter centerline is 10mm up from the base of the fence assembly (green arrow above)***.

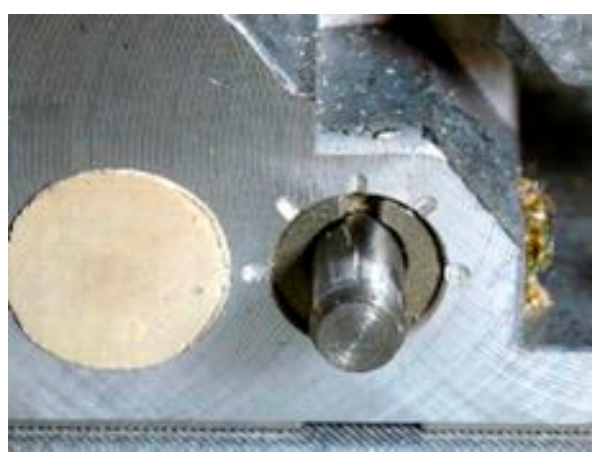
Two alignment pins are spring loaded and are set 74mm apart so each is 37mm from the centerline of the cutter.

The right and left spring loaded alignment pins are shown in detail below. The right pin is mounted in an eccentric with a screwdriver slot by which you can turn the eccentric to bring the two pins into exact alignment the same distance from the vertical centerline of the cutter. The left pin is fixed in position 37mm from the vertical centerline of the cutter and 24mm from the outside of the pin to the outside edge of the fixed portion (base) of the fence (blue arrow).

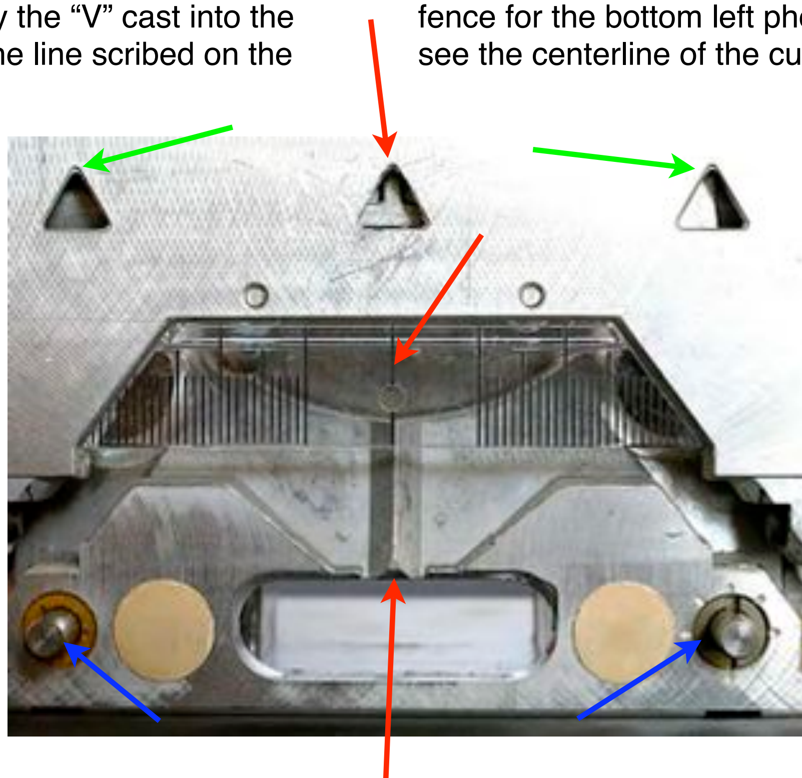
The pins are 5mm in diameter so the base is machined to be 132mm wide or 66mm from outside edge to vertical center of cutter. All of these measurements are very useful to keep in mind as they each can play a role in helping you precisely position the center of the Domino mortise slots.

When you first get your machine, make sure the adjustable fence height pointer is exactly on 10mm when the fence is on the stop block marked 20mm, the angle pointer is exactly on mark, and the distance between the two spring loaded pins is 74mm. Adjust the right pin shown below if necessary.





The vertical centerline of the cutter is also marked in several other ways (red arrows) as well: by the “V” cast into the fence base, by the line scribed on the clear plastic reference scale attached to the moving portion of the fence (note the hole in the plastic denoting center), and the point of the triangle cast into the moving portion of the fence.

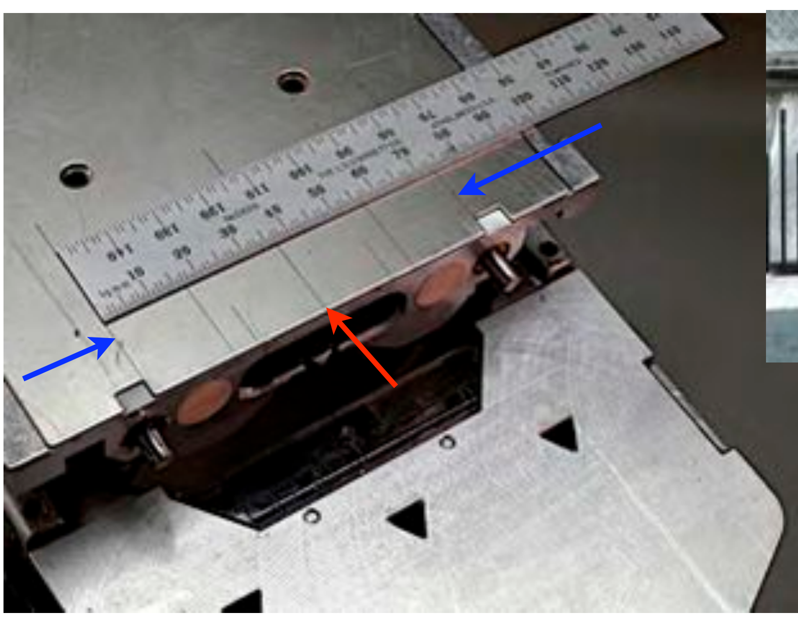


The outer two triangles (green arrows) cast into the moving portion of the fence have points that are exactly 74mm apart, the same as, and aligned with, the ***inside*** edges of the spring loaded alignment pins (blue arrows).

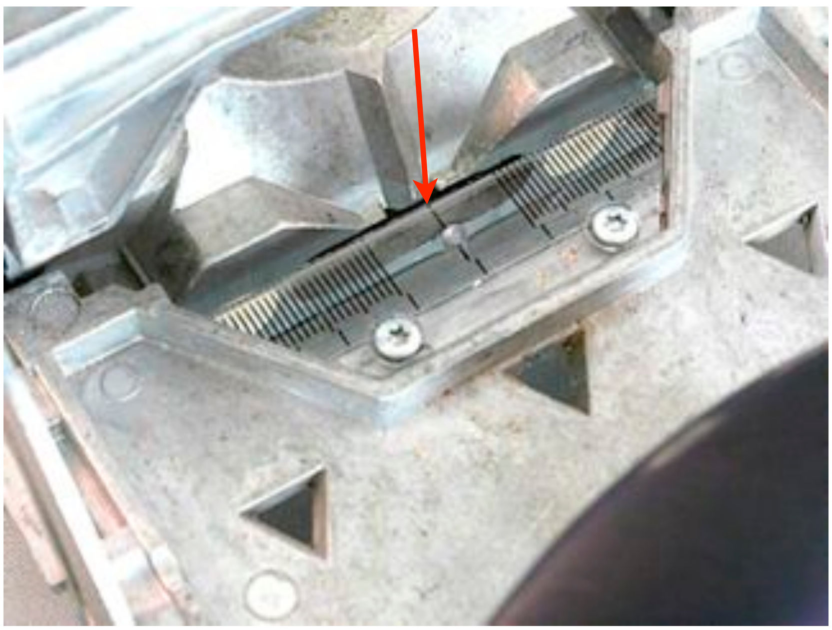
There is yet one further set of marks denoting the vertical centerline of the cutter. These are scribed on the bottom of the base of the fence (the fixed portion). I placed a rule on the inverted base of the fence for the bottom left photo so you can see the centerline of the cutter lined up with 37mm on the rule. The left end lines up with the mark for the inside of the left spring loaded alignment pin while the mark denoting the inside of the right alignment pin is at 74mm.

5mm beyond the left end of the rule and the 74mm mark are lines denoting the *outside* edges of the alignment pins.

Two additional sets of scribe lines are set 15mm from the vertical centerline of the bit (the shorter lines) and 20mm from the bit center (the longer lines).



The photos above show the clear plastic alignment scale that tilts with the moving portion of the fence. As we saw earlier, the center scribe line with the circle cut through it is the horizontal center of the bit oscillation movement and hence is the side to side center of any mortise slot cut with any bit. Long scribe lines are 10mm increments (yellow arrow) while the shorter lines are 1mm and 5mm increments on this clear plastic guide.



Here is a picture of the guide taken from above the fence when it is lowered to the horizontal position parallel with the bit oscillation. In use, it is quite visible and I am constantly impressed by just how close I can set the Domino mortise slot with just this visual reference.

Once you start using the Domino you will quickly learn to trust the marks and, so long as you lay out your mortise slots around centerline measurements, you can achieve great accuracy and also do all kinds of offsets using just your layout mark and these several methods of aligning the Domino.

The spring loaded pins are especially fast and accurate. By hooking one of the pins over an end or edge of your work piece, you will place a mortise slot centered exactly 37mm from that edge ***no matter what size cutter you use or what slot width setting you choose.***

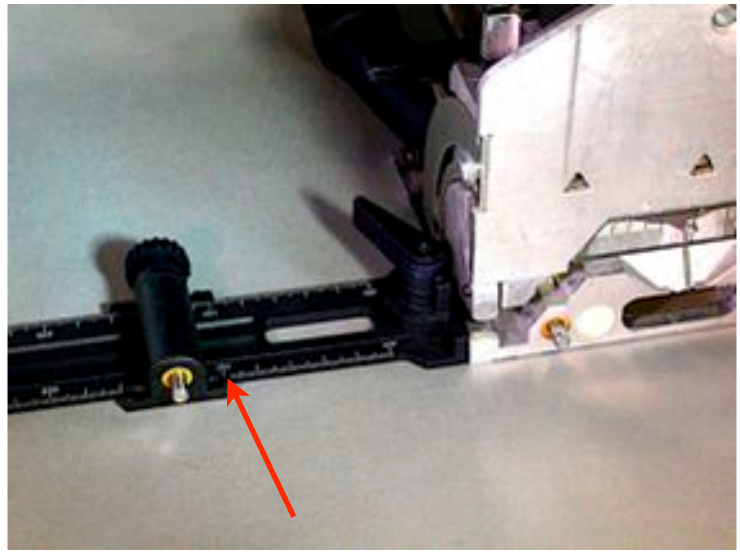
Take the case of an end to edge joint such as creating a 90 degree joint which properly lines up the outside edge of both pieces. Set the fence height to place the mortise slot where you want it on the edge and end of the work pieces, set the depth of cut you want and set the slot width to the narrowest mark (shortest white icon of the three surrounding the green round width adjustment knob). Hook the alignment pin over the ***end*** of one piece and make the mortise cut in that edge. Next hook the pin over the ***edge*** of the mating piece and make the cut into that end. Put the Domino tenon in place and the edges of the joint will be perfectly aligned with no layout marking on your part at all.

It is that easy!

Before we move on to look at all six ways that two boards can be joined and see how these various alignment marks and pins are used to precisely position your M&T Domino joints, there are three more positioning aids we need to examine. All come standard with the Domino Set (574-283). If you want just the machine itself with only a 5mm bit, that is item number 574-258.

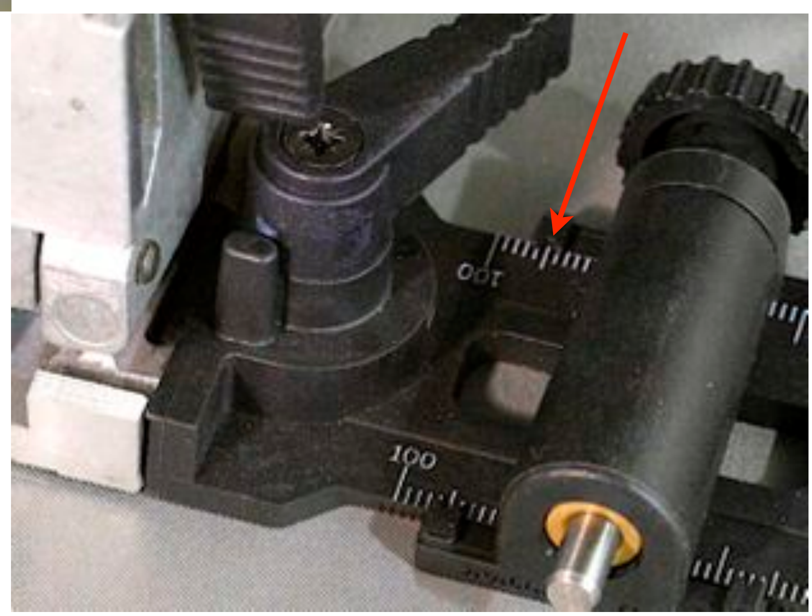
The first is a two part fence extender. One part attaches to each side of the Domino fence and each features a movable spring loaded reference pin and numeric scale. They attach by a clever dovetail machined into each side of the

Domino base as shown in the photo below taken from the bottom of the base.



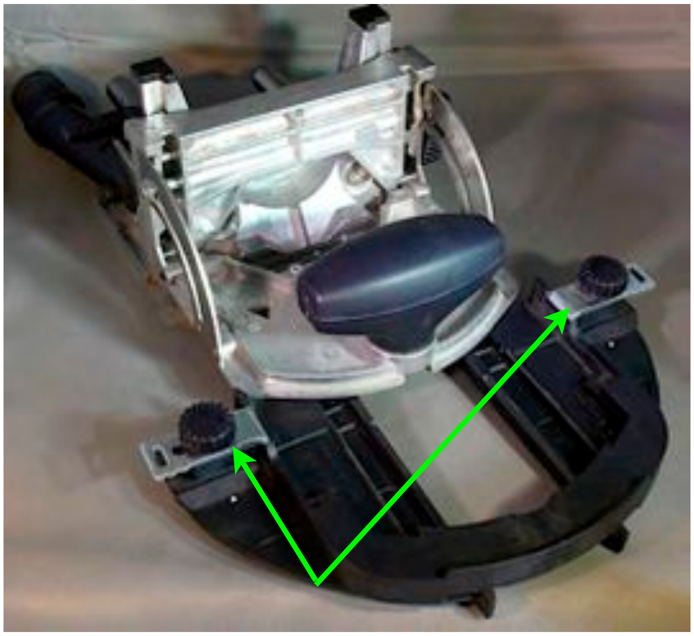
In the photo above the inside edge of the spring loaded pin is set to be 150mm away from the horizontal center of the mortise slot. The red arrows show the alignment scale and pointer.

In the close-up below the pin is set so it would register the work piece to position

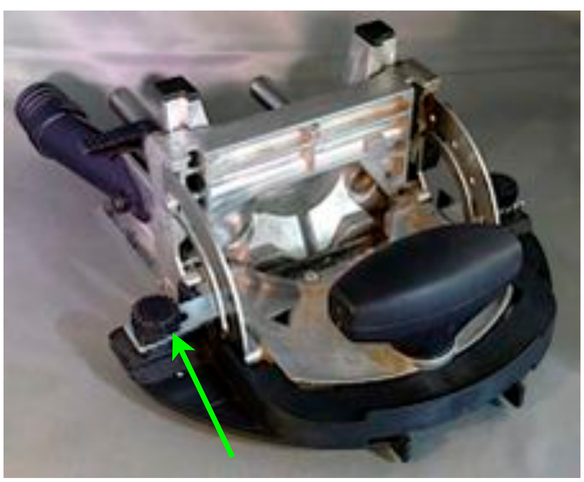


the mortise slot 105mm away from the edge of the work piece that rests against the stop pin.

The second very useful positioning accessory is a ***saddle fence*** that attaches to the bottom of the moving portion of the fence. Here the Domino body is removed from the fence to make it easier to see.

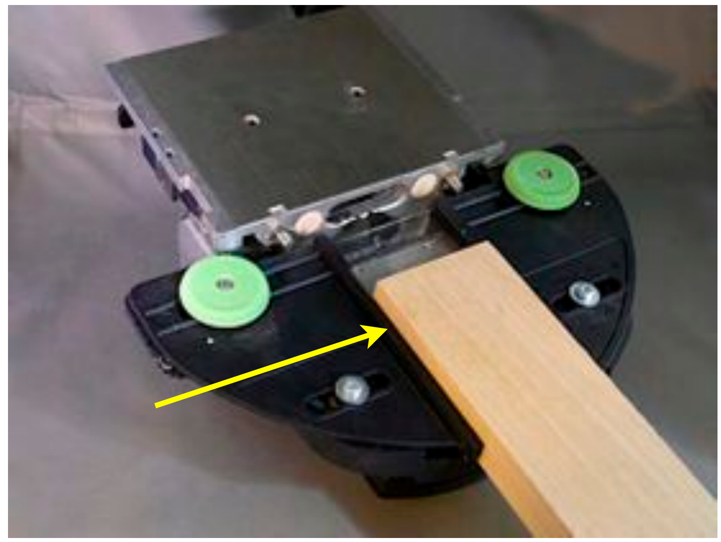


The saddle fence slides onto the fence



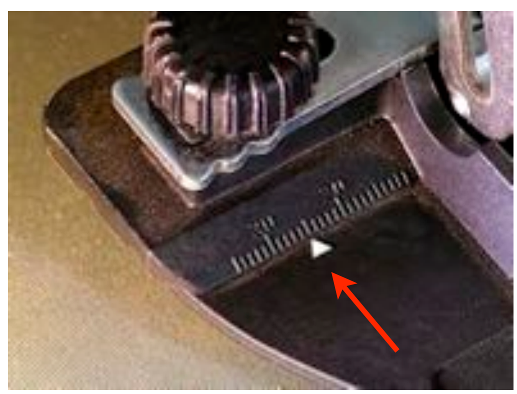
and locks in place via the two black knobs and metal fingers (green arrow).

The photo above right shows the bottom of the saddle fence. It features two movable fence elements that run parallel with the in-out motion of the cutter (yellow arrow). They capture and hold the edges of the work piece making it easy to cut mortises in the end grain. The green knobs secure the fences in the desired position,



and on top (detail below), is a scale that indicates how far away those fence sides are from the vertical center of the mortise slot.

Want to cut a 10mm mortise in the center of the end of a 20mm x 50mm work

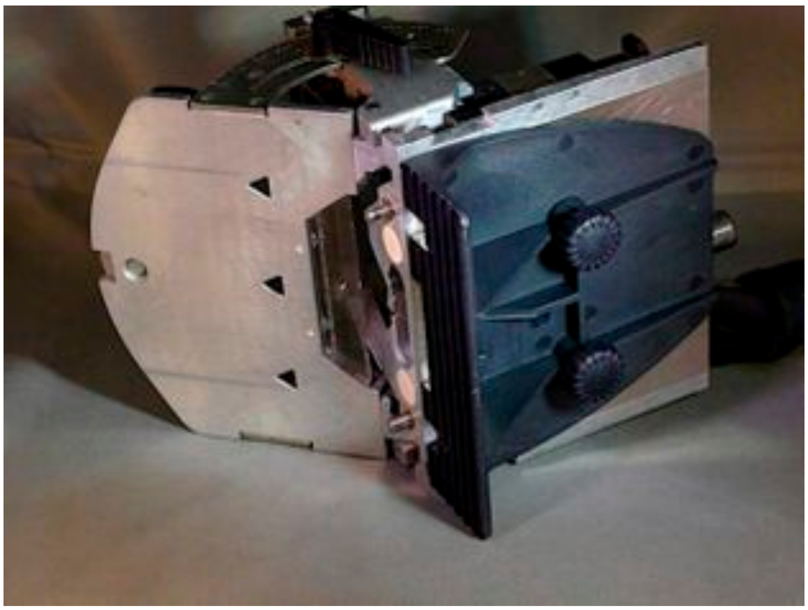


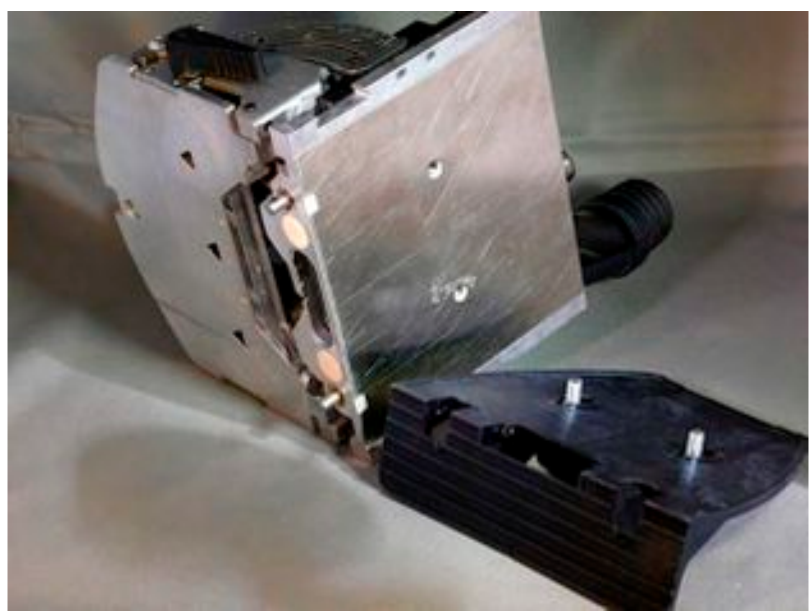
piece? Set the fence to 10mm high and set the two sides of the saddle fence to 25mm as shown above. The resulting mortise will be exactly centered in the end grain no matter which cutter you use or which width setting you select. Neat!

The third accessory is for stabilizing the Domino machine when used upright cutting into the face of a work piece registered off of an edge. It is an auxiliary fence that screws to the bottom of the moving portion of the Domino fence. This photo shows it installed with the fence set to 45 degrees. Right is a photo showing the auxiliary fence before it is mounted to the bottom of the moving portion of the Domino fence, shown here set at zero degrees (perpendicular to the movement of the cutter.)

Now that we are familiar with the Domino machine and the variety of ways to accurately register the location of the mortise slot, let's take a look at the six ways you can join two pieces of wood together.

Then we will move on to several build-along projects that show the amazing versatility of this innovative wood working tool.





There are only six ways you can join two pieces of wood together.

I will refer to the surfaces of a board as the faces (the wide flat top and bottom of the board), the edges (the sides of the board) and the ends.

Boards can be joined:

1) edge-to-edge

2) face-to-face

3) end-to-end

4) edge-to-face

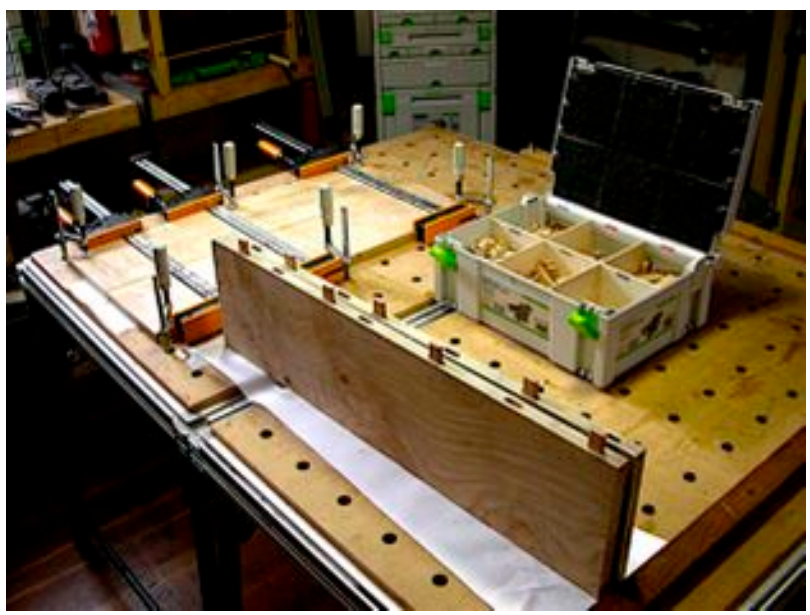
5) end-to-face

6) end-to-edge

Edge-to-edge is a common operation any time you need a board wider than the stock you have on hand. We usually call that a "glue up" or a "panel joint."

Reinforcing and properly aligning this edge-to-edge joint is easy, very fast and very precise with the Domino machine. Set the slot width to narrow, the fence to 90 degrees and the fence height to half the work piece edge thickness. Hook the pin over one end of each piece to be joined while pressing the fence down on the face of what is to be the top or good surface of the glue up. Turn on the Domino machine and push the body towards the work piece until it bottoms out at the desired depth of cut to machine the mortise slot.

Do that on both boards. Since the spring loaded pins set the horizontal mortise center and the fence sets the vertical mortise slot center, the ends and the faces of the two boards will be perfectly aligned. In the photo above you can see that I mark the end aligned with the spring loaded pin with an "X" mark. That mortise is centered 34mm in from the edge.



I suggest you always work with the fence on the top or "good" surface of your work pieces so those faces will align even if the two work pieces are not exactly the same thickness.

Add additional Domino mortises along the edges of each board using either of two methods. First you can use the excellent two part fence extender (called a “side stop” in Festool literature) we saw earlier. Set the pin spacing to match the desired mortise to mortise spacing. By hooking the alignment pin in the edge of the mortise you just cut, the next mortise will be spaced over by that amount. Progress across both board with the same settings and the mortises will all align perfectly.

You also can align by just marking the desired locations with a pencil line across both boards. Leave the slot width set to narrow and cut mortises with the bit center mark aligned with each of your pencil lines on one of the two boards to be joined. Reset the slot width to the wider slot setting and cut the remaining mortise slots in the second board (shown in the photo at the top of the previous page).

Since the first mortise slot in each board is the same width as the Domino tenon, that one M&T joint will align the two boards end to end. The slightly wider mortise slots you cut for the remaining mortises in the second board will offset any minor misalignment that might be present, allowing the two edges of the boards to come tightly together with the faces perfectly aligned.

The Domino mortise slot to Domino tenon fit is much tighter than is the case with a biscuit jointer so the face to face alignment is much better. The Domino tenons are also a lot stronger, set deeper and provide more glue surface area than a biscuit so a Domino reinforced edge-to-edge joint is superior in every way to an equivalent biscuit edge-to-edge joint in my experience.

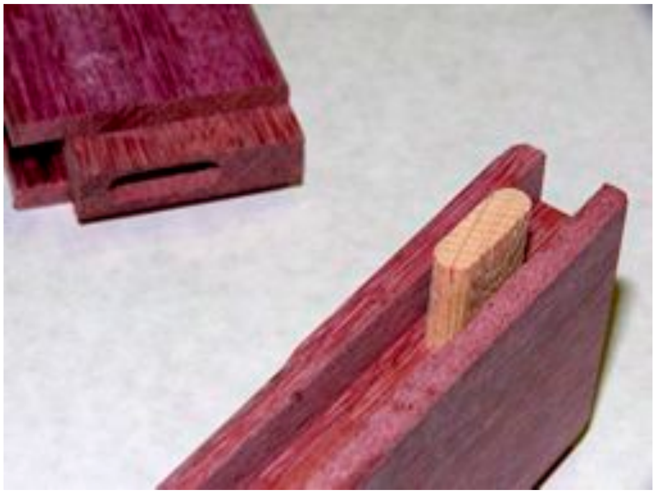
While you can cut these Domino mortise slots at any height down the edge from the face of the boards, conventional “wisdom” would have you place them in the middle of the two work pieces to be joined.   Usually the recommendation is to use a tenon one third the thickness of the work pieces to be joined thereby leaving an edge to slot width the same as the tenon width.

In working with Dominos I find I prefer to use a Domino that is ***half***, rather than one third, the thickness of the work pieces to be joined. The Domino tenons do not swell up the way biscuits can and the grain runs the length of the Domino tenon. Since the Domino penetrates into the edge of the work piece a relatively long way (anywhere from 15 to 25mm depending on the tenon length you use,) the bending moment is spread over enough distance that even on a stressed joint the relatively thinner wall provides plenty of support.

Now let’s look at the case of a common ***end-to-edge*** joint, such as you find in rail and stile work.

Because it is so easy to calculate dimensions in my head this way, I commonly use rail and stile components that are 50mm wide by 20mm thick and panel slots are 10mm wide by 10mm deep and centered on the 20mm thick work piece edges or ends.

A Domino mortise and tenon centered on the 20mm thickness of my work pieces matches these standards perfectly. And, I can reinforce the glued up 10mm thick panels by using a 5mm centered Domino mortise and tenon.



In the example shown on this page the R&S components are Purple Heart while the panels are Maple Burl.

If the joint is a stressed joint, such as the corners of a door, then I like to put an

8mm Domino M&T ***inside*** the 10 x 10mm tongue and groove cut into the rail and stile pieces as shown above. The 10mm tongue is cut into the rail piece and the 10 x 10mm groove cut into the stile piece. The 8mm Domino mortise is cut into the middle of the groove and the middle of the tongue (top photo).

The Domino M&T not only strengthens this joint, it also automatically aligns it as

well. And, by having glue on both sides of the trapped narrow 1mm tongue wall, the joint is incredibly strong.

In the photo left my finger points to the joint going together and above is a photo of a panel being inserted into a three panel R&S assembly that was made this way.

Below is a cut away of a door done this way to show how the precise positioning the Domino machine provides can quickly and easily cut what many would consider a most difficult joint - three 8mm M&Ts cut inside three 10mm tongue and groove joints, all perfectly aligned!

Just for fun here is an edge-to-edge joint used to join two thick pieces of maple together to make a fancy countertop chopping block.

Waterproof glue and four 10mm x 50mm Domino tenons make sure this chopping

The Domino machine makes a fast, secure & hidden joint without that fuss.

block will never separate. The waney edges add interest while the large breadboard end dovetailed to the body prevents any bowing or warping.

The dovetailed feet keep the bottom off the countertop.

I would not consider making this piece using biscuits as I would be concerned about joint strength. Over the life of this piece it will be hit with everything from a meat cleaver to a tenderizing hammer and it will be in and out of cleaning water constantly.

BD (before Domino, grin) the only way I could do this was to either use a spline or a sliding dovetail to hold the two pieces together.

Now back to the edge-to-edge joints....

One tenon centered on the edge of each work piece is usually more than strong enough given the strength of modern glues. If your application demands exceptional strength and the work pieces are more than 3.5 x the thickness of the tenon you intend to use, I suggest setting two tenons, each centered the tenon thickness down from each face if the two work pieces are exactly the same thickness. (For exceptionally stressed joints in thick material that is at least 5x the thickness of the tenon, set two tenons centered 1.5x the tenon thickness down from each face).

If the work pieces are not the same thickness, put the first tenon centered the tenon thickness down from the top or “good” face and the other tenon down far enough to be centered about the tenon thickness above the bottom of the thinnest of the two work pieces.

Make all of the Domino mortise cuts with the fence held firmly to the top or “good” face of each work piece. That way the good faces will be properly aligned and the tenons will fit together nicely to produce superior joint strength to what you would have if you used just one tenon centered on the edges.

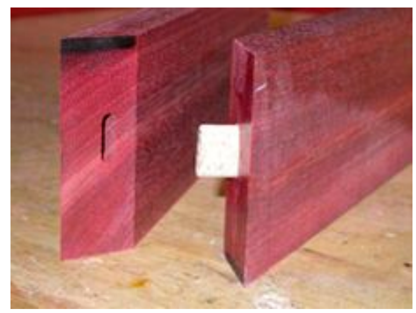
End-to-end joints.

For these, mount the saddle fence if your work pieces are each less than 70mm wide. Each saddle fence can be positioned 35mm away from the horizontal mortise center thus accommodating up to 70mm material.

If the work pieces are more than 70mm wide then use either the built in spring loaded alignment pins hooked over one edge to align the two ends and/or mount the two wings with the auxiliary spring loaded pins to position the Domino mortise slot(s).

If your work pieces are exactly the same width, you can work from both edges. If they are not, register all cuts from the same edge so that one edge will be properly aligned even if the other edge is not.

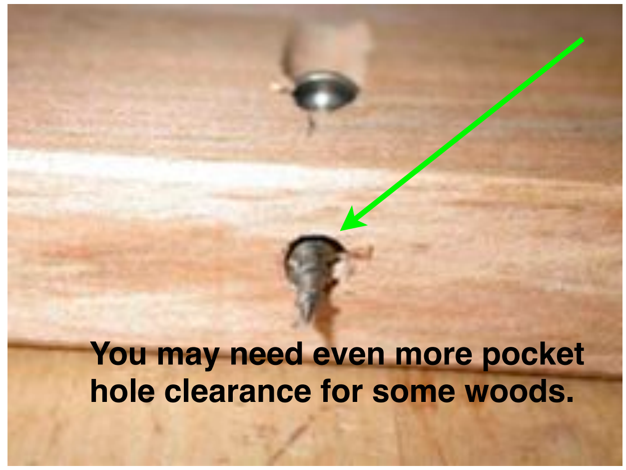
A variation on an end-to-end joint is strengthening a mitered end joint like the one shown here cut in African Blood Wood (sometimes called “Sealing Wax Wood” because of the rich, red natural color).



The ability to swing the fence over a 90 degree arc range is really handy for this cut.

Match the angle to the mortise angle, in this case 45 degrees. Set the depth of cut and the height of the fence to be sure you do not cut the Domino mortise

through to the good side of your work pieces. Usually that will mean placing the mortise below the joint center as shown on the previous page and using a short tenon. This is where the 12mm cut depth setting is really handy.

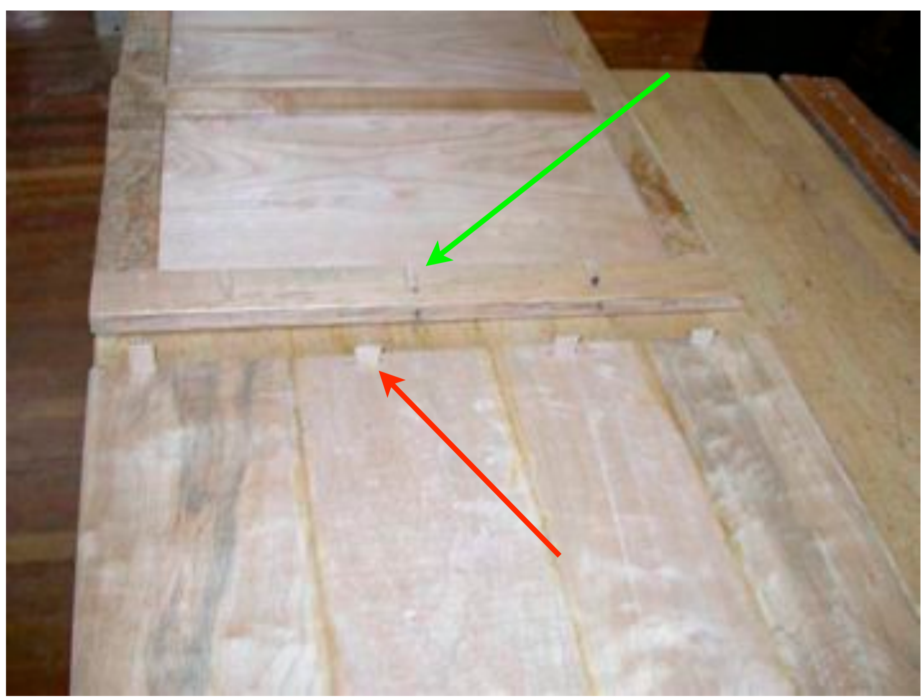


Edge-to-face joints are common when you want to mount one piece of wood perpendicular to another like putting a fixed shelf between two sides of a chest. This is simple and easy to do remembering that the bit center is 10mm above the base of the Domino machine. A board clamped across the side pieces 10mm back from your desired centerline will position the bit to cut the mortise on the sides to wind up centered on a 20mm shelf.

Here I am getting ready to do something similar, but with a significant twist.

While it may be hard to see in these small photos, one of these work pieces is a solid wood glue up (the bottom piece in the lower photo) with grain running up and down while the other is a rail and stile with the stile grain running across the wide grain of the glued up panel. We will see why this configuration is needed when we get to the pedestal desk build-along project a bit later.

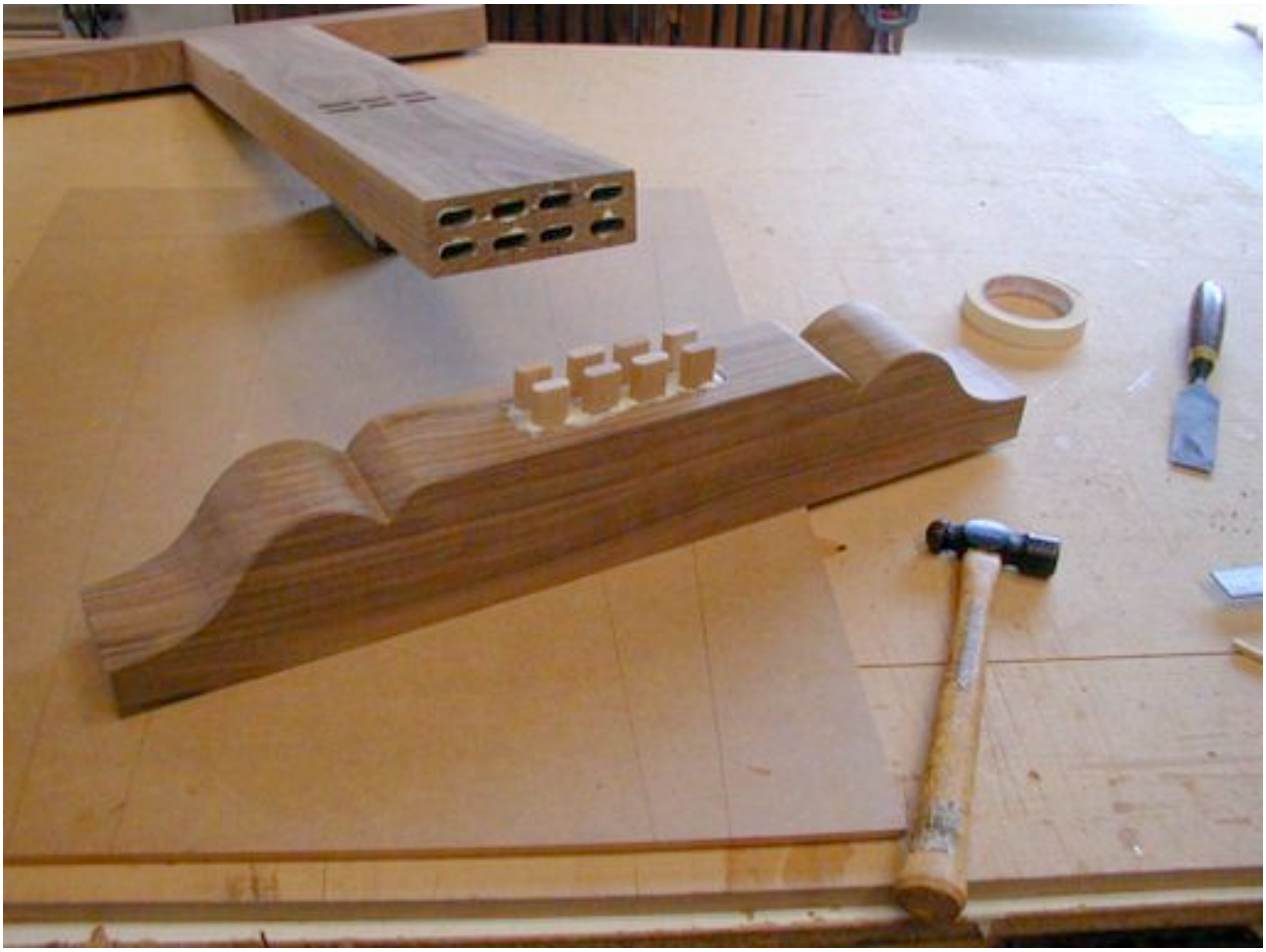
But, given the long grain to cross grain construction, we certainly cannot glue this joint or the expansion/contraction of the glued up panel would fracture the glue joint in a year or less.



To avoid this problem while still keeping the edge of one piece aligned with the face of the other, I am using four Domino M&Ts ***without glue*** to hold the alignment (red arrow), and pocket hole screws with elongated screw holes (green arrow) to actually hold the two pieces tightly together while still allowing one to slide enough relative to the other....a very handy trick to keep in mind.

One final note on joining two pieces of wood. Where even more strength is needed than you think would be supplied by one or two Domino placed along the thickness of the edge, it is good practice to stack Dominos using multiple sets in the same joint.

to side the joint edge closest to the point of force is placed in tension while the side of the joint furthest from the point of force is placed in tension. The shorter the dis-



This photo (supplied by Festool) shows one example. The leg to base joint uses eight Dominos stacked in a 2 x 4 array while the leg to stretcher joint uses six Dominos stacked in a 2 x 3 array.

The more Dominos you use the greater the glue surface area, the greater the Domino surface area, and the greater the strength.

Joints like this try to fail by the racking load applied. As the table is pushed side

tance between the edge of the leg (in this example) and the edge of the Domino, the less bending stress there is and the more pull out stress is applied to the Domino joints on the other side of the leg.

With this many Dominos and this much glue surface it would take a lot more rack pressure to fracture this joint than would ever be applied to a table in normal use.

The same technique also allows the construction of very strong doors.

Domino Machine In Action

Now let's turn our attention to how the Domino machine simplifies and improves the construction of several different furniture projects.

Small Conventional Coffee Table

The legs are cabrio style cut from glued up blocks of Maple. The Blood Wood skirts are attached to the legs with one Domino loose tenon which is more than strong enough given the small size of this particular table. The top is attached via "L" shaped tongue pieces screwed to the underside of the top with the tongue inserted into Domino mortises cut into the inner face of the skirts.

We start by gluing up blocks which will form the legs. Determine the distance you want your cabrio legs to curve out from the inside of the top of

This lovely small coffee table is constructed from highly figured Oregon Big Leaf Maple with Blood Wood skirts. The quilting in the top is so pronounced that you have to touch it to convince yourself that the top is really flat. As this photo shows, your eye is convinced the top is three dimensional with peaks and valleys.

The finish is a water based, environmentally benign pre-catalyzed conversion varnish that has been polished to a mirror like piano finish.

the leg where in mates with the skirt to the outer most portion of the curve.

Make the block that size square and a bit longer than the leg will be high. Do not use Dominos to join these pieces to form your blocks as the leg curve is likely to go

right through wherever you put the Domino tenon causing it to show once the legs are cut out. Next, square up and dimension the leg blocks. You can see the template I used to draw the cabrio leg outline on two adjoining faces of each block lying on the Festool MFT just behind the leg block in the bottom picture.

Next, place the four blocks together so

the corner where the top of the cabrio leg outlines are common are all placed to the center of the stack. Now roughly draw

the outline of the square top of the leg on each block and draw an arrow pointing diagnonally out to what will be the outside of the cabrio curved leg.

Behind the stack of four leg blocks you can see the glue up for the top. That was done using Domino M&T as described in the previous section under “edge-to-edge” joints.

Now set up the Domino machine to cut the leg-to-apron mortises in each face of each leg blank as shown. I wanted the skirts to be inset from the legs by 15mm and the skirts to be 20mm thick. So I set the fence on the Domino machine to be 25mm up from the cutter centerline as

we discussed earlier. Simple to do, just set the height pointer to 25mm and lock the fence as shown in this photo (the Domino body has been removed from the fence so you can more easily see the height setting).

Now make a mark on each leg about half the maximum height of the skirt down from the top of each leg on the two faces which will form the inside top of the leg. Make this mark with an adjustable square set to the desired length so it is the same on all four legs. Set the square aside and don't move the setting as we will need it to align the Domino mortise we will cut in the ends of each skirt piece. The mark indicates the centerline for the mortise relative to the top of each leg and the fence height setting establishes the centerline for the mortise relative to the outside of each leg. Put on the cutter you need, set the mortise width to minimum, and set the depth of cut to be half the nominal length of the Domino tenon you intend to use. As I recall I used a 10mm x 50mm for these legs so the mortise depth was set to 25mm.

Place the Domino fence on the leg surface where you want the mortise and slide it to where the centerline mark aligns with the mark you made on the leg blank, turn on the Domino machine and make the cut.

You will be amazed at how accurately you can position these mortises with "just" the visual reference marks. Using an adjustable square or other "story stick" and a sharp pencil or knife to make the mark, both mortises in each of the four legs will be very close to being in exactly the same place. And, it will only take a few minutes to cut all eight mortises.

Thank you Domino machine!

(Note: you can also just hook the spring loaded pins over the ends of the leg and skirt to align them for this cut as well, if you want to.)

Take each leg blank to the band saw and follow the leg shape you drew on one side of the cabrio leg with the template. Save the off cut piece and tape it back in place with clear package wrap tape. If you look carefully at the photo on the bottom of the last page you can see the saw kerf and the glare of the package tape holding the off cut piece on the leg blank shown.

The taped-on off cut piece reestablishes a flat surface for making the second leg profile cut on the band saw. When you get finished with all four legs, you will have quite a stack of scrap as shown in the photo on the next page.

Sand all the legs to final shape and dimension and cut the profile for the skirts. I like to break the edges on things like skirts with a 45 degree chamfer router bit so the hand feels a smooth, rather than a sharp edge.

Once the skirts are finished, use the adjustable square set as before to mark the centerline of the mortise to be cut in each skirt. Mark each from what will be the top of the skirt so you are always using the same reference and to make sure the top of the skirt and the top of the leg line up.

Reset the Domino fence height to be half the skirt height, keep the width set to minimum and the depth to the same setting you used for the legs. Place the fence on the outside face of each skirt piece, slide the Domino until the center mark lines up with your mark, and make the cut.

If you are nervous about your ability to cut all the skirt mortises to the same centerline you used for the leg mortises, then reset the slot width to the middle setting before you make the skirt mortise cuts. The resulting skirt mortise will be wider than the leg mortise providing some adjustment room at assembly time.

That said, I think you will find the visual reference accuracy built into the Domino machine to be plenty good enough for you to cut all the mortises on the minimum width setting allowing the tenon to do the leg top to skirt top alignment for you. However, if you prefer to cut a wider mortise slot and do your own alignment, there will be very little difference in the leg-to-skirt joint strength as most of the strength of a M&T joint is derived from the glue on the faces of the tenon, not on the edges of the tenon.

Next, shape and sand the top. I like to go up to 800 grit before the first seal coat when I want such a high gloss glass-like finish such as on the top of this piece. Seal it on all surfaces, sand again to 800 grit and do the build coats. Sand the final build coat to 800 and do one light top coat. Set the top aside to cure for a couple of days before polishing.

A bit of a confession here - I have done the polishing long enough to be comfortable polishing a piece after just a few hours of curing, but I don't recommend that to you until you gain a lot of experience as it is easy to burn the finish when it is so young. Once it fully cross-links, it will polish without burning.

For more detail on water based finishes, buffing and polishing take a look at the manual available on the targetcoatings.com home page.

While the top is being finished, assemble the legs to the skirts with glue, legs pointed up. Clamp the skirts down to the top of a flat surface like the MFT to register the top of the skirt and the top of the legs to the same plane and square that assembly while the glue dries.

Finish the leg and skirt assembly and you are ready to mate the top to the legs by

It is easy to make a tongue block with the base of the tongue up slightly less than 7mm from stock that is 12mm thick. That will present a 5mm tongue to insert into the 6mm slot cut on the inside of the skirts. By keeping the bottom of the tongue a bit less than 7mm, when you screw that block to the underside of the table top the tongue will press the skirt firmly to the top while still allowing it to move with normal seasonal changes in humidity.

machining Domino mortises on the inside of the skirts as shown in this photos.

Invert the now finished top on a soft, flat surface. I use a rubber sanding pad but an old blanket will work as well. You do not want to scratch the top you worked so hard to polish. Don't worry though, if you do scratch it, you can remove the scratch by repolishing.

The easiest way to cut the Domino mortises into the inside of the skirts is to cut them while the skirt and leg assembly is clamped to the flat reference surface. Remember that the distance from the base of the Domino fence to the centerline of the cutter is 10mm. If you use a 6mm cutter with the base on the reference surface a 6mm slot will be centered up 10mm leaving a 7mm distance from the bottom of the slot to the reference surface which is on the same plane that the bottom of the top will be on when you mate the two components together.

You can also cut these mortises from the top side if you want more bottom of slot to underside of top dimension. Set the Domino fence height to wherever you want the center of the slot. Add on the auxiliary base for stability. Place the fence on the top edge of the skirt with the auxiliary fence held to the inside face of the skirt and make the cuts. Machine tongue blocks to match, screw them down as shown and you are done. Almost.....

Be sure to sign and date your work before delivering it to family, friends or cus-

tomers. Generations from now that owner will want to know who built your beautiful piece of art furniture and when.

Next let's move to another more challenging coffee table that will help illustrate even more and different ways the Domino machine will speed up and improve the quality of your work.

This is a unique design for a special application. The customer wanted a coffee table with casters, a drawer, and an intermediate shelf for her downtown condo. She is an artist of repute and has decorated the condo in a tasteful blend of contemporary and traditional styles, but with a definite artist's flair.
She also likes to change things around as she rotates her own art into and out of the space.

It was important for the coffee table to both blend in and still be a functional art piece.

Usually wheels and drawers do not work well in the same piece: go to open the drawer and the piece moves requiring two hands to do a one handed operation - not good.

I hit on the idea of the "convertible" coffee table shown here.

The upper photo shows the table in the "contemporary" position while the lower photo shows the "traditional" position.

Converting from one look to the other is simply a matter of lifting off the top, slipping out the casters, inverting the base and leg unit, turning the drawer upright and replacing the top. In either configuration the top is indexed to either the legs or the base via hidden Domino tenons.

The base contains hidden casters and the drawer. When in the contemporary mode it rolls easily from place to place without the awkward look of exposed wheels.
With the drawer down low there is less tendency for the table to roll while opening the drawer for access.

Inverted into the traditional mode the table looks more fixed in the environment and the drawer opens easily in the traditional way.

The book matched intermediate shelf and legs in Oregon Big Leaf Maple compliment the Black Walnut of the top and side skirts. The top is made up of four book matched panels floating inside a picture frame with intermediate cross members and is a real knock out when seen in person.

The trick is to make it all work and that is where the Domino machine comes in. What is a bit tricky here is the need for both an upper and a lower platform made from maple that separates the walnut side skirts and the need for the drawer box to be able to support both a drawer that pulls from both directions and the hidden casters.

I wanted the upper and lower platforms to be mated to the legs to create a maple frame around the walnut skirts and drawer fronts when the table was in either mode. That meant that the skirts could not simply be attached to the upper and lower platform pieces or one would not be able to assemble it as the last edge would either not fit or would have to be attached without positive location by something like pocket hole screws.

The solution came in the form of a unique platform frame to leg joint that, as we will see in a moment, involves a dado in the upper and lower frame members which holds the walnut skirts in proper registration, a skirt-to-leg Domino M&T joint to keep the short skirts that flank the drawer openings

registered to the legs, and a Domino mortise and tenon frame-to-leg connection on both the upper and lower frames to provide the strength necessary to offset the leg stress imposed by rolling the unit around and/or converting it from one mode to the other.

Let's see if I can describe and show the construction details well enough for you to follow.

We will start with the legs. Like the previous coffee table, this unit features a simple cabrio leg that is cut the same way as the more complicated curved cabrio leg we saw before. In this case the legs just flair out in both dimensions so they look right in either mode. In this photo the leg blanks were glued up, a template used to mark the flair, and a band saw used to cut the rough shapes shown here.

This is the same process we used before except this time I waited to cut the mortises until after the legs were formed because you can see from the photo that we need three Domino mortises on each of two sides of each of four legs. The upper and lower horizontal mortises will attach the legs to the platform frames while the vertical mortise will attach the skirts to the legs.

By using the saddle fence shown in detail above, the Domino machine can straddle the square part of the leg to cut the upper mortise from a penciled reference mark using the same technique of an adjustable square or story stick to mark exactly the same distance up from the end of the legs on both sides of all four legs.

The lower horizontal mortise is cut with the leg standing upright on a flat reference surface and with the Domino base also sitting on that same flat reference surface. We know that the Domino base-to-cutter centerline is 10mm. Our platform frame is made from 20mm stock so the resulting mortise will be exactly centered on the frame and hold the frame

fence to one-half the leg thickness so the leg will snugly fit inside the saddle fence. Then I slide the Domino machine up until my mark is aligned with the mortise centerline on the Domino machine fence. Then the clamp

flush with the end of the leg once the mortise is cut in the center of the frame members.

As you can see in this photo the saddle fence keeps the leg standing upright and centered over the cutter laterally while the reference base puts the center of the mortise 10mm up from the end of the leg. While you can hand hold the pieces for the bottom-most horizontal mortises (the saddle fence & flat reference surface secure the work piece and all you need to do is hold it tight against the Domino machine during the plunge cut), it is not easy to hand hold for the upper horizontal mortise cuts.

Since these mortise slots are being cut after the legs have been roughed to shape, I clamp the Domino to the leg so neither the Domino machine nor the leg can move during the plunge cut. As we did before, I set each side of the saddle

holds it in that position while the cut is made.

To check to make sure both mortises in both sides of all four legs line up correctly, I put a dry (no glue yet) Domino tenon into each joint and push the legs together as shown in the top photo on the previous page. If the mortises are all perfectly aligned, the legs will go together easily. If they are not, the legs won't go together at all.

As before, all 8 mortises wound up in exactly the right places by indexing one off of the leg end and the other off of a visual reference mark. That would only work if all the Domino measurements, machining and markings are all spot on - and they are.

Now we need to cut the vertical mortises which will index the side skirts and the skirt pieces beyond the drawer openings to the legs. To cut these I needed to set

the Domino fence to be exactly 22.5mm to center those on the 45mm thickness of the legs. They must be spot on because those skirts will sit in a dado we will cut in the platform frames and they have to also index into the legs via these Domino M&T joints.

I keep a set of metric gauge blocks around just for such purposes. Remember the step block built into the base of the Domino machine? That slides back

and forth to establish a step that will position the Domino fence up half that amount from the centerline of the cutter. One of those stop block settings is for 40mm thick material and it will position the cutter right in the center, or 20mm up. We need 22.5mm up to center on our 45mm legs, so I placed a 5mm gauge block between the step and the fence to register the fence for a 45mm stock thickness to put the cutter centerline up 22.5mm.

I could have just eyeballed 22.5mm on the height scale and pointer, but the gauge block method is much more precise.

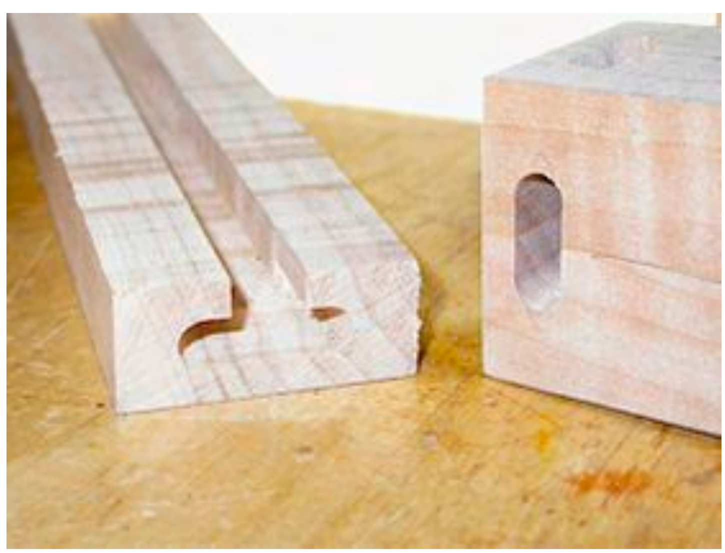
To establish the reference to center the mortise between the other two mortises I used the auxiliary spring pin wings that attach to the dovetail in the base of the Domino fence. You can see that in the photo to the left. By hooking that spring pin over the end of the leg and placing the fence firmly on the flat part of the leg, I could cut the vertical mortises just as accurately as the horizontal ones....great fun and it takes only minutes to do.

I know it looks a bit complicated in these pictures, but when you have a Domino machine in your hands and start using it you will see just how fast and accurate these cuts can be.

The next step was to machine the upper and lower platform pieces to size and then machine the dado that will hold the side skirts. Here I have clamped one of the platform pieces down to the top of a Festool 1080 MFT. I have five MFTs in my studio and they all are in use constantly as I just do not know of any better way to hold work pieces steady while you machine them.

In these photos you can see the Domino machine with the saddle fences set for the 50mm width of the platform frame members and the fence set to center the Domino mortise on the 20mm thickness of those pieces.

Drop the Domino machine onto the end of the work piece, slide it forward until the face of the Domino machine registers



with the end of the work piece and plunge to make the cut. The result is shown on the bottom of the previous page along with one of the legs that it will mate to.

The photos on this page show how the ends of the 10 x 10mm tongues on the side skirts are cut back to clear the Dom-

ino tenon since the centerline of the tenon and the bottom of the dado are both 10mm. (Suppose we should invent a term and call this a “Dominoed dado” joint? grin.)

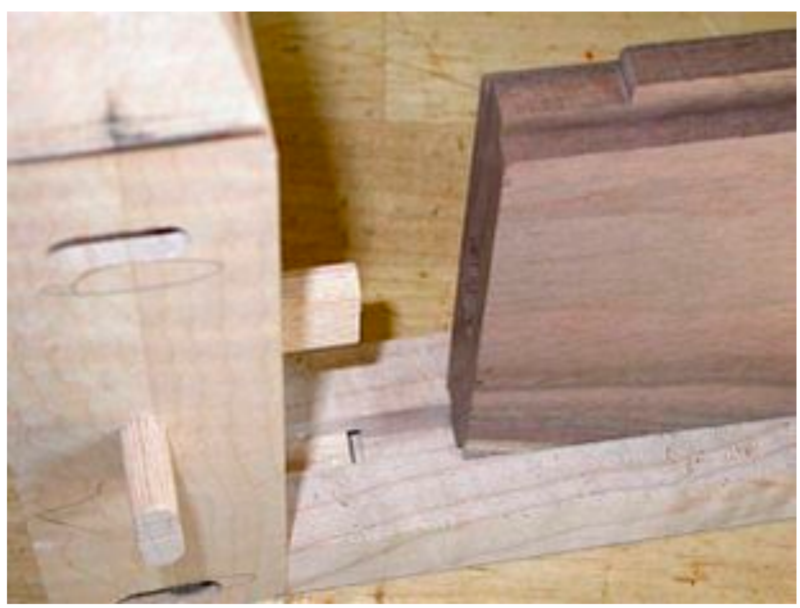
The views here are of the platform frame member that will index to the ends of the legs. The photo above is from the end of the leg view and the photo below right is taken looking down on the platform frame with both the leg and frame members flat on the reference surface.

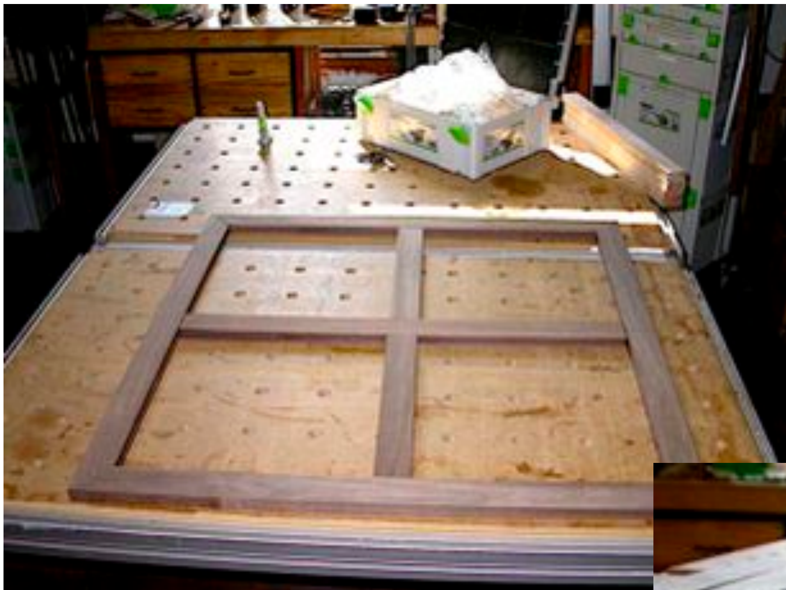
Notice that the side skirt 10 x 10mm tongue is cut back to clear the upper Domino M&T joint just as was done to clear the bottom frame-to-leg joint.

In the photo right you can also see how the vertical M&T joint between the leg and the side skirt will make up as the skirt slides in the dado and onto the leg tenon.

The photo above is after all the parts have been through final sanding, ready for finish and actual assembly.

It all works like a big puzzle and is much easier to do than to visualize beforehand or to see in small photos.





make the four square openings for the book matched top panels.

Mitered corners are not strong enough for such an application so Domino M&T joints were used to reinforce them as shown below left and in detail below.

The Domino fence was set to center the bit on the 20mm thickness of these pieces. I used an adjustable

More work was required to cut the dado in the inside of the top most frame member to accept the maple book matched panels you saw in the opening photos. There also was machining to do to hold the drawer slides and the bases for the hidden casters.

Now we will look at how the top was constructed and how the whole project came together.

The top is a picture frame with mitered corners and interior cross members to

square to establish the length I wanted each mortise to be down from the outside edge of the 45 degree frame corner and used that to make a mark on both ends of the four frame members.

Pressing the Domino fence down on the top face of each frame member and the Domino face snugly against the 45 degree miter cut on the end of the frame pieces, I slid the Domino to the point where the bit centerline was aligned with my mark and made the cut. As was discussed in the earlier section on miter corners, look carefully to make sure your mortises do not go through to the outside of the frame. Shorten the tenons by cutting them if you have to.

In the upper left photo the top is registered into the end-of-leg to underside of top Domino M&T joints to make sure the legs and top will properly mate in the final assembly.

With everything square and accurate I could invert the piece and do the top of frame to underside of top Domino M&T joints since those are in a different place than the end-of-leg to underside of top joints.

Once all the components fit together correctly, it was off to final sanding and then to the finish room.

Notice also how the frame center cross members are held in Domino M&T joints in both directions to make for a very strong outer frame for the walnut top.

The final steps are test assembly of all of these components. When these pictures were taken I had already finished the top. The photo above shows clamps holding the leg-to-panel frame joints tightly, clamps holding the whole assembly into a known square corner, and clamps holding the skirt pieces on each side of the drawer openings tightly to the leg-to-skirt M&T joints. I removed the clamps holding the unit to the known square corner front to back so you could see the details more clearly.

For more info on clamping into a known square corner, look at the manual I wrote about the Festool MFT which is available for download from the festoolusa.com web site.

The following photos show how I like to finish all components in the flat, before

final assembly.

With no top in the way it is easy to polish the book-matched maple panels that form the intermediate shelf and to spruce up the skirts, legs and frame members.

The last step was the signature block and then notifying the customer that the piece was ready for pick up.

They were thrilled, and so was I!

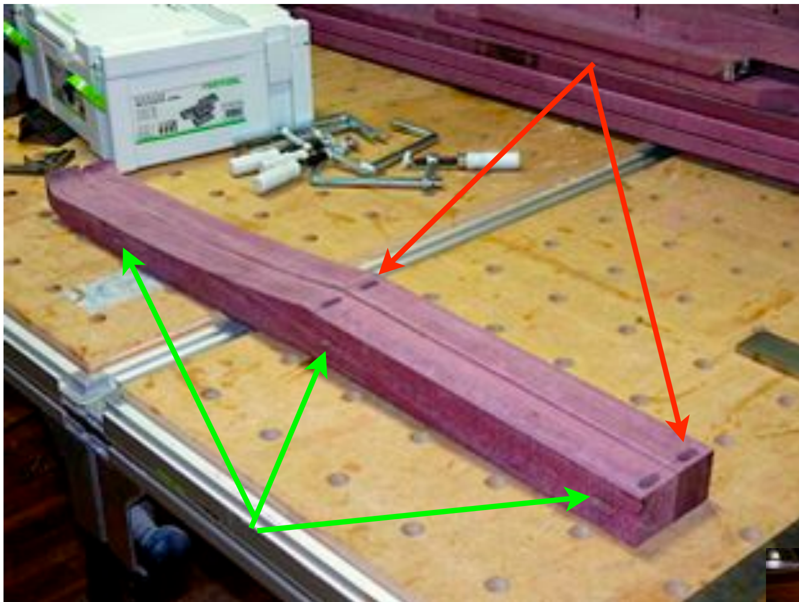
Let's switch gears a bit from how the Domino machine does all sorts of very precise M&T joints to how it can do many other things with ease as well.

Wine Service Center

First, let's look at an interesting wine service center, this one made from Purple Heart and Maple Burl. The sides and back are done as R&S with 10mm thick slabs of maple burl as the panels. The doors slide in machined grooves cut in the top and bottom front frame members. They have to fit the opening tightly to look right and feature a very unique Domino enabled moving pin mechanism that we will see in detail later.

A curved maple drop fits into a sliding dovetail groove to soften the opening below the base of the upper cabinet on the front, back and sides. The top is held to the legs and upper frame by tongued splines screwed to the underside of the top. The bottom shelf is held to the leg stretchers by wide Domino mortise slots and tenons inserted without glue to allow for seasonal expansion and contraction of the shelf.

Let's build it.....



and lower side frame members and to hold the leg stretchers. Since those frame members are oriented with their wide face up and down (where the front and rear frame members are oriented with their narrow edge up and down) we need to cut those mortises in a vertical, rather than horizontal orientation as shown below.

While they can be cut before the legs are profiled, I find it easier

to do so after profiling because the bottom frame is made up of pieces in different orientations (front and back narrow edge visible, sides wide face visible) and it is easier to see the relationship between these two locations after the leg is cut than before.

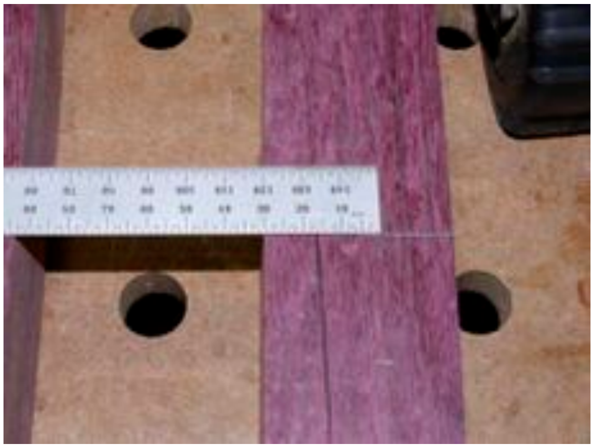
To do the locating I tape the cut off piece back onto the leg to provide a reference surface and more flat space to support the Domino base. You can see this in the

As before, let's start with the legs. Glue up stock to make four blanks. In this case the legs flair out side to side, but not front to back. Construction is the same, but we only need to scribe our template on one face, not both faces as is the case with cabrio legs.

Dimension all four leg blanks to be exactly the same size and perfectly rectangular so we can reference from both sides.

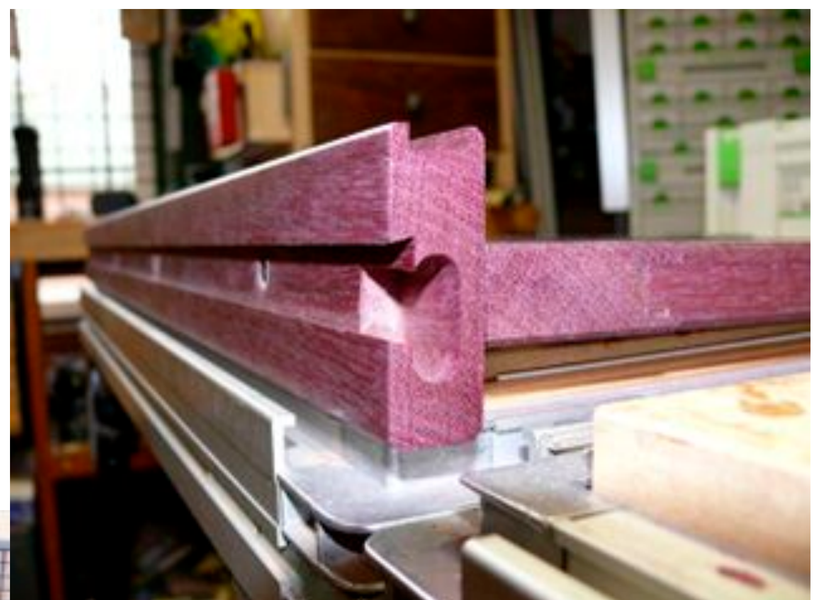
We will need Domino mortises cut horizontally (red arrows) on the faces of the legs that will be in towards the center of the completed piece. One will be set 10mm down from the top of the legs to hold the front and rear upper frame members. The other will be set down near where the leg flair begins to hold the lower front and rear frame members. The position of that mortise determines the overall depth of the cabinet portion of the piece.

We also need Domino mortises cut in the sides of the legs that will face front to back (green arrows) to hold the upper photos below. Here is the locating of the leg stretcher mortises. With both sides of



the leg curved you need the cut off piece to get a reference. Be sure to align the cut off pieces in the same place up and down on the leg so the relative saw kerf is the same on all four legs.

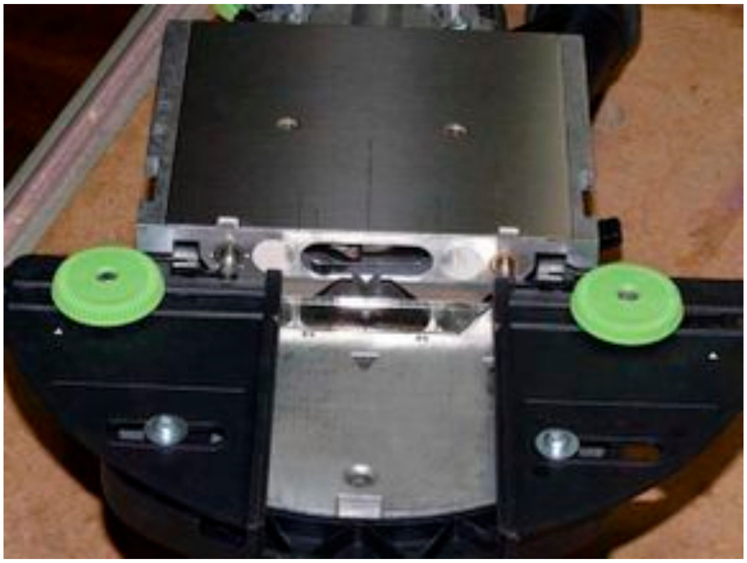
While I did not need it here, use of the auxiliary fence would provide more stability for the Domino machine for cuts such as these.



Next comes the cutting of the Domino mortises in the ends of the frame members. The front and back members are cut horizontally by use of the saddle

fence shown here and on the next page.

The mortises cut in the front and back upper and lower members are not cut in the center of the 50mm dimension. Instead they are offset a bit so their edges will line up properly with the side



such as cutting the tracks for the door slides, cutting the dados to hold the bottom of the cabinet, cutting the dados that hold the side burl panels, etc.

Meanwhile, let's see what the skeleton looks like. The shelf is not in place for these photos. We will get there a bit further on.

frame members. In the photo above you can see how one side of the fence is further away from the bit center than the other. In the lower photo on the previous page you can see how this results in a different centerline for the mortise than for the dovetail groove which will hold one of the curved maple pieces.

Even seemingly difficult alignments like this one are easy to do by using the lines scribed on the clear plastic window and the scales on the upper portion of the saddle fence.

To make the cut, clamp the work piece to the top of the MFT, drop the saddle fence over it and push the Domino up snugly to the end. Set the depth and the width of cut and plunge to make the cut....fast, easy and very accurate.

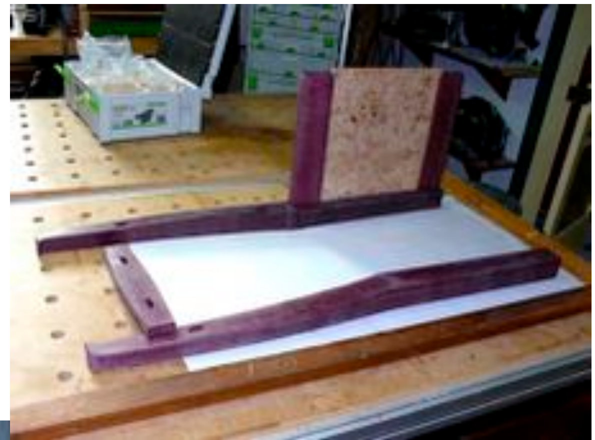
The next several photos will show a mock assembly of the main structural members so you can see how they go together. Before we actually assemble the piece, however, there is more machining to do

These are the main pieces of the skeleton. Note that the top edge of the front, back and side frame members all align with the top of the legs. The lower edge of the front, back and side frame members align together.

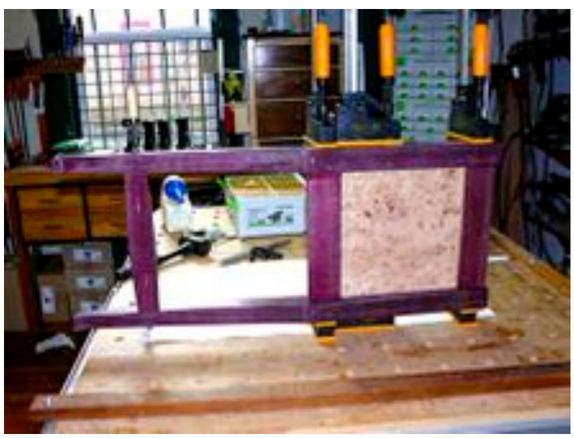
Now that we see what the structure is going to look like, let's go back and show some really innovative uses of the Domino machine.

The first thing to do is assemble the two sides after cutting the groove for the burl side panels. These photos show this sequence.

Once the sides are glued up and squared with the leg stretchers in place, we can turn our attention to building the back rail, stile and burl panel and the two front doors.



In the photo above notice how handy the Festool DX 93 E detail sander is for reaching into tight spots such as where the leg stretchers meet the legs. Any glue squeeze out on purple heart really shows once the finish goes on so be sure to sand very throughly.



The photo above shows a booboo. When I first started this piece I thought it would look good with a book matched maple top. You can see the glue up here. But, once the piece was completed it became clear that a maple top was "over the top" so I crafted the purple heart top you see in the final piece.

Now let's construct the rail, stile and maple burl back panel. The doors will be done the same way. We saw earlier how I now use Domino M&T joints cut inside the tongue and groove joints of the rail and stile components to both reinforce these joints and to make them self-aligning.

With normal rail and stile construction when you clamp up the assembly the rail pieces with the tongues cut in their ends can slide down the groove cut in the stile pieces leaving the assembly either out of square or with an unsightly gap between the edge of the rail and the end of the stile.

The Domino M&T eliminates that misalignment by holding the edge of the rail flush with the end of the stile speeding up the whole process by much more than the time required to cut the Domino mortises in the first place. That is what I call a real win-win.

The same is true with respect to placement of intermediate stiles as we will see shortly on the back assembly for this piece. Normally you have to measure and mark the location for those and make sure the intermediate stile stays in the right place while you glue up and clamp up. On many occasions that turns out to be quite a time consuming process.

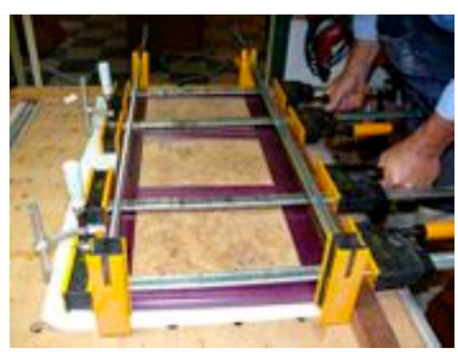
Well, watch here while the back rail, stile and panel components go together. The Domino M&Ts keep it all aligned without me having to do anything.

While this would not necessarily be true for everyone, I can justify the cost of the Domino machine for this one reason alone!



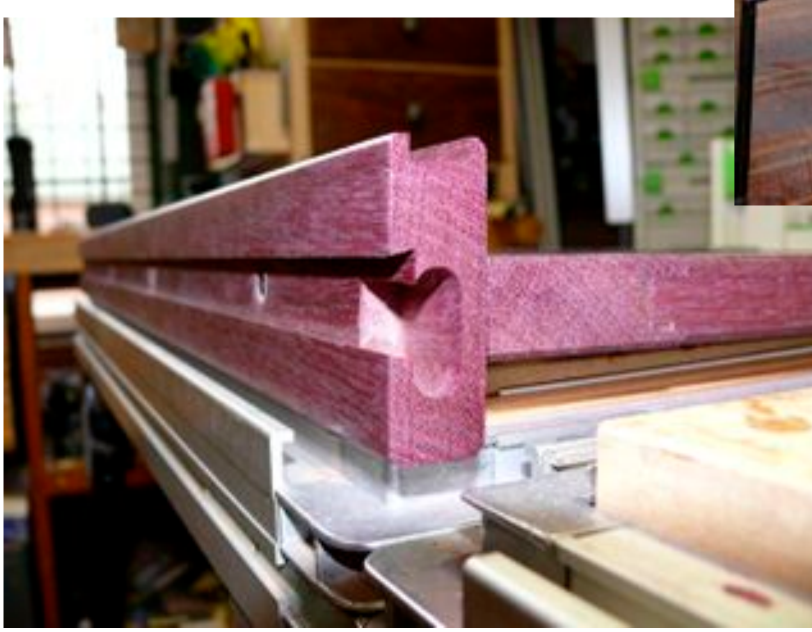






The self-aligning feature of a Domino M&T joint cut inside a normal R&S tongue and groove joint really speeds up the process of assembling a multi-panel component like the back on this piece.

With the back now finished it is time to mate the dovetailed and end mortised rear lower frame rails (which also have the groove that will hold the bottom of the cabinet in place) to the bottom of the back component. Since this is a long grain component that will attach to the long grain of the back lower stile, we can screw these two together with the screws placed inside the sliding dovetail slot.



As we assemble we can slide the lower maple curved pieces into the sliding dovetail slot while we insert the Domino tenons to affix the back and the front frame members to the sides we completed earlier.

Next we suspend the shelf

between the two leg stretchers using Domino tenons inserted dry (no glue) into wide mortises cut on the inside of the stretchers and the ends of the shelf. From previous descriptions, aligning these

mum depth) is cut parallel with and centered on the bottom and top surfaces of the door.

Then I turned the Domino machine sideways and cut a 5mm mortise centered on the 10mm mortise both side to side and top to bottom.

A 10mm tenon was drilled to accept a metal pin a bit

mortises should be easy for you to visualize. Here is the piece assembled (minus top and doors), squared up and waiting for the glue to dry. All of the major joints are Domino M&T joints so assembly is fast and self aligning.

Now let's revisit the sliding doors. Earlier I said that the doors had to fit snugly into the door openings to look right. The problem with most sliding doors is they have to fit loosely enough to lift up into a top track to let the bottom free of the bottom track to get the doors in and out. That simply looks bad and is not pleasing to use.

So, let's use the Domino machine to do something far more satisfying and sophisticated, a sliding pin assembly that can be withdrawn up into the door itself and then lowered into the door tracks once the snugly fitting door is in place.

In the lower close-up photo you can see that I cut two overlapping mortises. One (10mm wide and maxi-

smaller in diameter than the width of the sliding door tracks machined in the front upper and lower frame members. I cut the length of the tenon so the end of the pin would be flush with the bottom or top surface of the door when it was fully inserted into the 10mm mortise. A hole was then drilled into the face of the 10mm tenon through the center of the 5mm mortise so a small screw can secure the 10mm tenon/pin unit either withdrawn up into the door or with it lowered down into the track.

Get creative with the dowel or rod component and you can create all kinds of neat looks.

Slick as can be we have a snugly fitting door with hidden sliding pins yet the doors can be easily removed and replaced any time.

This same double overlapping mortise idea can be used for making nice hidden latches as well. For a latch cut the 5mm mortise in the front of the door and replace the screw with a nice small dowel or decorative rod. Slide the rod or dowel back to retract the Domino tenon to release the door. It doesn't matter whether you put the latch at the top, side or bottom of the door. It will work just the same way.

Now that we have seen how the Domino M&T can be used for joining pieces, aligning pieces to be joined by other means, and used for things like hidden door slide pins and latches, let's move to still two more projects to find even more innovative uses for the Domino machine.

Double Pedestal Desk with a Twist

Double pedestal desks are very common and many woodworkers eventually get around to building one either for themselves, some other family member or a friend. They mostly all look a lot a like as the top sits on two pedestals, usually with drawers both in the pedestals and in the bridge between the pedestals.

Some of these designs can be quite handsome.

Sometimes the requirements and/or the aesthetics call for something quite different while still maintaining the double pedestal look and function. Here is an example we will follow because it holds a number of hidden Domino "tricks" that greatly simplify construction and speed up what otherwise would be a long and involved build process.

The "finished product" pictures were taken in a show context in one corner of my booth space along with a couple of the other "Domino inspired" pieces we have already covered so excuse the background clutter.

In this case the client is an active, energetic person who spends a lot of time at her desk. She is slender and tall with long legs and her most comfortable working position is sitting in her chair with her legs folded. That meant the space between the pedestals and from the floor to the underside of the desk top had to be maximized.

This piece was a surprise birthday gift from her husband so I couldn't engage her in the design process as I normally would do. Fortunately, I had designed and crafted other pieces for them so I was familiar with her tastes, home and decorating style.

Retro, modern, clean, colorful and functional all describe what I was after, and what I though she would want. She also needed to be able to reconfigure her work space to fit a variety of the projects she does so "flexibility" also had to be added to the equation.

The "last" design requirement was she needed to temporarily house and hide a tower style computer until she purchased a new lap top. Then that pedestal needed to morph to some other use. Oh, and they move frequently, so transportability was an issue, too.

Ready to give up yet? Well, don't. I found a way to meet all of these requirements and design aesthetics that landed me a really big hug when she first saw the finished piece.

The husband arranged to have a very small "happy birthday" placard discretely tucked away on one corner of the top so she would eventually see it when he brought her into the show.

She entered the booth and after the greetings, she began, as she

always does, to examine the various pieces on display, oohing and awing as she went. A friend with them noticed the “happy birthday” placard on the desk first and nearly fell over. The guest contained herself until the client finally saw the card as well. Then the tears and hugs began.

Can’t beat that for a reward.

Now let’s look at the “Domino content” of this project.

Transportability meant that the top needed to come apart from the pedestals. The requirement for maximum space between the pedestals and between the ground and the bottom of the top meant the top had to be very strong to span the distance, yet there would be no conventional pencil drawer bridge to help support it.

The solution was to build the top as a two piece torsion box with the top and bottom layers of the torsion box joined with long sliding dovetail stringers as can be seen in this detail of one front corner of the top assembly.

There is a lot going on here. The top is one solid glued up slab of Oregon Big Leaf Maple so it will expand and contract a lot front to back, summer to winter. It also would want to warp in sympathy with the annular growth rings in each of the individual boards that make up the large glued up top.

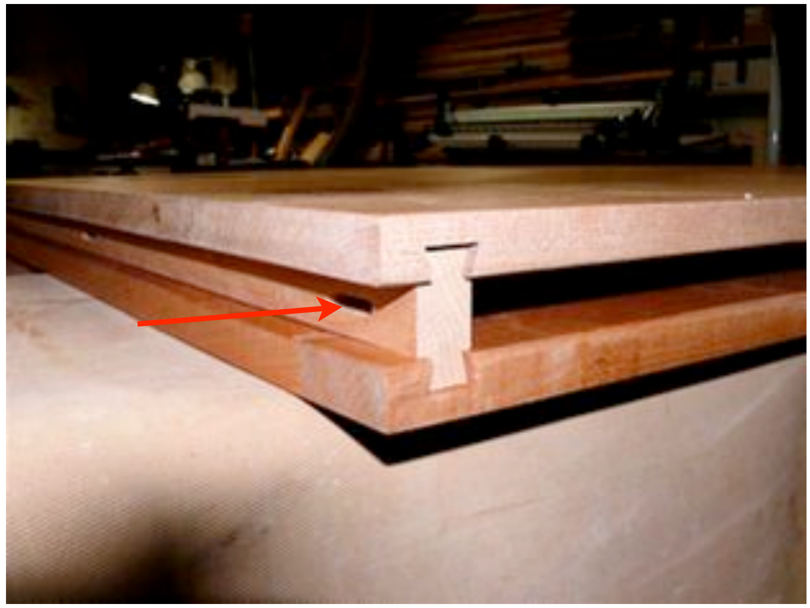
Sliding dovetail stringers going front to back and spaced about 300mm apart, such as I use under solid wooden kitchen counter tops, will solve the warp issue as they will hold the top plate perfectly flat for generations to come.

I could also dovetail the bottom of the same stringer to be the means of holding the bottom plate of the torsion box to the top plate. But, you can’t put those sliding dovetails too close to the edge of the top or the stresses from normal seasonal movement might break off the edges of the dovetail grooves.

Moving the outboard most stringer inboard far enough for strength would solve that issue.

The design of the piece required the top be banded with Blood Wood on all four sides to make the top look massive and allow it to float visually off of the blood wood risers on the top of each pedestal. That imparts a distinctly Oriental flavor to the piece that makes it both modern and clean at the same time.

But, how do you hold the blood wood banding across the end grain of the maple top? The top has to move front to back so you can't just attach the blood wood to the top.



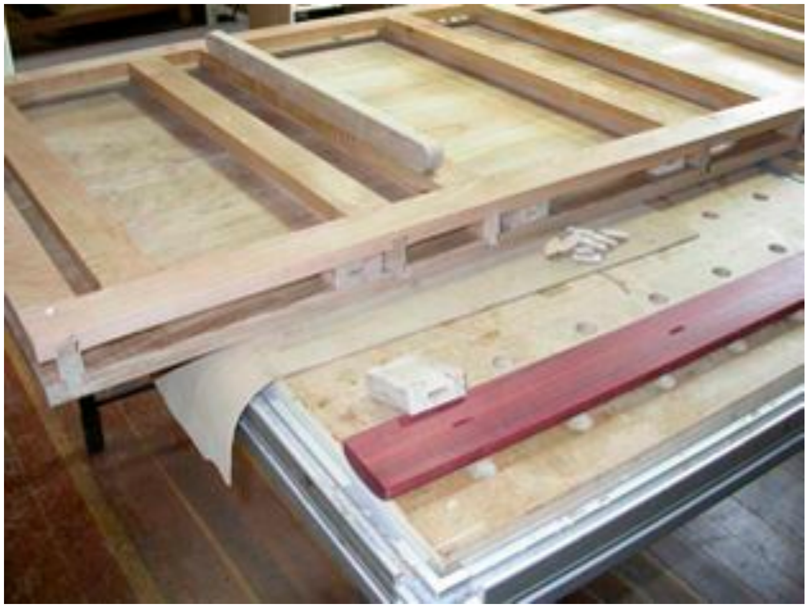
The solution was to add a dovetail groove to the inside of the blood wood and a dovetail stringer filling the space between the edge of the top and the outside edge of the torsion box stringer as shown in the photo on the previous page.

Domino mortises were cut on the inside of the space-filling stringer and the outside of the torsion box stringer (shown here by the red arrow). Domino tenons were glued to the dovetail stringer which is attached to the blood wood end banding. Then, after the top was completed, that assembly was glued into the mortises in the torsion box stringer. That holds the blood wood edge firmly in place but the top plate is free to move, both sliding beside the blood wood and across the dovetailed torsion box stringer.

The lower photo shows the underside of the torsion box top. The space between the dovetailed stringers running front to back to hold the top plate to the bottom portion of the torsion box were spaced to allow the two different sized pedestals to fully support the top assembly no matter which pedestal was on which end. More on that later.

The spaces between stringers support the slide-out work surfaces you saw a couple of pages back. The slide-out work surfaces are what allow her to configure the work space to fit the requirements of her various projects. The center pull-out is a shallow pencil tray that can be inverted to make yet another work space.

So that is how Domino helped solve the differential wood movement issue between the blood wood long grain edges and the maple wide grain top. Now, how about the blood wood banding across the back? It could just be screwed in place, but that would look ugly.



The solution here was to Domino M&T maple spacers to the inside of the rear blood wood banding to form a series of “tongues” the same thickness as the distance between the top plate and the bottom portion of the torsion box.

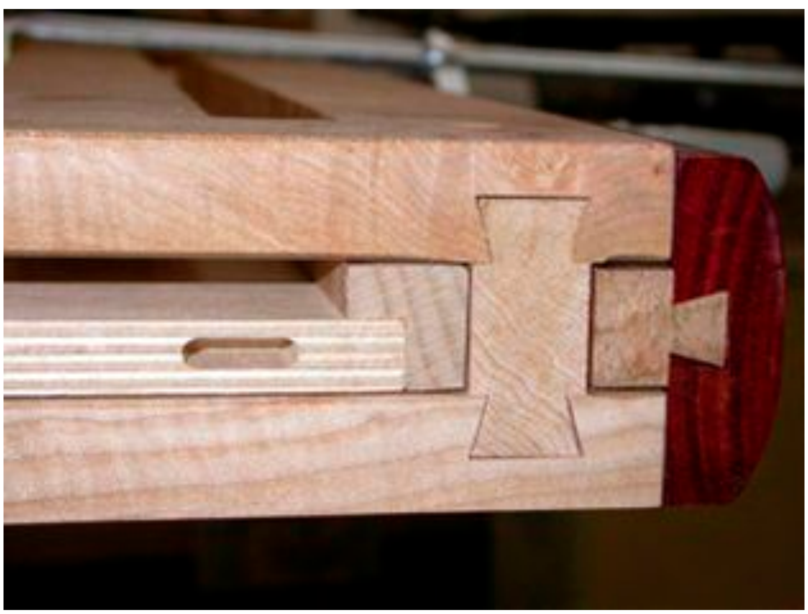
I drilled a hole in them that was larger than the diameter of the washer head screws I intended to use to hold those tongues to the underside of the top. That way I could pull the blood wood banding up to within 1mm of the back of the top plate and secure it with the washer head screws to the under side of the top. Now that band will move with the top in and out as the top expands and contracts. The oversized hole will take up any error if the top wants to contract more than I allowed for.

I also used a Festool counter-sink on the side of the tongue that would be against the top to provide even more wiggle room for those screws. You can see that in the bottom photo. The trim is inverted so I can counter-sink into the edge that will be against the top.

Here you can see how the rear corners fit so nicely while properly allowing for the movement.

The next step was to provide for the banding across the front. I made work surfaces by Domino M&Ting (is that becoming a verb?) the plywood extending work surface to a side slide that would hold the work surface flush with the underside of the top as shown here.

Worked like a charm!



Next, the blood wood banding was affixed to the front of each work surface and the shallow pencil tray by more Domino M&T joints.

The whole top can simply be lifted off and transported separately, yet it is so strong you could stand in the middle of it if you wanted to. With all the expanding work

surfaces closed, the top looks like one thick monolith that creates a strong horizontal line to accent the clean, modern look. When you actually see the desk, the blood wood spacers that hold the top up off the top of each pedestal blend with the blood wood band for a really slick effect.

would be considered the “back” of the desk?

The answer to this set of questions was to make the pedestals look exactly the same on both the front and the back and also to make them look the same side to side even though they are different widths.

Good solution, but we will need to deal with the wood movement issues since the back of the drawer pedestal and both ends of the open pedestal need wide grain solid maple from top to bottom to simulate the look of the drawer fronts, and the sides of each pedestal are rail, stile and panel components where the long grain of the side stiles will be running across the wide grain of the faux drawer fronts.

With the top completed it was time to deal with the pedestals. One pedestal was to be drawers while the other was to hide the tower computer and the peripherals. That pedestal was designed so the side you can’t see in these photos is open. When she changes computers, shelf holes drilled in the insides of that pedestal will allow a shelf to be added and it can become a bookcase.

Now, what if in a future location the bookcase pedestal needs to be turned around so it is open to the inside of the space between the pedestals? Or, what if she wants to swap pedestals side to side to put the drawers on that side? Or, what if she wants to have the desk in the center of a room and access to the drawers from what normally

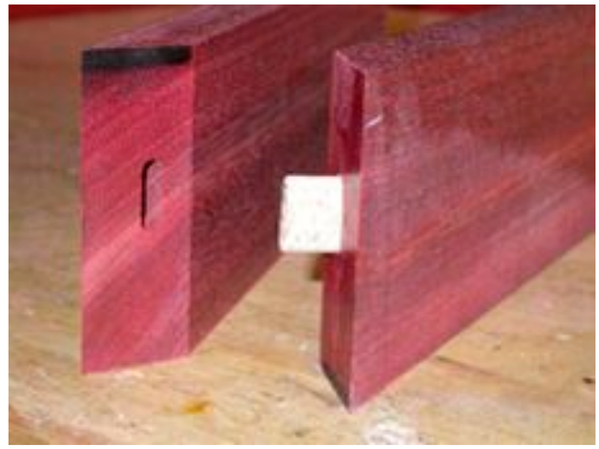
I thought long and hard about that one until I remembered the slick Domino double mortise sliding door pin idea. This time I cut wide mortises for 10mm tenons along the edge of the side stiles and a mating 5mm mortise running the same direction on the inside face of the side stile. By gluing the Domino tenon into a tight fit mortise in the back side of the solid maple pedestal end, the exposed end of the tenon would be visible through the 5mm mortise slot as in the photo at the bottom of the last page (photo taken before the tenon was glued so you can see what is going on). Insert a screw with a round head that was a tight fit into the 5mm slot and the answer was at hand.

The screw into the tenon prevents the tenon from withdrawing from the unglued mortise in the side stile while it still allows the solid maple pedestal faux drawer front to expand and contract independently. You could also use a dowel to pin the tenon, but the screw is faster.

That technique was used on the open pedestal as these slots are actually quite attractive and will not detract from the look when that open pedestal becomes a bookcase in the future. For the back side of the drawer pedestal that will never be seen from the inside and which needed greater strength, I used the Domino M&T (no glue) and pocket hole screws going into oversized

through holes as we discussed earlier in this manual.

In the photo above I have installed the other side with all the drawer slides in place and I am obviously please with this slick solution.



Again, thanks, Domino machine!

It was easy to build the blood wood top-of-pedestal stand offs using the Domino M&T joint to strengthen the otherwise weak miter joint. It is hard to see in these small photos, but the top of each pedestal is plywood for strength and each is inset into rebates in the sides and backs. The blood wood stand offs attach to those from underneath where the fasteners won't be seen.

In the lower photo you can see the faux drawer end attached to one side, and below while I am installing the drawer slides.

The last part of this project was to make separate pedestal bases that each pedestal would nestle into. The separate base allows the faux drawer fronts to expand and contract into a recess without effecting the floor to top dimension.

I added decorative corner dovetails made from blood wood to the corners of the pedestal bases to dress them up a bit.

While you may never make a desk such as this, I hope some of the Domino machine specific procedures demonstrated here find their way into your woodworking experience. They really are great problem solvers.

We are now to the final illustrative project to show off the many, many different uses for the Festool Domino machine - the butterfly leaf table.

But, before we start into that one, let's take a moment to talk about an easy way

to place Domino mortises into thinner work pieces like edge banding.

Making the mortise cuts is easy, holding thinner or smaller pieces safely is not.

What I do is place thinner pieces on the top of the aluminum extrusion that forms the sides and ends of a Festool MFT. The top plate is higher than the aluminum extrusion by about 14mm so, as long as

your work piece is wider than that, you can trap the work piece between the face of the Domino and the edge of the top while pushing down on the Domino fence to register and hold the material in place

while you cut the mortise. I also like to register the end of the piece against a stop so it can't slide side to side while I am making the cuts, especially if I am using one of the spring loaded pins for end to mortise registration as I am doing in this example.

At the vary beginning of this manual I said that the construction of a butterfly leaf table was for many woodworkers a bit of a rite of passage. Because it is so difficult to build correctly using conventional construction techniques, it is often a frustrating experience trying to get all the pivot points to line up properly.

The construction techniques we will follow here greatly simplify all aspects of these interesting and useful tables. I think you will find them helpful in expanding your woodworking skills into a whole new range of projects. At least, that is my hope.

So, here goes.

Butterfly leaf table

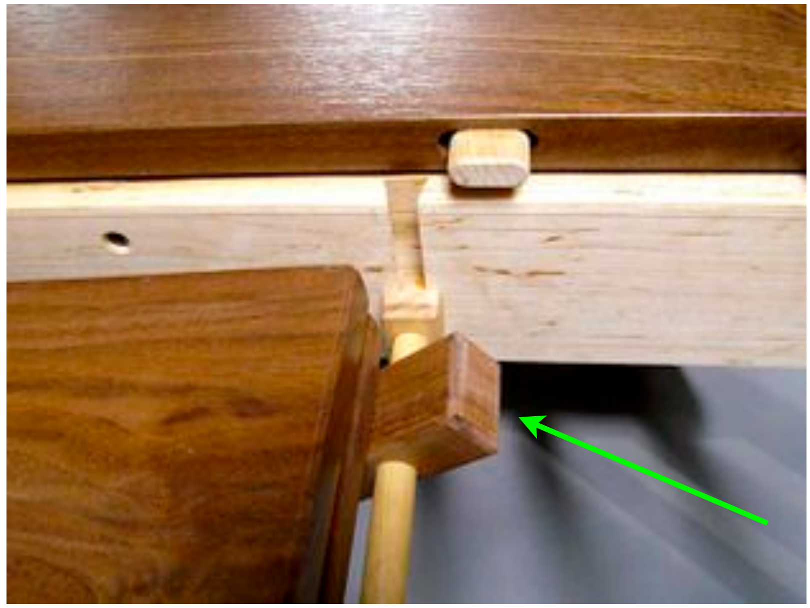
This example is a very small dining table sized to fit an upscale arts and crafts

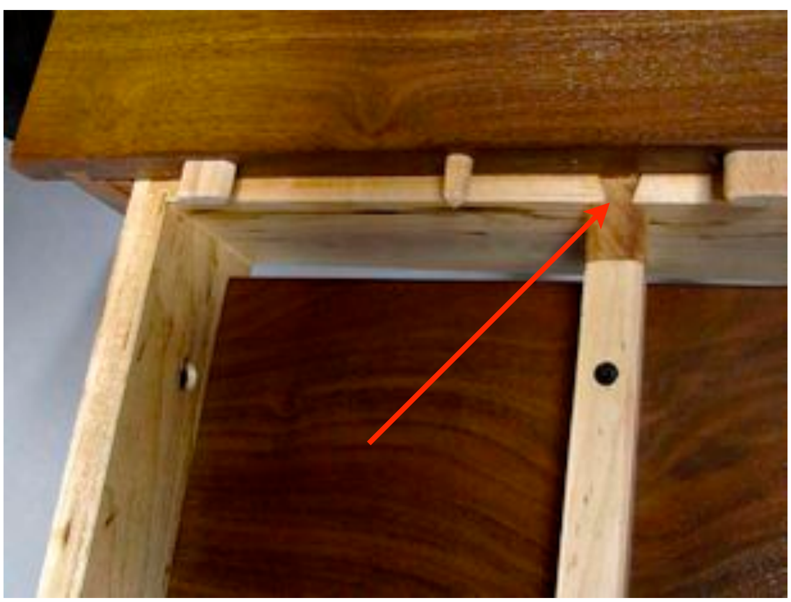
style condominium which has no formal dining room so it has to fit into the eating space in the kitchen area.

Because it is so much smaller than a conventional dining table, I designed it to look like a library table when closed. This one is made from Oregon Black Walnut and Australian Silky Oak (often called “Lace Wood” in this country). It is 850mm wide by 1580mm long when closed. It is standard height at 750mm. The leaf is 400mm wide so extended the table grows to 1980mm long. In inches these dimensions are 33.5” wide by 62.25” long closed (78” when extended) and 29.5” high.

The characteristic of a butterfly leaf table is that the leaf stores folded under the table top on hinges that allow it to automatically deploy and line up with the rest of the table surface just by lifting one section of the leaf. In order to line up properly the pivot points where the leaf folds and the pivot points for the deployment mechanism must be in exactly the correct locations relative to one another and to the top of the table. Lining those up is what generally makes this kind of table tough to build.

As we will discover as we progress through this project, here the deployment mechanism pivot points are set in vertical sliding dovetails and the leaf attaches to that mechanism by screws placed up from the bottom. What this





allows is for all of the critical alignment to take place ***after*** the table is constructed, not before as is required by the conventional construction methods.

One of the last steps in the construction process is to invert the completed top and leaf assemblies and align them the way they will be when the leaf is deployed. Then the table mechanism is placed upside down on the aligned top and leaf assembly. When everything is square the pivot mechanism (red arrow in this photo) slides in the dovetail groove until it is snug to the underside of the leaf. At that point the leaf is screwed to the pivot mechanism and the dovetails on either side are pinned in place so the pivot point can no longer move.

This results in the pivot points being properly aligned so the leaf will deploy as it should without any measuring or guesswork on the part of the furniture maker. Nifty and dead on accurate.

The leaf is guided up and over the table skirt by the slides (green arrow) shown above which also are set in sliding dovetail slots so they can be properly adjusted after the table is completed as well.

Let's go back to the beginning and start with the functional design requirements.

To be comfortable, a dining table needs to provide at least 600mm (a bit under 24") each for diners seated side to side. There must be at least 300mm on either end to accommodate diners seated at the ends of the table as well.

The width is really a matter of personal preference and proportional aesthetics. It needs to be at least 700mm wide and generally more in the range of 1000mm to 1200mm wide to allow for serving dishes or decorations in the middle of the table. In our case we did not have that luxury so I compromised the room in the middle of the table and made this one just 850mm wide.

The legs should not interfere with any of the diners. For frame style legs like these there needs to be at least 250mm clearance between the end of the table top and the legs to allow the diner knee space without hitting the leg structure.

For such a small table, the minimum length was dictated by the owner's desire to be able to seat four comfortably when the table is closed and six when it is open. To seat four the legs would need to be at least 250mm in from the ends of the top and at least 400mm apart. But, to accommodate two people seated on each side, the legs would have to be at least 800mm apart when the table is extended.

That makes the minimum extended top at least 1400mm long (800mm or more between the legs plus 250mm at each end plus the thickness of the legs). At 1400mm long the table would feel crowded with four people. To make it more comfortable and still stay within the very tight space constraints in the room, I designed this one to be 1580mm long when closed with the legs set back 270mm from the ends of the table.

While small, that is a remarkably comfortable length for four people while still allowing for minimal table decorations in the center.

The 400mm wide leaf provides plenty of shoulder room for two diners seated at the sides of the table and between the two leg frames so long as the legs move out with the top.

That is one of the design issues for this small table. Most butterfly leaf tables require a fixed pedestal or a trestle to support the folding, self-storing leaf and it's deployment mechanism. This table needs to be built strong enough to support the span between the legs when the table is deployed and also sturdy and rigid enough to support the leaf deployment mechanism.

Both Domino loose tenon joinery and sliding dovetail construction of the table structure play major roles in providing the necessary strength and rigidity.

Gluing up the top plates is just a matter of grain matching to achieve the desired look. In this case there are four boards in each half of the top. Starting at the center and working out these are laid out to be book-matched pairs. That is, the two center most boards on each half of the top are a book-matched pair. The next boards out are also book-matched pairs, and so on.

I selected pieces that had a lot of grain movement to mask the overall small dimensions of the top. Once each piece was joined for the glue edges and planed to the exact same thickness, Domino mortise slots were cut in the mating edges as described earlier.

The spring loaded alignment pins on the fence of the Domino machine were used to register the first slot in from the side while the side stop with it's pin registered into this slot automatically registered the others.

I always recommend doing your glue ups with the good side face clamped down on a Festool MFT work table. A piece of white butcher paper will protect the MFT top from glue squeeze.

When you glue them up clamped to a known flat reference surface they come out flat and remain that way. The glue lines sand off quickly with the Festool Rotex sander followed by working up through the grits until you have a nice, flat, perfectly smooth surface.

The next step is to glue up the leaf pieces. In this case the leaf hinges in the middle so you have a chance to do interesting things if you want to.

of stock so the hinge line would define two different leaf halves rather than just being an interruption to the flow of the grain. It looks really good in person, almost jewel like.

While we are on these photos, notice how Domino tenons are used for the vertical positioning of the two table halves and the leaf to table connections. On the

In the upper photo you can see the selection I made. I decided to have the leaf become the focal point for the table when extended. So, instead of building the leaf with the same grain look of the rest of the top, I instead built it as two side to side, but not end to end, book-matched pairs hinged in the middle. I used hidden Soss hinges (red arrow) to hold the two leaf parts together and allow them to be tight when deployed (as shown above) yet smooth in action as they are deploying.

You can see them in the photo right where the leaf stack has been turned all the way around to show the underside (where the signature block is located) of the left-most leaf half. The right-most leaf half is in its normally deployed position. You can also see the deployment guide pads (green arrow) that swivel on the dowel that connects the two pads side to side.

The leaf halves were also joined with Domino mortises and tenons the same way the top glue up was done. I selected walnut pieces which would produce an hourglass look when the two pieces were book-matched side to side. I purposefully did not make these from the same pieces

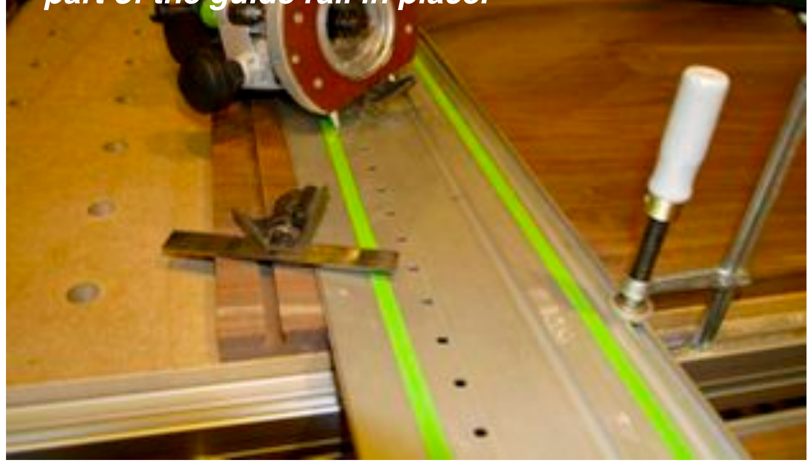
male side (where the tenon is glued in place) the mortises are cut with the narrow tenon width setting. On the female side they are cut with the intermediate tenon width setting.

To locate everything side to side I used standard leaf dowels. There are two Domino tenons and one dowel on both edges in each leaf half so the leaves are well and properly located with no fear of breakage over time even if someone were to lift the table by the center leaf.

The table top and the leaf have grain running side to side. That means they will expand and contract across the length of the table with normal seasonal changes in humidity. We need to accommodate that movement and also prevent the top sections from ever warping as they normally would try to do in sympathy with their annular growth rings.

Because our legs are going to move with the top, we also need a very strong skirt as a structural member. More on that in a moment when we talk about the construction of the legs.

Looking from the center to the top plates you can see the dovetail slot, the square used for guide rail alignment, and the clamp to hold the inboard part of the guide rail in place.



assembly to the exact same width as you cut each top plate making sure it is also very square edge to side.

Now clamp the inverted top plates down on a known flat surface. Keep the center edges of the top plates about 100mm apart. Line up the edges. As you can see in this photo, I used two Festool MFTs held side to side with table joining elements but left a bit of a gap between the two tables. We are going to cut a dovetail slot that starts in the middle of the table but stops short of the ends of the table so the space between the table plates allows the router to be plunged and moved across both top plates with the same setting to make sure the skirt dovetails exactly line up on each side.

To keep the skirts in place while still allowing the top to move relative to the long grain of the skirts, sliding dovetails are used to secure the top to the skirts.

The first step is to cut the top plates to exact size making sure they are dead on square where the two plates will join in the middle. Any error in the 90 degree angle between the sides of the top plates and the mating edges will really throw everything out of whack so be very precise with these cuts. Cut the hinged leaf

I used a known straight level clamped to both tables as a fence to align the two top plates. The top plates were positioned so the outboard ends would extend a bit over the edge of the MFT so I could

clamp a long Festool guide rail parallel with my intended line of cut for the sliding dovetail slots that will hold the side skirts (photo above).

Once the top plates were clamped to the tables from below, the level was removed so it would not interfere with the movement of the router.

After the cuts were made in one side, the level was replaced to make sure nothing would move and the guide rail was repositioned to the other side using the same adjustable square setting to insure consistent alignment of the two skirt sides. They have to be parallel as will become clear in a moment when we see how the leg/top plate/skirt assembly moves relative to the butterfly leaf deployment frame.

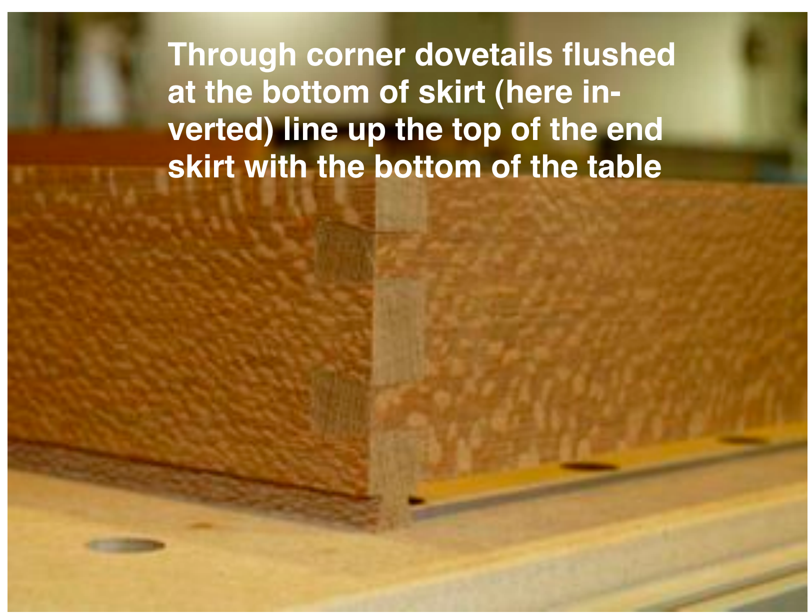
The next step is to machine the skirt side and end pieces from silky oak. Make the side skirt pieces 10mm taller than you want the skirt to be to accommodate the 10mm male dovetail you will cut in these pieces. Match the male to the female dovetail slot to get a snug, but still easy slide fit.

The ends of the skirts cannot be affixed to the top of the table since the top needs to be able to slide over them as the top expands and contracts seasonally so make the end skirt pieces 10mm narrower than the side skirt pieces. Use through dovetail joints to join the skirt ends to the sides.

Do not glue these dovetails!

Note that the skirt corner through dovetails are cut to be exactly the correct length. Most books say to cut through dovetails a bit long and sand them down

later, but in this case the side to side centerline width of the assembled skirt sides and end must be exactly the same as the centerline spacing of the two dovetail



Through corner dovetails flushed at the bottom of skirt (here inverted) line up the top of the end skirt with the bottom of the table

slots in the underside of the top. And, you have to be able to slide these dovetails more than 750mm without binding. So, leave the through dovetails unglued. If your slot centerline is off a little bit, the pins will slide in the tails to accommodate. If they were glued, you would

be......had.

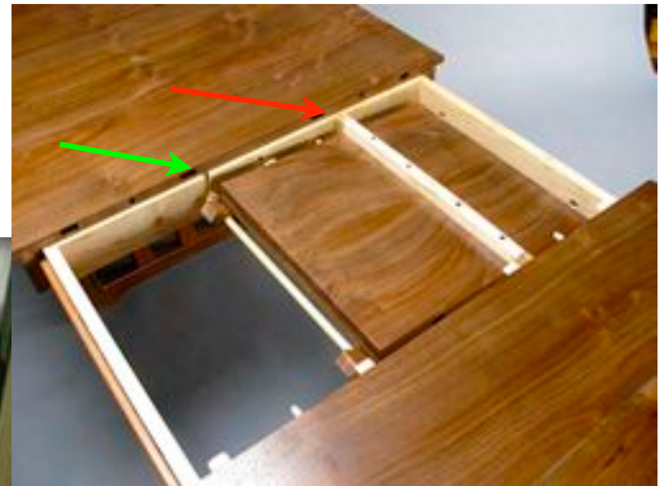
Above is a trial fit. Everything fits perfectly and the skirt assembly can slide snugly all the way to the end of the female dovetail slot. Don't mount this assembly until after you have cut away a bit of the end of the male dovetail so the assembly will fit with the faces of the side skirts exactly flush with the inside mating center of the table top plates. That way the skirts will come together tightly as the table halves are pushed together when the leaf is stored.

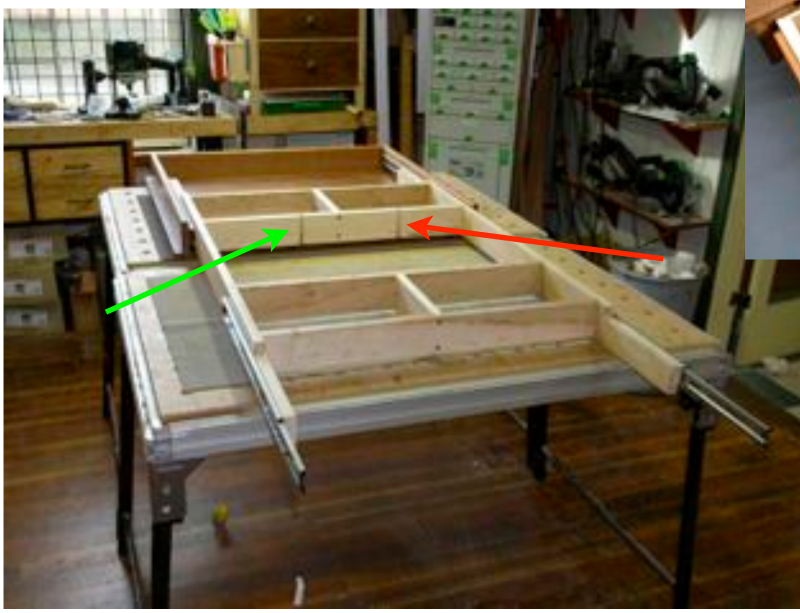
Break the edges on the ends and underside of the skirt pieces so they will have a nice feel to the hand. Sand and fully finish the skirts and table top plates before assembly. Fully finishing everything in the flat makes sure all surfaces are sealed, even the male dovetail and inside the female slot. That will reduce the movement of the top and also ensure that what movement needs to take place over time can happen easily.

When you do assemble these components, be sure to wax the female slot and male dovetail. If the slide fit is too tight once the pieces are finished, just take a hair (no more than 0.1mm) off the width of the male dovetail. That should loosen things up enough to keep it a snug, slide fit.

Next we will build the interior frame on which the table/skirt/leg assemblies will slide on steel ball bearing drawer glides and which will also hold the butterfly leaf mechanism sliding dovetail slots.

The frame is a simple box section made up of two side rails the same as the net height of your skirts, four cross members, and stiffeners to reinforce the cross members. Each joint is a sliding dovetail for strength and positional accuracy pinned with screws. Make the overall





width of the frame narrower than the inside dimension between the skirts by the width required by your ball bearing slides on each side. The normal clearance is 12mm to 13mm (a nominal 1/2") each for most of these slides, but check yours to make sure.

The overall length of the frame is 10mm shorter than the distance between the inside of your end skirts when the top plates are pushed together in the center. This is to accommodate the seasonal movement of the top plates.

The only critical locating you need to do is the placement of the two vertical sliding dovetail slots which will hold the leaf pivot mechanism (red arrows) and the leaf guide pad mechanism (green arrows).

When the leaf is folded out and lined up with the edges of the table top plates, the hinge line in the leaf will be exactly in the middle of your table. When the leaf is folded and stored beneath the top plates the hinge side of the leaf must clear the inside edge of the frame. So, the distance from the inside of the frame to the center of the pivot mechanism dovetail slot has to be about 15mm to 20mm ***longer*** than the distance from the pivot mechanism dovetail centerline to the centerline of the table.

The ball bearing slides will hold the centerline of your frame in line with the centerline of your table so make your measurements off of the table centerline.

The well into which the leaf halves will drop has to be wider than the leaf by enough to clear the Domino tenons and the dowels which protrude out from the male edges of the table top plate and the leaf plate assembly. That dimension also needs to allow the leaf to rotate around and past the male dovetails that hold the leaf pivot points.

I find making that well wider than the width of the leaf by about 40mm is about right. That accommodates the 12mm to

15mm projection of the alignment tenons and dowels and around 20mm of net support for the pivot mechanism.

The only other measurement you need to keep in mind is the distance from the inside of the end skirt to the outside of the outboard-most cross member. That has to be more than the distance the skirt/top/leg assembly will move when the table is opened up for leaf deployment.

I like to see the two table plates able to move out about 30mm to 40mm more than half the width of the leaf. That leaves plenty of clearance for the leaf to open easily as you can see in the photo below. Once the leaf is deployed, you will push the two halves of the table together, engaging and stabilizing the leaf.

Since I normally work with 20mm thick stock I set the centerline of the inner-most frame cross members to be the width of the leaf plus 60mm (leaf width plus 40mm net clearance, plus the 10mm distance out to the center on both of the two cross members.

On normal size tables the frame can be generous in size and still leave plenty of room for the leaf and leg movement so the inside of the end skirt to the outside of the outboard-most cross member is not an overly critical dimension.

Cut a step in the ends of each frame side rail as shown above. The step will allow the top plate part of the leg assembly to

clear the ends and will make more sense when we get to constructing the leg assemblies.

Mount the ball bearing slides centered down 0.5mm less than the centerline of the frame side rails. We will mount the other half of the ball bearing slides to the centerline of the skirt and that will provide for 0.5mm (~.020”) clearance between the underside of the top plates and the top of the frame members. Align the ***back end*** of the slide with the centerline of the inner-most cross member as shown in the photo above. Use the longest and strongest ball bearing slides that will fit your table dimensions.

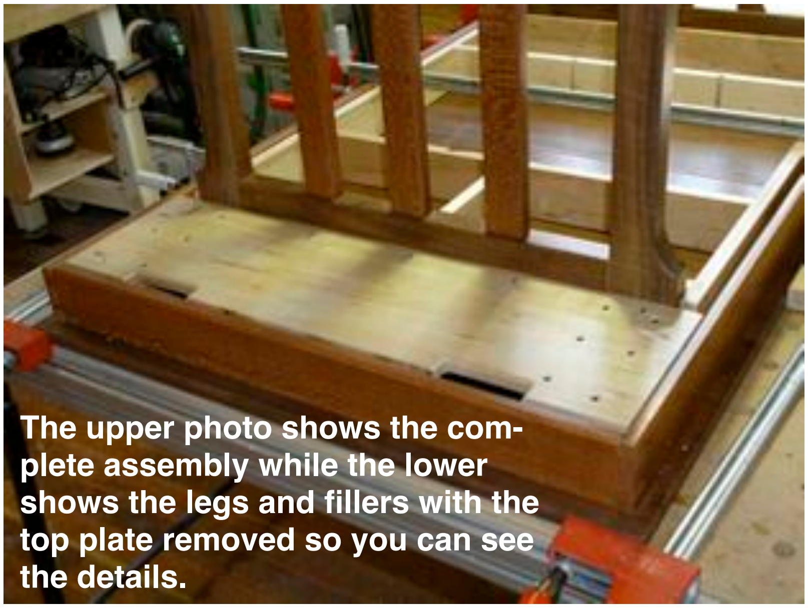
In these two photos I am mating the ball bearing slides which now hold the skirts and top plates to the frame. The top plate assembly slides onto the frame. That is why you need to mount the ball bearing slides with the back end of the slide aligned with the centerline of the inner-most frame cross member, rather than the other way around.

Note in the lower photo how I am using two Festool MFTs, each with a rubber pad protecting the finished top surface, to slide the whole thing together. I am moving the MFTs with the skirt/top assembly held stationary so I don't scratch the beautiful top.

This is just one of many reasons that I changed my mind after building the large, multi-plate MFT-like table shown in my, "Getting the Most From the Festool Multi-Function Table" manual. I subsequently removed the large multi-plate table from my studio and now use five individual MFT 1080 tables instead. For the kind of work I do, multiple MFTs provide more versatility than a fixed size large one.

Confused yet or are you still hanging in there with this project? Well, have heart, it is not nearly as hard to build this table as it is to describe how to build it!

Next, let's tackle the leg assemblies. Here is where the extreme strength of the Domino loose tenon joint is really going to pay off big time.



The upper photo shows the complete assembly while the lower shows the legs and fillers with the top plate removed so you can see the details.

Since the table legs have to move with the top to create enough space underneath for the diners' legs, there can be no leg stretcher which normally would be used to stabilize frame legs like these. The stretcher plays the important role of preventing rack when the table is pushed from one end. Since we don't have a stretcher, we need to build the leg with the anti-rack strength derived in some other way.

These legs are made from 50mm thick slabs of solid black walnut with silky oak spindles loosely set in Domino mortises cut into the leg top and bottom cross members. Domino M&T joints are used to reinforce all of the joints in the frame structure so it is very rigid and strong.

Four "L" shape fillers attach at right angles to the top of each leg reinforced with Domino glued loose tenons. Those fillers are pocket hole screwed to the underside of the top using over-size holes to accommodate the seasonal movement of the table top between these screws.

A maple top plate is then Domino mortised and tenoned into the leg holding the maple top plate flush with the top of the fillers and secure to the face of the leg. The plate is then screwed down tightly to the fillers. The underside of the top forms one side of a torsion box, while the maple top plate forms the other side. The fillers hold these two apart and act like an "I" beam spreading the rack loads placed on the legs out over the top, the skirts and the maple top plate itself.

The only way the legs can rack from an end load placed on the table is if the wood itself bends since the leg assembly is held firmly in place by the torsion box.

The photos on this page show more detail. One interesting thing about this construction technique is if you don't glue the leg to top plate tenons you can take the whole assembly apart if you ever need to just by removing the screws.

Look closely at the large photo. Again the top plate is removed so you can see the details better. The frame will remain stationary. The skirt, table top, leg and torsion box fillers (red arrow) will all move together as the table top plates are retracted to gain access to the stored butterfly leaf.

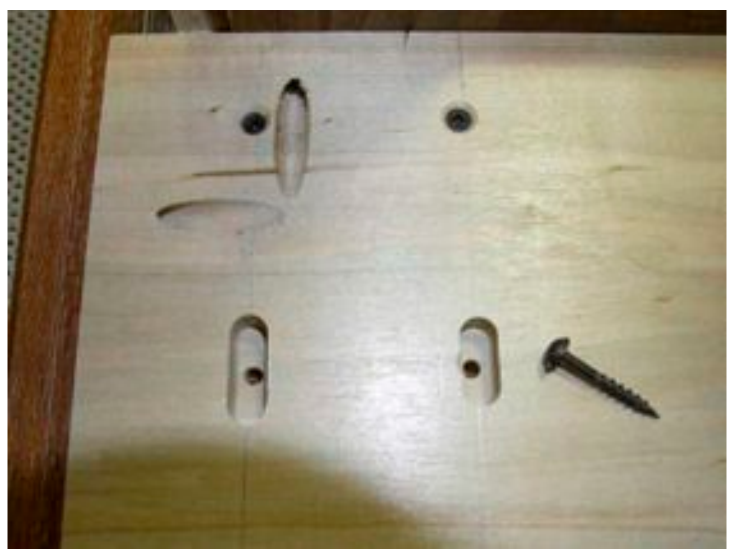
This photo was taken at final assembly time. The clamp holds the two top plates firmly together in the center of the table. The shims hold the outer-most torsion box filler just a smooth slide clear of the inside of the frame.

The small photo shows how the inside of the leg is held 5mm short of touching the outside of the outer-most cross member. This, too, is important to accommodate the seasonal movement of the top.

Here is a shot of the maple top plate sliding onto the Domino tenons near the top of the leg. I used pocket hole screws to hold the maple top plate to the leg instead of glue so I can take this assembly apart later if I ever need to. It also allows the customer to take it apart to move the table without the legs in place if they want to. However, pocket hole screws alone are not very strong in a bending force such as this joint will have to endure. That is where the extreme strength of the Domino tenons add the necessary structural support, and make possible a moving leg butterfly leaf table.

Before we move on we have to remember that the maple top plate itself is a piece of solid wood, so we need to accommodate it's natural wide grain movement as well.

This is easily done with a neat Domino "trick." Drill the through holes to be larger than the diameter of the attachment screws. Center a Domino mortise about 5mm to 10mm deep on those attachment holes as shown here. If the maple top plate wide grain moves relative to the long grain of the torsion box fillers, it can slide in the oversized hole with the washer head of the



attachment screw riding on the shoulder left at the bottom of the Domino mortise.

Keep this "trick" in mind any time you need to accommodate the movement of solid woods on surfaces which don't show. It is fast, easy, and very effective.

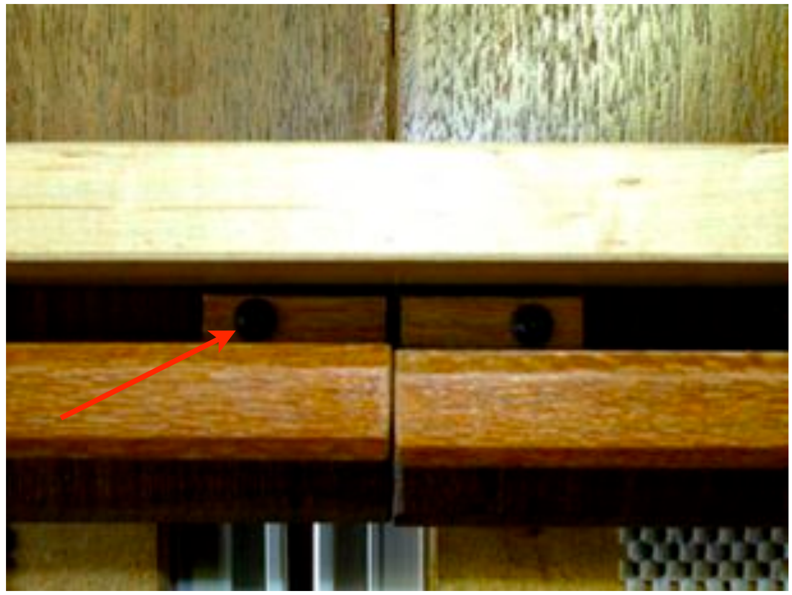
With the leg assemblies completed we can now add the butterfly leaf pivot mechanism. The photo below shows the simple components. Two short male sliding dovetail members are drilled to receive brass hinge pins. The cross member that will screw to the underside of the leaf is end drilled to receive those pins as well.

In the photo below the mechanism is sliding into place and in the upper right photo it is mated firmly to the underside of the leaf, automatically positioning everything! Screw it down and you have just built

what is so very difficult to do by more conventional means.

Once you also add the leaf guide pad assembly, use screws to pin these dovetails in place and you are nearly done. Notice how handy the Festool right angle attachment for the drill is in getting into the tight recesses of the frame.

The only thing left to do is add stop blocks to the inside of the skirts and the inside of the frame to limit how far the two top plates can be retracted. These are not absolutely necessary, but they do help the ergonomics of the table.



It may be hard to see in this shot looking down on the inverted table into the recess between the skirts and the frame side rails, but I also drill and screw the skirt stop block to the underside of the top (red arrow). That locks the center of the top in place flush with the center end of the skirts and forces all seasonal movement of the top towards the ends of the table. That way the top plates and skirts are always properly aligned in the middle.

In the final series of photos on this and the next few pages we will see the beauty and simplicity of the butterfly leaf being deployed.

Conclusion

I hope this series of build-along projects gives you a good idea of the many, many ways the Festool Domino machine can enrich your woodworking experience.

Yes, it is a superb way to join two pieces of wood together in all six ways one can join two pieces of wood. And, I think you will agree it is also much more than that.

It makes possible extremely strong yet hidden joints. It helps you solve a myriad of solid wood movement problems. It allows you to build retractable pins for door slides and latches. It helps you quickly align joints like tongue and groove raised panel constructs, and, used in conjunction with things like pocket hole screws, provides a means for creating very strong joints that can be easily disassembled.

Having used a Domino machine I am now spoiled. I would not want to go back to working wood without one!

Jerry