

FT-V Phase 1 Assembly Notes

Tools used:

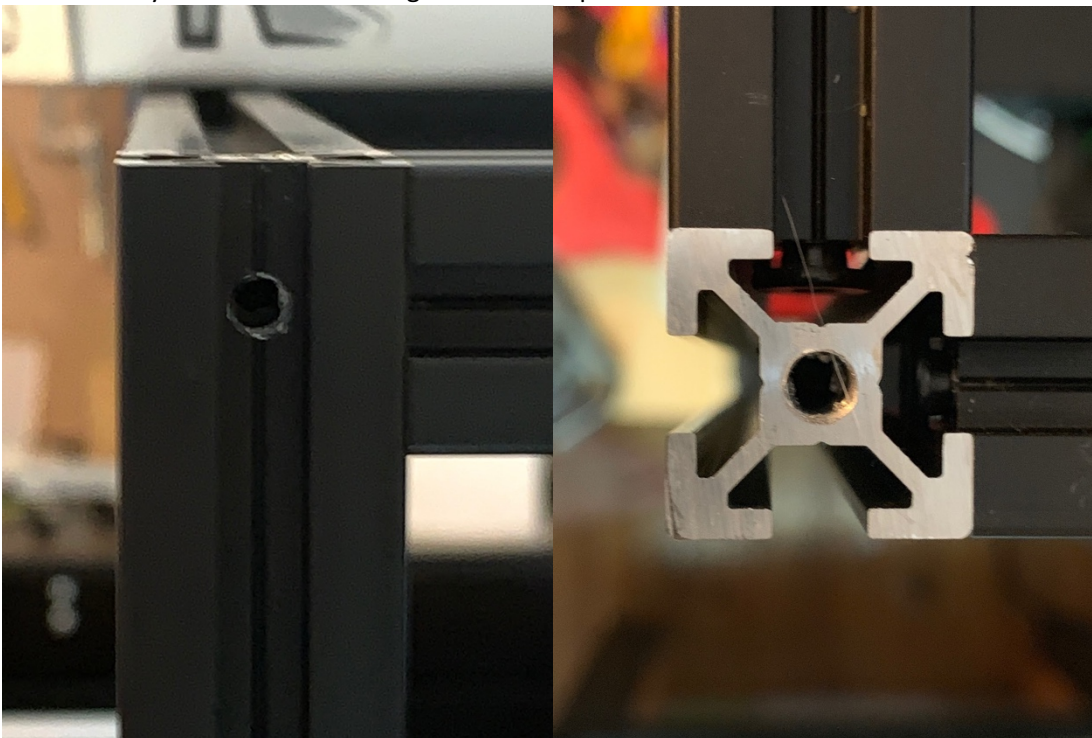
- M6 Tap, M3 tap - [Lowes](#)
- Assorted drill bits (7/32")
- Center Punch - [Harbor Freight](#)
- Calipers - [Amazon](#)
- Ball end Allen Keys (that won't strip) - [Allen Keys](#)

Disassembly:

Remove the entire gantry level structure from your FT5, disassembling and organizing parts as you go along. The bed and linear rods/lead screws can stay in place, just move it closer to the bottom of its travel. This will leave you with just the base frame of your FT-5--4 vertical extrusions, 4 extrusions connecting these at the top, and the base assembly with bed, linear rods, and lead screws sticking up floating in air.

Tip: If you plan on switching from the FT-5 corner brackets to blind joints (mandatory if you still have melamine brackets from the FT-5 R1, optional if you have the FT5-R2 with ACM brackets; also mandatory if you want to enclose your printer), now is the time to do so. My suggestion is to go ahead and do it--it's not very expensive (~\$20), makes the printer easier to square and the gantry to align, and the parts will stay aligned.

Items needed: M6 tap (~\$8-10), 7/32" drill bit (You should have this already), 16 pcs of button head M6x16mm or M6x20mm. All these can be purchased at a Lowes or Home Depot, if you get the screws with your screw order things will be cheaper.



Which joints need to be drilled and tapped:

- Each vertical extrusion to the base 2040 (access hole needs to be drilled all the way through the 40mm direction of the 2040, and the bolt tightened from the bottom of the printer--you may need to temporarily move the bottom feet of the FT-5 to stick a wrench through the access hole)
- Each of the 4 horizontal extrusions at the top of the printer
- Two 460mm extrusions, tapped at both ends. These will be used for the side extrusions that the Y rails sit on. Access holes will be drilled in the front of all vertical extrusions eventually.
- When assembling the frame back again, slide these two 460mm extrusions in to the vertical extrusions before putting the top extrusions on. If you don't, that's fine--you'll just have to remove the top extrusion temporarily to slide these in.

Blind Joint tapping/drilling process:

- Take your extrusion, mount it in something sturdy (like a vise) with the hole in the end of your extrusion exposed. Using your M6 tap mounted in a tap handle, dip the tap in some oil, then align the tap parallel to the extrusion and begin screwing it in. Every so often rotate the tap counterclockwise to break up chips. If you experience too much resistance, back the tap out, wipe off any metal chips, dip the tap in oil, and continue tapping. You'll need to tap deep enough that your M6x16mm or M6x20mm (whatever is in stock) can go all the way in to the extrusion.
- For drilling your access holes, take your caliper, adjust the distance to the length you want marked (ie, for a 20mm 2020, if you're mounting the extrusion near the end, generally $\frac{1}{2}$ of that or 10mm). Gently scribe a mark in the aluminum at that location using your caliper tip (these are cheap calipers, not Mitutoyo, right? :). Using a center punch, feel for the scribed line you marked, align with the center of the slot, and punch a divot into the aluminum. Using a 7/16" drill bit, drill straight through the extrusion.
- Screw the M6x16mm or M6x20mm button head screw in to the end of the tapped extrusion, nearly all the way, but leaving a large enough gap that the head of the bolt can slide into the slot in the extrusion. If you drilled your access hole correctly, you can slide an allen wrench through the hole into the hex head and tighten the screw.
- If you don't have a set of good ball end hex wrenches, now is a good time to have a set. With the small access hole and the ball tipped hex key, you can use hex wrench as a lever to adjust the alignment of the extrusion. This will become key down the road when we adjust the height of the gantry.
- If your access hole is off a bit, you can use your drill and rotate the drill along the slot in the extrusion to open up the access hole into an access slot.

Y Extrusion Assembly:

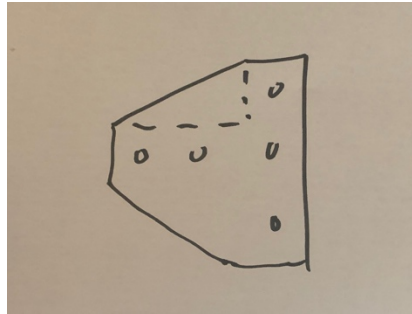
First of all, we're going to mount the two 460mm extrusions that the Y rails will mount to. As a precaution, look underneath the FT-5 base plate to make sure all Z linear rods are secured properly and flush with the bottom of the rod bracket.

To know what height the extrusions should be mounted, find your (4) Z rod supports, either `Z_Shaft_Upper_Support_8mm_StandardBed_x4 FT-V.stl` or `Z_Shaft_Upper_Support_8mm_Phase2_x4 FT-V.stl`. Attach two of them loosely to a 460mm extrusion, and then hold the extrusion in place in the frame. Slide the Z_Shaft supports along the extrusion until they line up with the Z linear rods, then tighten them down to the extrusion. Slide the shaft supports on to the Z linear rods until the top of the rod is flush with the top of the shaft support. Using your calipers, get an approximate measurement between the extrusion at the top of the frame and this floating extrusion--it should be somewhere

around ~130mm or so for the Phase 2 bracket, and something similar to that with the standard bed bracket.

If you're doing blind joints, now is the time to drill access holes for this extrusion--once you mark the location that you're going to drill, put the extrusion back in place temporarily just to make sure that you really got the right hole location. Take care to that all 4 of the access holes are the same distance from the top of the frame.

If you're using the standard FT-5 ACM brackets, you'll need to do some cutting here--since the MGN12 rail is wider than your 2020 extrusion, it extends beyond the extrusion and will hit the FT-5 corner bracket. Cut the 4 brackets as shown by the dashed line below:



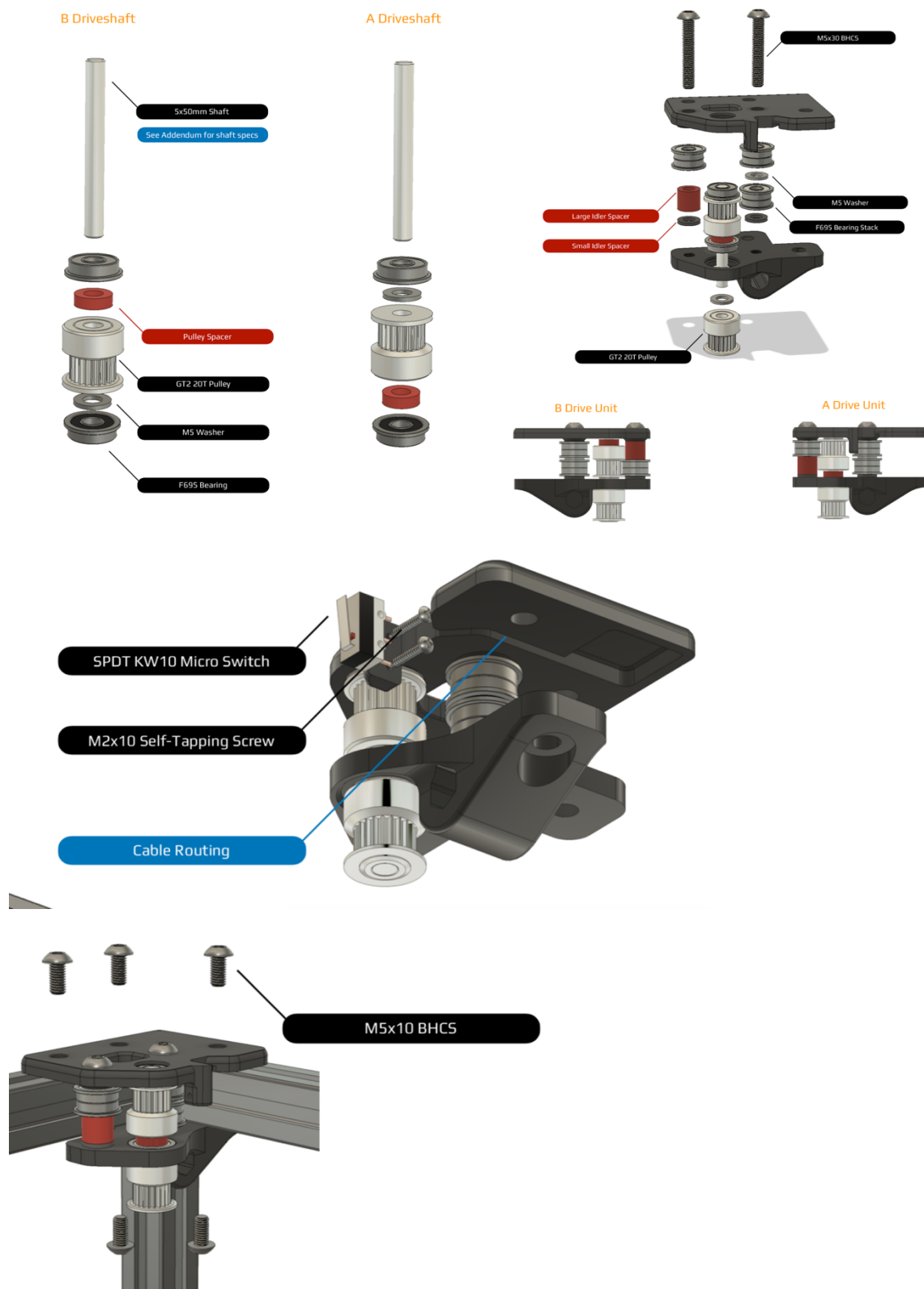
Finally--mount both of these 460mm extrusions to the frame using these brackets (or blind joints).

A/B Module Assembly

Assemble A and B drive modules using the Voron 1.6 instructions, but note the modified parts. Use printed spacers, but also use thin 5mm washers to make sure that everything fits together well. The bearings shouldn't have a lot of play, but they should rotate freely. Both the A and B driveshafts need flats ground on them.

Mount the end stop switch before the module is fully assembled! Otherwise you're going to have to disassemble it. When soldering the wires to the end stop switch, try to route the wire leads so they angle in to the channel. The modified FT-V parts have a deeper cutout here for the wiring, but it is potentially good to put a piece of tape or something similar to hold them in there, at least for assembly. Let the wires exit into a channel on the vertical extrusions.

Note that the FT-V parts also have two M5x10 holes to mount to the vertical extrusion—it's easiest if you have snap in (not hammerhead) T-nuts here, but if you have hammerhead, one is sufficient. These are a 3rd way of attaching the gantry to the frame, but are not necessary if you have blind joints or are using the FT-5 corner brackets.

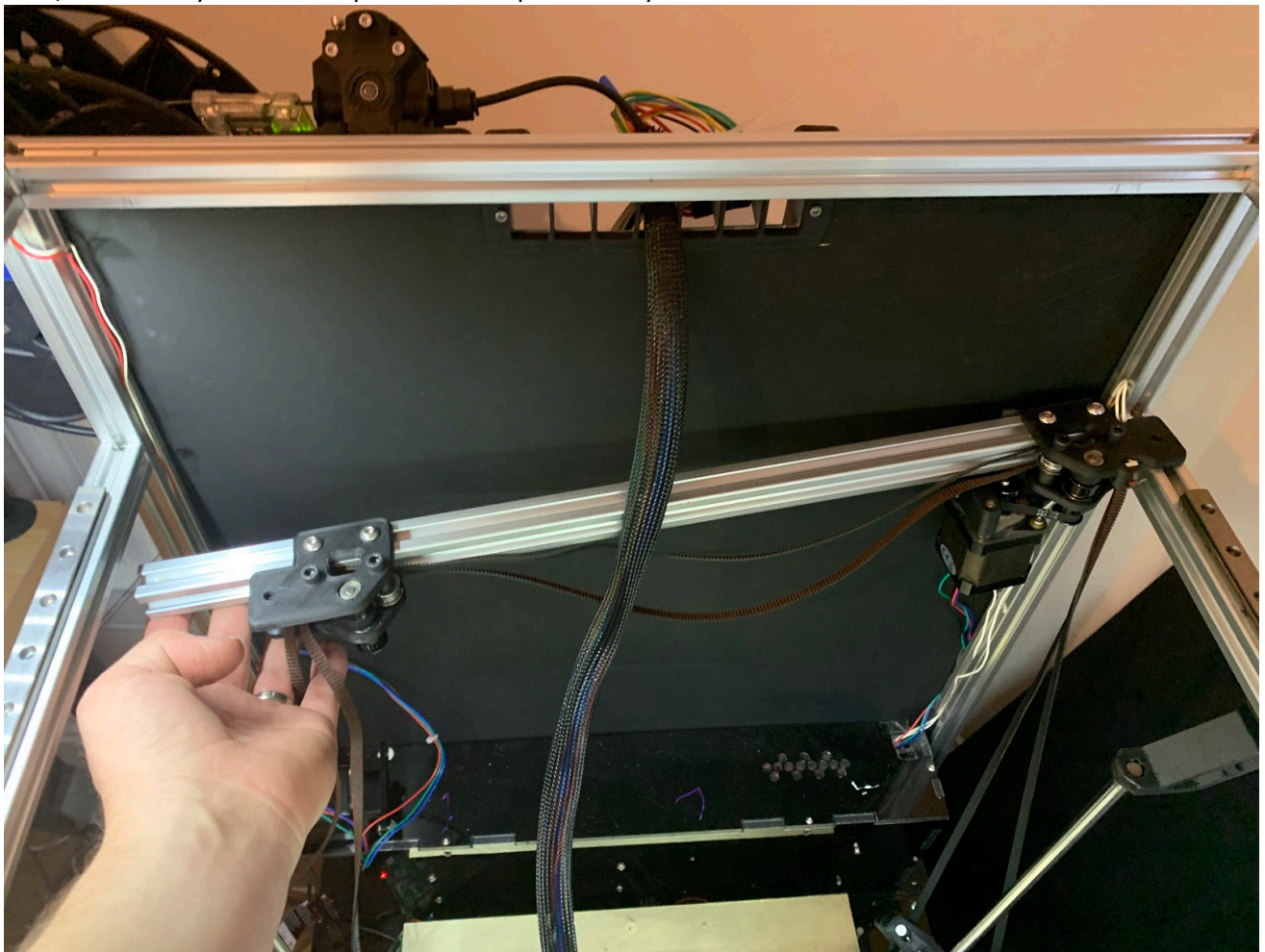


At this time, cut two very long lengths of GT2 belts. The V2.1 configurator says 2130mm, I would cut them so you have an extra foot of length, or roughly 8 feet for each belt. Route one belt through the A module (with the loop around the two bearing stacks and pulley), and another through the B module in the same fashion, leaving belt hanging from each end of the module.

Loosely mount the A and B modules to a 500mm extrusion, but slide them in so the outer edges are flush with the ends of the extrusion. At this point, route each belt through the other module, so all belts are coming forward out of each module.

Prepare the Y extrusions with snap in T-nuts, one in the top channel, one in the bottom channel, positioned so that you will be able to screw the A/B modules into them.

Hold the extrusion up to the frame, pushing the right module out to clasp the right Y extrusion. At this time, make sure your Y endstop wires aren't pinched anywhere.



Rotate the left side of the extrusion up in to place, and then slide the left module so it clasps the left Y extrusion.

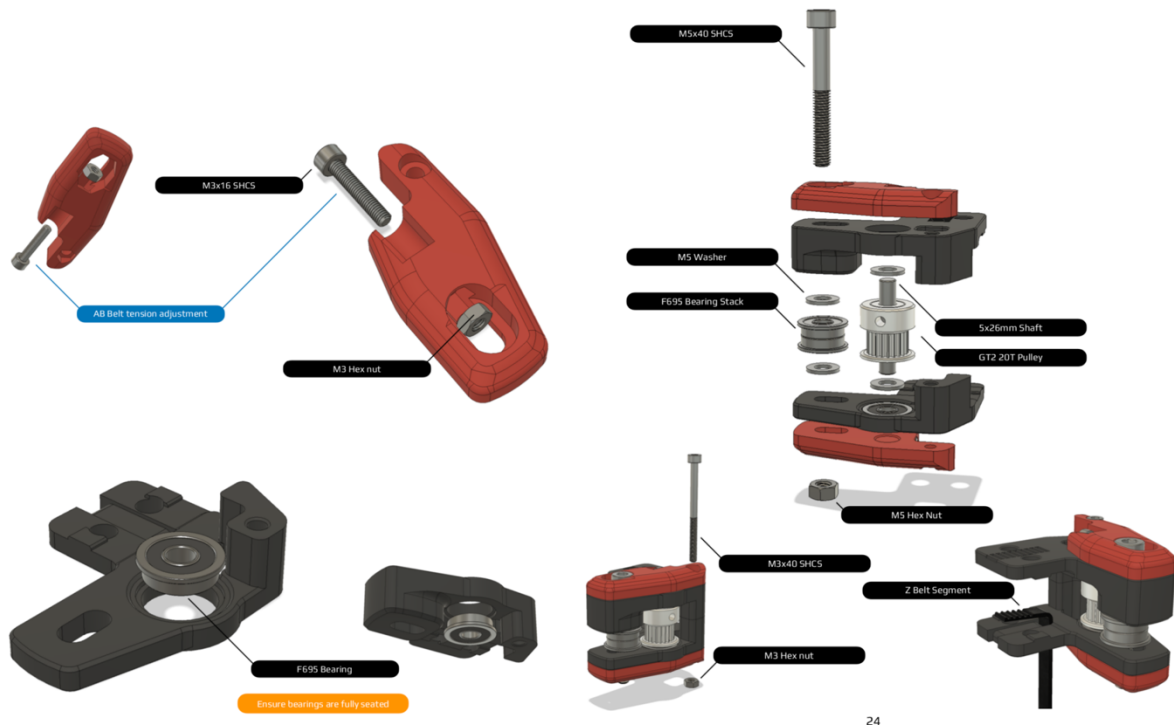


Secure both A/B modules to the Y extrusions and the back extrusion, making sure the modules are flush with the vertical extrusions and parallel with the Y and back extrusions.

At this time, take your Y rails and place them on top of your Y extrusions, but do not tighten the t-nuts.

Front Idlers:

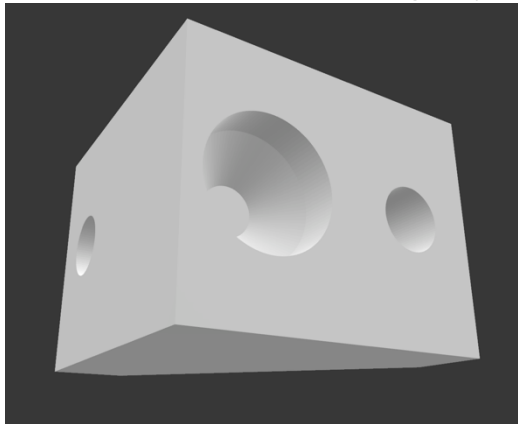
These assemble the same as V2.1 does, but note that the orientation is flipped vs. what V2.1 is (top belt is on the left, bottom belt idler is on the right). This is because our rails are on top of the 2020 extrusions, not on the bottom. Fortunately, this is the same belt orientation as V1.6's A/B modules, so what you just assembled above is fine.



Source: Vorondesign.com/Voron2.1

If you are not using blind joints or the FT-5 corner brackets:

For attaching the idlers to the gantry level, use the two M5 holes on top as normal. On the bottom, only screw the very front M5 bolt in. Then, take a slightly longer M5 bolt, and use the GantryBracket.stl to screw through the idler to the extrusion. The larger hole in the image below has clearance for an M5 button head screw that is going through the idler. Use an M5x10 screw and T-nut to secure the front side of the gantry bracket to the vertical extrusion.



XY Assembly:

Assemble the X rail assembly identically to the V2.1, except use the MGN12 compatible brackets and XY_Joint_backbrace_left FT-V in place of the stock one. This backbrace piece makes it so that the X axis triggers the Y endstop. Also, mount the rail on the “top” of the assembly (now bottom). Add the X_endstop_block to the right side of the extrusion on the back surface—the X endstop block mounts behind the extrusion and you can use this piece to adjust where the max position is. If you purchase a

slightly longer X axis rail, you can get rid of this piece, though you will need to still have a screw and T-nut mounted as a “mini” end stop block.

Mount the assembly upside down vs. V2.1, so the XY joints rest on the top of the Y carriages, and the X rail is down towards the bed.

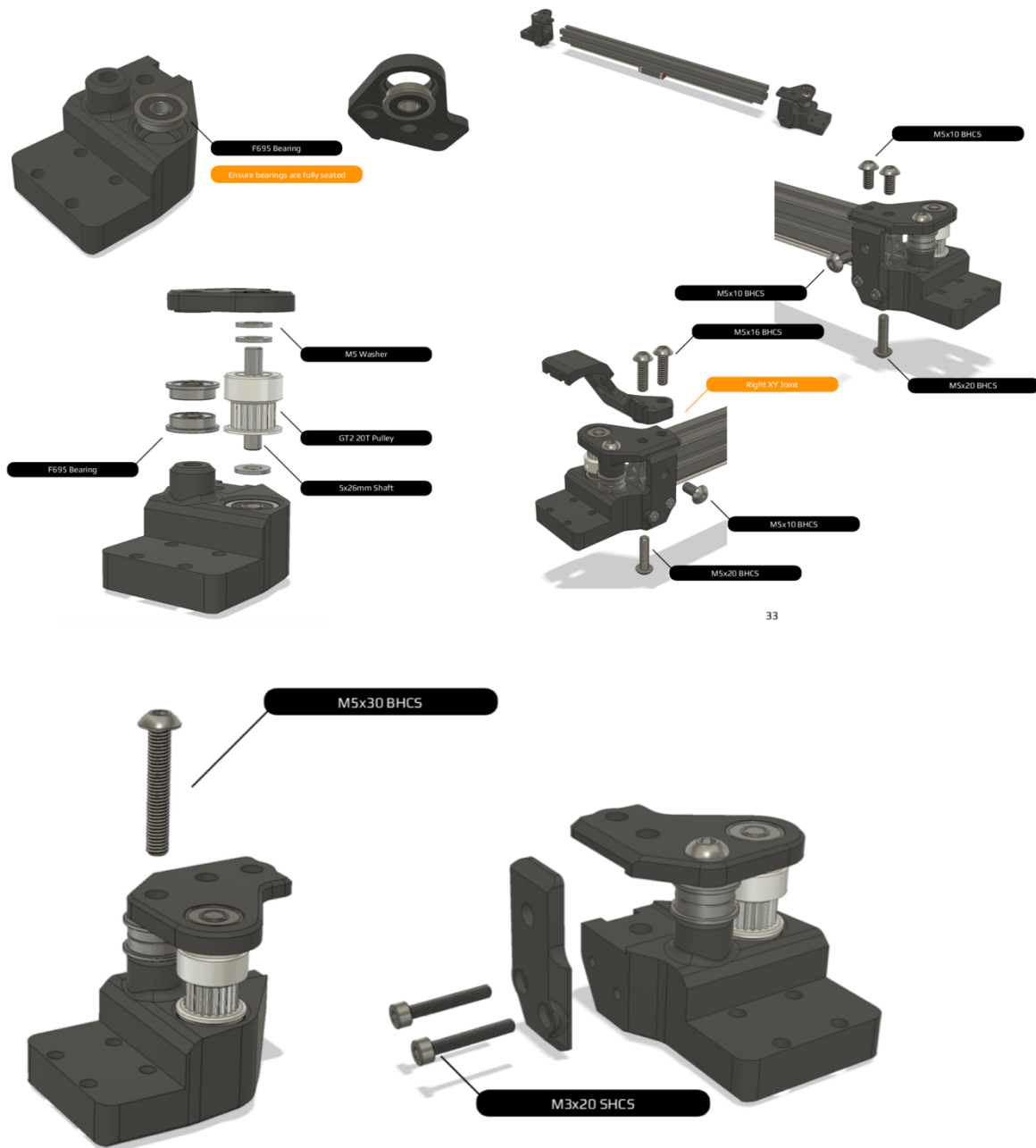


Image Source: Vorondesign.com/Voron2.1

X carriage:

Assemble the X carriage as normal for V2.1, except mount the X end stop in the back mounting section. Route the wires down below the X carriage, and back up the right side of the X carriage. Do not use both

clips for the probe—only the left is used. This gives space to route the wires up to the right of the probe, in to the tool head.

Toolhead:

Toolhead assembly is identical to the Voron Quick Change toolhead, which is detailed in both the V1.6 and V2.1 manuals.

Rail/Belt/Axis alignment and tensioning.

Before you tighten your belts, do the following:

1. Check to make sure your front idlers are pushed towards the front of the printer as much as possible, and secured.
2. Make sure Y rails can freely slide relative to the extrusions
3. Slightly loosen all bolts that secure the XY joints to the X axis extrusion (One on the top, one on the back, two on the bottom, per side) so that the XY joints can slide along the X axis extrusion.
4. Tighten the 4 screws per side that secure the XY joints to the Y rail blocks
5. With the X axis all the way forward, make sure that it contacts both front idlers at the same time. Push the ends of the X axis toward each other to make sure that the XY joints are fully seated on the X axis extrusion. Slowly tighten all screws between the XY joints and the X axis extrusion, making sure that the X axis continues to touch both front idlers.
6. Finally, with the X axis all the way forward, slide the whole assembly to the right and left to make sure that both MGN12 carriages are overhanging their respective Y extrusions equally. Tighten the front screw on the right Y rail at this point, but leave all of the rest loose.
7. Slide the X axis 95% of the way back, but so it is not touching the Y endstop. Do the same exercise, centering the overlap of the MGN12 carriages by feel. Secure the back screw on the right Y rail.
8. Secure all of the rest of the screws on the right Y rail, only when the MGN12 carriage is right next to the screw
9. Secure the front screw on the left Y rail when the X carriage is near the front, then the back screw on the left Y rail when the X carriage is at the back, and then the remaining screws. The Y axis should be smooth.
10. Loosen your front idler tensioning screws the whole way
11. Loosen one side of the A/B belt mount on the X carriage so that you can pull both belts through. Pull both through until they both have even tension, the X axis is touching both front idlers at the same time, and the tension is medium. You should be able to put a finger or two between the belts and the extrusion along the side, but not more.
