My method to the alignment process - Everett L. Davis

https://www.shopsmith.com/ss_forum/viewtopic.php?p=210669#p210669

This began in the thread above, and I have subsequently edited the text below to correct a word, added some punctuation, a few minor edits, and line spacing to make this more readable.

I added the section **"A Final Check"** to this explanation relative to subsequent discussions that have taken place or which are now taking place in other threads.

My process

I realize there are officially published alignment procedures and they will vary some based on the alignment tools you have to work with to do the job.

Here's my personal alignment process using a dial indicator and a sliding set of T-Bars, and a magnetic machinist square.

Start with some known bon-a-fide tests to insure you are working with parts that are not bent, warped or deformed in some way.

We need to see if the slots or T-Slots on the table are machined parallel to each other, as that establishes one of the reference points.

First things first....

Q: Is the table itself, flat?

A: Lay it down upside down on a **known flat segment** of MDF to see if it is warped. Use a feeler gauge if needed to insure its flat at the edges.

MODEL OPTIONS:

Q: Is it a 510 or 520?

If YES:

1) Roll the connecting tubes across the MDF to insure they all are straight and round. Check the Sliding T-Bars to insure they are flat as well. (See Appendix 1 below)

2) Lay the extension and floating tables down on that same MDF beside the main table.

If they remain flat, go to the next step. If not, likely only a new table or extension table will resolve it unless it is under some tension of some sort that you can mediate.

3) Next insert the connecting tubes in their positions through all segments. It should slide in without bumps or restrictions. It should go in like butter….

IF it does not reflect proper alignment to the tubes and remain flat against the MDF, adjust them until they are right.

Install the Table in the Carriage.

Install one sliding T-Bar in the slot closest to the Quill, and mount the Dial indicator pointing toward the other slot, to the right of the table insert.

Mount a steel post in the 2nd T-Bar and put it in the 2nd slot and measure the distance between the two.
Gently slide the bars through the slots and make sure the spacing between remains constant.

If it does, they are parallel. That's also essential, and if there is a variance, Shopsmith may need to step up if it is beyond their standards.

If all is still good, proceed.

Slide the Headstock close to the Table, and position the Dial indicator pointing toward Quill shaft on a non-beveled section and measure the difference if any through the hand rotation of the shaft to insure it is not bent.

If we are still good, slide the table away from the headstock or vice-versa.

Take the 12" Steel Sanding Disk (with no abrasive or adhesive) and lay it flat on the MDF. Is it flat across the entire surface?

If yes go on, if not find one, or acquire one that is flat.

Mount the verified flat Sanding Disk on the quill.

It is flat, but is it at 90 degrees to the 5/8" shaft mount it is on?

We need to measure that next.

Re-position the dial indicator to a point to measure to within ¼" of the edge closest to you of the 12" Sanding Disk.

Gently rotate the Disk observing the dial indicator.

If it is at 90 degrees as it is supposed to be, there will be very miniscule variance as it rotates, meaning the mount to the shaft is indeed 90 degrees to the face.

I keep a known good Sanding Disk around that I use on all machines, but I always check it, on the machine's sanding disk.

1) Now slide the T-Bar through the T-Slot to the other side of the 12" Sanding Disk. If the Table is parallel through the entire range. If it isn't the table is not square to the Quill and the table needs adjustment.

2) Here is where I vary somewhat on my procedure. I take a set of calipers and measure from the edge of the table to the side of the T-Slot closest to the Headstock. IF it is identical, then aligning the table to directly be flat against the Sanding Disk, will square the table. IF it isn't there is a discussion you may want to have with Shopsmith. We will presume it is the same.

3) Using a Magnetic Machinist Square attached to the Sanding Disk will allow you level Table to the travel of the Quill, while keeping it square as Table remains against the Sanding Disk, tightening in place making sure nothing moves out of place.

4) Reset your 0 degree indication if needed, and the saw Table is aligned to the quill / disk / blade / molding head etc.

A Final Check

As a final check, rotate the Table to the 90 degree position (as it would be set up if it were in vertical drill press mode [which it isn't]) and lock it. It now should be running parallel to the sanding disk, and slowly slide the carriage and table to a point where it touches the sanding disk and lock the carriage.

Using a bright flashlight, shine it into the spaces around the outside circumference of the sanding disk to illuminate the space between the sanding disk and table.

<u>If there is any deviation you should see it visually vary away from the table</u> (as you look from various points across that mating surface), indicating something is off, or something moved during your adjustments. If it is flat, that's all you need to do, other than waxing and lubricating the machine on a regular schedule.

That's my process start to finish

That's my process. Obviously I need the center points of the drive center and the dead center, or live center to align perfectly for turning, but that is at the Tailstock as always.

Obviously, excessive run-out on the Quill can manifest and test using the same Dial Indicator to Sanding Disk measurement set by taking the Sanding Disk and exerting a slight finger pressure to see if there is movement in the bearings.

I may check this on a machine new to me, but fairly infrequently afterwards. If I find a run-out problem, I get new bearings.

That's how I do it. I did not put pictures in purposefully. I want you to envision how I do it, not be distracted by the photos.

I am sure everyone has their own way of doing things. That's just mine. It works on 10E – Mark V pretty much the same way. Obviously the 12" Aluminum Sanding Disk isn't going to hold the magnetic machinists square, but you get the idea, use a steel one.

I know there is a parallel discussion about centering the blade in the insert, and that stands on its own merit, but the other alignments must be correct.

I hope that helps someone formulate a method that works for them.

Everett

Within that thread as it progressed, the discussion of MDF and its relative flatness as a reference for "flat" came up, just as it should.

Appendix 1

At that point in the thread, I added the following in a PDF, the text of which appears below.

Let me add some context

Let me add some context to better position my evaluation process and my objectives. I am sorry this is going to be longer, and I have to respect the length of the post by putting this in a PDF.

I think we all can accept precision costs money, and extreme precision, even more money and in tools and reference tools, it is a given.

Personally I will not invest the dollars it takes to achieve .00015 reference tool accuracy to measure woodworking tool surfaces when wood (the work product made with the tool I seek to align) is incapable of being reliably assembled to those tolerances and frequently vary with the environment, and disproportionately between species of wood, or between boards in the same lot.

This is further exacerbated by the fact that the machine being aligned itself is not manufactured to those tolerances and cannot be reliably adjusted to achieve those tolerances, but we must all accept that to verify what tolerance exists, we must measure with a reference tool that exceeds the tolerances.

The Starrett 20 Master Precision Square 50136 has 'squareness' accuracy to .0001" every 6" but is $656 this morning and if one wants that level of accuracy they can certainly acquire it and use it.

http://www.starrett.com/metrology/product-detail/Solid-Squares/Squares/Precision-Hand-Tools/Precision-Measuring-Tools/20-12

My point here is that with the Shopsmith Table, Miter Gauge, Rip Fence, 12" Sanding disk and so on, if irregular surfaces are found, we cannot adjust them, making the measurement of flatness a go-no-go, use or replace the part perhaps decision.

There is meat there, but you are going to have to season it to your own taste so to speak. If you are framing a house, you can accept more variances than if building an exotic piece of inlaid art in a music box for example.

In cabinetry we often leave gaps in assembly to allow for the movement of the wood in its usable life cycle by varying the joinery techniques of assembly to prevent it from tearing itself apart as it moves.

If the medium were machine steel, opposed to wood, that acceptable tolerance would tighten up significantly.

As you read through my method previously, you would have picked up on the fact that I use the 12" Sanding Disk (once verified flat and true) as a basis on which my other reference alignments are made.

This gets me away from the teeth of a 10" saw blade, and working around the set of the teeth, and even the overall flatness of the blade. I can take that easily to a machine shop to verify it is flat to very high tolerances if I choose, but the point is if it is flat and true, I can use it as my reference.

I can lay it face down on the MDF workbench and pass it all over it in all directions to visually inspect the workbench flatness. I can do that with the 48" Square and the Starrett or other Precision Square. They all are going to report the same thing on the MDF if they are true and it is true. The point here is that I don't just do one of them, I do all of them. I can still pass the level and the square over the surface of the 12" disk, which proves them up to each other. If one has been dropped for example and bent, it will show up.

Those then become my 'bon-i-fide' proofs that everything else will reference.

If I find the work table is not flat and rocks on the MDF, is it something I can remedy? If I take the time to remove the insert, I can even check the center 'cupping' with a feeler gauge in the center of the table between it and the MDF.

If either is off, can I remedy that? If the mounting bolts aren't torqued high on one and under on others perhaps (and before you ask, I do not have torque specifications

for tightness of those bolts) and even that would vary from steel to aluminum work tables.

Yes I can lay the 12” Sanding Disk on the table for a go-no-go flatness test as well, but that will not align the extension tables with the connecting tubes.

A flat MDF surface (Ok Baltic Birch Plywood) would work as well, but both have to be sealed and proven up to a reference flatness standard you can live with. Remember, you are not likely going to lay a 4’ level in one place on the surface and call it done. You are going to move it and measure various places at combinations of angles to validate reasonable flatness.

It doesn’t have to be 100% level, just very flat along the distance if you are rolling bench and way tubes over it. If you find them off, remember the set screw areas may need a quick pass with a bit of abrasive to remove bumps. Are you going to be able to repair the way or bench tubes if they are warped or distorted? No. Will they still work acceptably for you? Perhaps

Did that help you understand why I do it the way I do it?

I am looking to make sawdust or turnings and need a quick way to check things out. I am not into proving it to .002” per se. I want it square, flat, and aligned to itself. Whatever that tolerance is, is all I have to work with.