

## VORON2 2.4R2 BUILD GUIDE

We build space shuttles with gardening tools  
so anyone can have a space shuttle of their own.

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VERSION 2023-07-04



Before you begin on your journey, a word of caution.

In the comfort of your own home you are about to assemble a robot. This machine can maim, burn, and electrocute you if you are not careful. Please do not become the first VORON fatality. There is no special Reddit flair for that.

Please, read the entire manual before you start assembly. As you begin wrenching, please check our Discord channels for any tips and questions that may halt your progress.

Most of all, good luck!

THE VORON TEAM

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### PART PRINTING GUIDELINES

The Voron Team has provided the following print guidelines for you to follow in order to have the best chance at success with your parts. There are often questions about substituting materials or changing printing standards, but we recommend you follow these:

#### 3D PRINTING PROCESS

Fused Deposition Modeling (FDM)

#### MATERIAL

ABS

#### LAYER HEIGHT

Recommended: 0.2mm

#### EXTRUSION WIDTH

Recommended: Forced 0.4mm

#### INFILL TYPE

Grid, Gyroid, Honeycomb, Triangle or Cubic

#### INFILL PERCENTAGE

Recommended: 40%

#### WALL COUNT

Recommended: 4

#### SOLID TOP/BOTTOM LAYERS

Recommended: 5

### PRINT IT FORWARD (PIF)

Often times community members that have issues printing ABS will bootstrap themselves into a VORON using our Print It Forward program. This is a service where approved members with VORON printers can make you a functional set of parts to get your own machine up and running.

Check Discord if you have any interest in having someone help you out.

### FILE NAMING

By this time you should have already downloaded our STL files from the Voron GitHub. You might have noticed that we have used a unique naming convention for the files. This is how to use them.

#### PRIMARY COLOR

Example `z_joint_lower_x4.stl`

These files will have nothing at the start of the filename.

#### ACCENT COLOR

Example `[a]_tensioner_left.stl`

We have added “[a]” to the front of any STL file that is intended to be printed with accent color.

#### QUANTITY REQUIRED

Example `[a]_z_belt_clip_lower_x4.stl`

If any file ends with “\_x#”, that is telling you the quantity of that part required to build the machine.

### HOW TO GET HELP

If you need assistance with your build, we’re here to help. Head on over to our Discord group and post your questions. This is our primary medium to help VORON Users and we have a great community that can help you out if you get stuck.



<https://discord.gg/voron>

### REPORTING ISSUES

Should you find an issue in the documentation or have a suggestion for an improvement please consider opening an issue on GitHub (<https://github.com/VoronDesign/Voron-2/issues>). When raising an issue please include the relevant page numbers and a short description; annotated screenshots are also very welcome. We periodically update the manual based on the feedback we get.

### THIS IS JUST A REFERENCE

This manual is designed to be a simple reference manual. Building a Voron can be a complex endeavour and for that reason we recommend downloading the CAD files off our Github repository if there are sections you need clarification on. It can sometimes be easier to follow along when you have the whole assembly in front of you.



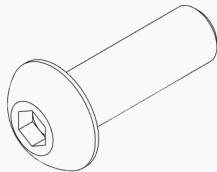
<https://github.com/vorondesign>



<https://docs.vorondesign.com/>

## HARDWARE REFERENCE

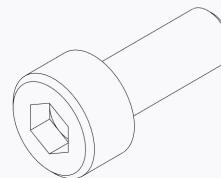
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### BUTTON HEAD CAP SCREW (BHCS)

Metric fastener with a domed shape head and hex drive. Most commonly found in locations where M5 fasteners are used.

ISO 7380-1



### SOCKET HEAD CAP SCREW (SHCS)

Metric fastener with a cylindrical head and hex drive. The most common fastener used on the Voron.

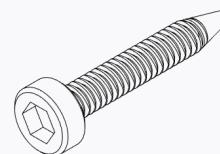
ISO 4762



### FLAT HEAD COUNTERSUNK SCREW (FHCS)

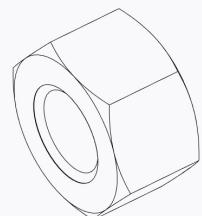
Metric fastener with a cone shaped head and a flat top.

ISO 10642



### SELF TAPPING SCREW

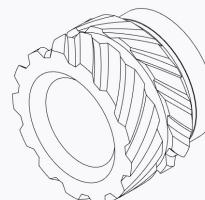
Fastener with a pronounced thread profile that is screwed directly into plastic.



### HEX NUT

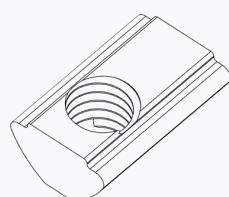
Hex nuts couple with bolts to create a tight, secure joint. You'll see these used in both M3 and M5 variants throughout this guide.

ISO 4032



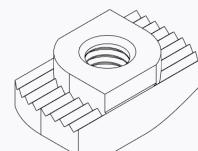
### HEAT SET INSERT

Heat inserts with a soldering tip so that they melt the plastic when installed. As the plastic cools, it solidifies around the knurls and ridges on the insert for excellent resistance to both torque and pull-out.



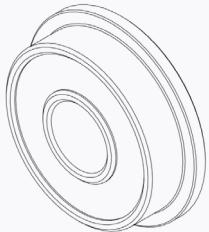
### POST INSTALL T-SLOT NUT (T-NUT)

Nut that can be inserted into the slot of an aluminium profile. Used in both M3 and M5 variants throughout this guide. Often also called "roll-in t-nut".



### HAMMERHEAD NUT

Nut that can be inserted into the slot of an aluminium profile. Used exclusively for panel mounting, all other components use T-Slot nuts.

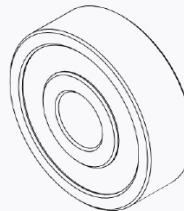
**F695 BEARING**

A ball bearing with a flange used in various gantry locations.

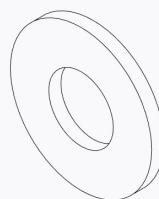
**SHIM**

Not to be confused with stamped washers. These are used in all M5 call-out locations in this manual.

DIN 988

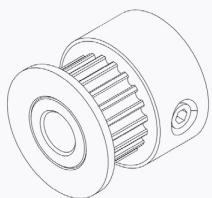
**625 BEARING**

A ball bearing used on the Voron Z drives.

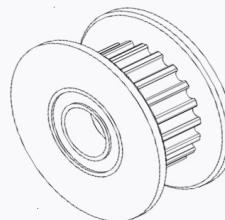
**WASHER**

Usually stamped from sheet metal this type of spacer is not as consistent in thickness as the shims are. Only used in M3 size.

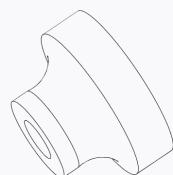
DIN 125

**PULLEY**

GT2 pulley used on the motion system of the Voron.

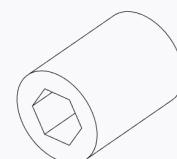
**IDLER**

GT2 idler used in the motion system of the Voron.

**THUMB NUT**

Used in the print bed as a spacer.

DIN 466-B

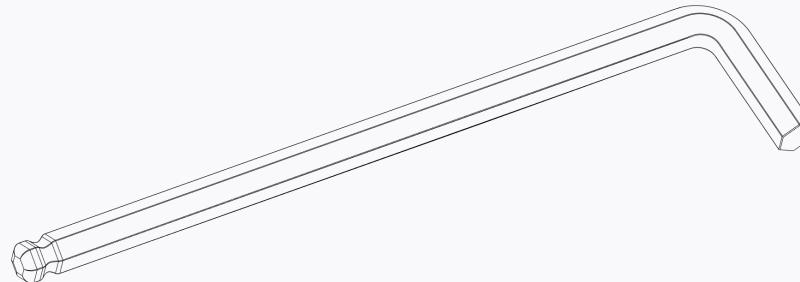
**SET SCREW**

Small headless screw with an internal drive. Used in pulleys and other gears. Also called a grub screw.

ISO 4026

### BALL-END DRIVER

Some parts of this design require the use of a ball-end hex driver for assembly. We recommend you get a 2.0mm, 2.5mm and 3mm one.



### 2.5MM HEX DRIVER

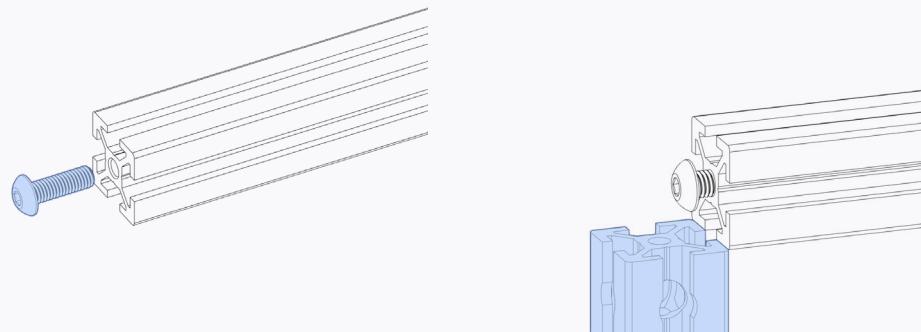
The 2.5mm hex driver will see a lot of use in this build. A quality driver is strongly recommended. Refer to the sourcing guide for suggestions.



### ADDITIONAL TOOLS

We provide additional tool recommendations in our sourcing guide. Visit

[https://vorondesign.com/sourcing\\_guide](https://vorondesign.com/sourcing_guide) and switch to the “Voron Tools” tab at the bottom of the page.



### BLIND JOINT BASICS

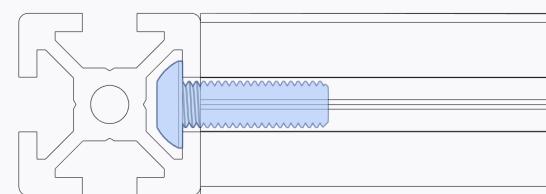
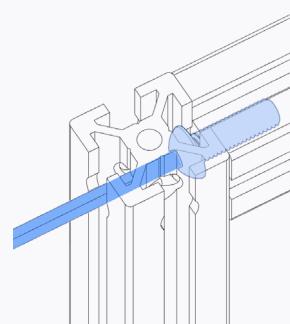
Blind Joints provide a cost effective and rigid assembly method.

The head of the BHCS is slid into the channel of another extrusion and securely fastened through a small access hole in the extrusion.

If you've never assembled one before we recommend you watch the linked guide.



<https://voron.link/onjwmcd>



The first Voron printer was released to the public on March 10 2016.

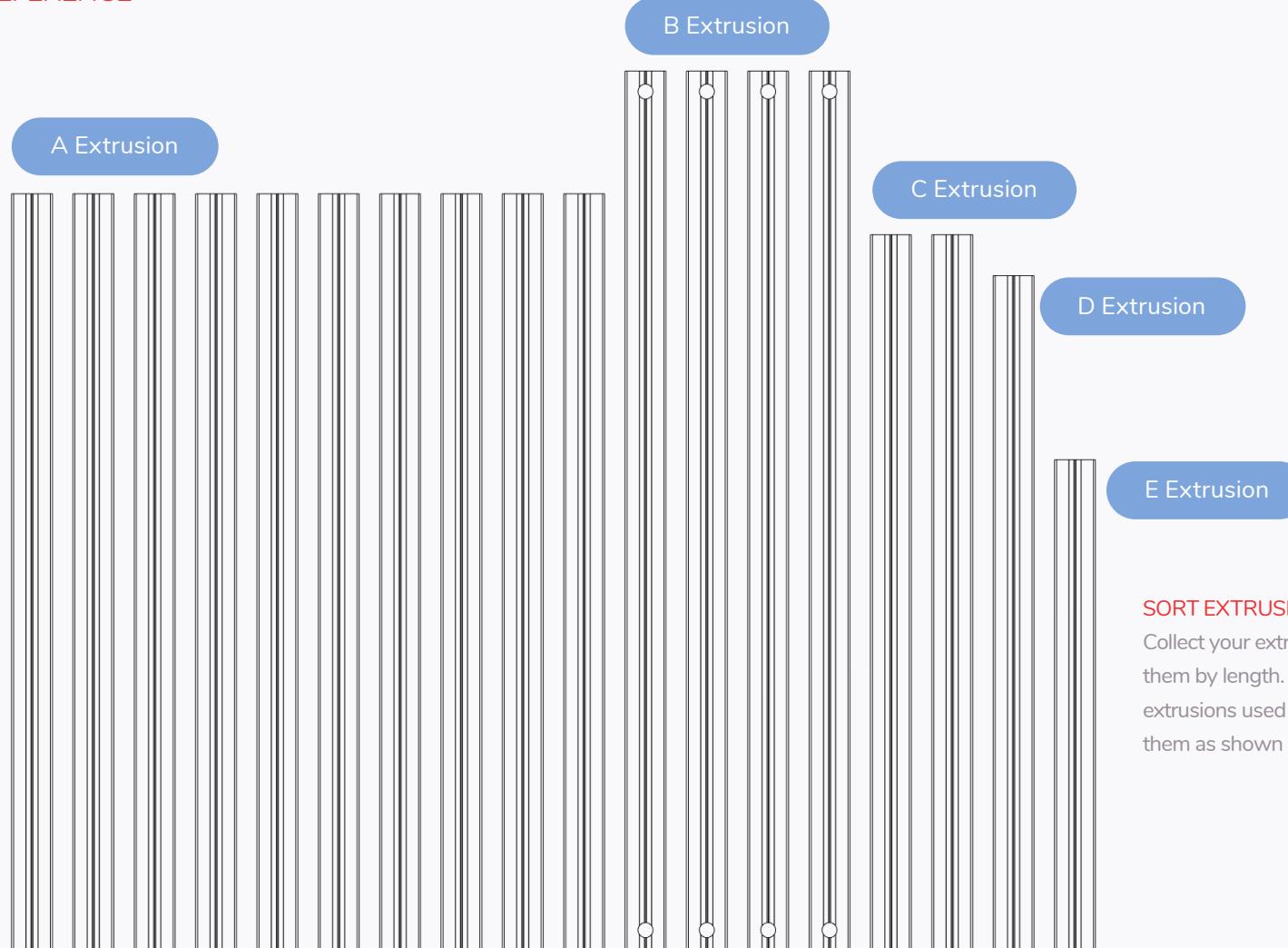
FRAME

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## EXTRUSION REFERENCE

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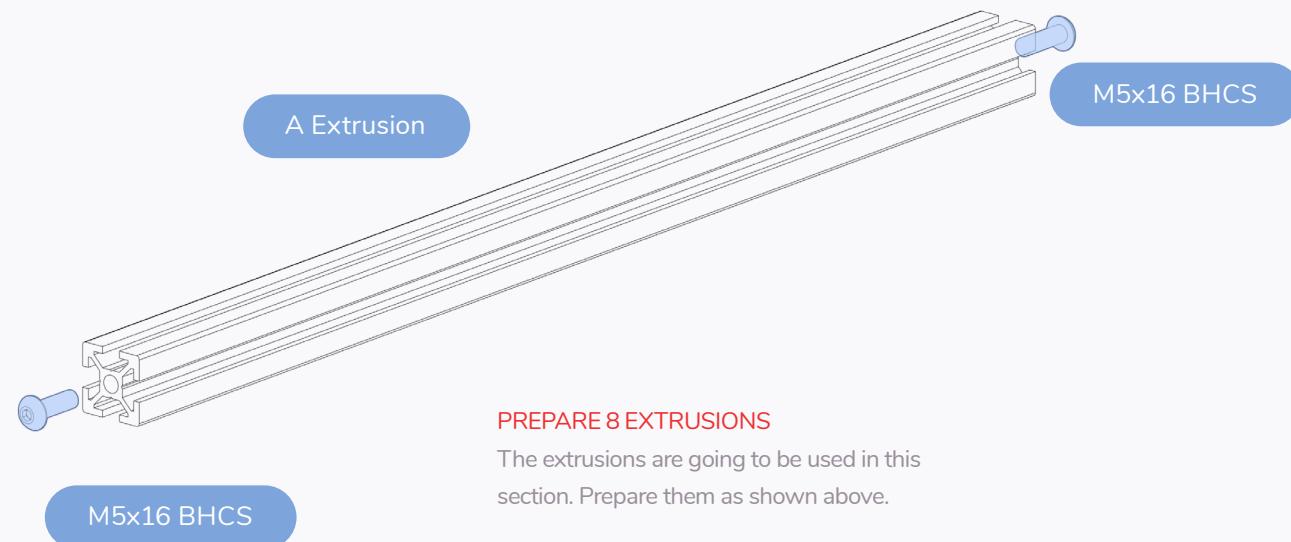
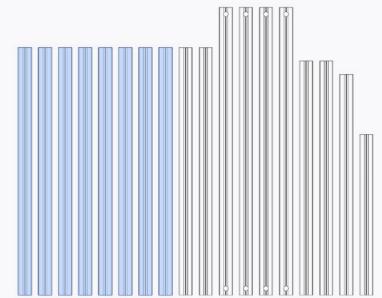


### SORT EXTRUSIONS

Collect your extrusions and sort them by length. We will highlight the extrusions used in each step and label them as shown on this page.

FRAME

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**PREPARE 8 EXTRUSIONS**

The extrusions are going to be used in this section. Prepare them as shown above.

## FRAME

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### FRAME ASSEMBLY

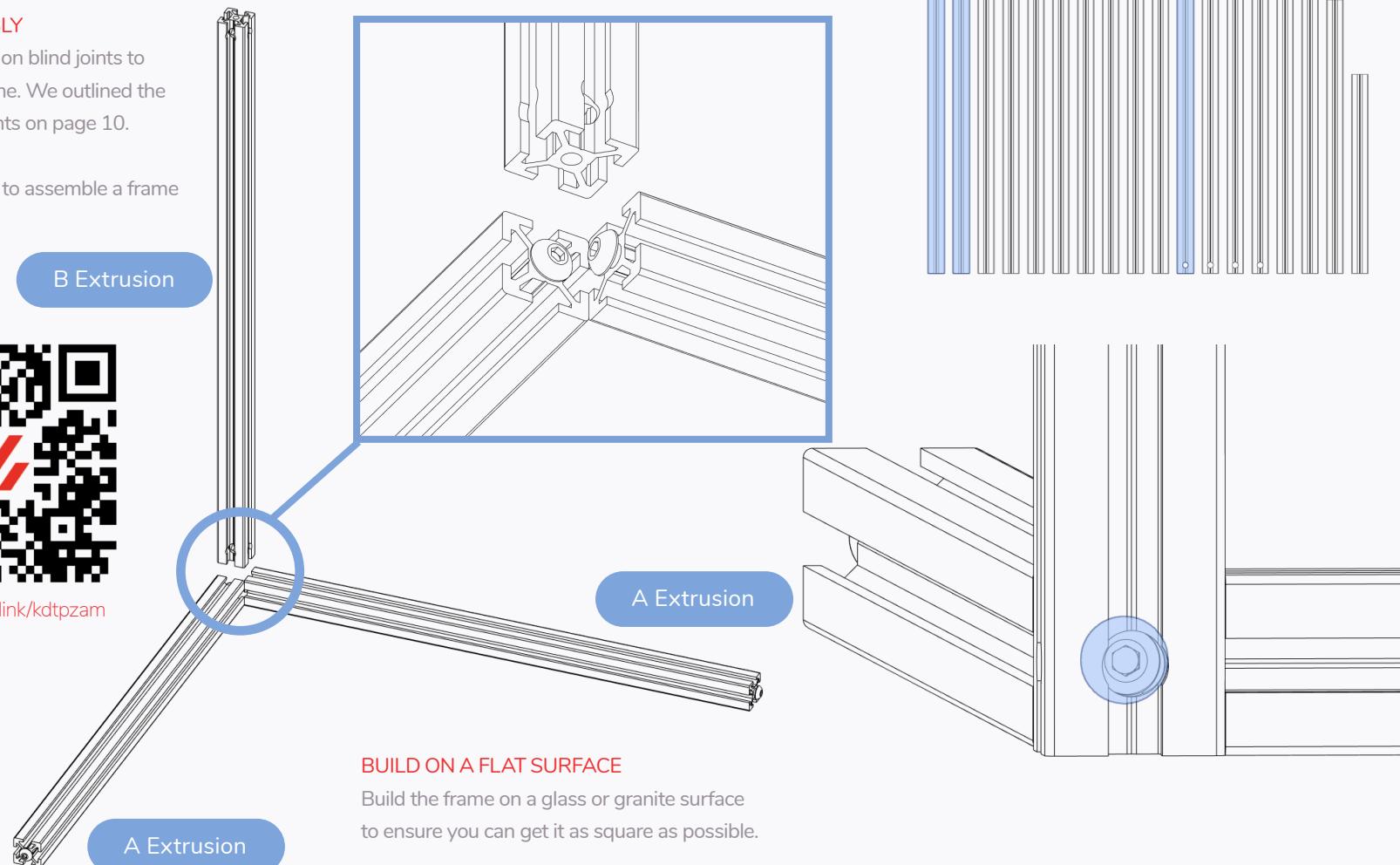
This design relies on blind joints to assemble the frame. We outlined the basics of blind joints on page 10.

More tips on how to assemble a frame are linked below.

B Extrusion



<https://voron.link/kdtpzam>



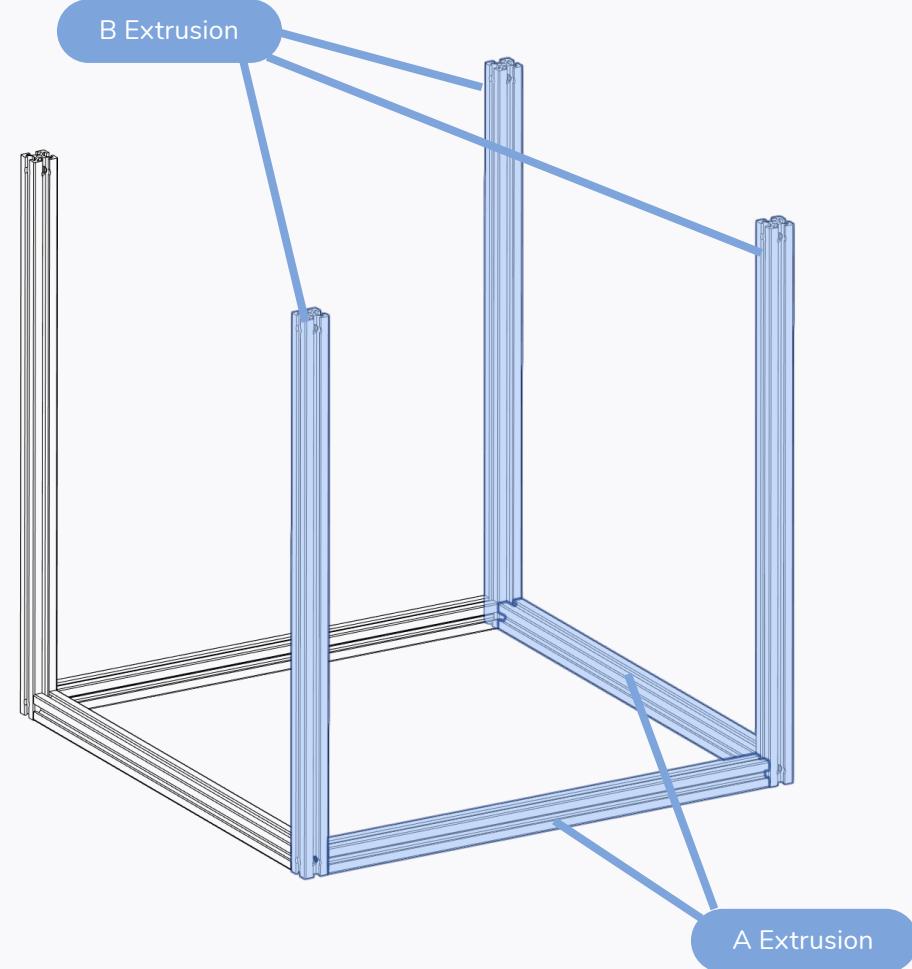
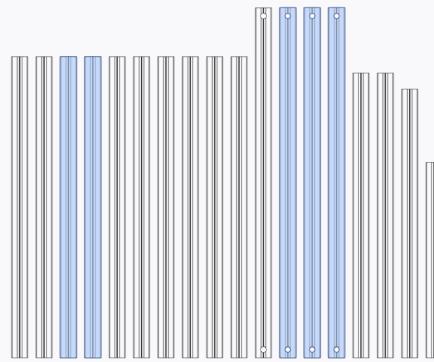
### BUILD ON A FLAT SURFACE

Build the frame on a glass or granite surface to ensure you can get it as square as possible.

A Extrusion

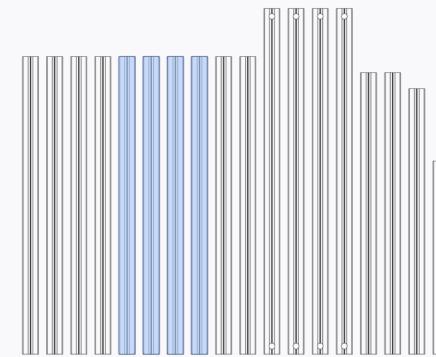
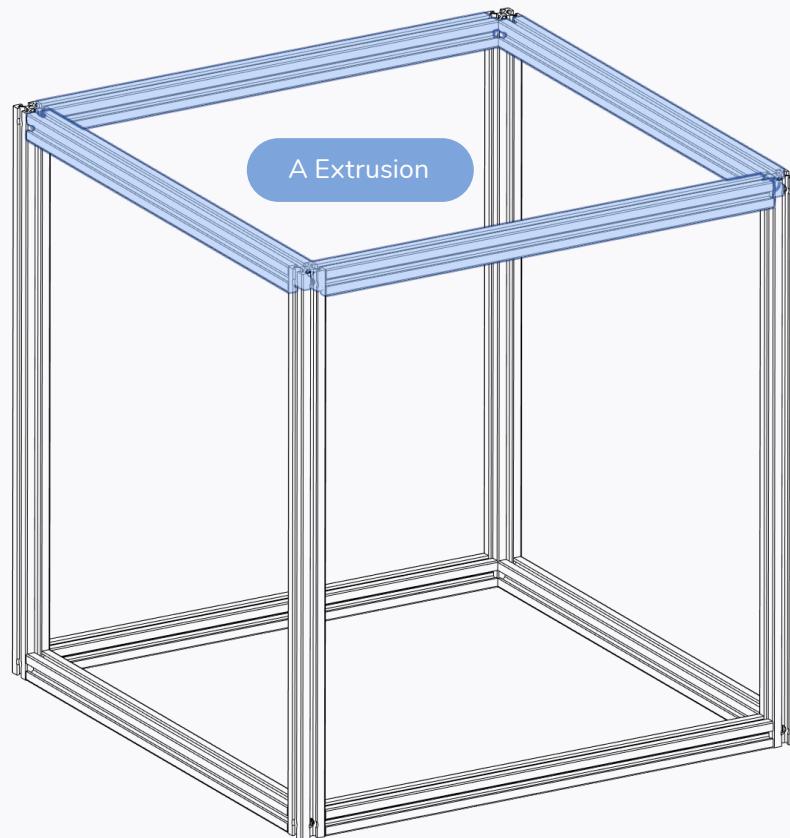
FRAME

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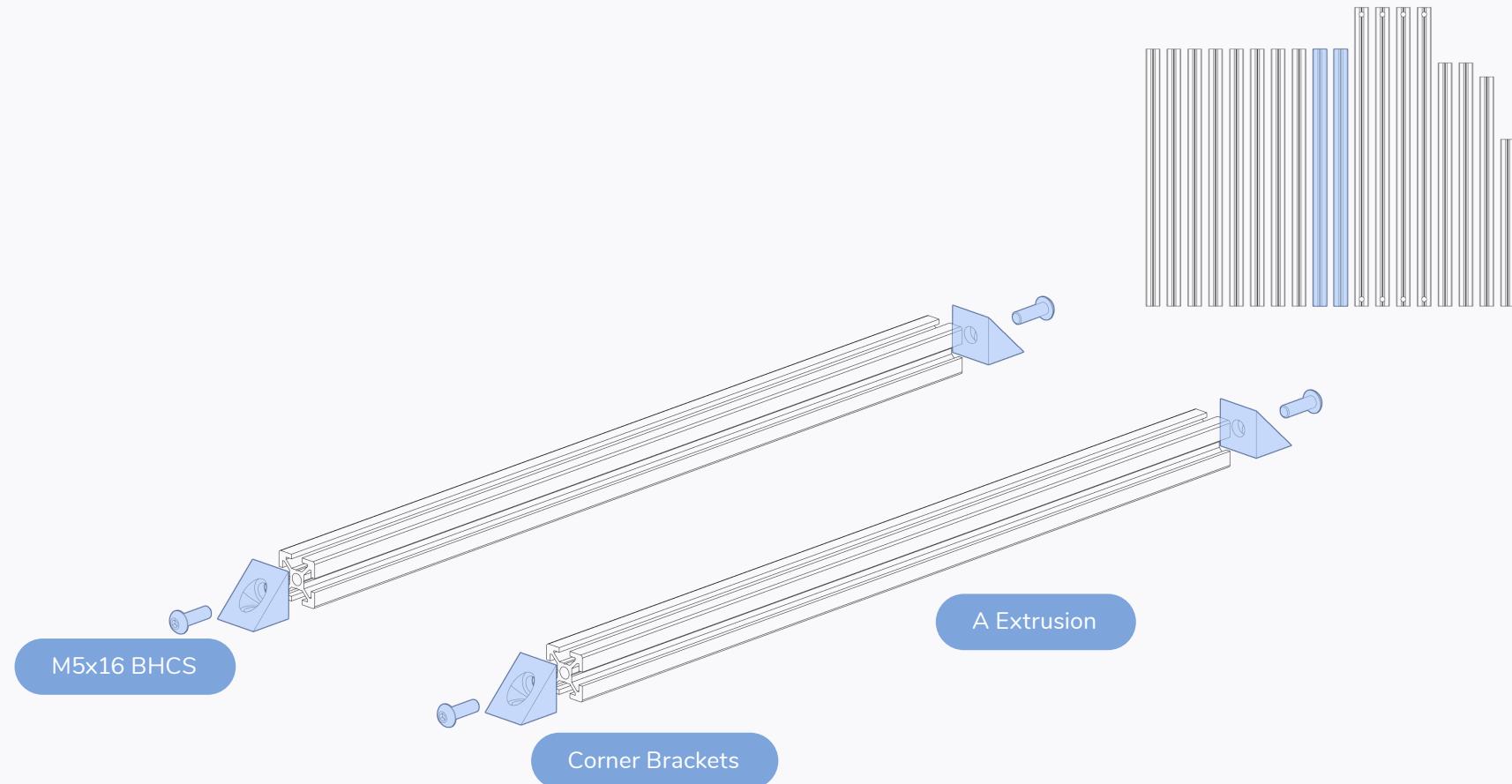


FRAME

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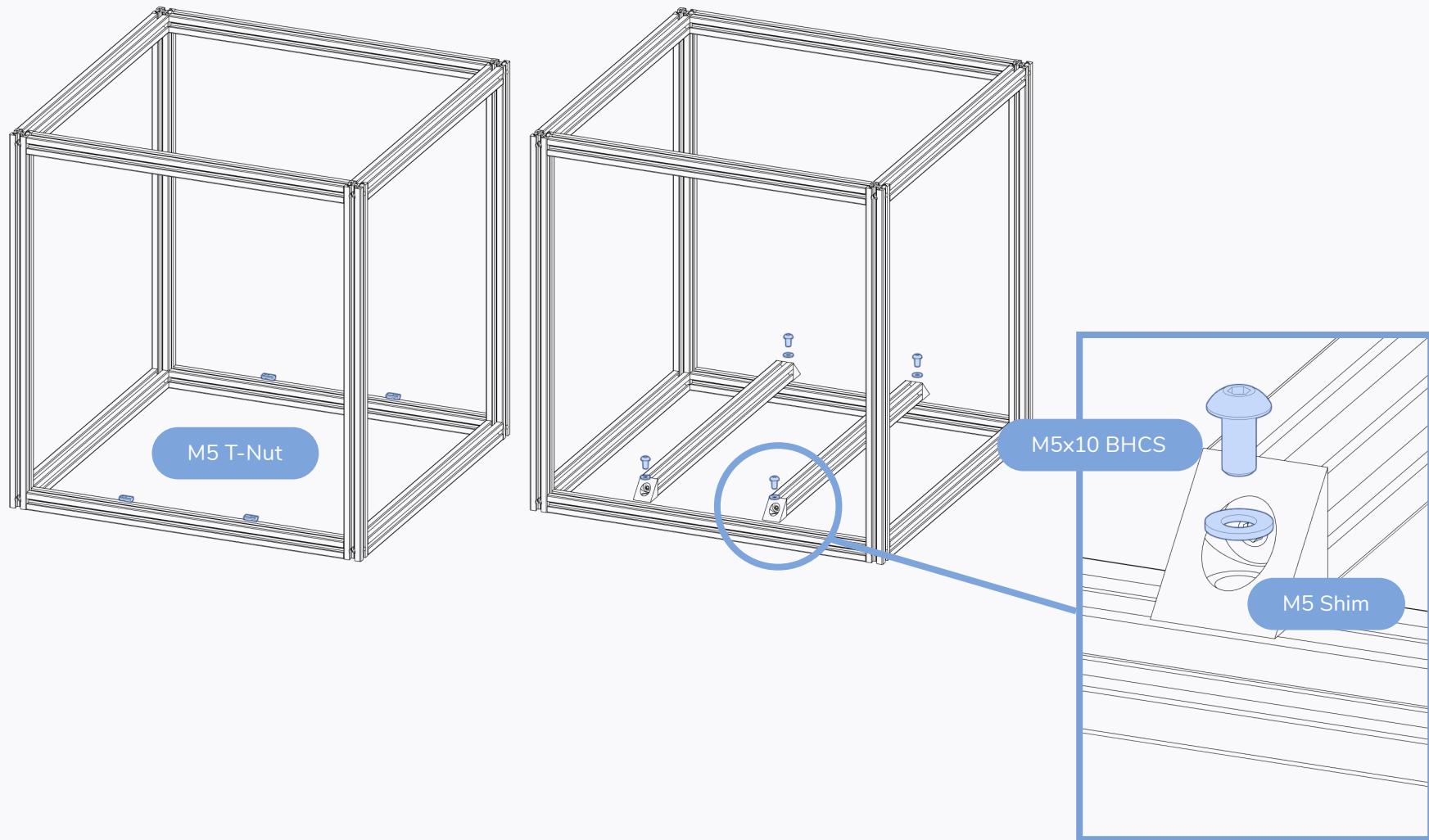


FRAME

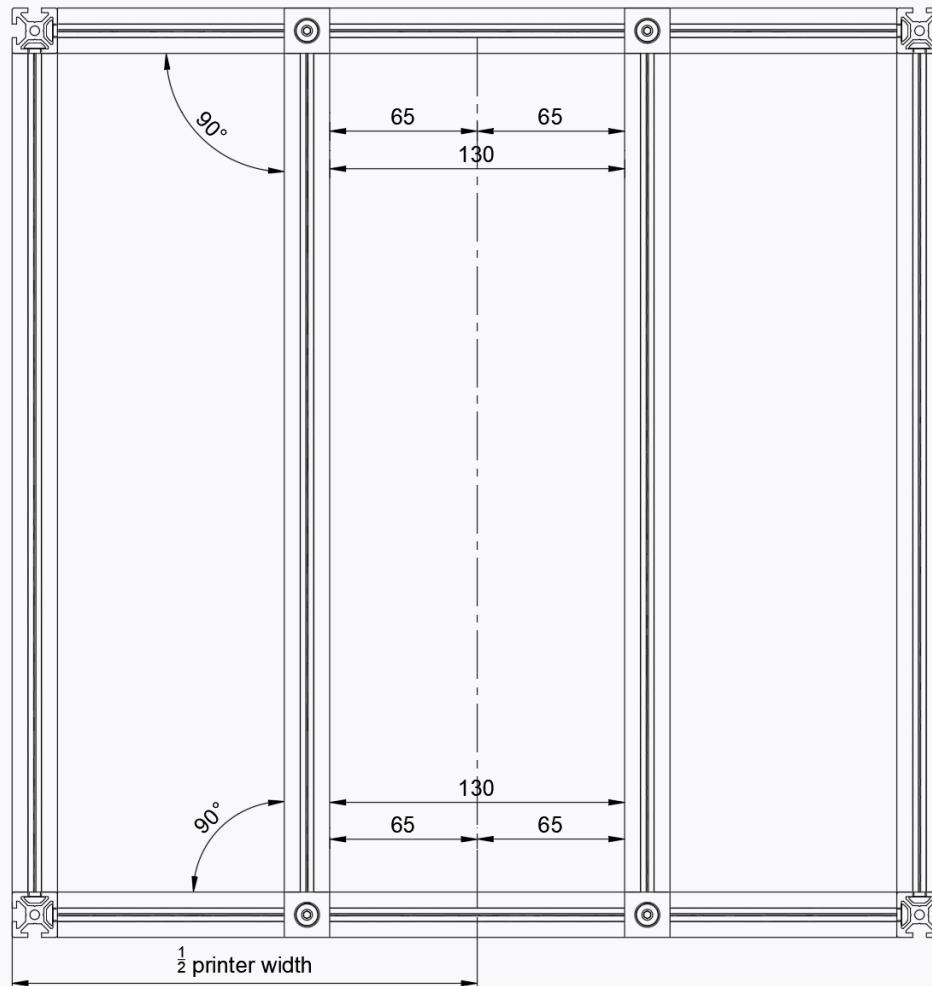


FRAME

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## FRAME



### POSITION BED EXTRUSIONS

Find the centreline of the printer and position the bed extrusions as shown in the diagram to the left. The distance between the extrusions is 130mm centred on the centreline of the printer.

1/2 printer width for standard sizes:

250 spec 205mm

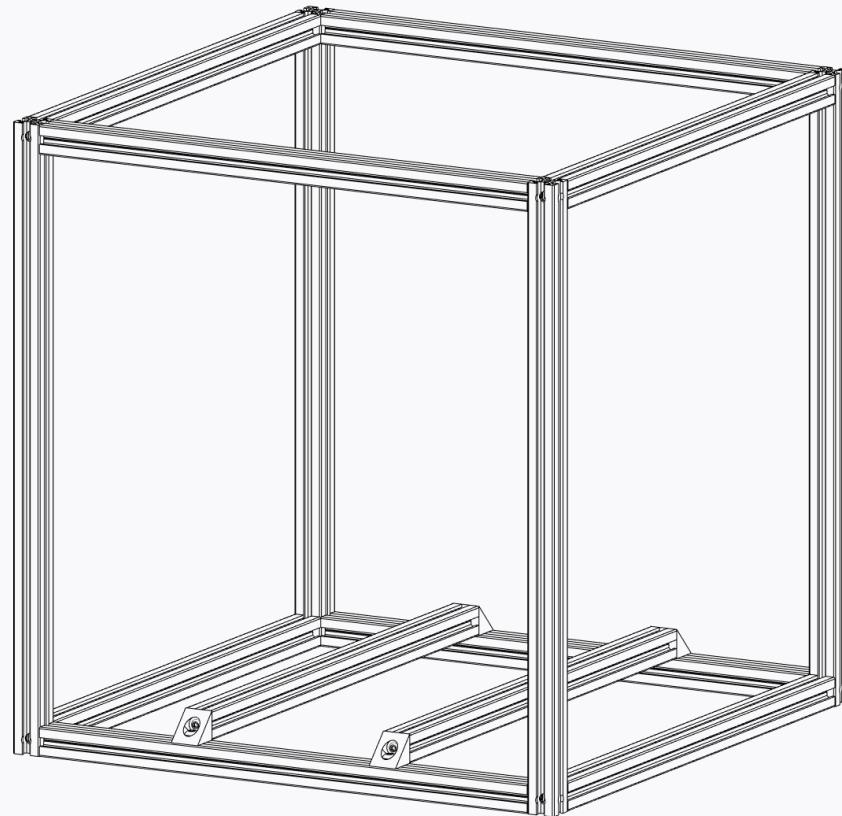
300 spec 230mm

350 spec 255mm

### ALL UNITS ARE METRIC

If a unit is not specified assume it's metric.

All distances are called out in millimeters.



#### CHECK FOR SQUARENESS

Verify the angle of all corners and the overall squareness by measuring the diagonals. Refer to the second half of the linked video for additional information.

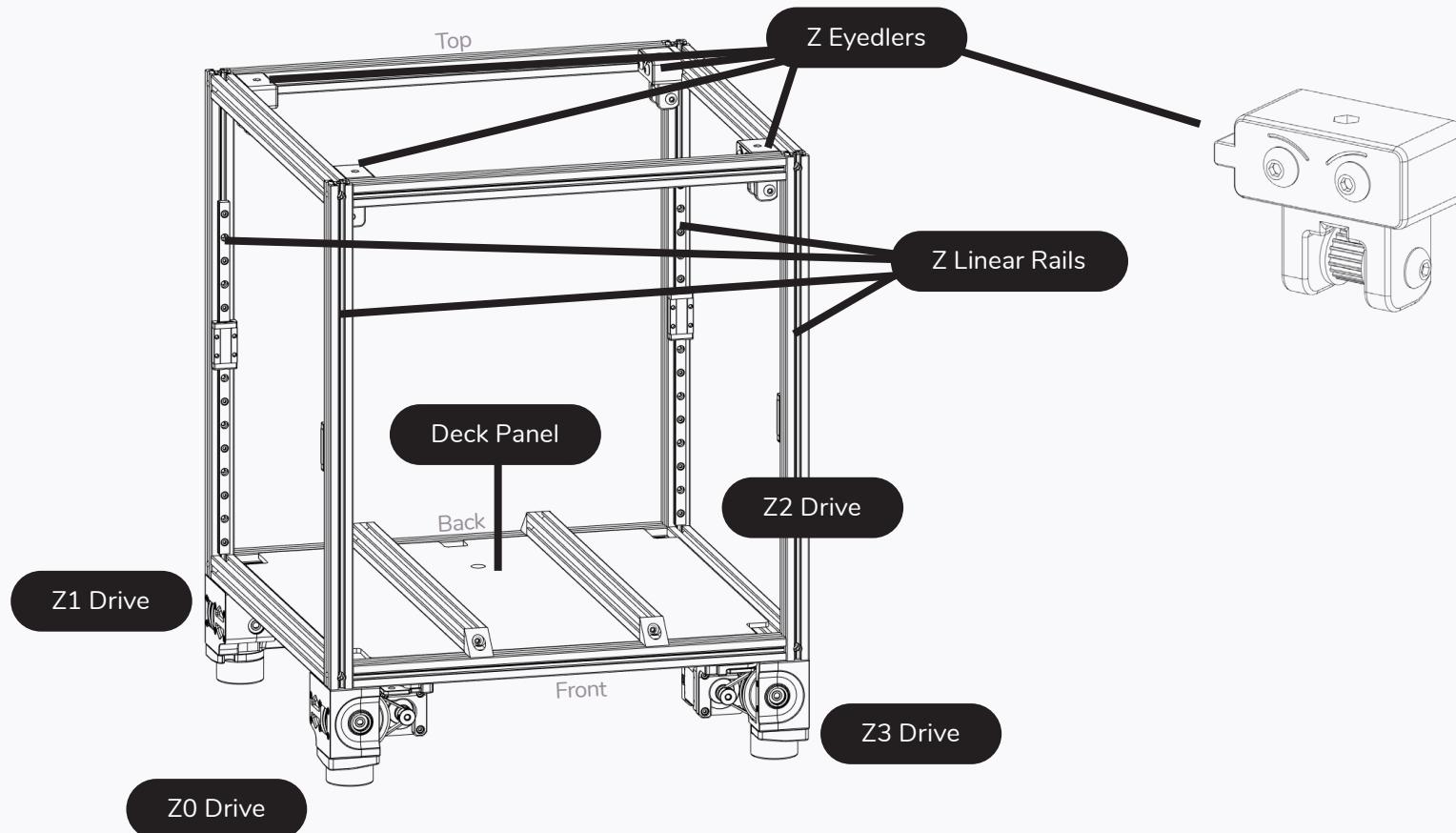


<https://voron.link/kdtpzam>

[WWW.VORONDESIGN.COM](http://WWW.VORONDESIGN.COM)

Z DRIVES



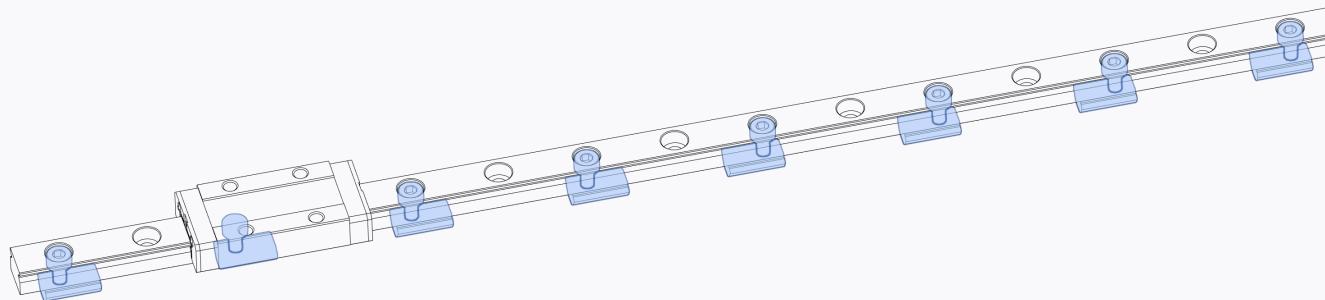


### OVERVIEW

Individual chapters start with an overview of the components that will be built/added to the printer in the chapter.

### HANDLE WITH CARE

The carriage can slide off the rail if not handled properly. Dropping the carriage will likely damage it. Any marks, dents or nicks might cause the linear rail to misbehave in operation.



### LINEAR RAILS - PREPARATION AND MOUNTING

Most linear rails arrive with shipping oil. To ensure a smooth gliding motion and long service life, this oil needs to be removed and its rail carriage greased. See the Voron sourcing guide for a recommended list of lubricants. We attached a link to a video guide to get you started.

We opted to skip every other mounting hole in the linear rail when designing the mounting pattern for this printer. This cuts down on mounting hardware and still meets the requirements for our use case.

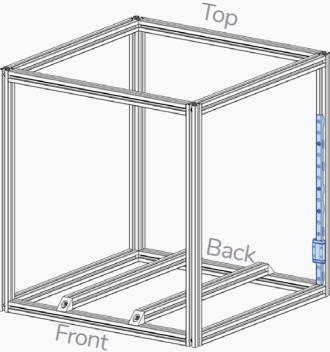
When tightening the bolts tighten them from the center outward to ensure that the rail sits flush on the extrusion.



<https://voron.link/aguOnes>

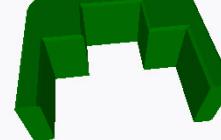
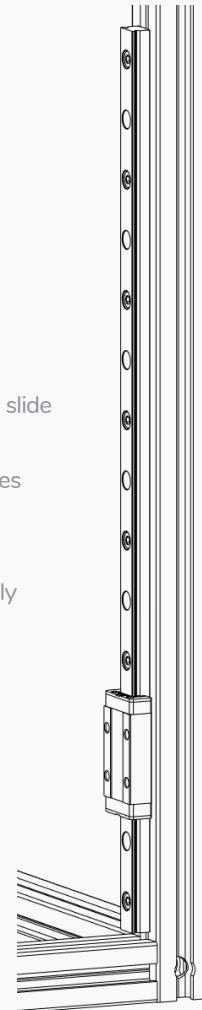
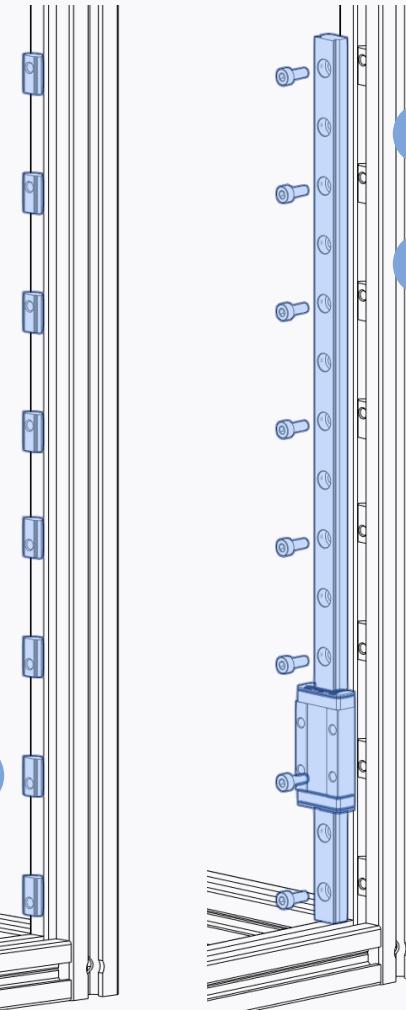
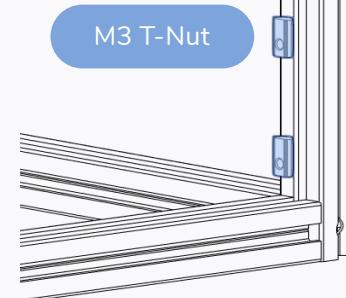
If you build a bigger Version than a 250mm, you need more screws / m3-T-Nuts. Start from the outer holes in the rail and work your way towards the middle screwing the rail down every second hole. The carriages are designed to slide along the rail easily. This unfortunately also includes sliding off the rails. Dropping the carriage likely irreparably damages it. **ALWAYS** put the little black rubber Carriage stoppers back on the rail (into the holes without screws) until your printer ist up and runnning!

## Z RAILS



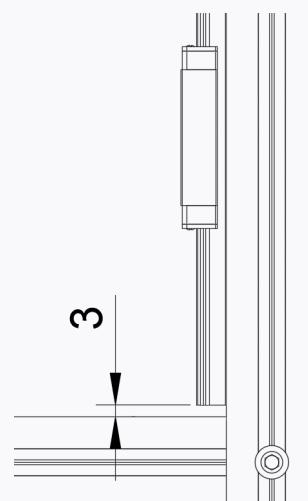
### WHY IS THIS HERE?

As you likely skipped over the advice to flip through the entire manual we added graphics like these to assist you with the orientation of the part before you actually put them on the printer.

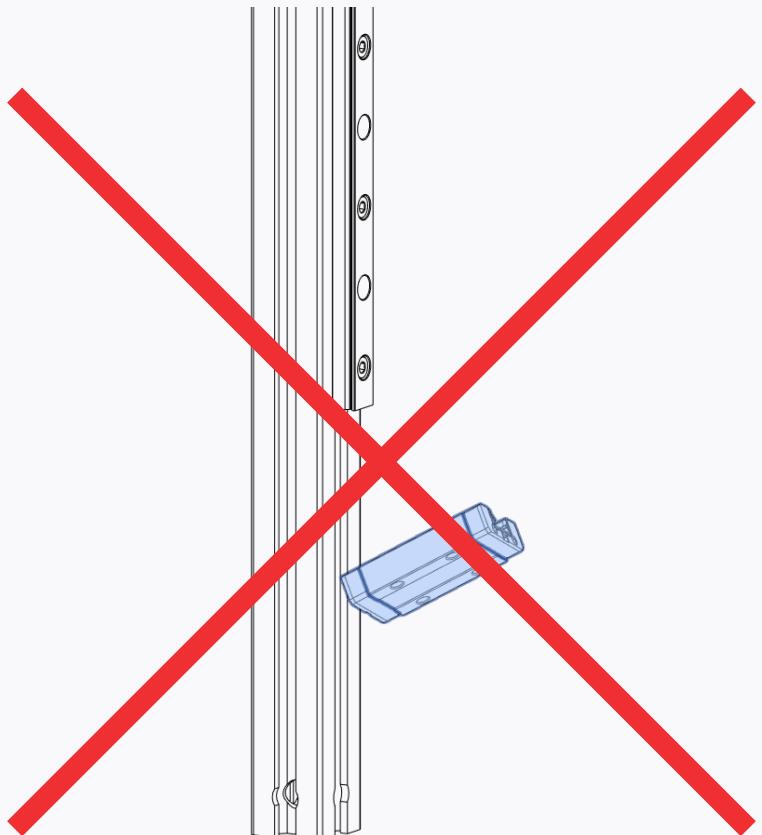


### CENTRED RAIL INSTALLATION GUIDE

Use the MGN9 guides to position the rail in the center of the extrusion prior to fastening the screws.



**BOTTOM GAP**  
Leave a gap between the printer frame and the rail. ~3mm is fine.



#### RAIL SAFETY

As we will turn the printer upside down during further assembly make sure to fix each carriage in position with a piece of sticky tape.

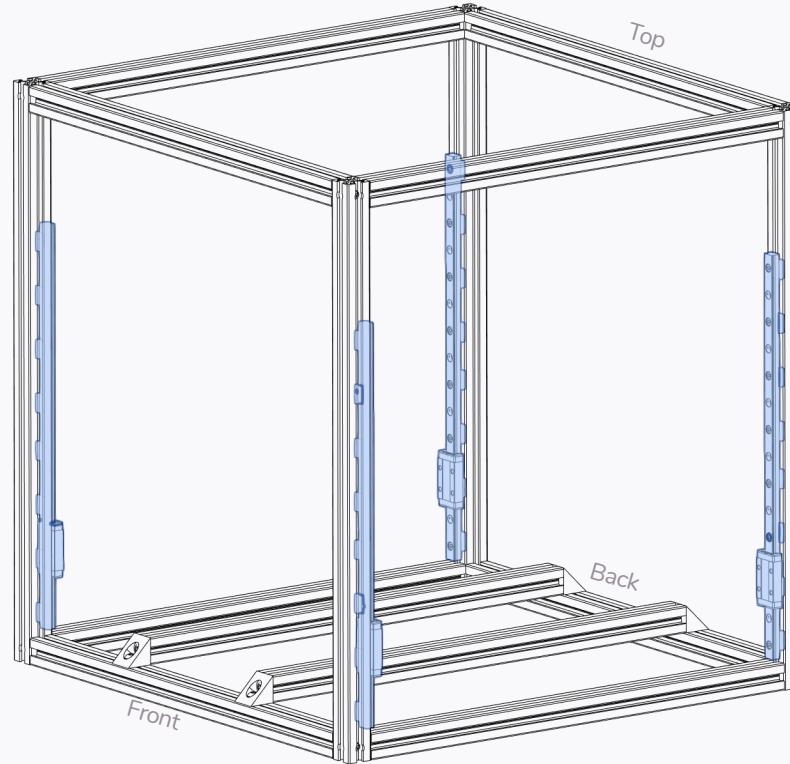
If your rails were delivered with plastic stoppers you can also temporarily reinstall them to prevent carriages from falling off their rails and spilling their bearing balls..

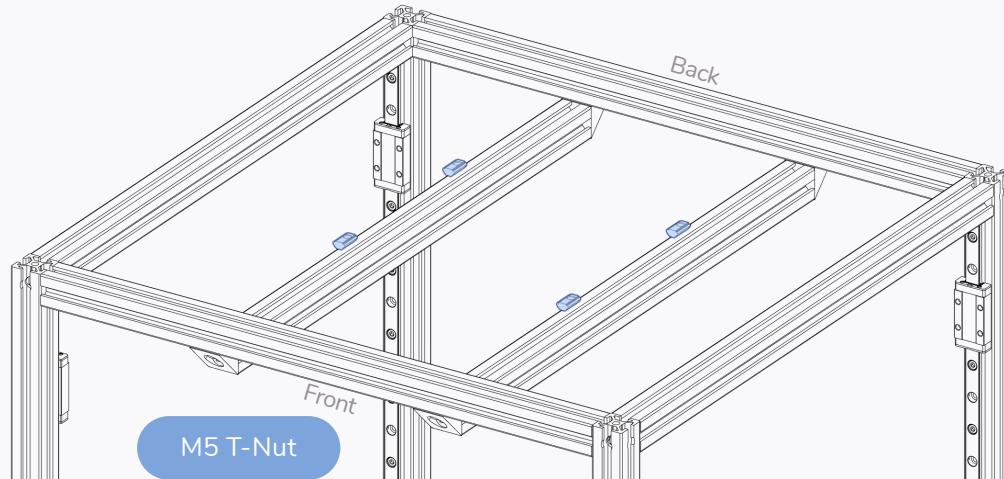
For illustration purposes only. Do not attempt to replicate.

**INSTALL REMAINING Z RAILS**

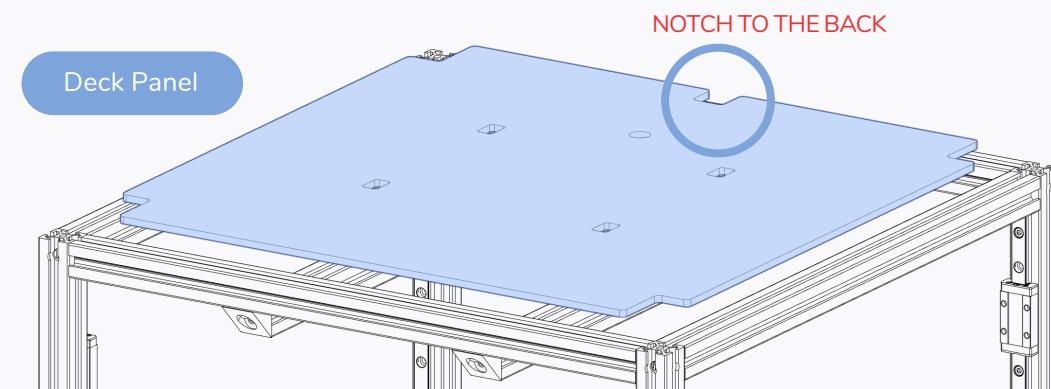
Add the remaining Z rails  
following the same instructions.

Make sure the rails face each  
other as shown in the graphic.



**FLIP PRINTER UPSIDE DOWN**

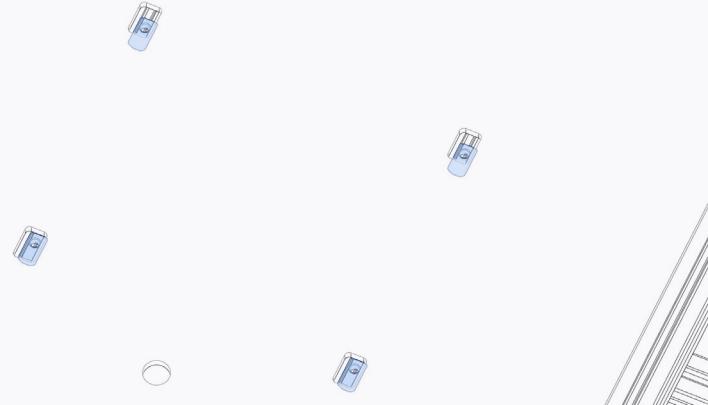
It's easier working with gravity than against it. But make sure the rail carriages are secure before doing so.



The DIN-Rails need to be rotated 90 Degrees so the cables are long enough later. They should run parallel to the bed extrusions (from front to back).

## DECK PANEL

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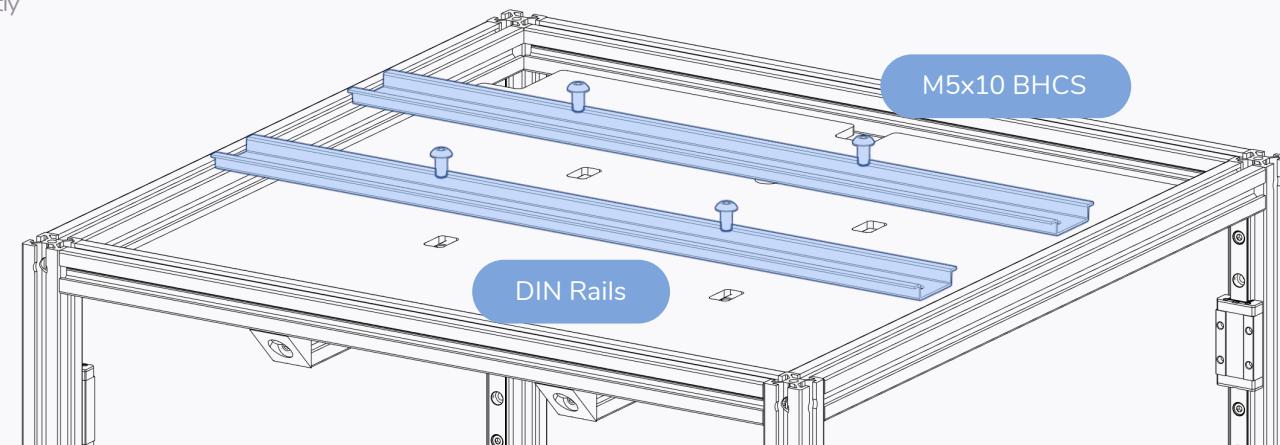


### ALIGN T-NUTS WITH HOLES

Position the 4 T-nuts so they are directly below the 4 holes in the deck panel.

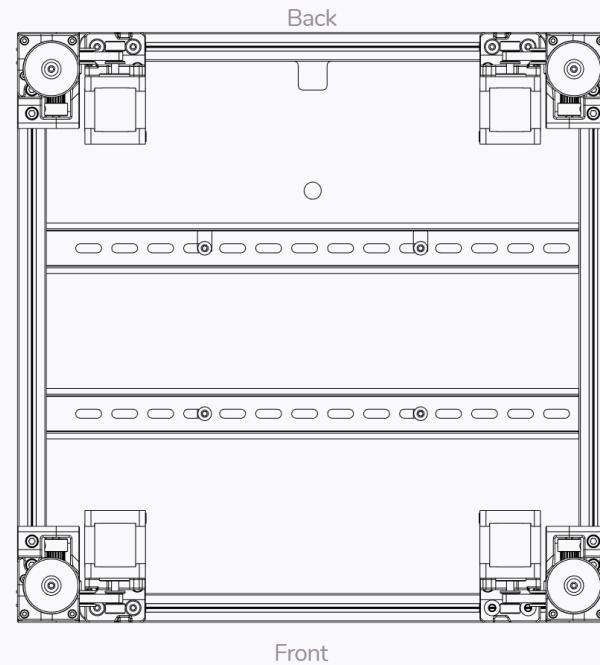
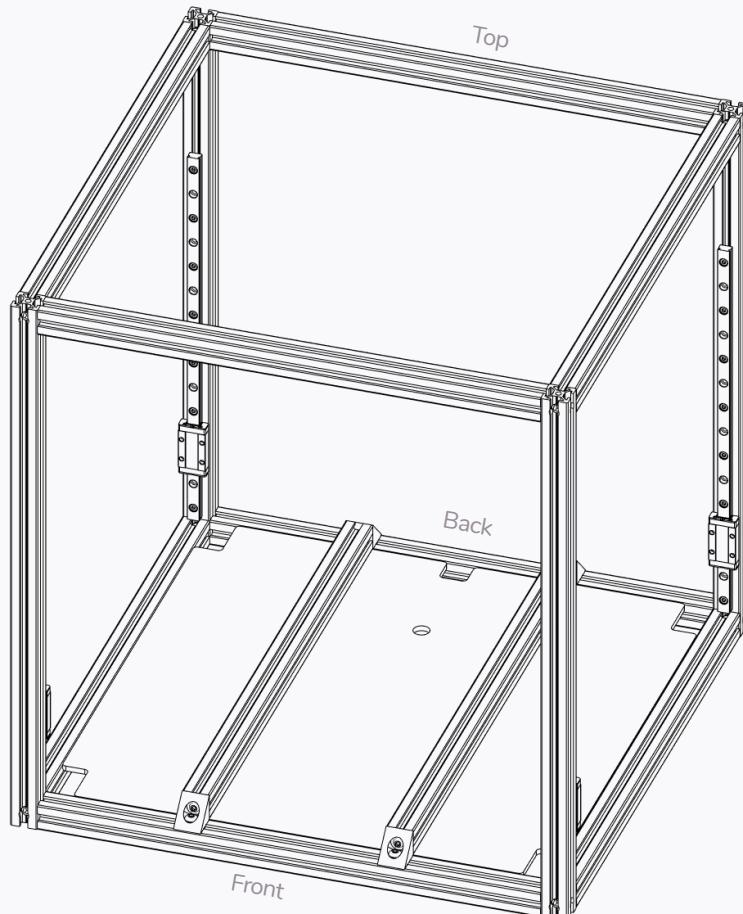
### DIN RAIL SLOTS

If the slots in the rails do not line up with the t-nut you can shorten the DIN rails by a few mm.



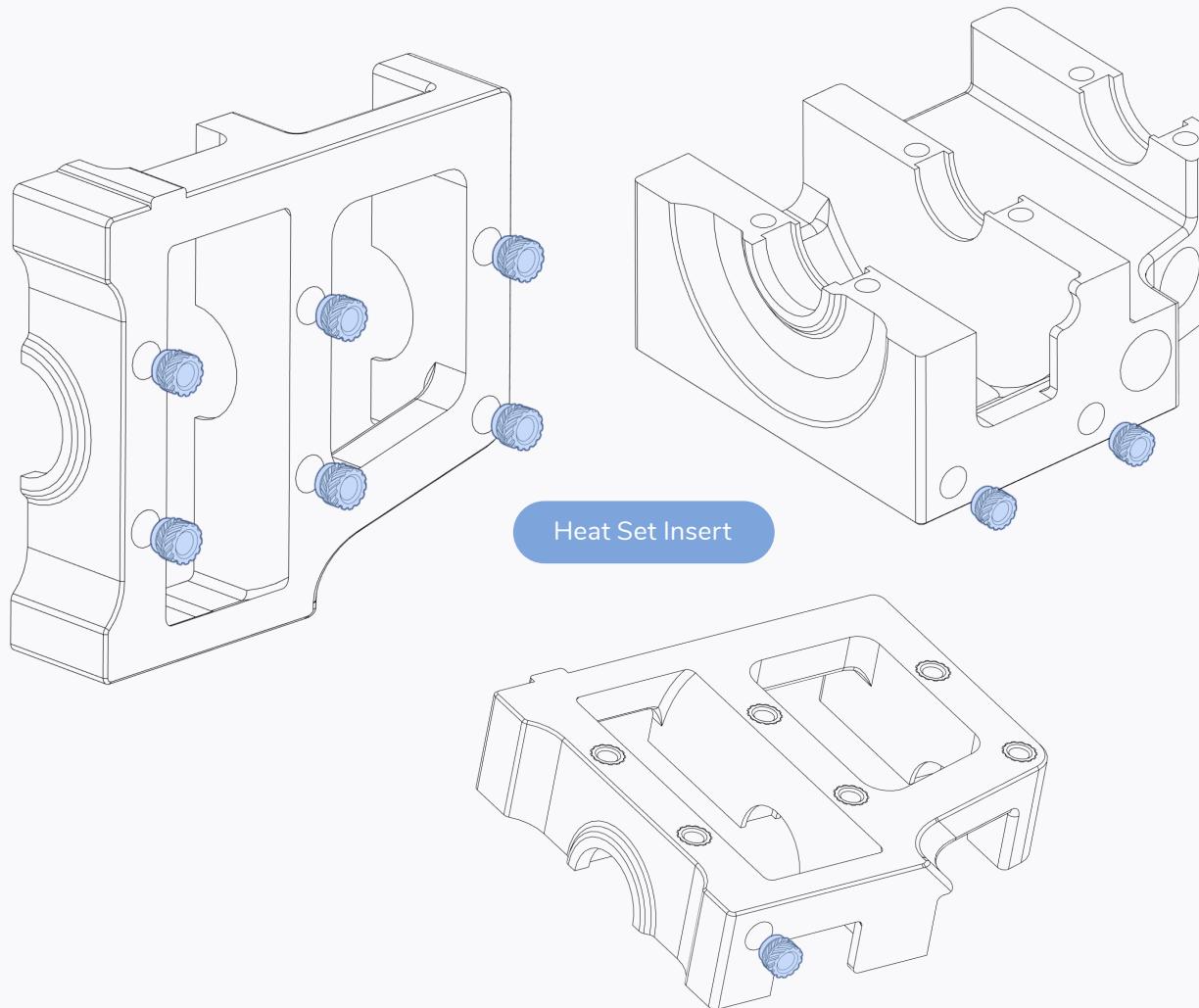
## ORIENTATION

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## PRINTER ORIENTATION

We regularly insert graphics like the ones above to help you along the build process. The sides are labeled to make it easier to keep track.



#### HEAT SET INSERTS

This design relies heavily on heat set inserts. Make sure you have the proper inserts (check the hardware reference for a close up picture and the BOM for dimensions).

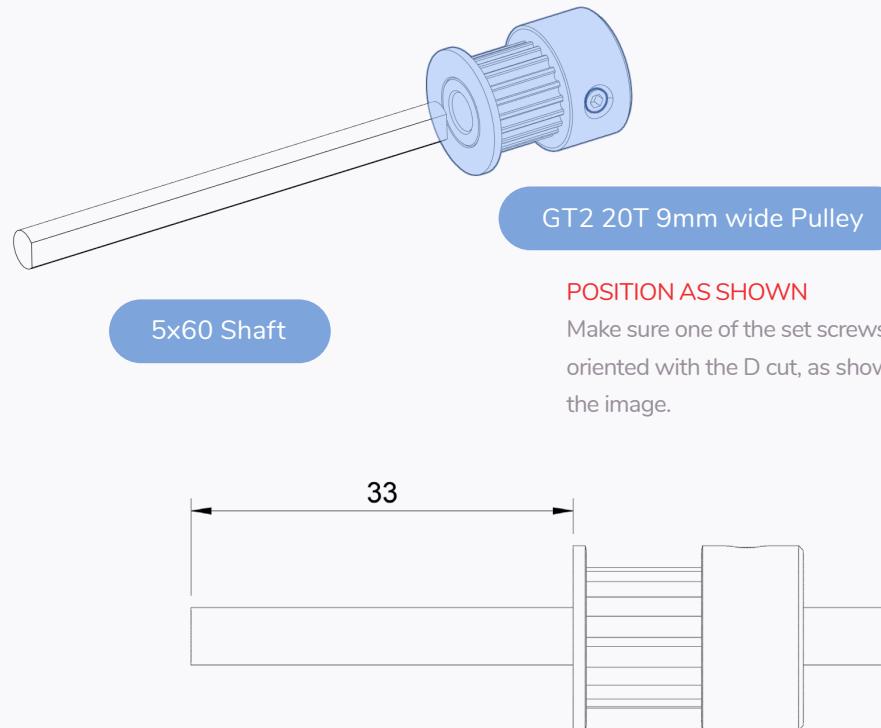
If you've never worked with heat set inserts before we recommend you watch the linked guide.



<https://voron.link/m5ybt4d>

## BELT DRIVE ASSEMBLY

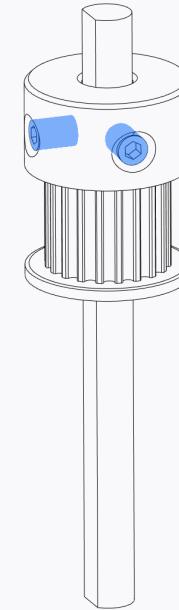
WWW.VORONDESIGN.COM



GT2 20T 9mm wide Pulley

### POSITION AS SHOWN

Make sure one of the set screws is oriented with the D cut, as shown in the image.



### SET SCREWS

#### AKA THE ROOT OF ALL ISSUES

Insert both set screws and use thread locker on all set screws.

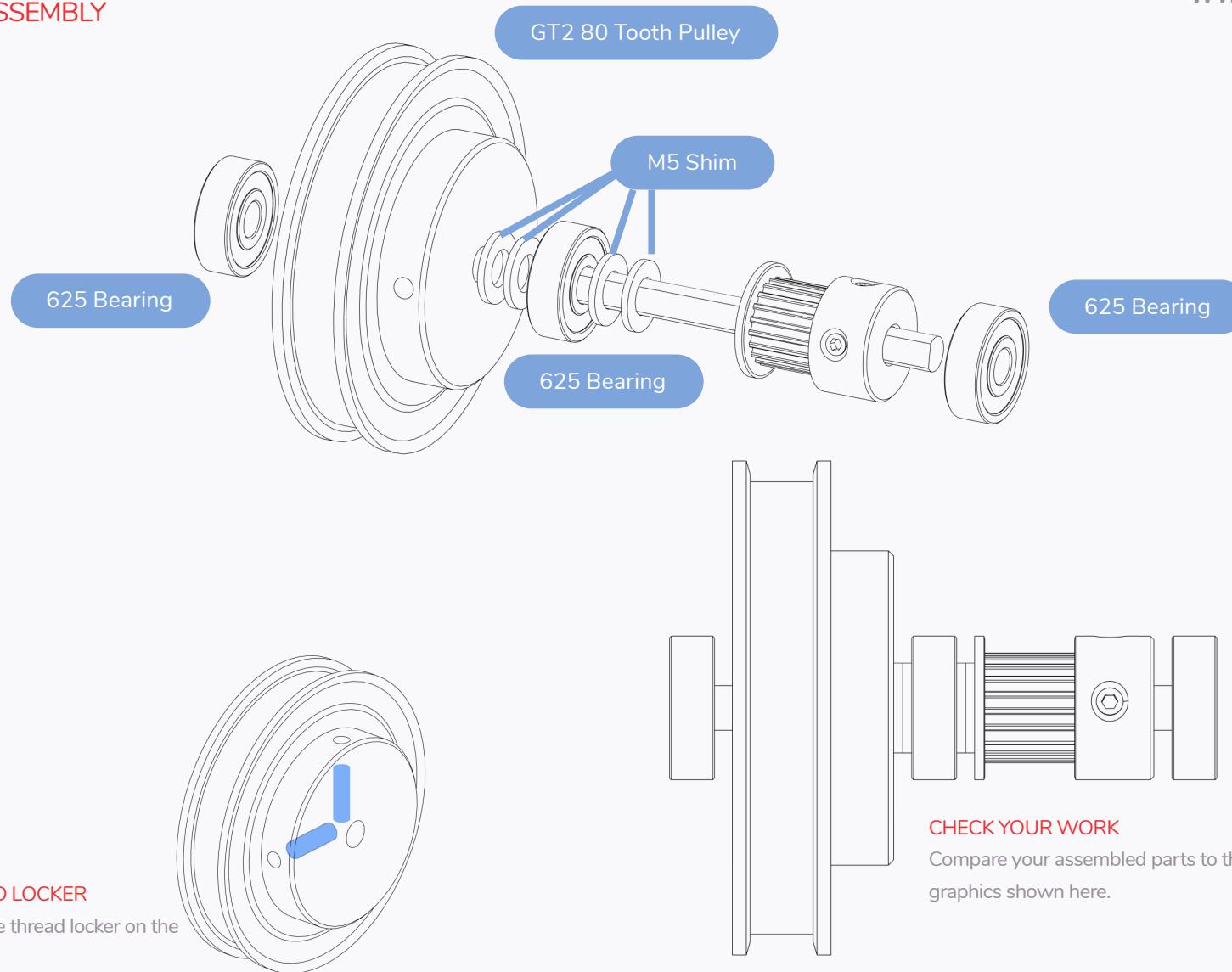
Use a high quality hex driver to prevent the hex profile from stripping. Ball-end drivers are not recommended.

Loose set screws account for the majority of issues that our users report. Save yourself hours of troubleshooting and apply thread locker to all set screws during the build.

See the product's application notes for instructions - keep away from printed parts.

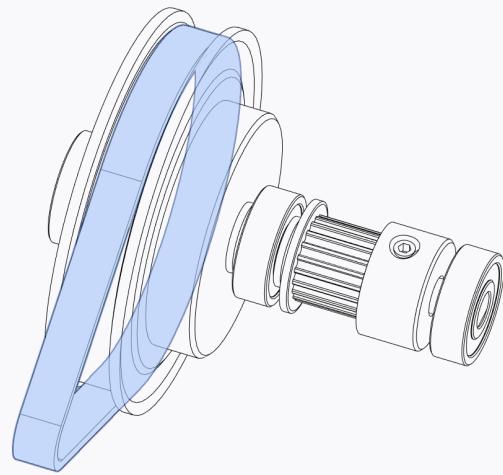
## BELT DRIVE ASSEMBLY

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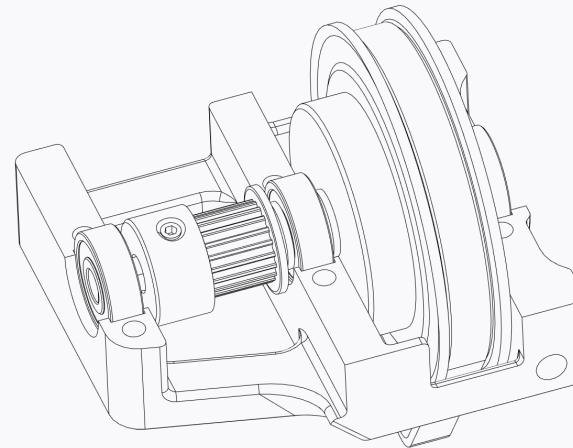
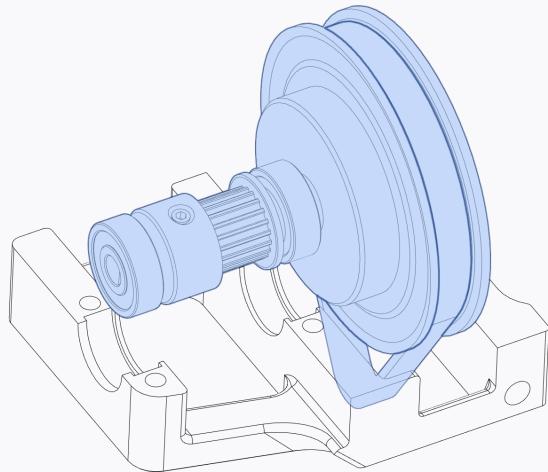


Z DRIVE

WWW.VORONDESIGN.COM

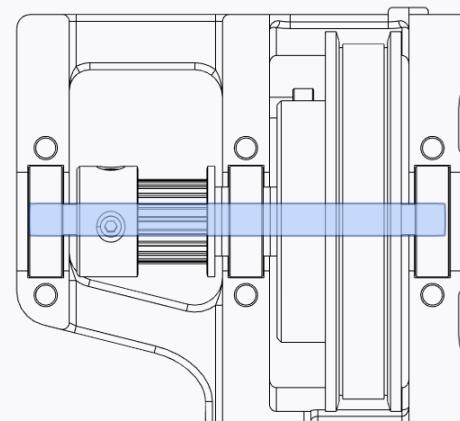


GT2 188mm Belt Loop



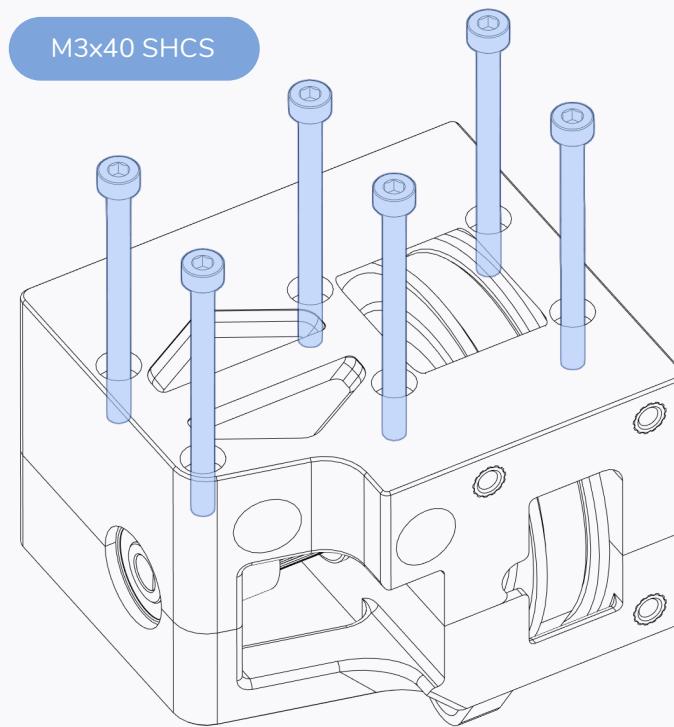
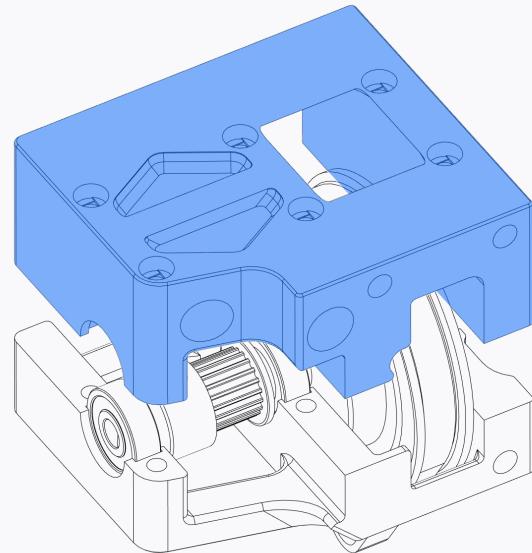
**CHECK SHAFT POSITION**

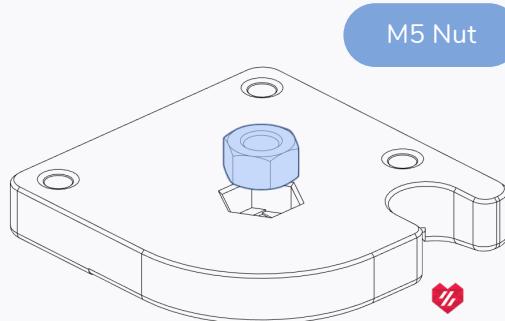
Compare your assembled parts to the graphics shown here.



Z DRIVE

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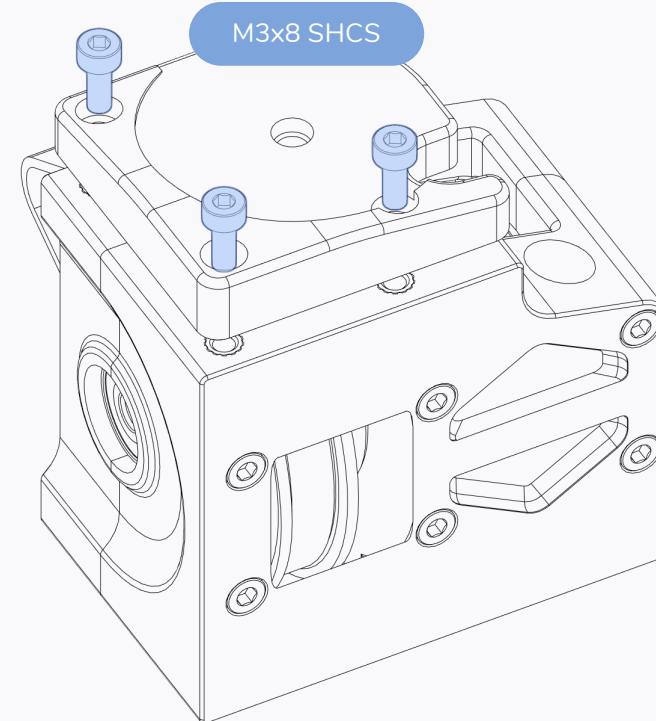




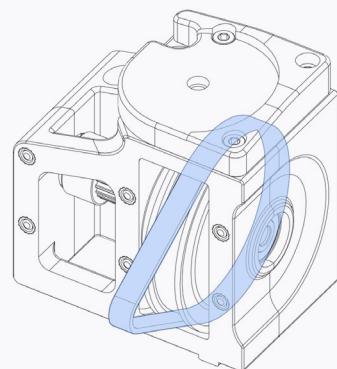
M5 Nut

**ACCENT PART?**

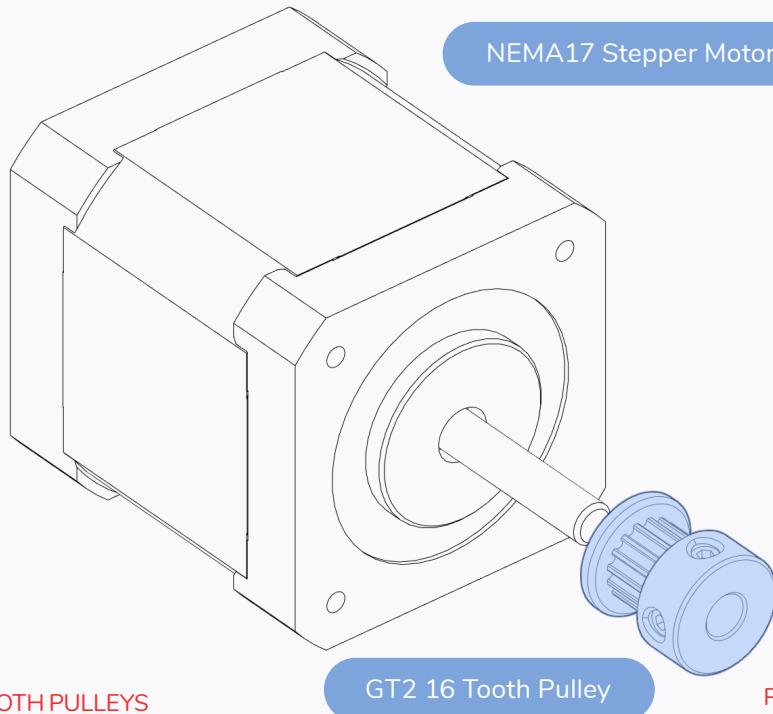
Look for Voron heart next to the part.  
It indicates that this is an accent part.



M3x8 SHCS

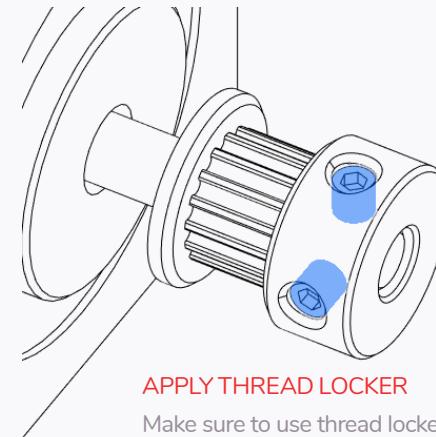
**CHECK FOR BELT**

Make sure the closed belt loop is in the part.



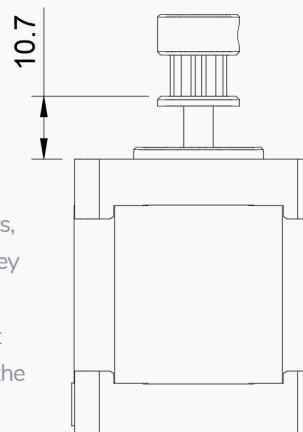
#### 16 TOOTH PULLEYS

The Z drive motors are the only place in the printer that use 16 tooth pulleys! Remove the pulleys from your work surface after you finish this chapter.



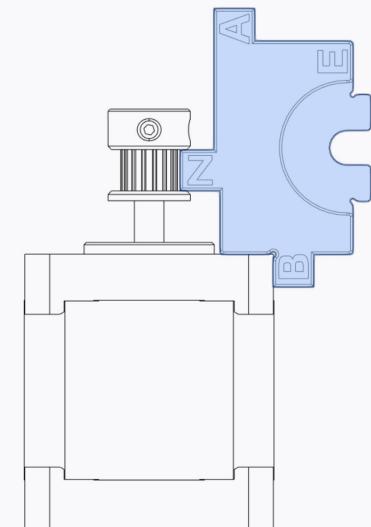
#### APPLY THREAD LOCKER

Make sure to use thread locker on the set screws. Ensure that at least one of the set screws is contacting the flat section of the drive shaft.

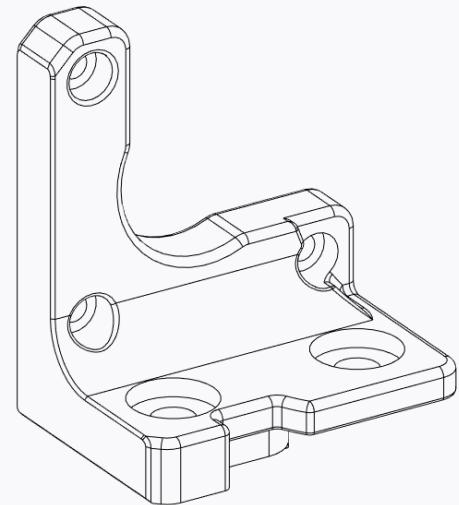


#### PULLEY POSITION

Depending on your motors, you may find that the pulley sits better in the opposite orientation. The important thing is the placement of the actual teeth.

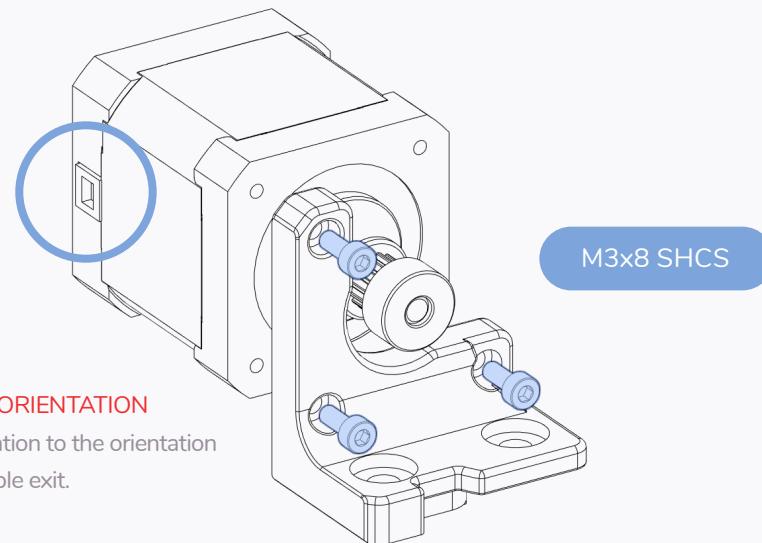


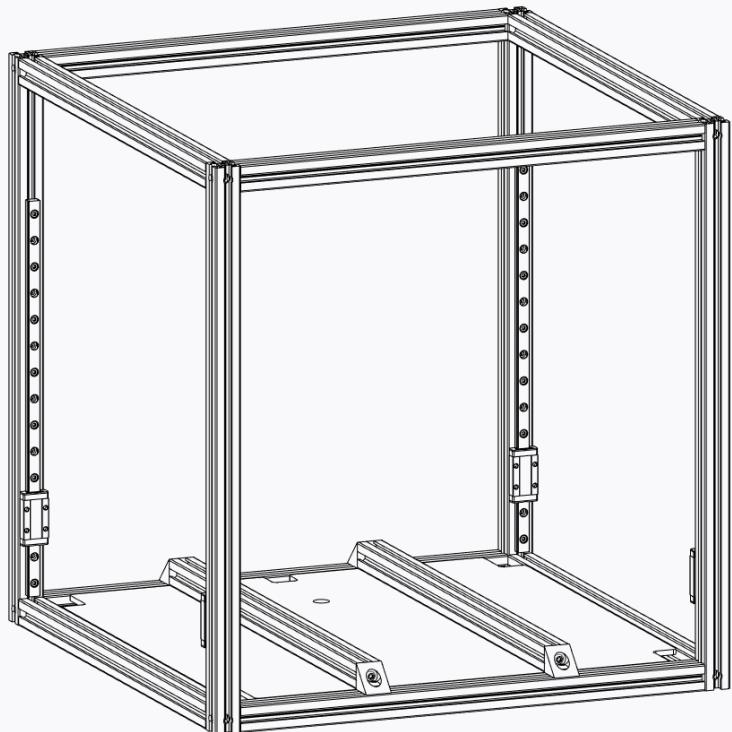
<https://voron.link/fx10m8e>



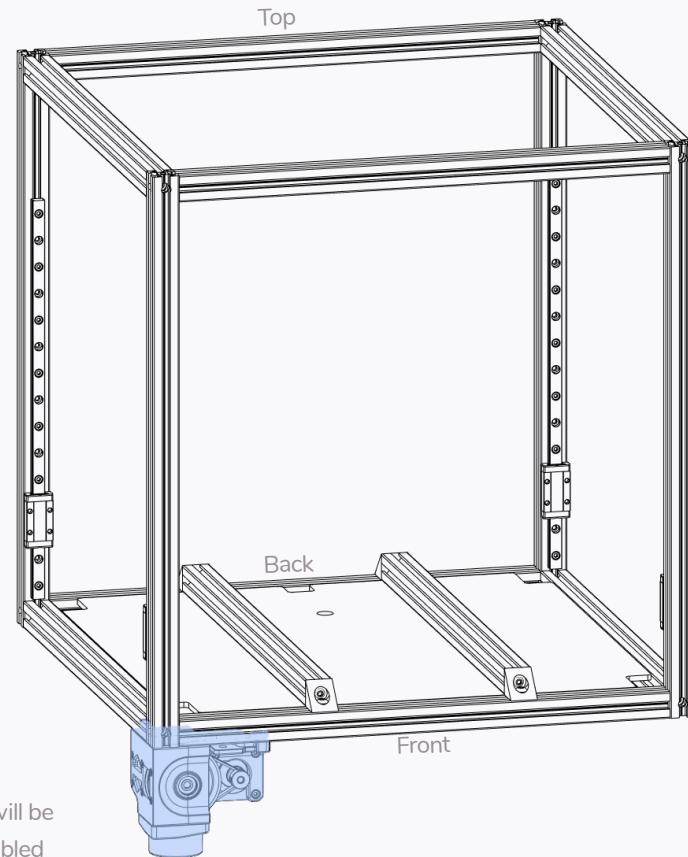
MOTOR ORIENTATION

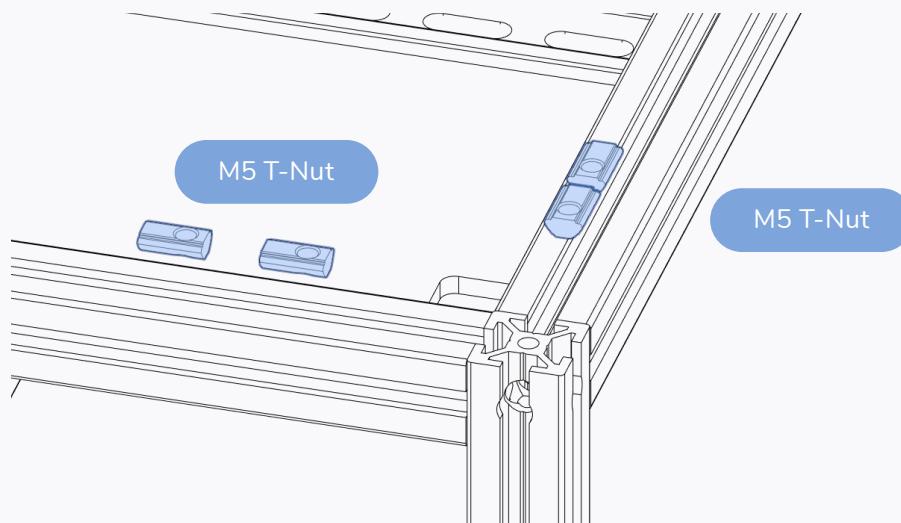
Pay attention to the orientation  
of the cable exit.



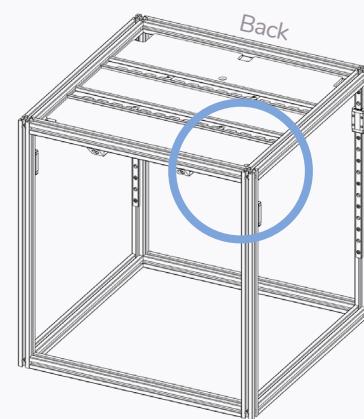
**PICTURE FOR ORIENTATION**

The Z0 drive is the first Z drive that will be added to the printer. The fully assembled Z Drive is highlighted in blue.

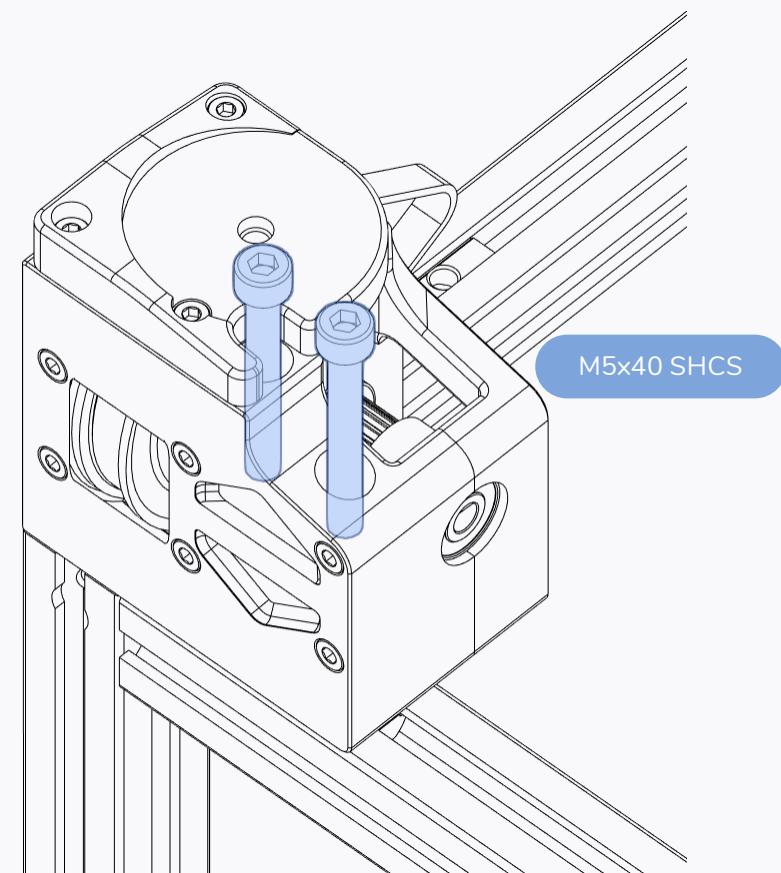


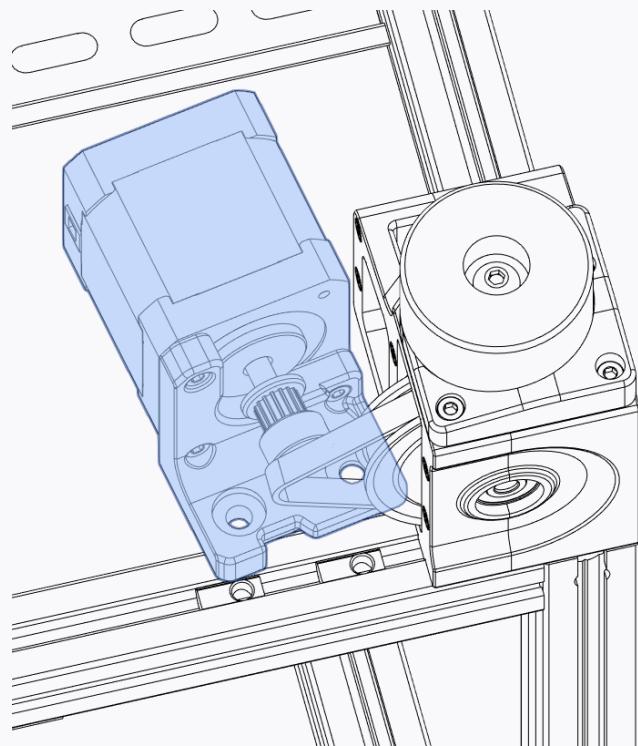
**WHICH CORNER IS THIS?**

We highlighted the corner with a circle.

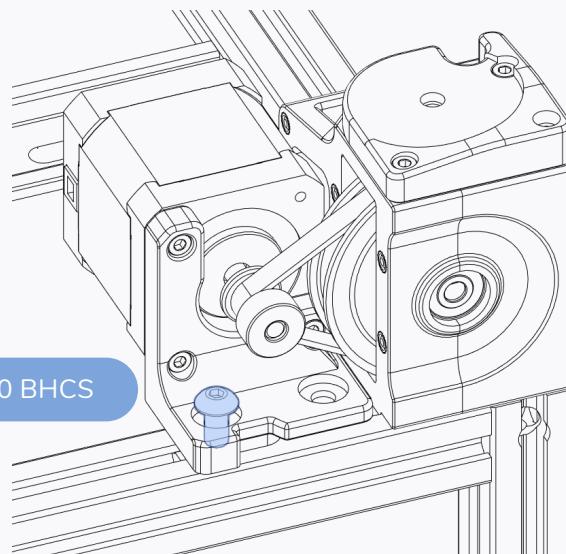
**UPSIDE DOWN ASSEMBLY**

For ease of assembly we recommend flipping the printer on its head for the next steps.



**SLIDE INTO PLACE**

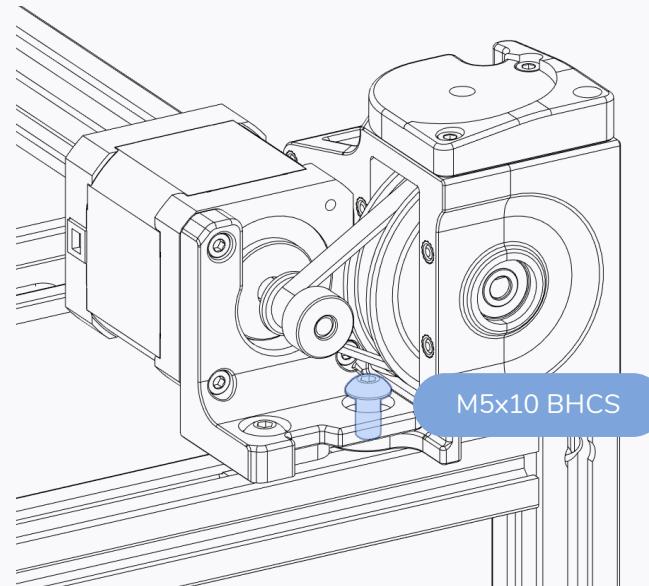
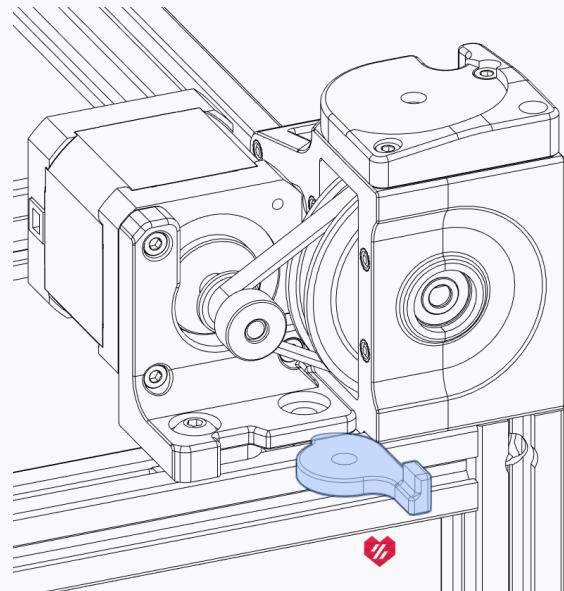
Insert at an angle and slide into place.

**M5x10 BHCS****DON'T TIGHTEN**

Leave the bolt loose for the next step.

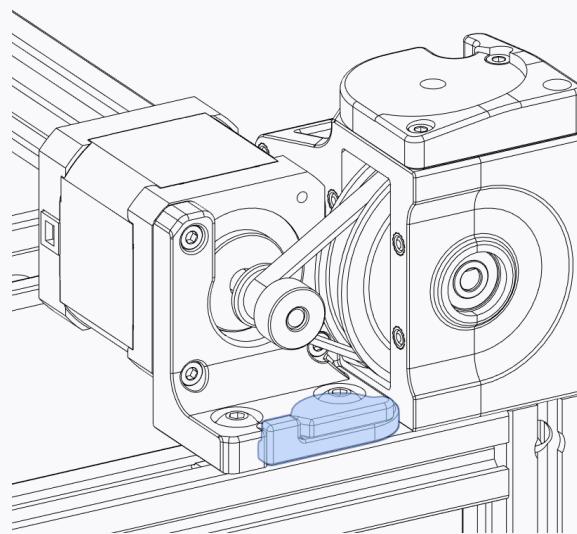
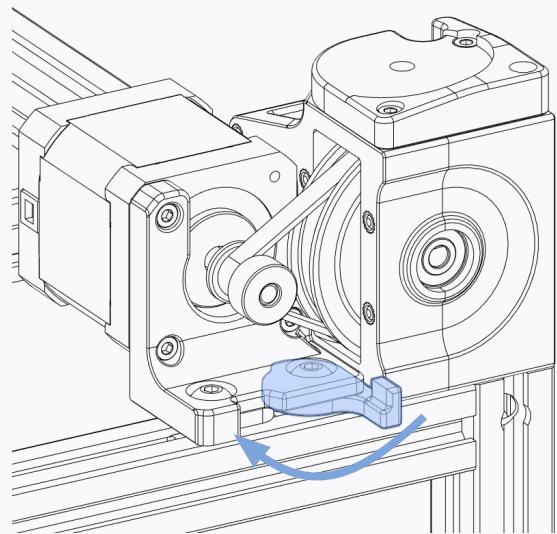
Z DRIVE

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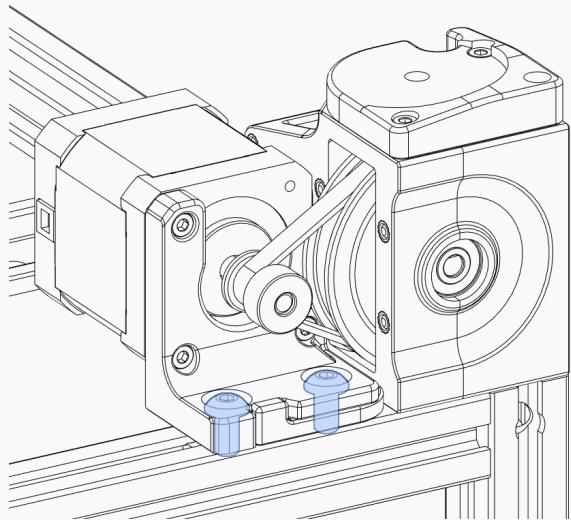
DON'T TIGHTEN

Leave the bolt loose for the next step.

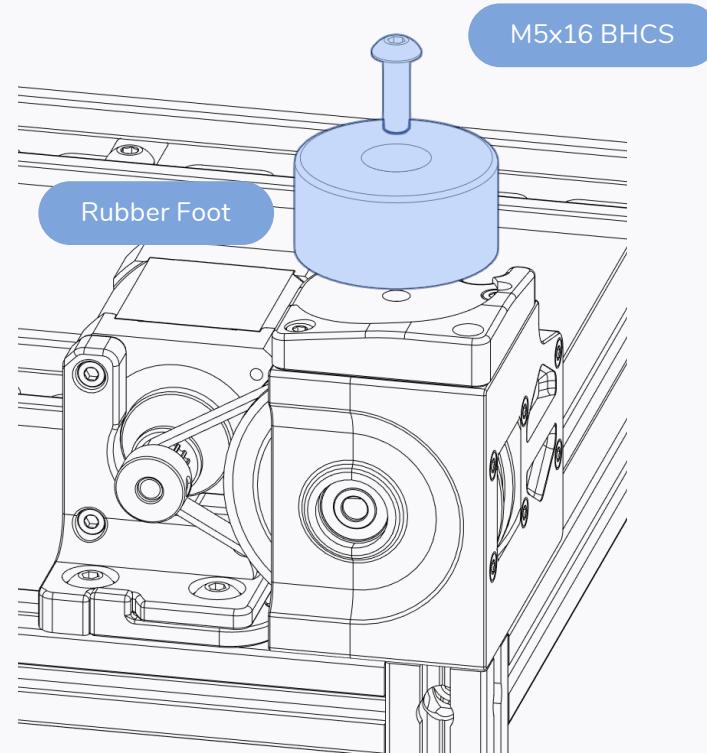


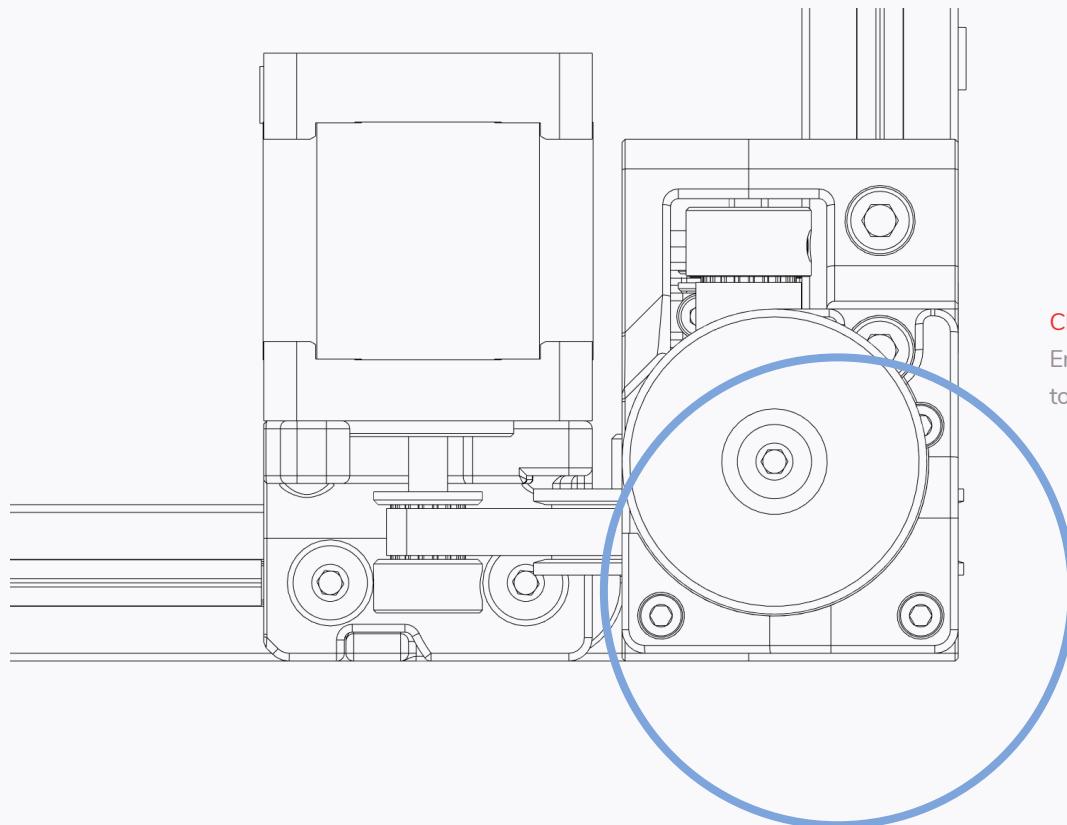
CLOSE THE BELT TENSIONER

Flip the belt tensioner latch closed.

**TIGHTEN BOLTS**

After closing the tensioner the M5 bolts can be properly fastened.



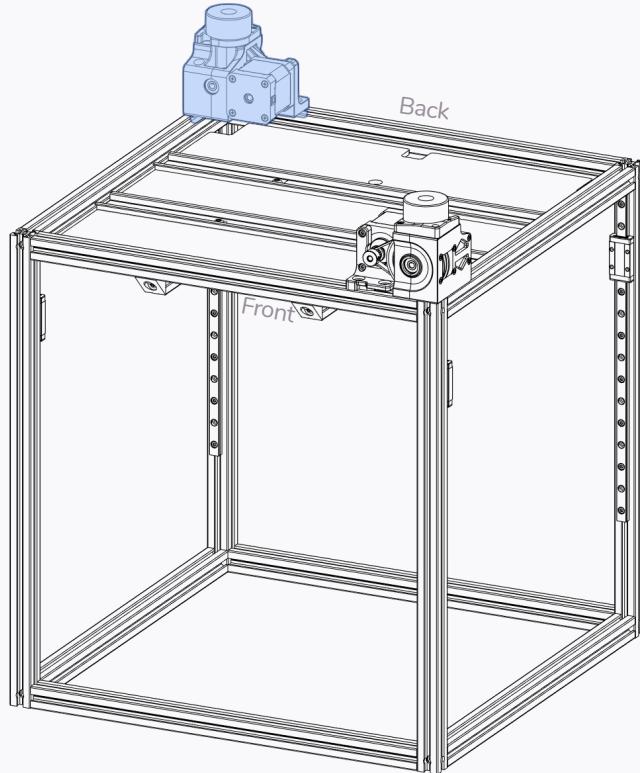


**CHECK POSITION**

Ensure that closing the belt tensioner did not cause the Z Drive to move/shift. If it did undo the bolts and realign.

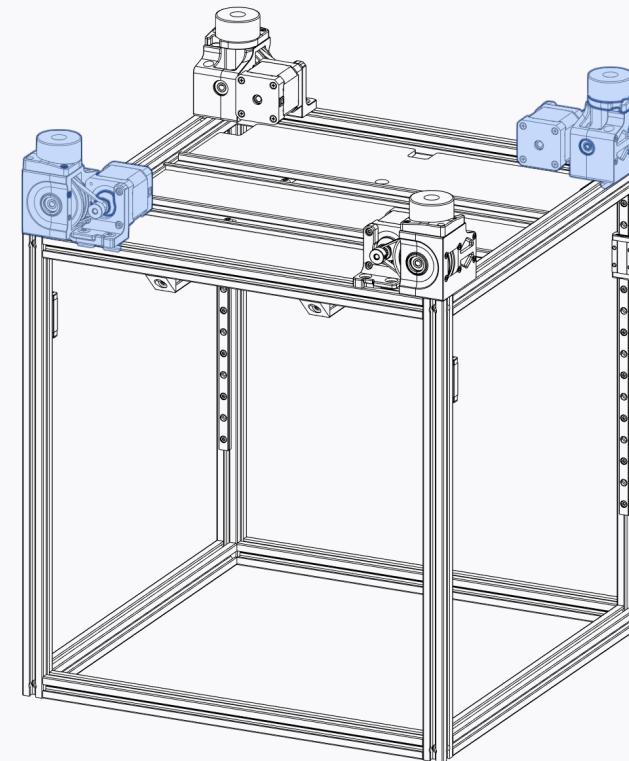
## OTHER Z DRIVES

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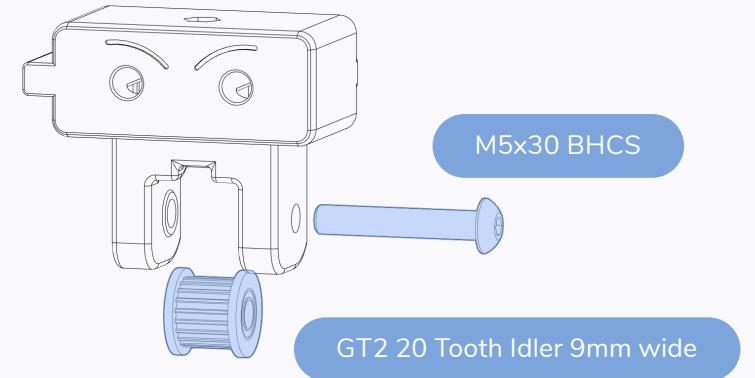
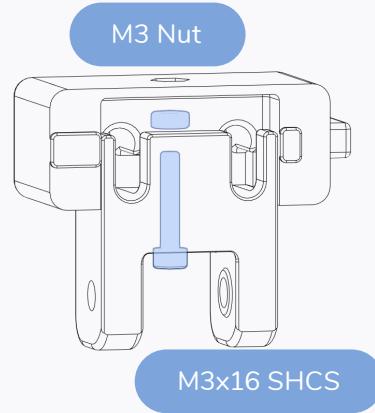
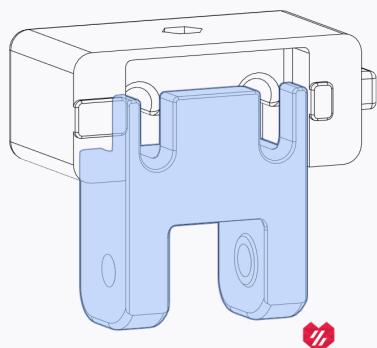
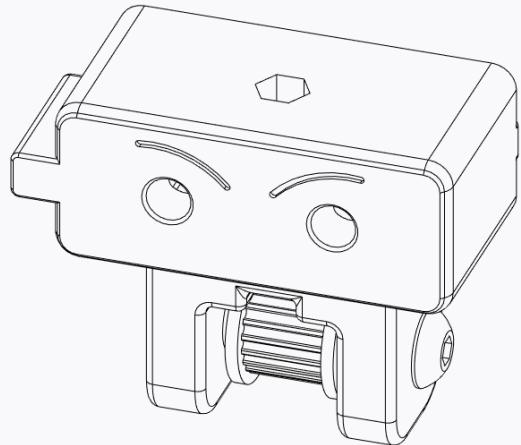
### REPEAT INSTRUCTIONS FOR OPPOSING CORNER

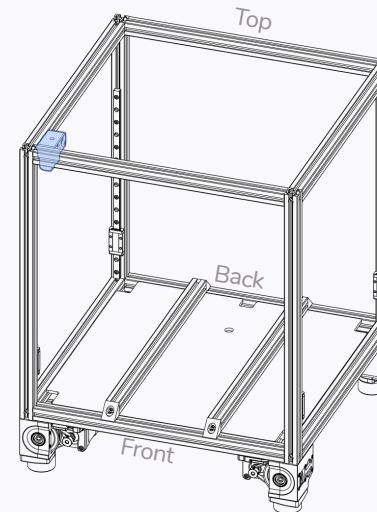
Build another Z drive, following the same instructions.



### REPEAT INSTRUCTIONS FOR THE MIRRORED DRIVES

Build two more Z drives following the instructions that came before. The printed parts are mirrored.

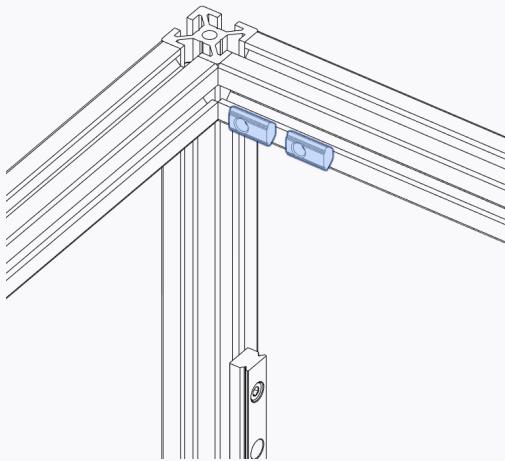




#### IDLER ORIENTATION

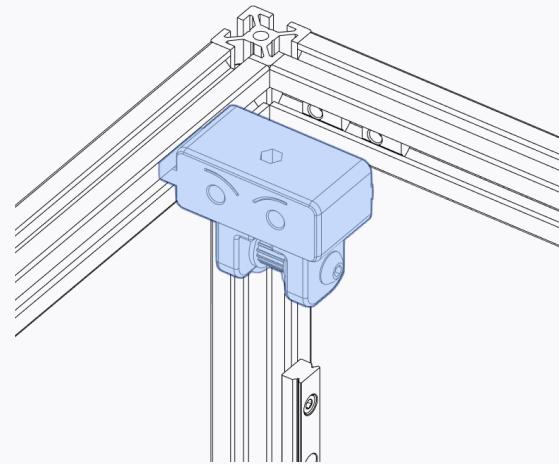
Mind the idler orientation. The idler must face in the same orientation as the pulley in the drive below it.

M5 T-Nut

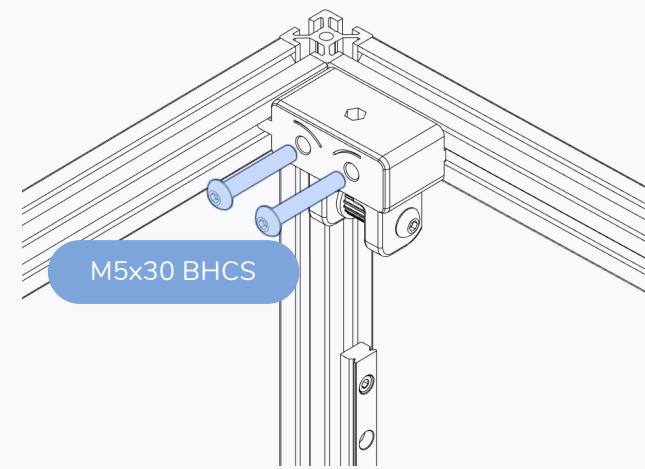


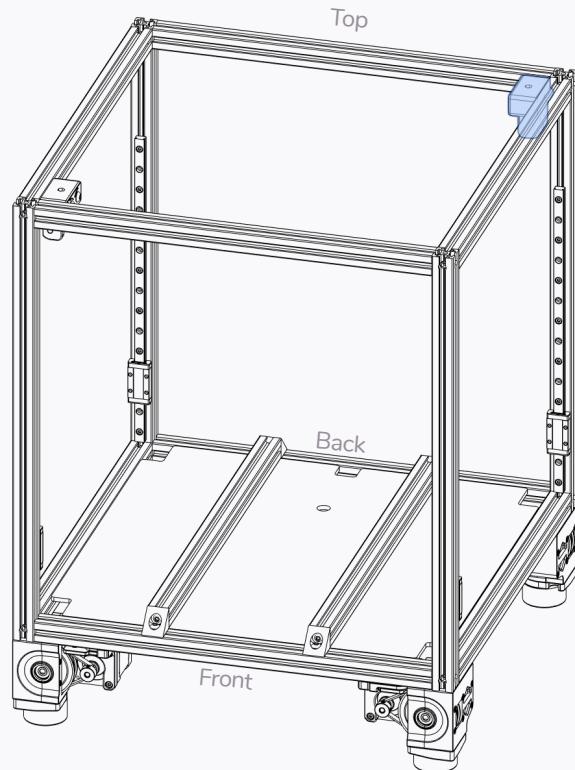
#### SEAT IN CORNER

Ensure idler is pressed firmly into corner before tightening.



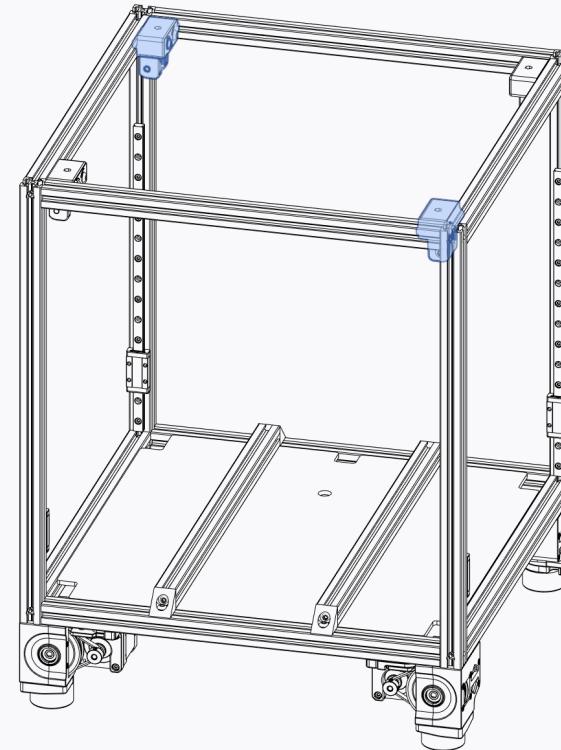
M5x30 BHCS





**REPEAT INSTRUCTIONS FOR OPPOSING CORNER**

Build another Z idler following the same instructions.



**REPEAT INSTRUCTIONS FOR THE MIRRORED DRIVES**

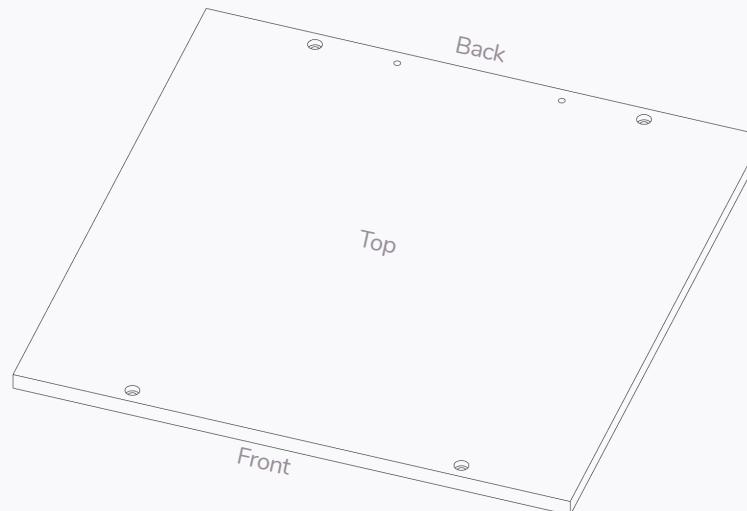
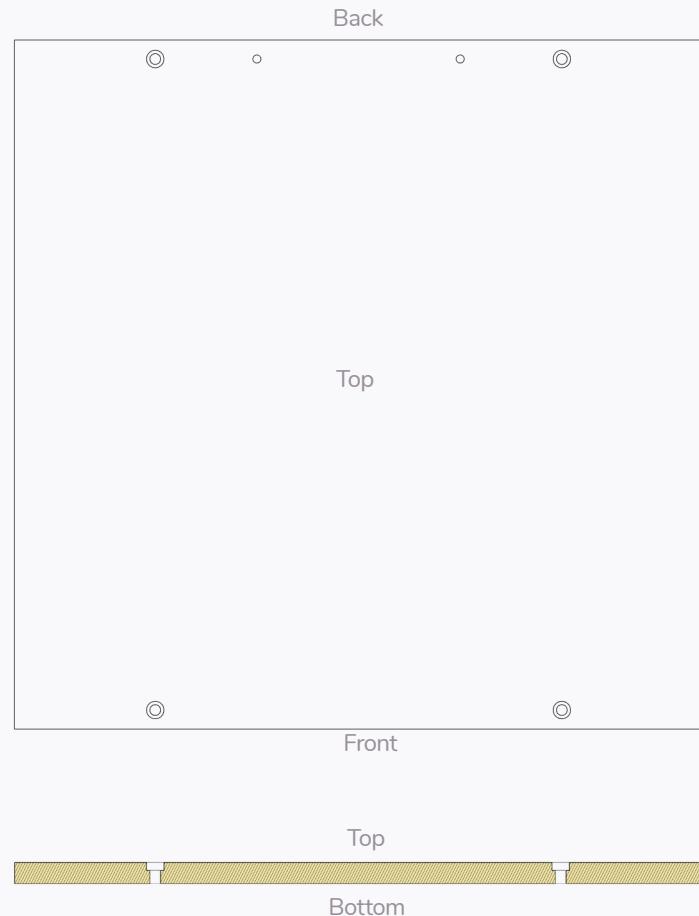
Build two more Z idlers following the instructions that came before. The printed parts are mirrored.

The first design released under the name Voron was the “Voron Geared Extruder”. This was on January 28 2015.

PRINT BED

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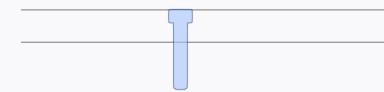


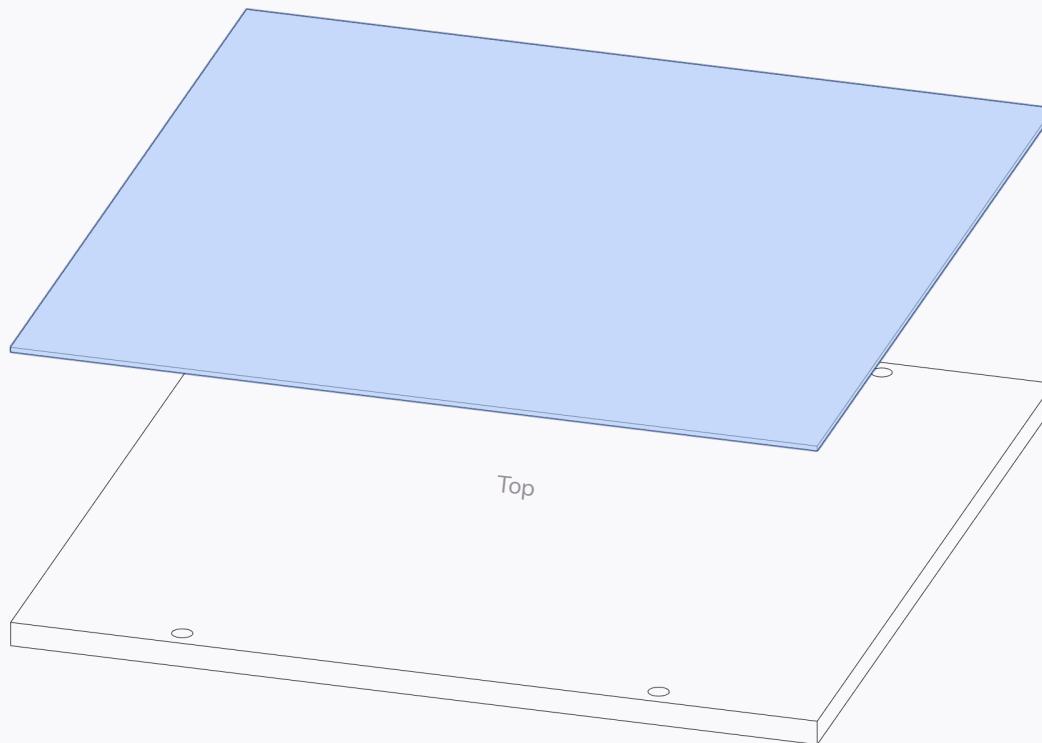


### WHICH SIDE IS WHICH?

The top of the plate has mounting holes with bores that allow boltheads to sit flush/below the surface.

The plate has additional tapped holes to secure the Protective Earth (PE) connection and a thermal fuse, those are on the back side of the plate.





#### MAGNET APPLICATION

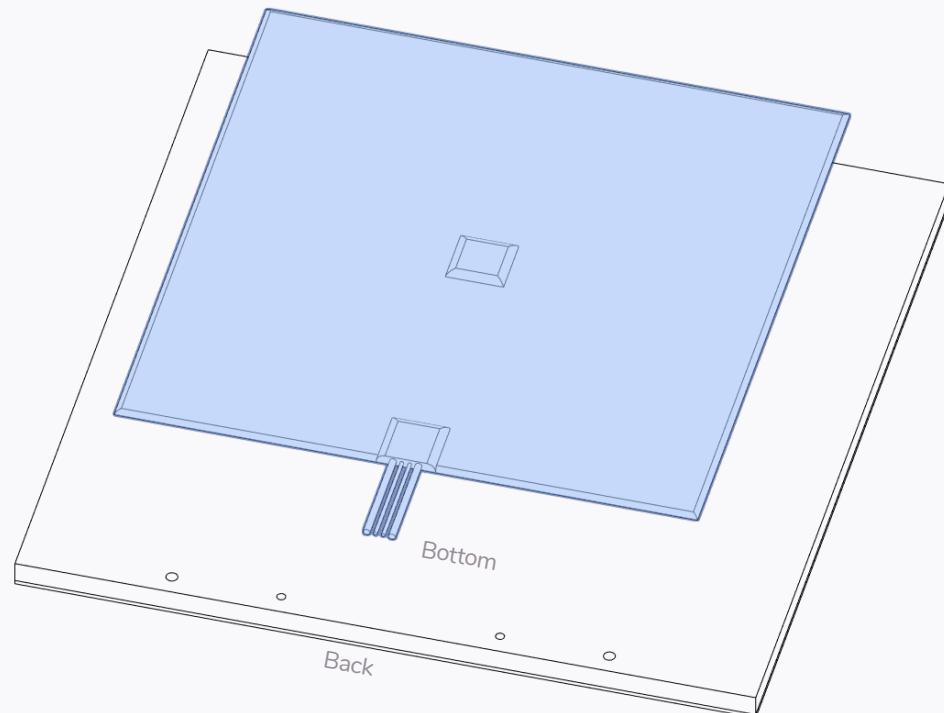
Clean the plate with isopropyl alcohol or similar cleaner prior to applying the magnet.

Use the edge of a plastic object or a small roller to firmly press the magnet on the plate to get a good bond from the adhesive backing.

If you have never done this before we recommend you watch the linked guide.



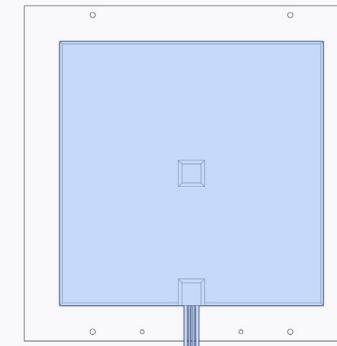
<https://voron.link/rm6tpIld>



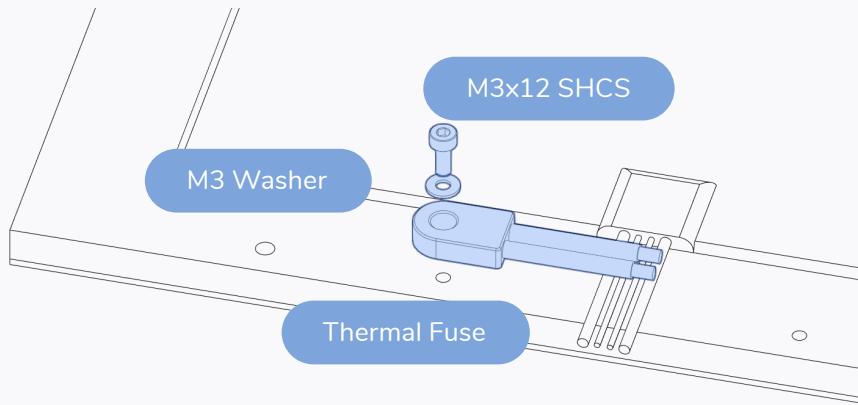
### HEATER APPLICATION

The heater is installed in the same fashion as the magnet.

Centre it on the bottom side of the build plate and make sure to firmly press it onto the build plate.



## HEATED BED

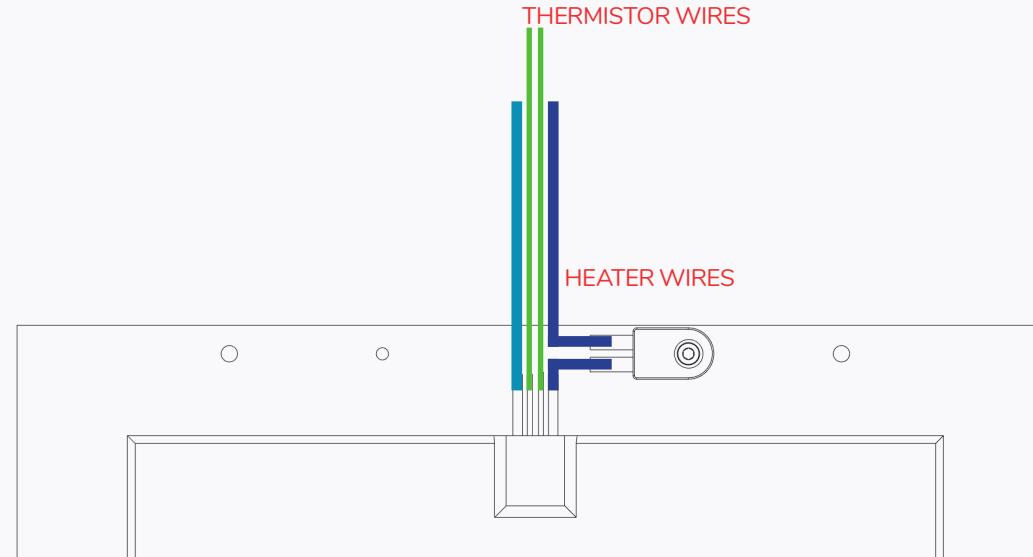


### THERMAL FUSE

While not required to operate the printer, a thermal fuse attached to the build plate adds an additional layer of protection against potentially dangerous malfunctions.

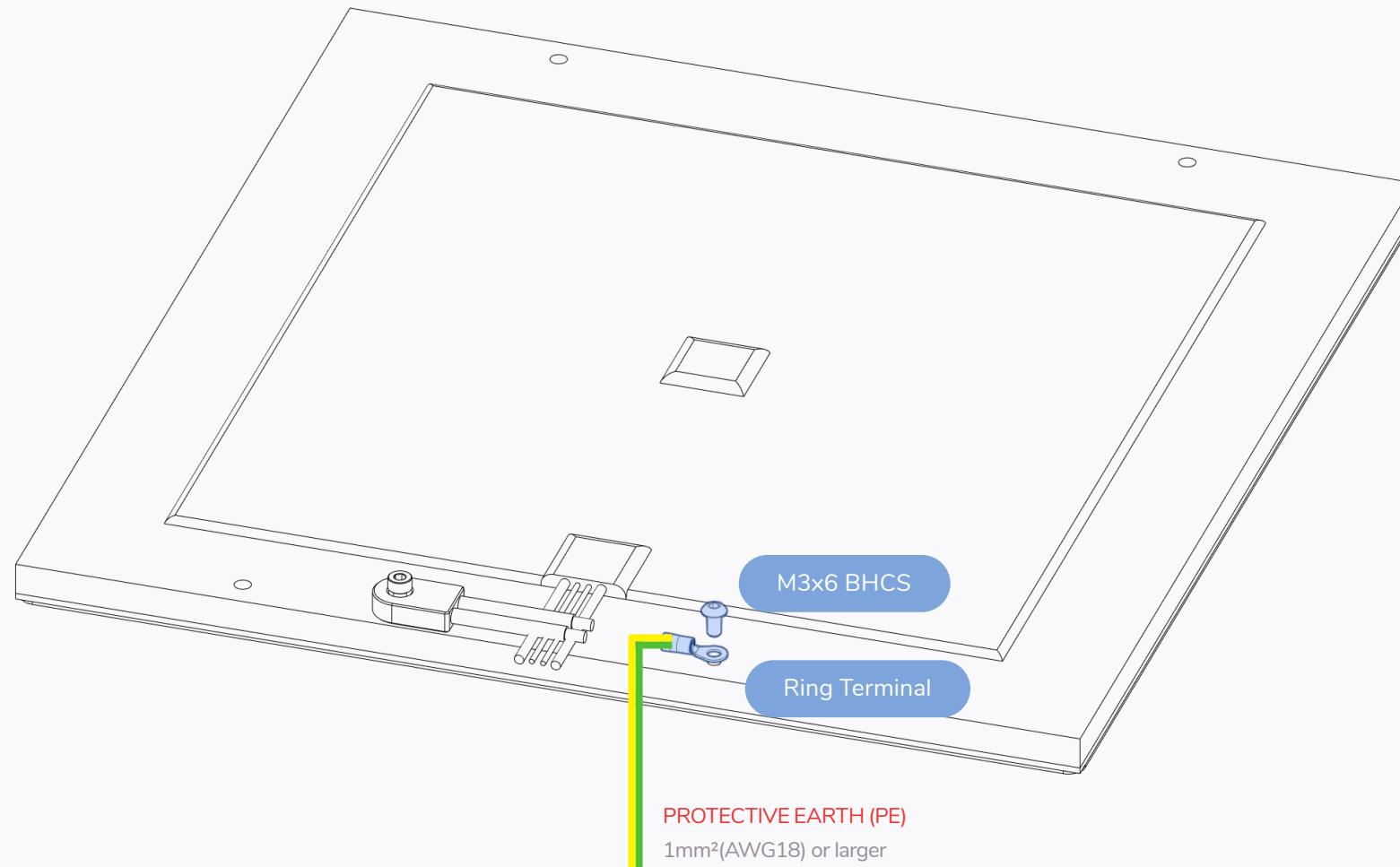
The thermal fuse is wired in-line with the heater wires.

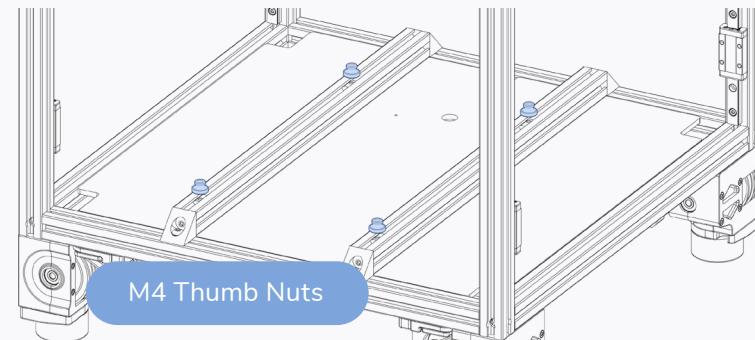
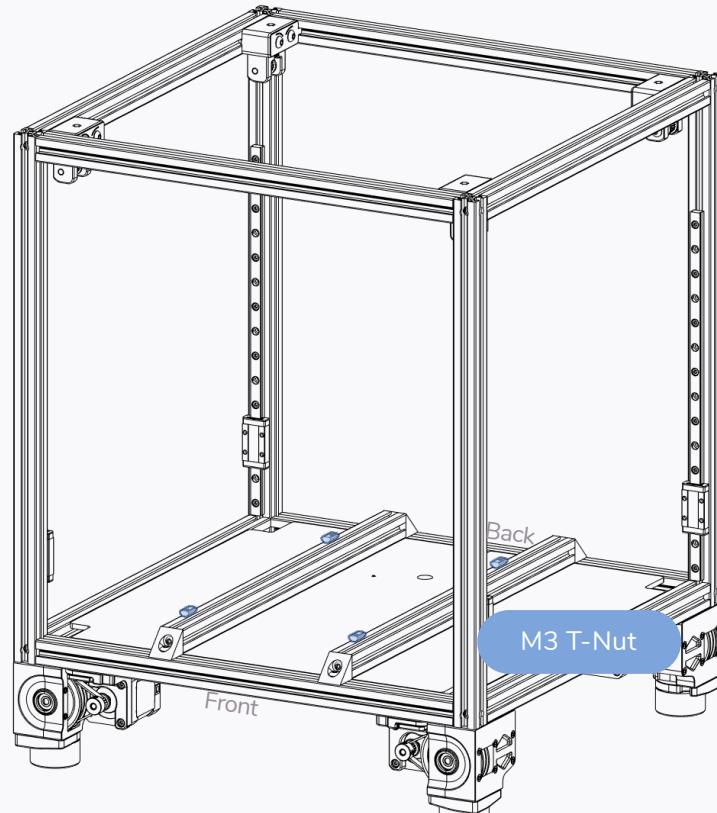
Depending on the tapped holes in the plate you may need to use a shorter bolt.



## HEATED BED

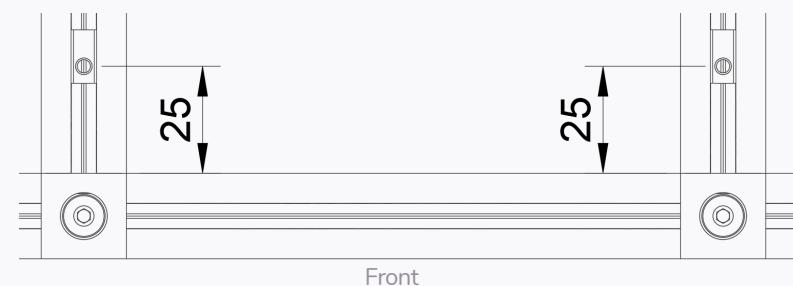
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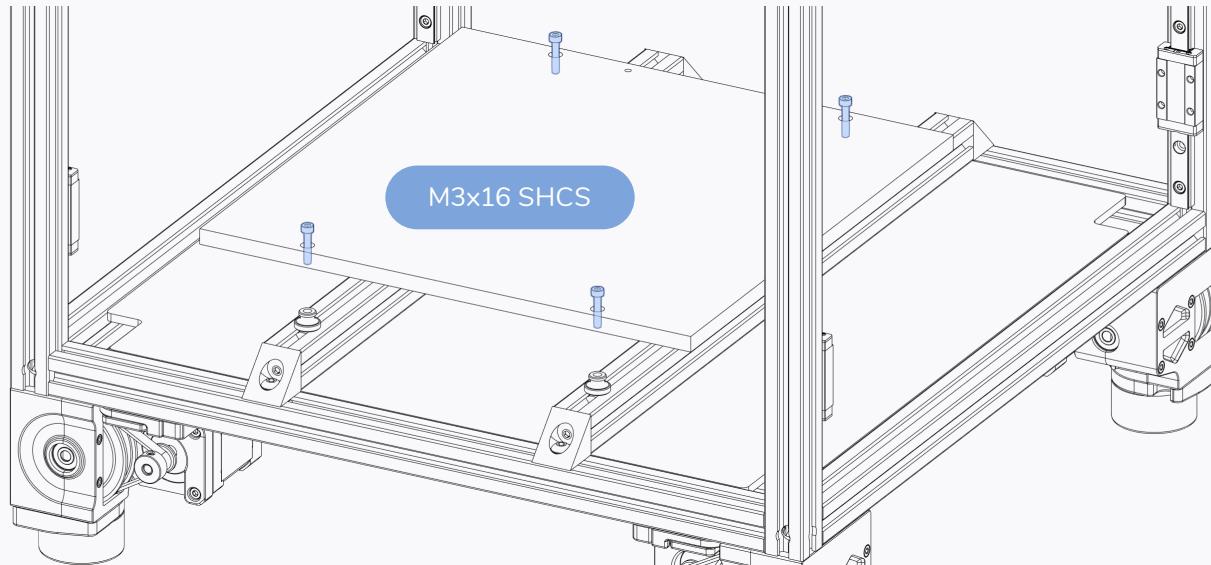
#### M4 NUT FOR A M3 BOLT?

We use the thumb nuts as spacers. You can replace them with different heat resistant spacers of the same length.



## HEATED BED

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### BED AND SPACER THICKNESS

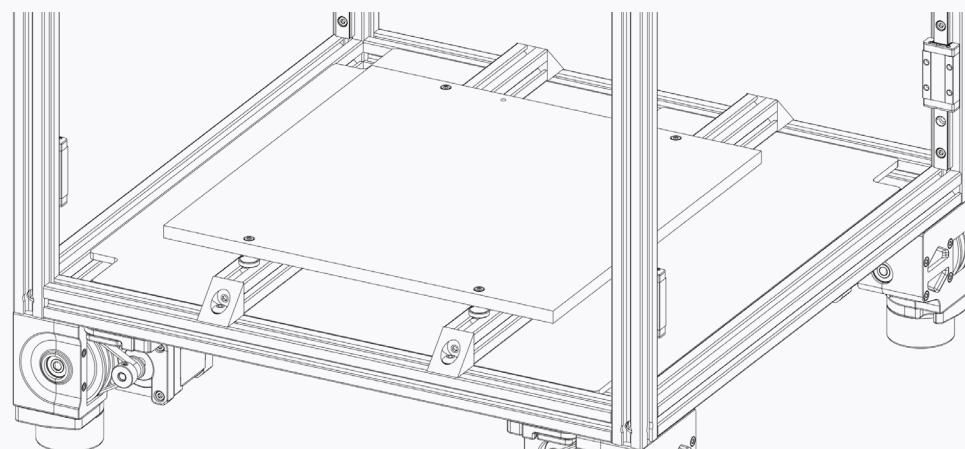
Depending on the combination of bed and spacer thickness you may need to use longer bolts to secure the bed.

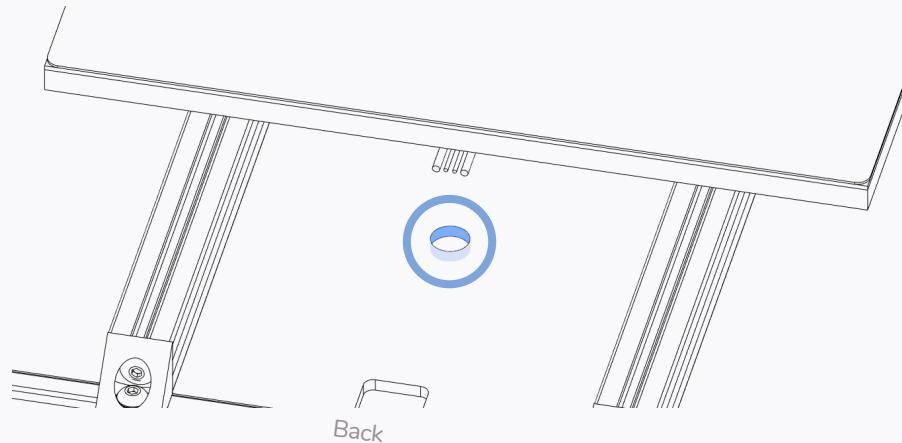
### DON'T TIGHTEN

Only tighten one bolt fully.

Leave the remaining bolts slightly loose.

This will allow for thermal expansion without putting additional stress on the plate.



**WIRE PASSTHROUGH**

Feed the bed related wires through the opening in the deck plate.

**VERIFY PLATE PLACEMENT**

The front edge of the print plate should sit 38mm behind the front edge of the frame.

The Voron Legacy is a modernized design true to the spirit of the original Voron 1.0.

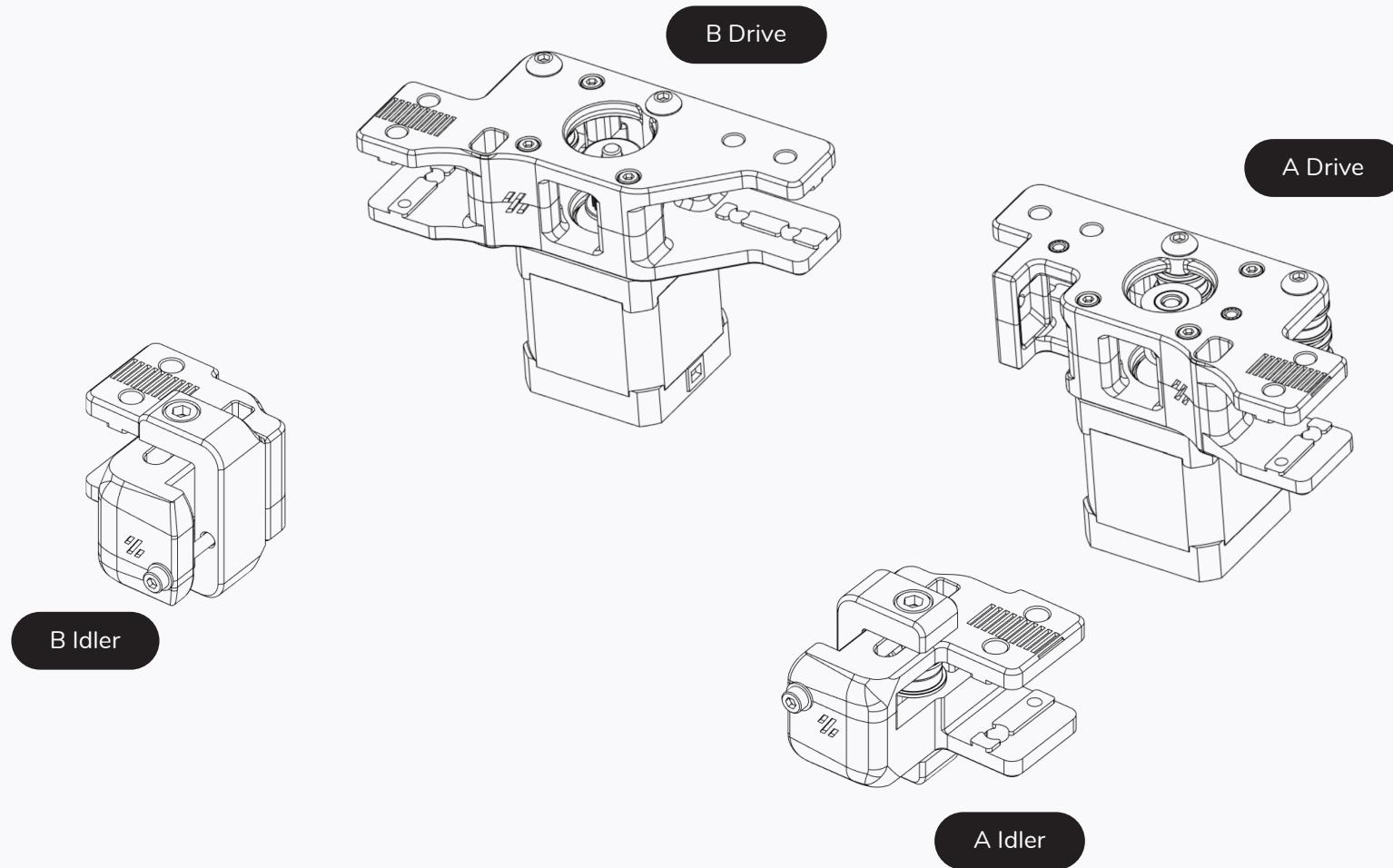
A/B DRIVES AND IDLERS

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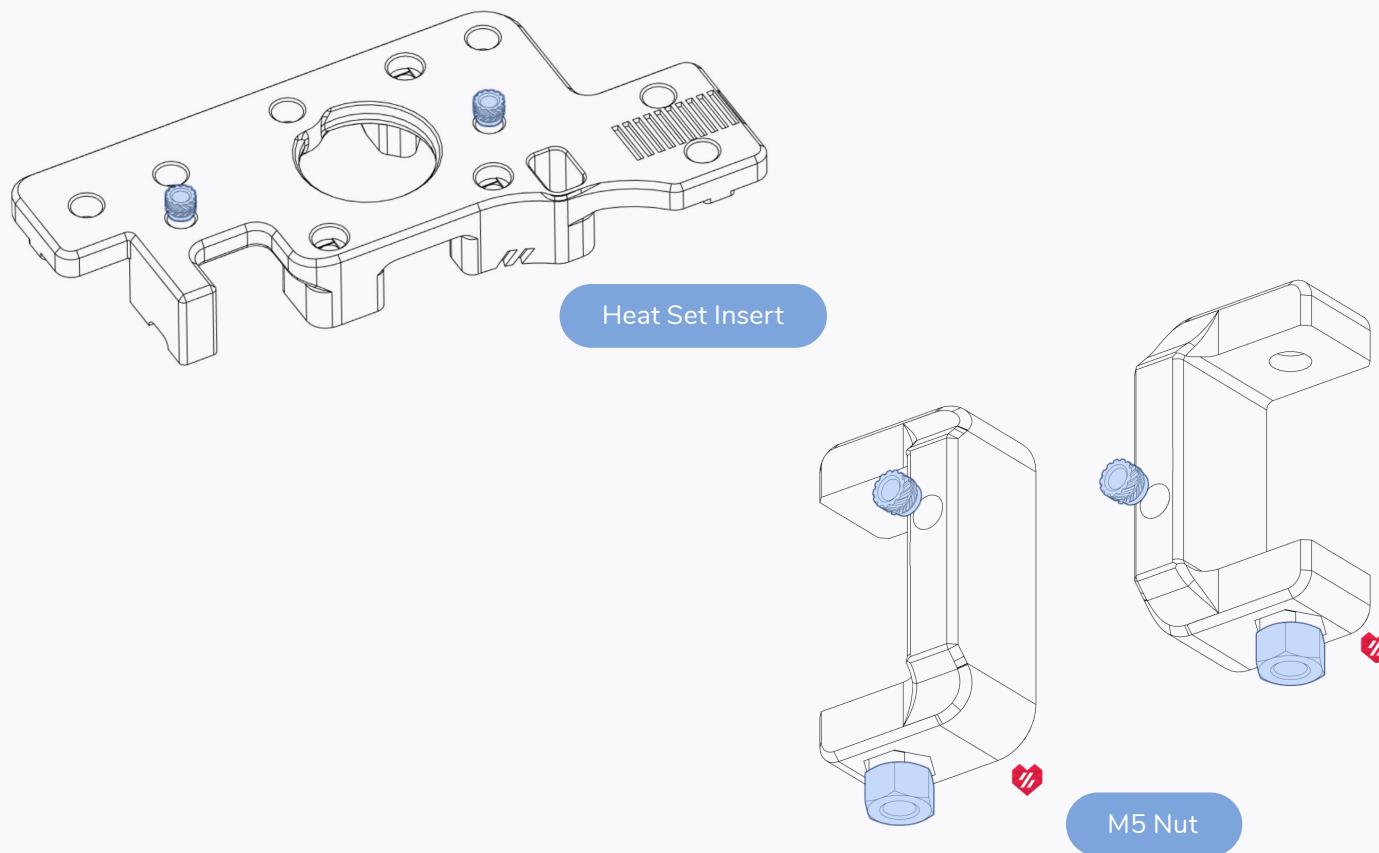
## OVERVIEW

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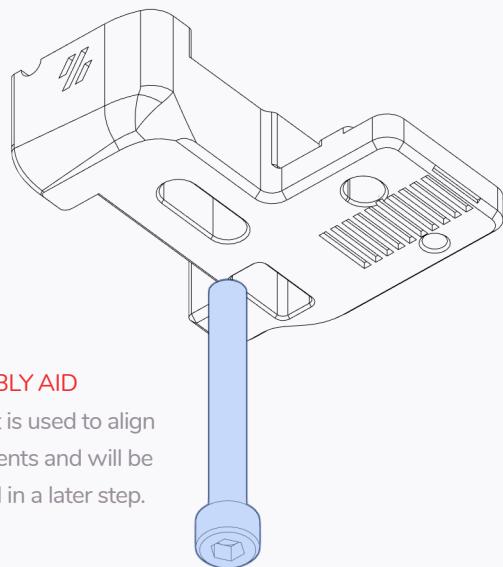
## PREPARATION

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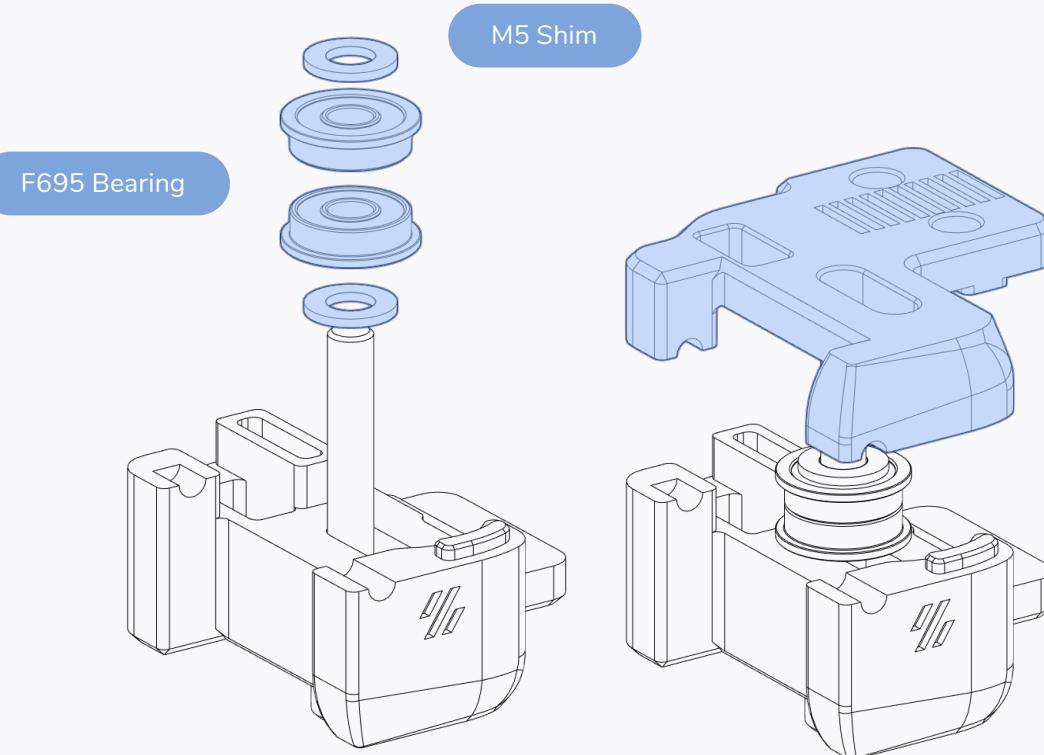
## A IDLER

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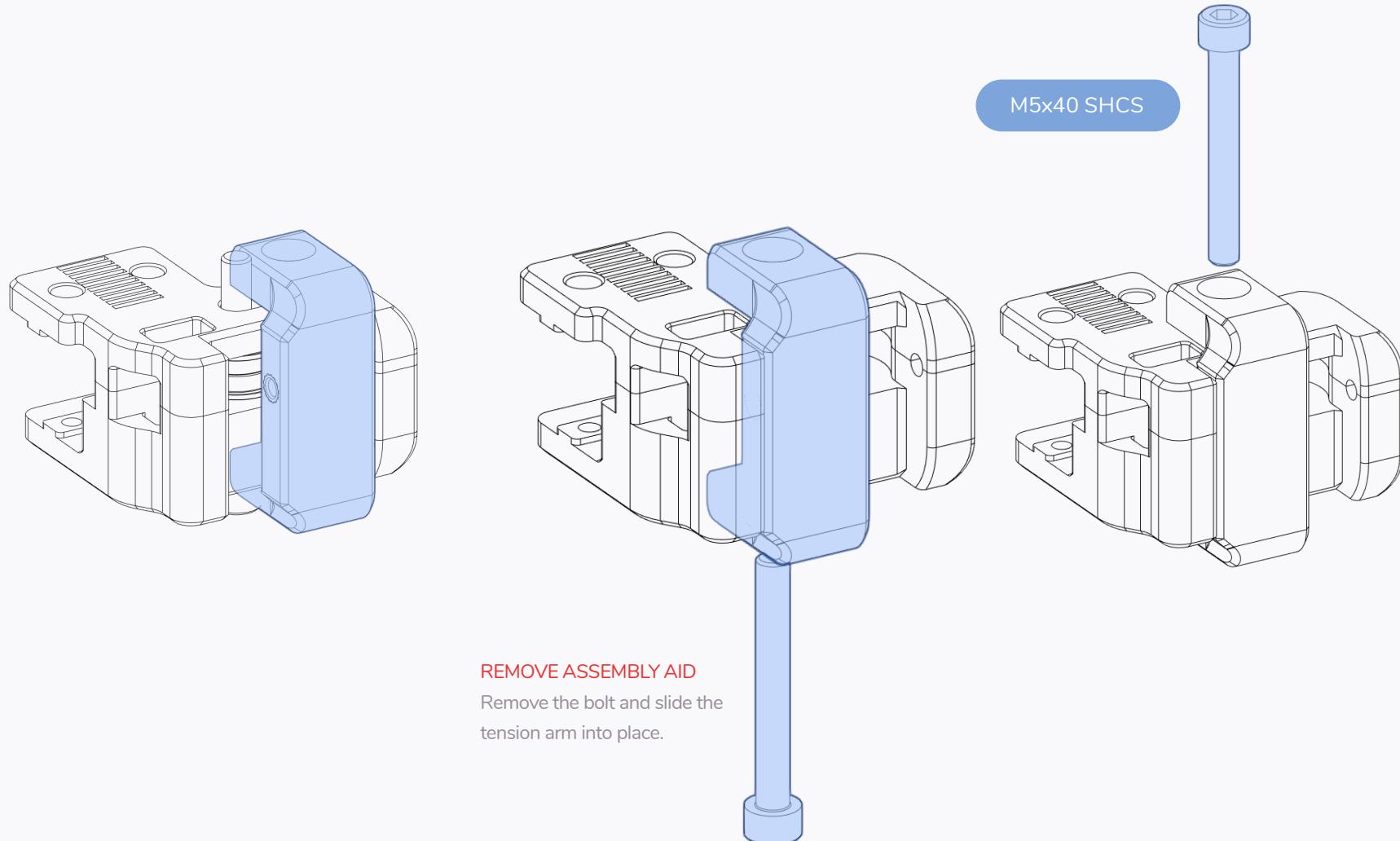


### ASSEMBLY AID

This bolt is used to align components and will be removed in a later step.



M5x40 SHCS



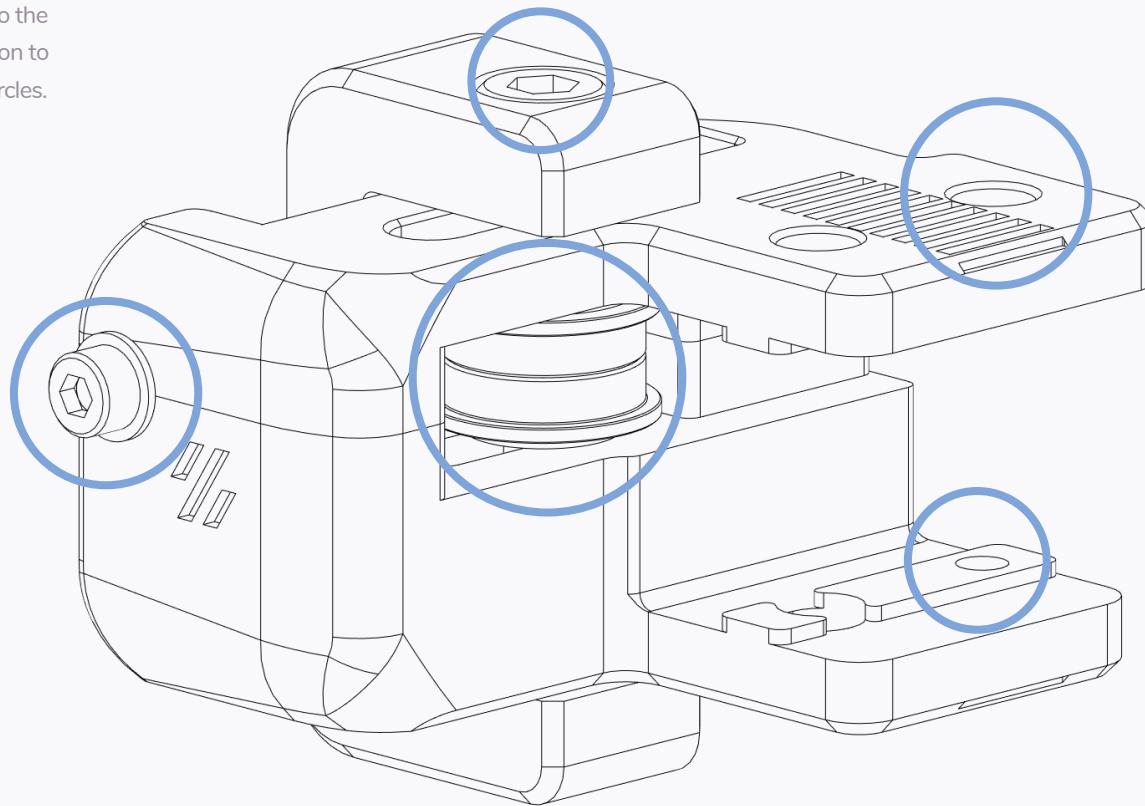
A IDLER

WWW.VORONDESIGN.COM



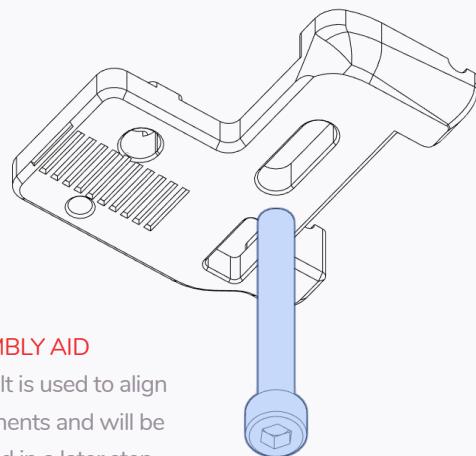
## CHECK YOUR WORK

Compare your assembled parts to the graphics shown here. Pay attention to the features highlighted by the circles.



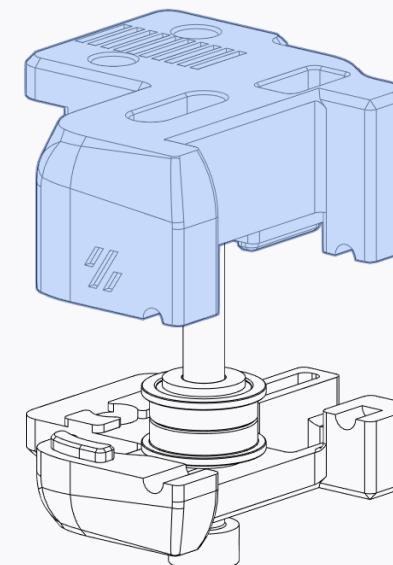
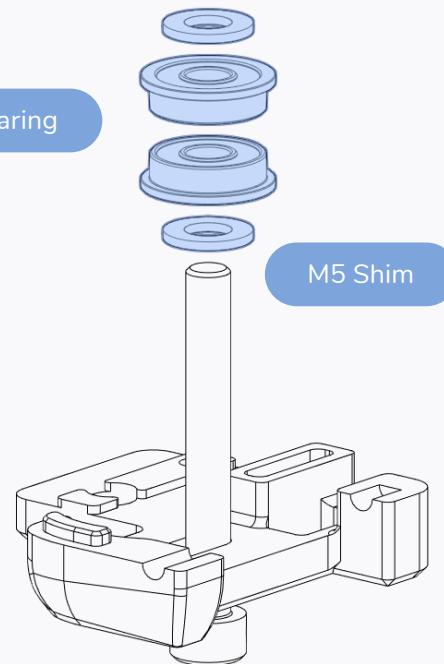
## B IDLER

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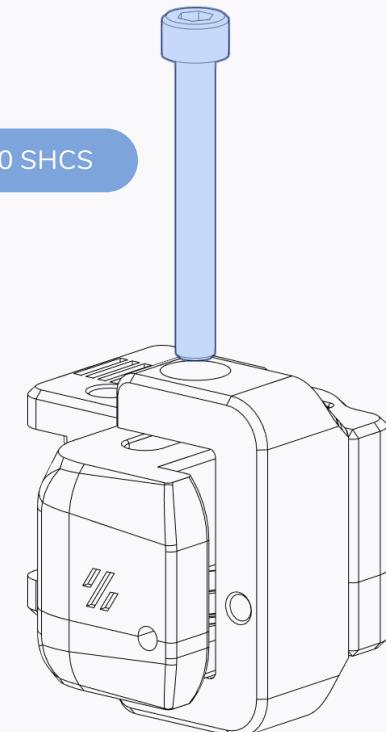
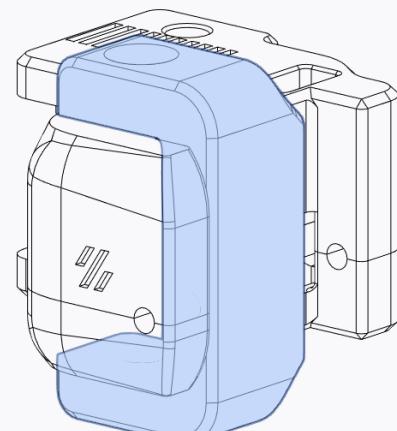
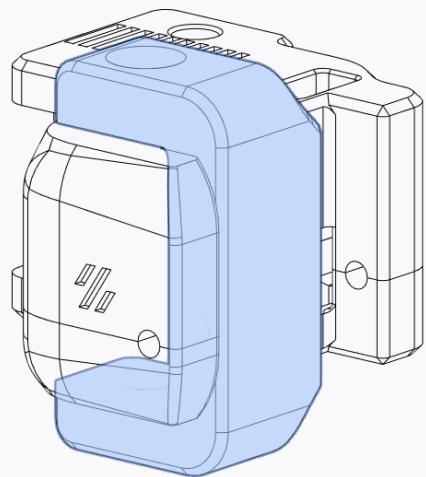
### ASSEMBLY AID

This bolt is used to align components and will be removed in a later step.



M5x40 SHCS

B IDLER



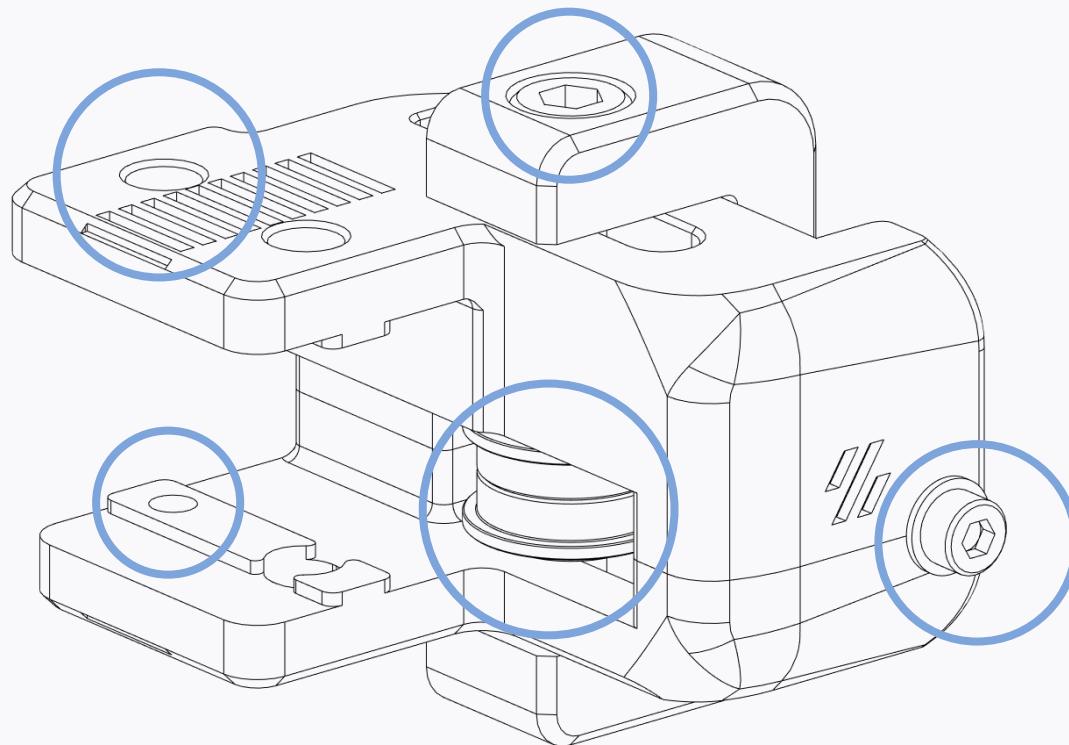
REMOVE ASSEMBLY AID

Remove the bolt and slide the tension arm into place.

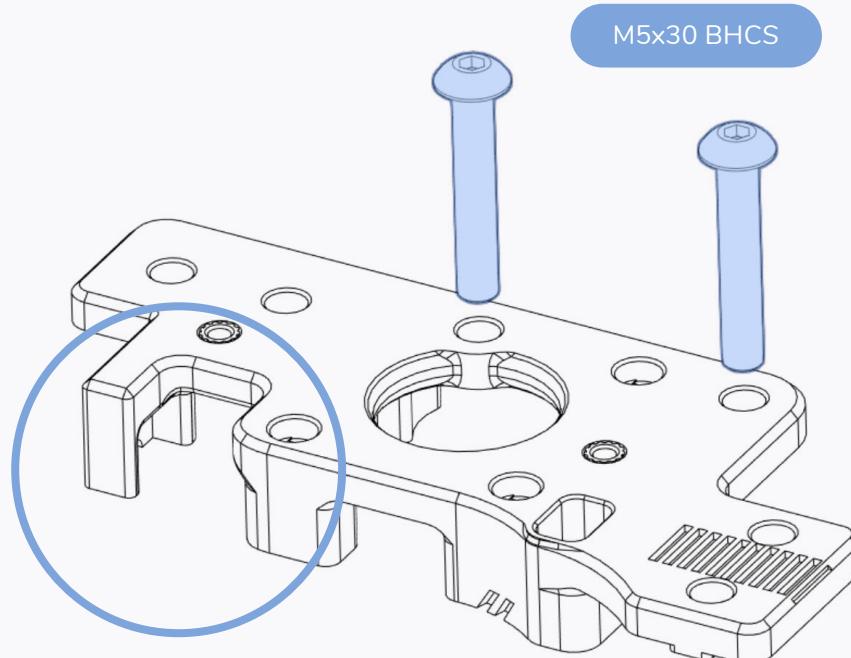
B IDLER

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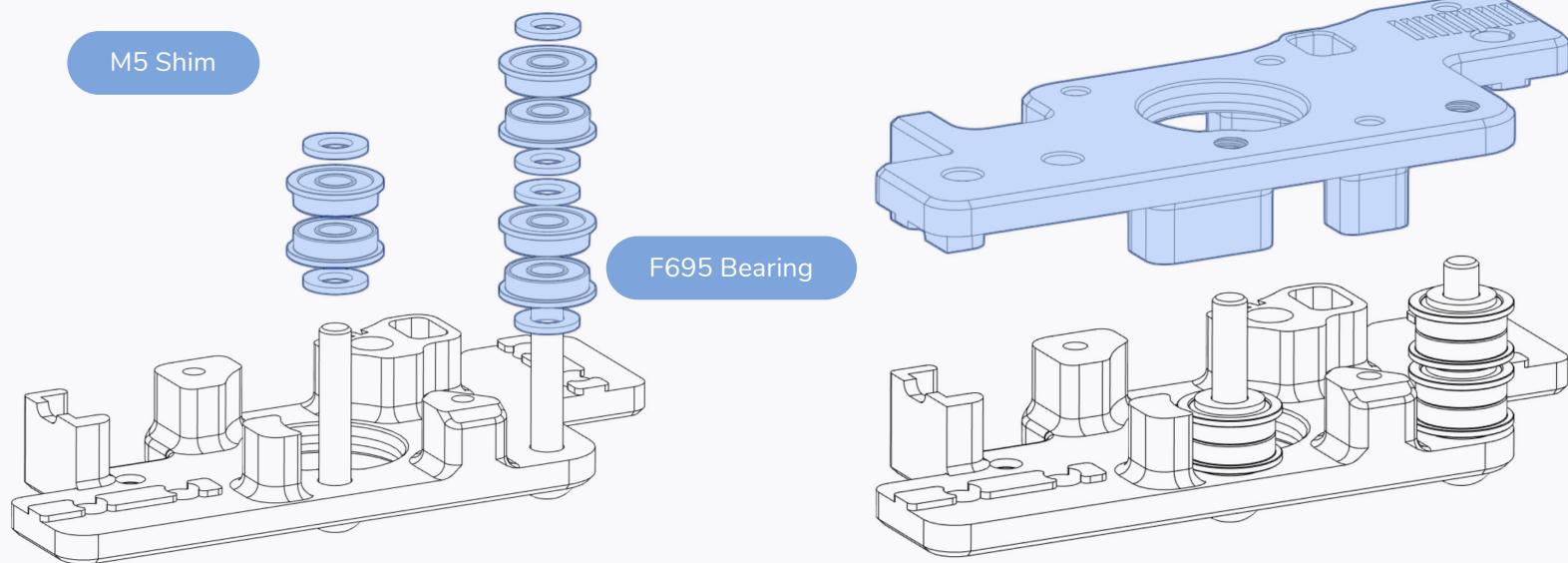


**CHECK YOUR WORK**

Compare your assembled parts to the graphics shown here. Pay attention to the features highlighted by the circles.

**CUTOUT**

The printed parts for the A drive  
have a cutout.

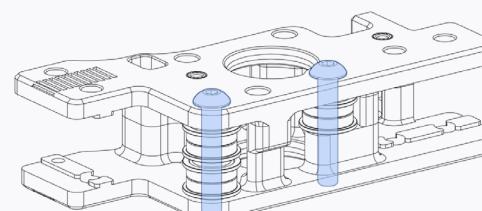


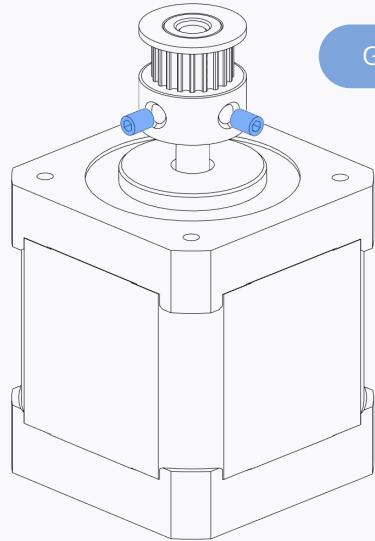
#### UPSIDE DOWN ASSEMBLY

For ease of assembly we recommend to assemble the A and B drives upside down.

#### DON'T OVER TIGHTEN

The M5 bolts are threaded directly into plastic.

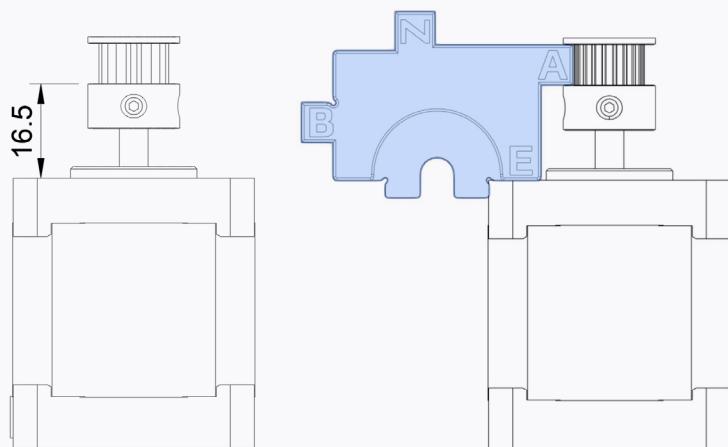
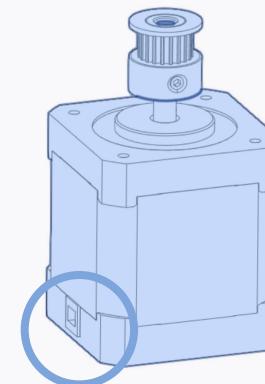
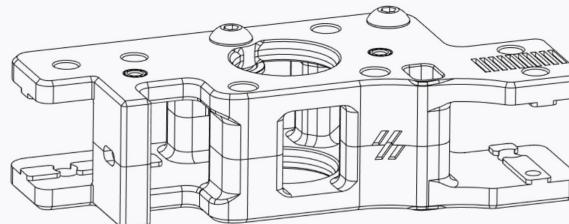




GT2 20 Tooth Pulley

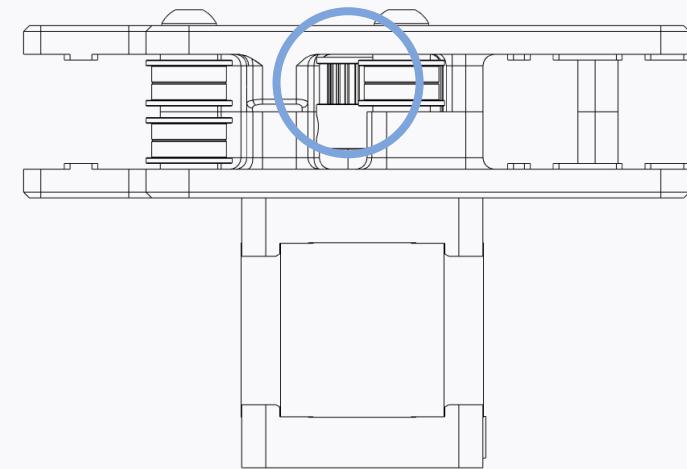
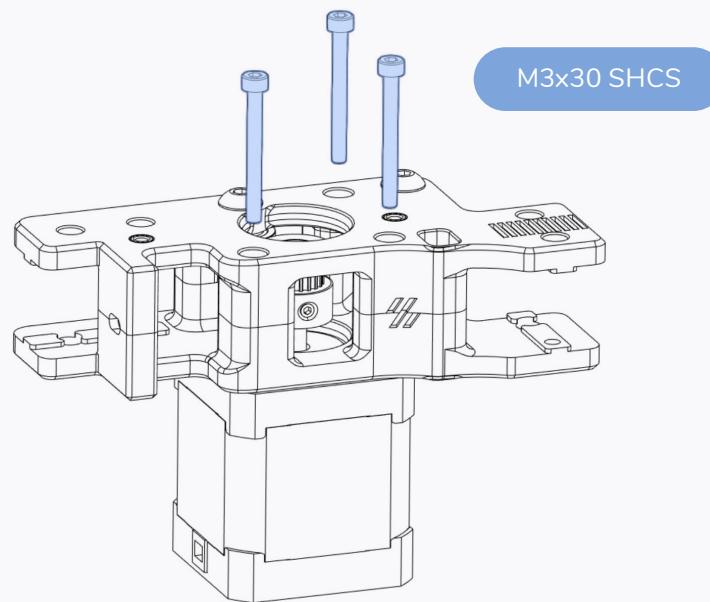
## APPLY THREAD LOCKER

Make sure to use thread locker on the set screws.



## MOTOR ORIENTATION

Pay attention to the orientation of the cable exit. The wires from the motors will be pointing towards each other once fully assembled.



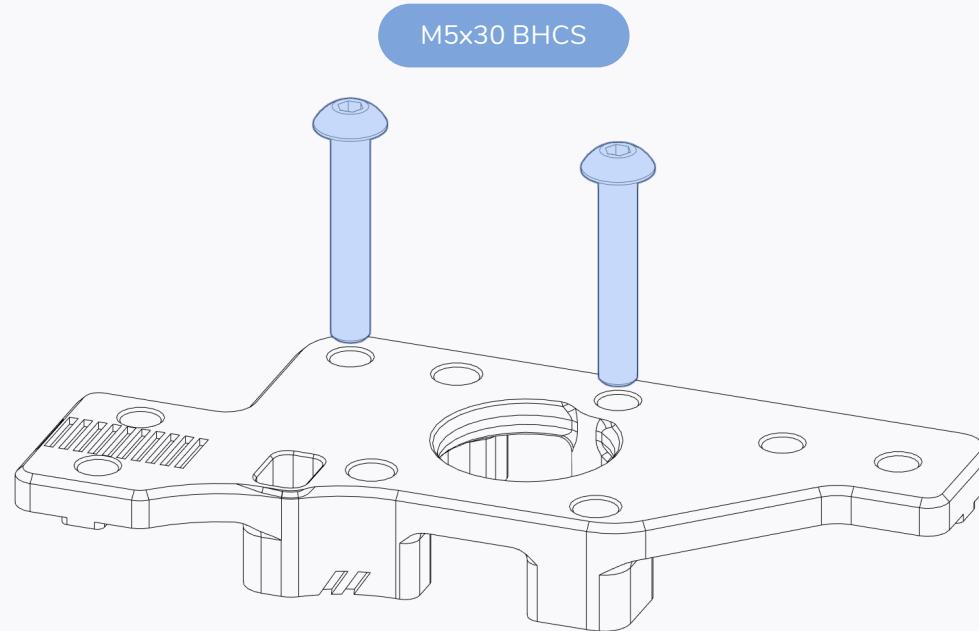
**CHECK YOUR WORK**

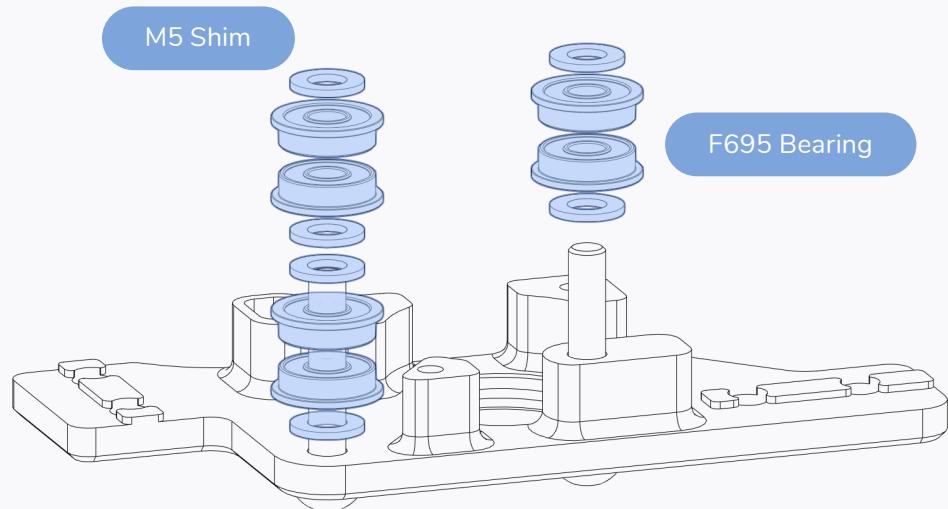
Compare your assembled part to the graphic shown here.

Pay attention to the pulley orientation and alignment with the bearing stack ups.

B DRIVE

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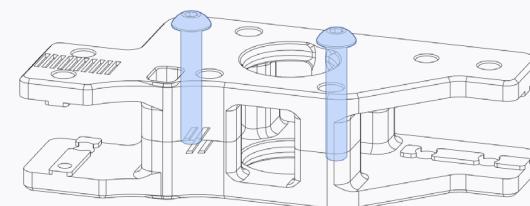
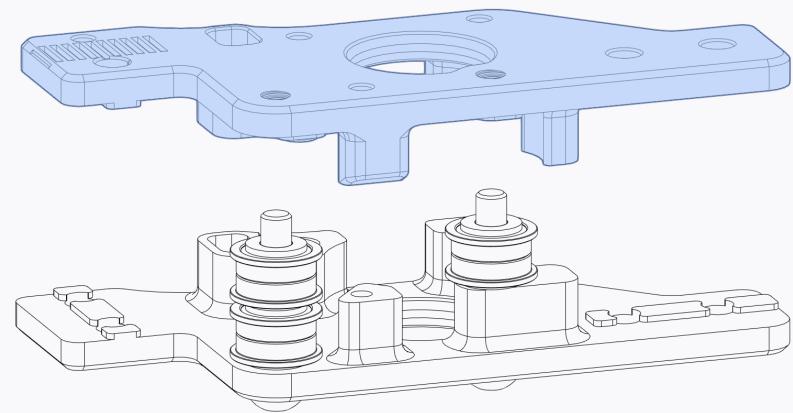


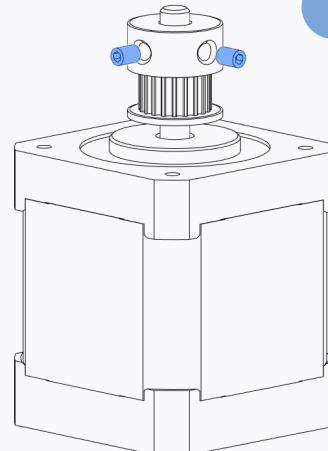
#### UPSIDE DOWN ASSEMBLY

For ease of assembly we recommend to assemble the A and B drives upside down.

#### DON'T OVER TIGHTEN

The M5 bolts are threaded directly into plastic.

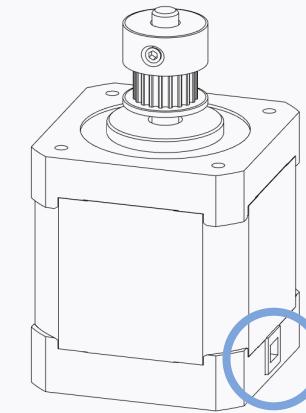
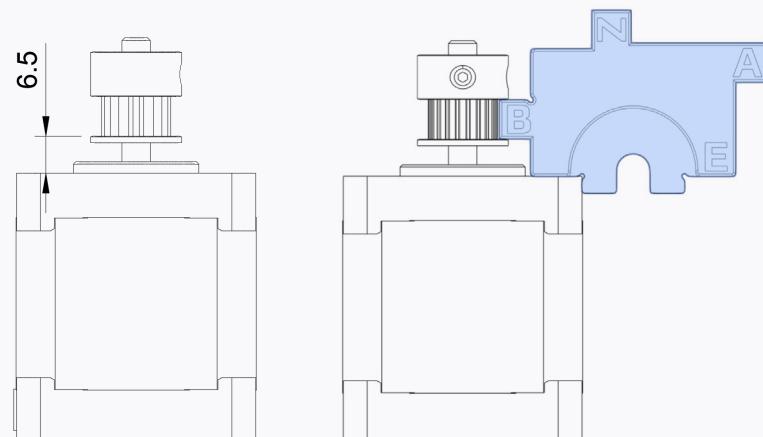
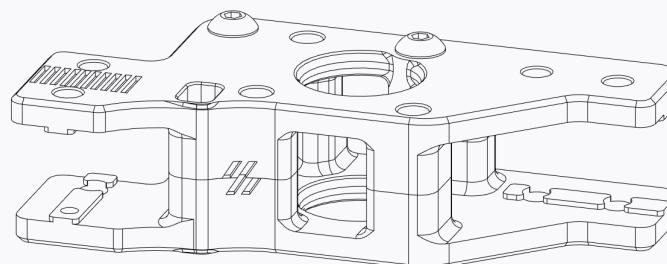




GT2 20 Tooth Pulley

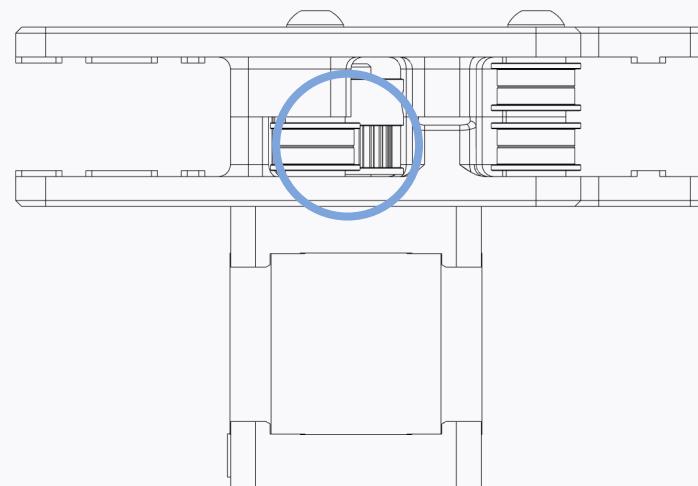
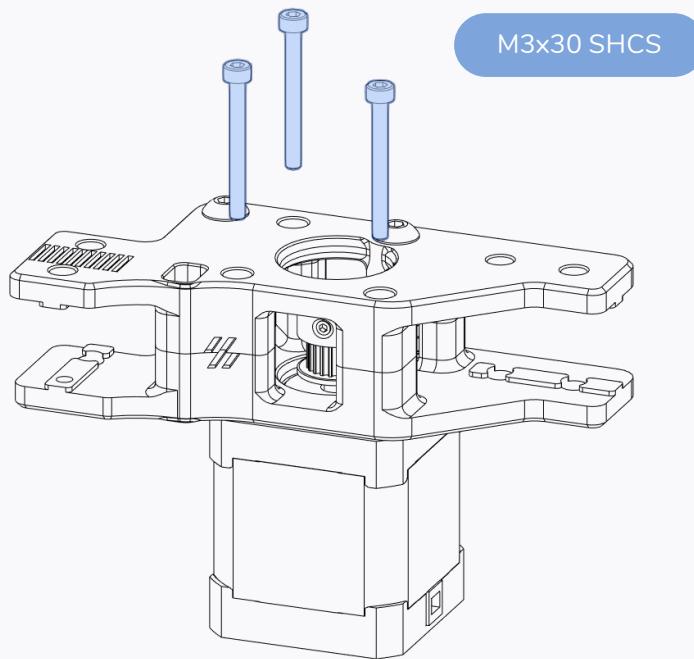
## APPLY THREAD LOCKER

Make sure to use thread locker on the set screws.



## MOTOR ORIENTATION

Pay attention to the orientation of the cable exit.



**CHECK YOUR WORK**

Compare your assembled part to the graphic shown here.

Pay attention to the pulley orientation and alignment with the bearing stacks.

V24 (not V2.4) was an experimental design, only 2 have ever been built. It's design became the basis for the Voron2.

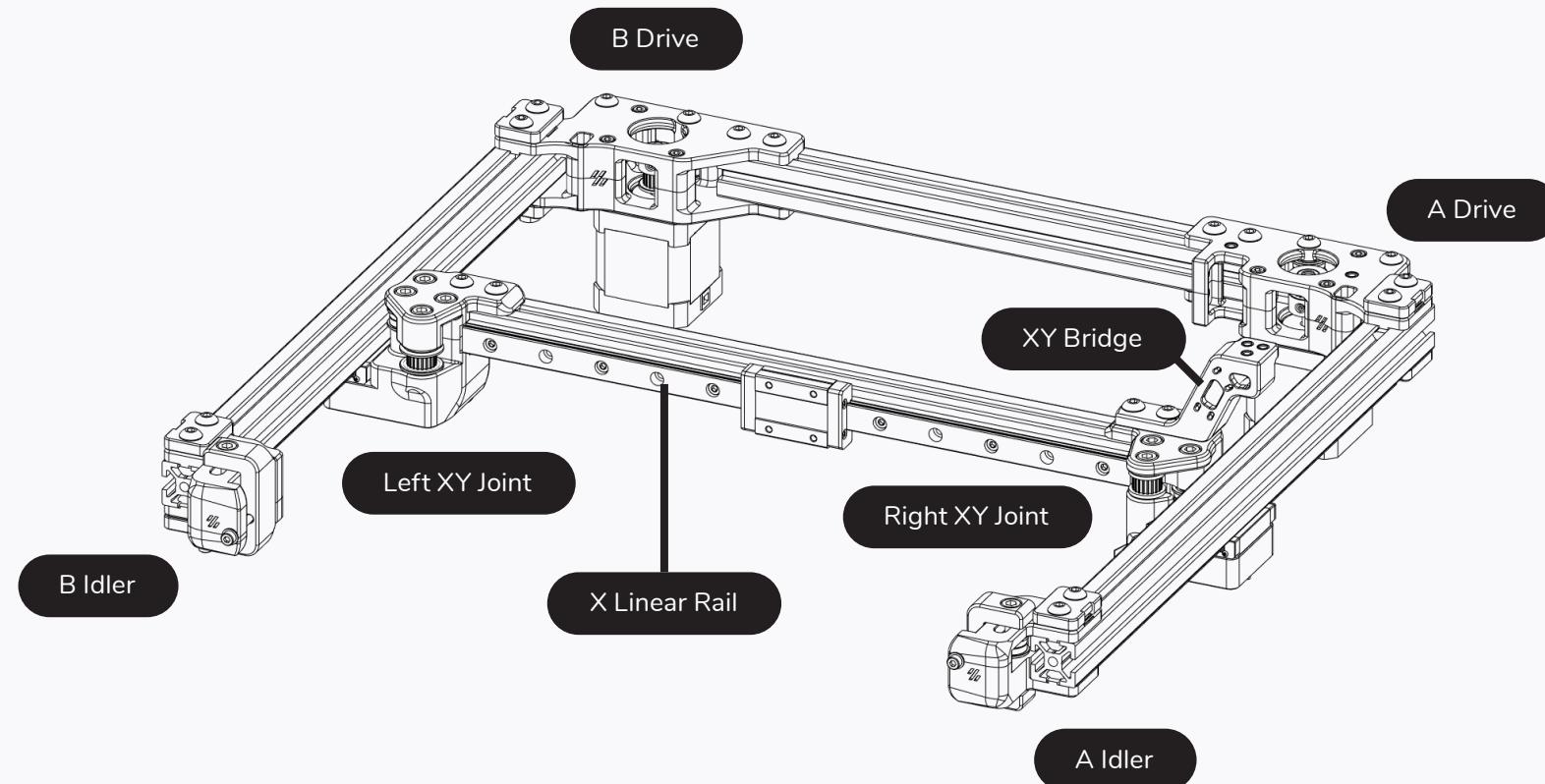
GANTRY

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## OVERVIEW

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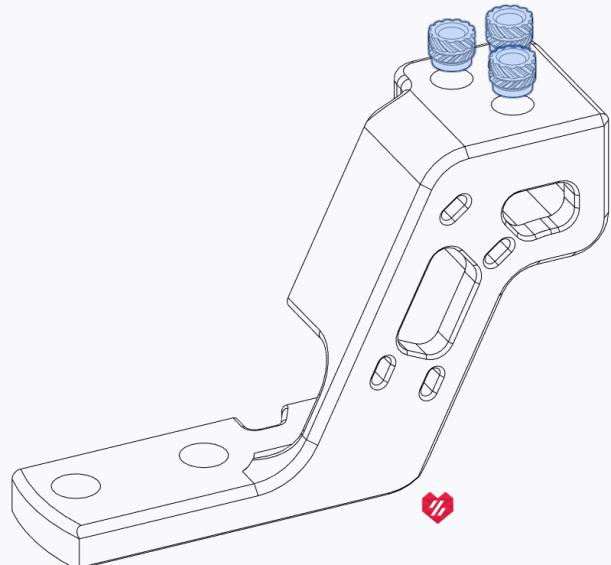
**Skip this step, this part is not used and therefore probably not included in your printed parts.**

## PREPARATION

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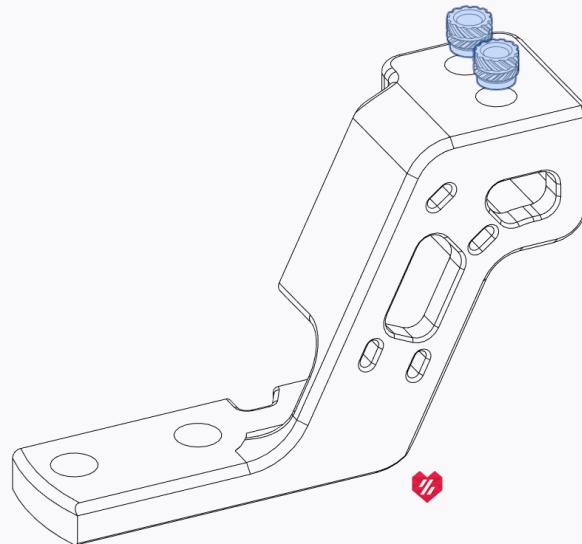
### GENERIC CABLE CHAINS

The 3 hole pattern is usually found on generic cable chains.



### IGUS CABLE CHAINS

IGUS chains have 2 mounting holes.

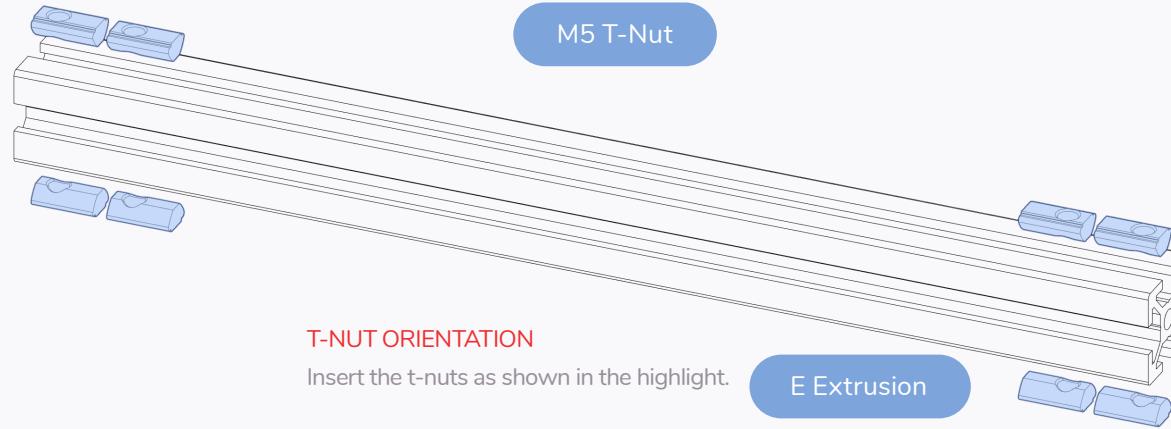
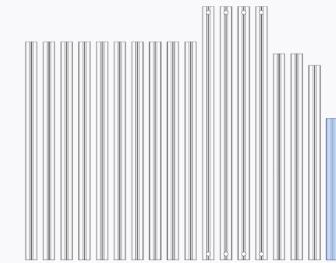


### WHICH TO CHOOSE?

Pick the style that matches the mounting pattern of your cable chains.

## GANTRY

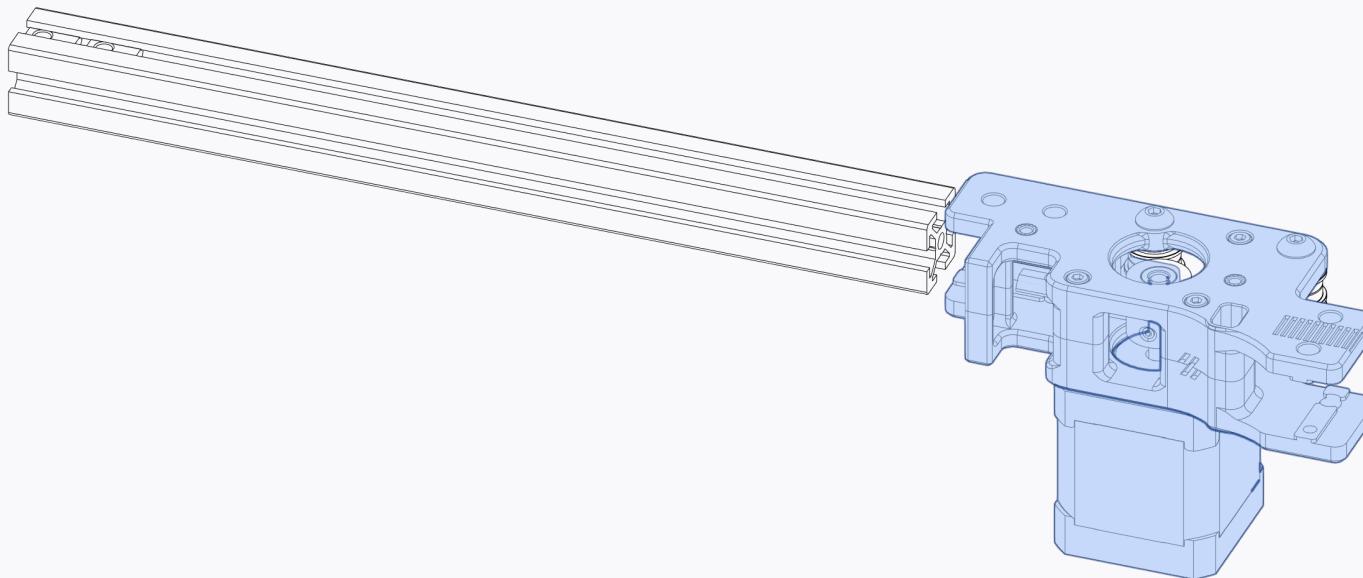
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### T-NUT ORIENTATION

Insert the t-nuts as shown in the highlight.

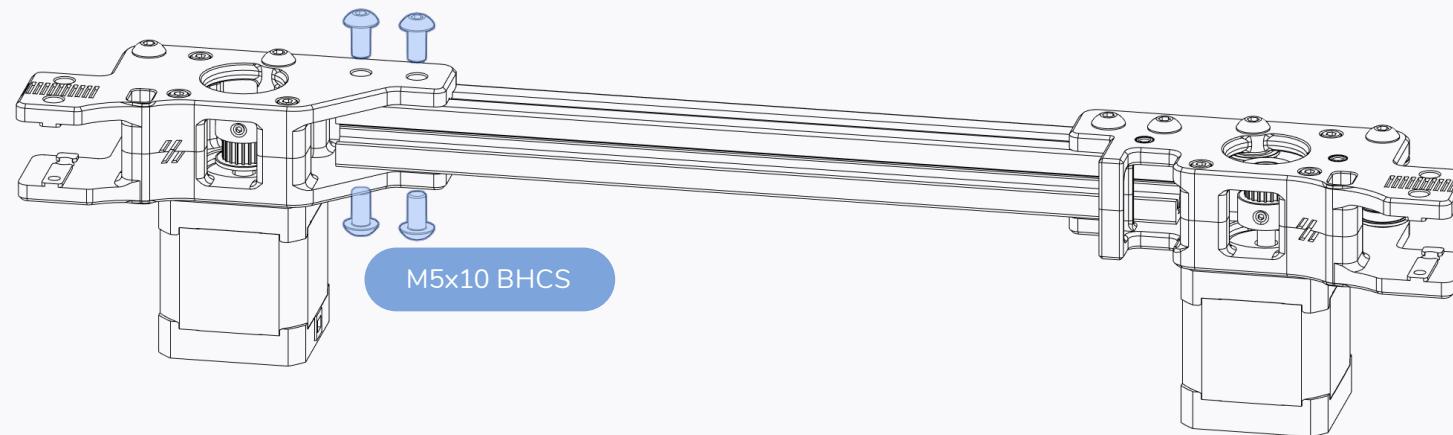
E Extrusion





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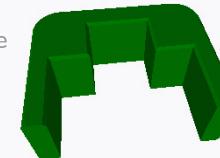
If you are building a 300mm machine you will need to start you screws from the second screw hole in the rails leaving the end holes open to allow space for T-nuts at later steps. Small reminder: The carriages are designed to slide along the rail easily. This unfortunately also includes sliding off the rails. Dropping the carriage likely irreparably damages it. **ALWAYS** put the little black rubber Carriage stoppers back on the rail (into the holes without screws) until your printer ist up and running!

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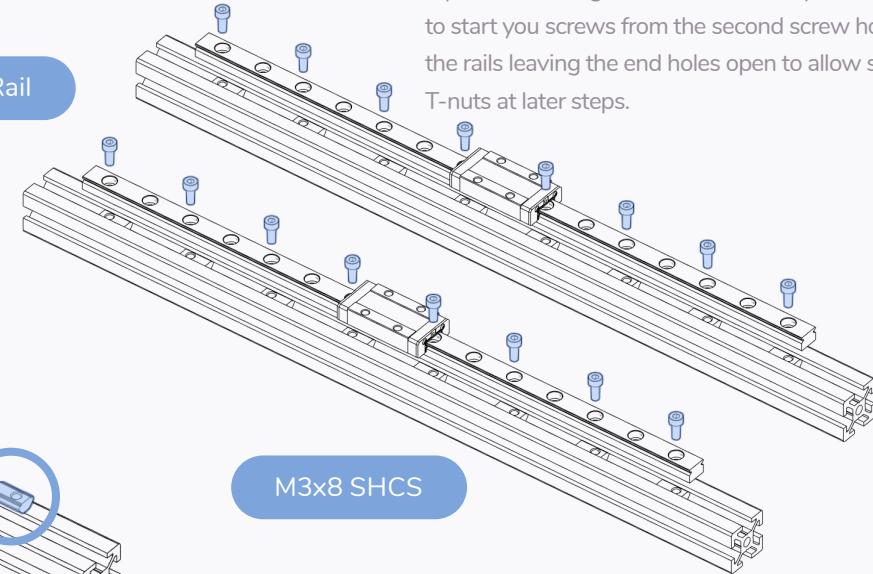
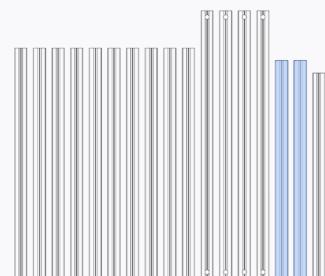
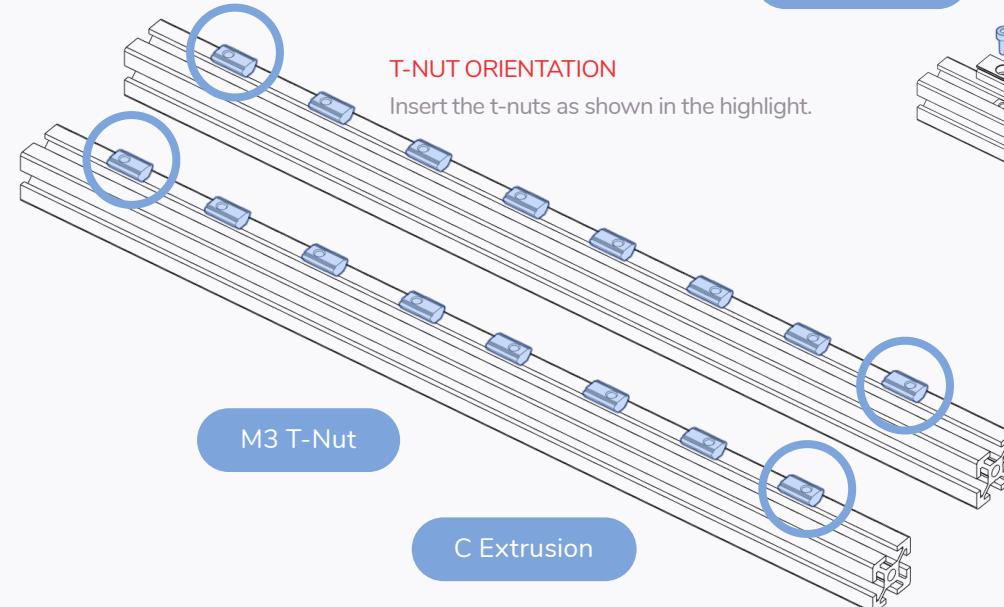
## Y AXIS

### CENTRED RAIL INSTALLATION GUIDE

Use the MGN9 guides to position the rail in the centre of the extrusion prior to fastening the screws.



MGN9 Rail



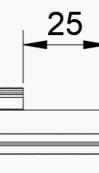
### 300MM BUILDS

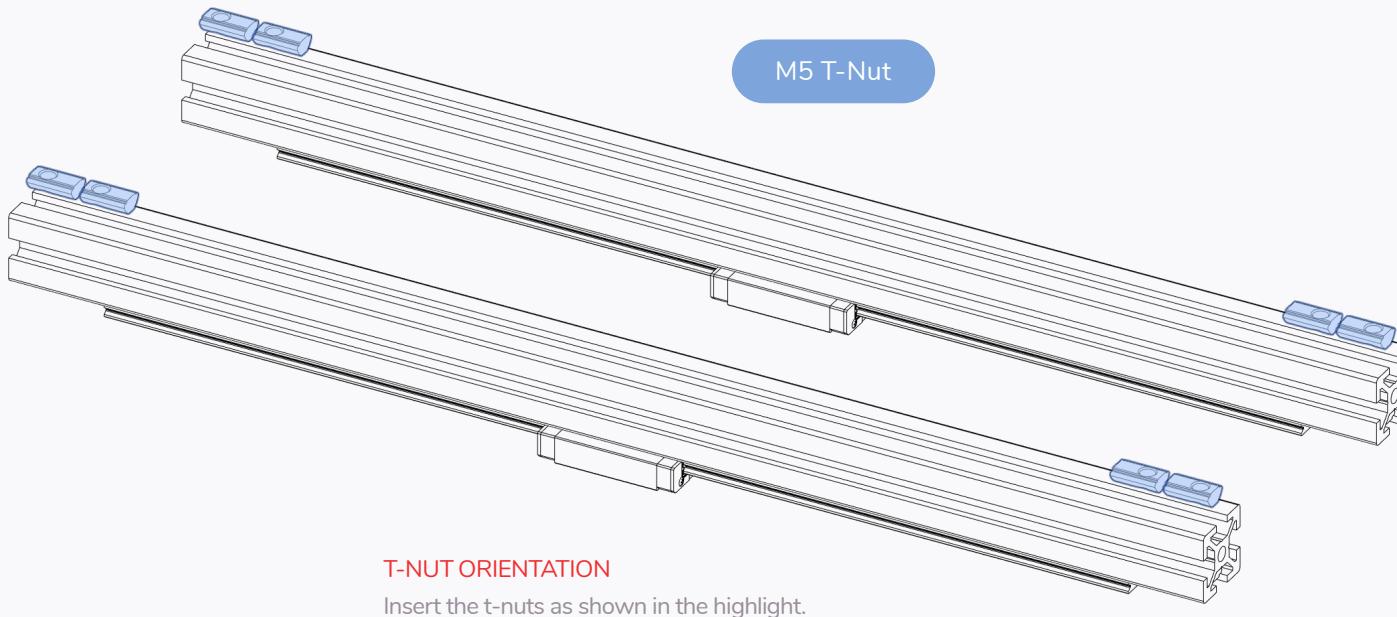
If you are building a 300mm machine you will need to start you screws from the second screw hole in the rails leaving the end holes open to allow space for T-nuts at later steps.

### MIND THE CARRIAGE

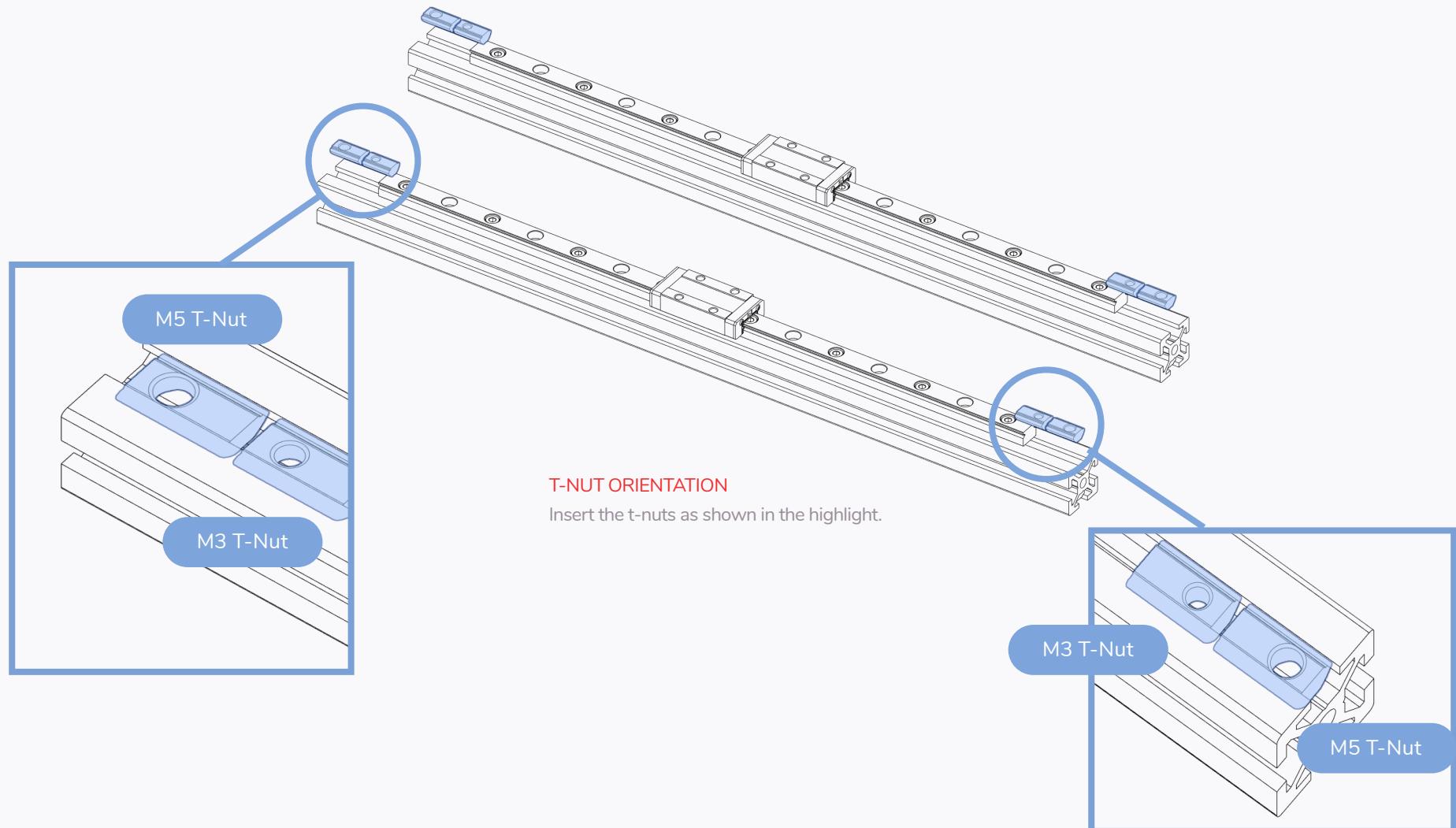
The carriages are designed to slide along the rail easily. This unfortunately also includes sliding off the rails.

Dropping the carriage likely irreparably damages it.

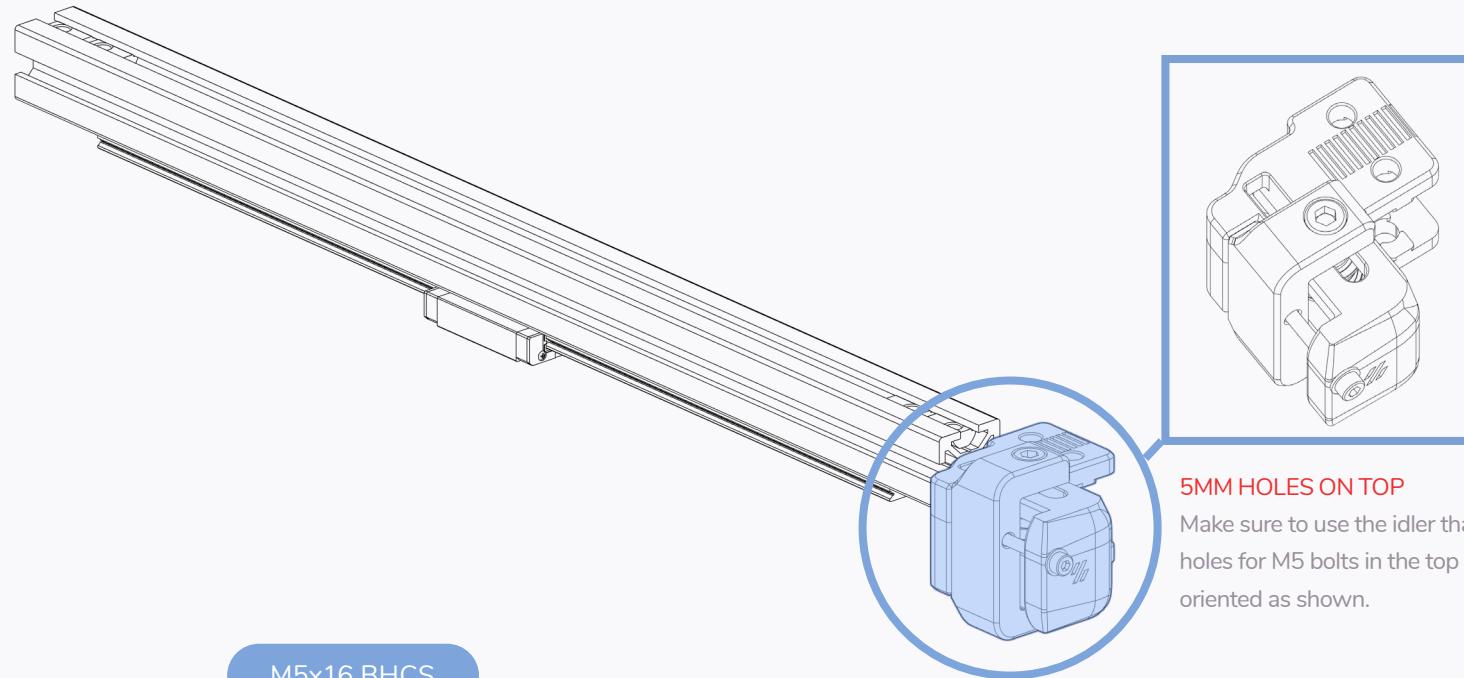




Y AXIS

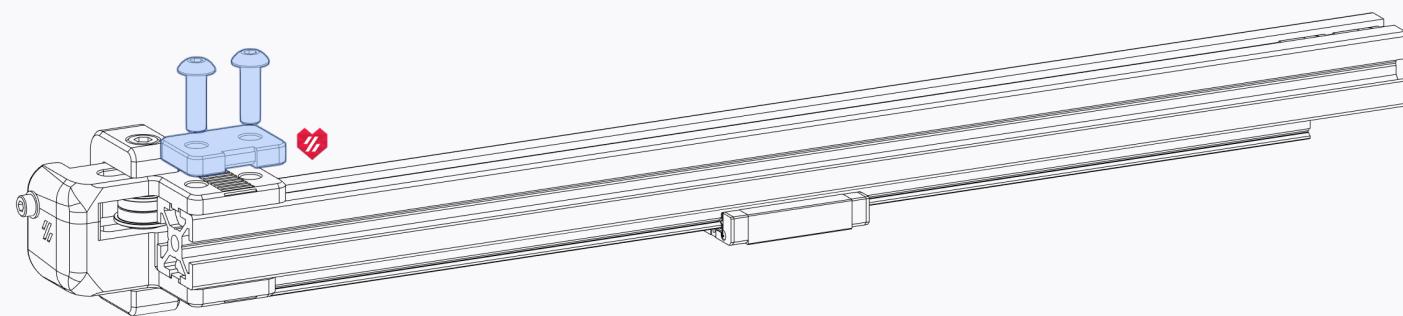


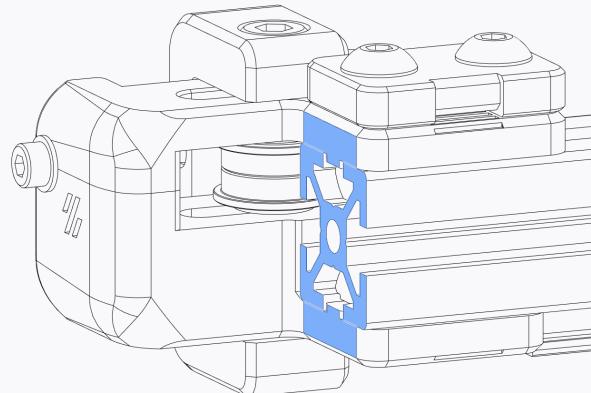
Y AXIS



**5MM HOLES ON TOP**

Make sure to use the idler that has 2 holes for M5 bolts in the top when oriented as shown.

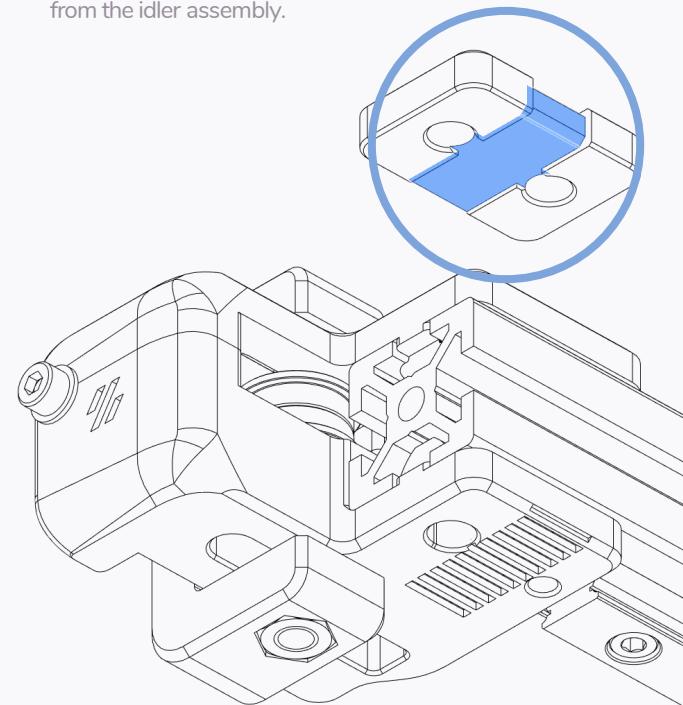


**FLUSH INSTALL**

Make sure the plastic part sits flush with the end of the extrusion. If not flush check if you installed the correct idler.

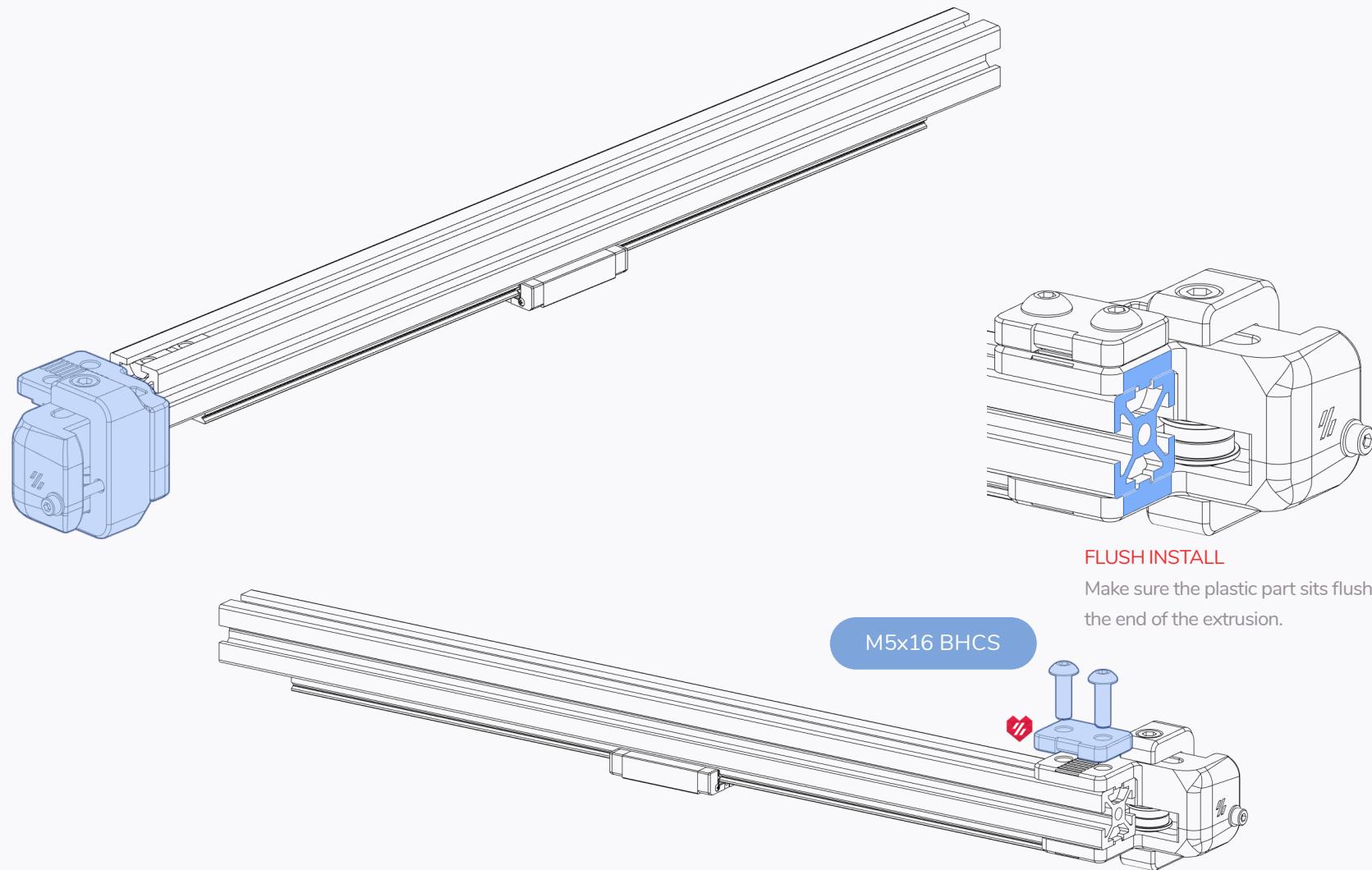
**NOTCH ORIENTATION**

The indentation along the part is designed to clamp on the belt. The notch points away from the idler assembly.



Y AXIS

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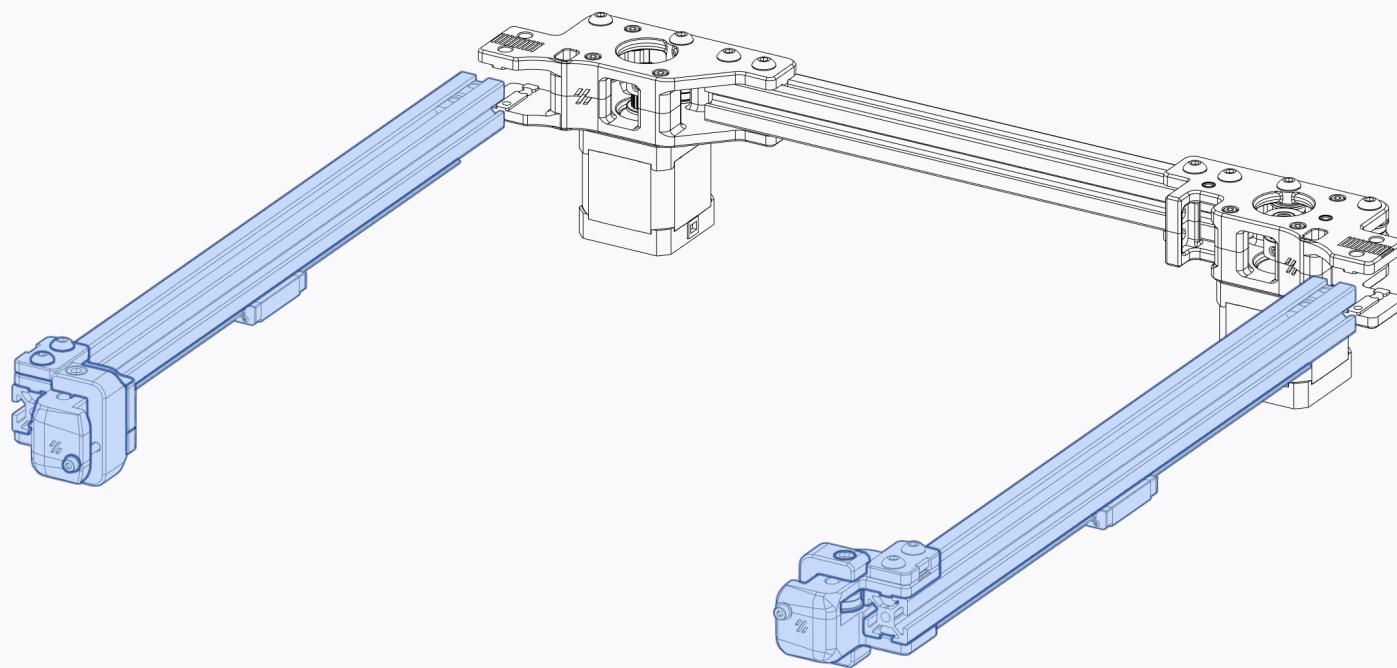
**FLUSH INSTALL**

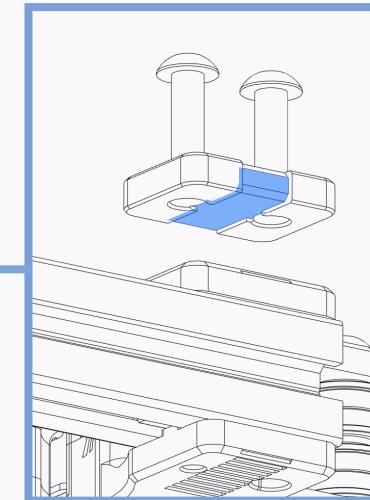
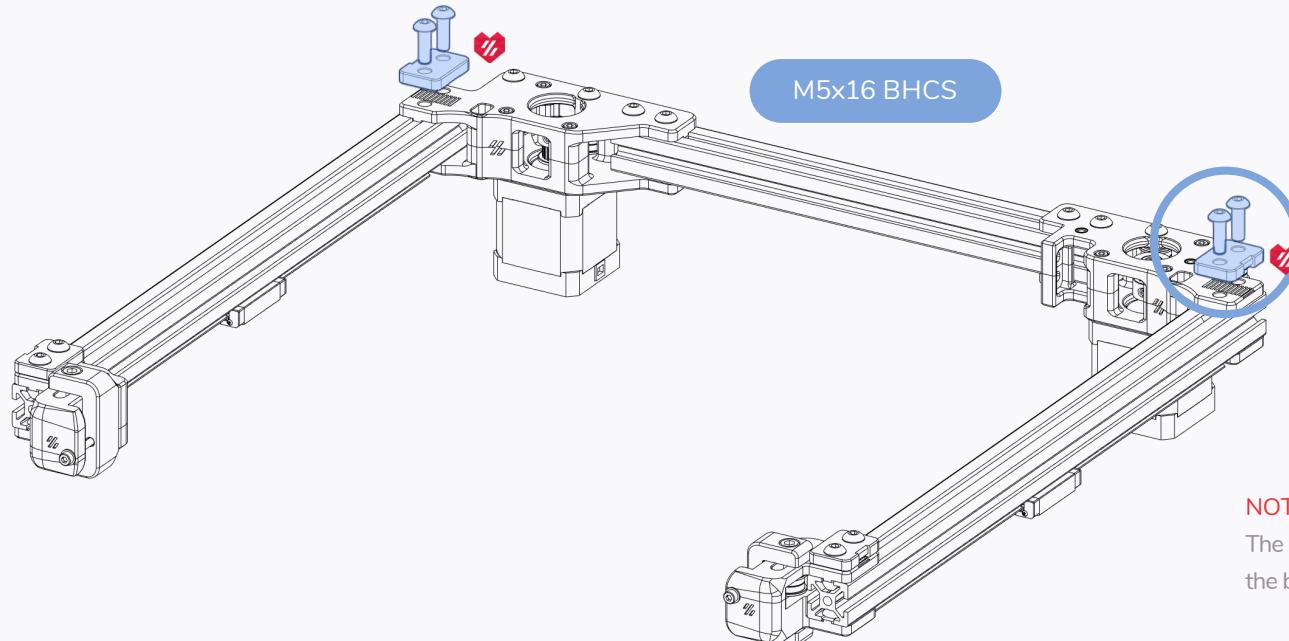
Make sure the plastic part sits flush with the end of the extrusion.

M5x16 BHCS

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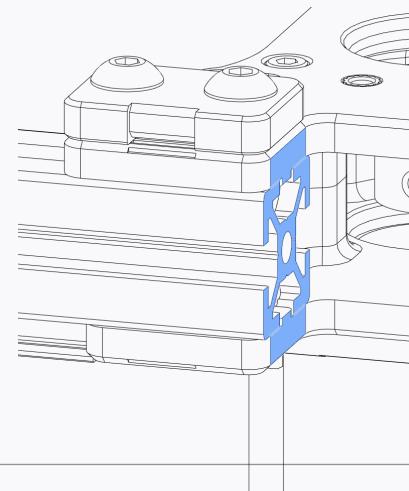


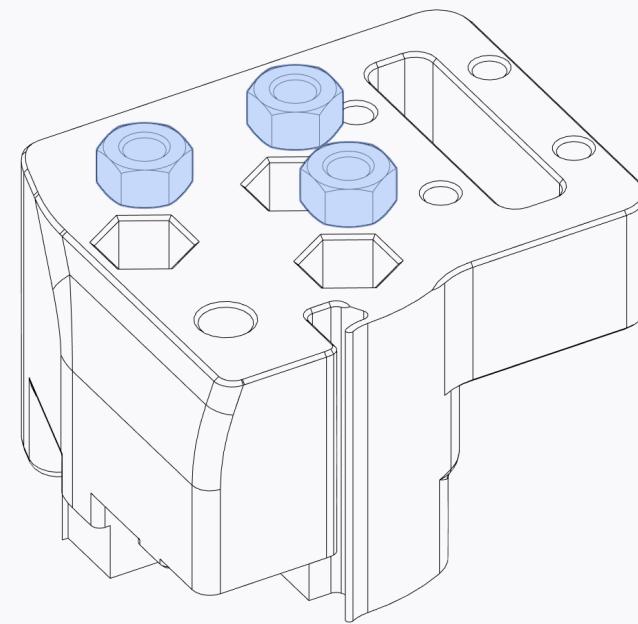
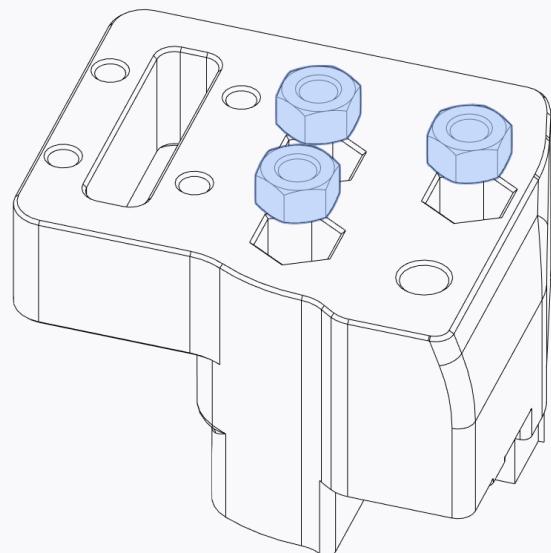
#### NOTCH ORIENTATION

The indentation along the part is designed to clamp on the belt. The notch points away from the drive assembly.

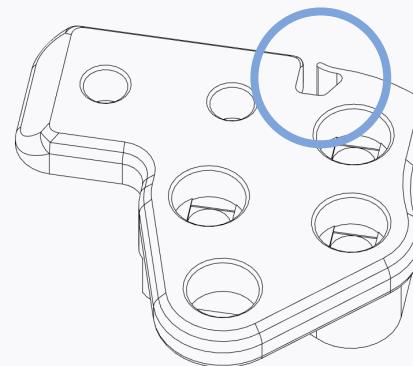
#### FLUSH INSTALL

Make sure the plastic part sits flush with the end of the extrusion.



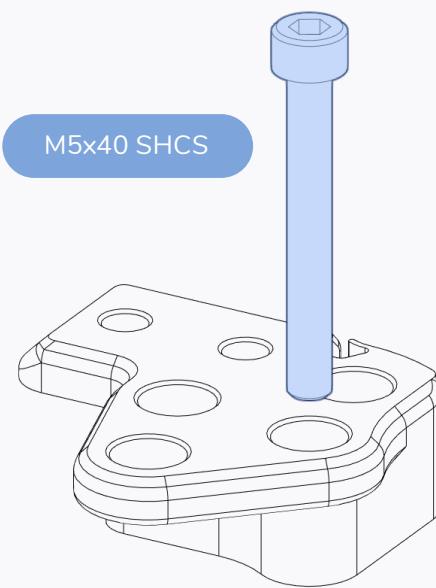


RIGHT XY JOINT

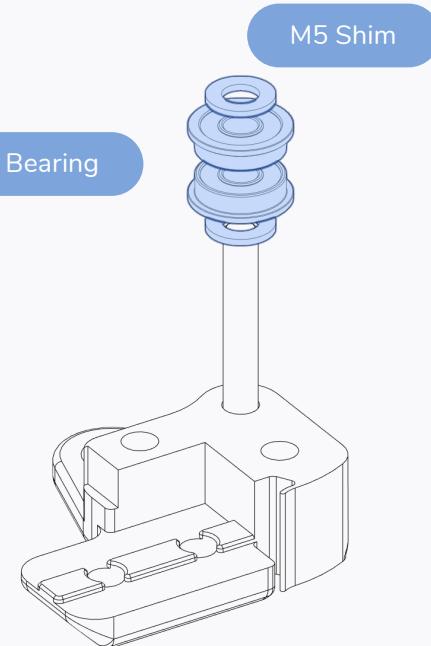


CABLE PATH

The printed parts for the right XY joint have a small channel to guide the end stop wires..

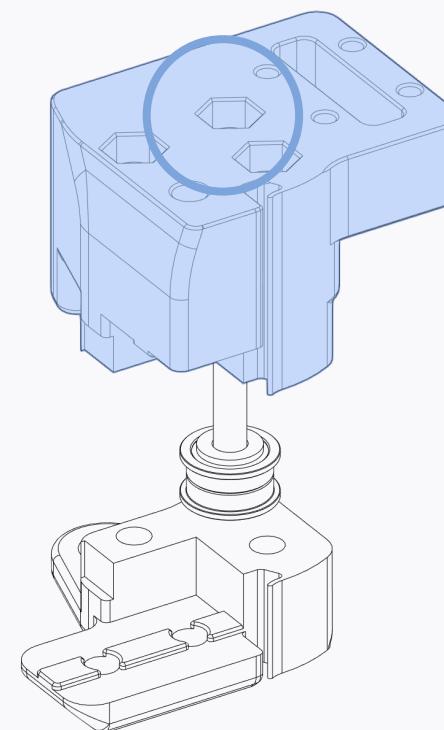


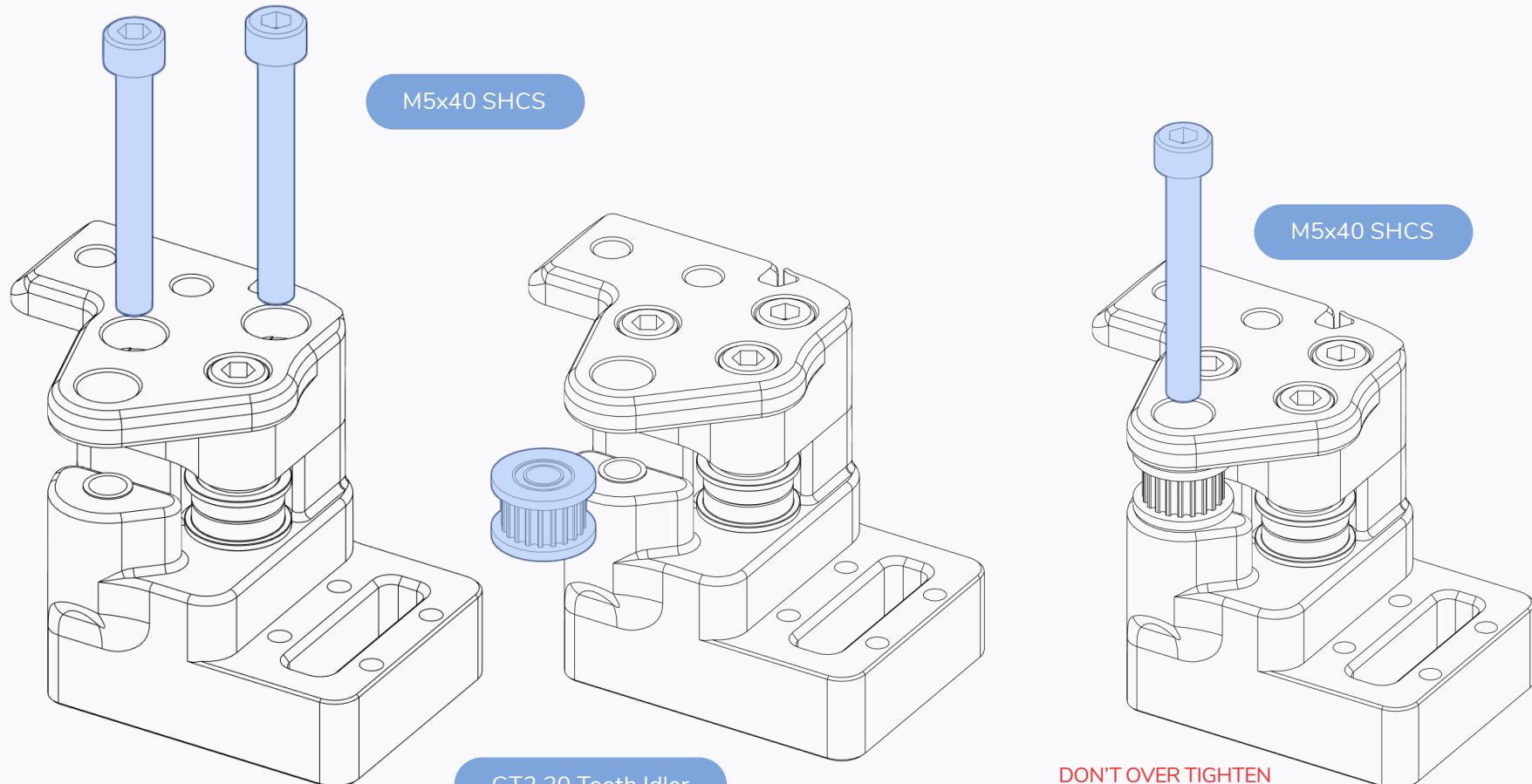
M5x40 SHCS



F695 Bearing

M5 Shim



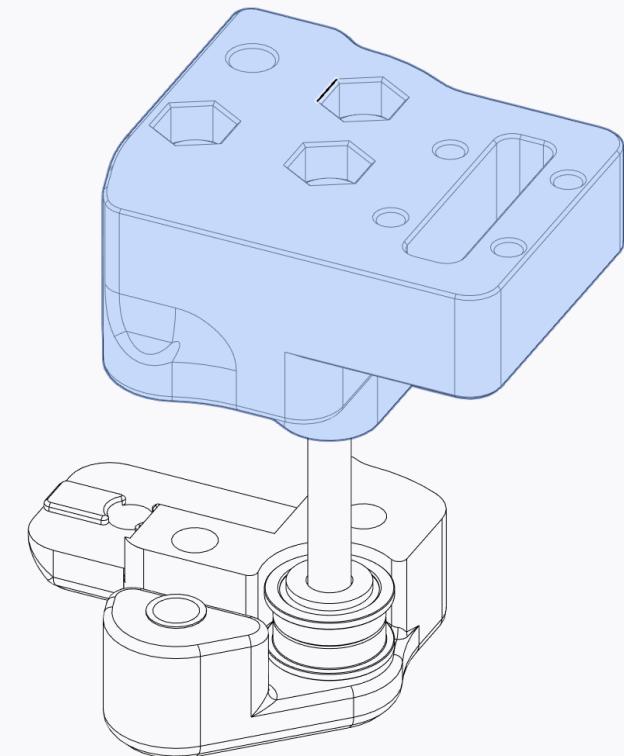
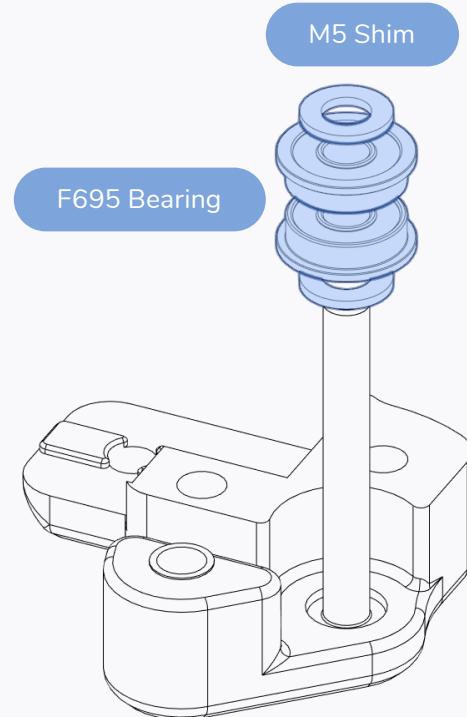
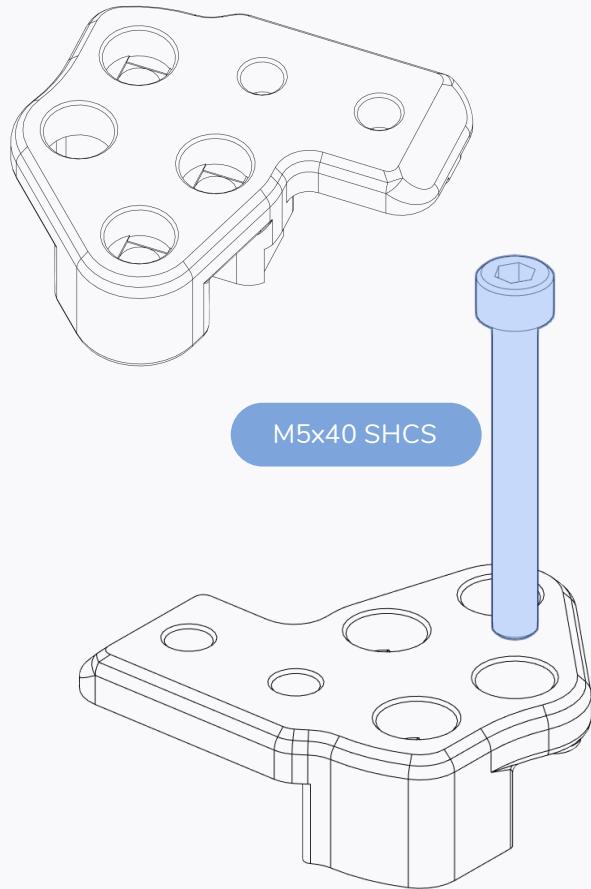
**DON'T OVER TIGHTEN**

The bolt is used to position the idler and is screwed directly into plastic.

The idler must spin freely.

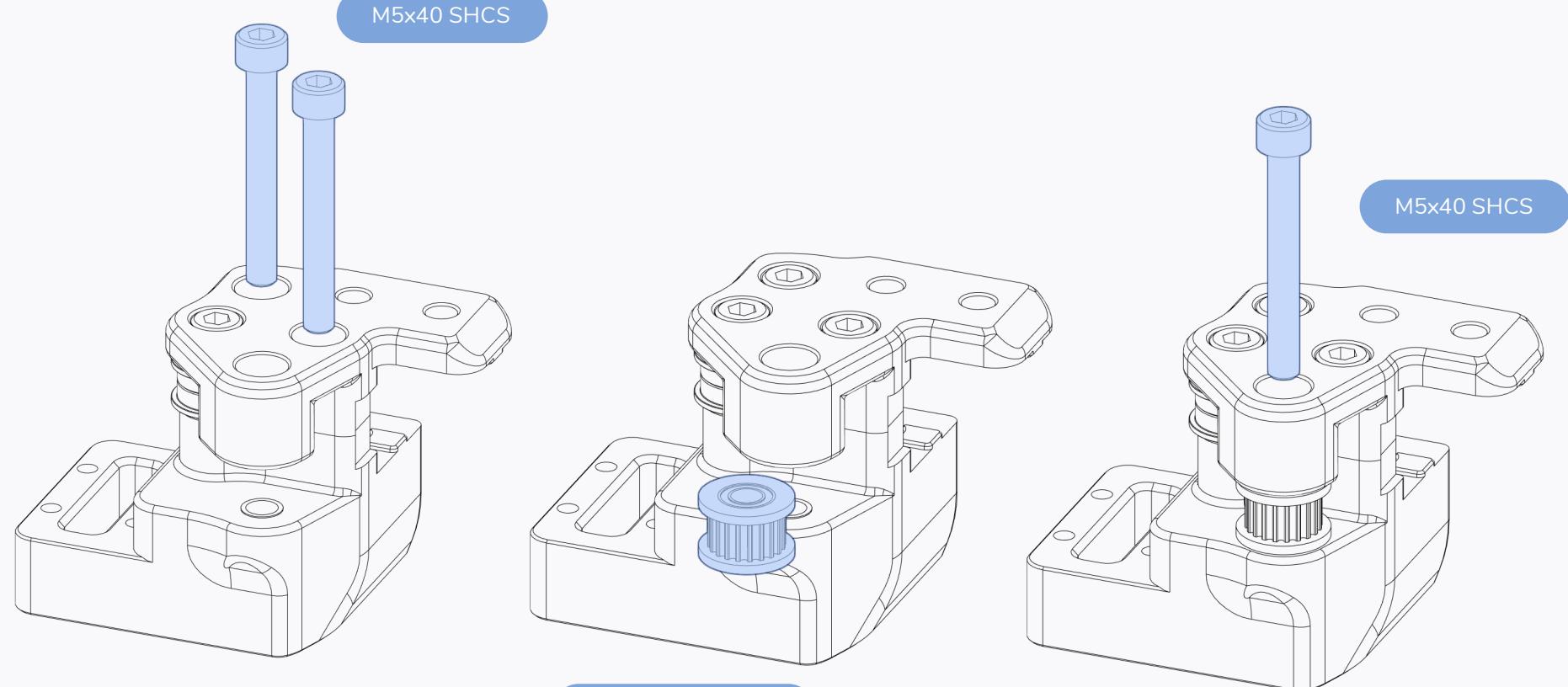
LEFT XY JOINT

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LEFT XY JOINT

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GT2 20 Tooth Idler

DON'T OVER TIGHTEN

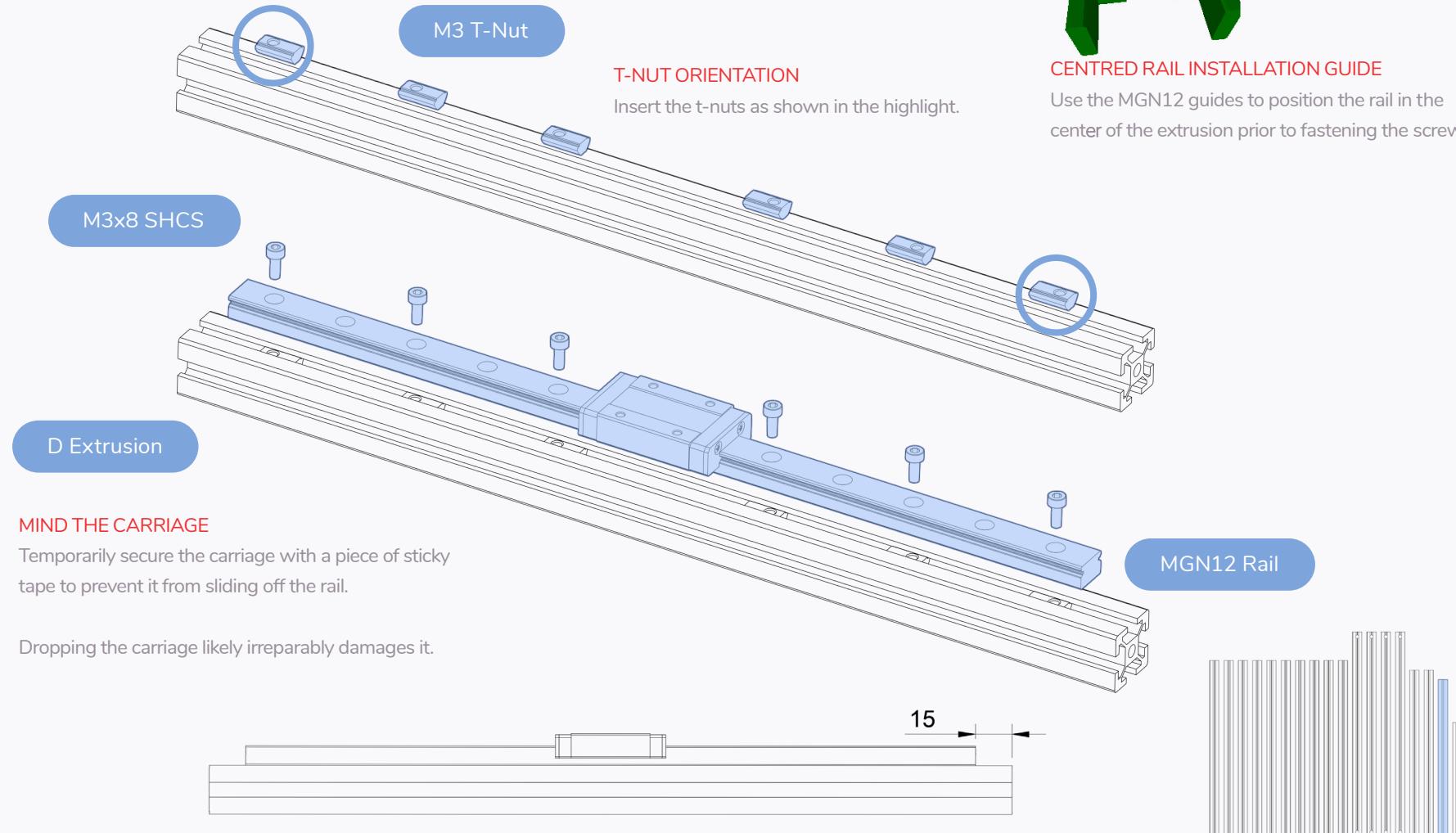
The bolt is used to position the idler and is screwed directly into plastic.

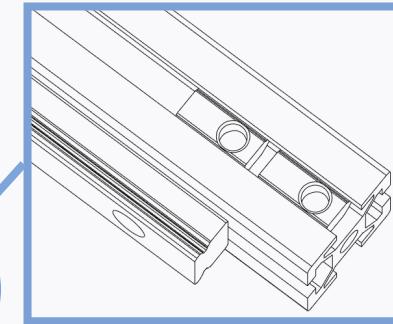
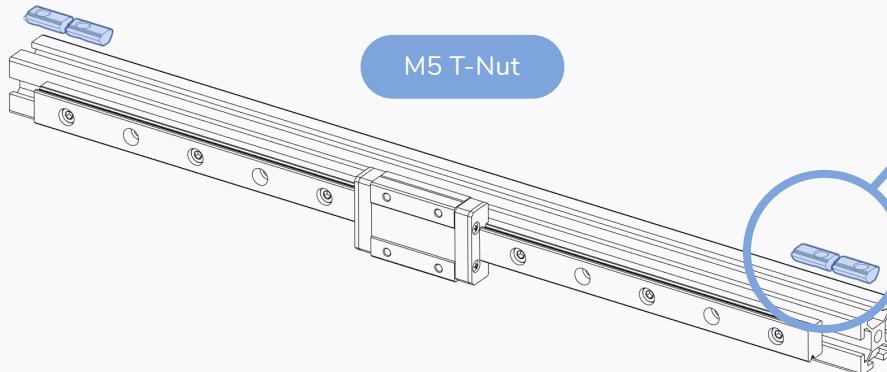
The idler must spin freely.

Again, if you are building a bigger printer than the 250mm version, start at the outer holes and screw the rail down every second hole. Small reminder (again): The carriages are designed to slide along the rail easily. This unfortunately also includes sliding off the rails. Dropping the carriage likely irreparably damages it. **ALWAYS** put the little black rubber Carriage stoppers back on the rail (into the holes without screws) until your printer is up and running!

X AXIS

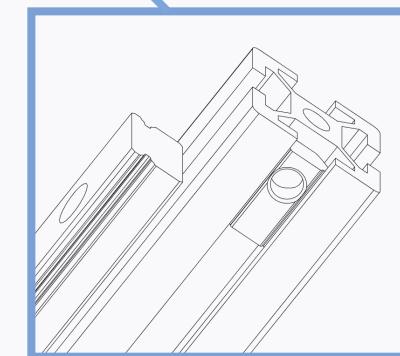
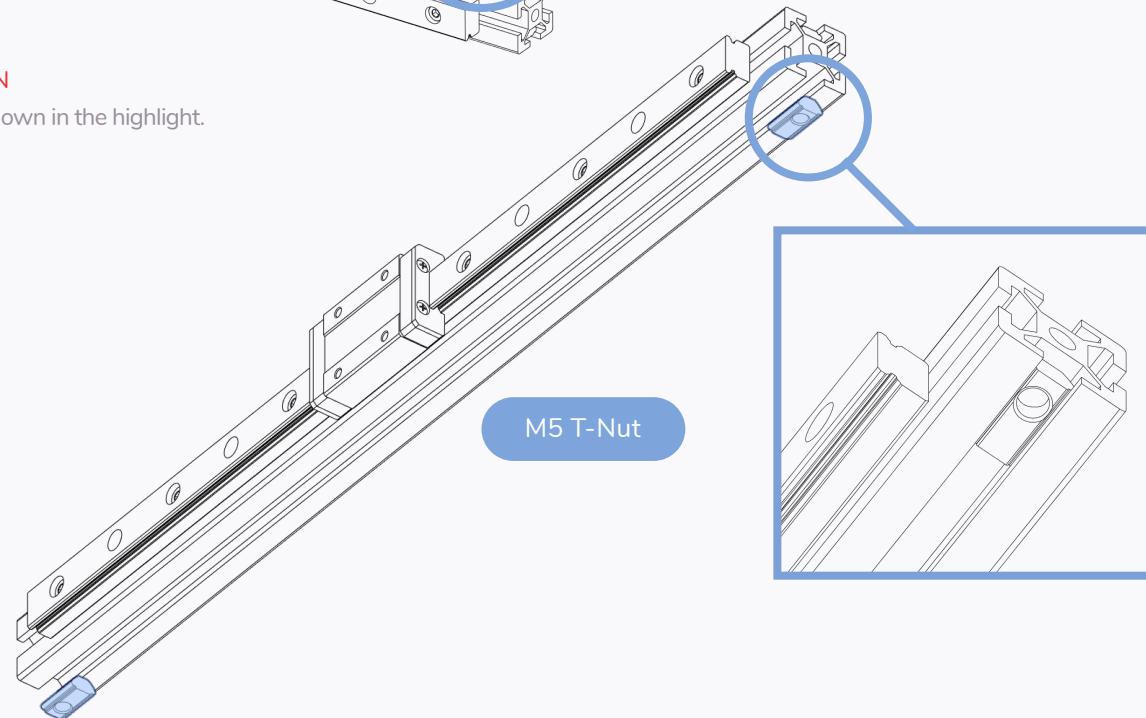
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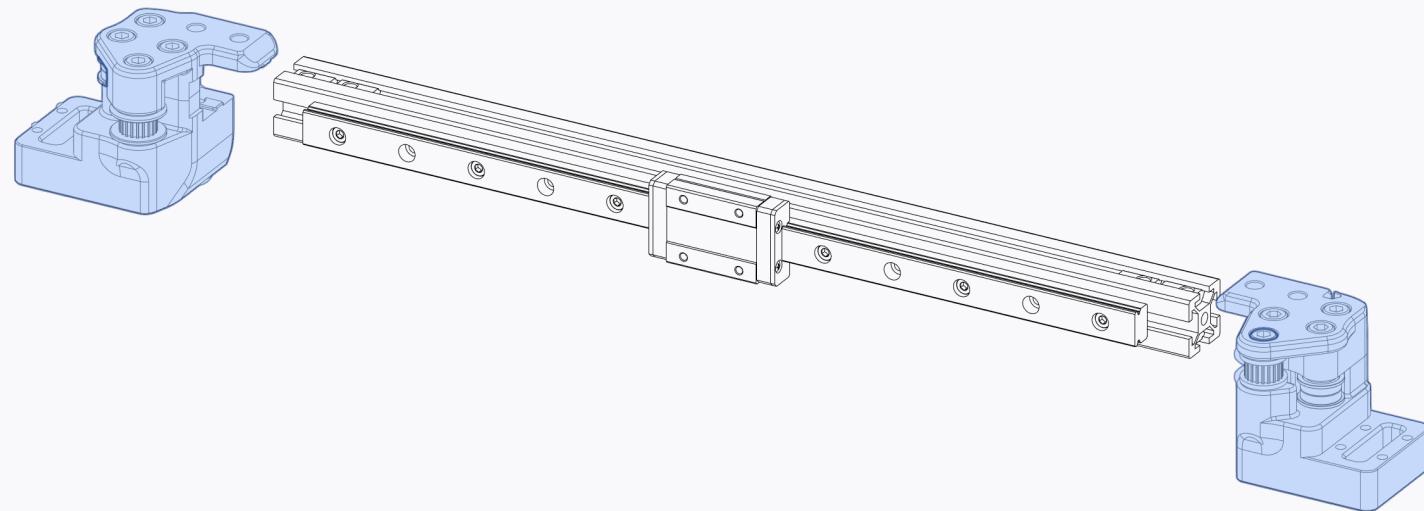
#### T-NUT ORIENTATION

Insert the t-nuts as shown in the highlight.



X AXIS

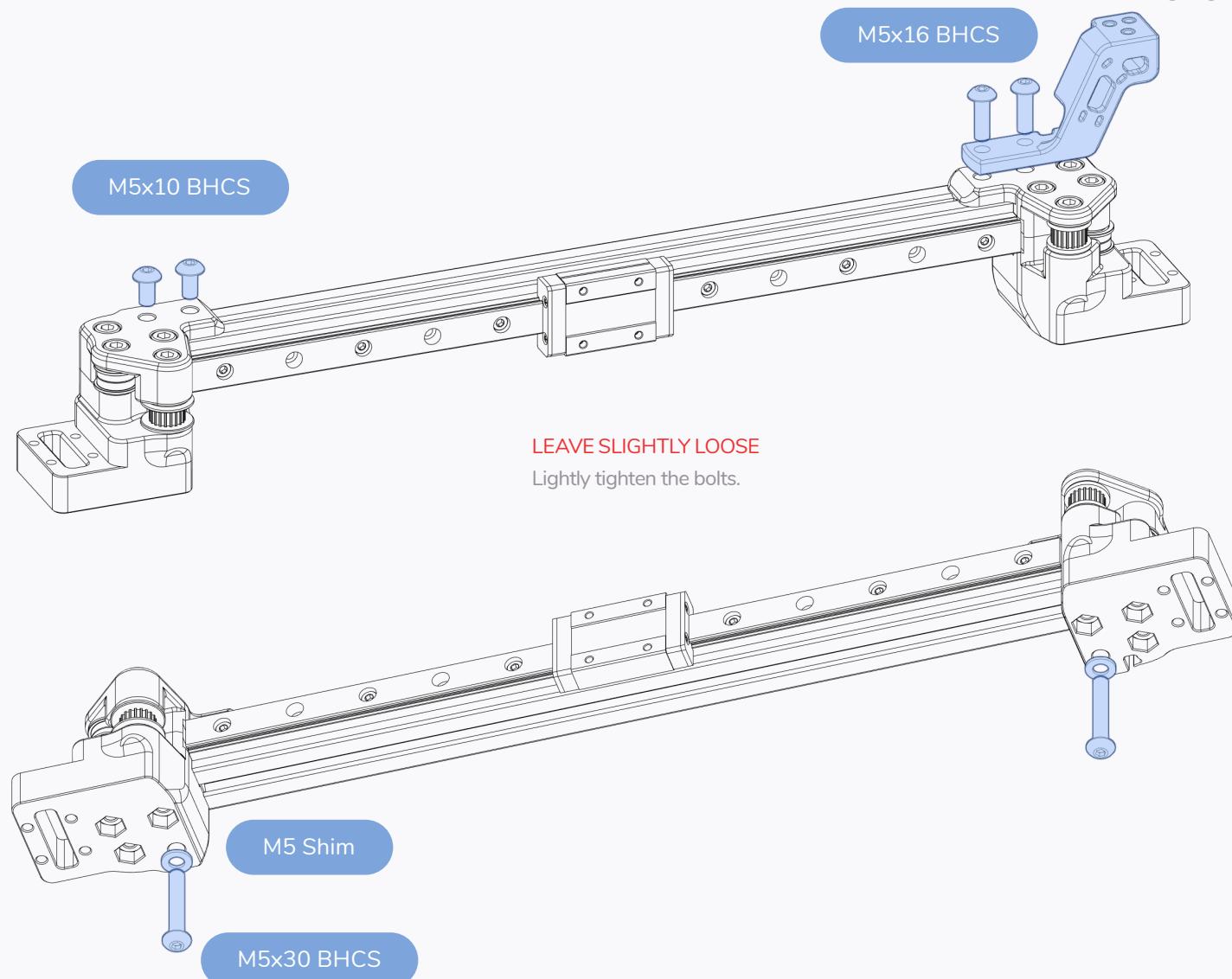
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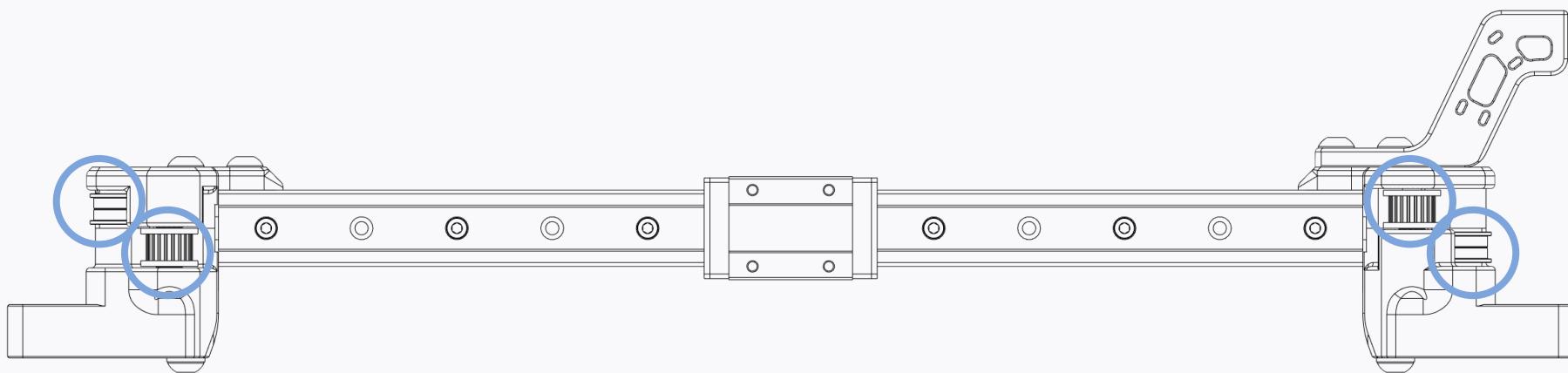


As said before, the part on top of the right XY-Joint is not used with this kit. Use m5x10 BHCS like on the left XY-Joint to secure the X Axis to the XY-Joints.

X AXIS

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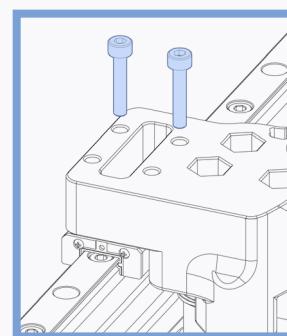
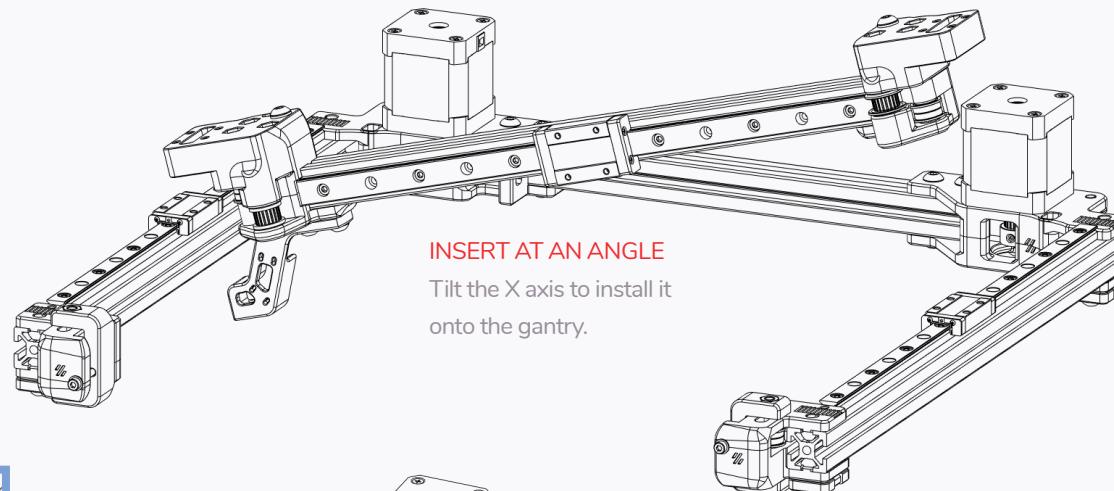
**CHECK YOUR WORK**

Compare your assembled part to the graphic shown here.

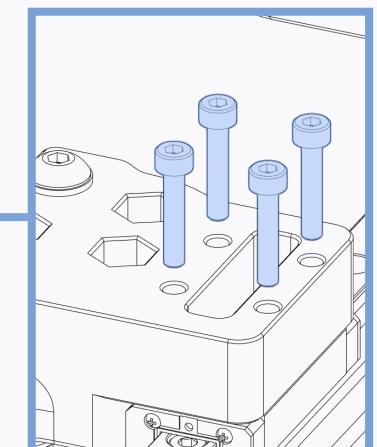
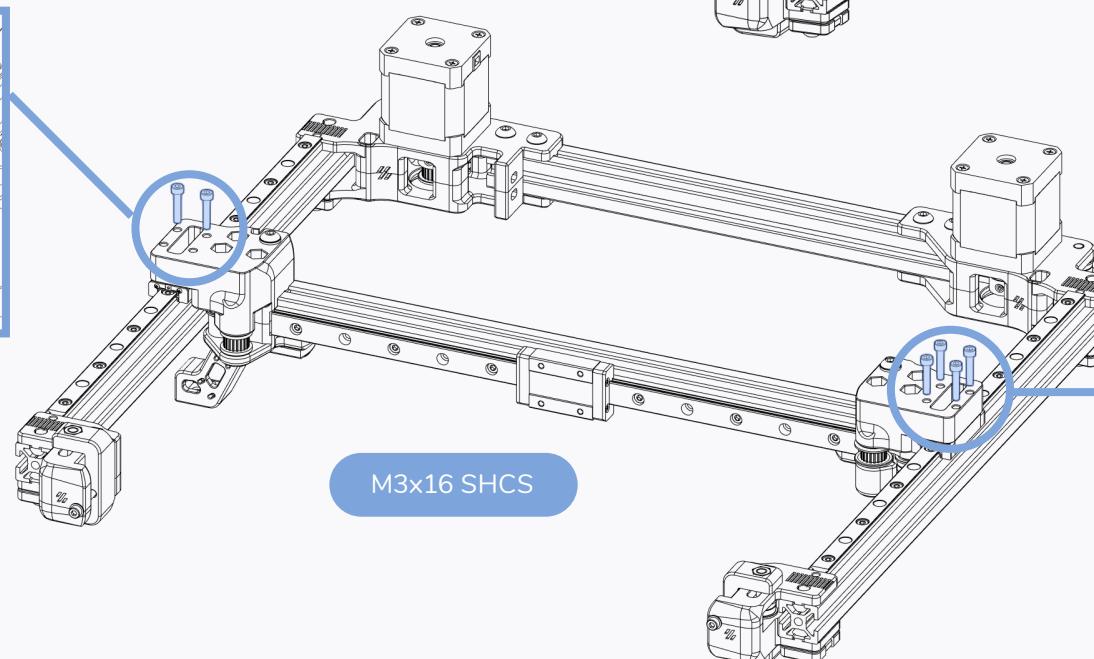
Pay attention to the pulley orientation and alignment with the bearing stack ups.

**FLIP GANTRY**

Turn the gantry around for the next step.

**2X BOLT ONLY**

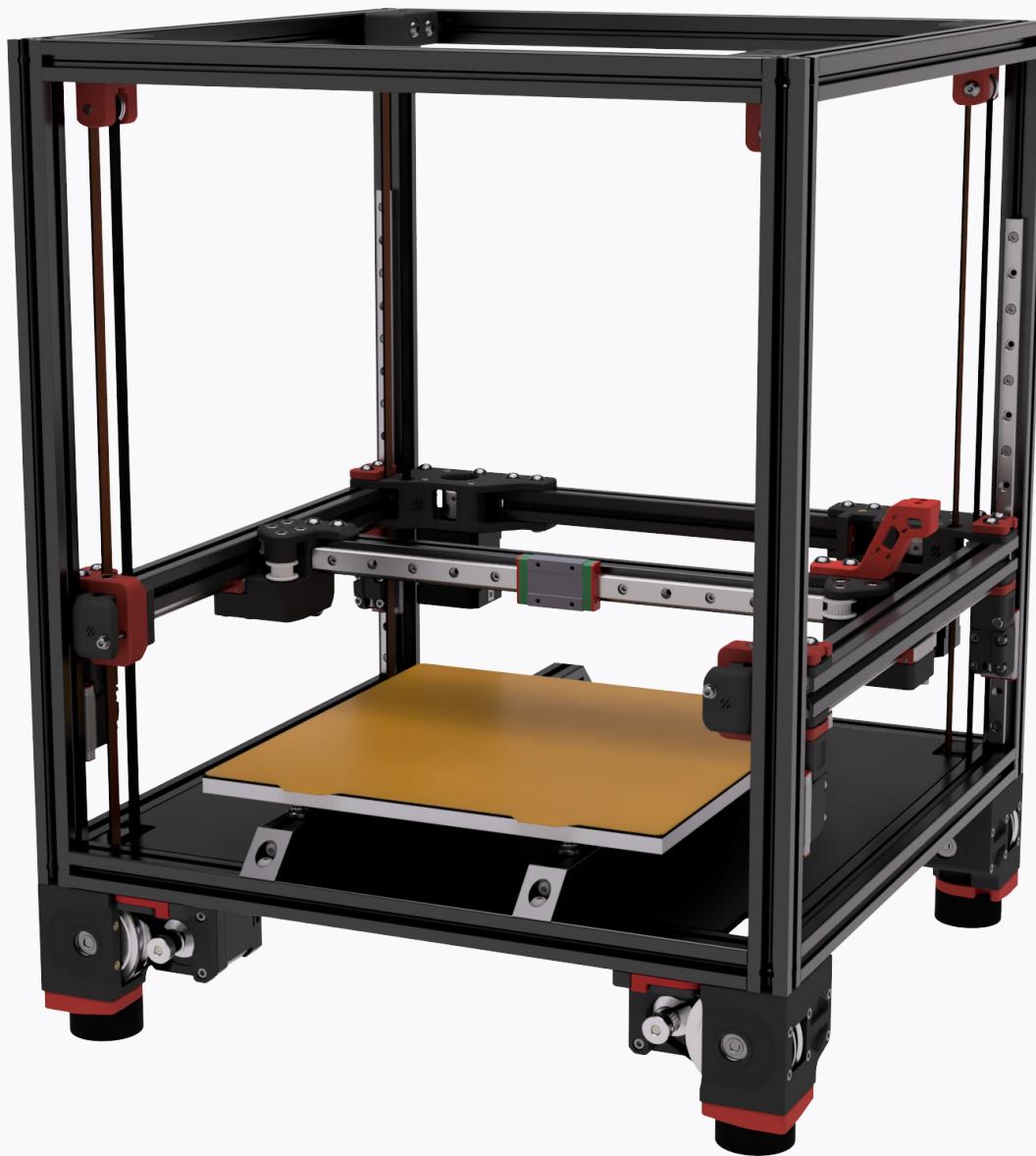
The remaining bolts will be installed during the end-stop installation.



V1 and V2 are not version numbers but the printer models/lines. We renamed the V1 to Voron Trident to address the confusion this caused.

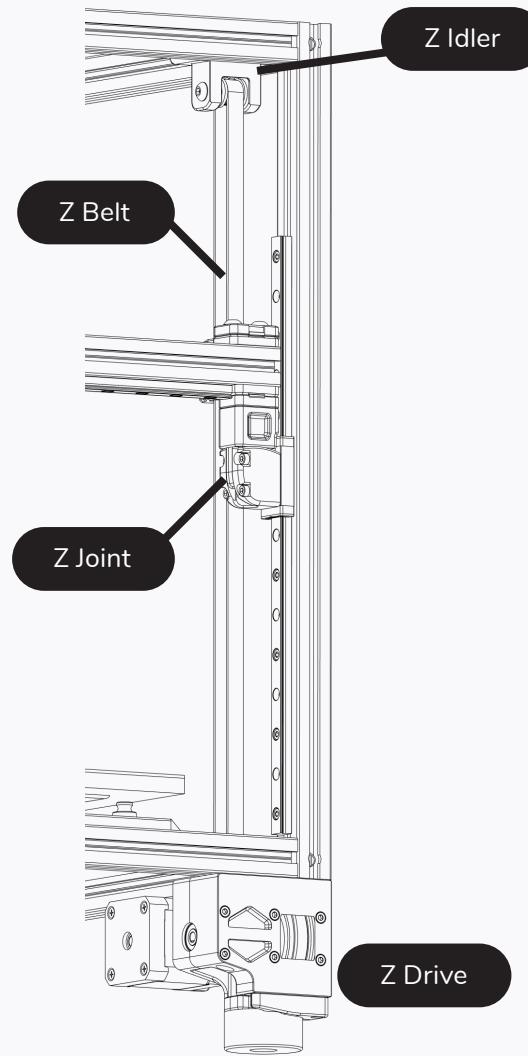
Z AXIS

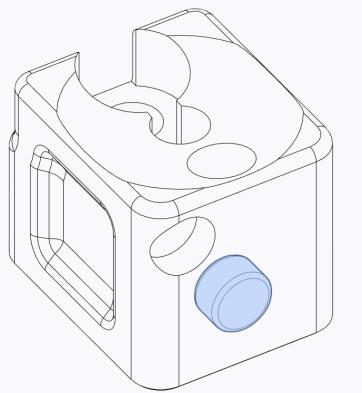
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## OVERVIEW

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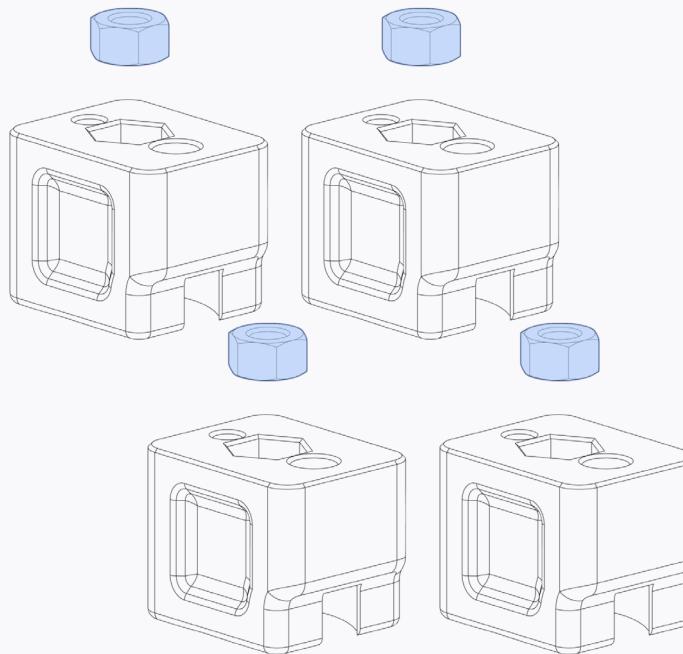


6x3 Magnet

**OPTION: HALL EFFECT ENDSTOP**

If you are building your printer with a Hall Effect Endstop add a magnet to the cutout.

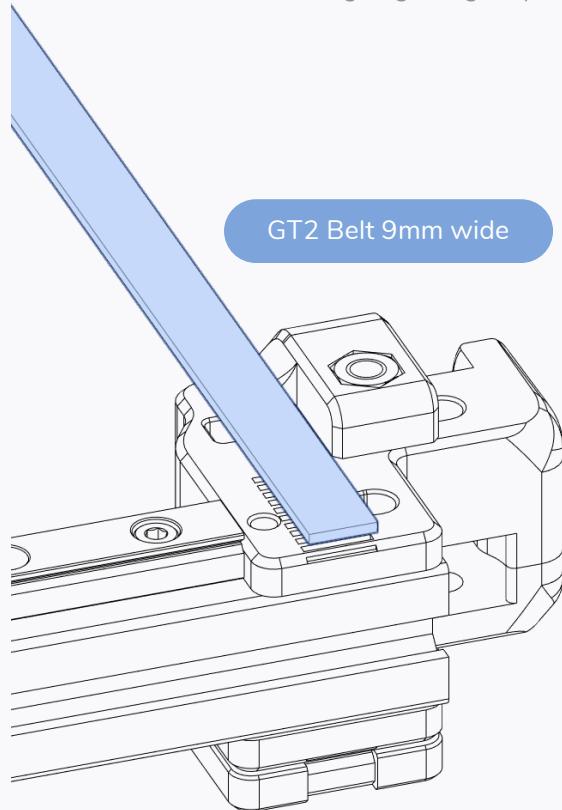
M5 Nut



## Z BEARING BLOCKS

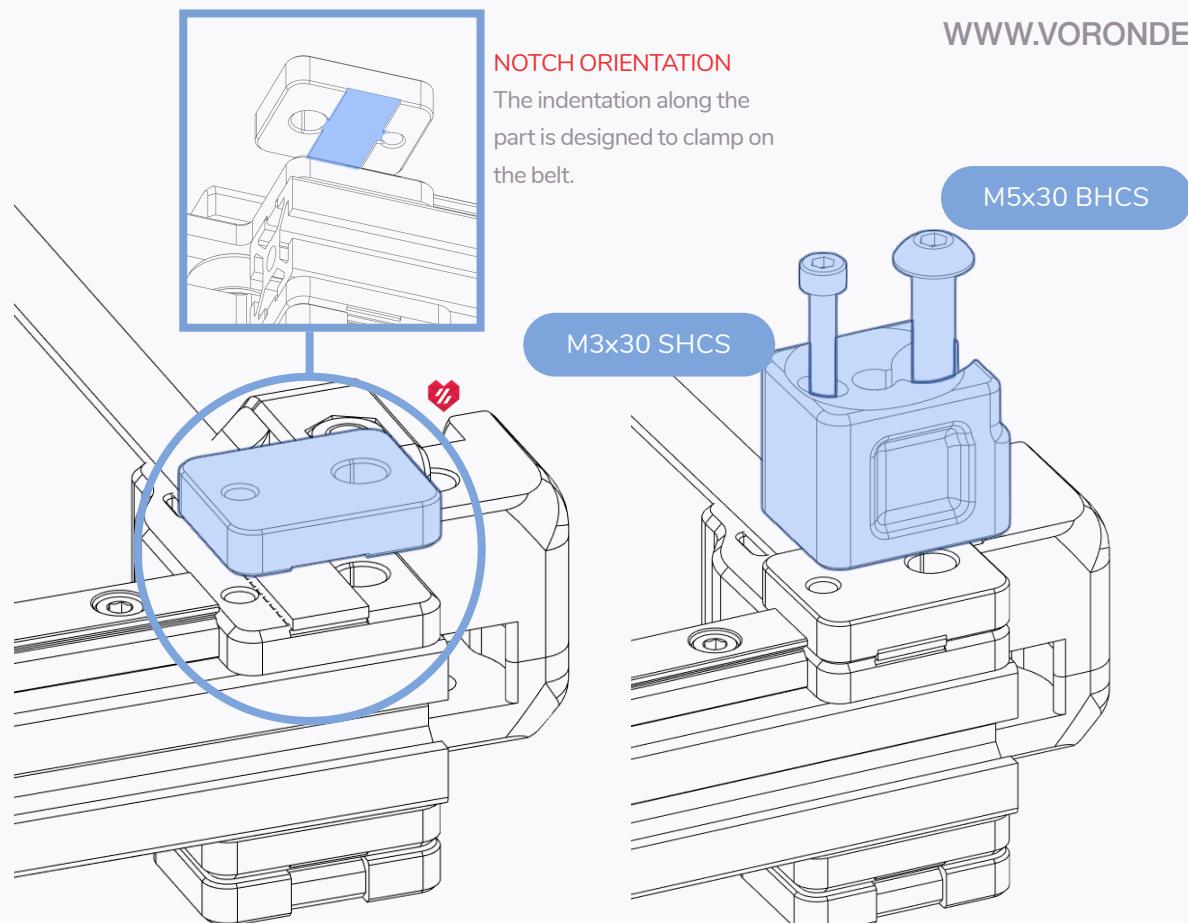
### GANTRY IS STILL UPSIDE DOWN

It's a lot easier than fighting with gravity.



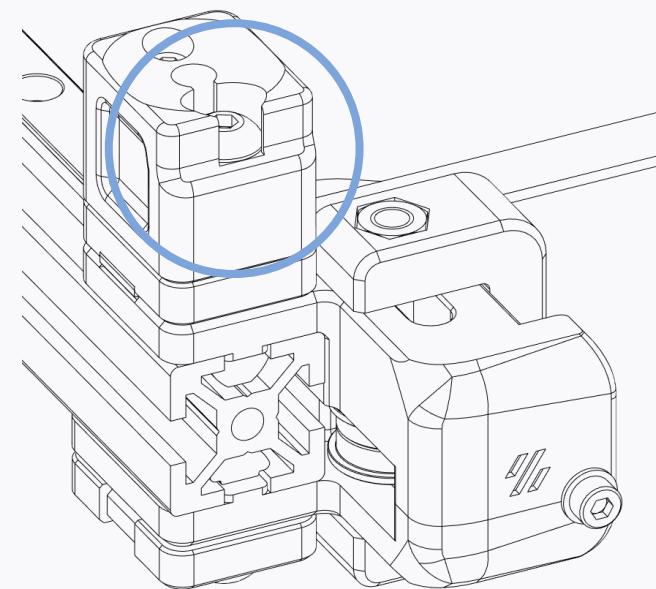
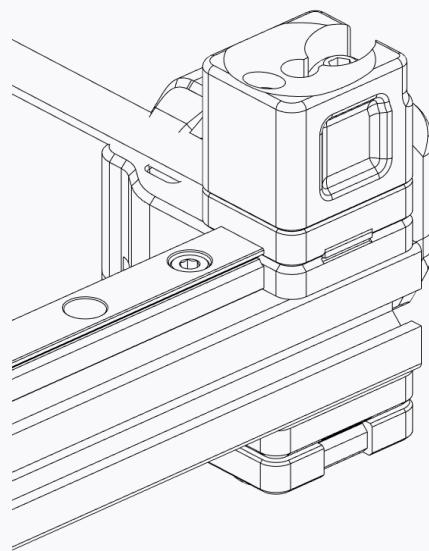
### TEETH DOWN

The teeth of the belts are facing down into the serrations in the printed part.



### MINIMUM RECOMMENDED BELT CUT LENGTH

250 spec 1000mm  
300 spec 1100mm  
350 spec 1200mm



MIND THE PART ORIENTATION

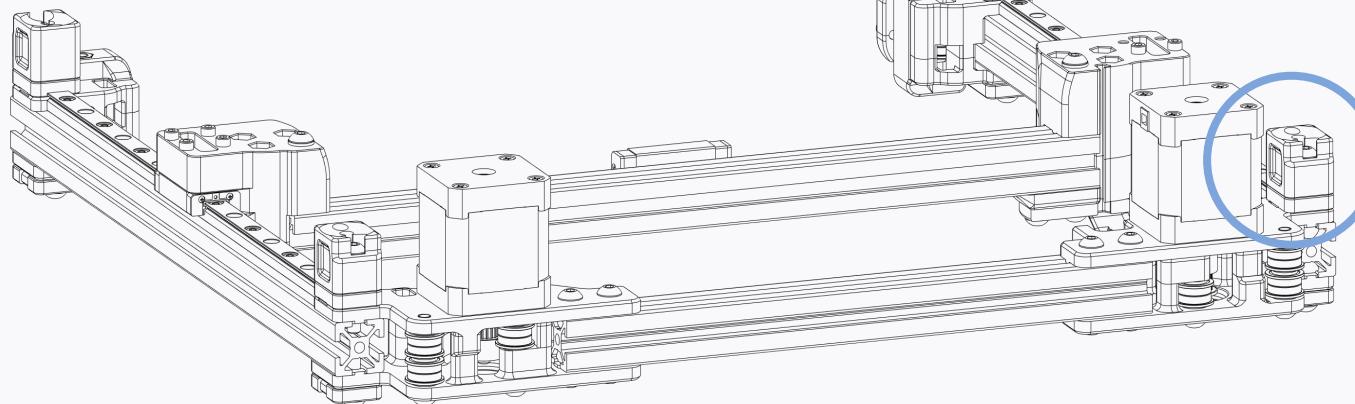
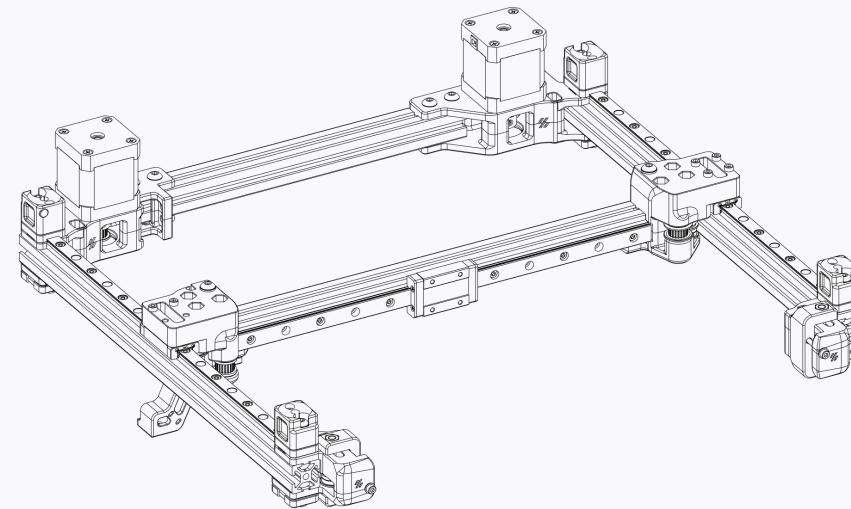
The cutout goes towards the outside.

## Z BEARING BLOCKS

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### REPEAT BELT INSTALL FOR ALL 4 BLOCKS

We are not showing the belts in the pictures on this page.

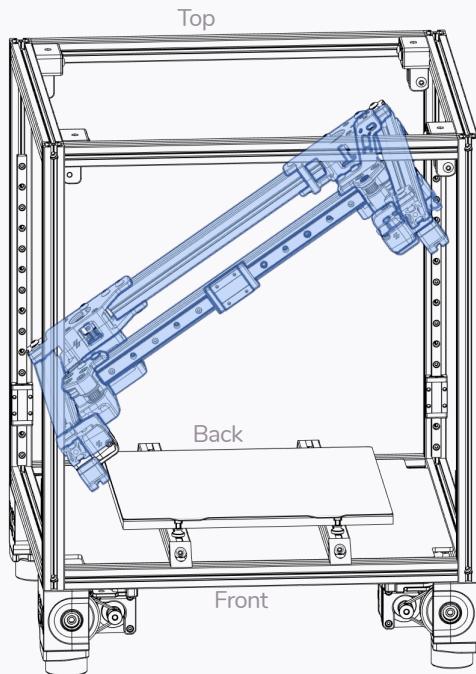


### OPTION: HALL ENDSTOP

Install the block with the magnet in this position. The magnet faces the XY joint.

## GANTRY INSTALL

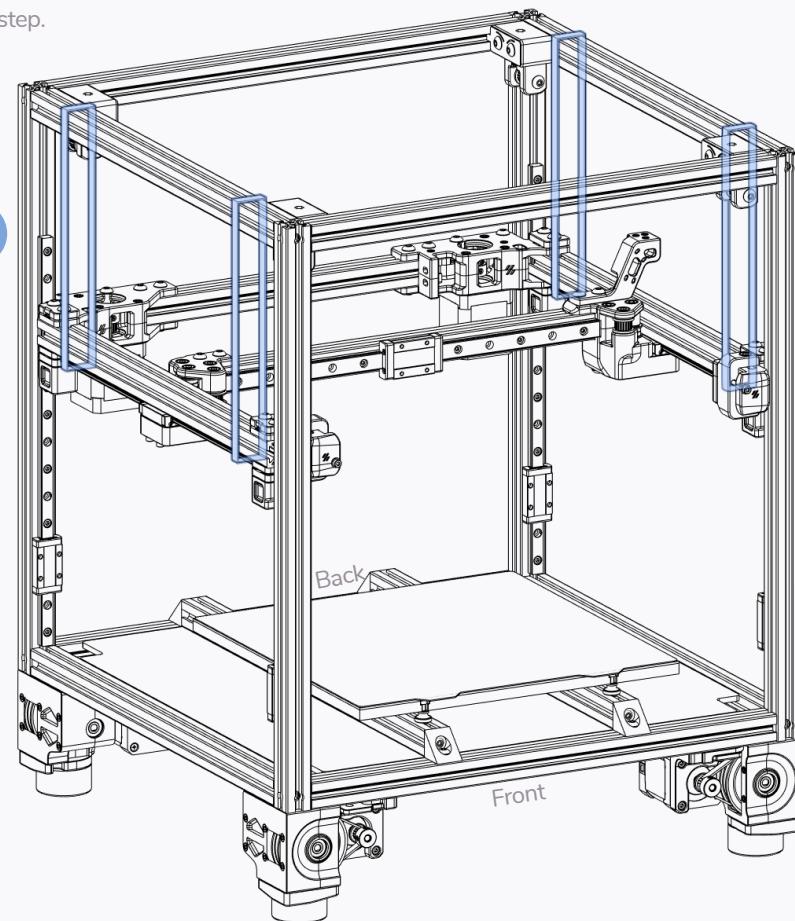
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### INSERT AT AN ANGLE

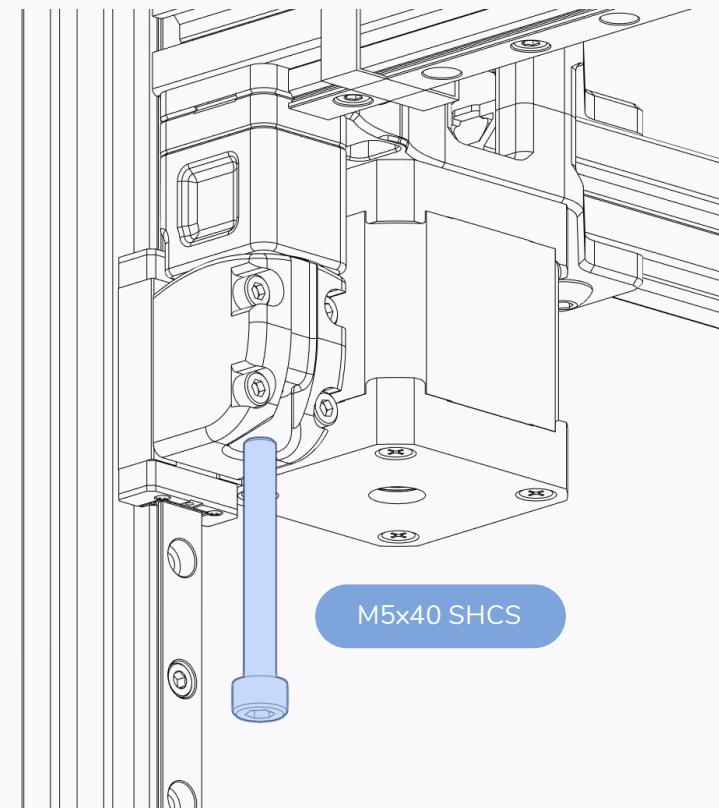
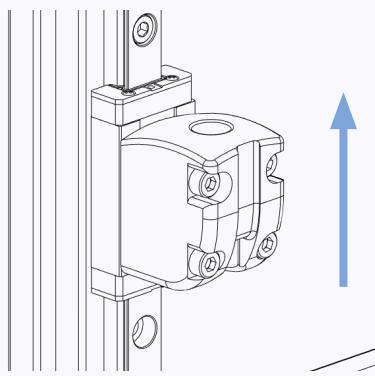
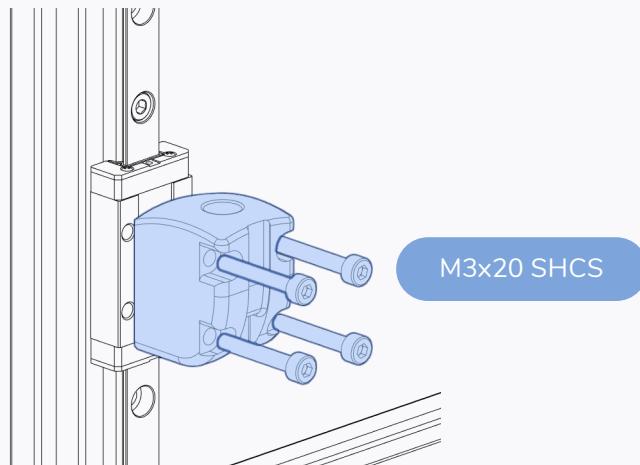
Tilt the gantry to move it past the uprights.

Long Zipties

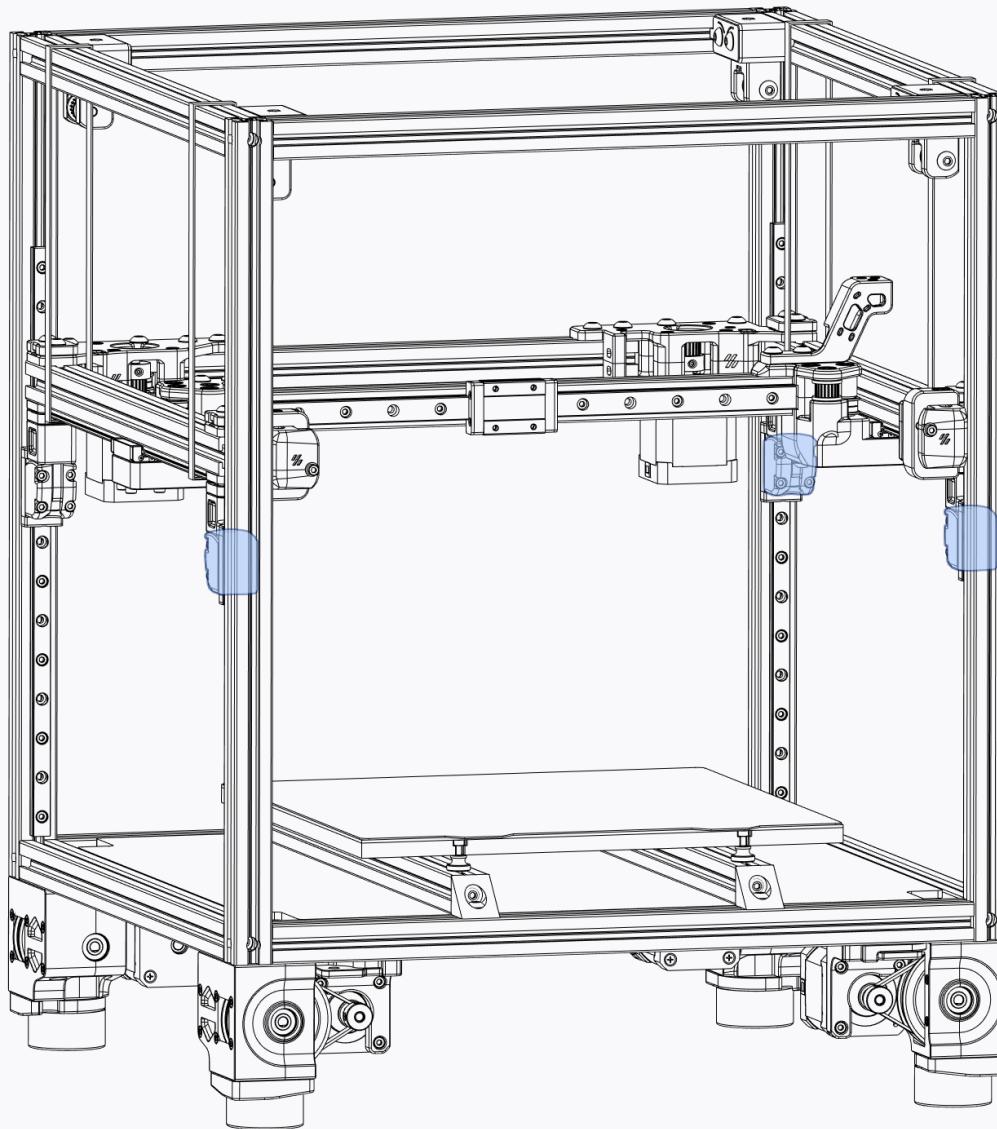


### A HELPING HAND

Secure the gantry with long zipties or similar while the gantry is being installed. An extra pair of hands helps with this step.



Z JOINTS

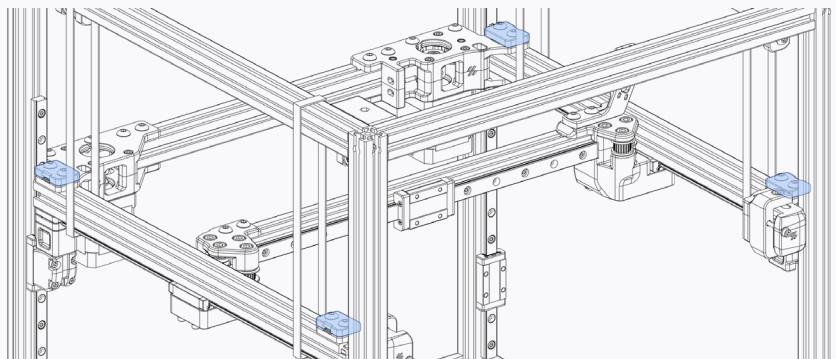


INSTALL REMAINING JOINTS

Add the other 3 joints repeating the same steps.

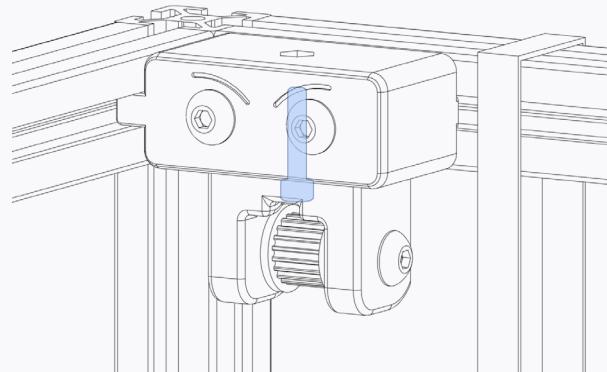
## PREPARATION

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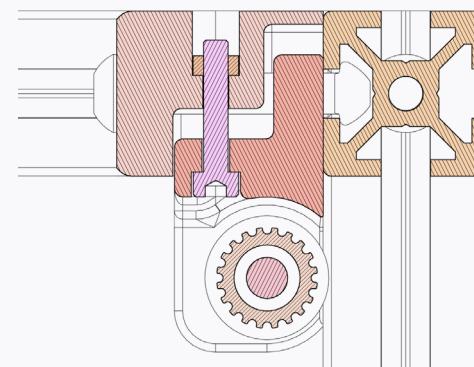
### LOOSEN TOP BELT CLAMPS

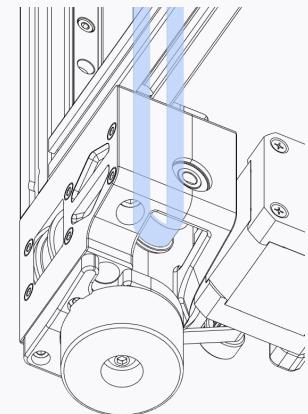
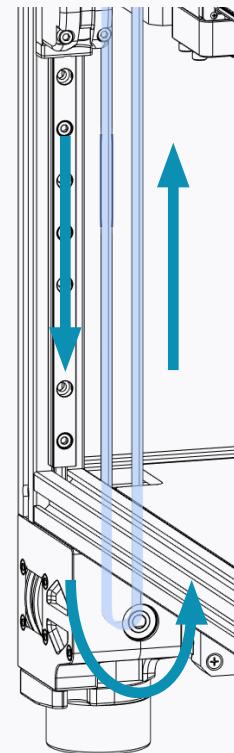
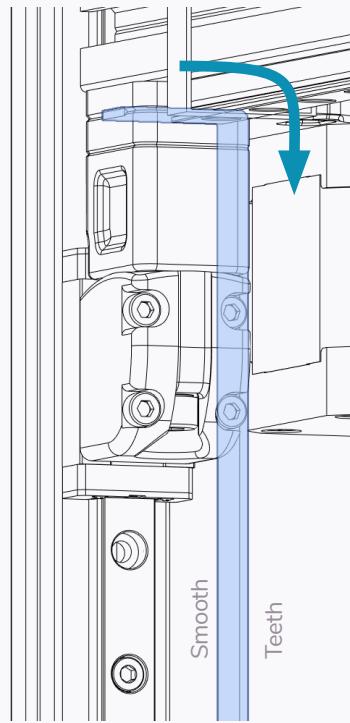
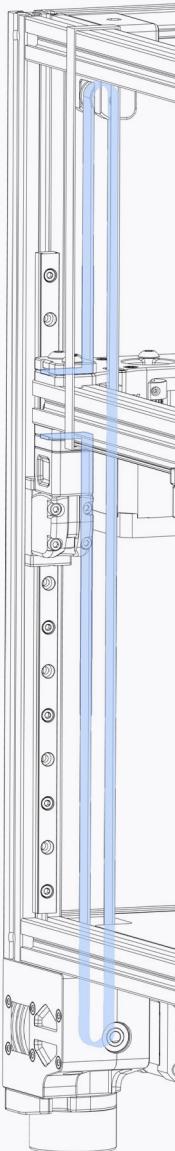
Undo the top belt clamps, we'll be installing the belts in the next steps.



### EXTEND IDLER

Loosen the idler bolt to extend the idler. Once extended to the maximum before becoming undone tighten 4 turns. Repeat for all 4 idlers.





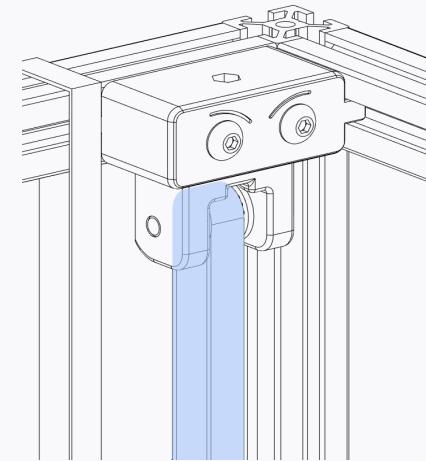
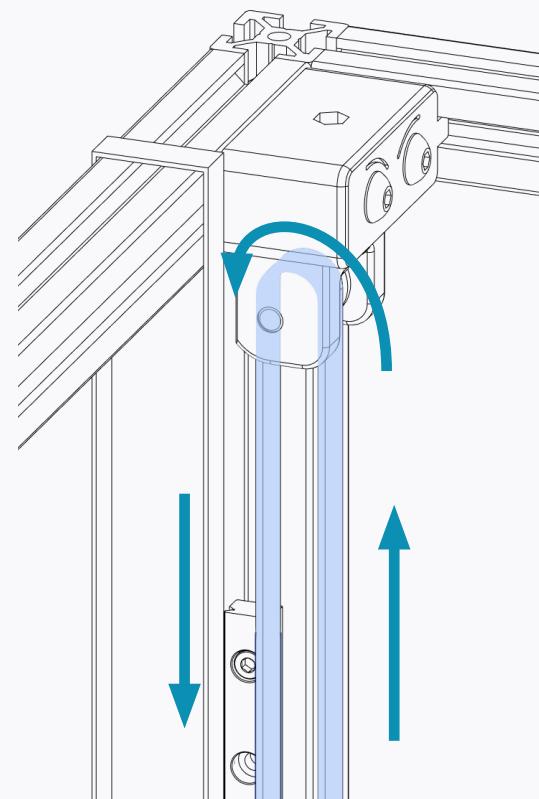
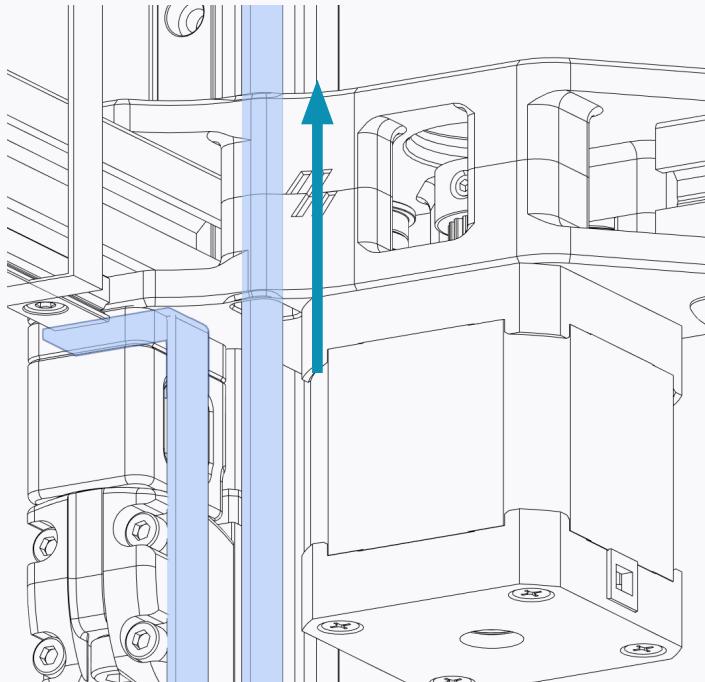
#### Z BELT ROUTING

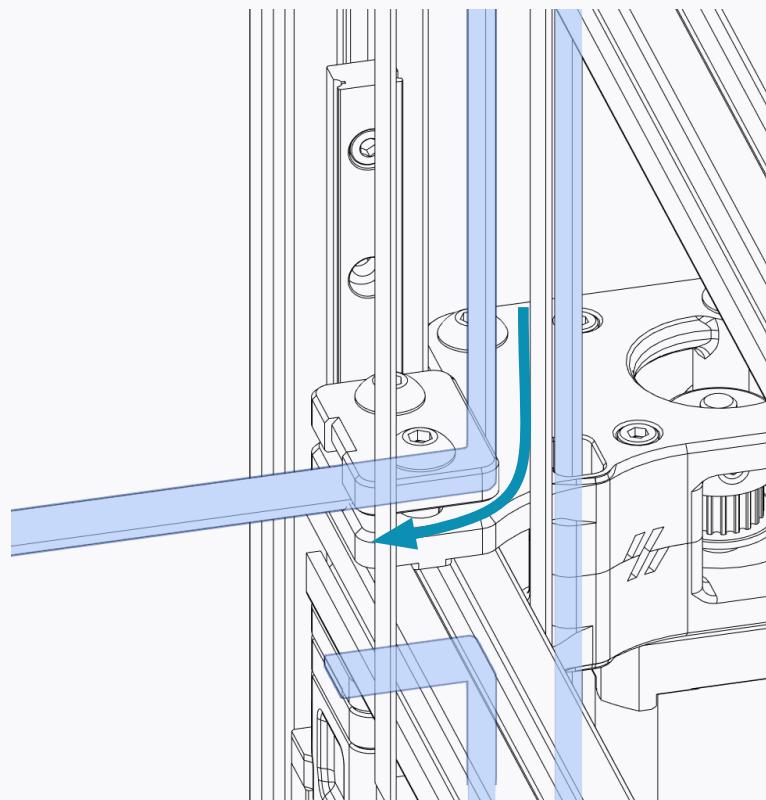
Follow the path pointed out by the arrows.  
Needle nose pliers, tweezers or similar tools  
can help in this step.

The belt teeth are on the inside of the loop.

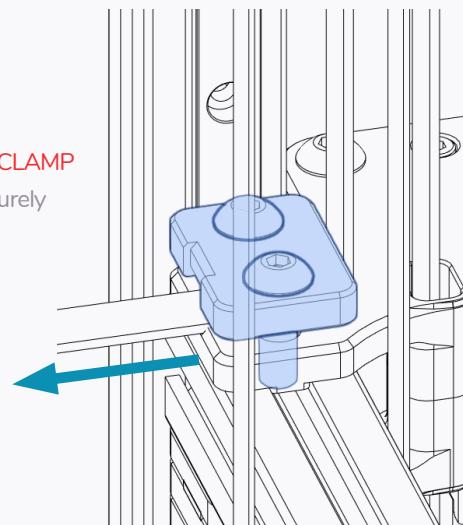
Z BELT

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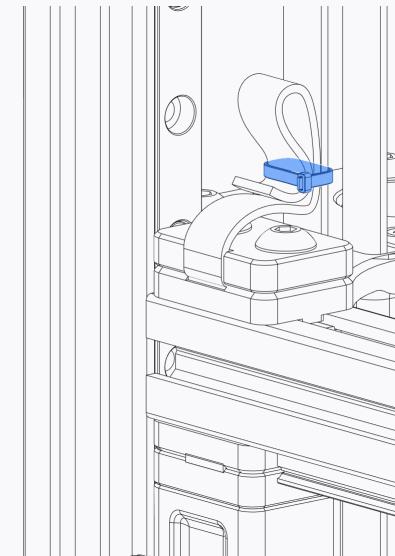


**PULL TIGHT AND SECURE BELT CLAMP**

Pull on the end of the belt and securely fasten the top belt clamp.

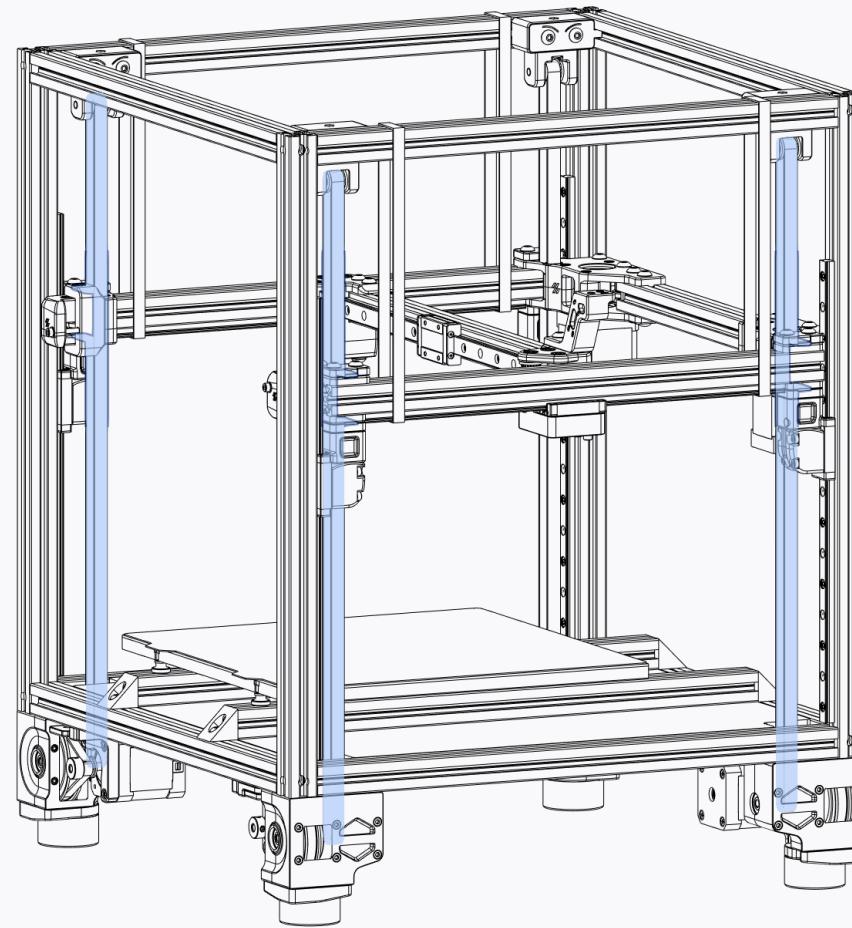
**EXCESS BELT**

Fold the excess belt over and use a small ziptie to secure the end.



**INSTALL REMAINING Z BELTS**

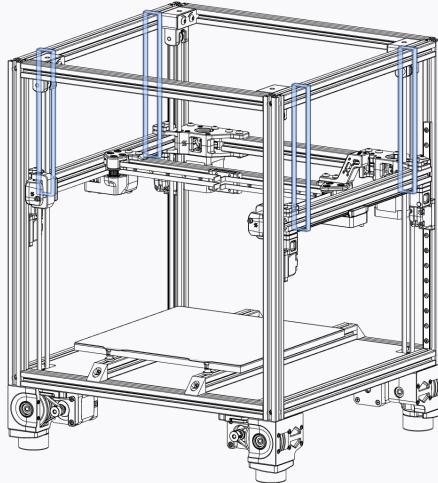
Repeat the install instructions for the other 3 Z belts.



**After you installed the Z-belts and squared the Gantry, make sure your AB belts are exactly the same length and have the exact same amount of teeth! Proceed with routing the AB-Belts, but be Aware that you will use a different X carriage as in the Voron 2.4 Manual.**

## GANTRY ALIGNMENT

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### REMOVE ZIPTIES

With the belts installed the gantry will stay in position.

### SQUARING THE GANTRY

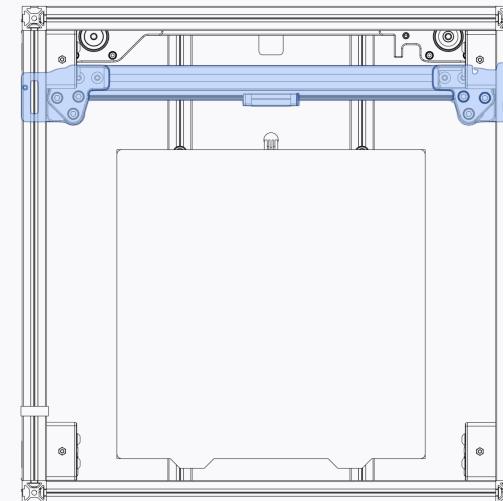
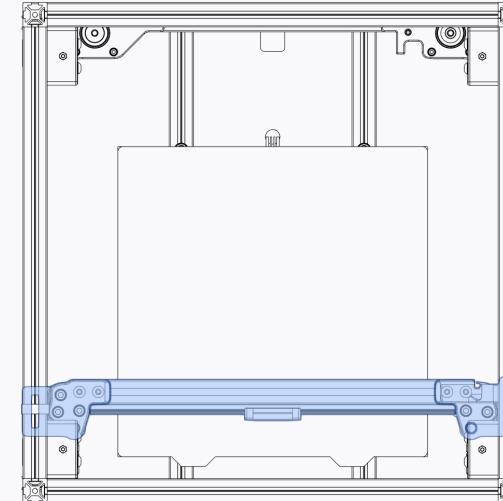
Move the gantry all the way back until it hits the A and B drive on both sides.

Fully tighten all screws on the X axis.

You may need to adjust the distance between the A and B drive to square the gantry. To do this loosen the bolts that secures the B drive to the rear gantry extrusion. Repeat the steps above and secure the fasteners again.



<https://voron.link/cekh81>



Voron2.0 was never officially released.

A/B BELTS



### THE VORON BELT PATH

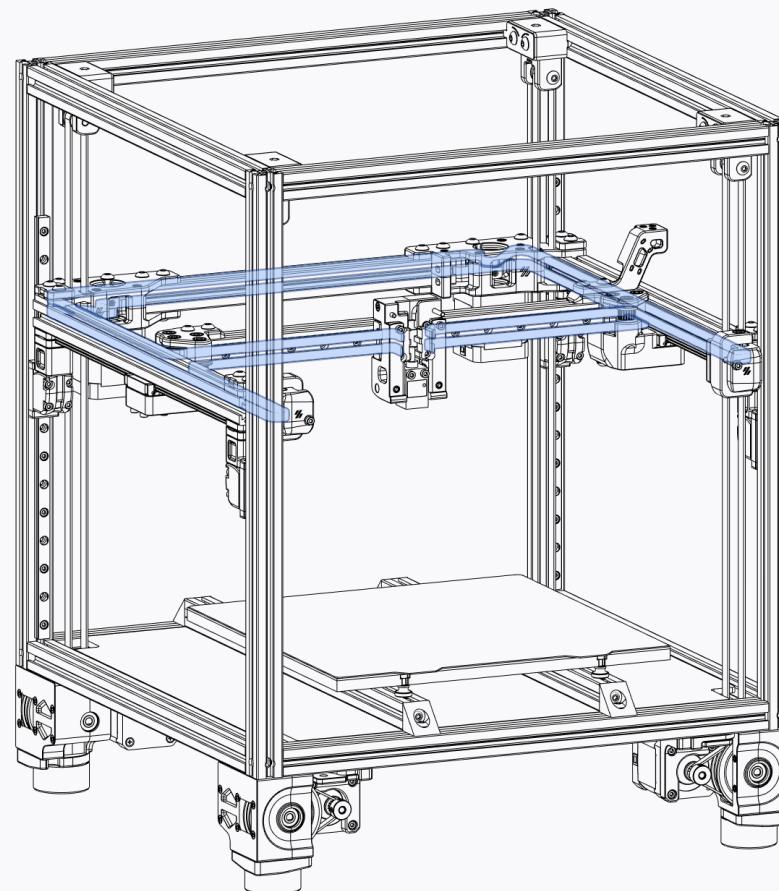
Voron printers use a belt path based on the popular CoreXY pattern.

The individual belt paths are stacked on top of each other and the crossing often found in CoreXY designs is omitted. Compared to many other implementations, the motors are moved to a less intrusive position. To learn more about the principles behind CoreXY visit <https://voron.link/ef72dd6>.

Equal belt tension is important to the proper function of a CoreXY motion system.

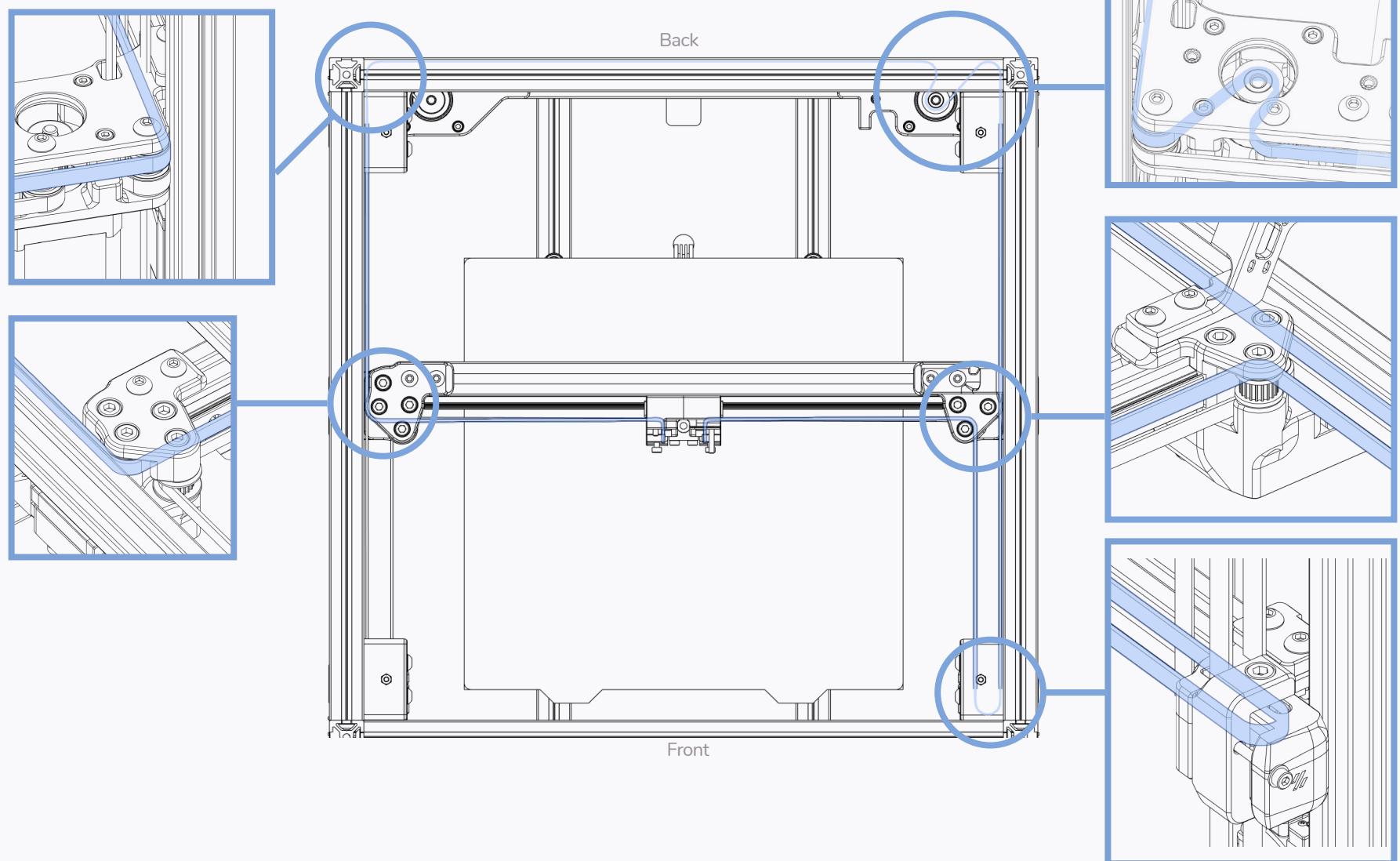
We recommend to run one belt to get the required length, remove the belt from the printer and cut the second belt to the exact same length.

As both belt paths have the same length this is an easy way of getting a consistent tension.



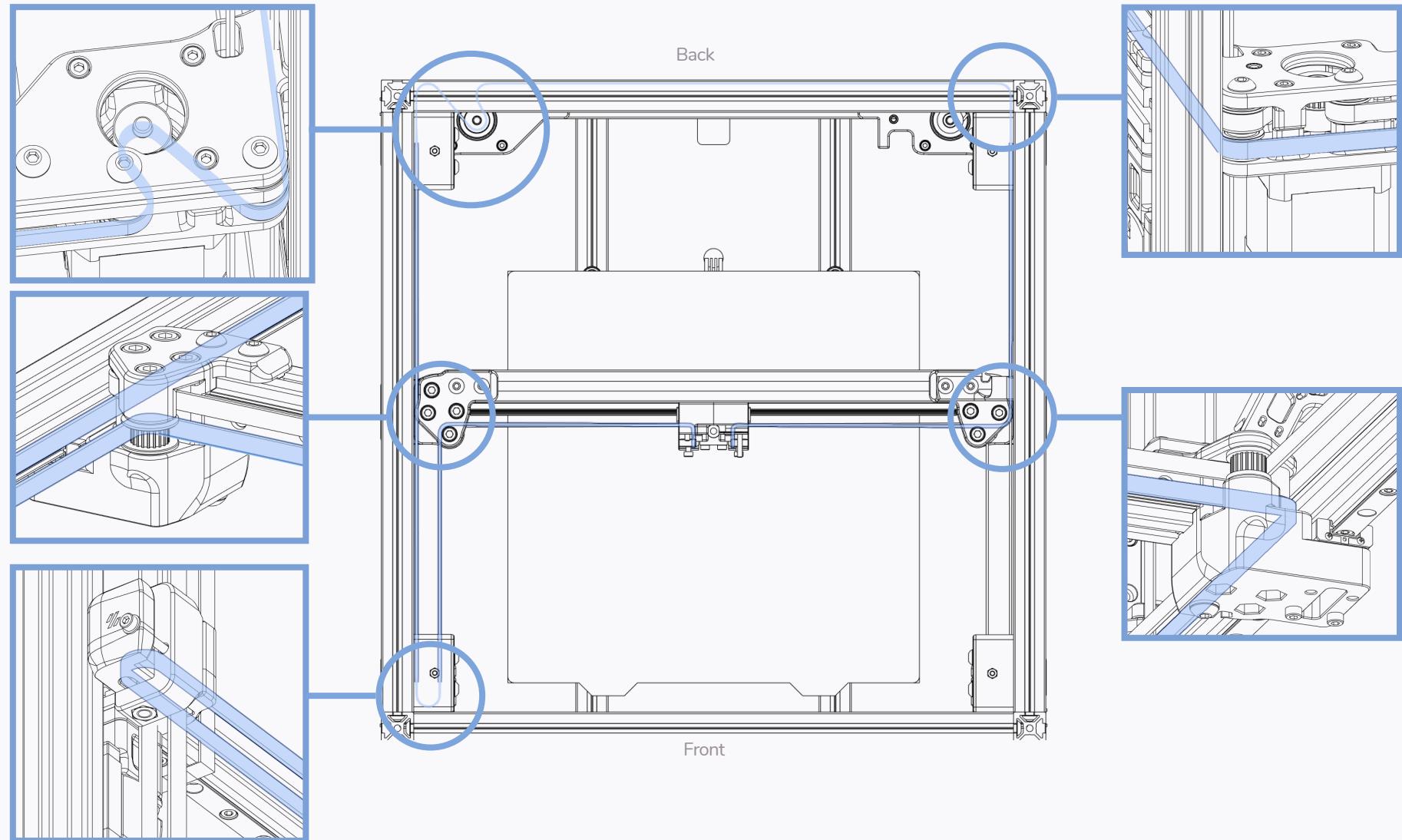
## OVERVIEW - A BELT

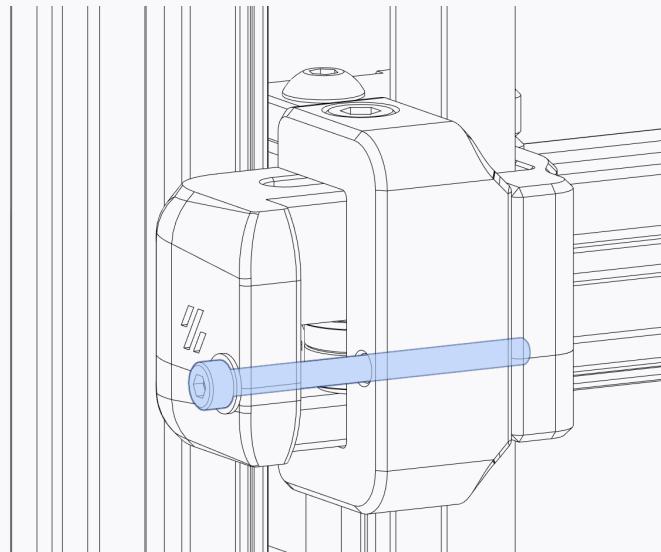
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## OVERVIEW - B BELT

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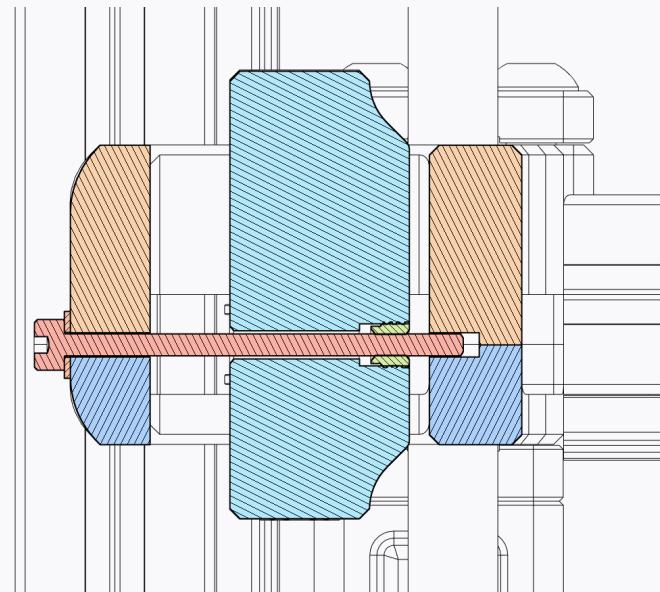




**EXTEND IDLER**

Loosen the idler bolt to extend the idler. Once extended to the maximum tighten 4 turns.

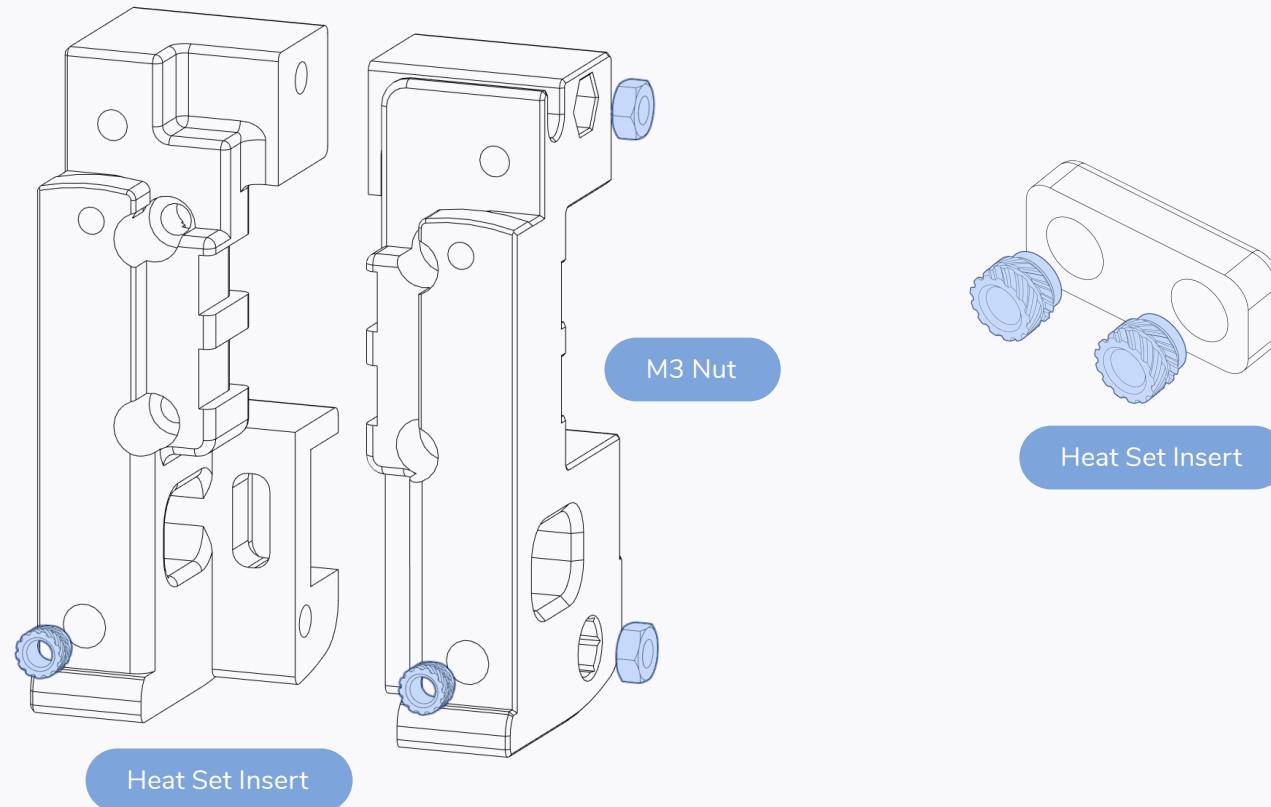
Repeat for the second idler.



**Skip these pages. Put the AB belts to the MGN12 Carriage with some tape, they dont have to be tight.**

PREPARATION

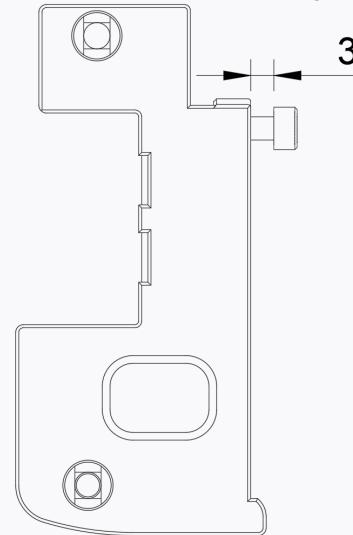
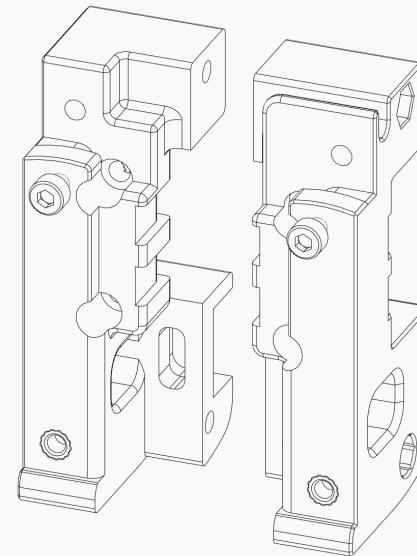
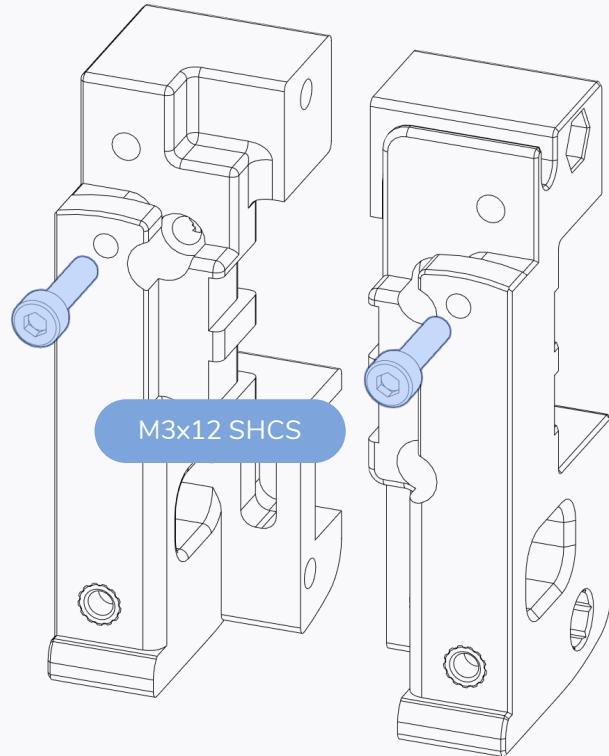
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**Skip these pages. Put the AB belts to the MGN12 Carriage with some tape, they dont have to be tight.**

X CARRIAGE

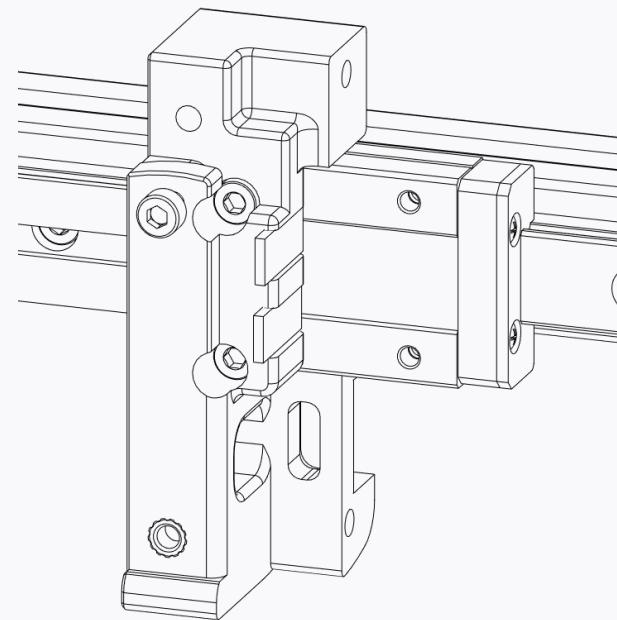
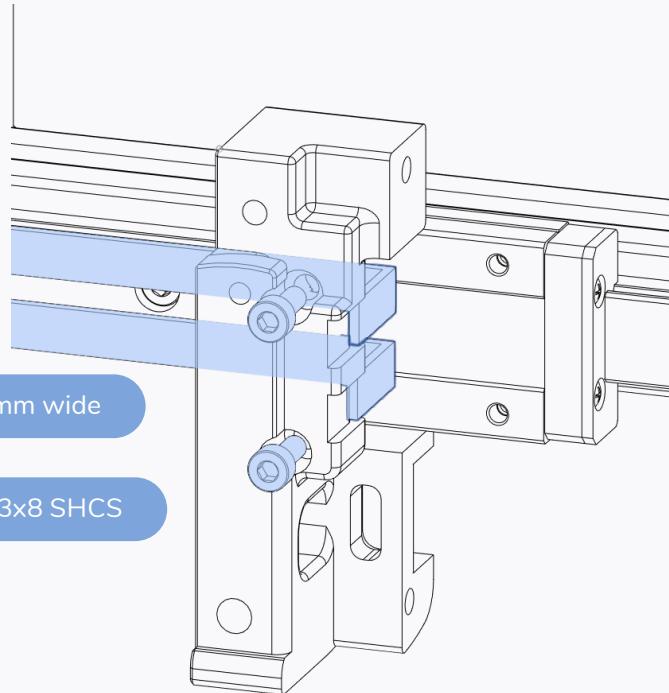
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**Skip these pages. Put the AB belts to the MGN12 Carriage with some tape, they dont have to be tight.**

## A/B BELTS

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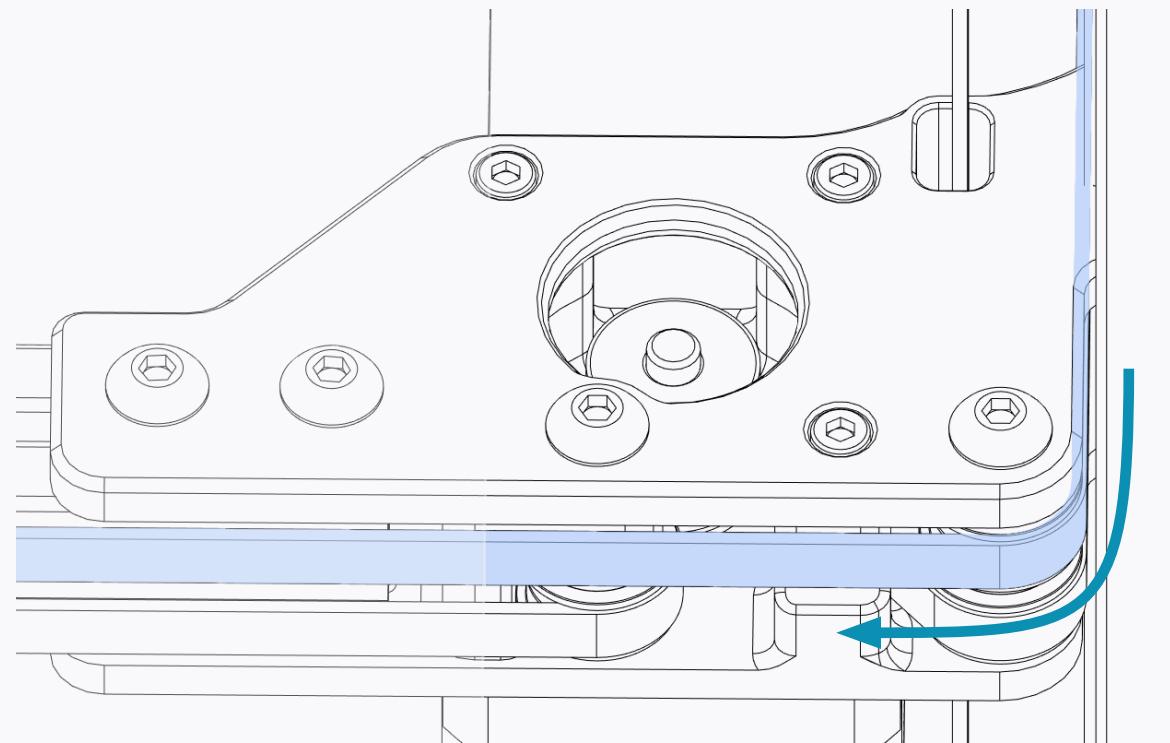
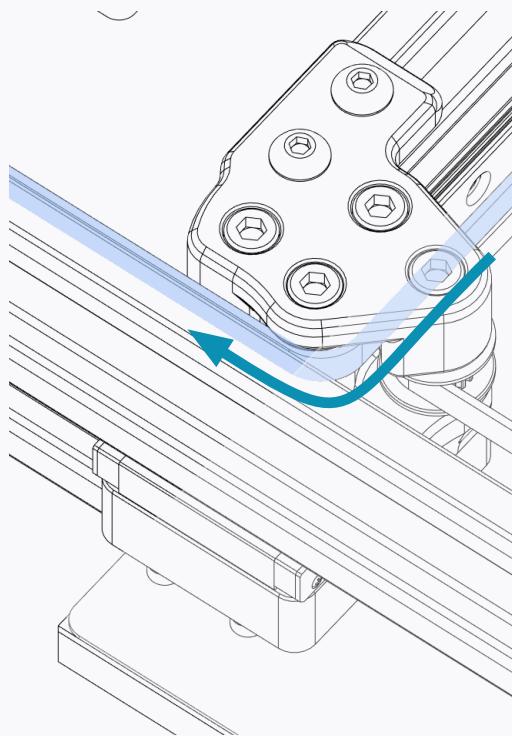


### CLAMP BELTS

Clamp both A and B belts in place by installing the left X carriage part.

The belt teeth face away from the extrusion.

A BELT

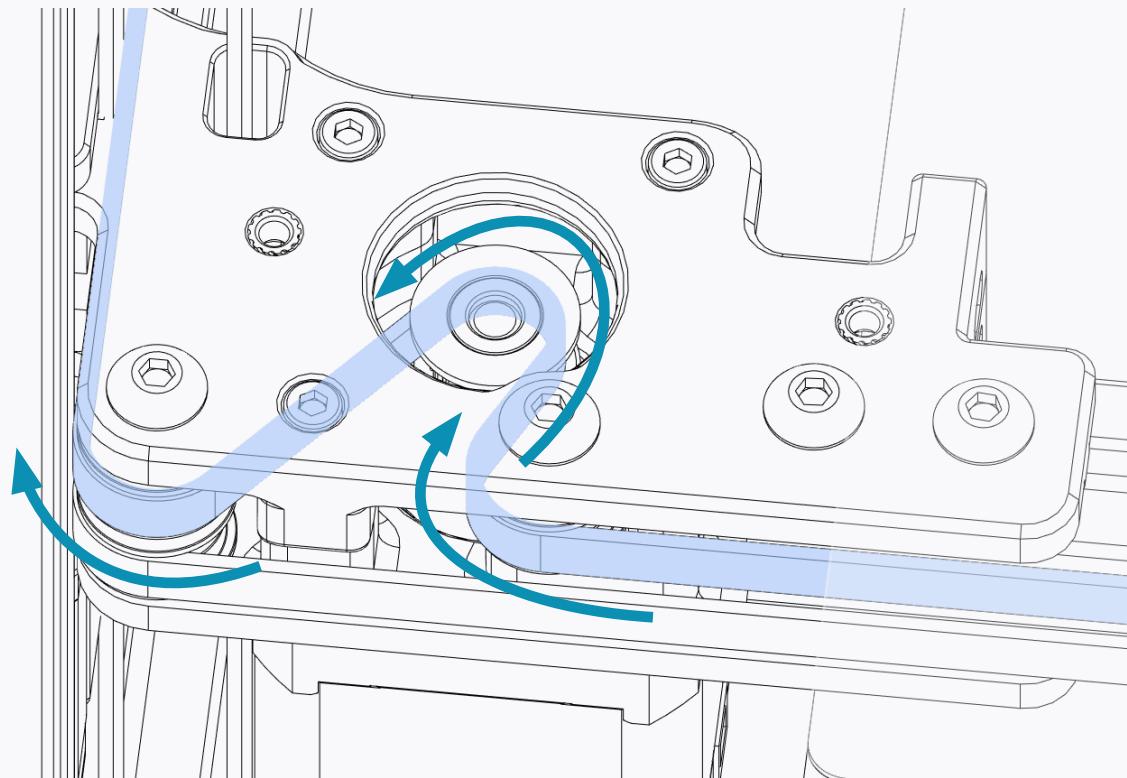


A BELT ROUTING

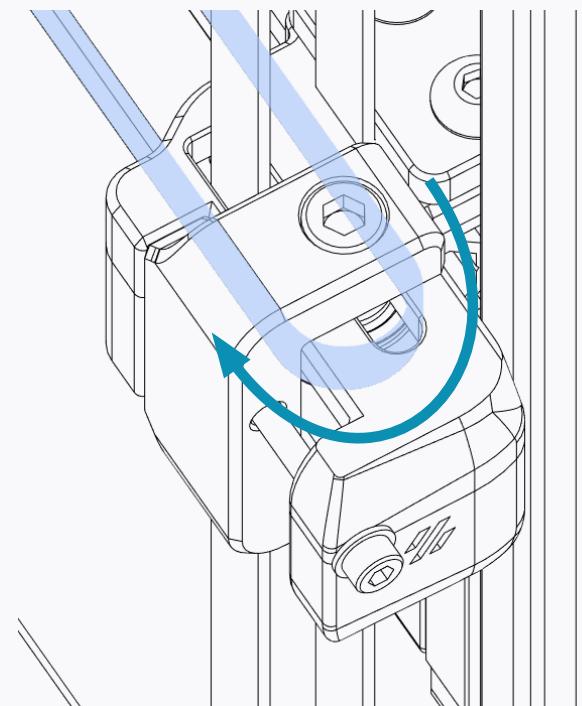
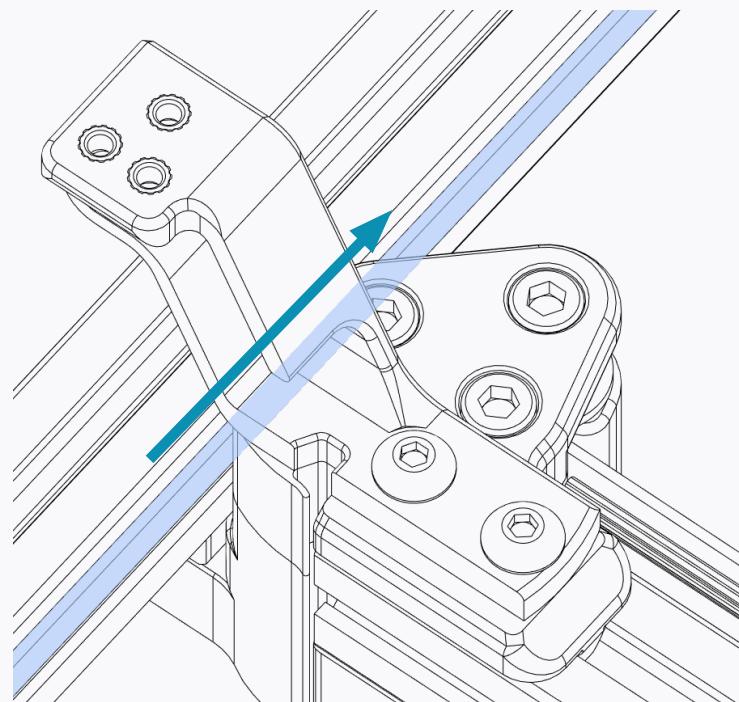
Follow the path pointed out by the arrows.  
Needle nose pliers, tweezers or similar tools  
can help in this step.

A BELT

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A BELT

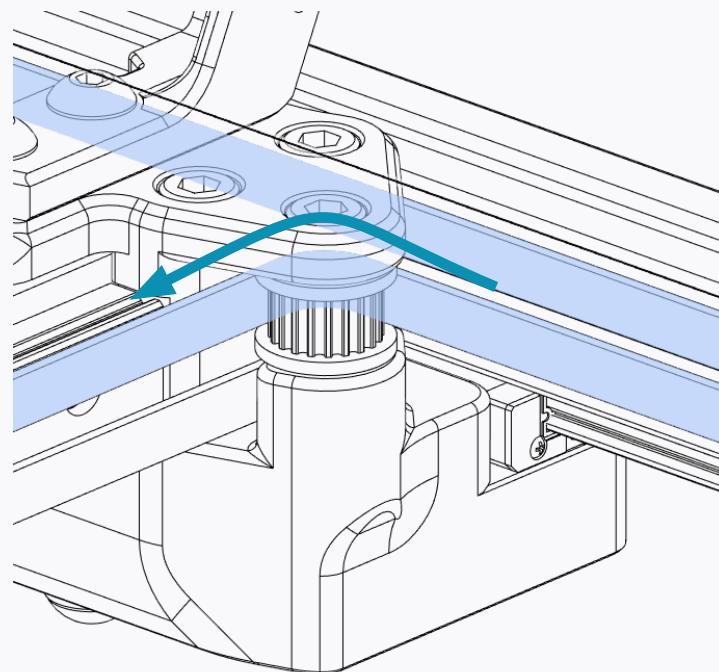


BELTING IDLERS

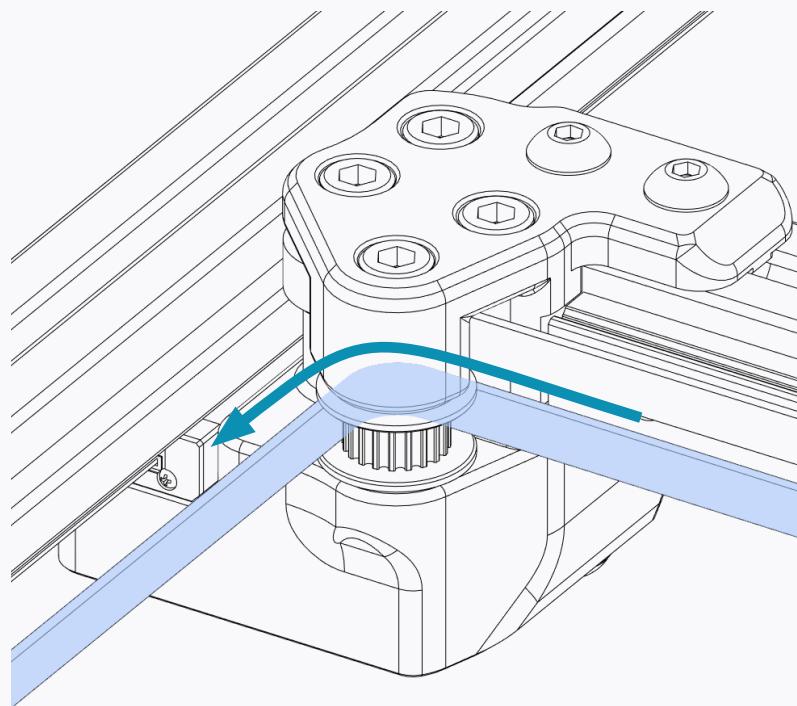
If you're having trouble guiding the belts around the bearing stack temporarily remove the M3x40 SHCS to get better access.

A BELT

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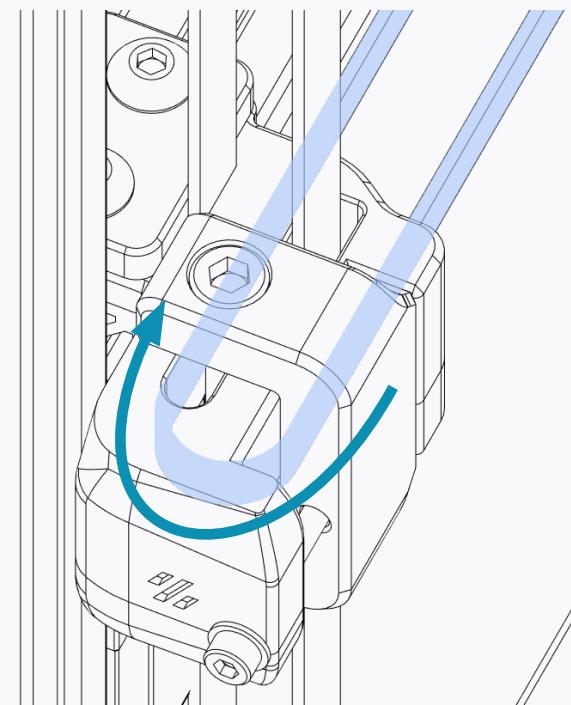


B BELT



**B BELT ROUTING**

Follow the path pointed out by the arrows.  
Needle nose pliers, tweezers or similar tools  
can help in this step.

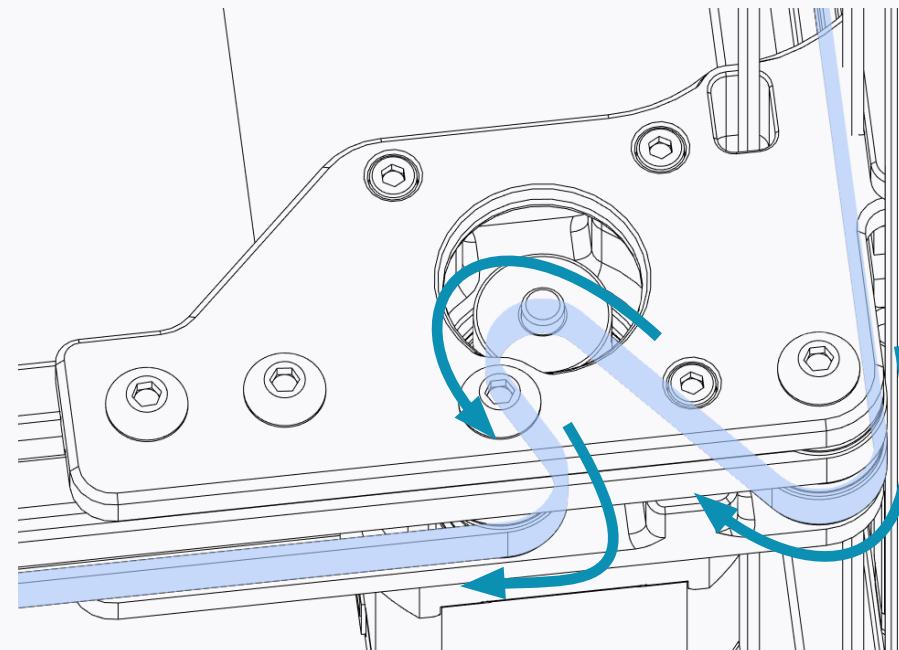
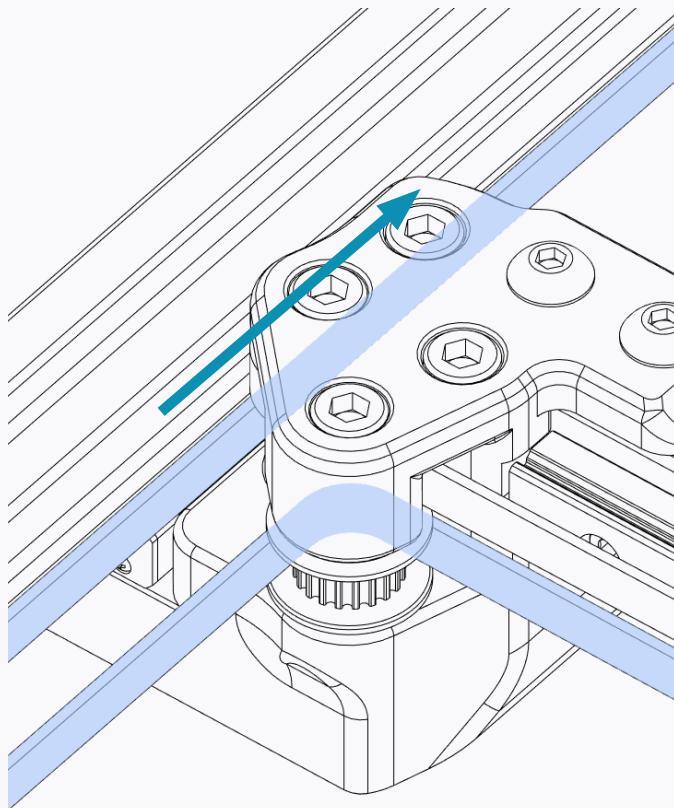


**BELTING IDLERS**

If you're having trouble guiding the belts around  
the bearing stack temporarily remove the M3x40  
SHCS to get better access.

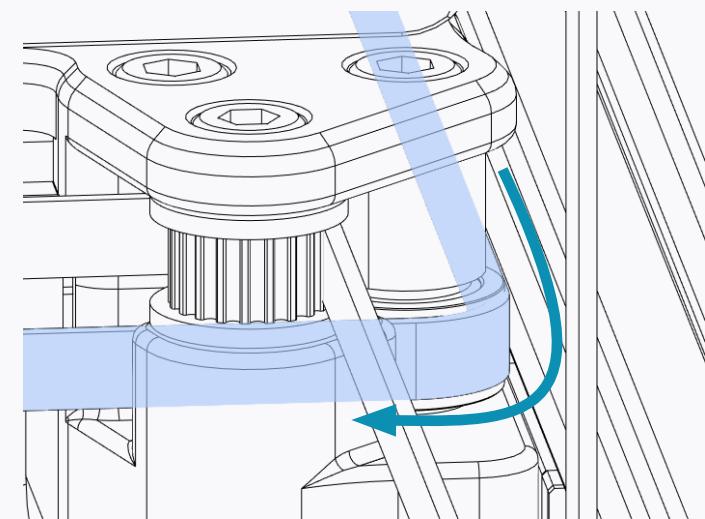
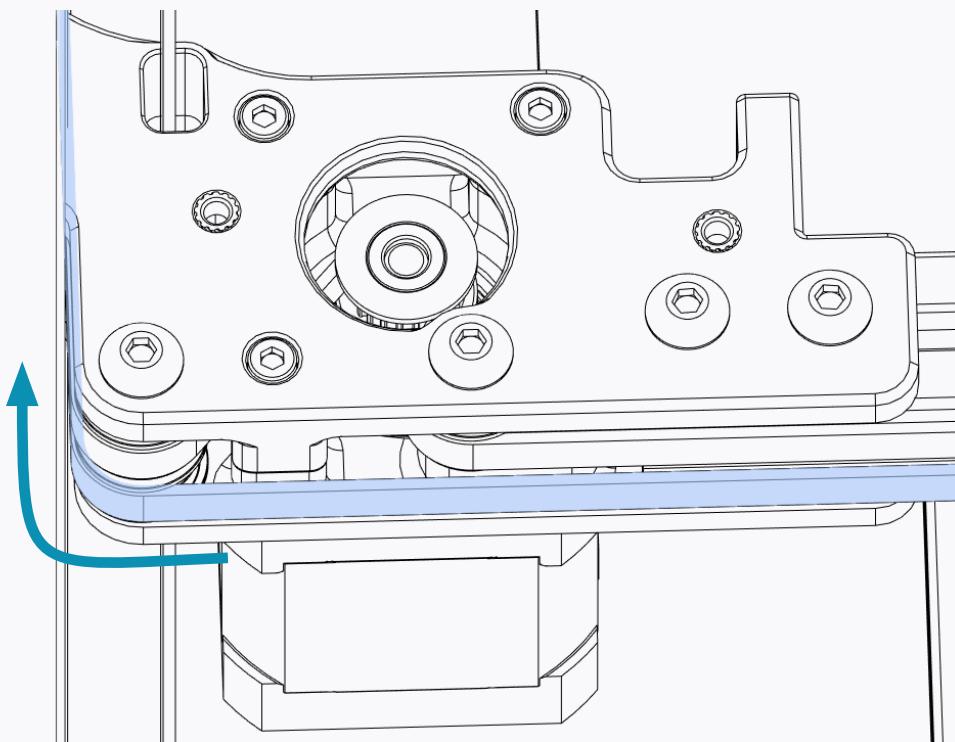
B BELT

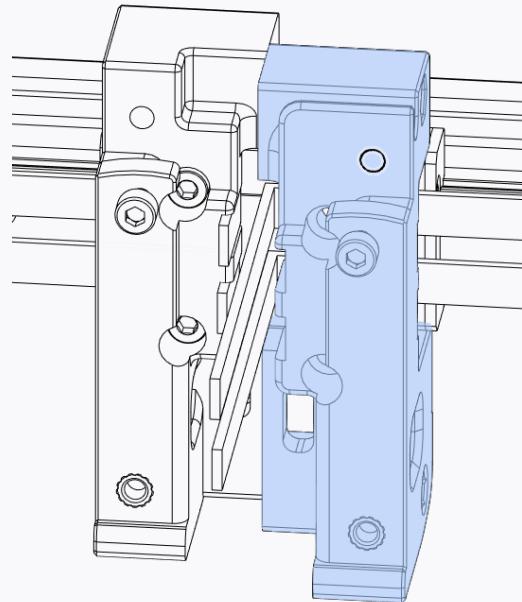
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B BELT

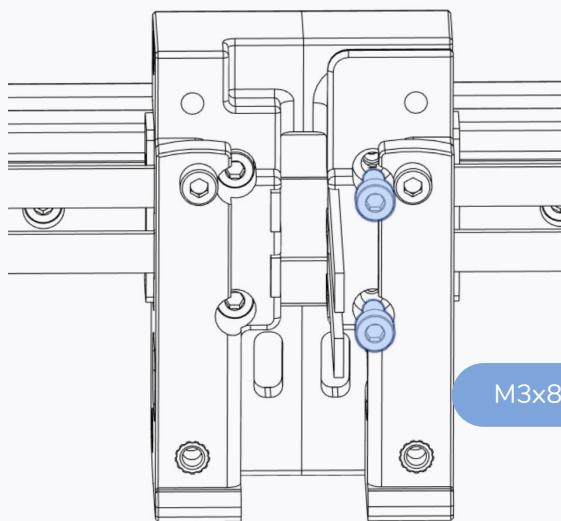
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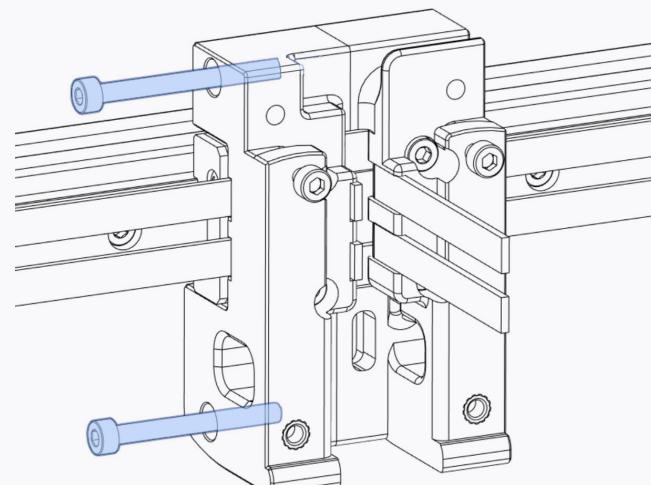
**X CARRIAGE**

Use the second part of the X carriage to capture the belt ends.



M3x8 SHCS

M3x30 SHCS



M3x30 SHCS

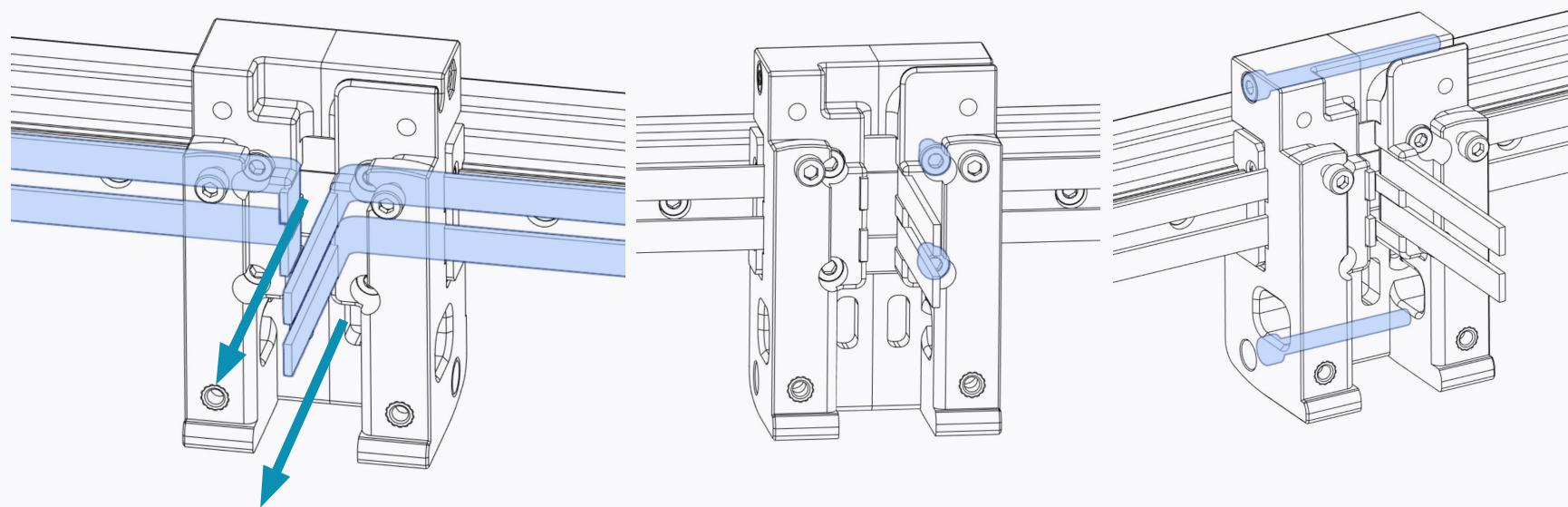
LEAVE LOOSE

Lightly tighten the bolts.

**FIX BELTS**

Lightly tighten the screws.

The belt must still be able to move.

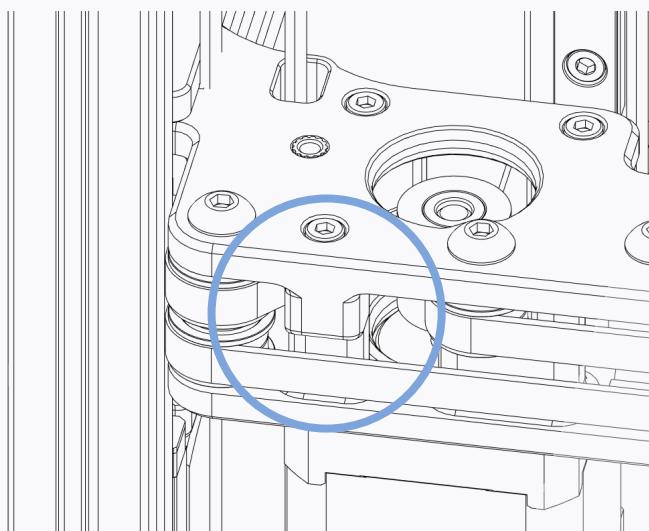
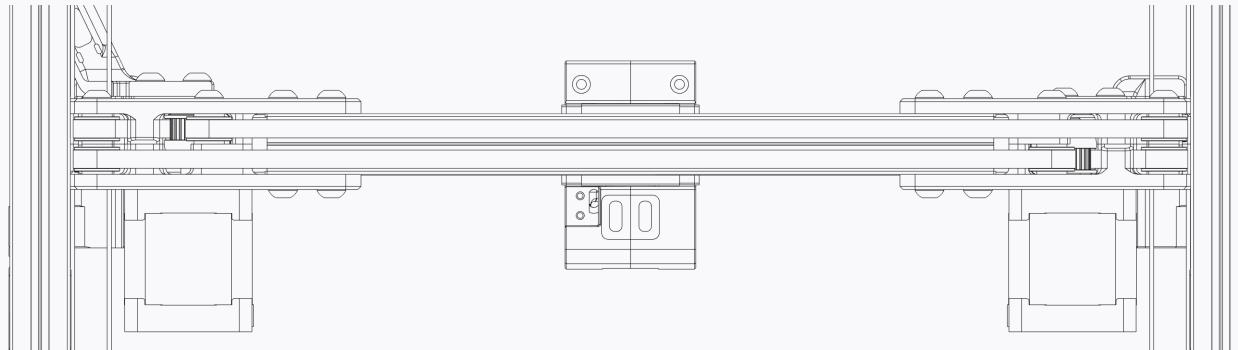
**PULL TIGHT**

Grab both belt ends with a pair of pliers and pull the belt tight.

As both belts are cut to the exact same total length and the belt paths are equal length in this design make sure the same length of belt protrudes from the carriage. you can tuck a small amount of excess belt into the empty space in the

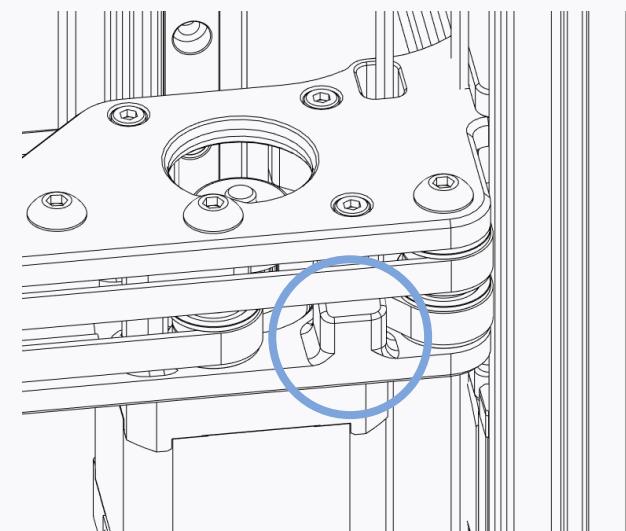
**TIGHTEN BOLTS**

Fully tighten the carriage bolts.



CHECK YOUR WORK

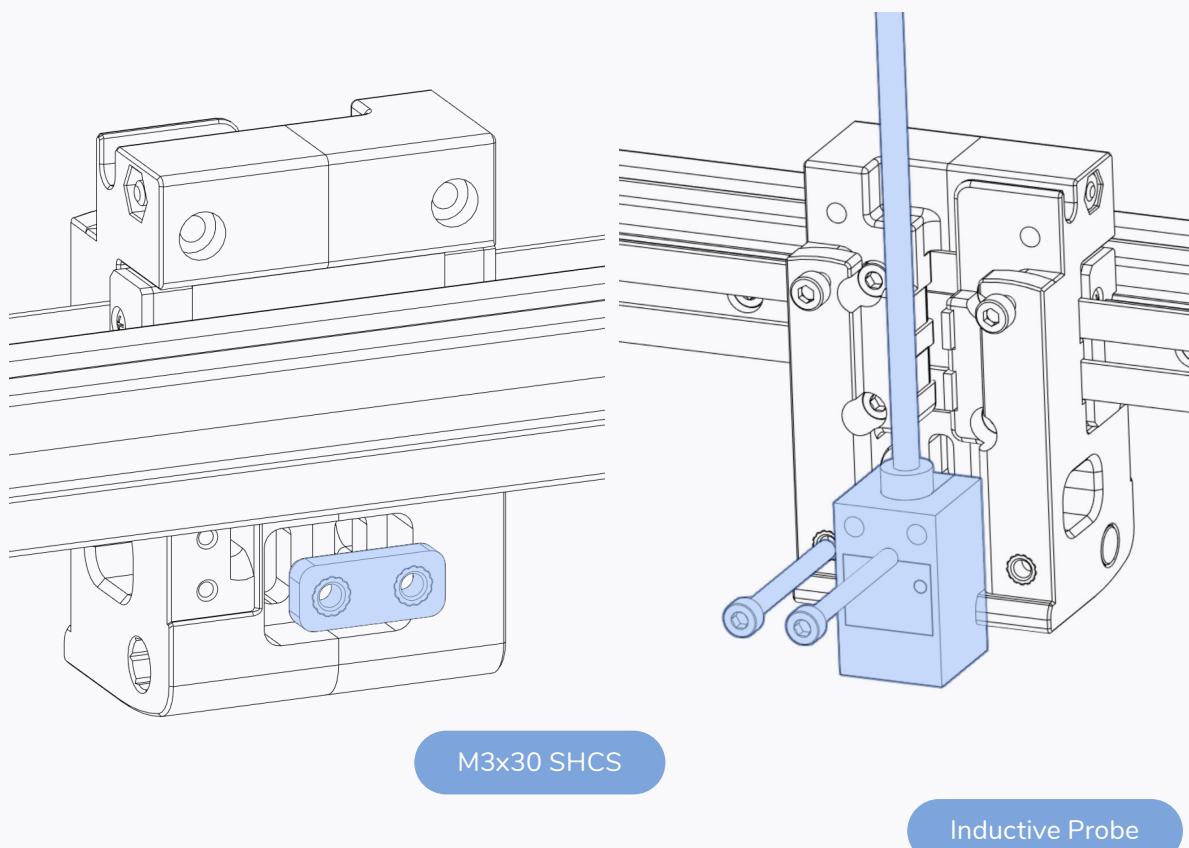
Make sure that the belt is not riding on the plastic parts.



**X Carriage: After finishing the AB-Belts Routing, switch to the TAP Manual. Optotap is used as the sensor. Be sure to take a look into the R8\_errata.md document, it Highlights some important changes from the Manual and install the X Endstop switch.**

## X CARRIAGE

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### PROBE WIRES

Cut the probe wires to about 150mm.

### OTHER PROBE TYPES

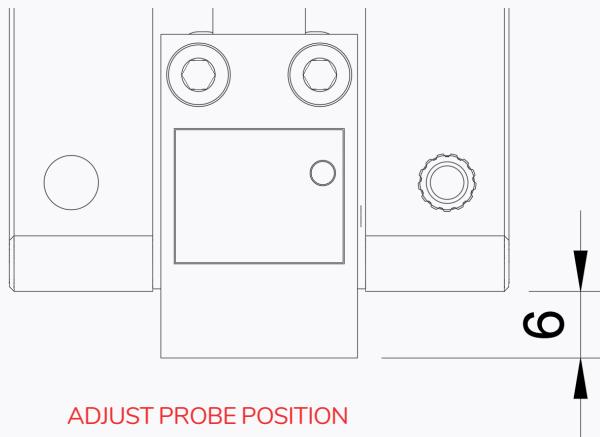
The picture shows the recommended Omron TL-Q5MC probe.

Other probes with a similar form factor and characteristics might work as well. A design for a PINDA probe adapter is included in the released files.

**Rotate the din rails 90° compared to the original layout.**

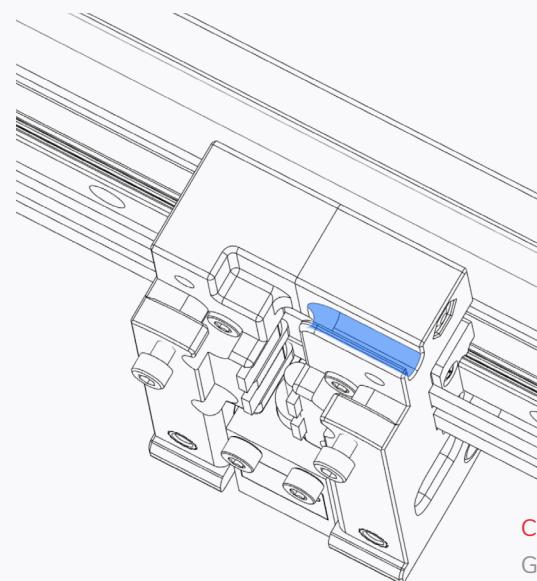
X CARRIAGE

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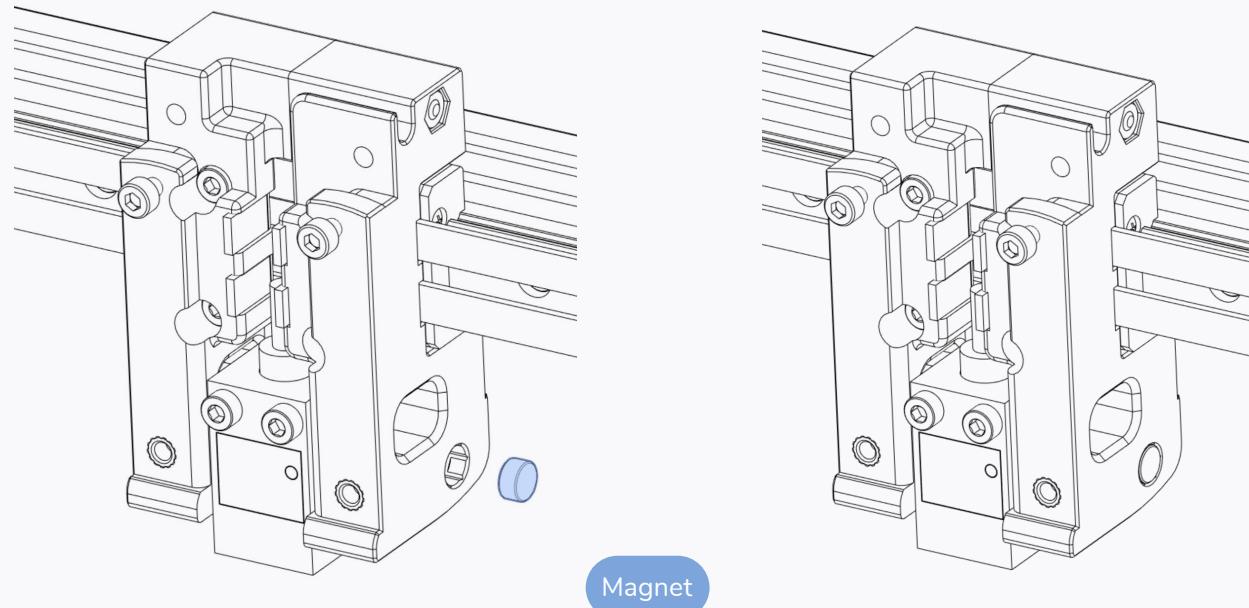
**ADJUST PROBE POSITION**

The position can be fine-tuned later.  
Set an initial position of about 6mm  
below the plastic part.



**CHANNEL FOR PROBE CABLE**

Guide the probe cable into the  
highlighted slot.

**OPTION: HALL EFFECT ENDSTOP**

If you are using a Hall Effect Endstop insert a 3x6 magnet into the highlighted position.

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STEALTHBURNER



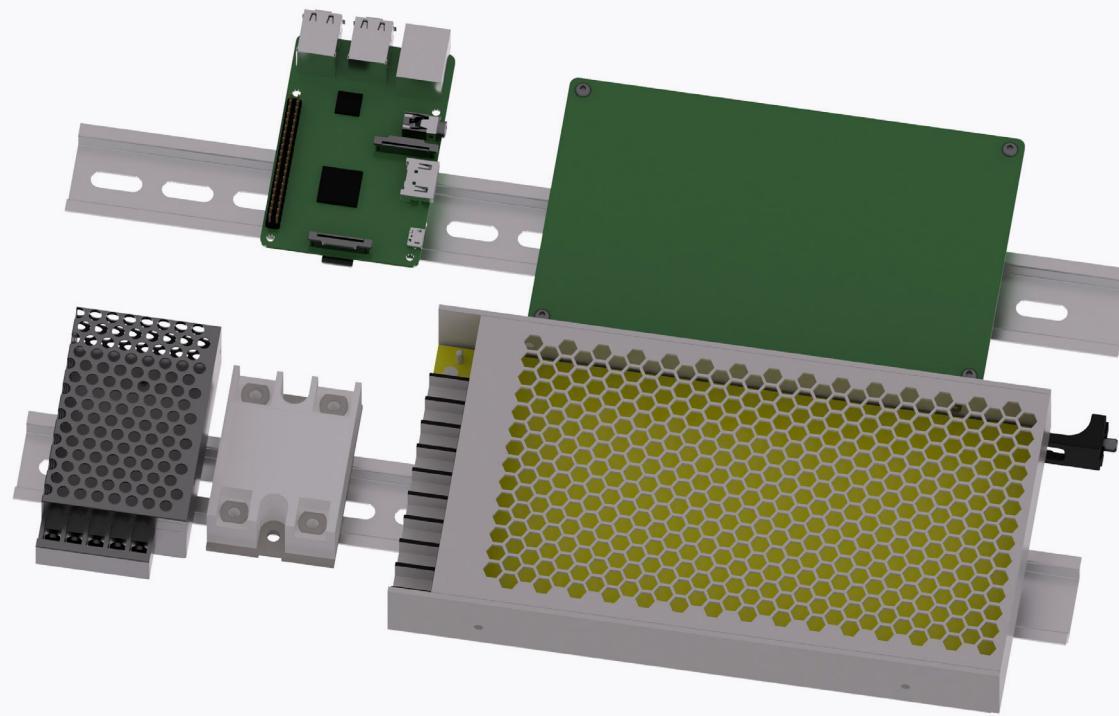
**UNIVERSAL TOOLHEAD**

This printer uses the StealthBurner toolhead, which is compatible with several of the printers in the Voron lineup. To keep things organized, StealthBurner's files are maintained separately. Follow the StealthBurner assembly manual to build your toolhead, and return here to proceed.



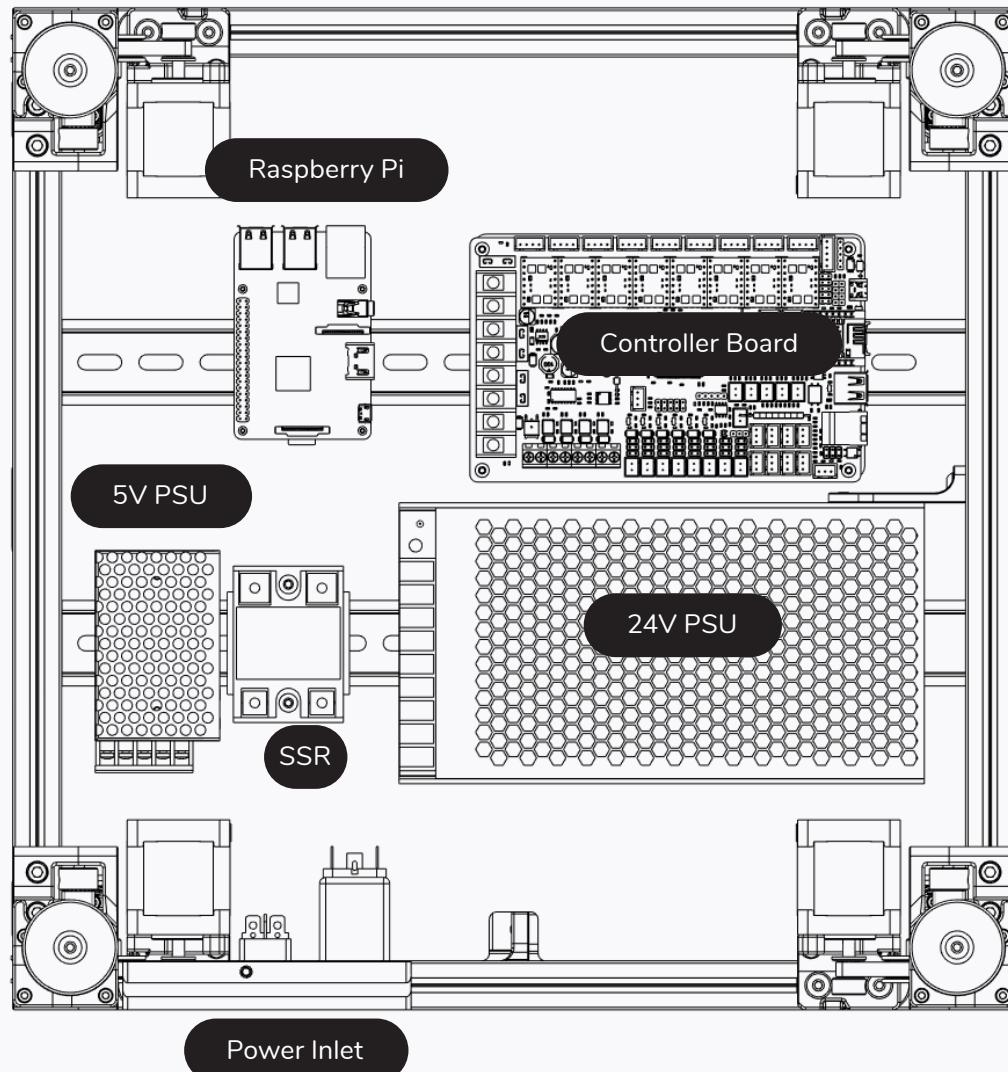
<https://voron.link/6hbi9n3>





## OVERVIEW

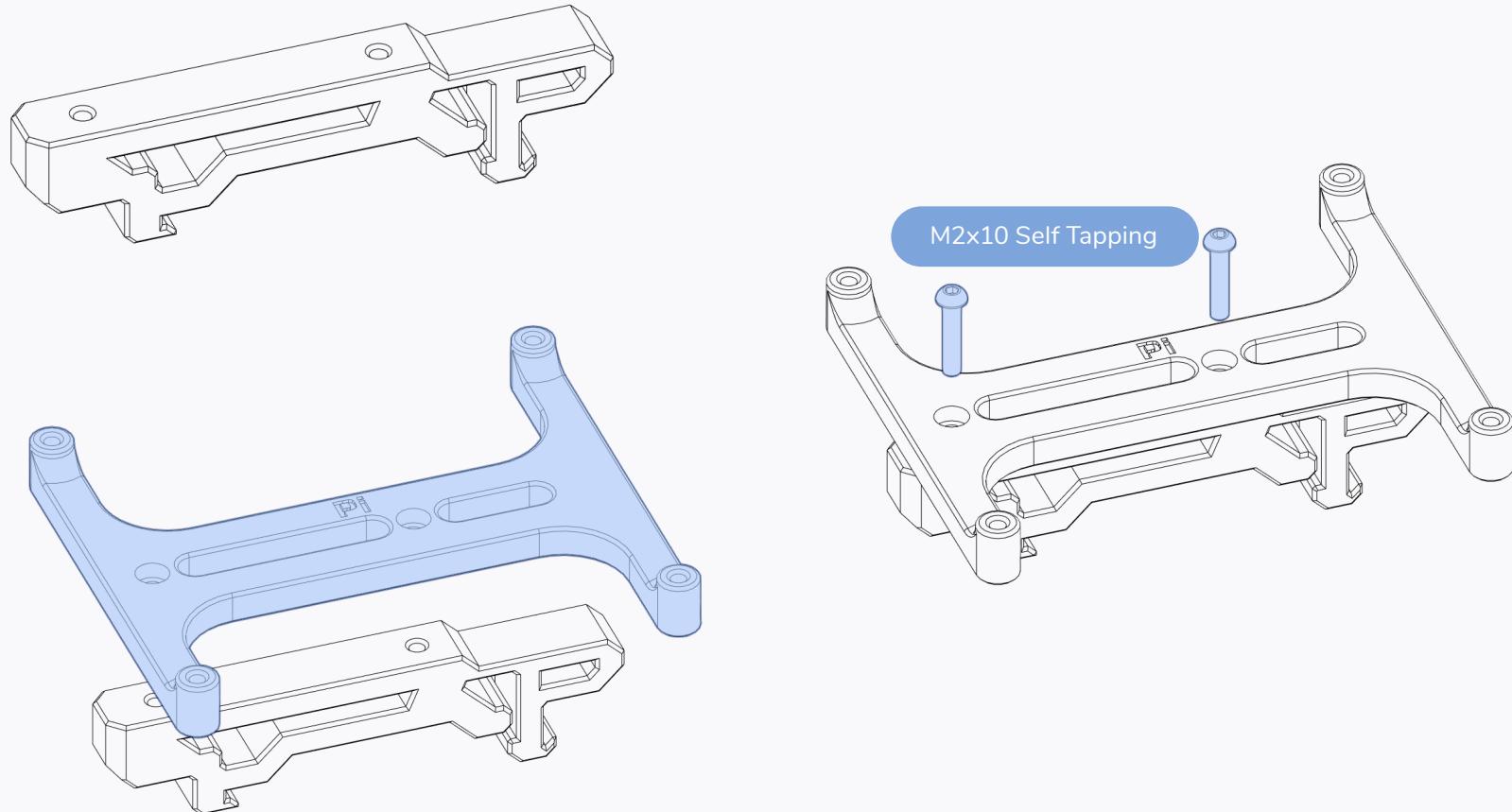
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**Skip; Raspberry Pi mounting and 5v PSU mounting is not needed. Instead, mount the CB1 / CM4 on the Manta.**

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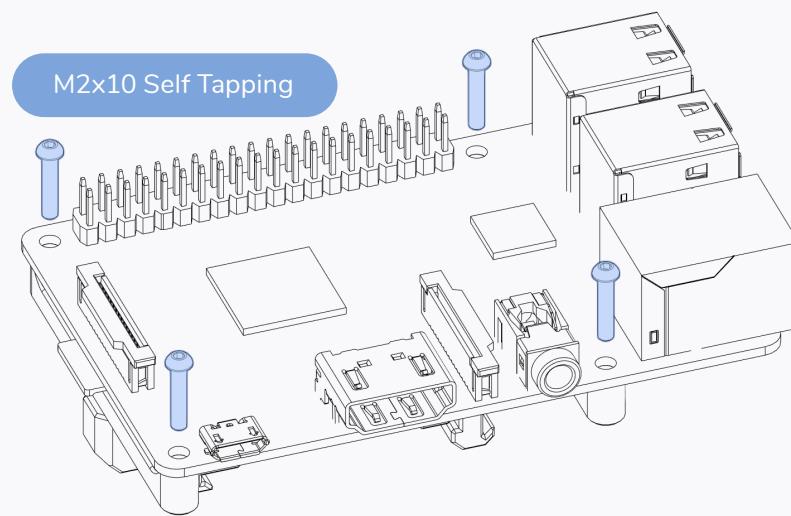
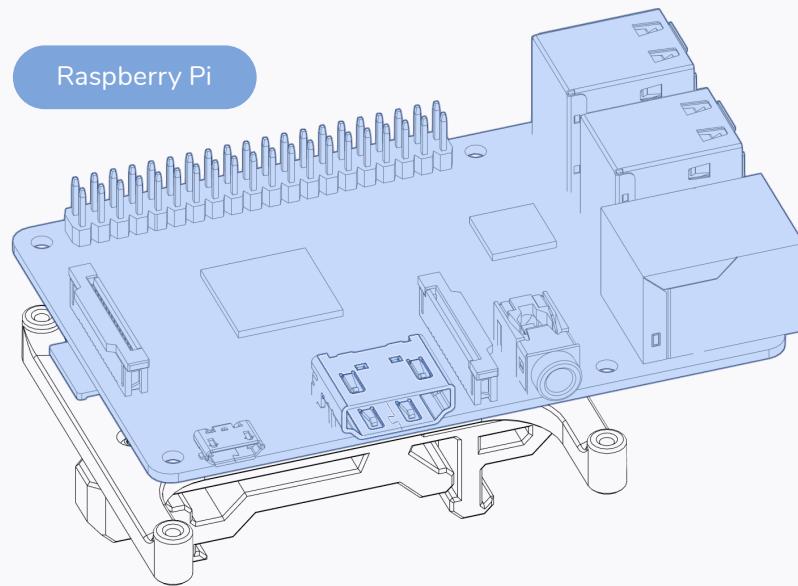
RASPBERRY PI



**Skip; Raspberry Pi mounting and 5v PSU mounting is not needed. Instead, mount the CB1 / CM4 on the Manta.**

RASPBERRY PI

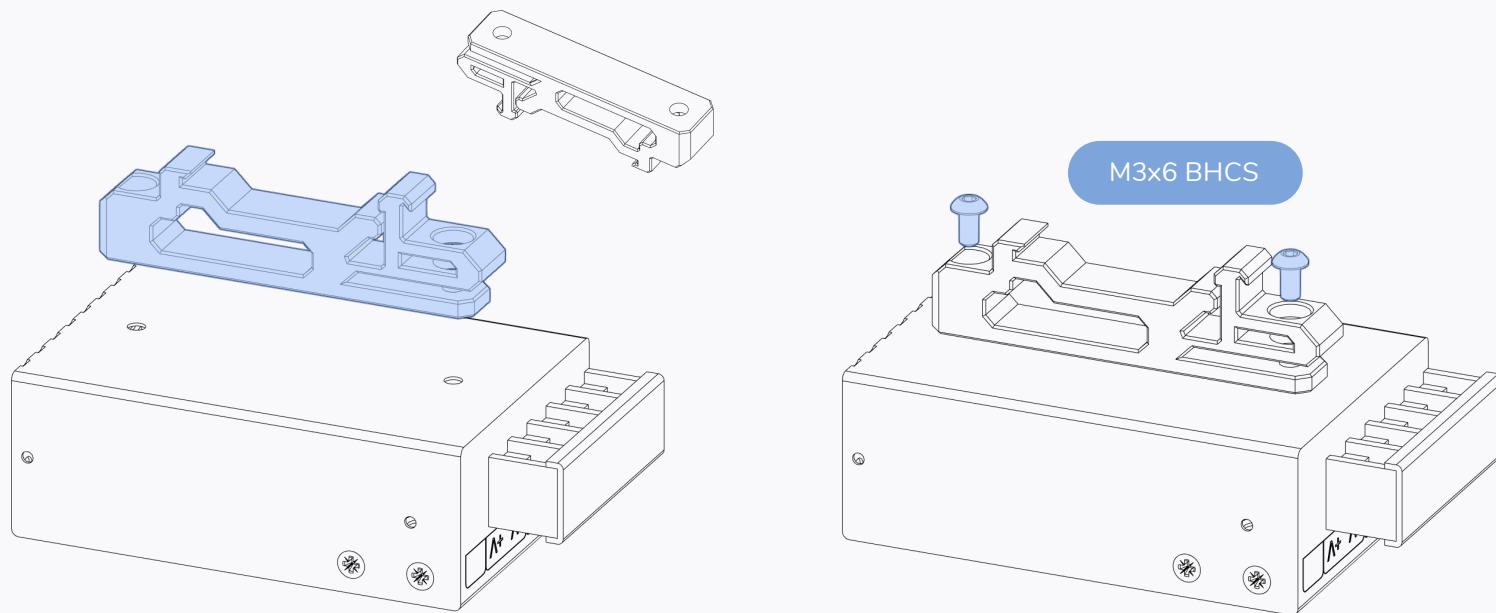
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**Skip; Raspberry Pi mounting and 5v PSU mounting is not needed. Instead, mount the CB1 / CM4 on the Manta.**

5V PSU

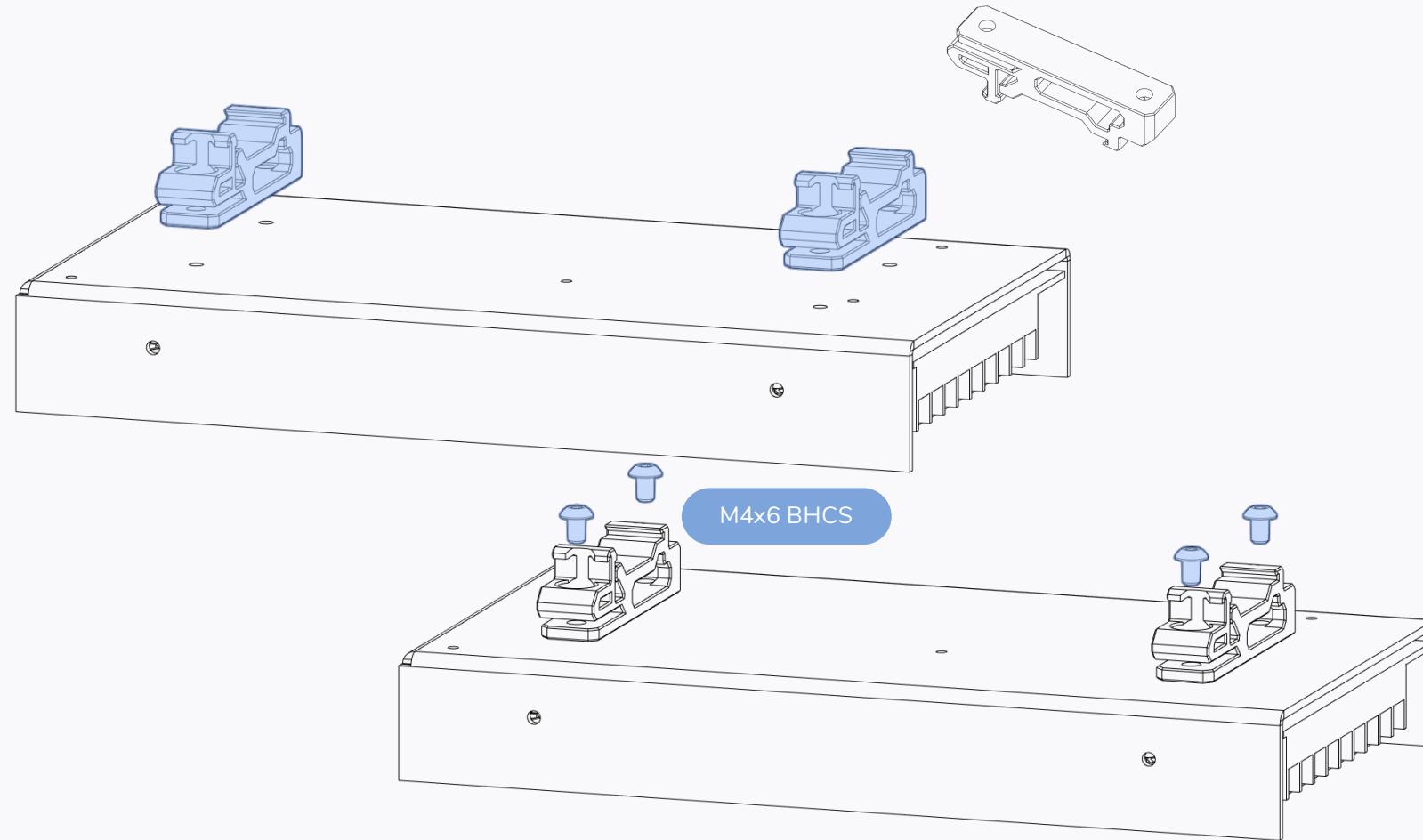
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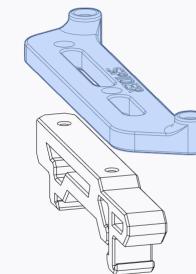
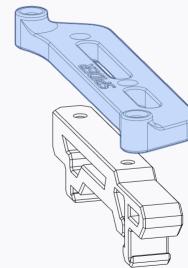
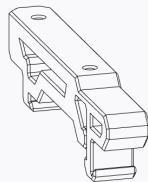


RS25-5 PSU

24V PSU

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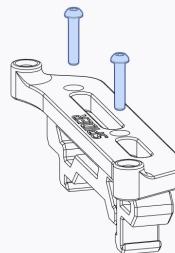




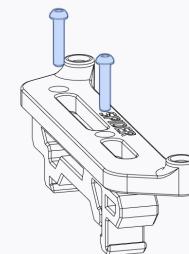
#### AVAILABLE MOUNTS

We also provide mounts for other controller boards.

They are assembled in a similar manner.

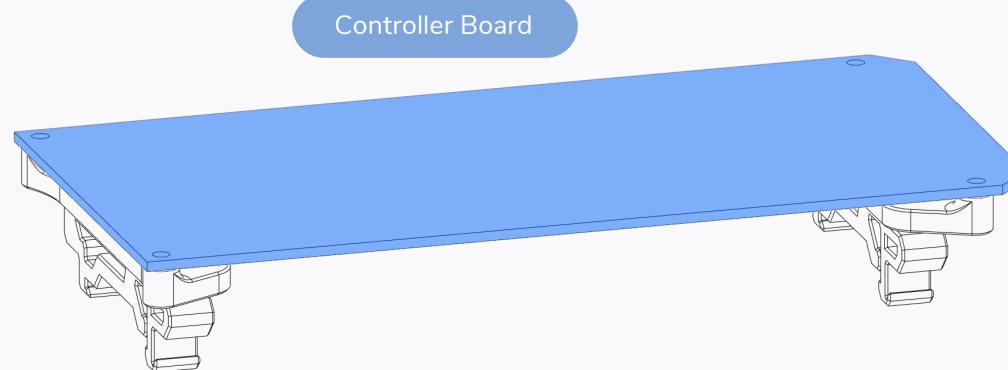


M2x10 Self Tapping



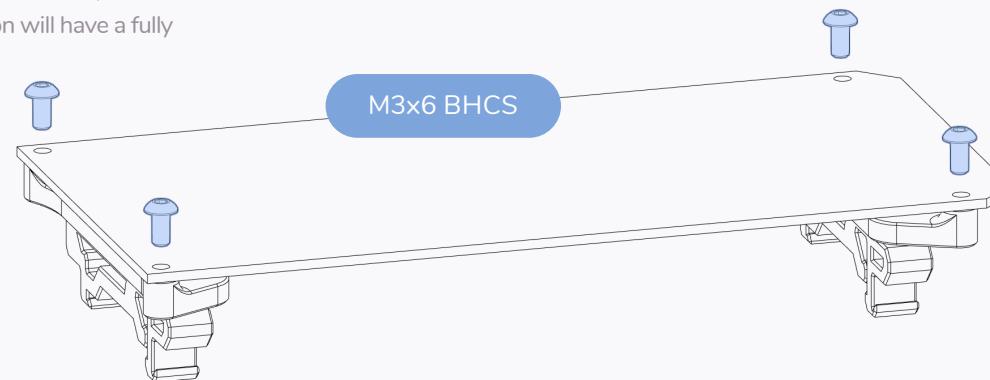
## CONTROLLER BOARD

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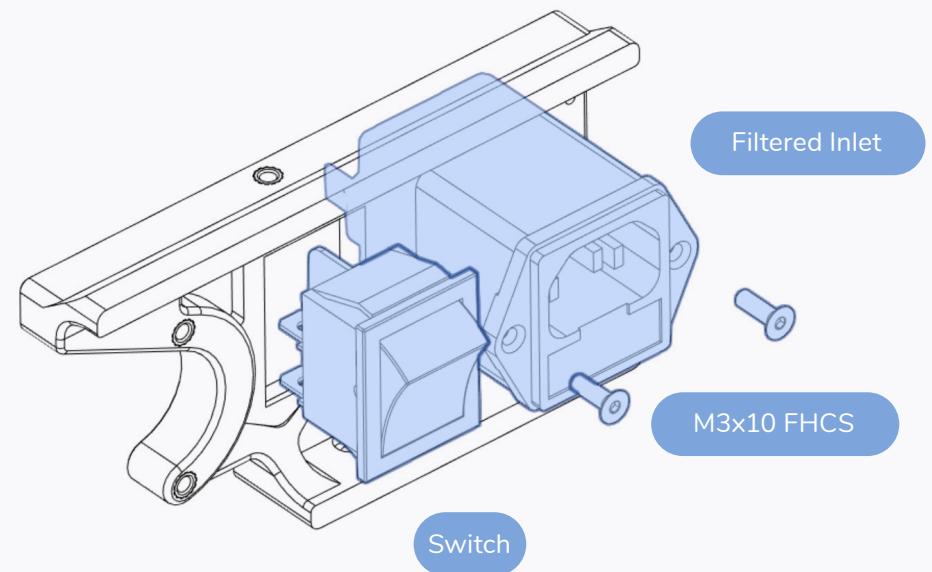
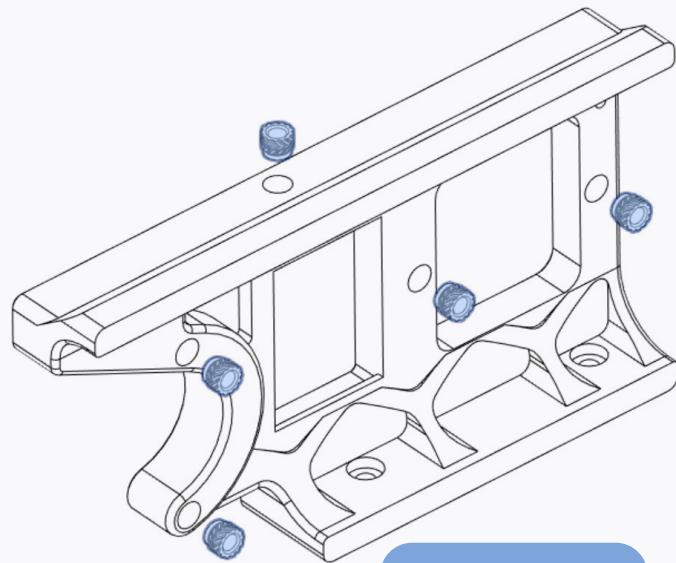
### WHY DOES IT LOOK THAT WAY?

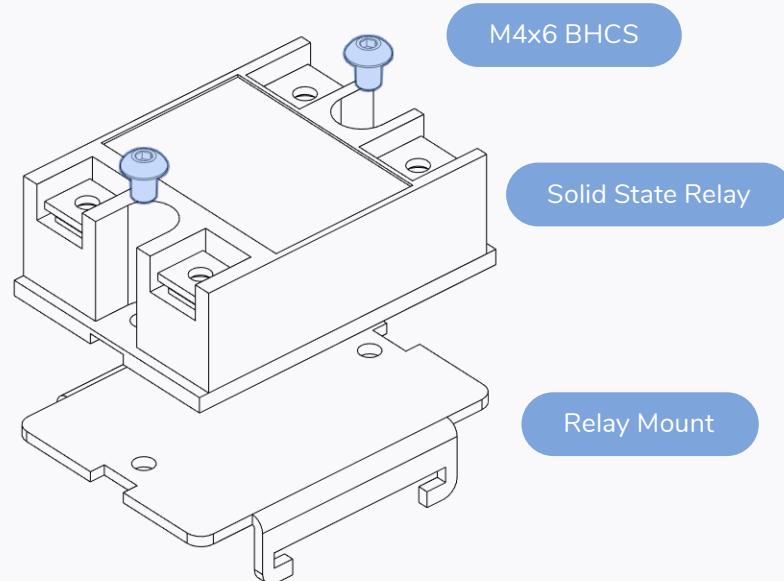
We used a dummy to keep the file size of the printers CAD manageable. The wiring section will have a fully featured image.



## POWER INLET

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WHERE CAN I FIND THE RELAY MOUNT?

The SSR mount is an off the shelf part. Look for a metal bracket in your pile of parts.

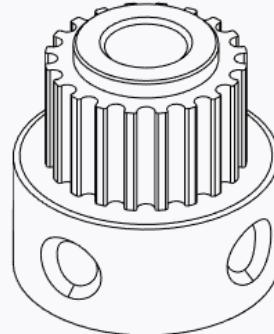
There is no printed mount.

**Skip; TAP is your Z-Endstop, your X Endstop sits on Tap and your Y endstop will be mounted on the A Motor mount later.**

## Z ENDSTOP

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GT2 20 Tooth Pulley



### REMOVE FLANGE & SET SCREWS

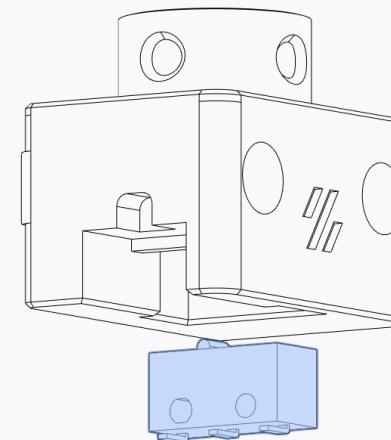
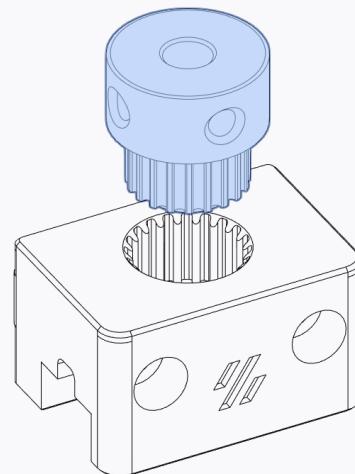
Use a bottle opener or some pliers to remove the top flange.



<https://voron.link/ict0j6x>

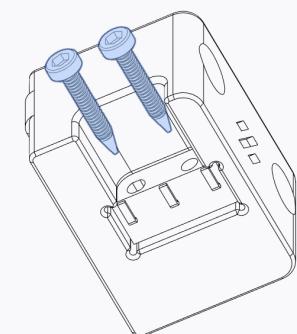
### PRESS FIT

Apply the required force to fully seat the pulley in the printed part.



Microswitch

M2x10 Self Tapping



### SWITCH W/OUT LEVER

This part requires a switch without lever to be installed in the shown orientation.

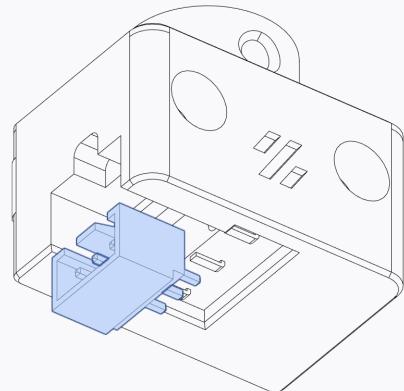


You can remove the lever from microswitches by gently pressing on the lever's hinge point.

**Skip; TAP is your Z-Endstop, your X Endstop sits on Tap and your Y endstop will be mounted on the A Motor mount later.**

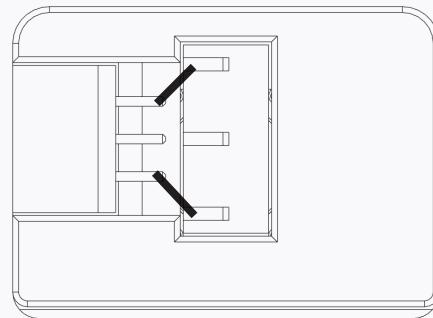
## Z ENDSTOP

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### PREVENTING MISHAPS

You can add a notch to the Z endstop point and capture it with a set screw to prevent it from falling out.



### SOLDER CONNECTOR

Solder a connection from the outer two terminals of the microswitch to the connector.

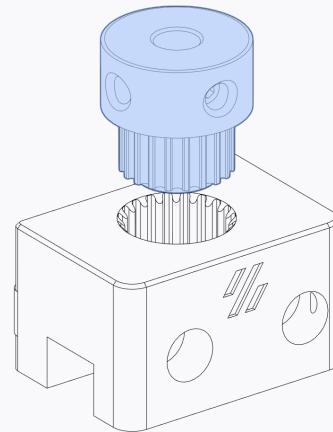
**Skip; TAP is your Z-Endstop, your X Endstop sits on Tap and your Y endstop will be mounted on the A Motor mount later.**

## ALTERNATE Z ENDSTOP

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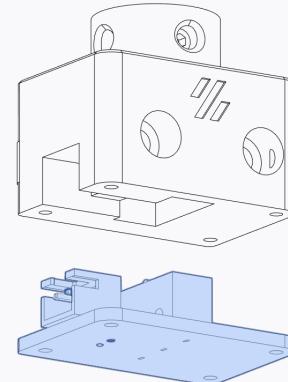
OPTION: Z ENDSTOP BOARD

GT2 20 Tooth Pulley

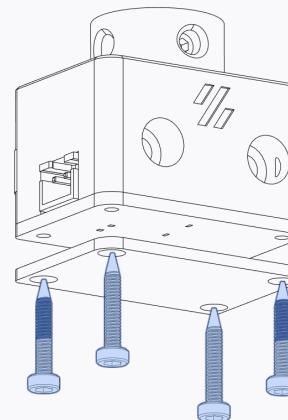


PRESS FIT

Apply the required force to fully seat the pulley in the printed part.



Microswitch Z Endstop Board



M2x10 Self Tapping

5mm Shaft

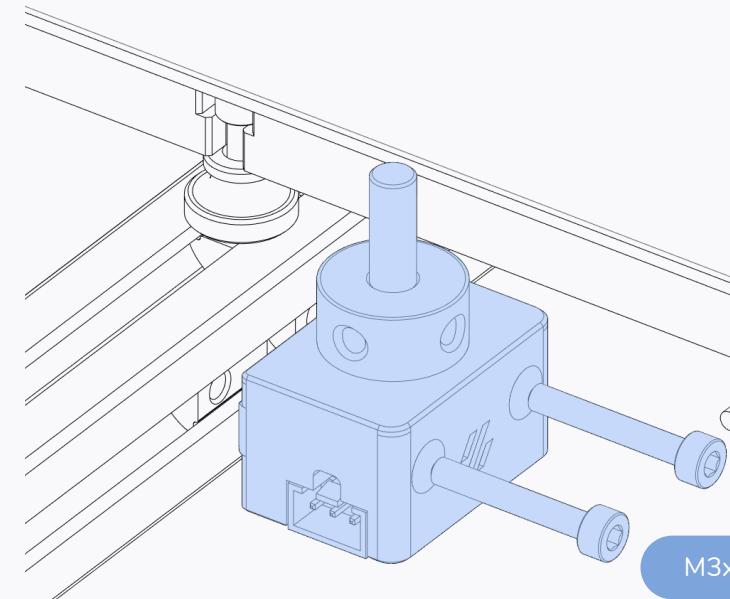
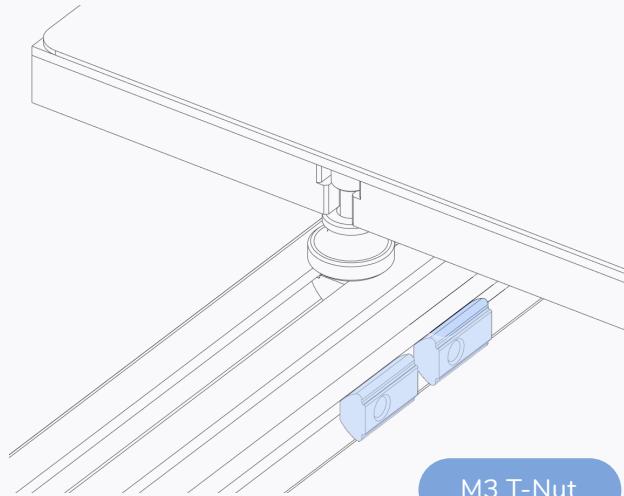
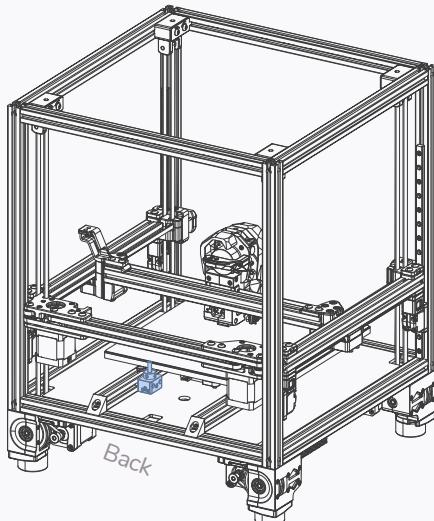
## ADDITIONAL INFORMATION

Visit [voron.link/3bwvnqy](http://voron.link/3bwvnqy) for design files and BOM.

**Skip; TAP is your Z-Endstop, your X Endstop sits on Tap and your Y endstop will be mounted on the A Motor mount later.**

## Z ENDSTOP

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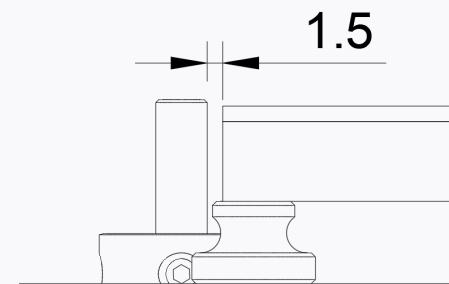


M3x20 SHCS

### ADJUST Z ENDSTOP POSITION

The shaft of the Z Endstop must not touch the print bed.

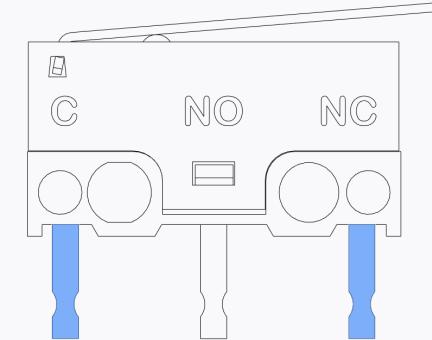
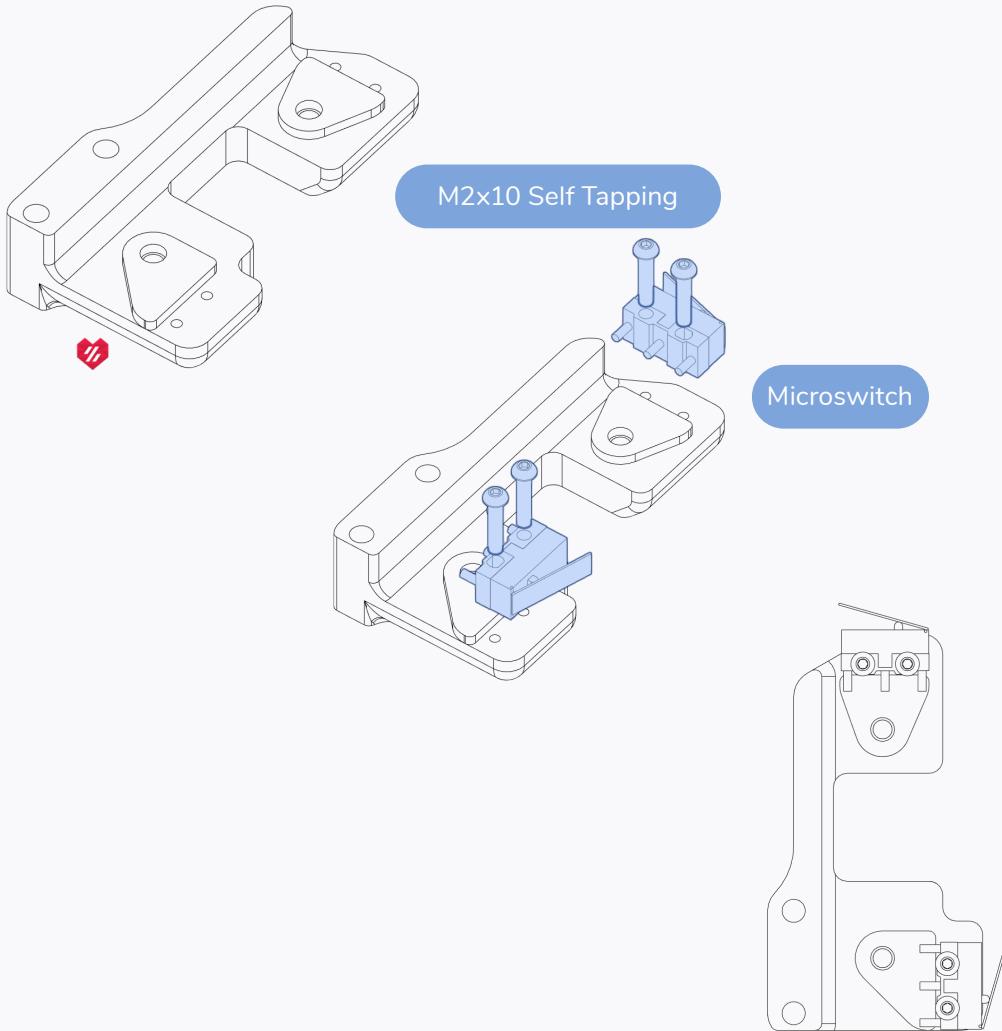
Adjust the position if required.



**Skip; TAP is your Z-Endstop, your X Endstop sits on Tap and your Y endstop will be mounted on the A Motor mount later.**

X/Y ENDSTOP

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#### END-STOP SWITCHES FOR X AND Y

End-stops are wired in a “Normally Closed” configuration. On microswitches those are the 2 outer terminals indicated by C and NC.

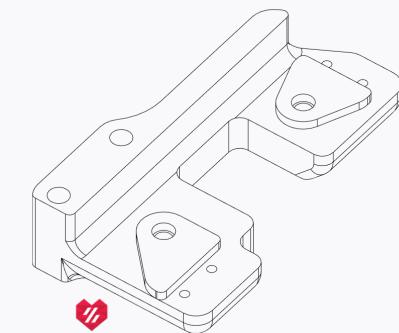
Prepare the switches for X and Y by soldering 150mm of wire to each of the outer terminals.

**Skip; TAP is your Z-Endstop, your X Endstop sits on Tap and your Y endstop will be mounted on the A Motor mount later.**

## ALTERNATE X/Y ENDSTOPS

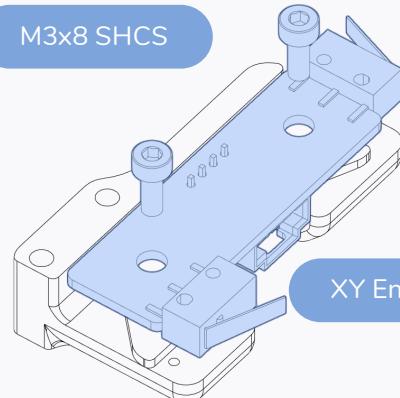
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OPTION: XY ENDSTOP BOARD

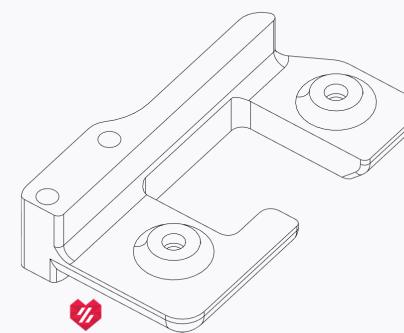


M3x8 SHCS

XY Endstop Board



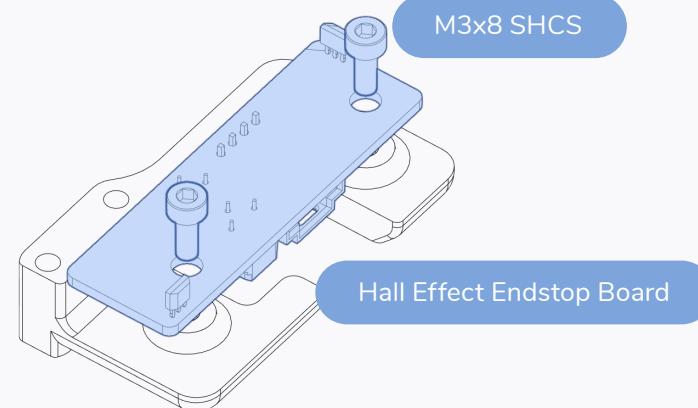
OPTION: HALL EFFECT ENDSTOP BOARD



◆

M3x8 SHCS

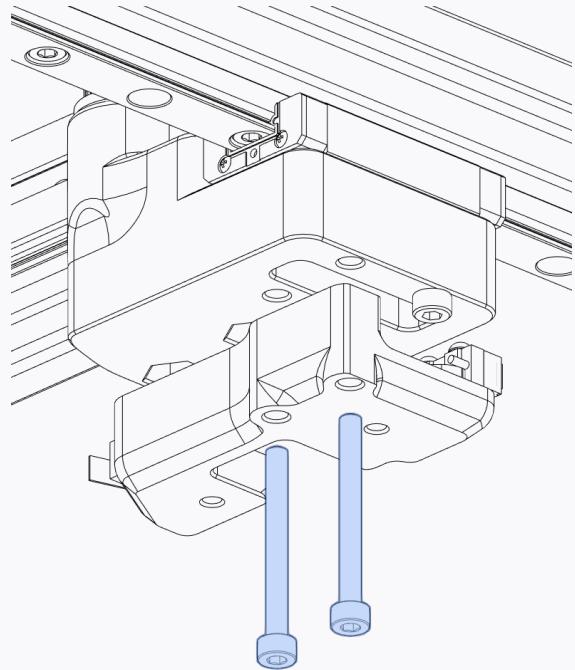
Hall Effect Endstop Board



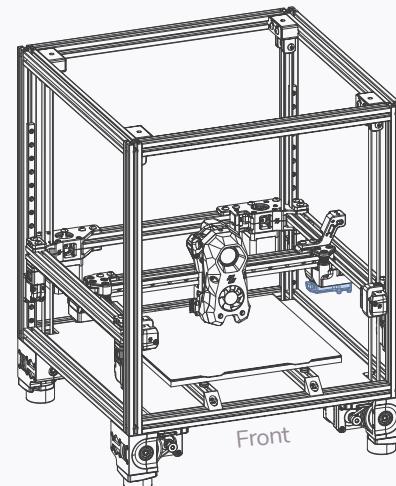
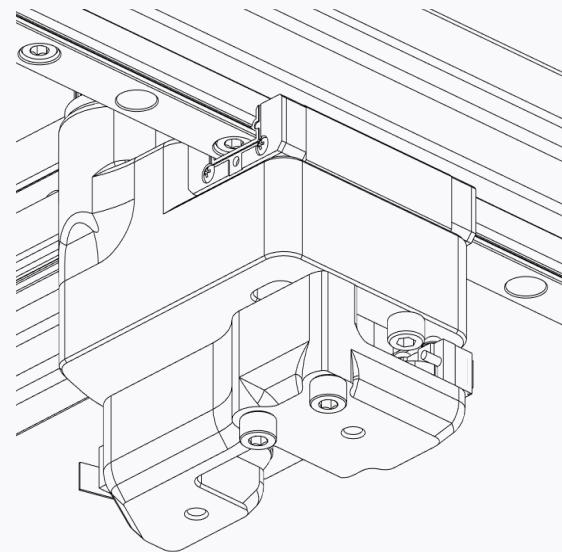
**Skip; TAP is your Z-Endstop, your X Endstop sits on Tap and your Y endstop will be mounted on the A Motor mount later.**

X/Y ENDSTOP

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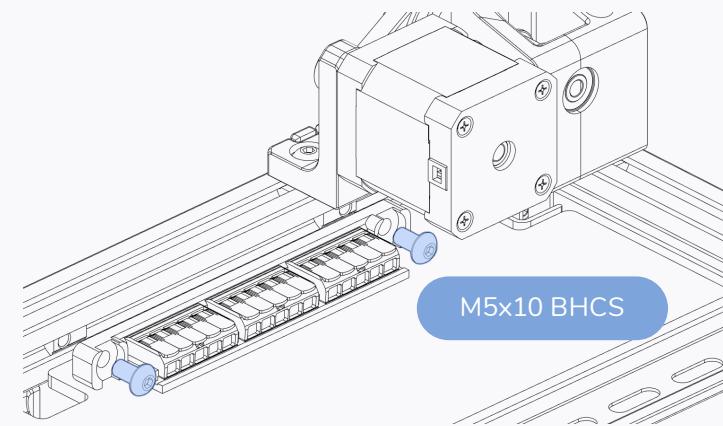
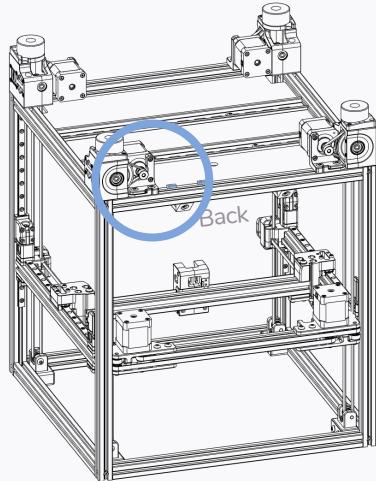
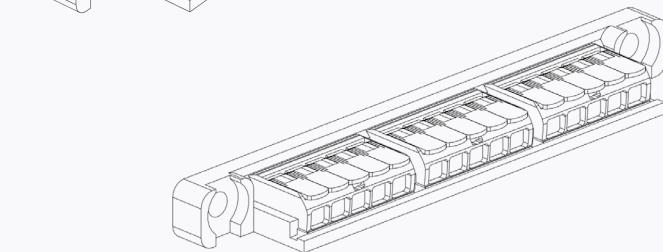
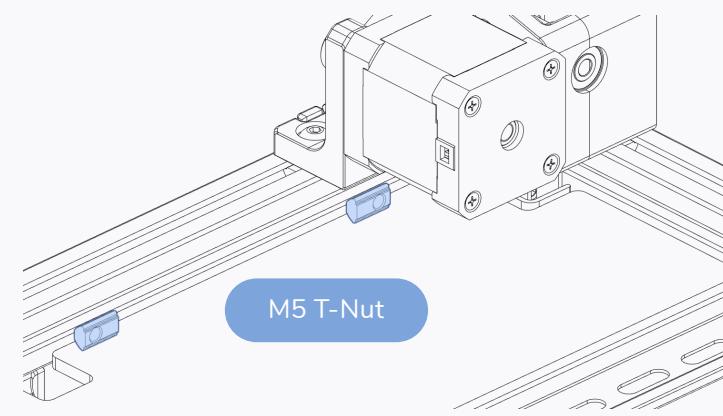
M3x30 SHCS



You use the 3in6 Power Distributor instead.

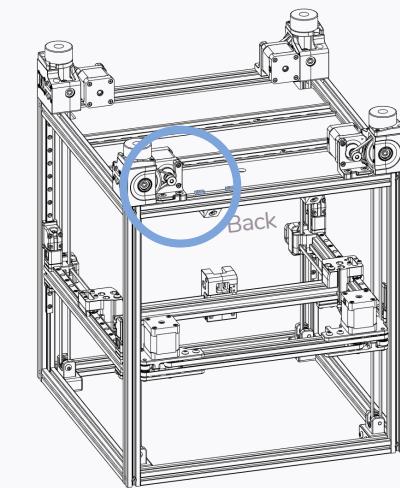
ALTERNATE MAINS DISTRIBUTION - WAGO

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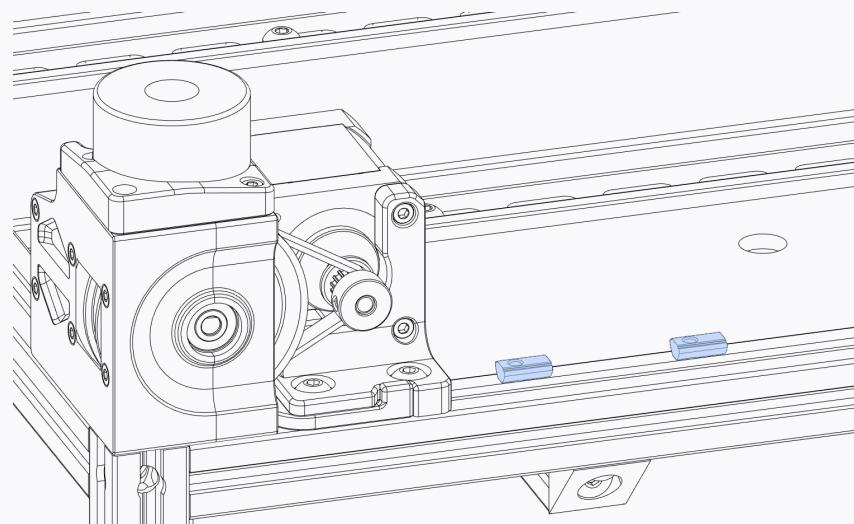
## POWER INLET

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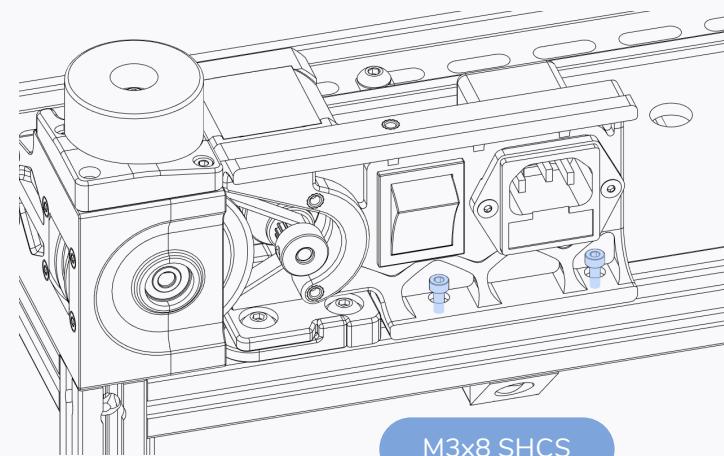
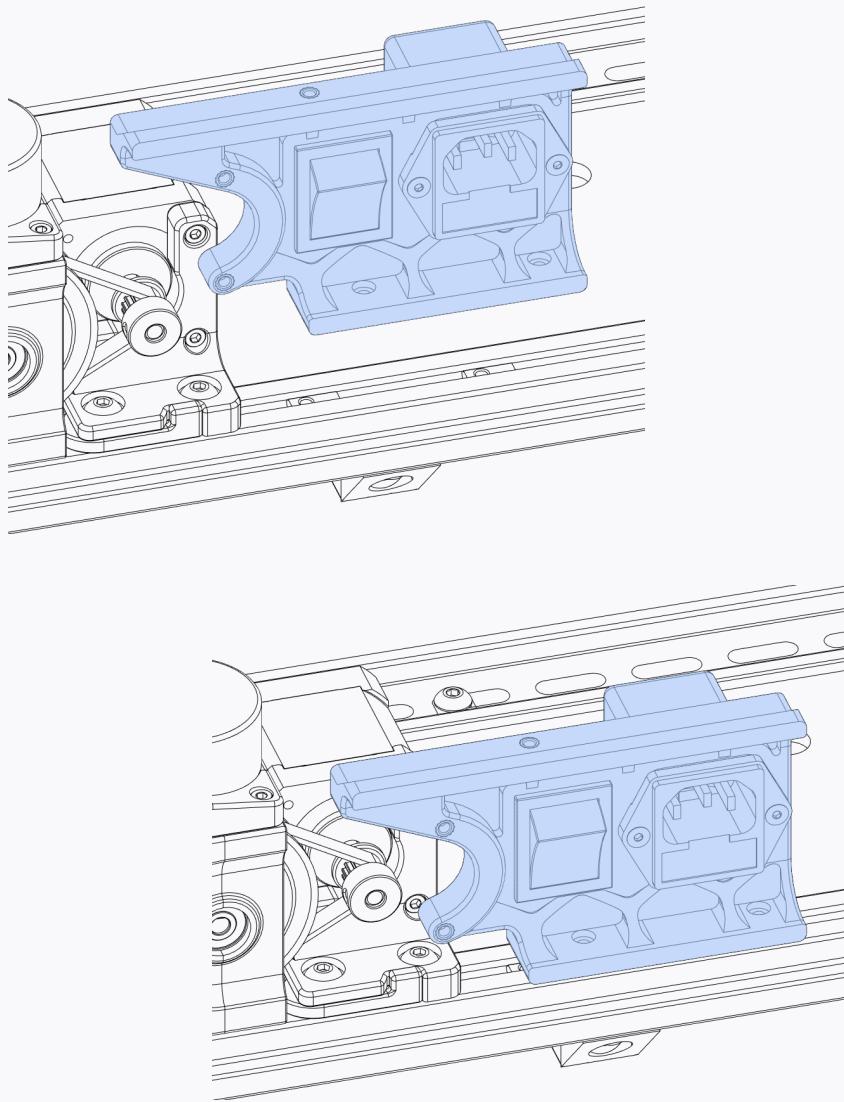
### UPSIDE DOWN ASSEMBLY

For ease of assembly we recommend to flip the printer on its head for the next steps. Hope you don't regret building a 350.

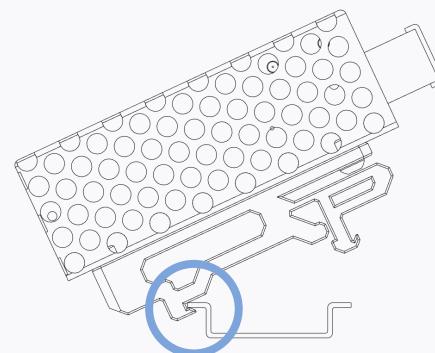
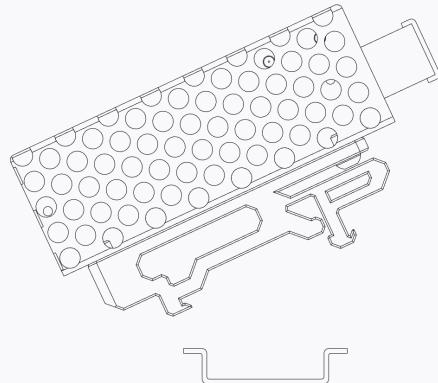


POWER INLET

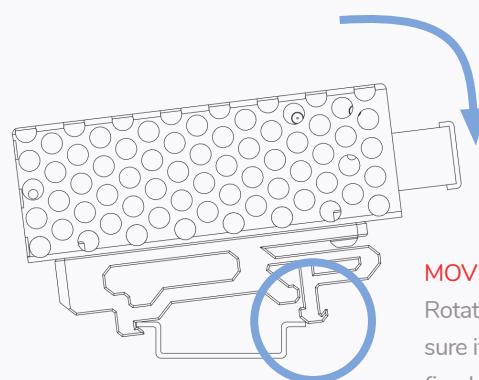
WWW.VORONDESIGN.COM



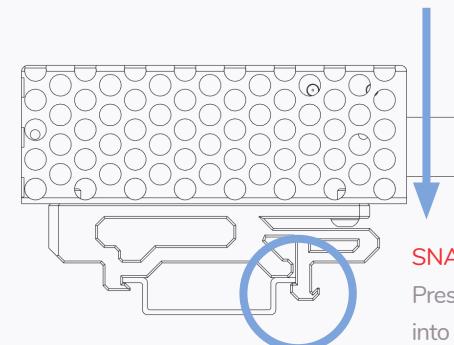
M3x8 SHCS

**HOOK FIXED SIDE**

Hook the fixed side of the printed mount on side of DIN rail.

**MOVE INTO POSITION**

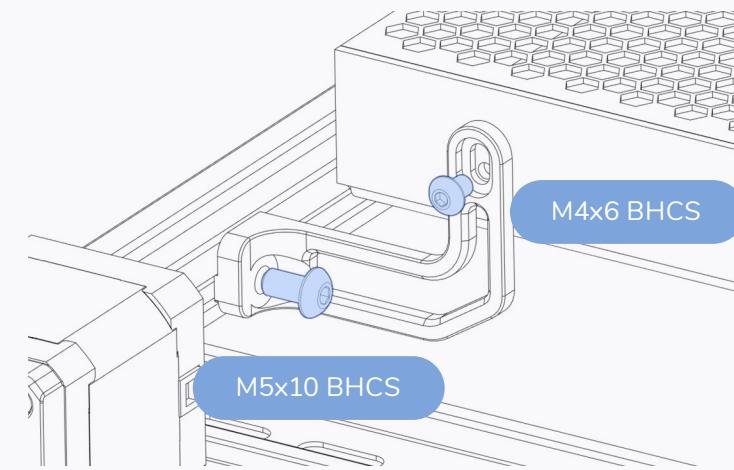
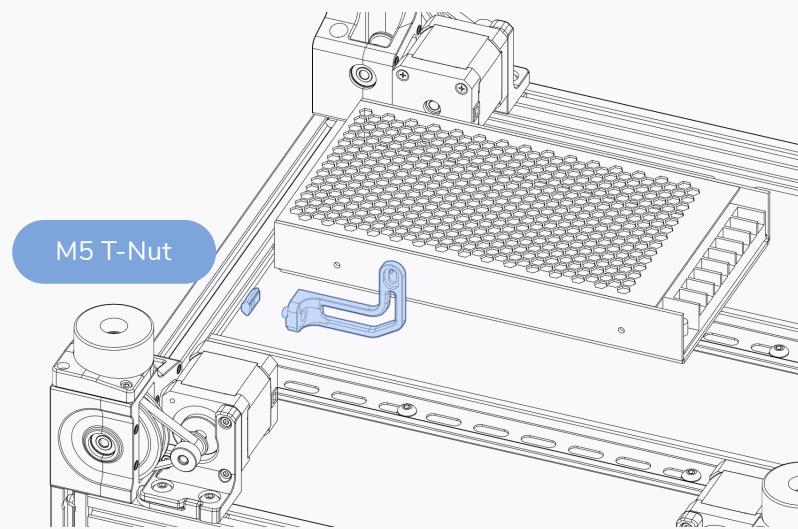
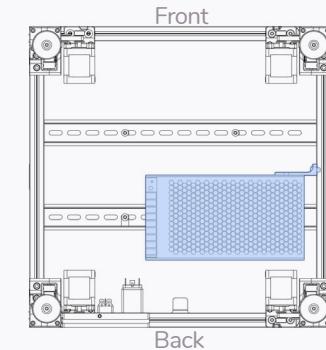
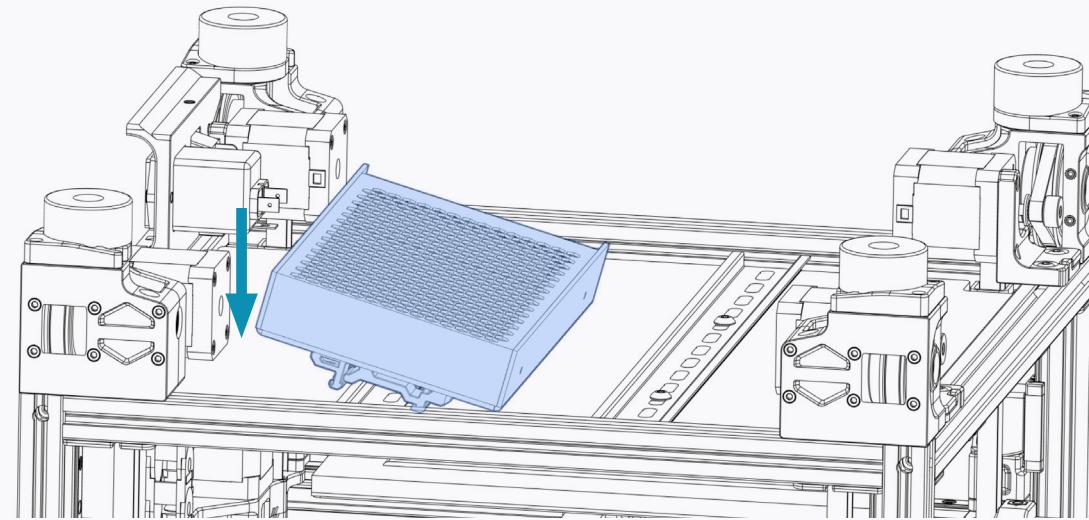
Rotate the part into place, make sure it does not unhook from the fixed side.

**SNAP INTO PLACE**

Press to snap the free side into place. The part should now sit securely on the DIN rail.

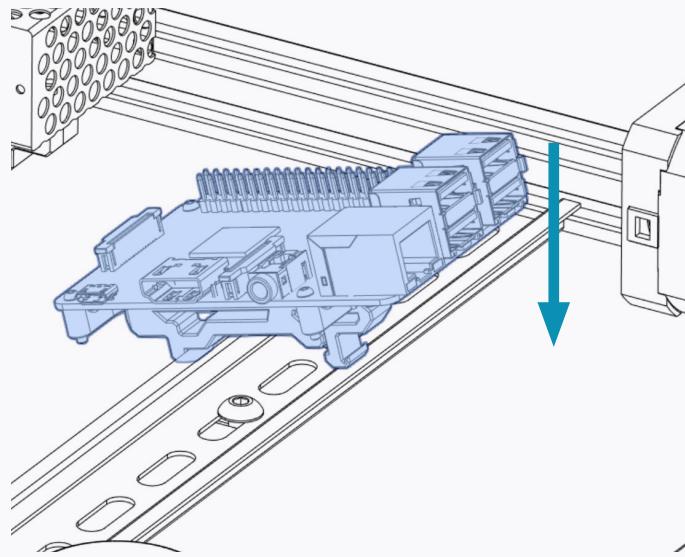
24V PSU

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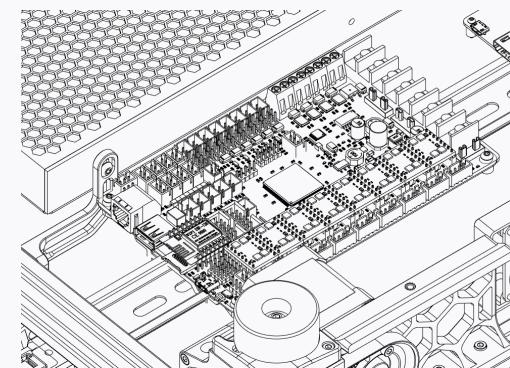
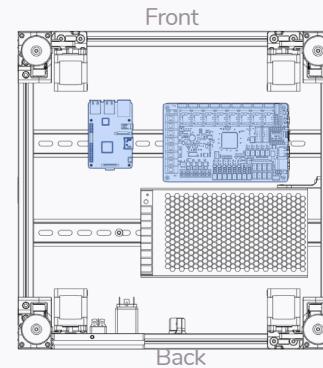
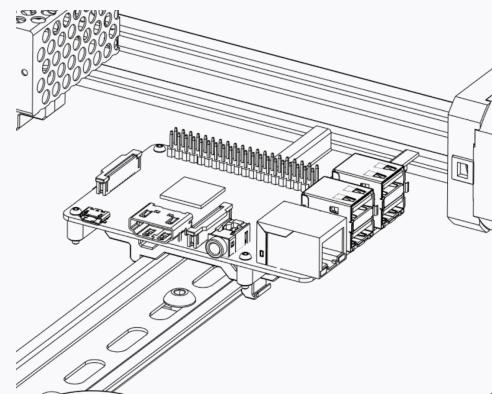
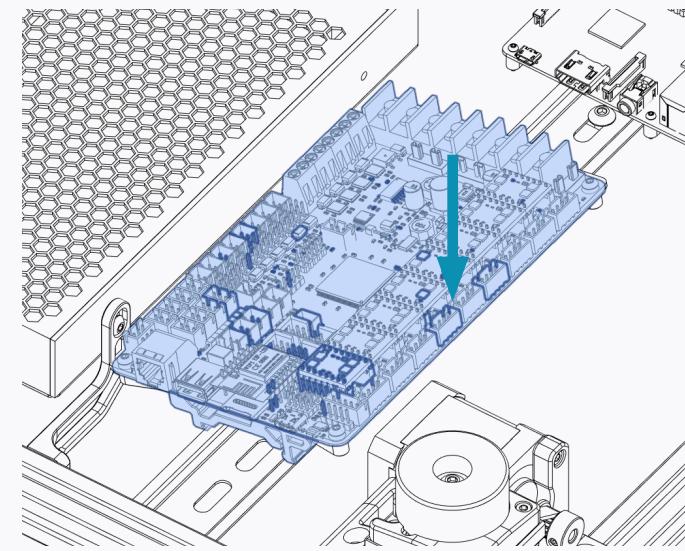


small reminder, you dont use a Raspberry Pi.

PI & CONTROLLER

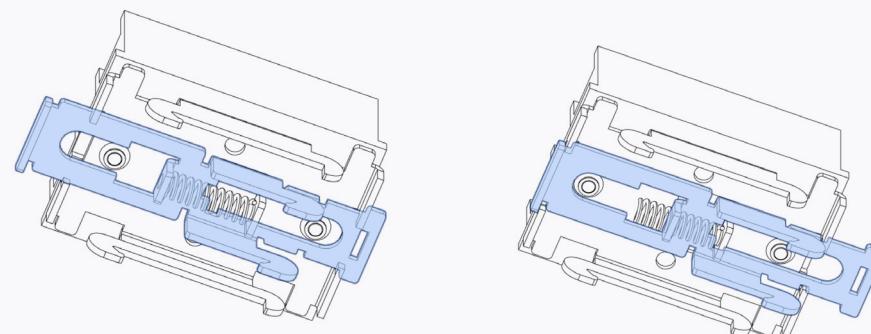
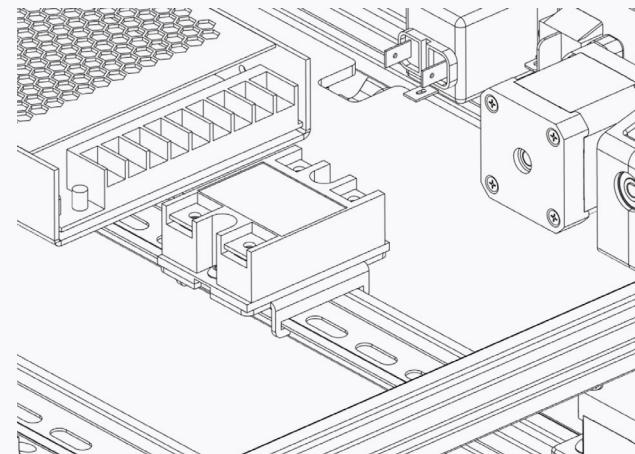
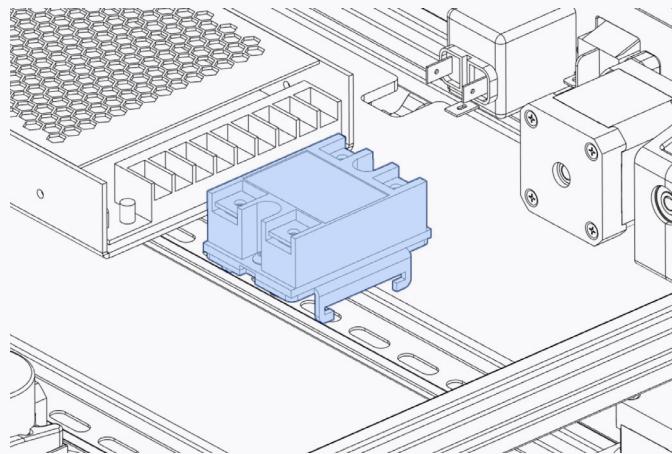


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## SOLID STATE RELAY

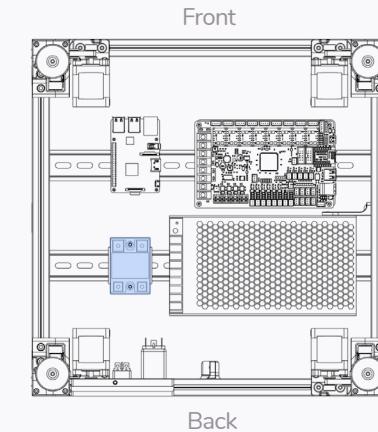
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### SPRING-LOADED

Use a flat head screw driver to pull the latch open. It will lock open.

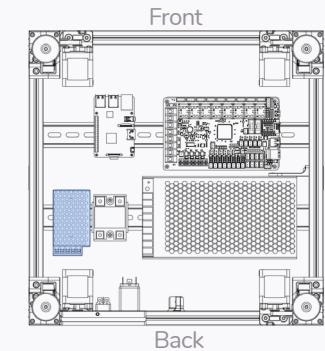
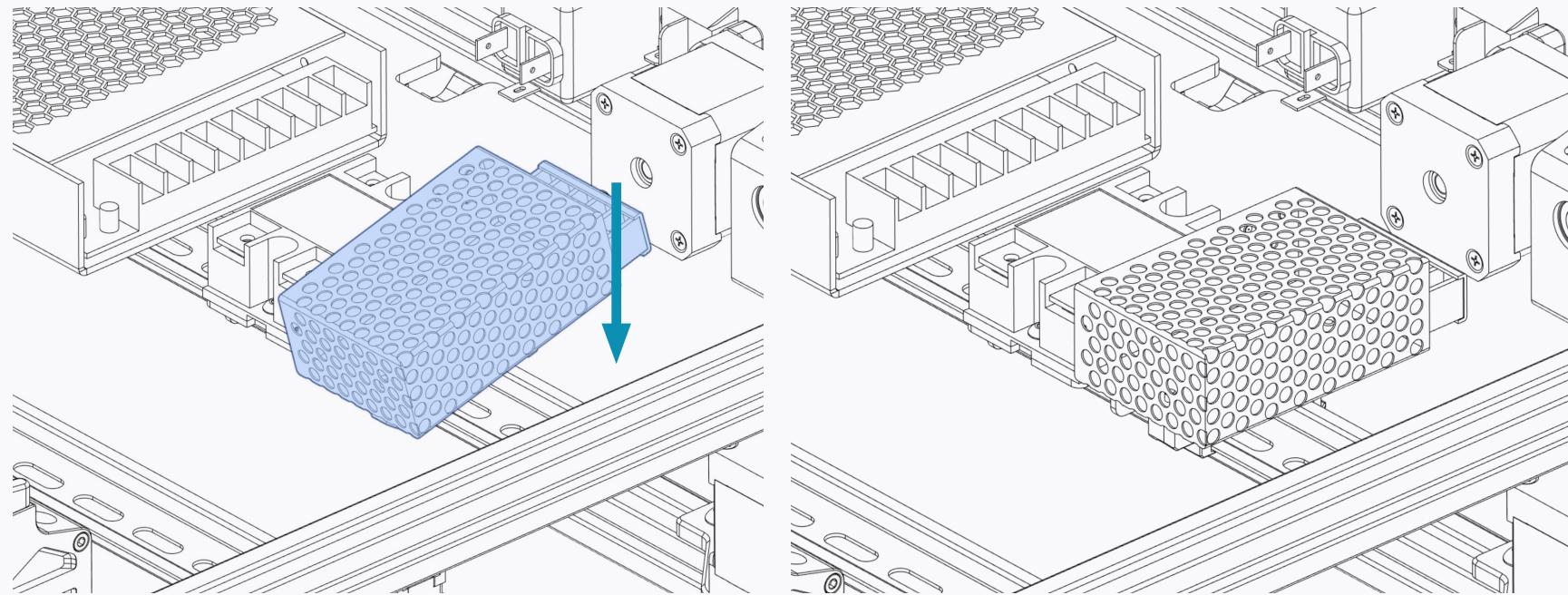
Be careful when releasing the latch, it will snap back into place. Mind your fingers.



**another small reminder, you don't use a 5v PSU.**

5V PSU

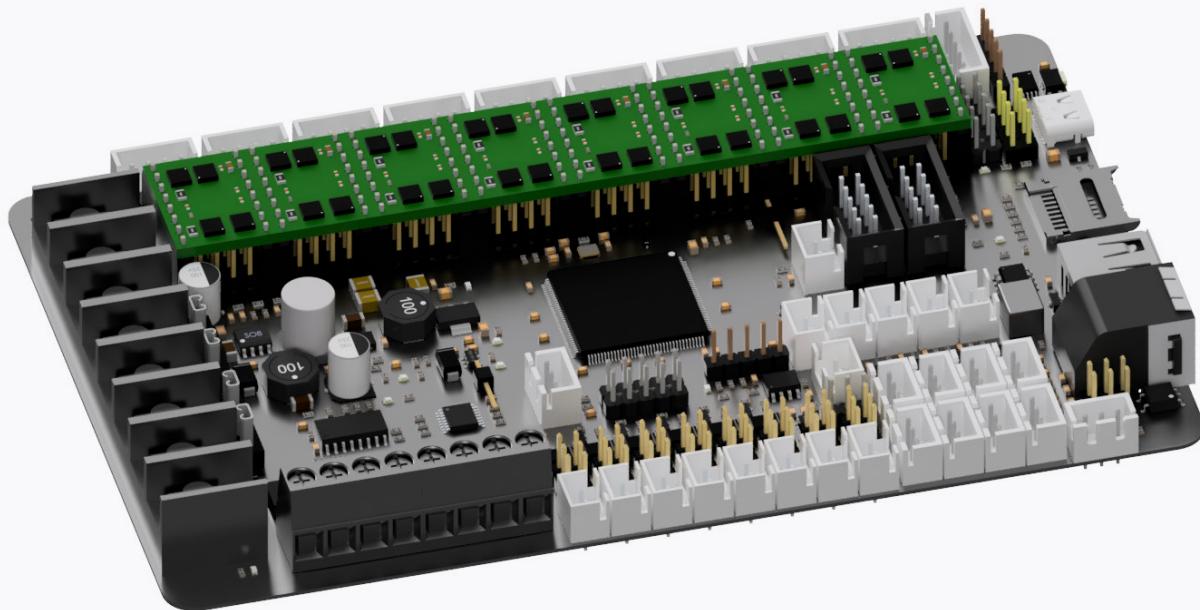
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By Febrary 2019 over 100 Voron2 printers had been built and serialized.

CONTROLLER BOARD

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Skip these steps, instead configure your Manta like this: M8P\_v2 Jumper / Driver marking Place a Jumper on all yellow marked pins and place the TMC2209s with attached heatsink on all driver ports with a blue circle after installing the jumpers.

## CONTROLLER BOARD

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### CONTROLLER BOARD

The assembly manual will outline the wiring for a Bigtreetech Octopus V1.1 board. You can find additional documentation and alternative configurations on [docs.vorondesign.com](https://docs.vorondesign.com).

### JUMPERS

Several jumpers need to be configured on the controller board. We will begin by **removing all the JUMPERS** from the controller board (MCU).

1) Remove the jumpers in the “driver sockets”.

2) Remove all the jumpers in the “DIAG” header when using microswitch or Hall Effect endstops.

3) Remove the “USB 5V power supply” jumper to avoid the interaction between the USB 5V of Raspberry Pi and the 5V of the MCU.

4) Remove all the jumpers on the “Fan Voltage Selection” headers so that you can set the correct supply voltage.

5) Remove the jumper in “Probe Voltage Selection” header so that you can set it to the correct supply voltage.

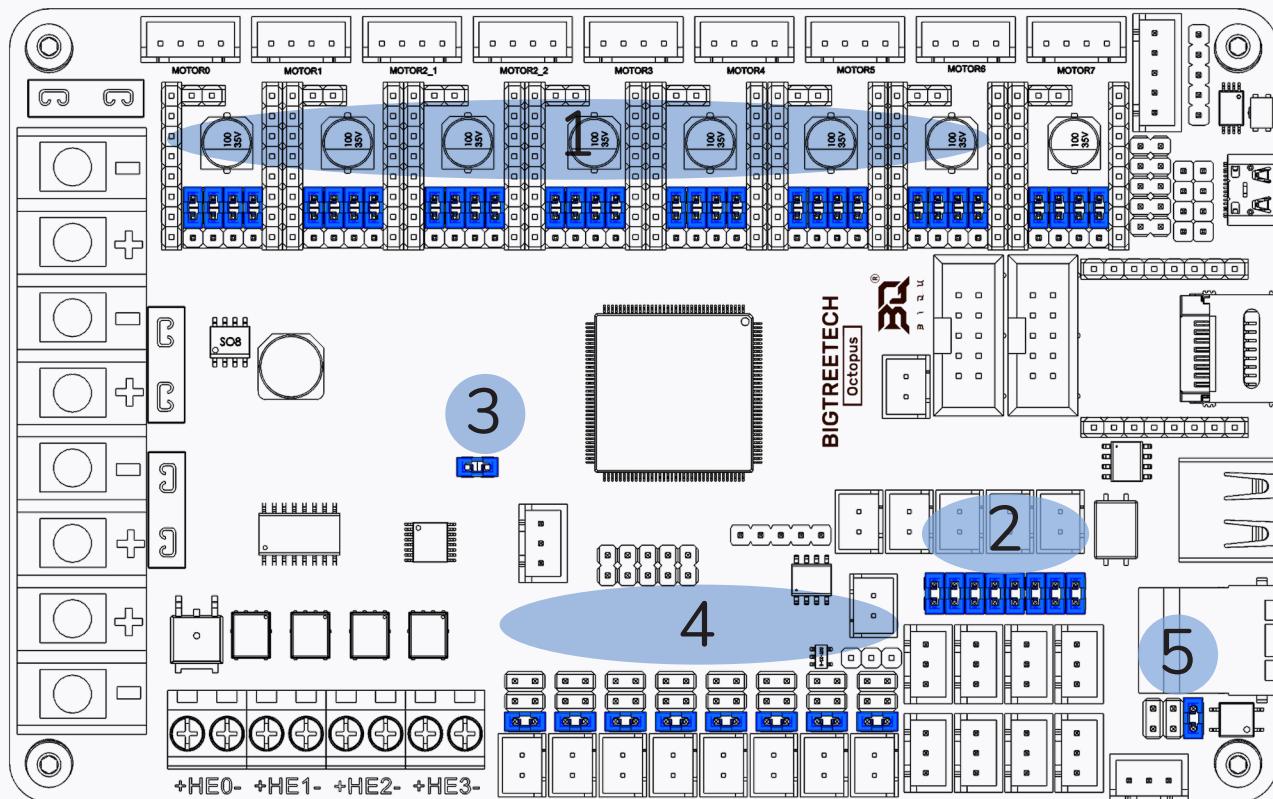


Diagram courtesy of @GadgetAngel

Skip these steps, instead configure your Manta like this: M8P\_v2 Jumper / Driver marking Place a Jumper on all yellow marked pins and place the TMC2209s with attached heatsink on all driver ports with a blue circle after installing the jumpers.

## CONTROLLER BOARD

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### JUMPERS

Several jumpers need to be set on the MCU.

Add the following JUMPERS to the controller board (MCU).

- 1) Set the jumpers in the "driver sockets" as shown to set TMC2209 UART mode.
- 2) Ensure all the jumpers in the "DIAG" header are removed.
- 3) Ensure the Power Selection header is empty.
- 4) Set the Jumpers for the "Fan Voltage Selection" header so they match your fan's voltage. Shown here are the settings for 24VDC.

- 5) Set the jumper in "Probe Voltage Selection" header to 24VDC.

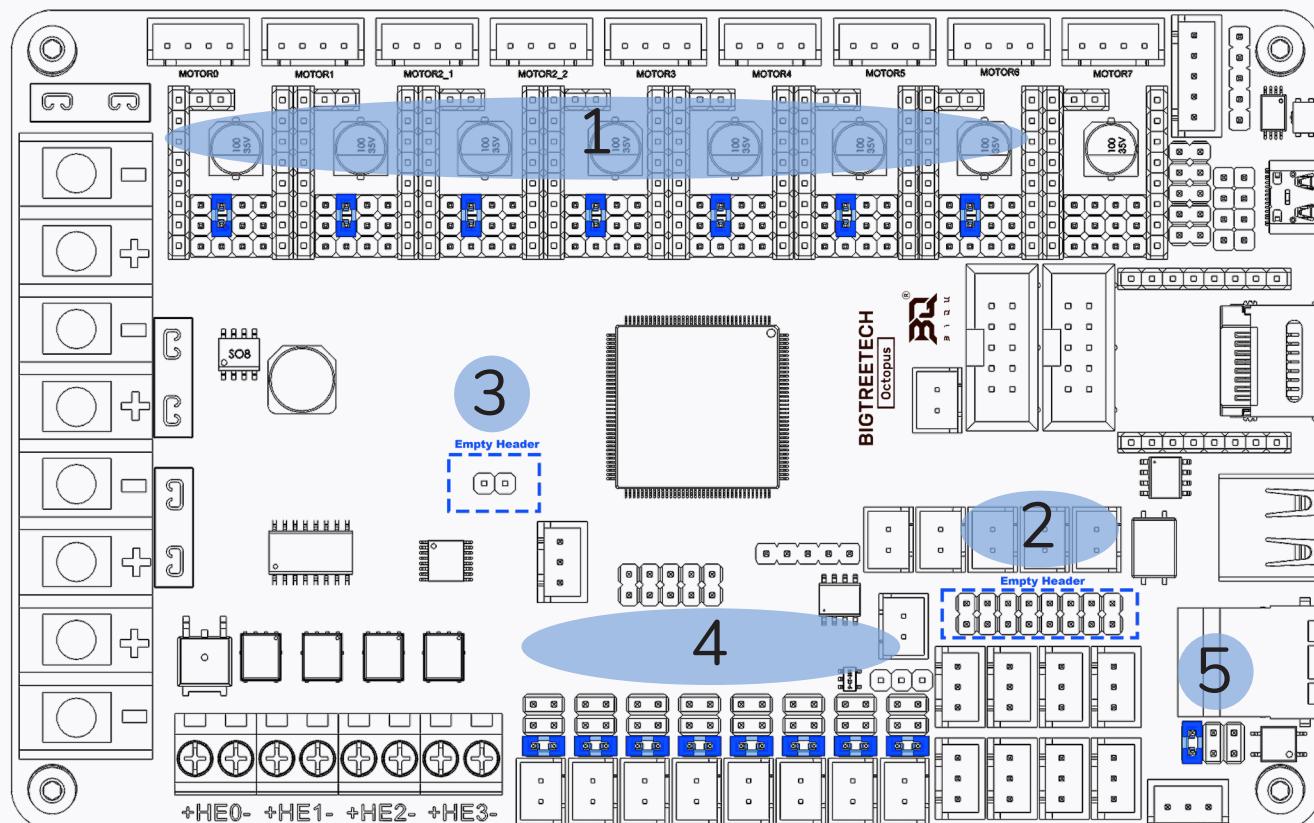


Diagram courtesy of @GadgetAngel

Skip these steps, instead configure your Manta like this: M8P\_v2 Jumper / Driver marking Place a Jumper on all yellow marked pins and place the TMC2209s with attached heatsink on all driver ports with a blue circle after installing the jumpers.

## STEPPER DRIVERS

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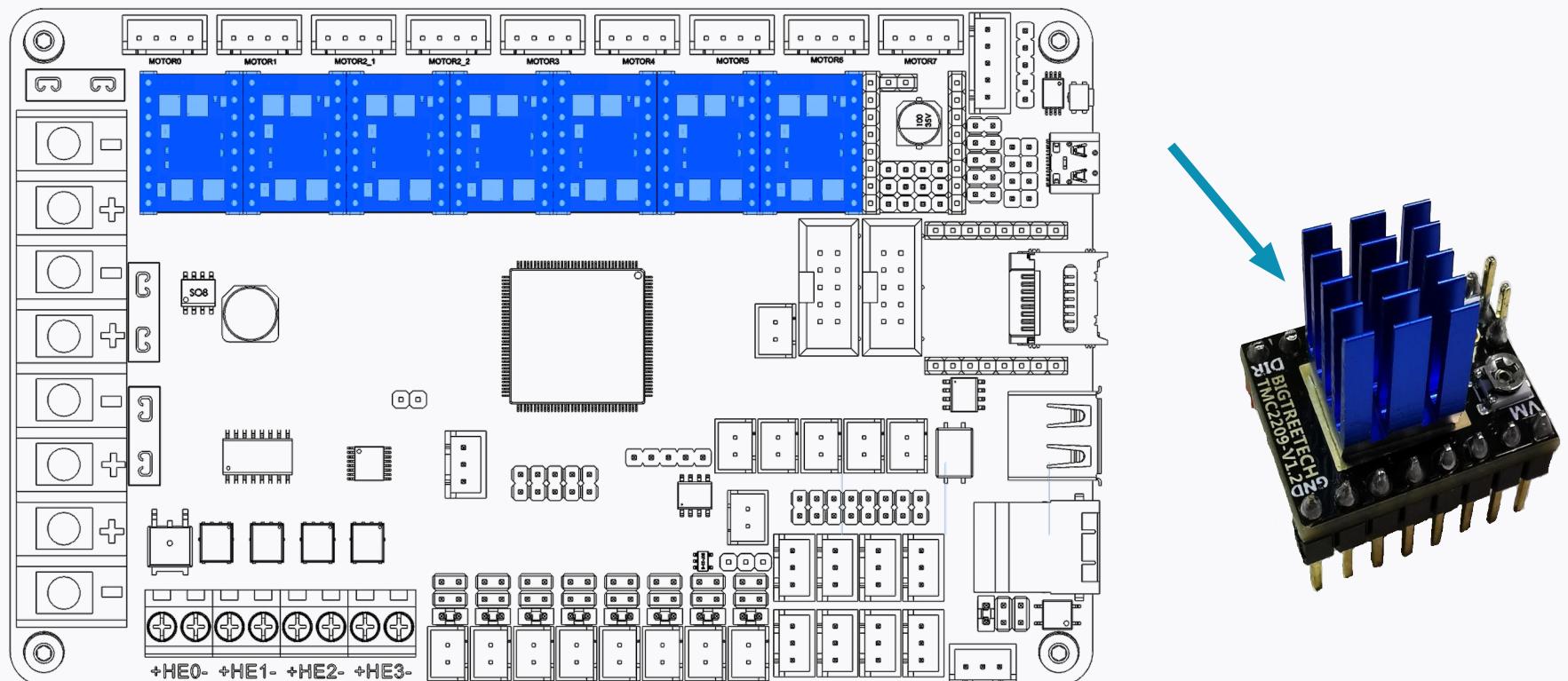


Diagram courtesy of @GadgetAngel

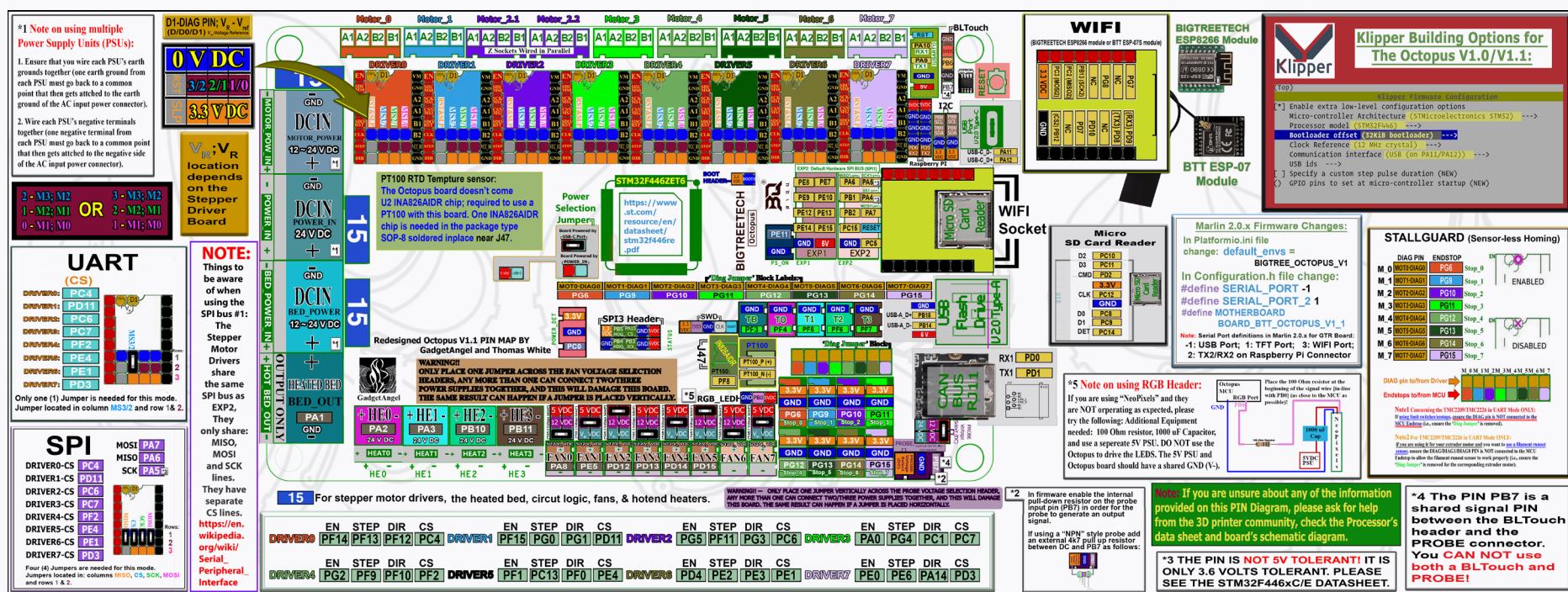
Skip these steps, instead configure your Manta like this: M8P\_v2 Jumper / Driver marking Place a Jumper on all yellow marked pins and place the TMC2209s with attached heatsink on all driver ports with a blue circle after installing the jumpers.

## CONTROLLER BOARD

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## OCTOPUS PINOUT REFERENCE

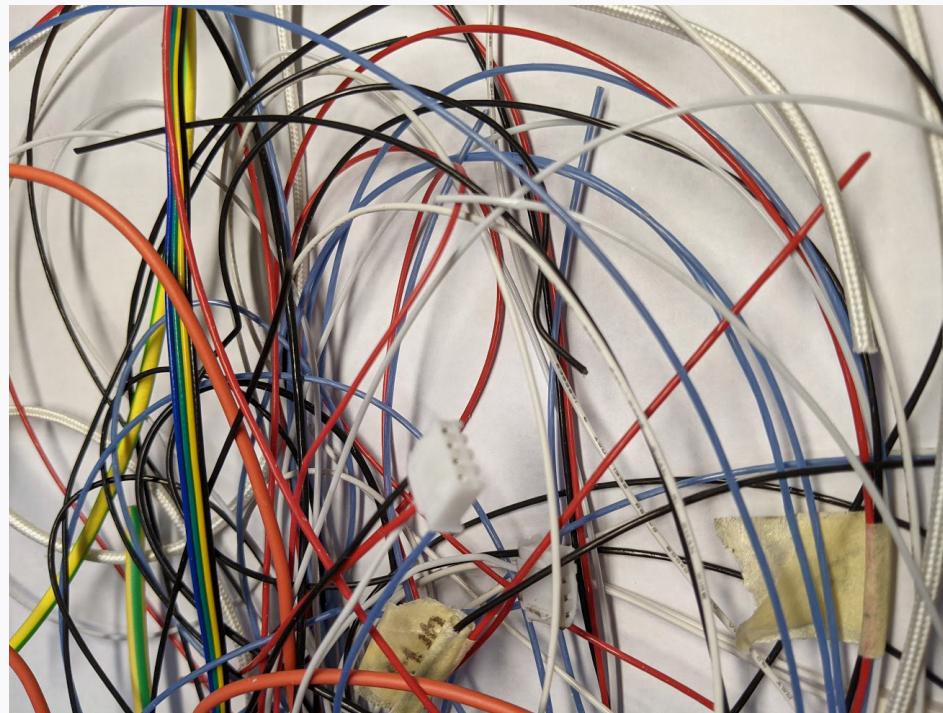
This Coloured PIN diagram can be found on GadgetAngel's GitHub repository for the Octopus V1.1

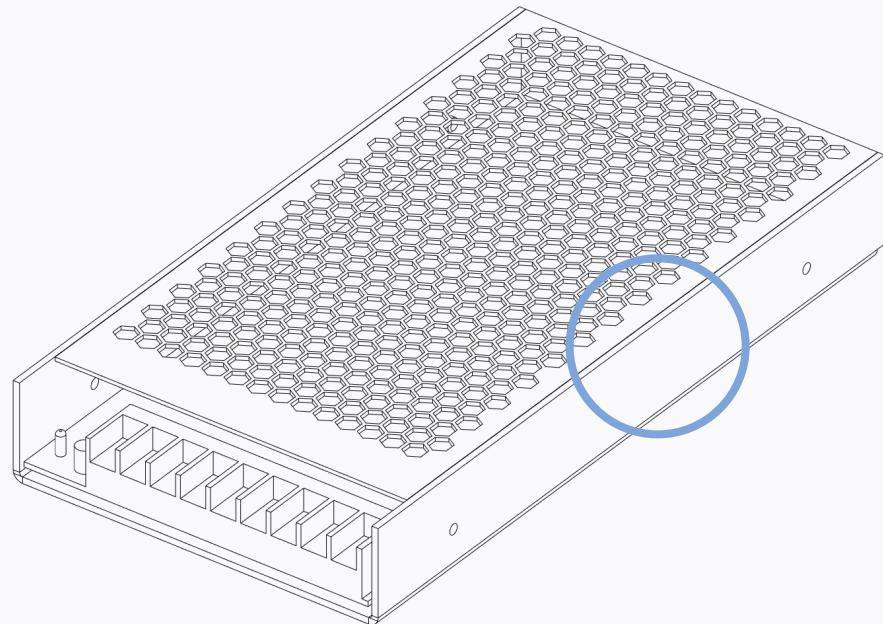


The original PIN diagram can be found on Bigtreetech's GitHub repository for Octopus V1.1.

Diagram courtesy of @GadgetAngel

A year later this figure grew to 350 Voron2 printers.





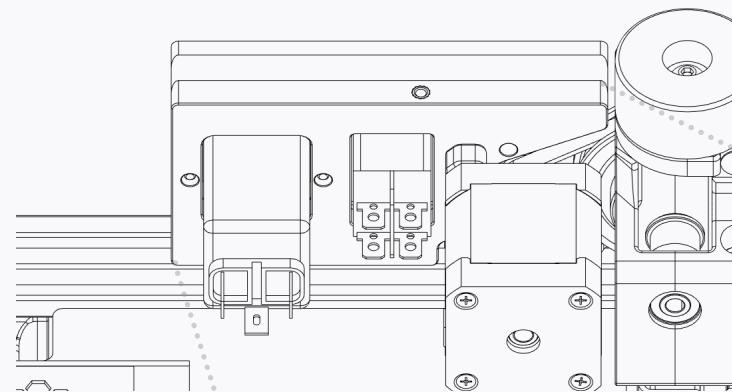
#### INPUT VOLTAGE SWITCH

Check the input voltage switch of the power supply. It is located in the highlighted area.

Make sure the selection matches your local mains voltage. Refer to the Mean Well LRS-200 datasheet for possible settings ([voron.link/e0szdyh](http://voron.link/e0szdyh)).

## POWER INLET

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### MAINS INLET WIRING

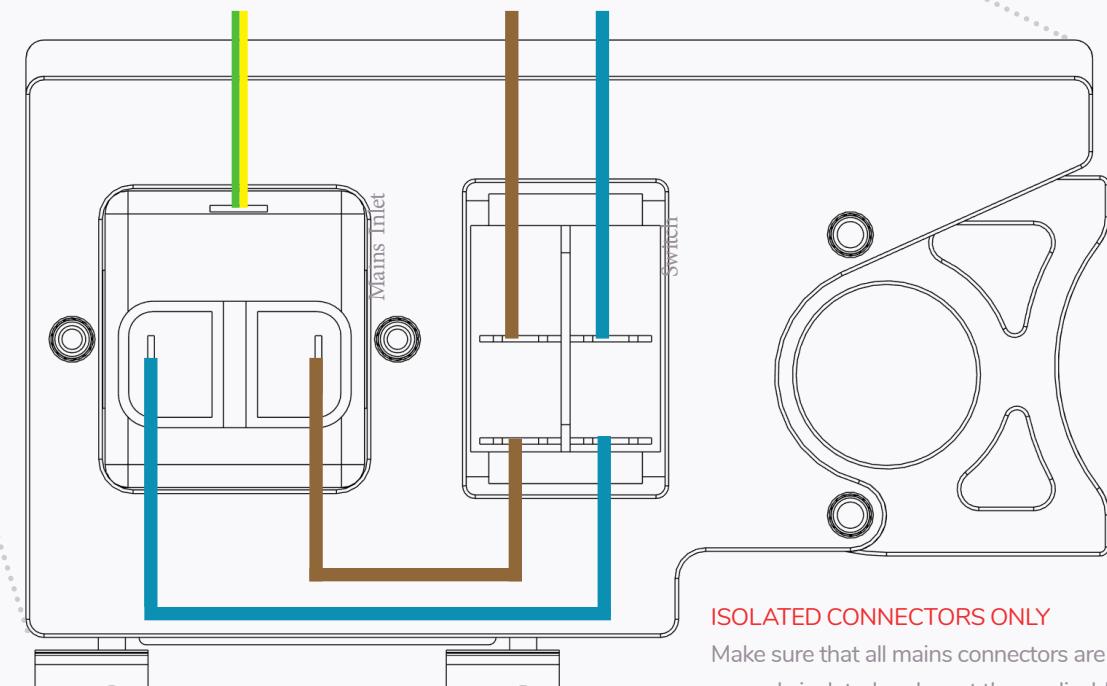
We show the wiring in the IEC colour scheme.  
Depending on your region the colour scheme and  
wiring standards will differ.

Mains wiring should only be done by qualified personnel trained in local regulations and safety standards. Depending on your local regulations you may be forbidden from wiring the mains side and/or putting the printer into operation; seek professional assistance.

Failure to observe those could result in bodily harm.

### ATTACH 250MM OF WIRE

Cables should be at least 1mm<sup>2</sup> (AWG18) or thicker depending on local regulations.



### ISOLATED CONNECTORS ONLY

Make sure that all mains connectors are properly isolated and meet the applicable safety standards.

**Leave the cables to the 5v PSU out.**

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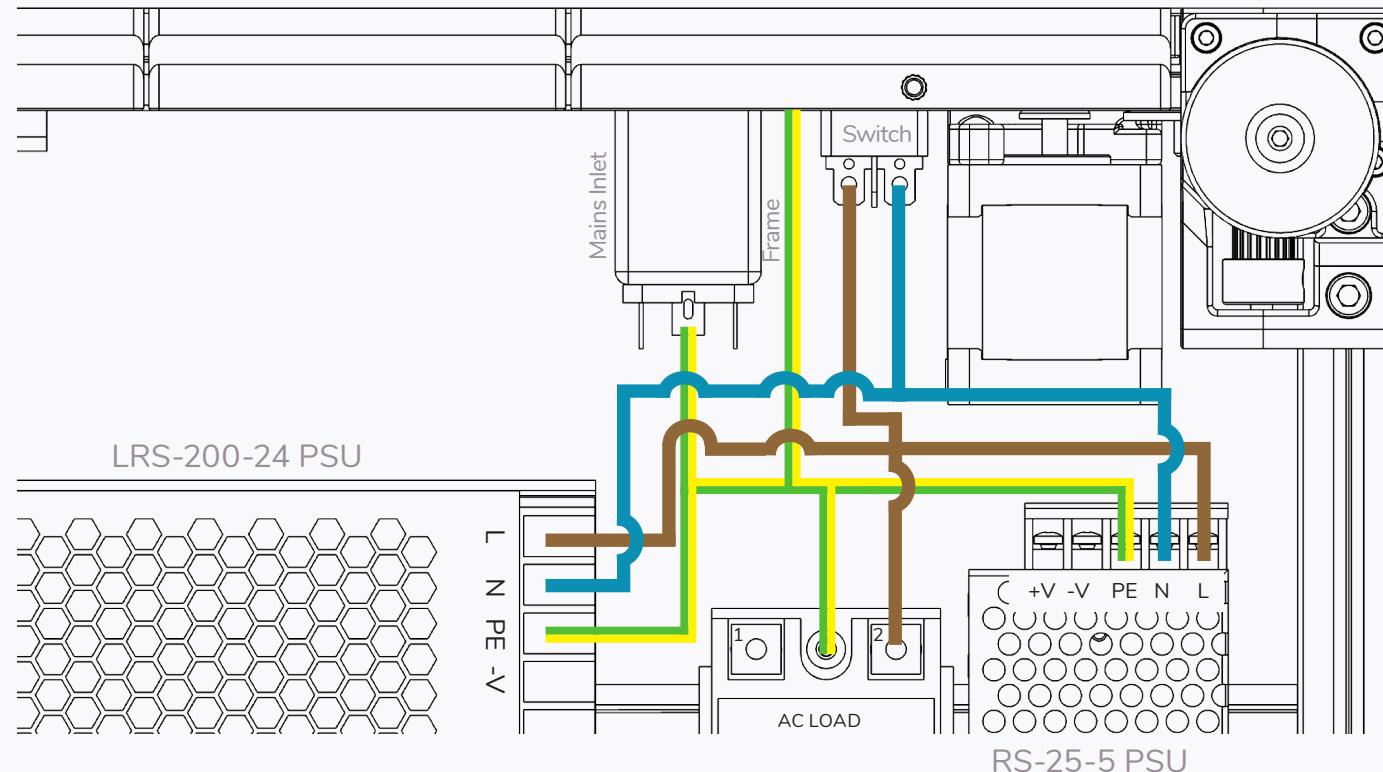
## MAINS WIRING

### MAINS WIRING CONTINUED

Secure the wires with cable clips / cable tie anchors.

The bed heater is powered by AC voltage and receives its PE in a later step.

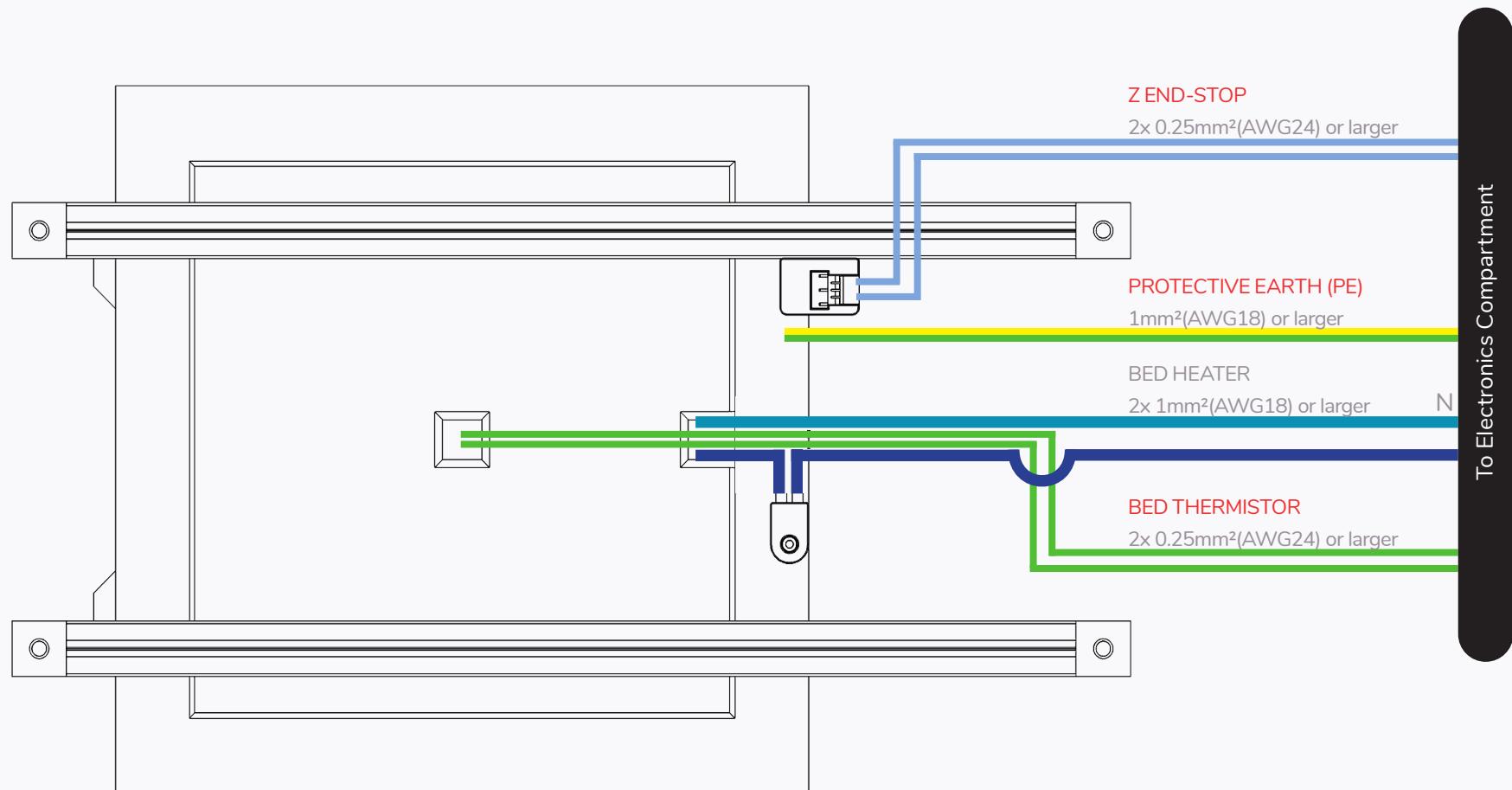
Observe your local regulations in regards to the Protective Earth connections for the frame/other components.



The Z-Endstop cables are not needed.

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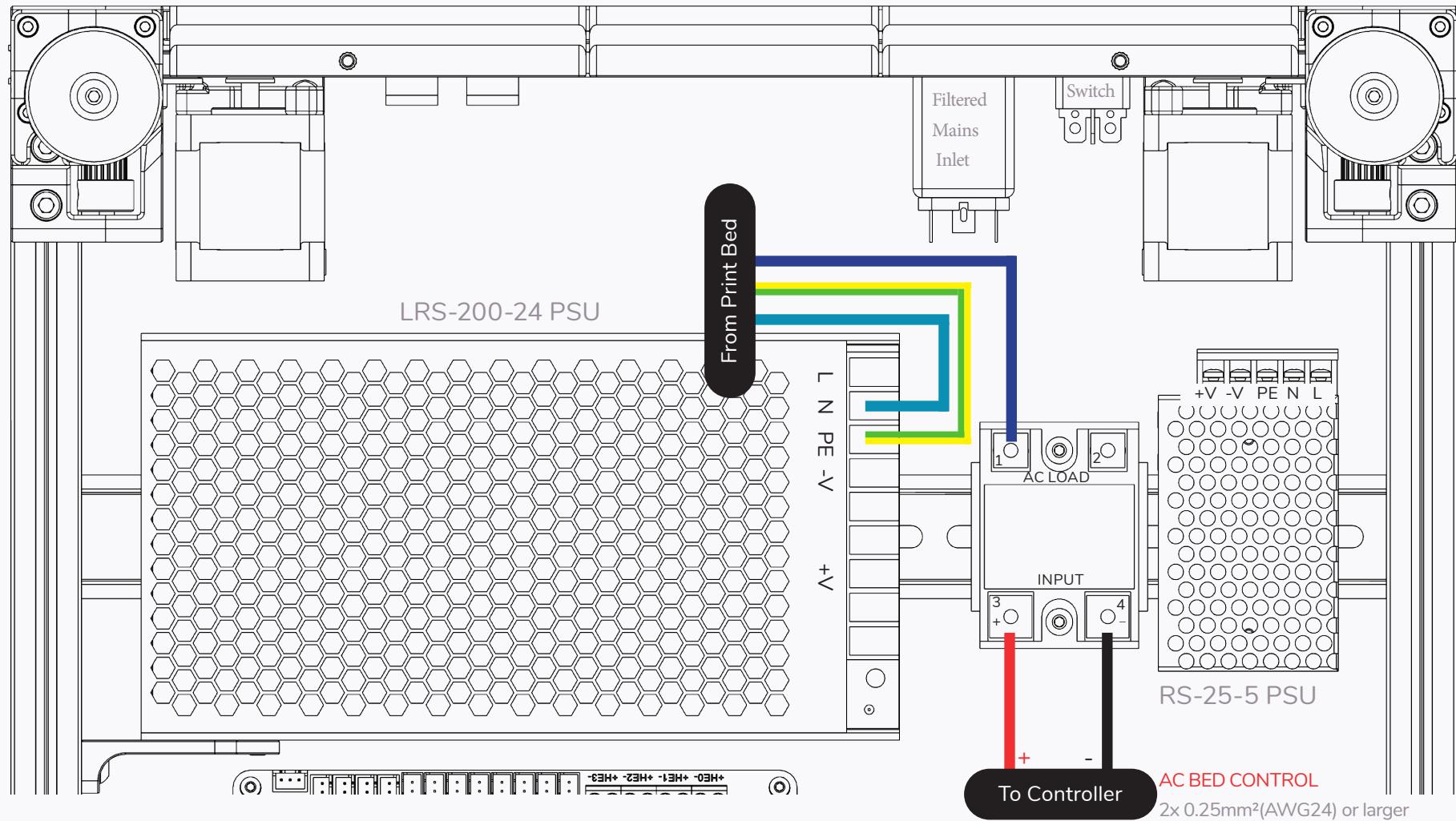
BED CABLE HOOKUP



**Be 100% sure that the SSR cables are connected correctly, otherwise your printer is not safe to be powered on.**

## MAINS WIRING

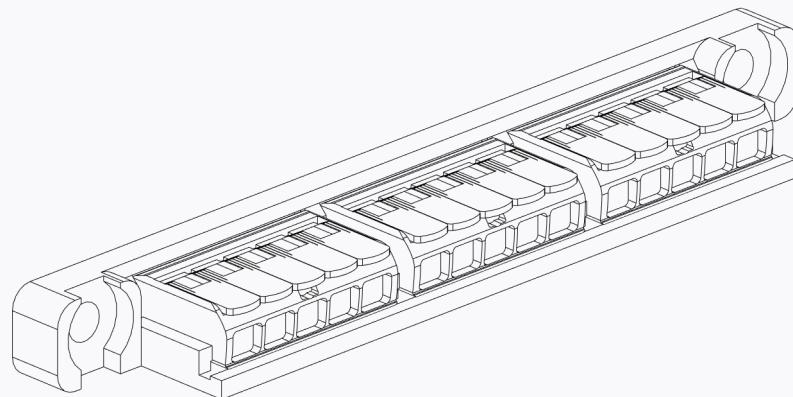
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**This kit doesn't use Wagos to distribute the High Voltage cables.**

ALTERNATE MAINS WIRING - WAGO CLAMPS

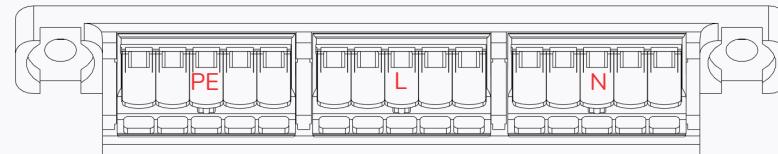
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**OPTION: WAGO CLAMPS FOR MAINS**

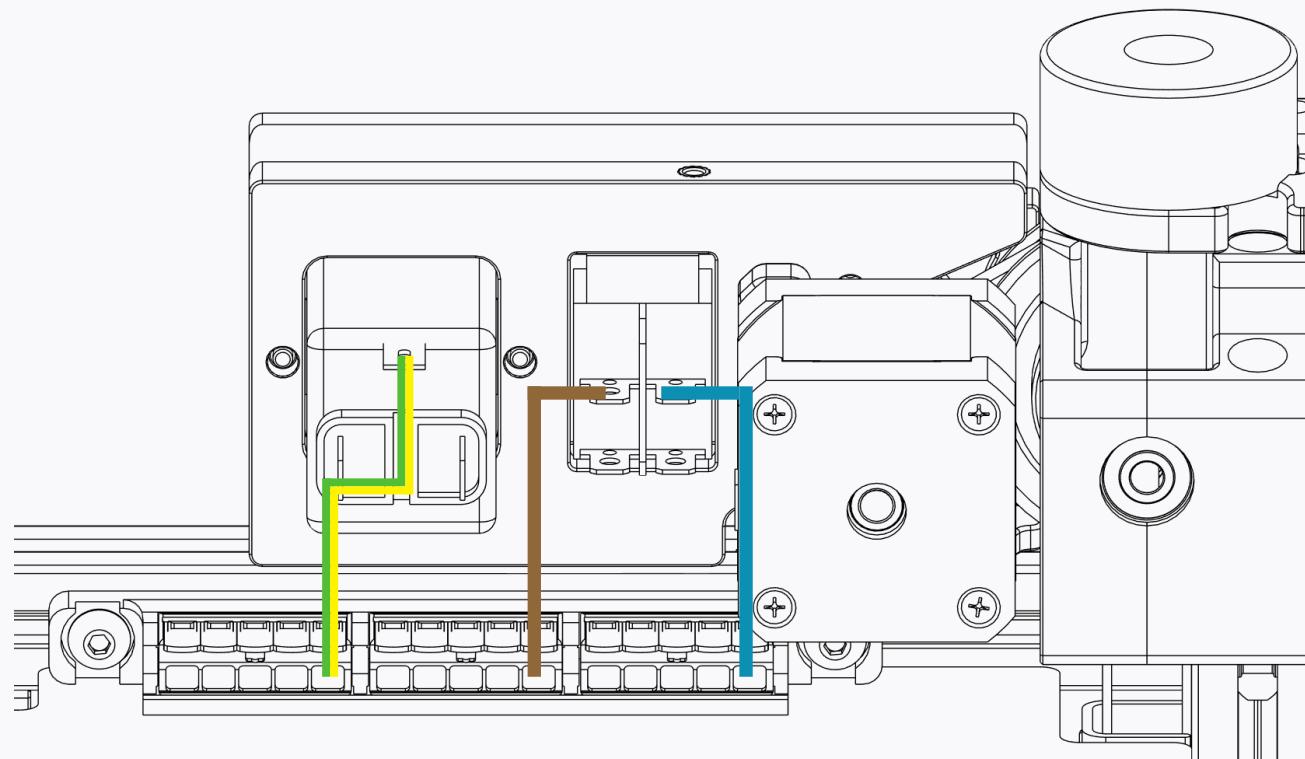
WAGO wire clamps allow for a clean and easy wiring of the mains side.

You may want to label your clamps as shown below.



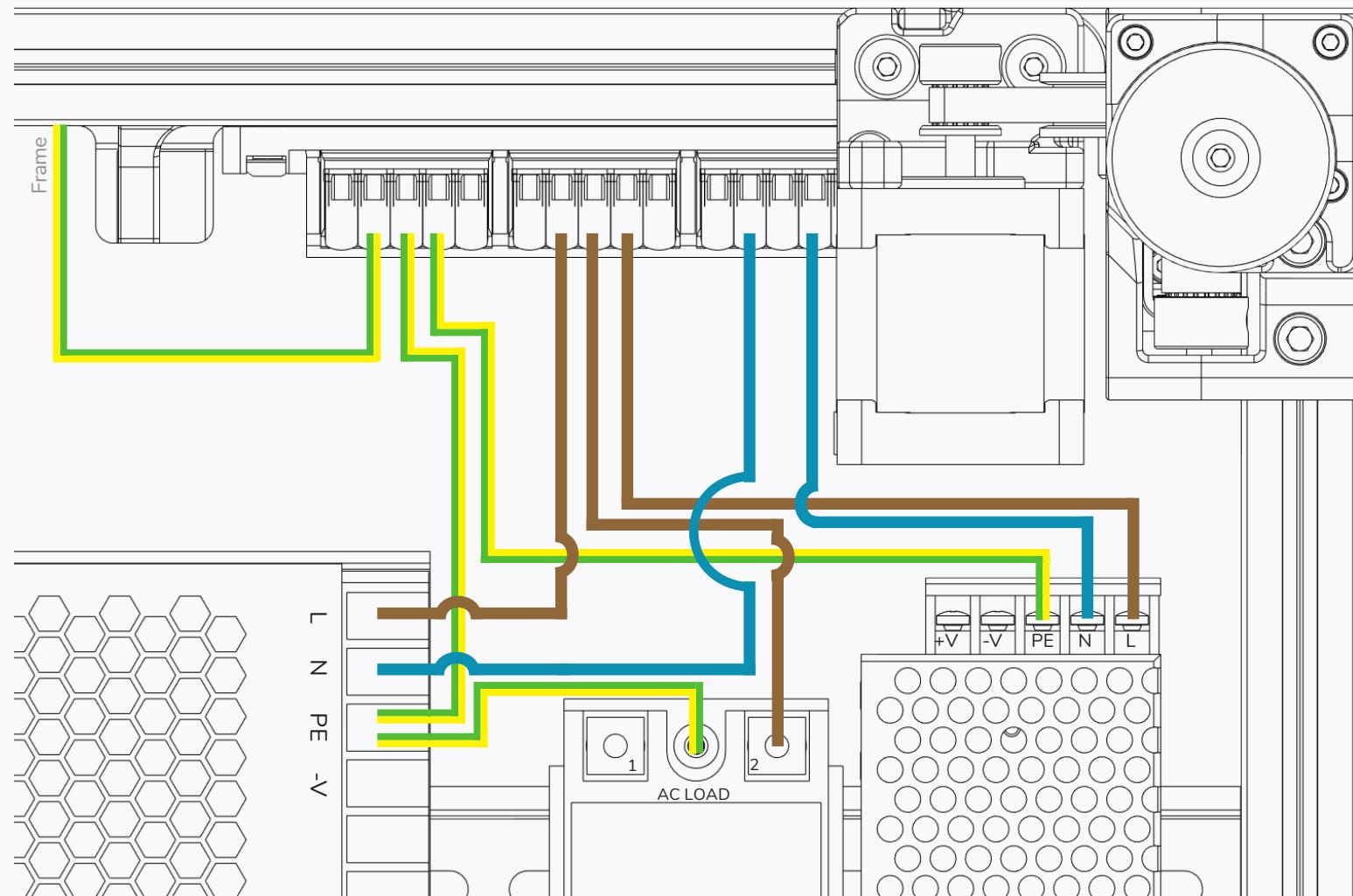
ALTERNATE MAINS WIRING - WAGO CLAMPS

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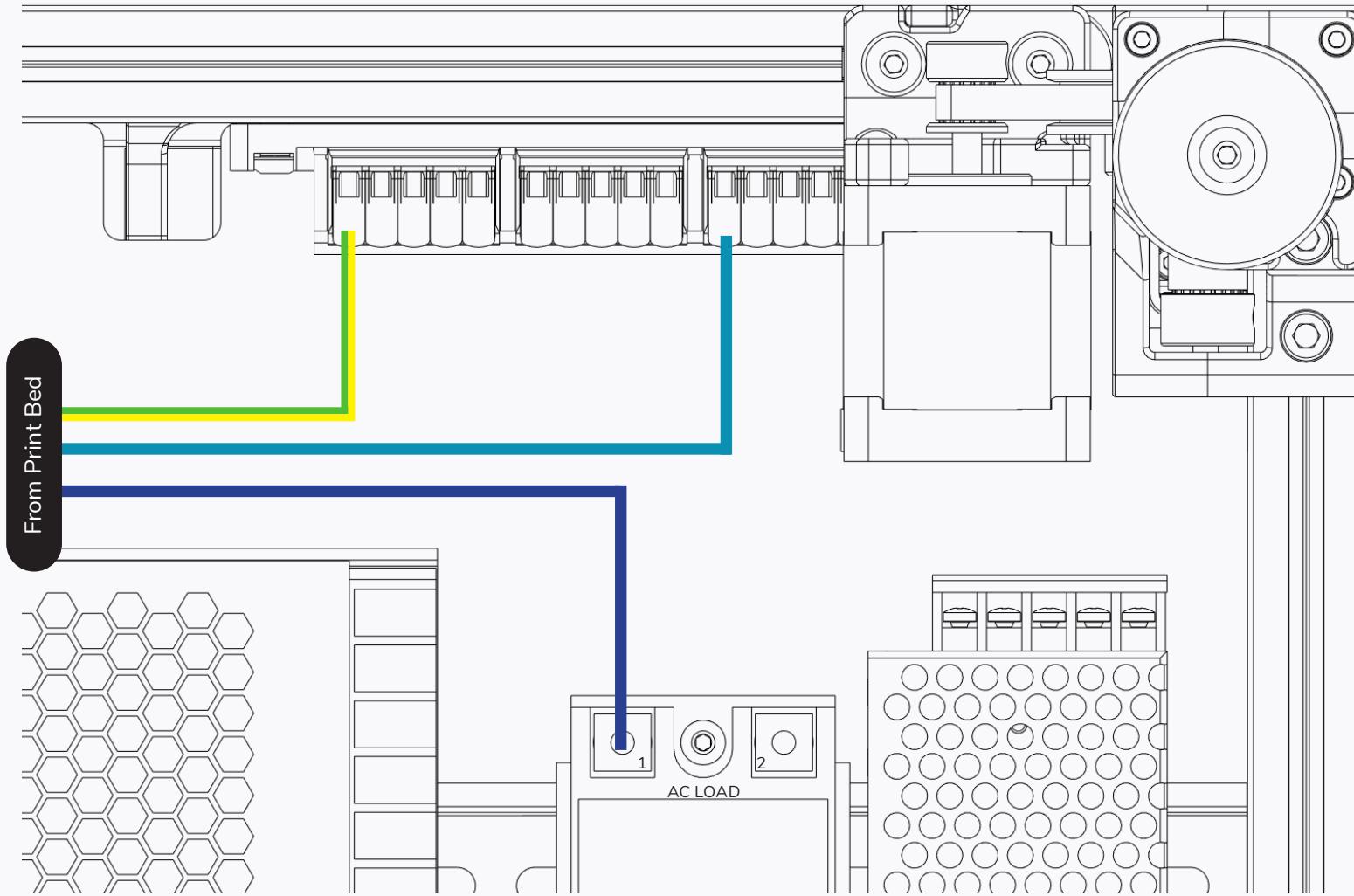
ALTERNATE MAINS WIRING - WAGO CLAMPS

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## ALTERNATE MAINS WIRING - WAGO CLAMPS

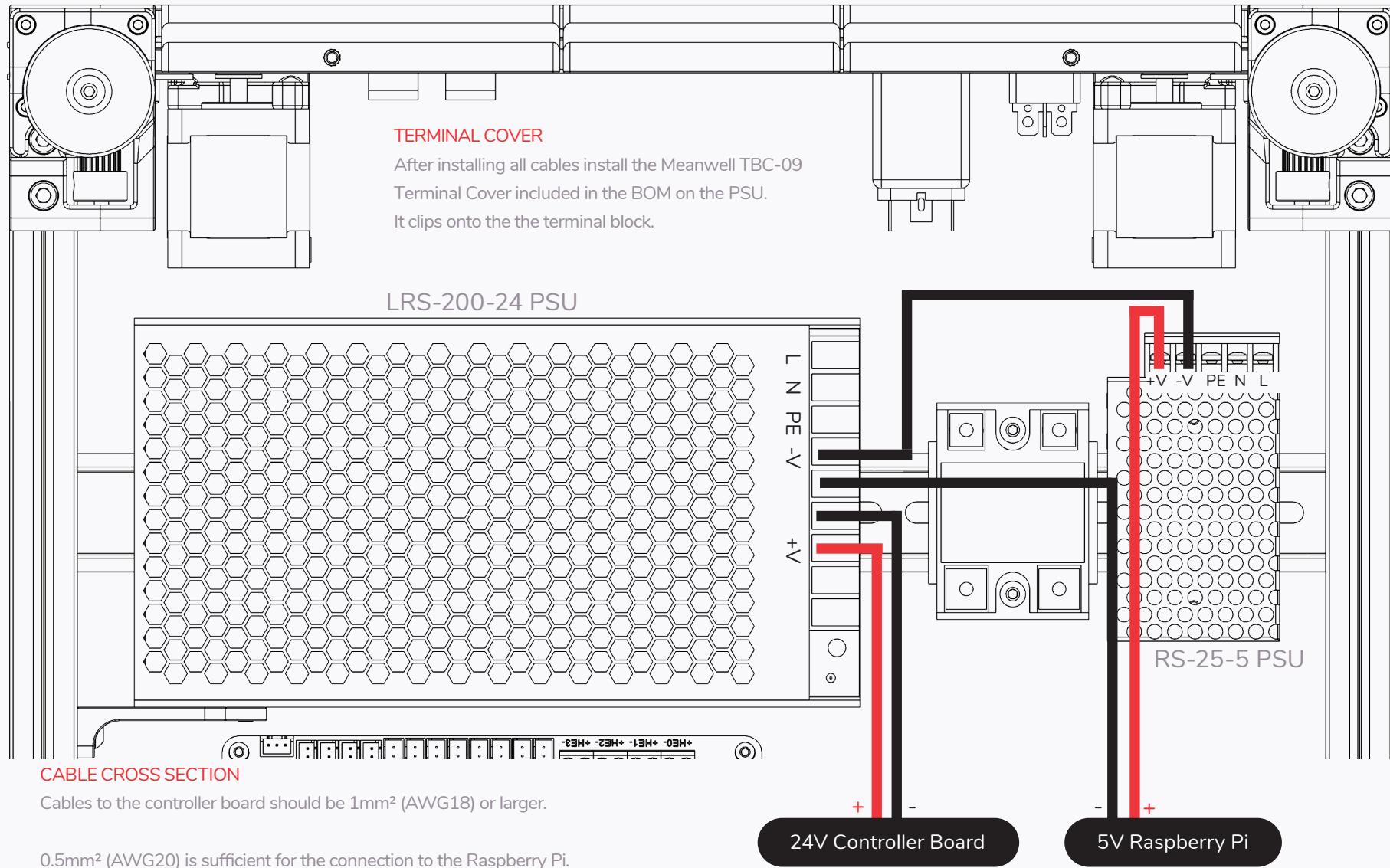
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These steps are for an octopus Mainboard. Use this wiring diagram instead: v2.4 M8P wiring diagram For now, only connect z0-z3, the bed heater, 24V from the 24V PSU and the bed thermistor.

## DC POWER

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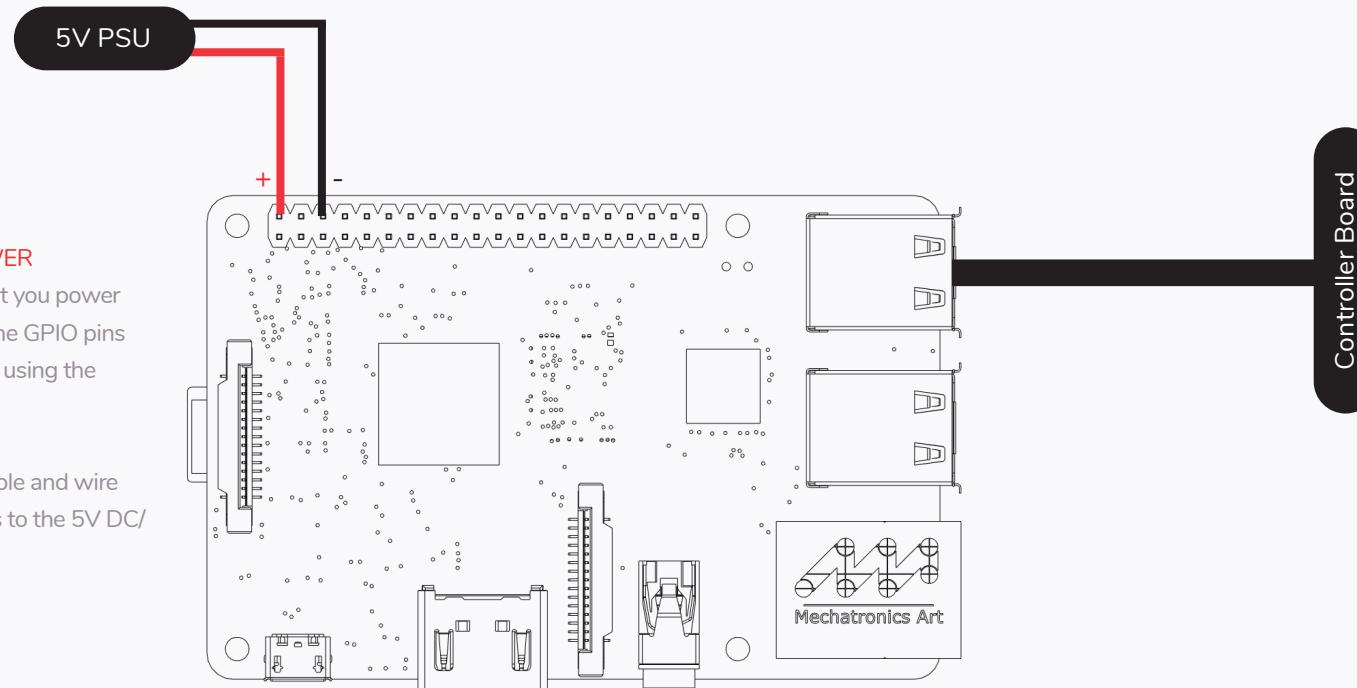
RASPBERRY PI

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#### RASPBERRY PI POWER

While we suggest that you power the Raspberry Pi via the GPIO pins you may also power it using the "Power-In" USB port.

Cut a suitable USB cable and wire the + and ground lines to the 5V DC/DC converter instead.



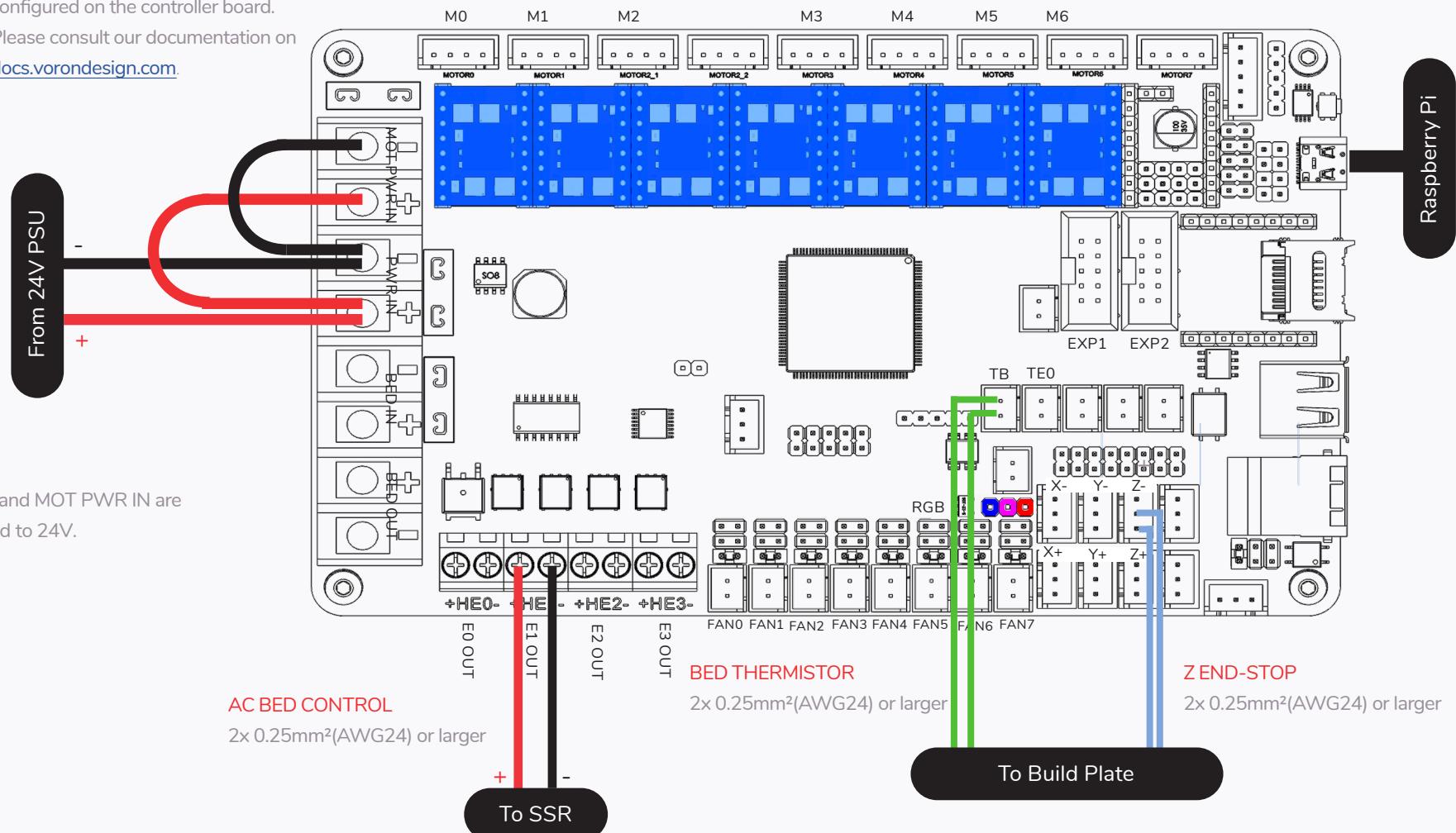
**These steps are for an octopus Mainboard. Use this wiring diagram instead: v2.4 M8P wiring diagram For now, only connect z0-z3, the bed heater, 24V from the 24V PSU and the bed thermistor.**

## CONTROLLER BOARD

## JUMPERS

Several jumpers may need to be configured on the controller board

Please consult our documentation on [docs.vorondesign.com](https://docs.vorondesign.com).



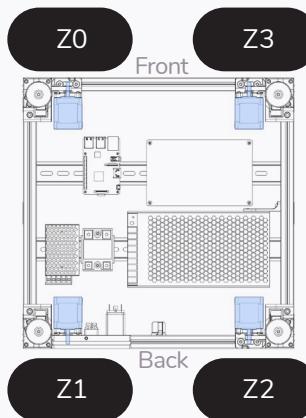
CONTROLLR BOARD

The assembly manual will outline the wiring for a Bigtreetech Octopus V1.1. You can find additional documentation and alternative configurations on [docs.vorondesign.com](http://docs.vorondesign.com).

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**These steps are for an octopus Mainboard. Use this wiring diagram instead: v2.4 M8P wiring diagram For now, only connect z0-z3, the bed heater, 24V from the 24V PSU and the bed thermistor.**

## CONTROLLER BOARD

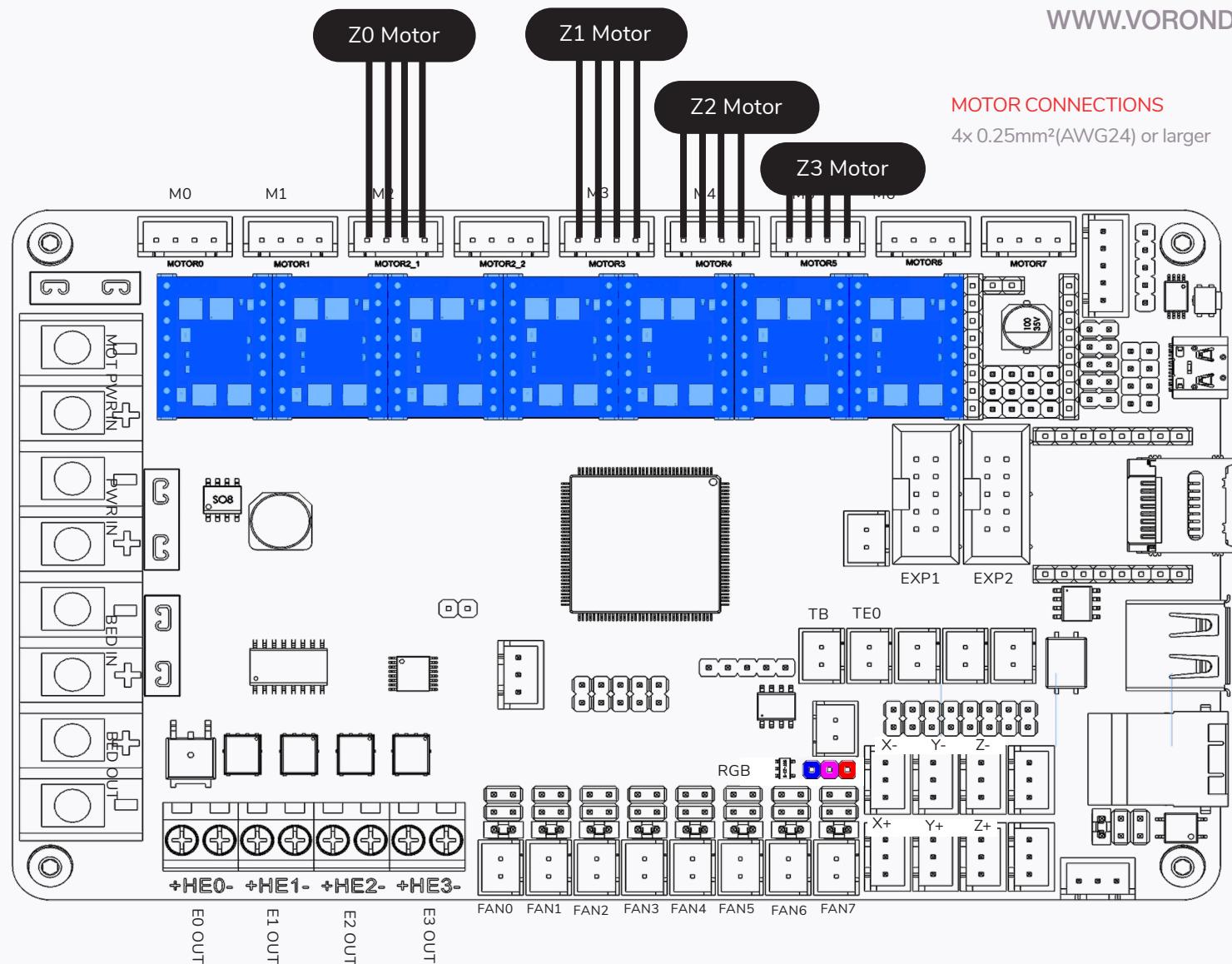


## BLACK MOTOR WIRES?

There is no standardized stepper wire colouring scheme. Each manufacturer implements their wires colours slightly different.

Please consult the datasheet of your stepper motors for the correct order.

If your motors came with plugs it's usually safe to assume that this order is correct.

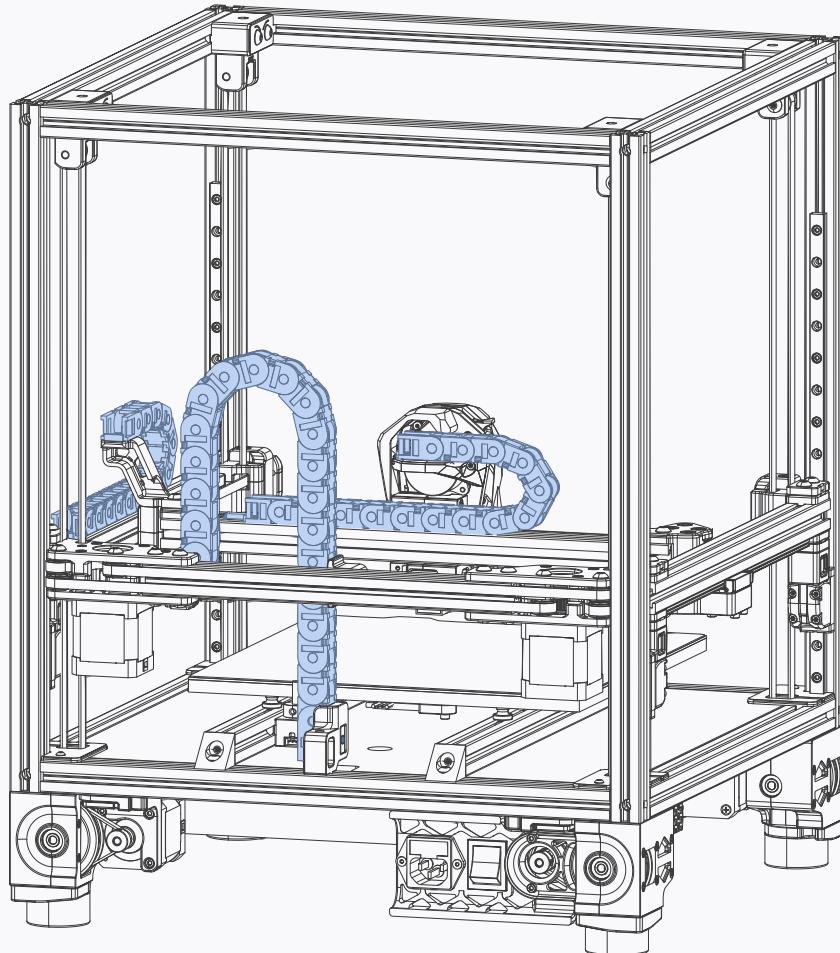


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**Skip these steps, you use Umbilical on X and Y.**

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## CABLE CHAINS - OVERVIEW



### CABLE CHAINS INSTALL

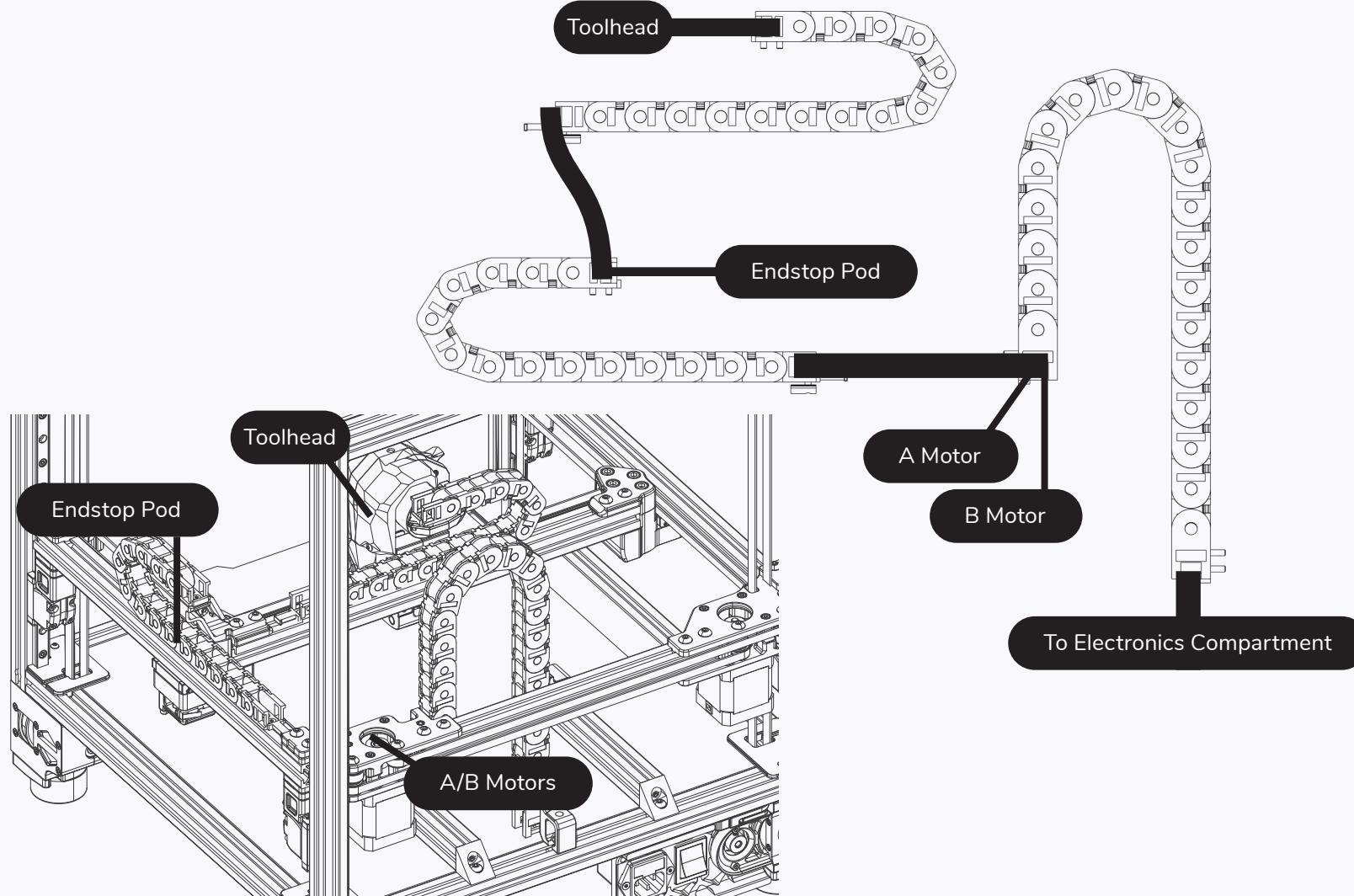
You can opt to install the chains now and fish the wires through the chains or build the complete harness outside of the printer and install it in one go. Either approach does work.

If you sourced a pre-built wire harness completing the harness outside of the printer is recommended.

**Skip these steps, you use Umbilical on X and Y.**

CABLE CHAINS - OVERVIEW

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**Skip these steps, you use Umbilical on X and Y.**

HOTEND

HOTEND COOLING FAN

2x 0.25mm<sup>2</sup>(AWG24) or larger

PART COOLING FAN

2x 0.25mm<sup>2</sup>(AWG24) or larger

EXTRUDER MOTOR

4x 0.25mm<sup>2</sup>(AWG24) or larger

INDUCTIVE PROBE

3x 0.25mm<sup>2</sup>(AWG24) or larger

HOTEND HEATER

2x 0.5mm<sup>2</sup>(AWG20) or larger

HOTEND THERMISTOR

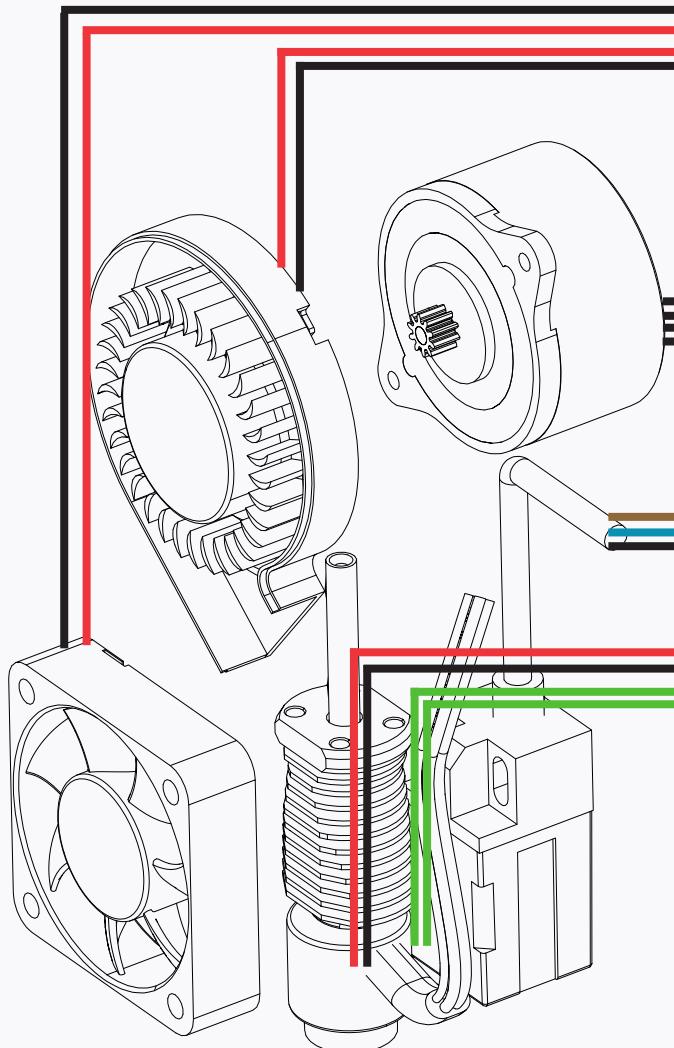
2x 0.25mm<sup>2</sup>(AWG24) or larger

To Controller Board

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**OPTION: TOOLHEAD PCB**

If you are planing to use a toolhead PCB consult the Board manufacturer for wiring instructions.



**WIRES, DRAG CHAINS AND CRIMPS**

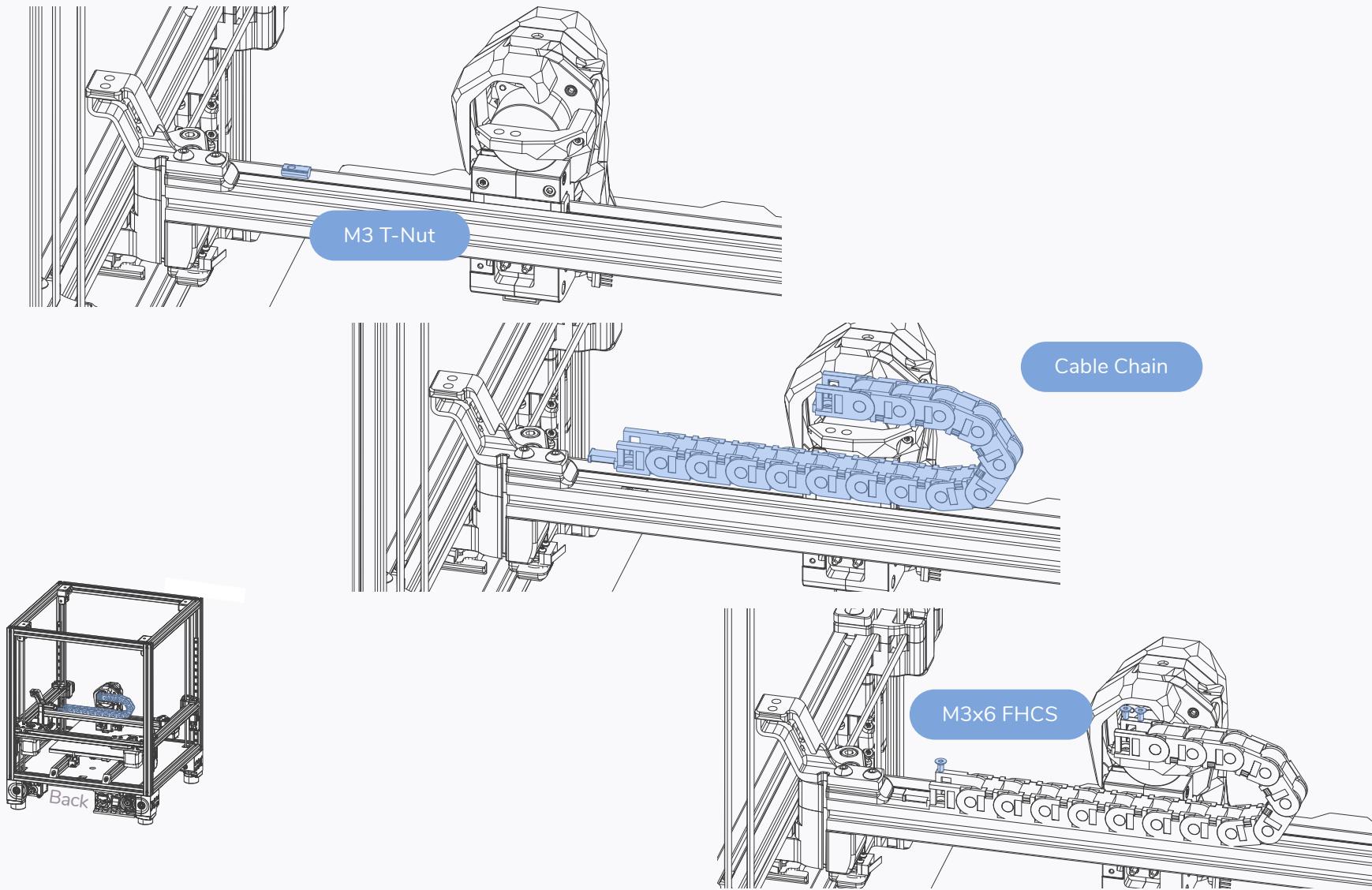
The wires attached to the probe, fans, heater, etc. are usually not rated for use in drag chains.

Add crimp connectors at the toolhead and run suitable wire down the drag chains. Refer to the sourcing guide for options.

**Skip these steps, you use Umbilical on X and Y.**

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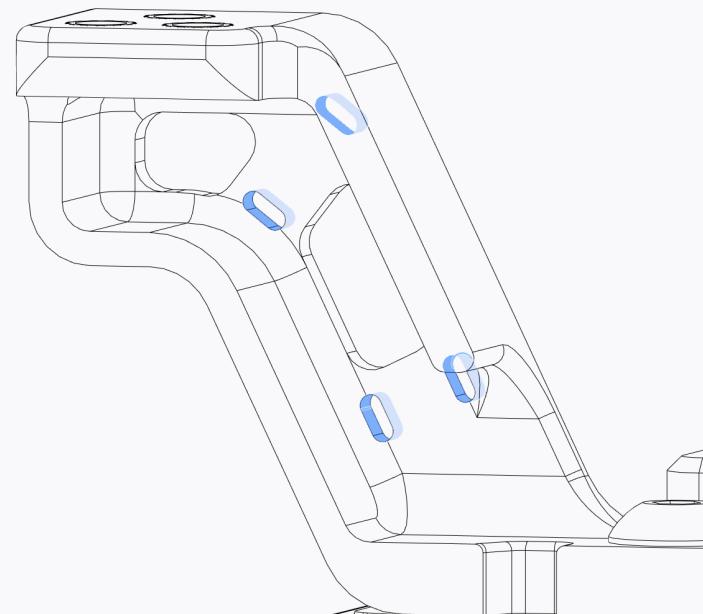
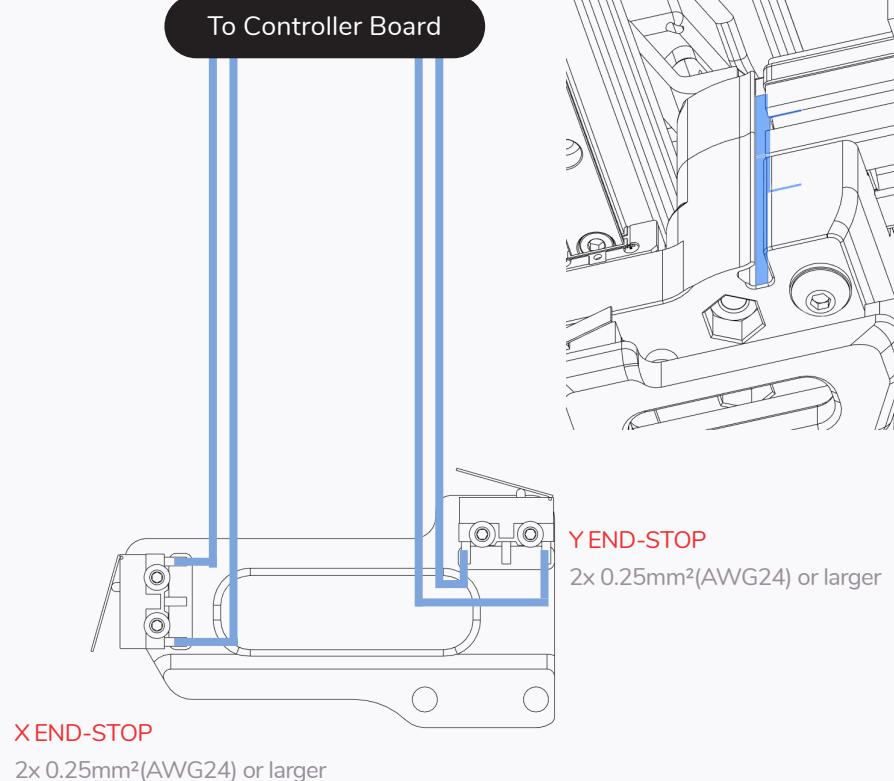
X CABLE CHAIN



**Skip these steps, you use Umbilical on X and Y.**

## TOOLHEAD/XY END-STOP ROUTING

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### ZIP TIE LOOPS

Secure the wire bundle to the strain relief using small zip ties.

### OPTION: ENDSTOP BOARD/HALL EFFECT BOARD

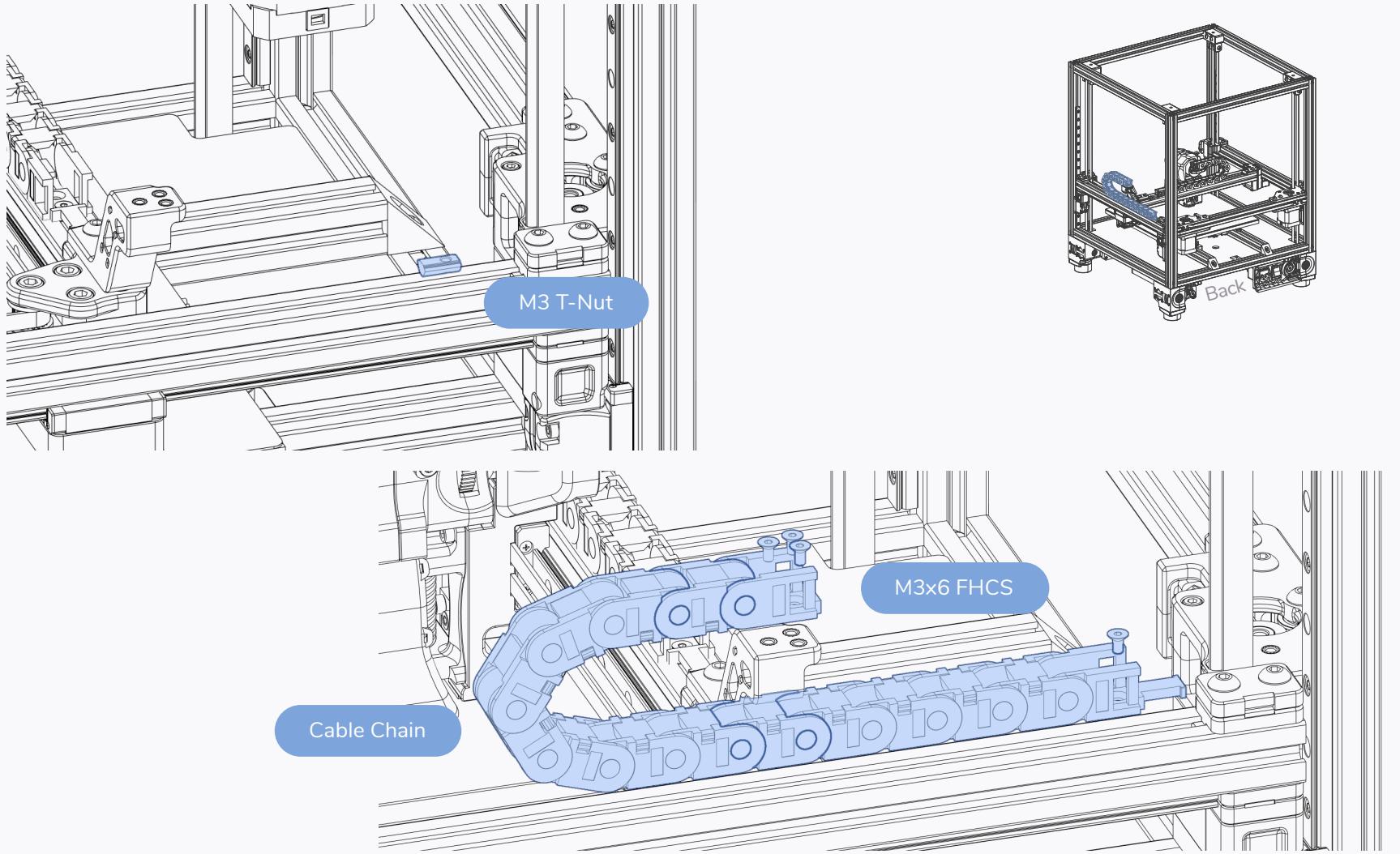
Those boards utilize a 4 pin connector instead. Please refer to

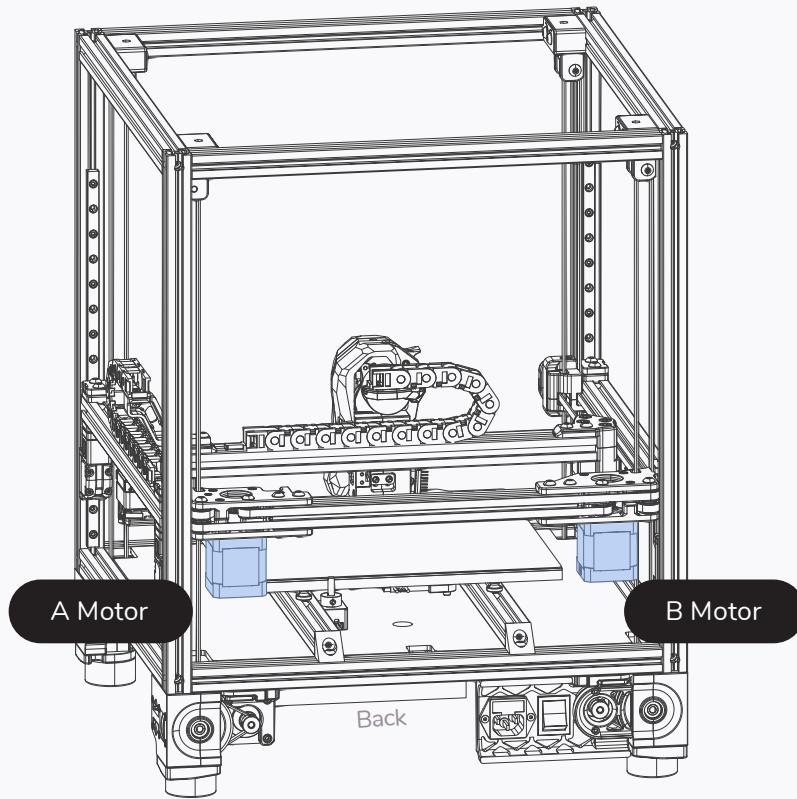
<https://voron.link/djhyygu> and <https://voron.link/d6qb7o6> for details.

**Skip these steps, you use Umbilical on X and Y.**

Y CABLE CHAIN

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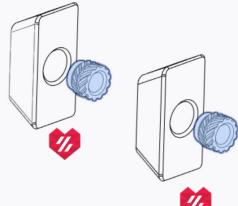


#### SECURING MOTOR CABLES

Secure the wire bundles for the A and B motors along the small extrusion that sits between the drives with small zip ties. These motor wires will both enter the Z cable chain that is installed on the next page.

## Z CABLE CHAIN

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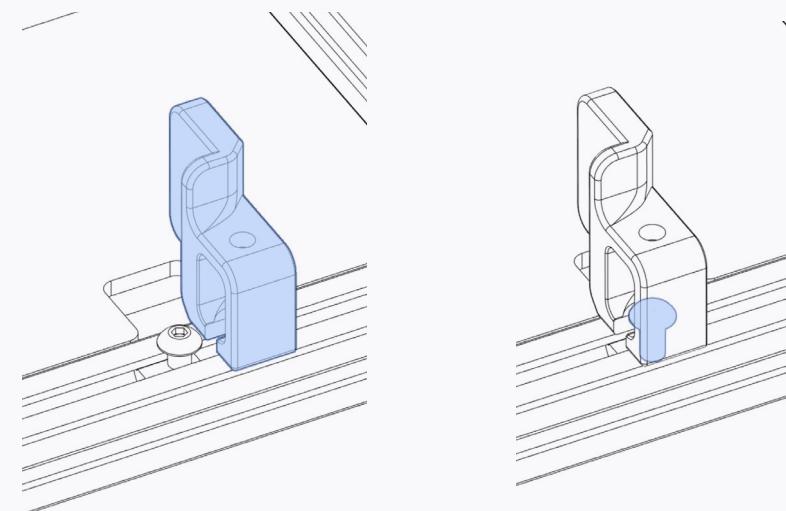
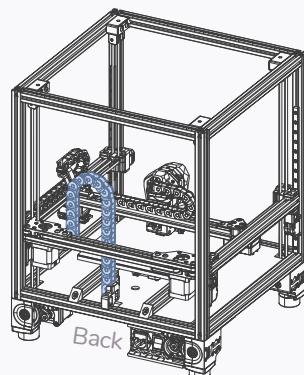
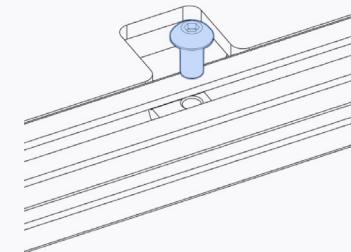


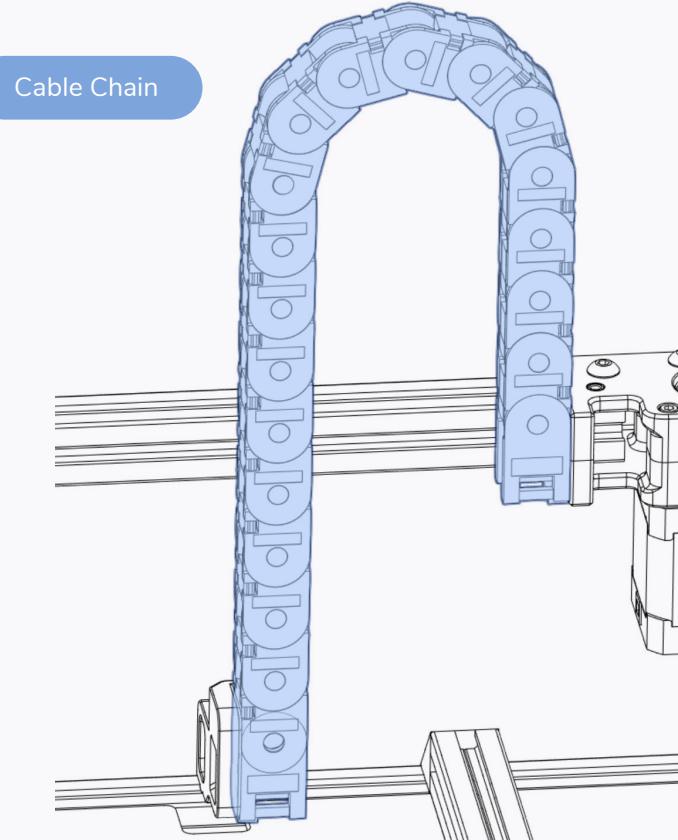
Heat Set Insert



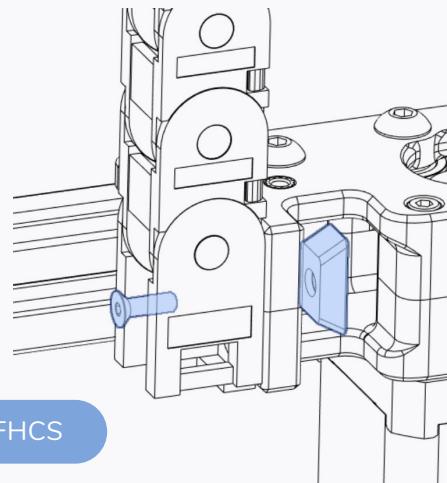
M5 T-Nut

M5x10 BHCS

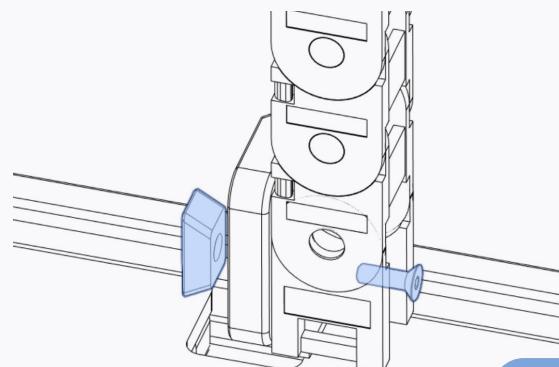




Cable Chain



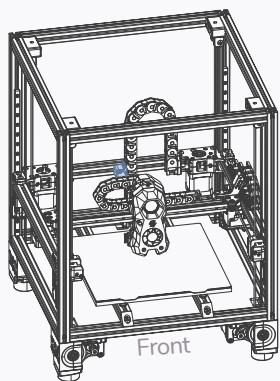
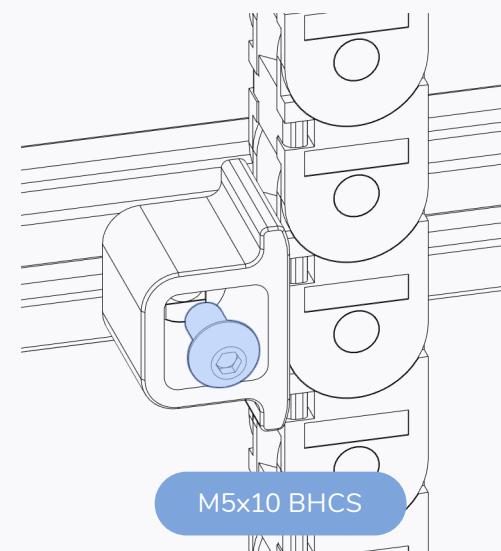
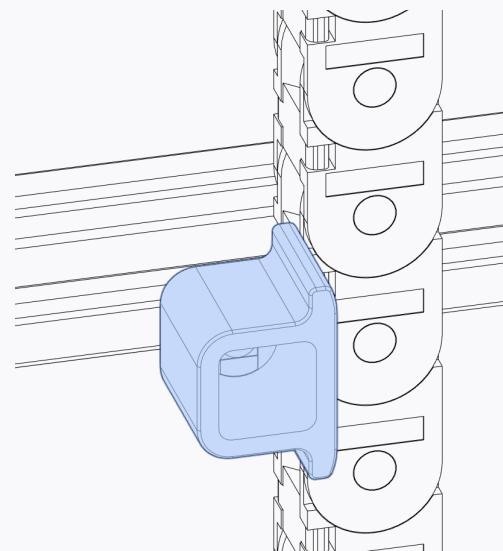
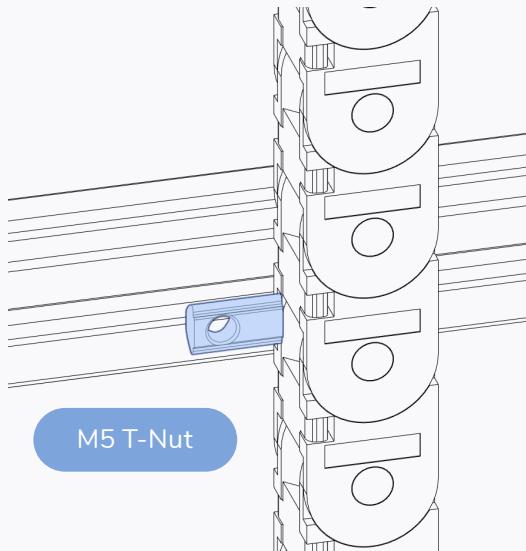
M3x10 FHCS



M3x10 FHCS

## Z CABLE CHAIN

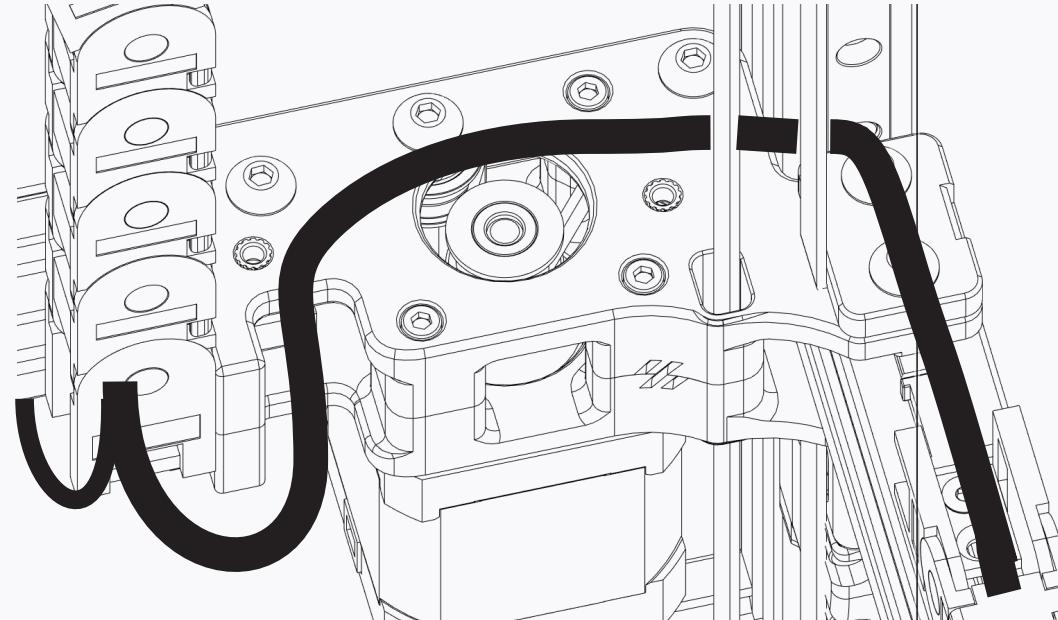
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You use a bit different Wire guide where you have to screw in a pg7 cable gland. From here you route the Can cable down through the z chain, together with the A and B Motor cables. v2.4 M8P wiring diagram Connect the B motor (left motor) to X Motor, connect the A motor (right motor) to Y Motor. Connect the CAN-Cable to the right CAN-Port on the M8P and 24V / GND to the 24V PSU. If you think the cables are not Long enough, you haven't done this step.

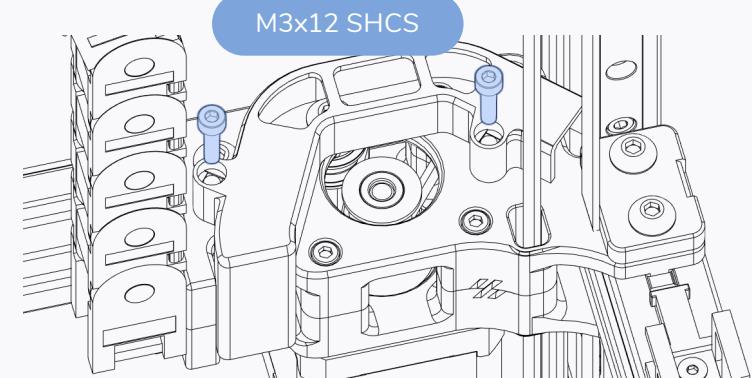
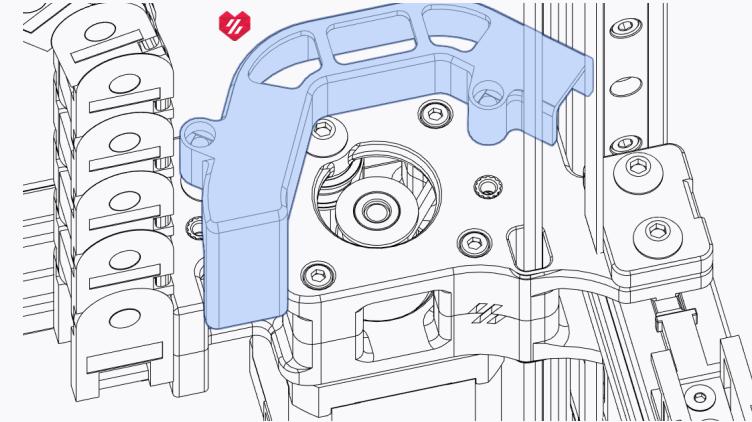
### Z CABLE CHAIN

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#### WIRE PATH

Guide the wire bundle behind the Z belt and over the A drive as shown above. Secure it with zip ties on the strain relief of the cable chains.



## CONTROLLER WIRING

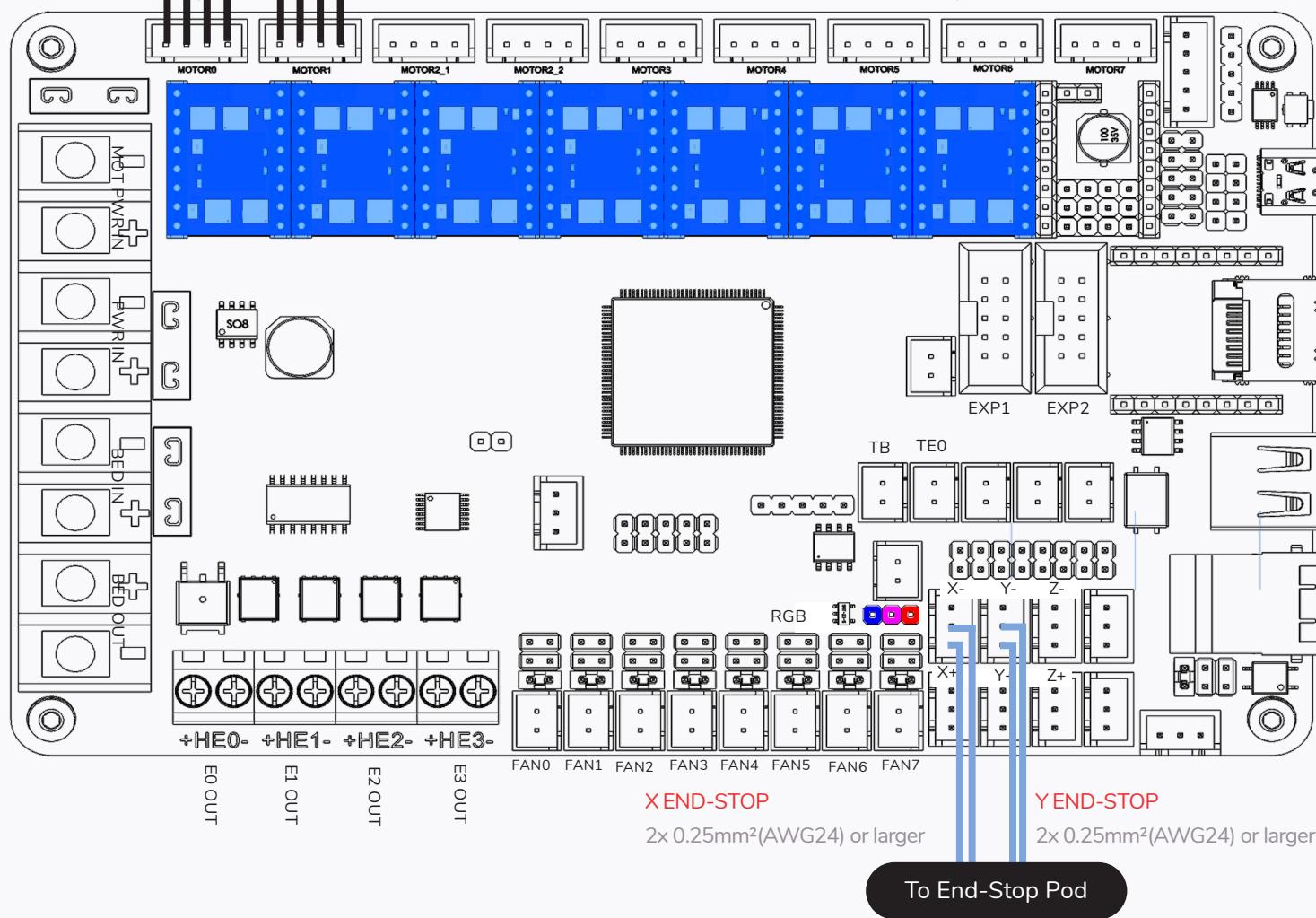
## B MOTOR

4x 0.25mm<sup>2</sup>(AWG24) or larger

B Motor

A Motor

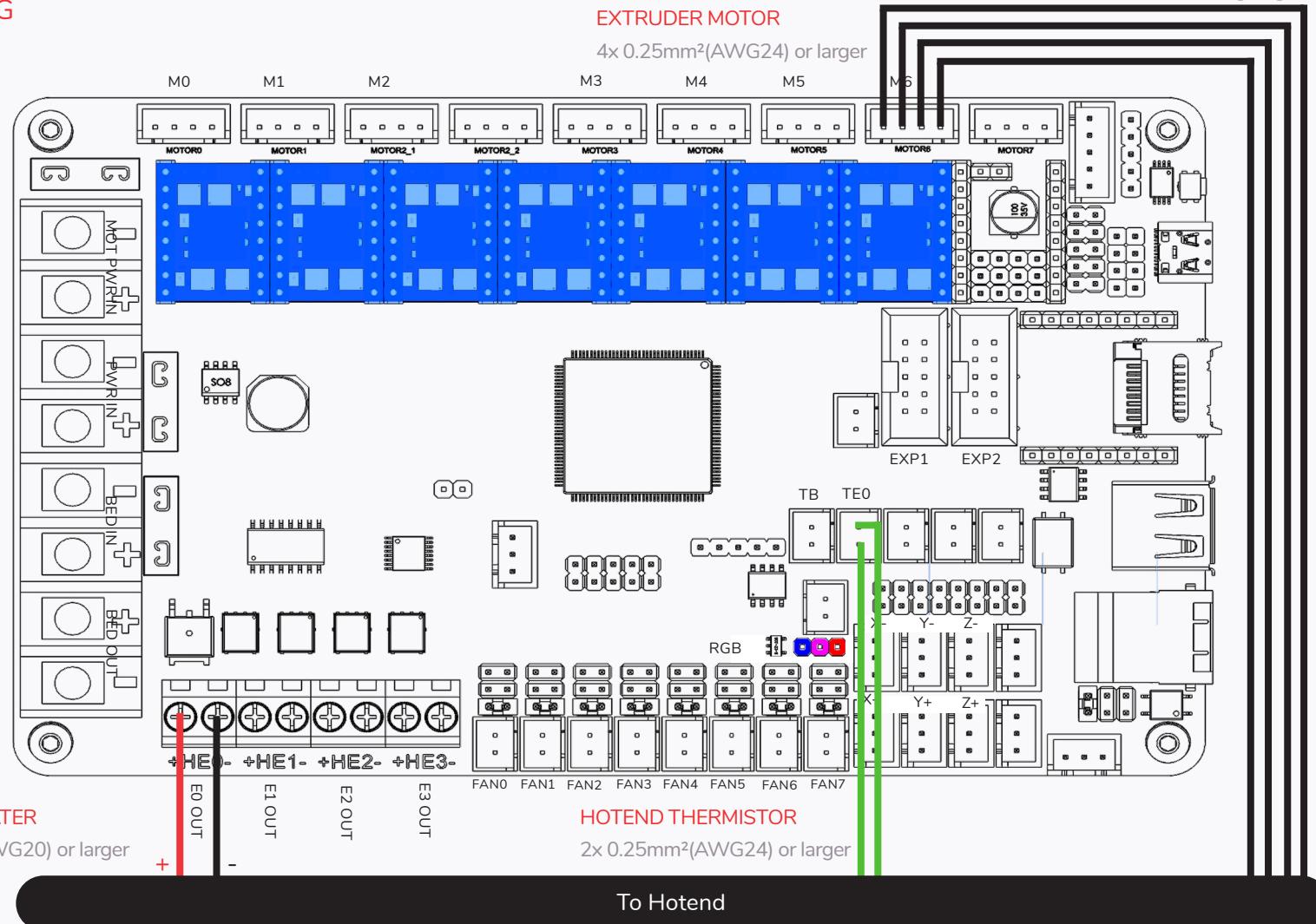
A MOTOR

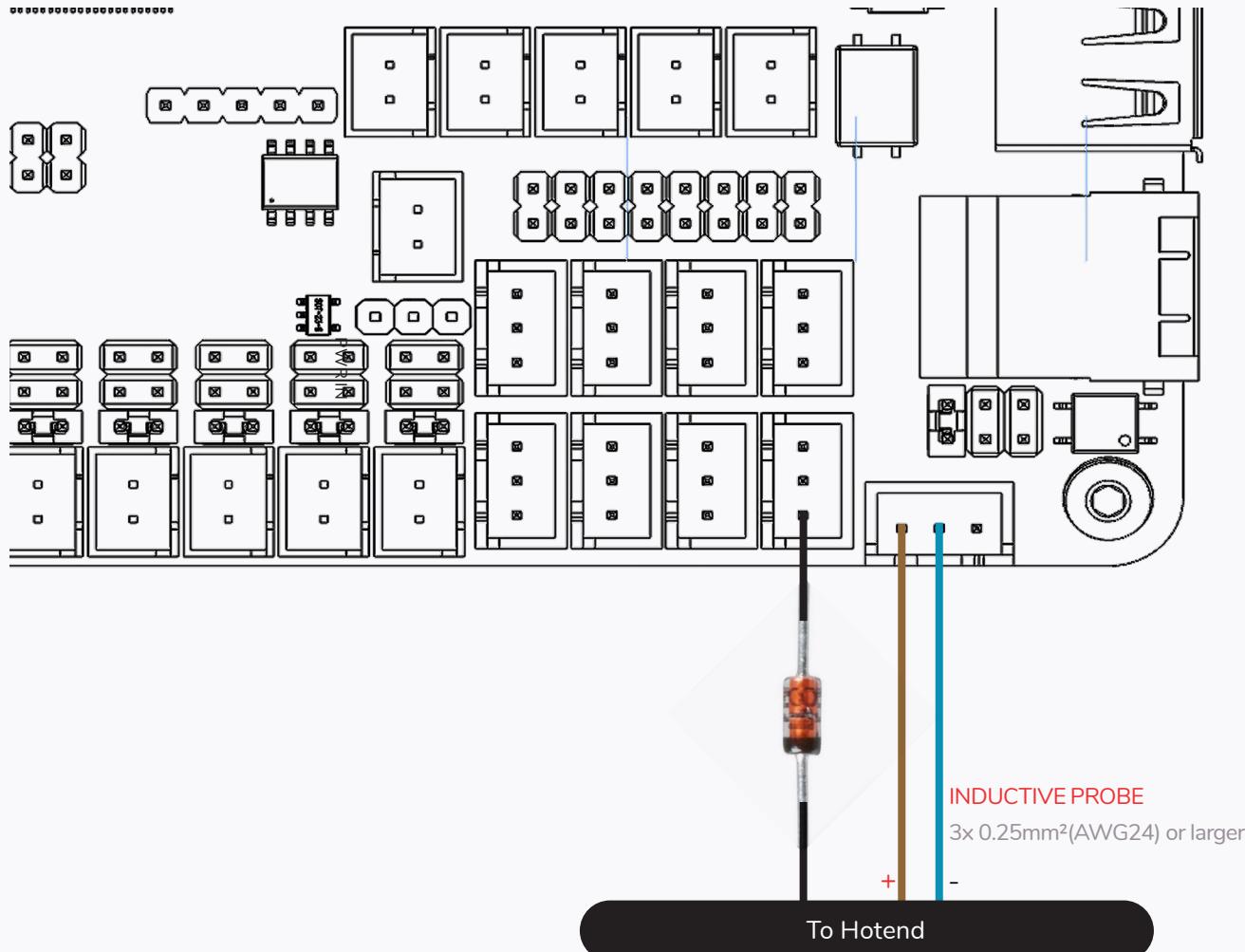
4x 0.25mm<sup>2</sup>(AWG24) or larger

You can skip these steps.

## CONTROLLER WIRING

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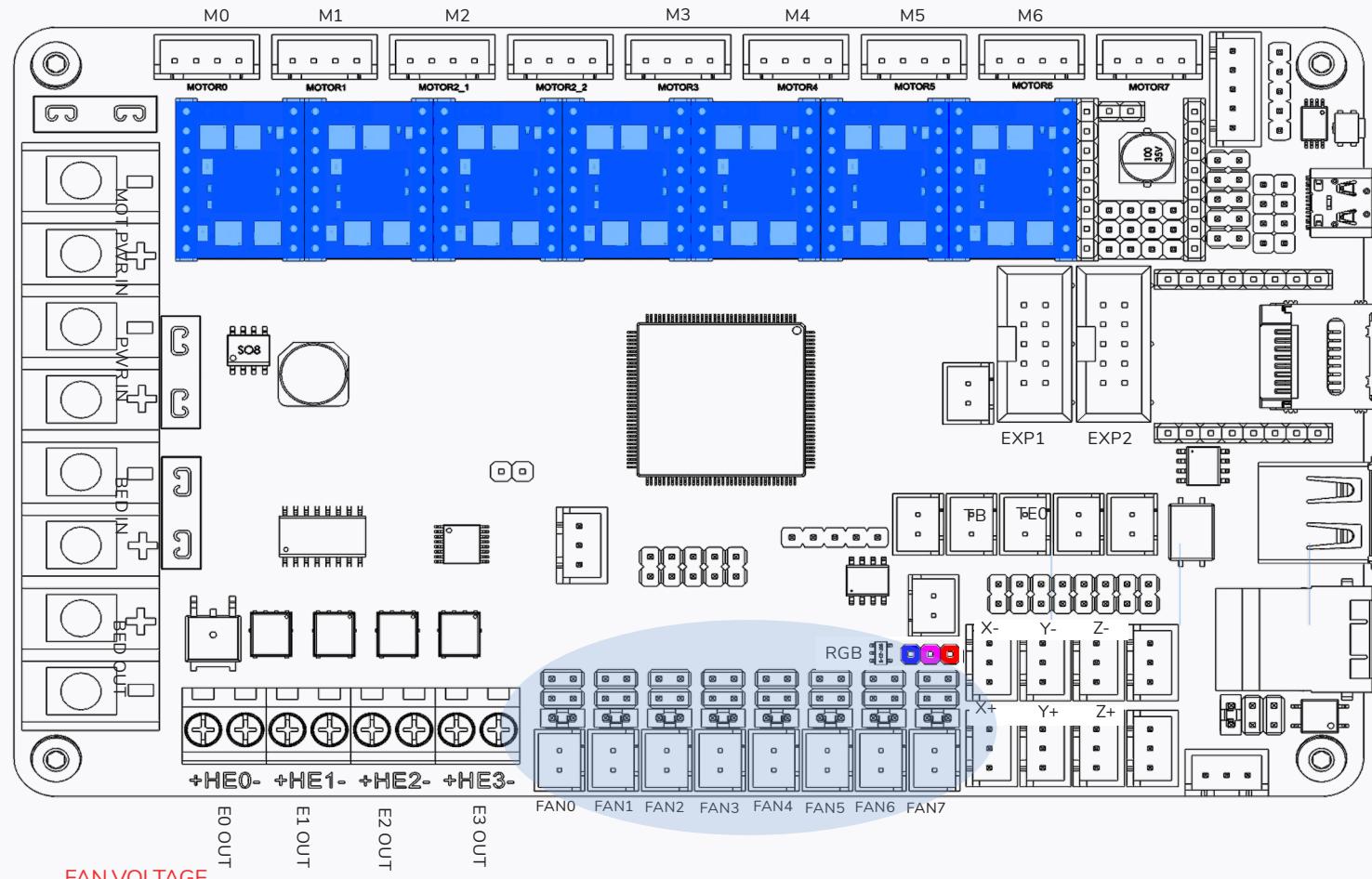


#### PROBE HOOKUP

Instead of using the dedicated probe input of the BTT Octopus we recommend wiring the probe's signal line to an endstop input using a BAT85 diode as protection.

The black ring on the diode "points" toward the toolhead.

For technical details please refer to <https://voron.link/n9i7lss>.

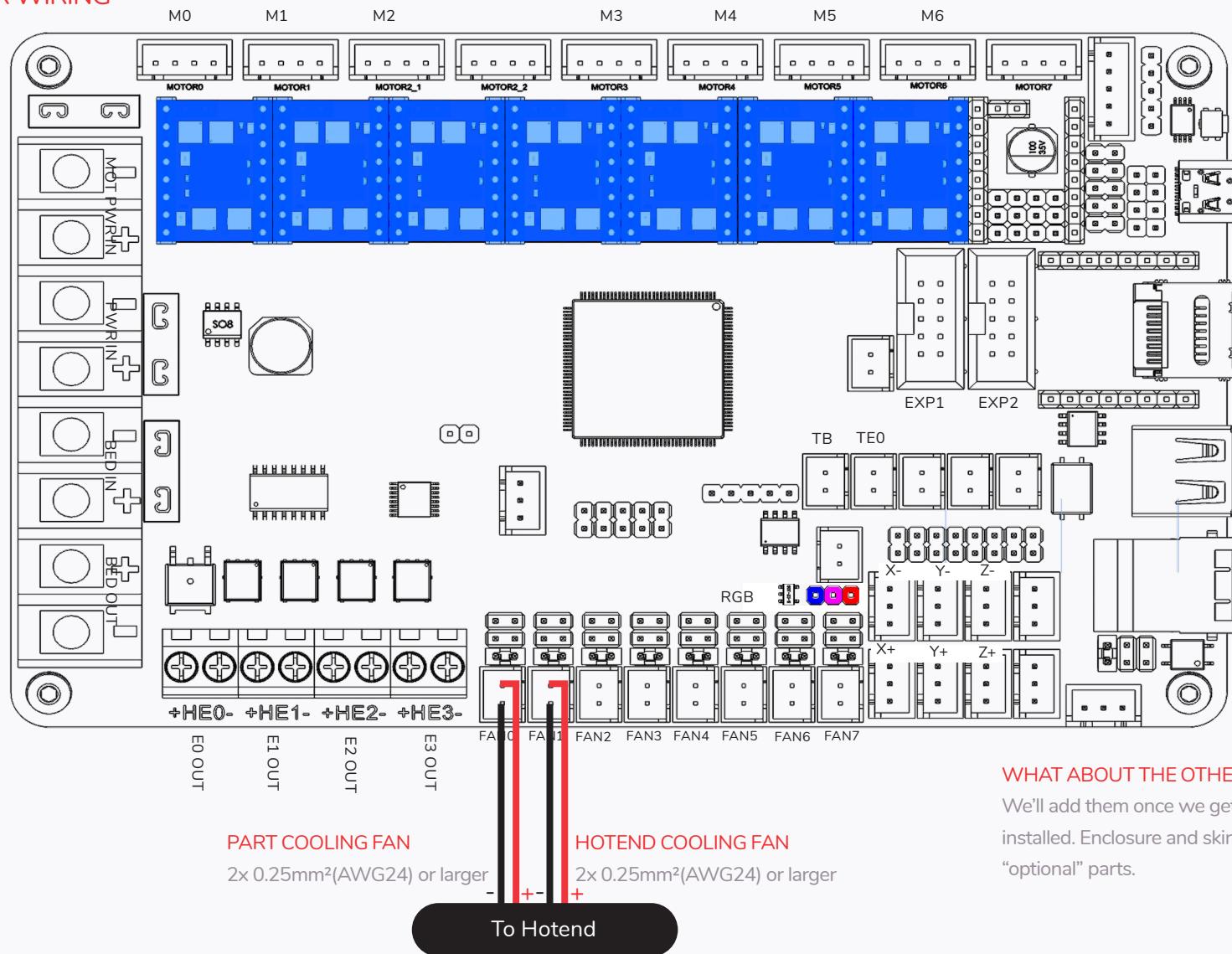


The fans recommended in the sourcing guide are 24V fans.

Please check your hotend cooling (40x40x10 axial), part cooling (40x40x20 blower) and exhaust/electronics (60x60x20 axial) fans for their voltage rating and jumper the voltage selection accordingly. Refer to the [Bigtreetech Octopus V1.1 manual](#) for possible settings.

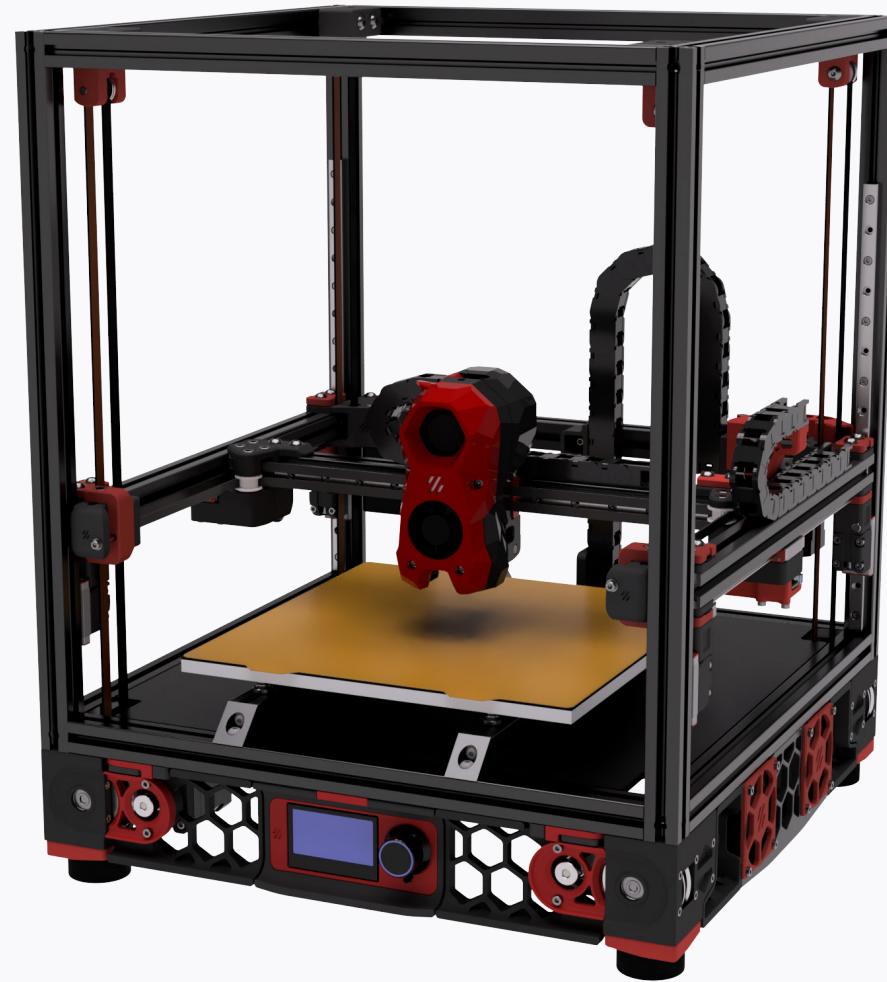
## CONTROLLER WIRING

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SKIRTS

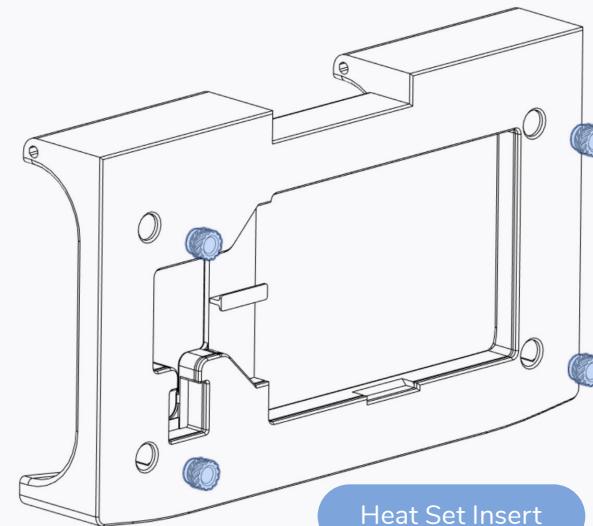
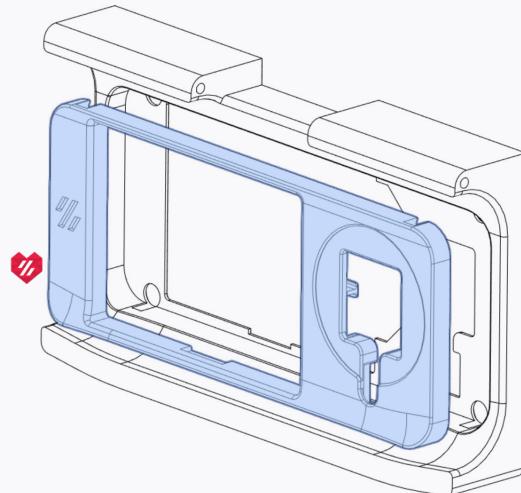
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**Skip; you don't need these parts because you use the touchscreen.**

## PREPARATION

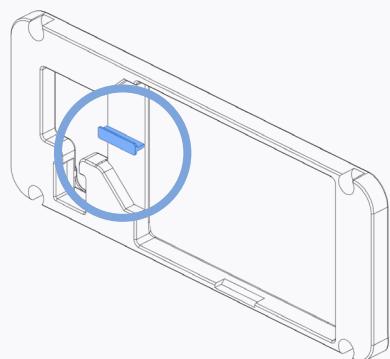
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Heat Set Insert

### FRONT COVER

The front cover is held in place by the heat set inserts. Hold the front face firmly in place while inserting the heat set inserts.

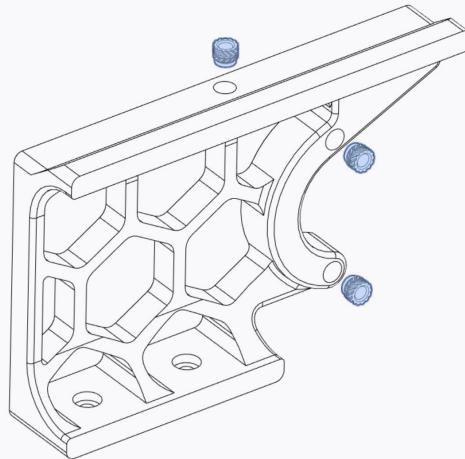
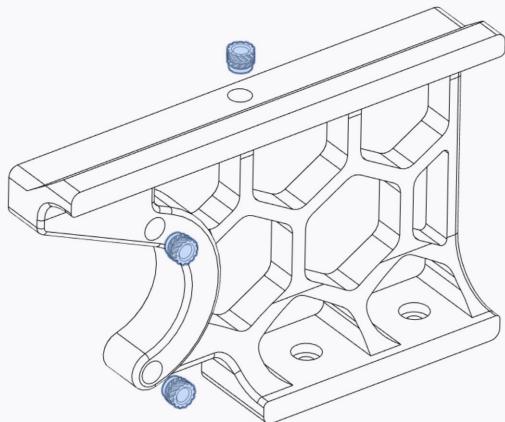


### BUILT-IN SUPPORT

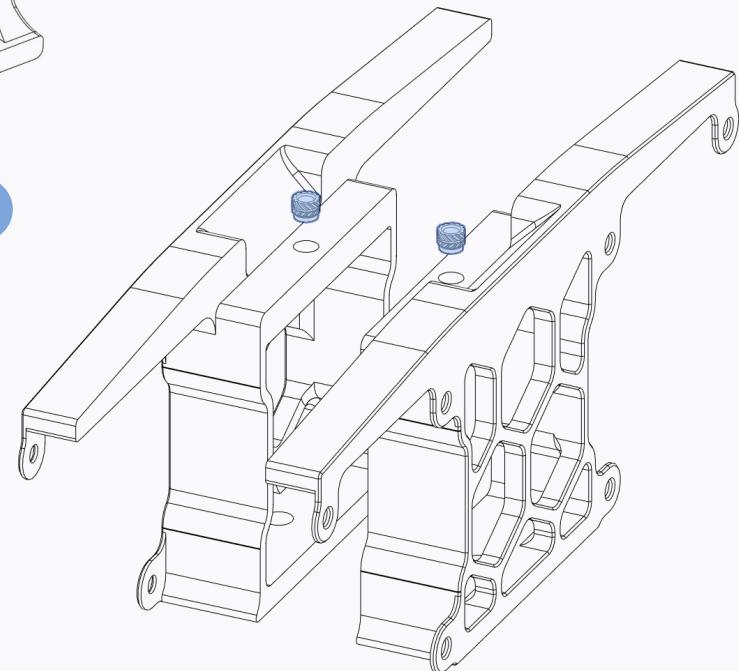
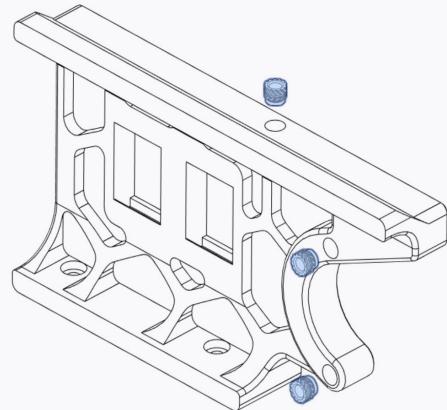
Remove the highlighted section. It's a built-in support for printability.

## PREPARATION

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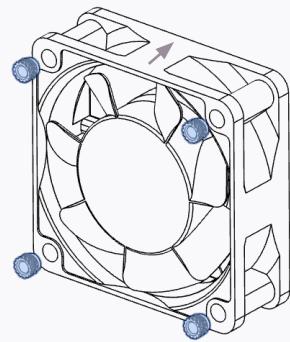


Heat Set Insert

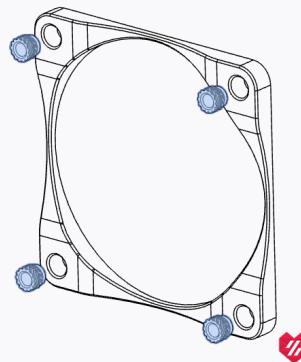


## PREPARATION

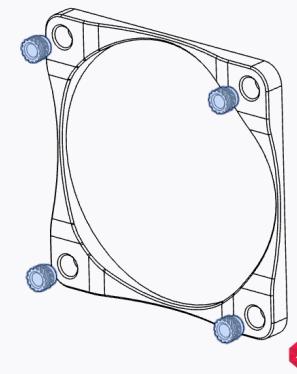
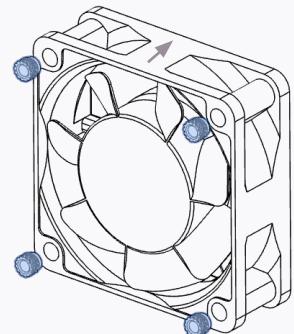
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60x20 Fan



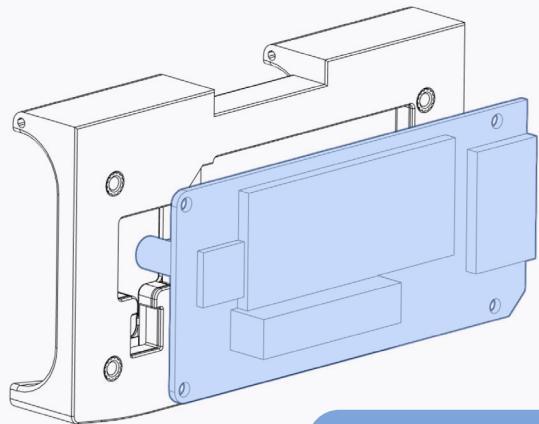
Heat Set Insert



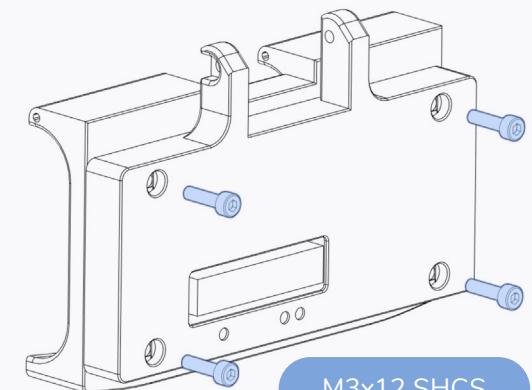
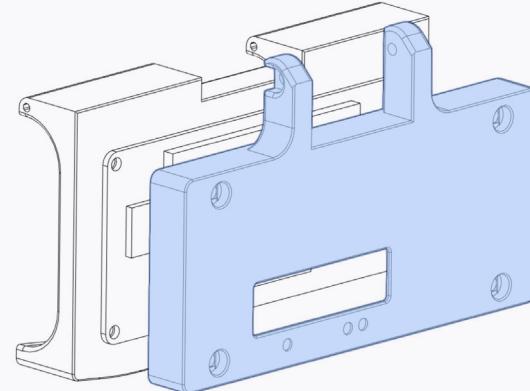
**Skip; you don't need these parts because you use the touchscreen.**

LCD

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Mini 12864 Screen

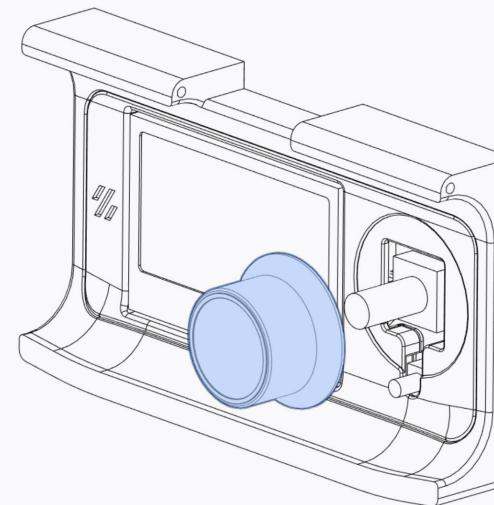
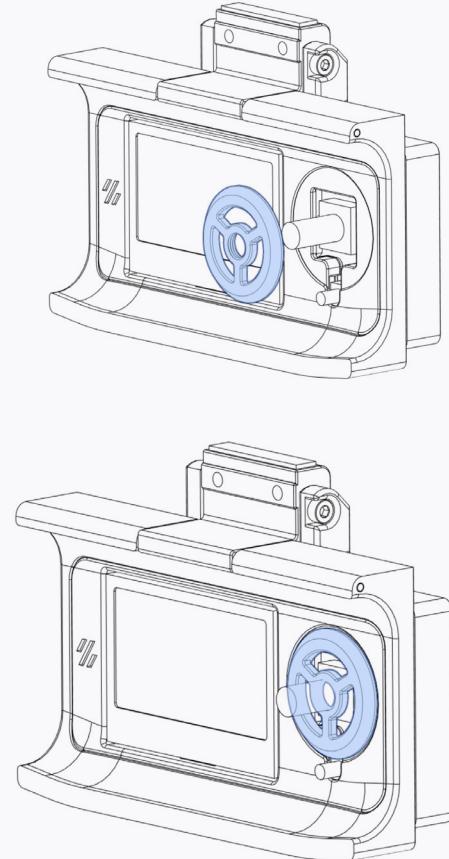


M3x12 SHCS

**Skip; you don't need these parts because you use the touchscreen.**

LCD

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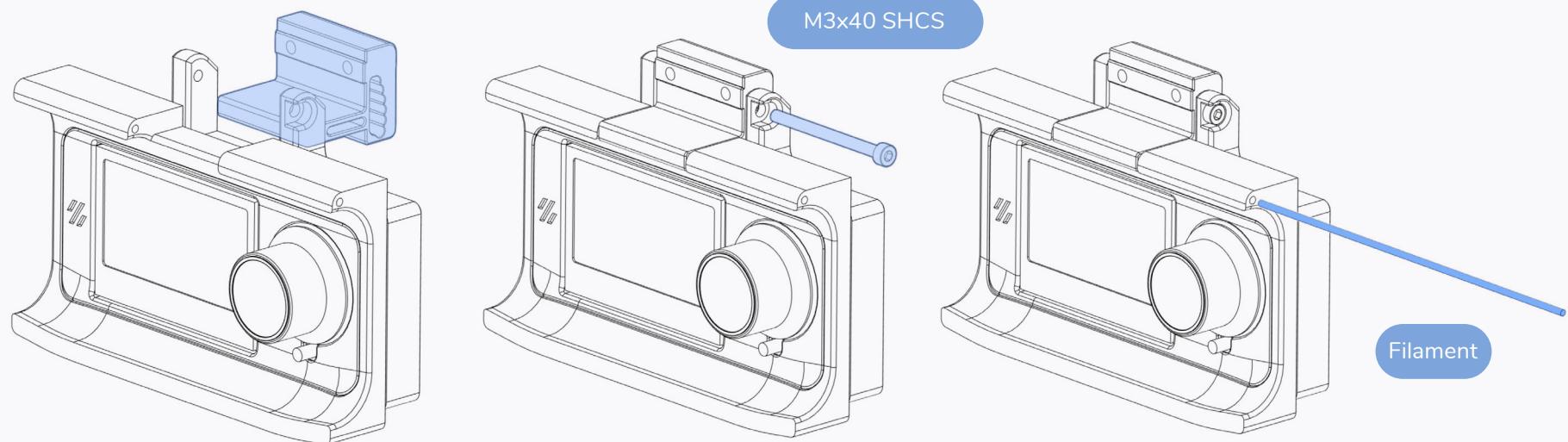
**OPTION: LIGHT BLOCKER**

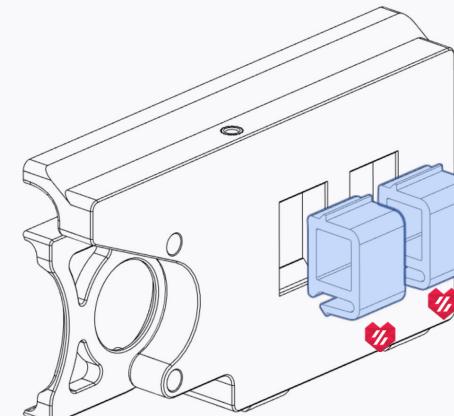
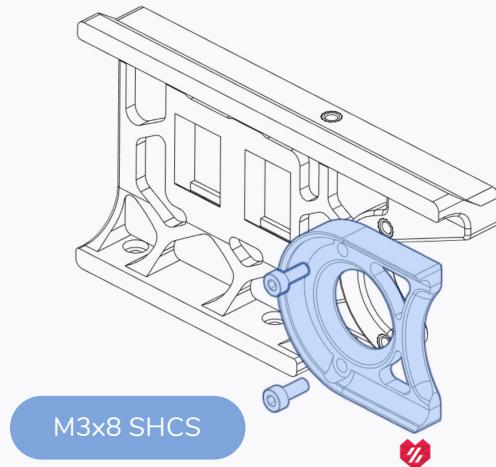
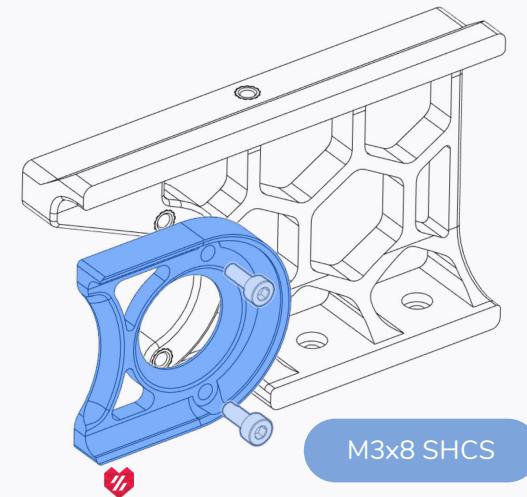
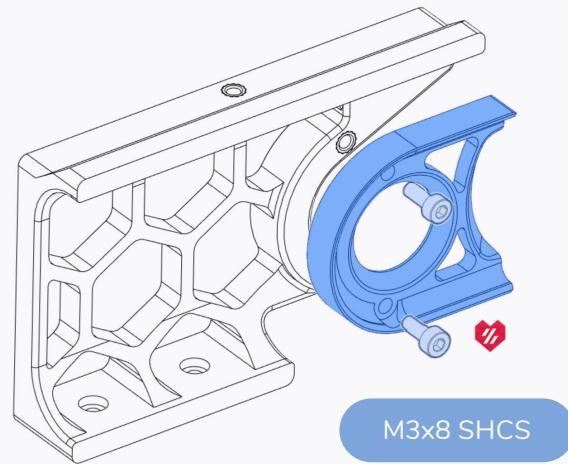
Some LCDs come with a smaller encoder knob. This extra piece prevents excess light bleed. Threads onto the encoder before the knob is pressed on.

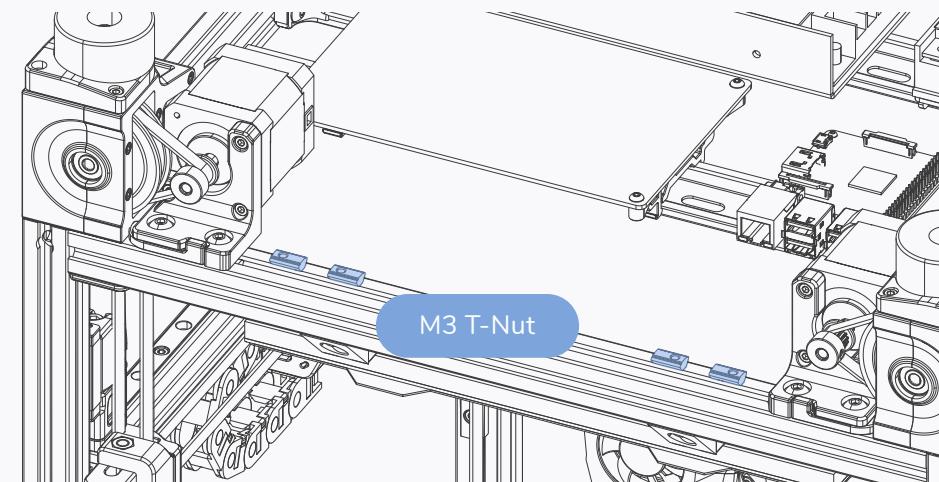
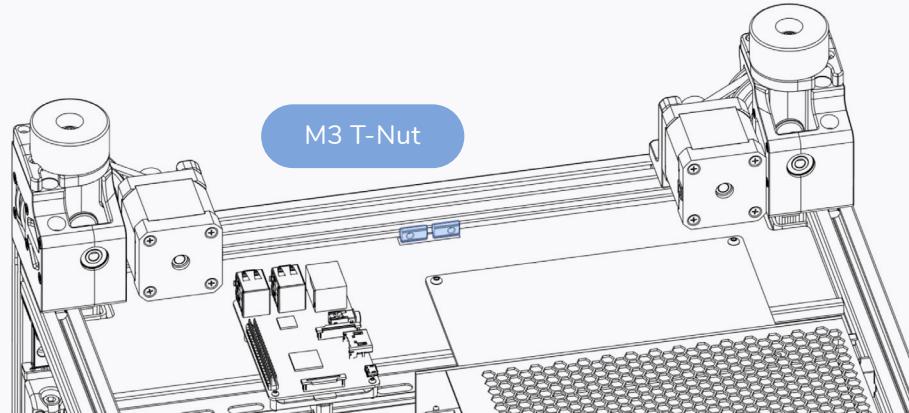
**Skip; you don't need these parts because you use the touchscreen.**

LCD

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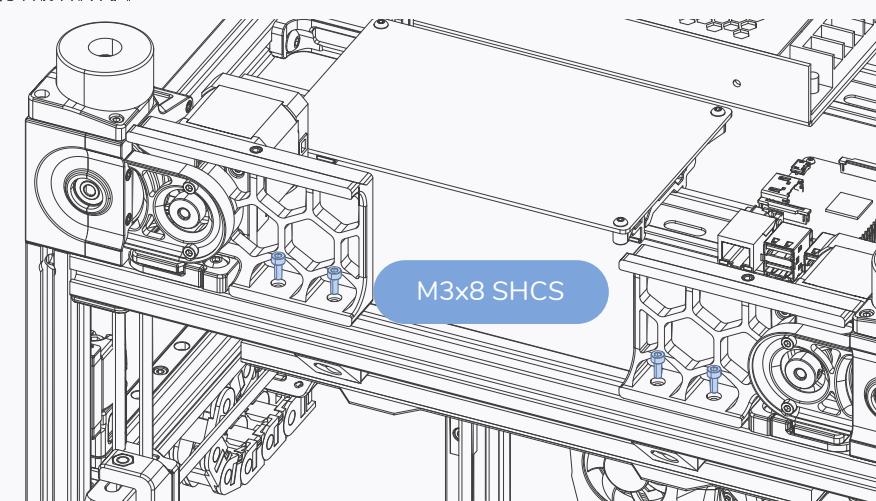
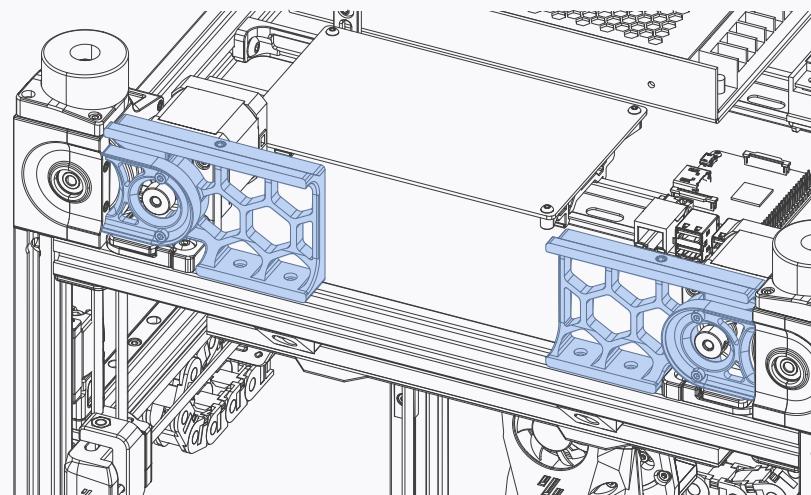






SKIRTS

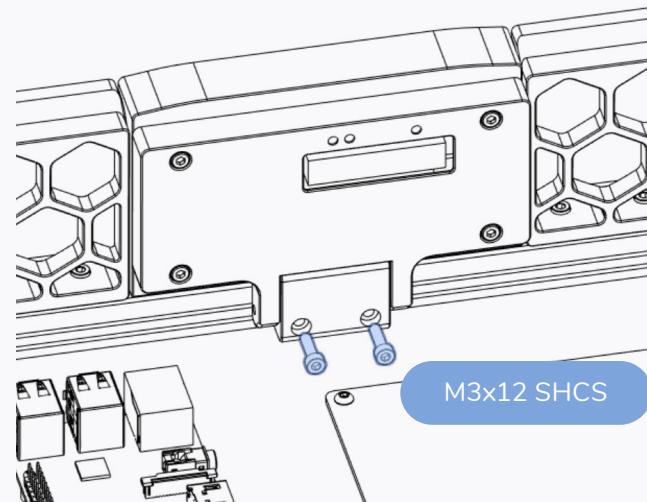
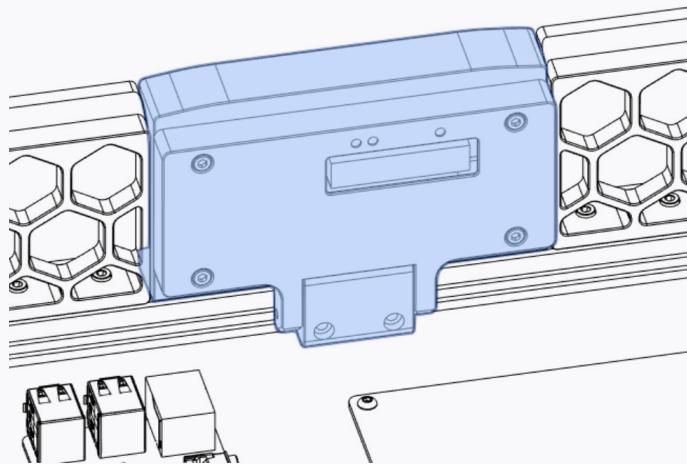
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**Skip; you don't need these parts because you use the touchscreen.**

SKIRTS

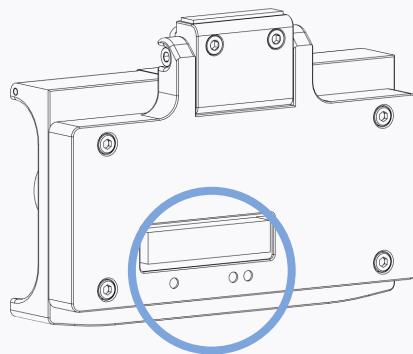
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**Skip; you don't need these parts because you use the touchscreen.**

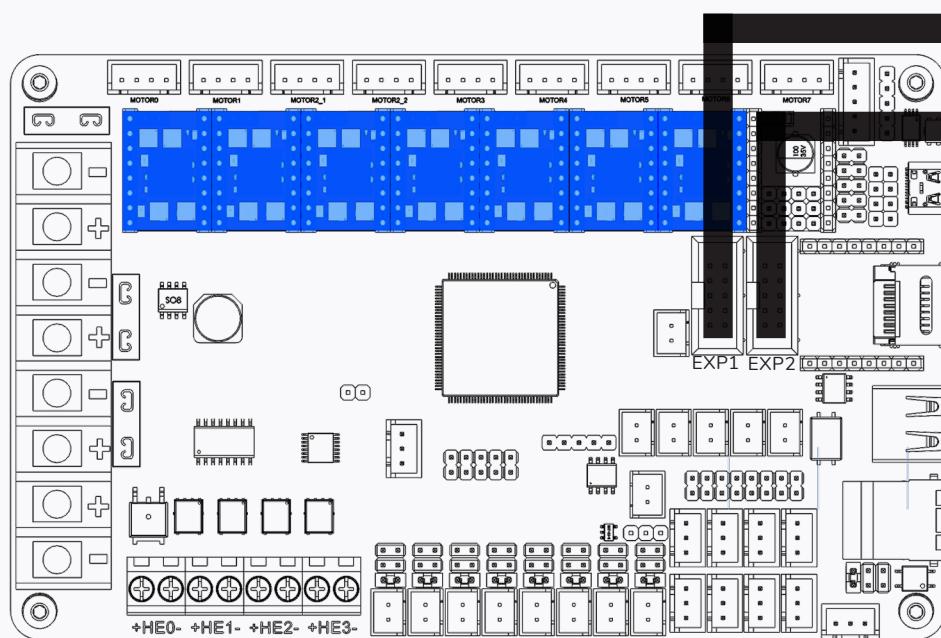
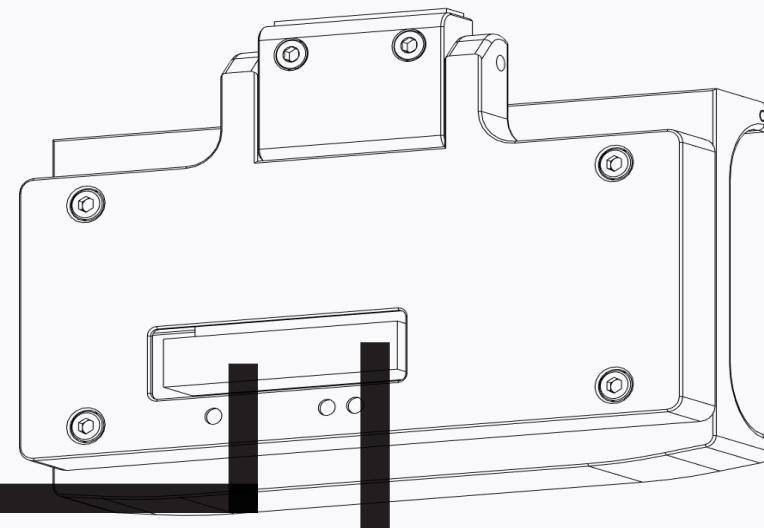
## LCD HOOKUP

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### WHICH IS WHICH?

The socket with 1 dot below it is EXP1 and the socket with 2 dots below it is EXP2.

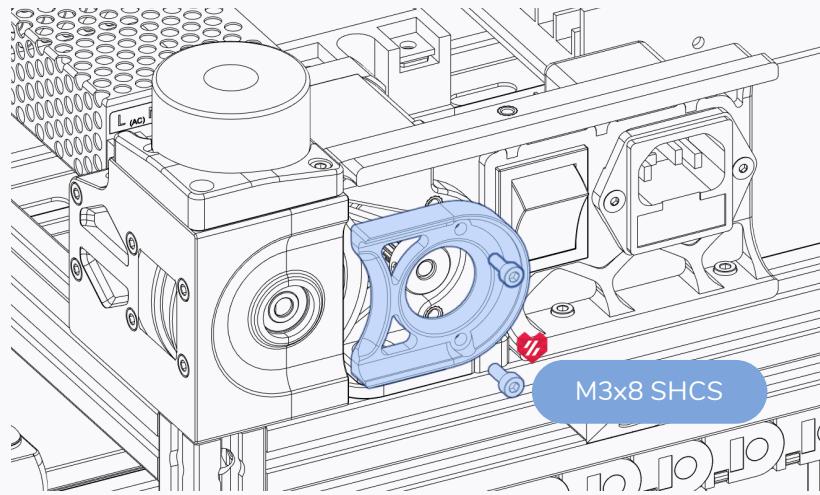


LCD

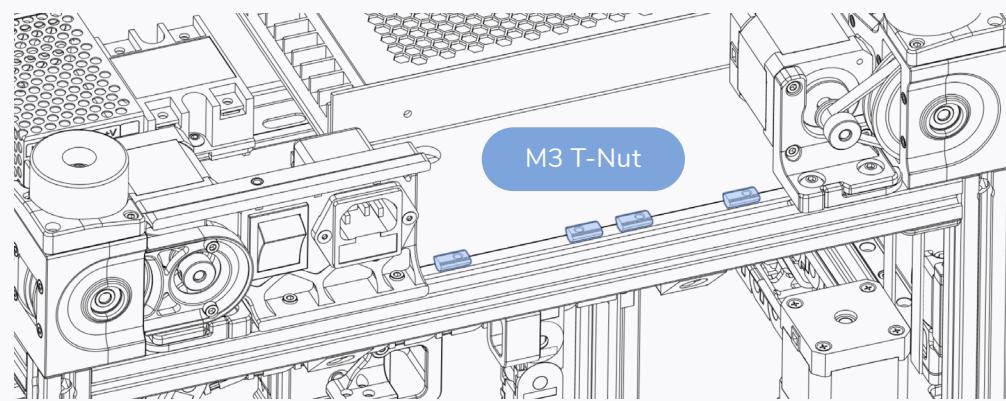
2x Flat Ribbon Cable

SKIRTS

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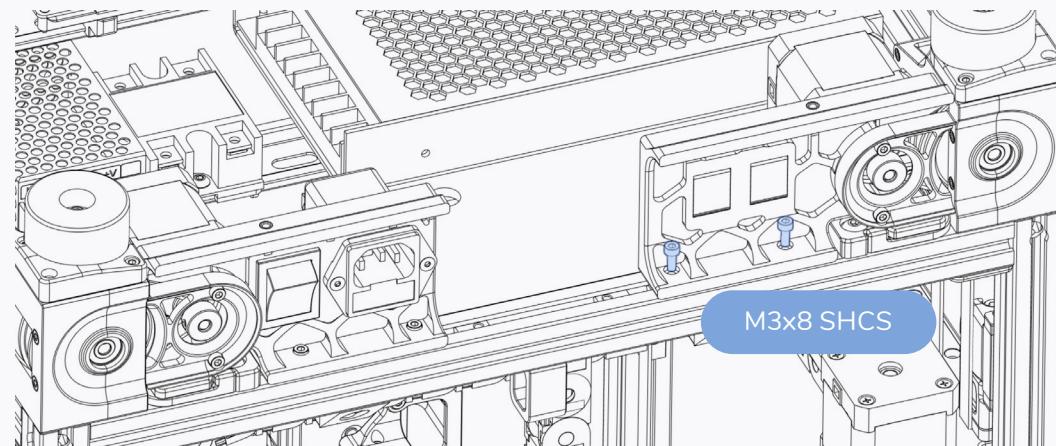
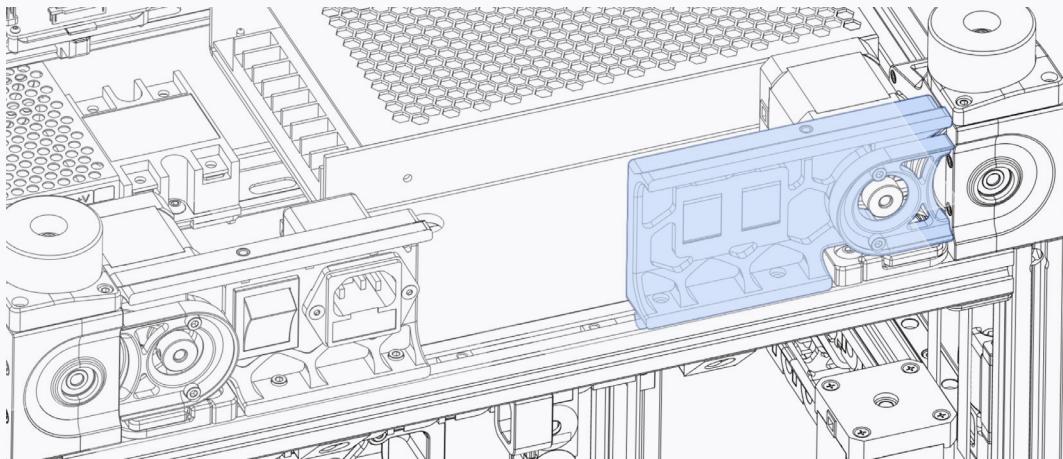
M3x8 SHCS



M3 T-Nut

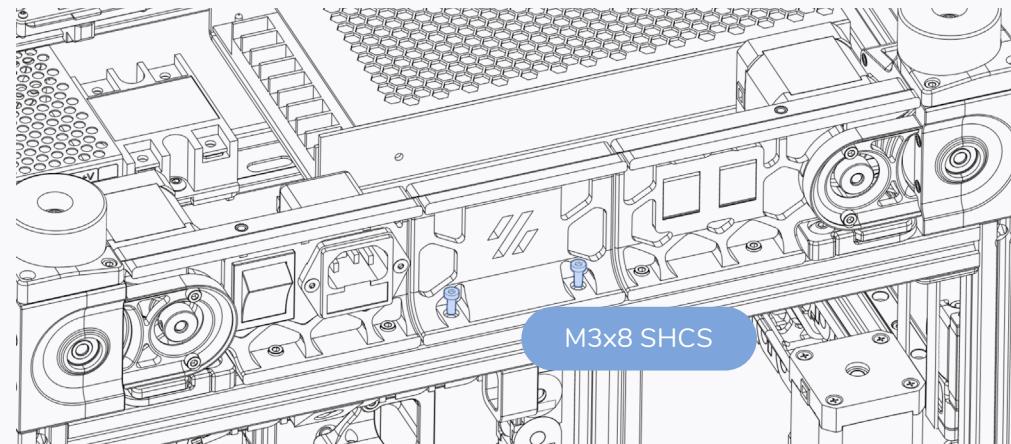
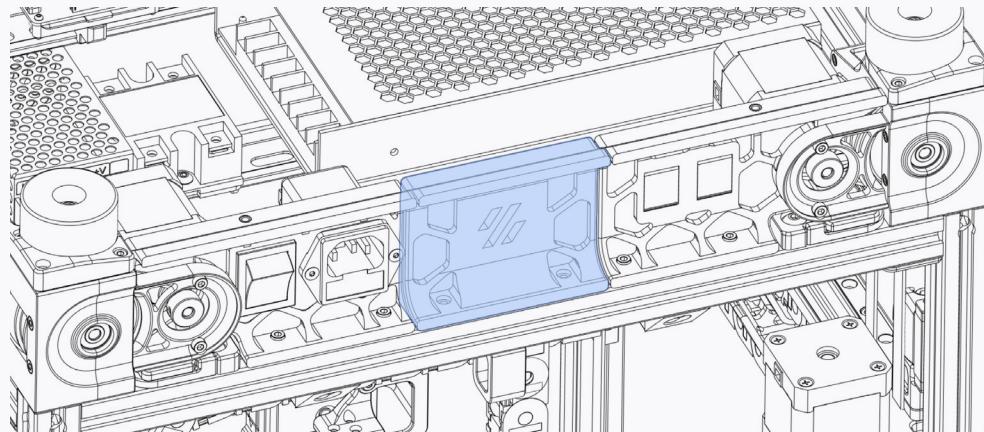
SKIRTS

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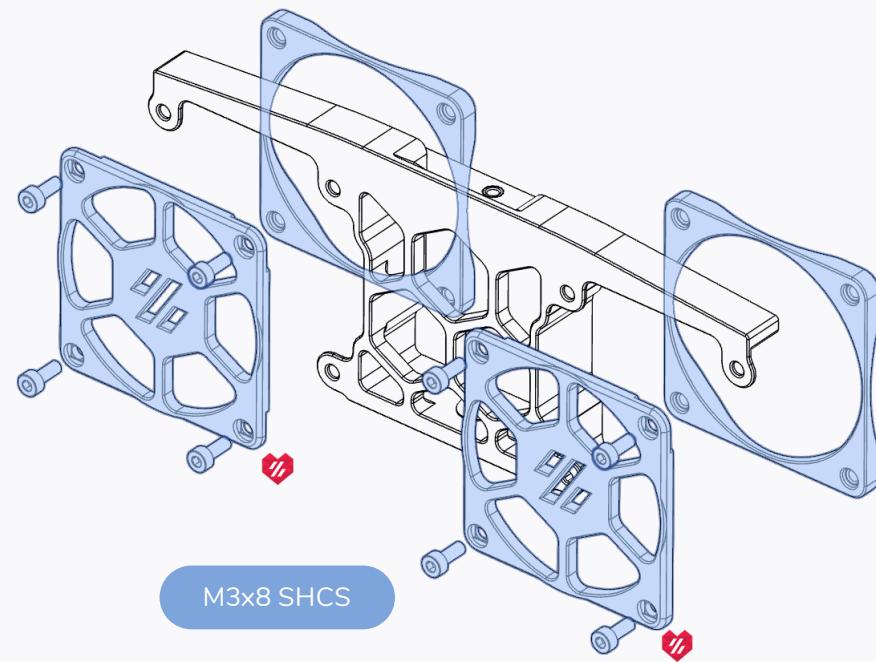
SKIRTS

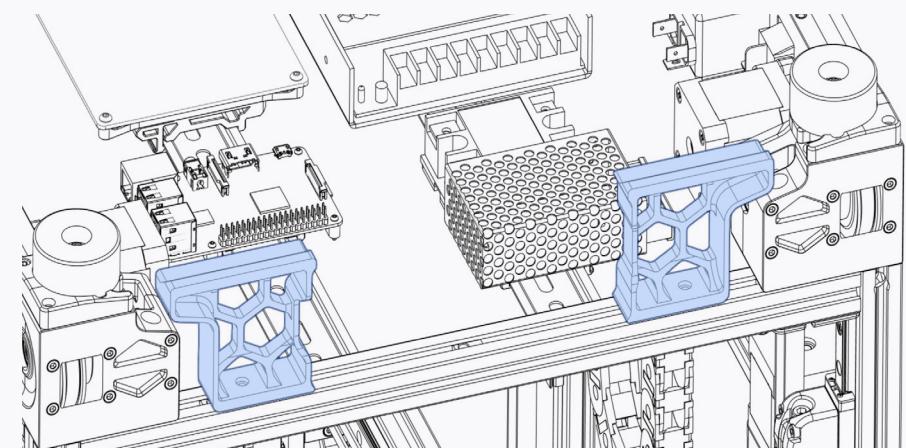
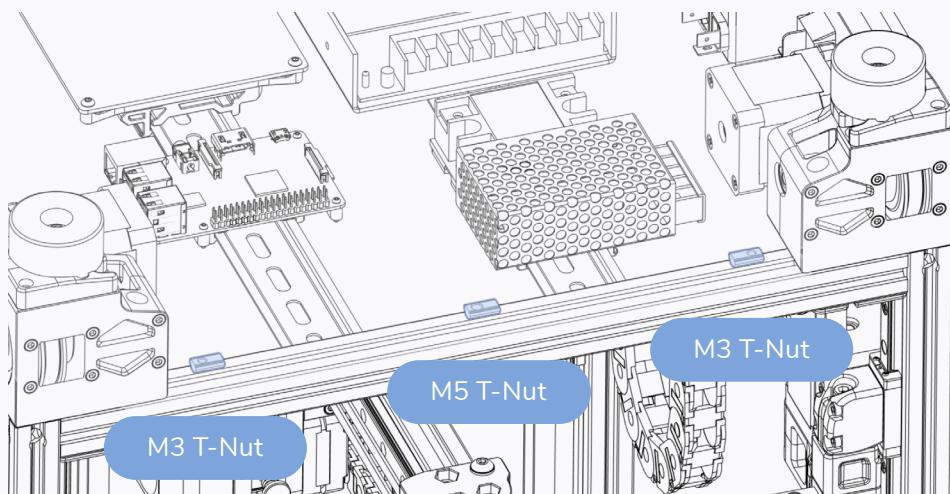
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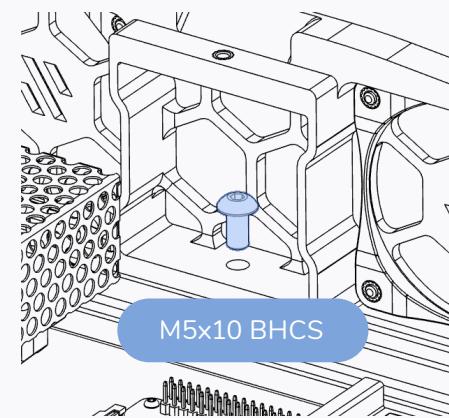
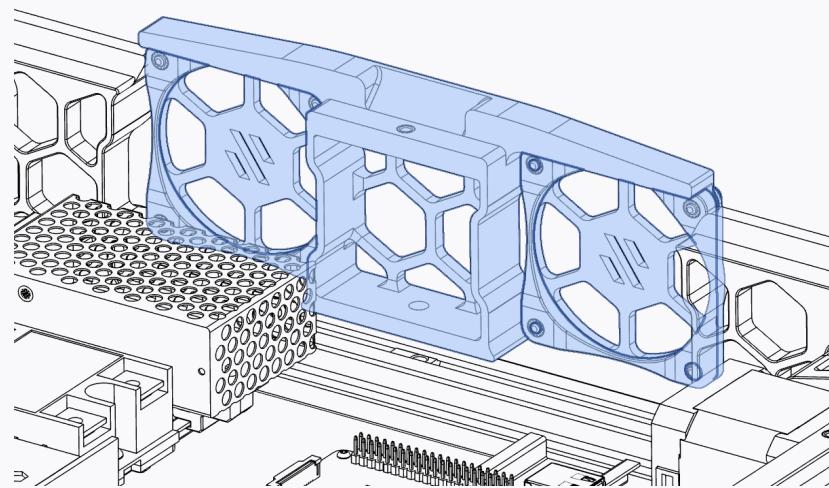
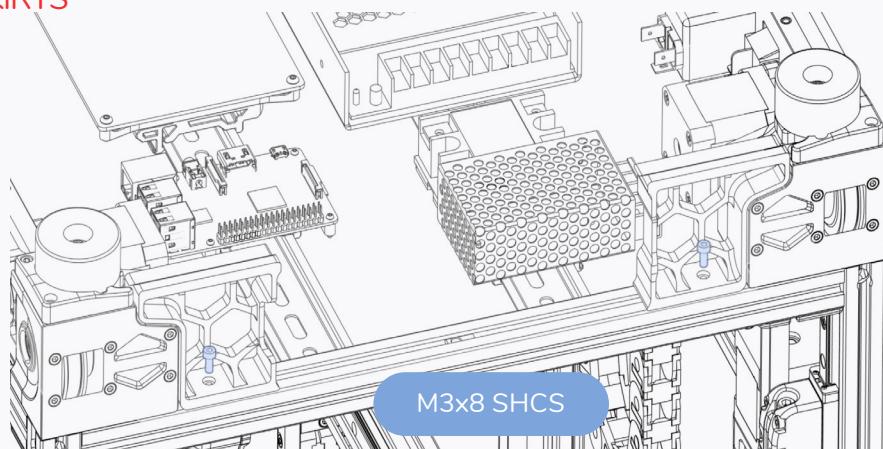
SKIRTS

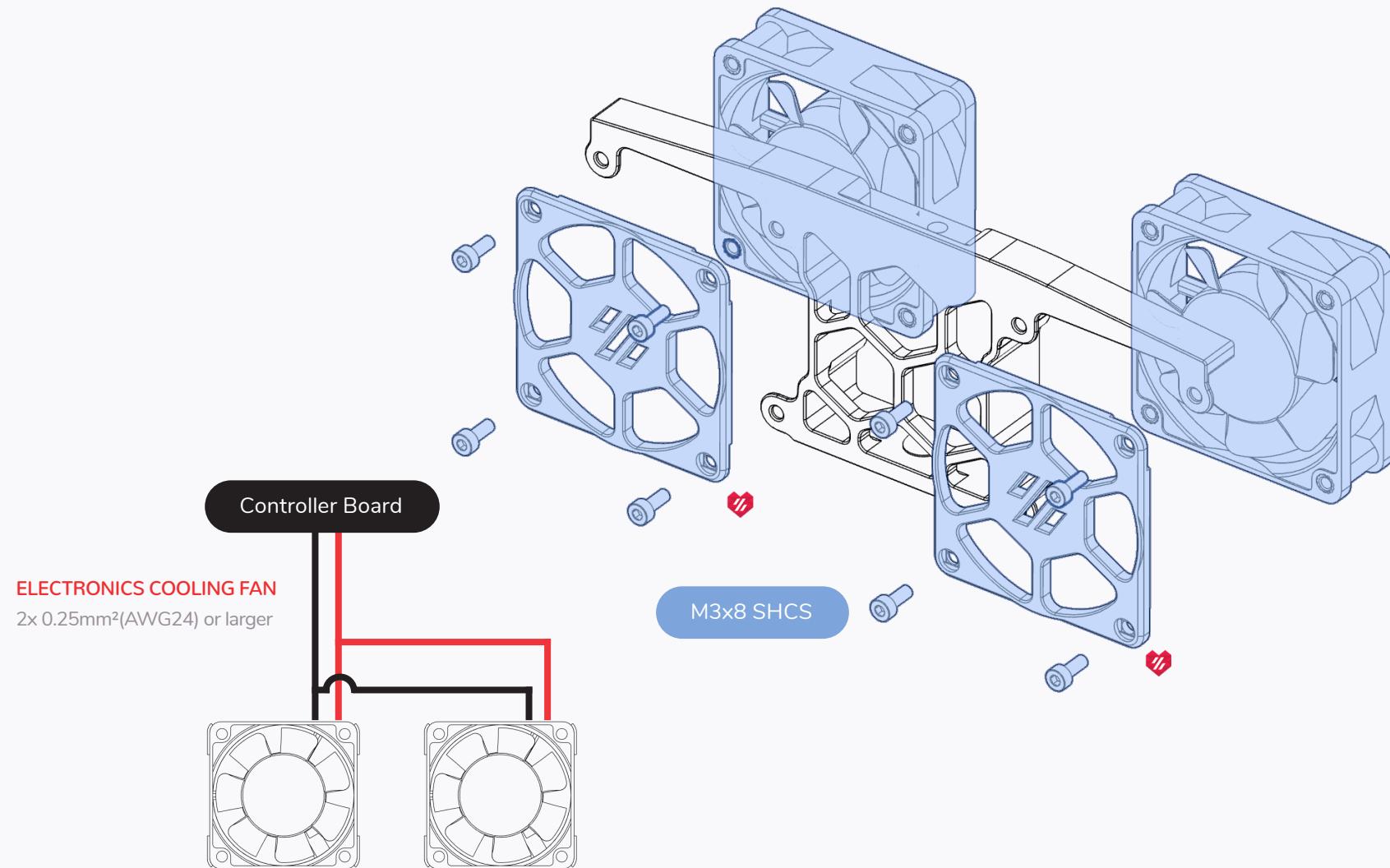
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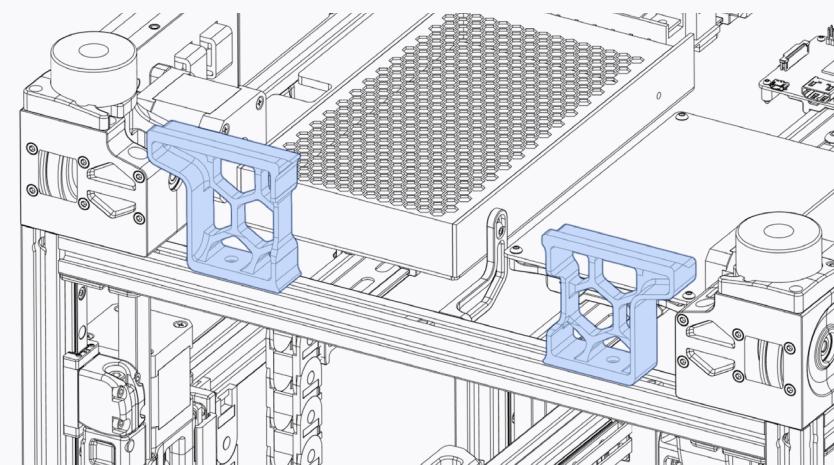
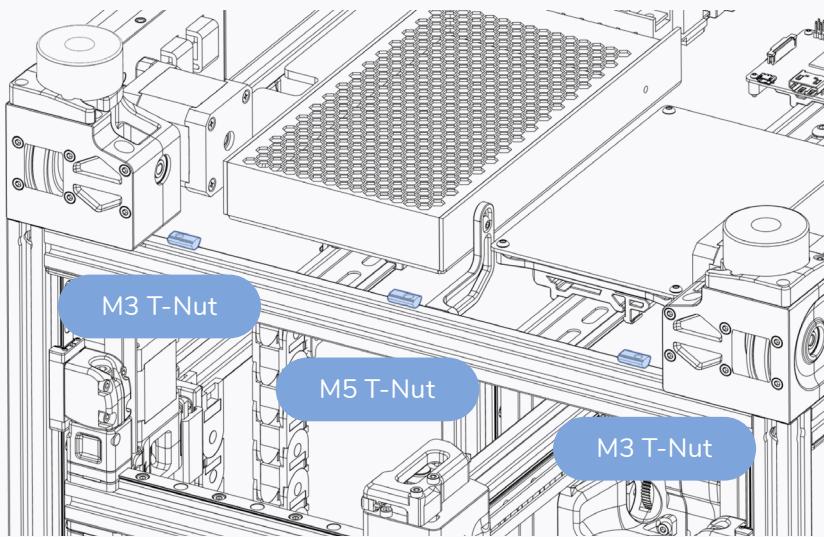
SKIRTS





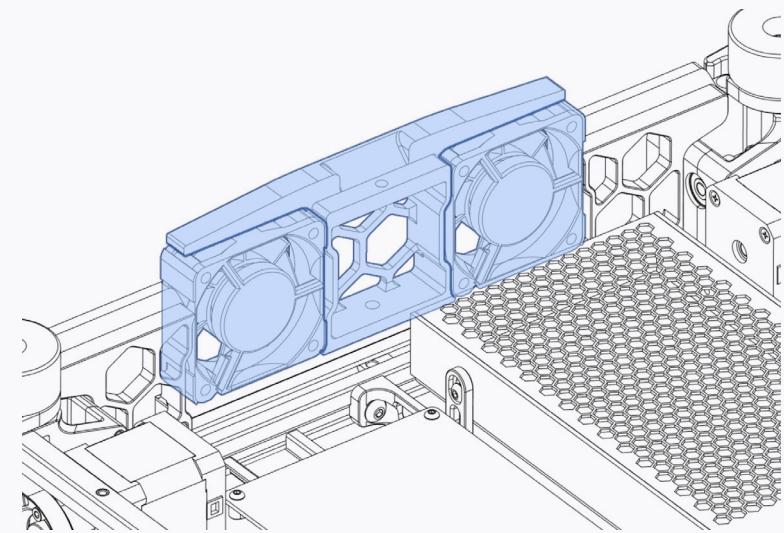
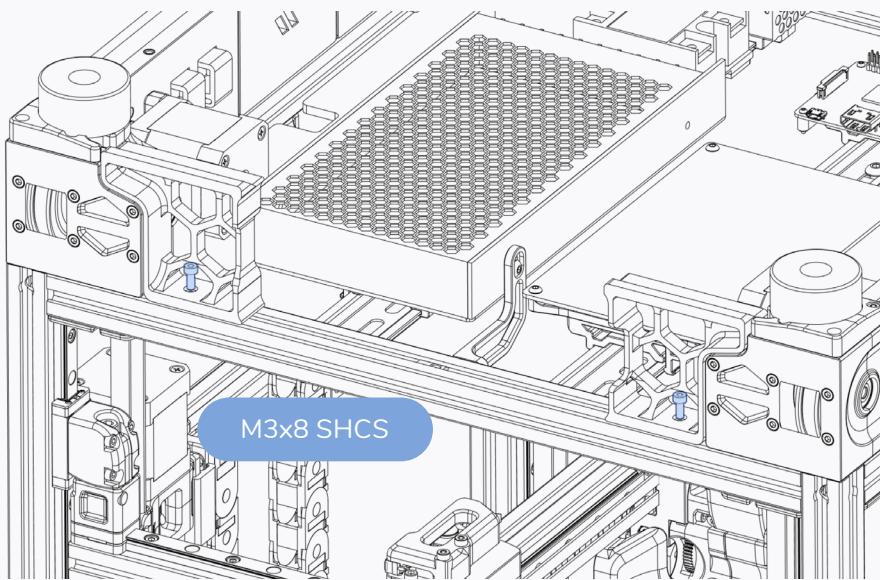
## SKIRTS

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SKIRTS

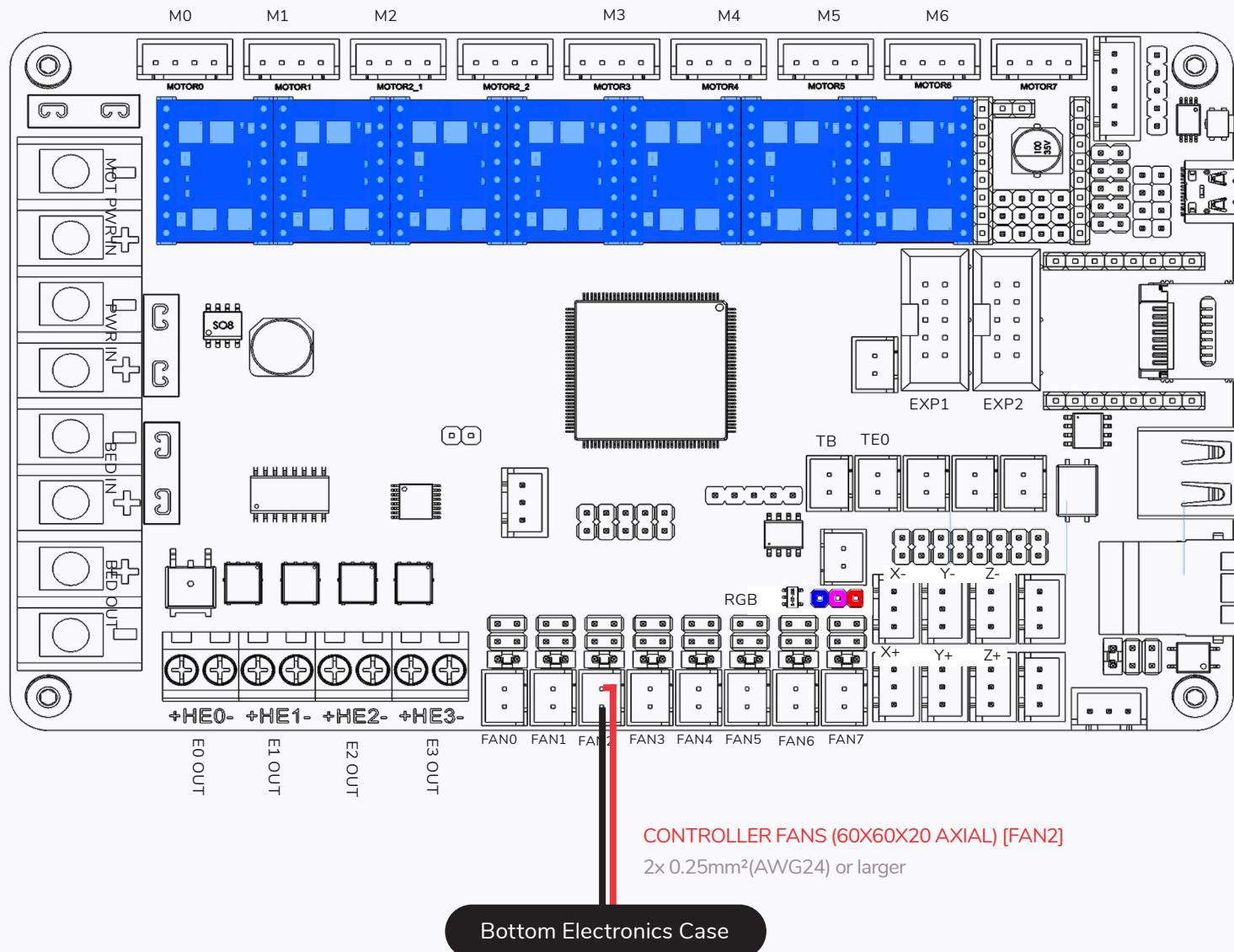
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Use the v2.4 M8P wiring diagram to wire the electronics fans.

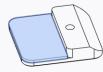
SKIRTS

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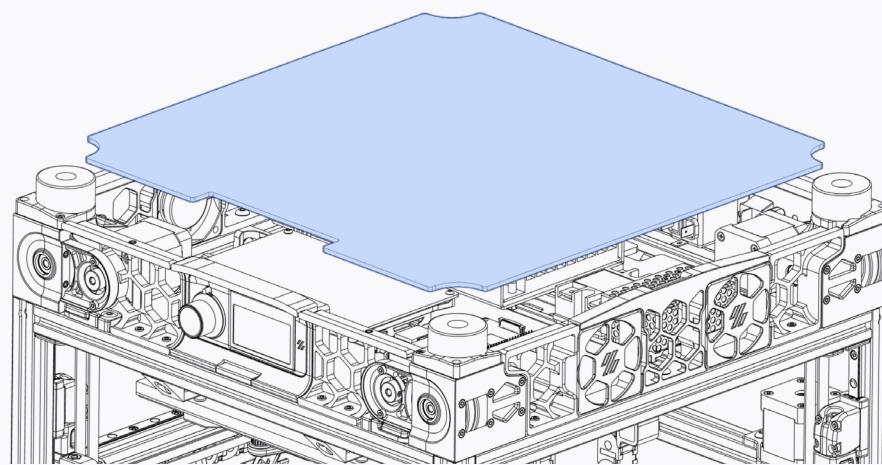
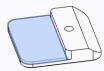
## BOTTOM PANEL

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### APPLY VHB TAPE

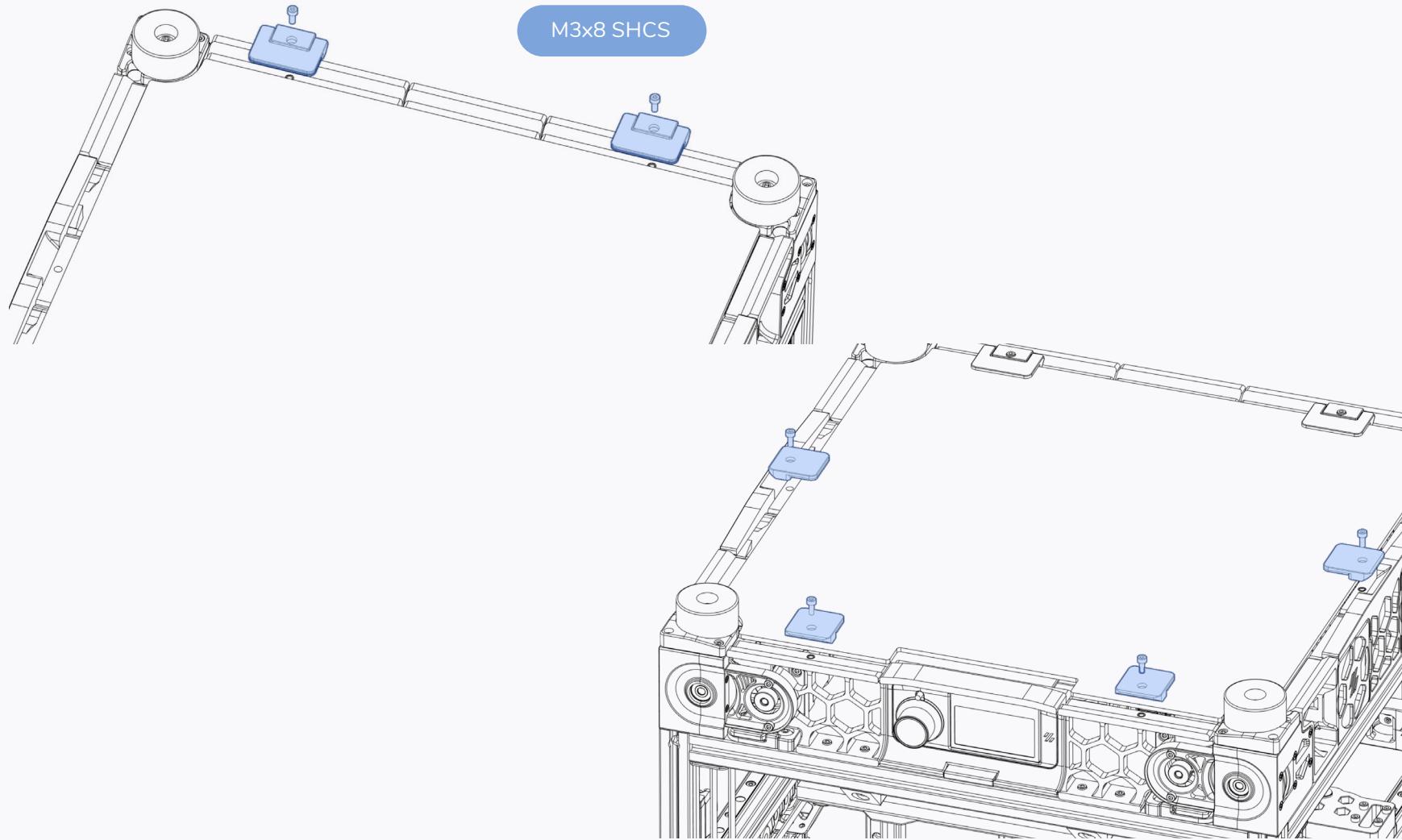
VHB Tape is a double sided adhesive tape.

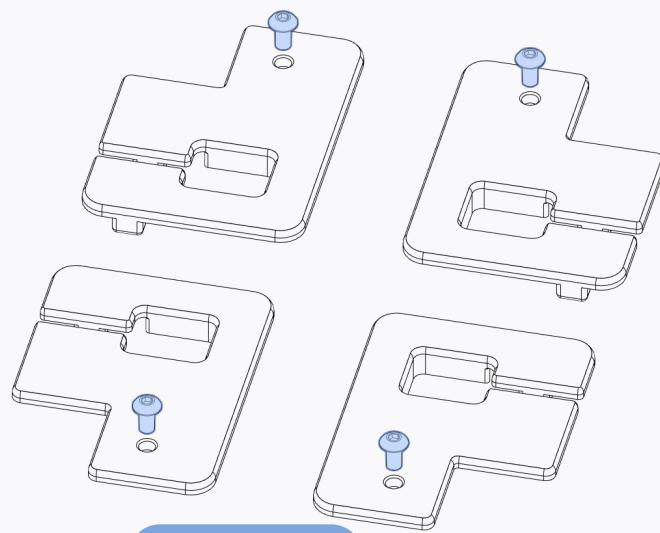


**Don't close the electronics compartment yet, you will need to acces this while flashing the boards.**

BOTTOM PANEL

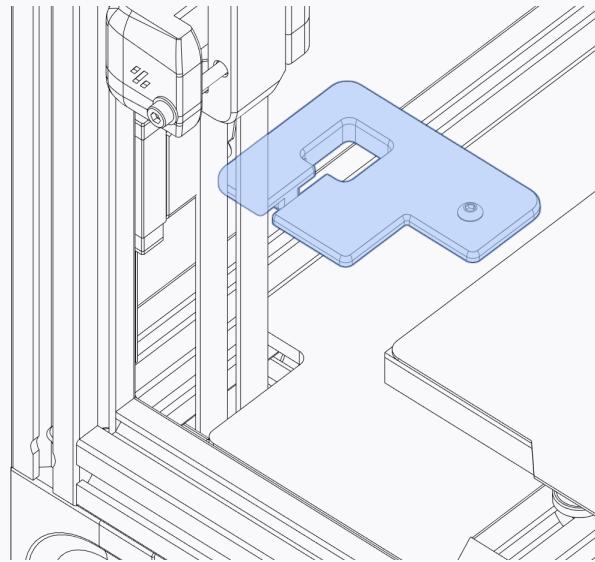
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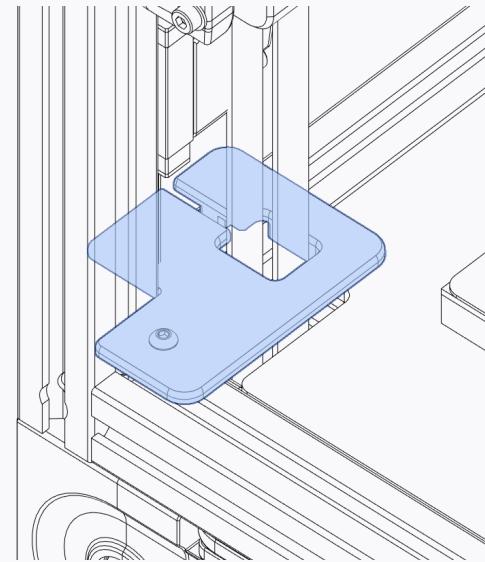
## Z BELT COVERS

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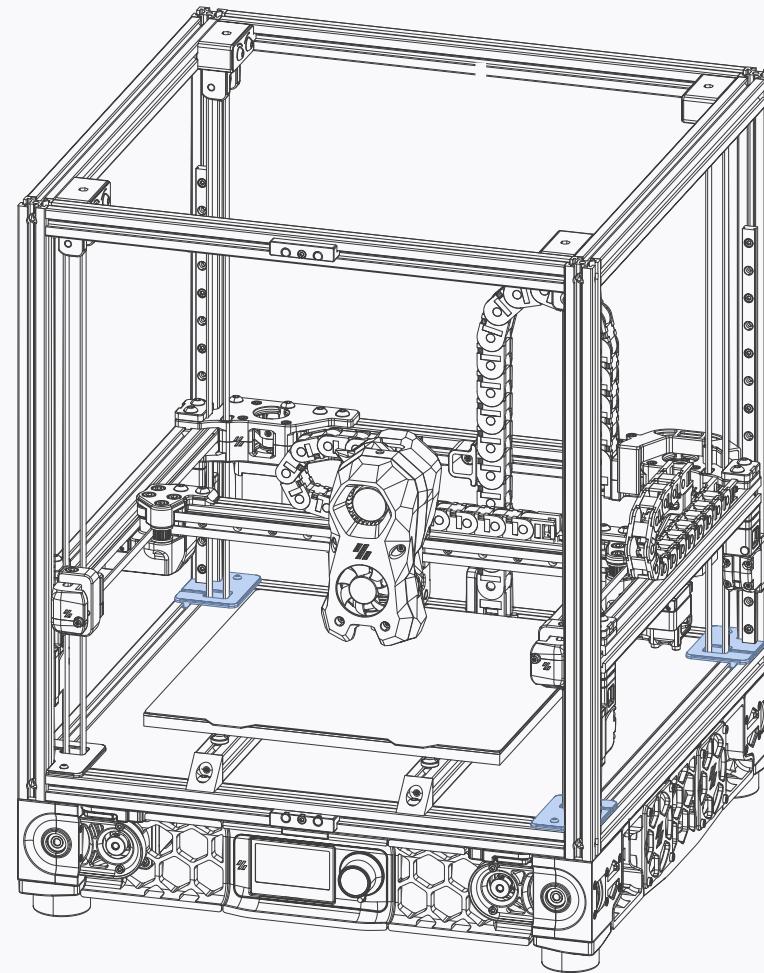
### PINCH BELT

Pinch the Z belt loop flat  
and slide the cover in place.



### TURN TO FASTEN

The hammerhead nut will rotate and  
lock into place when you fasten the  
screw. At least that's the theory.



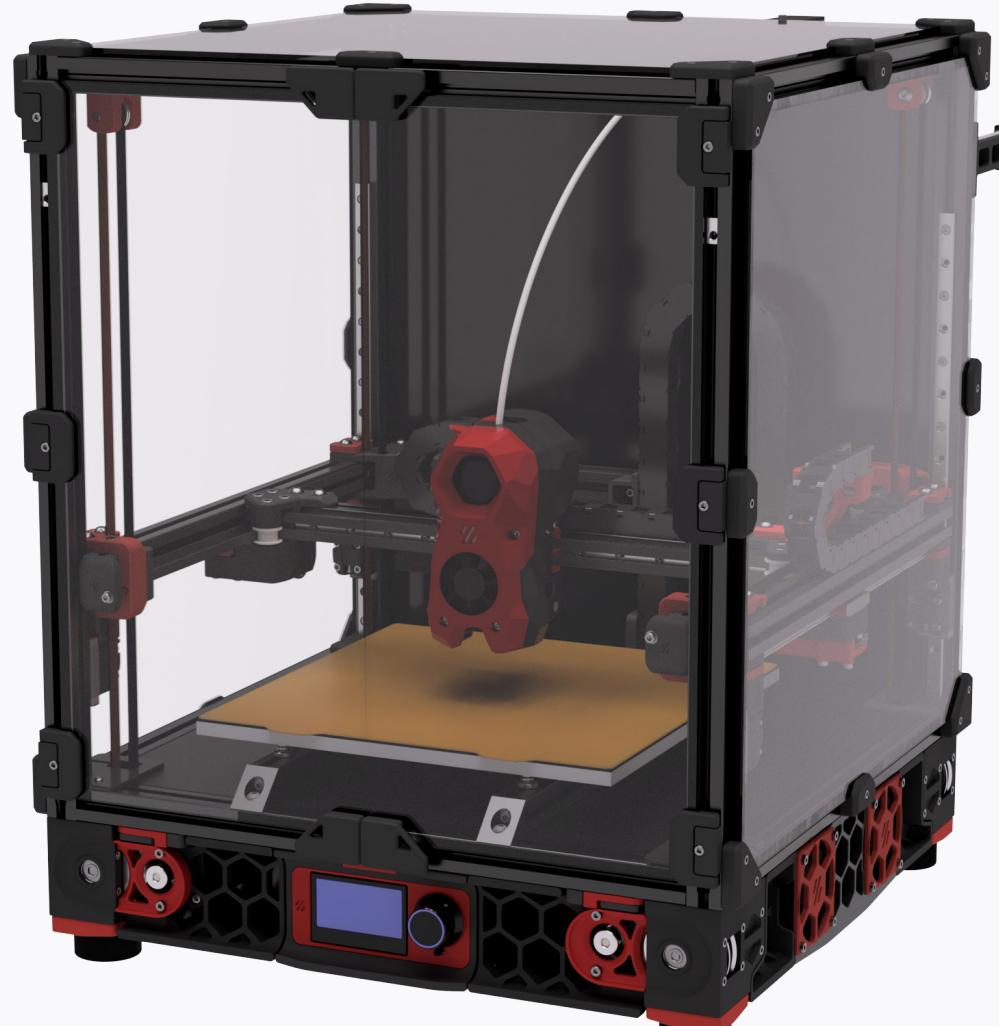
**REPEAT FOR REMAINING COVERS**

Repeat the assembly steps and install the remaining 3 covers.

Voron2.4 was released on May 13 2020. Between the releases of 2.4 and 2.4R2 over 2500 Voron2 printers have been build and serialized.

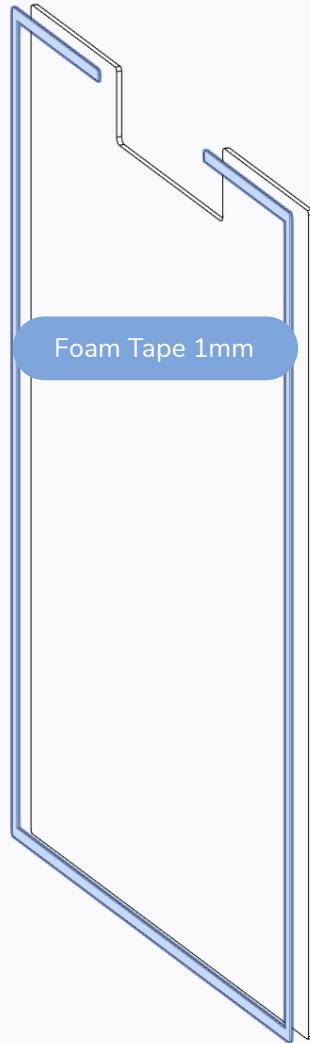
PANELS

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## BACK PANEL

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### APPLY FOAM TAPE

Use foam tape on the contact areas between the panels and the frame to mitigate noise from vibrations.



M3x8 SHCS

### HAMMERHEAD NUTS?

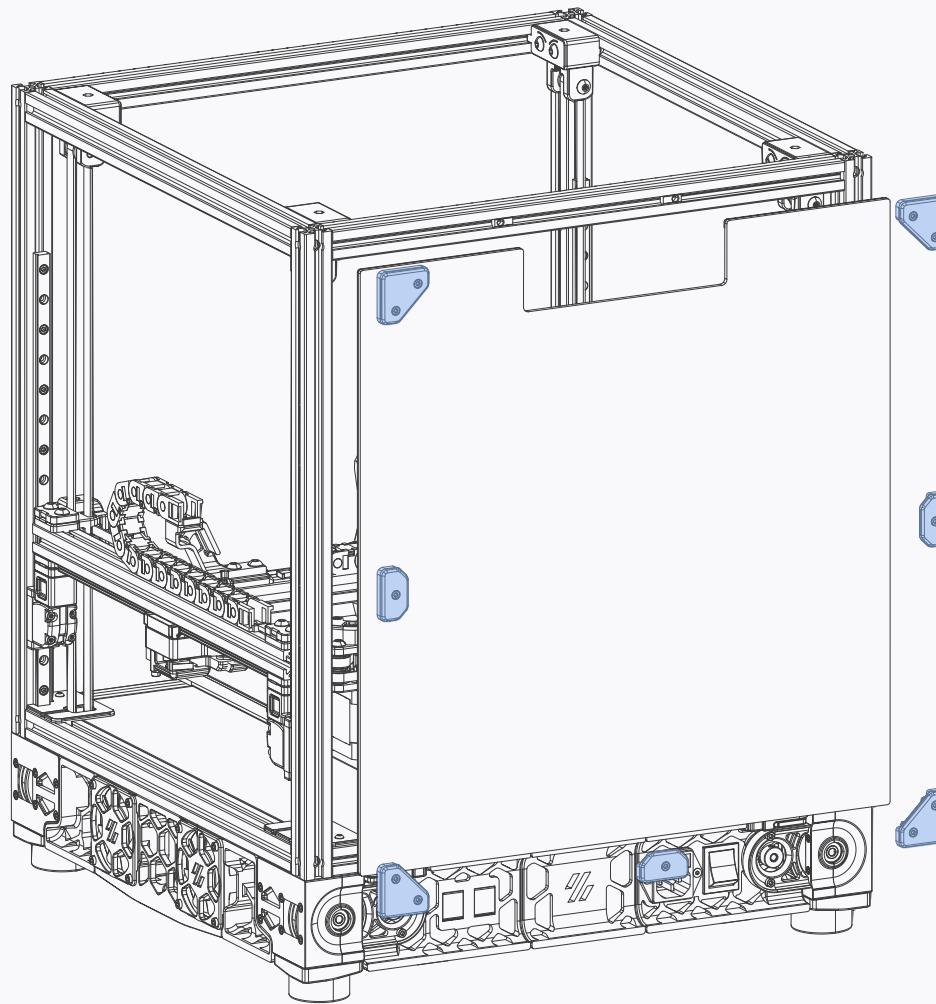
A drop of thread locker will turn the hammerhead nuts into a 1/4 turn quick release for the panels. Best done once the assembly is finished.



M3 Hammerhead Nut

BACK PANEL

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## SIDE PANELS

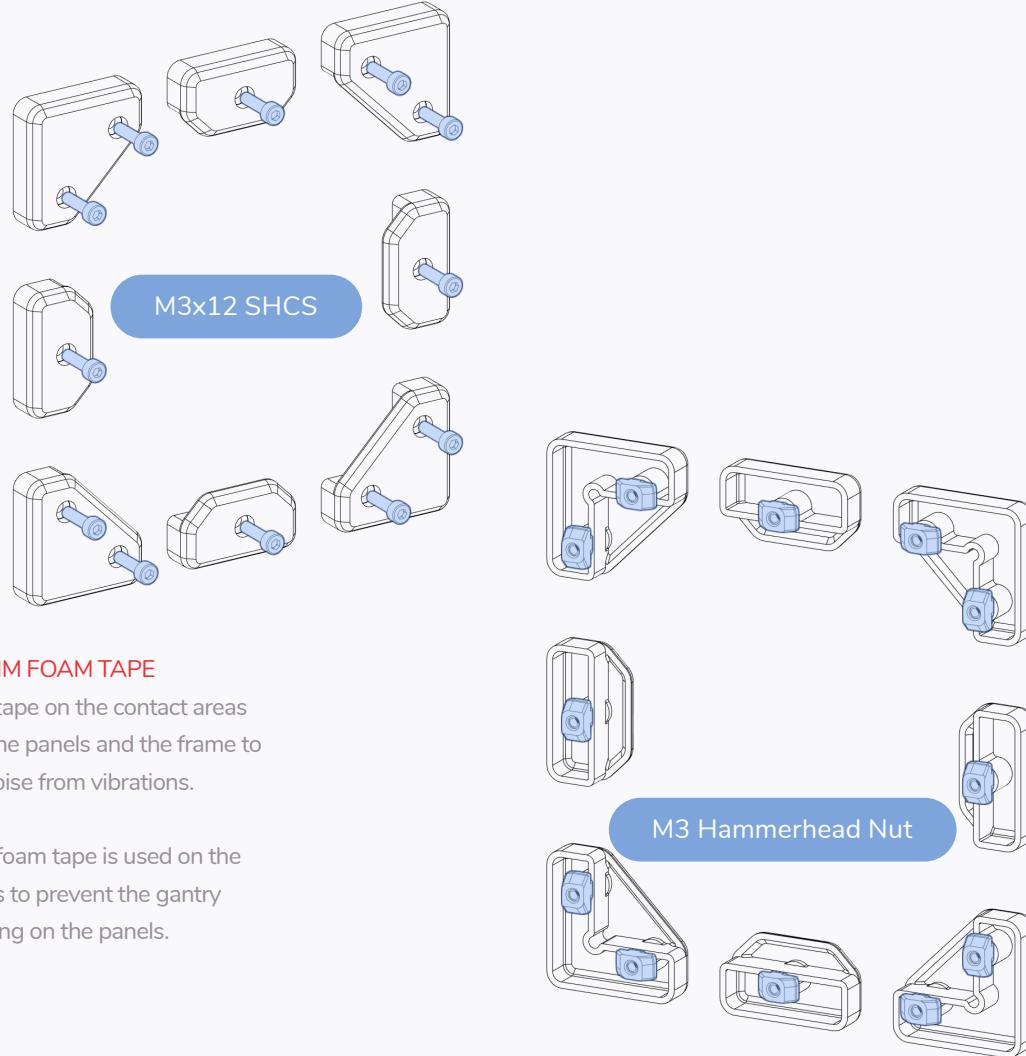
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### APPLY 3MM FOAM TAPE

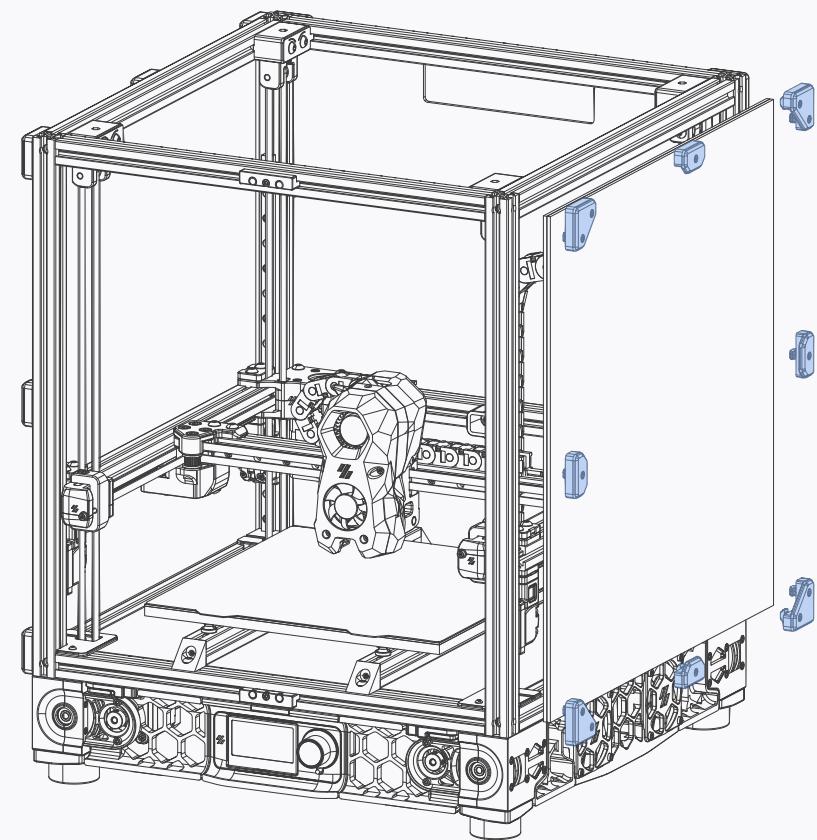
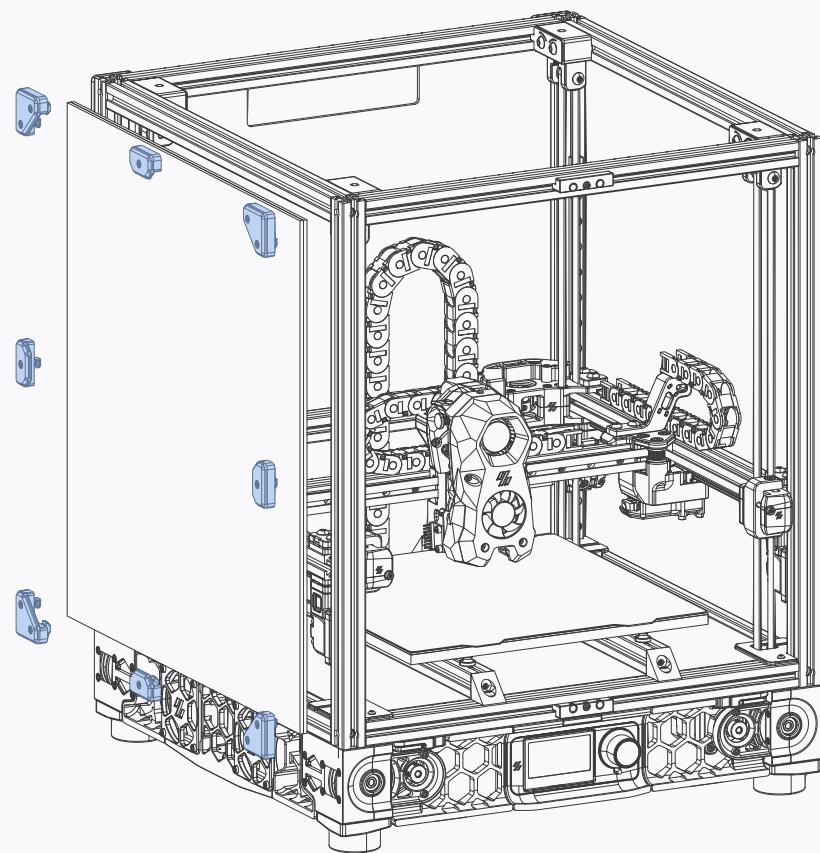
Use foam tape on the contact areas between the panels and the frame to mitigate noise from vibrations.

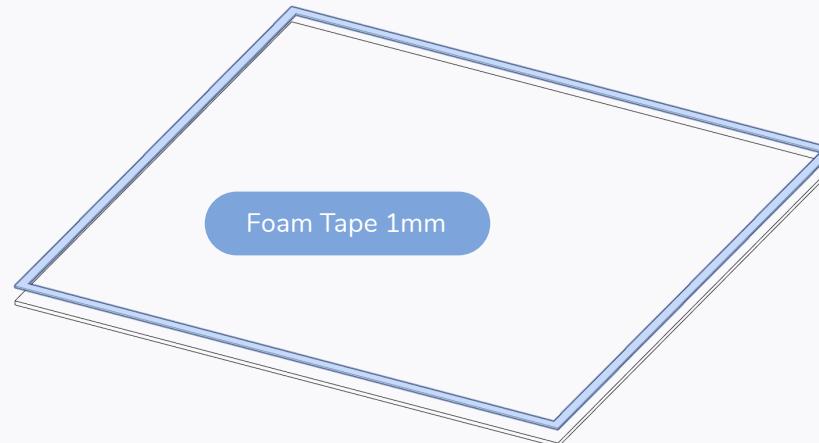
The 3mm foam tape is used on the side panels to prevent the gantry from rubbing on the panels.



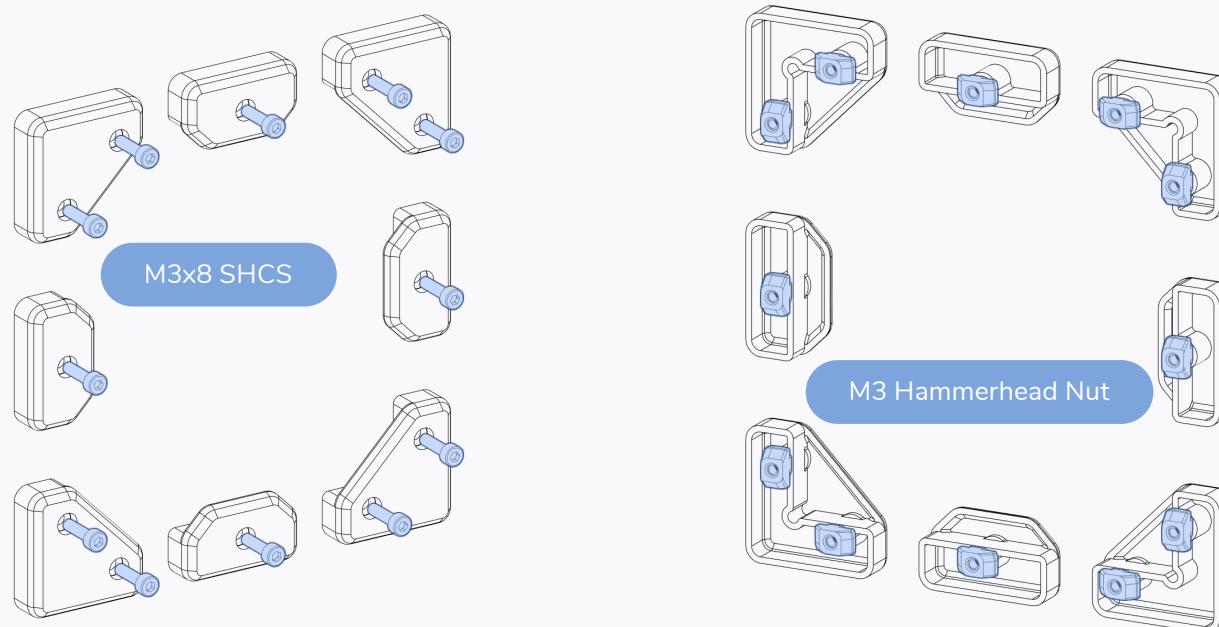
SIDE PANELS

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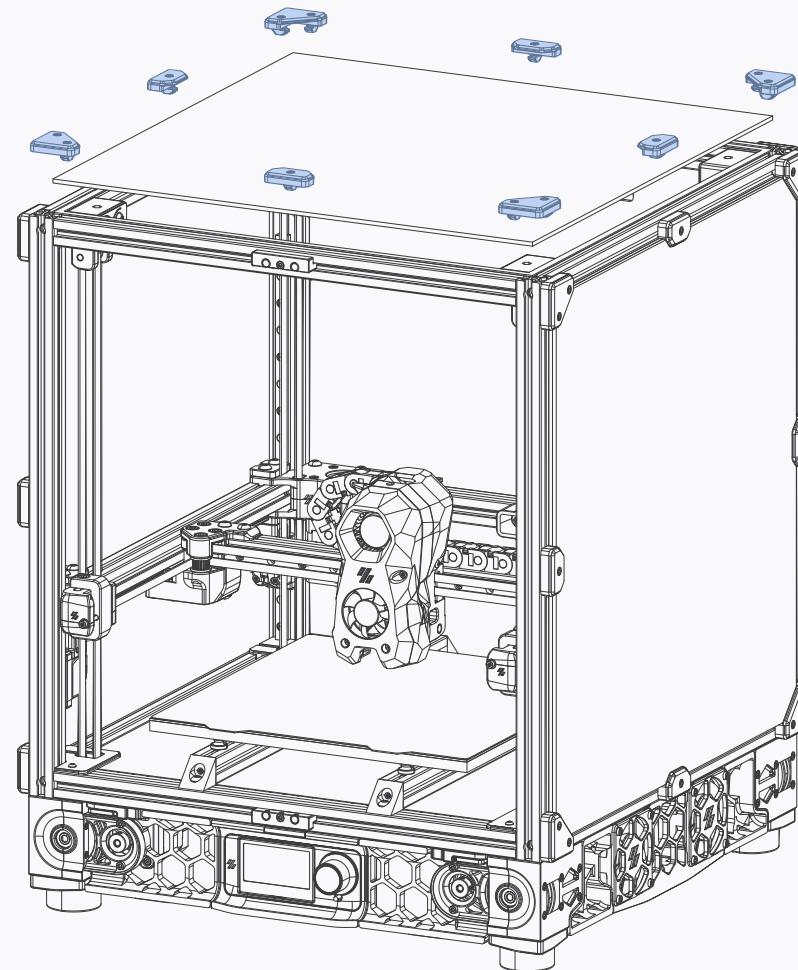
**APPLY FOAM TAPE**

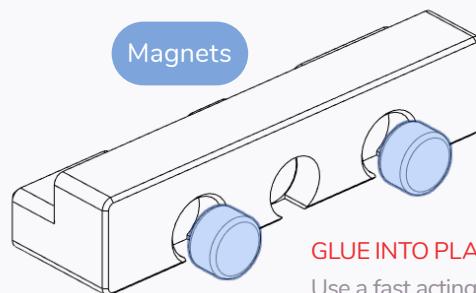
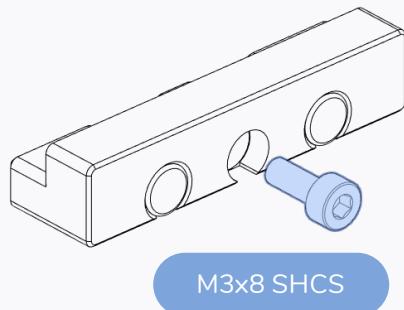
Use foam tape on the contact areas between the panels and the frame to mitigate noise from vibrations.



TOP PANEL

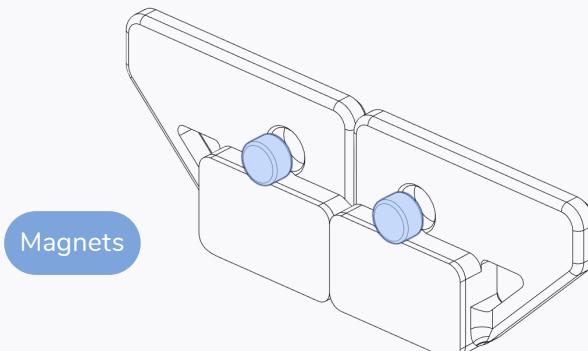
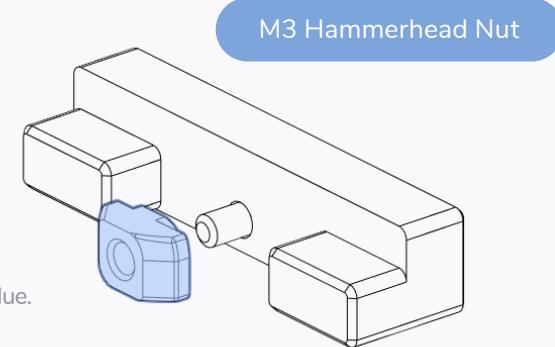
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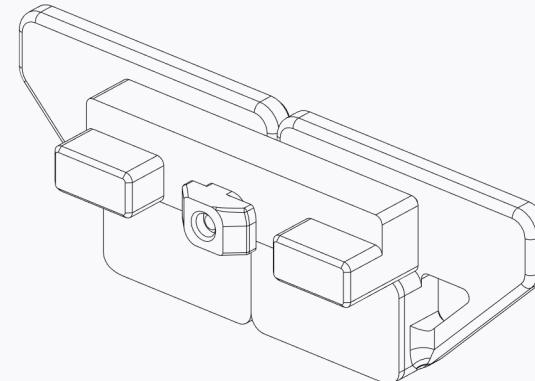
GLUE INTO PLACE

Use a fast acting glue like super-glue.



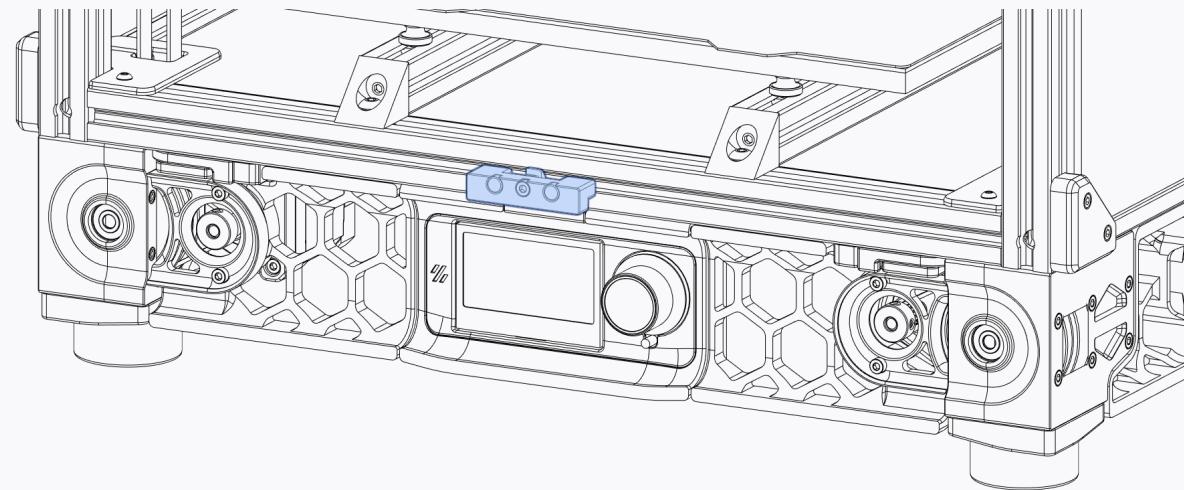
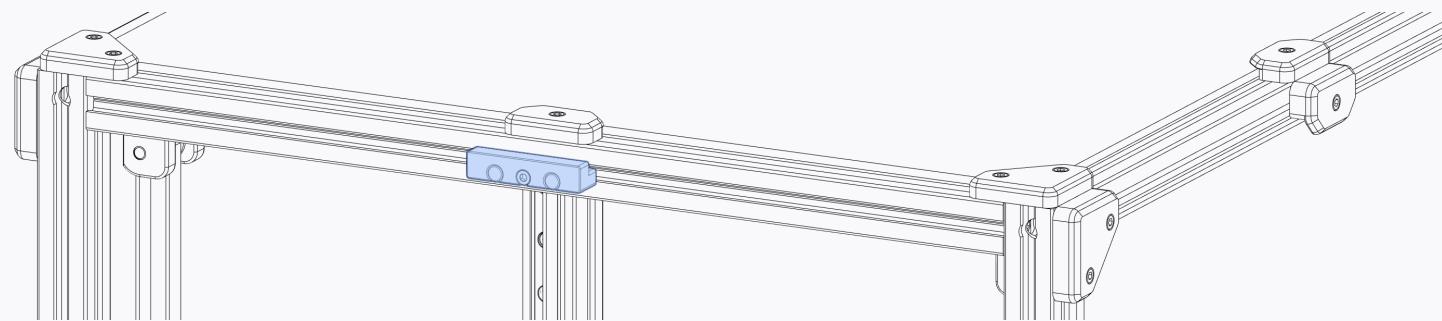
MIND THE MAGNET POLARITY

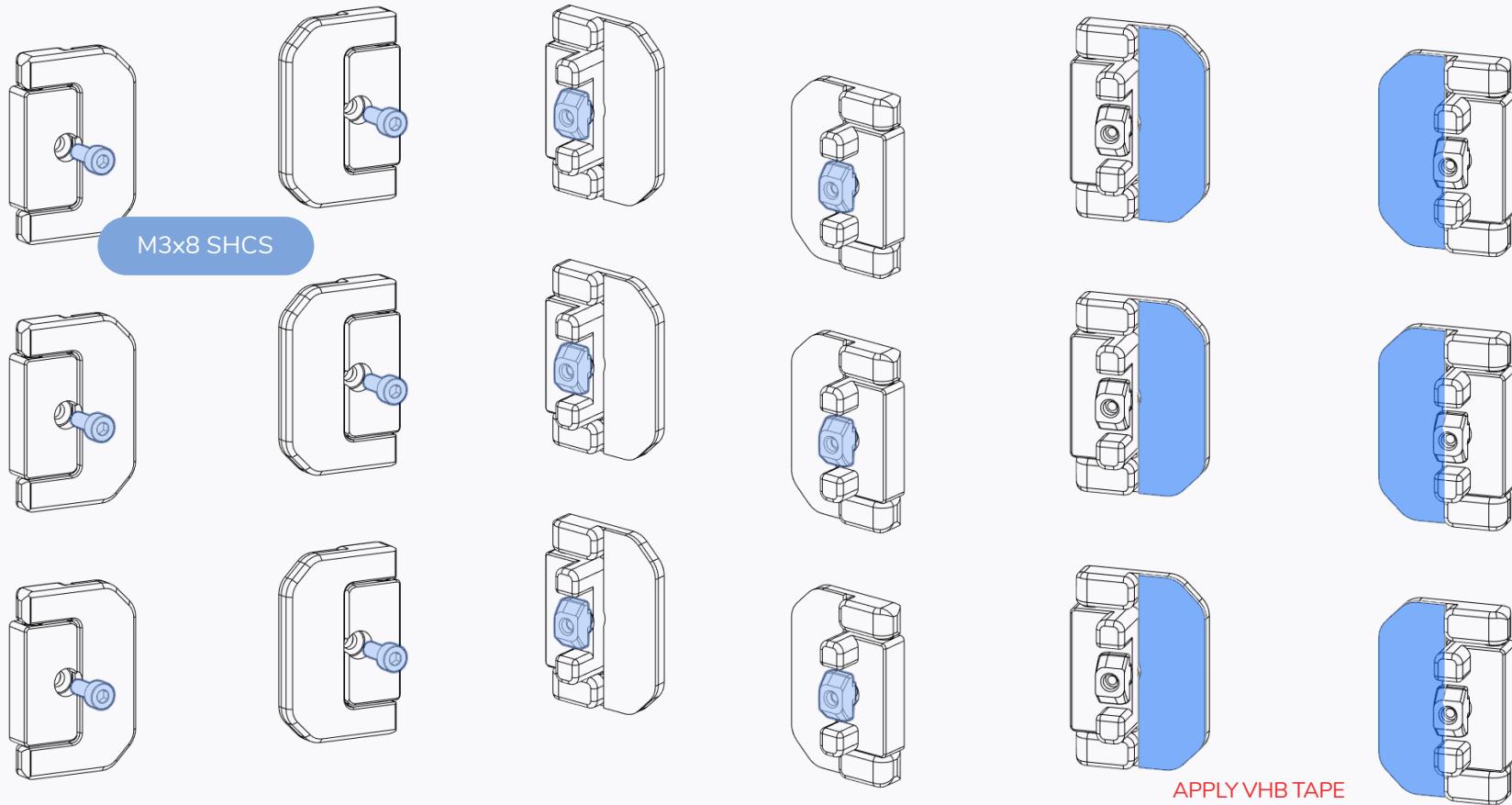
Ensure that the magnets are facing in the right direction prior to gluing them into place.



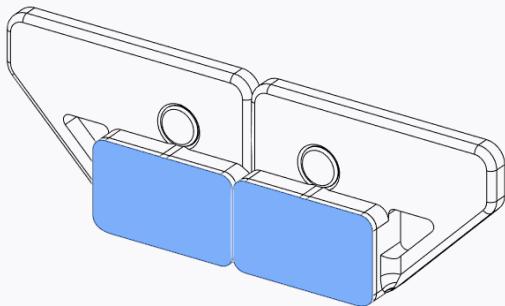
DOORS

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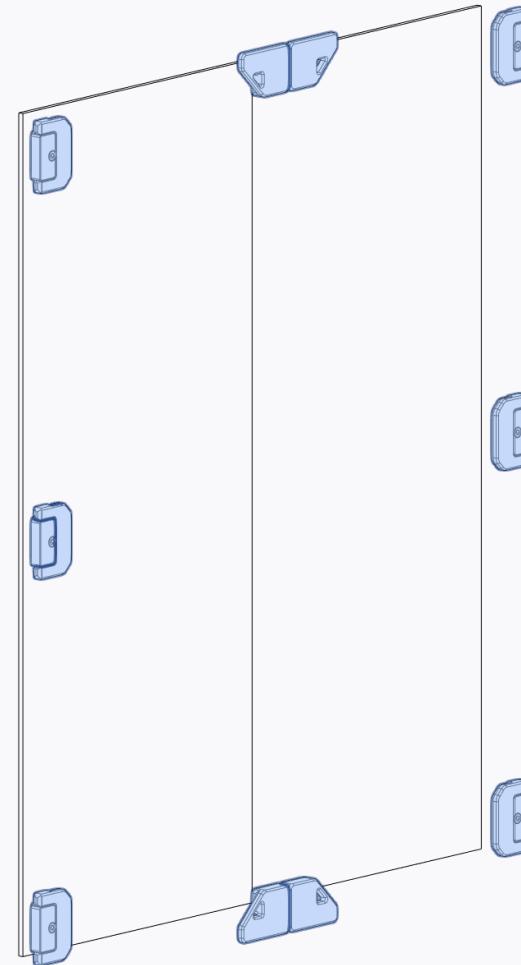
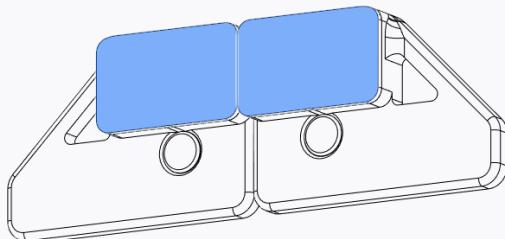




VHB Tape is a double sided adhesive tape.

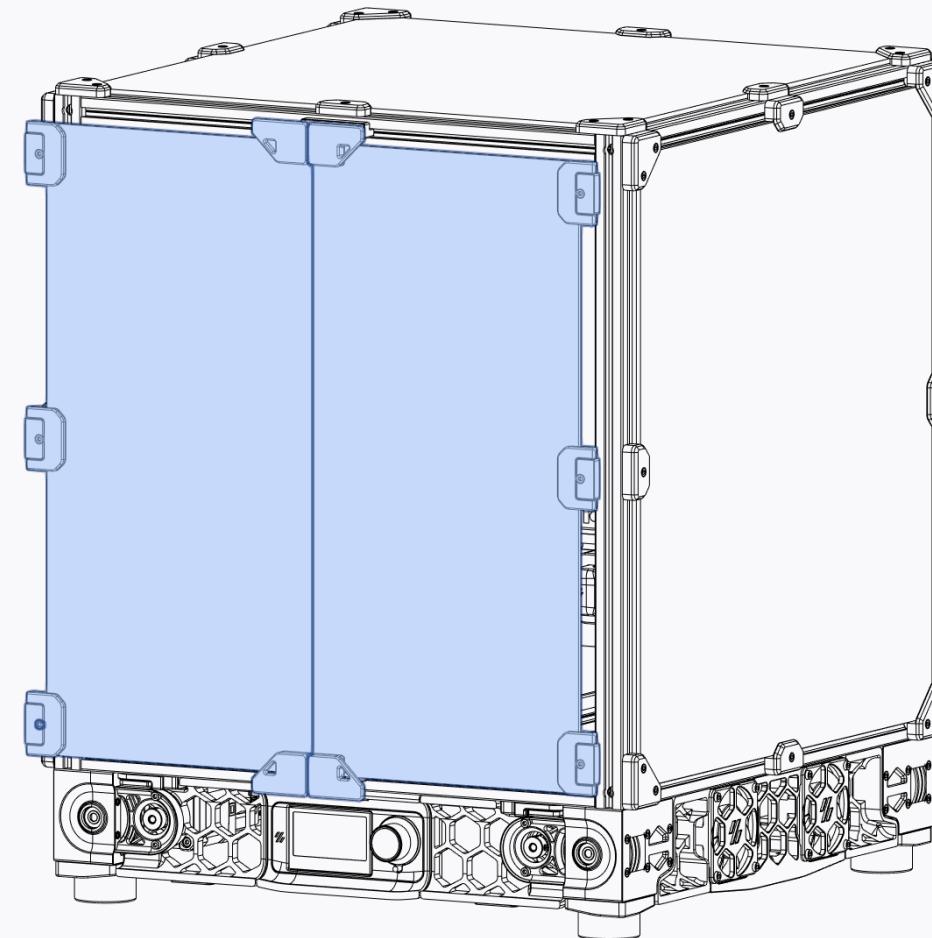
**APPLY VHB TAPE**

VHB Tape is a double sided adhesive tape.



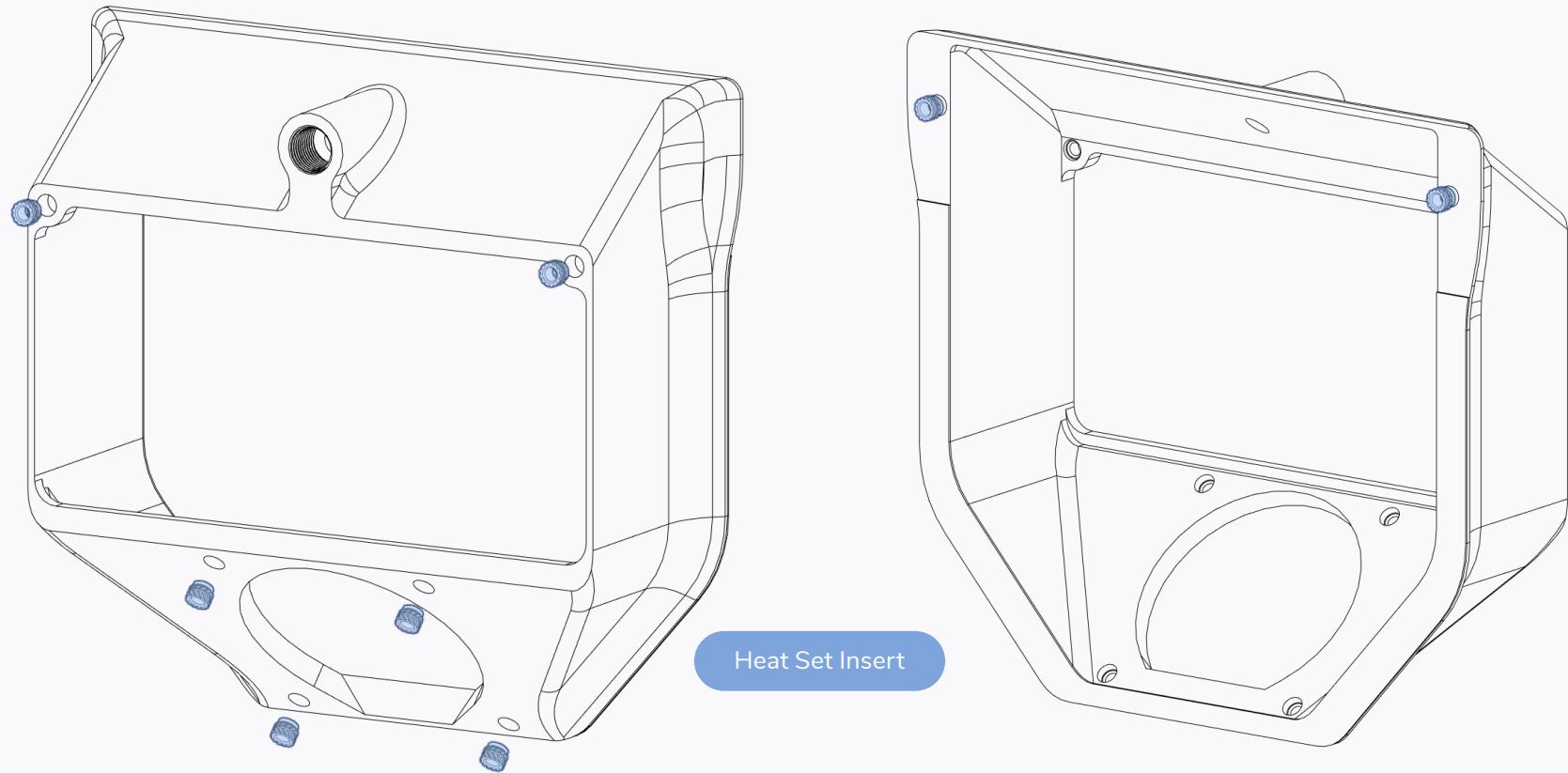
DOORS

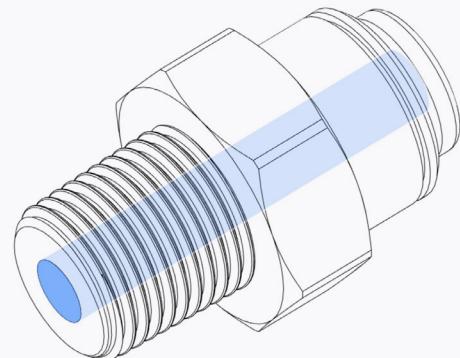
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EXHAUST

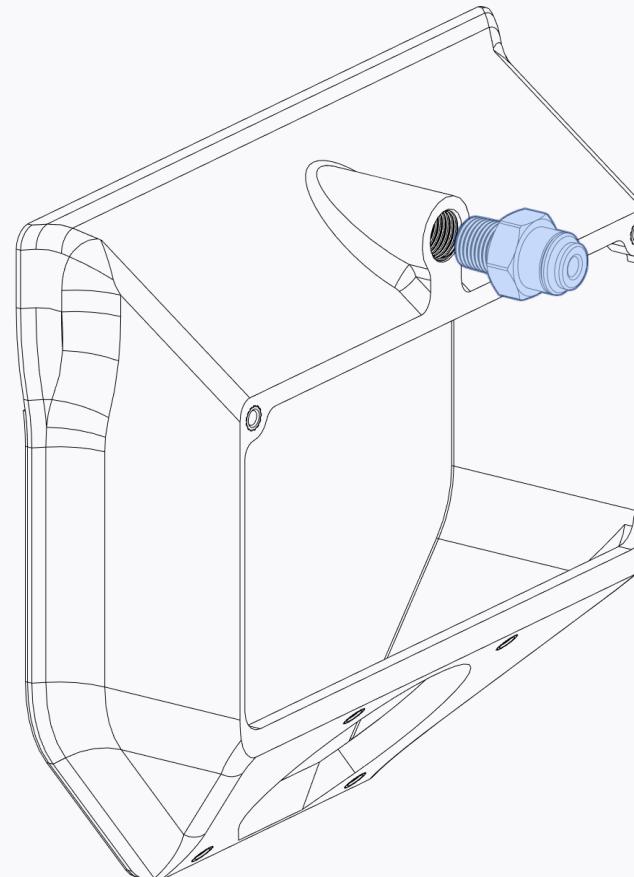
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**BSPP ADAPTER**

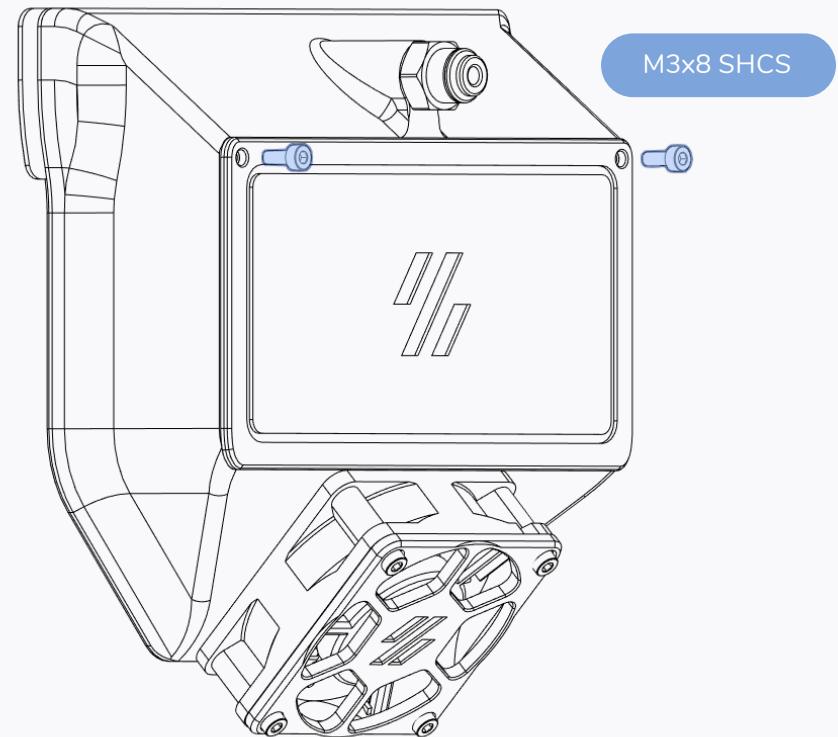
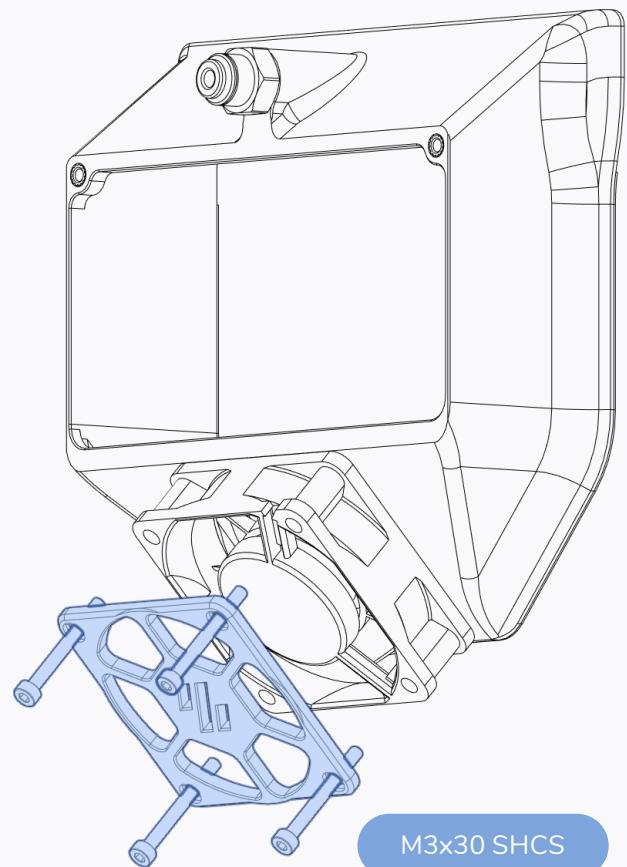
Some adapters have a small lip that prevents the PTFE tube from passing through.

Inspect the adapter and if necessary use a drill to carefully remove the lip.



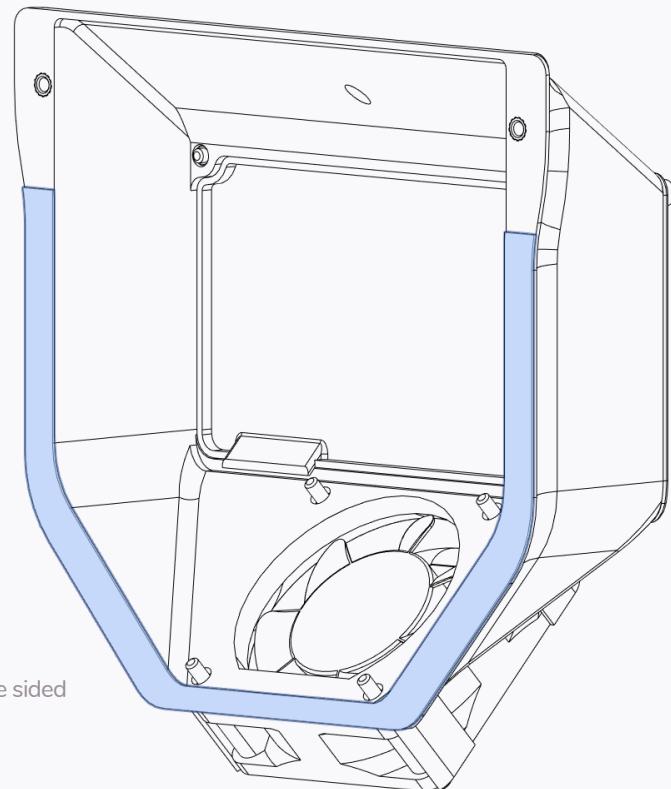
EXHAUST

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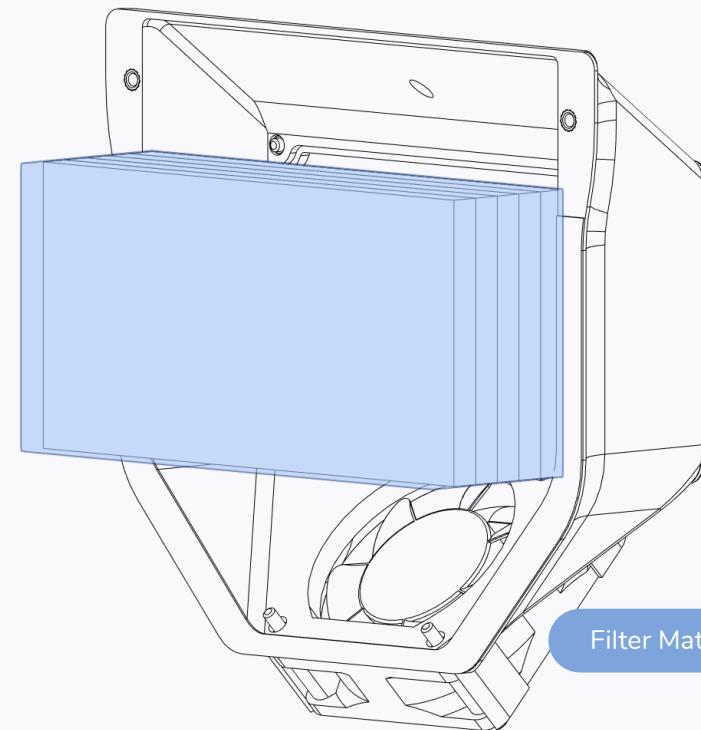
## EXHAUST

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### APPLY VHB TAPE

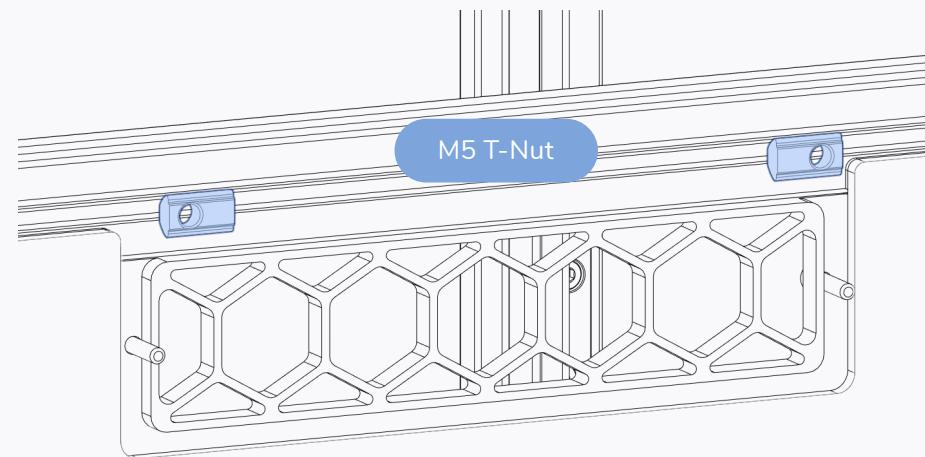
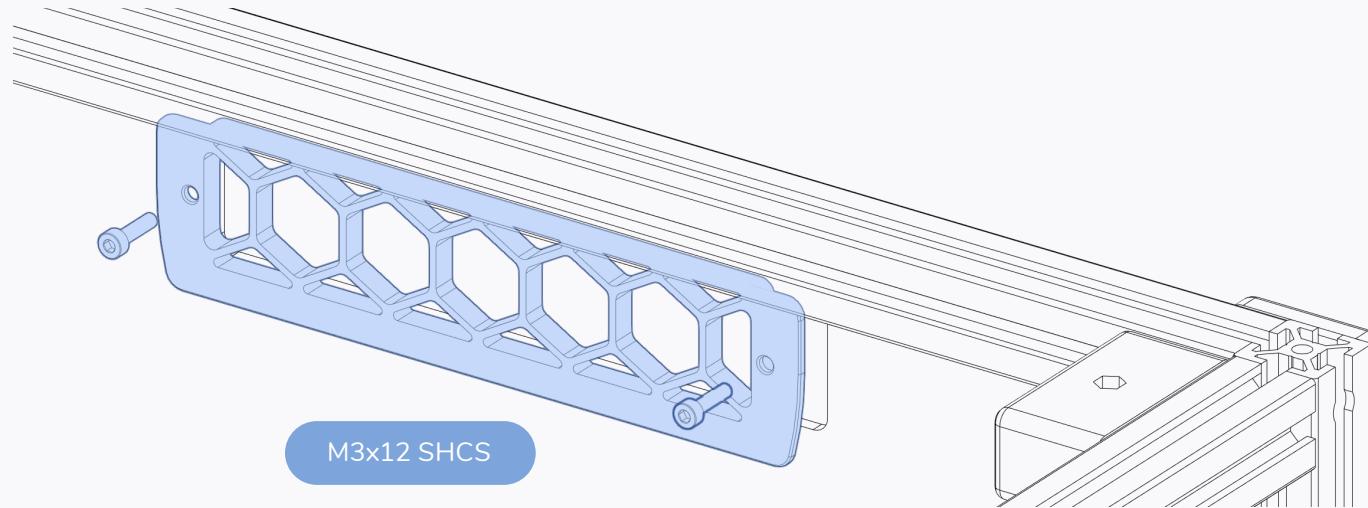
VHB Tape is a double sided adhesive tape.



Filter Material

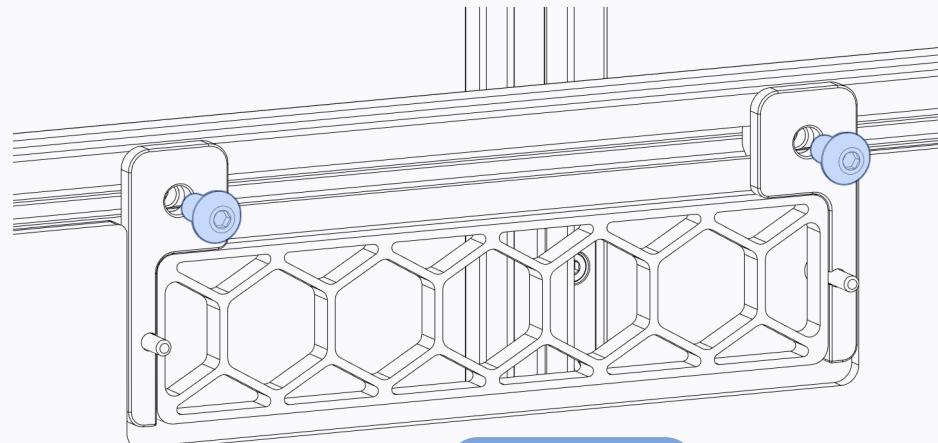
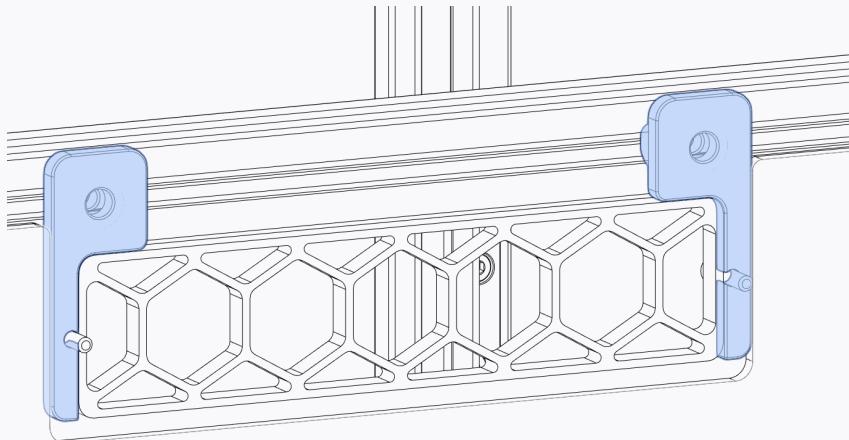
EXHAUST

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EXHAUST

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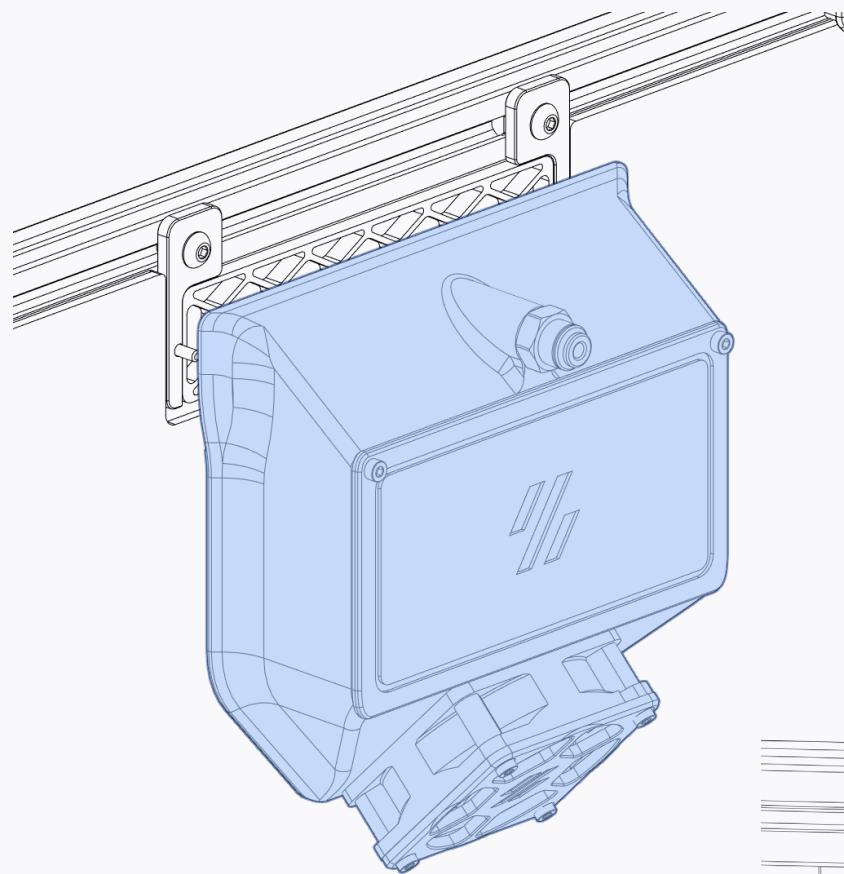


M5x10 BHCS

**Use the big cable sleeve around the exhaust fan cable (if you use the stock exhaust).**

EXHAUST

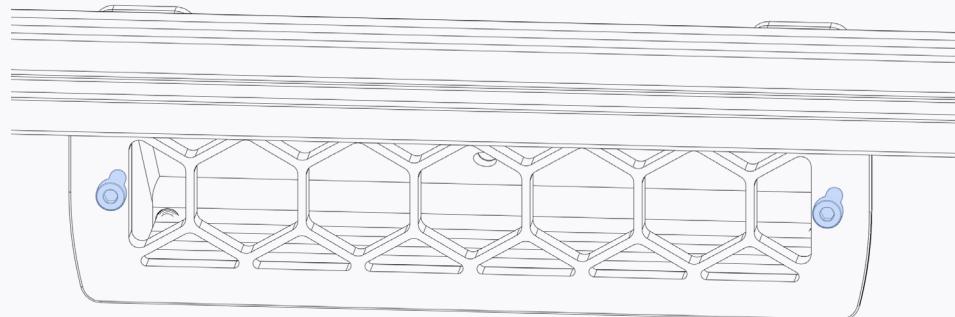
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**REMOVE TAPE BACKING**

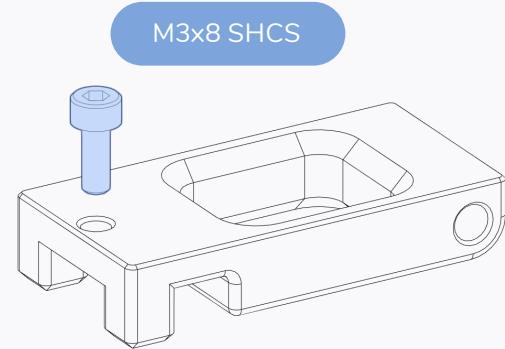
Attach the exhaust assembly to the back panel and secure it with the bolts on the other side of the exhaust gril.

**TIGHTEN BOLTS**

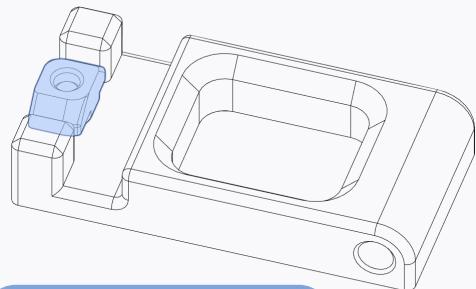


## SPOOL HOLDER

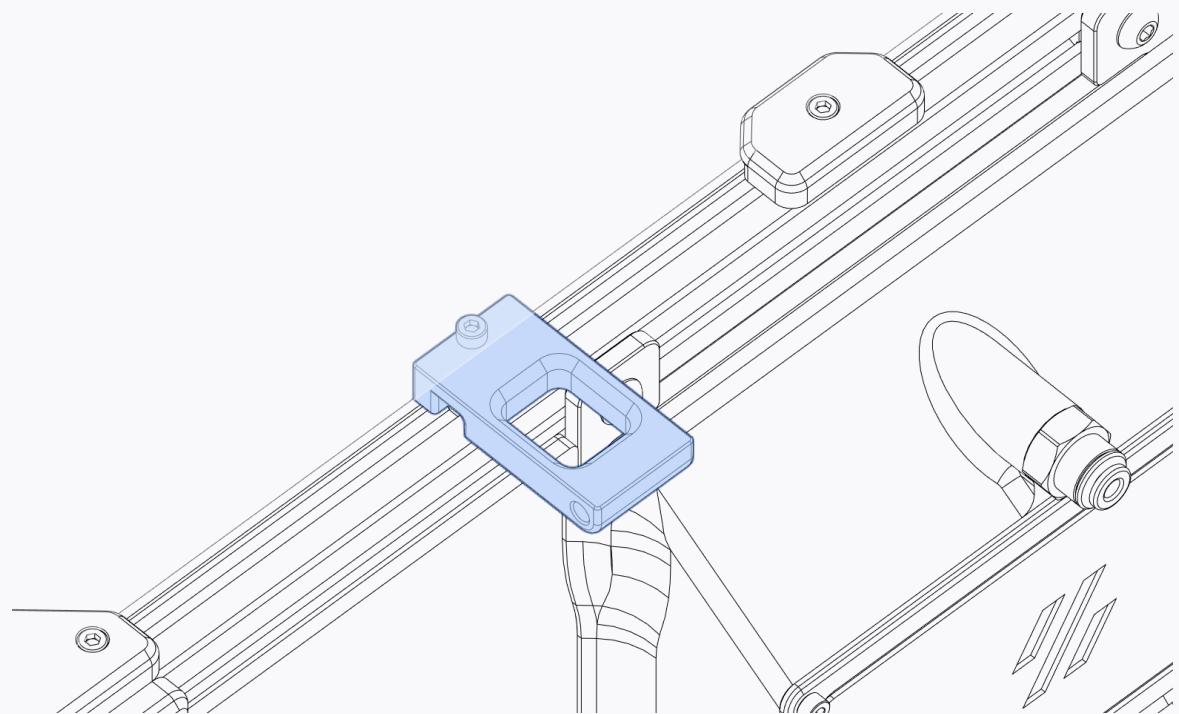
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M3x8 SHCS

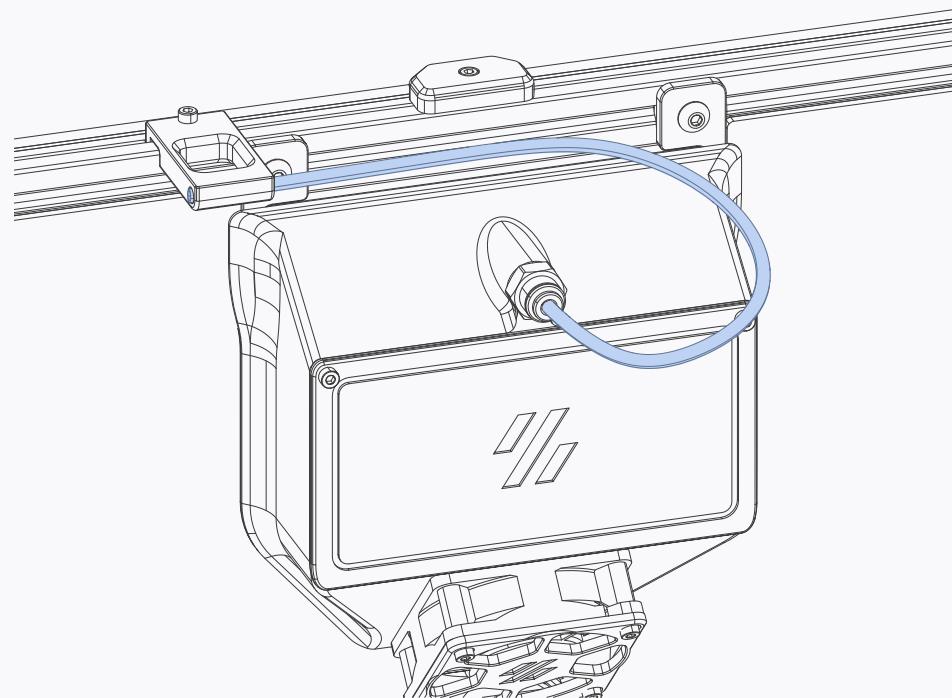


M3 Hammerhead Nut



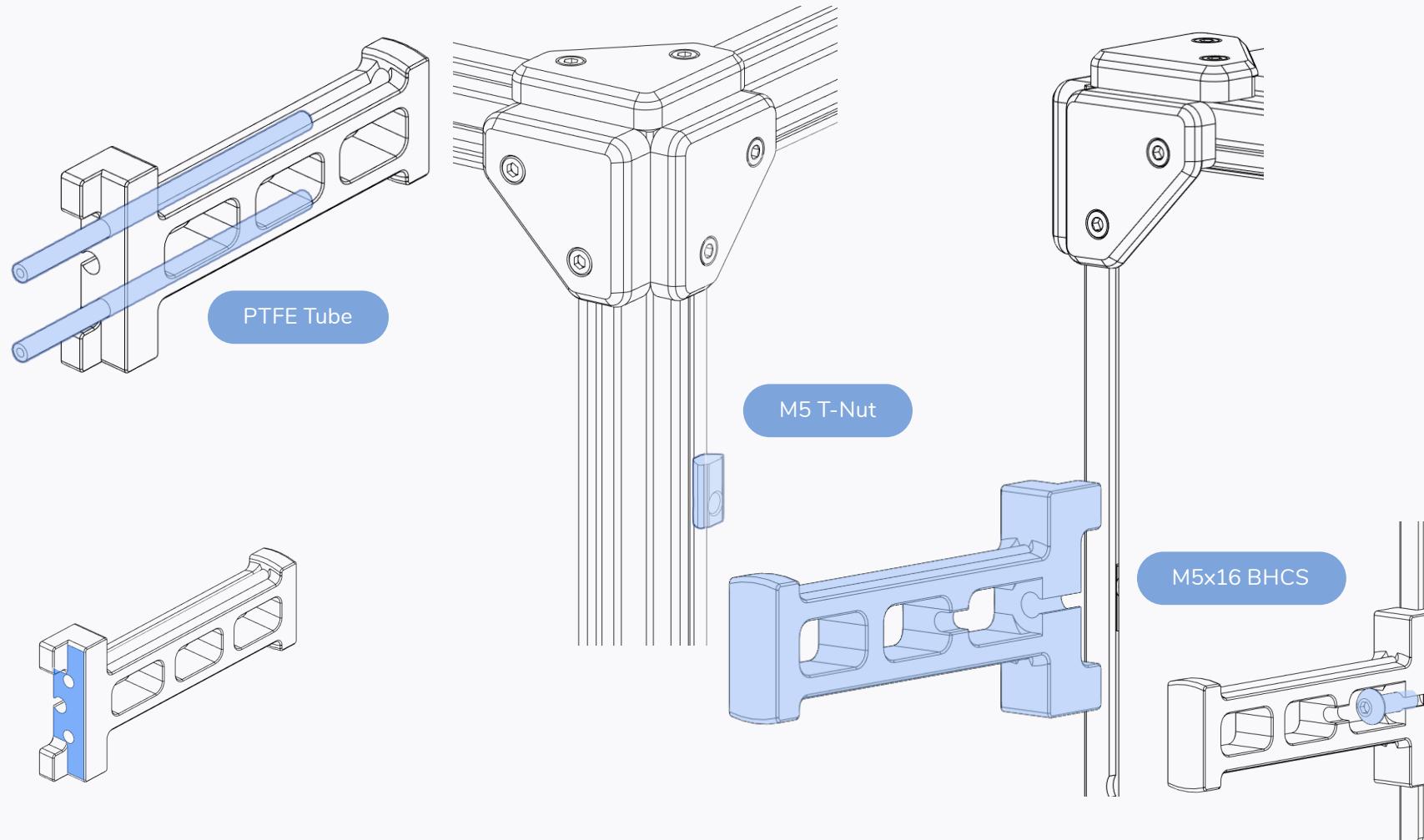
SPOOL HOLDER

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## SPOOL HOLDER

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**ASSEMBLY COMPLETED! ... NEXT STEP: SETUP & CALIBRATION**

This manual is designed to be a reference manual for the build process of a Voron2 printer. Additional details about the build and background on advanced topics can be found on our documentation page linked below.

The software setup and other initial setup steps with your new printer can also be found on our documentation page. We recommend starting [here](#).



<https://docs.vorondesign.com/>



<https://github.com/VoronDesign/Voron-2>

#### HOW TO GET HELP

If you need assistance with your build, we're here to help. Head on over to our Discord group and post your questions. This is our primary medium to help VORON Users and we have a great community that can help you out if you get stuck. Alternatively, you can use our subreddit.



**DISCORD**

<https://discord.gg/voron>



<https://www.reddit.com/r/VORONDesign>

#### REPORTING ISSUES

Should you find an issue in this document or have a suggestion for an improvement please consider opening an issue on GitHub (<https://github.com/VoronDesign/Voron-2/issues>).

When raising an issue please include the relevant page numbers and a short description; annotated screenshots are also very welcome.

We periodically update the manual based on the feedback we get.

[WWW.VORONDESIGN.COM](http://WWW.VORONDESIGN.COM)

Enjoy your printer.



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**Website**  
[www.vorondesign.com](http://www.vorondesign.com)

**Github**  
[github.com/vorondesign](https://github.com/vorondesign)

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