Intro:

Thank you for purchasing the Hobby-Fab OX kit. The OX is widely popular and can be found around the globe. If you run across a snag, feel free to send us a message or hop online; there are communities just for this machine. You can join the G+ OX community (https://plus.google.com/communities/110852928951643236736) where you will find a helpful, experienced group that uses this very machine.

The OX was first generated by Mark Carew. Our group soon picked up the design, cleaned it up slightly, and the end product is what you are about to build. Good luck with this project and we look forward to seeing the awesome things you will create!

The below instructions will assist you in building the Hobby-Fab OX CNC kit. Each step begins with a BOM, then guides you through that step. If something looks confusing, or a term doesn't make sense, scroll a few photos up or down and the query will most likely become clear.

Note:

The BOM has been double-checked by our team. We suggest a full inventory by the builder prior to beginning the build as well but must warn, **DO NOT open all boxes and dump all parts in a pile**! This will make the build next to impossible to complete.

The extruded aluminum is cut to length. Pairs of the axis, i.e. both X gantry 20 x 60 and one 20 x 40 are **cut together, surfaced together, and bundled together** to be an exact fit. The most frequent comment we get comes from builders unbundling the entire kit and getting pieces and parts incorrectly assembled. We take extra precaution to ensure the kit goes together as smoothly as possible. Leaving the extruded aluminum bundled up and parts in their step number box until you reach that step, will ensure a smooth and quick build.

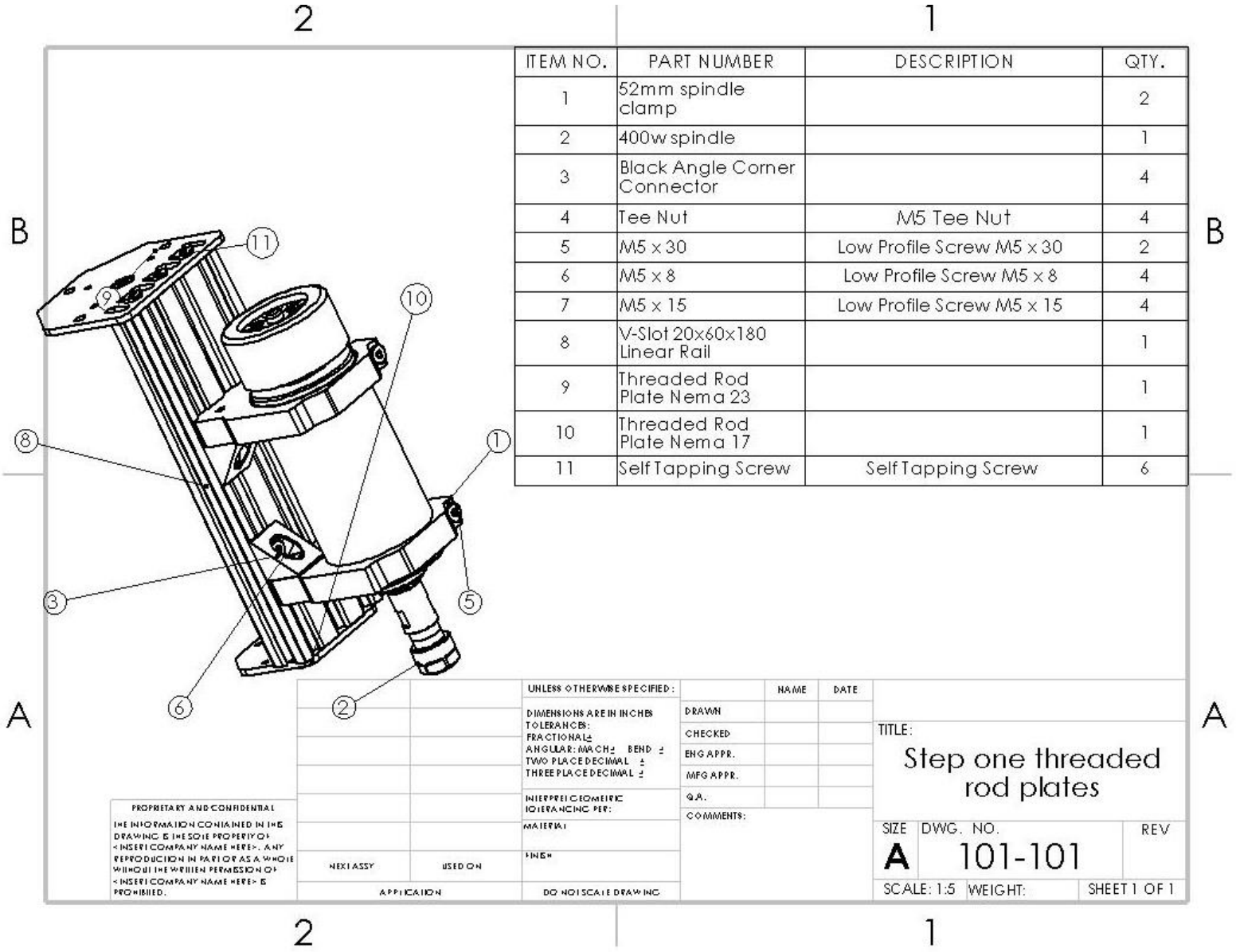
Safety:

Use of a CNC can be dangerous. There is noise, electrical, respiratory, and other safety concerns. Please read about the use of a CNC machine and understand its purpose and the materials you will be working with prior to continuing the build and use of this machine.

Hobby-Fab, SMW3D, and its affiliates cannot bear any responsibility for damages or personal injury caused by the use of this machine. It is up to the end user to ensure all safety matters are addressed and proper use of this machine is understood. Have fun and be careful!

Step 1

Z-axis:

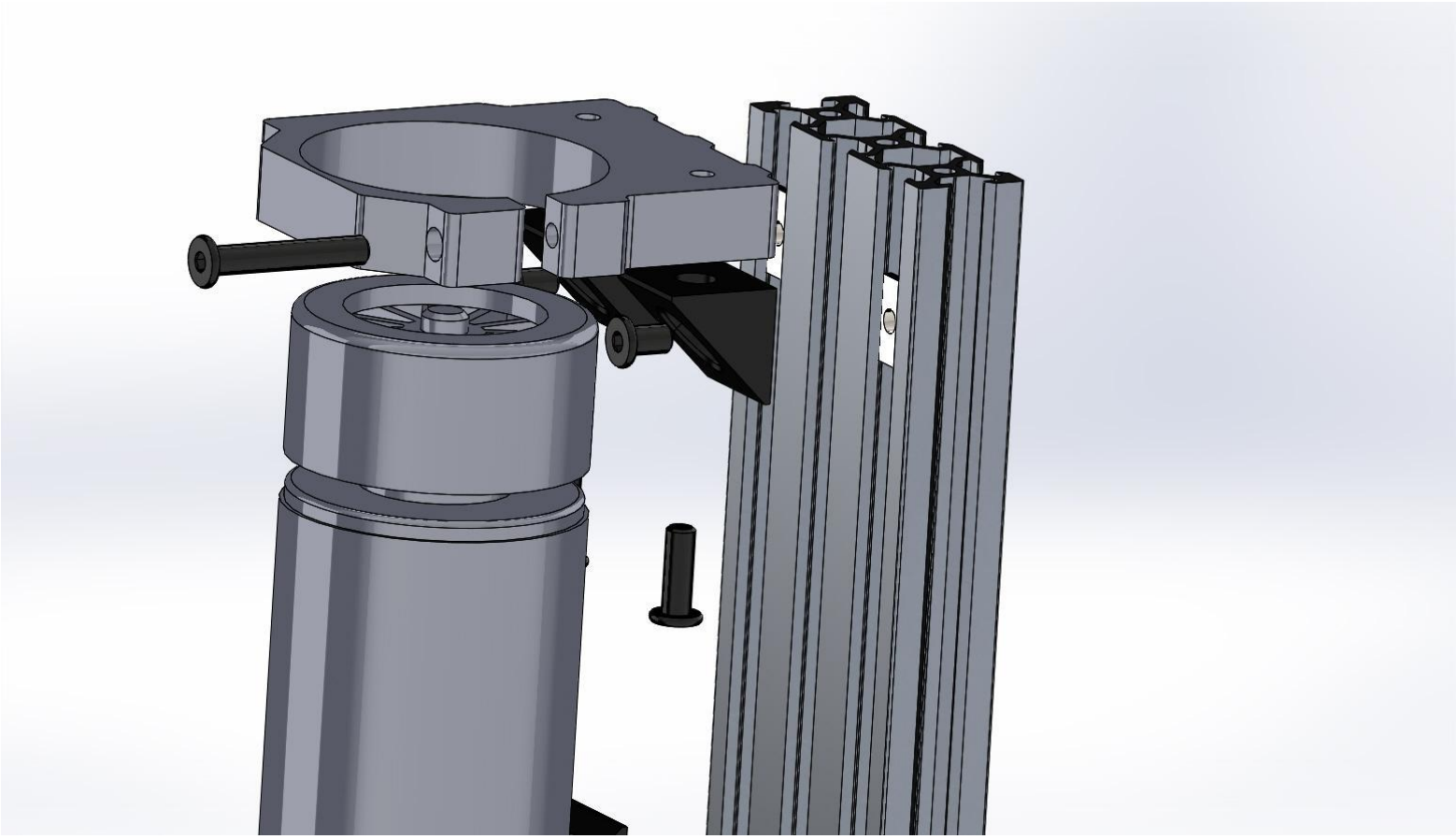


ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	52mm spindle clamp		2
2	400w spindle		1
3	Black Angle Corner Connector		4
4	Tee Nut	M5 Tee Nut	4
5	M5 x 30	Low Profile Screw M5 x 30	2
6	M5 x 8	Low Profile Screw M5 x 8	4
7	M5 x 15	Low Profile Screw M5 x 15	4
8	V-Slot 20x60x180 Linear Rail		1
9	Threaded Rod Plate Nema 23		1
10	Threaded Rod Plate Nema 17		1
11	Self Tapping Screw	Self Tapping Screw	6

The M5 x 30mm bolts are pre-installed in the clamps.

600W upgrade:

The 600w spindle upgrade is mounted in the same fashion. The builder will also find the 600w power supply in step one.

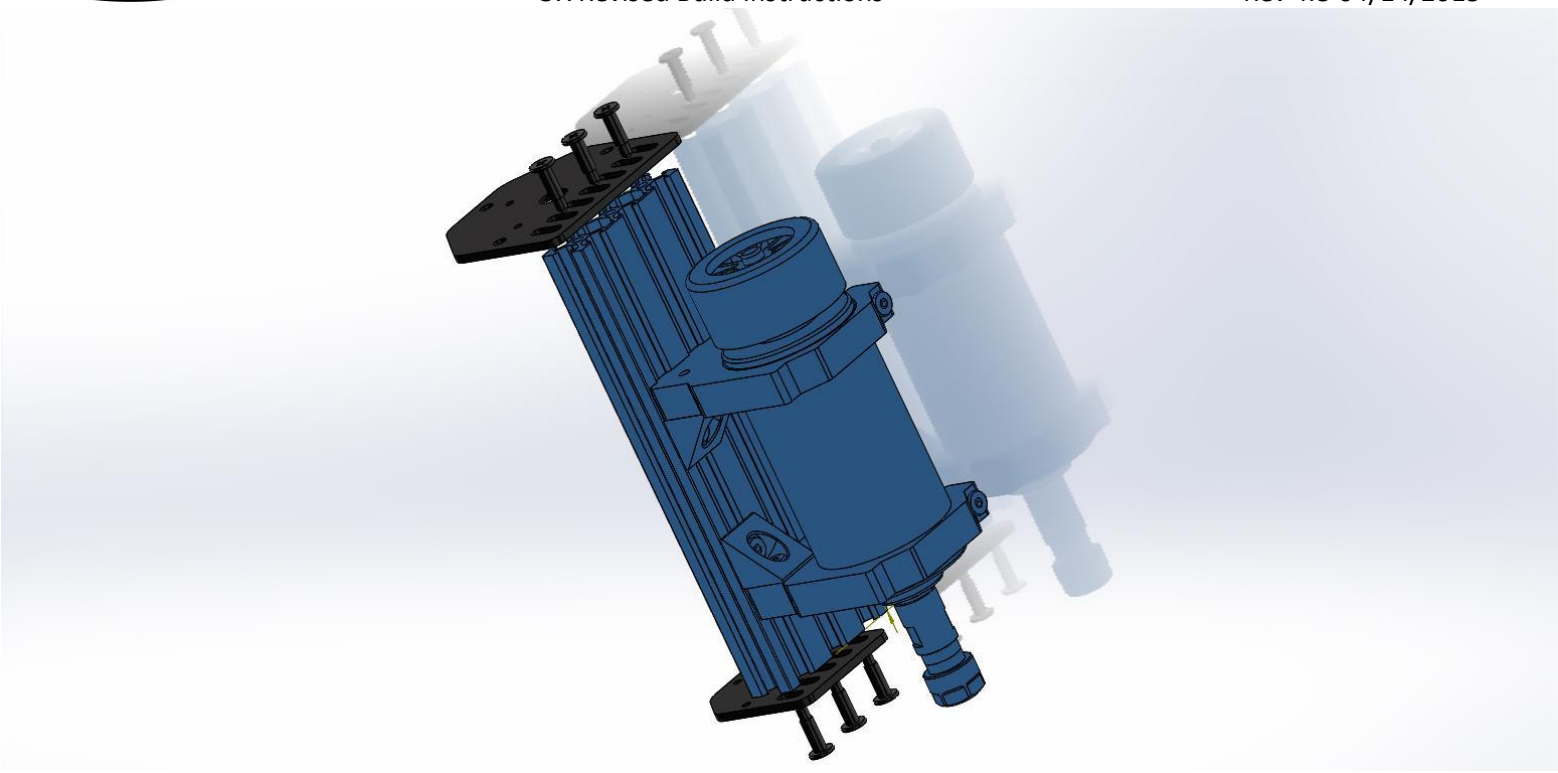


Exploded View. M5 x 8 bolts go into Tee-nuts, M5 x 15 go into V-Slot.

Note here we are installing the black 90s on the inside, facing towards each other between the clamps, if this is difficult they can be installed on the outside (top and bottom) of the clamps.

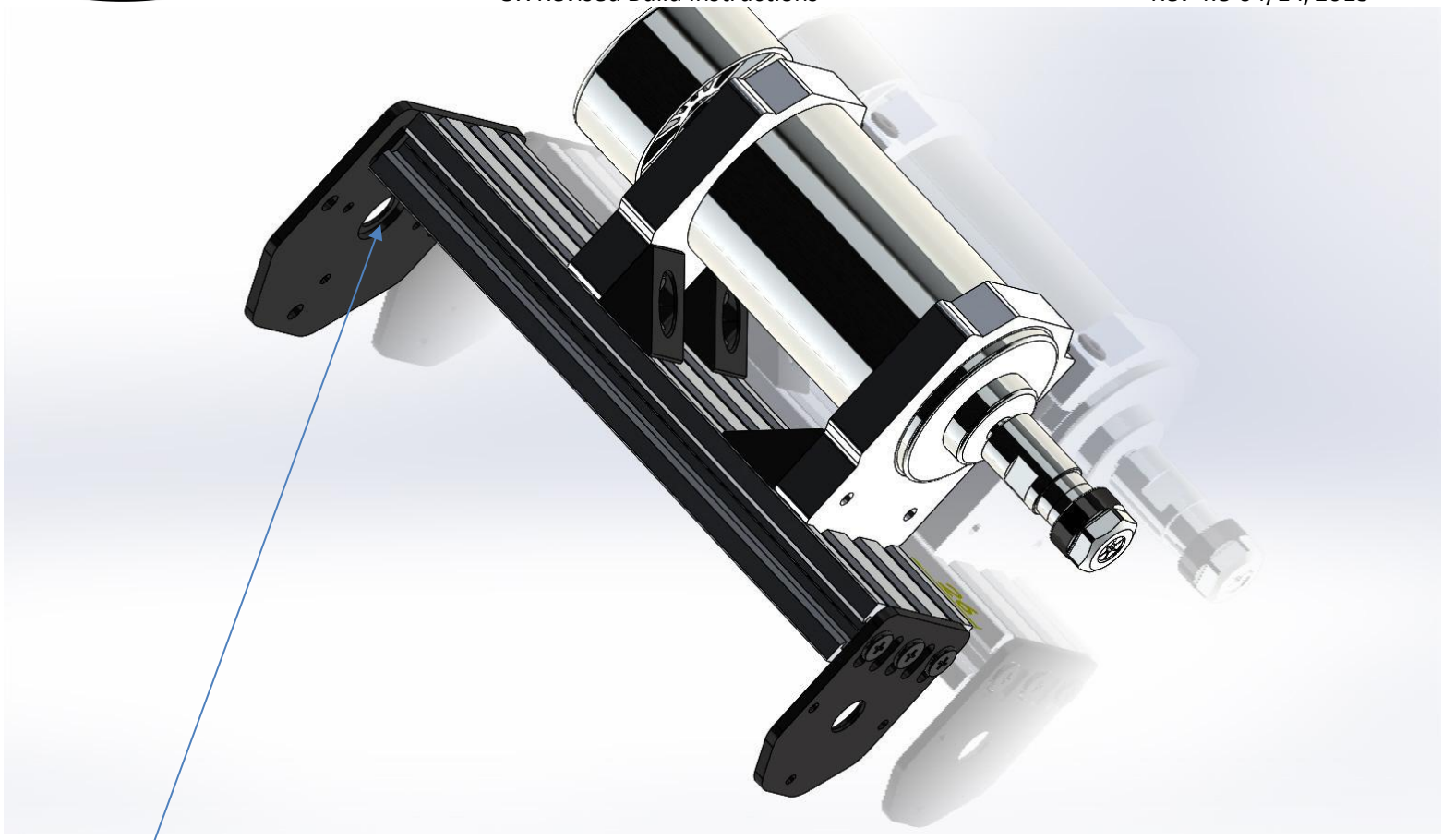
1. Slide the clamps over the spindle motor (these are a tight fit, you can open them with slight hand pressure to install over spindle).
2. The clamps should ride at the top and bottom of the spindle, the bottom clamp should be approximately 40mm from the bottom of V-Slot extruded aluminum.
3. Loosely install the M5 x 30 bolt in the spindle clamps and tighten at the last step. Perform on a flat surface so both clamps are oriented the same direction.
4. Slide Tee-nuts in V-Slot
5. Install M5 x 8mm bolts through black 90 brackets into tee-nuts in V-Slot loosely.
6. Install spindle clamps to black 90 brackets with M5 x 15mm bolts.
7. Once all is aligned, tighten M5 x 8mm, M5 x 15mm, and M5 x 30mm bolts.

Now we install the threaded rod plates.



8. The smaller plate goes on the bottom, the bearing recesses (on the threaded rod plates) face each other. Install with 3 qty (per side) self-tapping screws and leave loose. Note, we provide a screw driver, but the self-tapping screws are much easier to set with a drill motor.
9. Now that the self-tapping screw threads have been set, you will need to remove either the top threaded plate or the bottom threaded plate for step 3. It is easier to set the threads before we do the final assembly, hence doing it here then removing them for the final assembly.

We are now completed with this step; the assembly can be set aside.

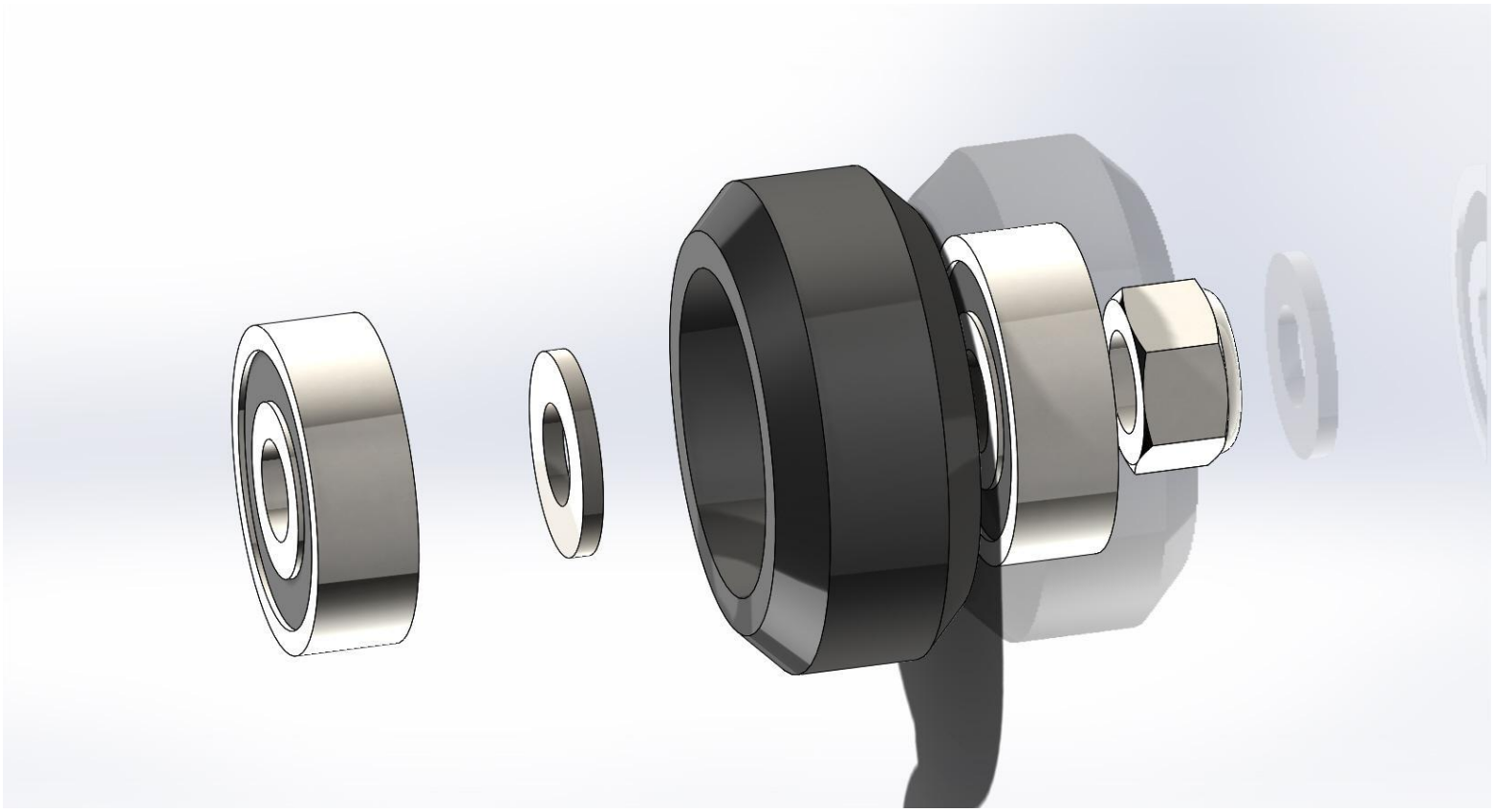


Bearing recess

Step 2:

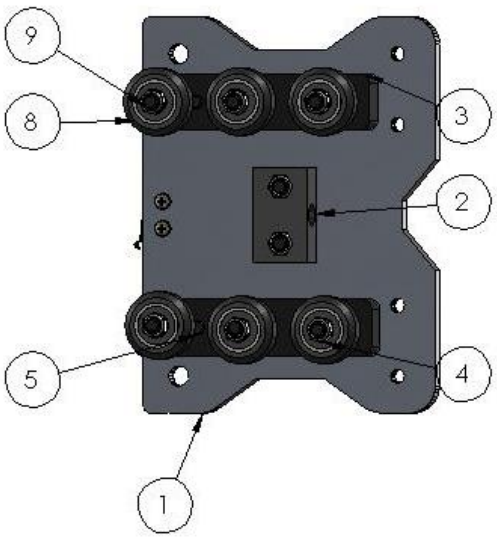
X_Z-Axis gantry plate assembly:

Before we begin this step let us look at how to assemble a wheel assembly. Note the package comes with the bearings and shims loose. You will need to build the wheel kits. See here:



Bearing, shim, wheel, bearing. In some instances, the additional shim is required outside the wheel, the extra shim is not used in this build. Do not use both shims inside the wheel. If the additional shim is required, the build instructions will indicate where to put them.

After you build at least 6 qty wheel kits it is time to continue the X_Z axis build.



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	OX Front X gantry plate		1
2	8mm Acme Nut Block		1
3	Spacer Block		2
4	Nylon Insert Lock Nut M5	Nylon Insert Locknut	2
5	M5 x 20	Low Profile Screw M5 x 0.8 thread. 3mm hex.	6
6	Mini Eccentric Spacer 0.25in		3
7	Aluminum Spacer .25in		3
8	Wheel Kit	Solid V-Wheel Kit	6
9	M5 x 45	Low Profile Screw M5 x 45	6
10	Aluminum Spacer 3mm		6

		UNLESS OTHERWISE SPECIFIED:		NAME	DATE
		DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ± ANGULAR: MACH ± BEND ± TWO PLACE DECIMAL ± THREE PLACE DECIMAL ±	DRAWN		
			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
PROPRIETARY AND CONFIDENTIAL		MATERIAL	COMMENTS:		
NEXT ASSY	USED ON	FINISH			
APPLICATION		DO NOT SCALE DRAWING			

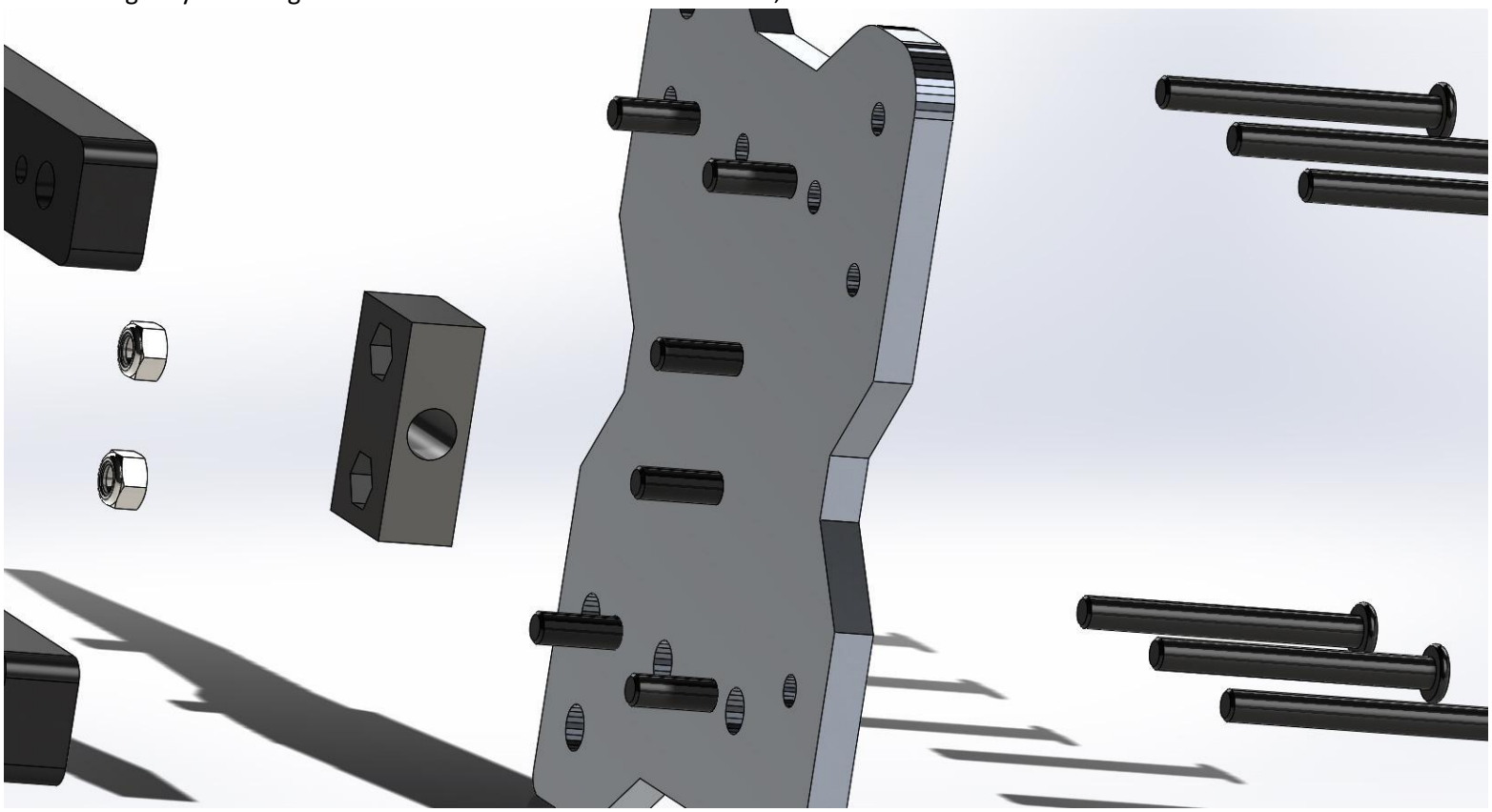
TITLE: X_Z Gantry plate Assembly

SIZE	DWG. NO.	REV
A	101-102	

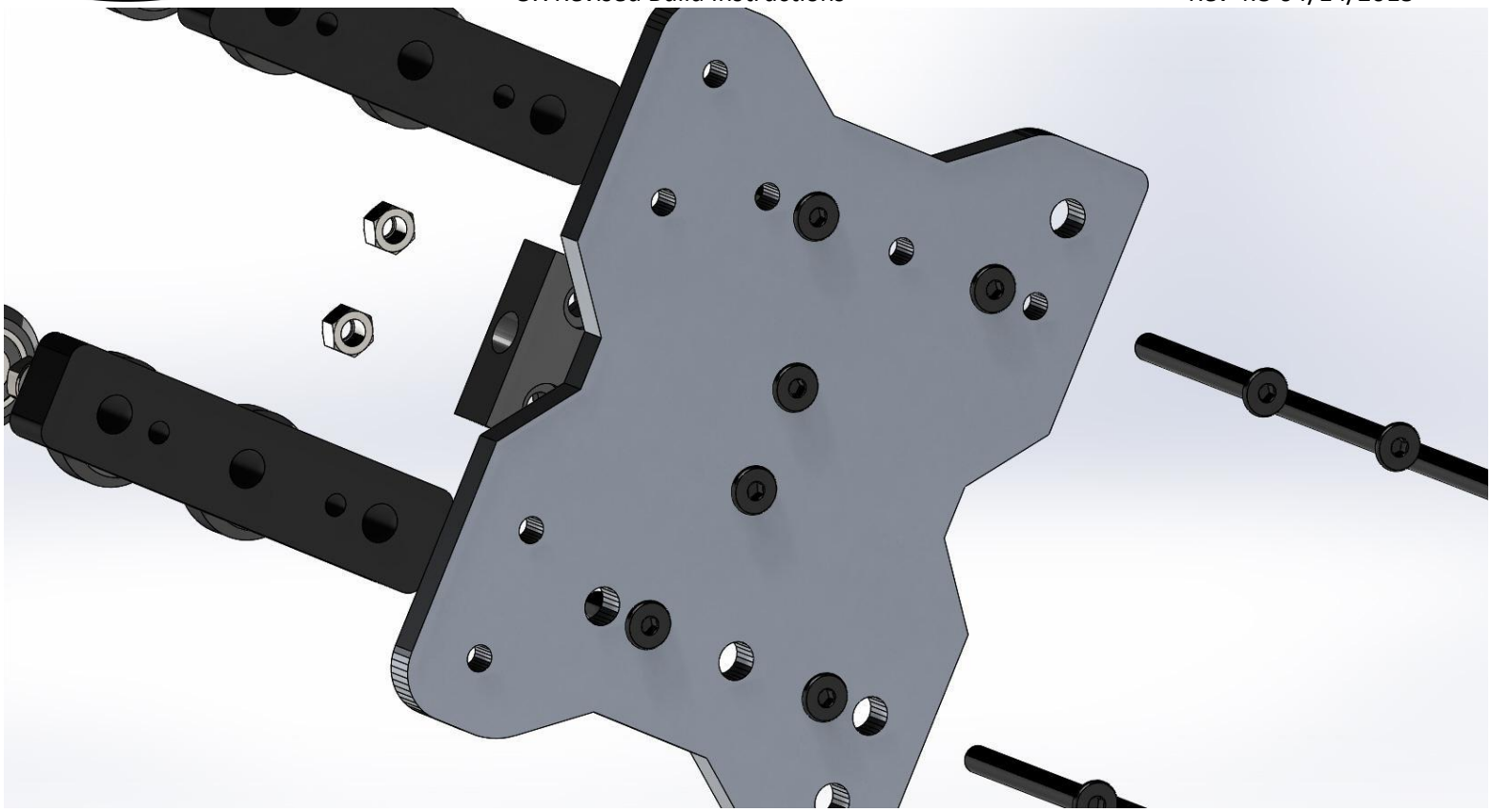
SCALE: 1:2 WEIGHT: SHEET 1 OF 1

The limit switch will face down. This is what will be considered the Z limit switch.

1. Begin by installing M5 x 20mm bolts in the center two holes, and the smaller holes as shown here:

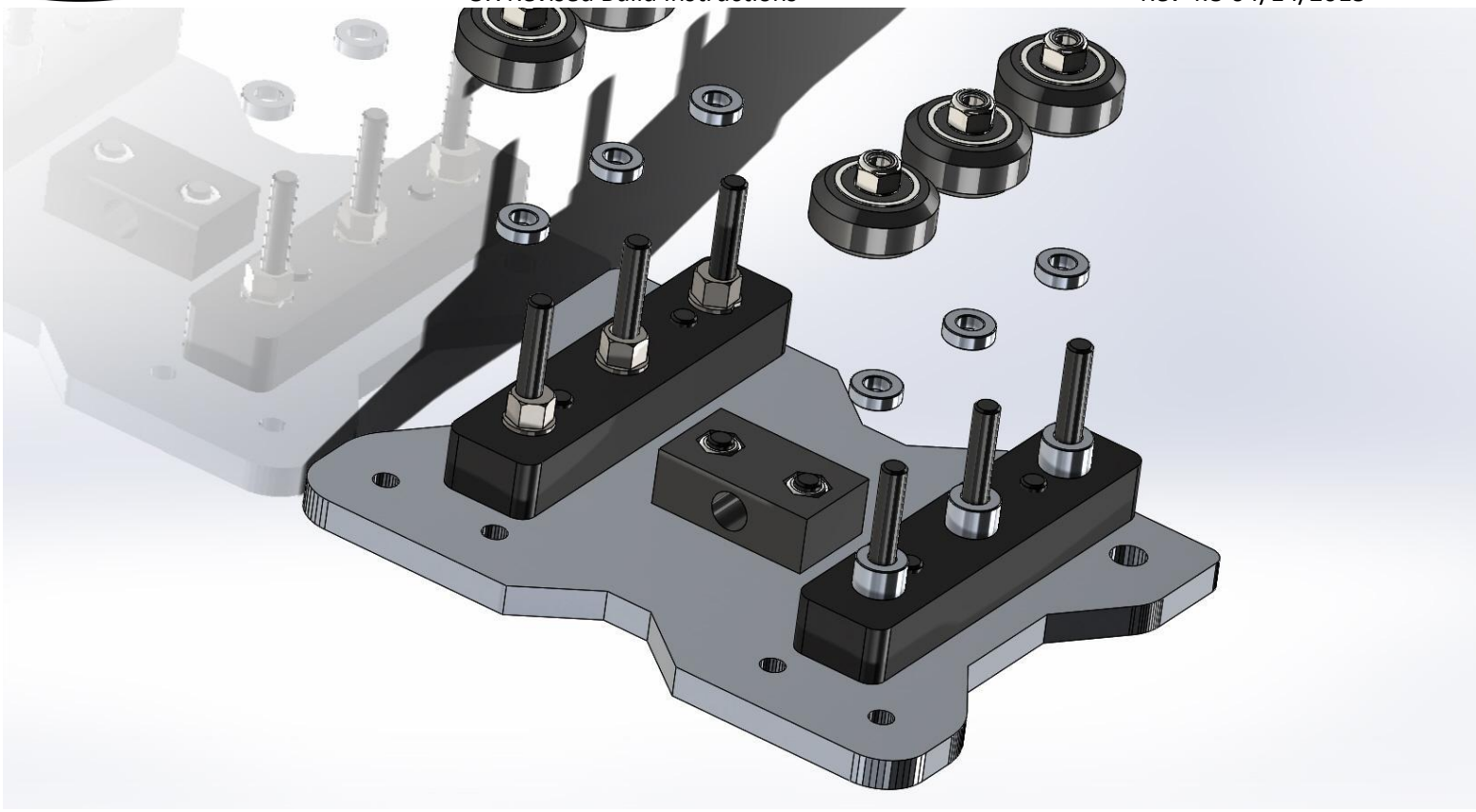


*NOTE: We added a Z limit switch during the writing of these instructions. The gantry plate has since been modified in shape. The sharper corners face towards the bottom of the Z axis. The limit switch should be installed on the side of the plate that the bolt heads (not threads) are on. The images used will show the old profile of the plate in some instances, such as above.

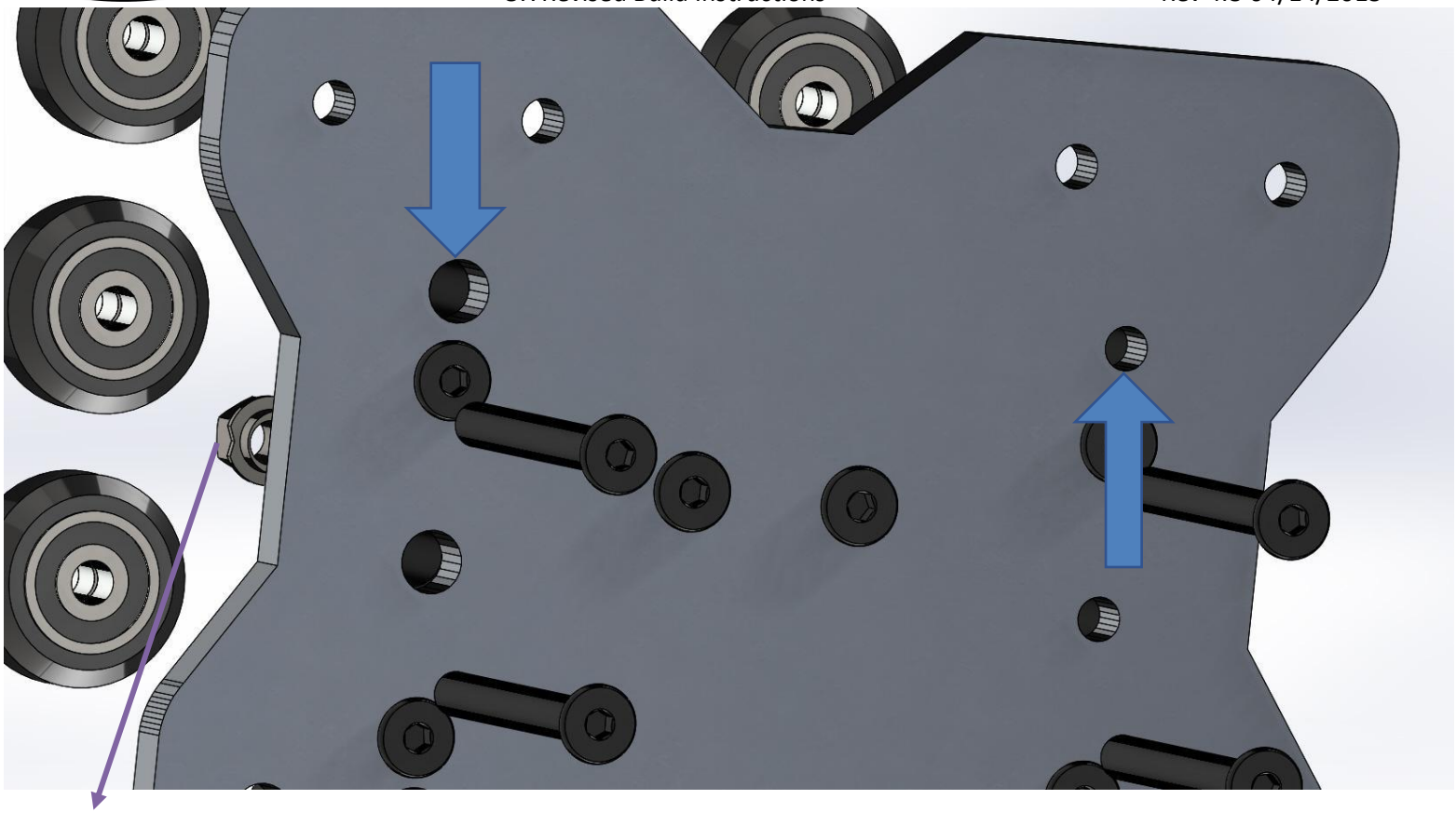


2. Next install 2 qty M5 nuts into the plastic ACME nut block. Note one side has cut outs for the nuts.

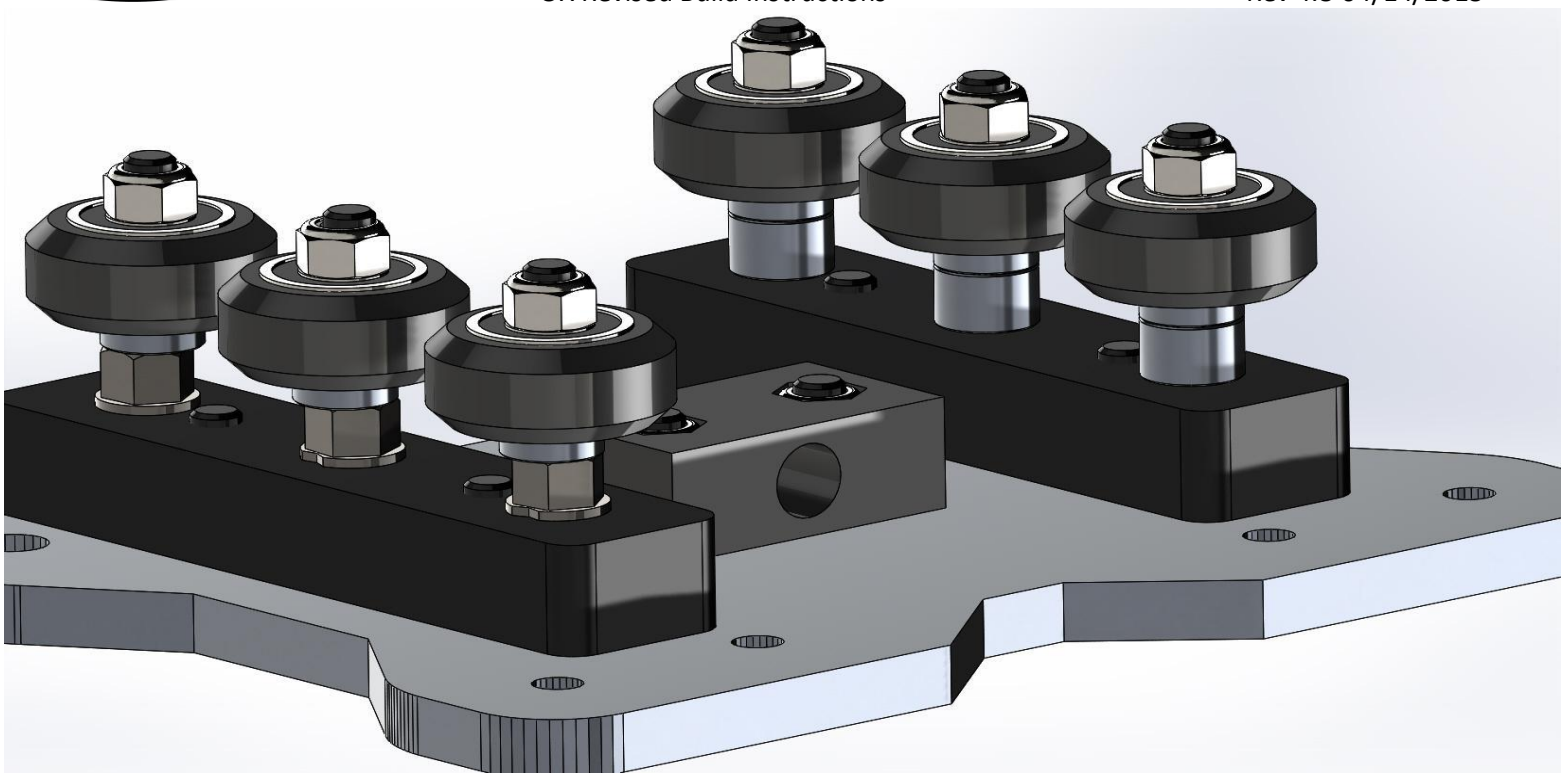
3. Tighten the M5 x 20 bolts holding the black plastic ACME nut block on, snug, do not crush the plastic nut… it is possible! The bolts need to be tight, not torqued.
4. Next install the spacer blocks (long black pieces) there are threaded holes that the M5x20 bolts will affix to as shown above.
5. Afterwards slide the M5x45 bolts into the holes in the back of the plate, through the spacer blocks as seen here:

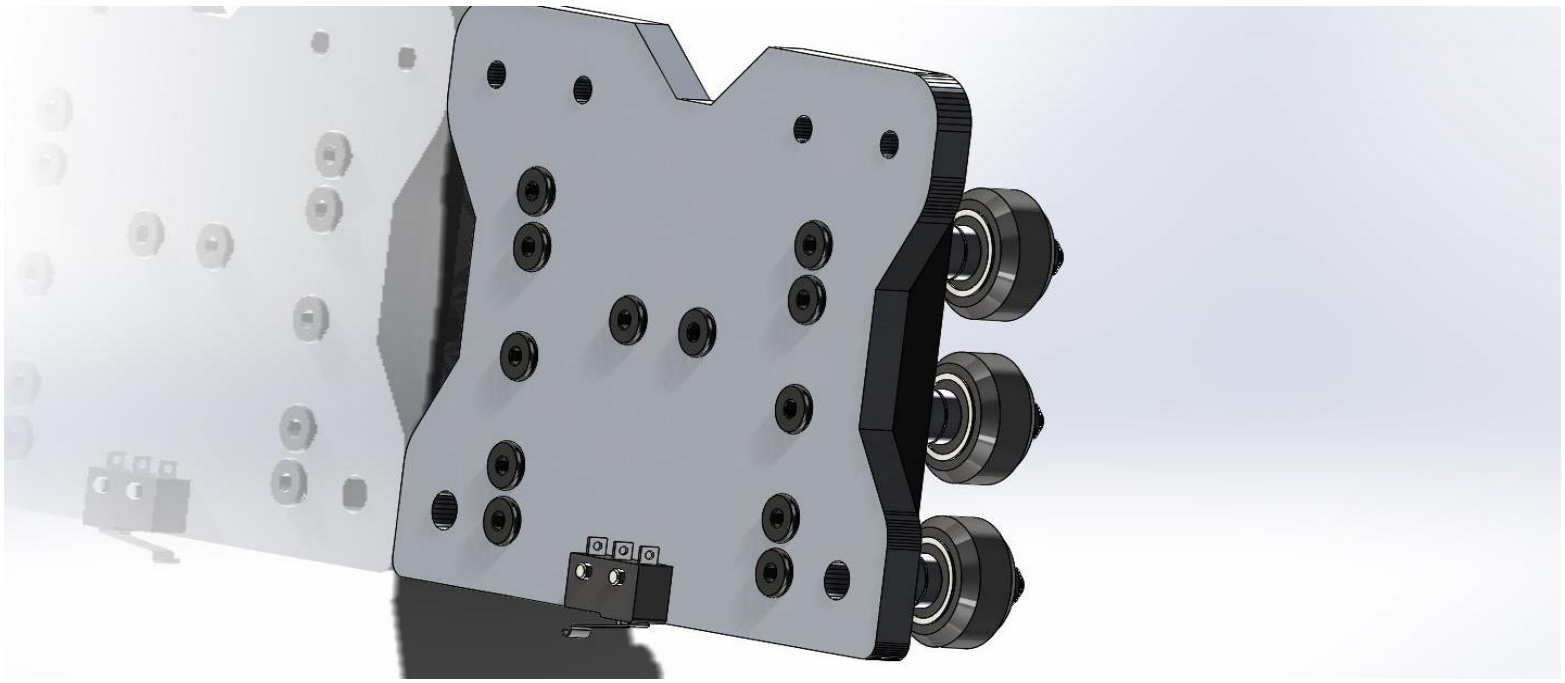


6. Now we will install eccentric spacers on one spacer block and plain spacers on the other. Next install the thinner spacers (3mm) on top of the eccentric and standard spacers. The eccentrics (later) will allow for us to remove slack from the drive. Before installing the eccentric spacers, note that one set of holes on the rear of the X gantry plate is larger than the other. Install the eccentrics on the larger hole set:



7. Install the eccentrics with the cut-out (on the flange of the eccentric spacer) facing towards the outer edge of the plate.
8. Install the wheels and snug up the M5 nuts holding the wheels onto the M5 x 45mm bolts.

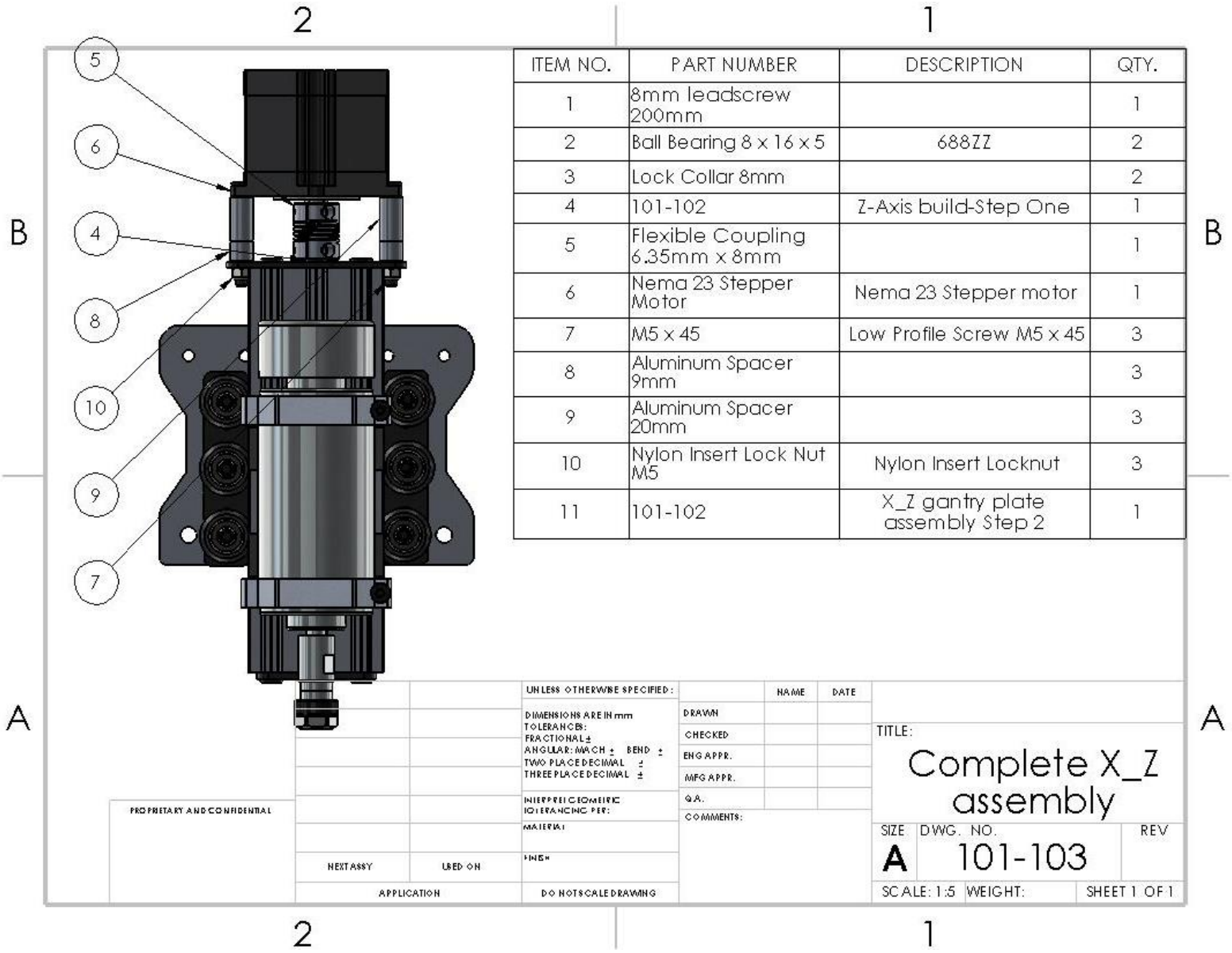




Step 3

Complete X_Z gantry assembly

In this step, we will build the X_Z gantry assembly.



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	8mm leadscrew 200mm		1
2	Ball Bearing 8 x 16 x 5	688ZZ	2
3	Lock Collar 8mm		2
4	101-102	Z-Axis build-Step One	1
5	Flexible Coupling 6.35mm x 8mm		1
6	Nema 23 Stepper Motor	Nema 23 Stepper motor	1
7	M5 x 45	Low Profile Screw M5 x 45	3
8	Aluminum Spacer 9mm		3
9	Aluminum Spacer 20mm		3
10	Nylon Insert Lock Nut M5	Nylon Insert Locknut	3
11	101-102	X_Z gantry plate assembly Step 2	1

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN mm
TOLERANCES:
FRACTIONAL ±
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±
THREE PLACE DECIMAL ±
INTERPRET GEOMETRIC TOLERANCING PER:
MATERIAL
FINISH
DO NOT SCALE DRAWING
NAME DATE
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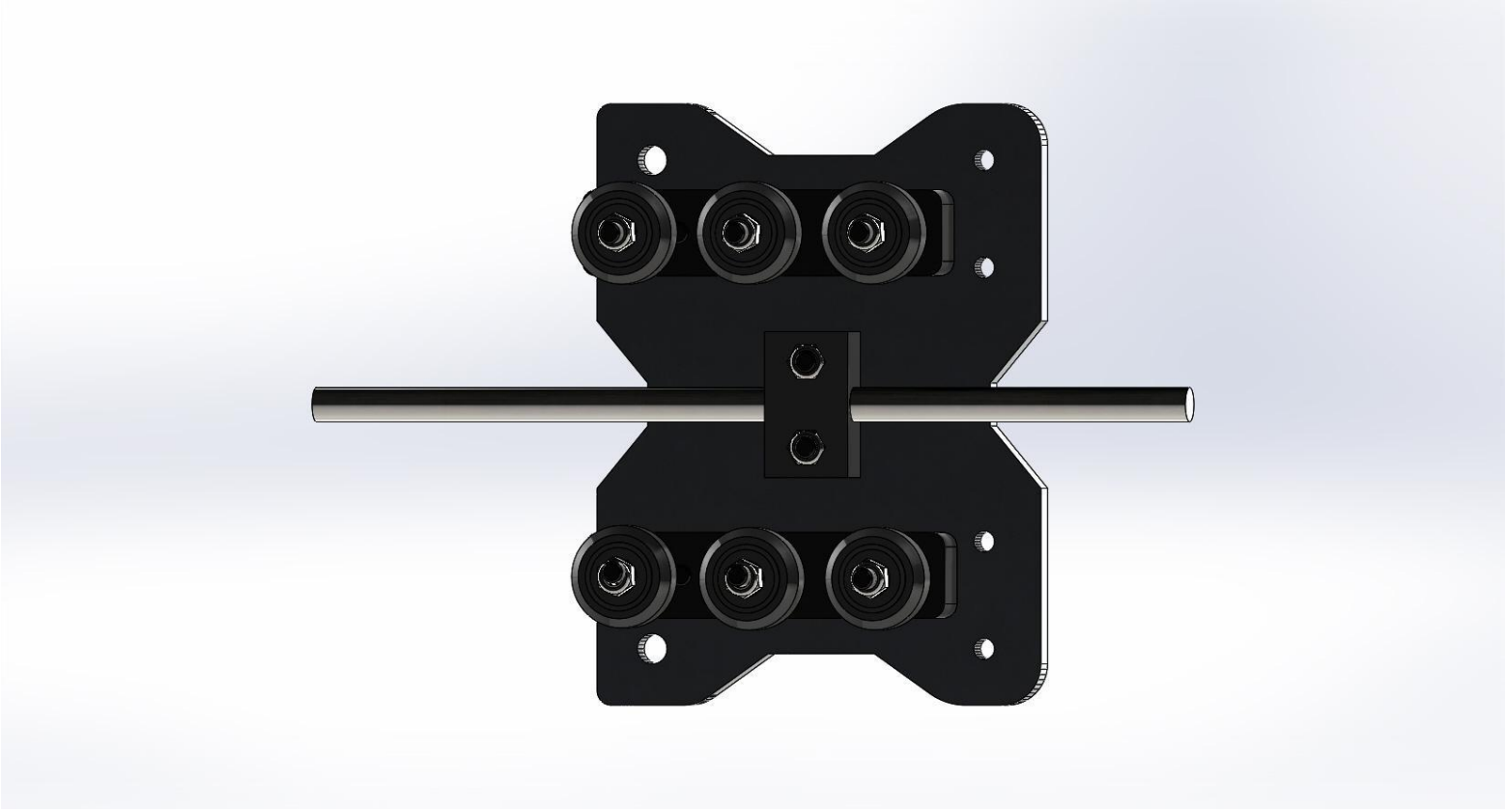
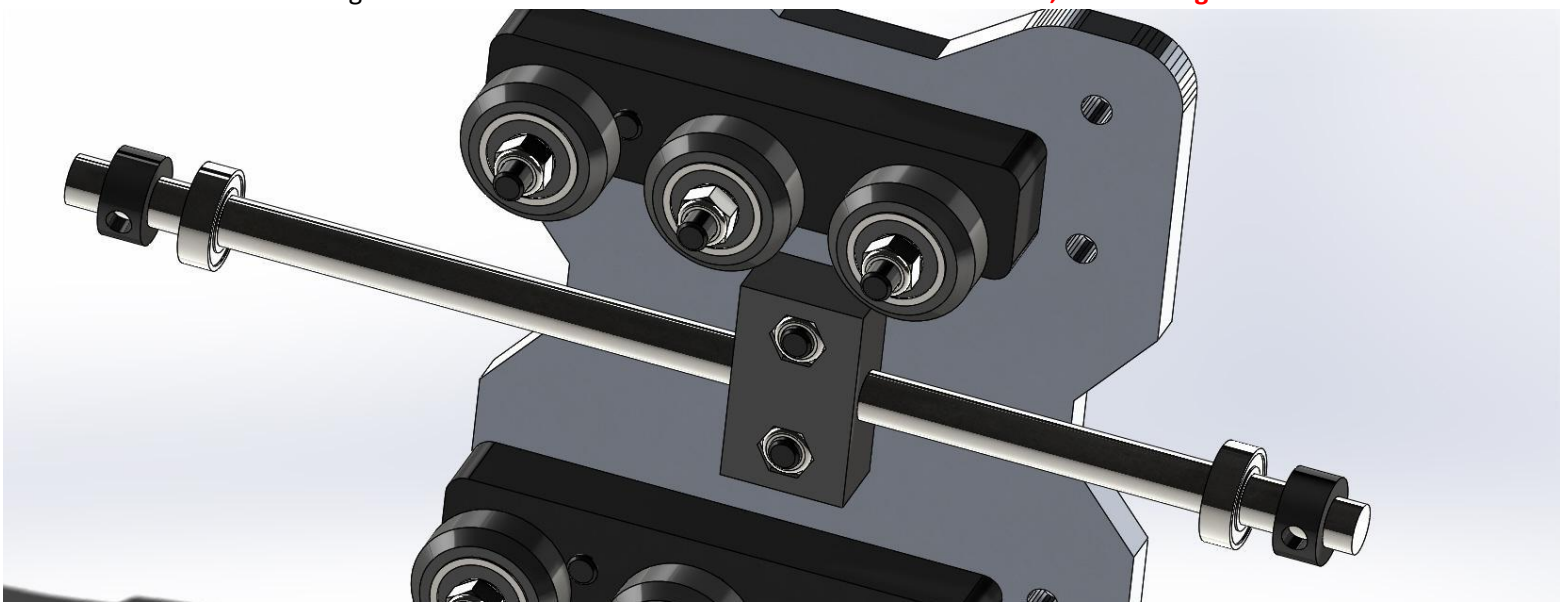
ENG APPR.
MFG APPR.
Q.A.
COMMENTS:
PROPRIETARY AND CONFIDENTIAL
NEXT ASSY USED ON
APPLICATION
TITLE:
Complete X_Z assembly
SIZE A
DWG. NO. 101-103
REV
SCALE: 1:5 WEIGHT:
SHEET 1 OF 1

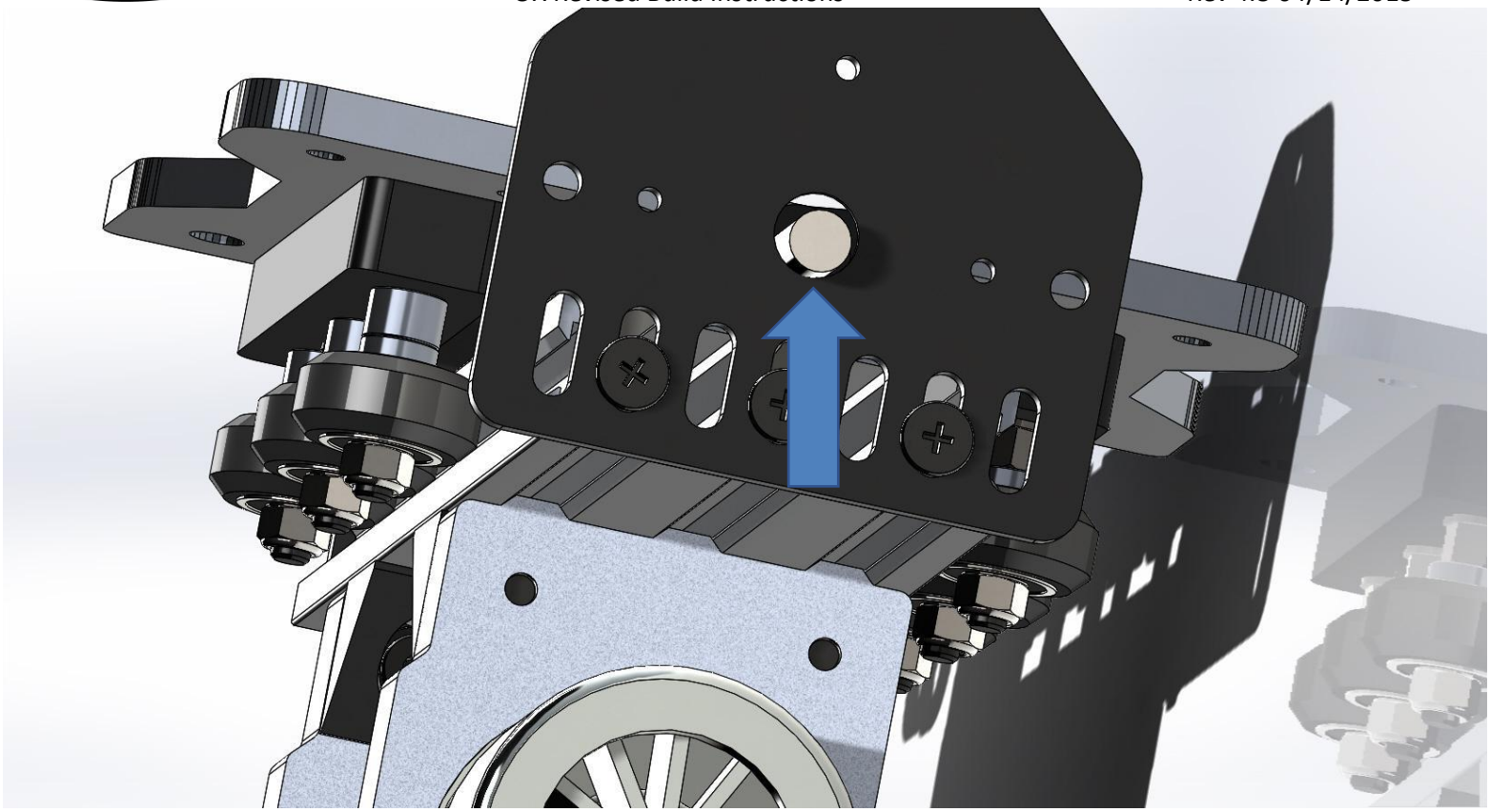
1. Begin by installing the ACME rod in the ACME nut block from step 2. (NOTE) The ACME rod is in bottom of the 12”x12”x12” square box that all the parts came in.



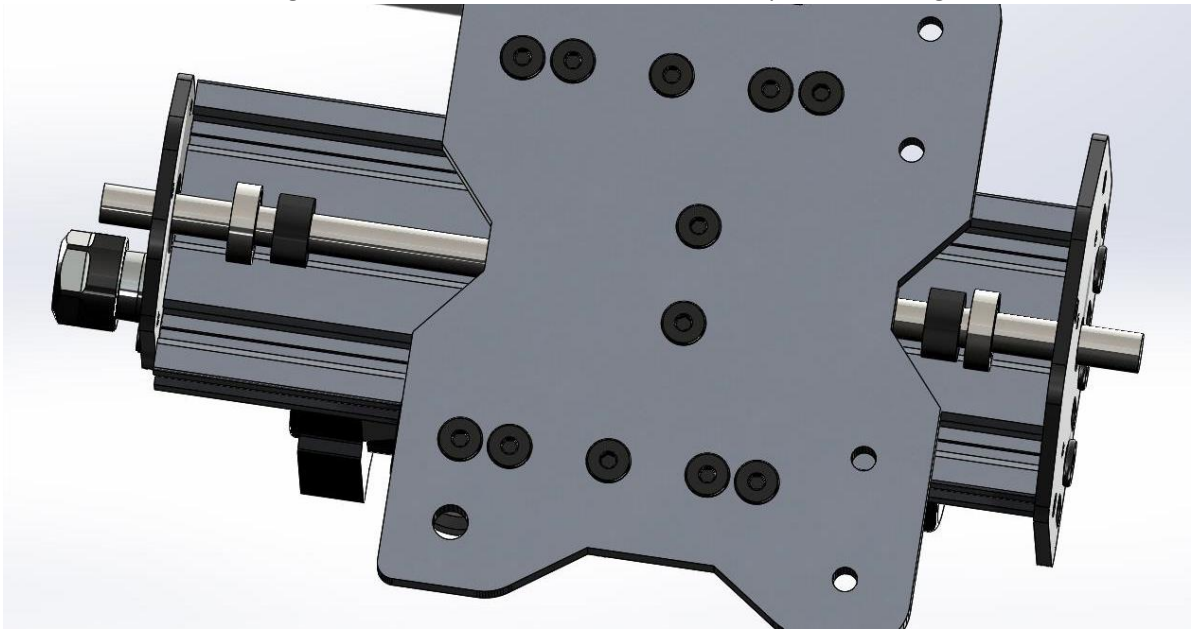
2. Install a 688zz bearing and lock collar on each end. **Reverse order shown below, lock collar goes on first.**

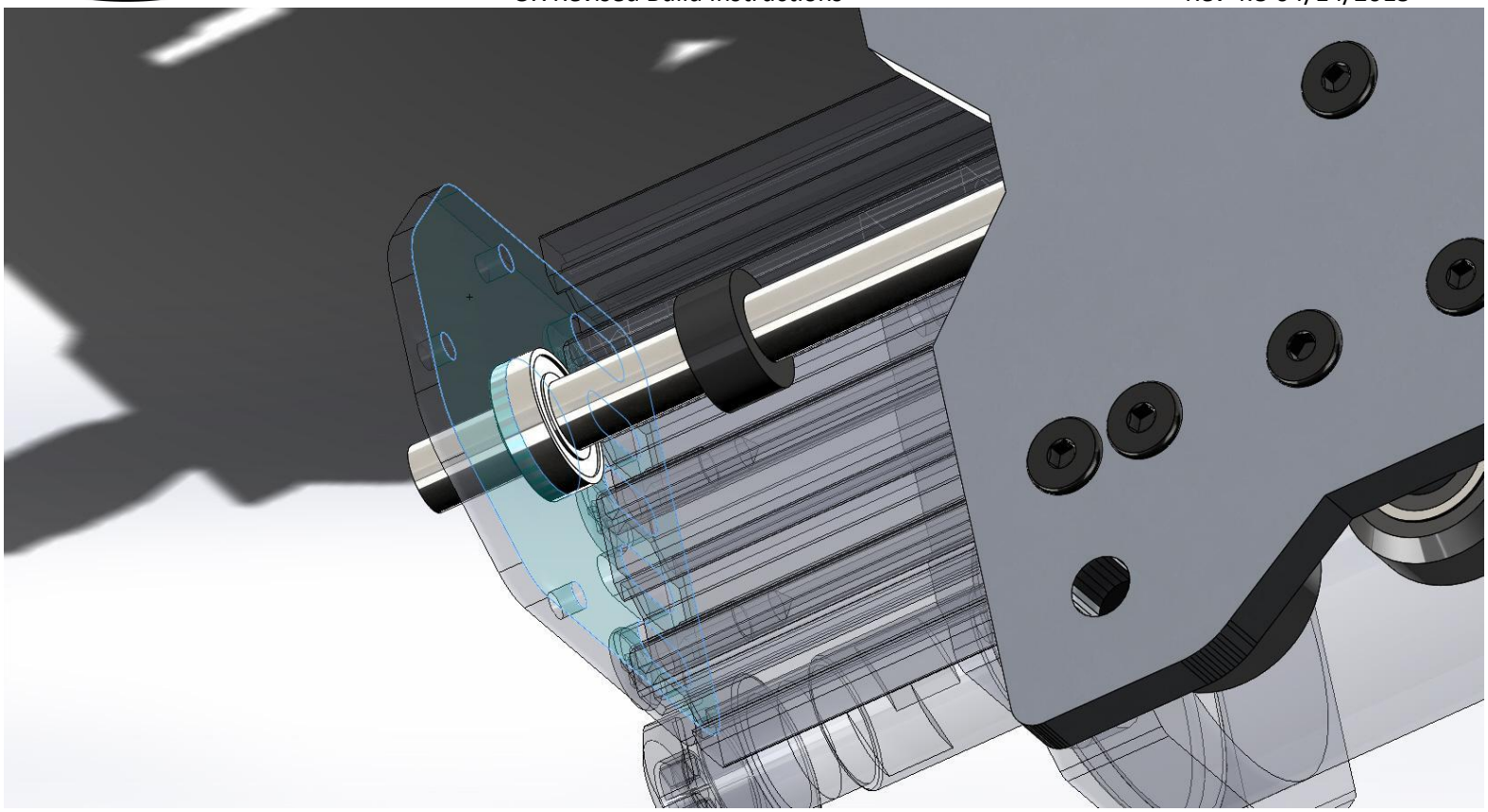


3. Position the Z axis from step one (with one removed threaded rod plate) over the wheels and slide into place. Be cautious of the tension between the wheels and the 20x80, if it is too tight make sure the eccentrics are properly placed.

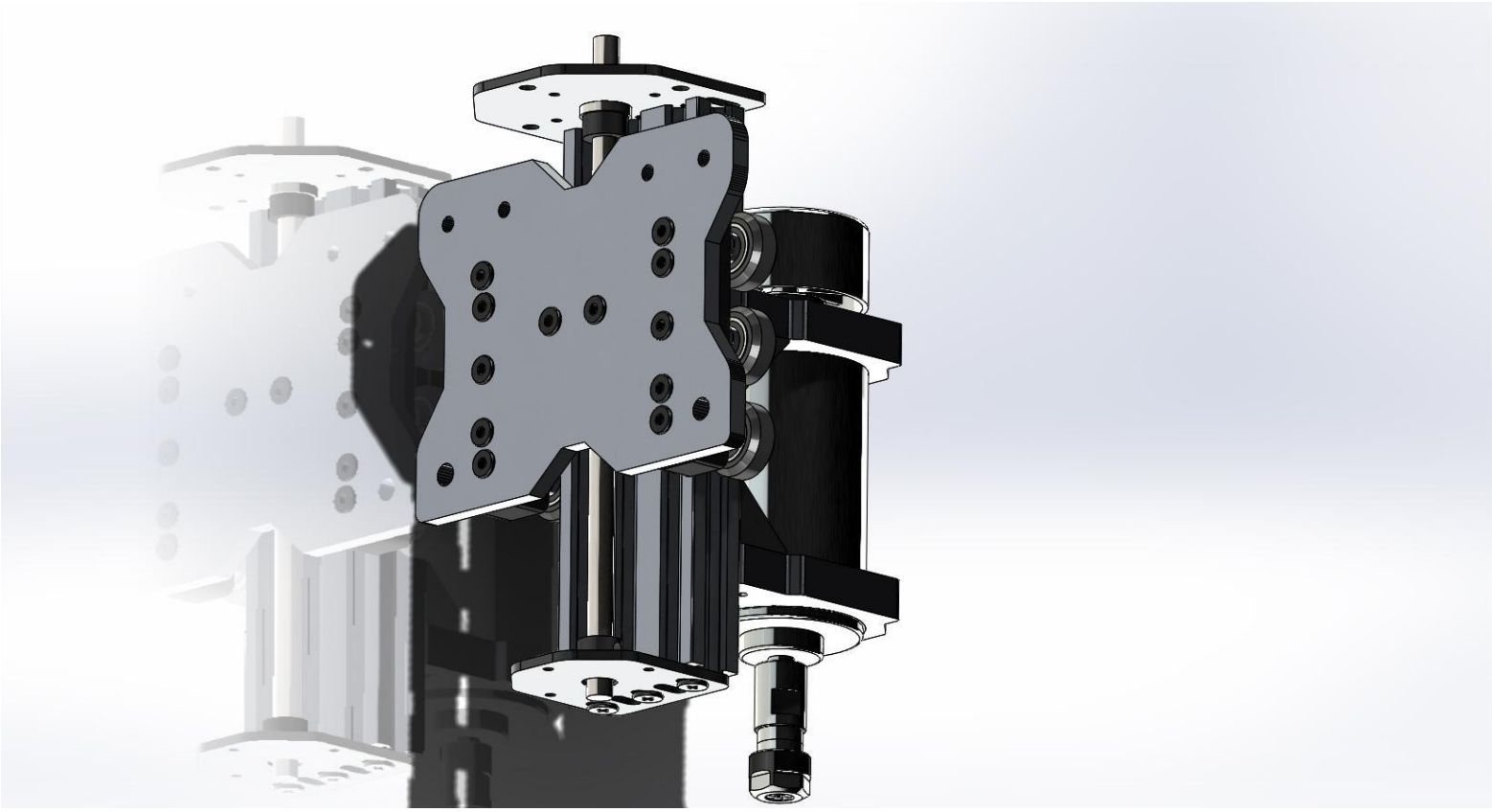


4. Next, with the screws loose on the threaded rod plate, we will align the bearings with the recesses in the threaded rod plate.
5. Push the bearings into the recesses of the threaded rod plates, then tighten the threaded rod plates in place.

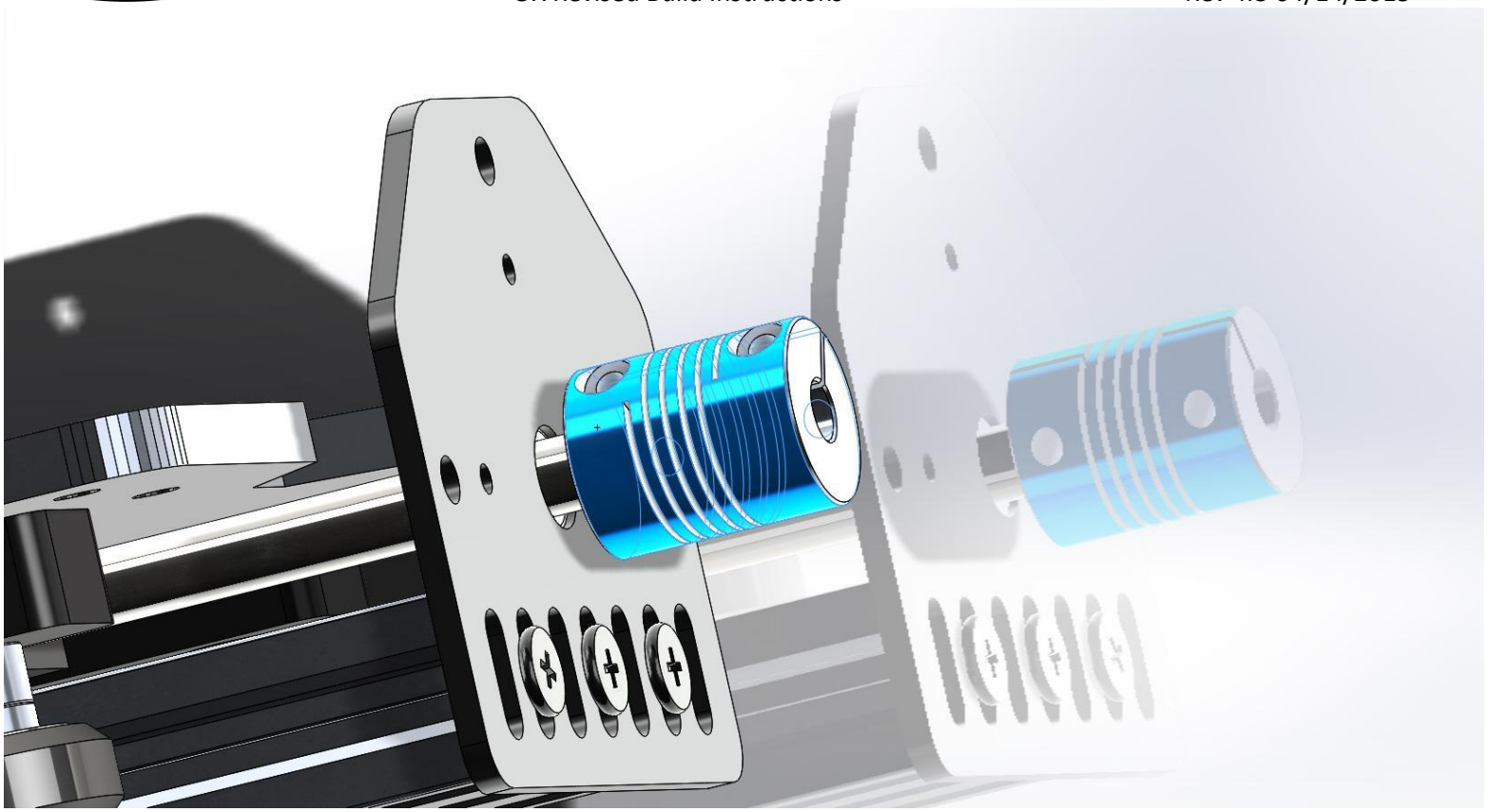




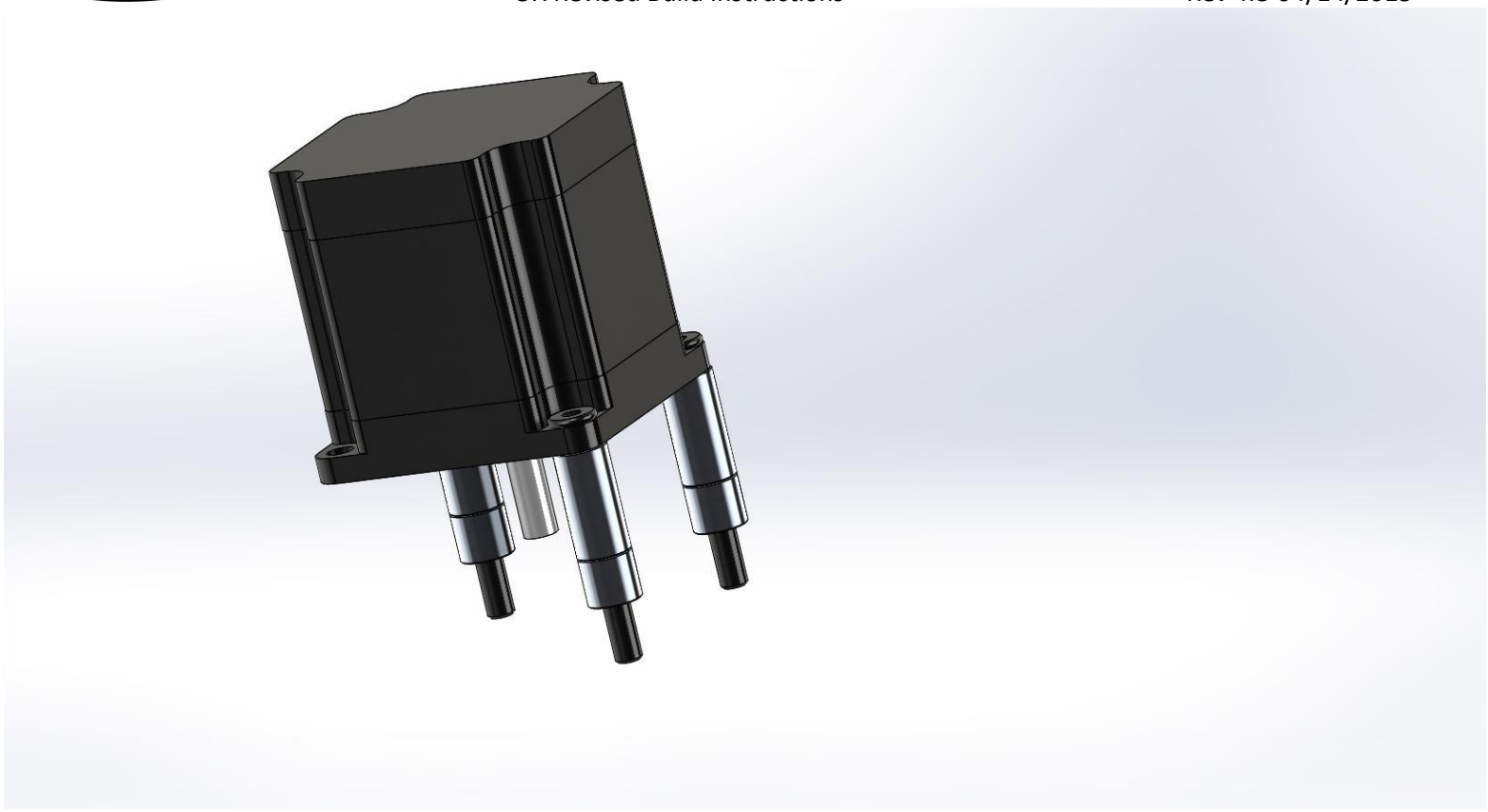
6. Once the threaded rod plates are tightened down, lock the bearings in place with the lock collars. NOTE: you will need to leave about 2mm of ACME hanging out of the bottom of the lower (smaller) threaded rod plate. The above pictures shows an exaggerated amount hanging out for display.



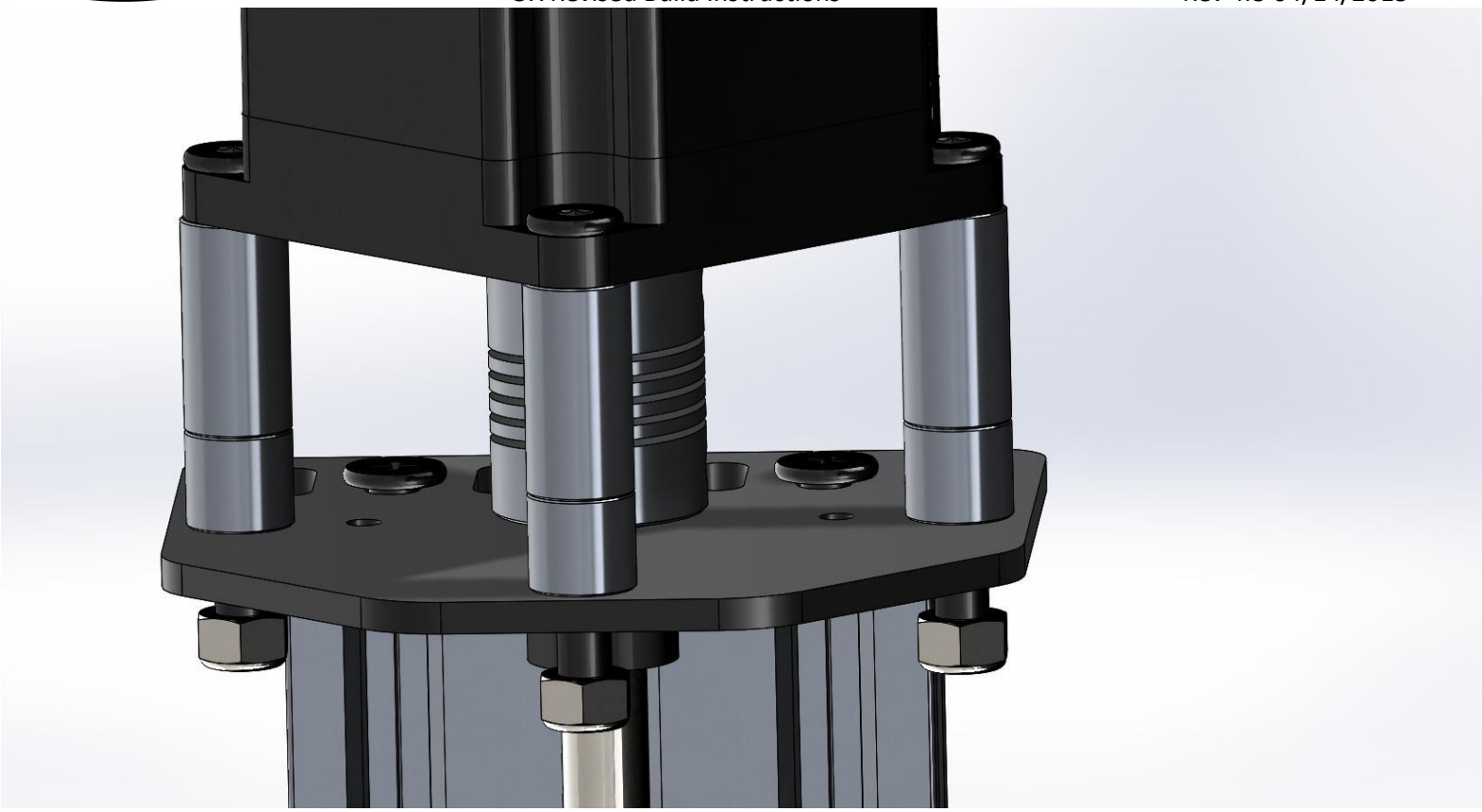
7. Check to make sure there is little to no play when you turn the ACME by hand. Also check to make sure the ACME does not bind when turning by hand. If it does either adjust the lock collars or threaded rod plates to remedy this.
8. Next install the 6.35mm x 8mm coupler on the ACME rod. This goes on the top, the side with the larger threaded rod plate. Slide the coupler down on the ACME till it stops and tighten the lower set screw on the lock collar.



9. Grab the NEMA 23 stepper motor install 3 qty M5 x 45mm bolts in any three holes, slide one each 20mm spacer and nine mm spacer over each bolt.

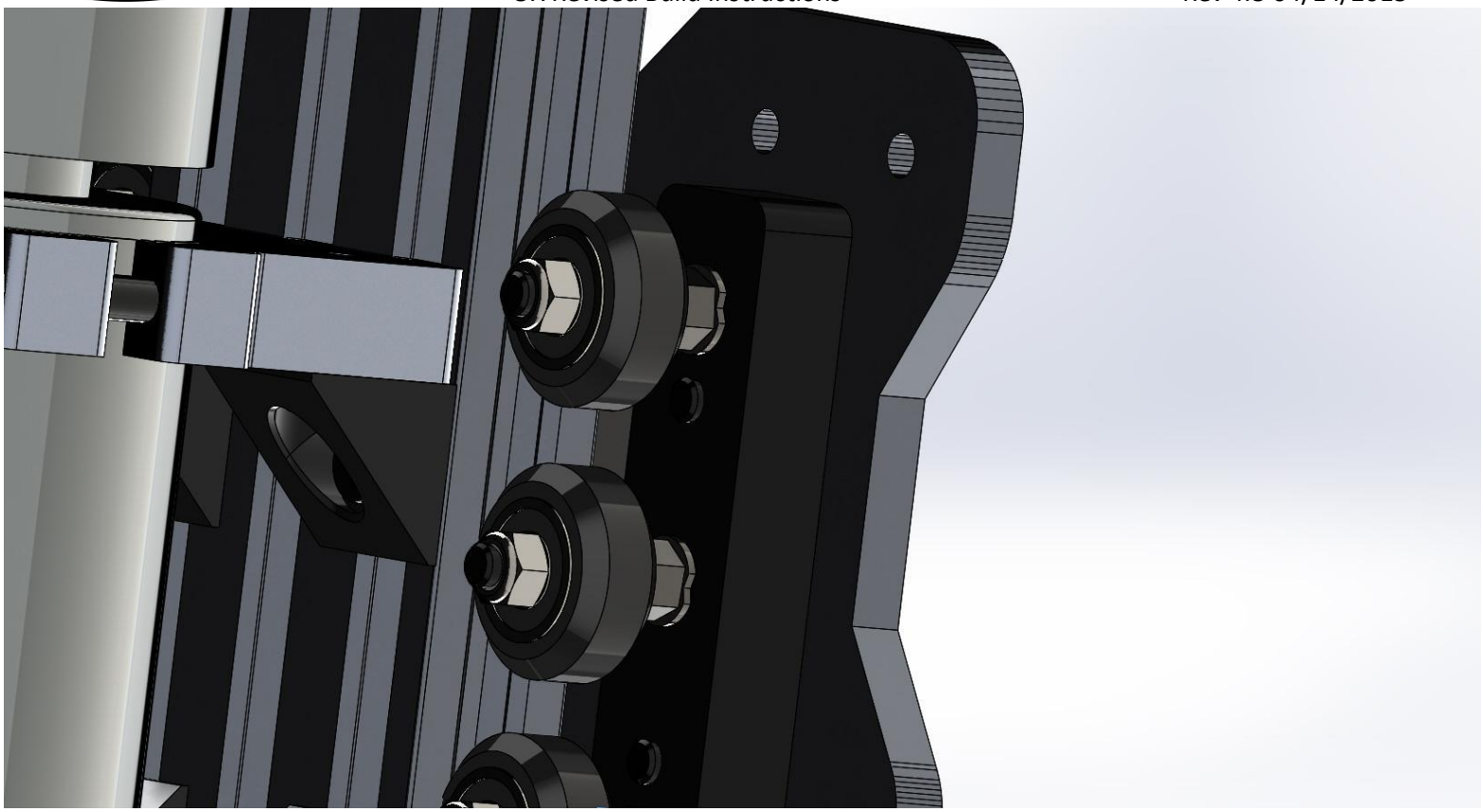


10. Now slide the stepper motor shaft into the coupler and run the three bolts into the matching holes in the threaded rod plate.
11. Follow this with installing three qty M5 nuts and tightening the coupler onto the motor shaft.



Tighten the M5 nuts to secure the motor.

12. Recall the eccentric spacers installed on one of the spacer blocks above. It is now time to give these a turn and take the side to side slack out of the Z axis. When installed we did so with the cutouts facing the outside of the plate, as seen here:

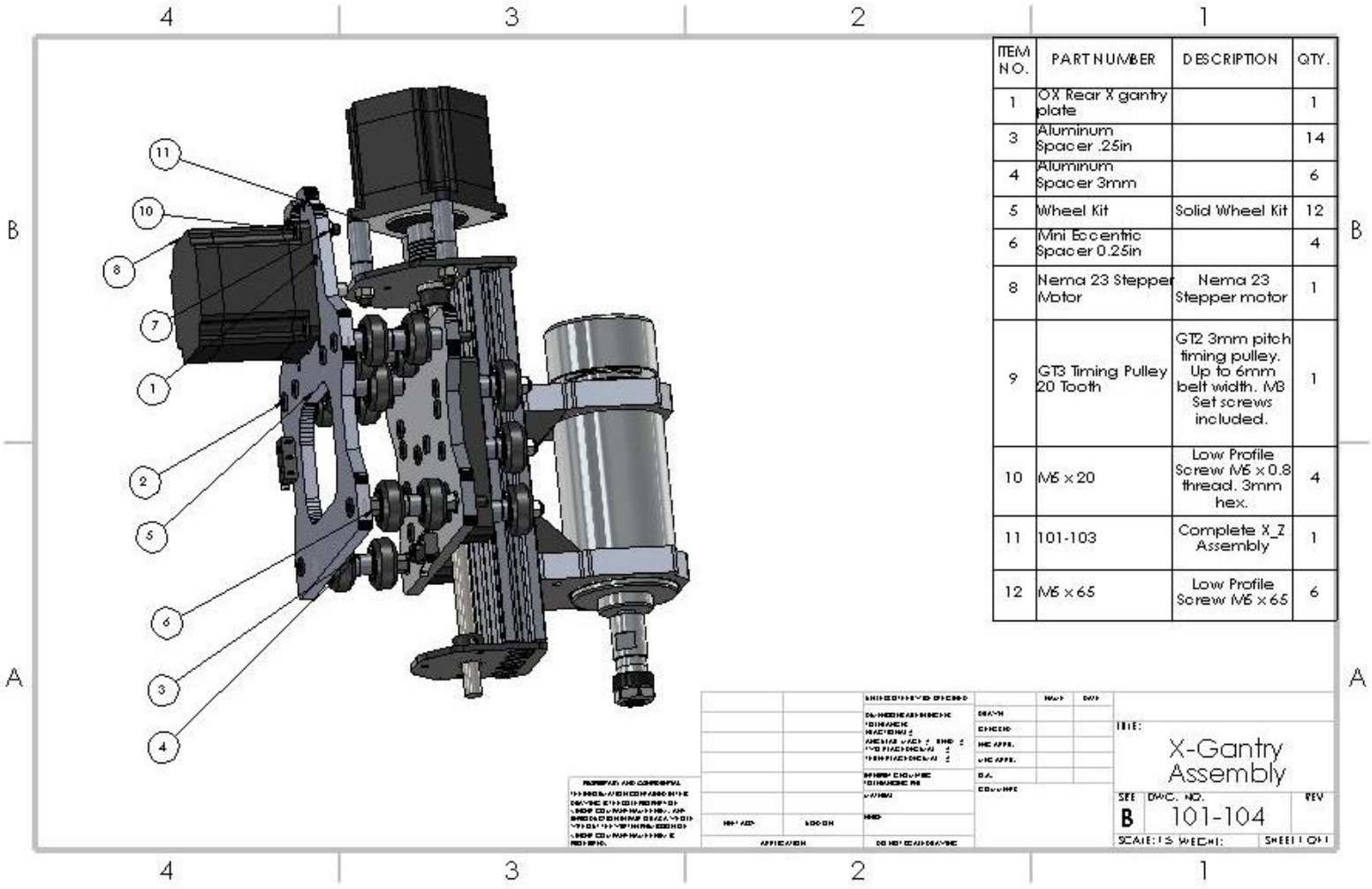


Taking the 8mm combination wrench turn each eccentric 1/8 of a revolution of a turn at a time. The wheels will get closer to the 20x60x180 extrusion. Do the top eccentric, middle, bottom. Physically feel the play in the wheel. If there is a lot of play, i.e. you can turn the wheel freely do another 1/8 of a revolution turn. Repeat till all three wheels on the left side and right side of the 20x60x180 extrusion all slightly drag. DO NOT OVER-TIGHTEN, you can damage the wheel by tightening them too much. The wheels should not lock on the metal, just rub.

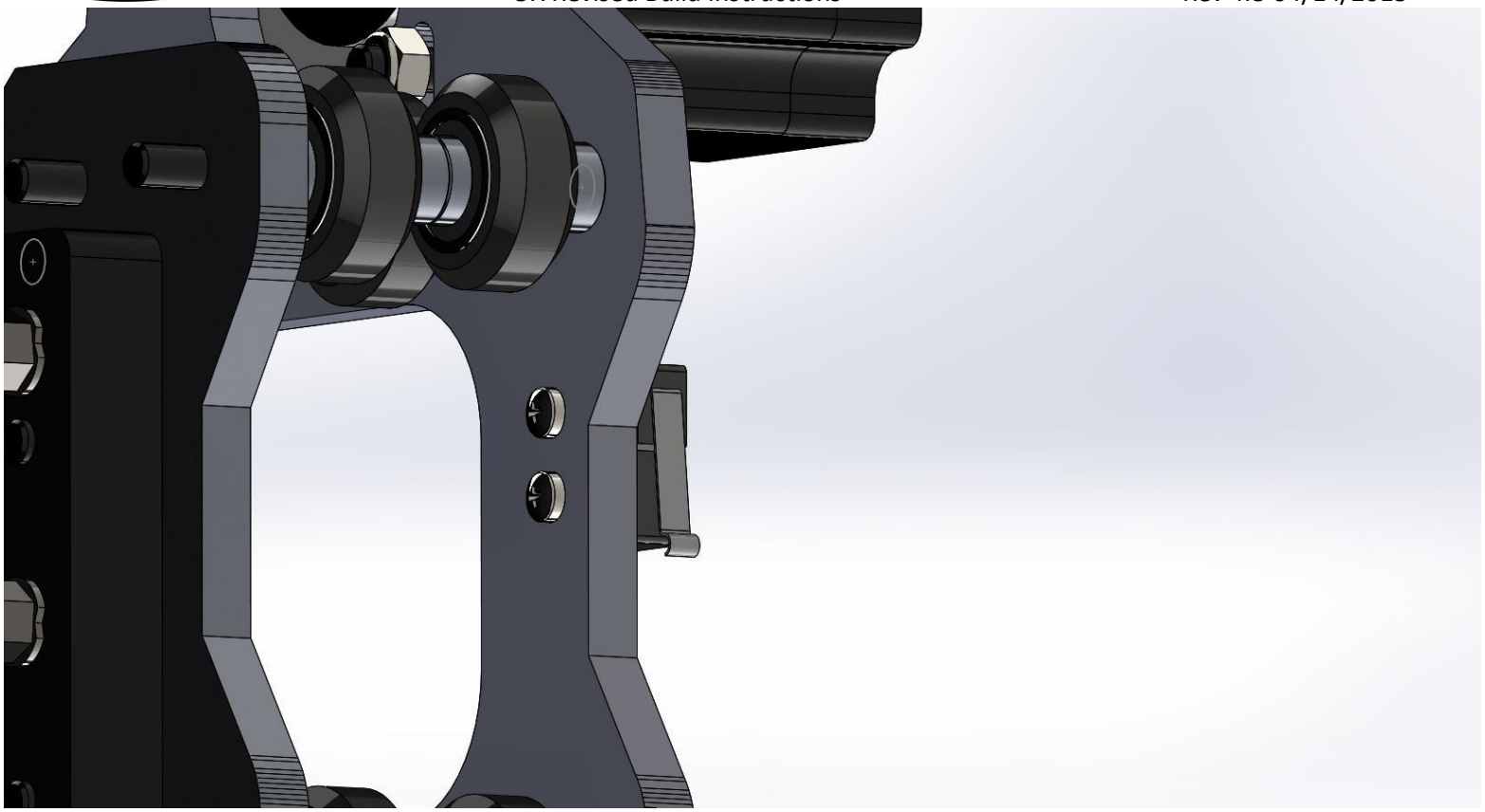
The X_Z gantry is now complete.

Step 4

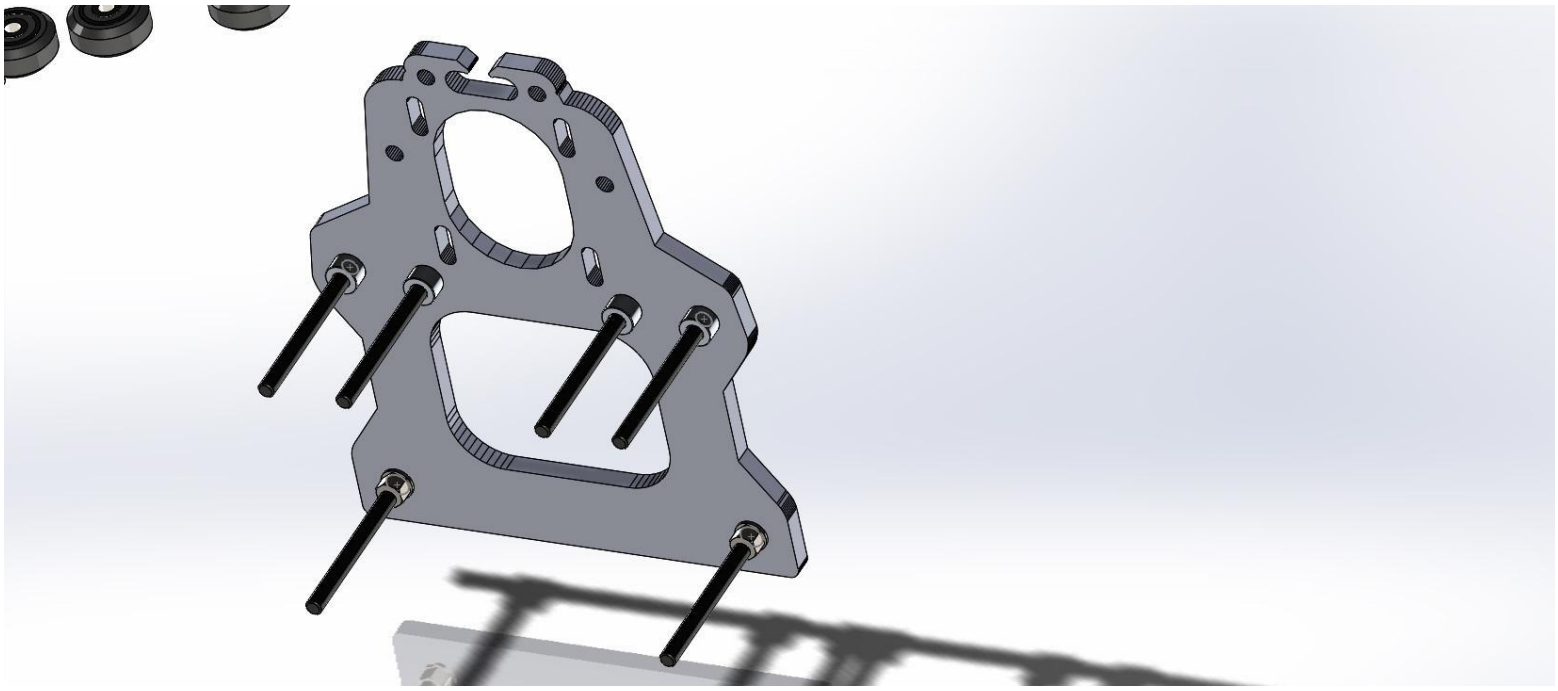
X gantry assembly



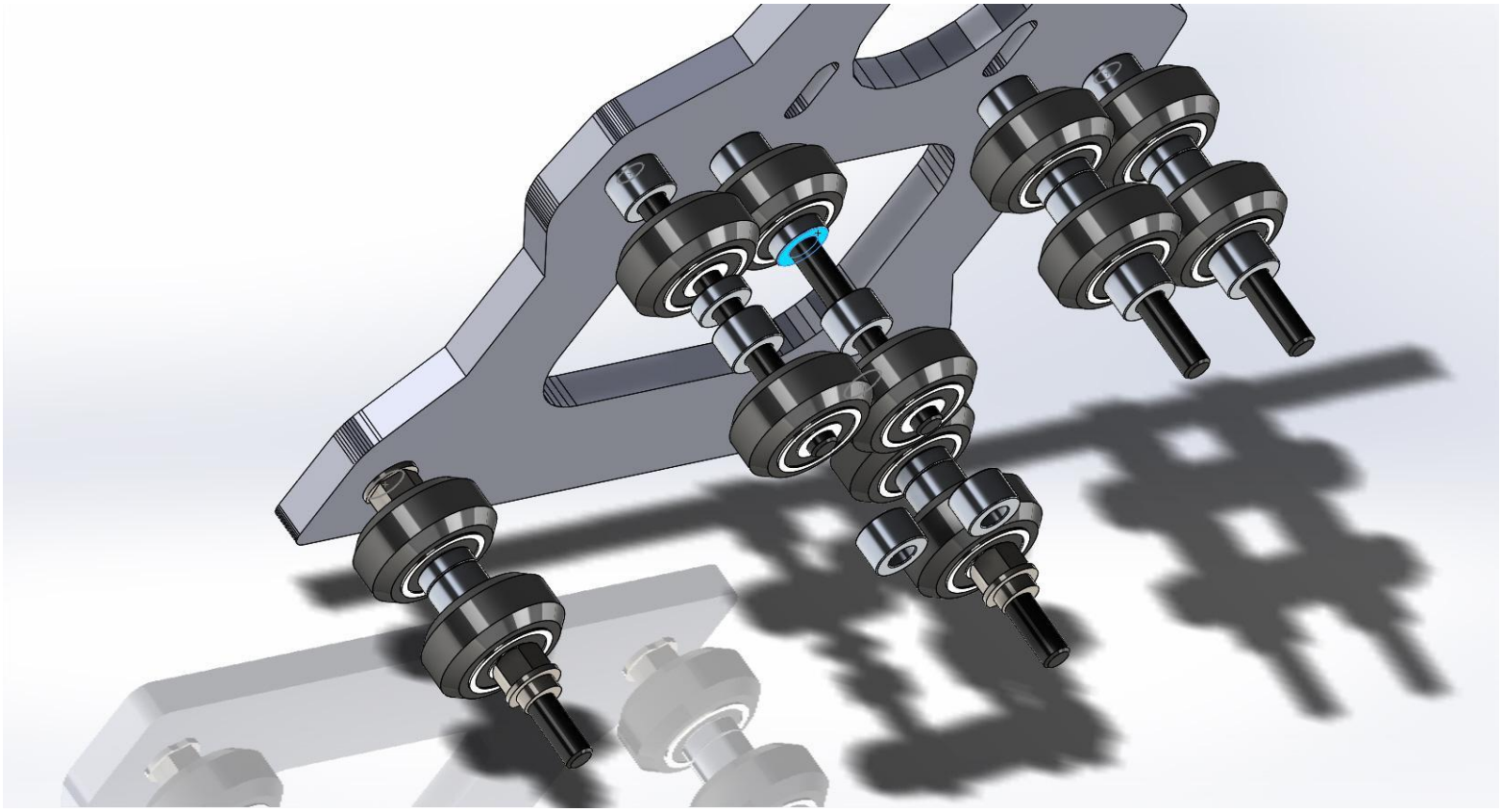
Note, again limit switches were added to the scope of the OX kit, some images below will not show the limit. The limit switch gets installed on the side of the head of the bolts as shown here:



The rear X gantry plate will receive six qty M5 x 65mm bolts. Slide these through the rear plate as shown. Slide a .25” spacer over the top bolts, and .25” eccentric spacers over the bottom bolts.

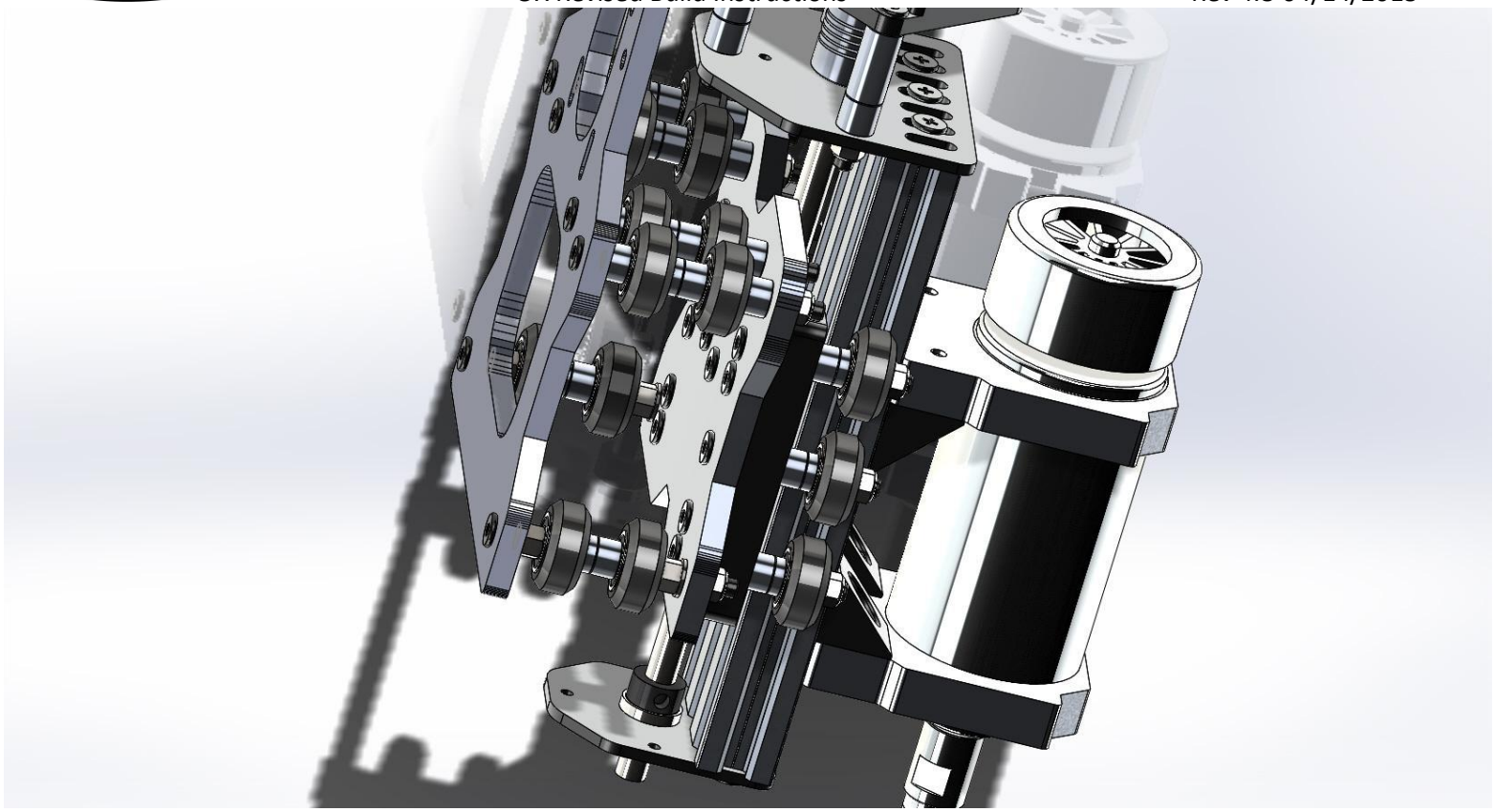


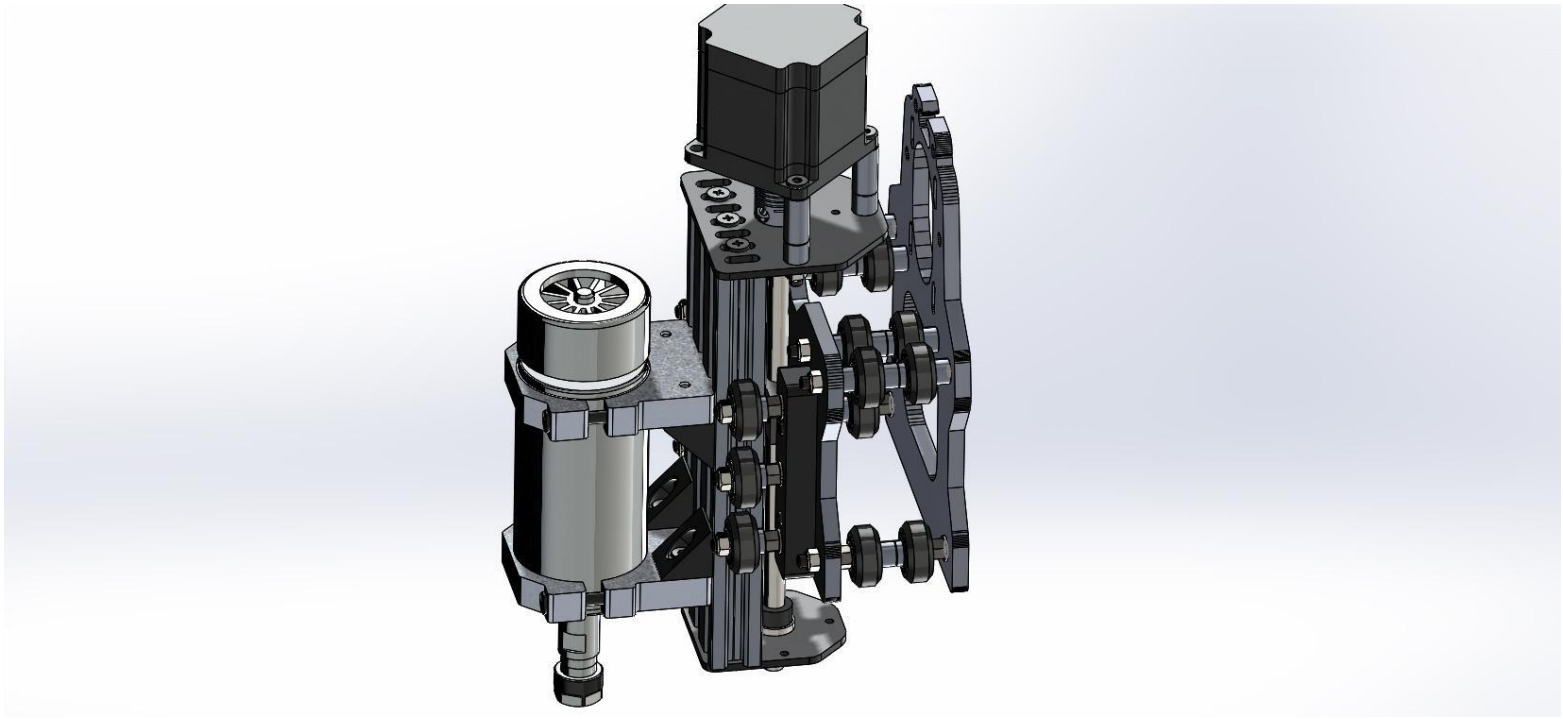
Next, install six wheel assemblies over the bolts, followed by a .25” spacer AND 3mm spacer. Follow with another six wheels and matching .25” plain spacers and eccentrics as done in the beginning.



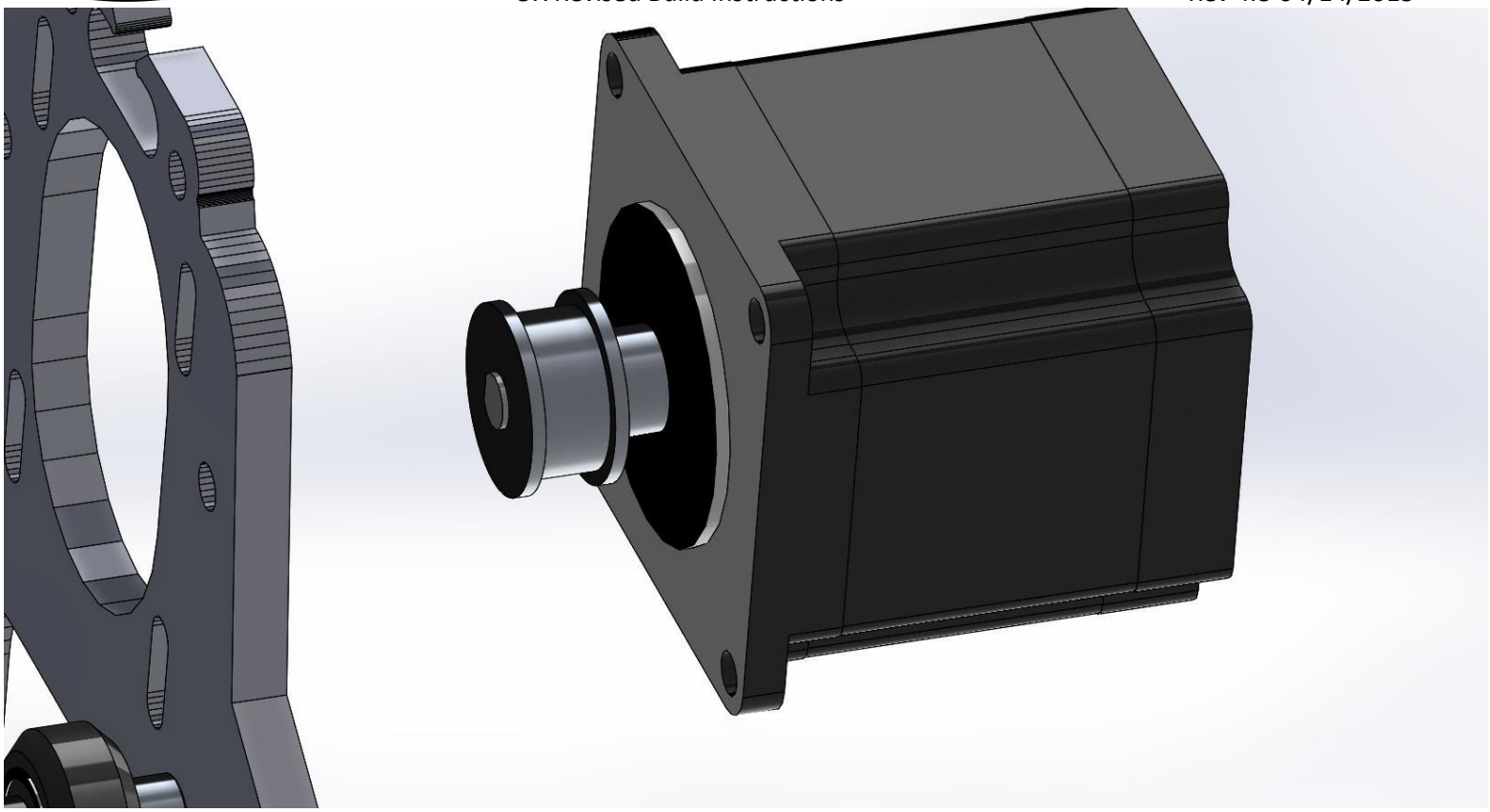
Install the X_Z assembly onto the front of the bolts and loosely tighten the M5 nuts to hold everything together. Do not snug the nuts down to the front of the X_Z plate yet as it will make installing the extruded aluminum difficult, we simply want to hold the assembly together.

Note you can install the M5 x 65mm bolts either direction with the head of the bolts on the spindle side or the back side.

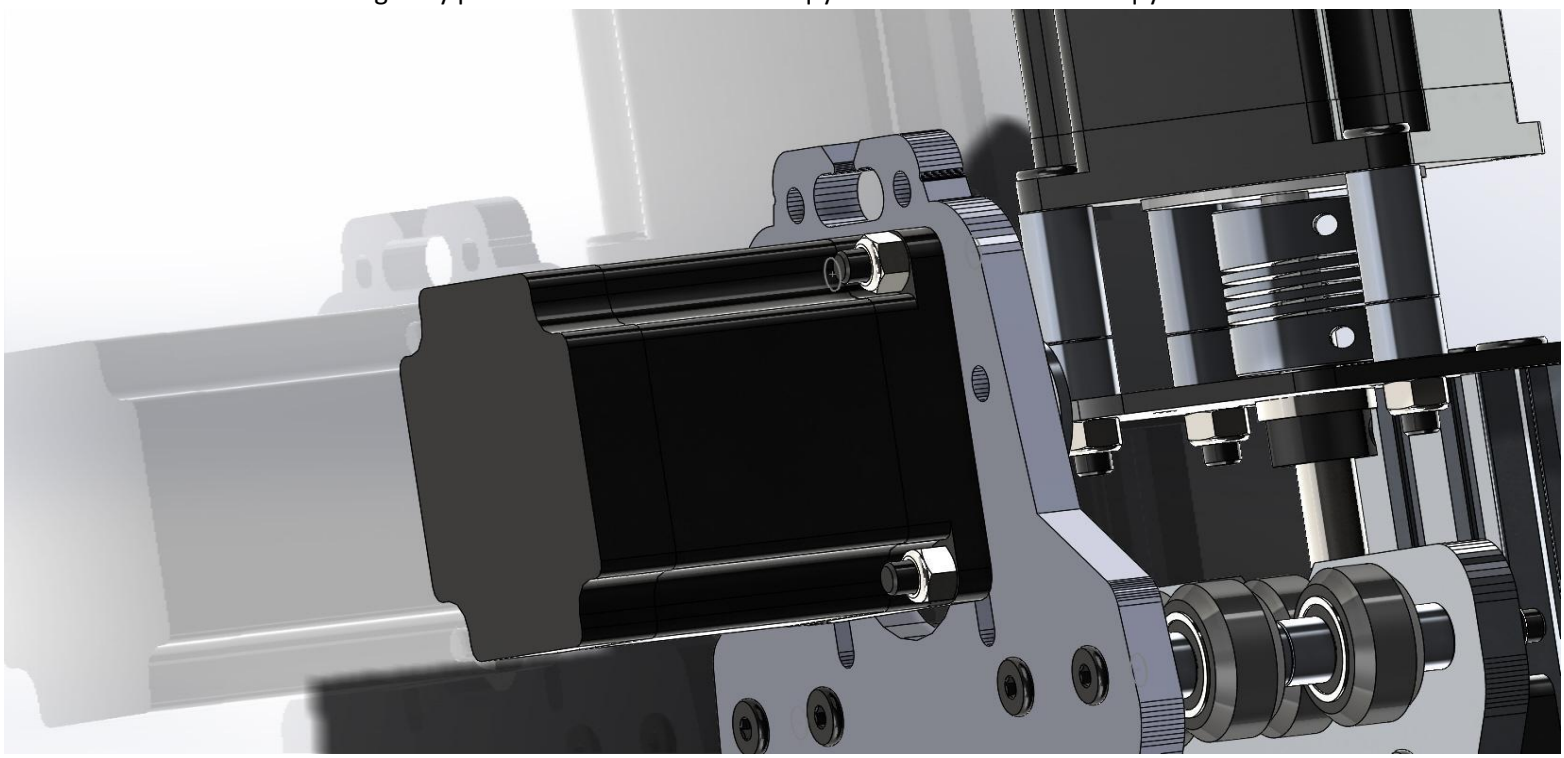




Next install a GT3 pulley loosely onto the NEMA 23 with the shoulder of the pulley closest to the motor.



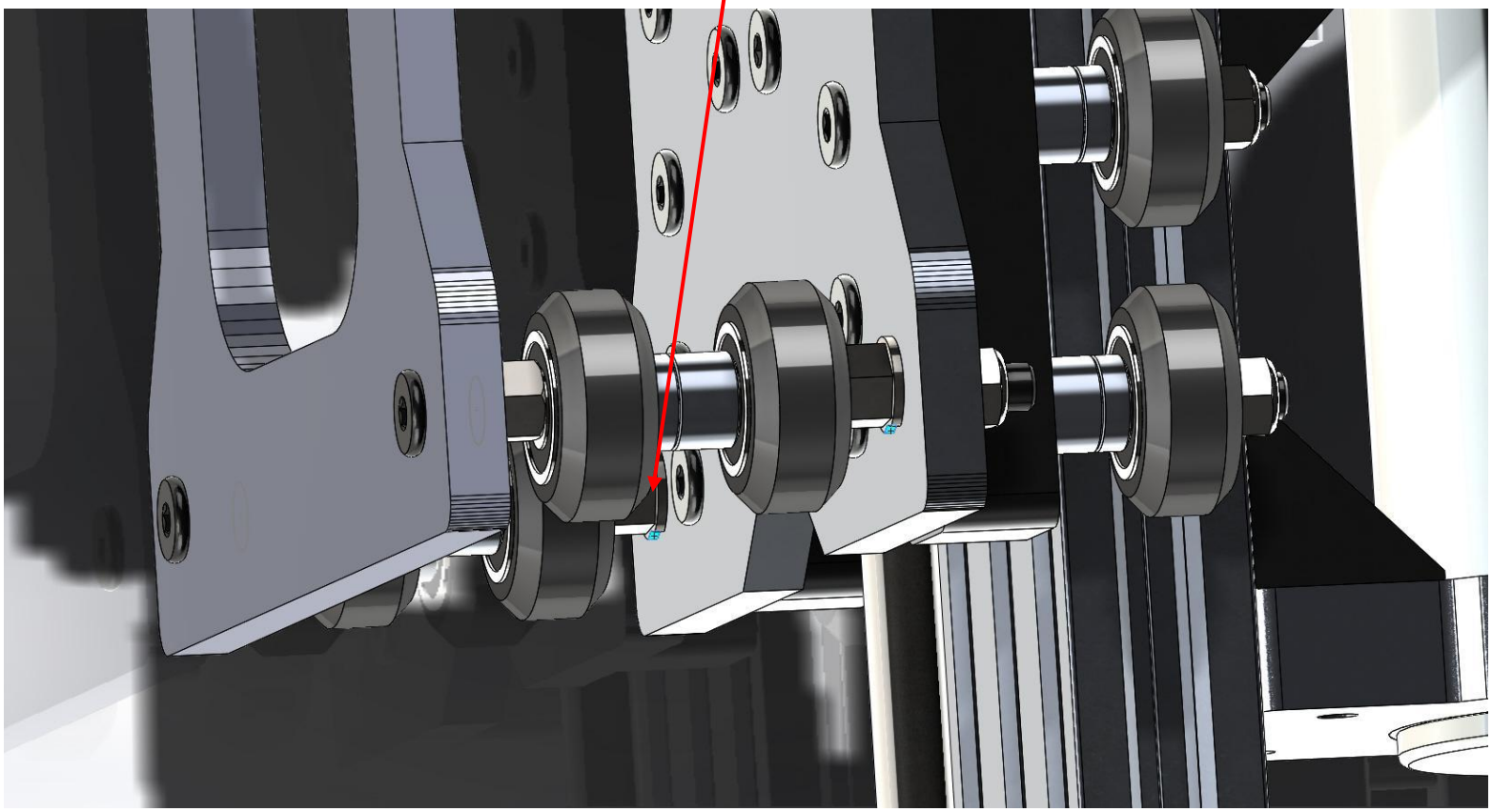
Install the motor onto the rear gantry plate. This is done with four qty M5 x20mm bolts and 4 qty M5 nuts.



The GT3 pulley should be a distance away from the top threaded rod plate by a distance equal to the thickness of a piece of paper.

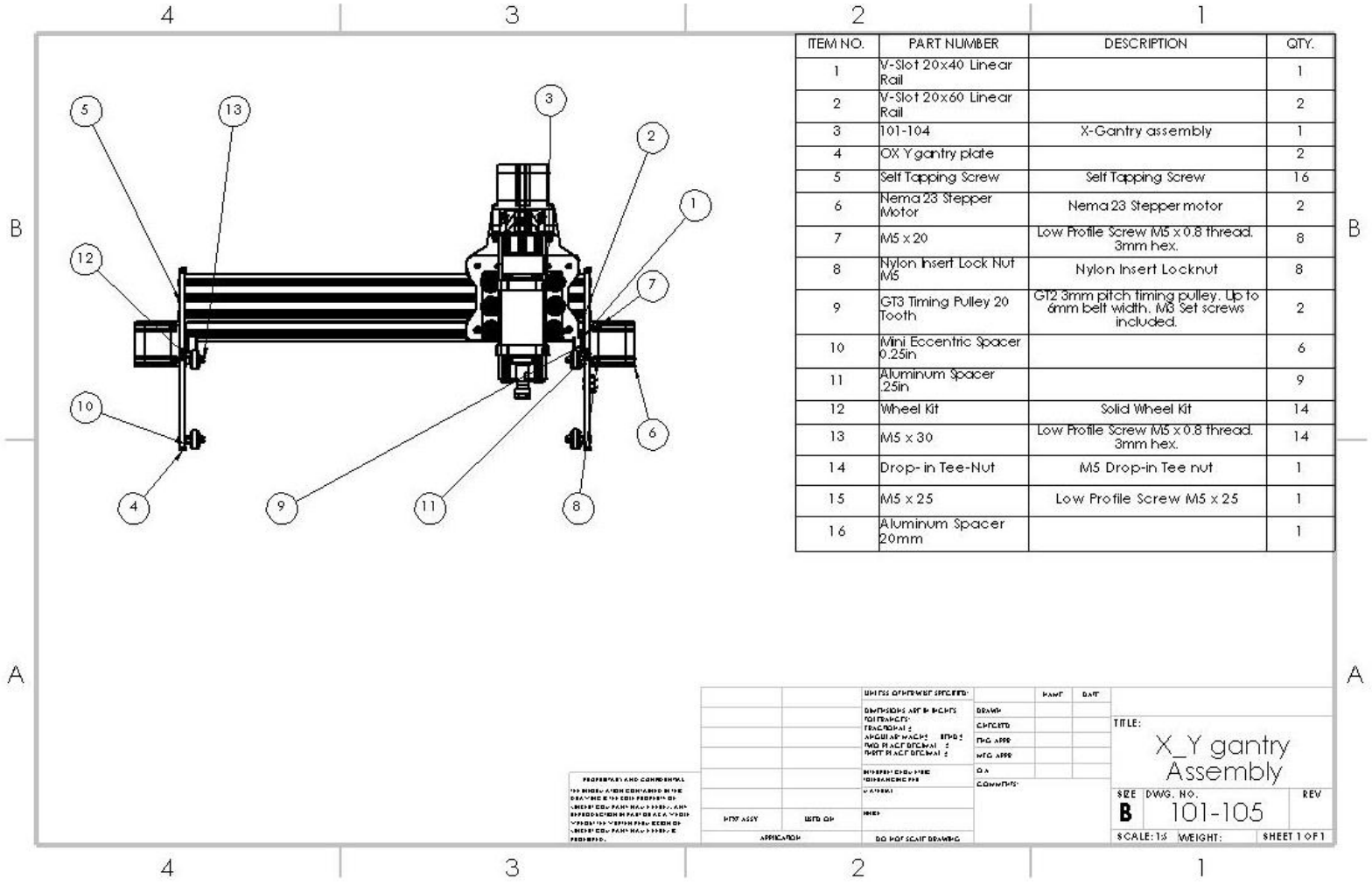
Use a piece of paper as a gauge and tighten the set screw on the pulley to the shaft of the NEMA 23 stepper motor.

Lastly, the eccentrics on the bottom axles of this assembly, turn till the notches face up. Shown facing down here for ease of viewing.



Step 5

X_Y gantry assembly

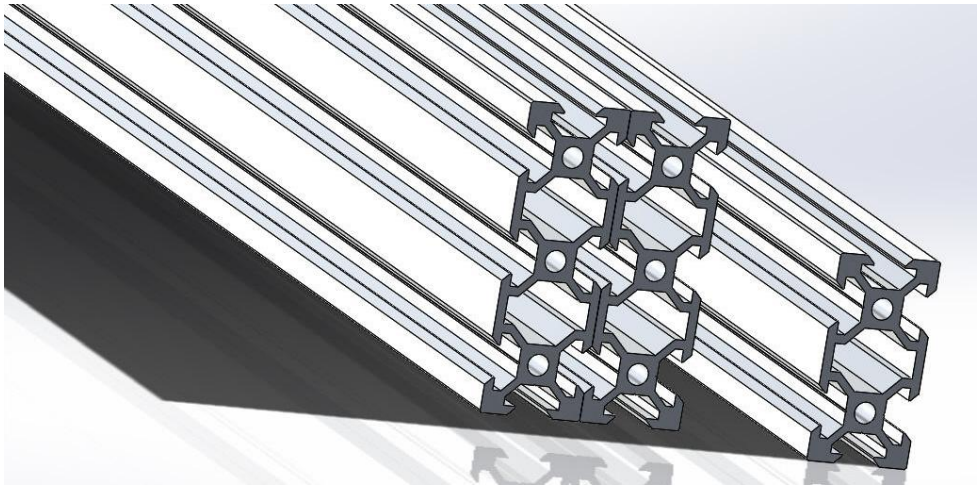


ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	V-Slot 20x40 Linear Rail		1
2	V-Slot 20x60 Linear Rail		2
3	101-104	X-Gantry assembly	1
4	OX Y gantry plate		2
5	Self Tapping Screw	Self Tapping Screw	16
6	Nema 23 Stepper Motor	Nema 23 Stepper motor	2
7	M5 x 20	Low Profile Screw M5 x 0.8 thread. 3mm hex.	8
8	Nylon Insert Lock Nut M5	Nylon Insert Locknut	8
9	GT3 Timing Pulley 20 Tooth	GT2 3mm pitch timing pulley. Up to 6mm belt width. M3 Set screws included.	2
10	Mini Eccentric Spacer 0.25in		6
11	Aluminum Spacer .25in		9
12	Wheel Kit	Solid Wheel Kit	14
13	M5 x 30	Low Profile Screw M5 x 0.8 thread. 3mm hex.	14
14	Drop-in Tee-Nut	M5 Drop-in Tee nut	1
15	M5 x 25	Low Profile Screw M5 x 25	1
16	Aluminum Spacer 20mm		1

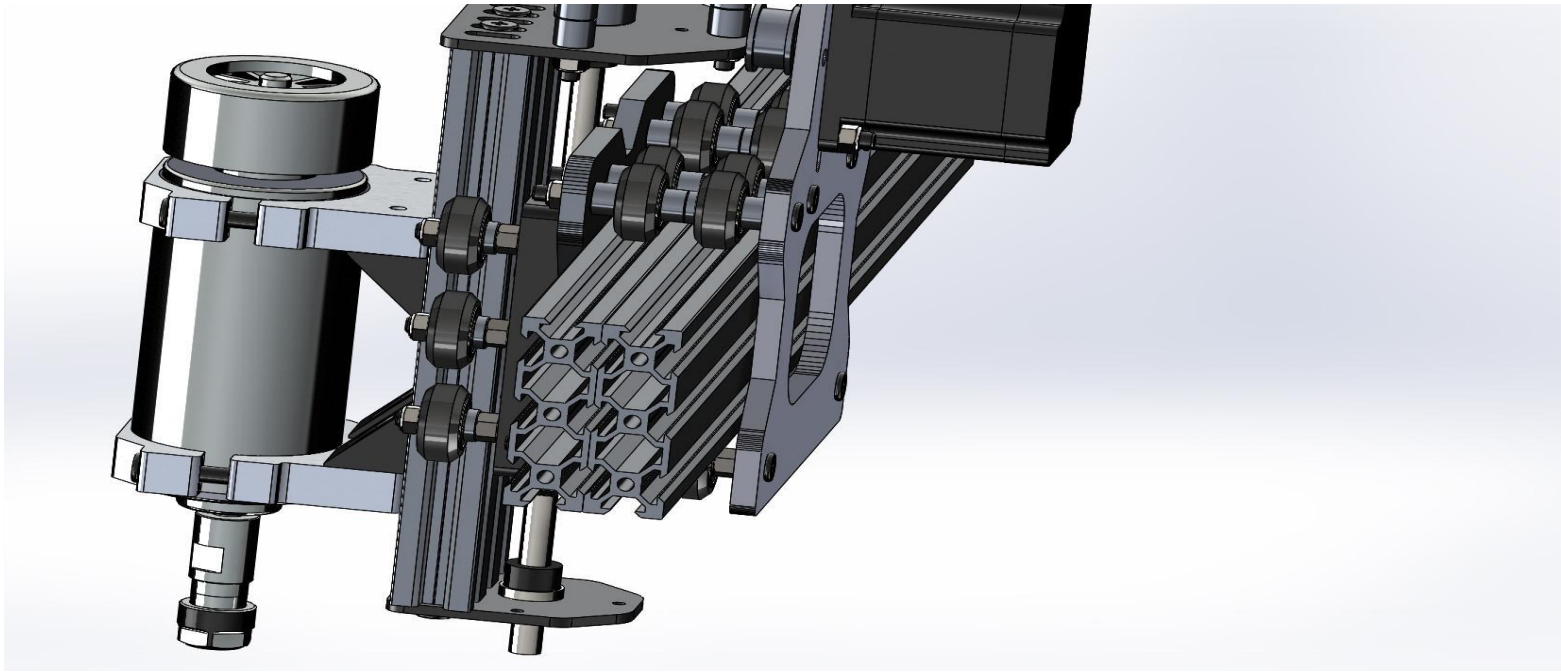
Remove the X gantry extruded aluminum, the length will be based on the kit size you chose. It can be noted which bundle the X is because it contains two qty 20x60 and one 20x40 that are all the same length.

For this demonstration, we will use the 500x750 build so the image can fit better on the screen.

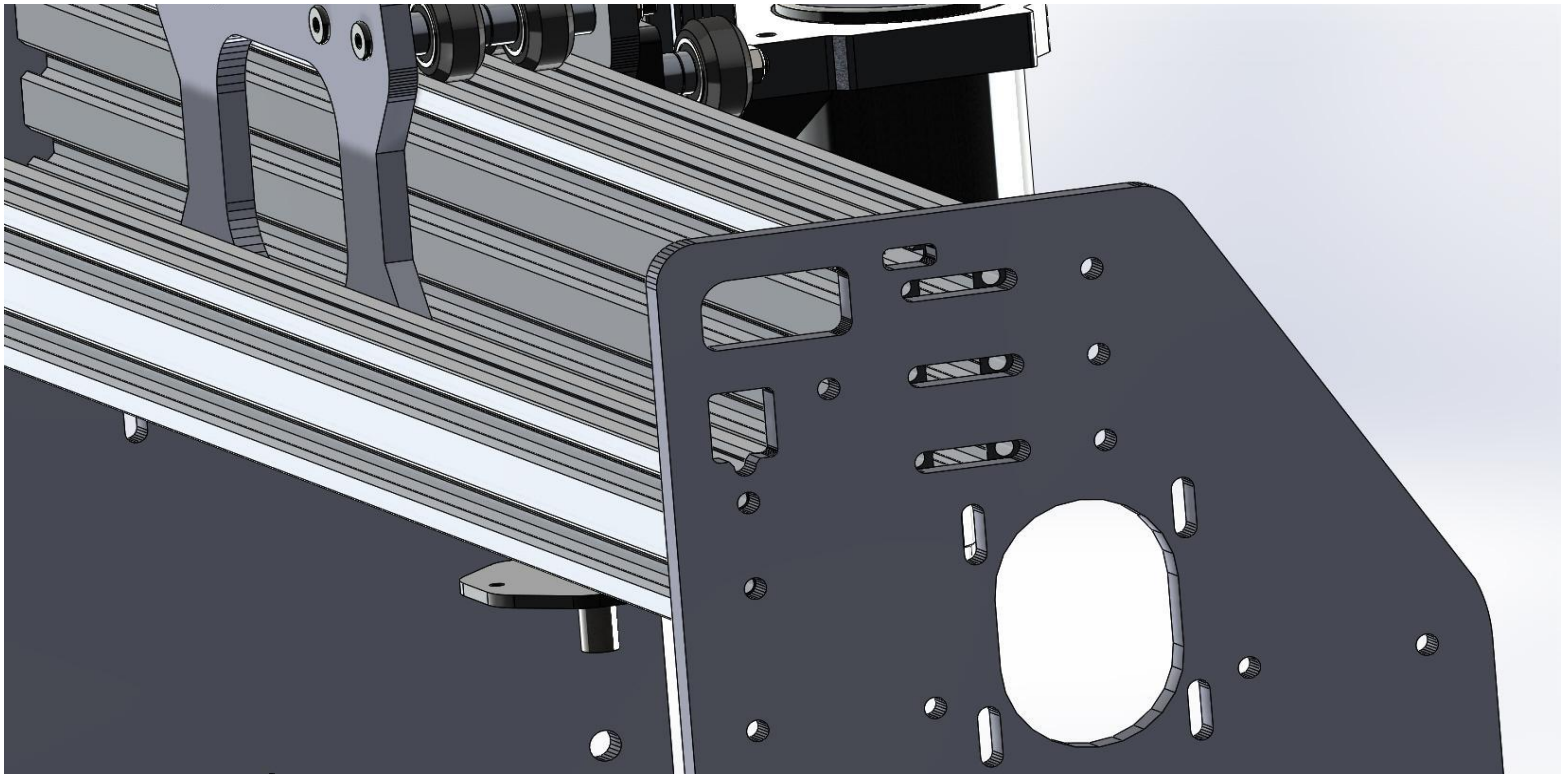
A quick note, when we say 20x60 we are referring to the dimensions of the extruded aluminum in 20mm squares. A 20 by 60 is a 20mm wide by the 3 x 20mm boxes tall. An easy way to see this from the end is each 20mm box has a hole in the center of it.



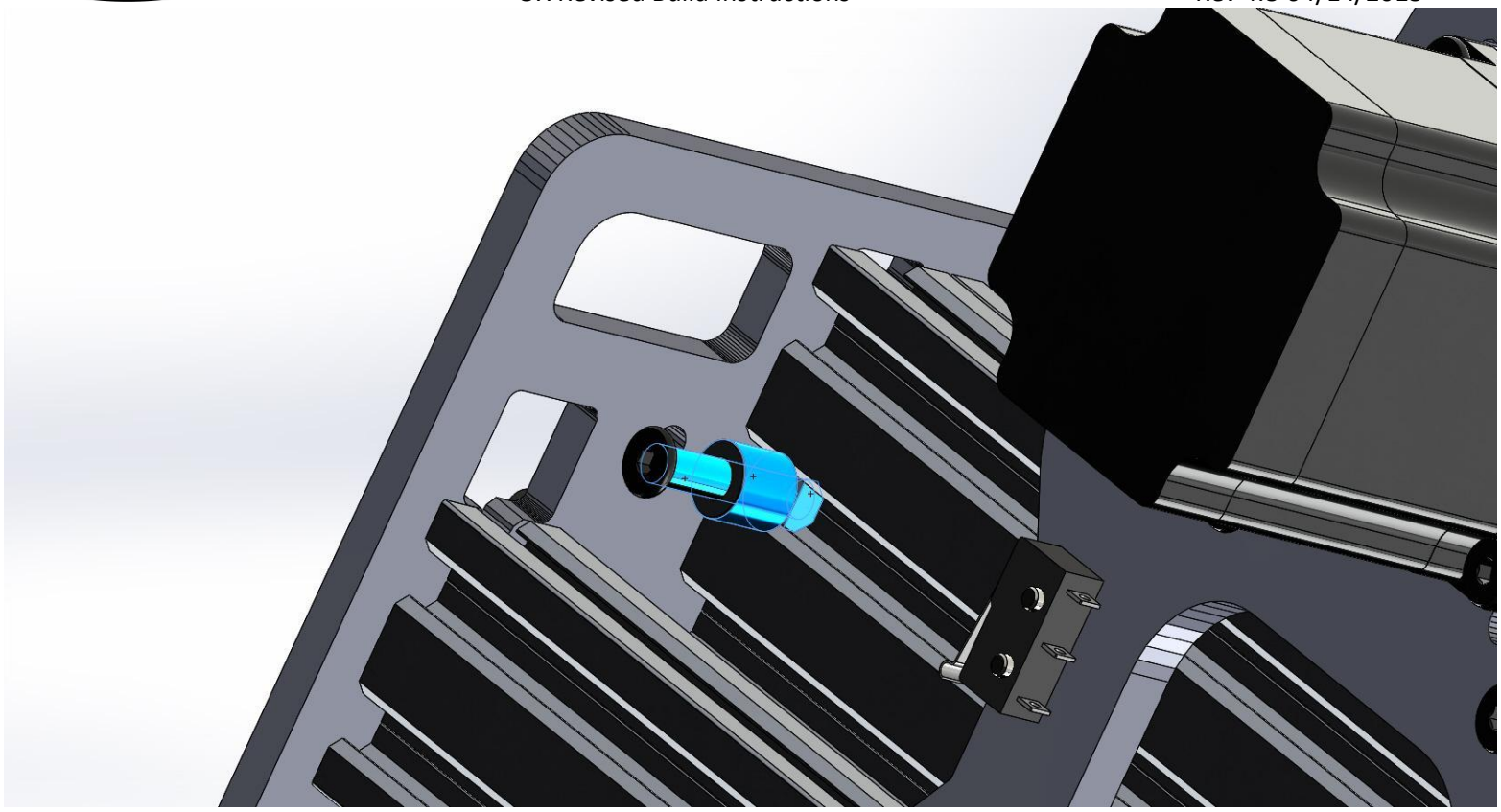
Carefully and slowly insert the two 20x60 extrusions into the X_Z assembly. If it is hard to install the assembly onto the 20 x60 make sure the eccentrics on the bottom of the X_Z assembly are facing towards the top of the assembly.



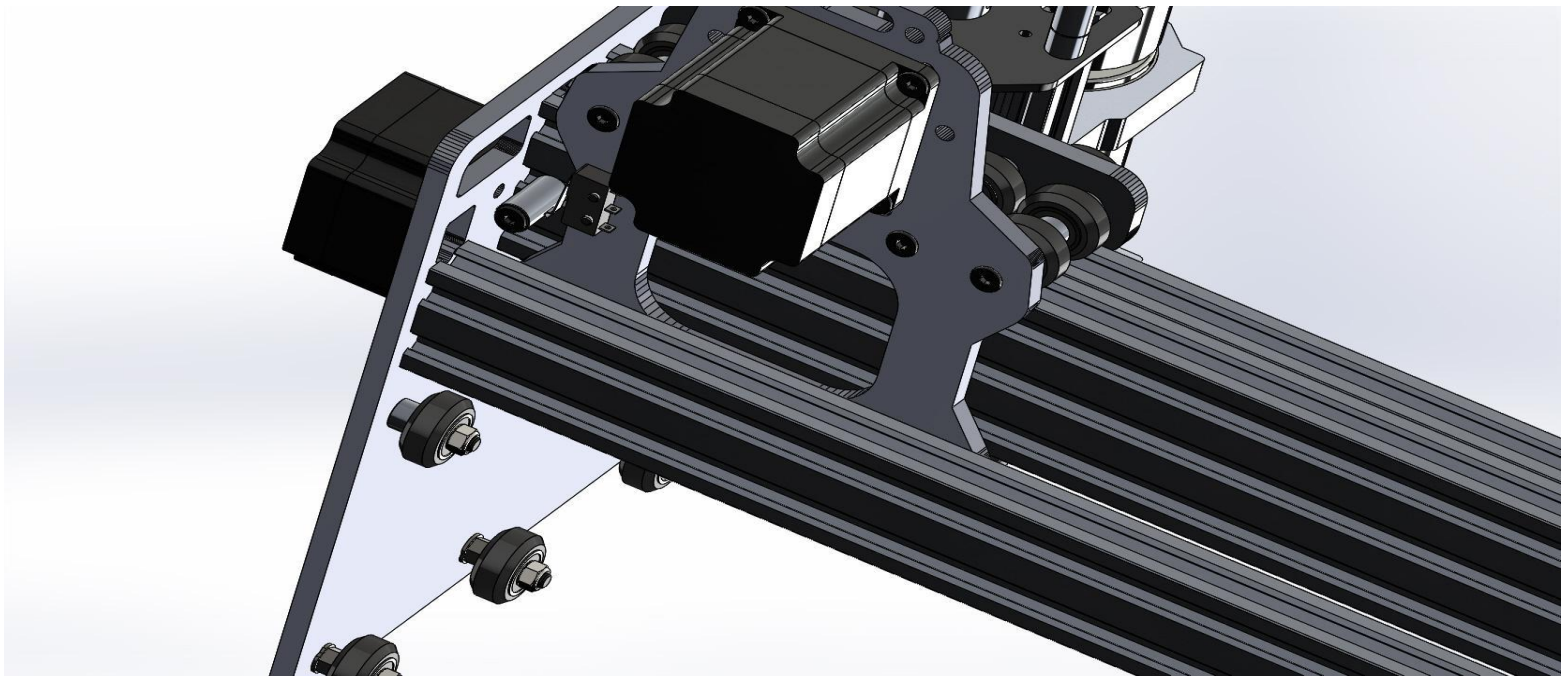
Install a Y gantry plate on the end of the 20x60s using self-tapping screws. Follow with the rear 20x40 before completely tightening the self-tapping screws. IF the rear 20x40 is short you have mixed the bundles of aluminum. Look for the 20 x 40 that exactly matches the 20 x60 length.

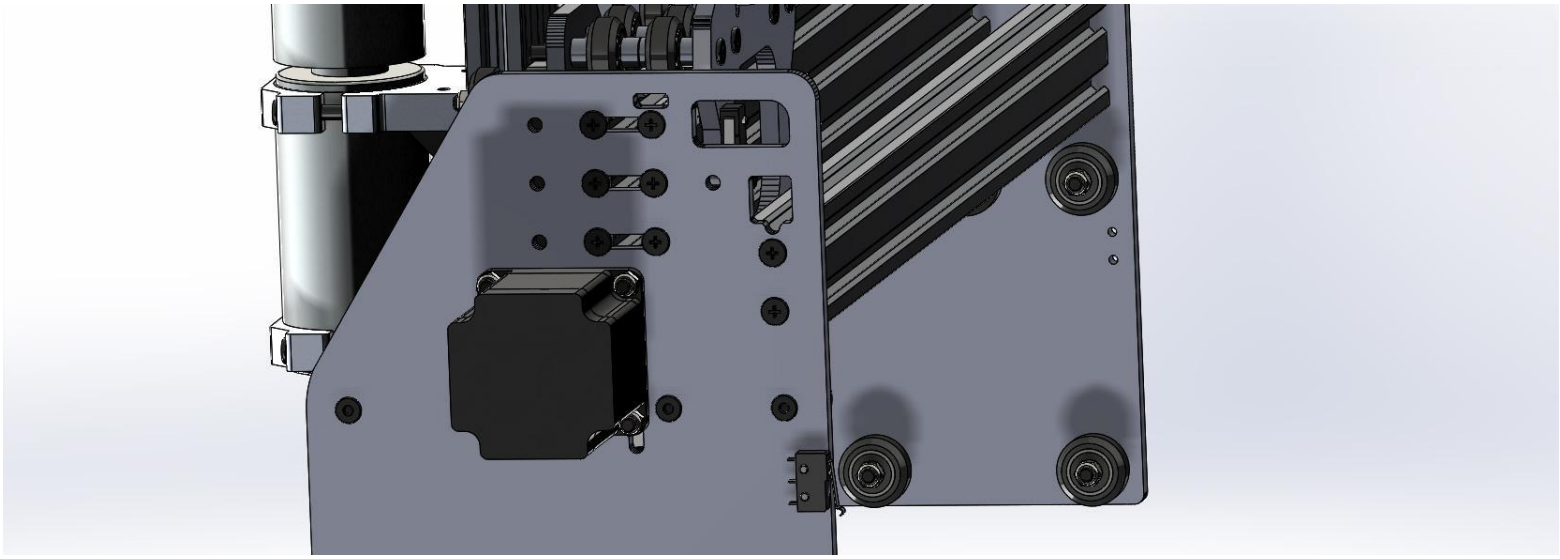


Note: Limit switch stop can be added here. A drop-in tee nut, M5 x 30mm bolt, and 20mm spacer will be assembled and inserted here. On the back of the 20x60 on the LH rear side, about 20mm(~1”) away from the gantry plate install in the middle slot:



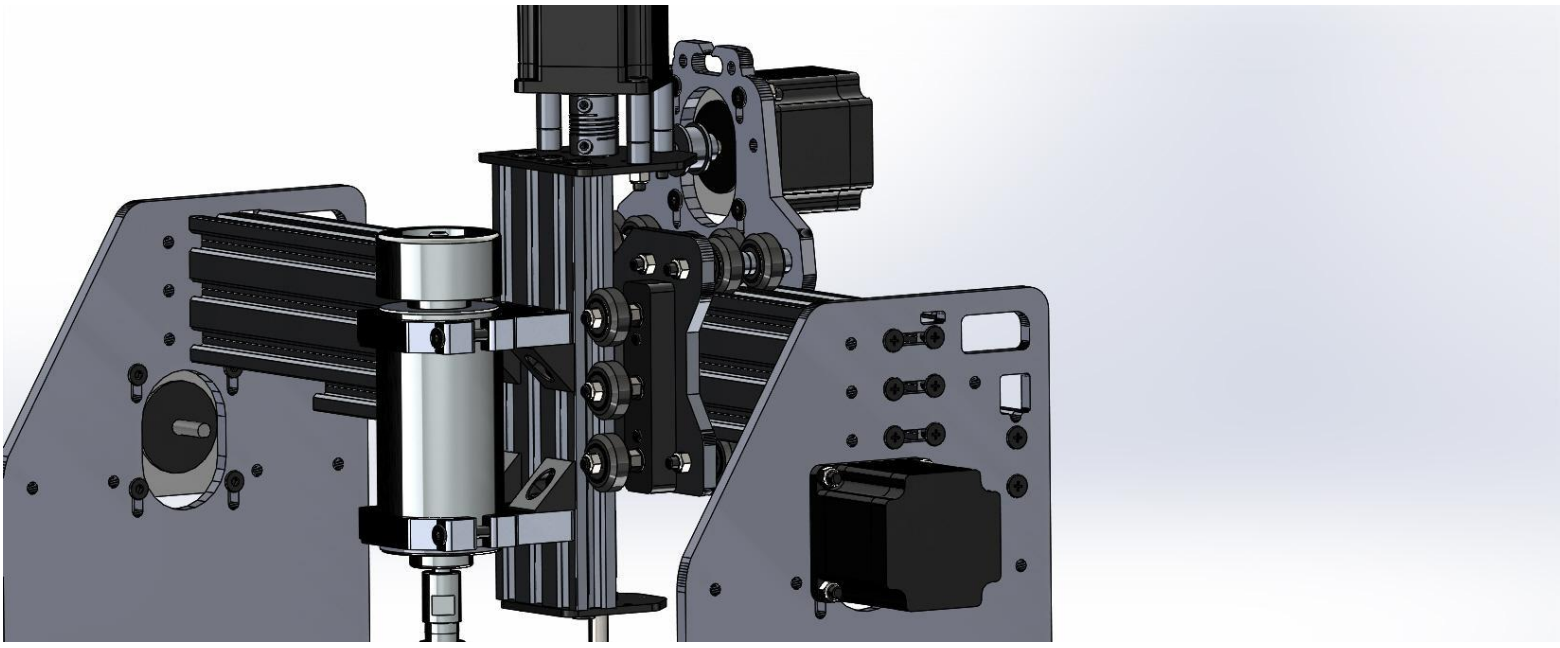
This can always be adjusted later, tighten the bolt down for now in the approximate location shown above. The limit switch arm should contact the 20mm spacer.



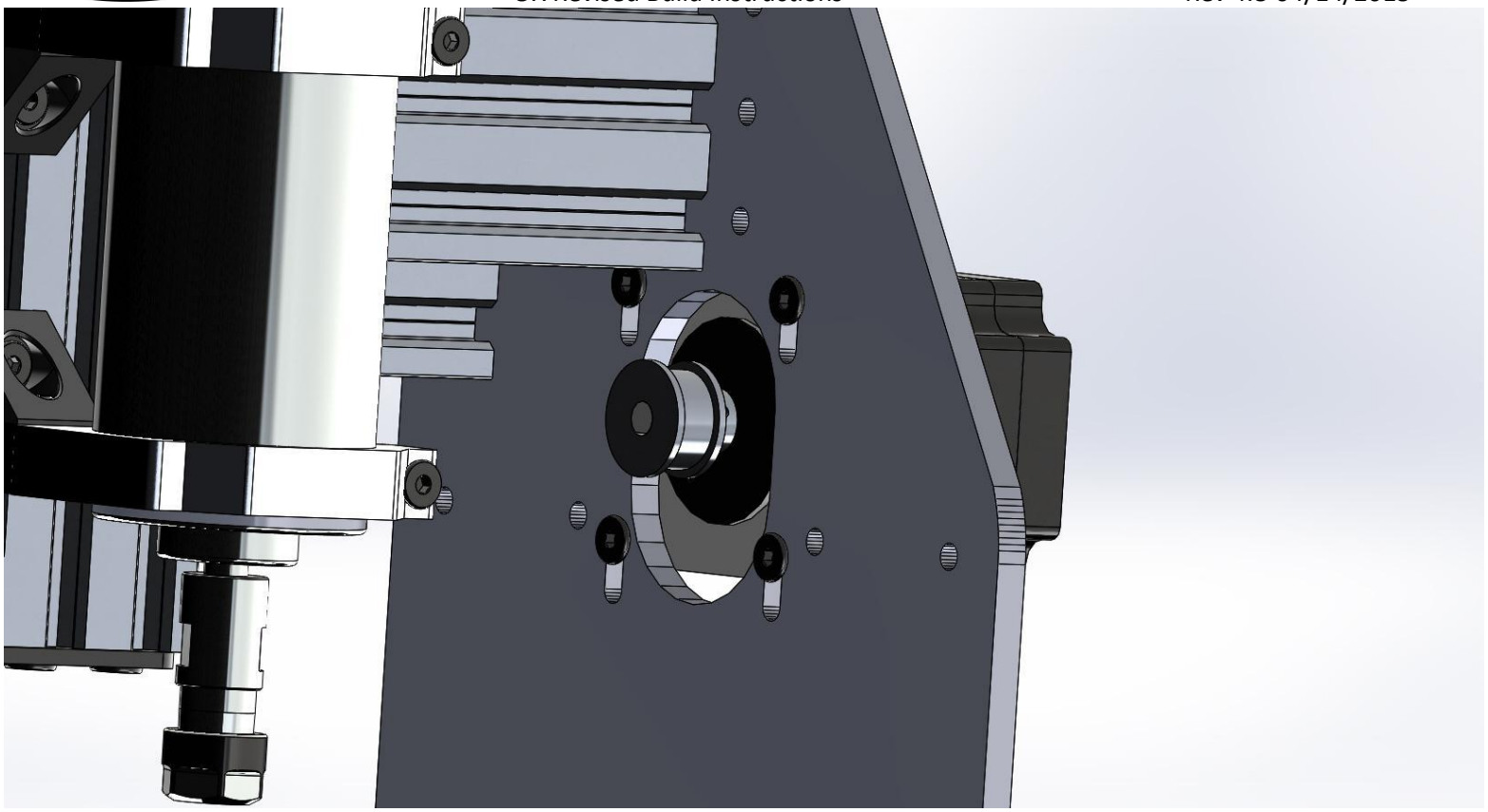


Next, install a NEMA 23 Stepper motors on each Y gantry plate with M5 x 20mm bolts ad secure with M5 nuts.

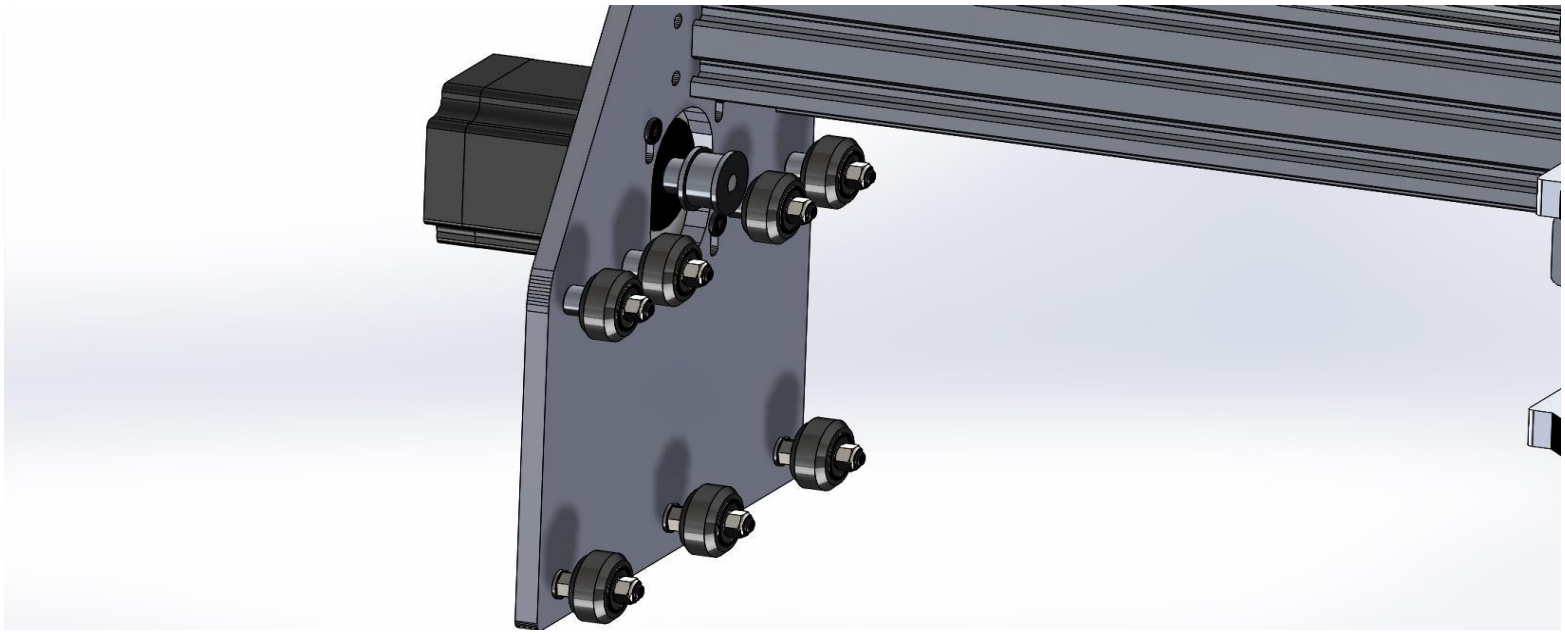
Also note limit switch installed on back of Y gantry plate edge.



Install the GT3 pulleys on the NEMA 23 stepper motors. Leave the set screw loose for now. After installing the belts in the final Y assembly, align the pulley with the belt and tighten the set screw.



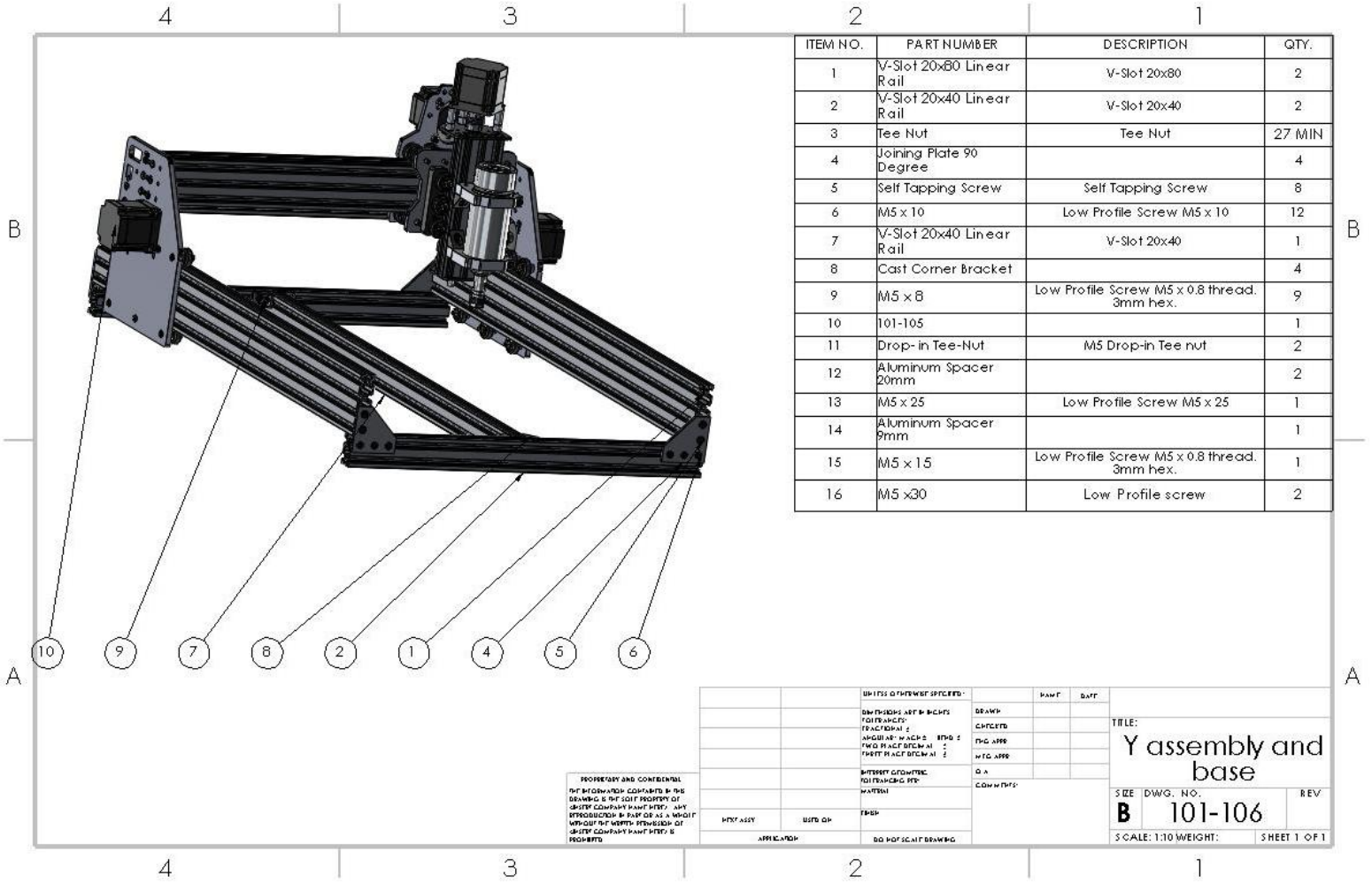
Install the upper wheels on the Y gantry plate with .25” spacers. The lower wheels get installed with .25” eccentric spacers. The bolts are installed with M5 x 30mm bolts and M5 nuts. Again, turn the eccentric spacers to give the most room.



You should be able to now set the Z,X,Y gantry on a table and tighten the X Gantry eccentric spacers (the ones located on the bottom of the X_Z assembly assembled in step four) tighten, by small even turns, both eccentrics on the bottom of the X gantry. You want the wheels to slightly drag, but not grab.

Step 6

Y and Base gantry assembly



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	V-Slot 20x80 Linear Rail	V-Slot 20x80	2
2	V-Slot 20x40 Linear Rail	V-Slot 20x40	2
3	Tee Nut	Tee Nut	27 MIN
4	Joining Plate 90 Degree		4
5	Self Tapping Screw	Self Tapping Screw	8
6	M5 x 10	Low Profile Screw M5 x 10	12
7	V-Slot 20x40 Linear Rail	V-Slot 20x40	1
8	Cast Corner Bracket		4
9	M5 x 8	Low Profile Screw M5 x 0.8 thread. 3mm hex.	9
10	101-105		1
11	Drop- in Tee-Nut	M5 Drop-in Tee nut	2
12	Aluminum Spacer 20mm		2
13	M5 x 25	Low Profile Screw M5 x 25	1
14	Aluminum Spacer 9mm		1
15	M5 x 15	Low Profile Screw M5 x 0.8 thread. 3mm hex.	1
16	M5 x30	Low Profile screw	2

GT3 Belt found in this step __ Ft

+4 tee-nuts per size larger build (for center supports)

+4 cast 90s per size larger build (for center supports)

+4 M5 x 8mm bolts per size larger build (for center supports)

Electrical BOM:

*6 conductor wire __ Ft *Based on size of build*

*2 conductor wire __Ft

White ribbed connectors 24 qty

Red ribbed connectors 2 qty

Spindle Speed control 1 qty

48V power supply

.47 uF capacitors 3 qty

10x15 cable chains 2 qty * 1500 build gets 3 qty, they must be modified to create two qty that are 1500 mm long*

Power supply cable 1 qty

48V fan 1 qty

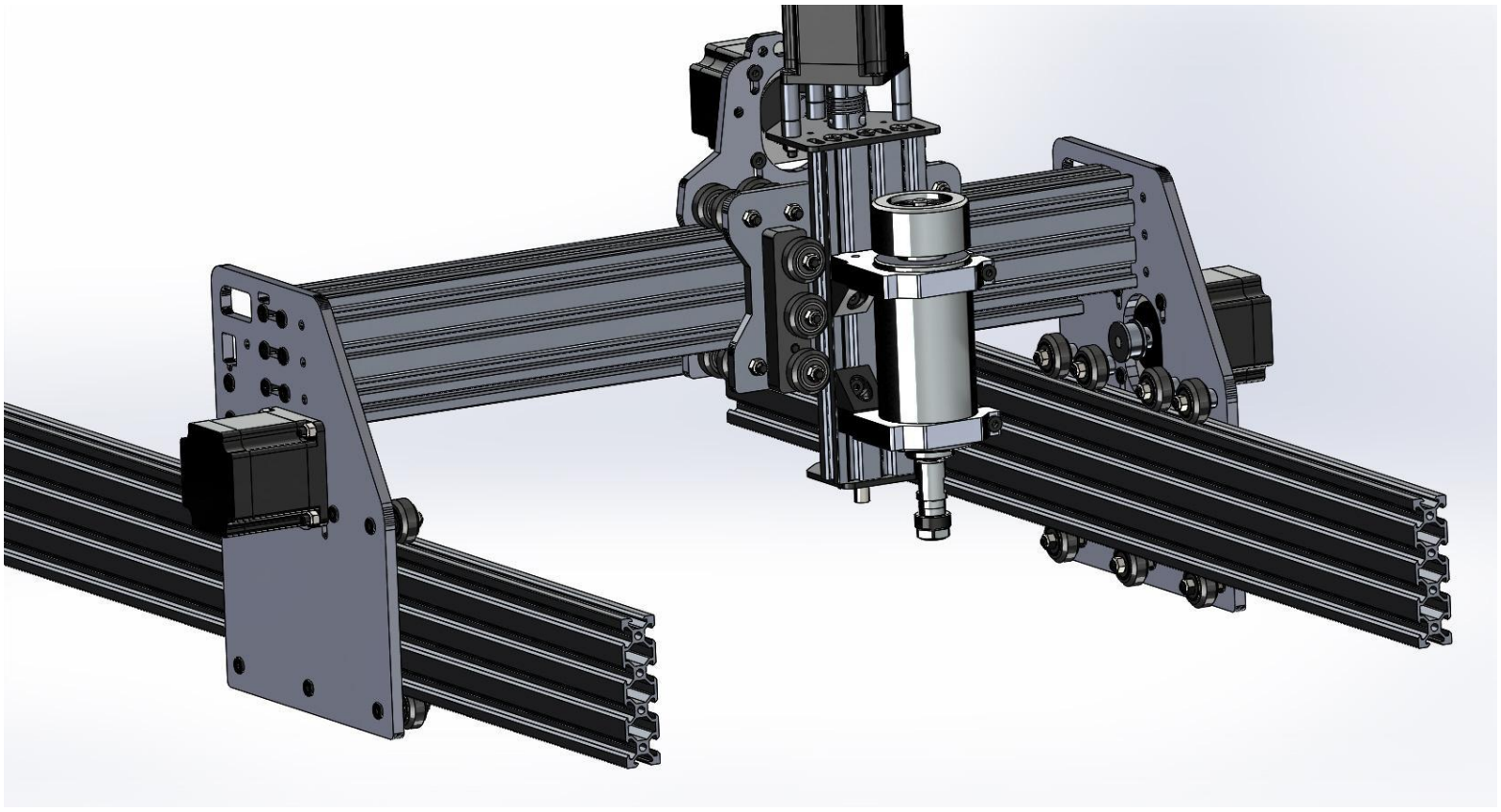
Heat shrink tubing

M1 GRBL controller

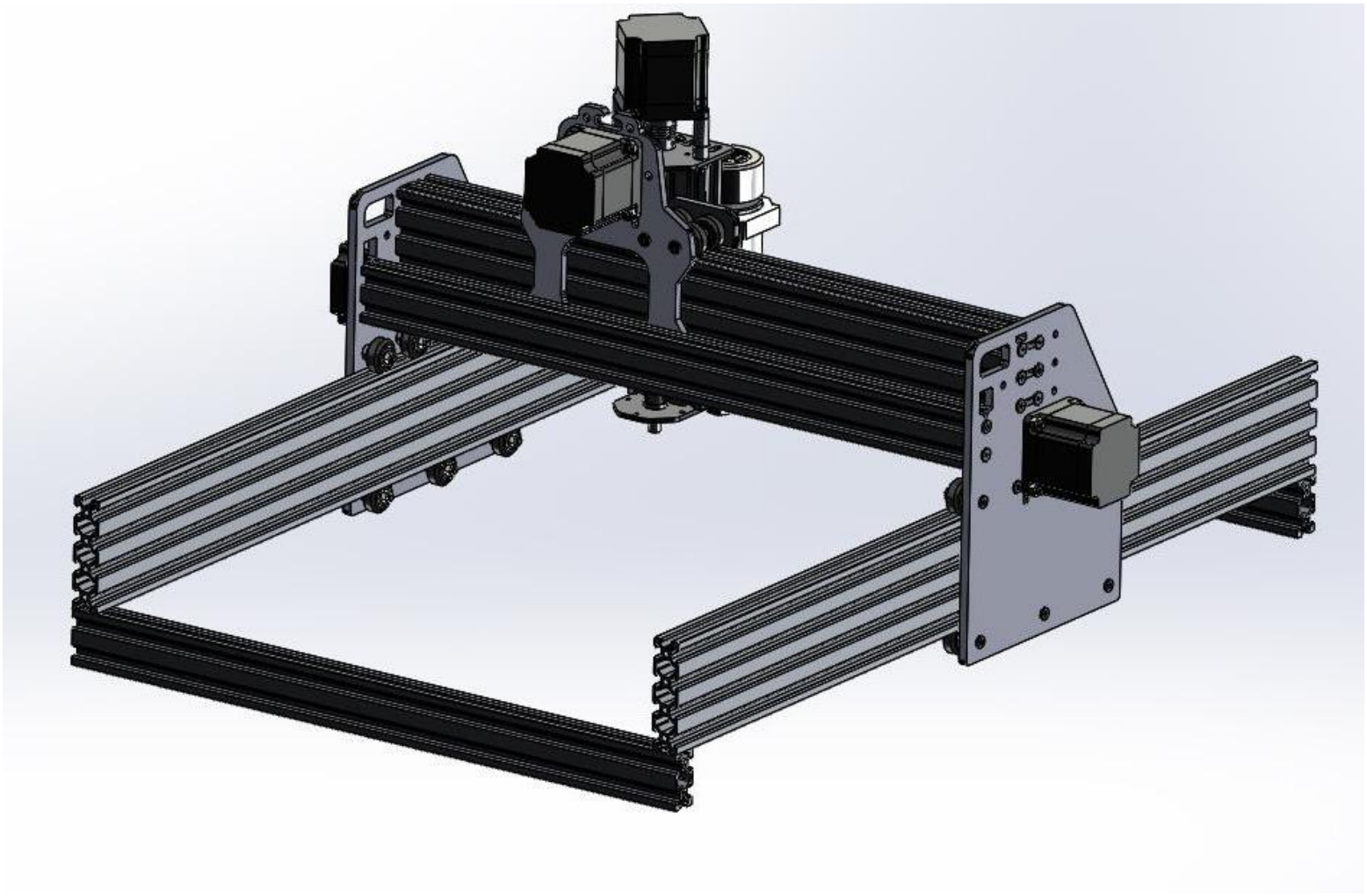
Bigfoot stepper sticks

We will continue to expand on the assembly.

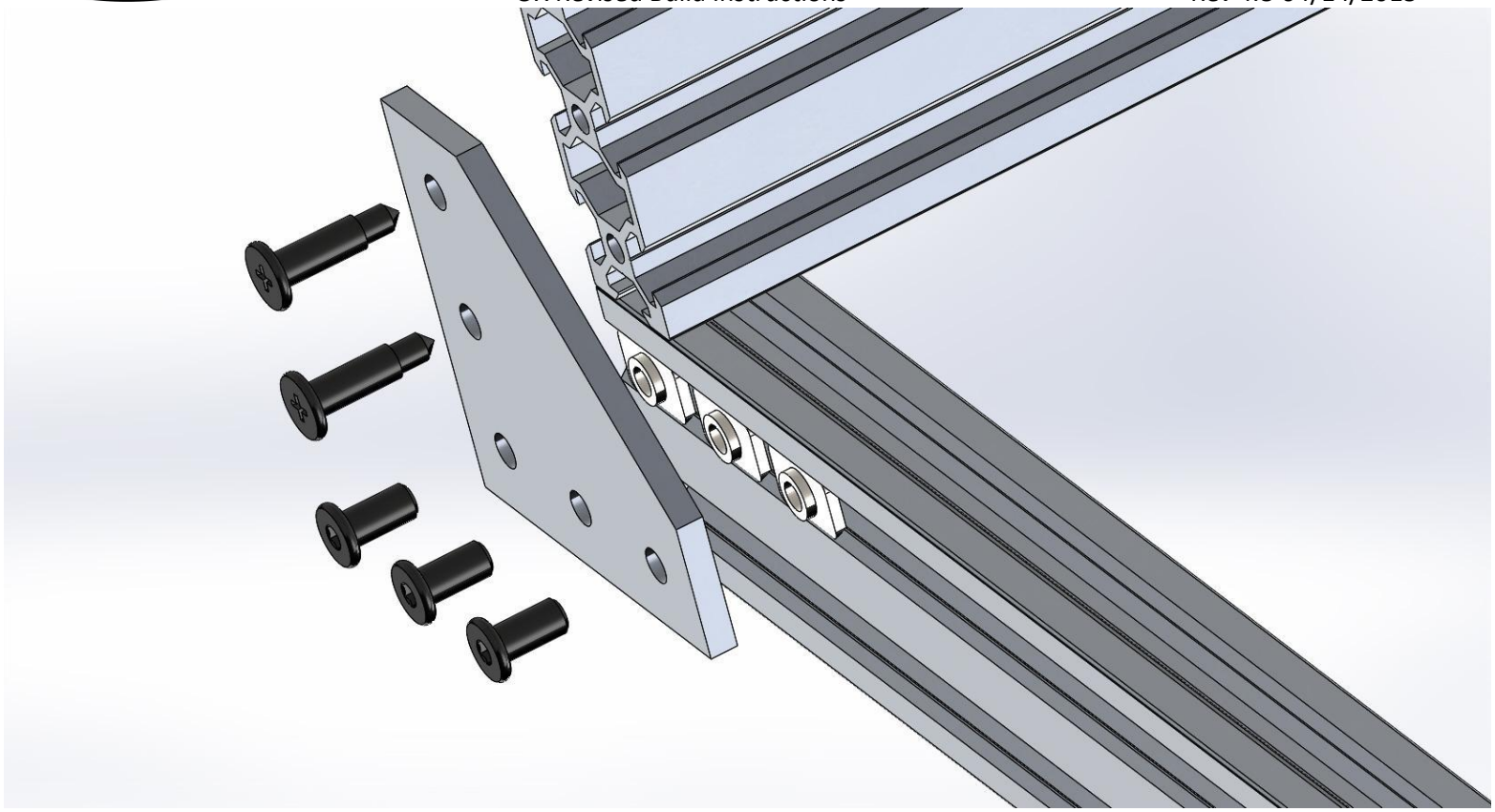
Again, for this example we will use the 500 x750 build. We will grab the two 20x80x750 extrusions, note again these should be bundled together. Gently slide them into the wheels on the Y gantry plates.



Next grab the two 20x40 pieces bundled together that are very slightly shorter than the X gantry, in this model the X gantry is 500 the support pieces that will go in the base are 496mm.



Using the 5-hole 90s from this step install them between the 20x80 and the 20x40. Use Tee-nuts with M5 x 10 bolts in the 20x40 and self-tapping screws in the 20x80.



Use a speed square or some device that has a known good 90-degree angle and true the corner of the build, then tighten the screws down on all four corners.

The base should be very sturdy now.

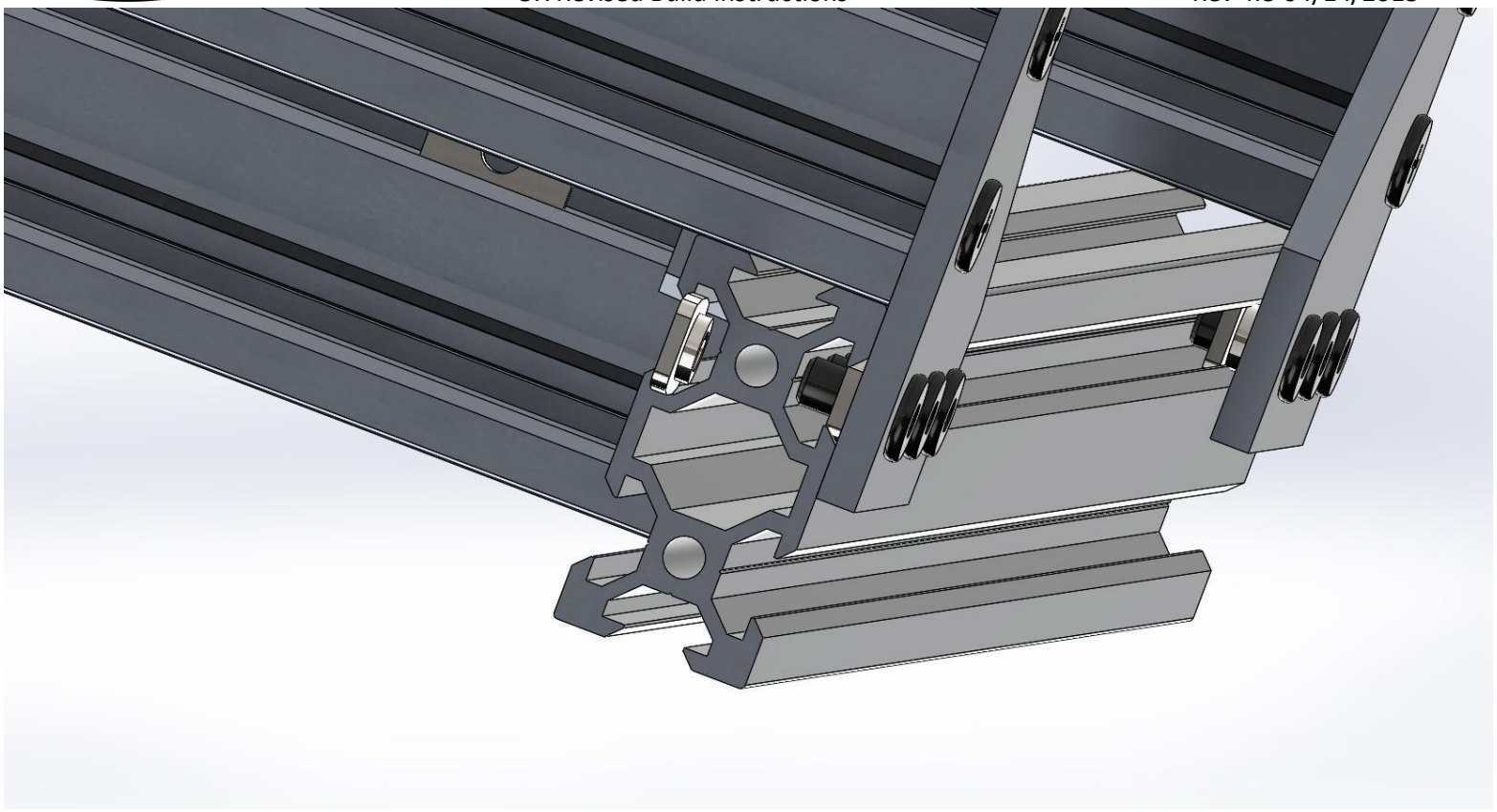
Next, we need to add supports for the spoiler board.

The 500 x750 build has one center support, the 750 x 1000 has two, the 1500 x1500 build has three.

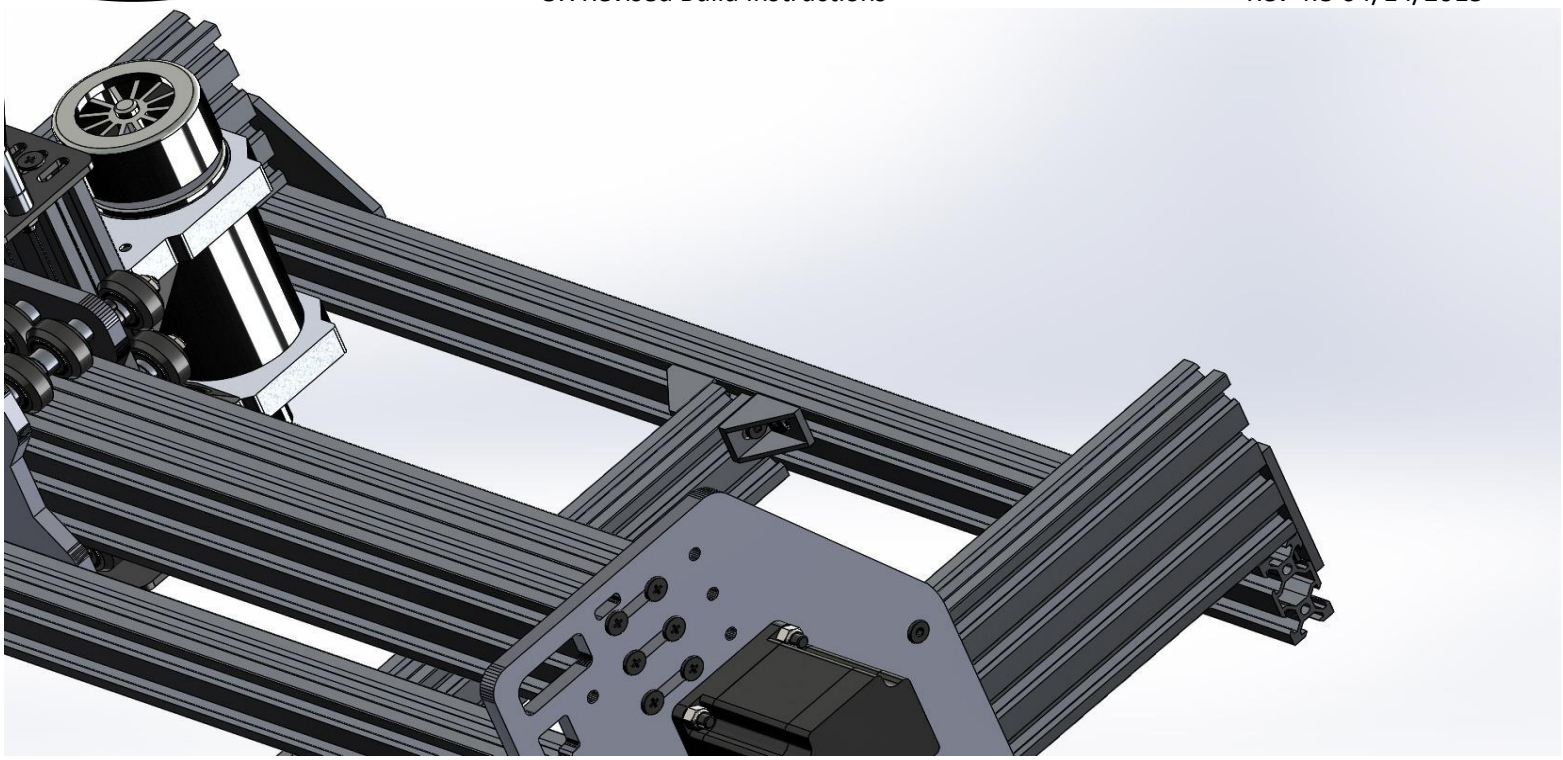
The support(s) will be the length of the Y axis minus 40 mm and we normally remove another two mm to allow an easy fit. This build will have one support 708mm long.

The support(s) should be equally spaced under the bed of the build. They are constrained by cast aluminum 90 degree brackets.

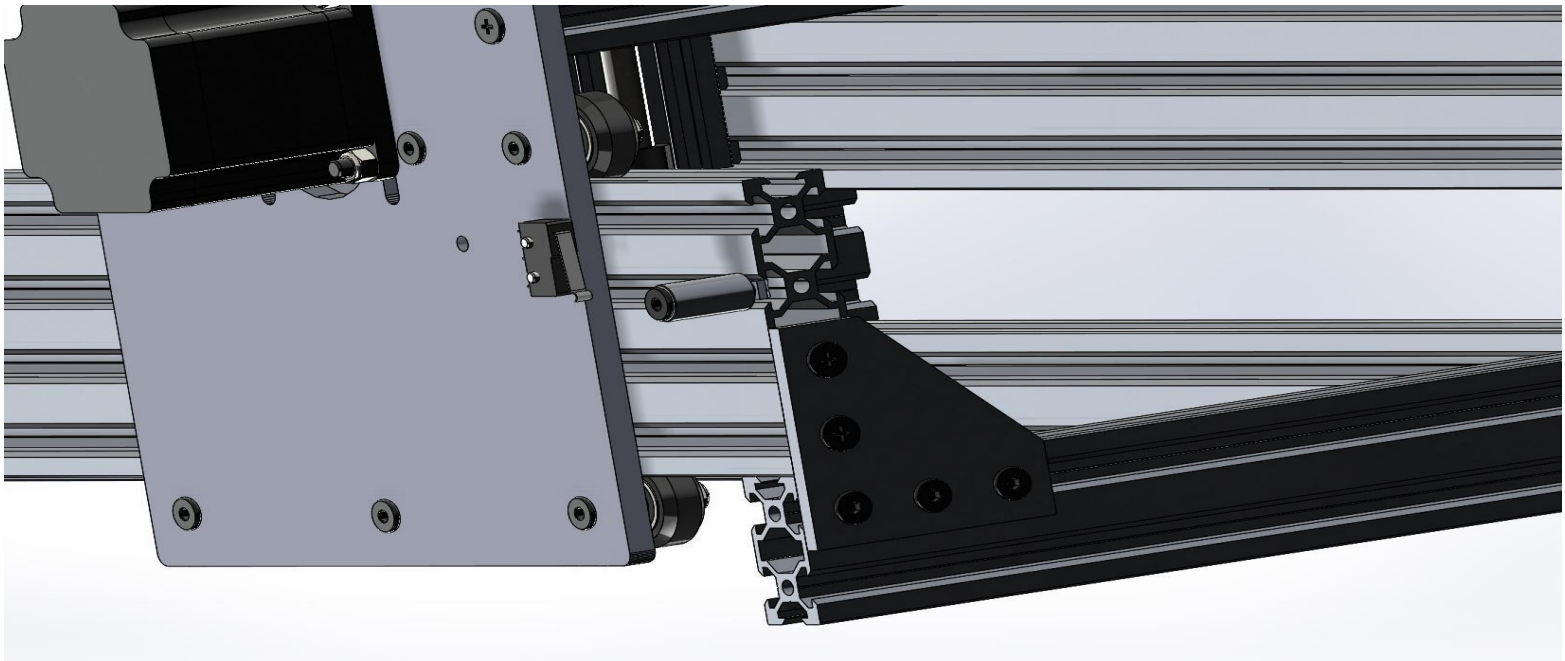
Before sliding in the center support slide tee-nuts into the top slot of the rail. And attach the cast 90s loosely. On the opposite side of the front support of where you installed the 5-hole 90s slide tee-nuts in to mount the center support(s).



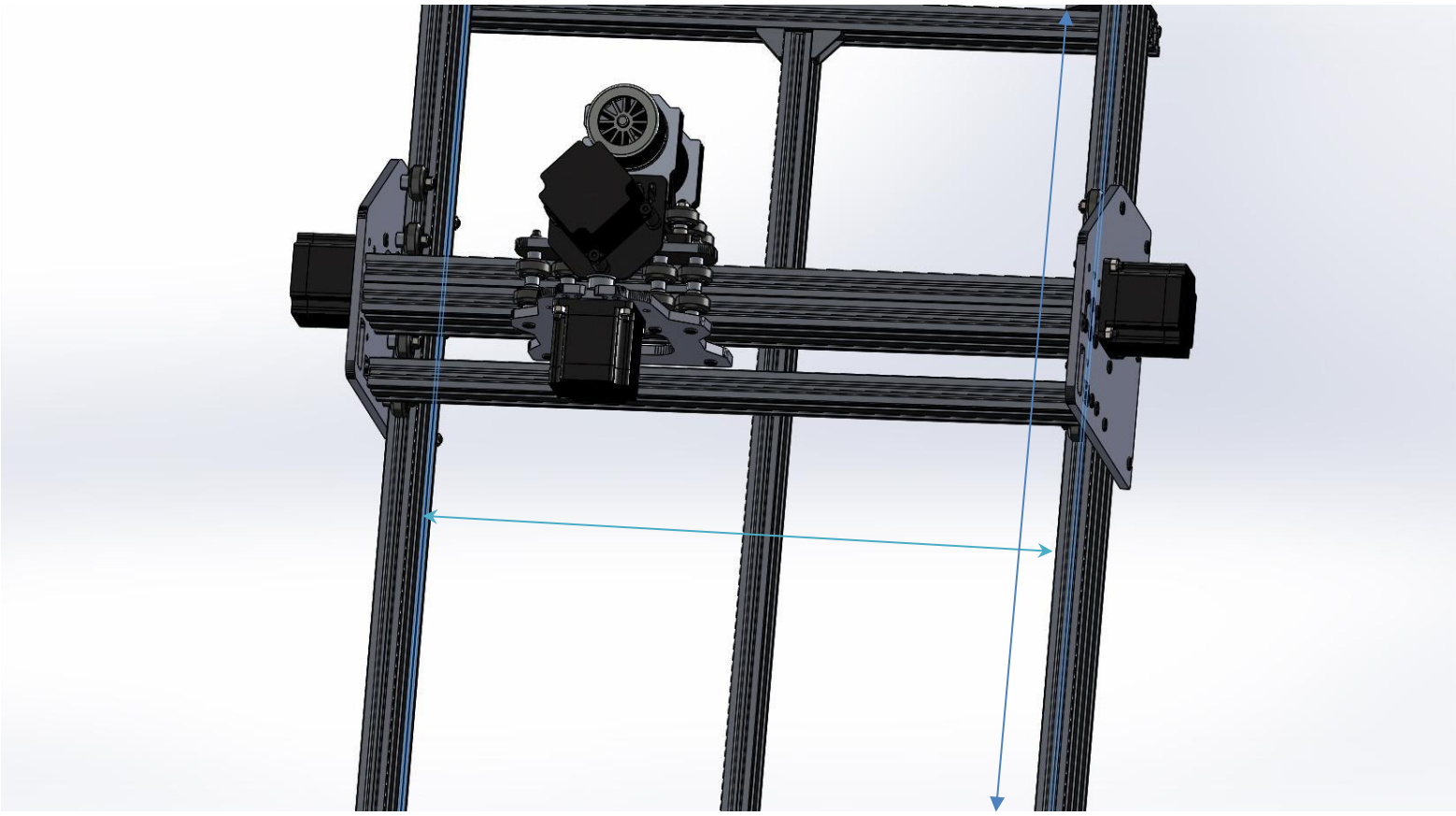
Install all cast 90 degree brackets by M5 x 8mm bolts, square and tighten. 8 qty M5 x 8 used in this example here.

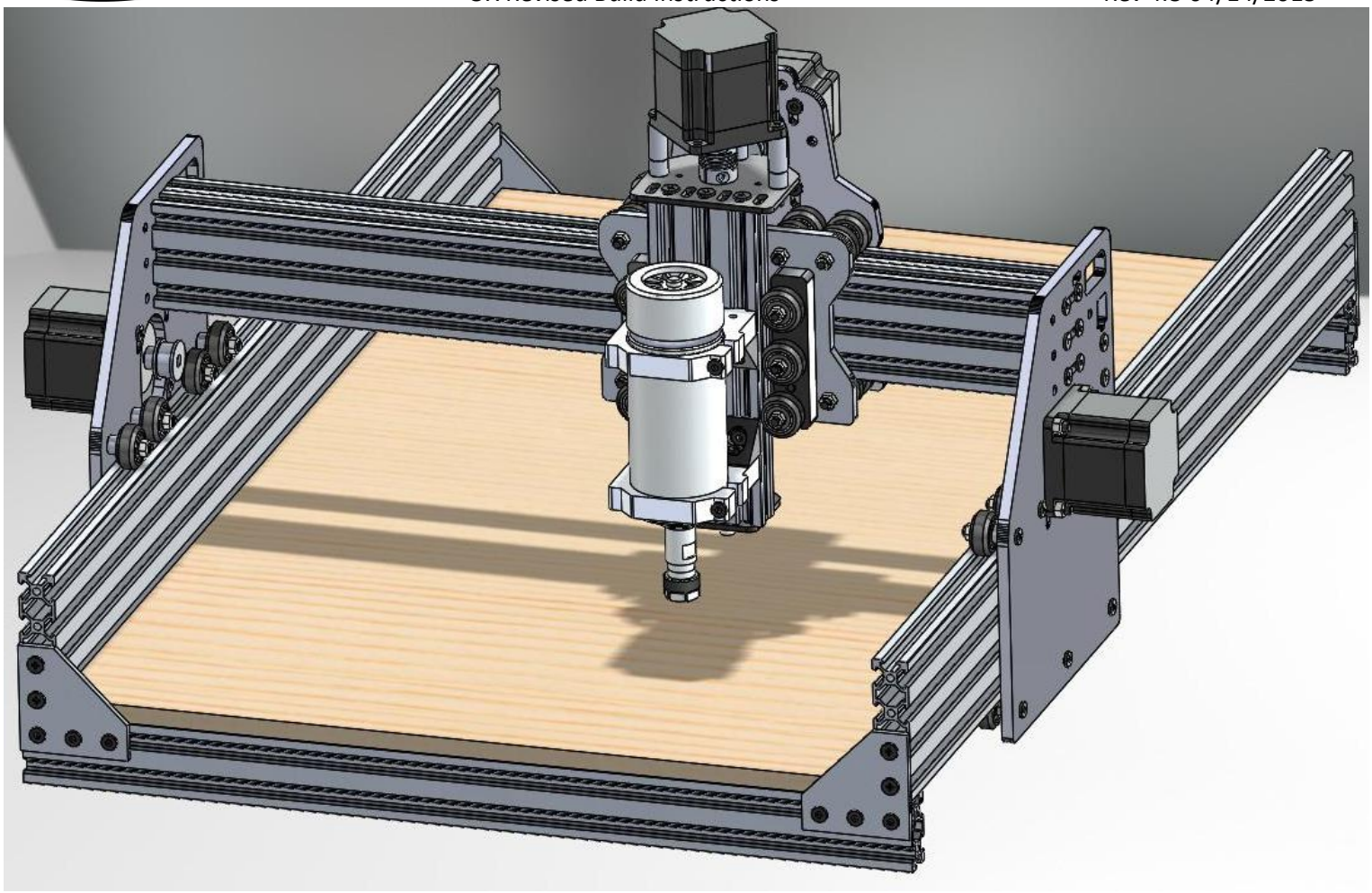


Now lets us add the Y limit switch stop. Just as we did earlier use a drop-in tee-nut, spacer and bolt and set the stop in the rear of the 20x80 Y run on the side with the limit switch. The spacer is 20mm tall and the bolt is a M5 x 30, see below, this is held on with a drop-in tee-nut.



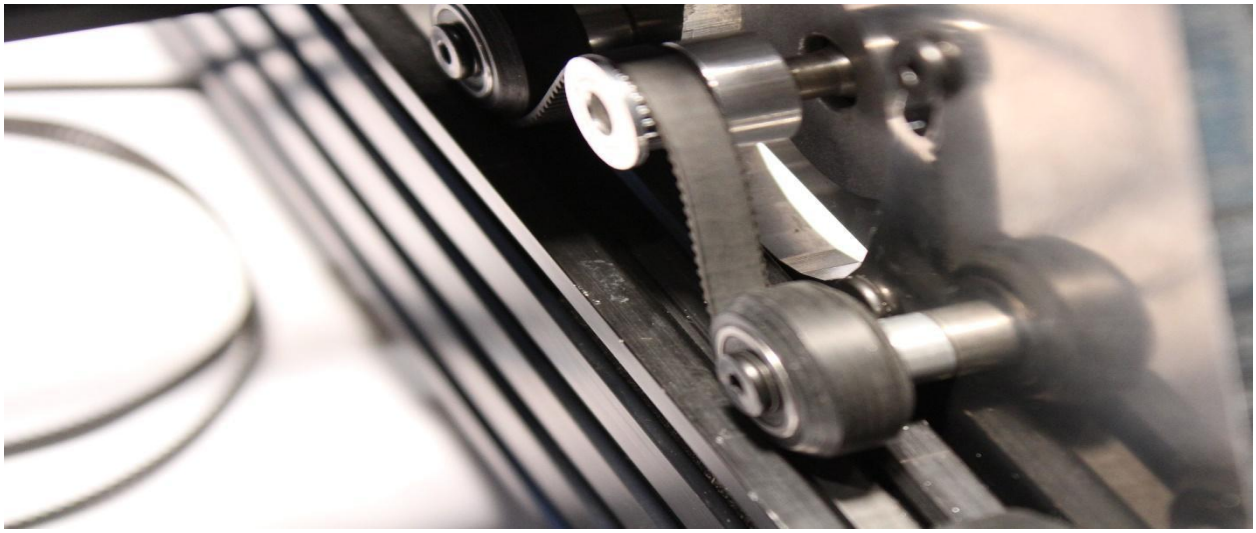
Now it is time to install your spoiler board. The spoiler board is 1/2” MDF that can be purchased at any lumber yard or home goods store. Most will cut it to size for you if request. Measure the inside of the frame form one 20x80 Y to the other 20x80 Y, this is the width you need. Measure inside of 5-hole 90 to 5-hole 90 this is the length you need.



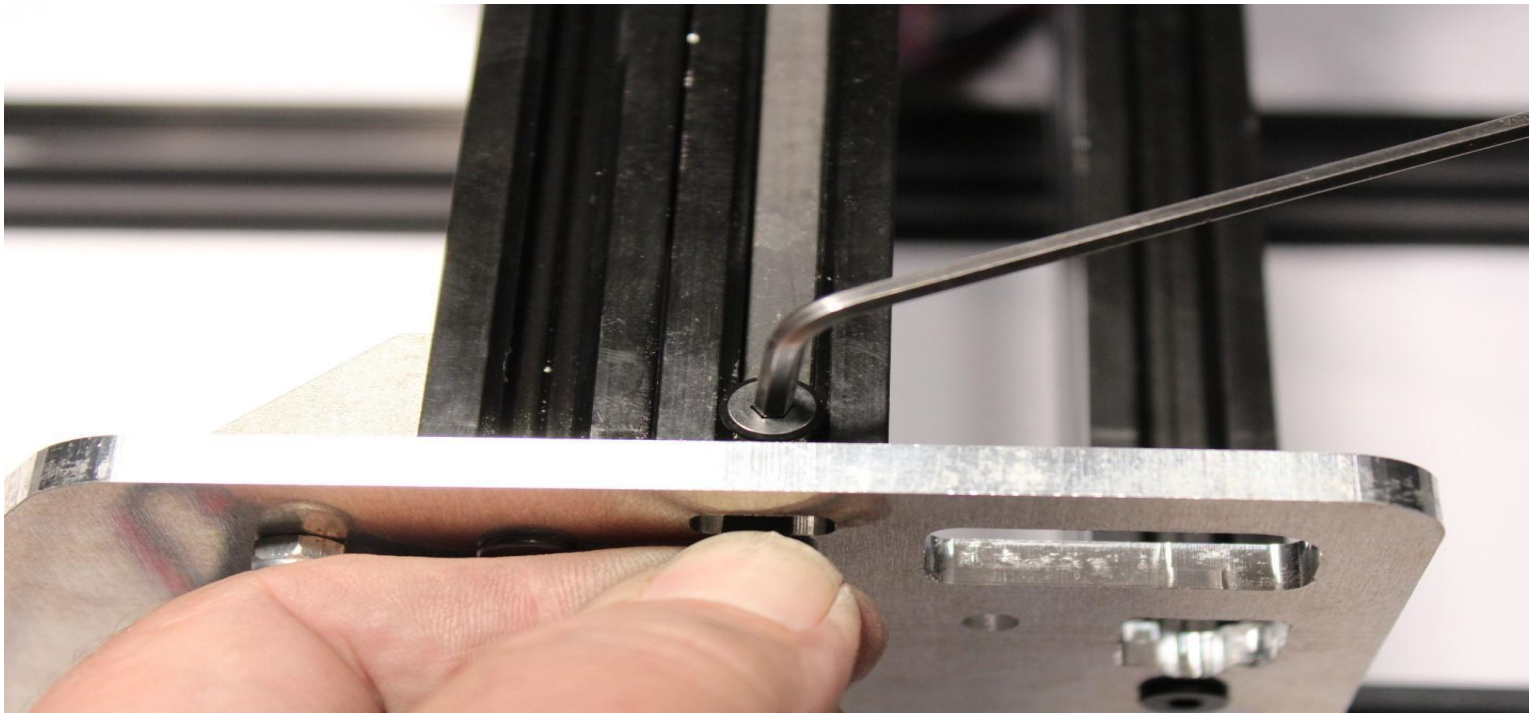


Now we need to run belts.

Tee-nuts and bolts are used to secure the ends of the belts, wrap the belt under the wheels and over the pulley:



Run it to the end of the gantry and slide a tee-nut over it. Tee nuts are used on the X gantry. Do not over tighten, we do not want to go through the belt with the bolt, just snug against it. Use an M5 x 8mm bolt.



End of the Y gantry shown above, give it a good pull and tighten the M5 bolt in the tee-nut. Don't get too tight! You can go all the way through the belt if not careful, we do not want to go through the belt, just snuggly against it.

If you didn't already, align all pulleys and tighten the set screws now.

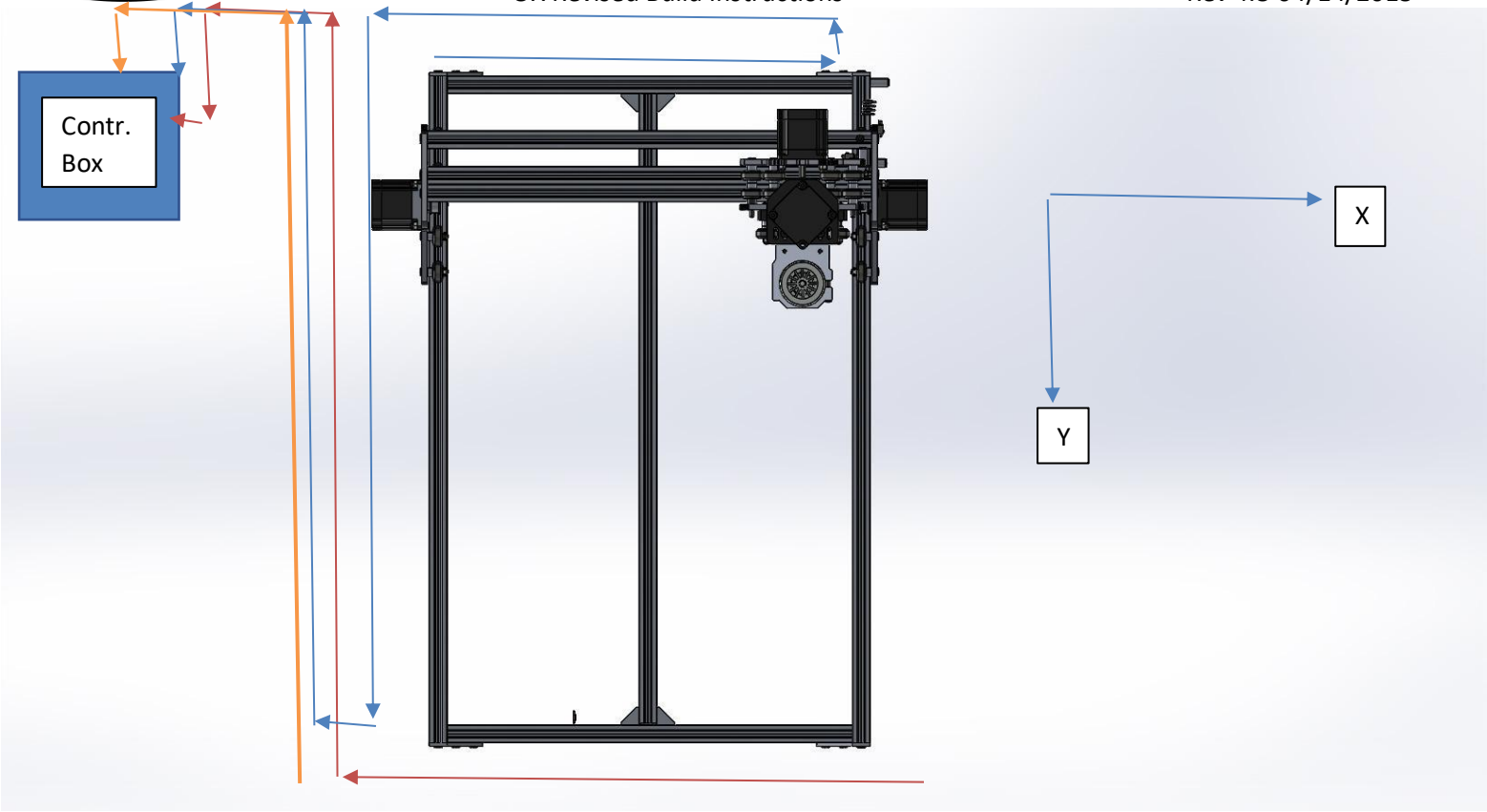
Congrats, your machine is mechanically complete.

Now we need to wrap up the electronics. View this video for a break down of how to complete the wiring https://youtu.be/LhTec1ATZKc

Begin by figuring out which side of the build you will install the control board and power supply. You want these close to an outlet and somewhere easy to reach and out of harm's way of debris from the machine.

As an example, let us assume we are going to install the controller and such on the left-hand side of the machine looking at it.

Take the 6-conductor wire and stretch it from the right side of the machine to the left side of the machine, then from that stopping point add to the length, the length of the machine, plus where we want to mount the controller. See below for an example of this.

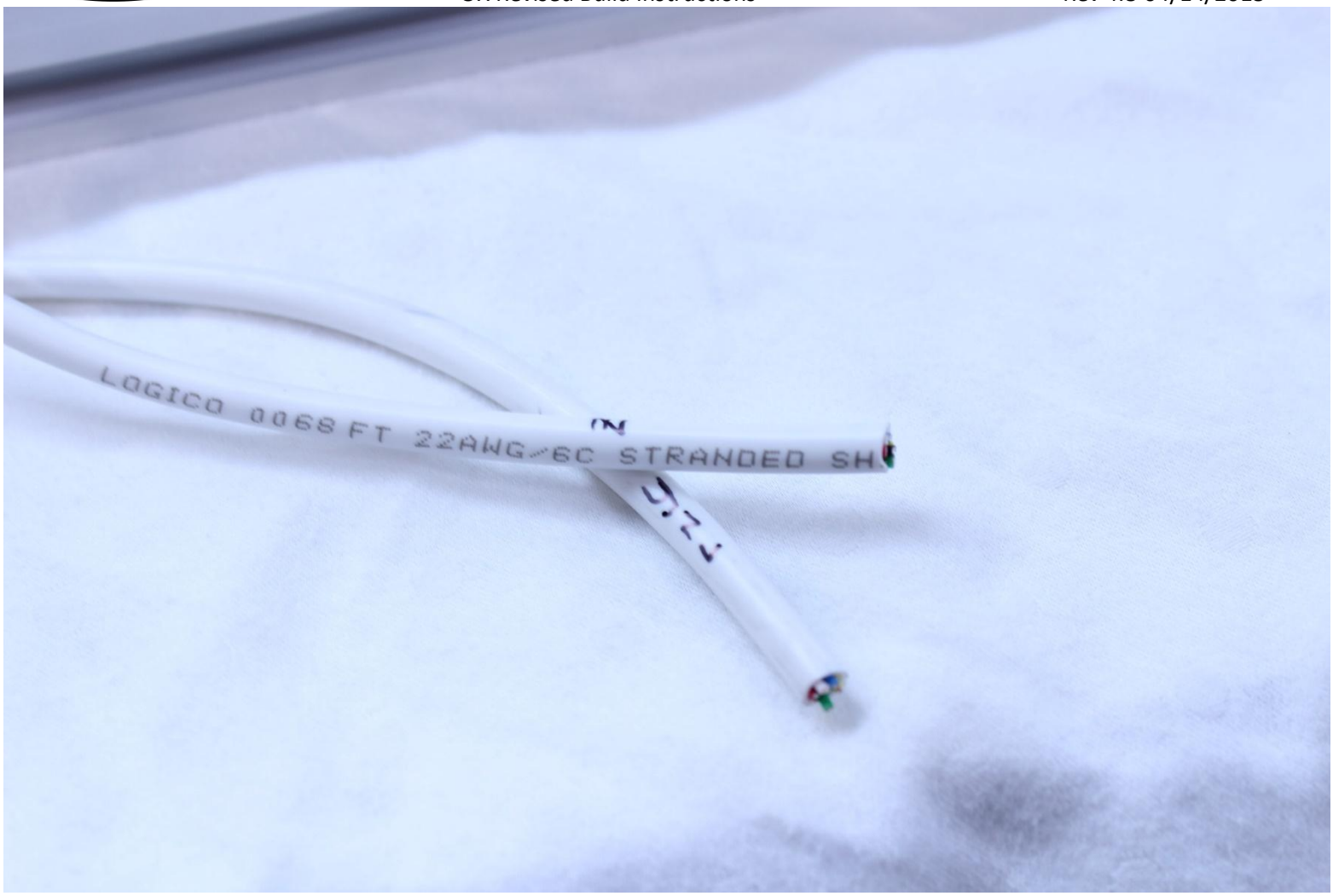


Orange illustrates how to measure out the length required for the Y opposite the control box.

Blue illustrates how we want to lay out the X, Z, and 2-wire for the spindle.

Heavy green illustrates how we want to lay out the Y closest to the controller.

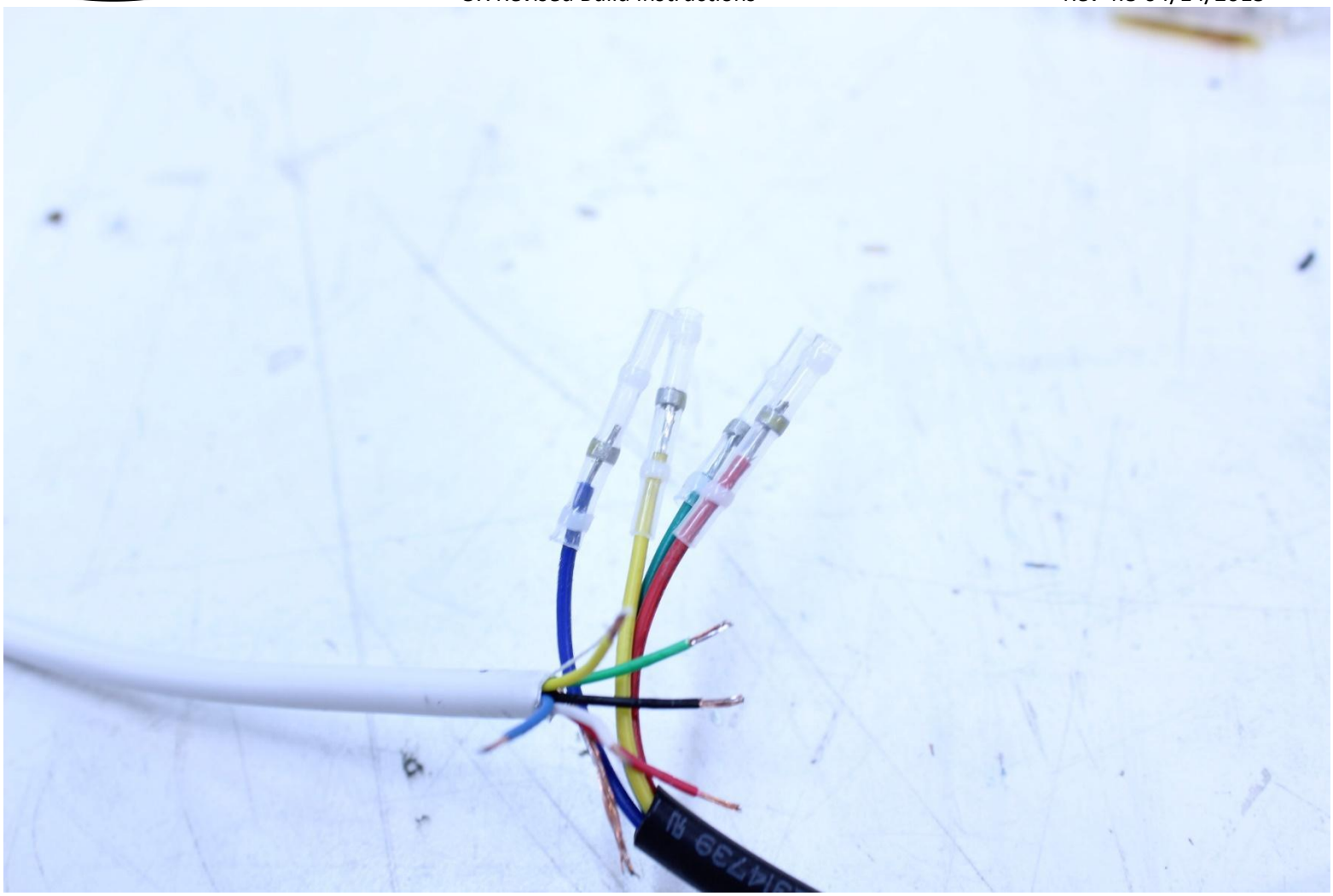
NOTE: write on the opposite end of the wire the motor the wire is connected to, for instance if you are making the connection to the X motor (shown above as blue) mark the opposite end of the wire that will connect to the controller with “X”. We do this as we will be running all the wires through a cable chain and will need to identify which axis is which.



We label one here as YNL, this stands for Y no limit, this is the Y side of the build we did not install the limit switch on.

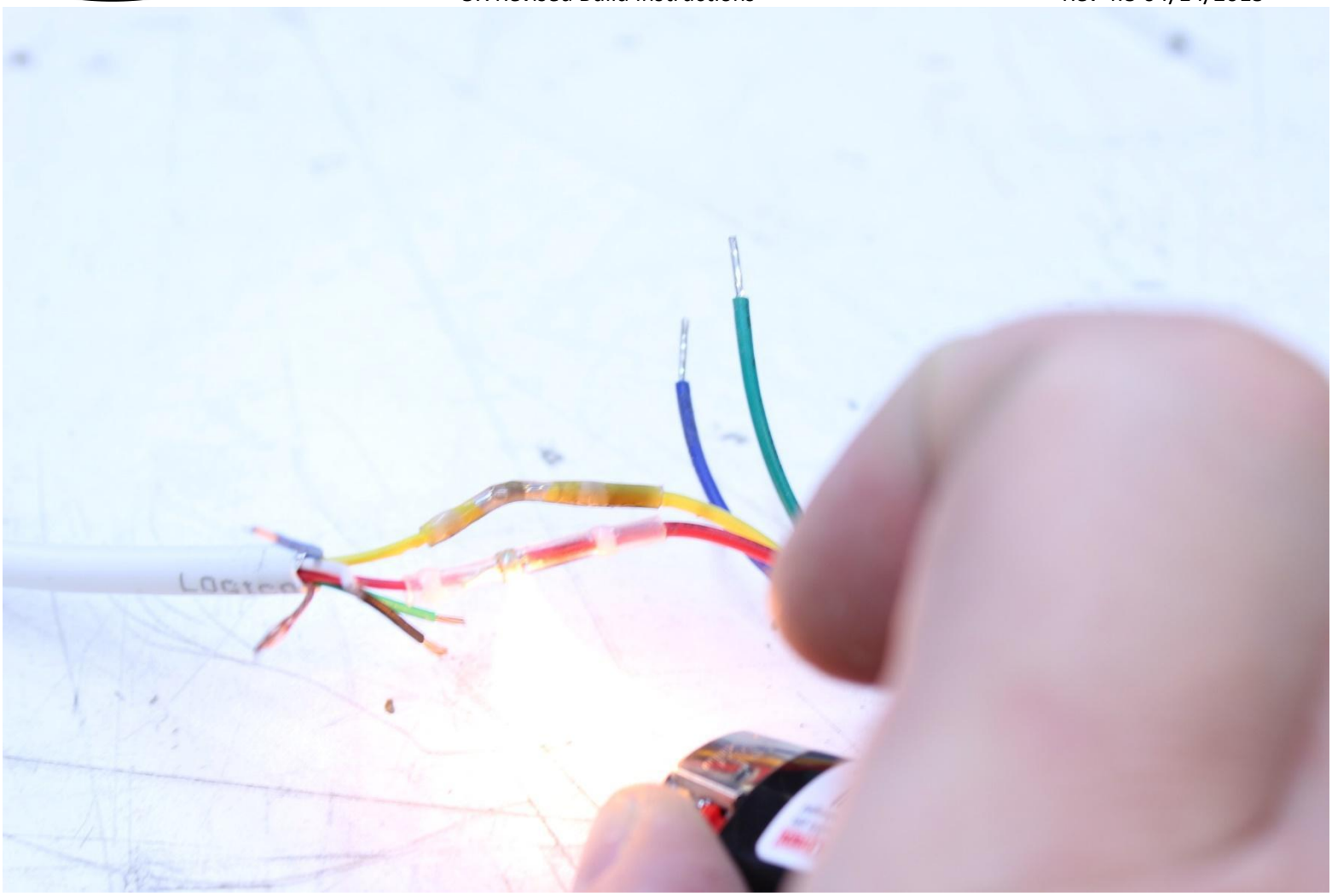
We will connect one 6 wire cable to the X motor and X limit switch. This is done with a typical lighter and four qty white ribbed soldered connectors for the motor and two qty for the X limit switch. The X motor is the one on the back of the plate that will drive the X/Z assembly side to side. We will do the same for the Z drive and Z limit, which is up and down looking at the machine.

Strip the white (color may vary) main sheathing around the wire back far enough to reach the motor wires and limit switch.

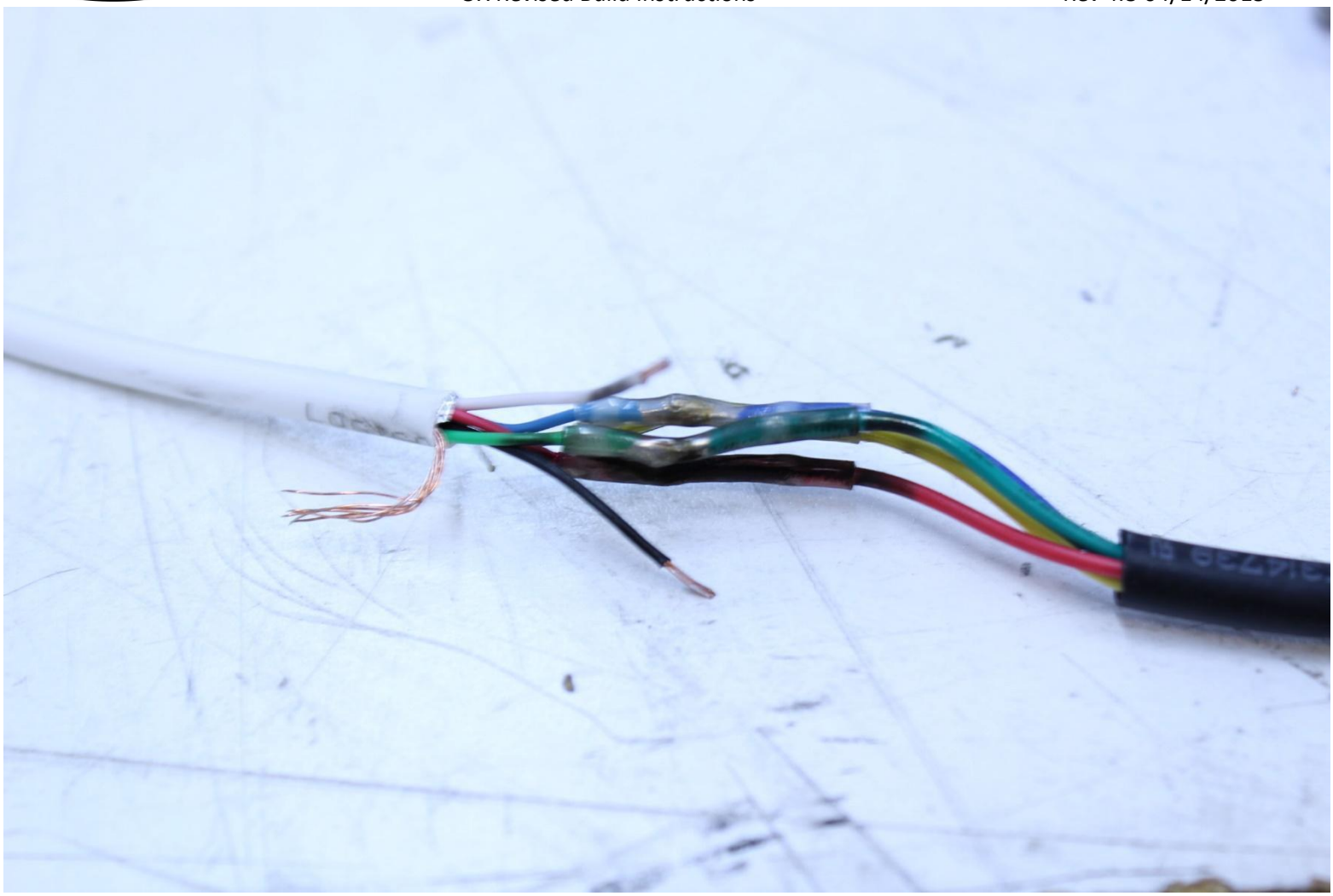


Install so that the tinned wire end meets the inner solder band on the white banded solder connector.

Match the wire colors, green to green, red to red, etc. Slide the matching color wire in making sure the stripped wire end meets the solder ring inside the connector. Lightly heat the connector with the lighter till the solder ring melts onto the wire ends.

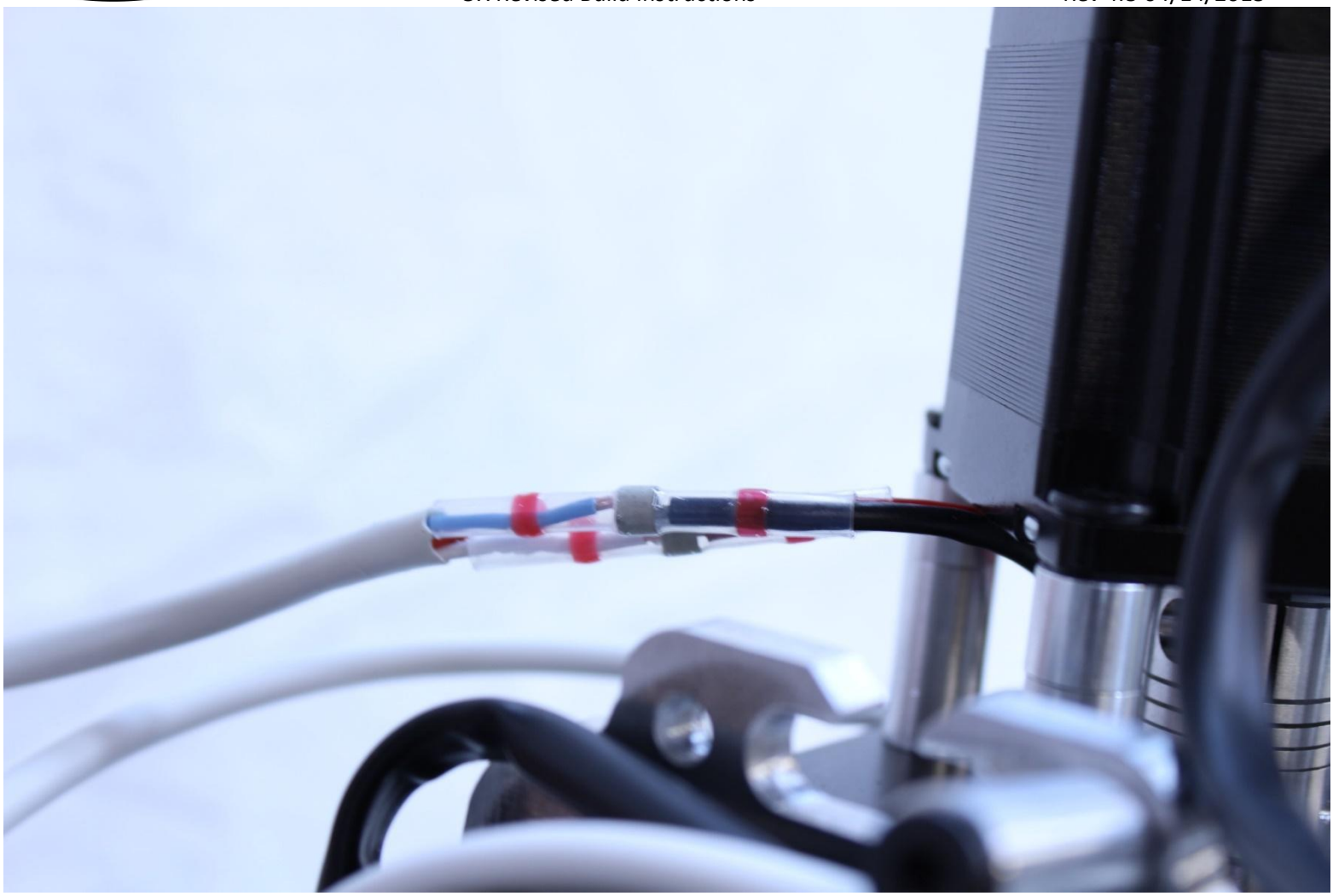


The yellow connection in the image above is complete, the red is in process of melting.



Once all four connections are made, repeat the same for the limit switch attaching them to black and white wires.

Repeat this process for the Z motor and Z limit switch. Repeat the same for the spindle motor. Use the red banded solder connectors for the red and black wire that comes out of the spindle to the 2-wire included in the kit.



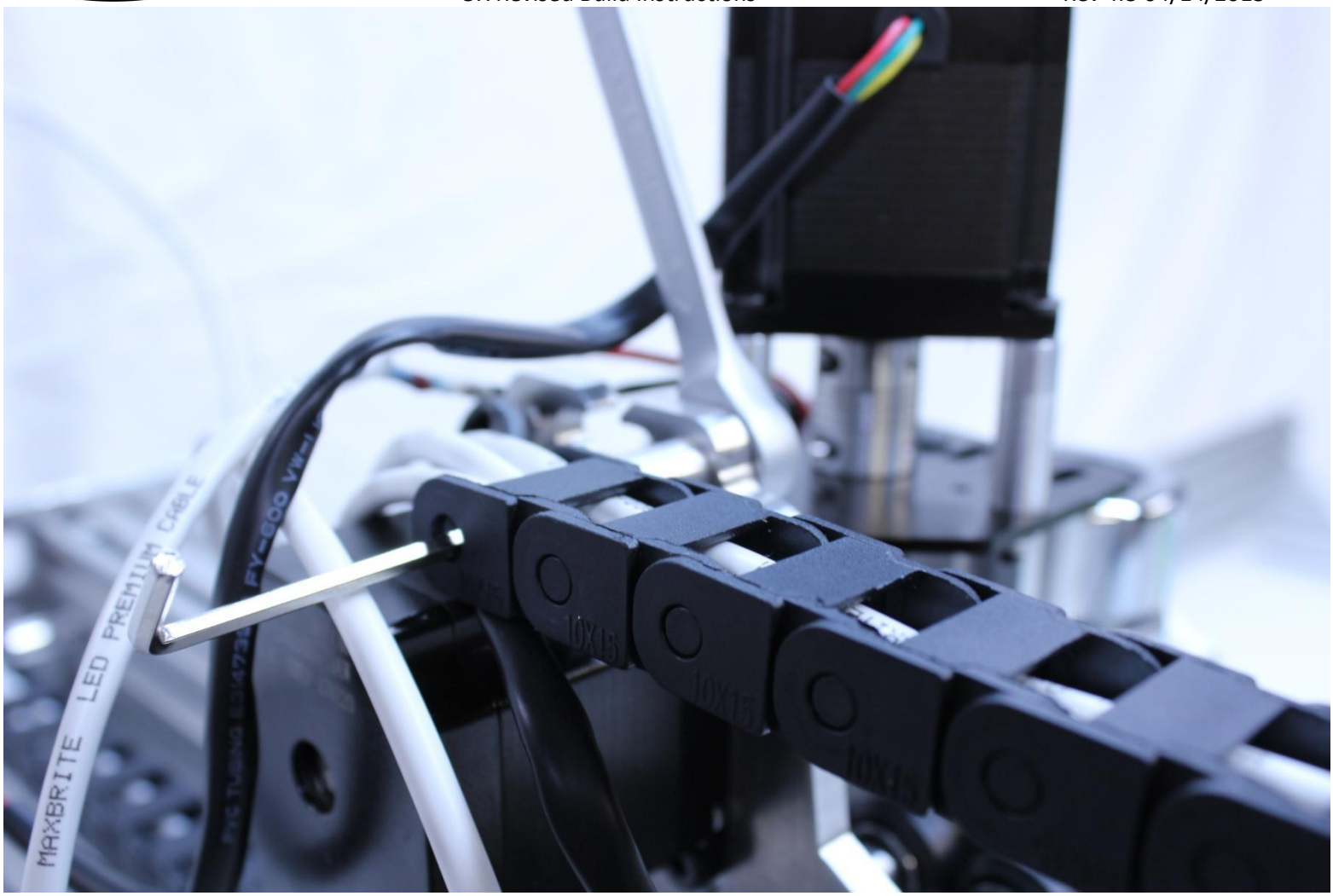
The opposite side Y should run under the cable chain and jump through the bottom of the cable chain prior to exit.

Install the cable chain with a drop-in tee-nut on the 20x40 behind the X gantry and the other end to the rear X/Z gantry plate.

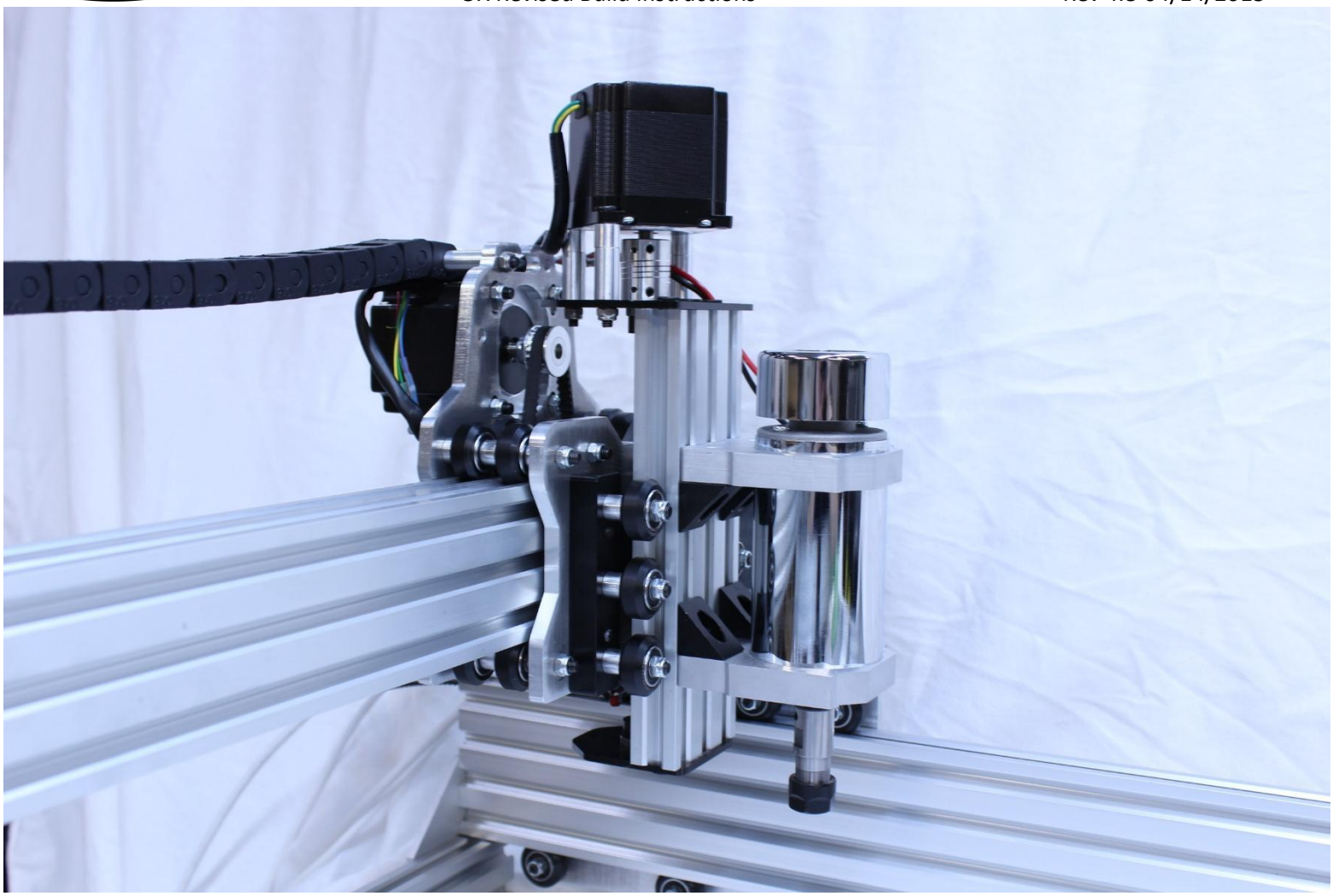
Group the X,Z and Spindle wires and run them through a cable chain. Not the length of the cable chain before you begin! IF you have a 500mm X then remove half the cable chain prior to installing. If you have a 1500mm build, combine 1.5 cable chains.

You can either drill a hole through the side of the end of the cable chain or remove the end connector and use the hole in the side of the connector, this depends on which way you installed the cable chain on the wires. Hold the end of the M5 x 30mm bolt, use a 20mm spacer and install with a M5 nut and tighten in place.

It was noticed that the spacer that holds the cable chain was too long. A M5x20mm bolt replaces the M5 x 30 and a 9mm spacer replaces the 20mm spacer. Perfect alignment is found at about 10-11mm distance. Two spacer spacers from the wheel kits can be added here to get the perfect cable chain alignment with the 20x20 rear brace.



The other end will lay on the 20x40 and is installed with a drop-in tee-nut:



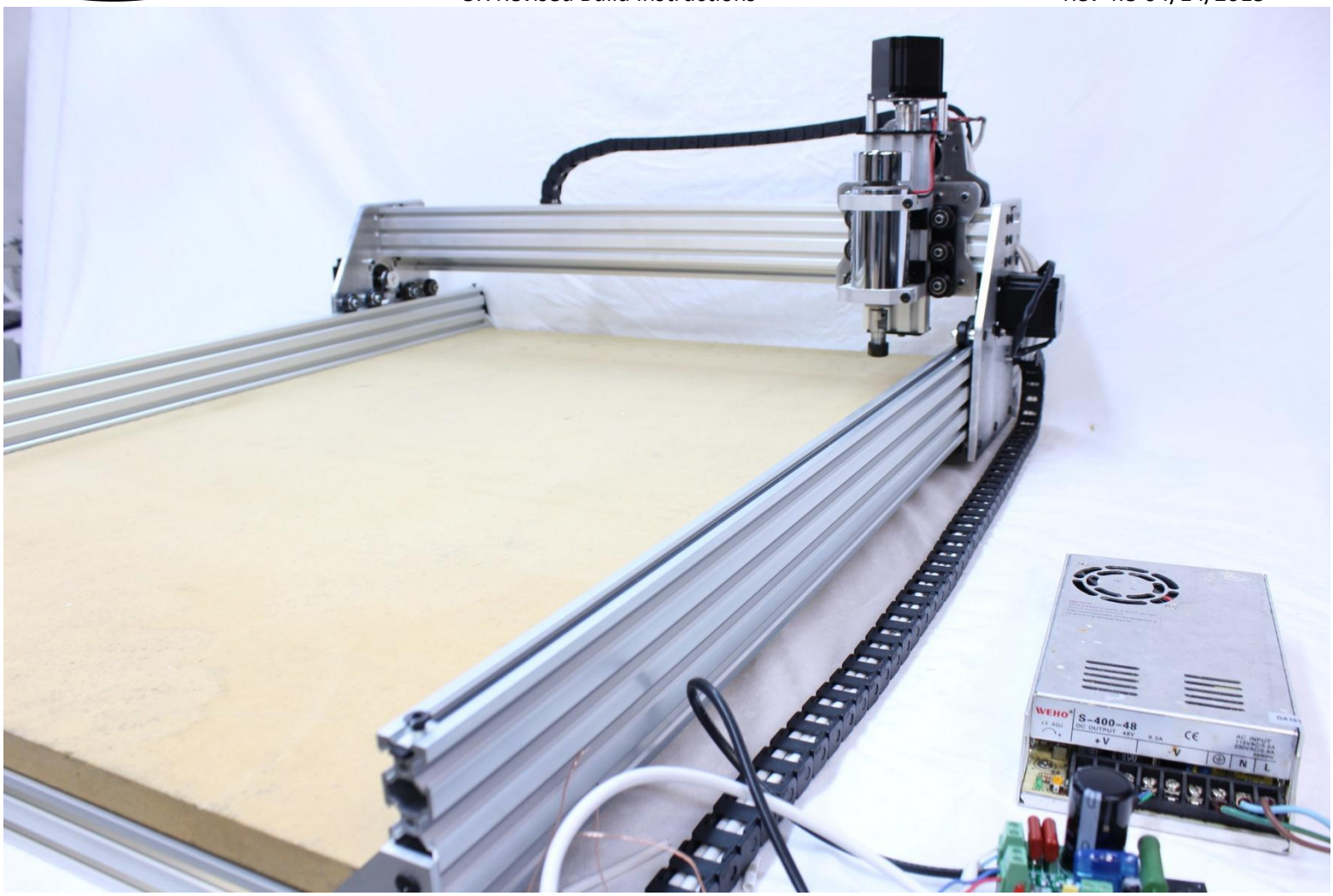
Now, coming out of one side or the other Y gantry plate you should have wires that are connected to the X, Z, and opposite side Y motors and limit switches.

Connect the last wire to the one Y stepper motor that is not connected. After, run all four wires and the spindle wire through the remaining cable chain.

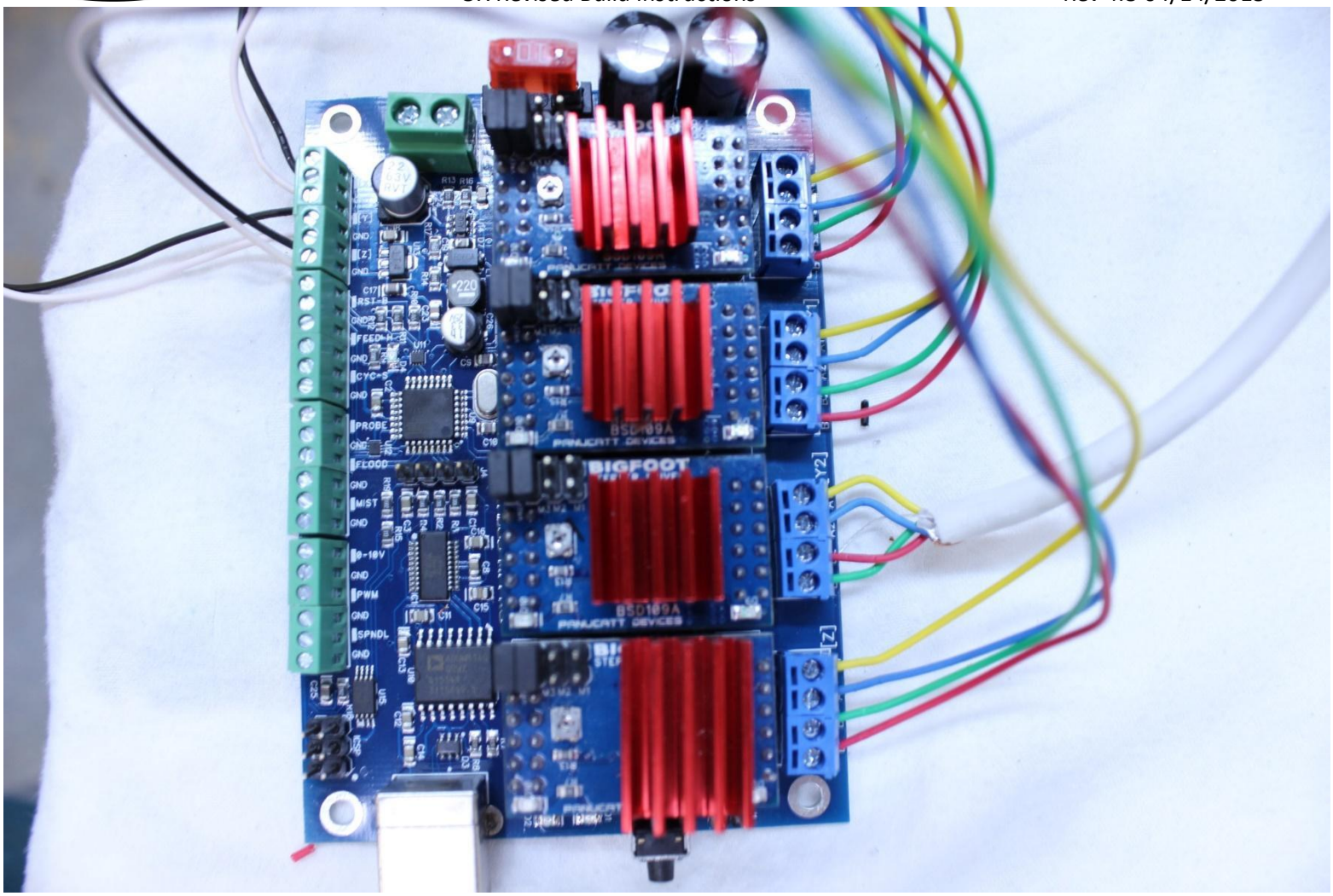
It may be required to break the cable chain into smaller sections to get all the wires through it.

Attach the cable chain to the Y gantry plate threaded hole (9mm spacer, 15mm bolt) as we did earlier on the rear X/Z gantry plate.

Attach the free end to the table with a wood screw.



Now let us connect to the controller, we are showing an M1 here, but the controller may vary. The connections will remain the same.



X goes to the top connector, Y then Y, then Z is the bottom. The colors of the wires are important! Connect them just as shown here. The limits will wrap around the other side and are (from top to bottom) X,Y,Z. Notice how the second Y motor has a reversed connection.

400 watt spindle:

Now connect the PWM connection on the controller to the spindle speed control. Polarity matters!

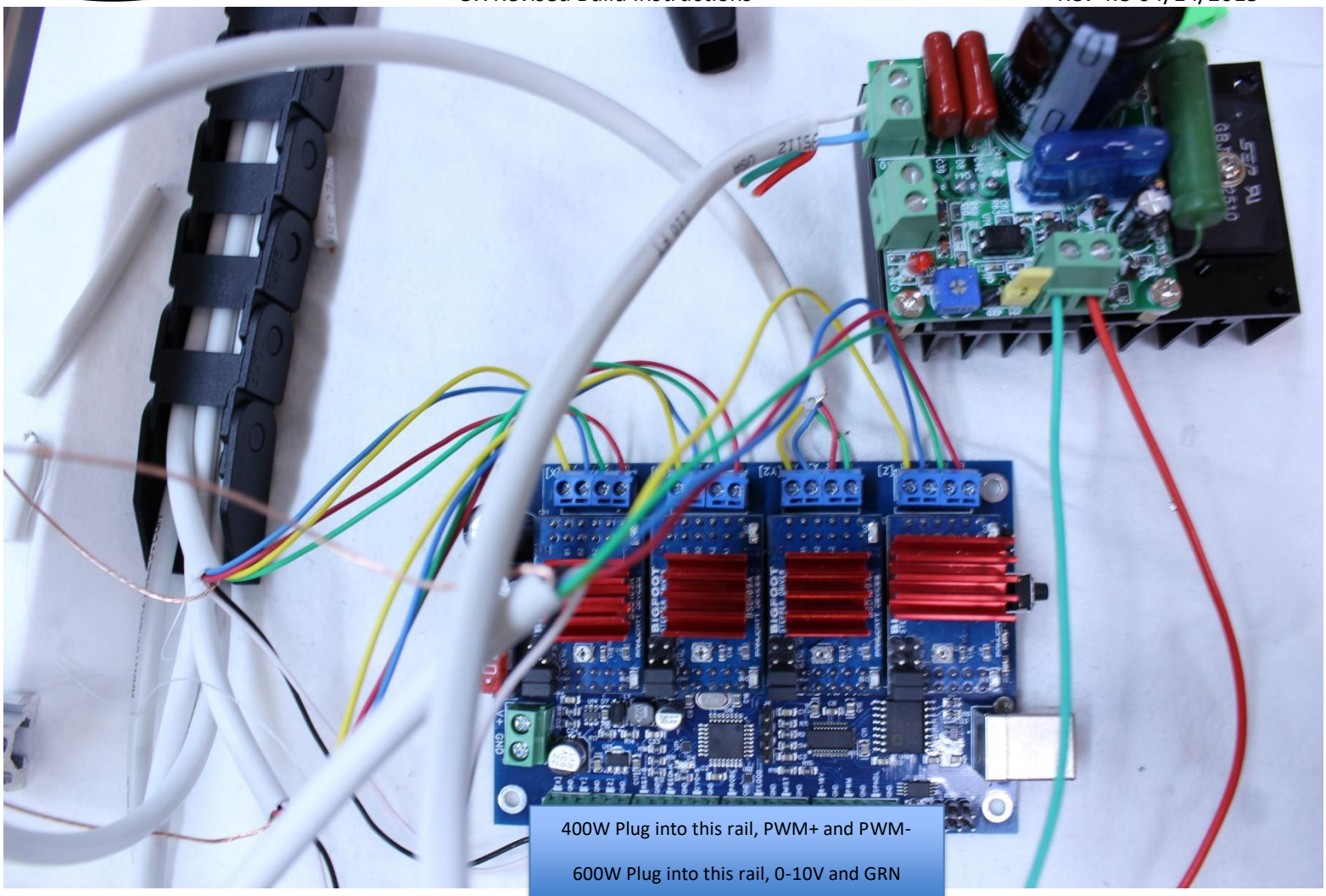
600 watt spindle:

Connect 0-10V from the M1 controller pins (right above the PWM pins) and ground to the 600 watt power supply. The front of the 600w power supply has 0-10v and ground connections. Polarity matters.

Remove the potentiometer that comes installed on the 600w power supply.

Run spindle motor wires to the 600w power supply and connect red to M+ and black M-.

Run 110VAC to the 600w power supply in the same fashion as the 48VDC power supply.



Connect the power supply to the controller and spindle speed control

_____BE VERY CAREFUL OF POLARITY HERE!!!_____

On the controller GND goes to V- on the power supply, hook negative and positive to the spindle speed control as well from the power supply.

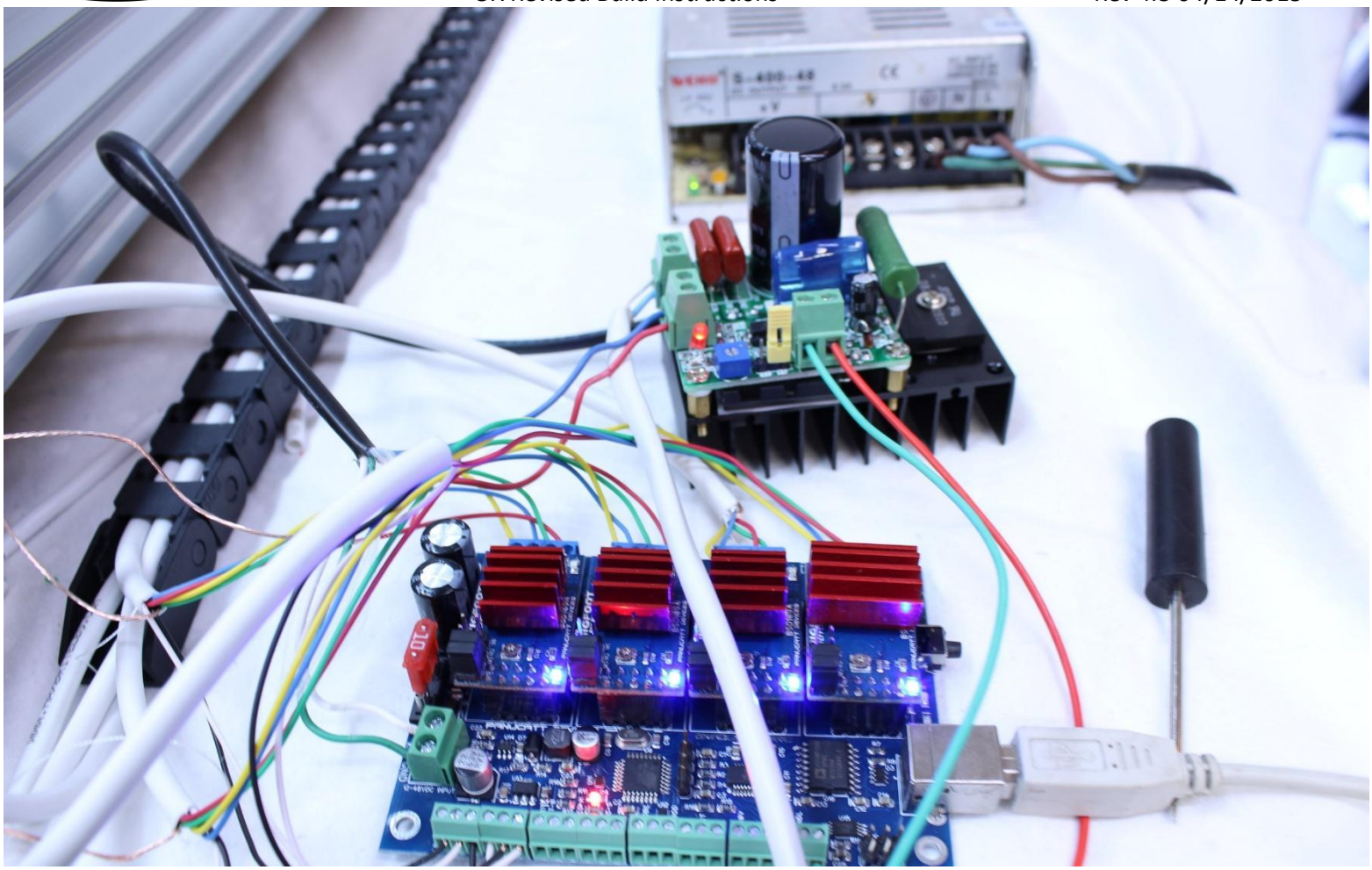
Hook the spindle to the spindle speed control.

Now connect the USB cable (not provided) to the controller.

Connect the power supply cable to the power supply, Green to Ground, Black to N, White to L.

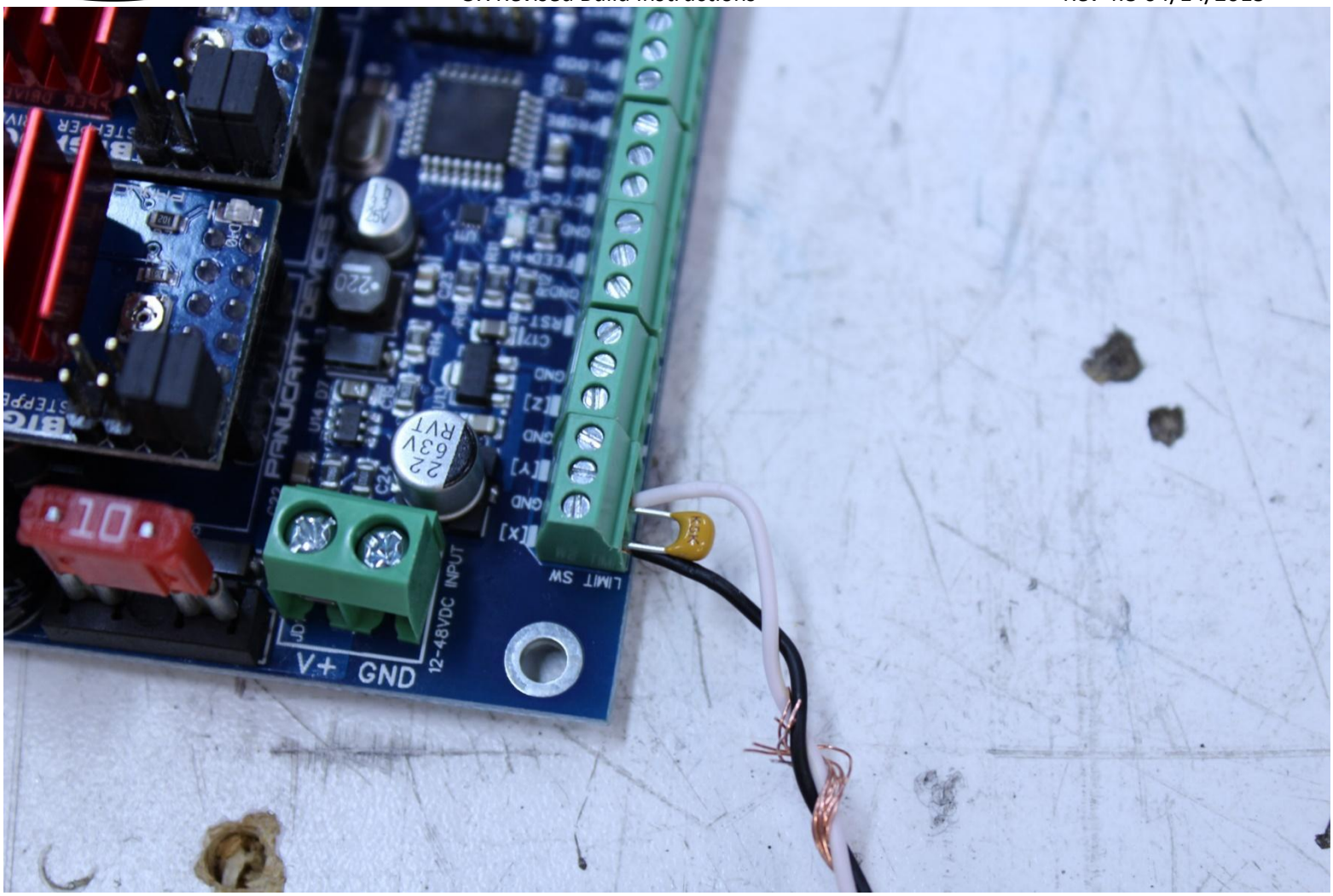
A fan is included in the kit, plug the fan directly to the power supply and aim it directly at the heatsinks (red metal) on the M1.

Plug in the power supply to a wall outlet after checking all connections.

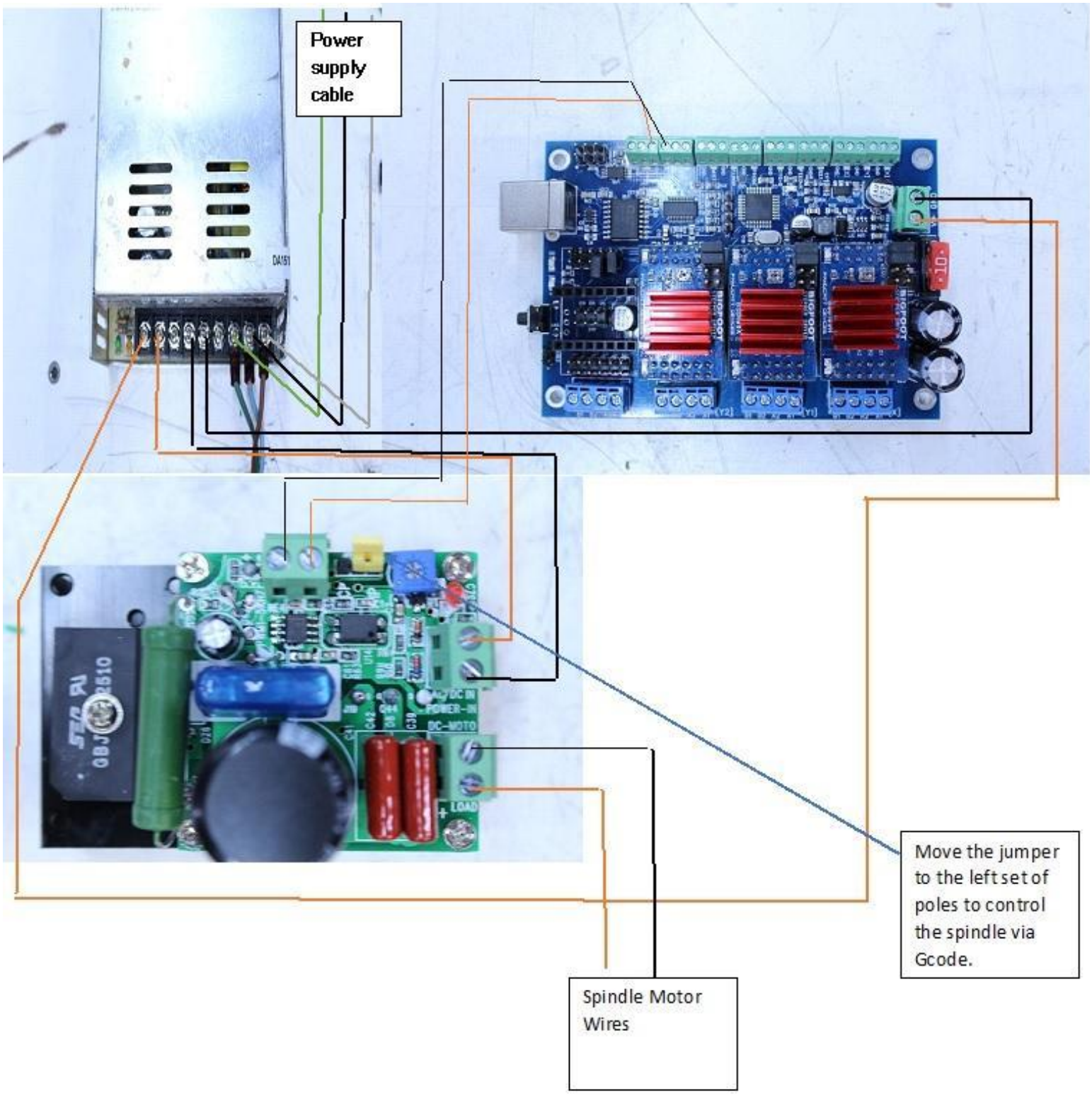


Power down after you have noted lights on the controller and spindle speed control.

There are 3 quantity capacitors included in the kit. If you have problems with noise on the limit switches, install them as shown here:



Not all will have this issue, but it does occasionally happen.


Power supply cable
Move the jumper to the left set of poles to control the spindle via Gcode.
Spindle Motor Wires

Communicating with the machine:

Plug a USB cable A to B into the control board and the opposite end into a computer and plug the power supply cable into a 110V outlet.

Start your computer and open a google chrome window.

Go to this address:

https://cnc.js.org/docs/desktop-app/

Download the appropriate desktop app for your system, OS, windows, etc.

Open CNC.js

Look for a connection window on the top left hand side.

Power the OX machine.

Under port, hit the refresh button, use the drop down to find a USB port that states “Manufacturer FTDI”, select this.

A blue button labeled “Open” is also in the connection window. Click this button.

You should now be connected. You must home the machine prior to jogging around. There is a blue button labelled “Homing” in the upper right hand corner, click this.

The machine should raise the Z, then lower a bit, then go back up. X and Y axis should follow.

Once homing is complete you can now jog around.

If you jog the wrong direction, you will lock grbl. The system purposely does this to avoid damage. If locked, simply hit the refresh and unlock buttons located near the homing button.

You are now connected to the machine and it is fully usable!

You can try jogging around, homing the machine, starting the spindle (M3 S1000), etc.

Take time to familiarize yourself with this window. There are a lot of features here. If you want to jog the machine around go to the upper right-hand window, called Axes, click the down button and the box will expand. Click on the “move” tab and select “1”

Then click any of the direction buttons. The machine should move.

GRBL Settings change:

Example

If an axis such as X, Y, or Z moves in the opposite direction it should you will need to change the “$3” mapping. For an understanding of this see the GRBL page:

https://github.com/grbl/grbl/wiki/Configuring-Grbl-v0.9

Scroll down a bit and you will see a set of numbers “$1” through “$132”, below this is an explanation of what each does. Related to the example above, if X moves the opposite direction we tell it, we would need to set “$3=1” based on this information:

Setting Value	Mask	Invert X	Invert Y	Invert Z
0	00000000	N	N	N
1	00000001	Y	N	N
2	00000010	N	Y	N
3	00000011	Y	Y	N
4	00000100	N	N	Y
5	00000101	Y	N	Y
6	00000110	N	Y	Y
7	00000111	Y	Y	Y

To make changes, go to the Com screen. Look in the mid-left hand side of the screen. Note it is black with white text.

At the bottom of this box you will see an area where you can type things, type in this box, $$

You will see what your current settings are. Only if an axis is going the wrong direction should you make the below change.

Note that $3=0 out of the list of things there.

Type $3=1

Then type $$

Note that now in your list $3=1, and when you jog the machine X now moves in the opposite direction. If all axis move in the wrong direction you would type $3=7, for example.

One last thing to check is that the spindle turns the right direction. Type M3 S11000 in the serial port. This should turn the spindle on at 12000 RPM. Type M5, the spindle stops. Looking down at the top of the spindle, it should turn to the right. If it turns the opposite direction, switch the red and black wire on the spindle speed control.

The machine is set up and ready to be used! Play around with the $ settings. Set travel limits, set max velocities and accelerations.

Have a read on our page about “How to CNC” here: https://www.smw3d.com/blog/how-to-cnc/

Read about feeds and speeds here: https://www.smw3d.com/blog/what-is-the-right-feeds-and-speeds-for-my-cnc-router-kit/

Explore the machine, explore software, explore all that various things you can create. There is so much to learn and new opportunities around every corner when you can build the world around you.

Congrats you have completed a nice build, you have now have a tool that you built that can be used to make amazing things.

We love to show off the things our makers have done, once you get comfortable, shoot us some pics of your craftsmanship.

Thank you again for letting be part of your build, don’t hesitate to contact us if you have any questions, we are happy to help!