Shapeoko 3®

Assembly Guide and Owner's Manual

Assembly Manual Designed, Written & Illustrated by Union|Nine

浪人

Welcome to Shapeoko!

Shapeoko was started in 2011 with the hopes of bringing CNC machining capabilities to anyone who wanted it. We helped start the desktop manufacturing revolution—and while some of our objectives have changed over the last few years, one thing remains the same: Shapeoko is a CNC machine for people who want to get into CNC and don't want to break the bank or fabricate their own machine from scratch.

You Are Not Alone!

With thousands of Shapeokos in the wild, from v1 machines all the way through the latest generation, the Shapeoko 3, you will find Shapeoko people all over the Internet; but our main place of gathering is the Shapeoko forum. You can sign up for a free account and get started talking to other members of the community by visiting: http://www.shapeoko.com/forum.

We're a welcoming bunch and work hard to help out newcomers. At one point, everyone in the shapeoko forum was standing where you are today—in front of a box of parts, ready to conquer the world of CNC. So, if you get stuck, or need a second opinion, feel free to drop in and ask away.

In addition to the forum, the community has been curating information for the Shapeoko wiki since the very beginning. If you would like to roll up your sleeves and get dirty, there are hundreds of articles across the wiki on every topic from work-holding to writing your own g-code.

If you're looking for something specific to Shapeoko 3, we recommend taking a look at our Carbide3D Docs pages. We've packed them full of all kinds of useful information to help you get up and running, and to help answer the most common questions: http://docs.carbide3d.com

If you run into an issue that you can't find an answer for on the forum or the docs pages, or find that something in your kit is missing or broken, please contact us for customer support by emailing support@carbide3d.com. We'll get back to you as quickly as we can and get you fixed-up and running in no time.

Software

Carbide3D provides a machine control package, called Carbide Motion, with every machine we ship. This software allows you to control your machine by jogging it around, setting zeros, and loading and running g-code. For more software, such as CAD/CAM packages, check the Docs site and the Shapeoko wiki for recommendations and helpful information.

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Full Packing List

Part #	Description	Qty
	Controller & Heat Plate & Shroud	1
	Power Supply	1
	AC Power Cable	1
	NEMA23 stepper motor	4
	USB Cable	1
	12v Fan	1
S3000	85mm x 55mm x 600mm Custom Extrusion	3
S3006	20mm x 27mm x 200mm Custom Extrusion	2
S3078	M5 x 55mm, SHCS - SS	2
S3079	M6 Hex Nut - SS	1
S3077	M5 x 40mm, BHCS - SS	4
S3075	10-24 Thread, 3/4" Length - SS	2
S3076	M5 x 20mm, BHCS, SS	22
S3081	M6 x 30mm, BHCS - SS	1
S3024	M6 Flat Washer, black oxide - SS	4
S3025	M5 Flat Washer, black oxide - SS	18
S3026	M6 Square Nut	4
S3027	M3 Hex Nut, Ny-loc	12
S3029	M3 x 12mm, SHCS - SS	12
S3030	M8 x 35mm, BHCS - SS	6
S3032	M6 x 12mm, BHCS - SS	30
S3033	M5 x 25mm, BHCS - SS	1
S3035	M5 x 16 mm, BHCS - SS	25
S3038	M8 Hex Nut - SS	6
S3044	M5 Hex Nut - SS	29
S3001	Y Axis Mount Plate	2
S3003	X-Axis Mount Plate	1
S3004	Z-Axis Mount Plate	1
S3056	DNP611 Mount, Aluminum	1
S3060	Base Frame - Front Back Plate	2
S3063	Base Frame - Edge Strap	2
S3064	Base Frame - Center Strap	1
S3066	Waste-board, half, MDF	2
S3067	Base Frame - Cross Strap	1
S3090	2.25in to 6.25in Extension Spring	2
S3091	6mm flanged bearing	2
S3005	Belt Clip	6
S3014	8x22x7mm bearing	12
S3092	4" Cable Ti	10
S3015	3/4" x 3/4" - Adhesive Backed Cable Tie	4
S3078	3M Bump-on - 7.9mm x 3.6mm	12
GT2_800	GT2 Belting - Open Ended, 800mm	3
S3023	GT2 pulley, 20 tooth, 6.3mm bore	4
S3042	Eccentric Nut, SS	8
S3045	Dual Bearing V Wheel Kit (assembled)	16
S3074	GT2 Profile - 524mm Endless Belting	1

Full Packing List *(Continued)*

Part #	Description	Qty
S3077	GT2 pulley, 20 tooth, 5mm bore	1
S3082	Aluminum Spacer 3/8 OD x .219 ID x 3/8 Long	4
AS38-12-64	Aluminum Spacer 1-1/4" #12 Bore	4
S3018	Aluminum Standoff 3/8 OD x .257 ID x5/16 Long	1
AS50-1024-64	Aluminum Standoff, 1/2 OD x 10-24 Thread x 1" Long	2
S3081	Aluminum Spacer M5 x 15mm Threaded	2
S3016	Aluminum Spacer 1/2 OD x .319 ID x 10mm Long	6

Included Tools:

Part #	Description	Qty
S3T01	8mm Combination Wrench	1
S3T02	Jet-Lube Thread Locker, Blue	1
S3T03	1.5mm Hex Key, straight	1
S3T04	2.5mm Hex key, ball point	1
S3T05	5mm Hex key, ball point	1
S3T06	3mm Hex key, ball point	1
S3T07	Slip Joint Pliers	1
S3T08	4mm Hex key, ball point	1

Before You Start

Assembly will go much more smoothly if you:

1) **Clear a large working area**

Preferably 30” x 50” or larger, and clean up the surrounding area before you unpack and get to work on your Shapeoko3. You want enough room to have your tools and spare parts to the side of your assembly space, within reach.
(You will spend far less time looking for hardware you’ve dropped on the floor this way)

2) **Conduct your assembly on a tough surface**

You are likely to ding, dent, and scratch your work area as you will be dealing with some fairly sharp-cornered parts and heavy components. To minimize collateral damage to furniture, protect your work surface with a sheet of cardboard or similar material. Assembling at the kitchen table without an adequate covering on it is not recommended.

3) **Check your kit against the packing list**

Make sure you’ve got all the tools and parts that should ship with the machine, and also validate that nothing was bent or damaged in shipping. *Nothing is more frustrating than discovering you’ve been looking for a part you don’t have.*

4) **Organize components & hardware by subassembly**

Each subassembly calls for specific hardware, so rather than having all of the hardware out at once, it will be faster and easier to ensure you’ve got all the parts properly assembled if you only lay out what you’ll need for each stage of the assembly process. This also reduces the likelihood that you’ll knock extra small pieces on the floor or otherwise misplace them.

Assembly Overview

Assembly has been broken down into four stages for clarity:

1) **Building the frame and motion components**

   The Shapeoko3 consists of four major assemblies that need to be mostly built before they can begin to be integrated together. These are the Base Frame, the Gantry, the Carriage, and the Z-plate. Our goal in this first stage is to use up the vast majority of the large components and get ready to tie these assemblies together.

2) **Assembling the components into the overall system**

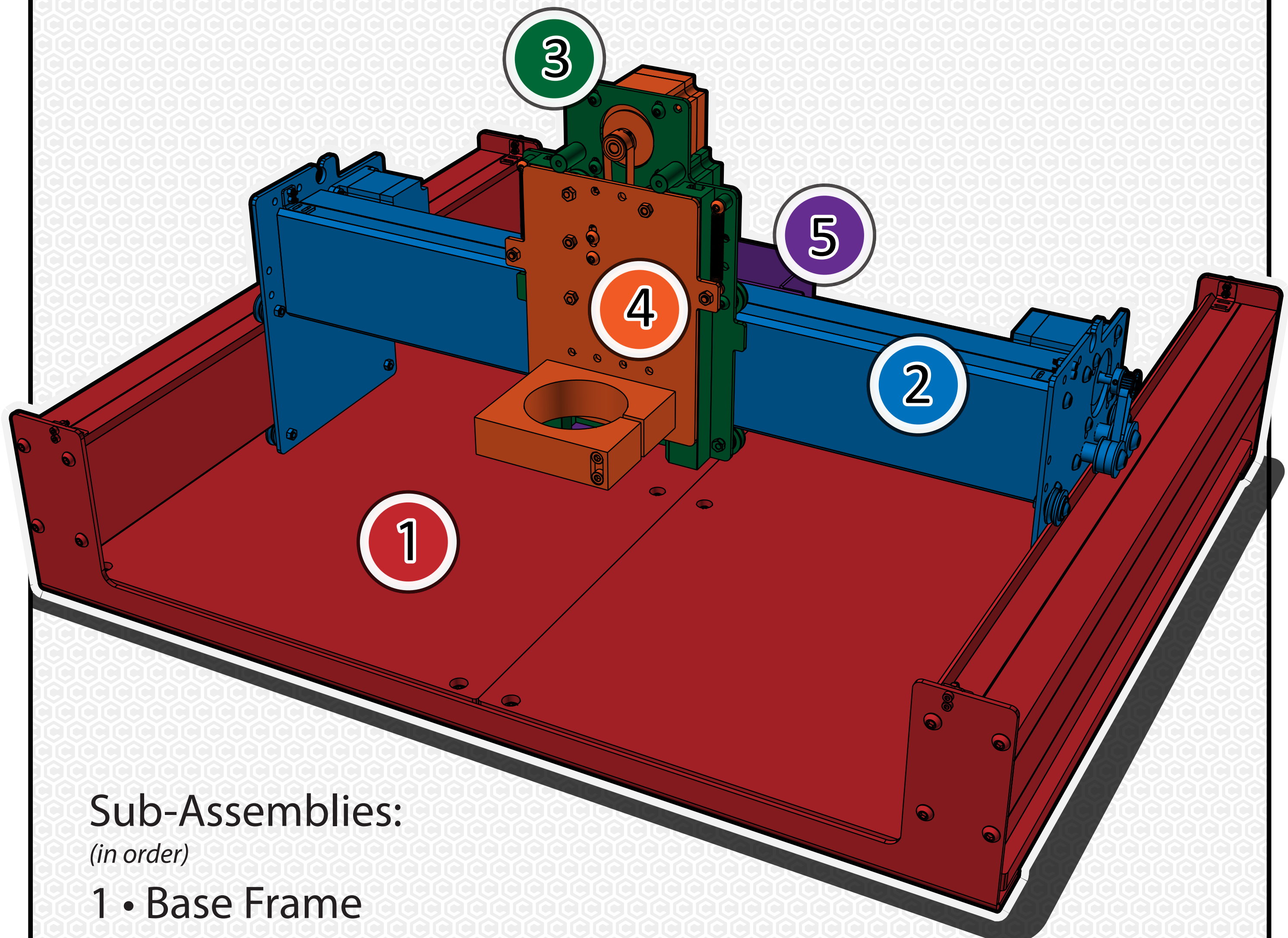
   Once the four assemblies are mostly built, then they're ready to be attached together and held in place with the motion-components: the belts and v-groove linear bearing wheels. This will provide a stable platform to attach the rest of the hardware to, and make it easier to install certain parts.

3) **Integrating it all together and making adjustments**

   Once the bulk of the system is assembled, it's time to tighten everything up and make sure everything is squared up adequately, the belts are tight, and there are no interferences or other potential hardware gaffes.

4) **Electronics and Wiring**

   Lastly you will attach the controller board, plug in the motors, and route the wiring to get ready to boot your Shapeoko3 up for the first time.

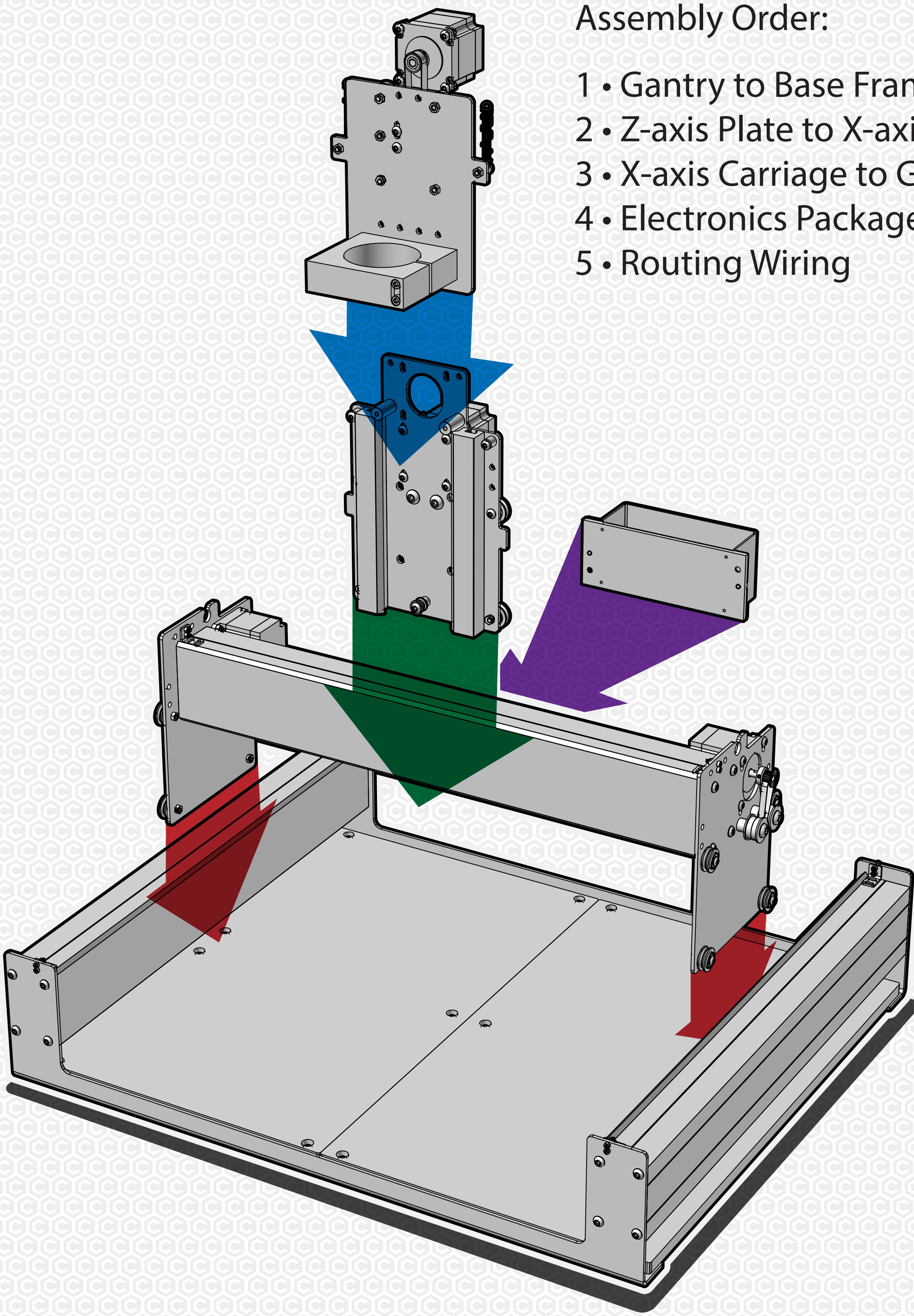


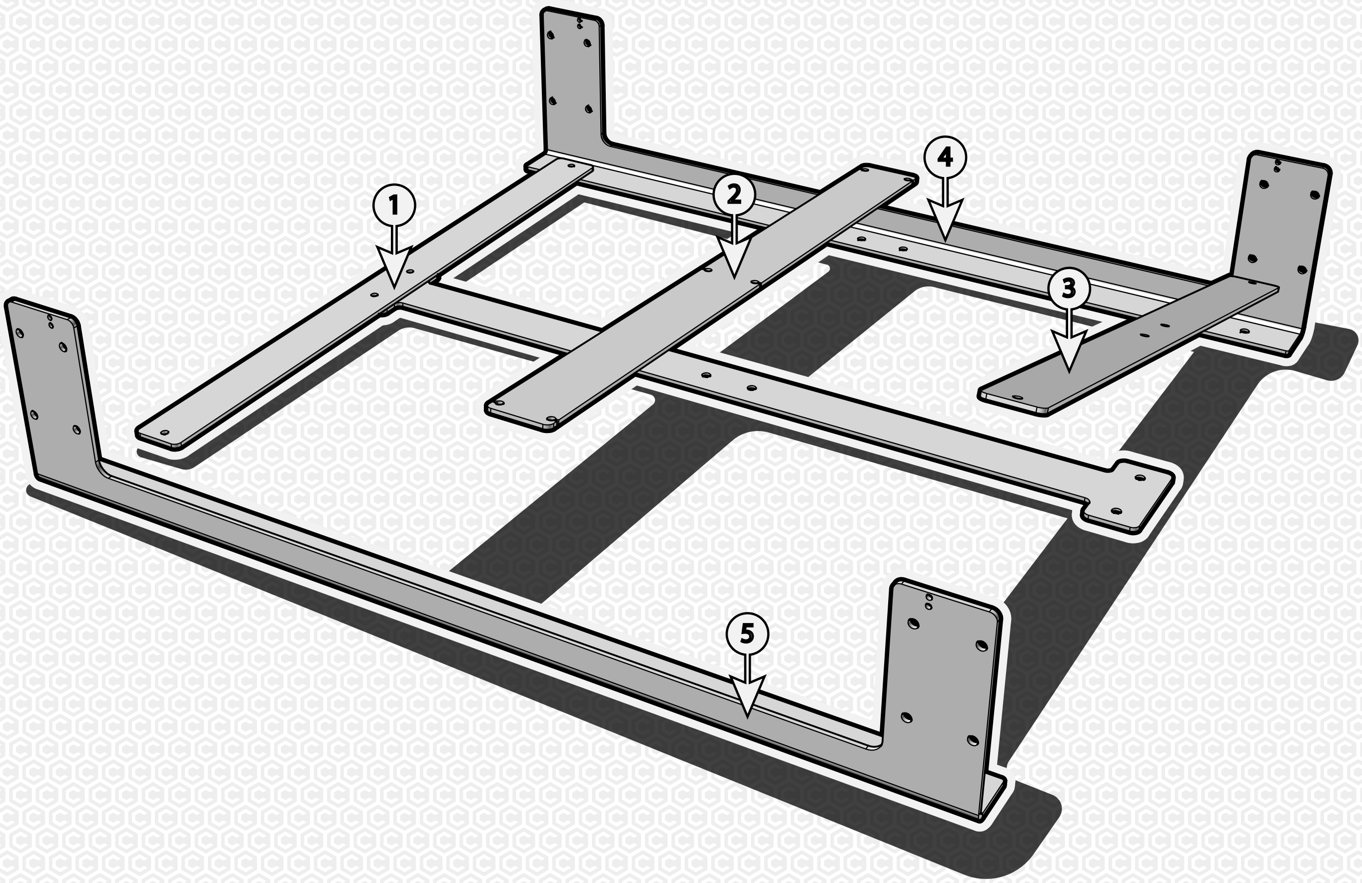
Sub-Assemblies:
(in order)

1 • Base Frame
2 • Gantry
3 • X-axis Carriage
4 • Z-axis Plate
5 • Electronics

Assembly Order:

1 • Gantry to Base Frame
2 • Z-axis Plate to X-axis Carriage
3 • X-axis Carriage to Gantry
4 • Electronics Package to Gantry
5 • Routing Wiring

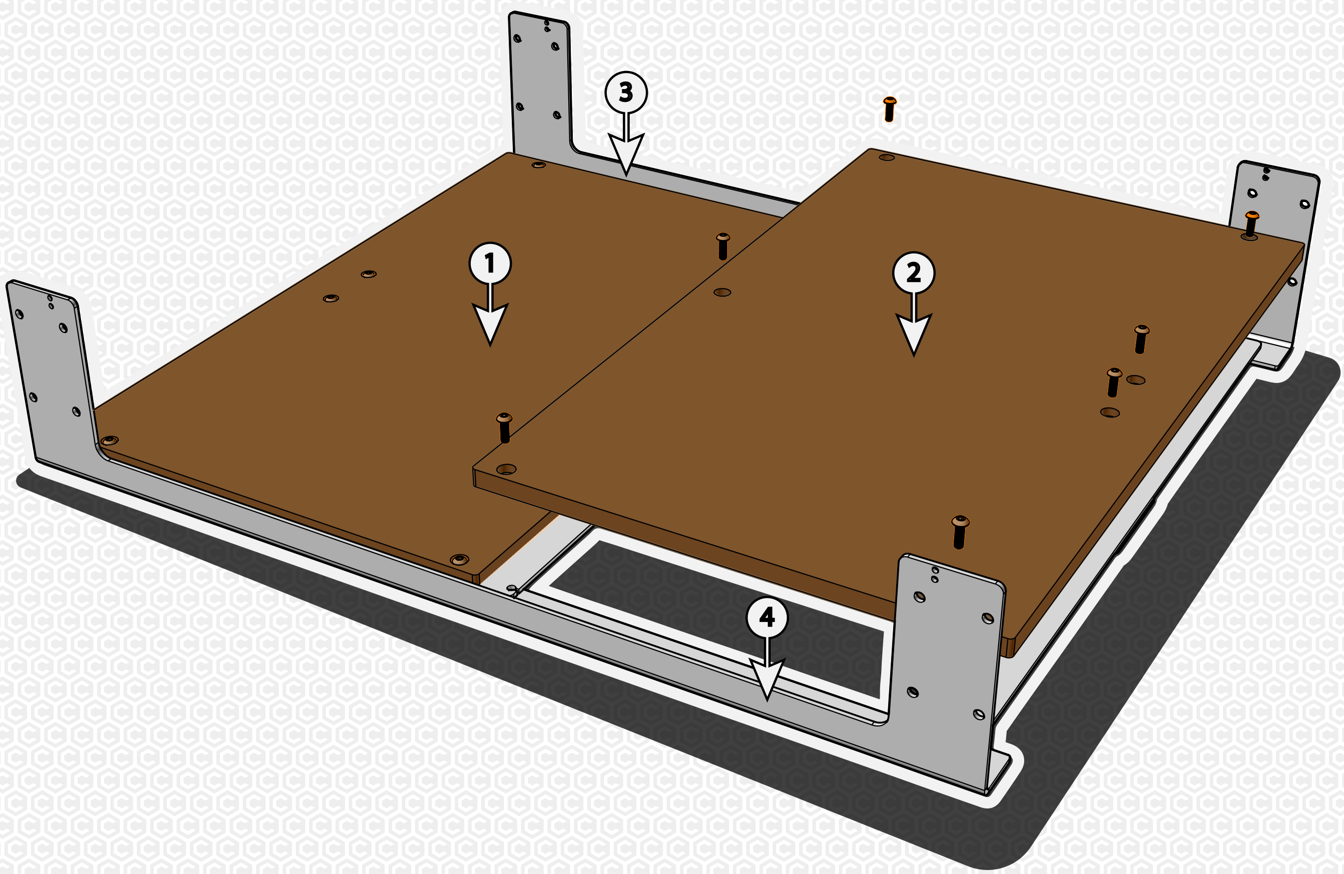




To begin base frame assembly, lay the metal straps and brackets out on your work-surface, and align the bolt holes between the various components so they make a window frame shape.

The numbers above indicate the order we recommend for installing the screws in the next step.

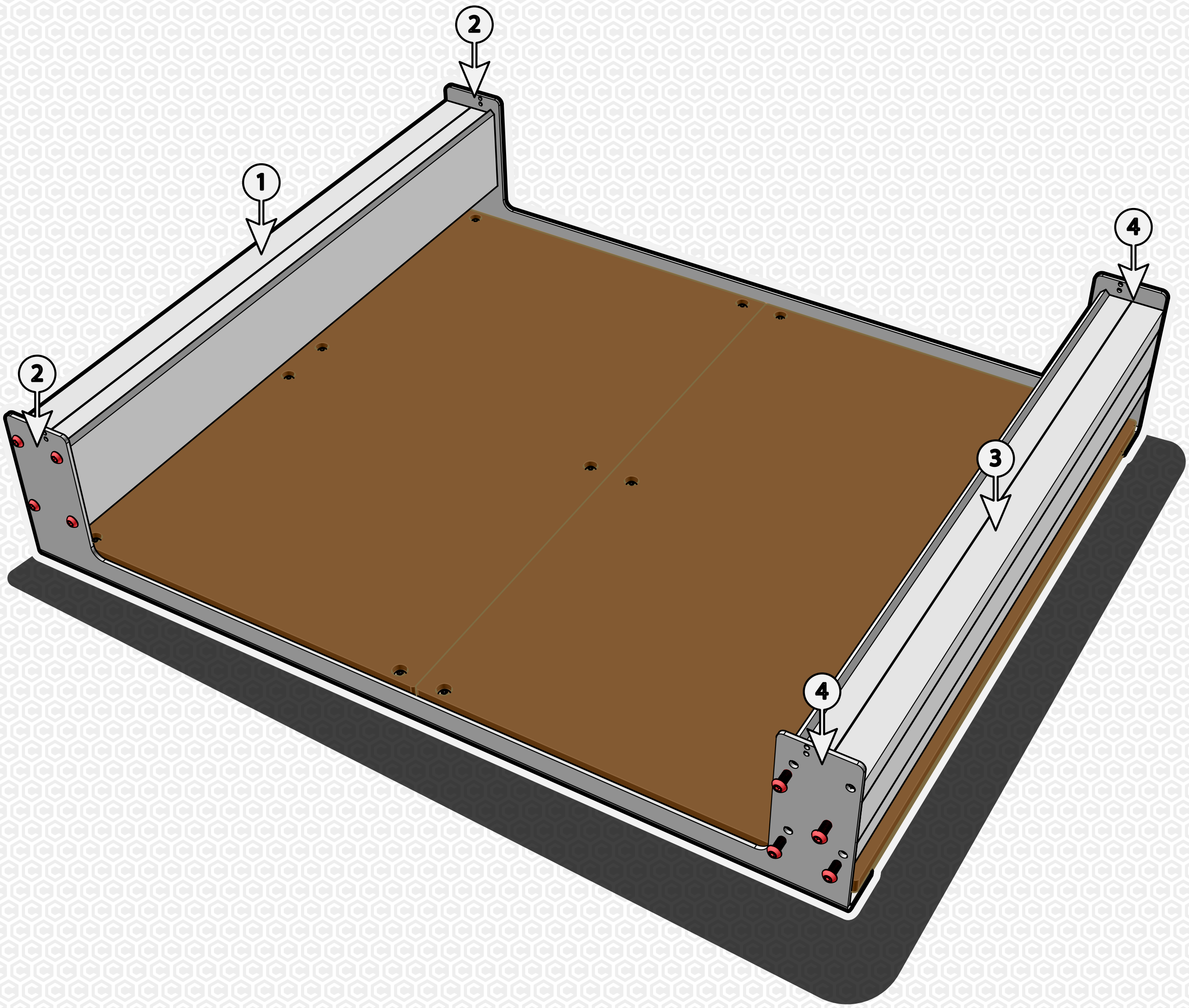
Note: The straps that run front-to-back have through-holes, while the center strap and the angle brackets have threaded holes in them. Make sure you have them stacked in the right order.



Once you've laid out the frame pieces, lay down one MDF panel at a time and attach it to the base frame with M5x16mm button-head cap screws.

Don't screw these in too tightly now, because you'll need to square things up later and some wiggle room will help.

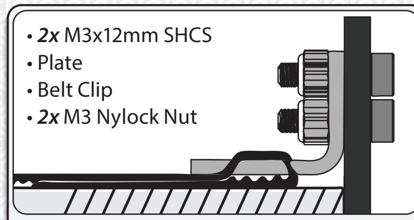
Note: It is generally easier to attach the MDF panels to the center strap first, and then the back and front brackets as indicated by the numbers above.



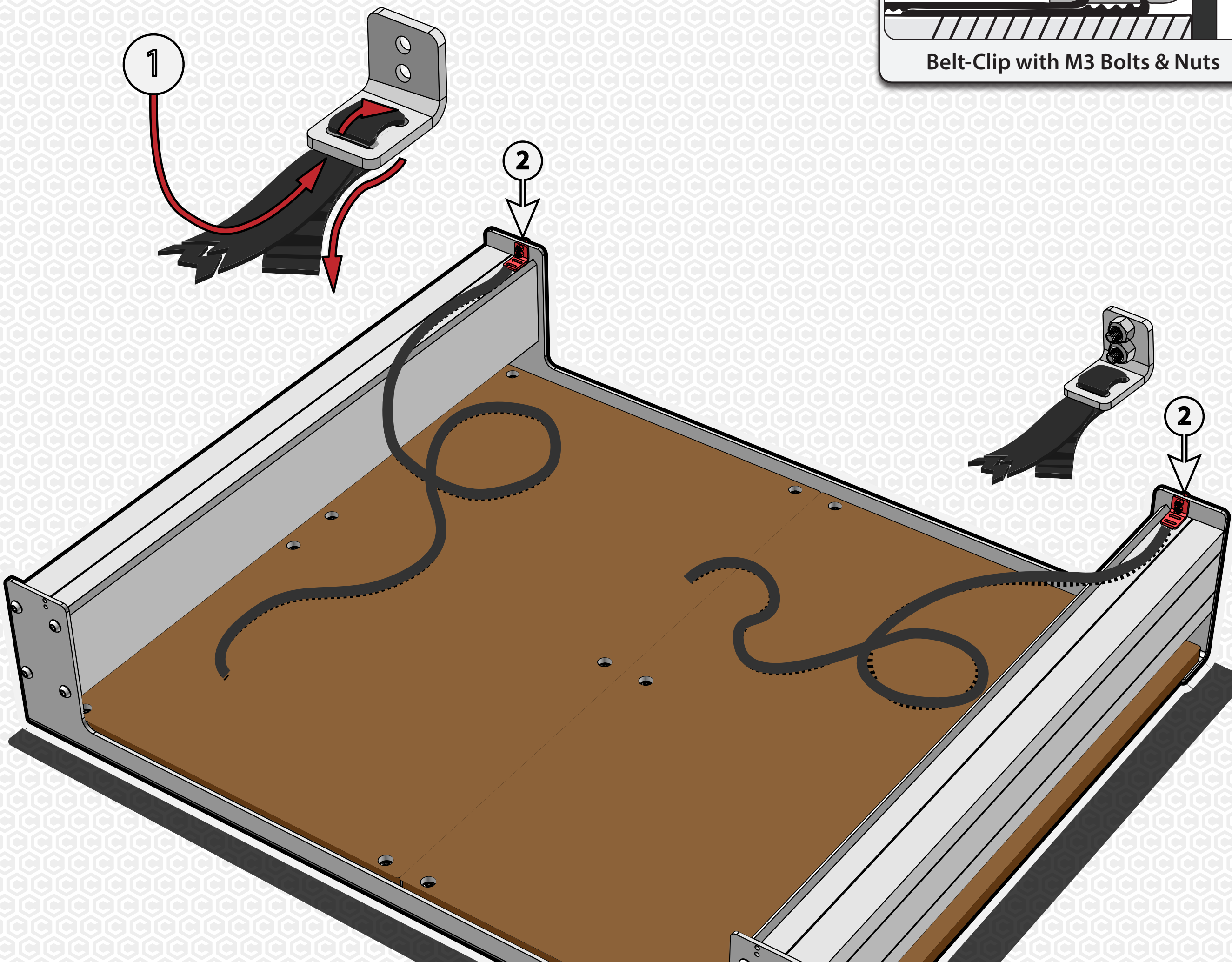
Next you will mount the two Y-axis extrusion rails to the base frame you've assembled so far.

Take one extrusion at a time and line it up with its end-plates and alternate putting M6x12mm button-head screws in either end, in order to make sure they all align and go in smoothly.

Do not tighten these bolts fully until they are all installed, as you want to ensure that you do not have skew in your assembly thus far.



Belt-Clip with M3 Bolts & Nuts



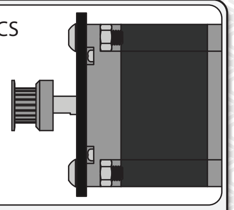
To attach the rear belt-clips thread one end of a 800mm belt through the clip *toothed-side-down* until you have 30-40mm sticking through the second slot.

Then double this extra belt length back under the incoming belt so that the teeth of the belt engage itself.

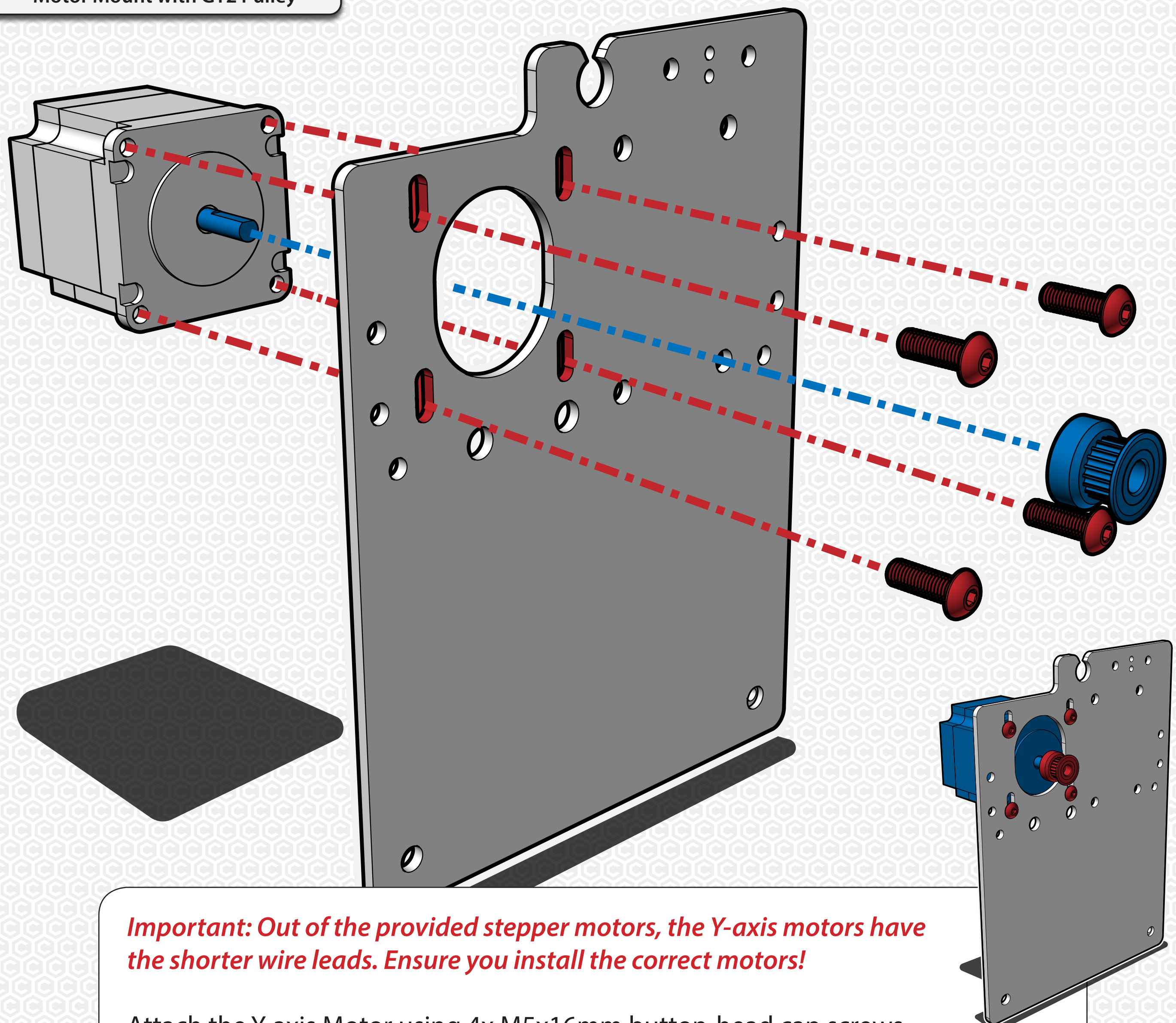
Align the clip with the bolt-holes above the Y-axis extrusions and put both bolts through each clip and screw on the M3 Ny-loc nuts.

Tighten the top screws all the way, but leave bottom screws relatively loose for now—you'll tighten them when tensioning the y-axis belt later.

- 4x M5x16mm BHCS
- GT2 Pulley
- Steel Plate
- Nema 23 Motor
- 4x M5 Hex Nut



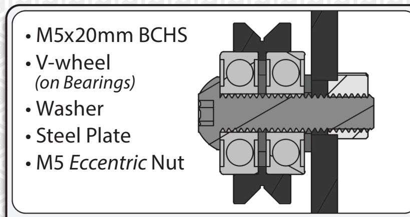
Motor Mount with GT2 Pulley



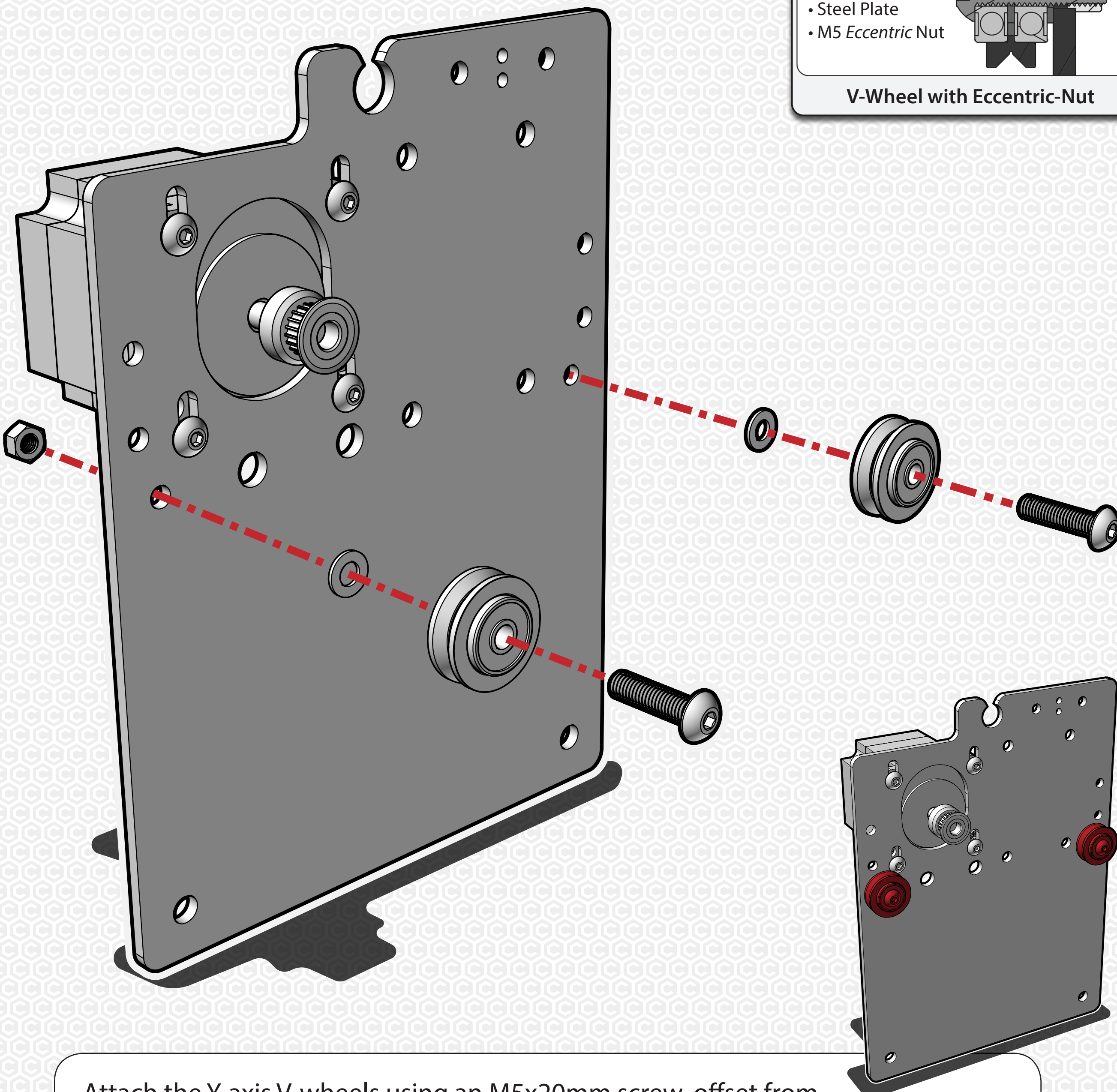
Important: Out of the provided stepper motors, the Y-axis motors have the shorter wire leads. Ensure you install the correct motors!

Attach the Y-axis Motor using 4x M5x16mm button-head cap screws and M5 hex nuts into the adjustment slots, toward the *lower* end of the slot. Prevent the M5 hex nuts from spinning by pressing them against the motor housing with your index finger while tightening the screw with your other hand.

For now do not apply too much torque to the motor mounting screws, because later you will tension the Y-axis belt by pulling the motor up and tightening the screws fully.



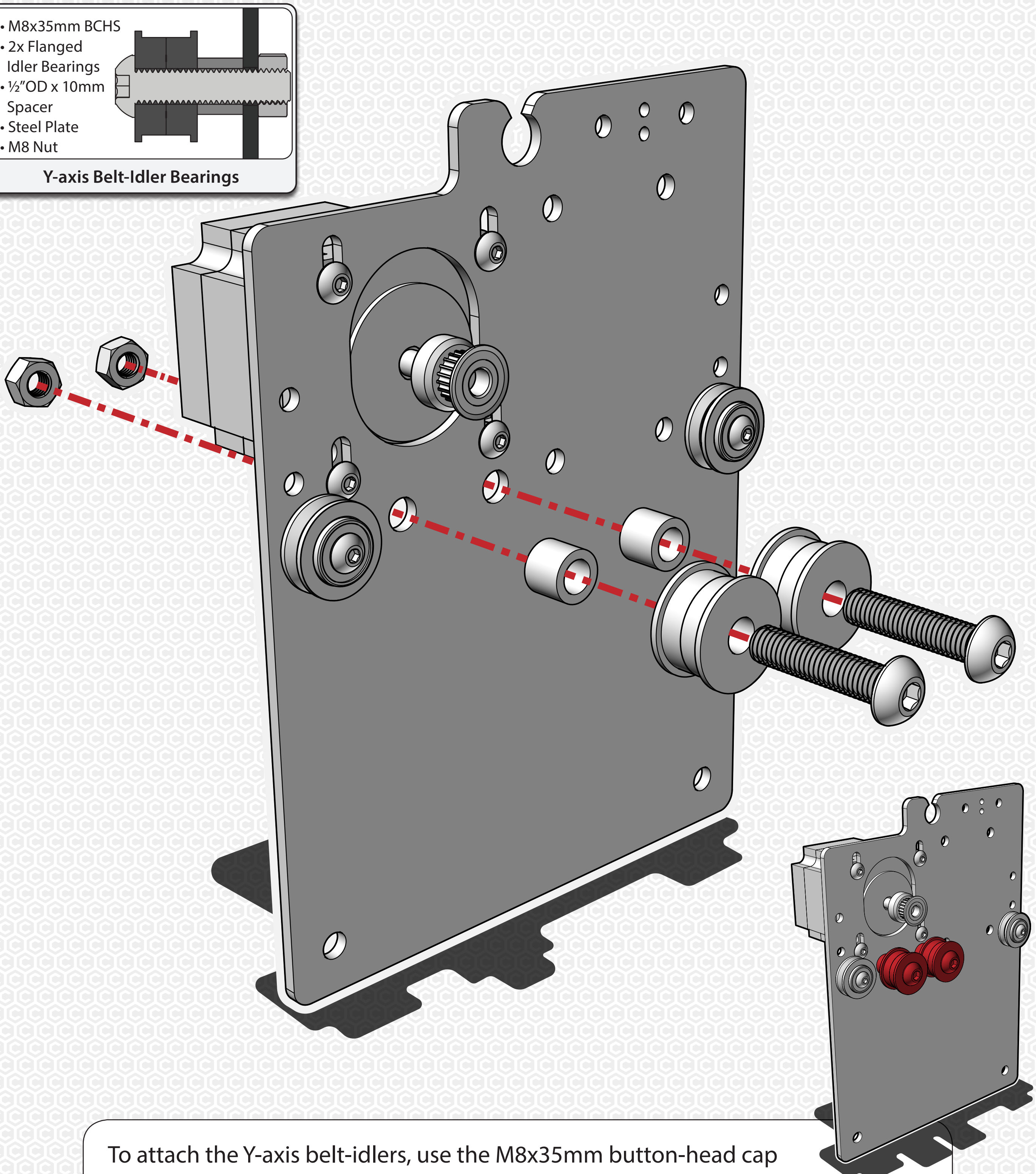
V-Wheel with Eccentric-Nut



Attach the Y-axis V-wheels using an M5x20mm screw, offset from the plate with an M5 washer. For both of the upper V-wheels use regular M5 hex nuts on the other side of the plate.

Ensure that the V-wheels can turn after you've tightened the screws down. If they don't spin then inspect your assembly and make sure you've used the washer *between* the V-wheel assembly and the plate, not the bolt-head and the V-wheel.

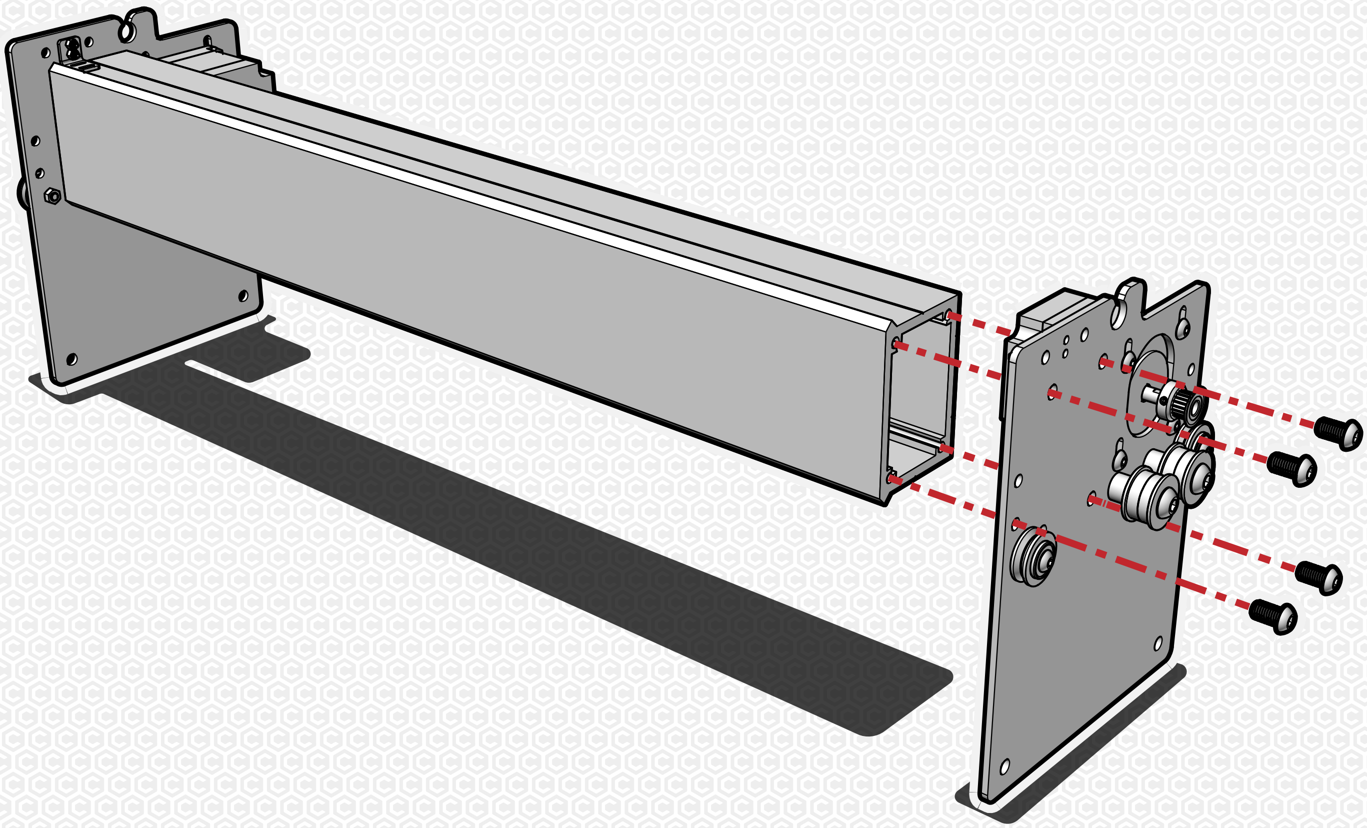
- M8x35mm BCHS
- 2x Flanged Idler Bearings
- ½″OD x 10mm Spacer
- Steel Plate
- M8 Nut



Y-axis Belt-Idler Bearings

To attach the Y-axis belt-idlers, use the M8x35mm button-head cap screws and M8 nuts, as well as a 1/2″ Aluminum spacer between the two idler bearings and the steel plate.

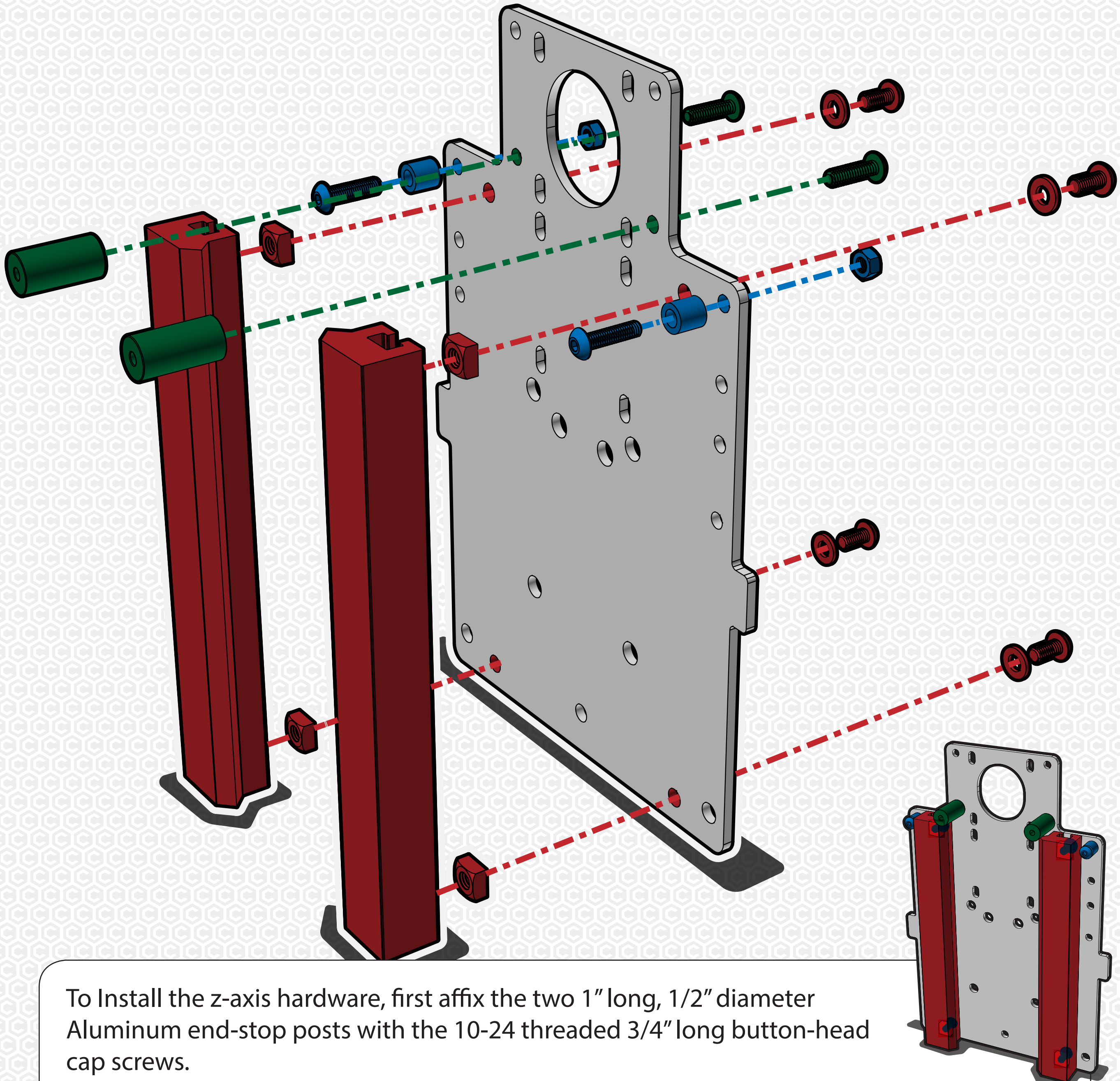
Ensure after tightening that the idlers can turn without binding.



Lastly, attach the left and right Y-axis plates to the gantry extrusion with M6x12mm screws.

To ensure that the two plates are parallel, start all the screws and then place the gantry on a flat surface as you finish tightening the screws to keep the plates aligned vertically relative to each-other.

Tighten the screws incrementally on both sides, working each screw in a few turns at a time to ensure that you don't have a misalignment between the plates such that it makes tightening of other screws difficult.

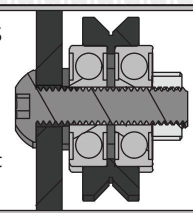


To Install the z-axis hardware, first affix the two 1” long, 1/2” diameter Aluminum end-stop posts with the 10-24 threaded 3/4” long button-head cap screws.

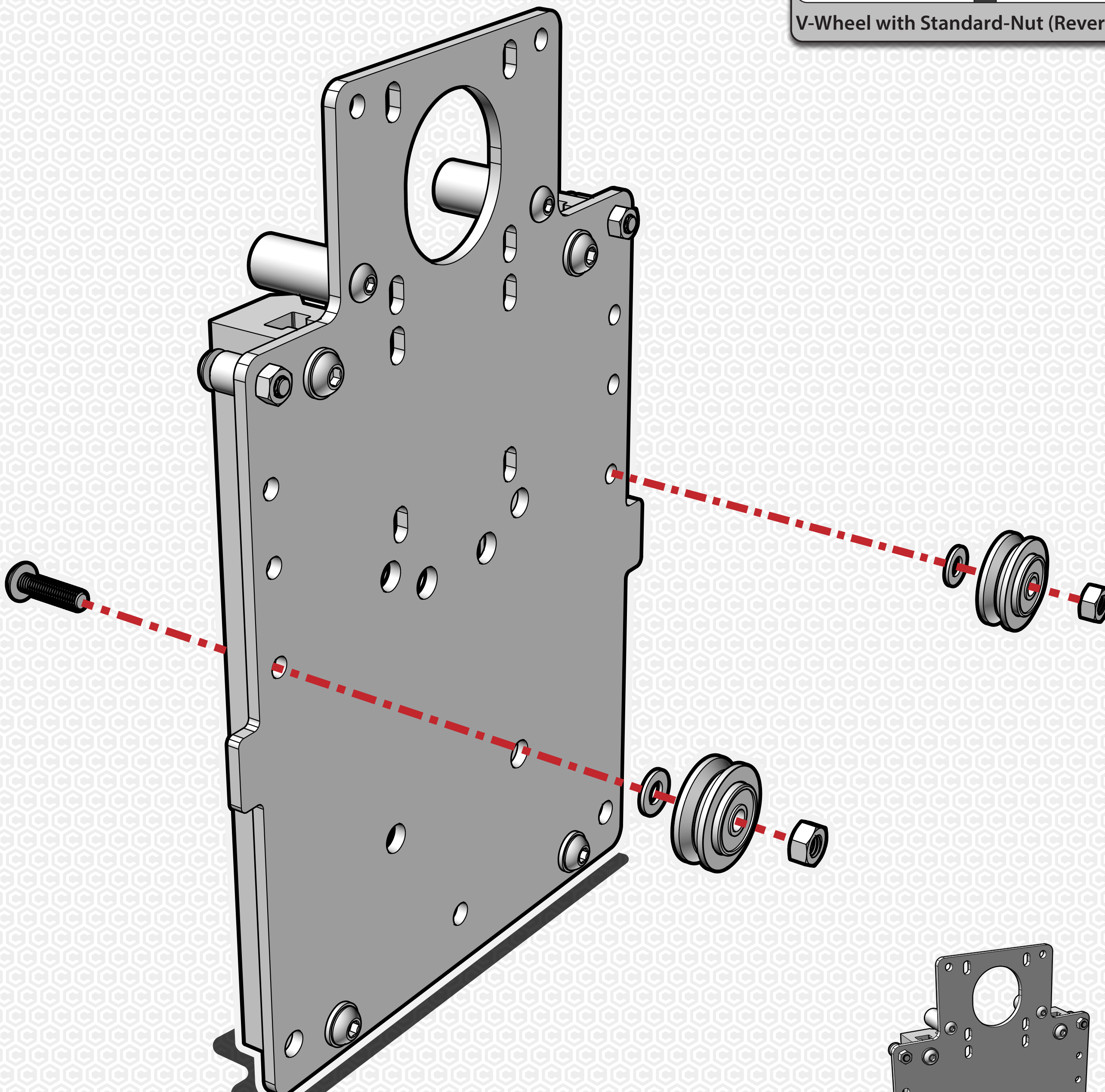
Next, to create a stand-off post for the springs, mount M5x20mm button-head cap screw s through a pair of 3/8” long, 3/8” diameter aluminum spacers, through the plate and affix with M5 hex nuts. You do not need to make these too tight, as you will be clamping the spring between the screw head and the spacer in a future assembly step.

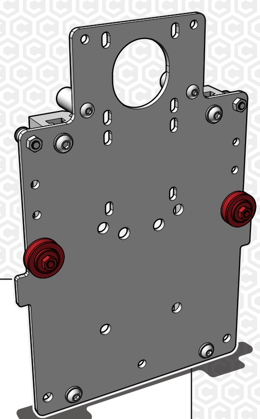
Lastly, insert M6x12mm button-head cap screws through M6 washers, through the plate, and thread an M6 square nut onto each loosely. Next, slide the Z-axis linear guide rails over each square-nut pair. Carefully stand the assembly up on a flat surface so that the rails are parallel and level and fully tighten the M6 screws, anchoring the rails.

- M5x20mm BCHS
- Steel Plate
- Washer
- V-wheel *(on Bearings)*
- M5 *Standard* Nut

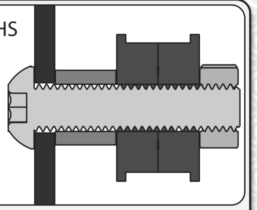


V-Wheel with Standard-Nut (Reversed)



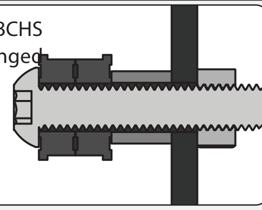


Affix the X-axis plate fixed-center v-wheels in the same manner as the Y-axis wheels, in the outer-edge hole pair just above the side tabs.



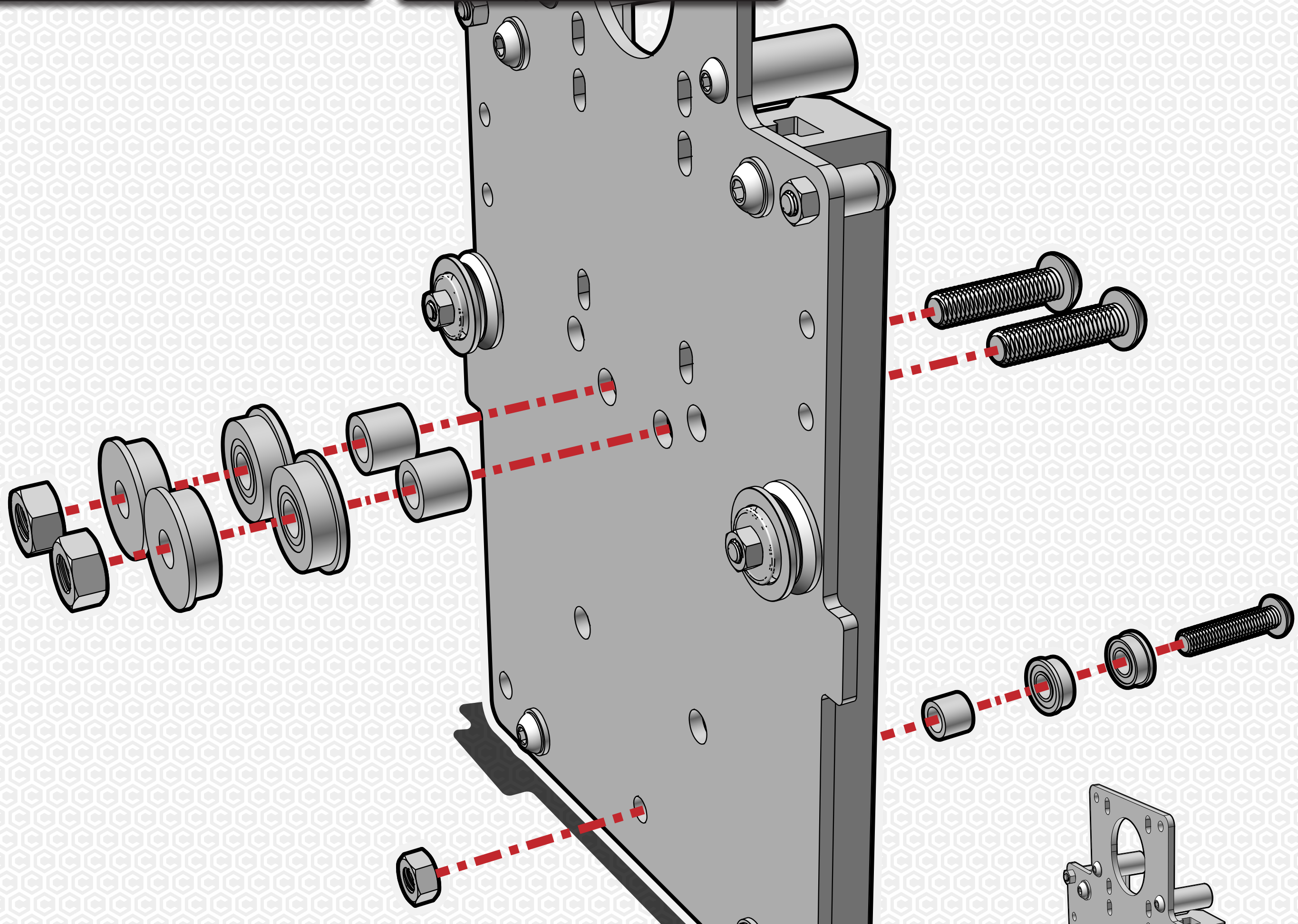
- M8x35mm BCHS
- Steel Plate
- ½″OD x 10mm Spacer
- 2x Flanged Idler Bearings
- M8 Nut

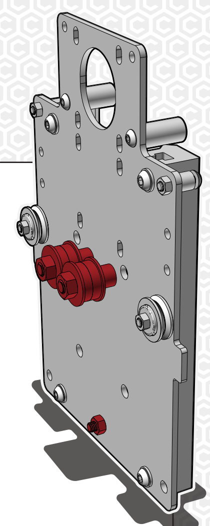
X-axis Belt-Idler Bearings



- M6x30mm BCHS
- 2x 6mm Flanged Bearings
- ⅜″ x 5⁄16″ Spacer
- Steel Plate
- M6 Hex Nut

Z-axis Belt Bottom-Idler Bearing



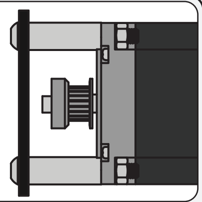


Affix the X-axis belt-idler pair in the same manner as the Y-axis plate idler pairs, BUT note that the screw head and nut ordering is reversed, with the nuts on the bearing side instead of in direct contact with the plates.

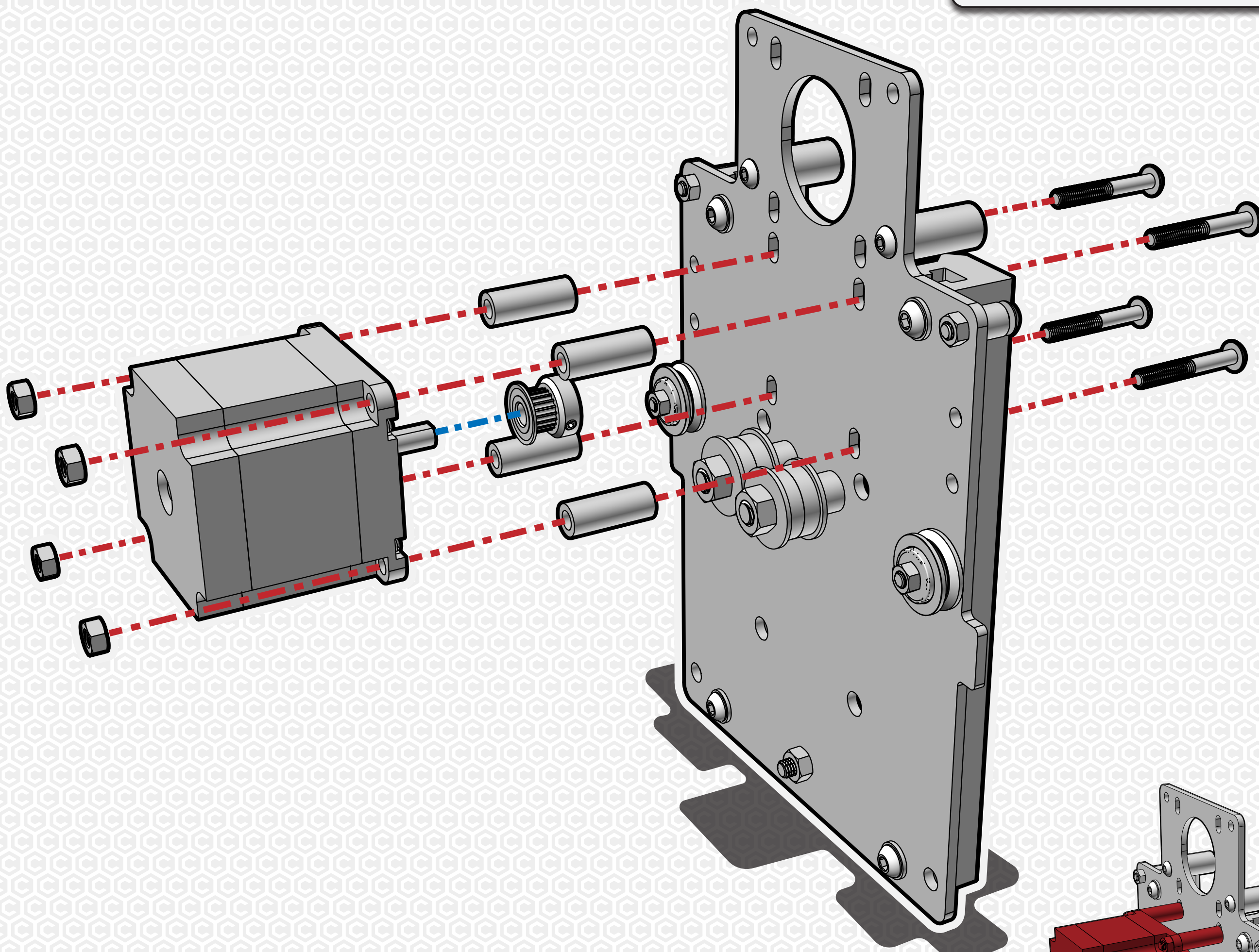
This ordering is reversed because the nuts are too tall and will interfere with the Z-axis plate hardware when you install the z-axis plate.

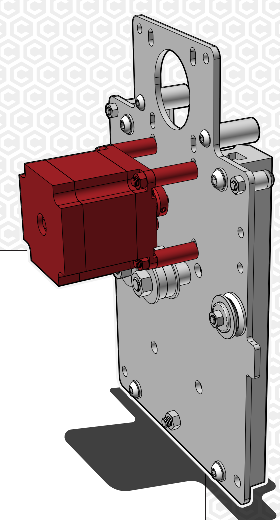
Install the Z-axis belt-idler bearing pair using the M6x30mm button-head cap screw, the 3/8″Dx5/8″L aluminum spacer, and an M6 hex nut. For this belt-idler the nut should be on the gantry-facing side of the plate rather than the side with the bearings.

- 4x M5x40mm BCHS
- Steel Plate
- 1¼" Standoff
- GT2 Pulley
- Nema 23 Motor
- 4x M5 Hex Nut



X-axis Motor Mount with GT2 Pulley

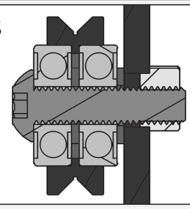




The X-axis Motor mounts in the lower set of adjustable motor slots on the X-axis plate, and mounts with the GT2 pulley _inverted_ to how the pulley is usually oriented, almost flush with the motor body.

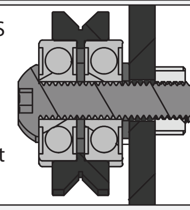
Mount the motor using M5x40mm button-head cap screws inserted through the plate, 1-1/4" #12 bore aluminum spacers, and then the motor mounts. As with the Y-axis motors, use a finger to push the M5 hex nuts against the motor housing to prevent the nuts from spinning while tightening. Do not tighten these too much, as the motor will need to be adjusted along it's adjustment slot to tension the X-axis belt in a later assembly step.

- M5x20mm BCHS
- V-wheel *(on Bearings)*
- Washer
- Steel Plate
- M5 *Eccentric* Nut

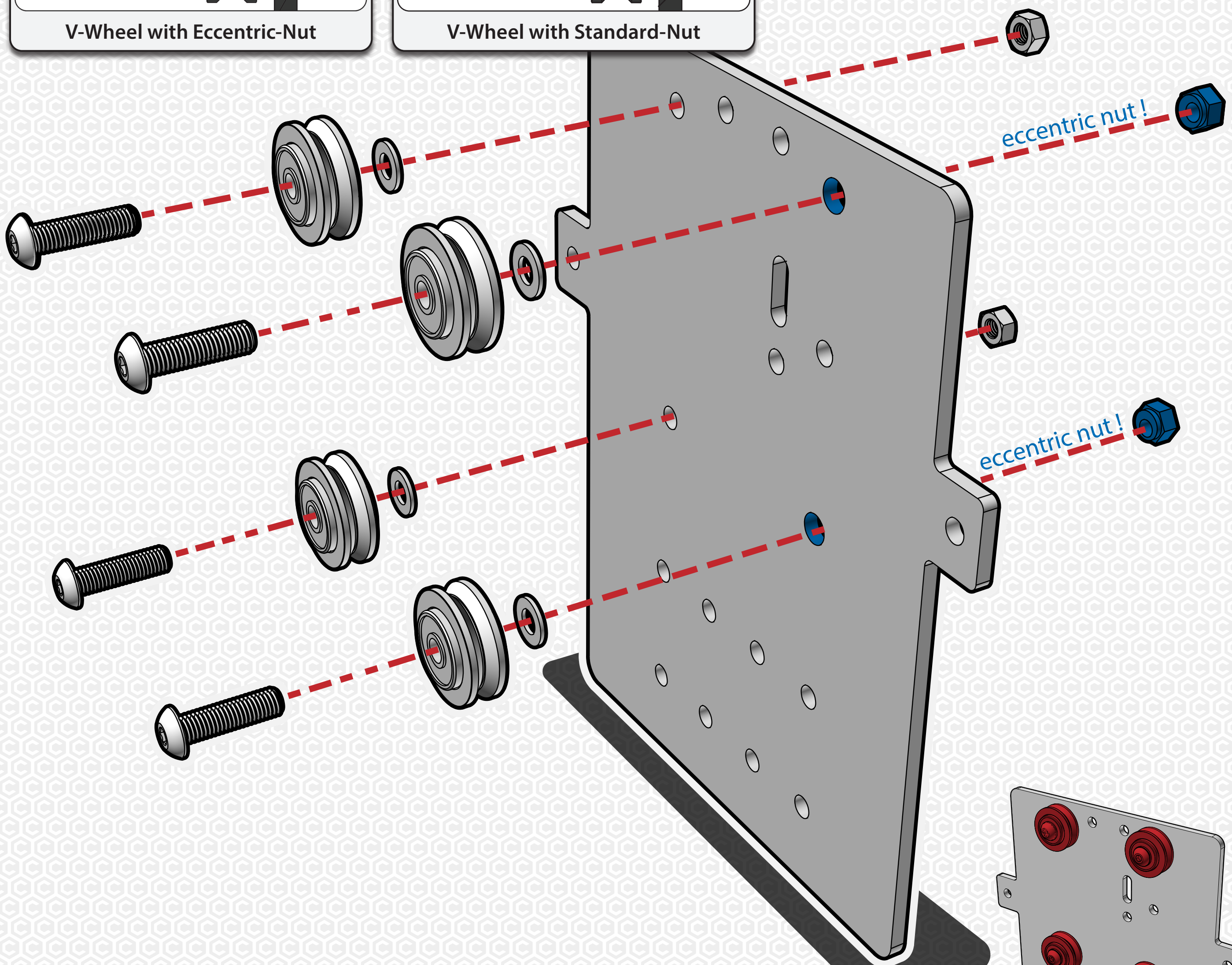


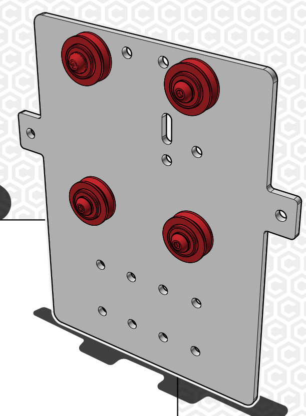
V-Wheel with Eccentric-Nut

- M5x20mm BCHS
- V-wheel *(on Bearings)*
- Washer
- Steel Plate
- M5 *Standard* Nut



V-Wheel with Standard-Nut

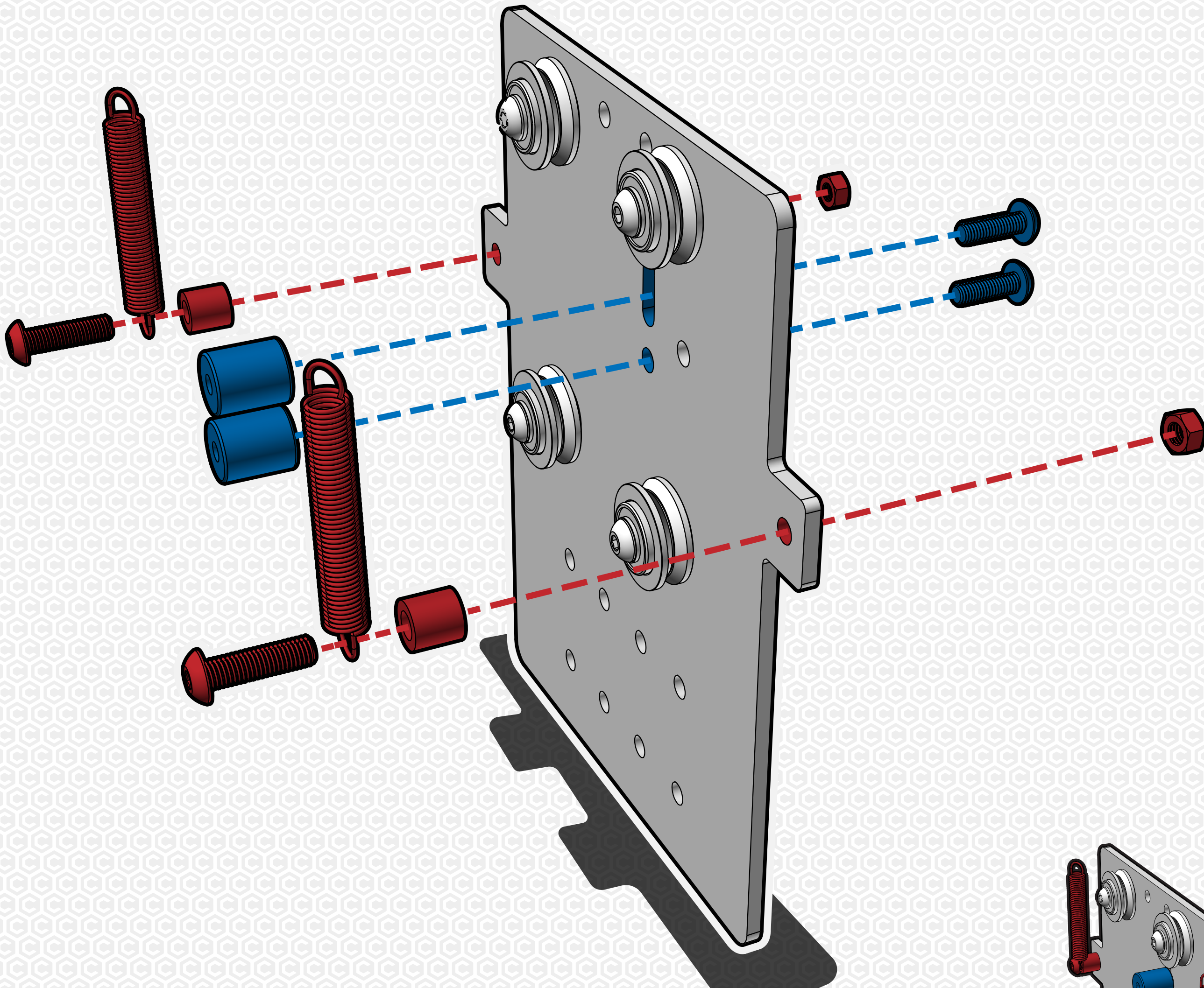


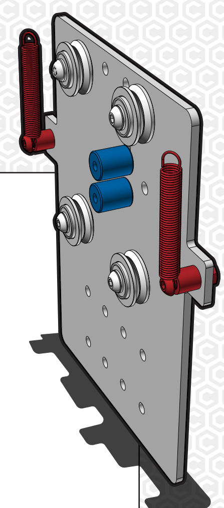


Begin assembly of the Z-axis plate by affixing all four of the V-wheels as you have affixed the wheels on the Y and X-axis plates.

****Note that the one side has holes sized for the eccentric nuts, while the other side has normally-sized holes!** If the wheels are on the side of the plate facing you, then the eccentric nuts should go on the *right* side.

When installing the eccentric-nut side, be sure to put the offset hole of the nut away from the center-line of the plate, biasing the v-wheel toward the center of the plate. These will be turned 180° later to engage the rails on the X-axis carriage.

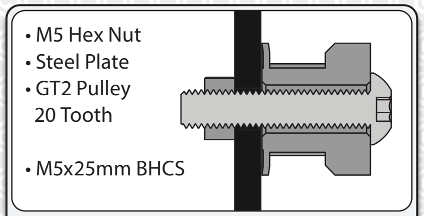




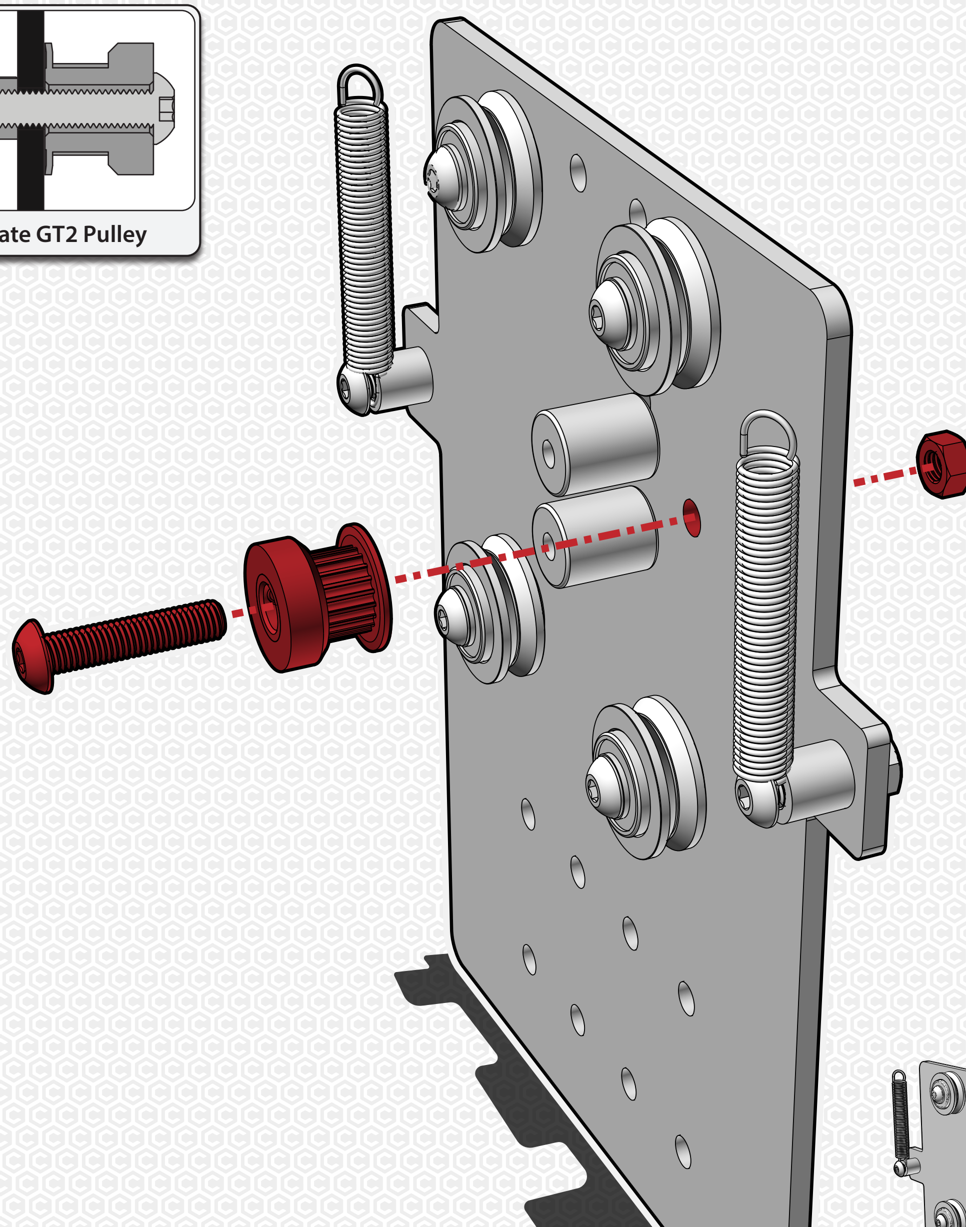
The two belt-tension posts have M5 threads, and are anchored with M5x16mm screws. Install the post that goes in an adjustment slot toward the ***top*** of the adjustment range for now, to make it easier to install and tension the belt later.

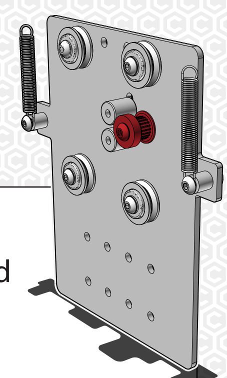
The spring-posts on the Z-plate use the same hardware as the posts on the X-axis plate—M5x20mm button-head cap screw, M5 hex nut and a 3/8"Lx3/8"D Al uminum spacer each—and can be installed the same way.

It is recommended to anchor one end of the each spring in-place between the screw head and the spacer when tightening the posts down, to make it easier later to position them and attach the springs to the other posts.



Stationary Z-plate GT2 Pulley



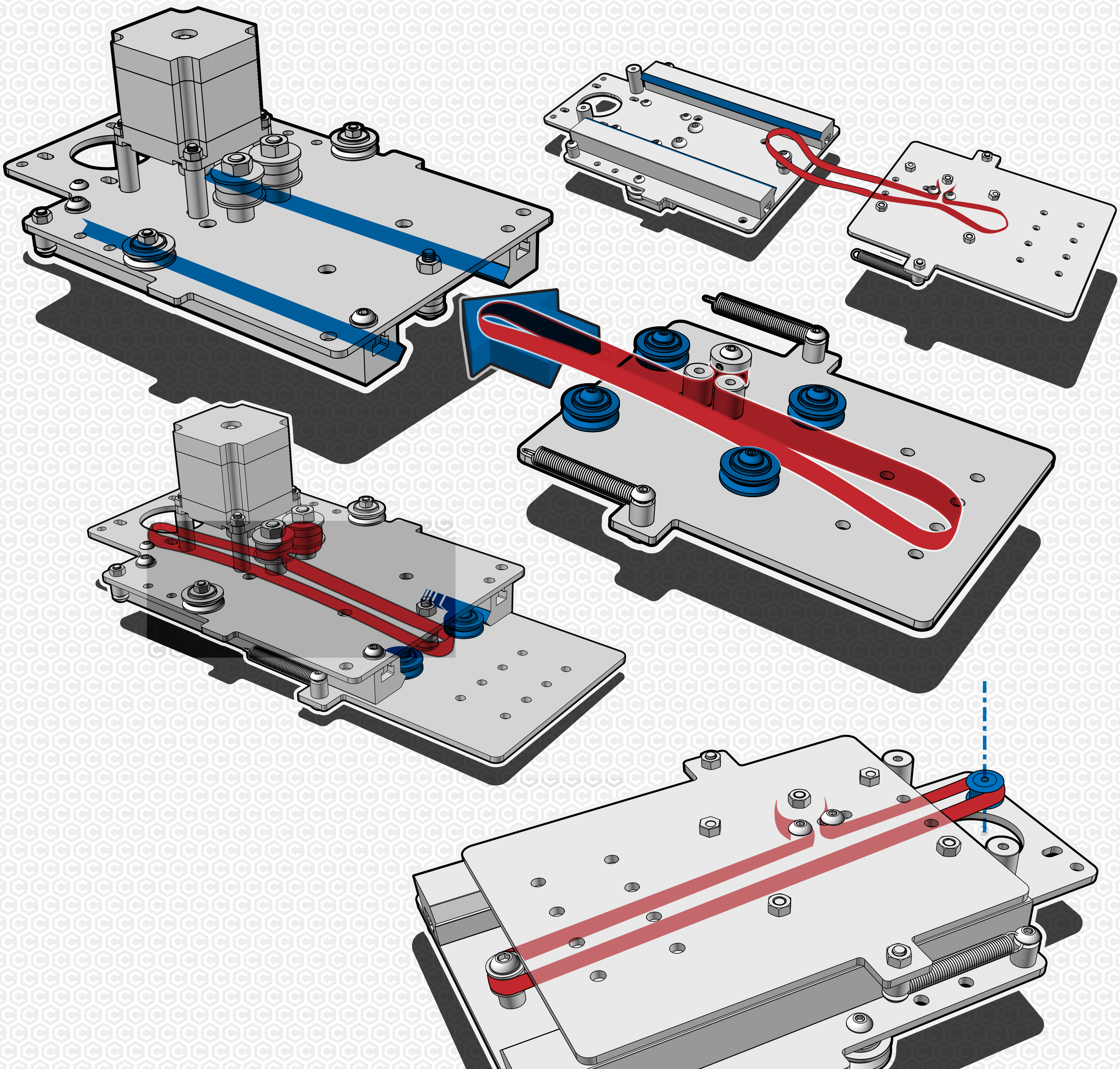


The Z-axis belt is a continuous belt, rather than a linear belt like the X and Y axis belts. Therefore it is anchored differently: by looping around a stationary GT2 toothed pulley and between two constraining aluminum spacers.

Install the GT2 Pulley using an M5x25mm button-head cap screw and M5 hex nut.

Note that it's very important due to tight clearances to put the nut and screw-head on the correct side of the steel plate

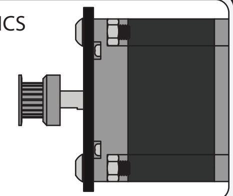
Then loop the belt around the stationary pulley and pass it between the two aluminum spacers.



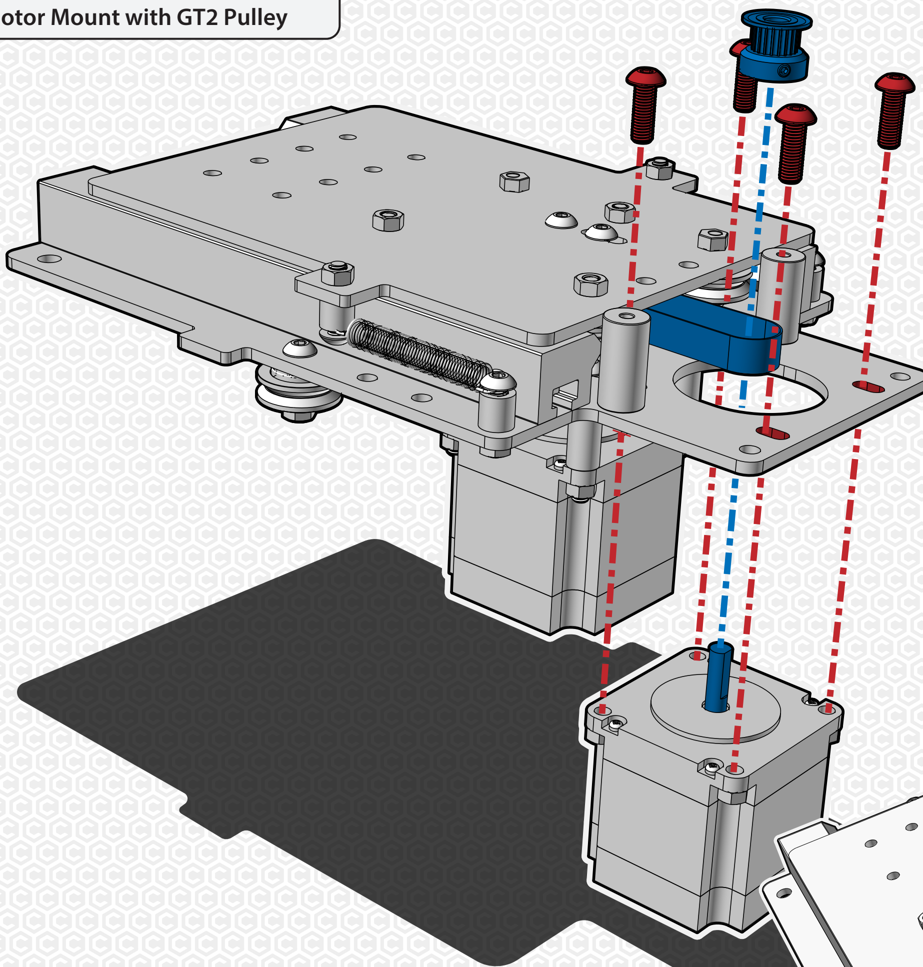
Slowly slide the Z-axis plate v-wheels onto the guide rails on the X-axis Carriage plate, checking for interference between any of the hardware. Also, mind the Z-axis belt during installation to ensure that it is sticking out on both the top and bottom so that it can be looped around the z-axis motor pulley and belt-idler pulley respesctively.

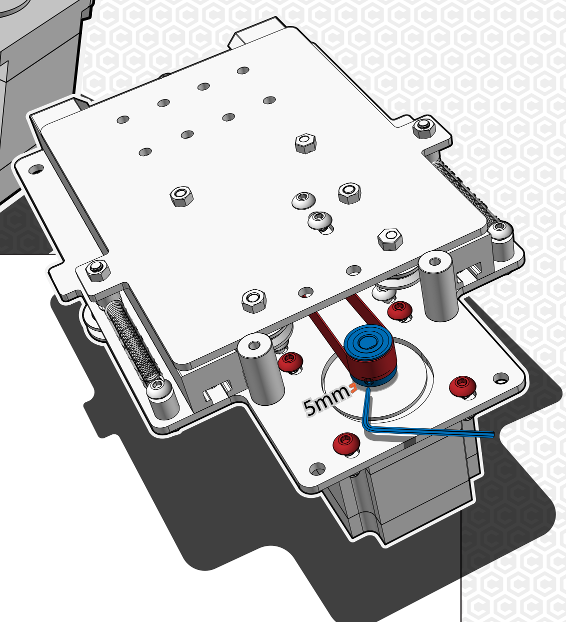
Loop the bottom end of the belt around the idler pulley, and prepare to install the Z-axis motor with the motor pulley through the top end of the z-axis loop.

- 4x M5x16mm BHCS
- GT2 Pulley
- Steel Plate
- Nema 23 Motor
- 4x M5 Hex Nut



Motor Mount with GT2 Pulley

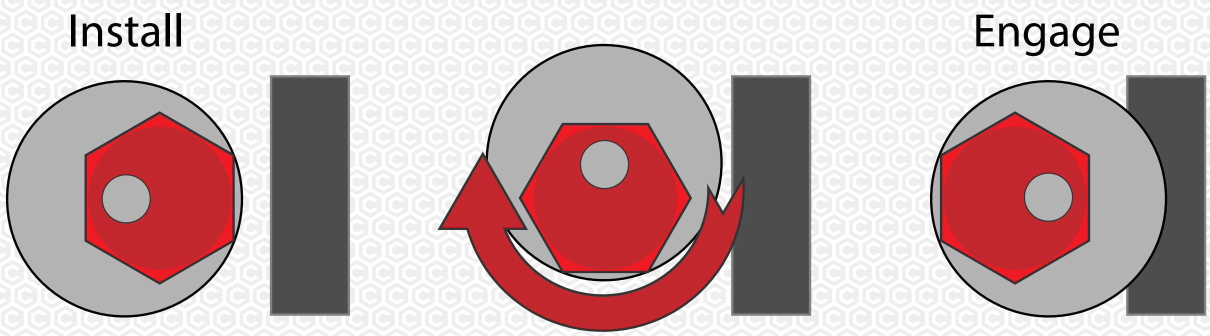


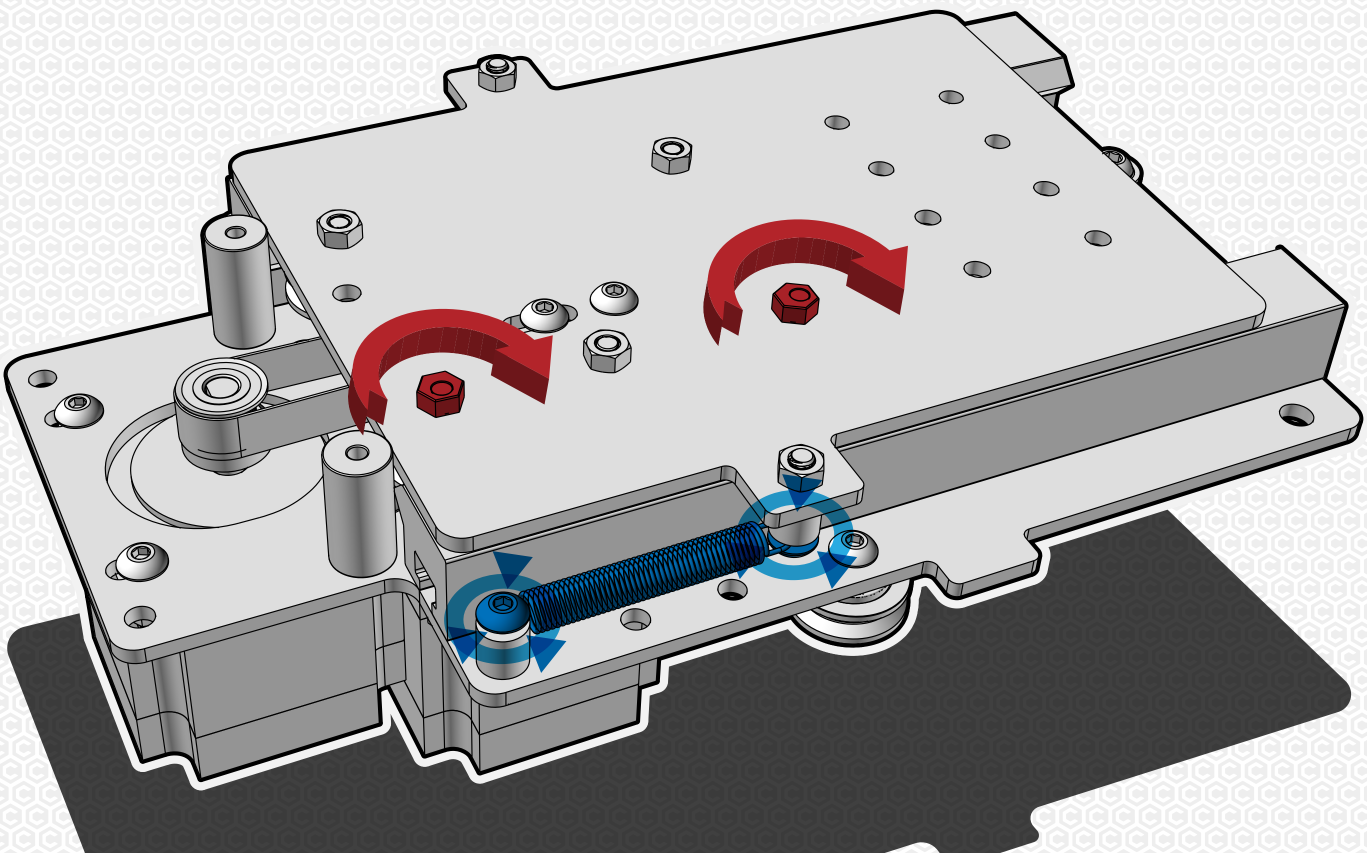


Start the installation of the Z-axis motor by first mounting the motor to the X-axis plate ***toward the bottom*** of it's adjustment slots with 4x M5x16mm button-head cap screws and M5 hex nuts,, just like the other motors installed so far.

Then loop the z-axis GT2 belt around the GT2 pulley, and press it onto the motor shaft. Ensure that it's in the correct orientation, wtih the shoulder of the pulley towards the motor.

The motor should be inserted onto the shaft such that a 5mm hex wrench should fit behind it. Then tighten the two shaft set-screws.

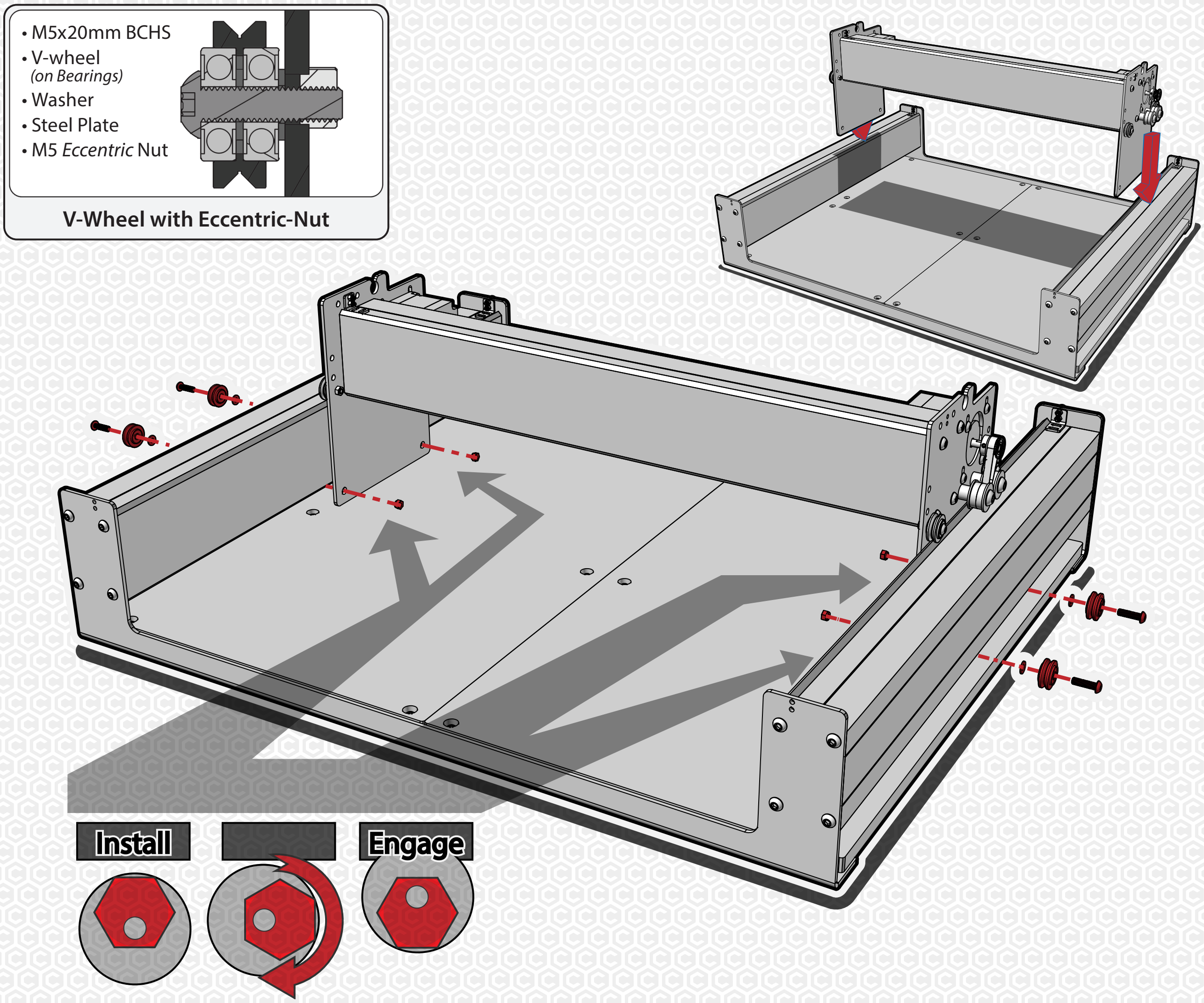




Once the Z-axis plate has been mounted to the rails, adjust the eccentric nuts by turning them 180° to have them apply pressure to the v-wheel bearings, removing any play in the assembly.

The z-axis plate should slide smoothly on the rails—any grinding or resistance indicates something has been installed incorrectly.

Install the currently loose end of the Z-axis support springs by loosening the screws on the spring-posts on the X-axis plate enough to fit the end of the spring in between the screw head and the top of the aluminum spacer, and then tighten the screw back down snugly.



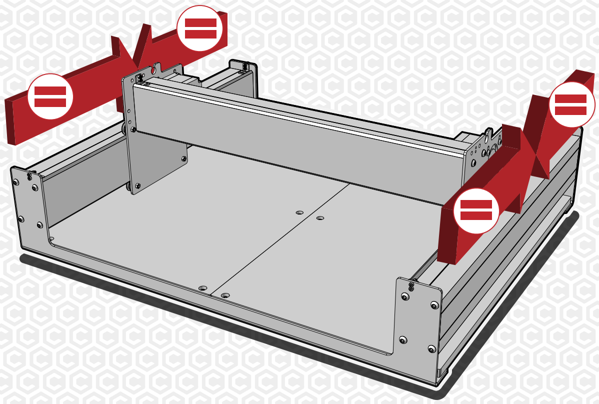
Place the gantry on the base frame such that the v-groove wheels align with the raised ridge of the Y-axis extrusions. The gantry should roll freely forwards and backwards on the Y-axis rails.

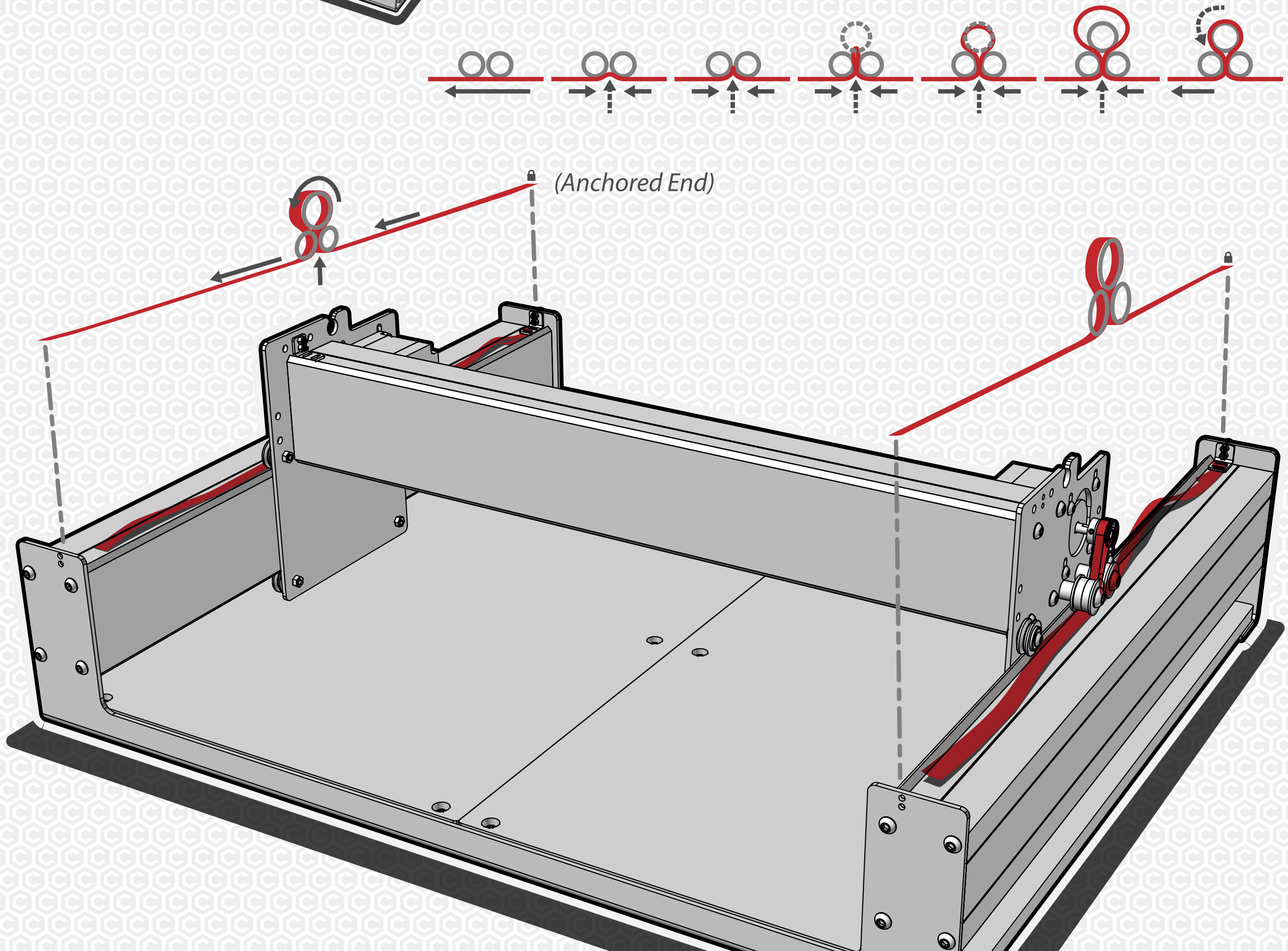
Install the lower V-groove bearing wheels with the nuts rotated such that the threaded thru-hole is at the bottom of the rotation range, and that the nuts are inserted fully into the plate when fully installed.

Once all four nuts have been installed, rotate the eccentric nuts such that the threaded thru-hole is now oriented upwards in the larger mounting hole, which will apply pressure between the v-groove wheels and the Y-axis extrusions.

There should be no play, grinding, dragging or other irregularities in the motion of the gantry when gliding the gantry forwards and backwards on the Y-axis rails once the eccentric nuts have been adjusted to tighten down the V-groove bearings.

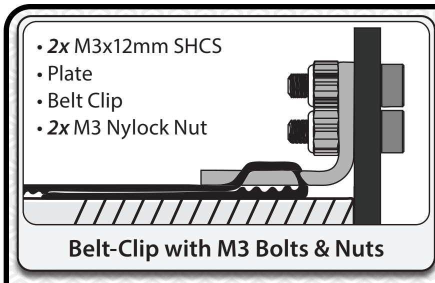
Installing the Gantry and Bottom V-Wheels

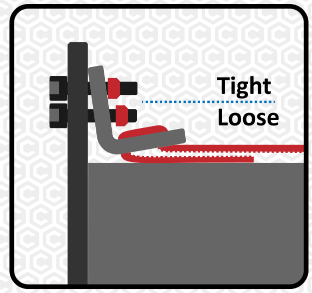


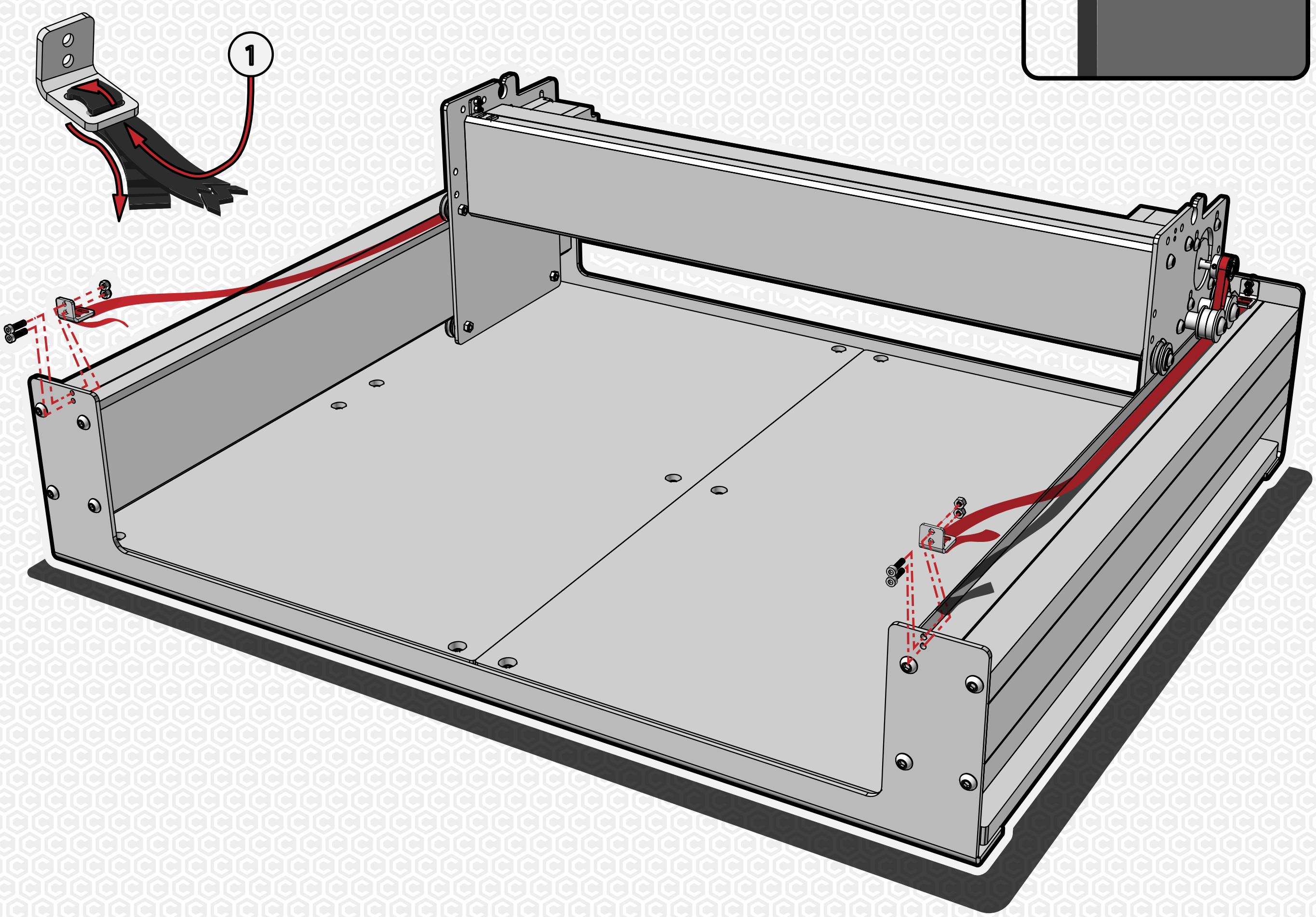


Slide the Gantry to the approximate center of its movement range on the Y-axis in preparation for routing the y-axis belts.

Run the y-axis belt underneath the belt-idler wheels, and then push the belt from both sides of the idlers to cause it to buckle upwards between the two belt-idler wheels. Feed enough of this belt loop upwards such that you can loop the belt around the Y-axis motor drive pulley, and then remove the slack from the belt by pulling on the loose end, pulling it toward the front of the base frame.

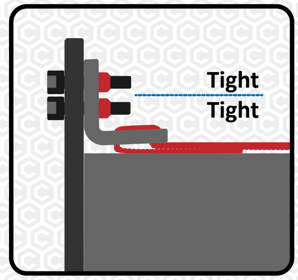


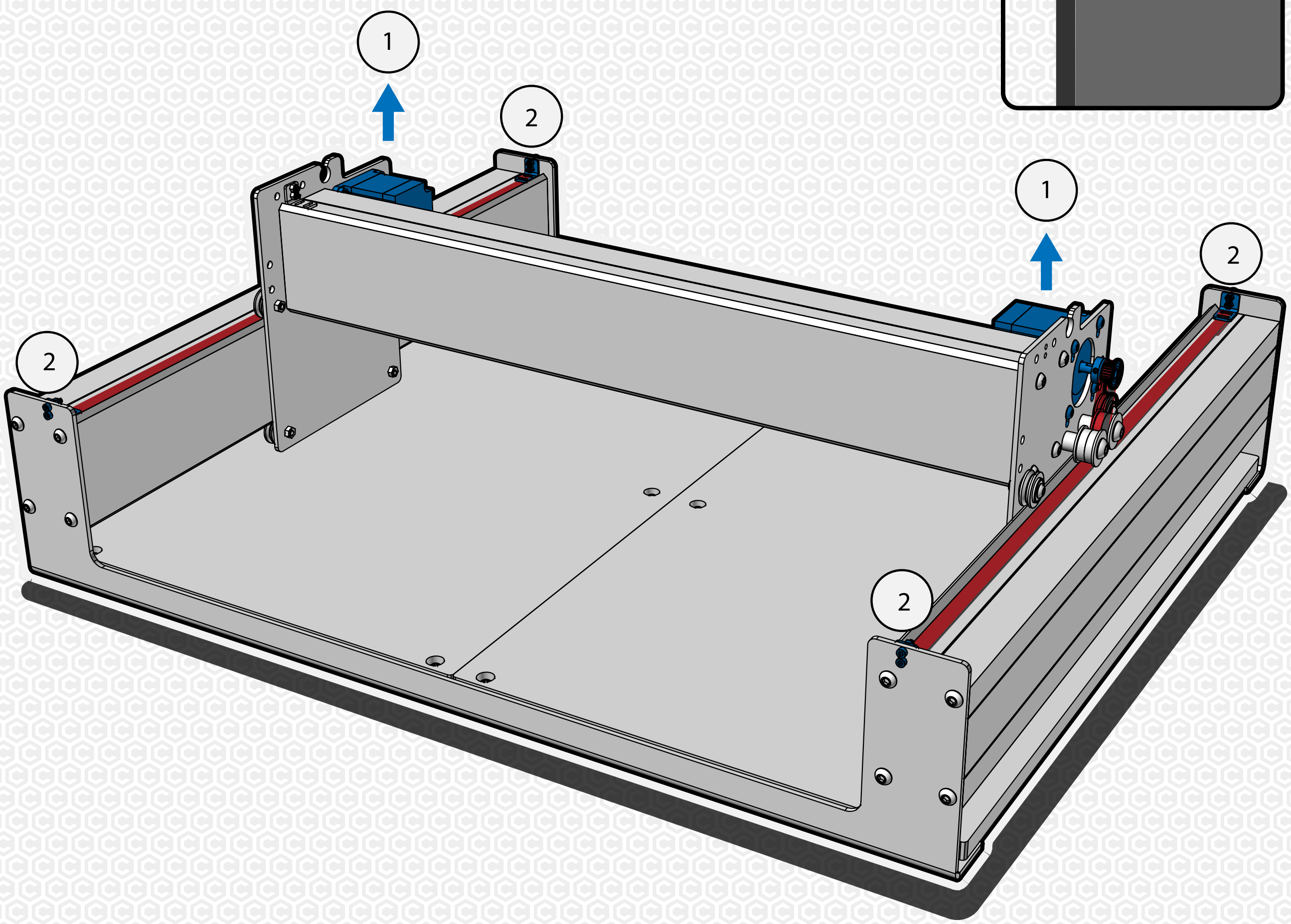




Push the gantry to the back of the base frame while keeping tension on the belts to take out any slack. Route each belt through the first slot of a belt-clip, and position it near where it will be fastened to the front frame end-plates. Pull the belt through so that it's lightly taut and thread it through the second clip slot, so that the belt teeth will inter-mesh when the belt-clip is fully anchored.

Install the front belt-clip screws with their matching nuts, but only fully tighten the top screw. Leave the bottom screw only hand-tight for the time being.

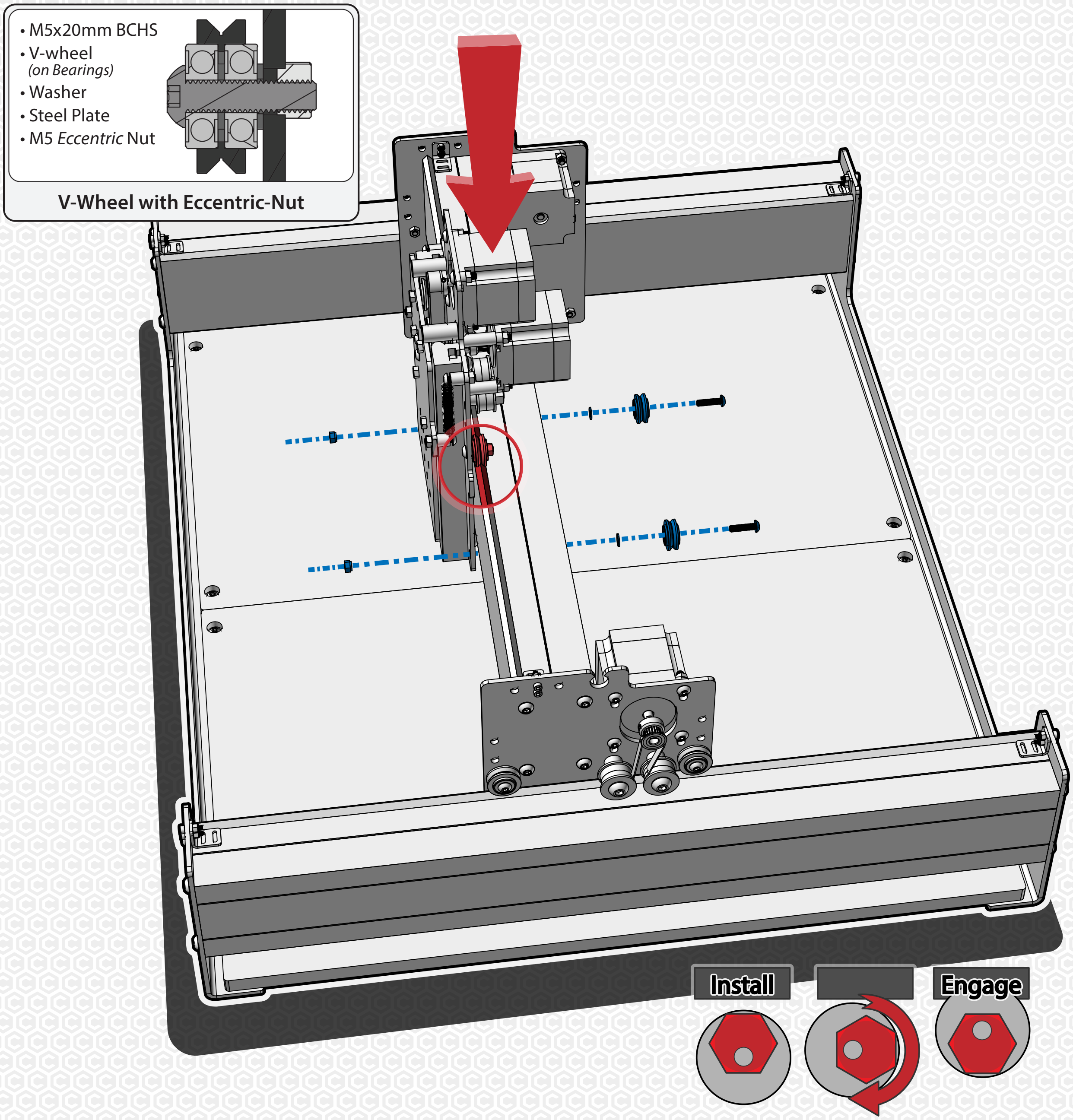




With the gantry centered along the Y-axis, loosen the motor-mount screws on a Y-axis motor and pull upwards on it as far in the adjustment mounting slots as possible, and then re-tighten the mounting screws. Repeat this process for the other Y-axis motor.

Lastly, fully tighten down the bottom mounting screw on the front and back belt-clips in order to draw the clips fully tight against the base-frame plates.

Move the gantry back-and-forth throughout it's entire range of motion. The belt should not slip at any point during the motion or when changing directions, and should be taut like a guitar string.

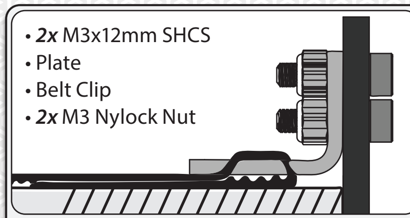


Place the X-axis Carriage onto to the Gantry Extrusion, aligning the upper v-wheels with the raised bearing ridge.

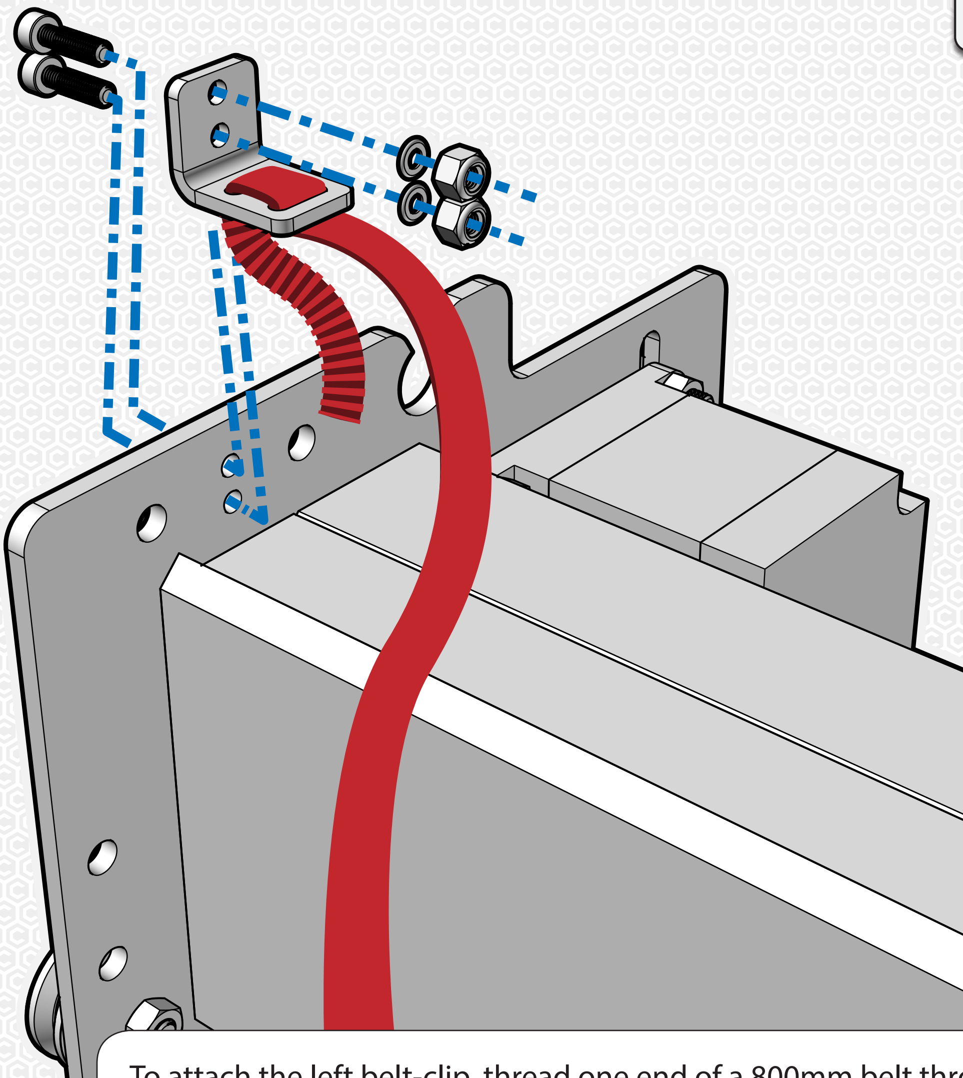
Install the lower V-groove bearing wheels with the eccentric nuts rotated such that the threaded thru-hole is at the bottom of the rotation range, and that the nuts are inserted fully into the plate when fully installed.

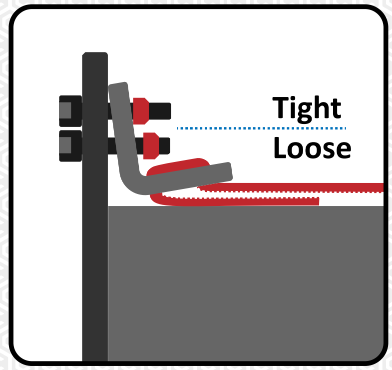
Once both nuts have been installed, rotate the eccentric nuts such that the threaded thru-hole is now oriented upwards in the larger mounting hole, which will apply pressure between the v-groove wheels and the X-axis extrusion.

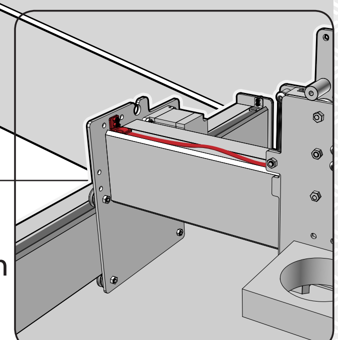
- **2x** M3x12mm SHCS
- Plate
- Belt Clip
- **2x** M3 Nylock Nut



Belt-Clip with M3 Bolts & Nuts



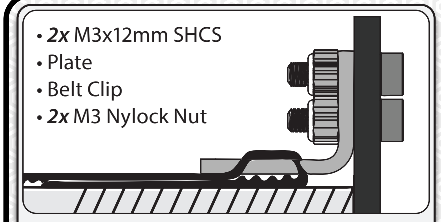




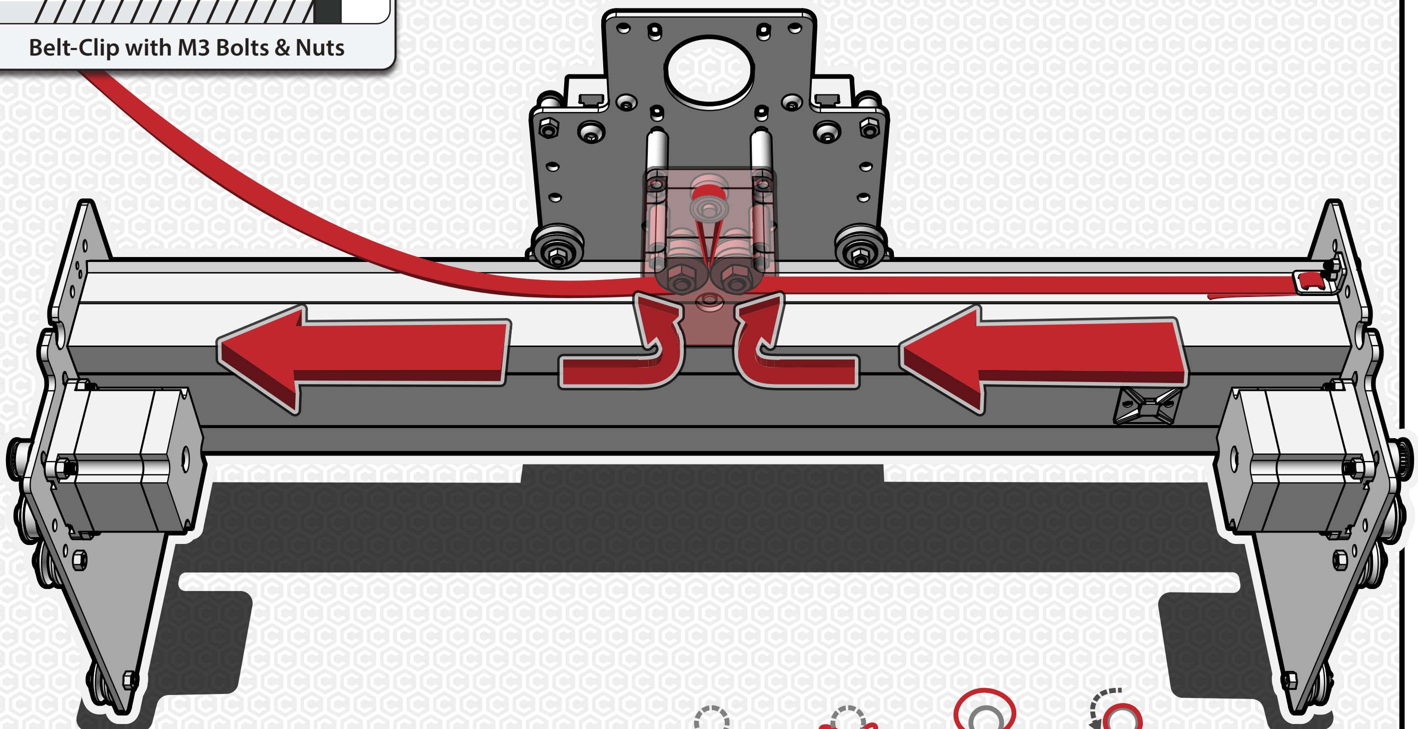
To attach the left belt-clip, thread one end of a 800mm belt through the clip, toothed-side-down until you have 30-40mm sticking through the second slot.

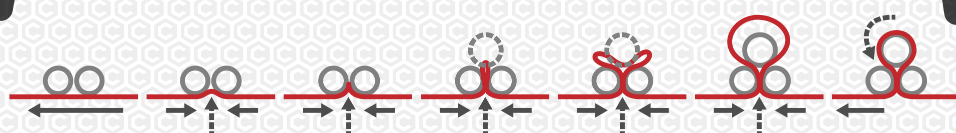
Then double this extra belt length back under the incoming belt so that the teeth of the belt engage itself. Align the clip with the bolt-holes above the X-axis extrusion and put both bolts through the clip, then screw on the M3 Ny-loc nuts.

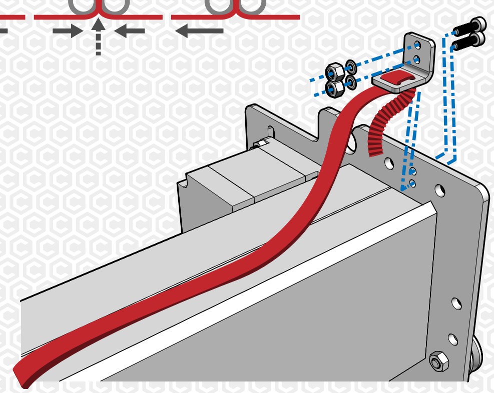
Tighten the top screw all the way, but leave the bottom screw relatively loose for now—you'll tighten it when tensioning the x-axis belt later, as you did with the Y-axis.



Belt-Clip with M3 Bolts & Nuts

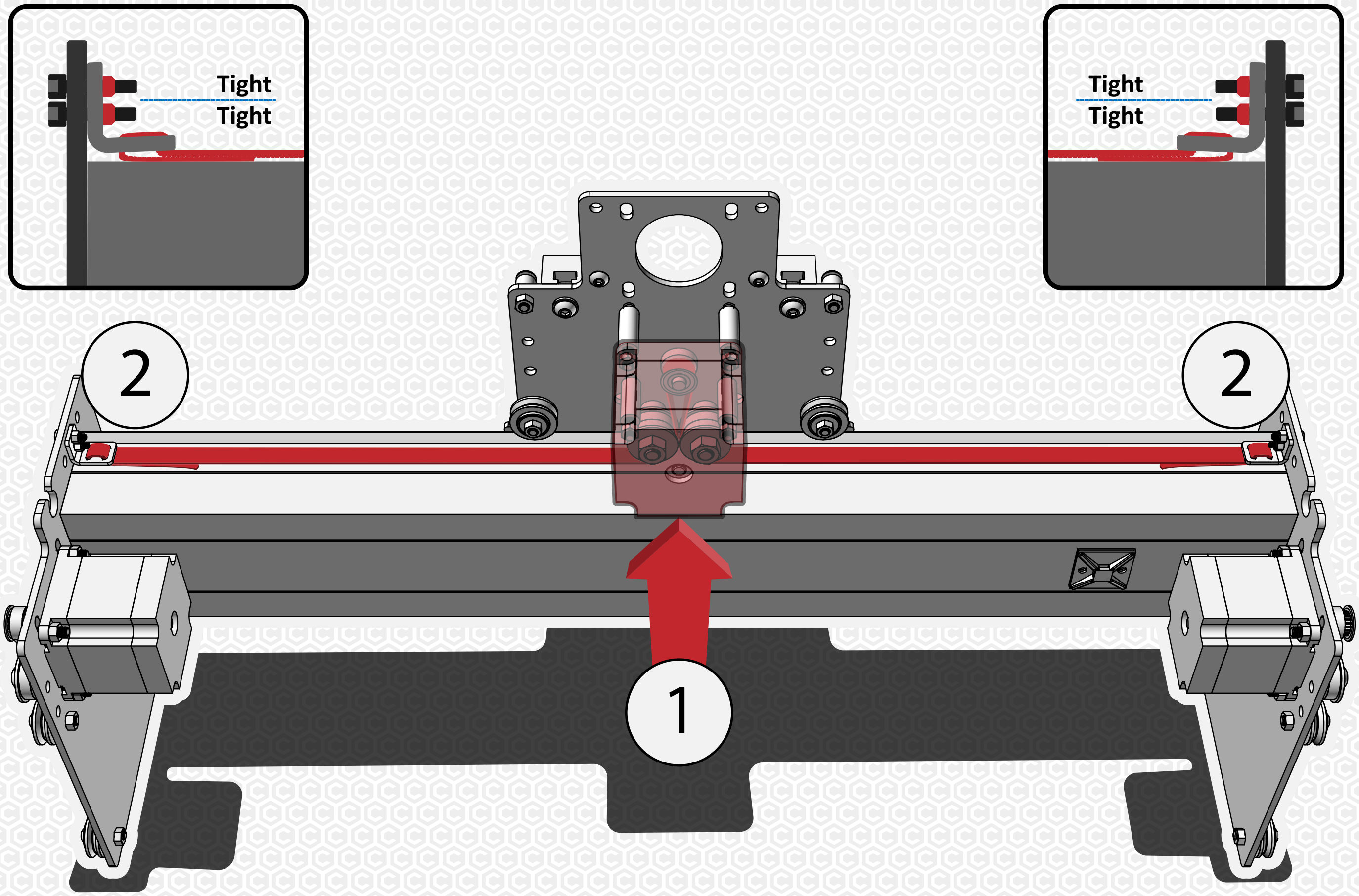






Slide the X-axis carriage to the approximate center of its movement range on the gantry in preparation for routing the x-axis belt.

Run the x-axis belt underneath the belt-idler wheels, and then push the belt from both sides of the idlers to cause it to buckle upwards between the two belt-idler wheels. Feed enough of this belt loop upwards such that you can loop the belt around the x-axis motor drive pulley, and then remove the slack from the belt by pulling on the loose end, pulling it toward the right-hand end of the gantry. Then affix the

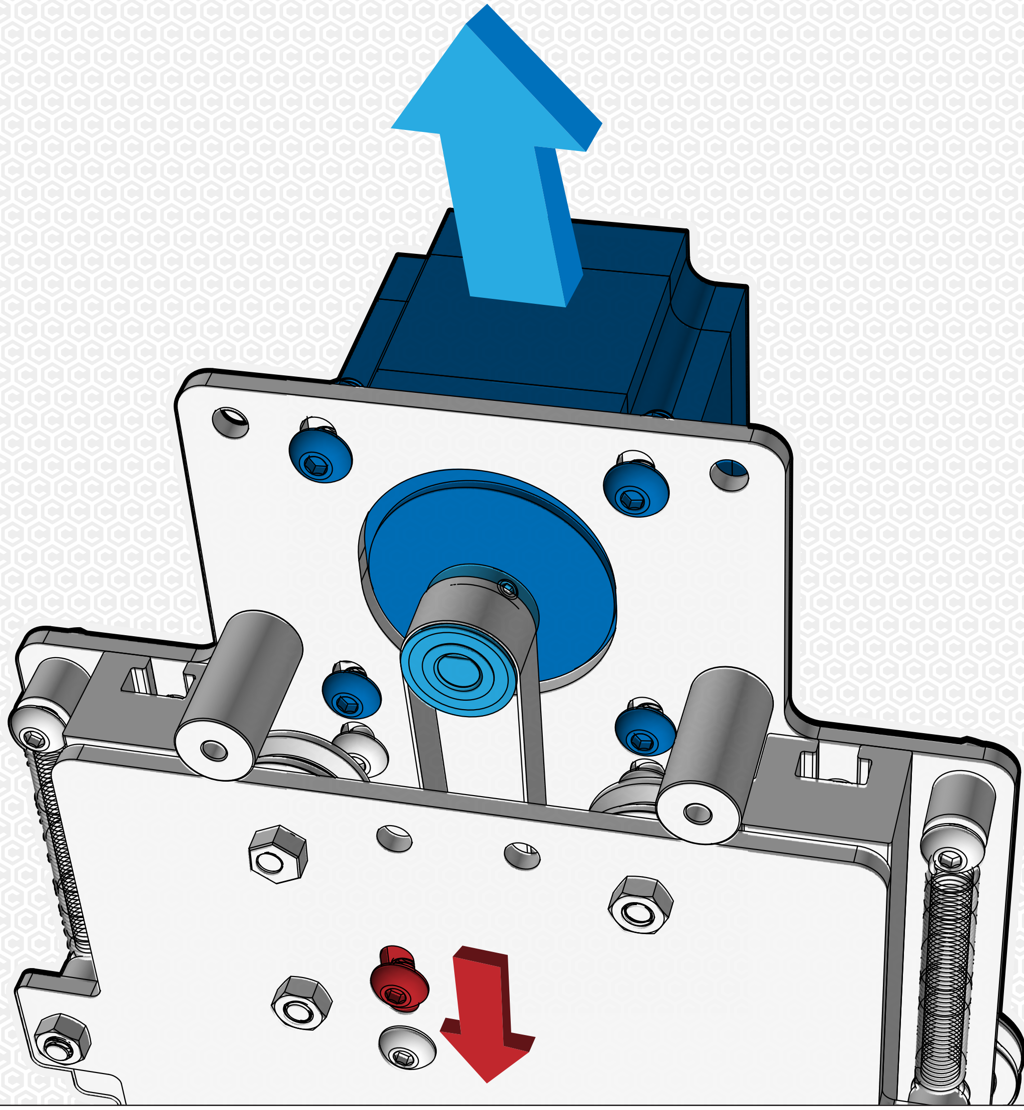


Push the carriage to the left end of the gantry while keeping tension on the belt to take out any slack. Route the belt through the first slot of the right belt-clip, and position it near where it will be fastened to the right-end gantry end-plate. Pull the belt through so that it's slightly taut and thread it through the second clip slot, so that the belt teeth will inter-mesh when the belt-clip is fully anchored.

Install the right-end belt-clip screws with their matching Ny-loc nuts, but only fully tighten the top screw. Leave the bottom screw only hand-tight for the time being.

Loosen the X-axis motor and pull upwards on it to tension the belt, either sufficiently hard that it won't raise any further under un-aided lifting effort, or as far as it will go in it's adjustment track. Then re-tighten the motor mounting screws. Lastly tighten the bottom belt-clip screws on both sides.

Tip: in order to work on the X-axis motor the z-axis plate should be lowered down such that it rests on the table.

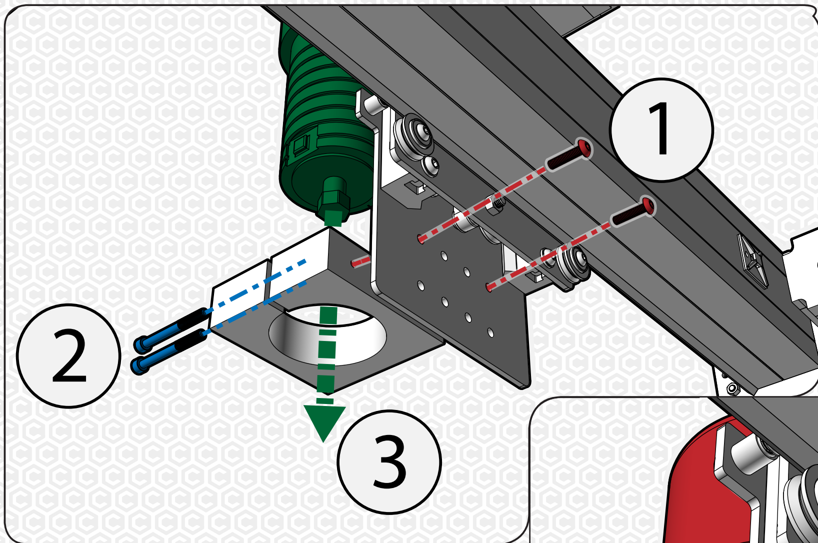


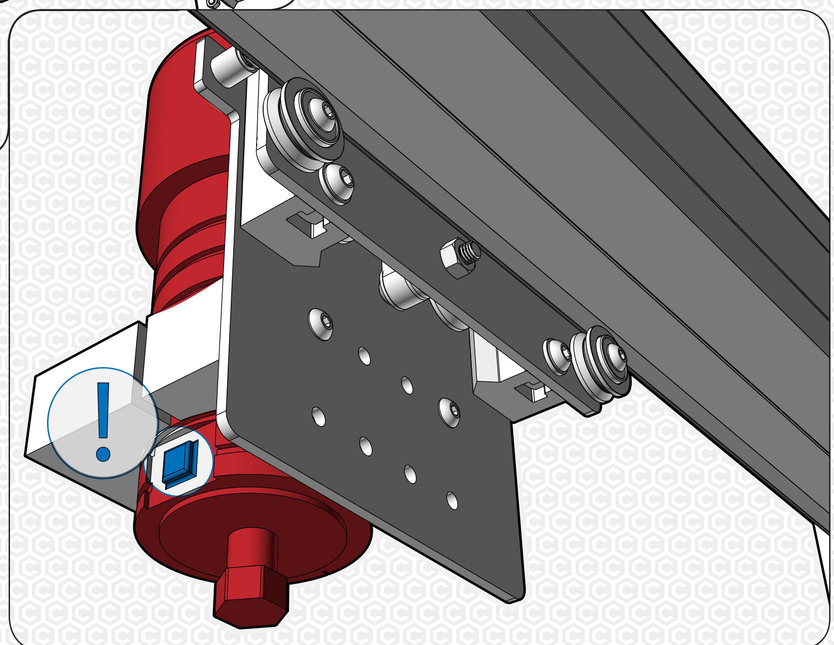
After ensuring the belt is routed correctly around the stationary pulley, between the two belt guide-posts, around the lower belt-idler and around the motor pulley, it needs to be tensioned to prevent it from slipping during operation.

To tension the Z-axis belt, first loosen the upper belt guide-post and move it from it's upper position in its adjustment slot down as far as possible in the slot, and then re-tighten the screw.

Then loosen the motor mounting screws and pull upwards on the motor as far as possible in its adjustment slots, and re-tighten these screws as well while pulling upward on the motor. The belt should now stay engaged and not skip when traversing the z-axis plate up and down the z-axis rails.

Note: be careful when moving the z-axis plate up and down that you do not pull it out far enough to disengage it from the rails!

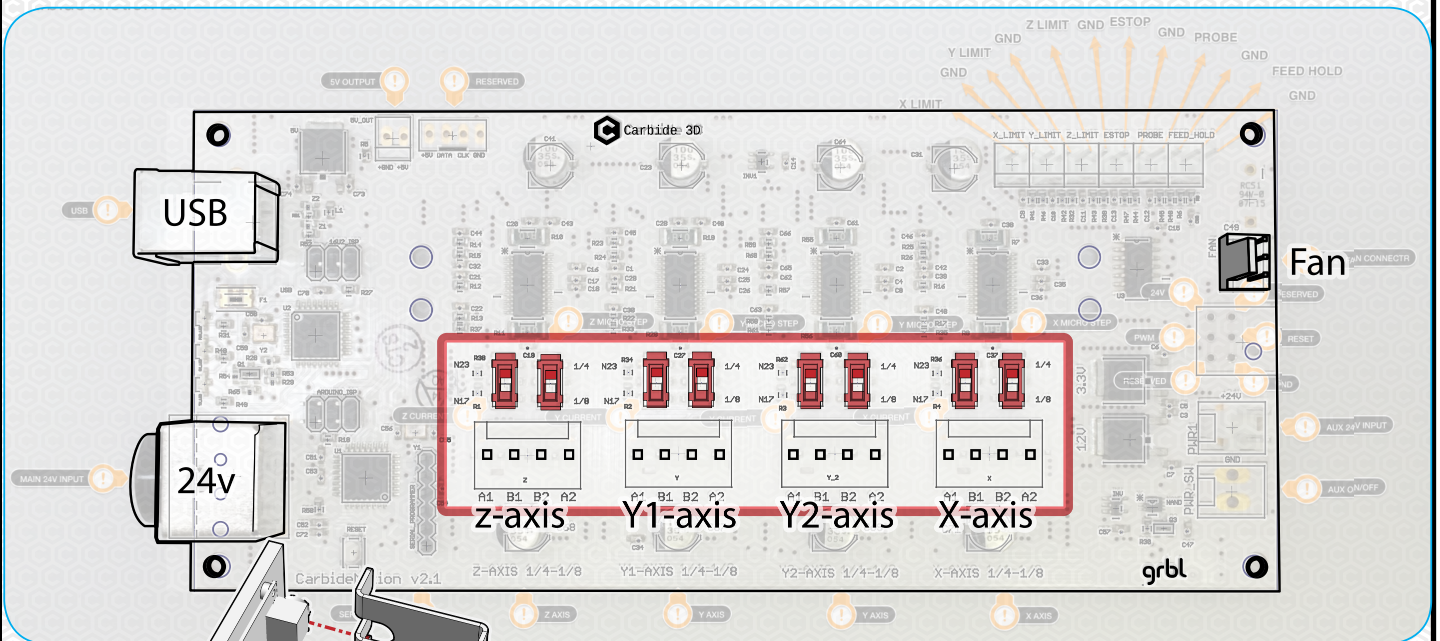


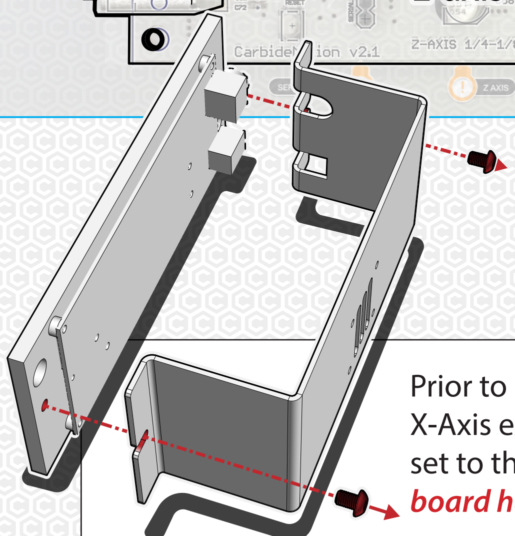


To Install the router mount, first lower the z-axis plate to expose the set of eight mounting holes below the gantry. Insert two M5x20mm button-head cap screws through the top left and top right corner holes in the Z-axis plate and into the aluminum clamping bracket. Note there are two rows of 4 holes, placed 20mm apart. It is recommended you use the upper set of holes to attach your router mount.

Raise the Z-axis plate sufficiently so that when the router is inserted into the clamping bracket the router can rest on it's collet on the MDF base-board, and the clamp is higher than the shaft-locking button, as shown above. Once aligned, tighten the clamp lightly around the router body using the two M5x55mm socket-head cap screws, so you can check the router mount height.

Raise the z-axis plate and ensure that when the plate is fully raised the router body is approximately level with the bottom of the X-axis plate, and then tighten the M5x55mm clamping screws fully. Then progressively tighten each screw a few turns at a time in order to spread the loading between them.

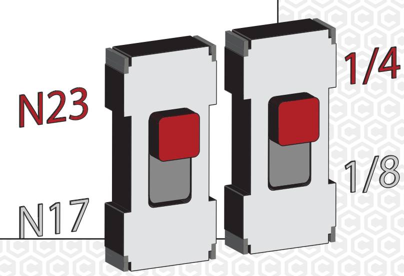


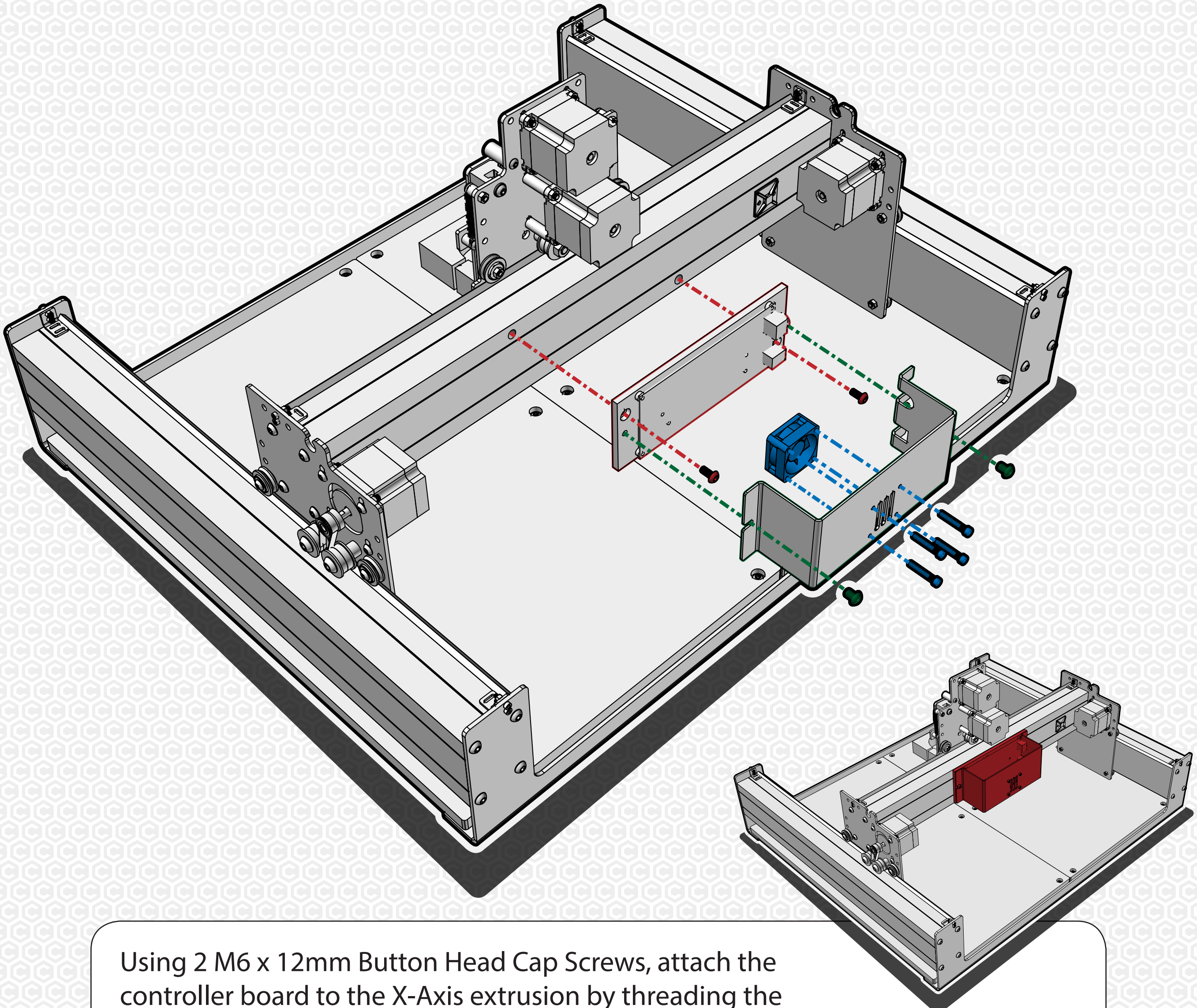


Prior to installing the controller board on the back of the X-Axis extrusion, check to make sure the DIP switches are set to the correct positions, ***if your version of the controller board has DIP switches.***

In order to access the board, remove the cover shroud. To protect the controller during shipping, the shroud is installed at the factory before being placed in the box. To remove it unscrew the 2x M6x8 SHCS mounting it to the heat-sink plate. Removing the shroud will expose an additional countersunk mounting hole, which you'll use to mount the board to the back of the gantry. Leave the shroud off for now.

Both switches should be moved *away* from the white molex connector for the motor that each pair of switches are adjacent to. Reading the silkscreen on the board, ensure the current switch is set to N23 instead of N17, and the micro-step switch is set to 1/4 instead of 1/8.





Using 2 M6 x 12mm Button Head Cap Screws, attach the controller board to the X-Axis extrusion by threading the screws through the clearance holes and threaded them into the extrusion as shown.

Ensure your controller is oriented in the same manner shown in the graphic: USB and Power Connectors should be pointing to the right, when viewing the machine from the rear. After the controller board is installed, install the fan to the shroud, and then re-install the cover shroud.

The fan is attached using 4 M3 x 25mm SHCS, to the *inside* of the shroud. The M3 screws should come from the inside to protrude outwards, so the nuts are on the outside of the shroud. When installing the fan, note the wires are positioned on the end of the fan that the air enters. It is suggested to have the fan blowing air onto the chips to cool the board, so ensure the fans airflow is pointed in the correct direction. Then install the shroud with 2x M6 x 8mm SHCS.

The machine ships with 4 stepper motors. These motors are identical in every way except the length of their wires. Two motors have 'long' wires, and two motors have 'short' wires.

The short wire motors go on the Y-Axis, which is the outside of the gantry. The longer wire motors go on the X and Z axis, the parts that slide left to right and up and down on the machine.

The Y axis motors should be installed so as the wires are pointing towards the X-Axis extrusion as shown. This will maintain a simple routing path for the wires to get the the controller.

The X and Z axis motors should be installed so the wires point to the right (when viewing the machine from the rear).

After the motors are installed

Route the Y axis motors through a tie down located about half way between the Y plate and the controller, one tie down per side, use a zip-tie to secure the wires to the tie downs. Once to the controller, route through the side slots, and plug wires into their respective terminals. Note on the board, each white terminal is labeled X, Y1, Y2, Z.

Zip Ties the X and Z wires together with 2 zip ties placed about 3 inches apart. Run your carriage all the way to the left side of the gantry. Place a tie down on the top of the X extrusion, centered on the back half of the extrusion. Now plug both your X and Z into their terminals on the controller. Pinching the wires together, secure them to the tie down you just placed on the X axis.

(pending graphics)

Route your power and USB Cable from the controller out to the right side of the gantry (when viewing from rear). Holding them together, put a zip tie just on the other side of the slot on the Y axis plate. This will prevent your wires from being pulled or drooping back into the work area.

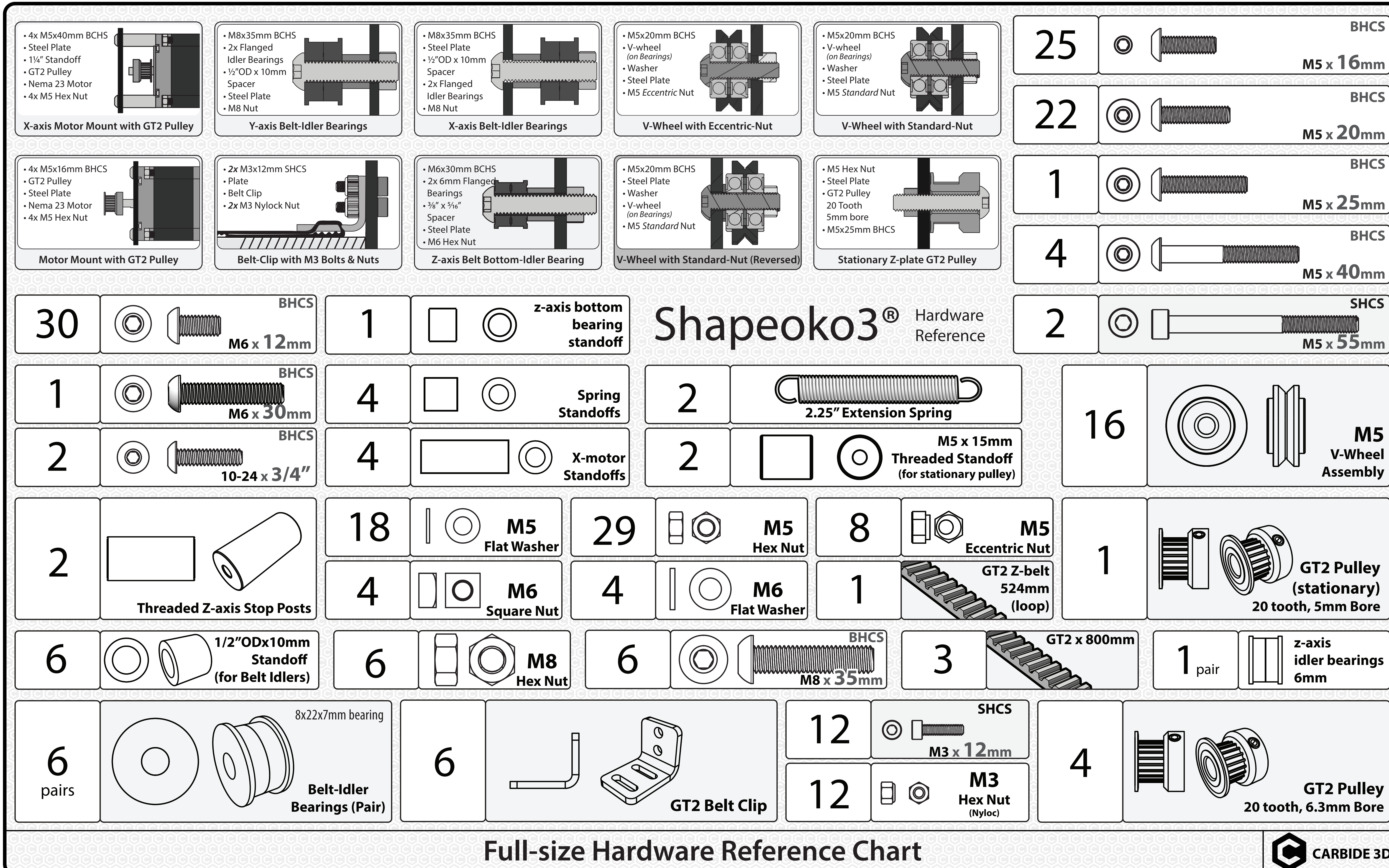
Place a tie down at exactly the middle of the extrusion on the outside face. Move your gantry all the way to the rear of the machine and Route the power and USB to the tie down you just placed. Secure the cables with a zip tie.

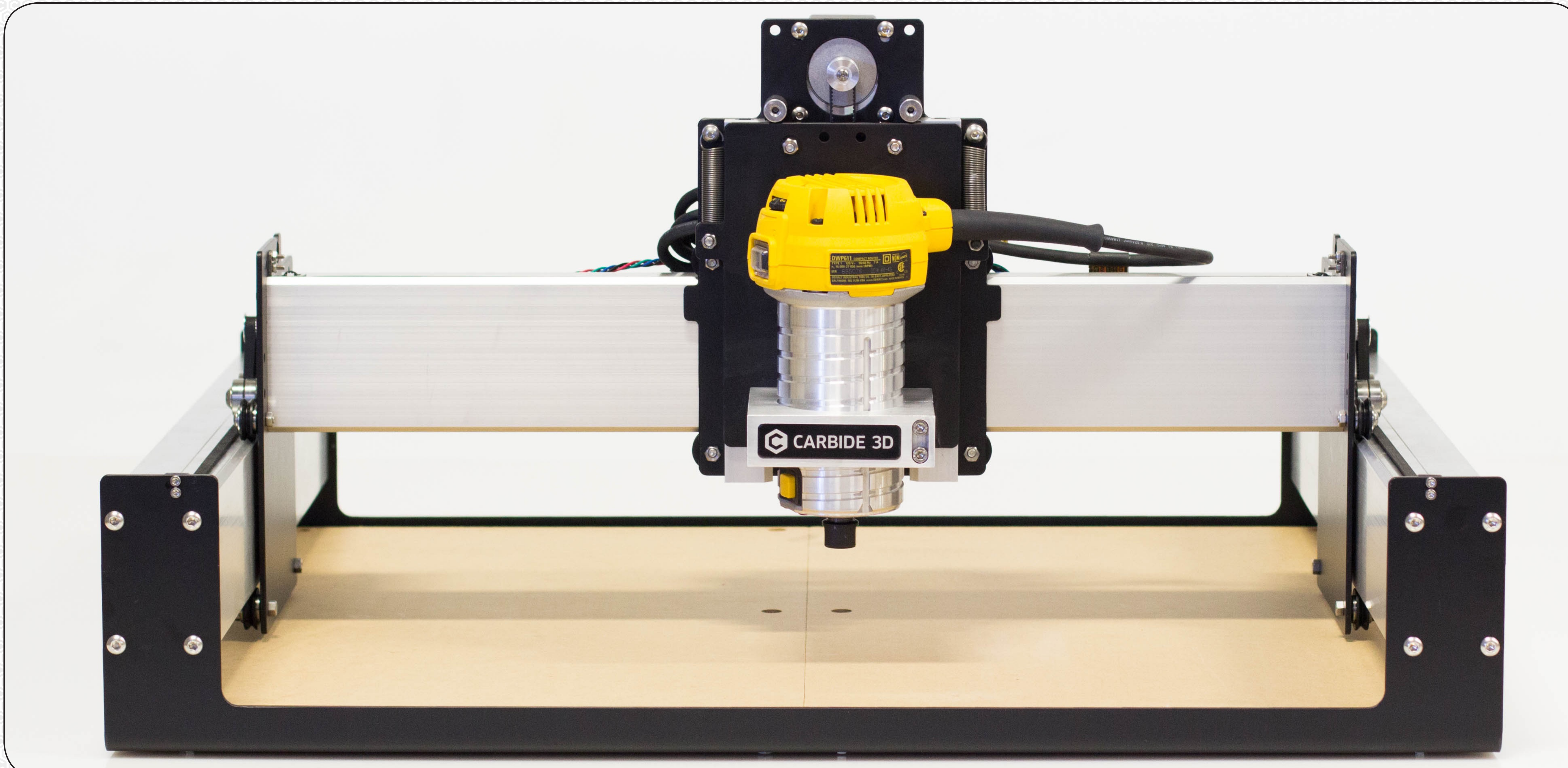
Place another tie down at the very rear of the extrusion, right in front of the rear plate. Route your power and USB to that tie down and attach with a zip tie.

Your wiring is complete.

Glossary of Terms

Extrusions (AKA Rails): The aluminum load-bearing members of the structure which are manufactured by pushing molten metal through a profiled hole while cooling/hardening.
GT2 Belt: A type of timing belt which is used as the primary transmission in the So3, as opposed to gear or screw-driven transmissions.
V-Wheel: The pre-loaded primary drive bearings which ride on the profiles on the extrusions to make sure the machine maintaines linear alignment on each axis.
Idler/Belt-Idler: Smooth-rolling bearings which guide the GT2 drive belts during machine motion.
Eccentric Nut: Nuts which have off-center thru-holes and a cylindrical section of their depth that is used for adjusting the v-wheels to ensure pre-load on the bearing surfaces of the extrusions.
Square Nut: A nut which is four-sided instead of six-sided so that it fits in a channel and will not rotate, allowing for adjustment along the axis of the channel.
Gantry: The portion of the machine that spans the X-axis (left-and-right), travels forwards and backwards along the side Y-axis rails, and carries the carriage.
Carriage: The assembly on the machine which carries the Z-axis rails and plate, and which travels left-and-right on the gantry in X-axis motion.
Stepper Motor: An electric motor that moves in fixed increments (steps) and which is driven with pulses of current. Usually does not have a feedback mechanism, so is considered an "open-loop" driven motor.
Machine Controller: The electronics board which interprets the g-code streamed from the computer and provides the correct pulses to the motors to drive the machine according to the program.
Power Supply: The Shapeoko3 uses a 24v power supply.
DIP Switch: "dual-inline-package" switch, a switch used for setting options on a PCB circuit.
Micro-stepping: a method of making smaller movements using a stepper motor—usually 1/4 or 1/8 steps
Current: the flow of electricity through wires/circuits, also known as 'amperage'
Leads: wires running from a component used to make it easier to assemble/wire together with other components
BHCS: 'button-head cap screw'
SHCS: 'socket-head cap screw'
SS: 'stainless steel'
MDF: 'medium-density fiberboard'
"Skew": a term to describe deviation from orthagonal or 90° angles
"Hand-tight": fasteners secured only as tight as an individual can tighten without any tools
"Fully-Tight": fasteners tightened as much as possible with the use of tools (wrenches/screwdrivers, etc....)


• 4x M5x40mm BCHS
• Steel Plate
• 1¼″ Standoff
• GT2 Pulley
• Nema 23 Motor
• 4x M5 Hex Nut
X-axis Motor Mount with GT2 Pulley
• M8x35mm BCHS
• 2x Flanged Idler Bearings
• ½″OD x 10mm Spacer
• Steel Plate
• M8 Nut
Y-axis Belt-Idler Bearings
• M8x35mm BCHS
• ½″OD x 10mm Spacer
• 2x Flanged Idler Bearings
• M8 Nut
X-axis Belt-Idler Bearings
• M5x20mm BCHS
• V-wheel (on Bearings)
• Washer
• Steel Plate
• M5 Eccentric Nut
V-Wheel with Eccentric-Nut
• M5x20mm BCHS
• V-wheel (on Bearings)
• Washer
• Steel Plate
• M5 Standard Nut
V-Wheel with Standard-Nut
25
BHCS
M5 x 16mm
22
BHCS
M5 x 20mm
• 4x M5x16mm BHCS
• GT2 Pulley
• Steel Plate
• Nema 23 Motor
• 4x M5 Hex Nut
Motor Mount with GT2 Pulley
• 2x M3x12mm SHCS
• Plate
• Belt Clip
• 2x M3 Nylock Nut
Belt-Clip with M3 Bolts & Nuts
• M6x30mm BCHS
• 2x 6mm Flanged Bearings
• ⅜″ x 5⁄16″ Spacer
• Steel Plate
• M6 Hex Nut
Z-axis Belt Bottom-Idler Bearing
• M5x20mm BCHS
• Steel Plate
• Washer
• V-wheel (on Bearings)
• M5 Standard Nut
V-Wheel with Standard-Nut (Reversed)
• M5 Hex Nut
• Steel Plate
• GT2 Pulley 20 Tooth 5mm bore
• M5x25mm BHCS
Stationary Z-plate GT2 Pulley
1
BHCS
M5 x 25mm
4
BHCS
M5 x 40mm
30
BHCS
M6 x 12mm
1
z-axis bottom bearing standoff
Shapeoko3®
Hardware Reference
2
SHCS
M5 x 55mm
1
BHCS
M6 x 30mm
4
Spring Standoffs
2
2.25″ Extension Spring
16
M5 V-Wheel Assembly
2
BHCS
10-24 x 3/4″
4
X-motor Standoffs
2
M5 x 15mm Threaded Standoff (for stationary pulley)
2
Threaded Z-axis Stop Posts
18
M5 Flat Washer
29
M5 Hex Nut
8
M5 Eccentric Nut
1
GT2 Pulley (stationary) 20 tooth, 5mm Bore
4
M6 Square Nut
4
M6 Flat Washer
1
GT2 Z-belt 524mm (loop)
6
1/2″ODx10mm Standoff (for Belt Idlers)
6
M8 Hex Nut
6
BHCS
M8 x 35mm
3
GT2 x 800mm
1 pair
z-axis idler bearings 6mm
6 pairs
8x22x7mm bearing
Belt-Idler Bearings (Pair)
6
GT2 Belt Clip
12
SHCS
M3 x 12mm
12
M3 Hex Nut (Nyloc)
4
GT2 Pulley 20 tooth, 6.3mm Bore
Full-size Hardware Reference Chart
CARBIDE 3D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