copymaster3D

VORON

1.8 ASSEMBLY MANUAL

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

VERSION 2020-10-25

copymaster3D

www.copymaster3d.com
sales@copymaster3d.com

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

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 our community members 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.

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.

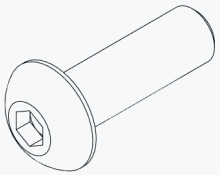
DISCORD https://discord.gg/voron

A full assembly manual is available at: copymaster3d.com/voronmaual
If you need any help and/or support, please visit: copymaster3d.com/voronsupport

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 be sometimes be easier to follow along when you have the whole assembly in front of you.

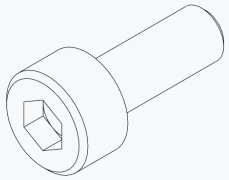
GitHub https://github.com/vorondesign



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.

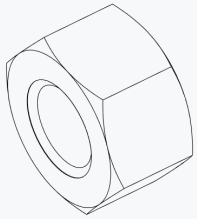
ISO 7380-1



SOCKET HEAD CAP SCREW (SHCS)

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

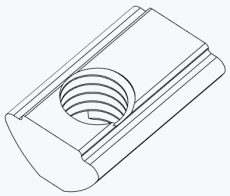
ISO 4762



HEX NUT

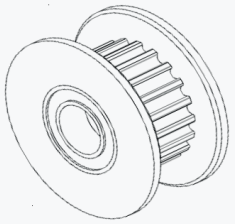
Hex nuts couple with bolts to create a tight, secure joint. You'll see these used in both M3 and M5 variants throughout this guide.

ISO 4032



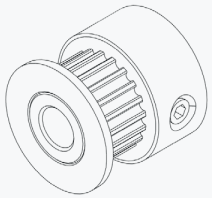
POST INSTALL T-SLOT NUT

Nut that can be inserted into the slot of an aluminium profile. Used in both M3 and M5 variants throughout this guide.



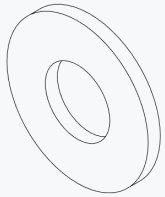
IDLER

GT2 idler used in the motion system of the Voron.



PULLEY

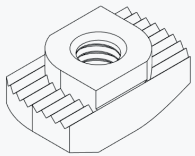
GT2 pulley used on the motion system of the Voron.



SHIM

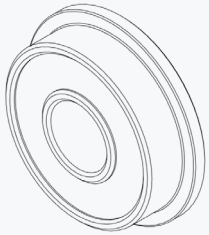
Not to be confused with stamped washers. These are used in all M5 call-out locations in this manual.

DIN 988



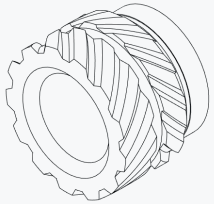
HAMMER HEAD NUT

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



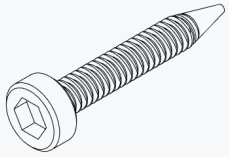
F695 BEARING

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



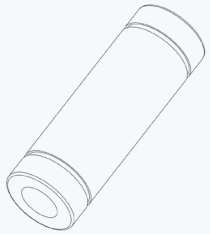
HEAT SET INSERT

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.



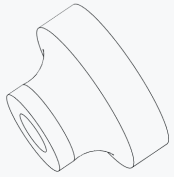
SELF TAPPING SCREW

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



LM8LUU BEARING

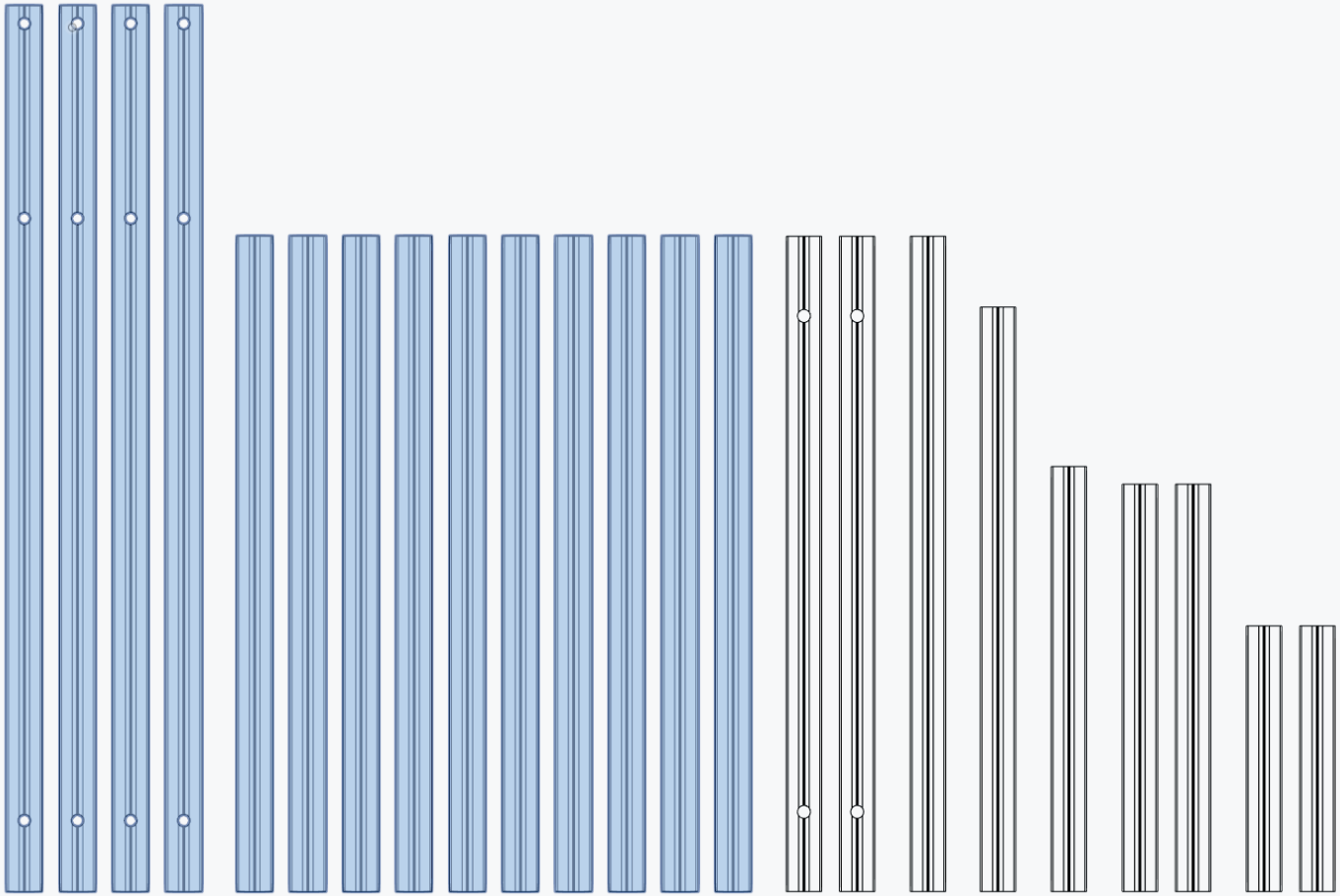
A long linear ball bearing used in the Z axis.



THUMB NUT

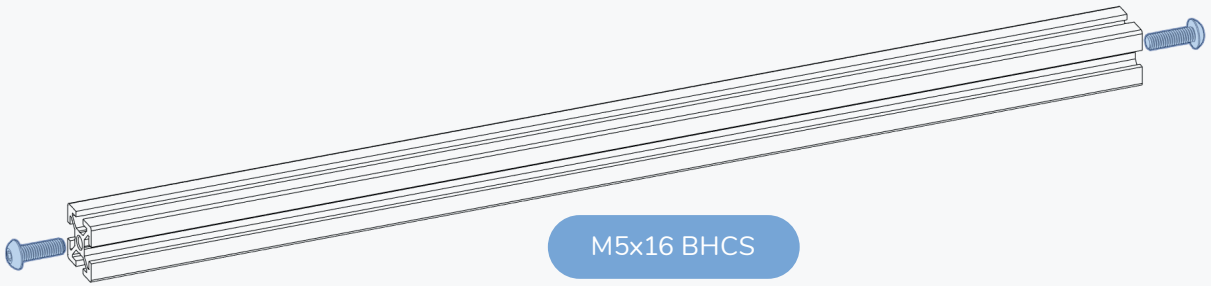
Used in the print bed both for manual tramming and as a spacer.

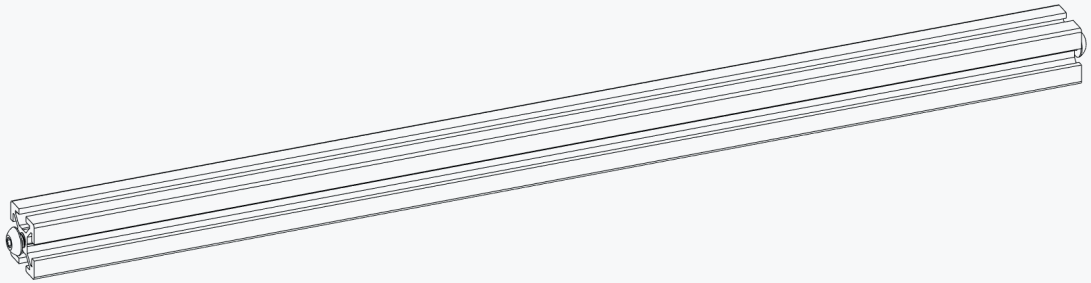
DIN 466-B

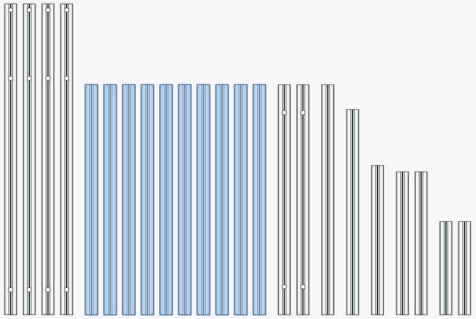


GETTING EXTRUSIONS TOGETHER

Separate the extrusions you're going to need for this section of the build. We've laid out all the parts you should have and highlighted the ones that will be used in the following sections.

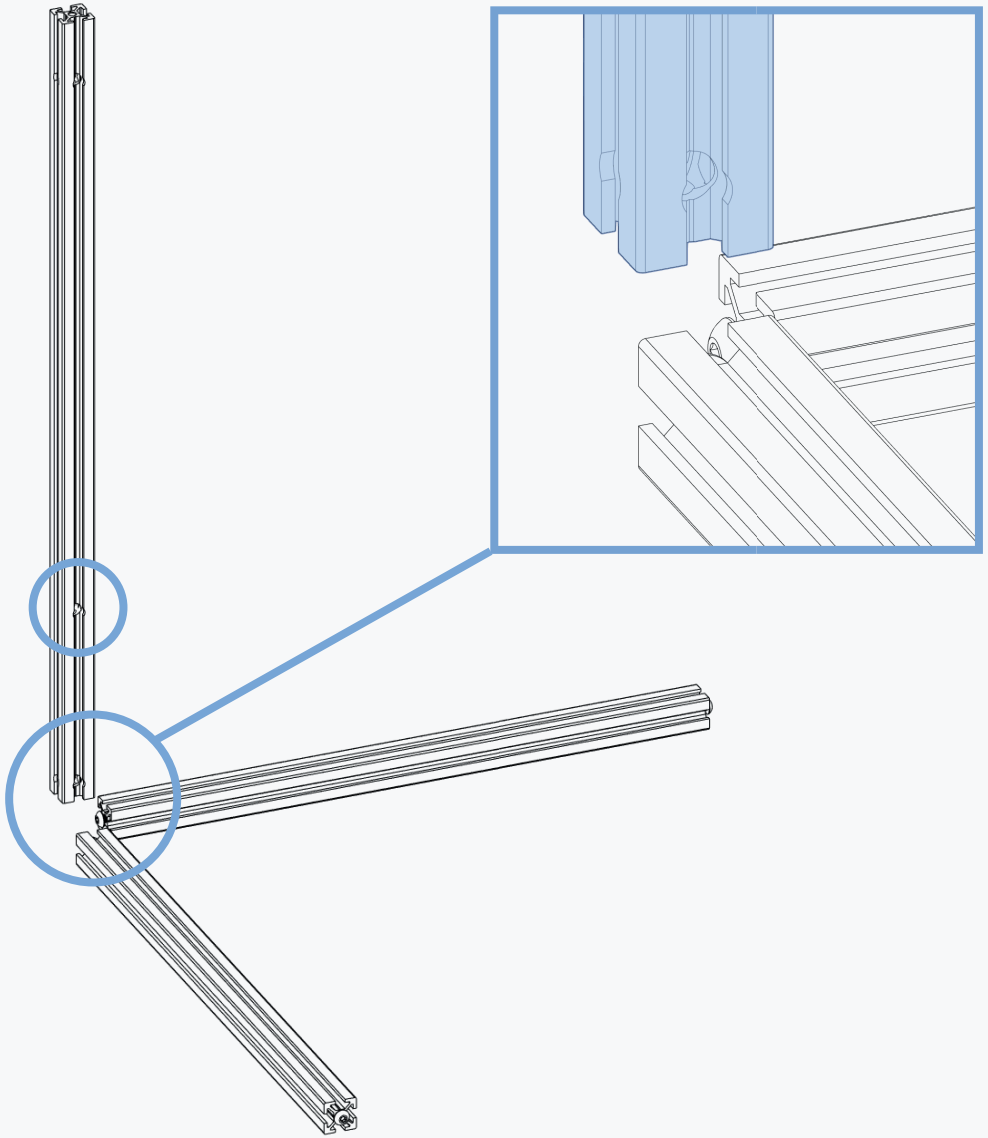






PREPARE 10 EXTRUSIONS

All 10 extrusions are going to be used in this section. Prepare them as shown to the left.

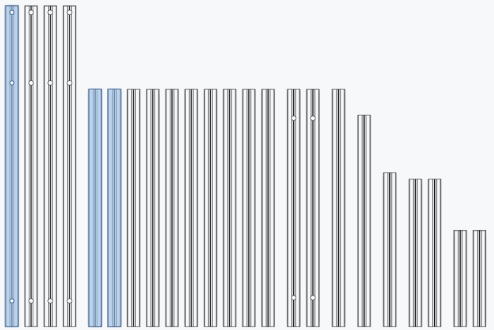


BUILD ON A FLAT SURFACE

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

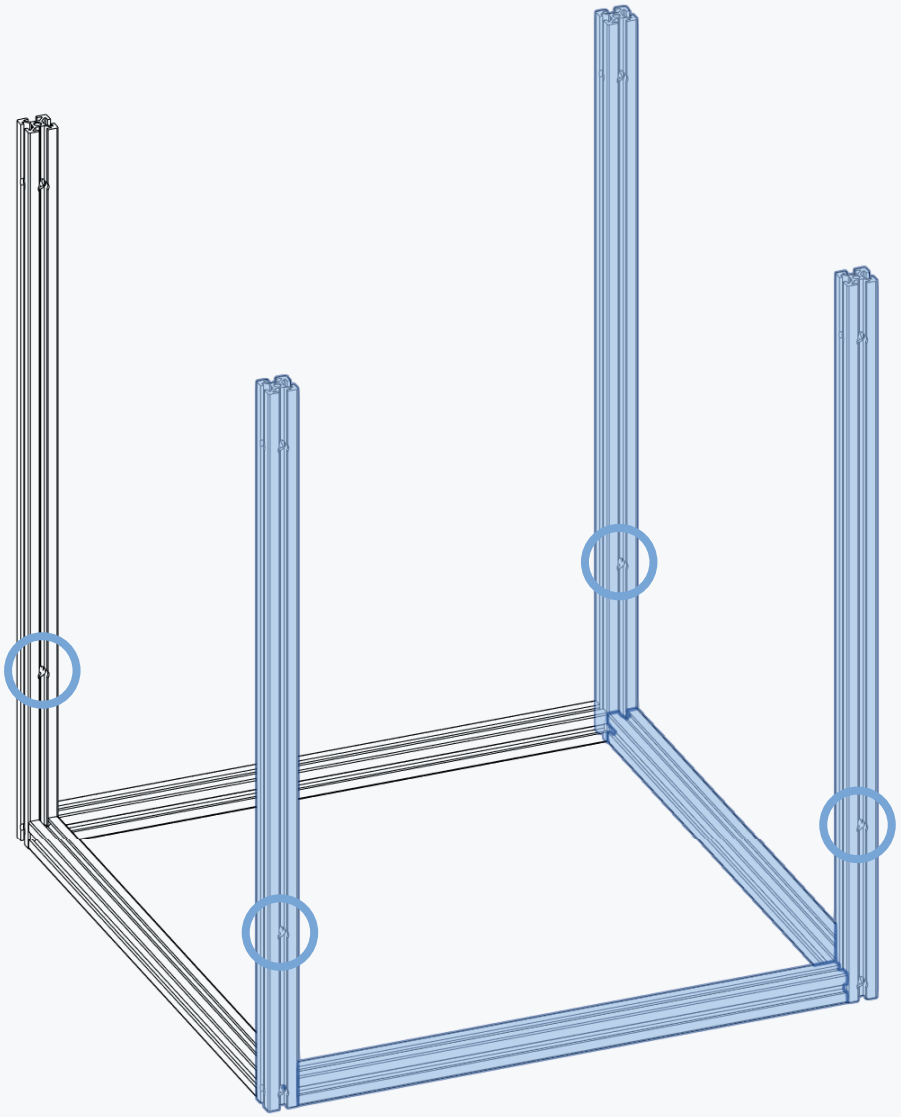
UPSIDE DOWN ASSEMBLY

For ease of assembly we recommend to
assemble the frame upside down.
Mind the position and orientation of the access
hole on the vertical extrusions.



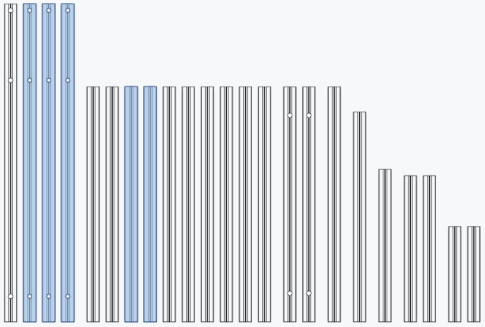
copymaster3D

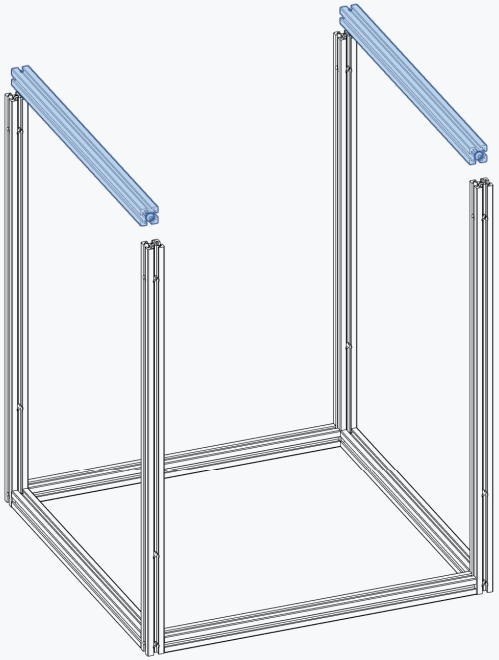
www.copymaster3d.com
sales@copymaster3d.com

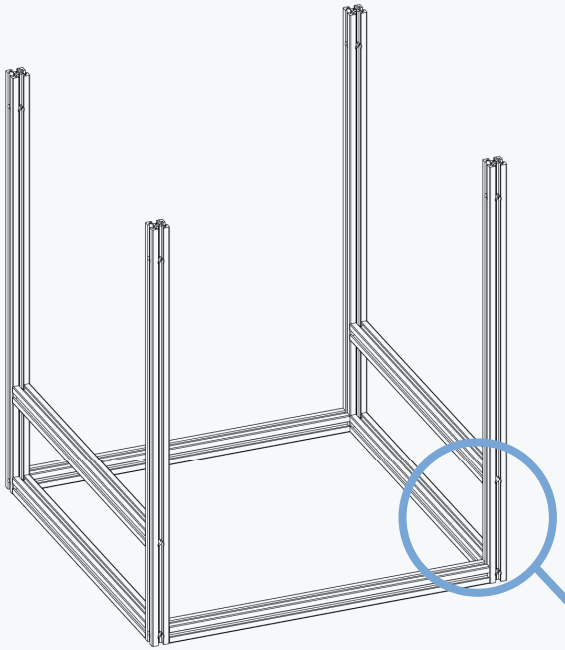


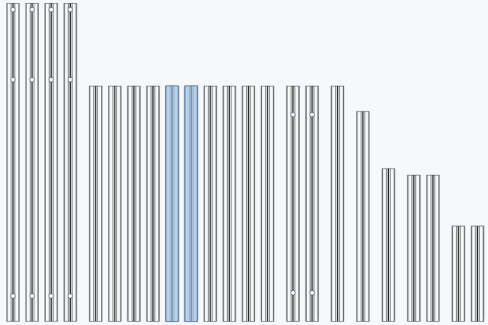
MIND ACCESS HOLE POSITION

We do our best to call out things that may bite you later in the assembly process but may skip things that seem obvious to us. If in doubt please refer to the CAD model, it might save you some considerable time down the road.





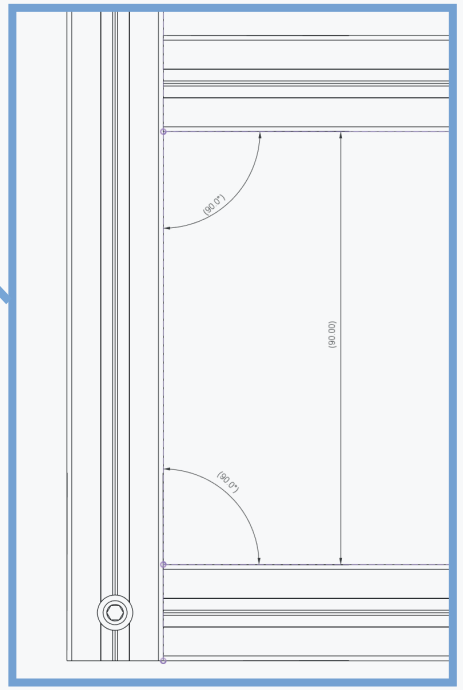


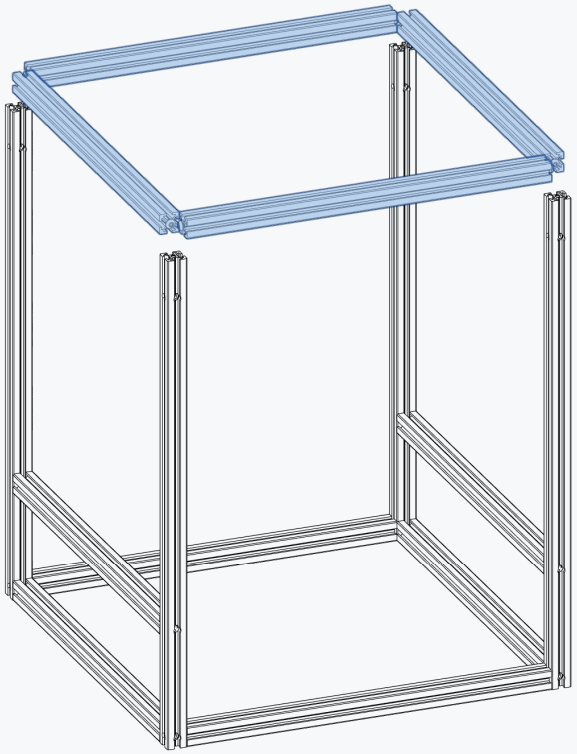


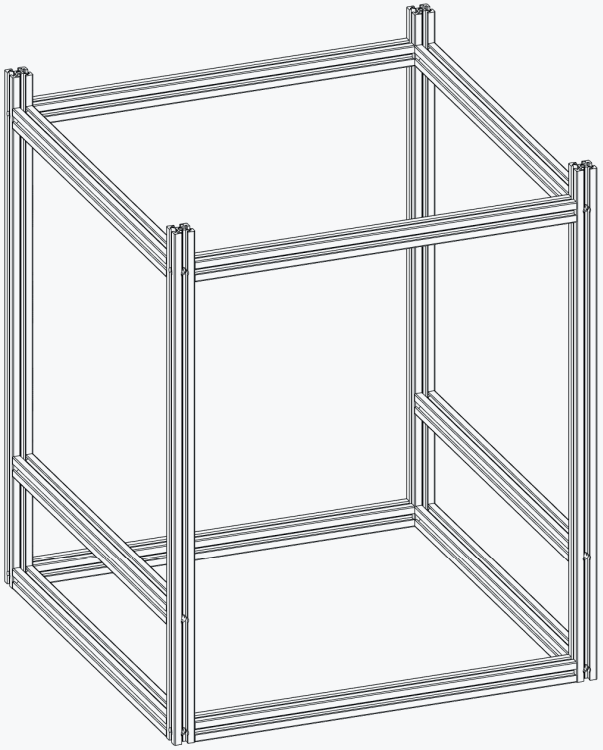
ADJUST TO 90MM DISTANCE

The extrusions that will later hold the Y-Rails are spaced 90mm from the top extrusions (110mm from the work surface).

Make sure that they sit flush with the vertical extrusions and aren't twisted/rotated. A small machinist square will help with this task.







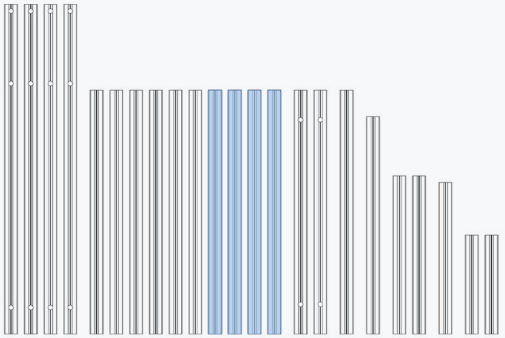
FINDING THE RIGHT POSITION

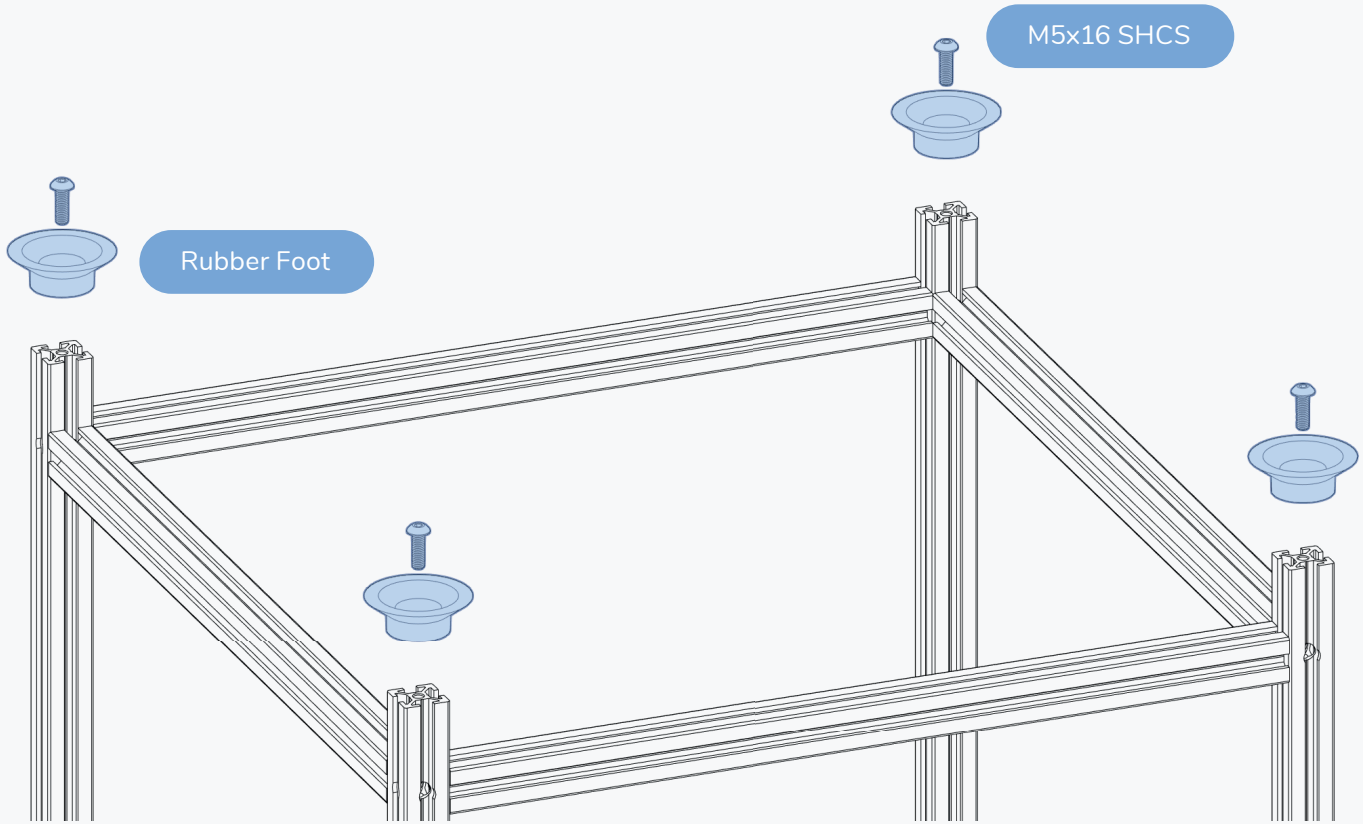
The bottom extrusions are spaced 320mm from the Y extrusions.

Use the linear rods of the Z drive as a guide. Make sure that you are able to slide them in from the side.

Make sure that the extrusions sit at an 90° angle and are free of any rotation/twist. The outsides of the extrusions should be flush.

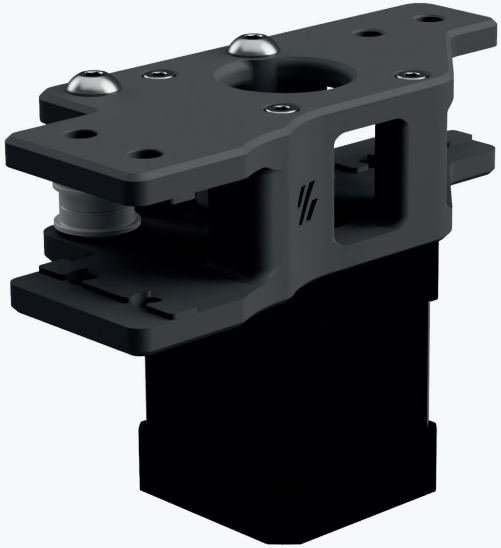
The position of the front/back facing extrusion is not critical.

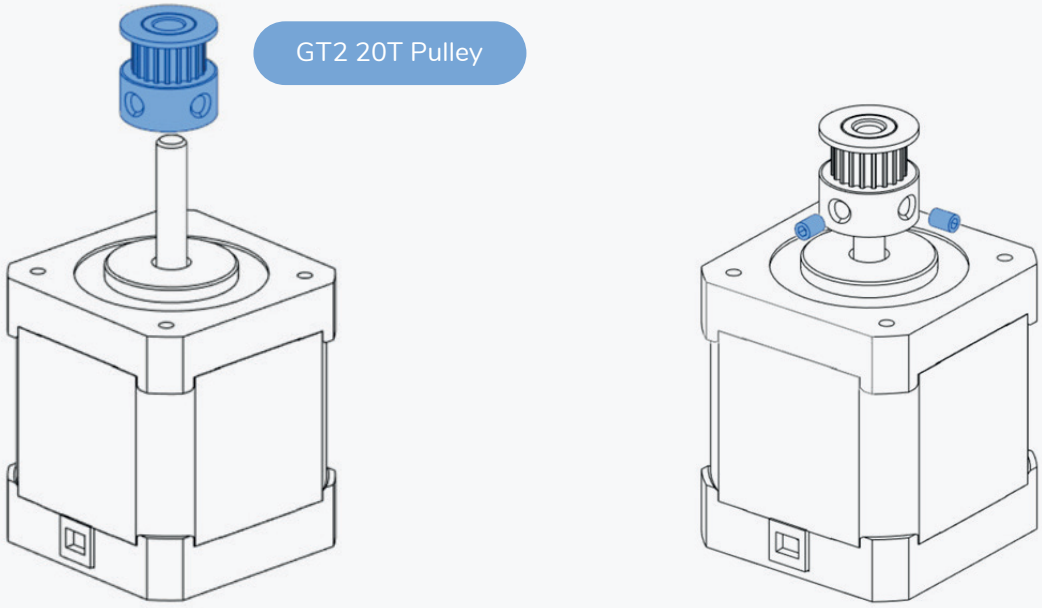




FLIP RIGHT-SIDE UP

This concludes the first section of the assembly. Time to put the printer on it's own feet.
Don't forget to take a photo of your success.





A/B DRIVE MOTORS

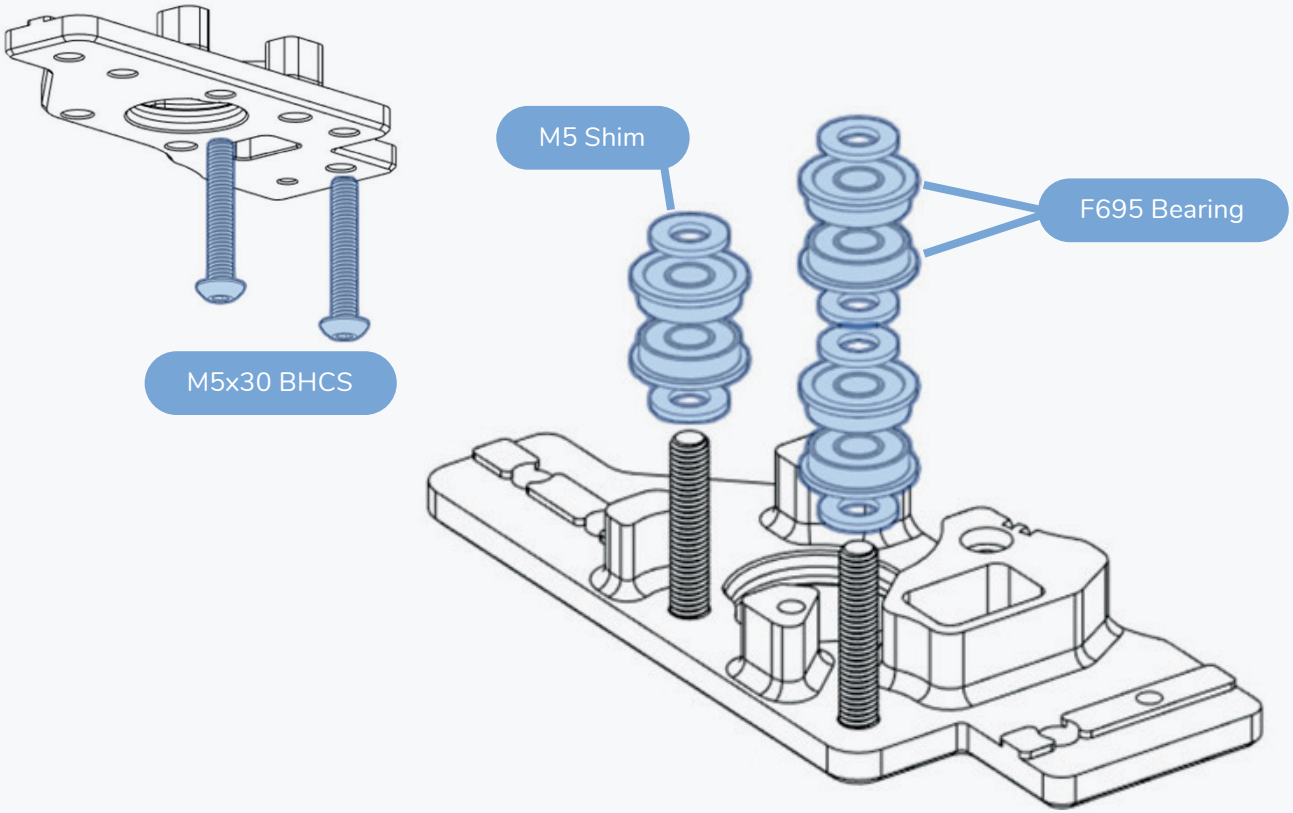
The picture shows the A Drive motor (left hand side of the printer). B Drive motor is assembled in the same fashion with the pulley orientation flipped.

GRUB SCREWS

AKA THE ROOT OF ALL ISSUES

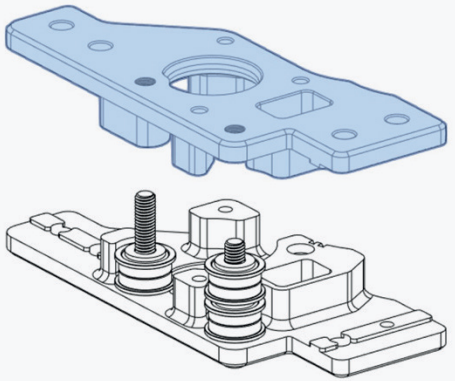
Use thread locker on all grub screws.

Loose grub screws account for the majority of issues that our users report. Save yourself hours of troubleshooting and apply thread locker to all grub screws during the build.
See the products application notes for instructions.



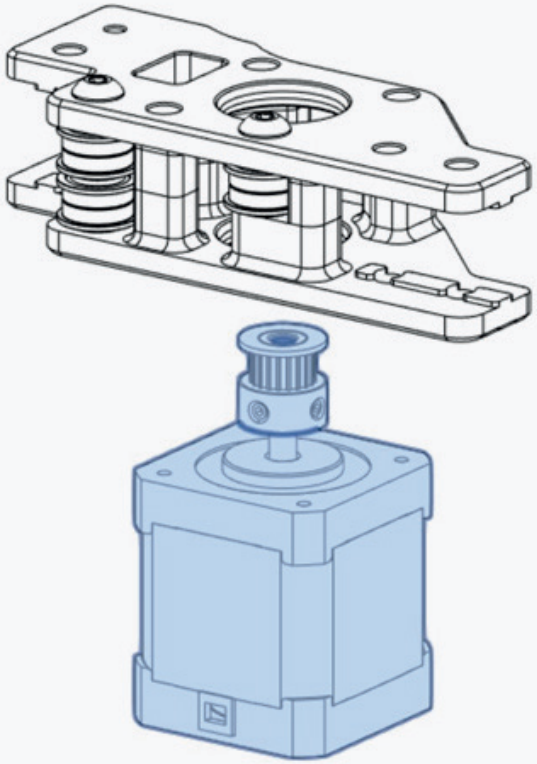
UPSIDE DOWN ASSEMBLY

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

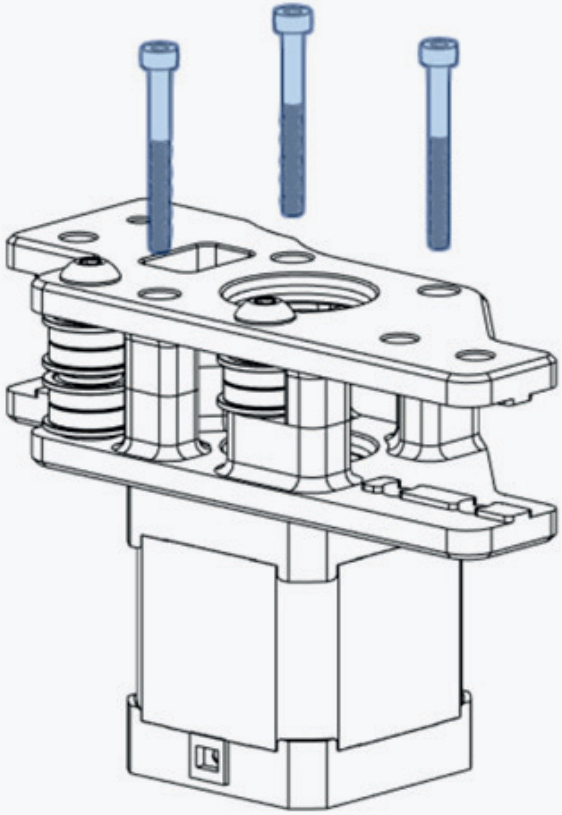


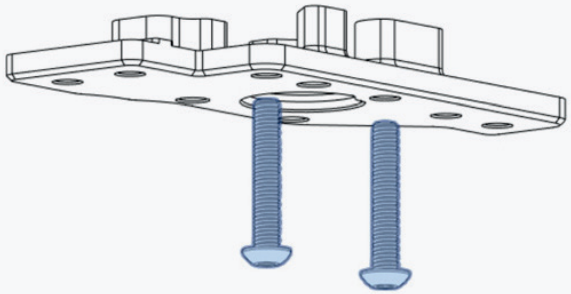
FLIPPED RIGHT SIDE UP

Turn the part over

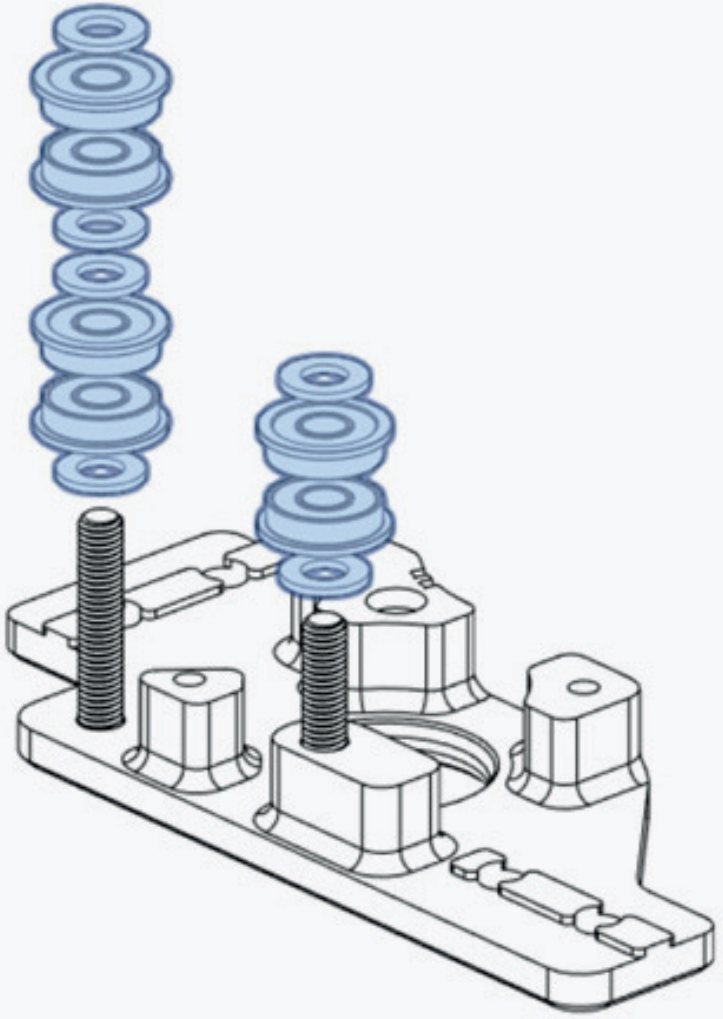


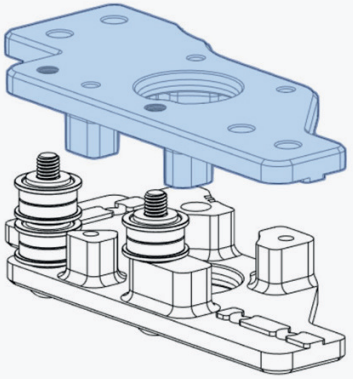
M3x30 SHCS

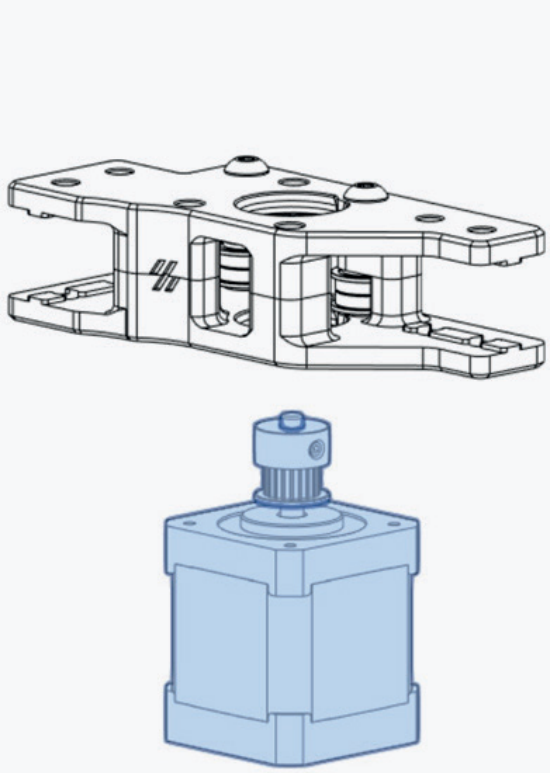


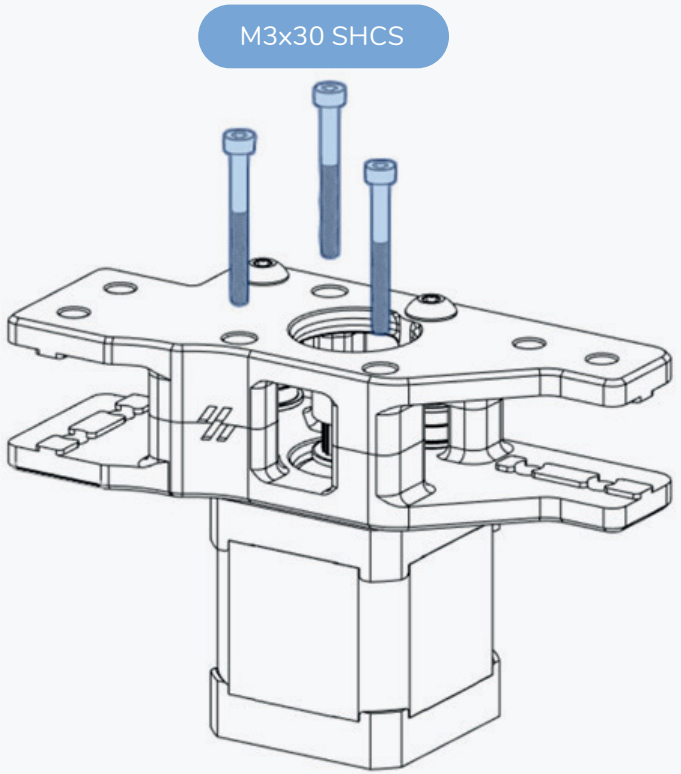


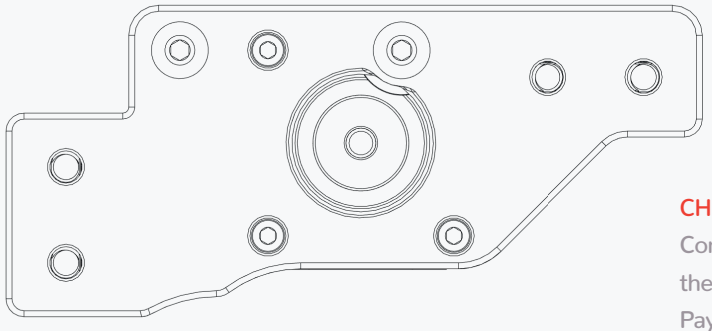
M3x30 BHCS

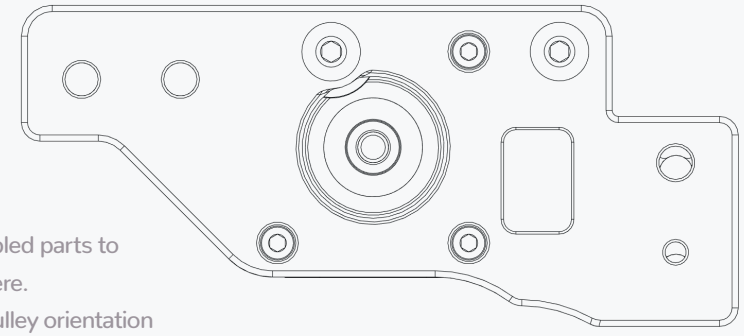






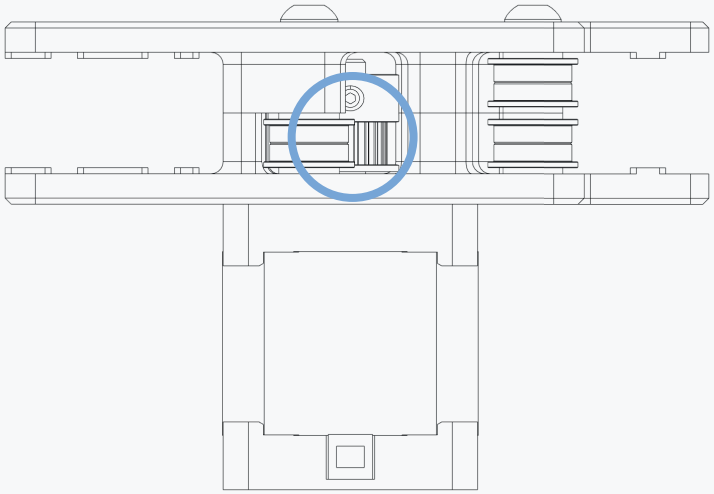


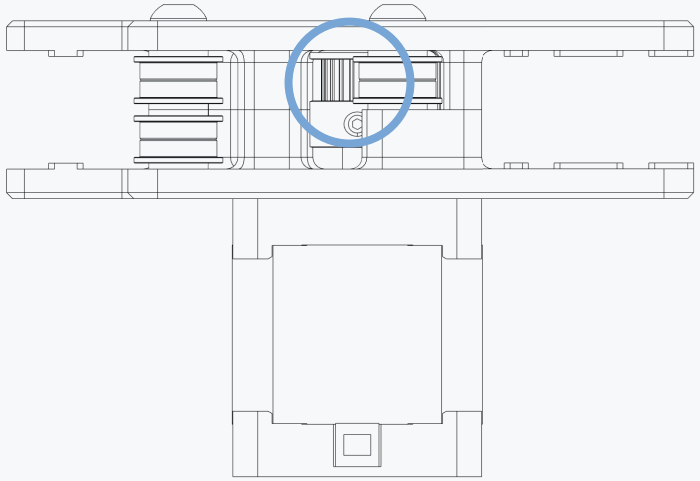




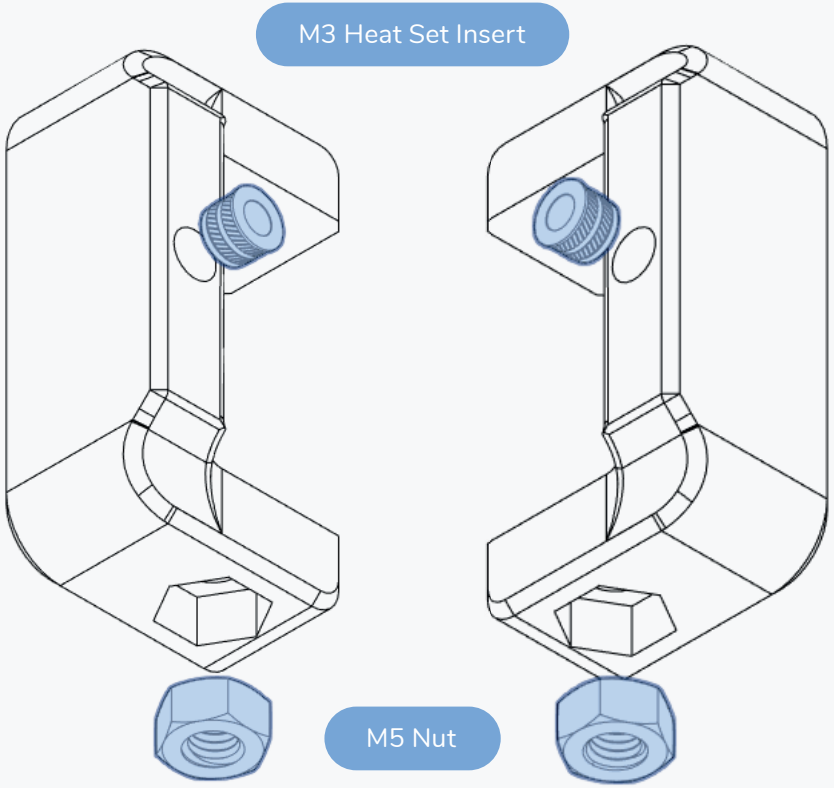
CHECK YOUR WORK

Compare your assembled parts to the graphics shown here.
Pay attention to the pulley orientation and alignment with the bearing stack ups.



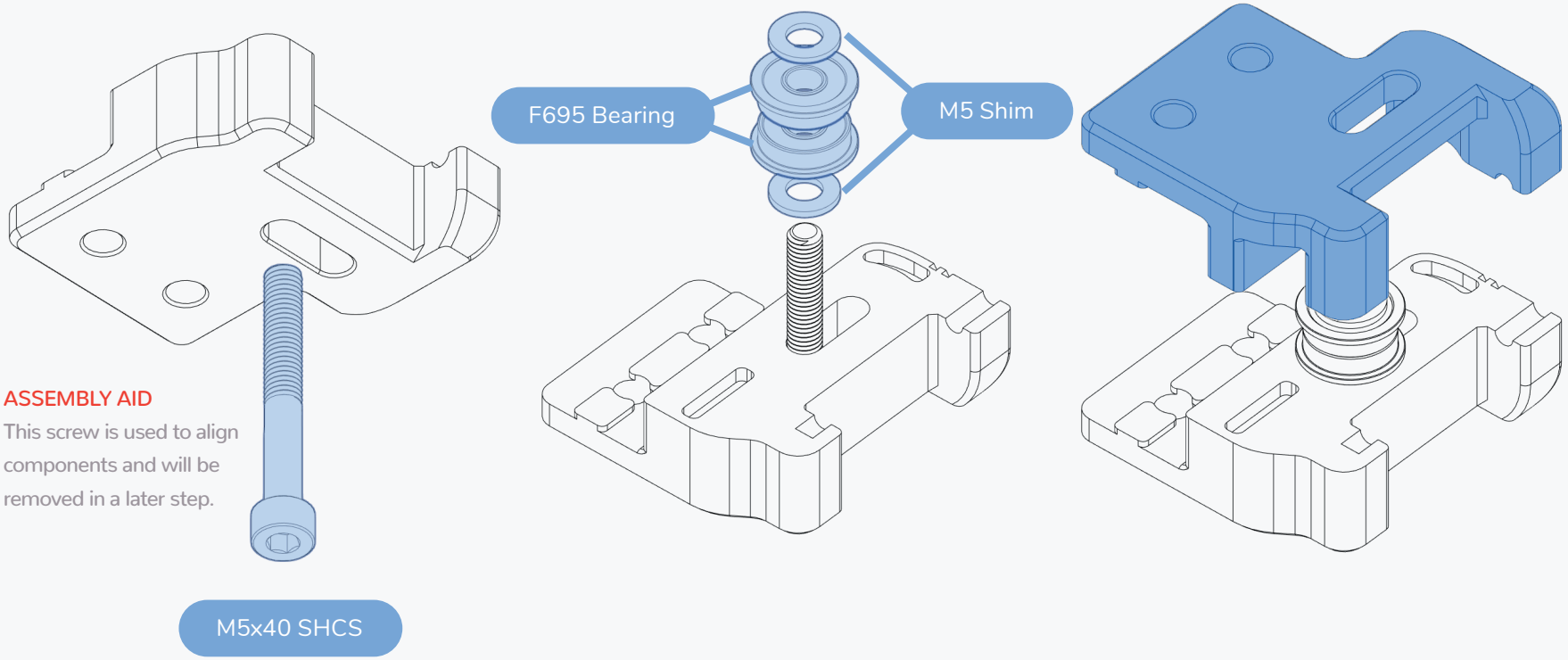


This page intentionally left blank.



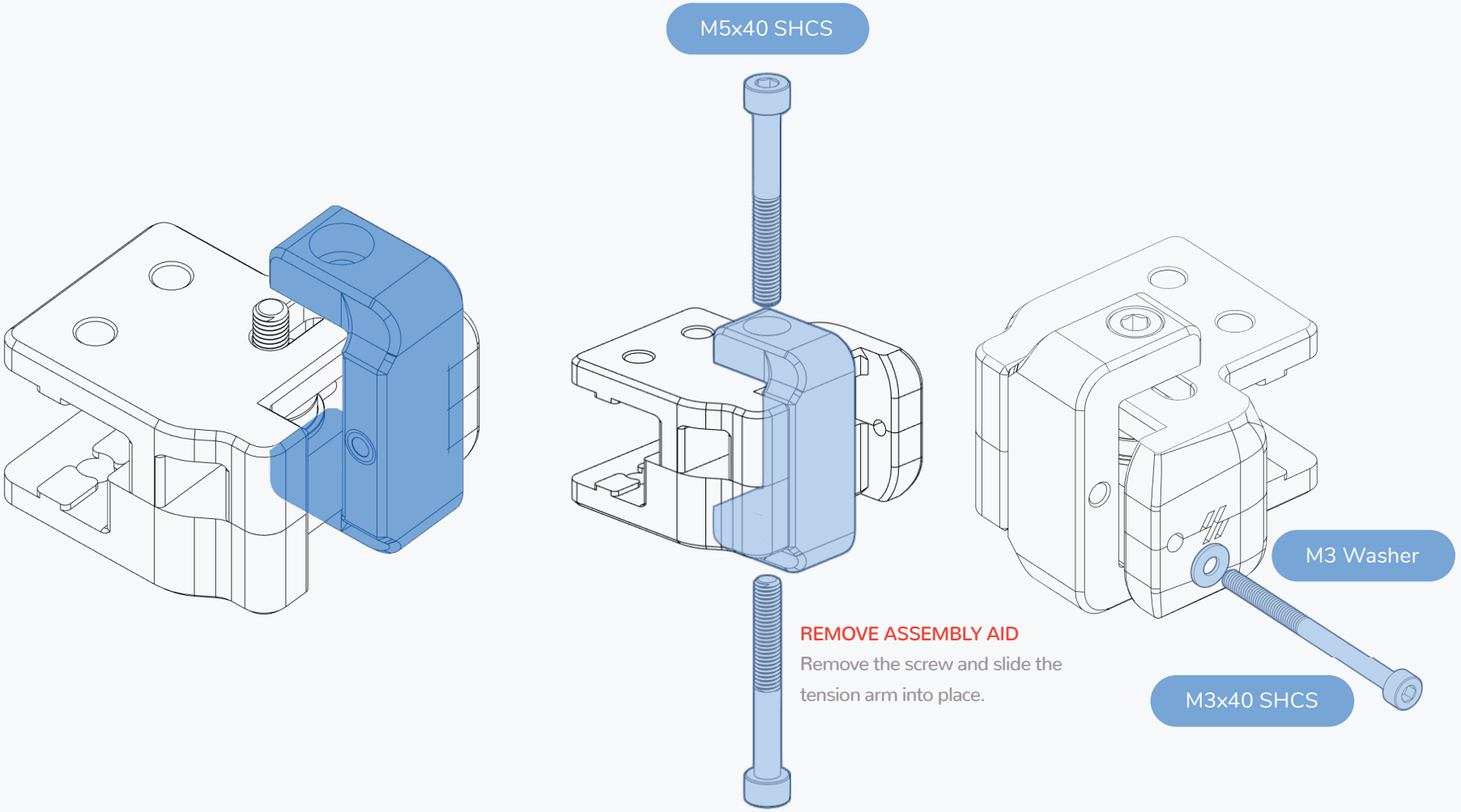
HEAT SET INSERTS

You will need to install heat set inserts into the tension arms. If you need help on the correct procedure, ask in Discord.



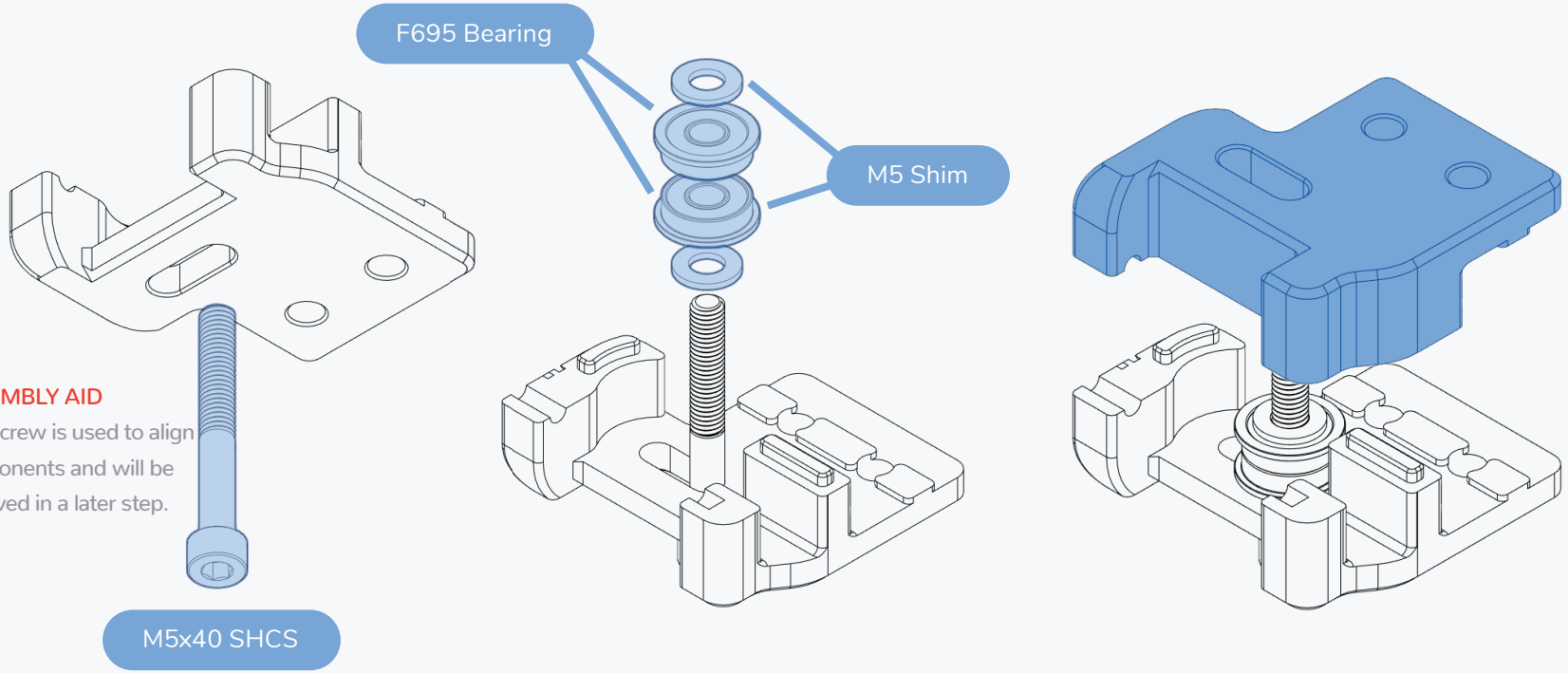
ASSEMBLY AID

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



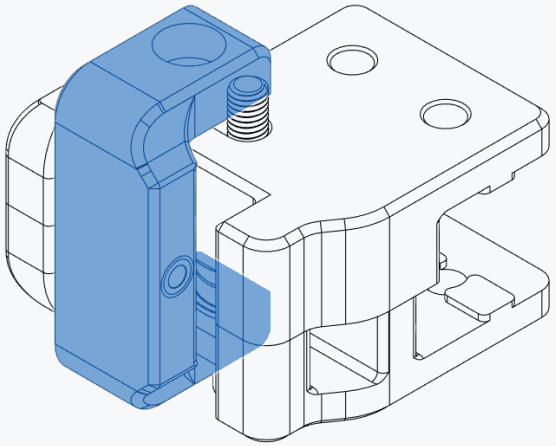
REMOVE ASSEMBLY AID

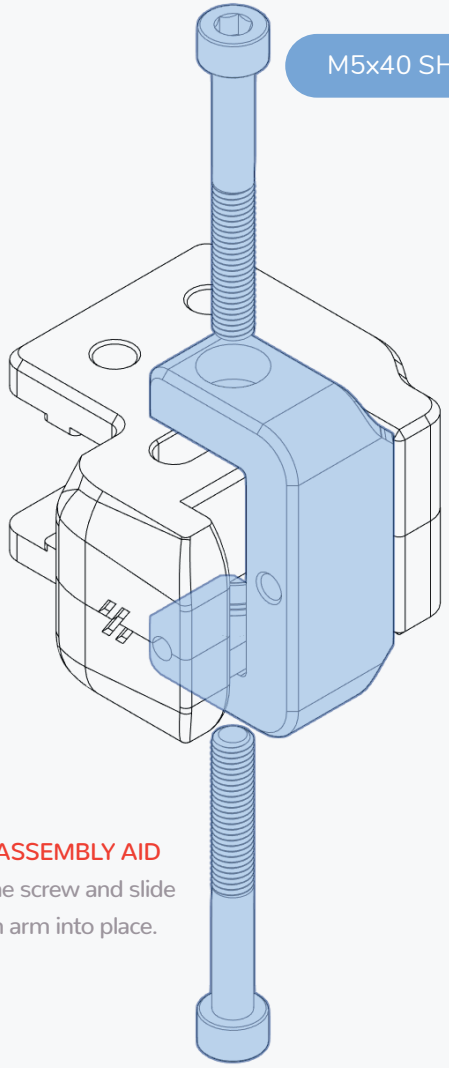
Remove the screw and slide the tension arm into place.

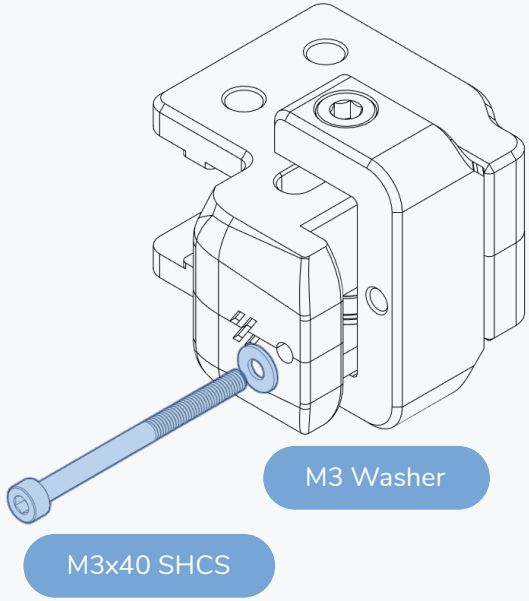


ASSEMBLY AID

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

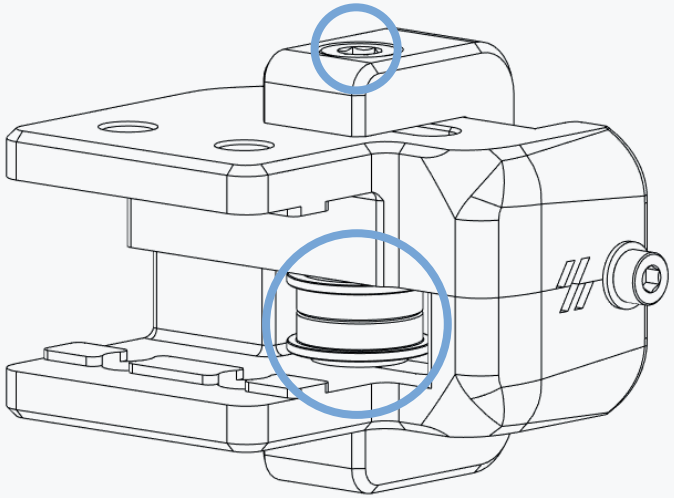


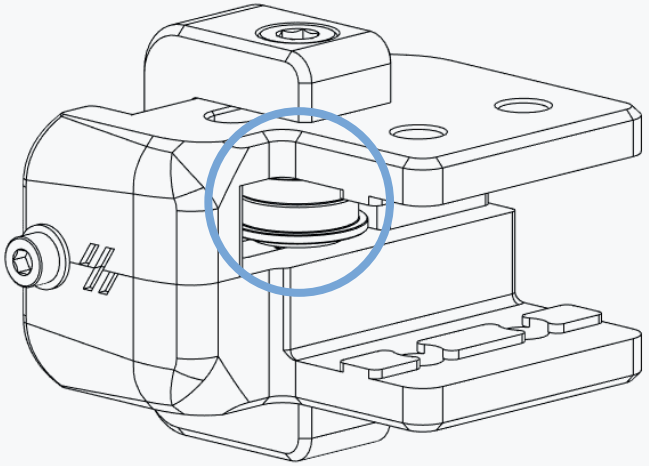




REMOVE ASSEMBLY AID

Remove the screw and slide the tension arm into place.

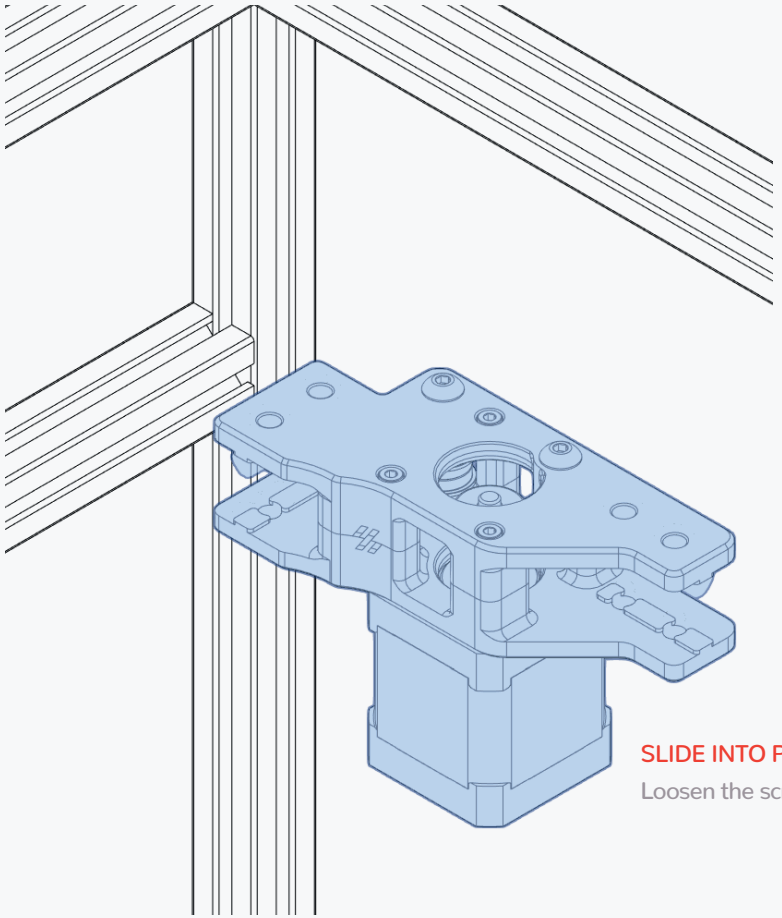


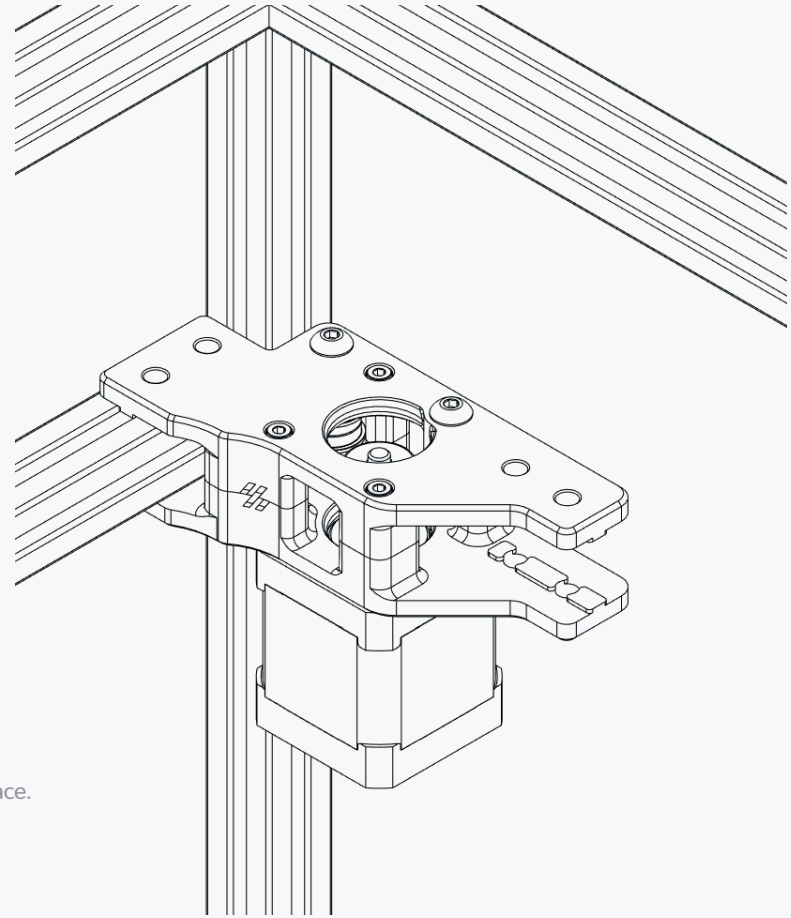


CHECK YOUR WORK

Compare your assembled parts to the graphics shown here.

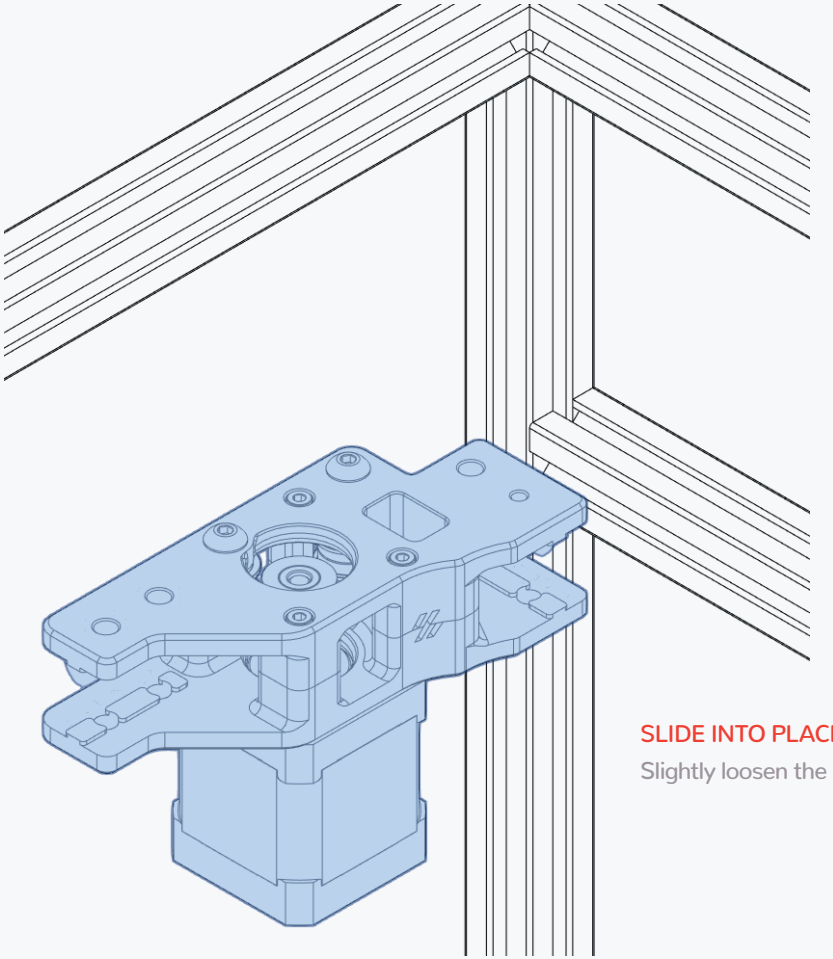
This page intentionally left blank.





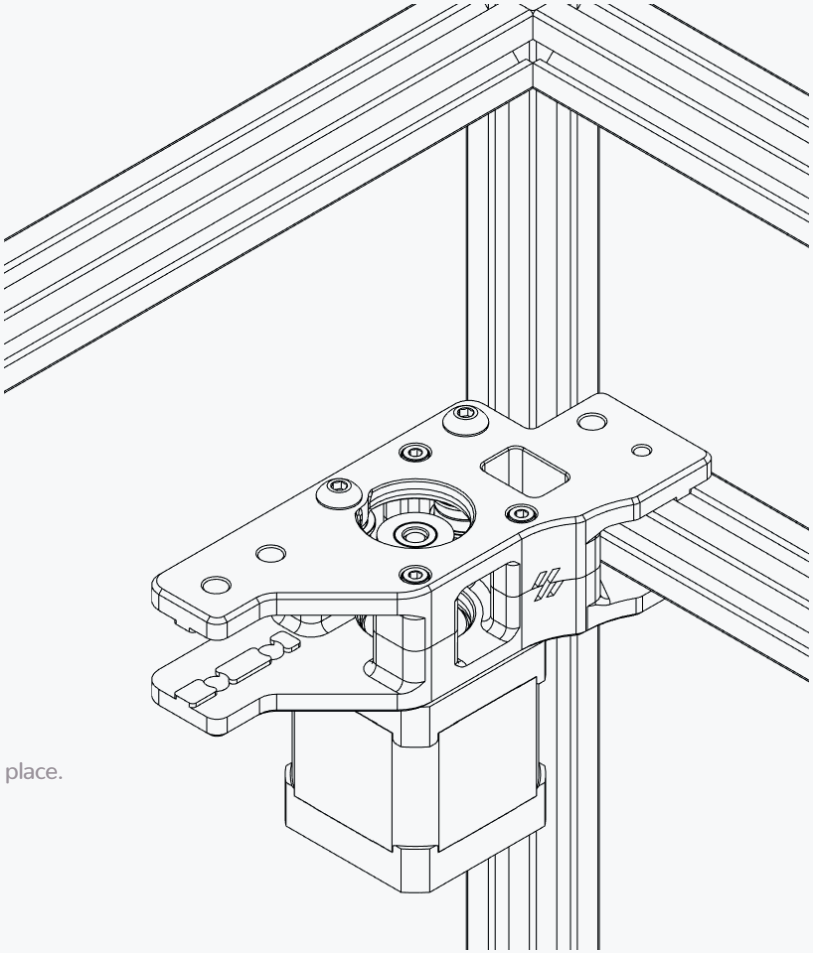
SLIDE INTO PLACE

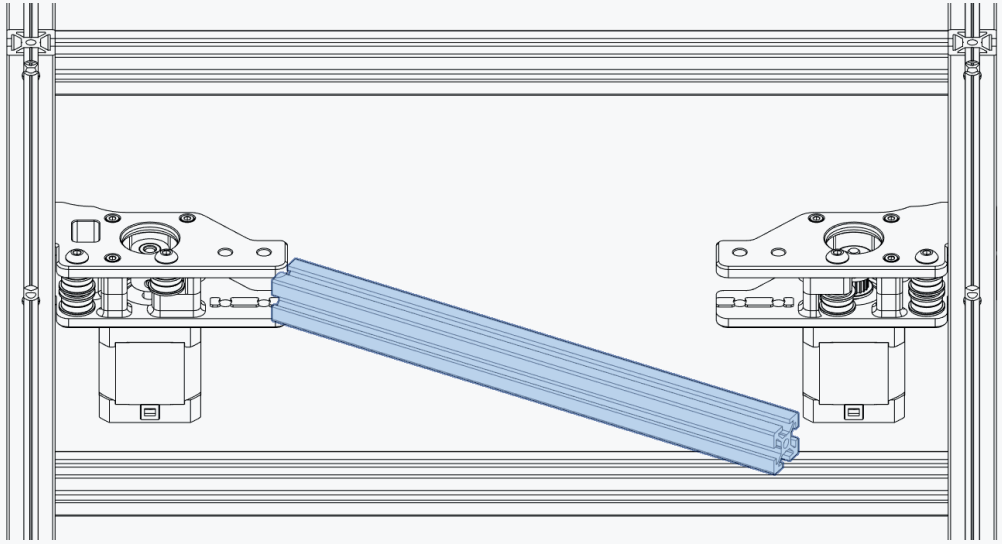
Loosen the screws and slide into place.

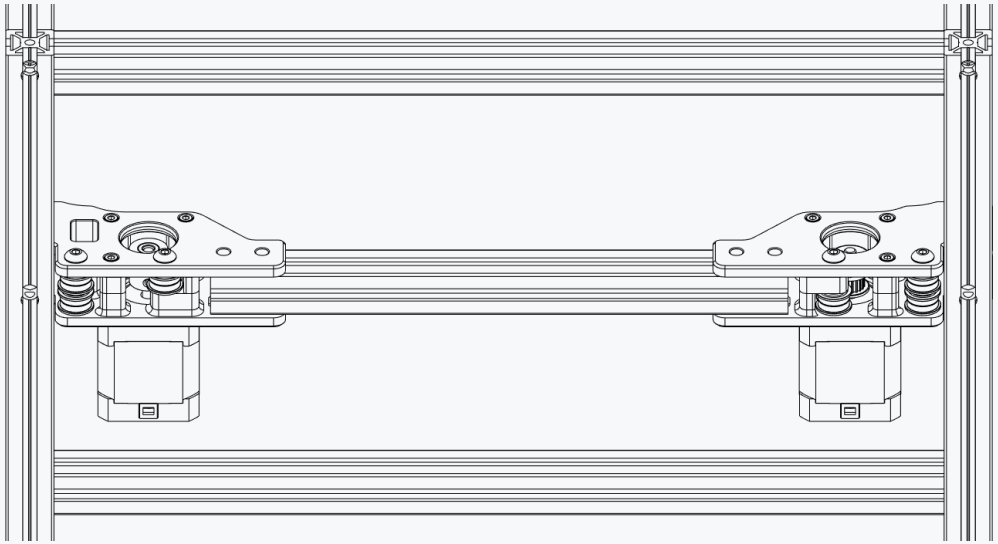


SLIDE INTO PLACE

Slightly loosen the M5 screw and slide into place.

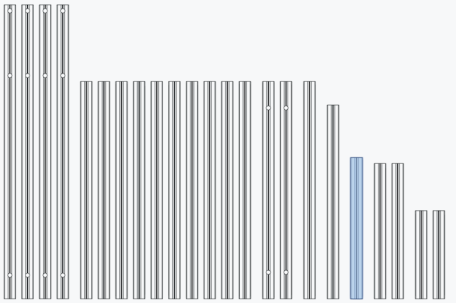


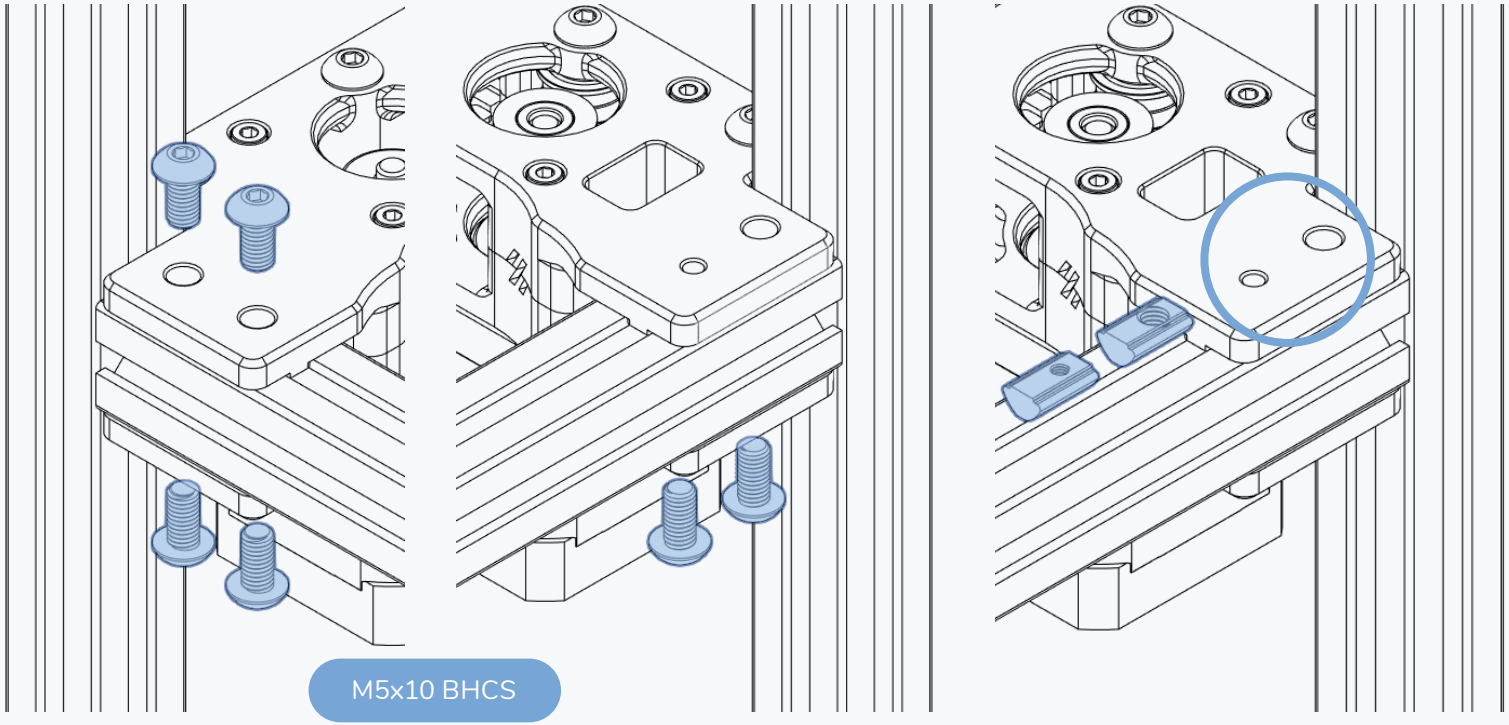




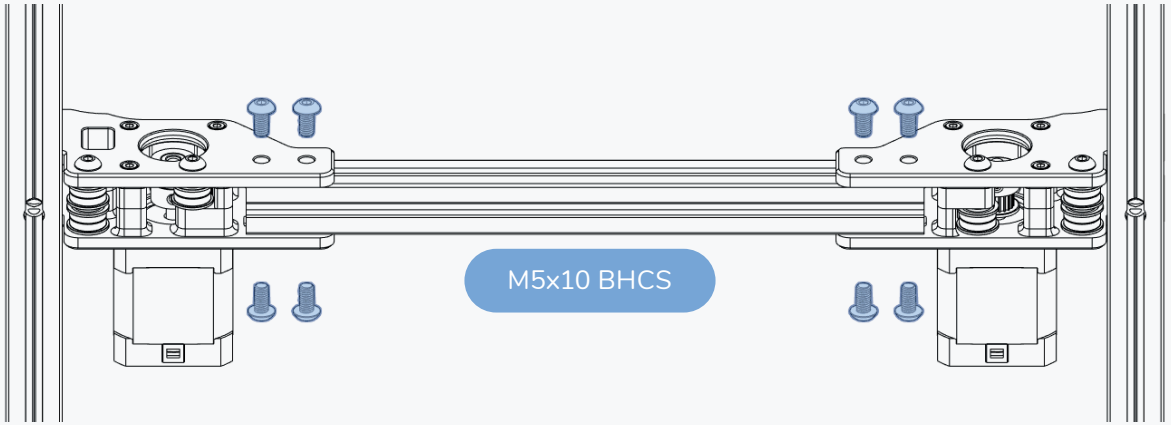
SLIDE INTO PLACE

The rear crossbar can be slid into place. You may need to loosen the M5 screws.





M5x10 BHCS



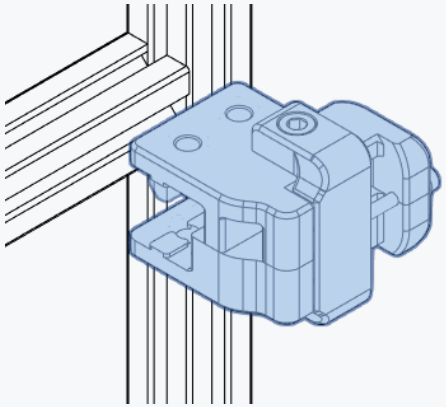
M5x10 BHCS

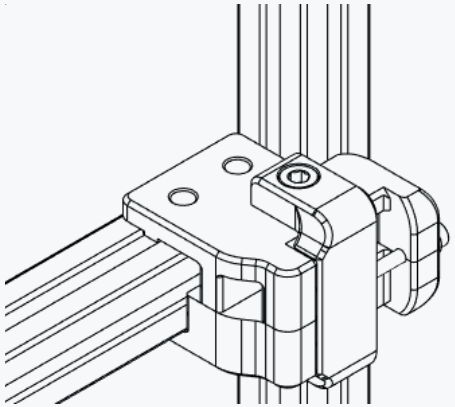
PRELOAD T NUTS

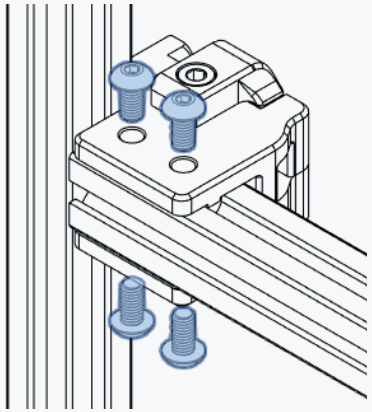
You won't be able to access this spot after the rails are installed. Preinstall and align 1 M5 T Nut and 1 M3 T Nut now.

M5 T-Nut

M3 T-Nut



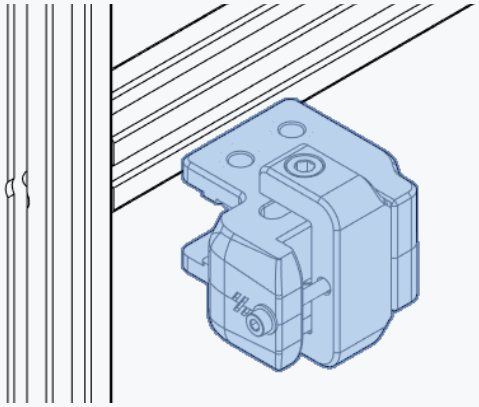


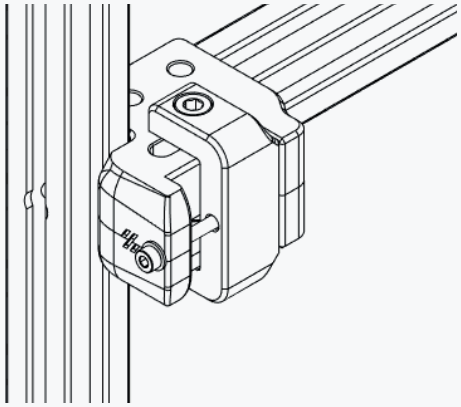


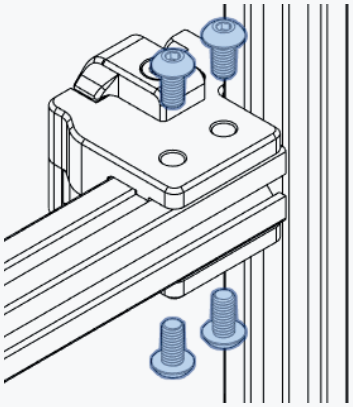
SLIDE INTO PLACE

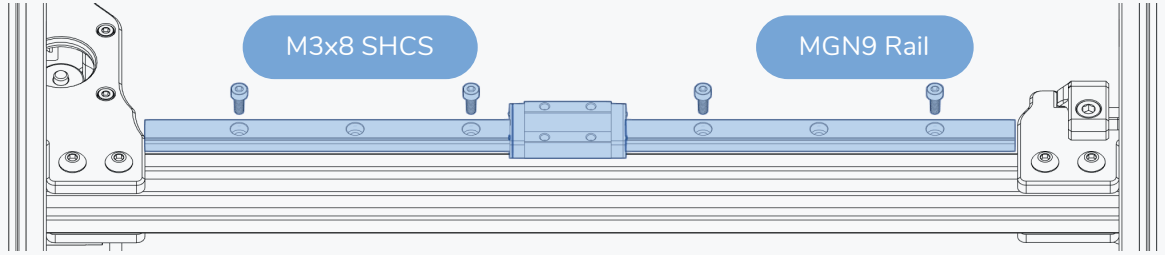
Slightly loosen the M5 screw and slide into place.

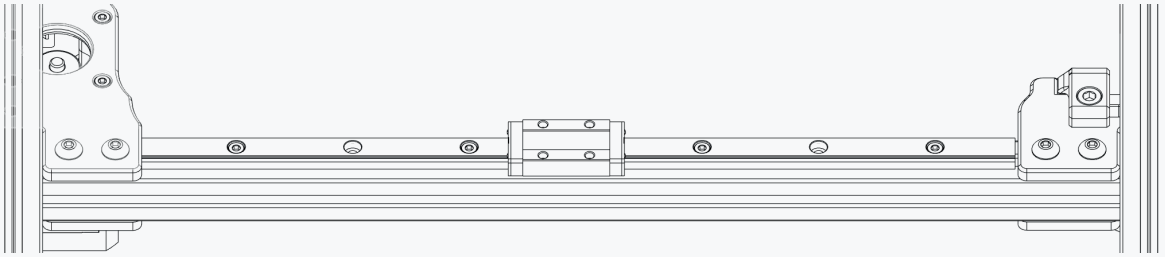
M5x10 BHCS











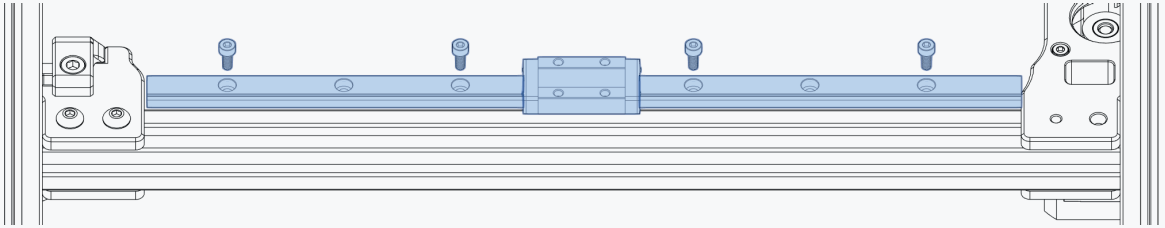
MIND THE CARRIAGE

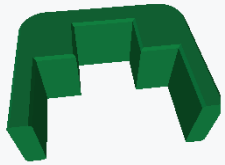
The carriages are designed to slide along the rail easily. This unfortunately also includes sliding off the rails.

Dropping the carriage likely irreparably damages it.

USE A BALL END DRIVER

The top extrusion will block access for a regular straight driver.

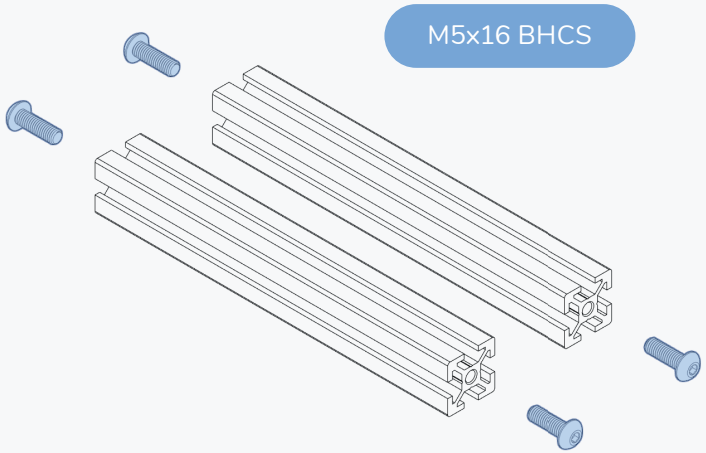


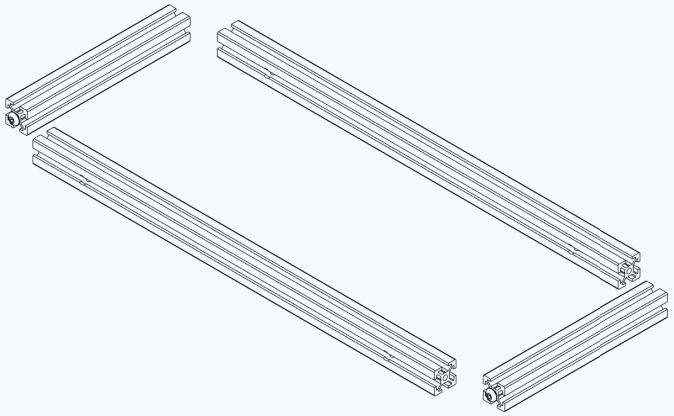


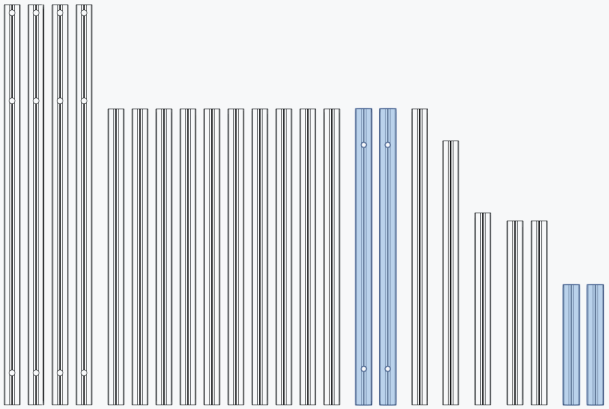
CENTERED RAIL INSTALLATION GUIDE

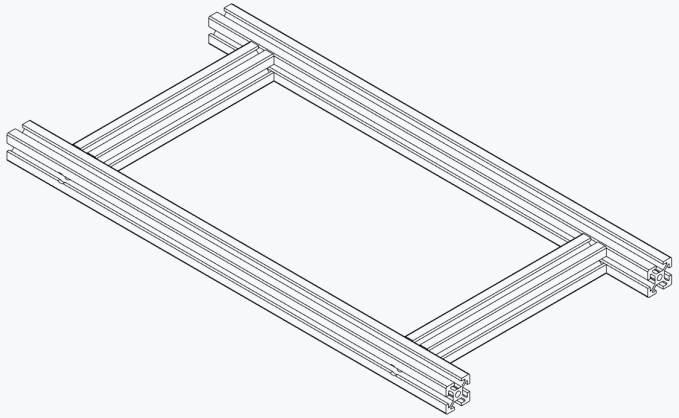
Use the guides to position the rail in the center of the extrusion prior to fastening the screws.

This page intentionally left blank.

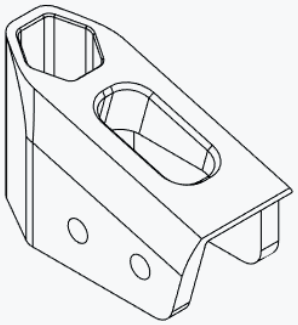






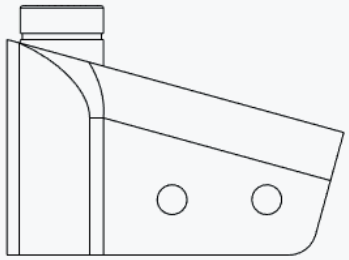


LM8LUU Bearing



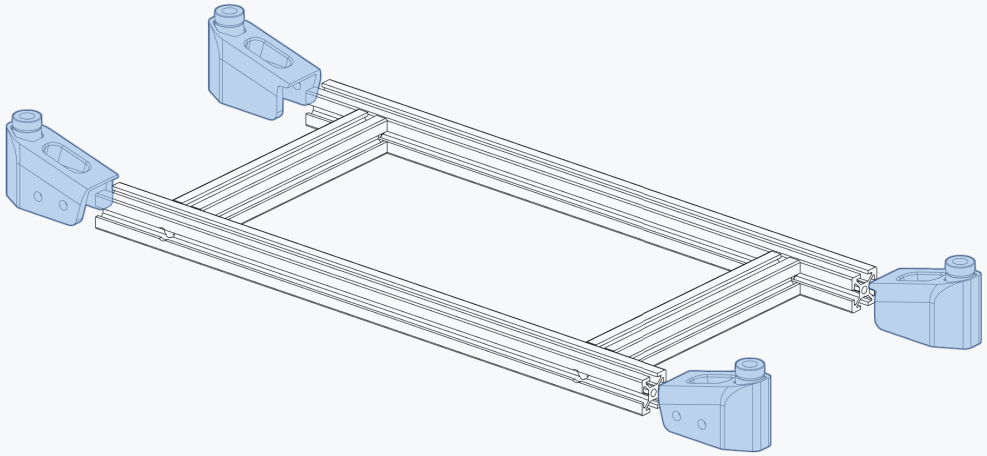
BEARING LUBRICATION

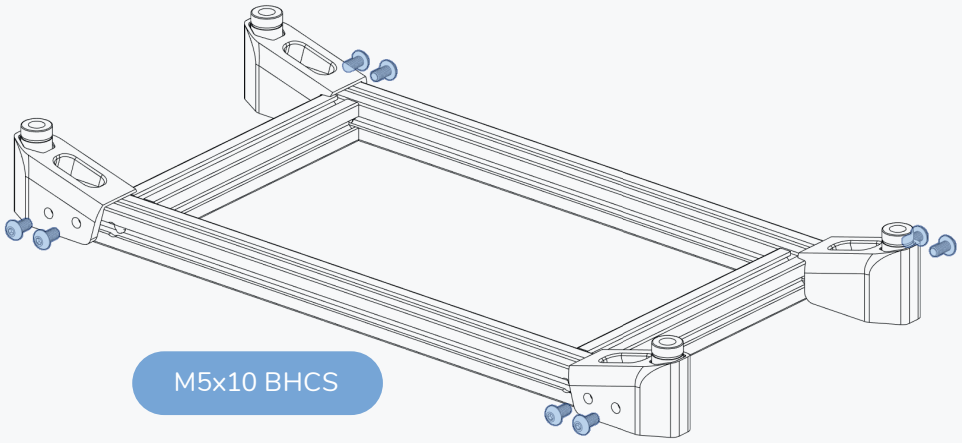
Bearings are usually shipped in a rust prevention oil . Clean and properly lubricate prior to installation.



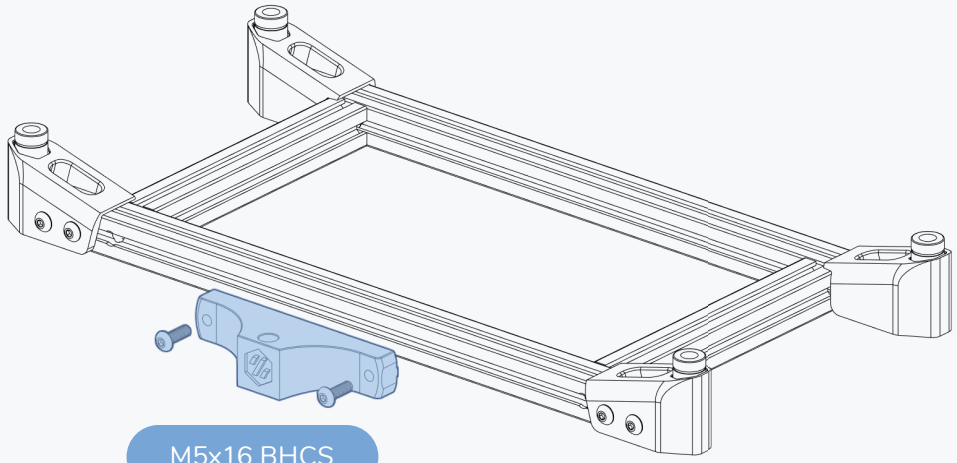
FLUSH WITH BOTTOM

Insert the bearing all the way until it sits flush with the bottom of the part.





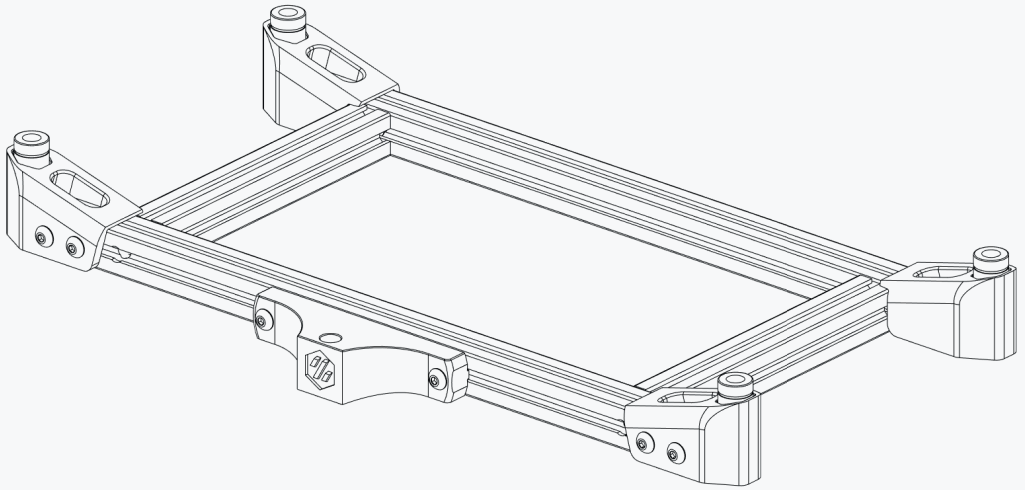
M5x10 BHCS



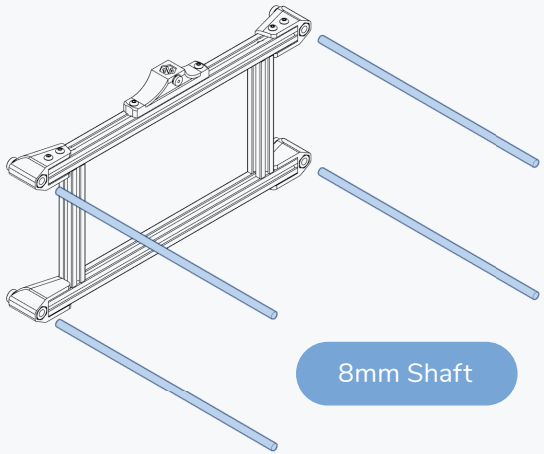
M5x16 BHCS

CHECK YOUR WORK

Compare your assembled parts to the graphics shown here.

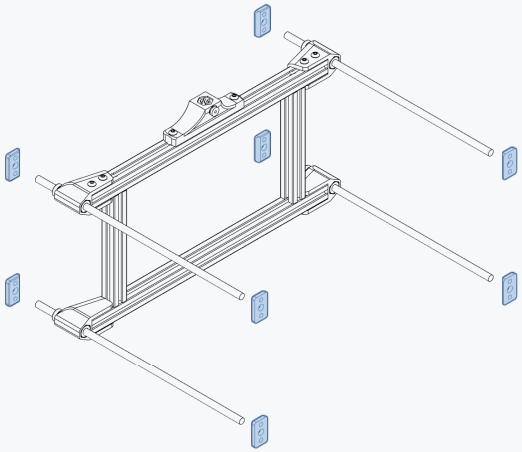


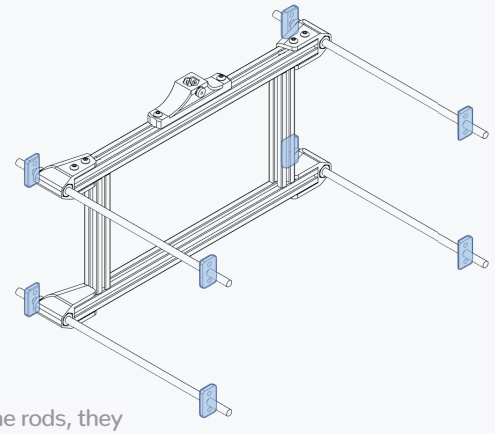
This page intentionally left blank.



APPLY LUBRICATION

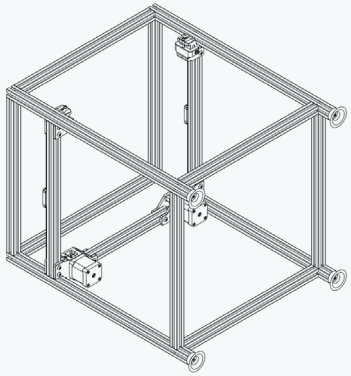
A thin layer of lubrication will prevent rust.





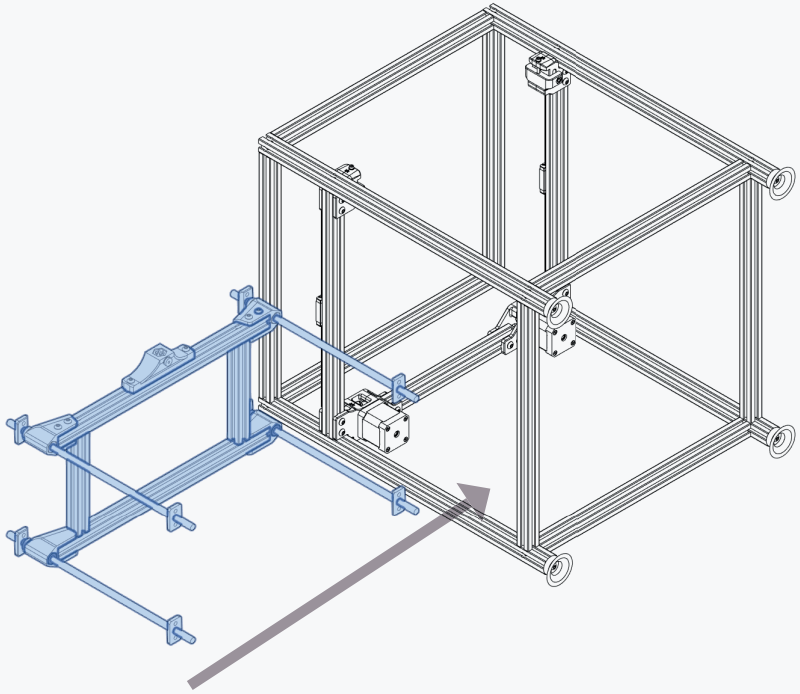
IMPROVISED STOPS

Push the brackets onto the rods, they will prevent the rods from slipping out.



FLIP PRINTER BACKWARDS

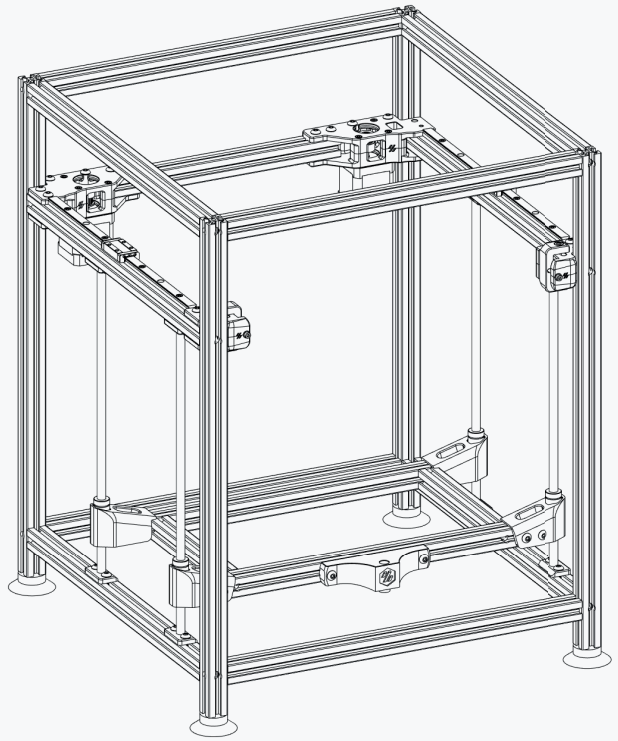
Flip the printer on it's back if you're having trouble installing the Z stage installed



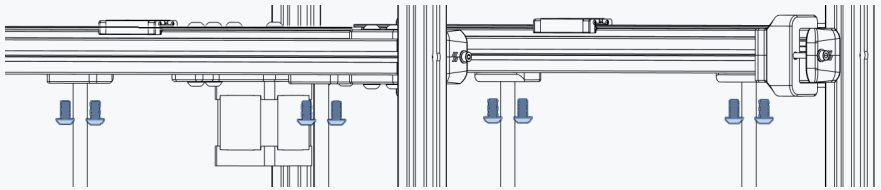
INSERT FROM THE SIDE

Insert the Z stage at an angle to position all rods close to their final place.

If required loosen the bottom extrusion.
Do not loosen the middle or top extrusions.



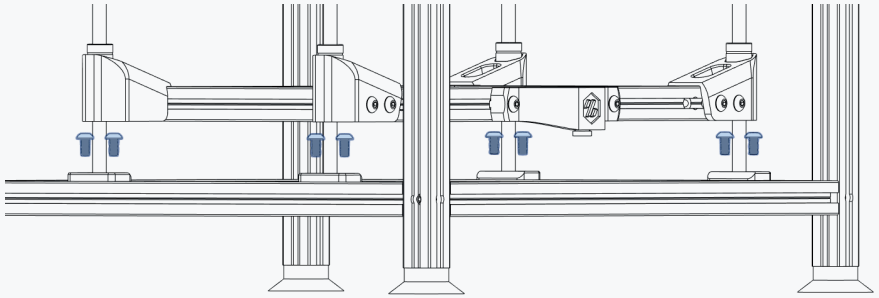
FLIP PRINTER UPRIGHT

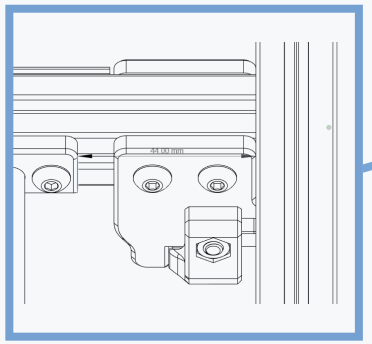


M5x10 BHCS

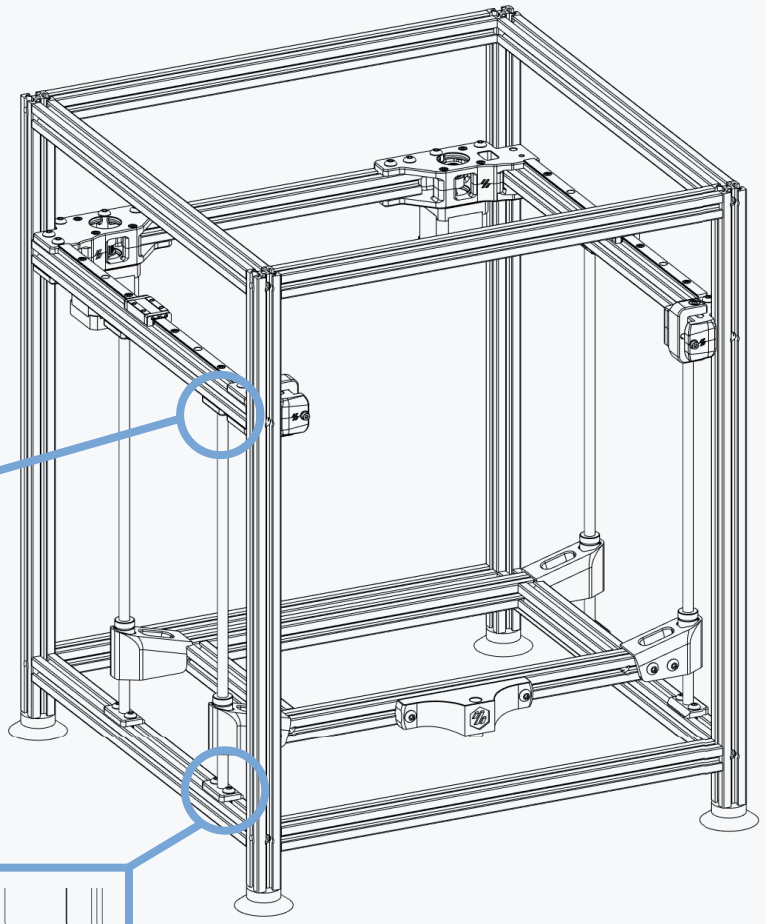
DON'T TIGHTEN

Leave the screws slightly loose for the next step.





44mm distance to front extrusion



44mm distance to front extrusion

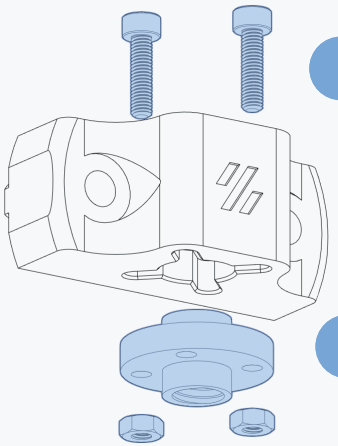
ALIGNING THE Z RODS

Position the plastic brackets as shown on the left (44mm from the front extrusion) and fasten the screws for that rod.

Repeat for the front right rod.

Move the bed carrier up and down to bring the other rods into position. Fasten their screws.

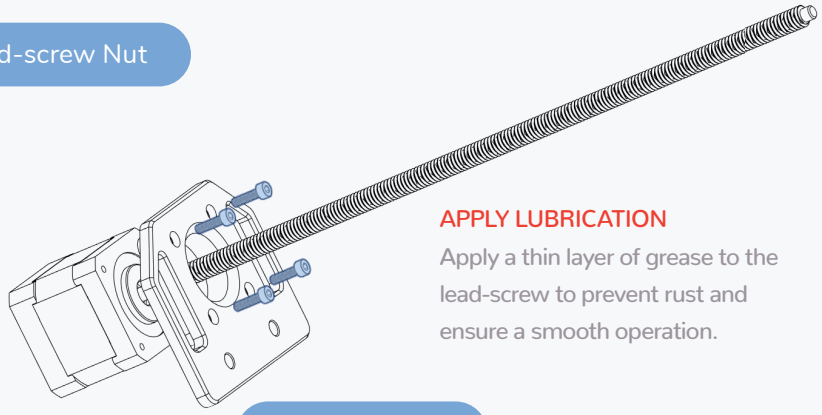
Tweak the position of the rods until the axis moves freely without any binding.



M3x12 SHCS

Lead-screw Nut

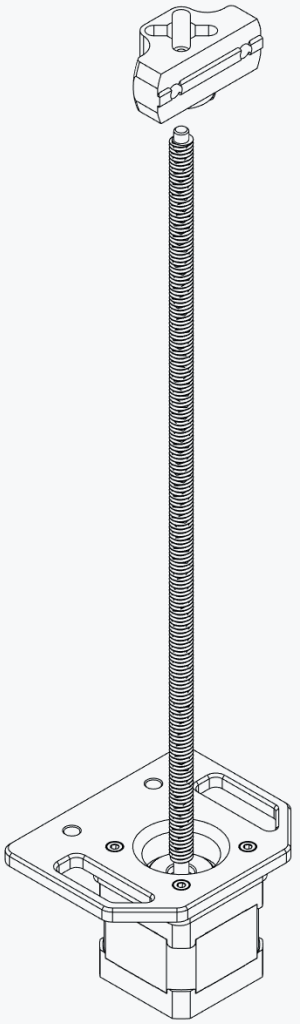
M3 Nut

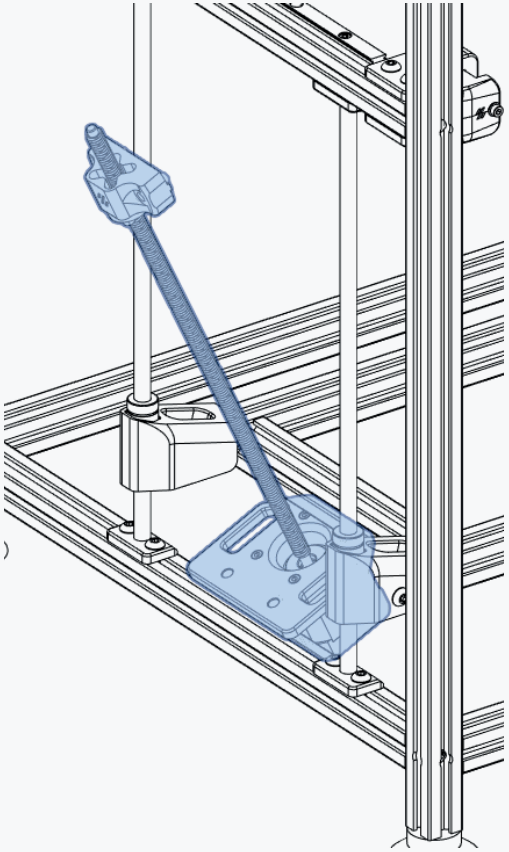


M3x12 SHCS

APPLY LUBRICATION

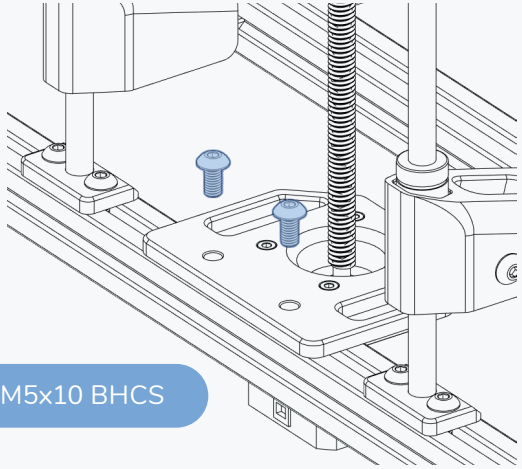
Apply a thin layer of grease to the lead-screw to prevent rust and ensure a smooth operation.





SWING INTO PLACE

Insert one of the Z motors on an angle and secure it to the extrusions.



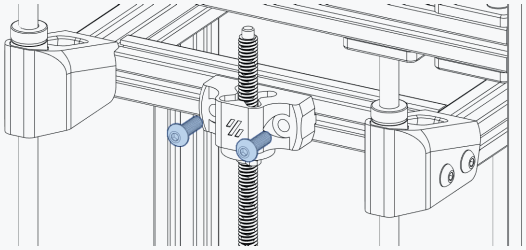
M5x10 BHCS

REPEAT FOR SECOND MOTOR

Repeat the install steps for the second Z motor.

LEAD-SCREW BLOCK

Lift the bed carrier and fasten the lead-screw block to it.

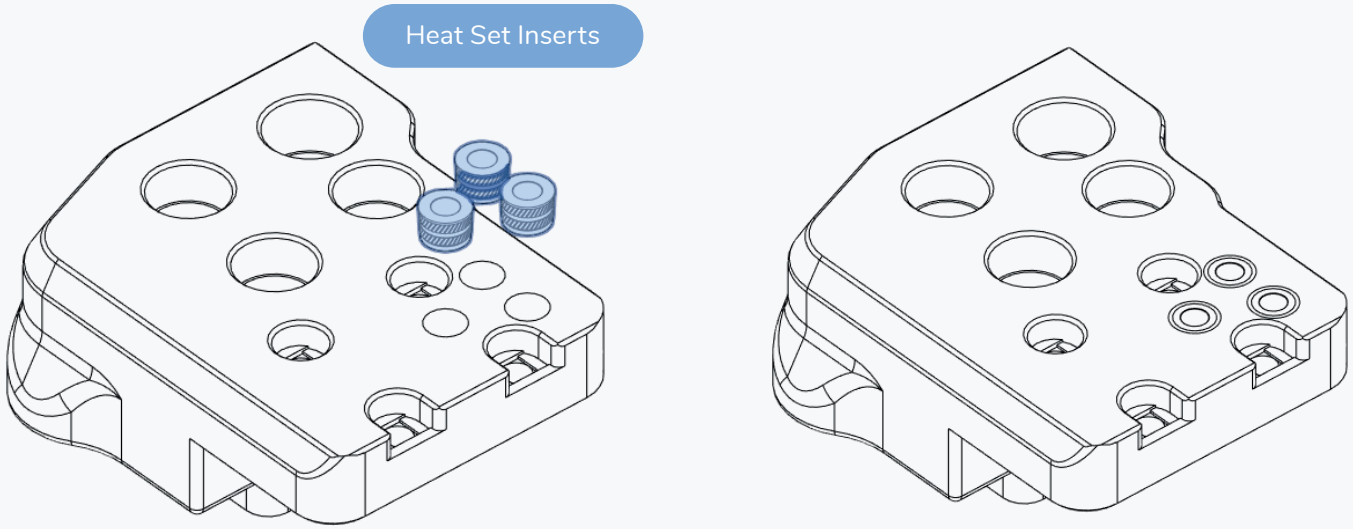


M5x16 BHCS

ALIGNMENT

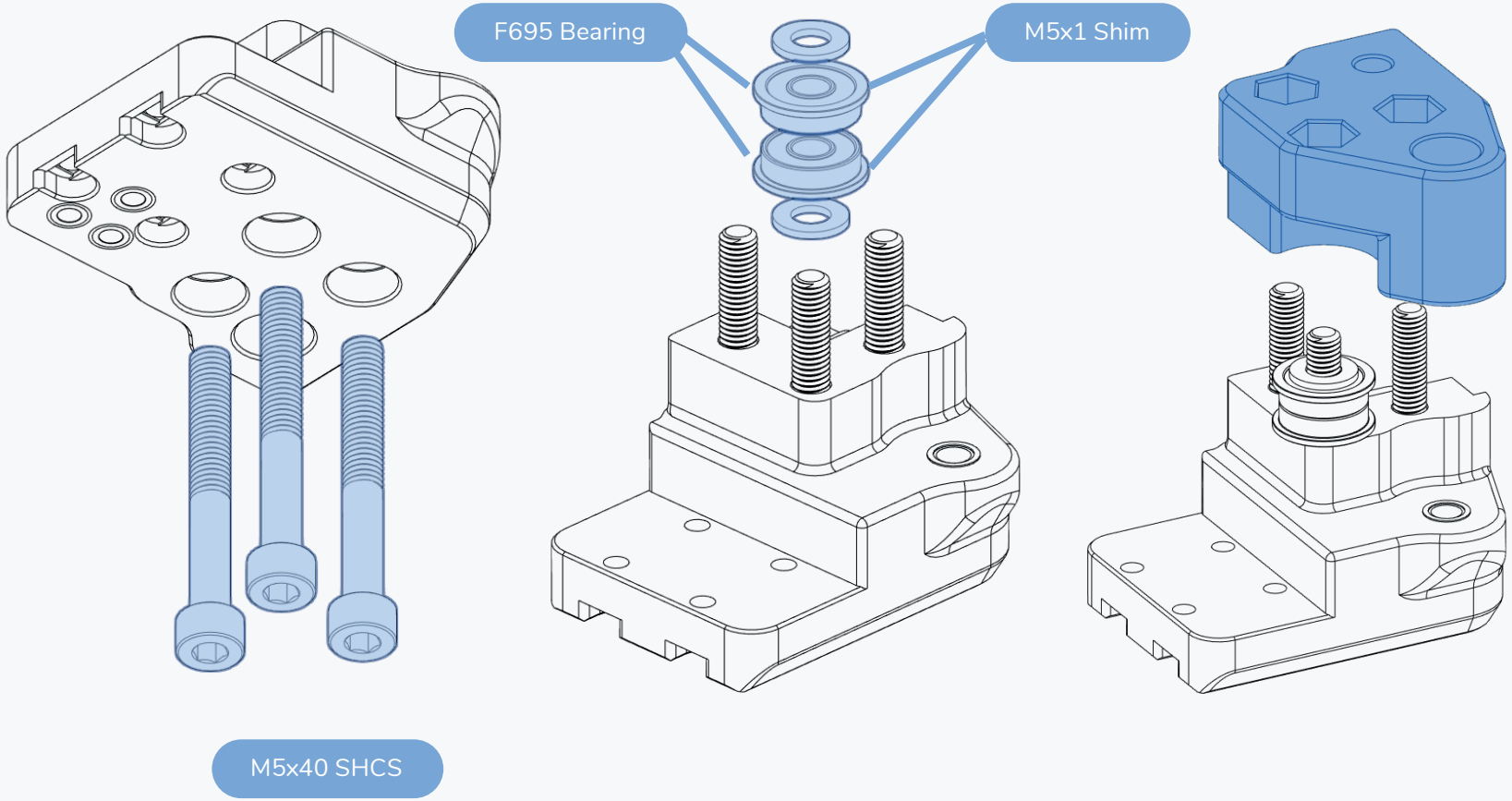
Position the lead-screw block in the center of the extrusion.
Adjust the position of the motor mount until the lead-screw is perpendicular.

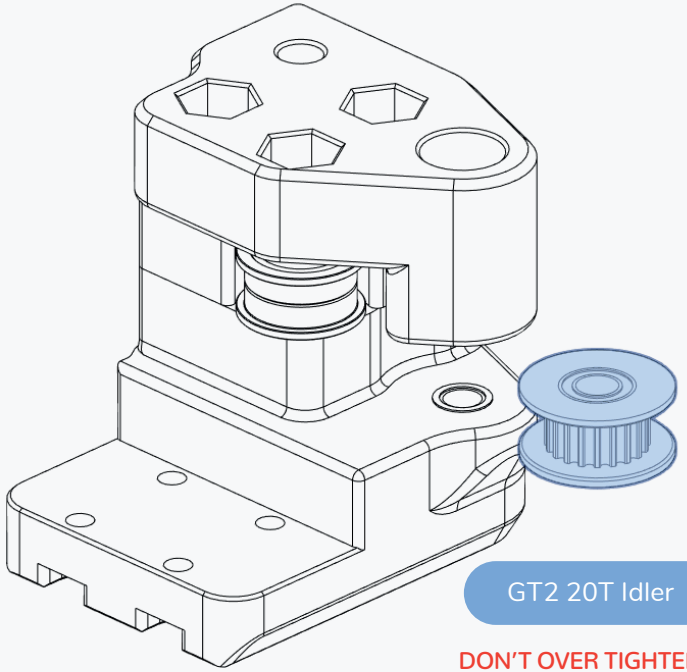
This page intentionally left blank.



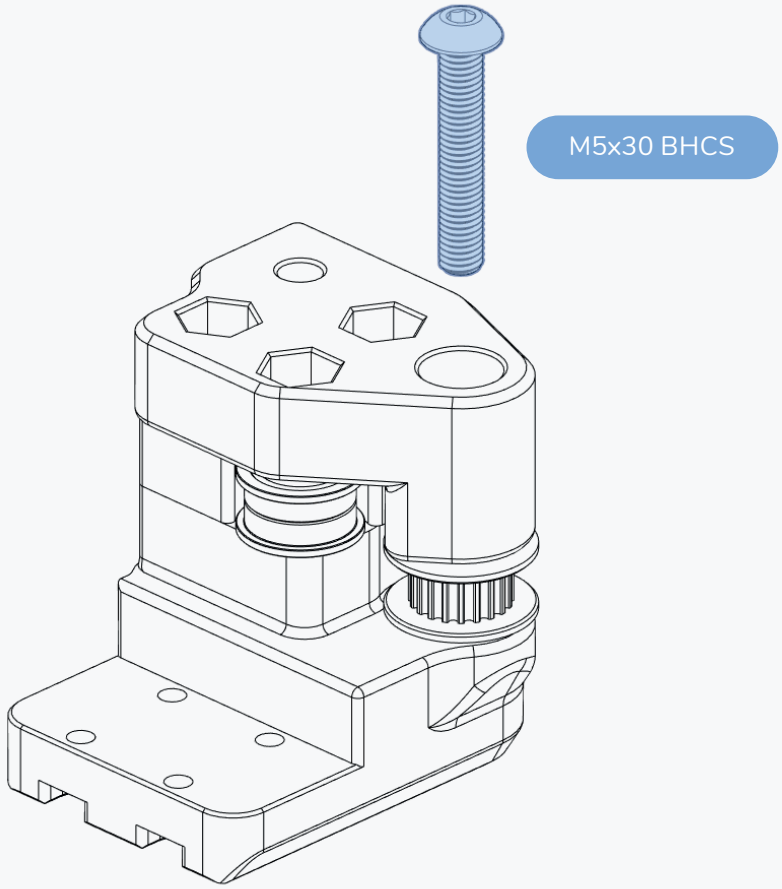
HEAT SET INSERTS

You will need to install heat set inserts into the XY joint.
If you need help on the correct procedure, ask in Discord.





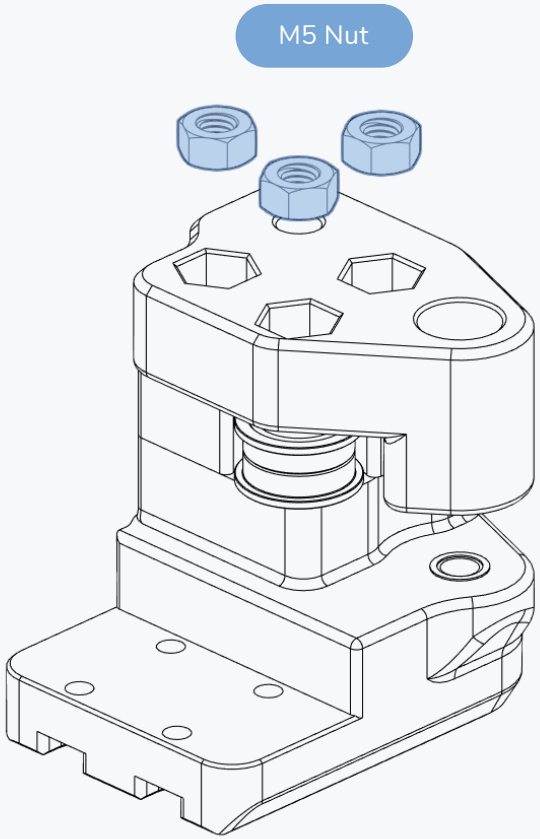
GT2 20T Idler

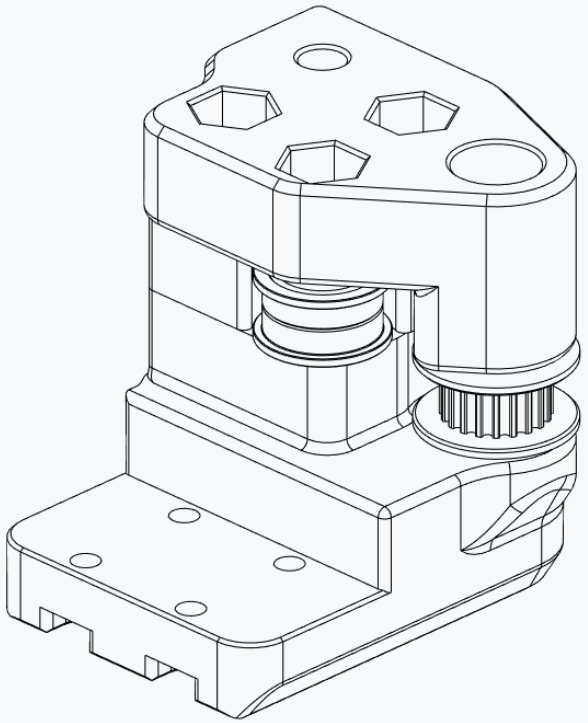


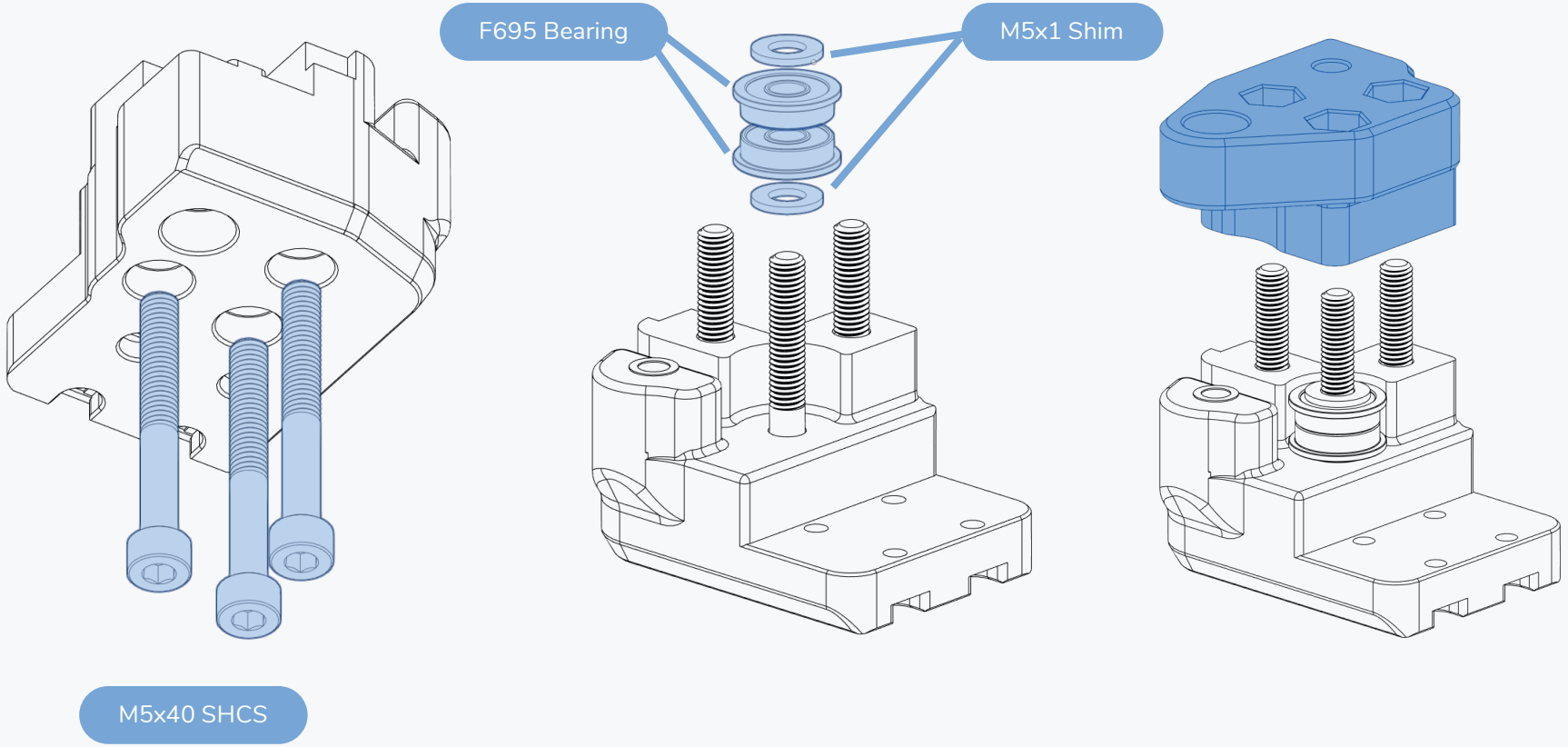
M5x30 BHCS

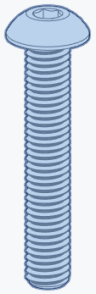
DON'T OVER TIGHTEN

The screw is used to position the idler and is screwed directly into plastic.
The idler must spin freely.

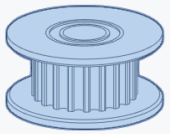




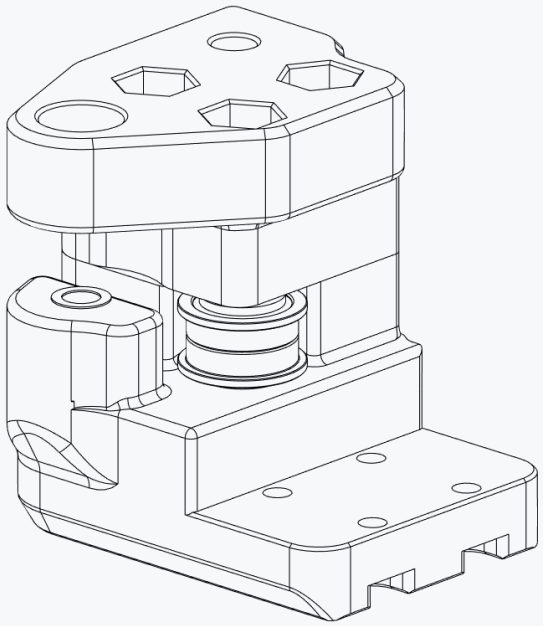


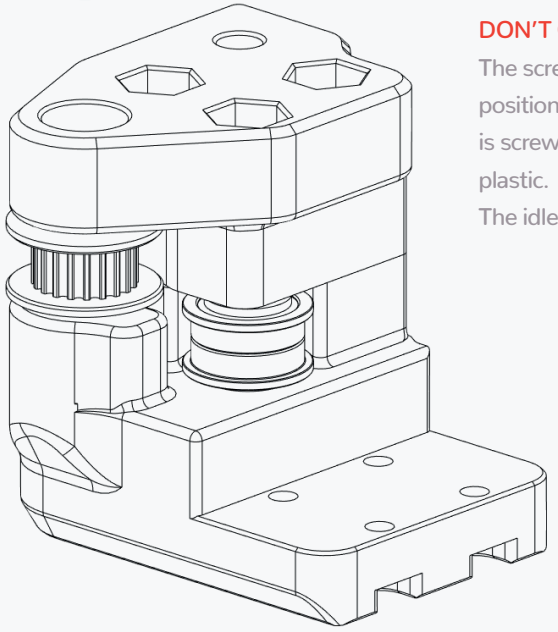


M5x30 BHCS



GT 20T Idler

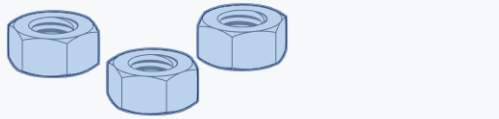


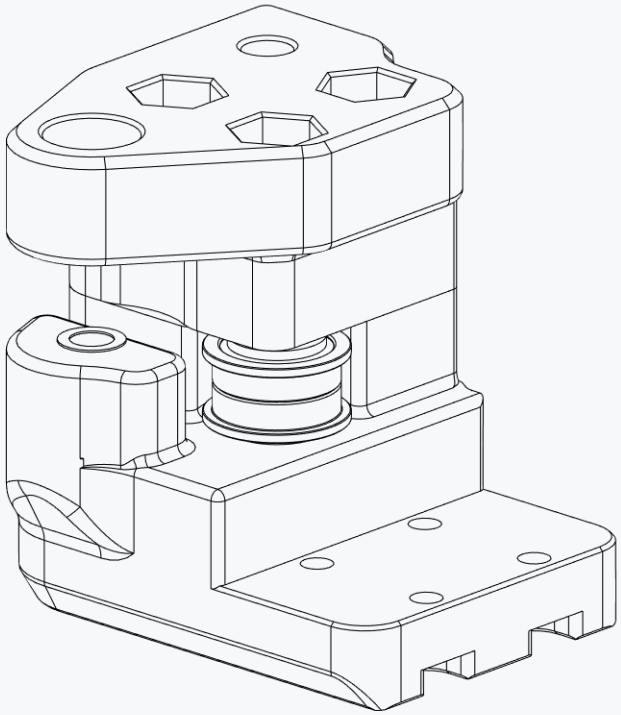


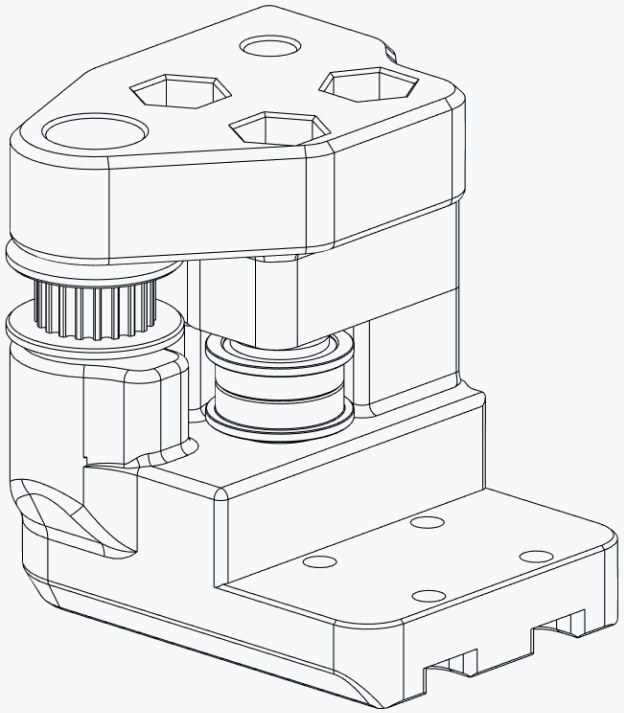
DON'T OVER TIGHTEN

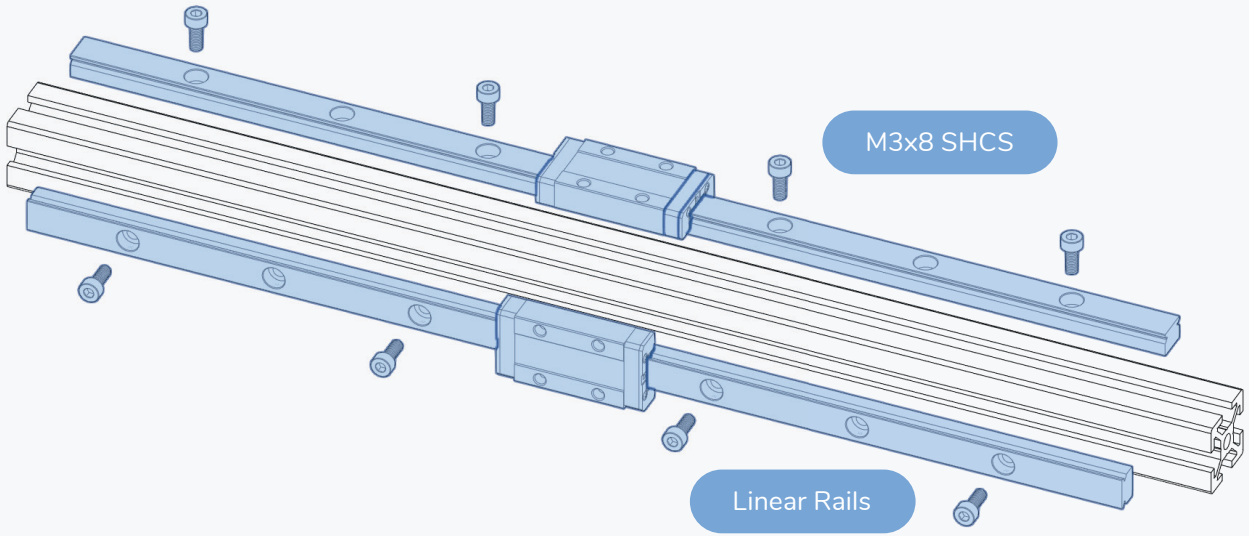
The screw is used to position the idler and is screwed directly into plastic.
The idler must spin freely.

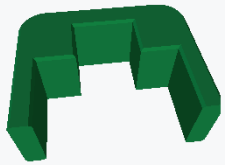
M5 Nut









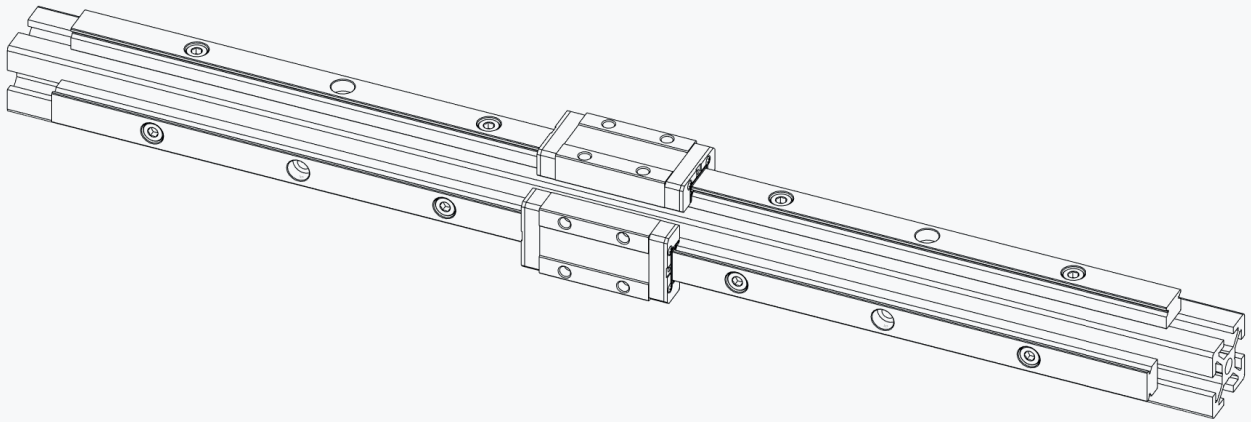


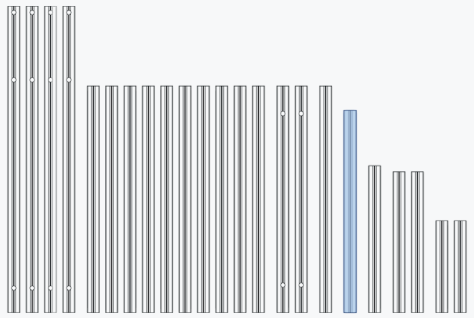
CENTERED RAIL INSTALLATION GUIDE

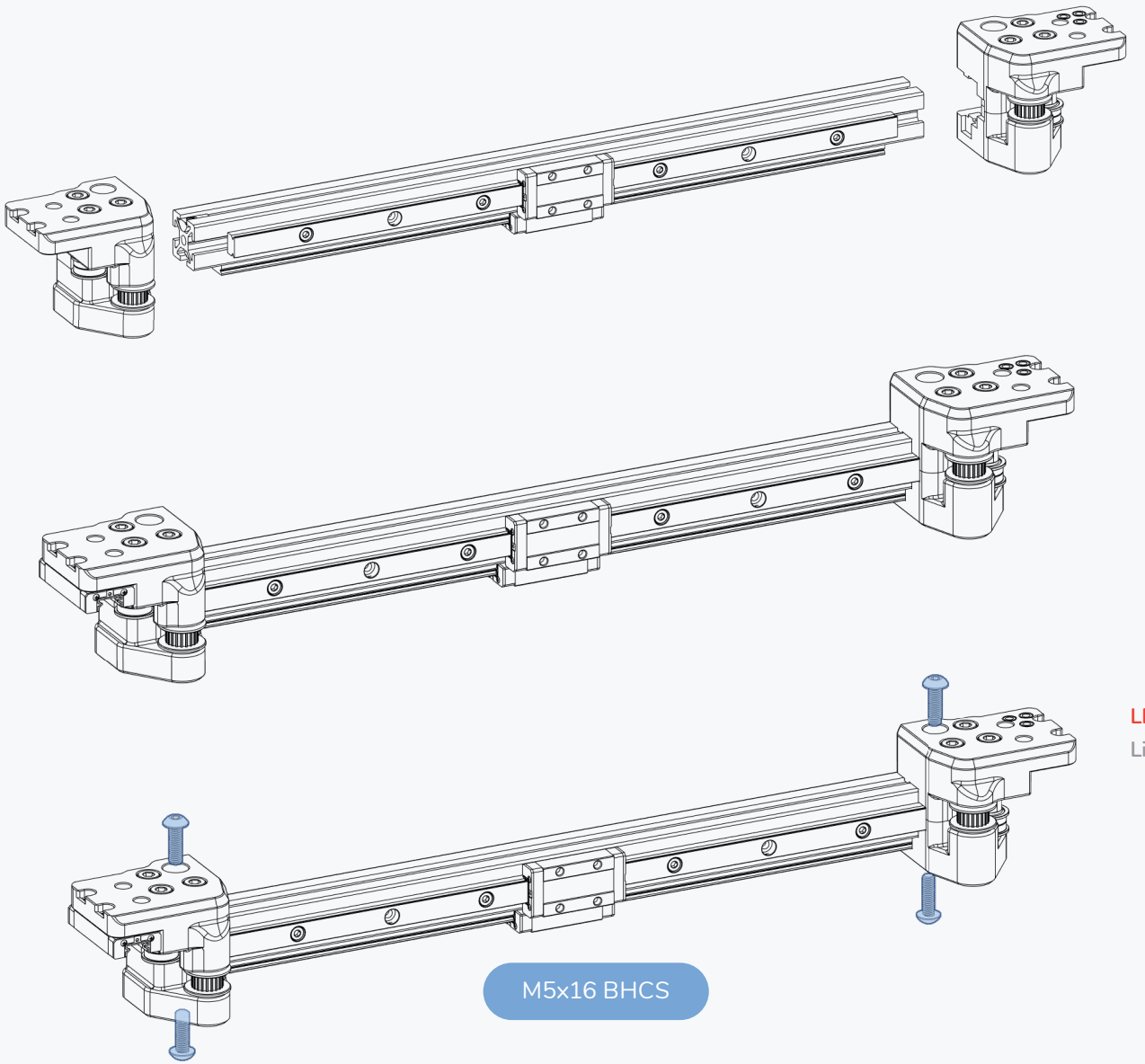
Use the guides to position the top rail in the center of the extrusion prior to lightly fastening the screws. This rail will become the forward facing rail.

Loosely position the other rail and lightly fasten the screws.

Rails will be aligned in a later step.

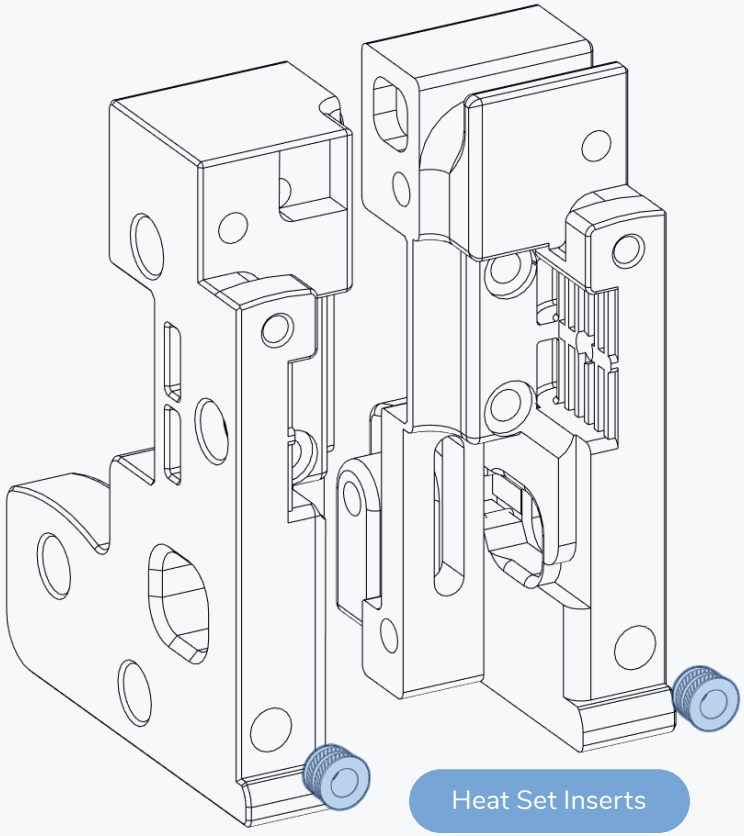


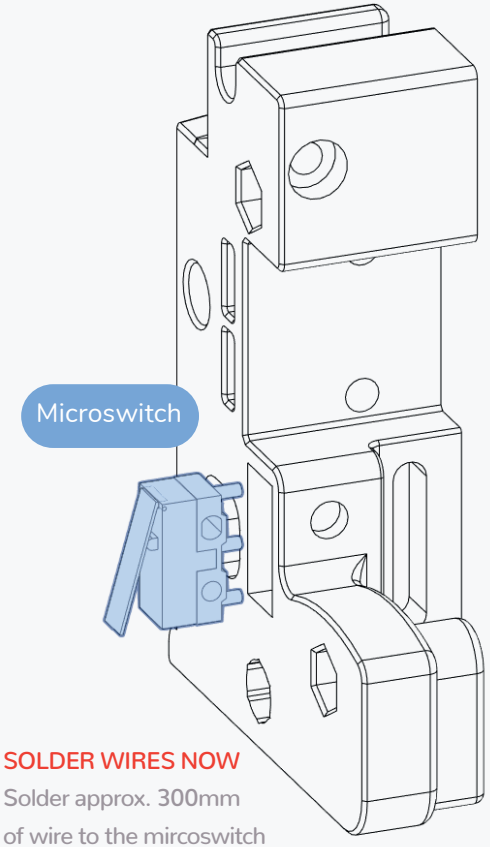




LEAVE LOOSE

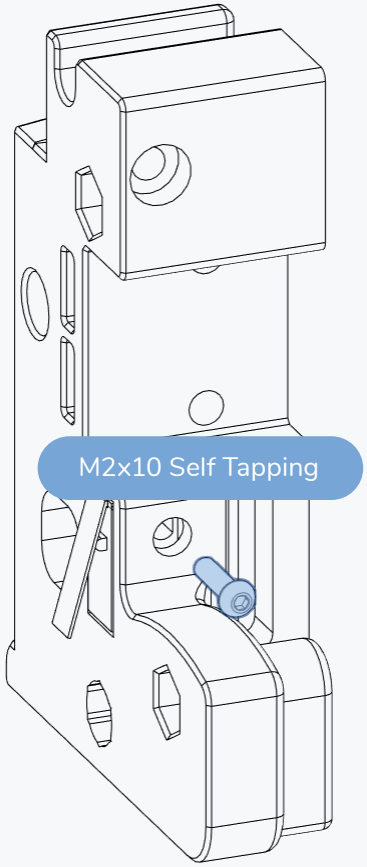
Lightly tighten the screws.

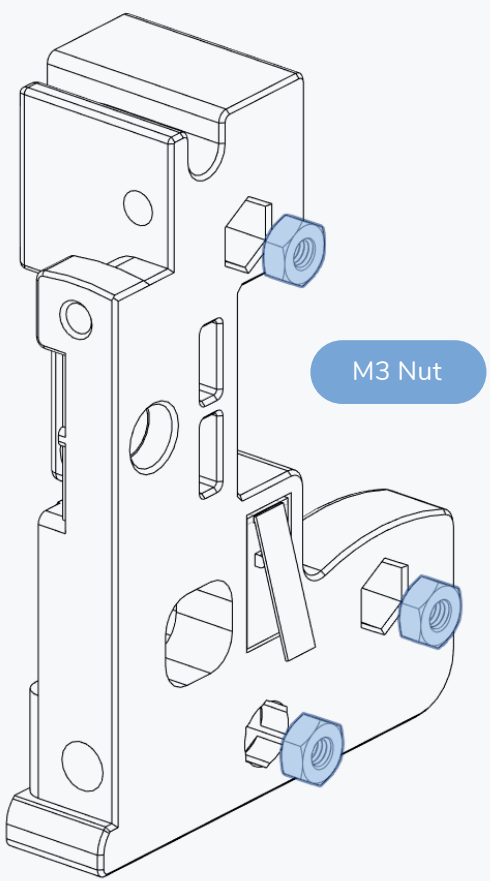


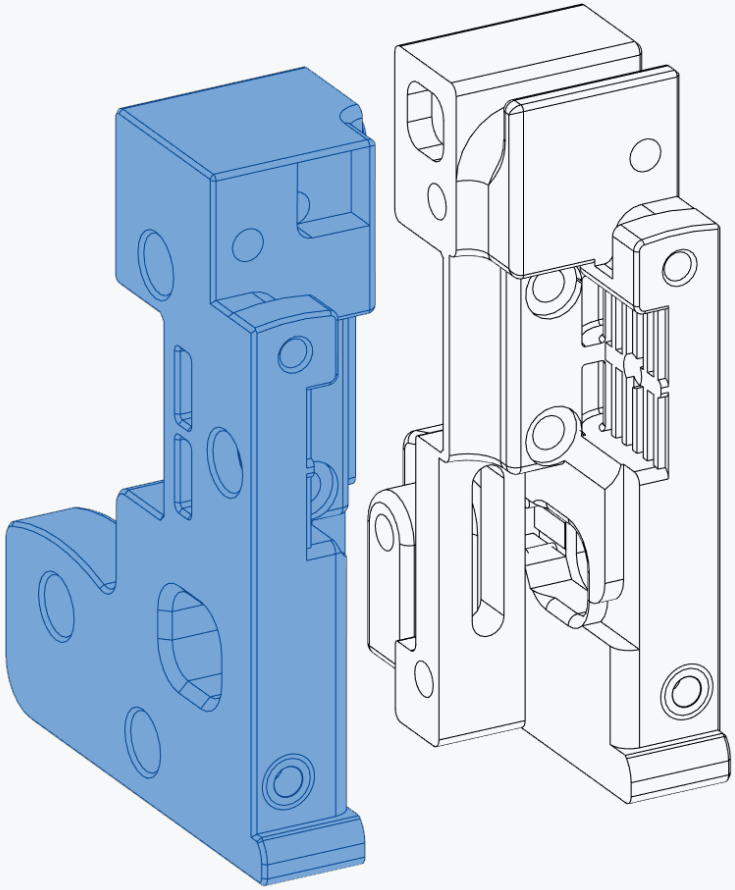


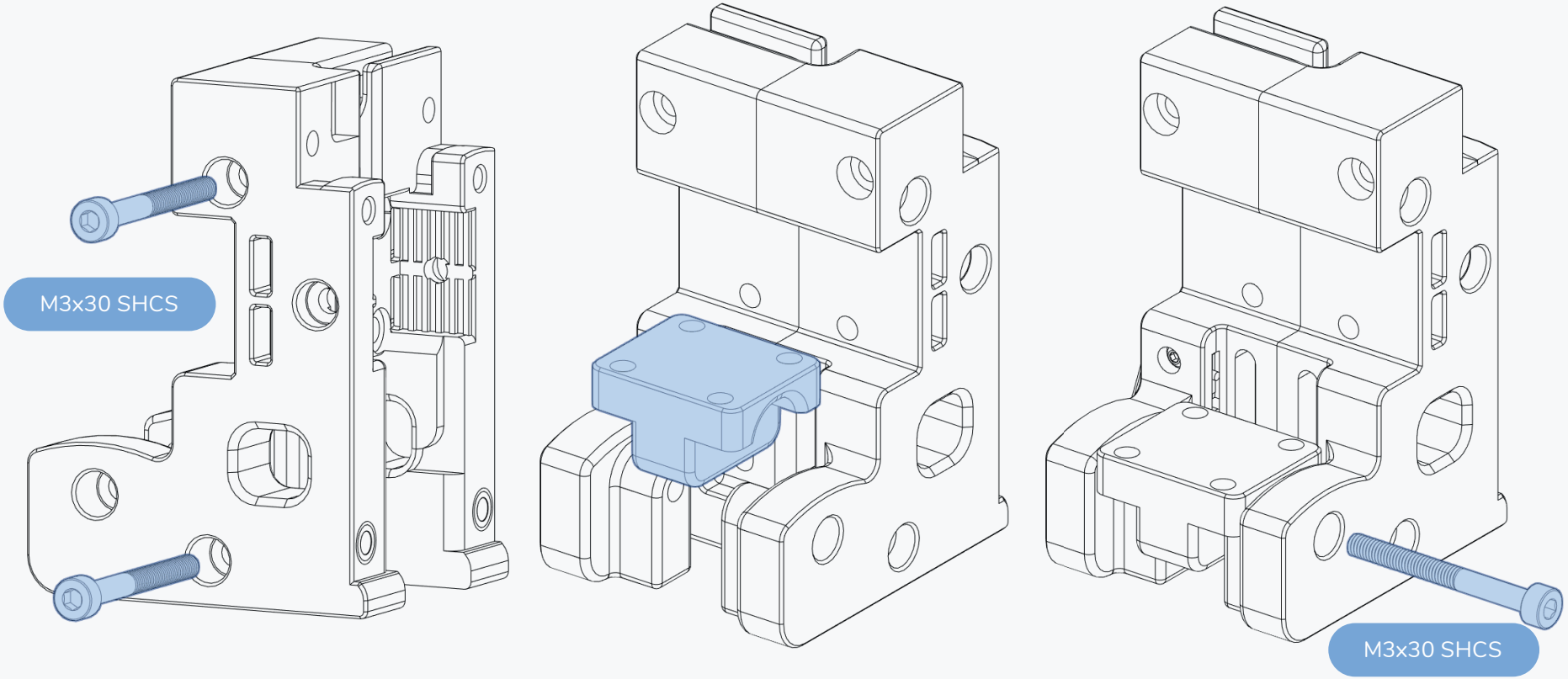
SOLDER WIRES NOW

Solder approx. 300mm of wire to the mircoswitch before installing it.
See setup guide for details.





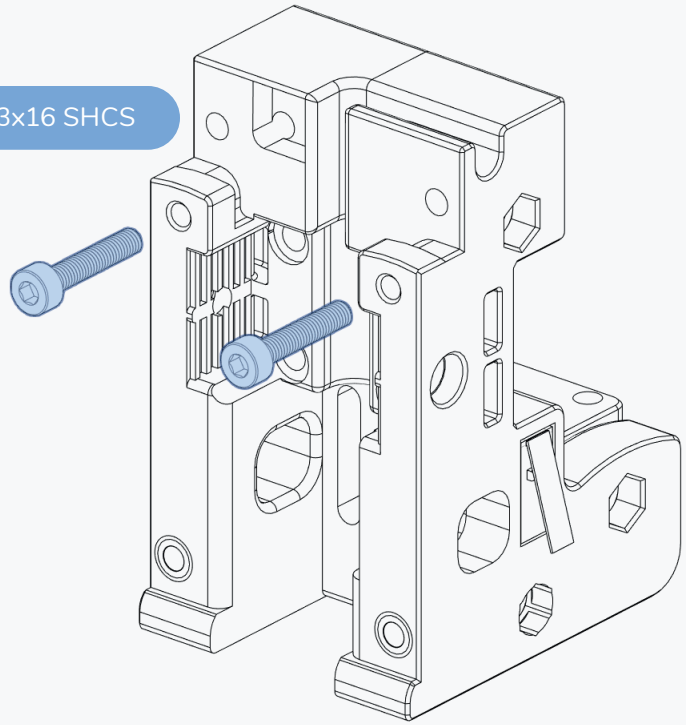




LEAVE LOOSE

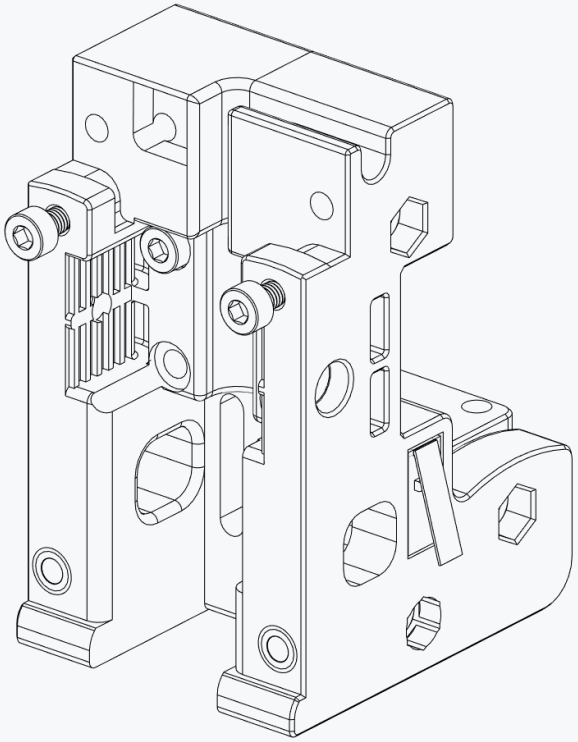
Lightly tighten the screw.

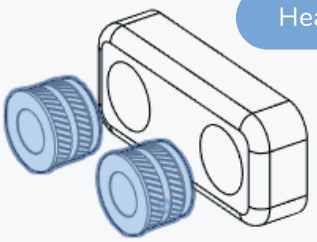
M3x16 SHCS



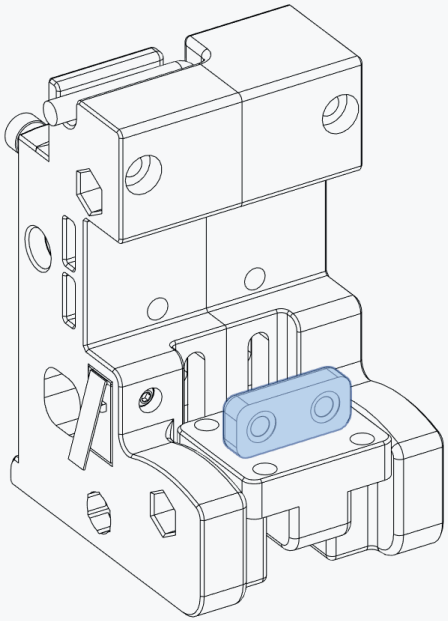
3MM DISTANCE

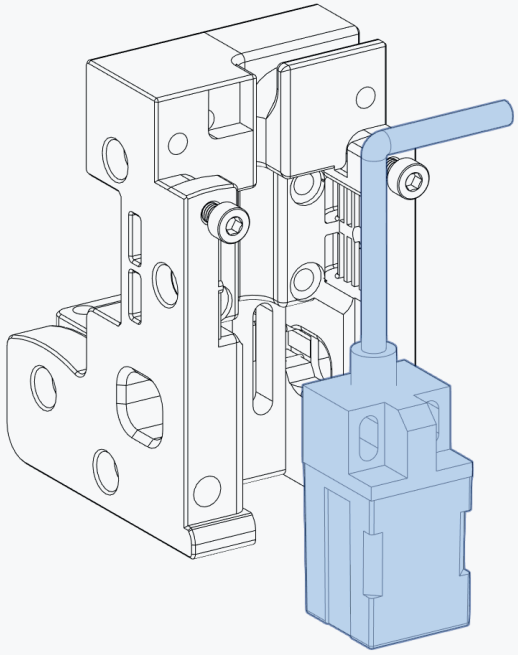
Fasten the screw until there is 3mm space between the screw head and the printed part.





Heat Set Insert





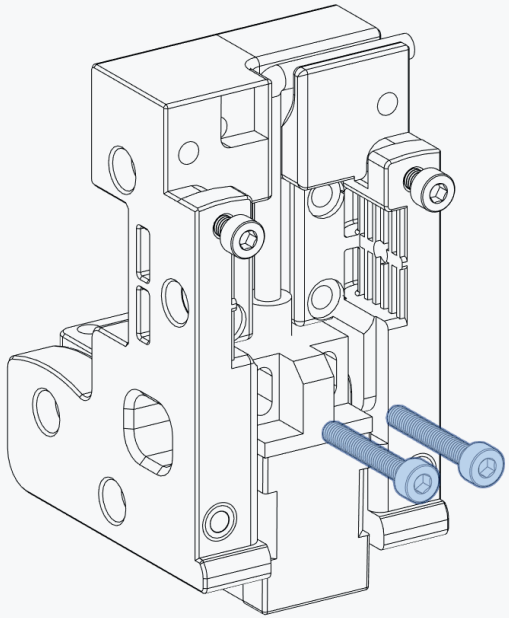
Inductive Probe

PROBE WIRES

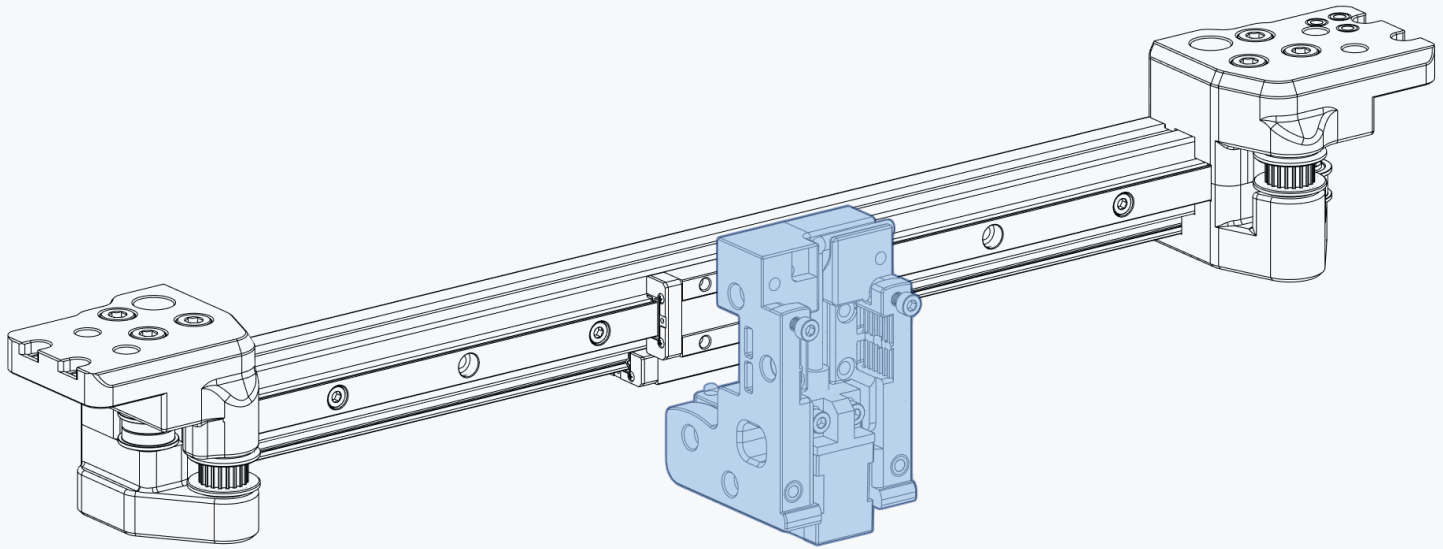
Cut the probes wires to about 15cm.

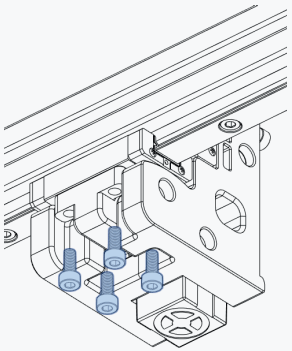
ENDSTOP WIRES

Place the endstop wires into the same channel.

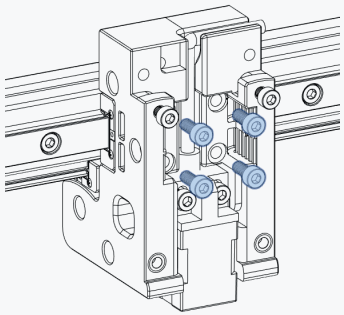


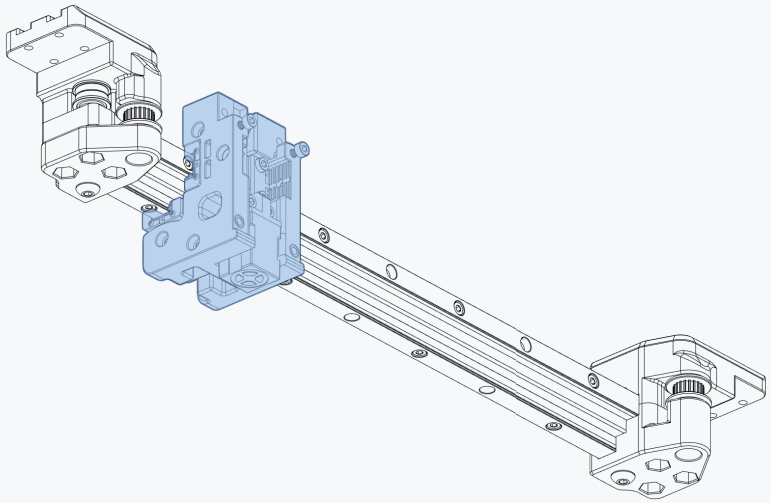
M3x20 SHCS

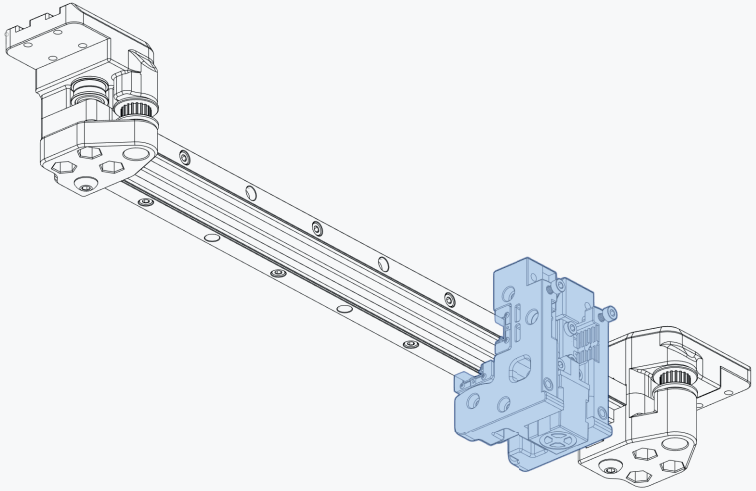




M3x8 SHCS







RAIL ALIGNMENT

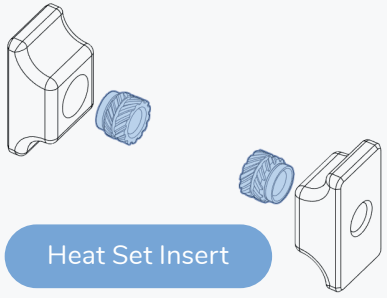
Move X Carriage over the full range to initially align the bottom rail.

Slightly tighten the screws of the front rail, the screws of the bottom rail and the pivot block screw on the underside of the carriage.

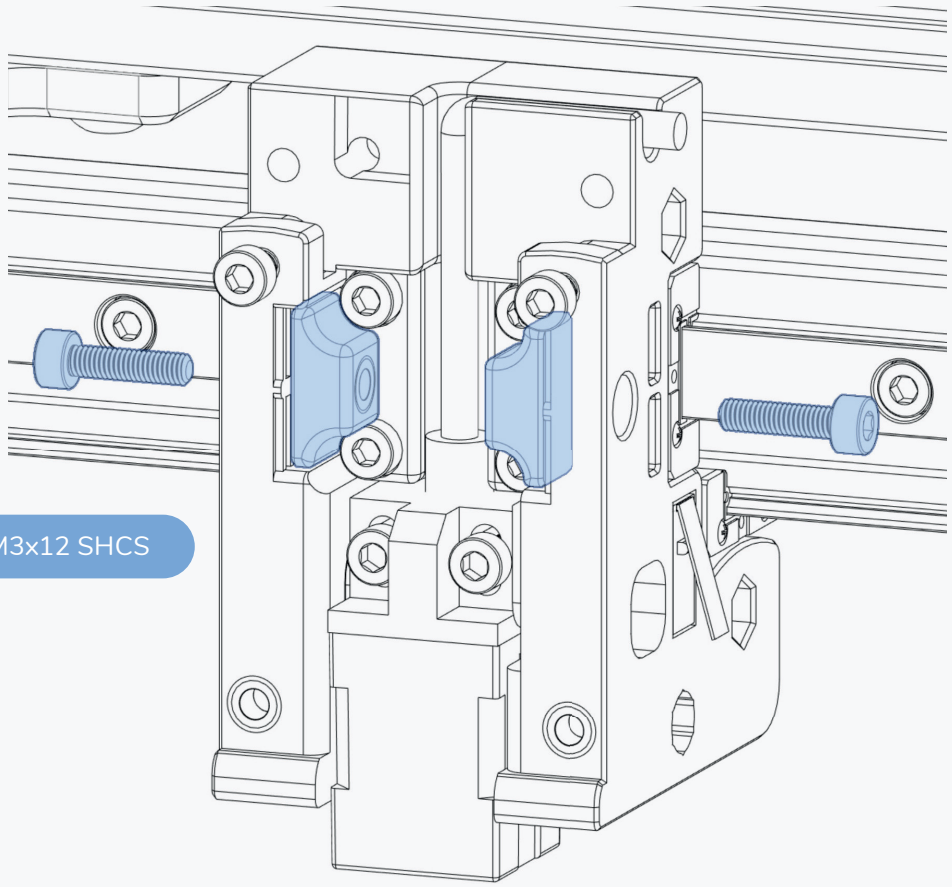
Move the X Carriage to check for any binding.

Repeat until all screws are fully tight. If you get binding at any point slightly loosen the screws and retry.

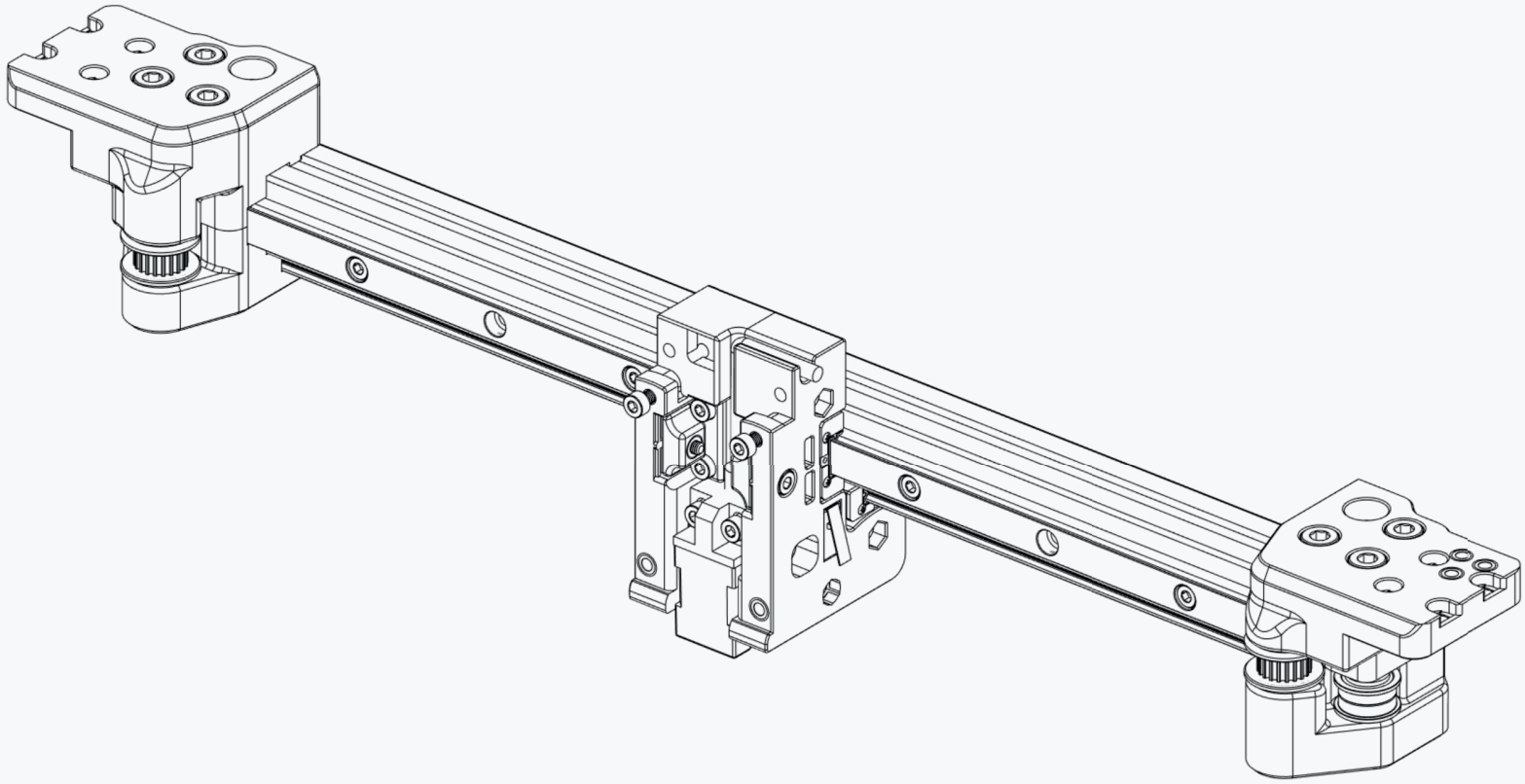
Refer to Discord if you are having issues with the alignment.

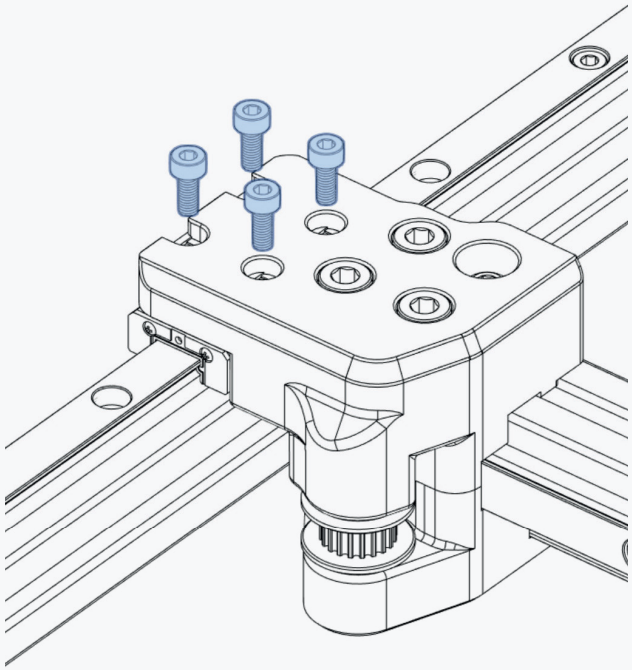


Heat Set Insert

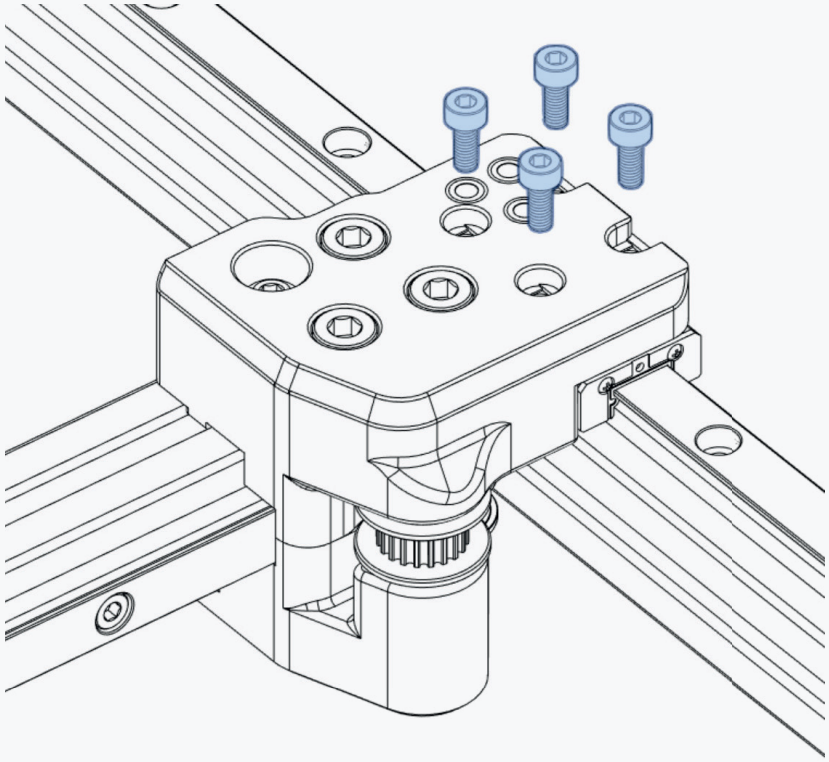


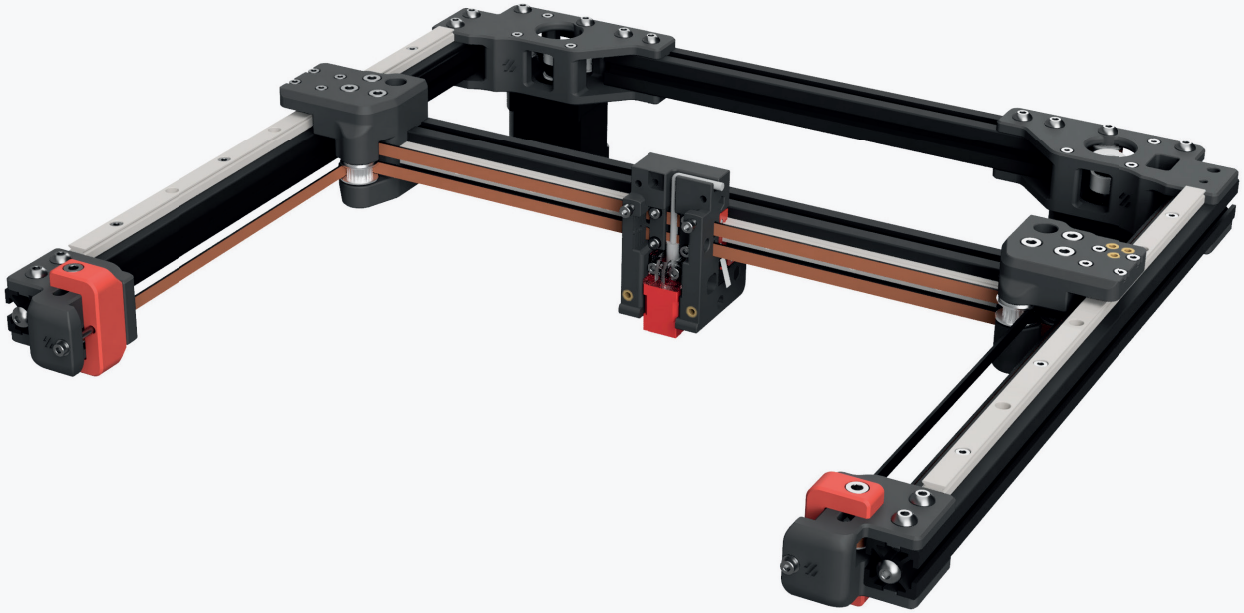
M3x12 SHCS

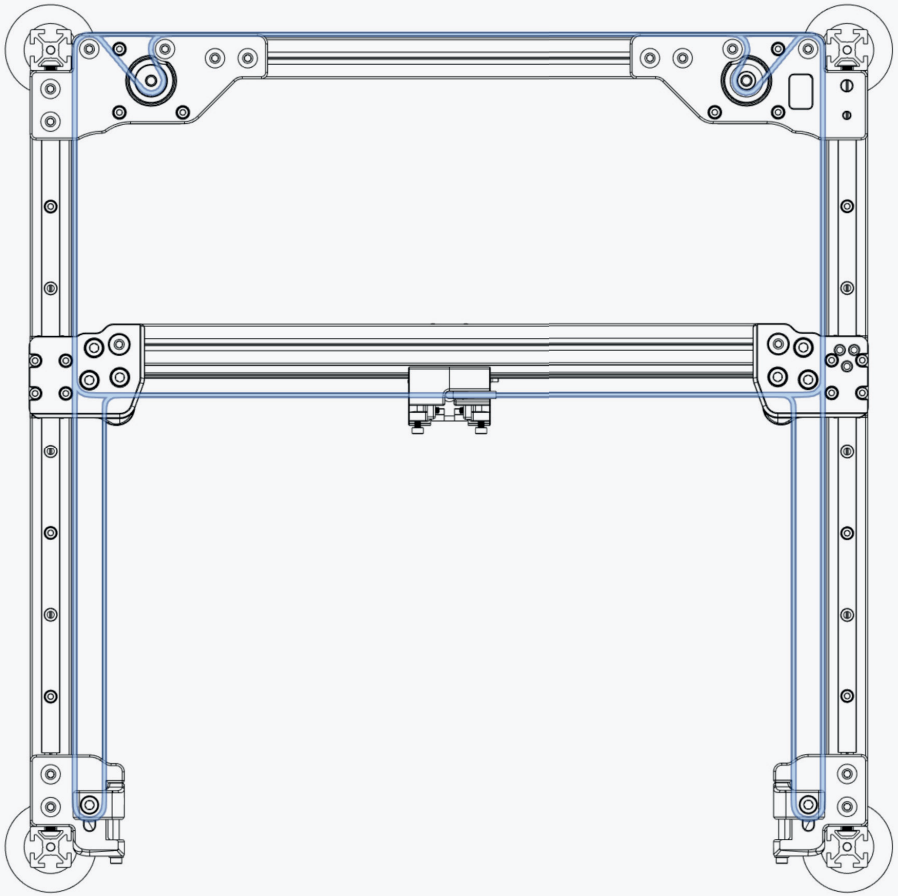


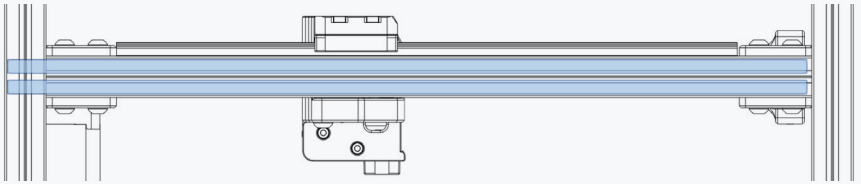


M3x8 SHCS







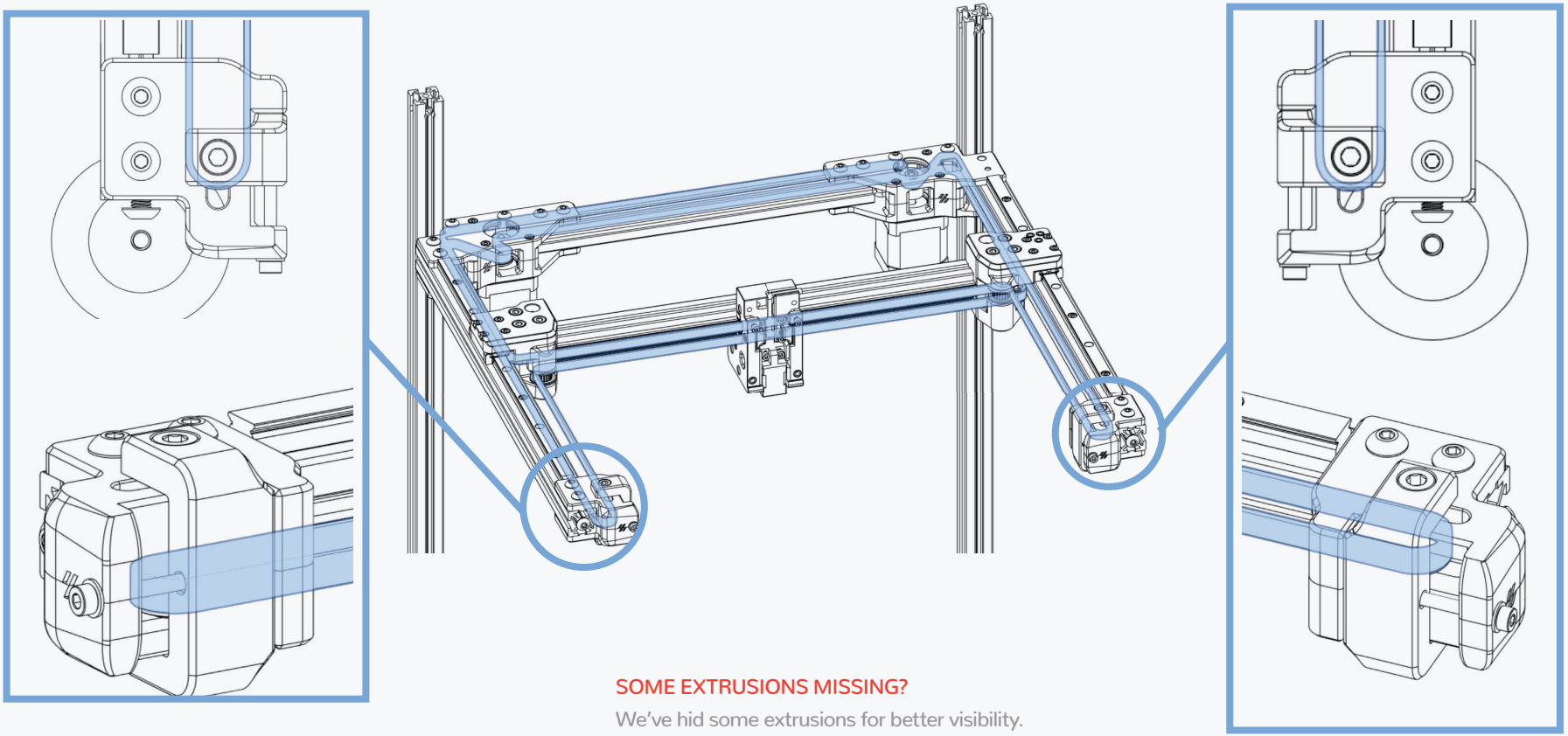


THE VORON BELT PATH

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

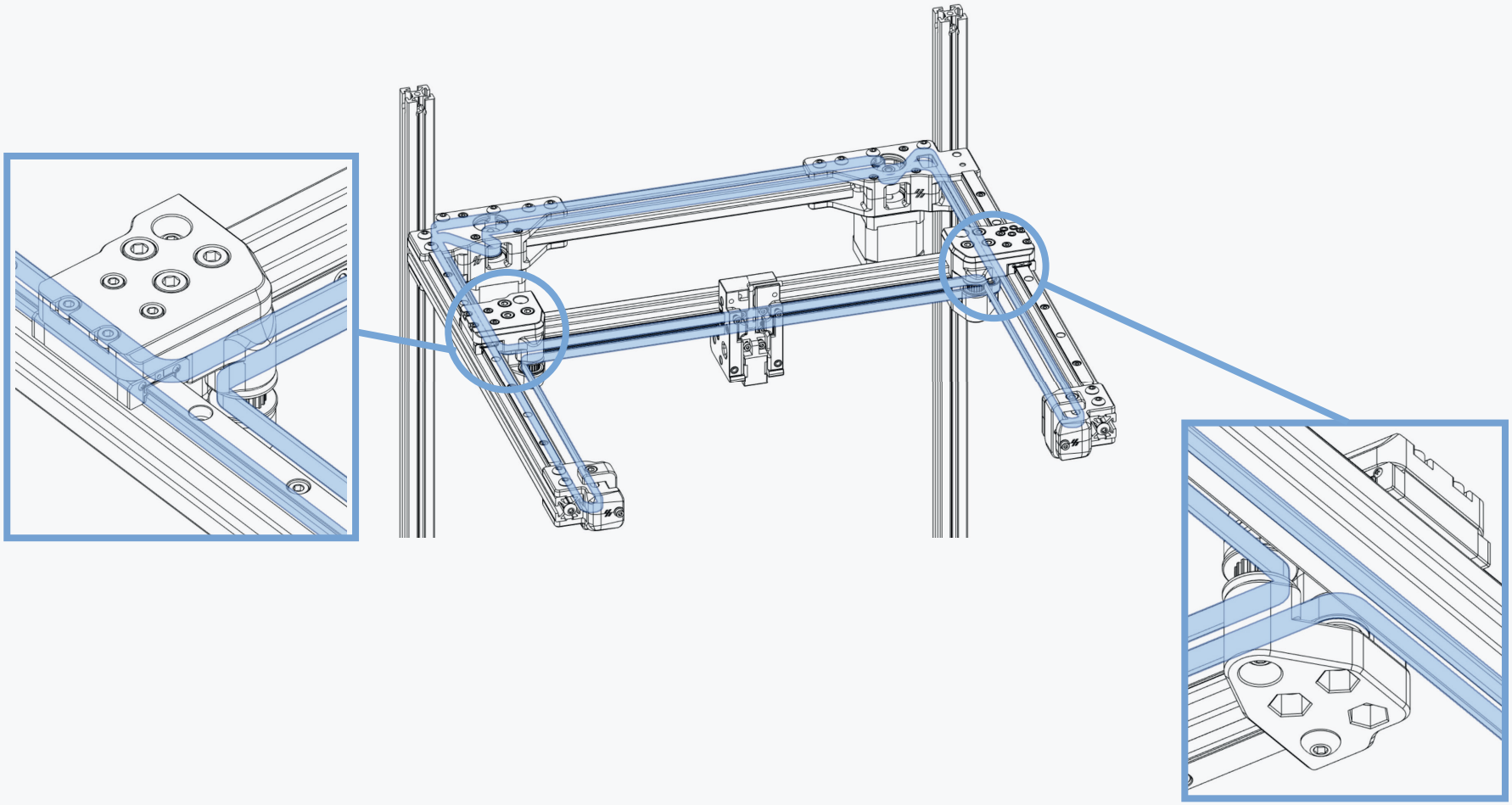
The individual belt paths are stacked on top of each and the crossing often found in CoreXY designs is omitted.

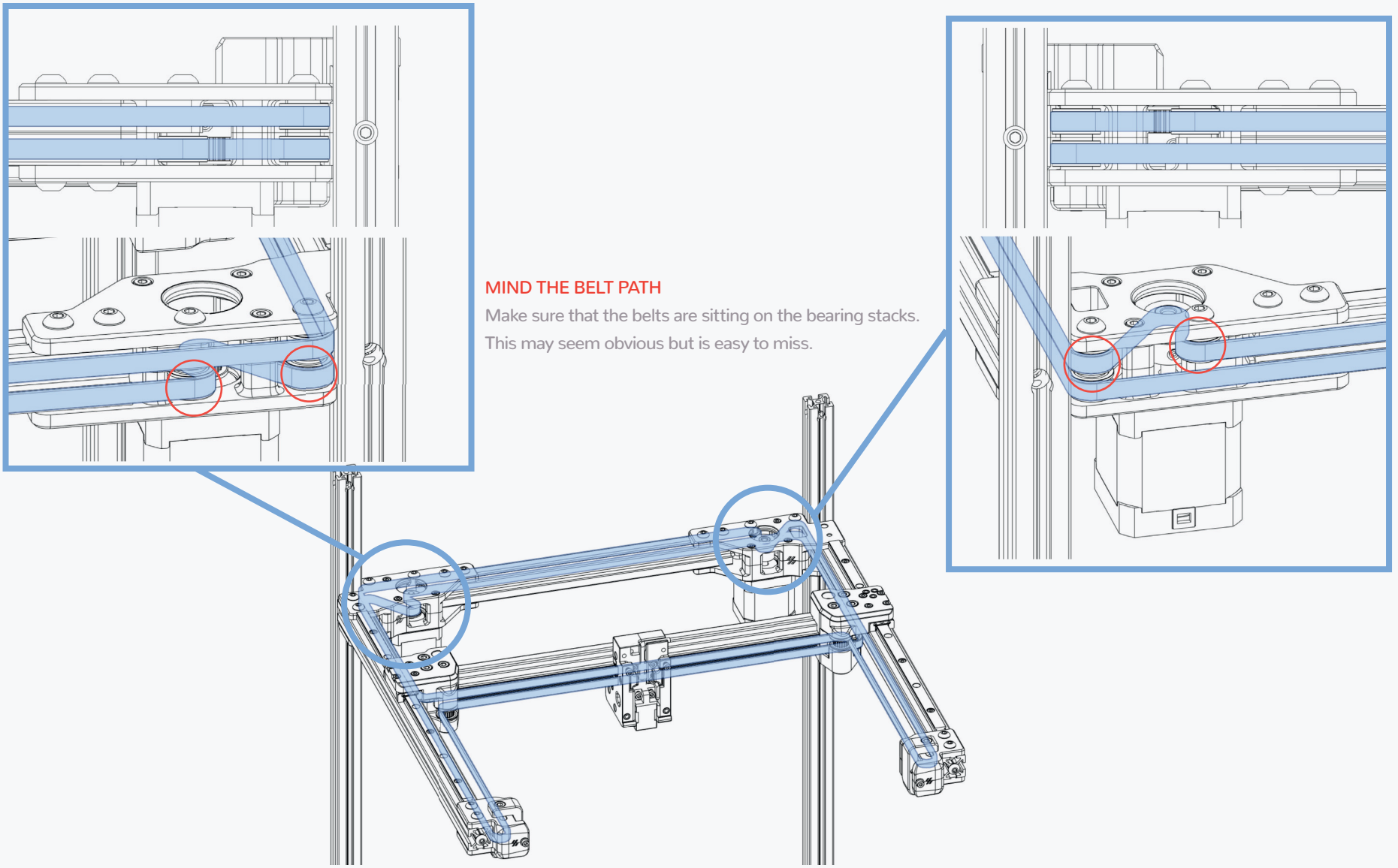
Compared the many other implementations the motors are moved to a less intrusive position.



SOME EXTRUSIONS MISSING?

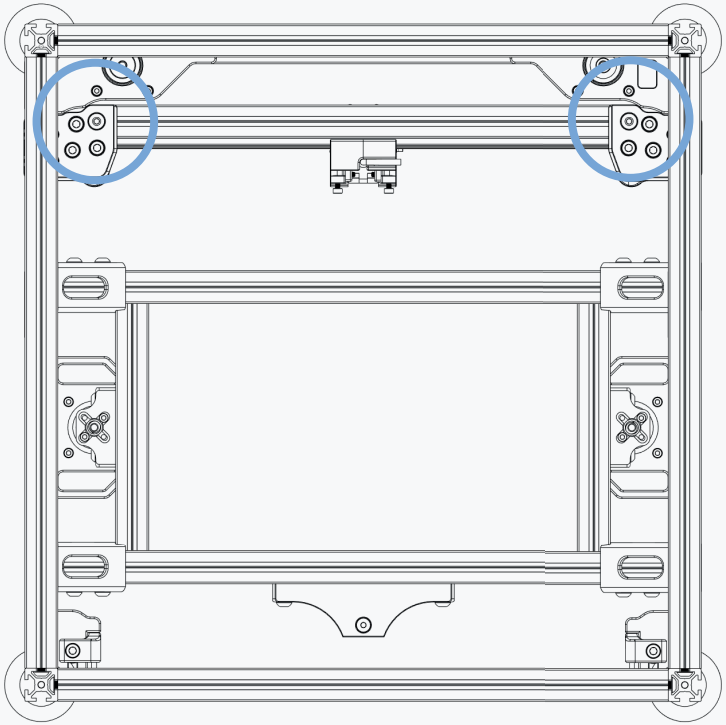
We've hid some extrusions for better visibility.
No need to disassemble anything.





MIND THE BELT PATH

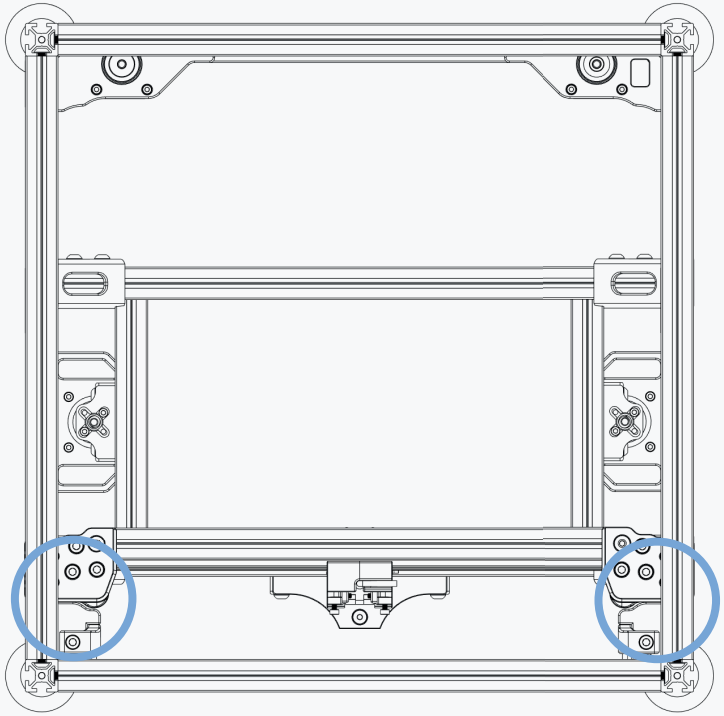
Make sure that the belts are sitting on the bearing stacks.
This may seem obvious but is easy to miss.



MOVE X AXIS BACK

Loosen the X Beam screws.

Move the axis all the way back. Both XY Joints must touch the motor mounts.



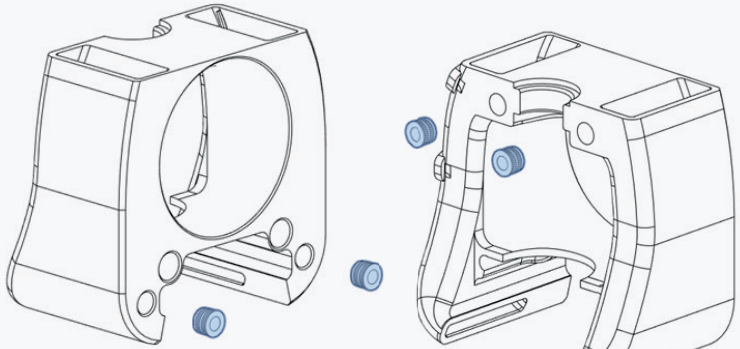
MOVE X AXIS FORWARD

Move the axis all the way forward until both XY Joints touch the idlers.

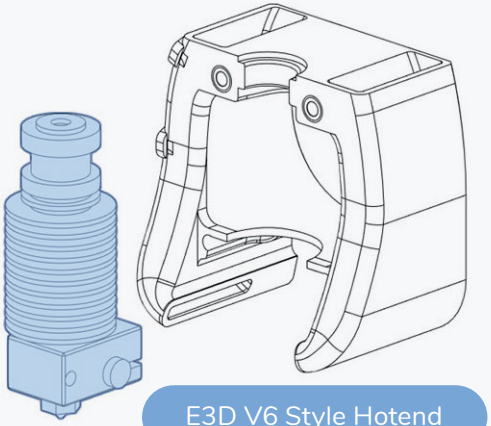
Tighten the screws on the xy joints.

AVAILABLE MOUNTS

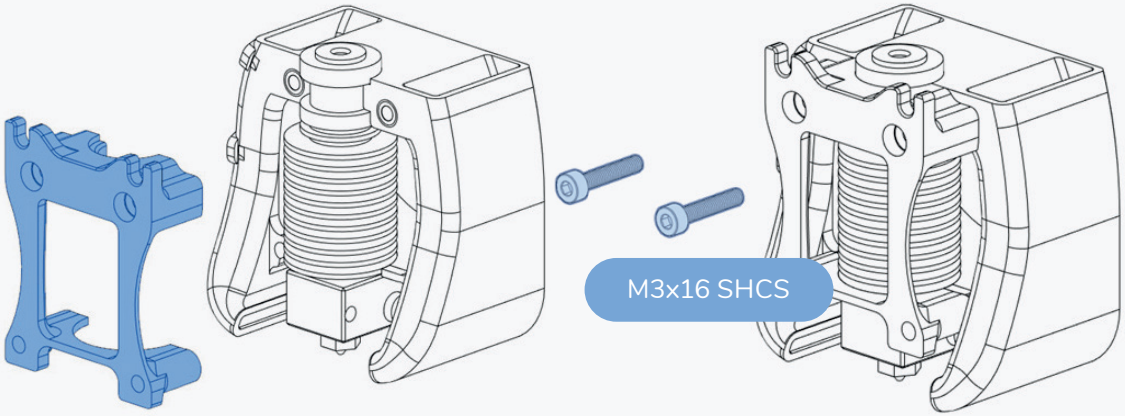
We also provide mounts for the Slice Engineering Mosquito and TriangleLab/Phaetus Dragon Hotend.
They are assembled in a similar manner.



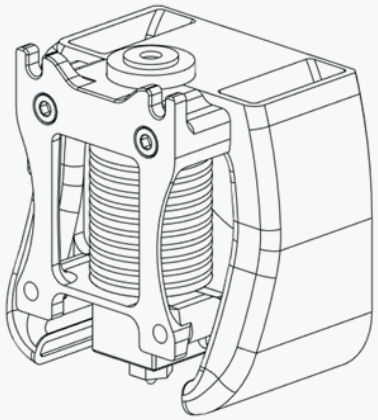
Heat Set Insert

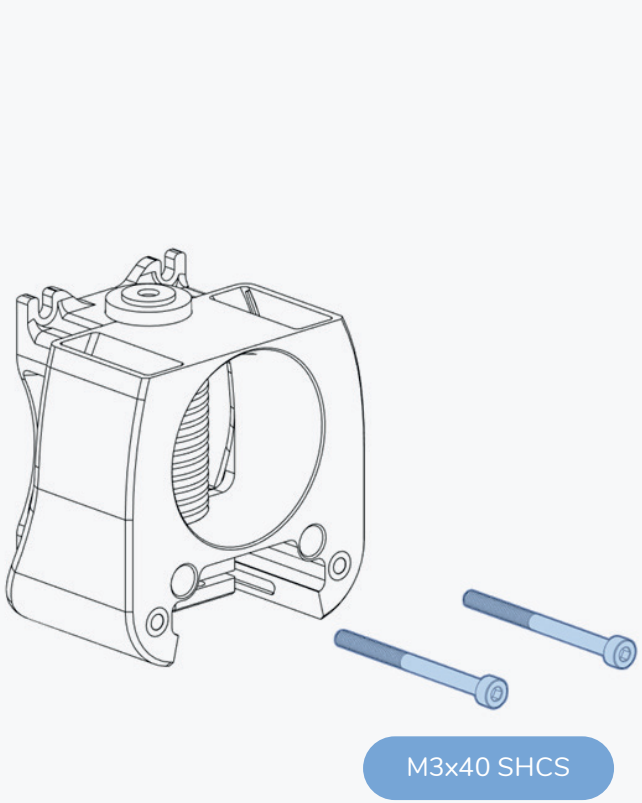


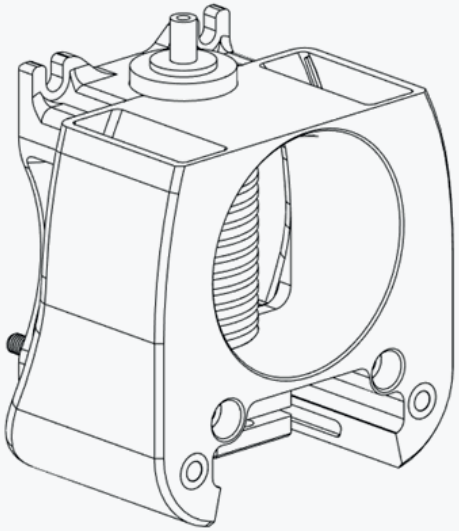
E3D V6 Style Hotend



M3x16 SHCS

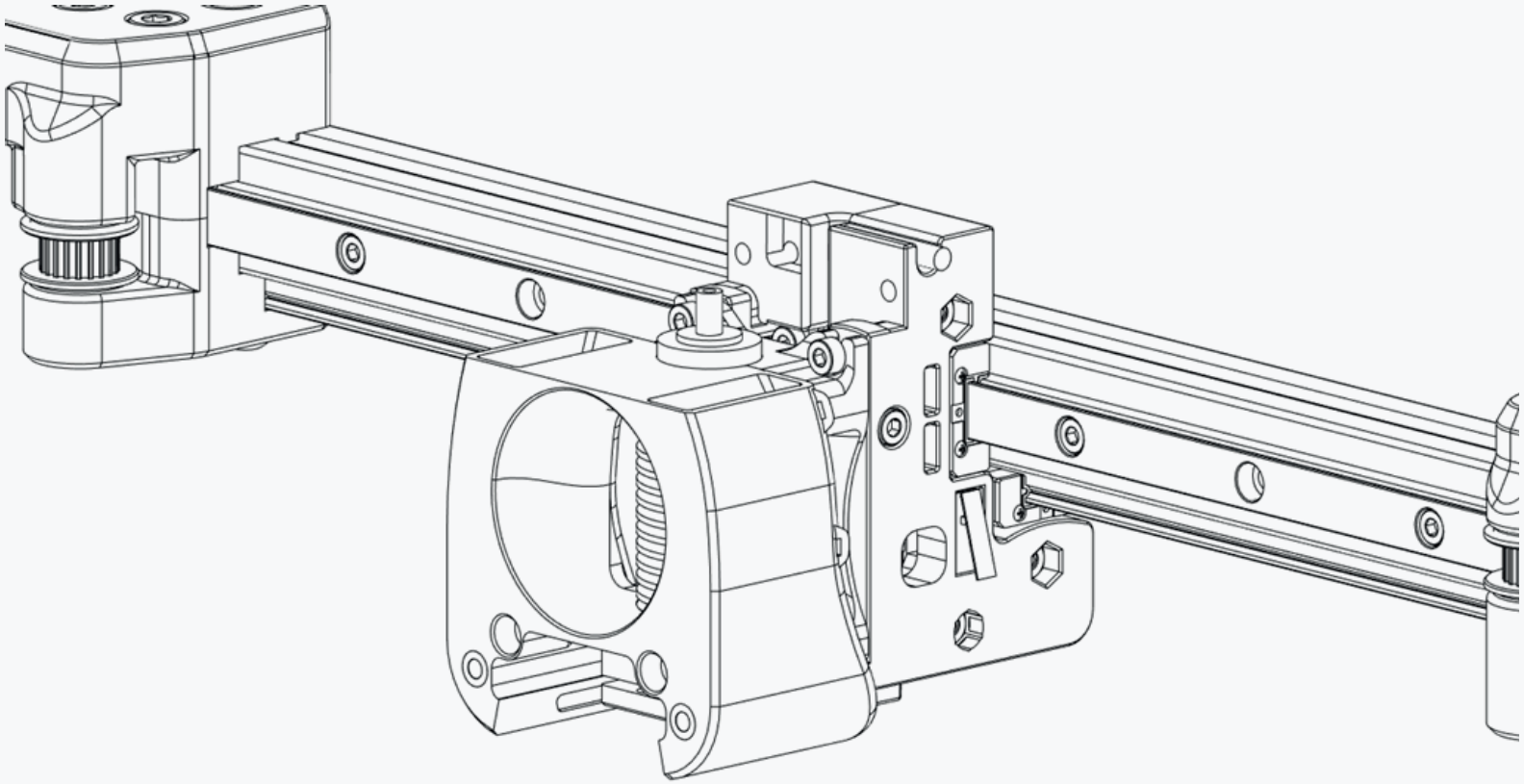


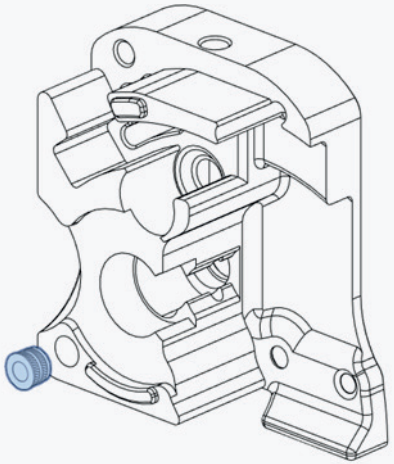


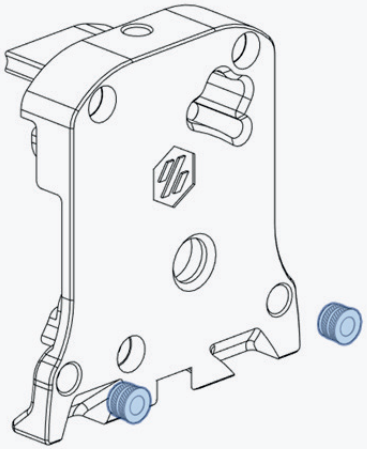


PTFE STICKOUT

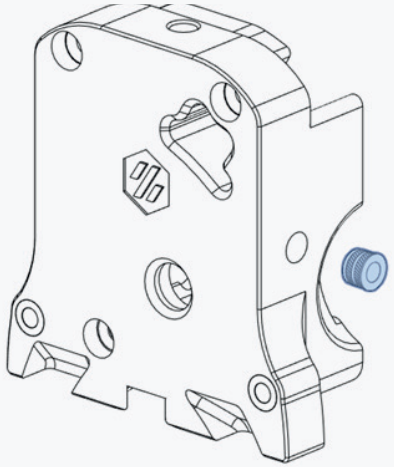
The PTFE tube should end 10mm above the surface of the printed part.

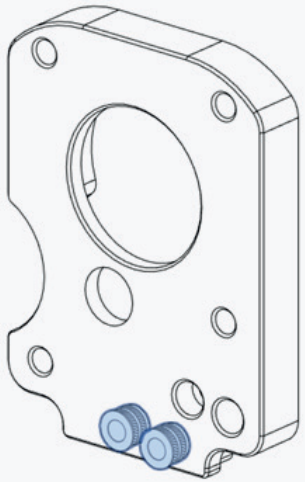


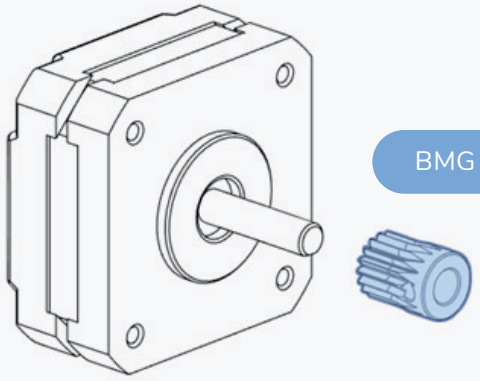




Heat Set Insert

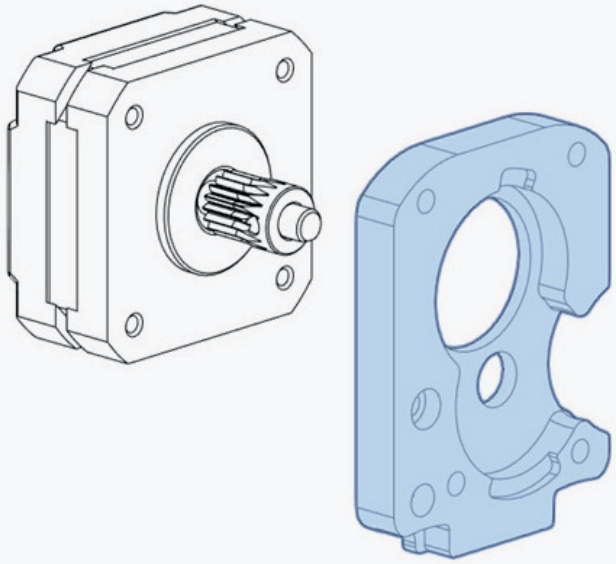


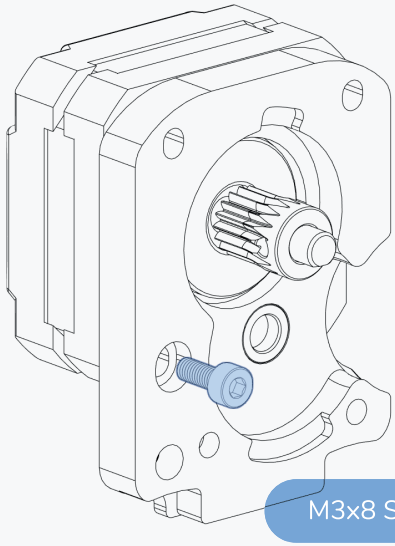




Stepper Motor

BMG Drive Pinion

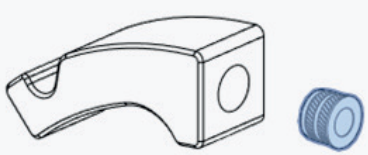




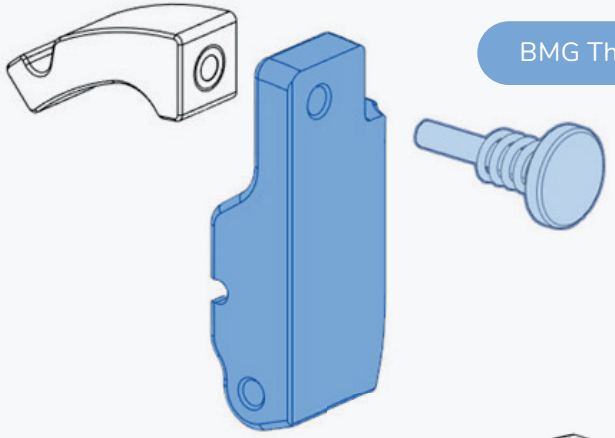
M3x8 SHCS

STEPPER WIRES

If the steppers has wires cut them to approximately 150mm. Wires/connector to the right hand side.

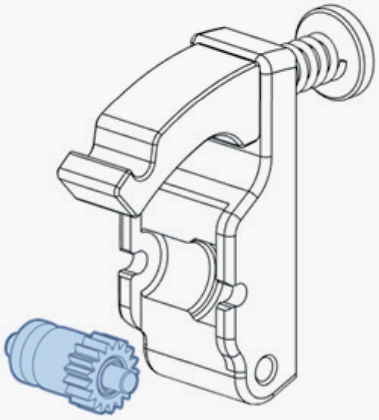


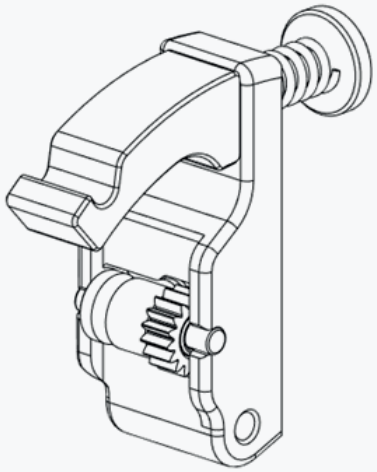
Heat Set Insert



BMG Thumb Screw

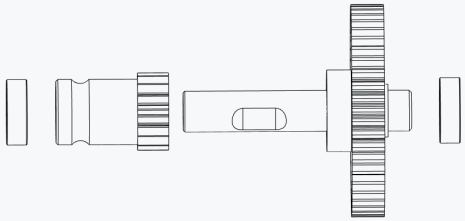
BMG Idler Assembly



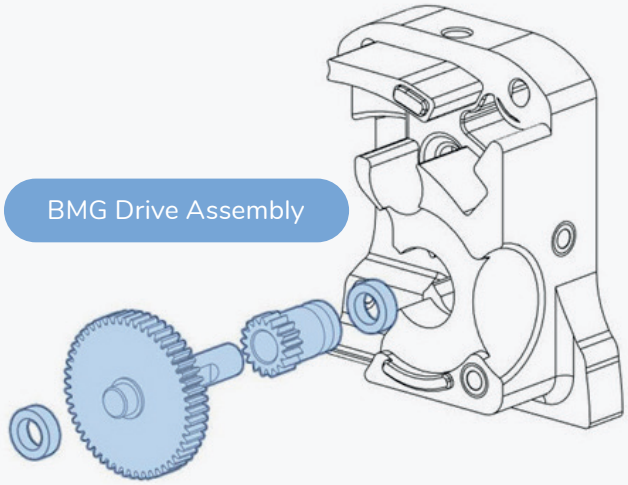


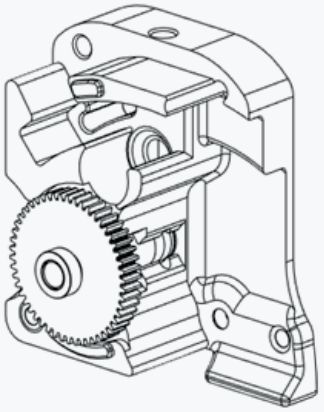
LUBRICATE BEARINGS

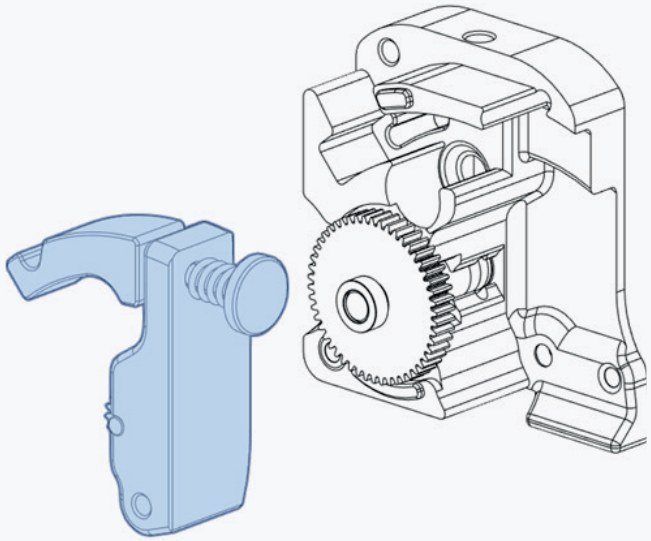
A light lubrication film will help with smooth operation and longevity.



BMG Drive Assembly

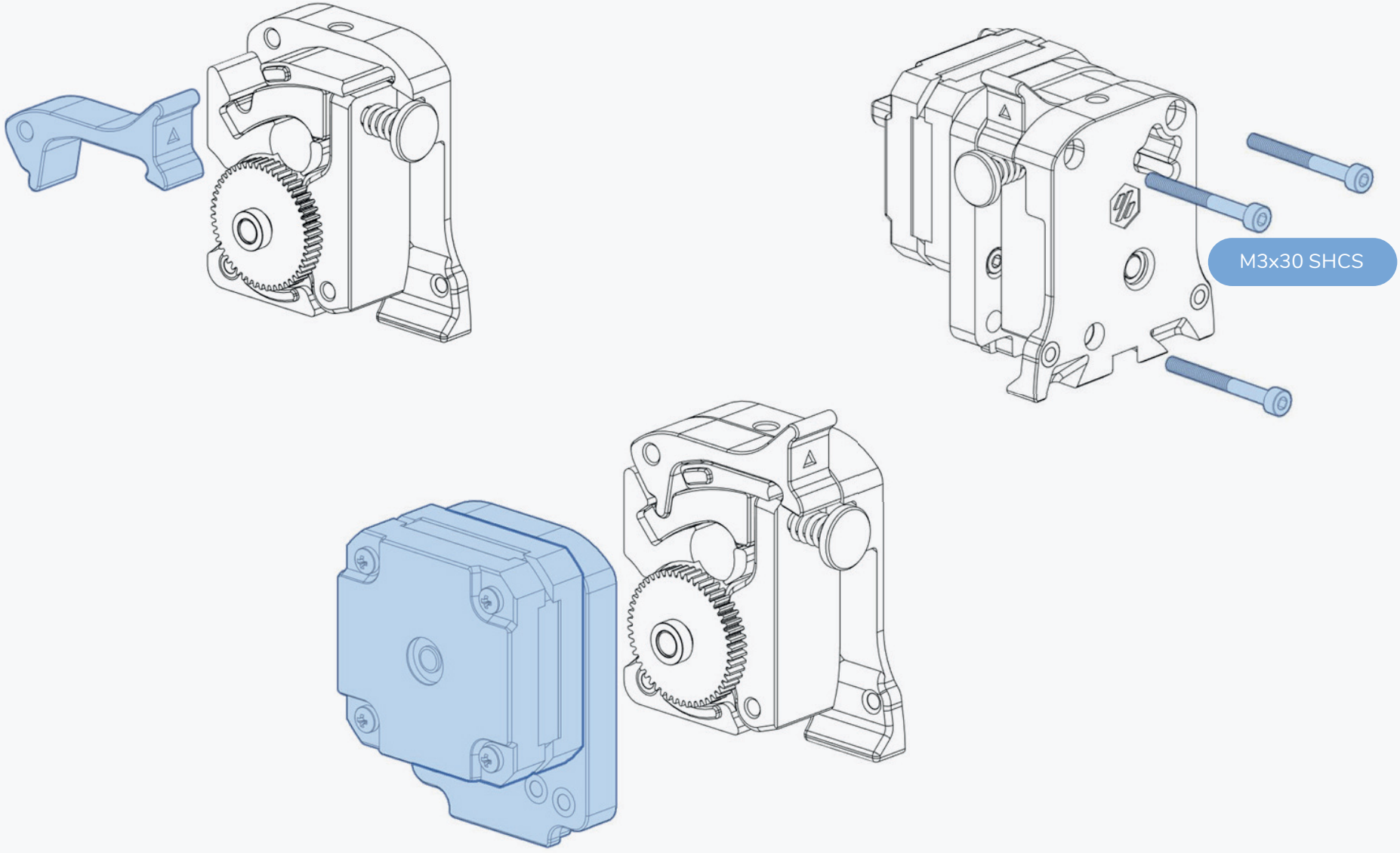


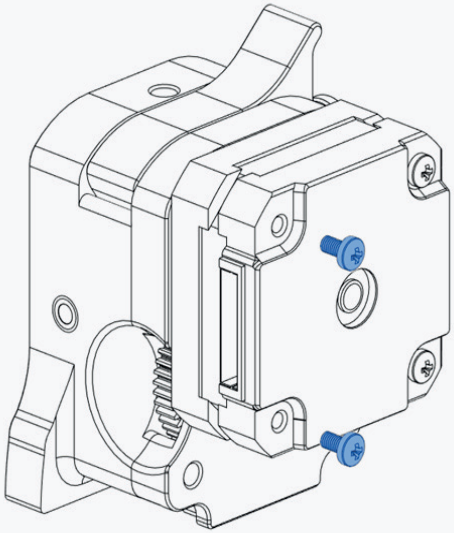


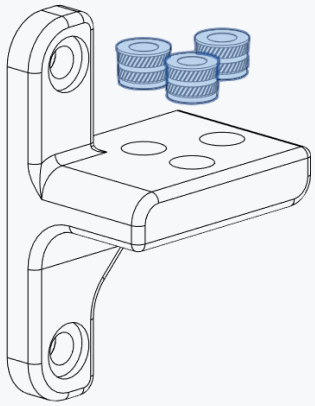


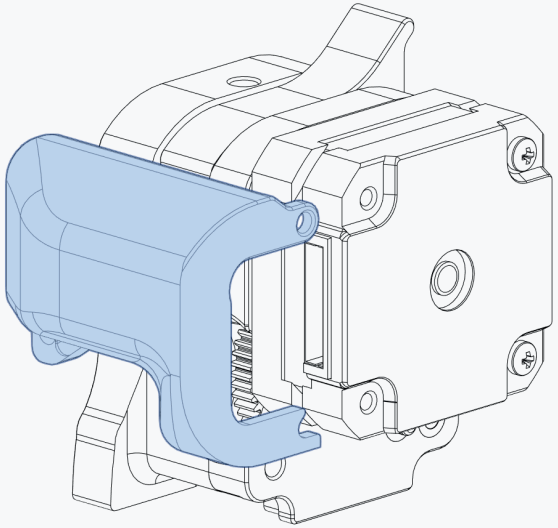
CHECK BEARING FIT

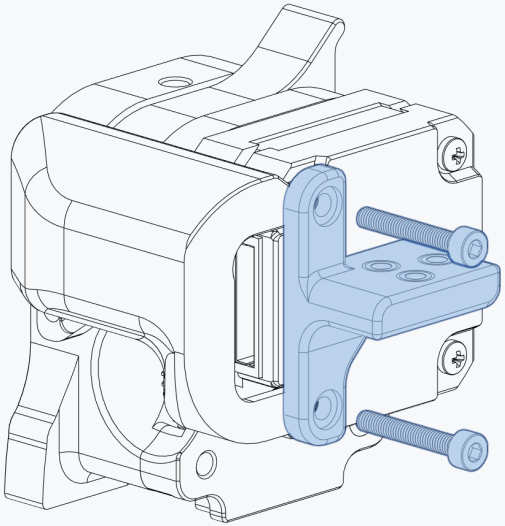
The bearings must slip on and off the shaft easily. Pressing the bearings on the shaft will damage them. Lightly sand the shaft if required.



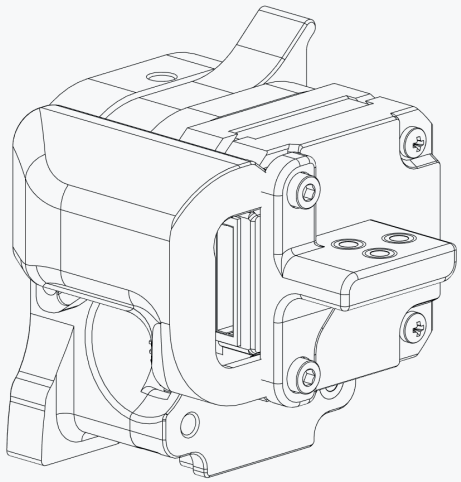


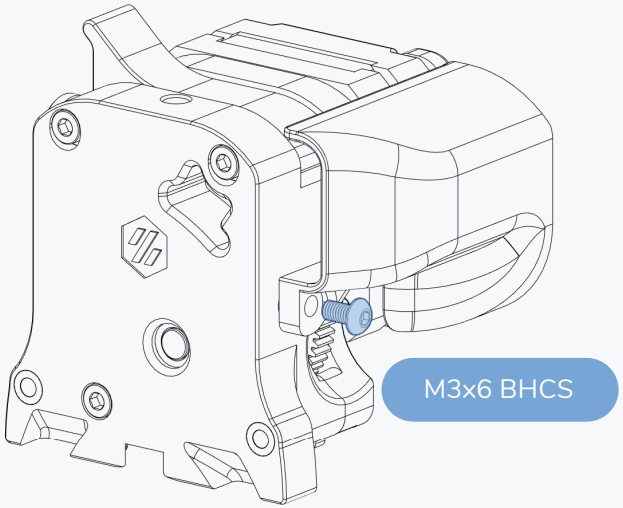


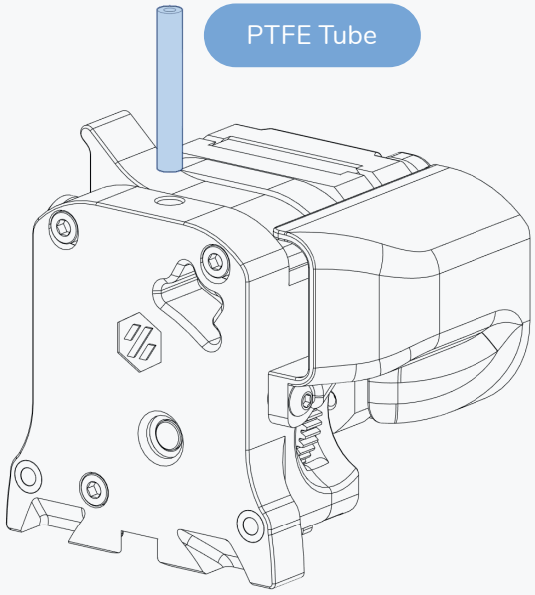


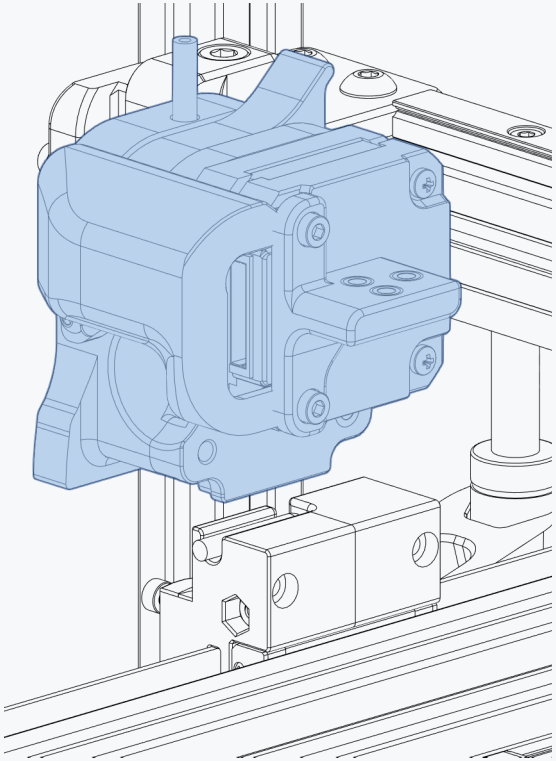


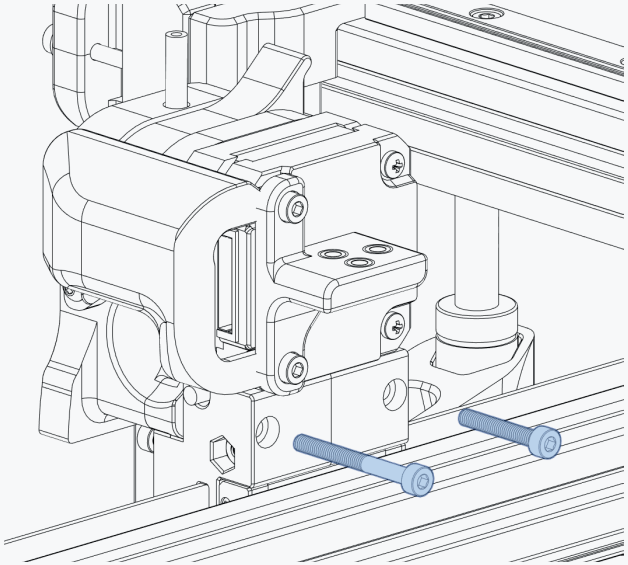
M3x20 SHCS





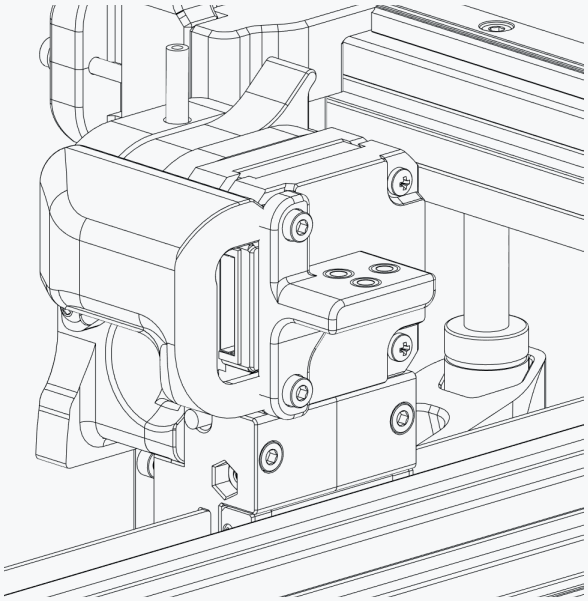


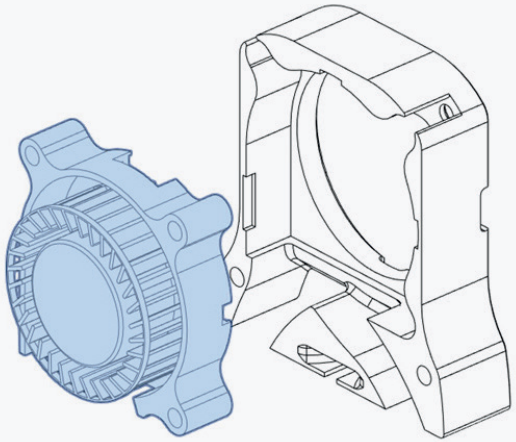




M3x30 SHCS

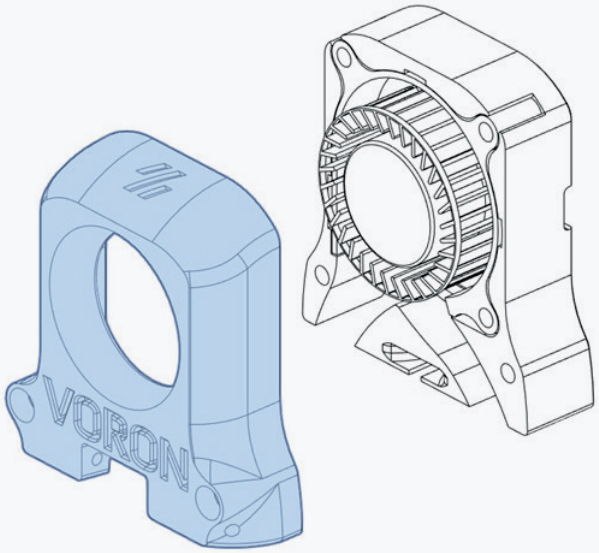
M3x20 SHCS





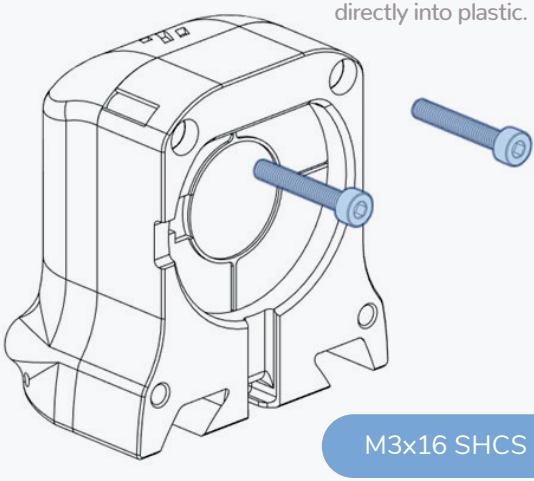
REMOVE TOP COVER

Split the fan open by bending the taps on the side.

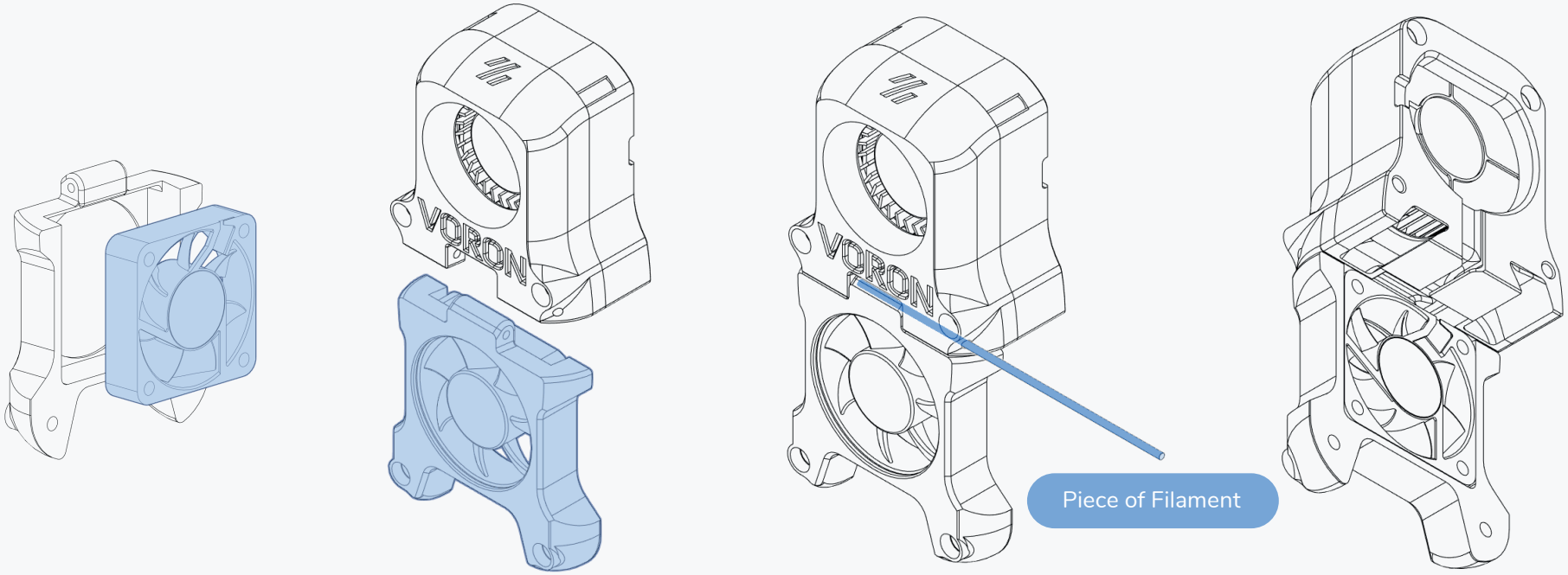


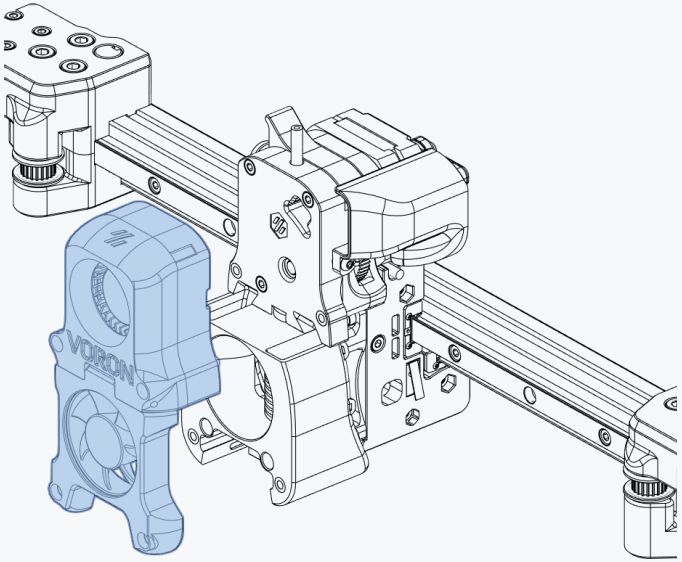
DON'T OVER TIGHTEN

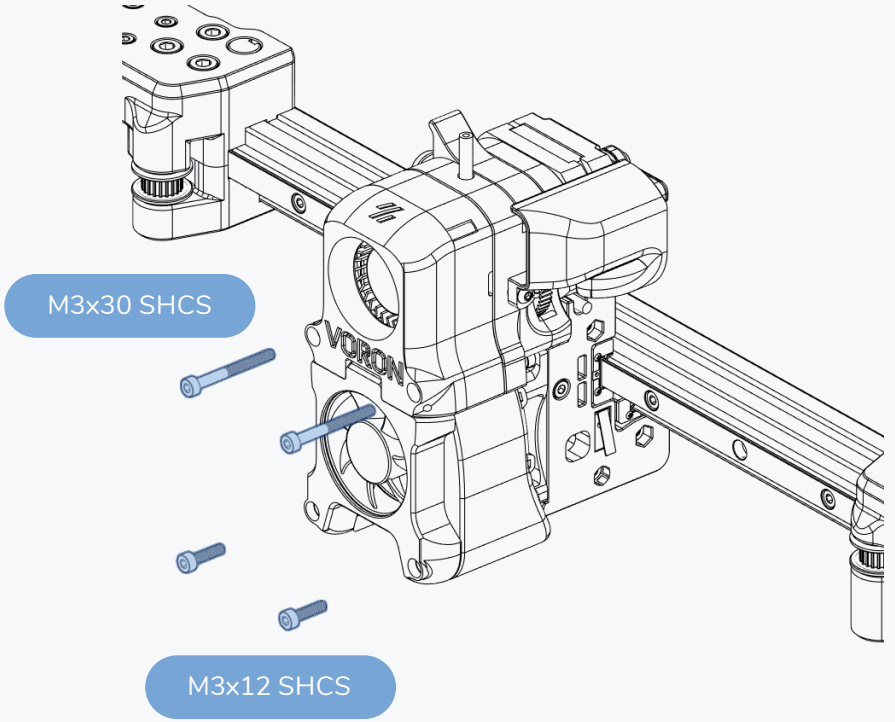
The screws are screwd directly into plastic.



M3x16 SHCS



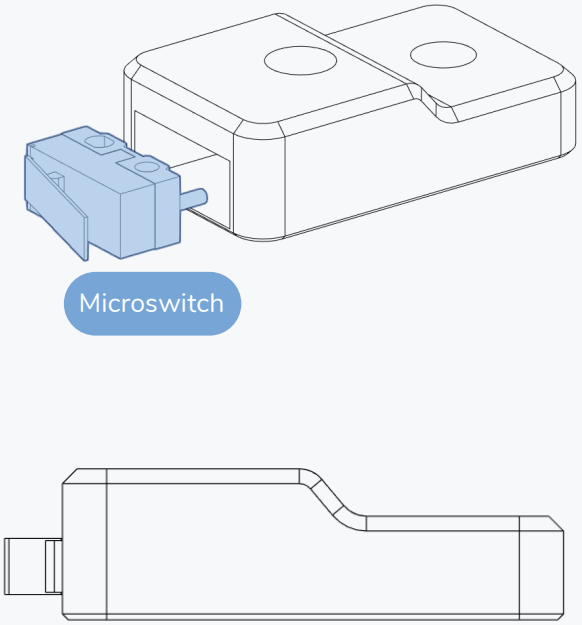


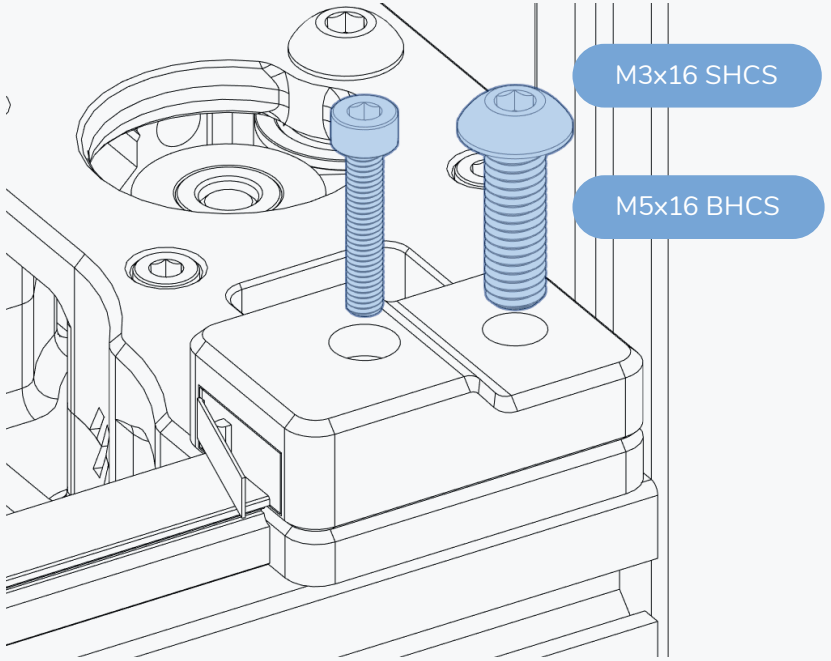


This page intentionally left blank.

SOLDER WIRES

Solder 500mm of wire to the microswitch before inserting it flush into the housing.

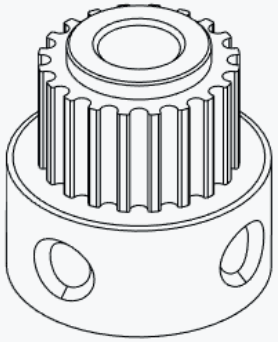




PRELOADED NUTS

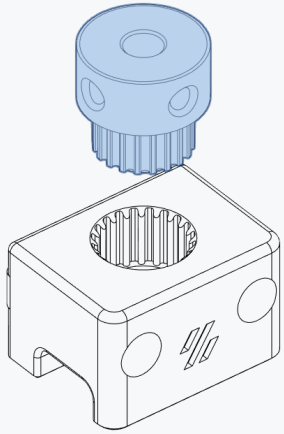
The nuts have been installed several chapters before.

GT2 Pulley



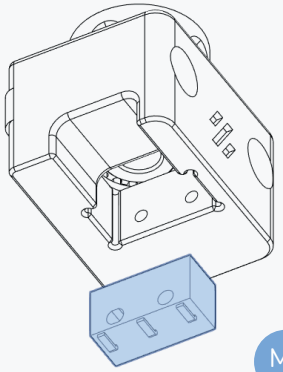
REMOVE FLANGE & GRUB SCREWS

Use a bottle opener or some pliers to remove the top flange.
Remove the grub screws from the pulley.



PRESS FIT

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

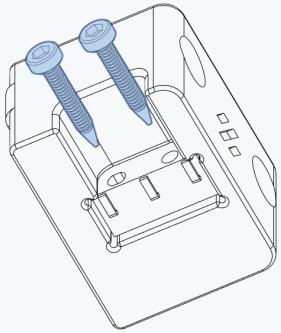


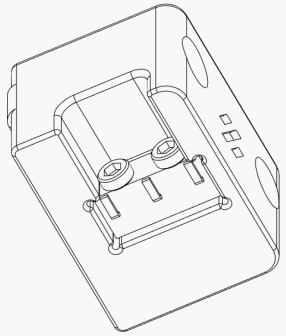
SOLDER WIRES

Solder 100mm of wire to the microswitch before inserting it into the housing.

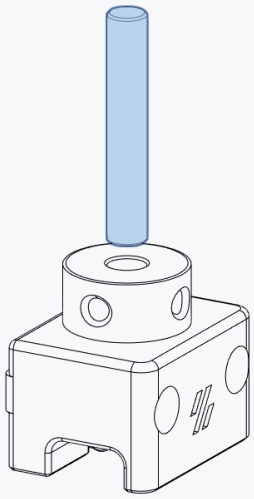
Microswitch

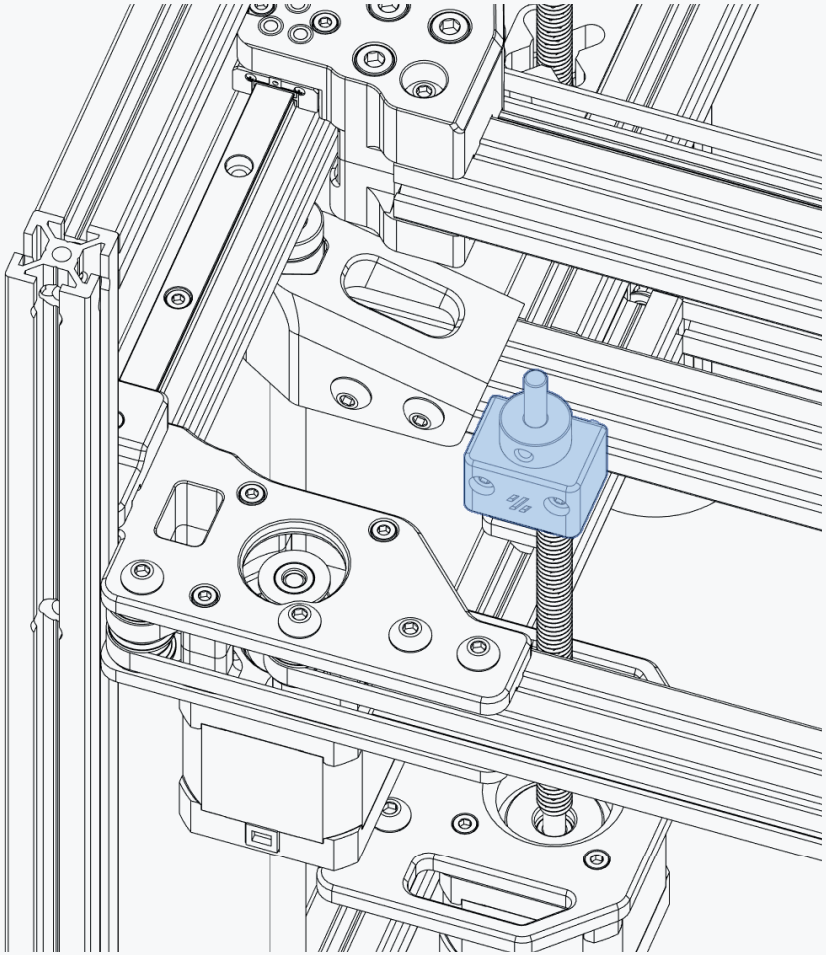
M2x10 Self Tapping

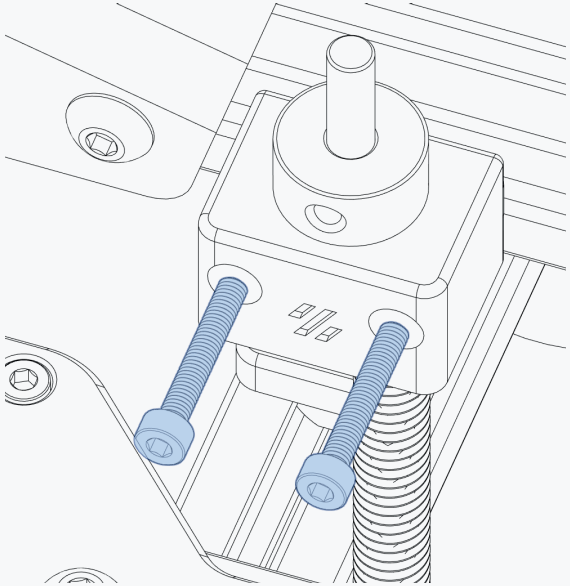




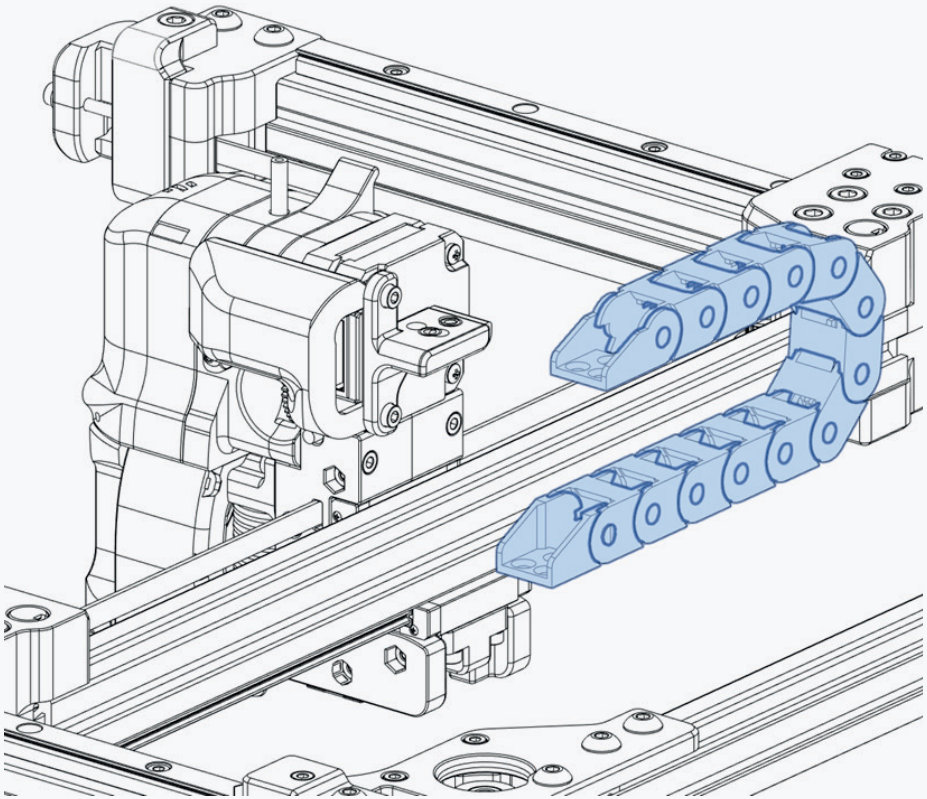
5mm Shaft





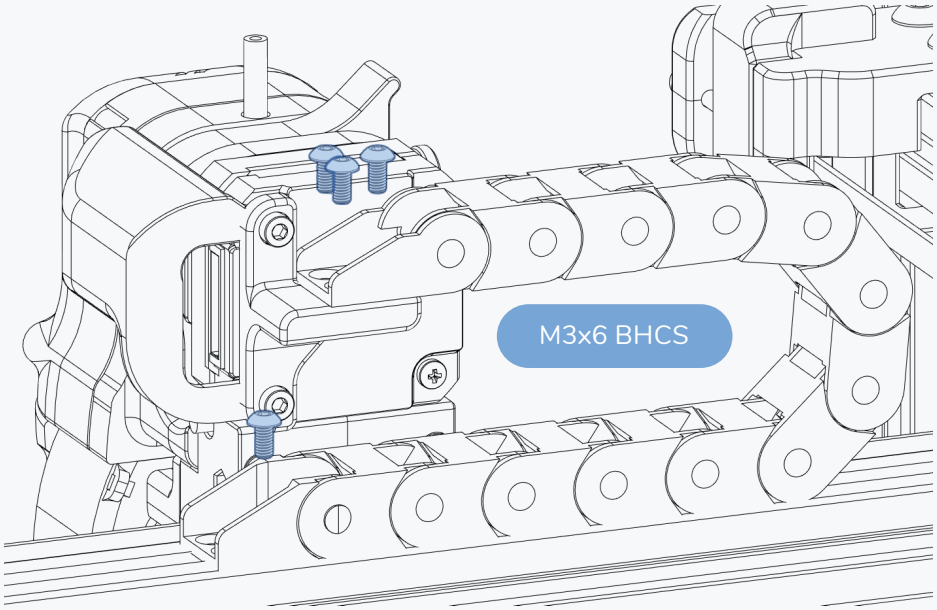


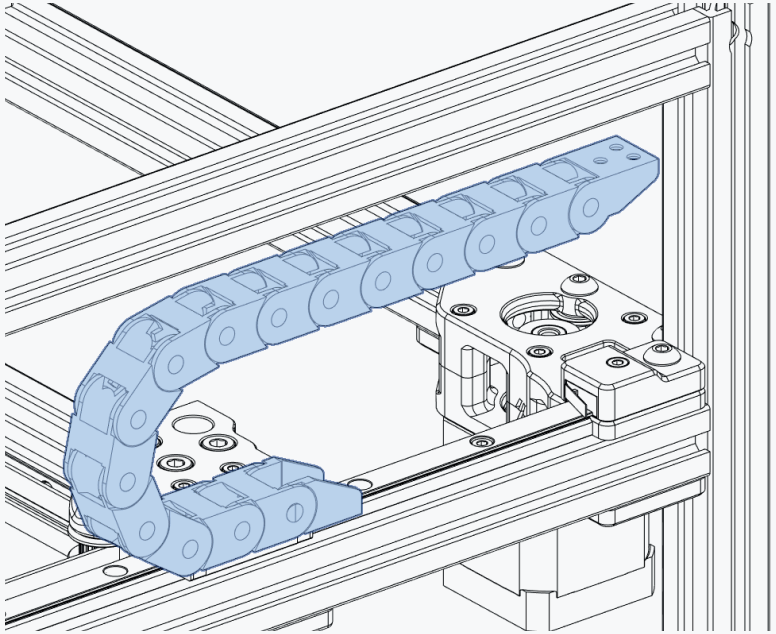
M3x20 SHCS

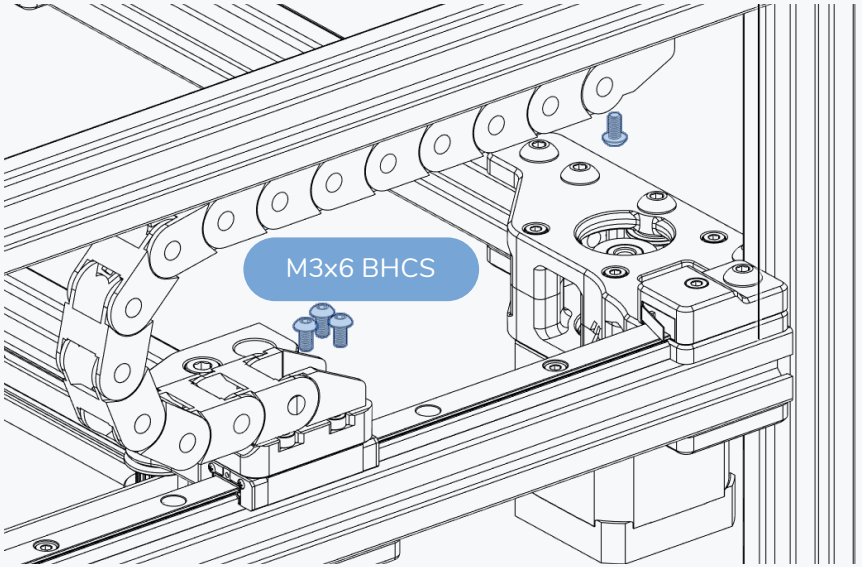


FIXED END VS. FREE END

Some cable chains only have one end that is able to swing freely. Use this end on the back of the Afterburner.

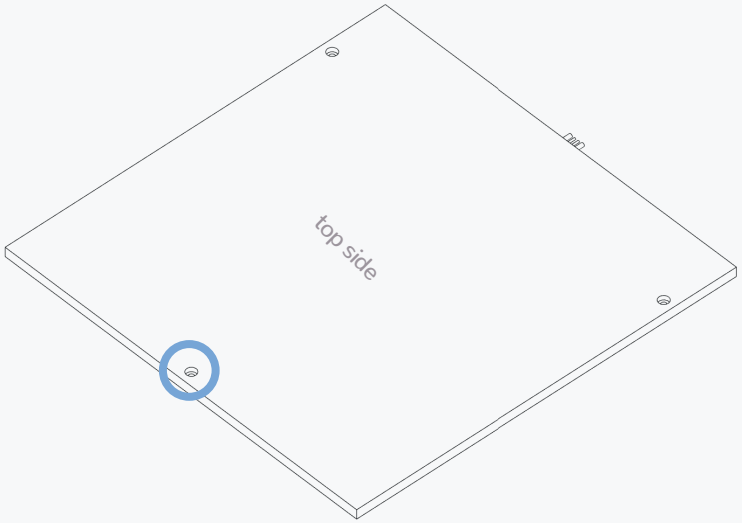


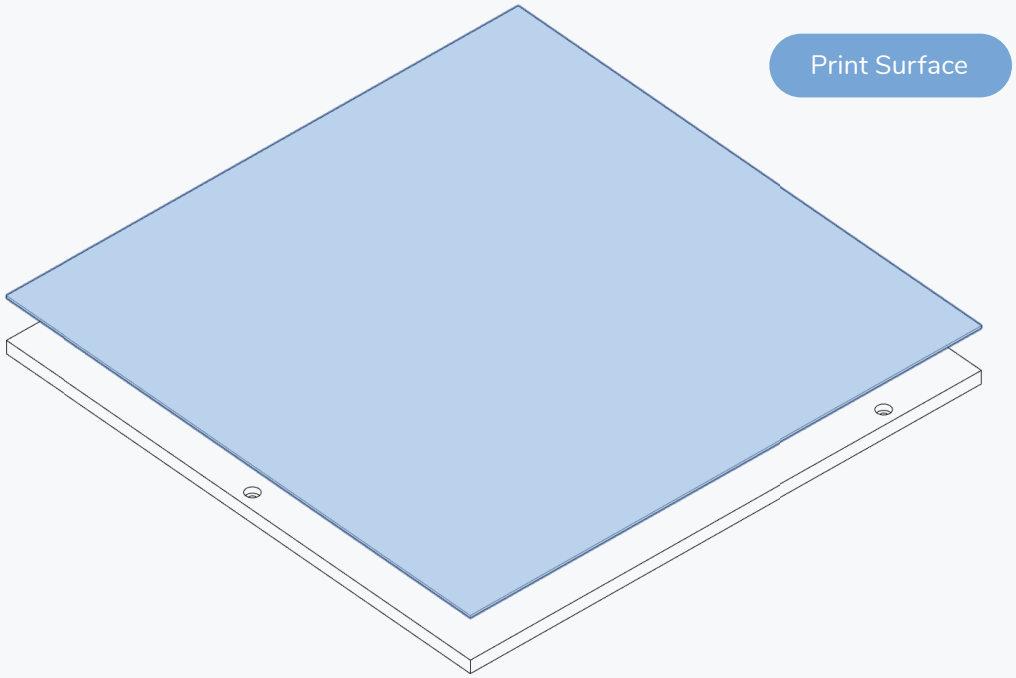




FIXED END VS. FREE END

If you cable chain as a fixed and use this end on the XY joint.





PRINT SURFACE

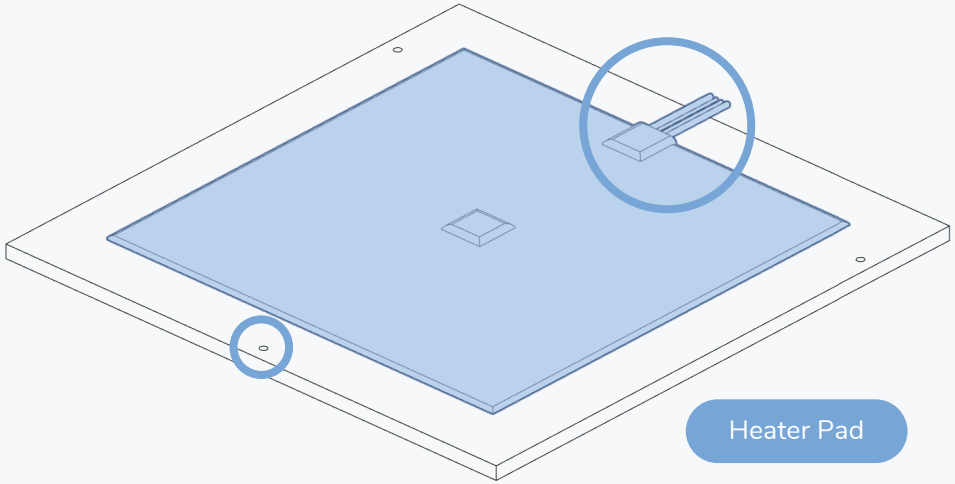
The print surface can be applied directly to the print bed or alternatively a magnet based removable system can be used.

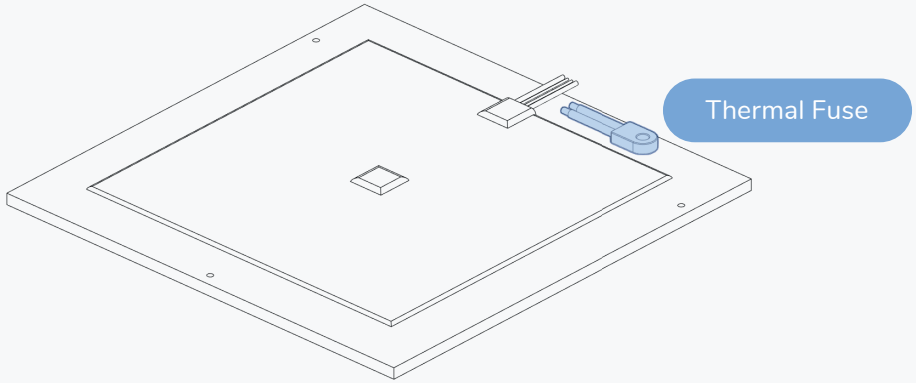
A removable surface is recommended. Preinstalling the screws is possible but not recommended as those will interfere with the heater application.

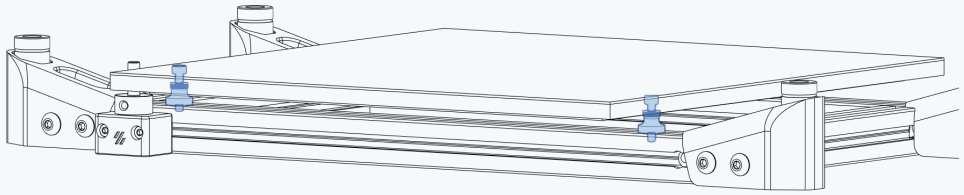
Read/watch a guide about the proper application if you are unsure.

HEATER APPLICATION

Attach the heater to the bottom of the plate with wires facing away from the center hole.
Read/watch a guide on heater installation if you are unsure about the procedure.

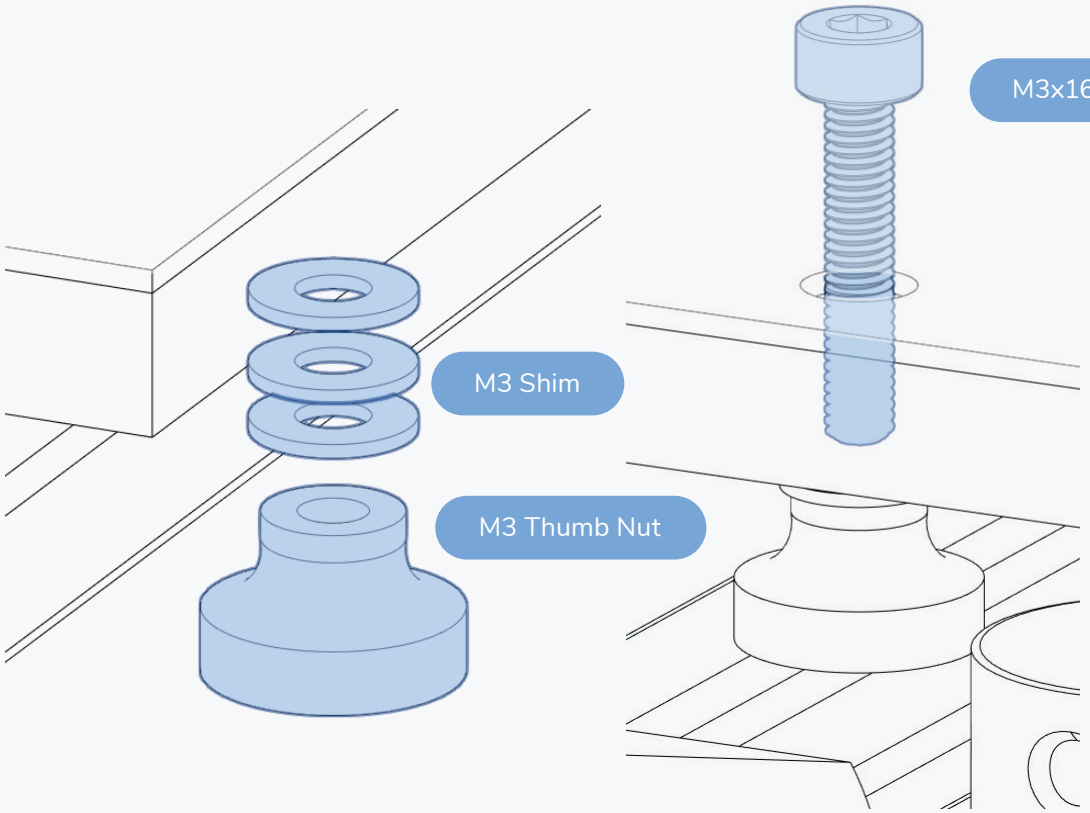




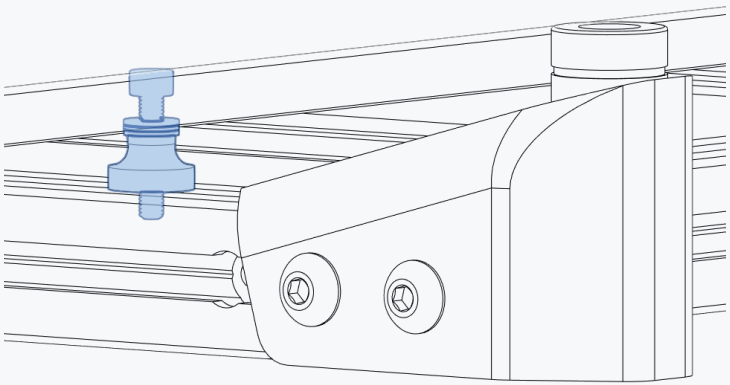


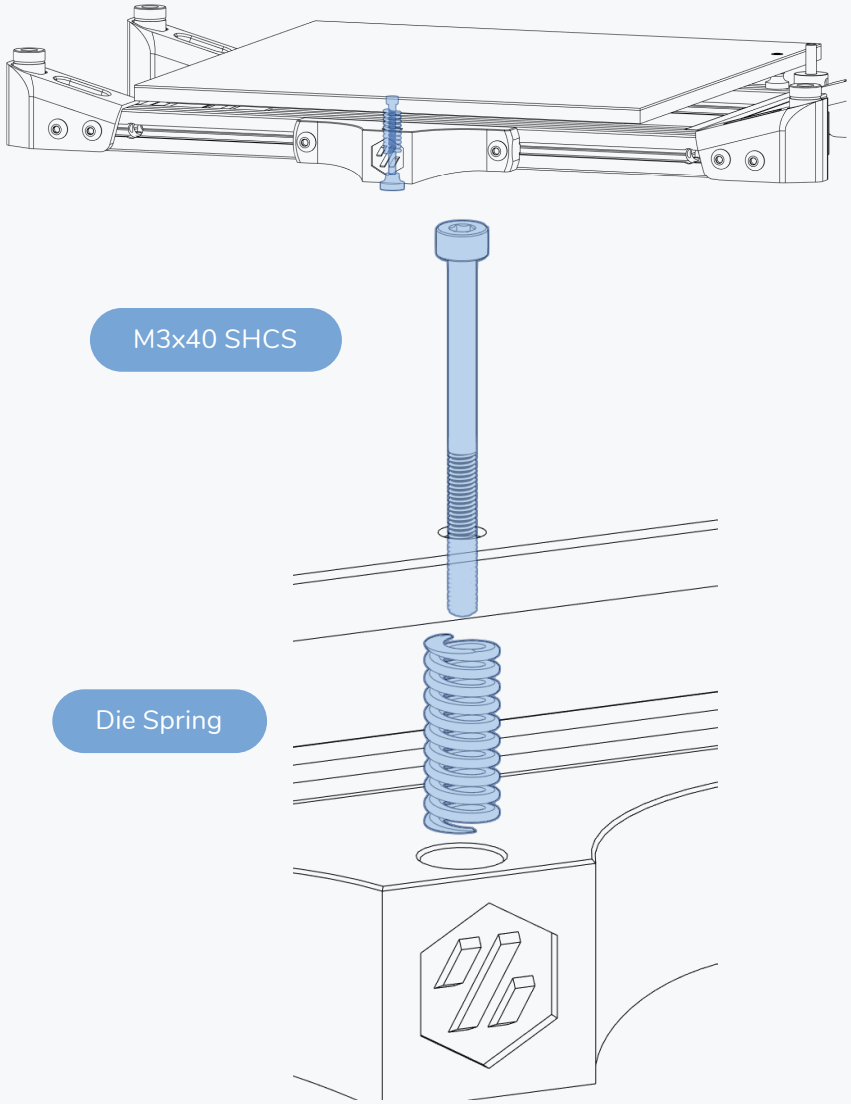
SCREW ACCESS HOLES

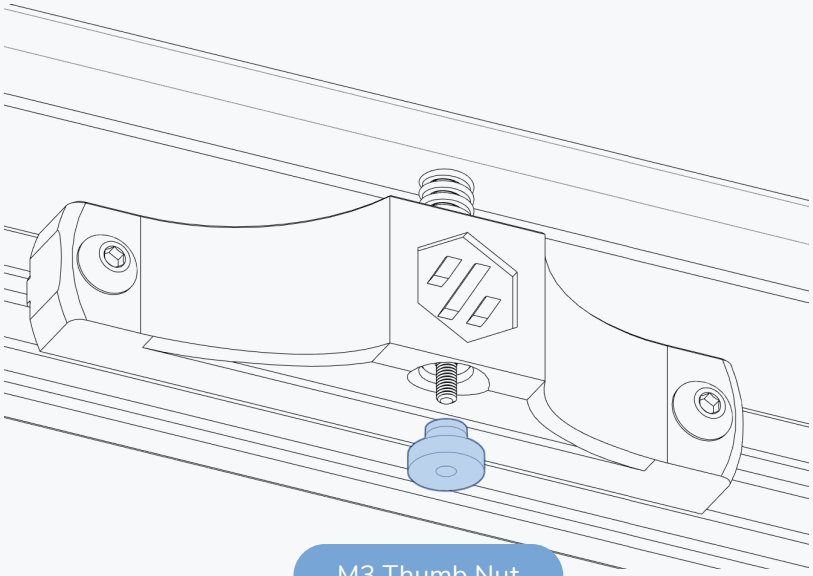
Cut holes for the screws.

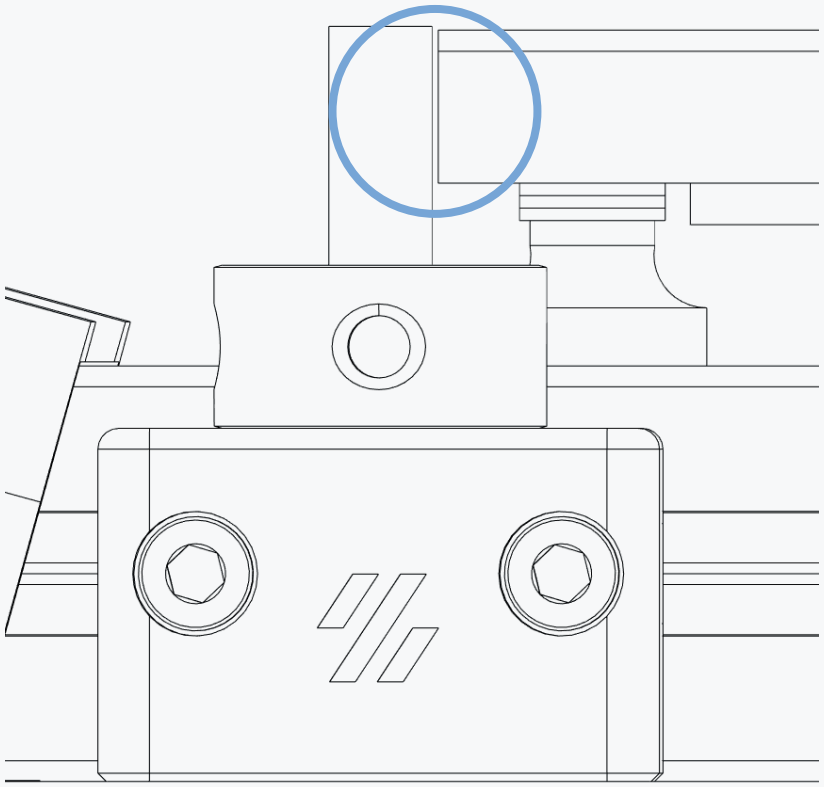


REPEAT FOR SECOND MOUNT







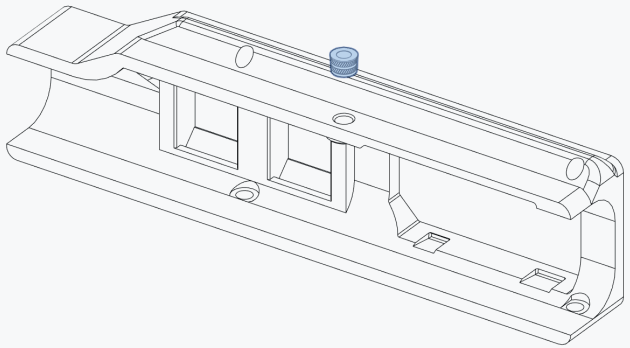


ADJUST Z ENDSTOP POSITION

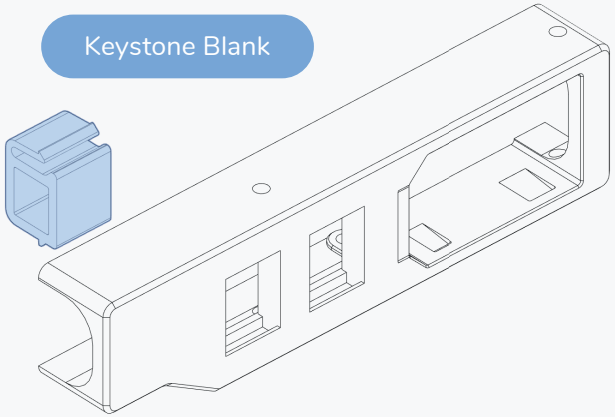
The shaft of the Z Endstop must not touch the print bed.
Adjust the position if required.

This page intentionally left blank.

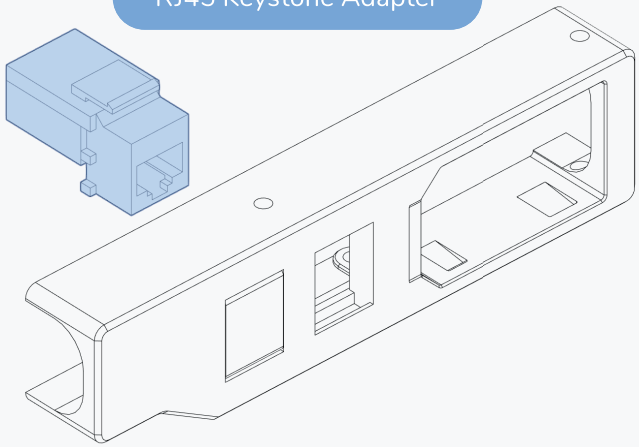
Heat Set Insert

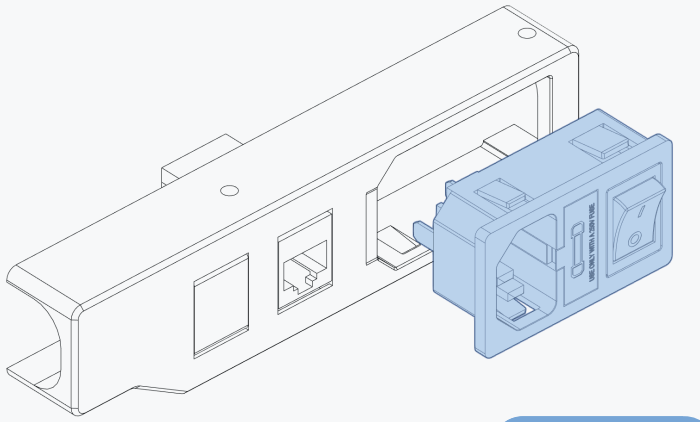


Keystone Blank

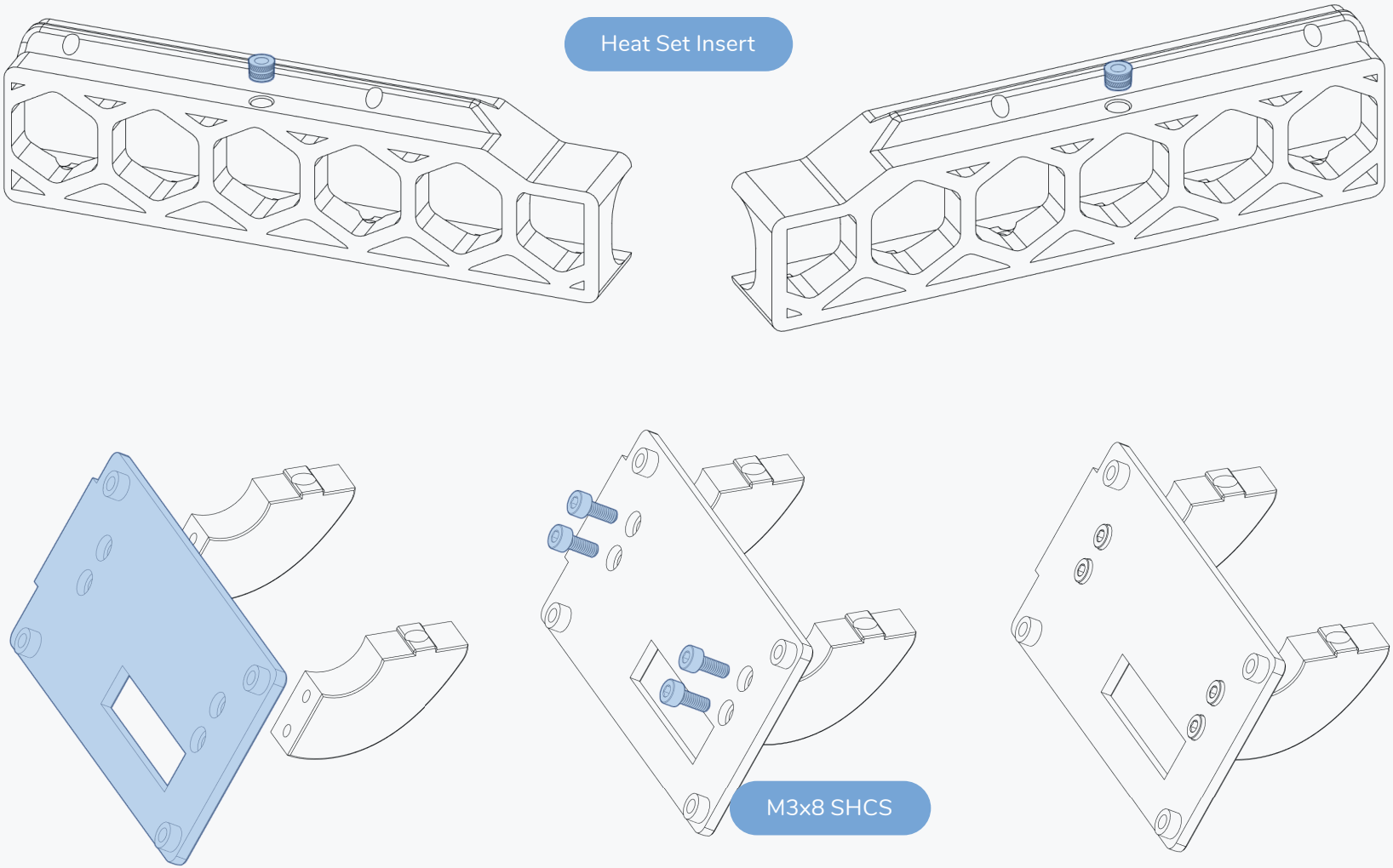


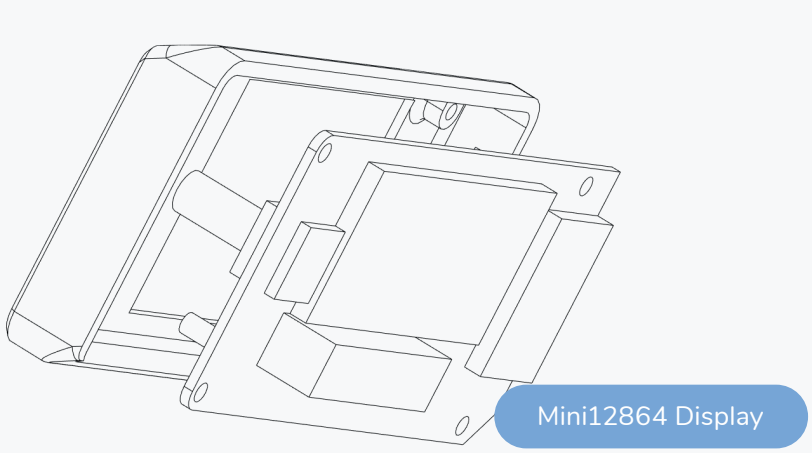
RJ45 Keystone Adapter



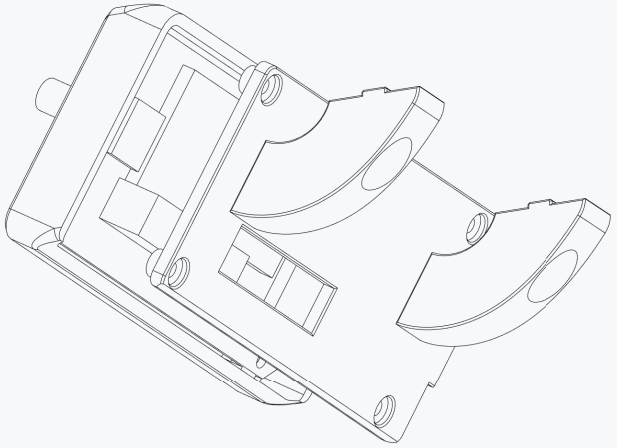


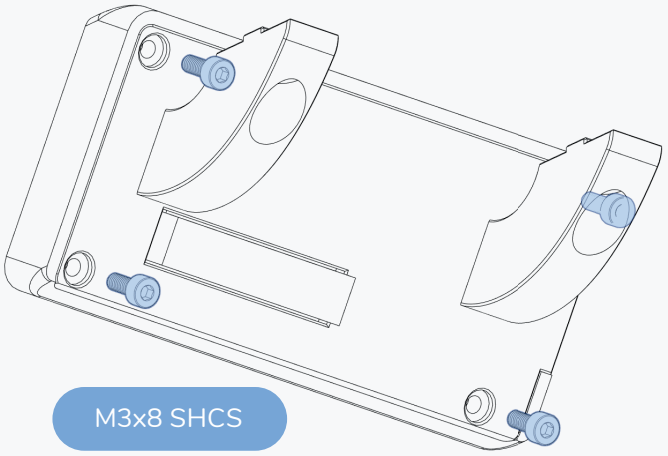
Power Inlet



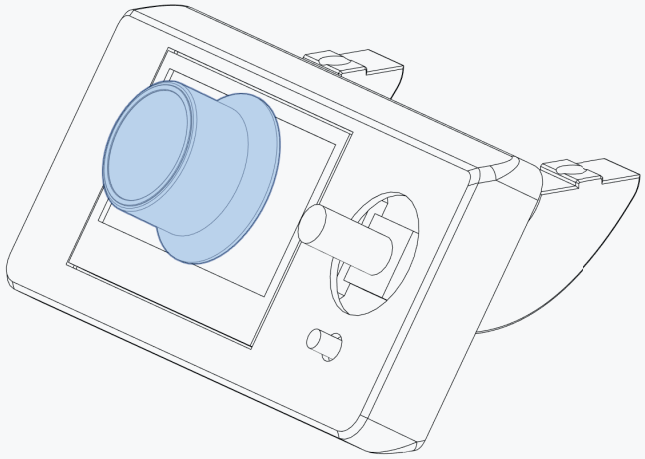


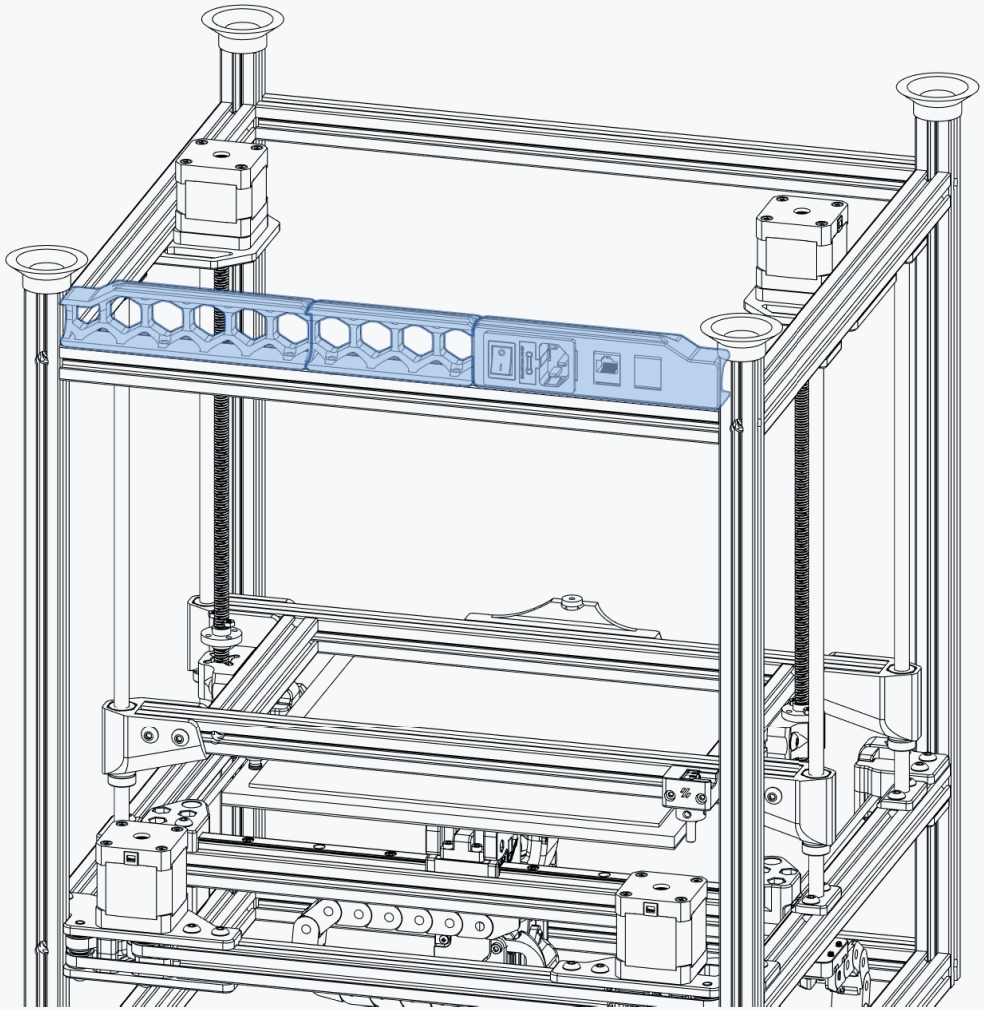
Mini12864 Display

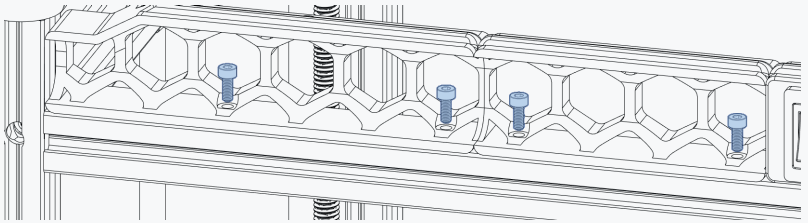




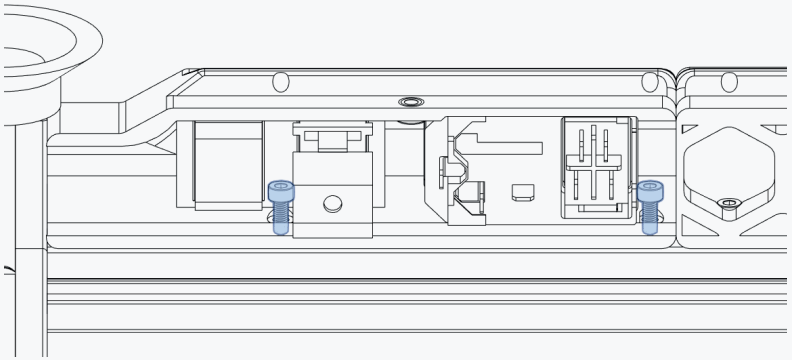
M3x8 SHCS

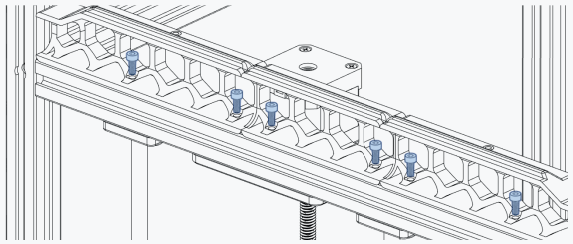




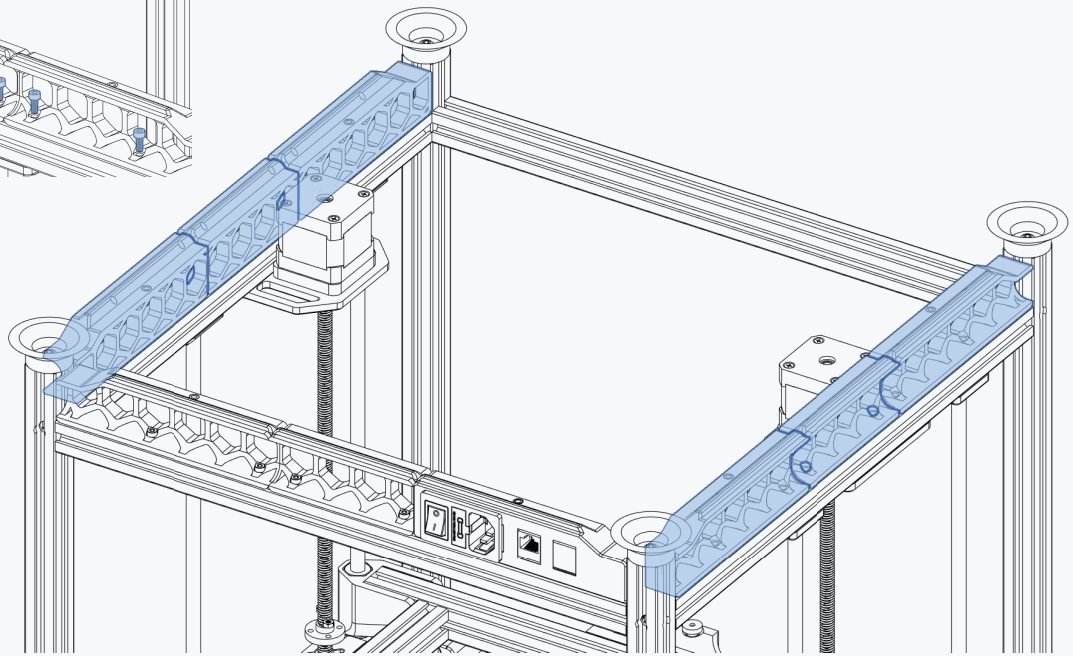


M3x8 SHCS

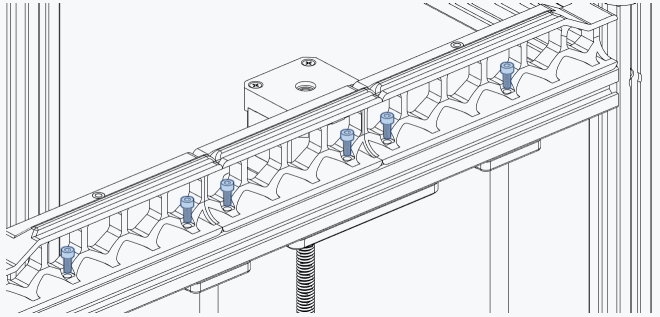


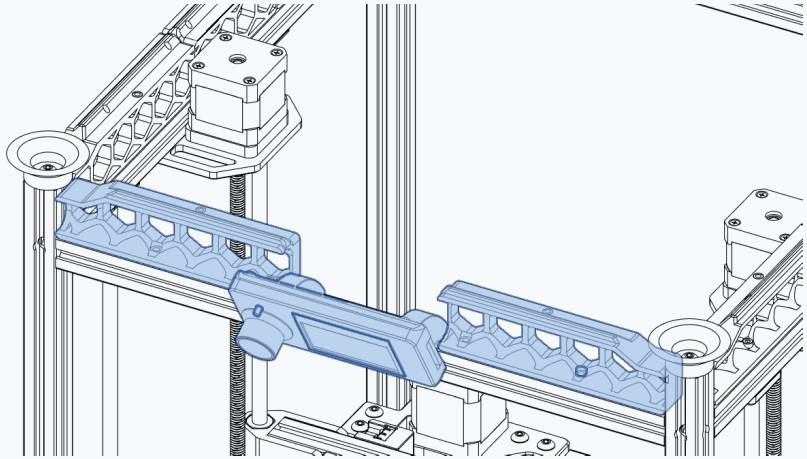


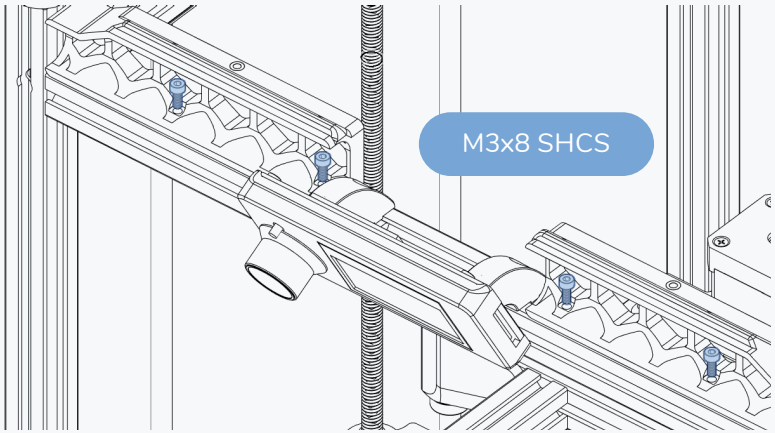
M3x8 SHCS

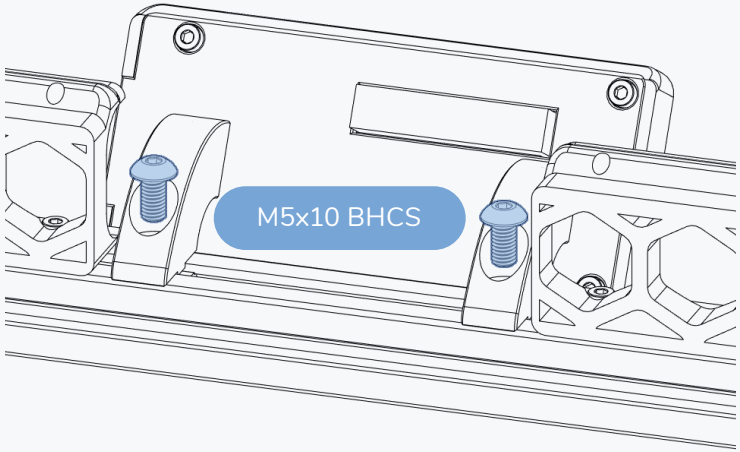


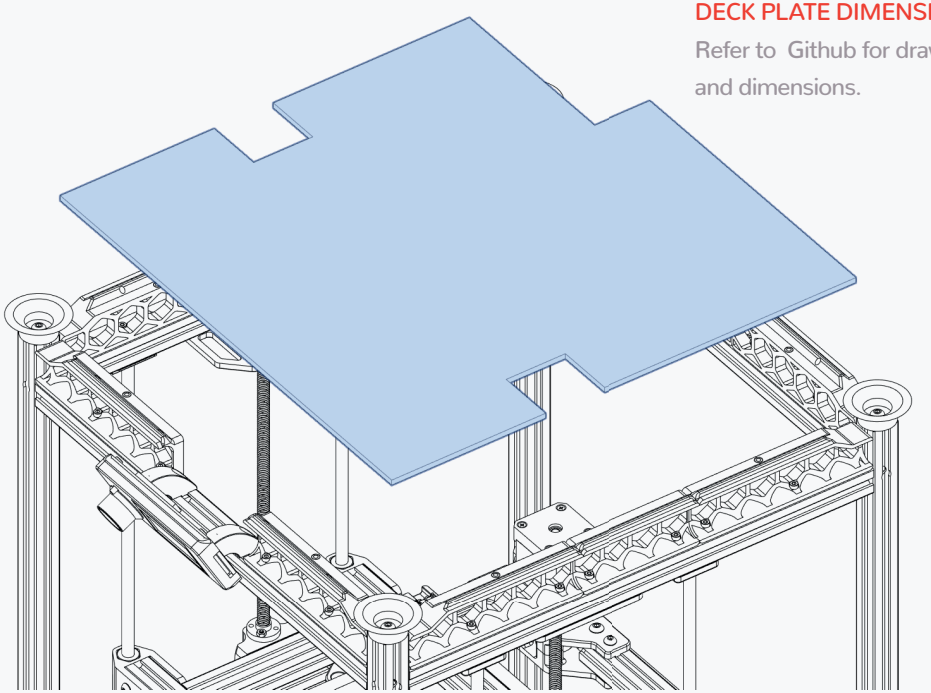
M3x8 SHCS





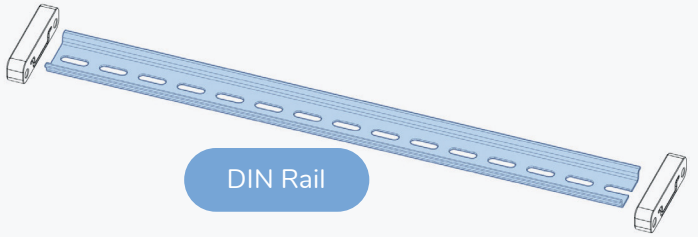


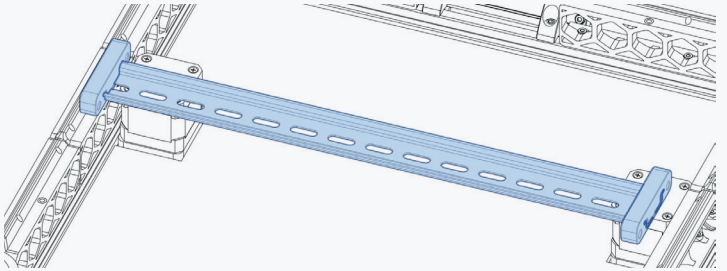


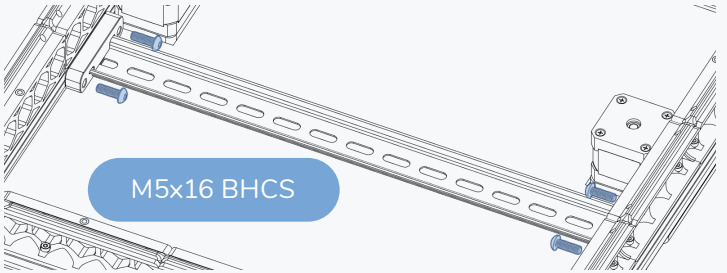


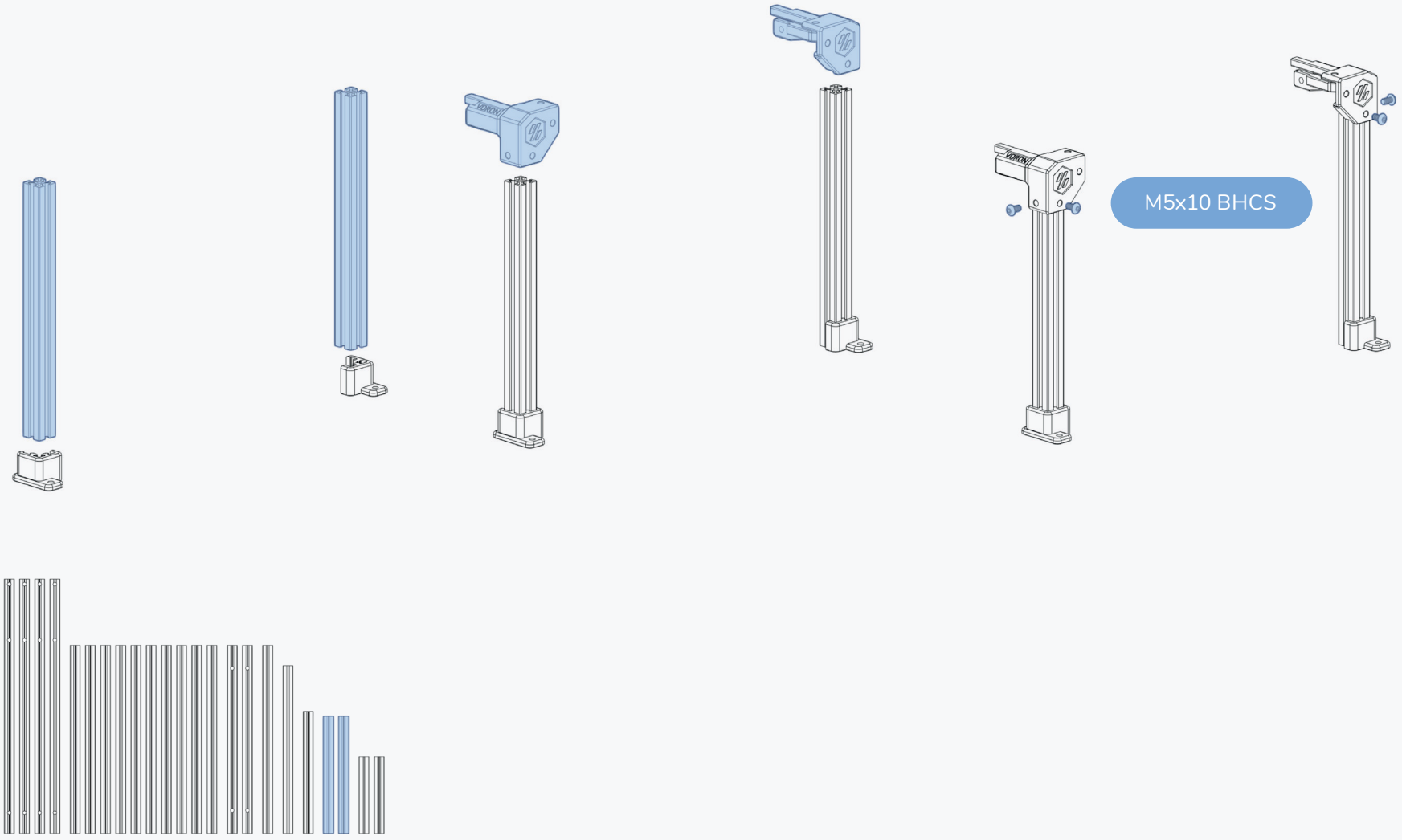
DECK PLATE DIMENSIONS

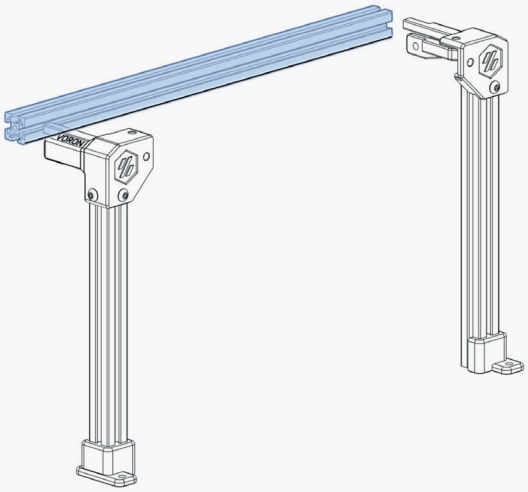
Refer to Github for drawings and dimensions.

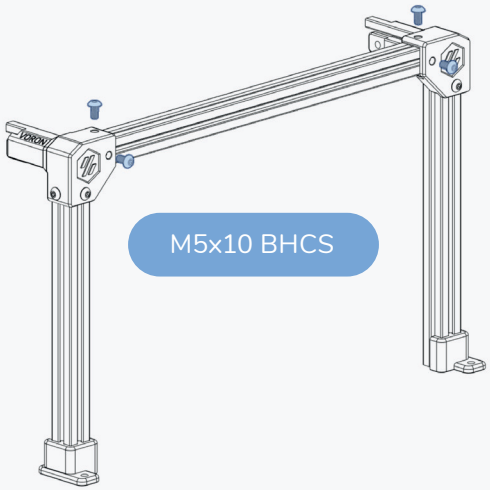


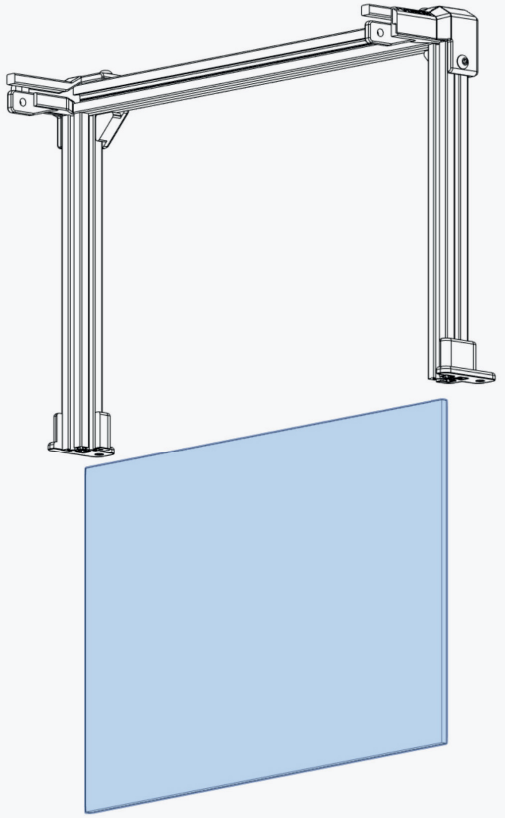


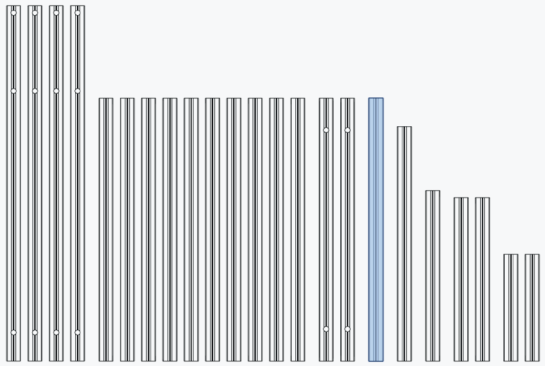


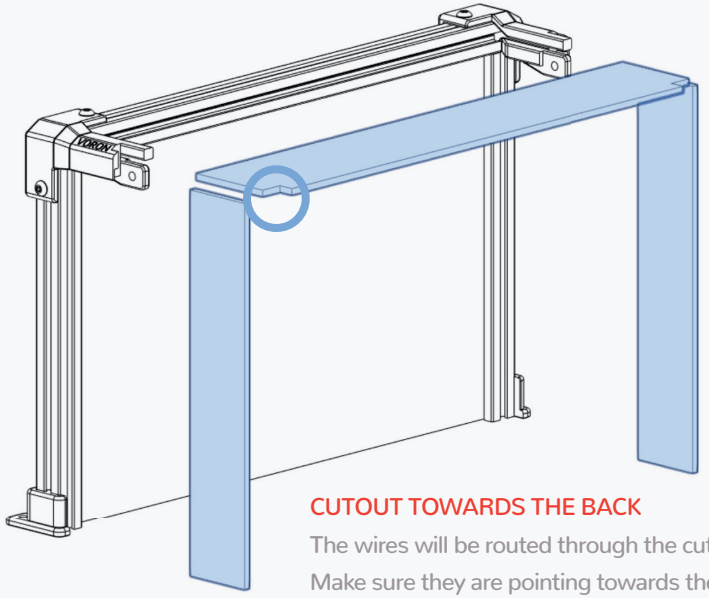


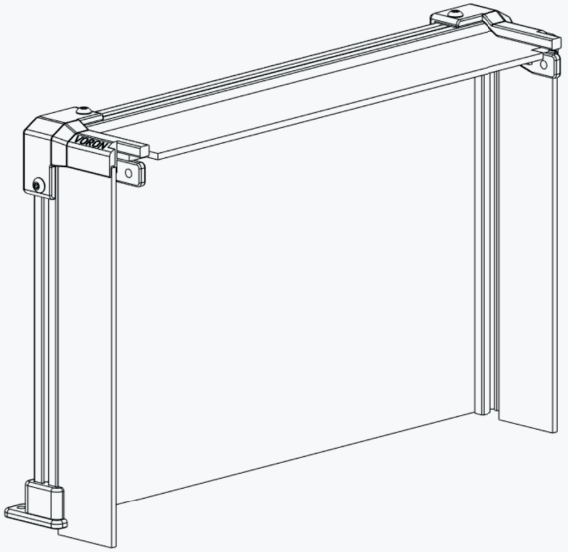






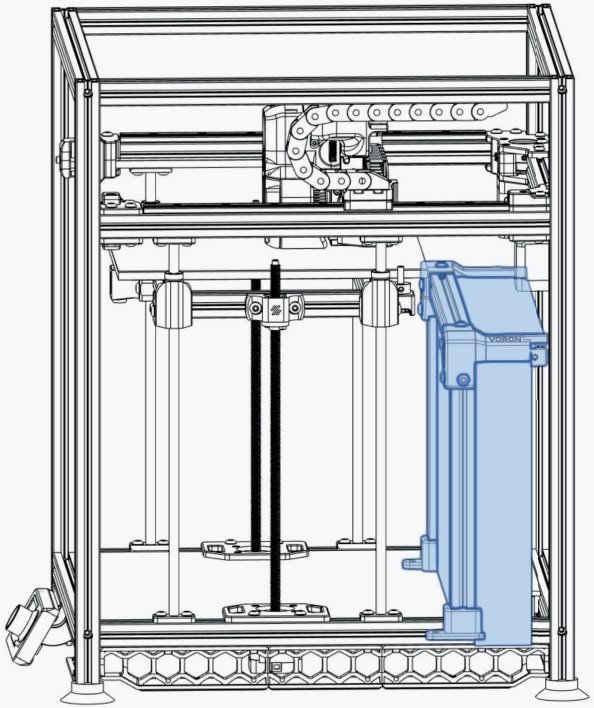


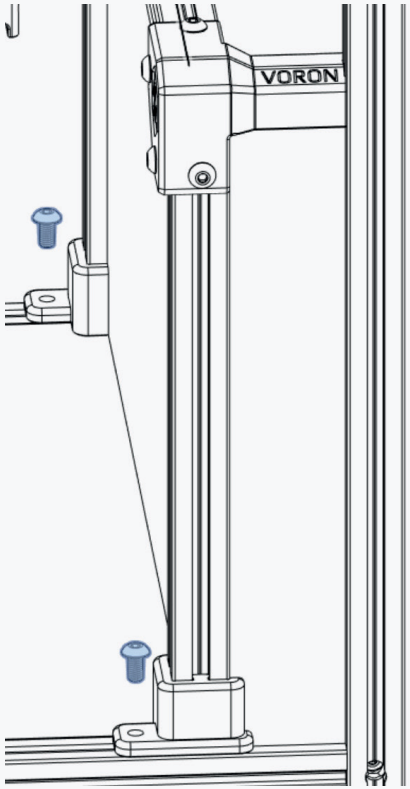


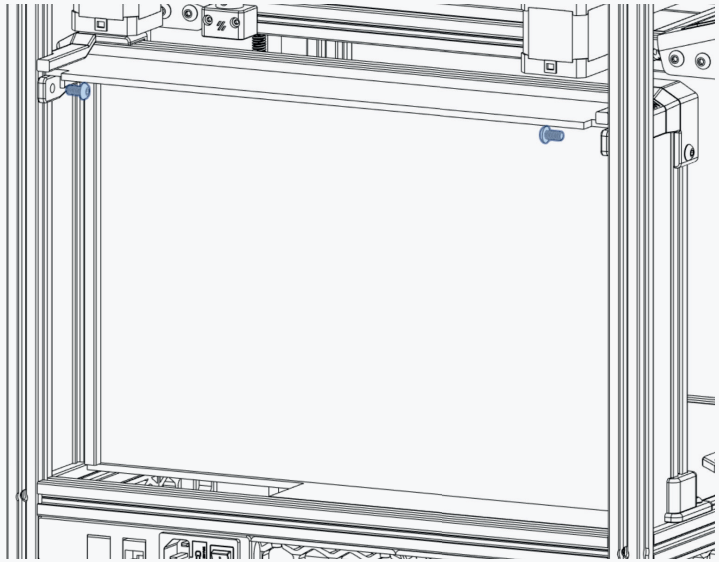


CUTOUT TOWARDS THE BACK

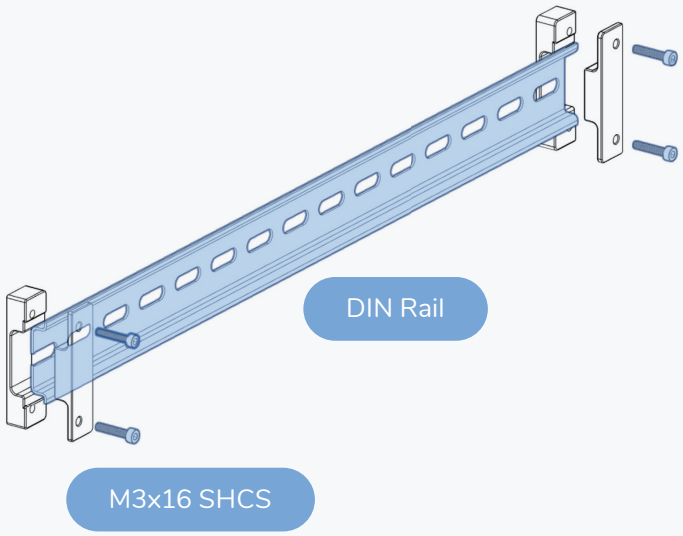
The wires will be routed through the cutouts. Make sure they are pointing towards the back of the printer.

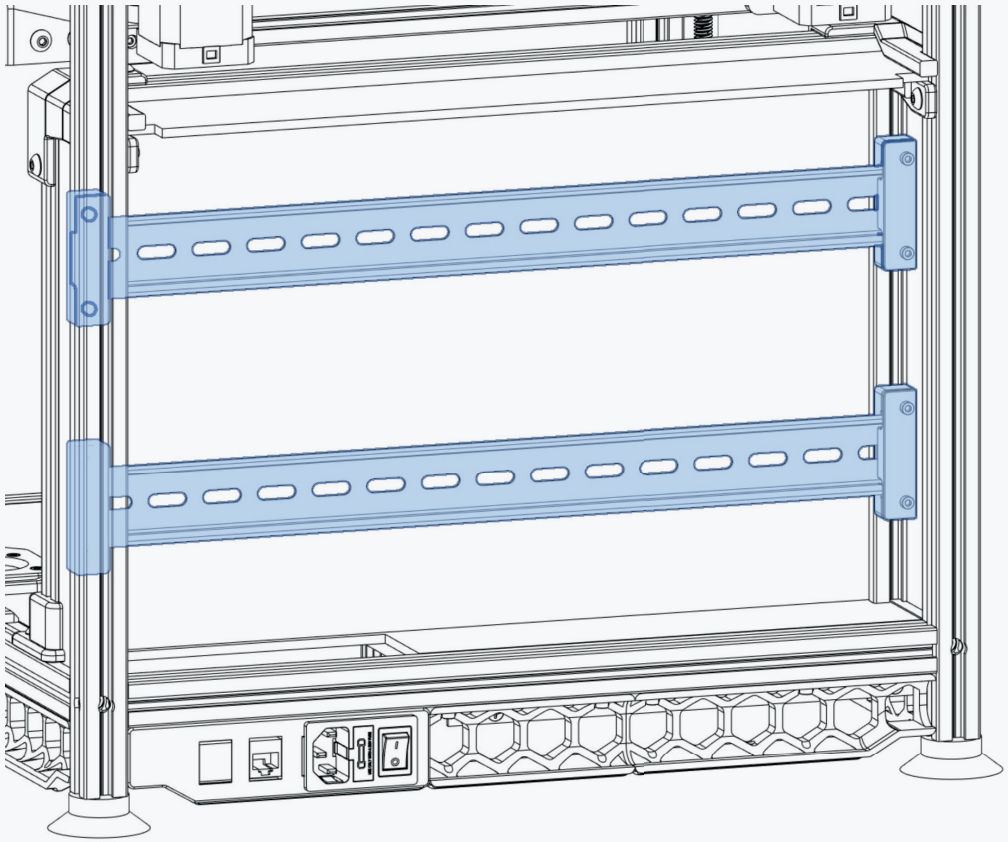


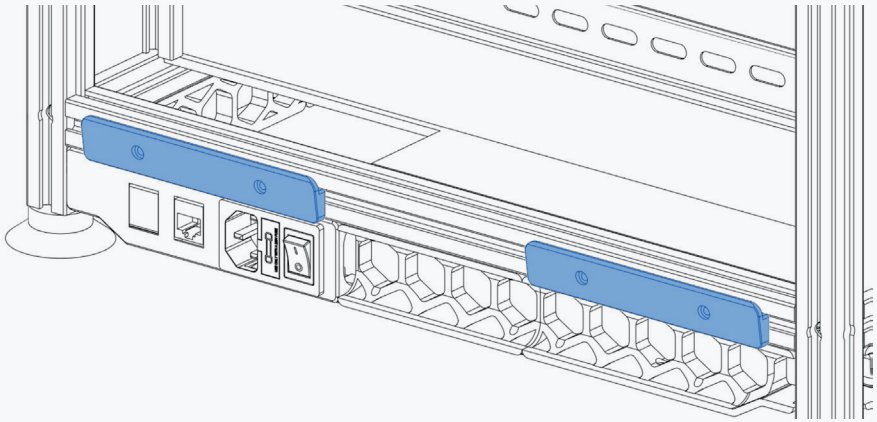


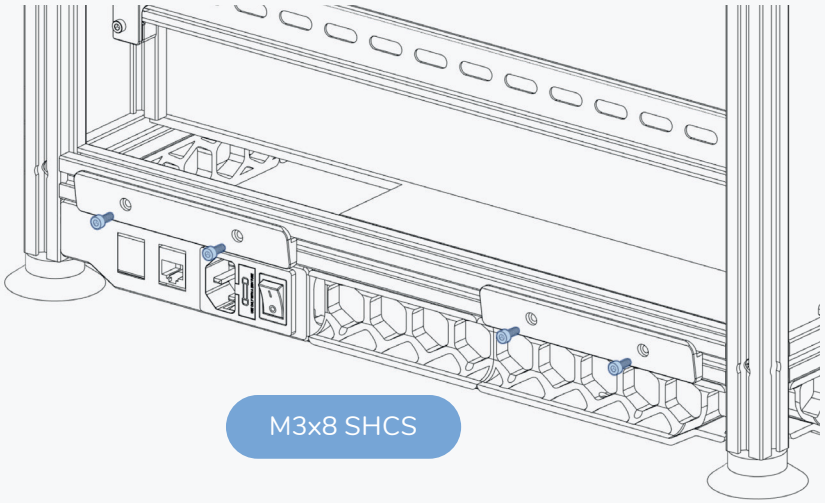


M5x10 BHCS

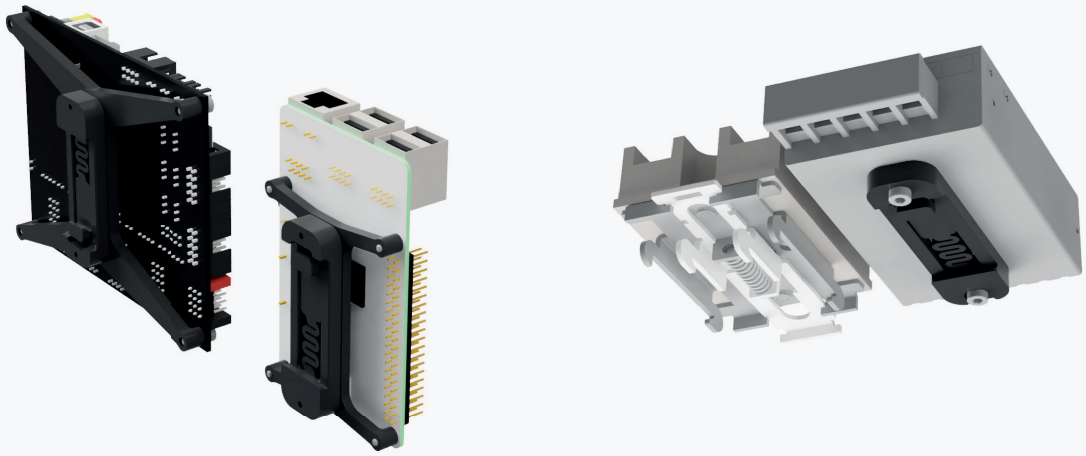




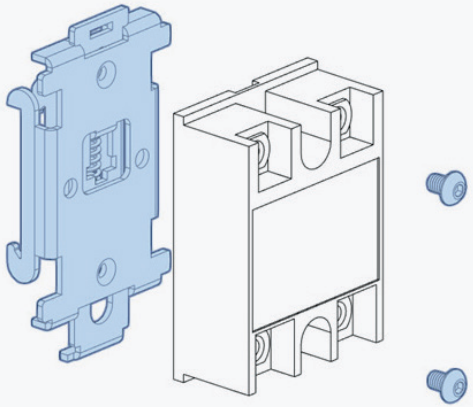




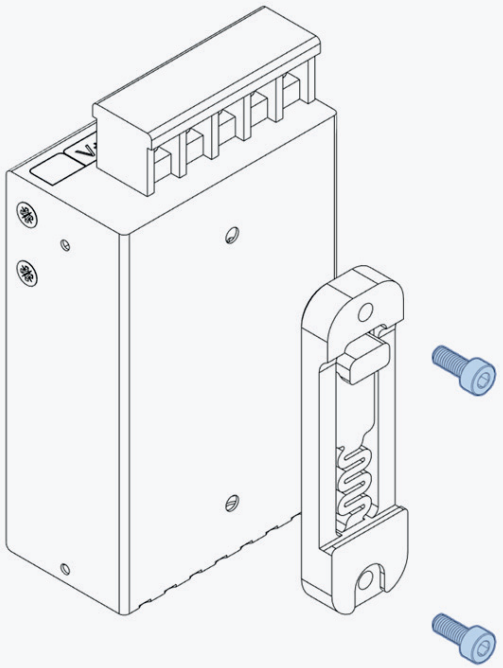
This page intentionally left blank.



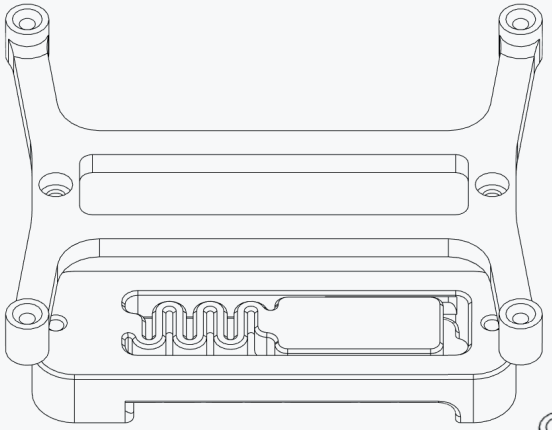
SSR Din Mount

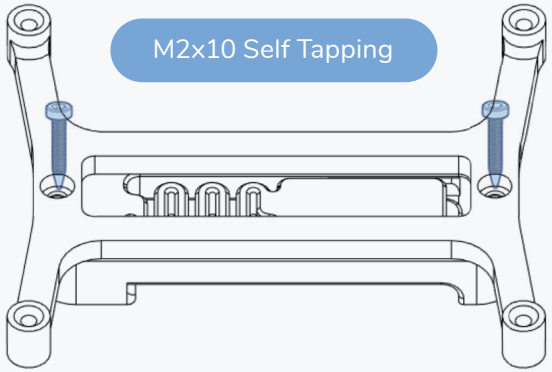


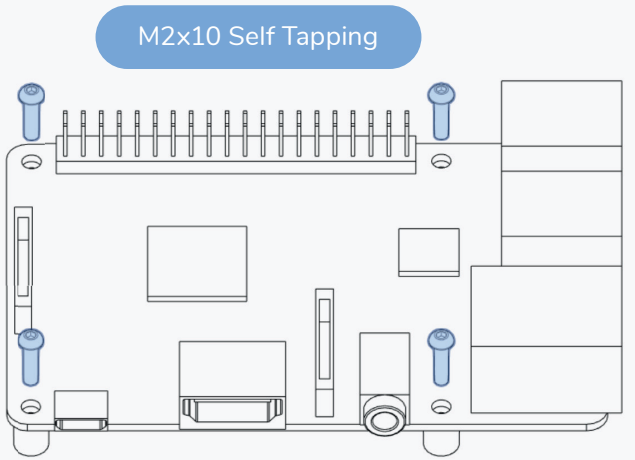
M4x6 BHCS

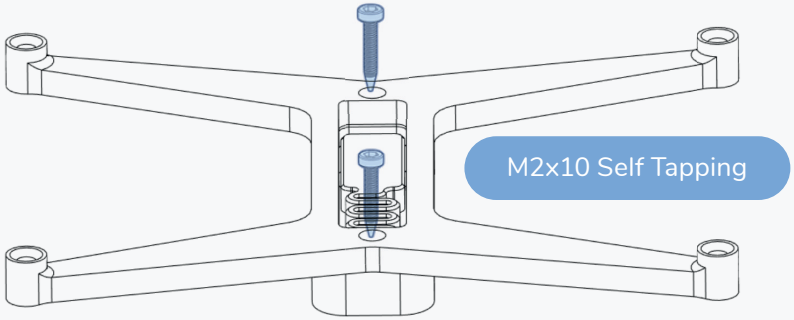


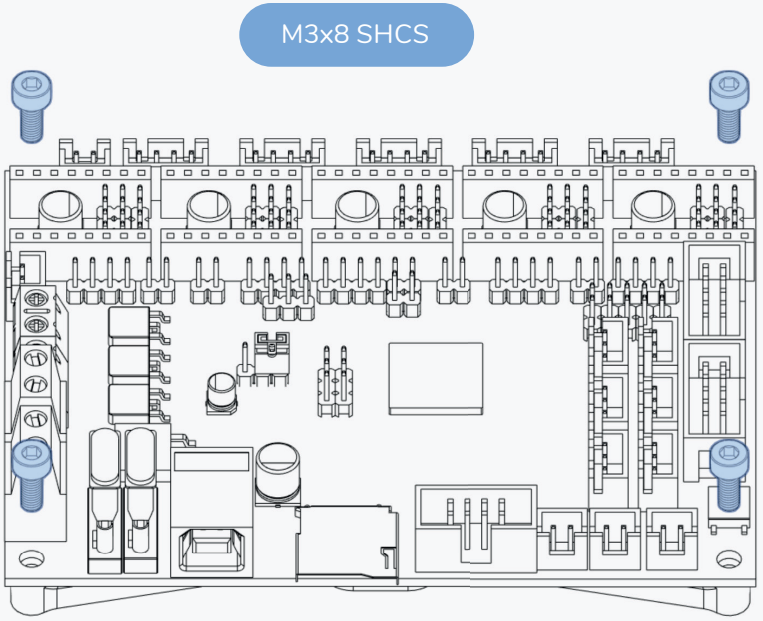
M3x8 SHCS

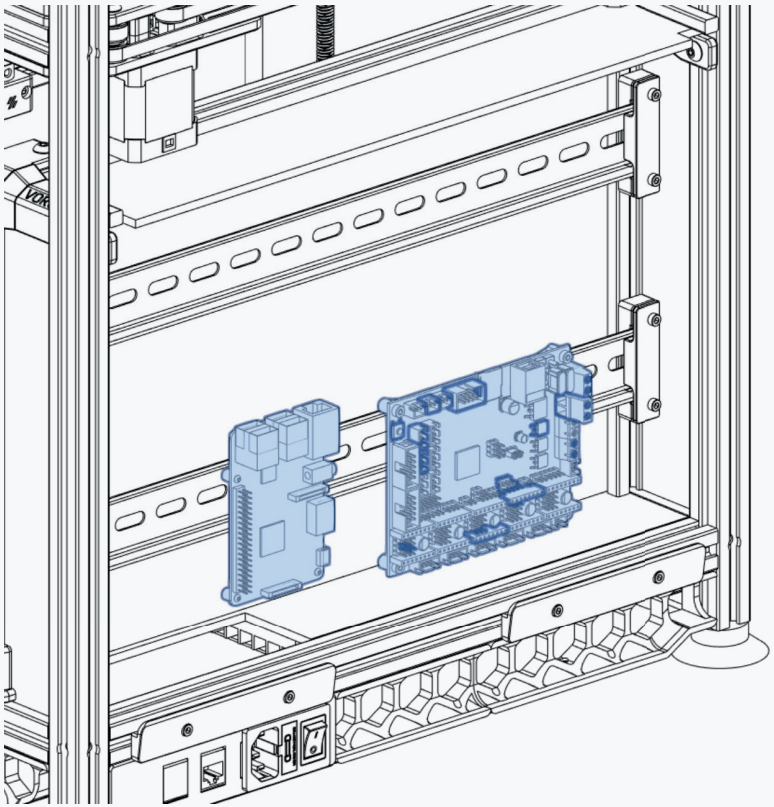


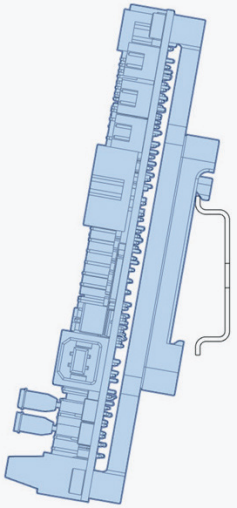

M2x10 Self Tapping

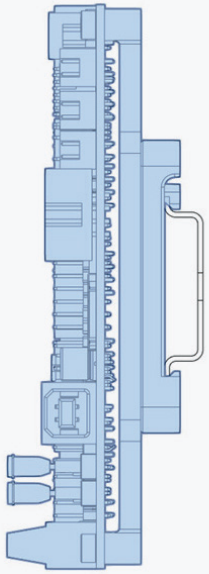

M2x10 Self Tapping

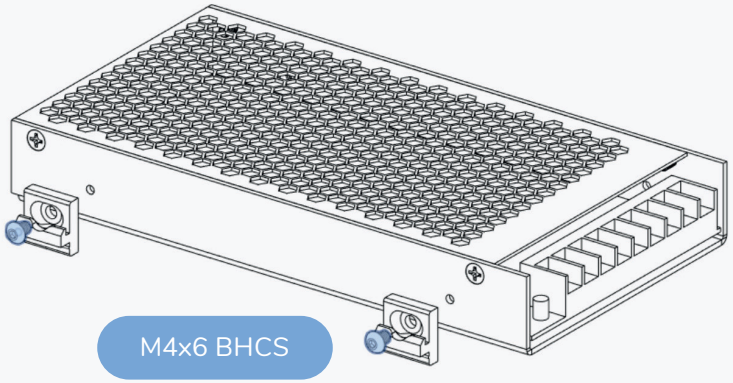


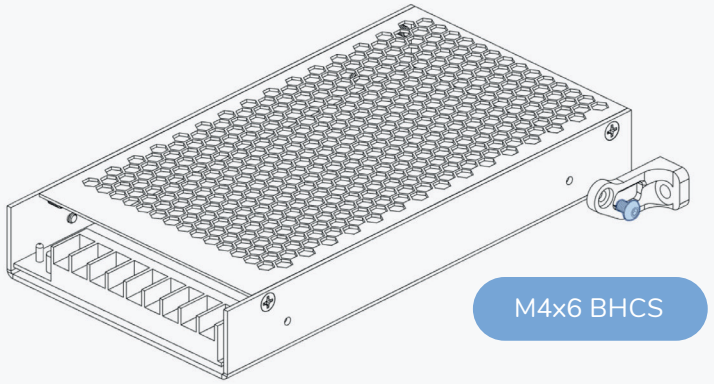


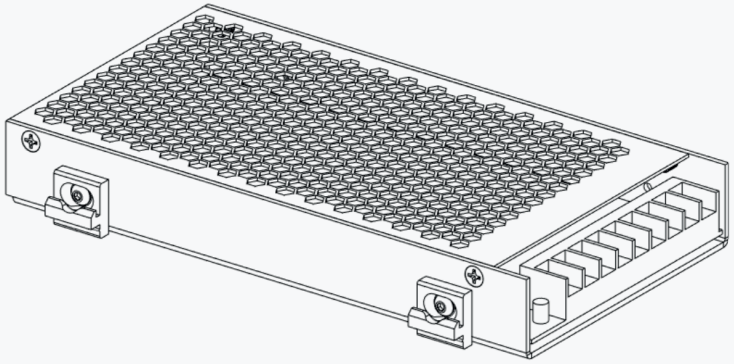


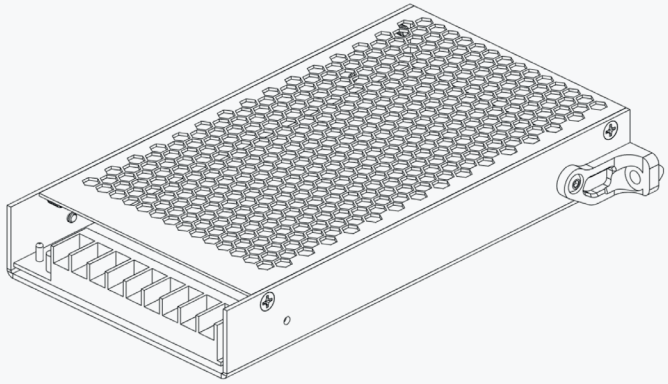


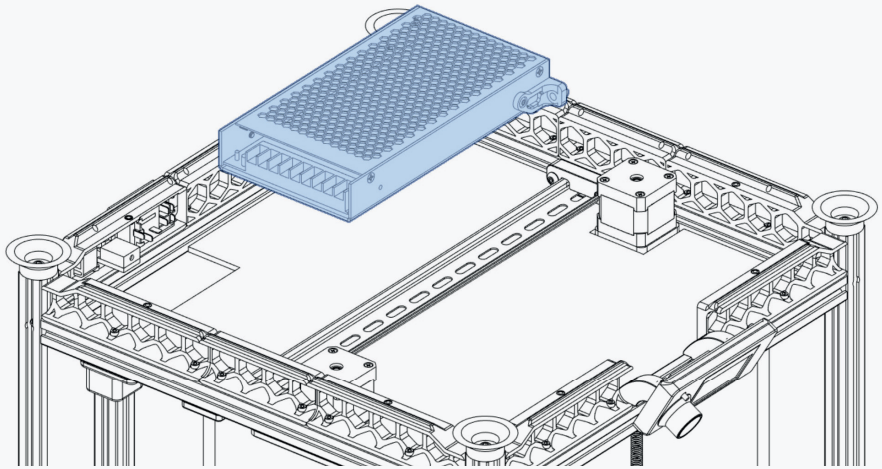


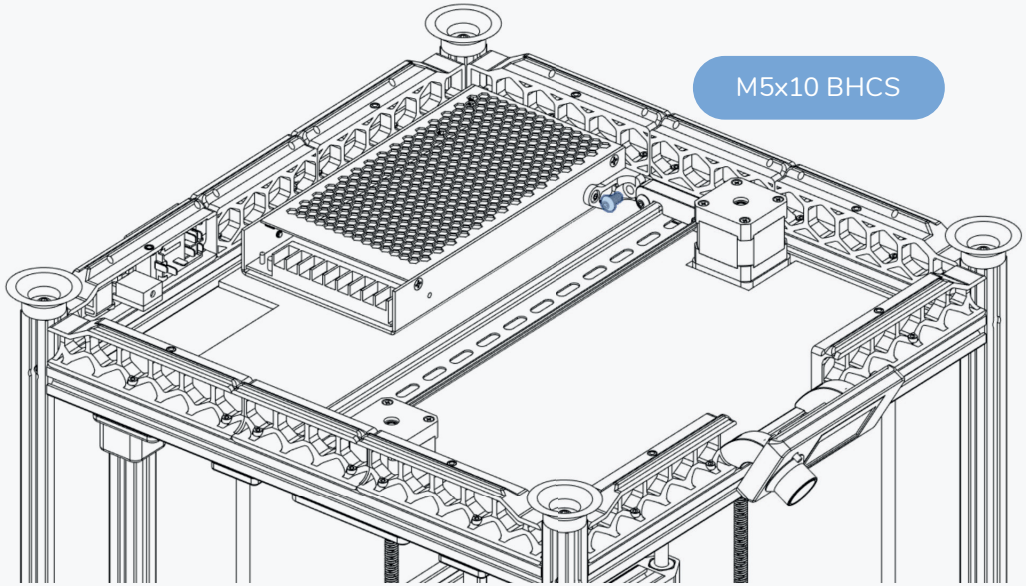


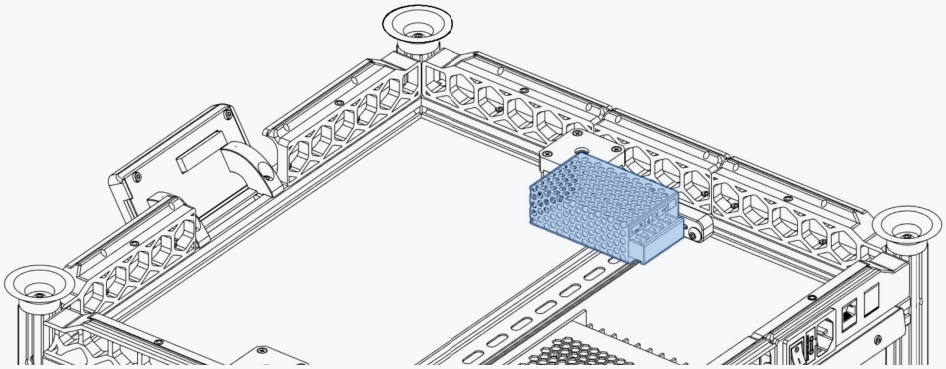


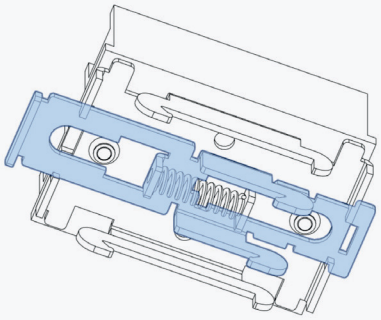


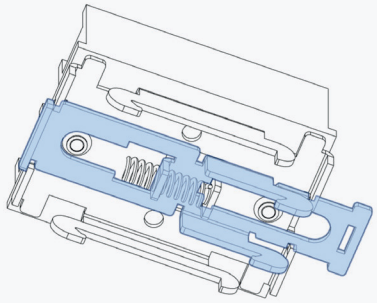








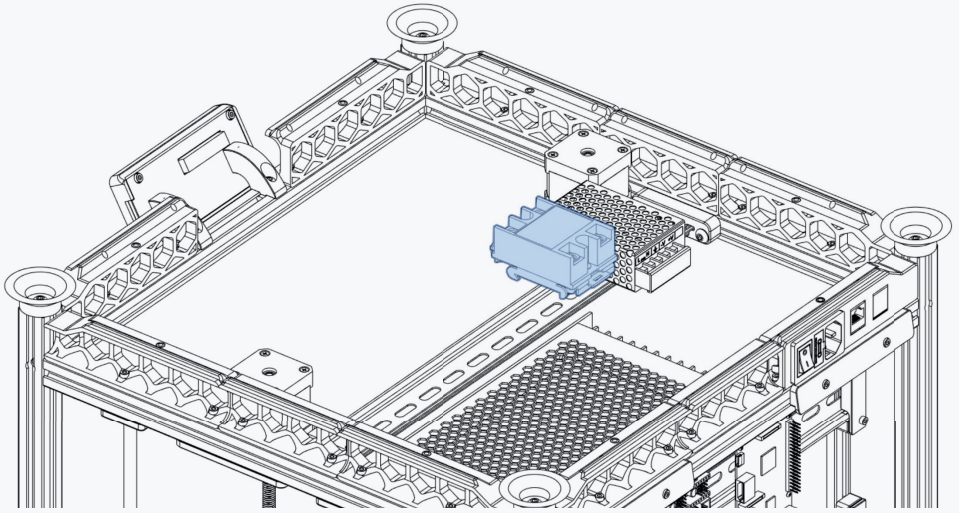


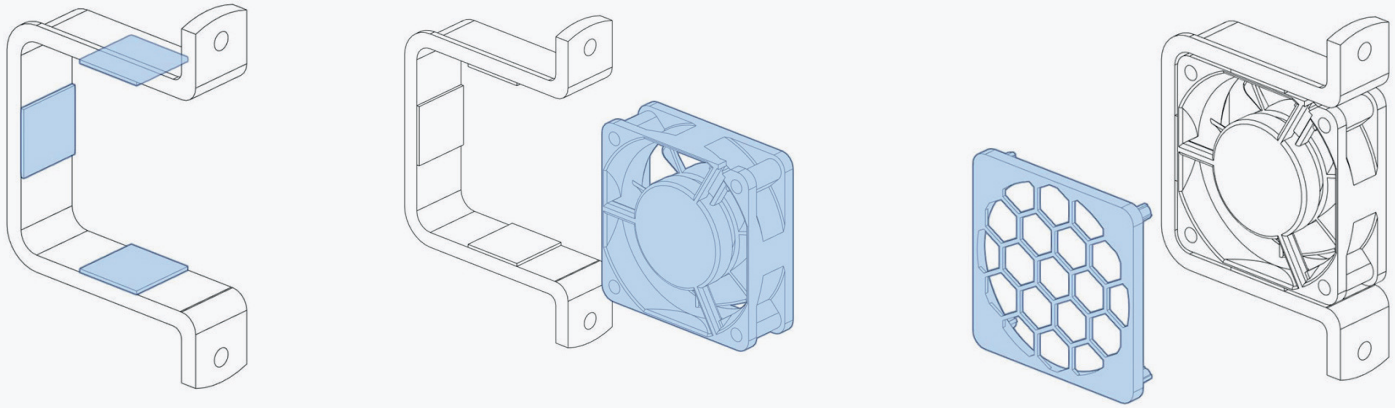


SPRING LOADED

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

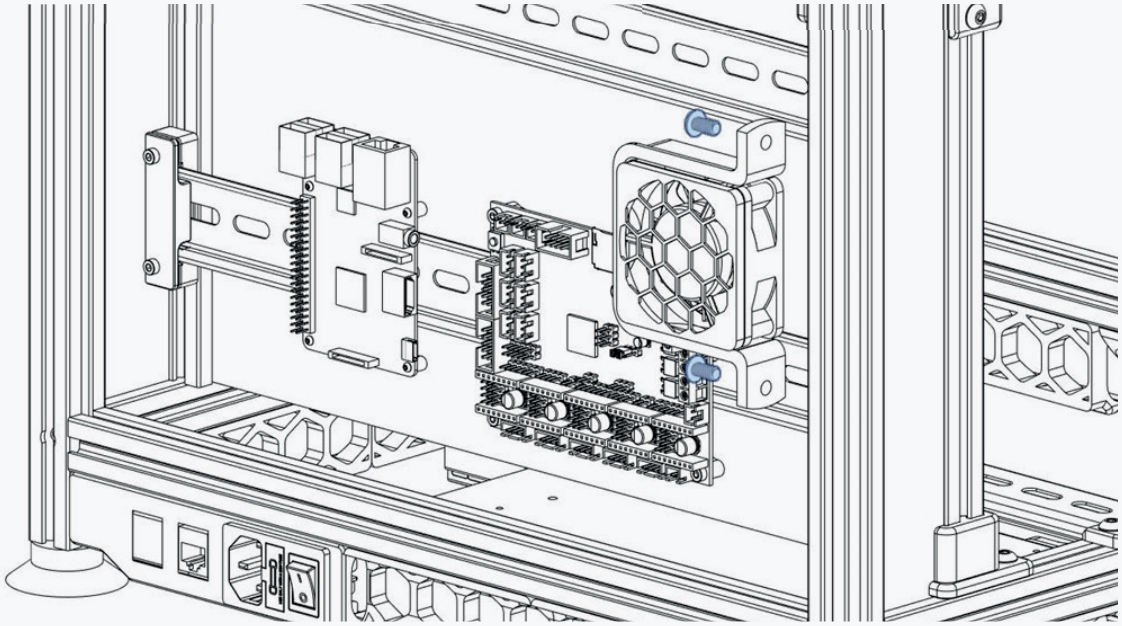
Be careful when releasing the latch, it will snap back into place. Mind your fingers.



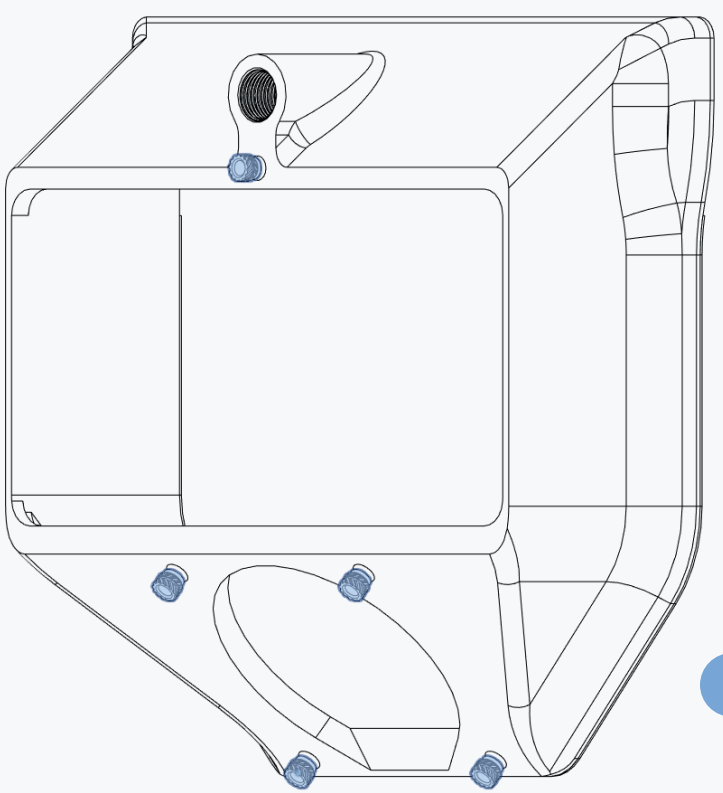


APPLY VHB TAPE

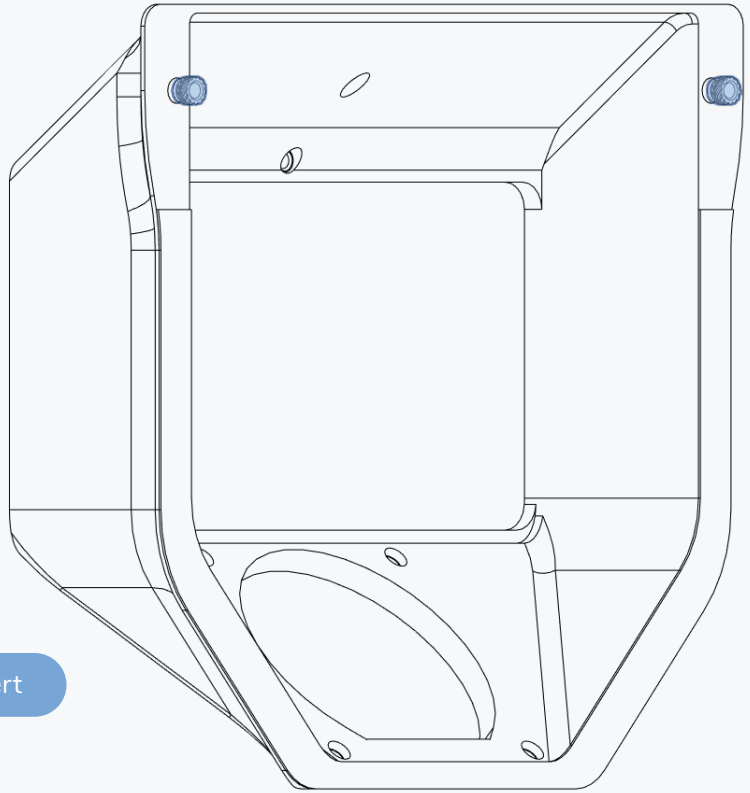
3M VHB tape is a double sided adhesive tape. Other vendors have similar products that you can use as a substitute.

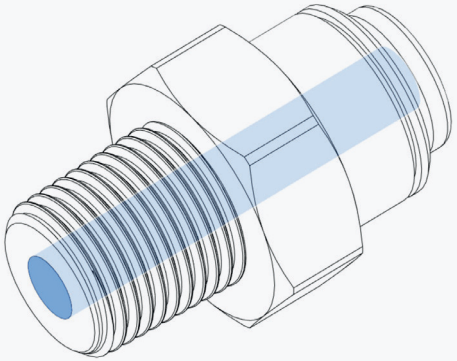


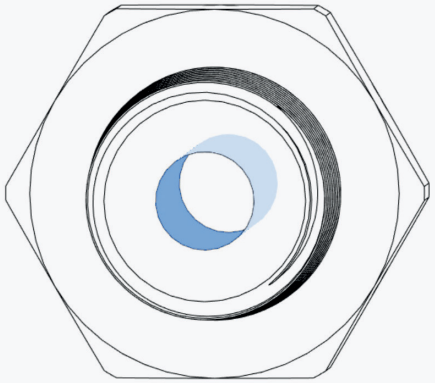
This page intentionally left blank.



Heat Set Insert



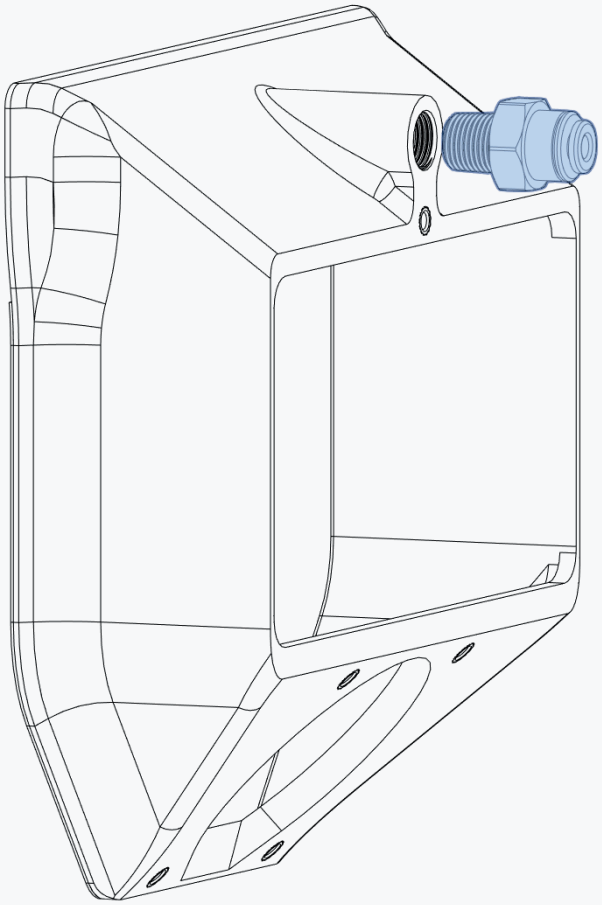


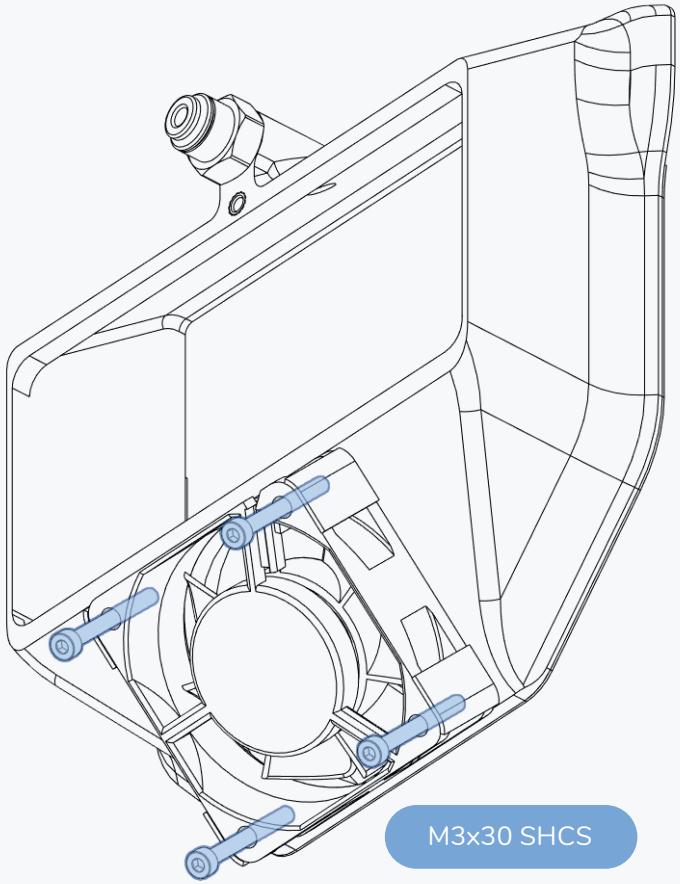


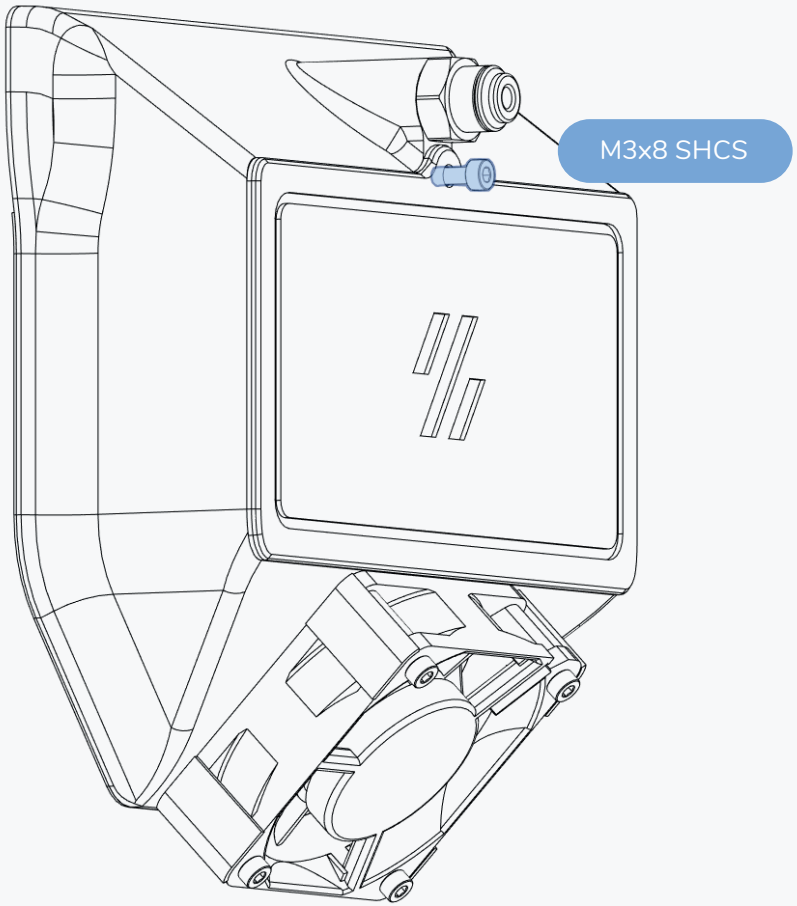
BSPP ADAPTER

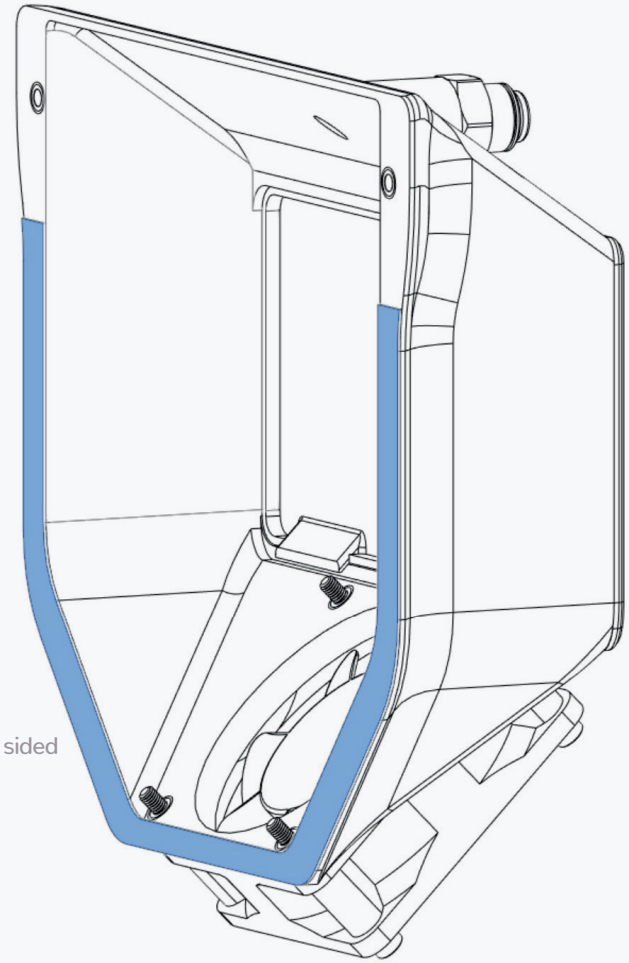
Some adapters have a small lip that prevents the PTFE tube from passing through.

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



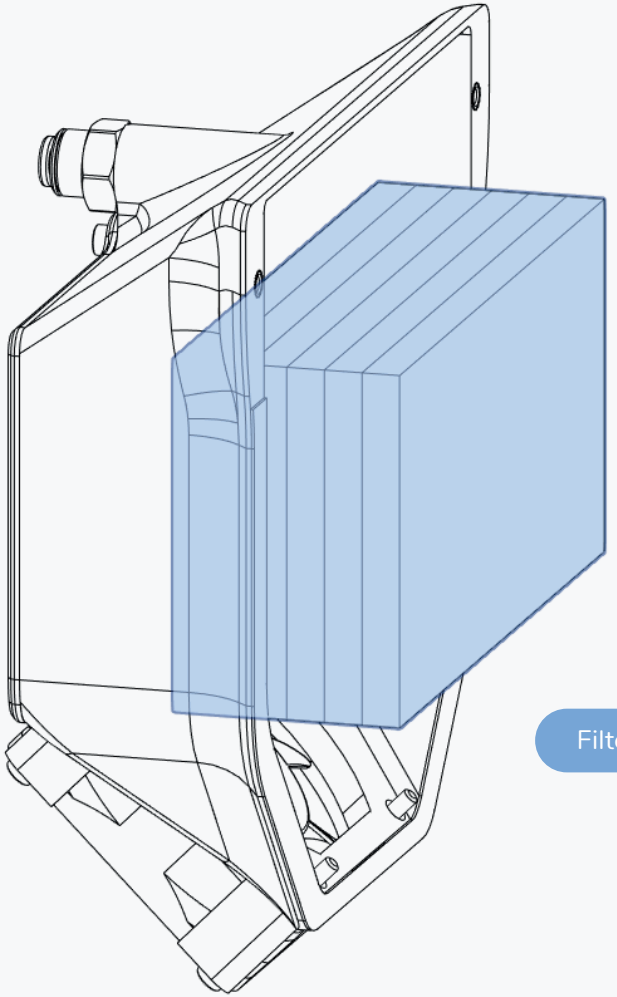




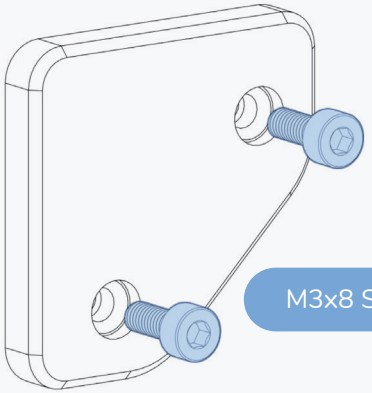


APPLY VHB TAPE

VHB Tape is a double sided adhesive tape.



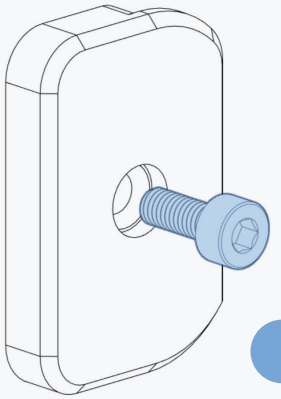
Filter Material



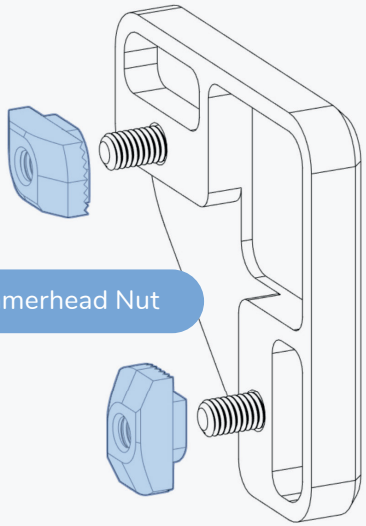
M3x8 SHCS

HAMMERHEAD NUTS?

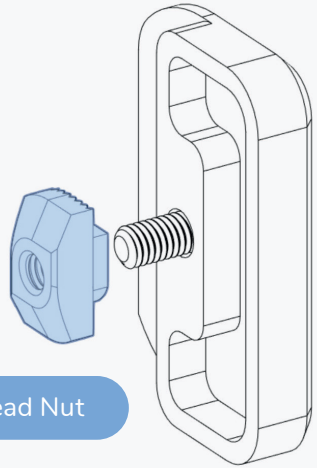
A drop of thread locker will turn the hammerhead nuts into a 1/4 turn quick release for the panels. Best done once the assembly is finished.



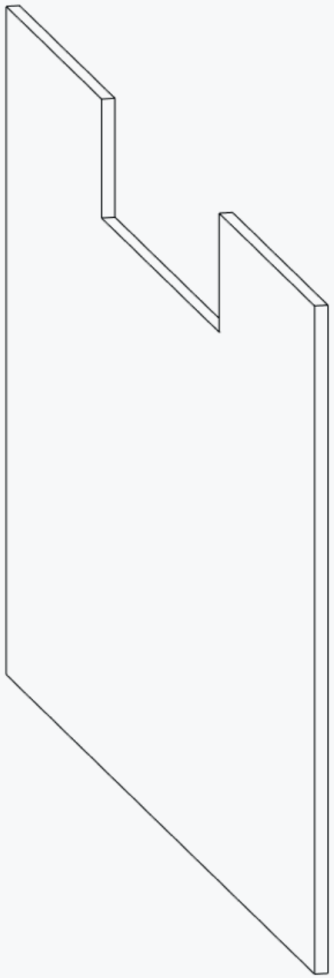
M3x8 SHCS



M3 Hammerhead Nut

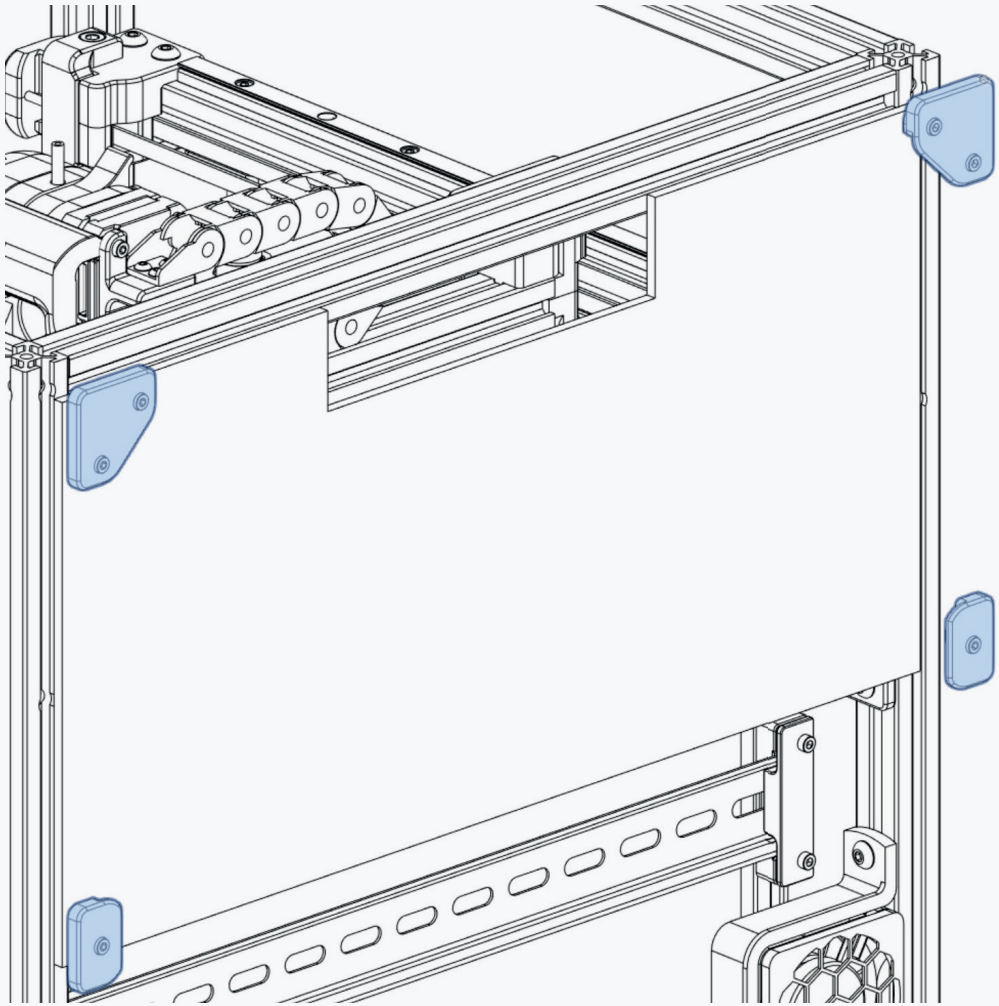


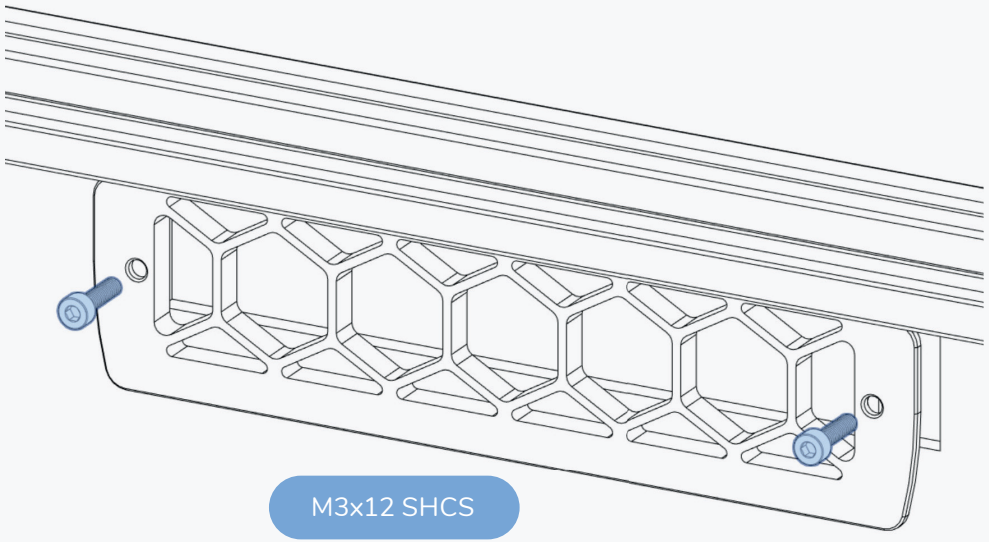
M3 Hammerhead Nut



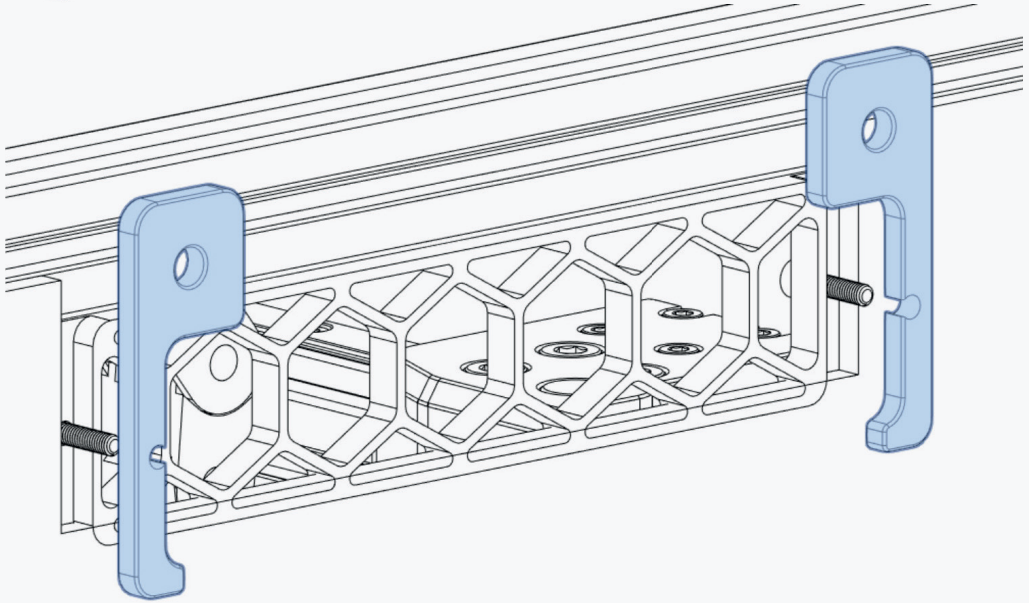
APPLY FOAM TAPE

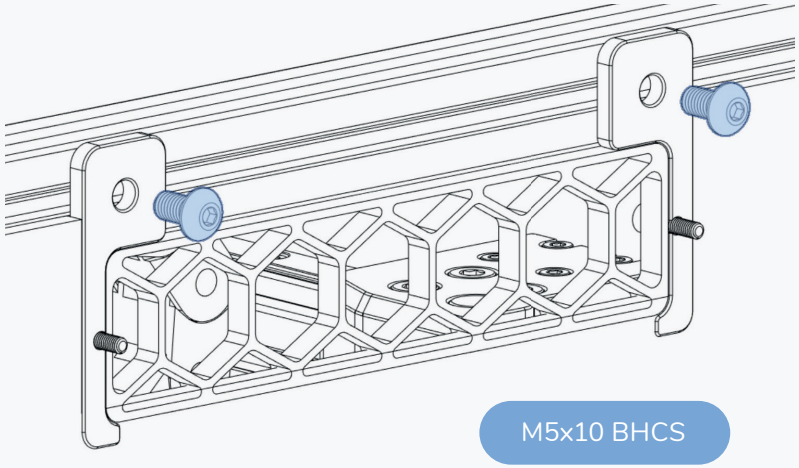
Use foam tape on the contact areas between the panels and the frame to mitigate noise from vibrations.





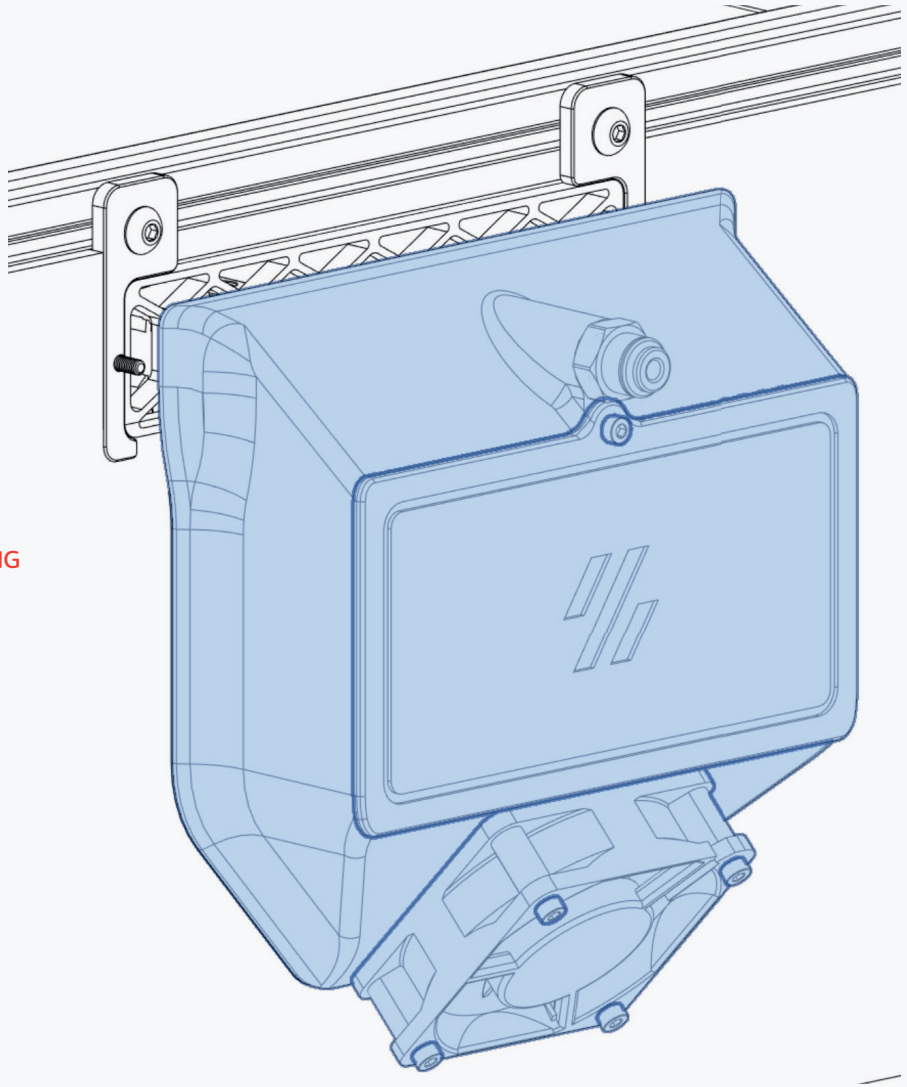
M3x12 SHCS



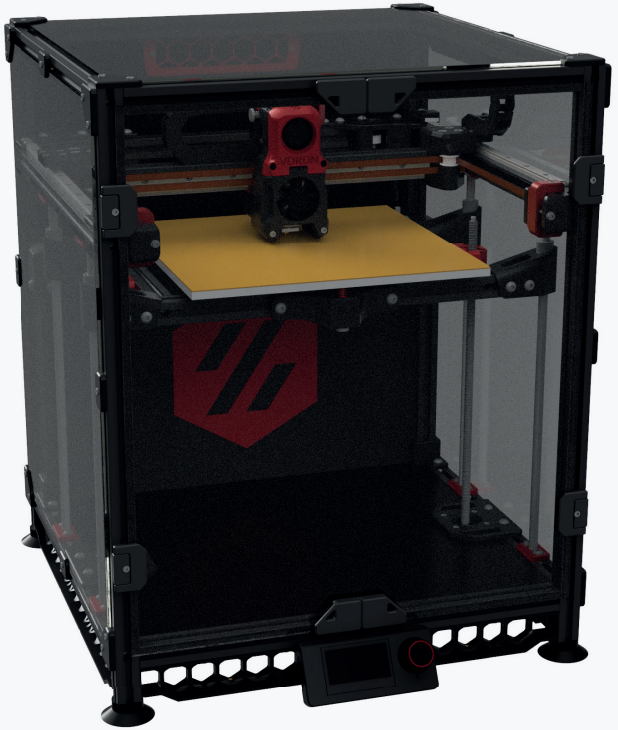


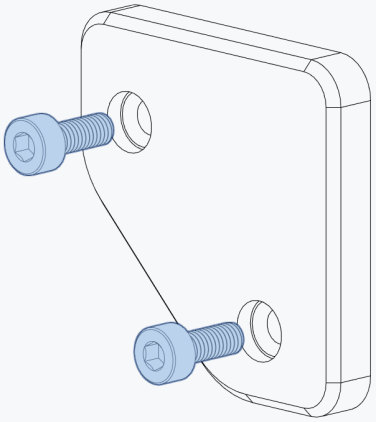
M5x10 BHCS

REMOVE TAPE BACKING

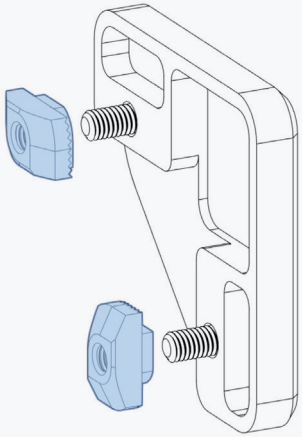


This page intentionally left blank.

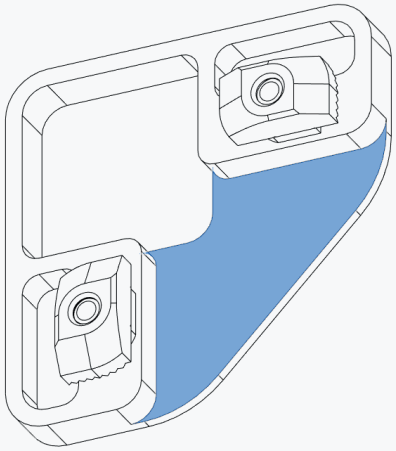




M3x8 SHCS

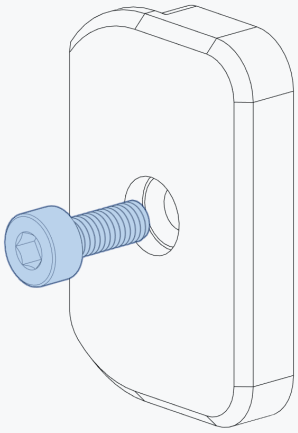


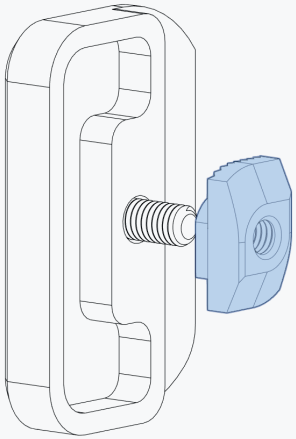
M3 Hammerhead Nut

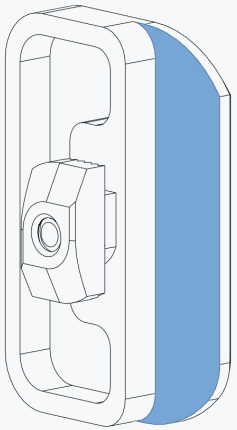


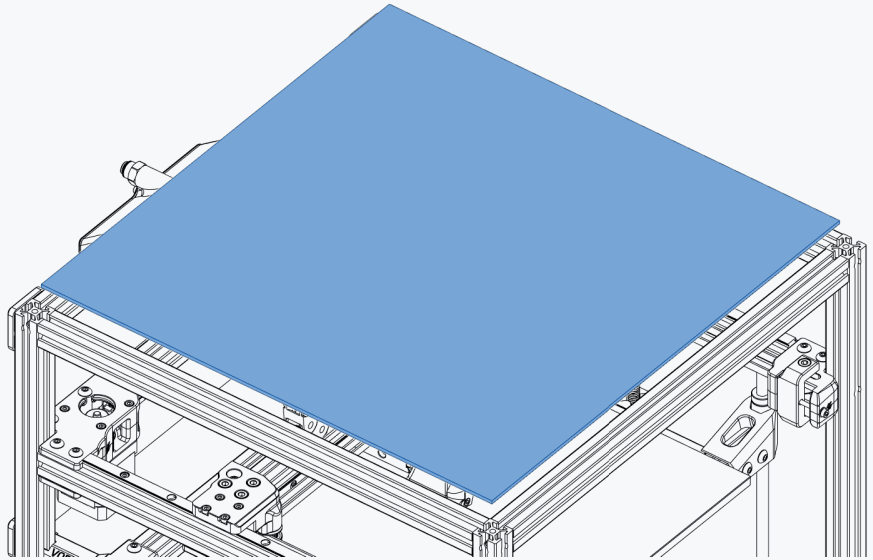
APPLY FOAM TAPE

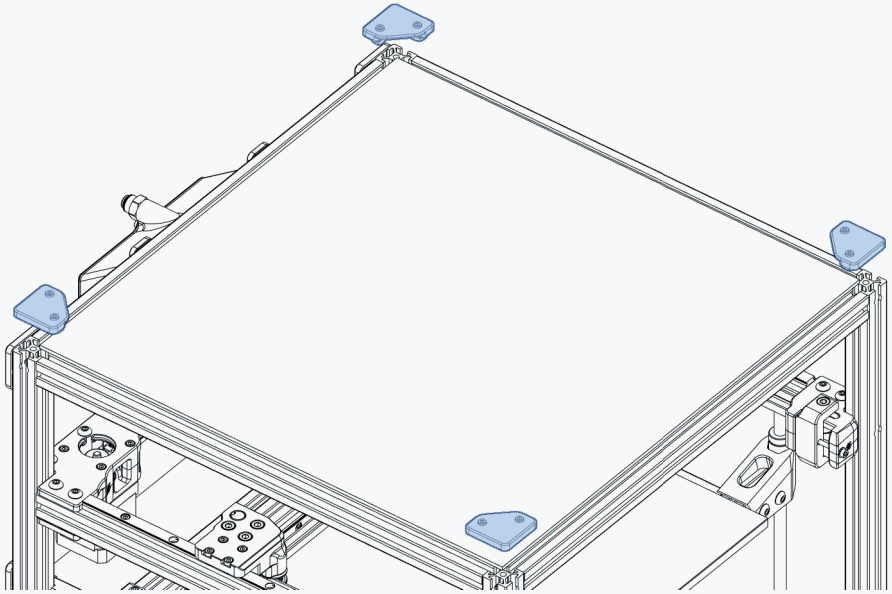
Use foam tape on the highlighted areas to mitigate noise from vibrations.





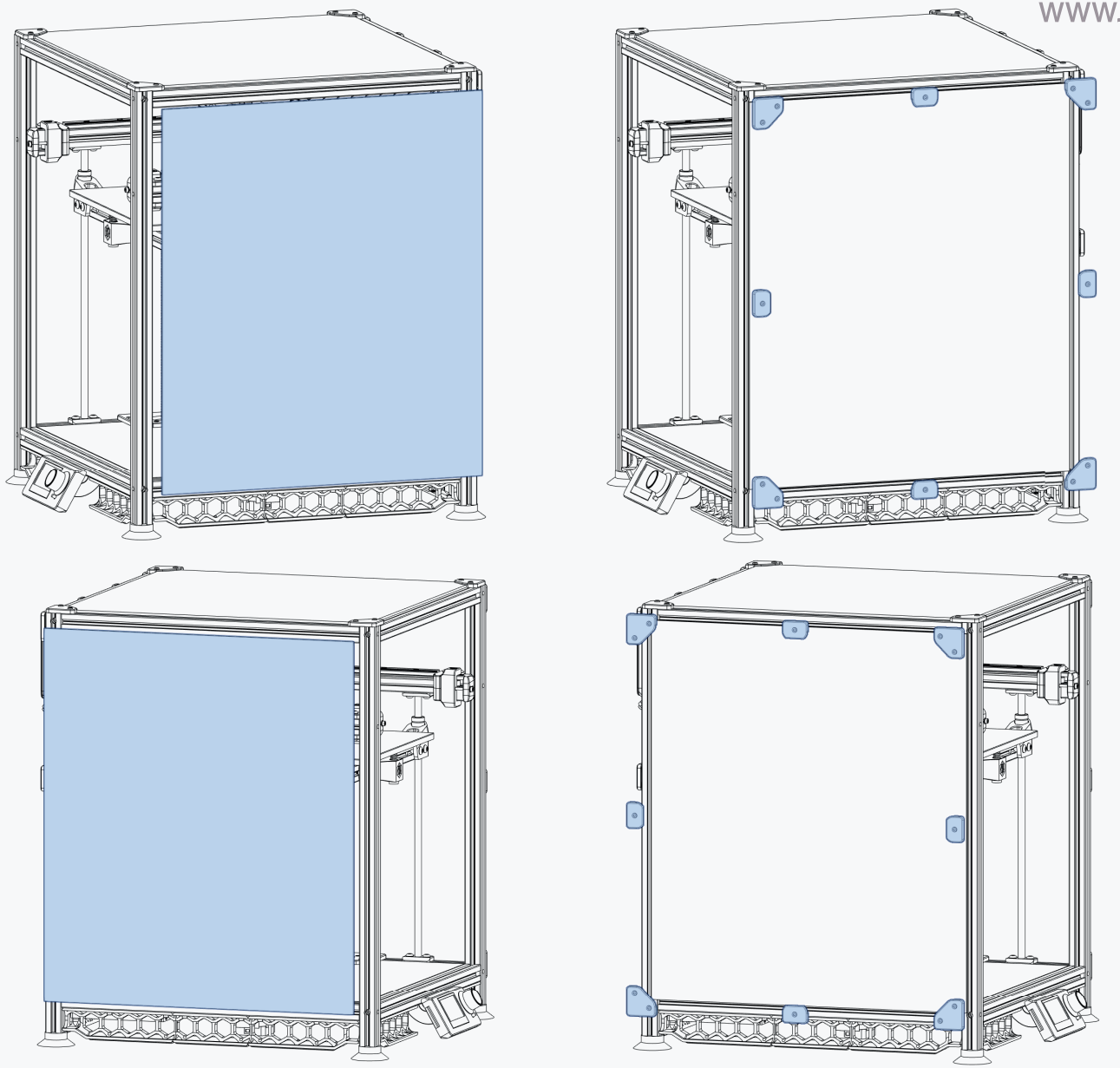






APPLY FOAM TAPE

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

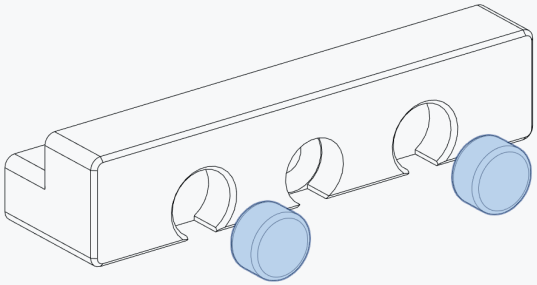


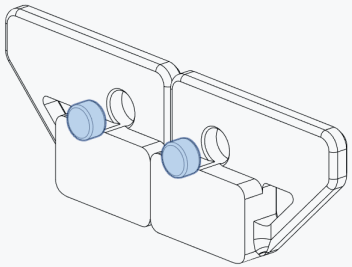
APPLY FOAM TAPE

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

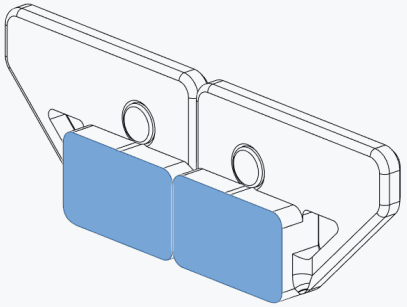
GLUE INTO PLACE

Use a fast acting glue like super-glue.





Magnets

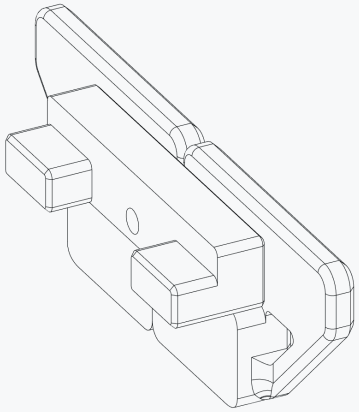


APPLY VHB TAPE

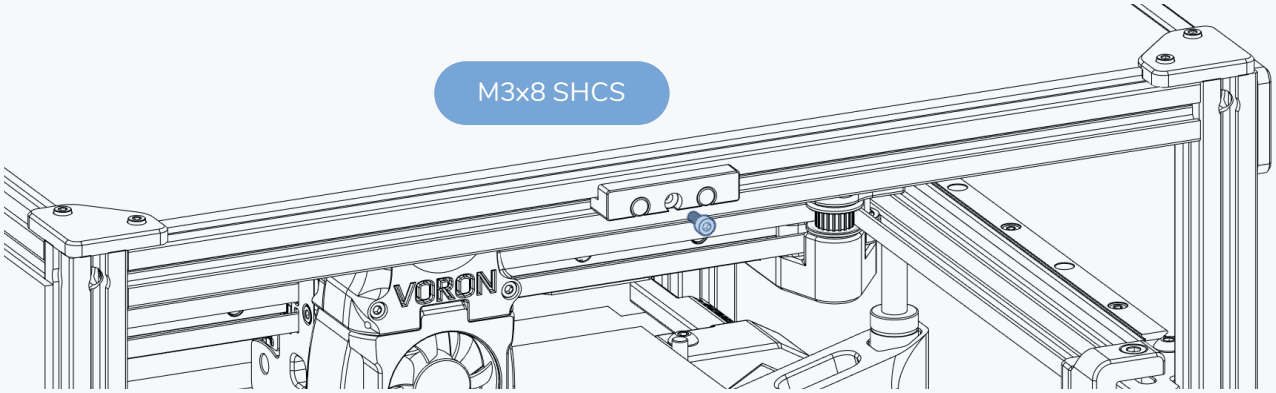
The parts will be bonded to the panels using double-sided adhesive tape.

MIND THE MAGNET POLARITY

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

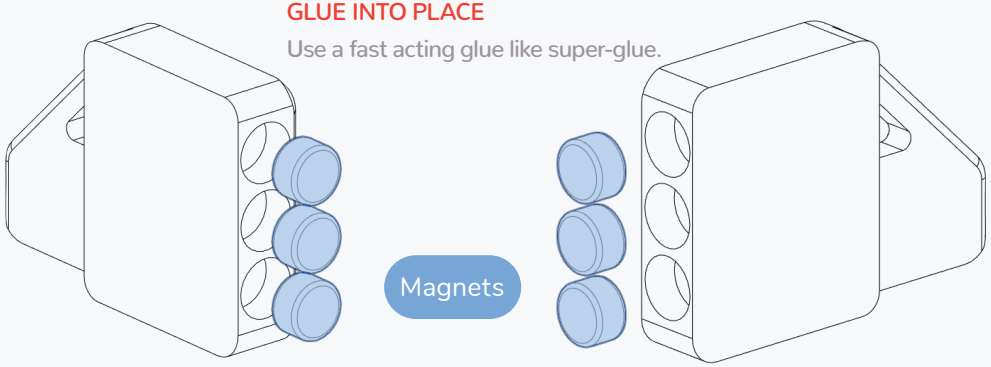


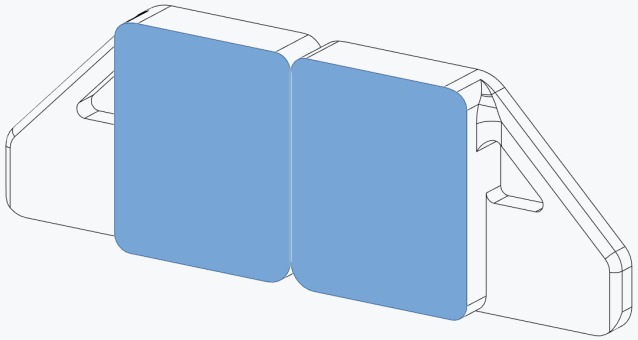
M3x8 SHCS



GLUE INTO PLACE

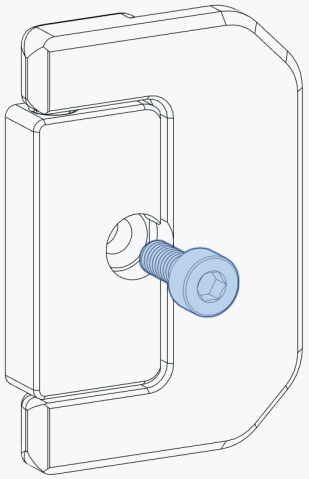
Use a fast acting glue like super-glue.



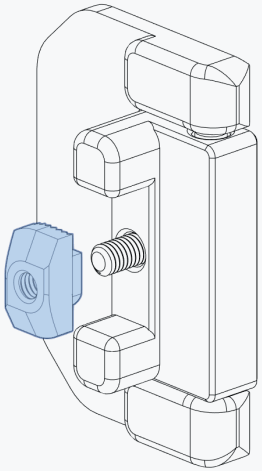


MIND THE MAGNET POLARITY

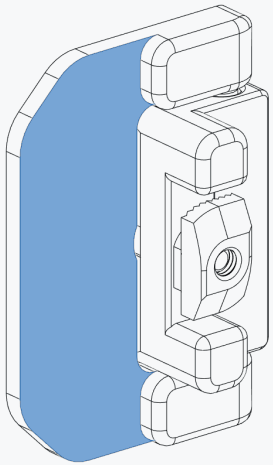
Ensure that the magnets are facing in the right direction prior to glueing them into place.



M3x8 SHCS

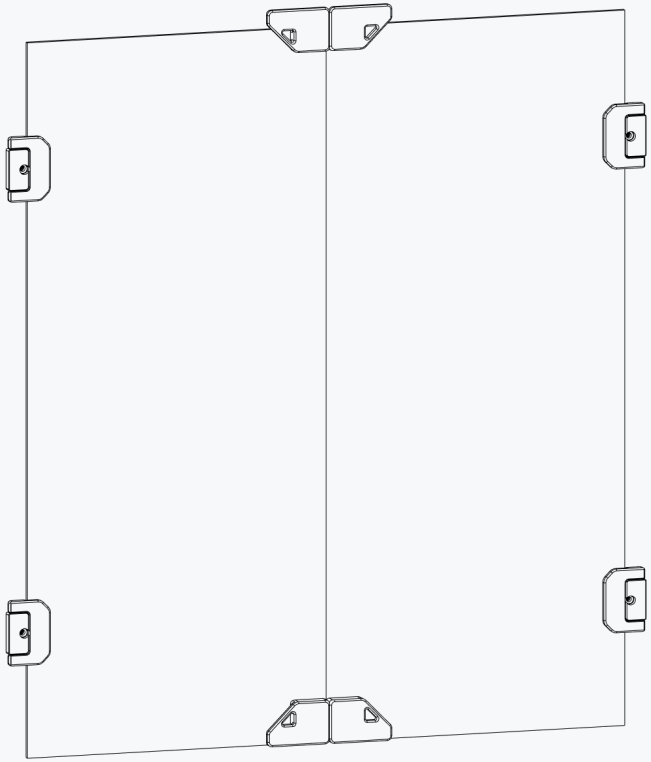


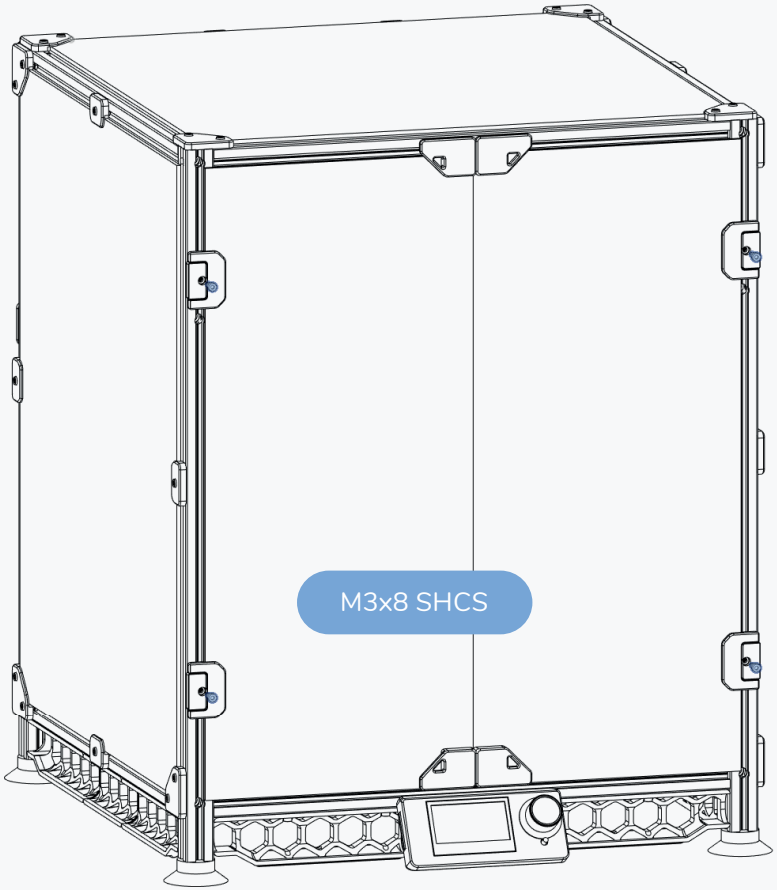
M3 Hammerhead Nut

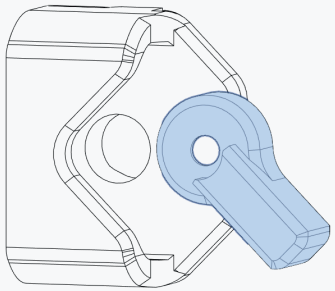


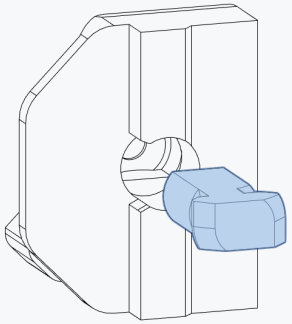
APPLY VHB TAPE

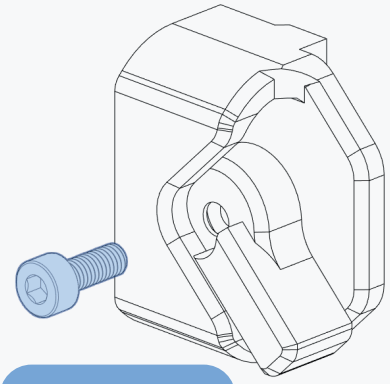
The parts will be bonded to the panels using double-sided adhesive tape.



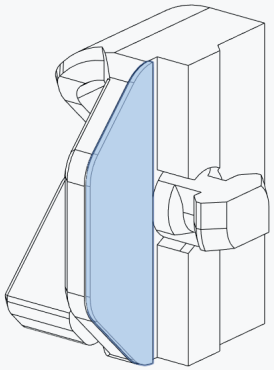


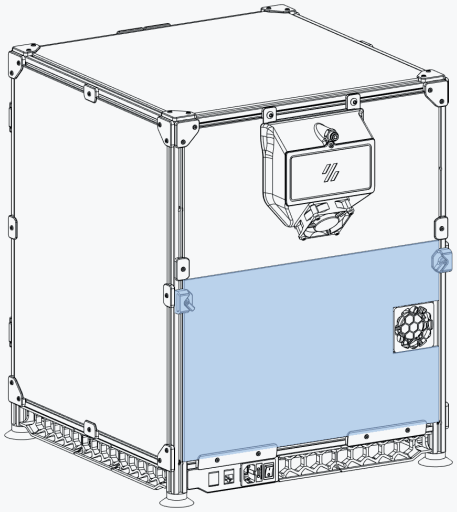






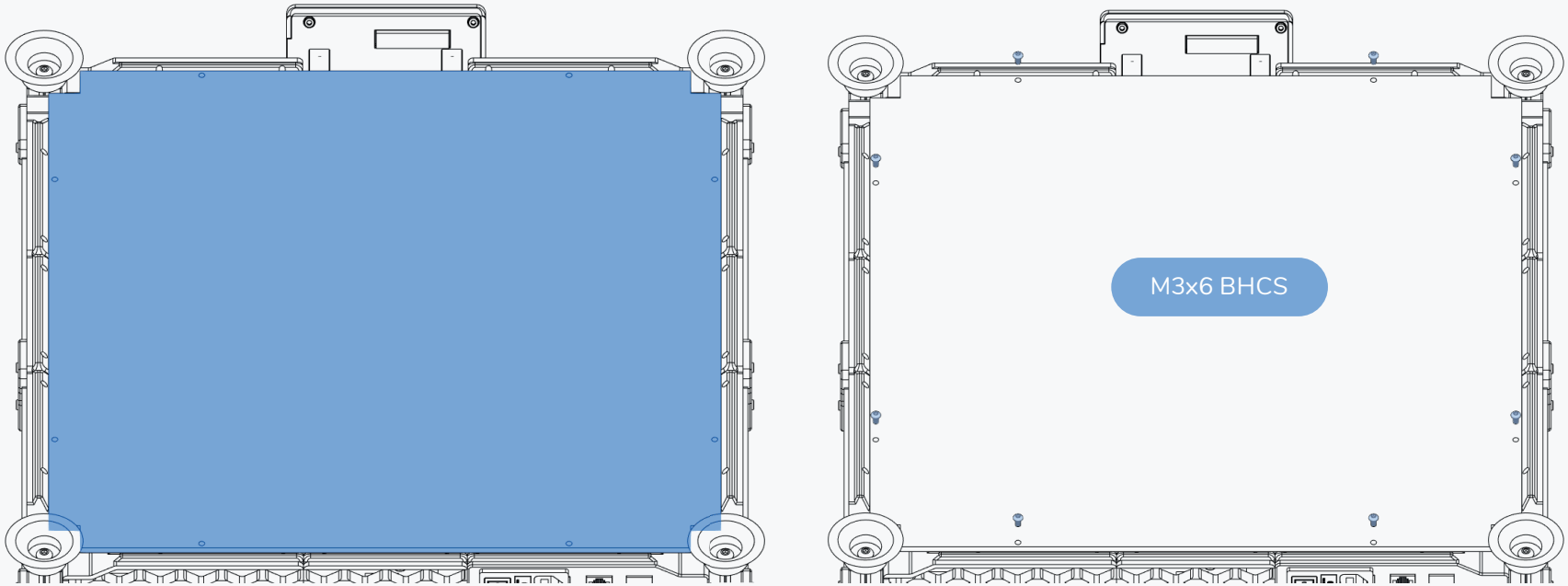
M3x8 SHCS



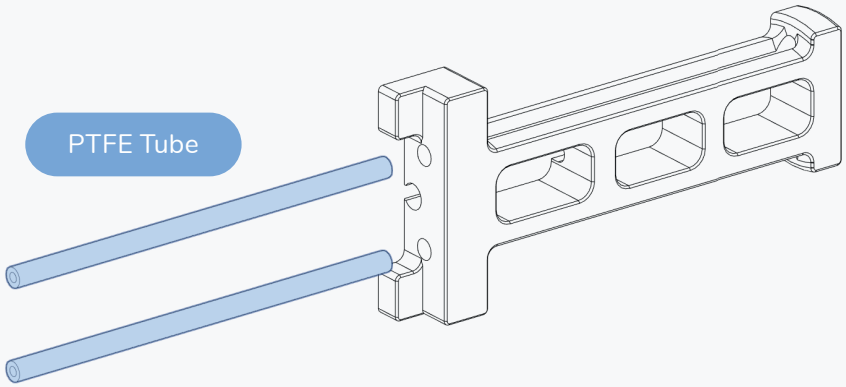


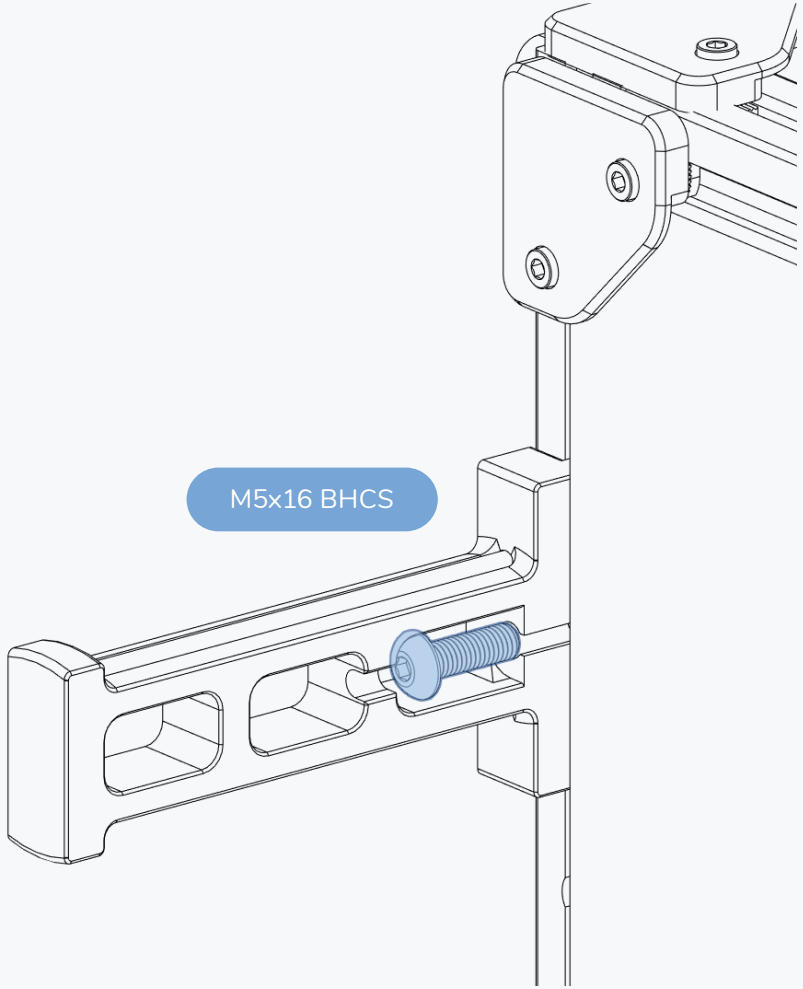
ROTATE LEVERS TO LOCK

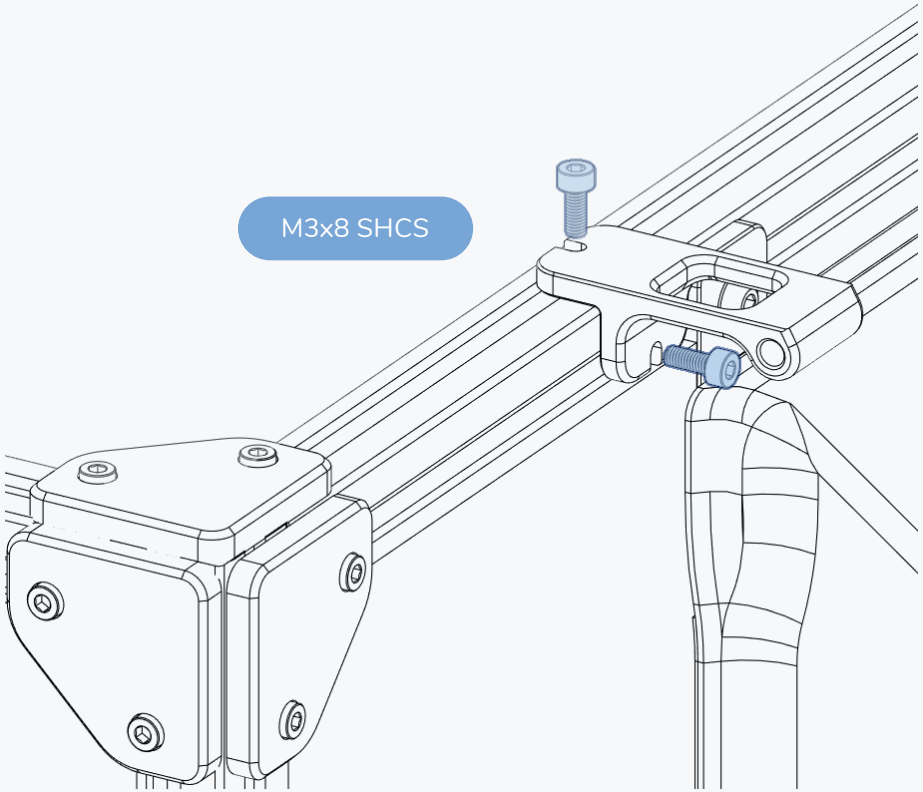
Use the levers to lock and unlock the panel for the electronics

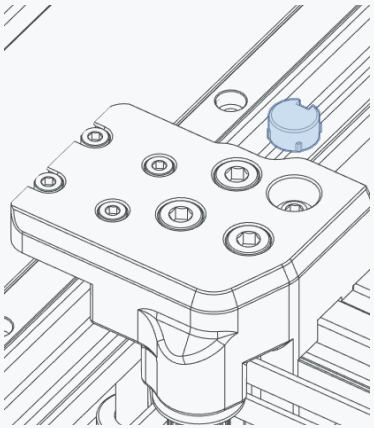


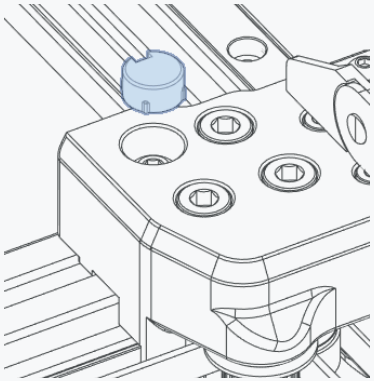
This page intentionally left blank.











This page intentionally left blank.

MECHANICAL ASSEMBLY COMPLETED ... NEXT STEP WIRING & ELECTRICAL

This manual is designed to be a simple reference manual for the build process. Wiring and the initial setup of your printer is not included.
For details on wiring, setup of the electronics and other initial steps of your new printer please visit our documentation available on github.

GitHub https://github.com/vorondesign/voron-1

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.

DISCORD https://discord.gg/voron

VORON

Website
www.vorondesign.com

Github
https://github.com/vorondesign

Discord
https://discord.gg/voron

copymaster3D

www.copymaster3d.com
sales@copymaster3d.com