



## VORON STEALTHBURNER

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

---

VERSION 2022-08-16



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

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

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

Most of all, good luck!

THE VORON TEAM

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### PART PRINTING GUIDELINES

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

#### 3D PRINTING PROCESS

Fused Deposition Modeling (FDM)

#### MATERIAL

ABS

#### LAYER HEIGHT

Recommended: 0.2mm

#### EXTRUSION WIDTH

Recommended: Forced 0.4mm

#### INFILL TYPE

Grid, Gyroid, Honeycomb, Triangle or Cubic

#### INFILL PERCENTAGE

Recommended: 40%

#### WALL COUNT

Recommended: 4

#### SOLID TOP/BOTTOM LAYERS

Recommended: 5

### PRINT IT FORWARD (PIF)

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

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

### FILE NAMING

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

PRIMARY COLOUR	ACCENT COLOUR 	CLEAR/TRANSPARENT	OPAQUE	QUANTITY REQUIRED
<a href="#">Example z_joint_lower_x4.stl</a>	<a href="#">Example [a]_tensioner_left.stl</a>	<a href="#">Example [c]_led_diffuser.stl</a>	<a href="#">Example [o]_led_diffuser_mask.stl</a>	<a href="#">Example [a]_z_belt_clip_lower_x4.stl</a>
These files will have nothing at the start of the filename.	We have added “[a]” to the front of any STL file that is intended to be printed with accent color. The parts are marked with a heart in the manual.	We have added “[c]” to the front of any STL file that is intended to be printed with clear or transparent filament (cloudy is better than clear; white or light grey may also work in a pinch).	We have added “[o]” to the front of any STL file that is intended to be printed with an opaque filament (blocks light, dark colours and blacks).	If any file ends with “_x#”, that is telling you the quantity of that part required to build the machine.

### HOW TO GET HELP

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



<https://discord.gg/voron>

### REPORTING ISSUES

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

### THIS IS JUST A REFERENCE

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



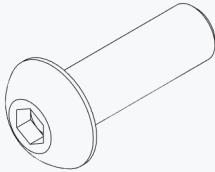
<https://github.com/vorondesign>



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

## HARDWARE REFERENCE

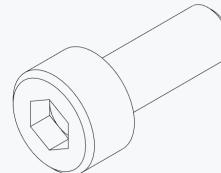
WWW.VORONDESIGN.COM



### BUTTON HEAD CAP SCREW (BHCS)

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

ISO 7380-1



### SOCKET HEAD CAP SCREW (SHCS)

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

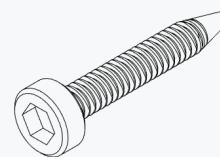
ISO 4762



### FLAT HEAD COUNTERSUNK SCREW (FHCS)

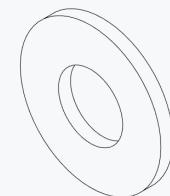
Metric fastener with a cone shaped head and a flat top.

ISO 10642



### SELF TAPPING SCREW

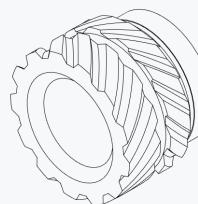
Fastener with a pronounced thread profile that is screwed directly into plastic.



### WASHER

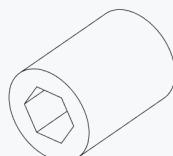
Usually stamped from sheet metal this type of spacer is not as consistent in thickness as the shims are. Only used in M3 size.

DIN 125



### HEAT SET INSERT

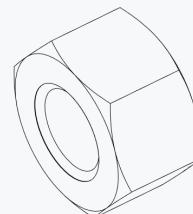
Heat inserts with a soldering tip so that they melt the plastic when installed. As the plastic cools, it solidifies around the knurls and ridges on the insert for excellent resistance to both torque and pull-out.



### SET SCREW

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

ISO 4026



### HEX NUT

Hex nuts couple with bolts to create a tight, secure joint.

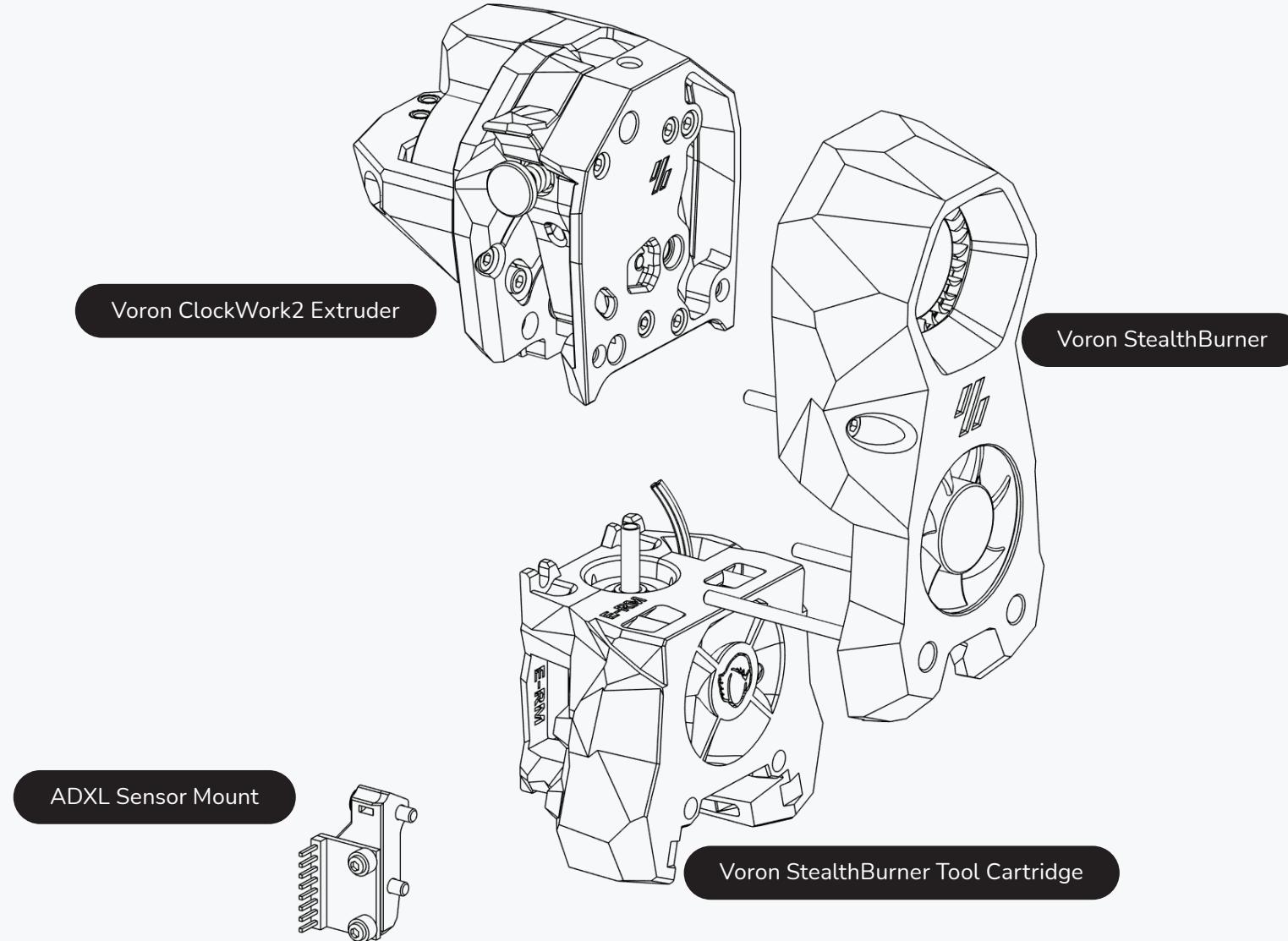
ISO 4032

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## OVERVIEW

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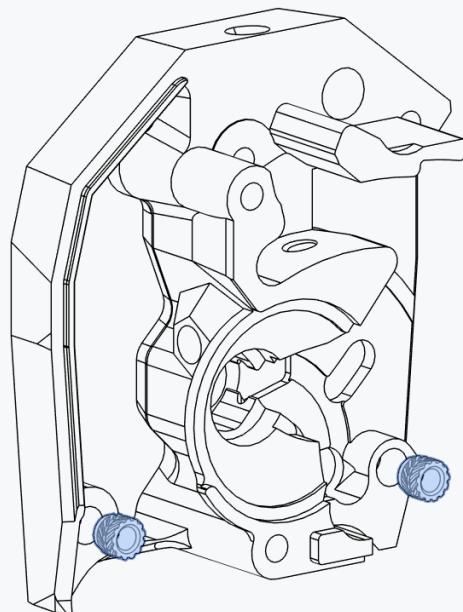
VORON CLOCKWORK2

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## HEAT SET INSERTS

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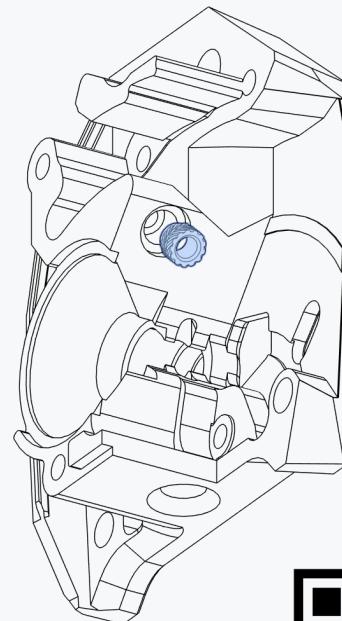


### HEAT SET INSERTS

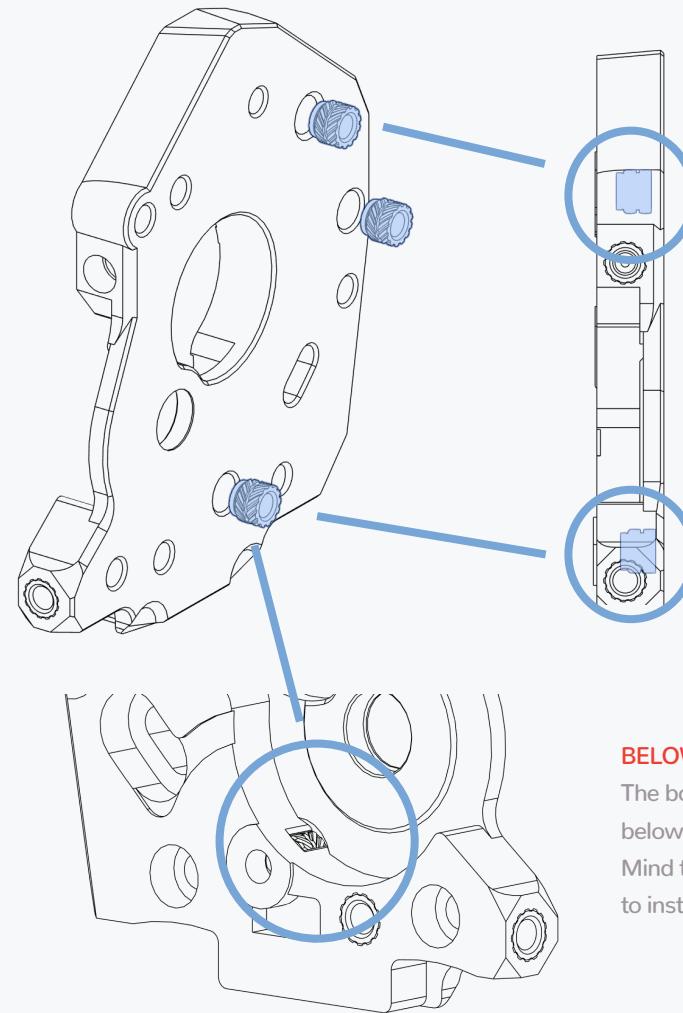
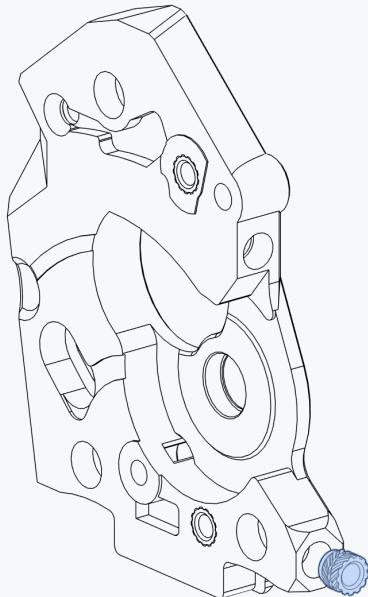
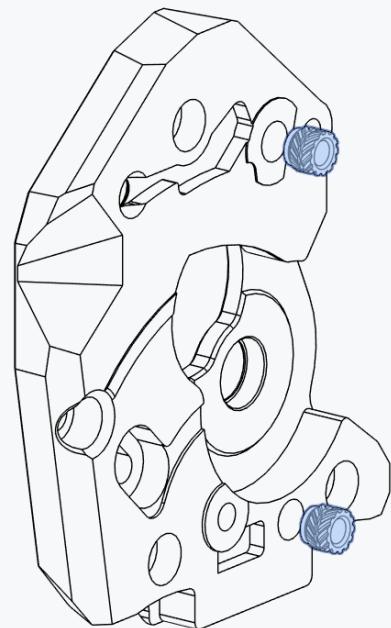
This design relies heavily on heat set inserts. Make sure you have the proper inserts (check the hardware reference for a close-up picture and the [Sourcing Guide](#) for dimensions).

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

Heat Set Insert



<https://voron.link/m5ybt4d>



**BELOW SURFACE**

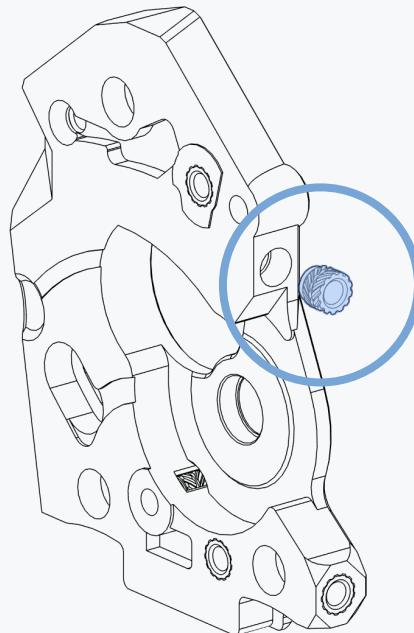
The top heatset insert needs to sit below the surface of the printed part.

**BELOW SURFACE**

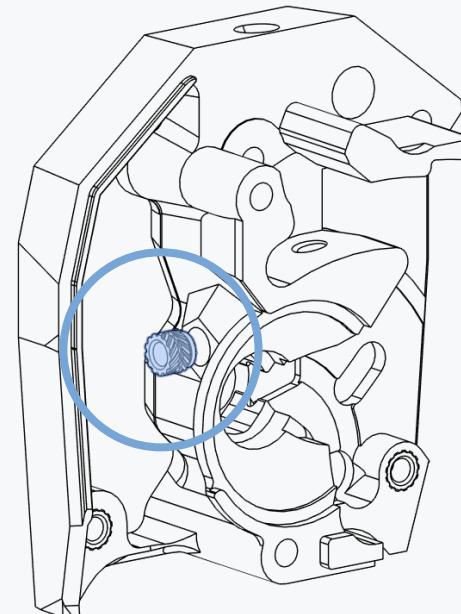
The bottom heatset insert needs to sit below the surface of the printed part.  
Mind the cutout in the part and make sure to install it straight.

**OPTION: TOOLHEAD PCB**

If you opt to use a toolhead PCB, add additional heat set inserts into locations highlighted below.



Heat Set Insert

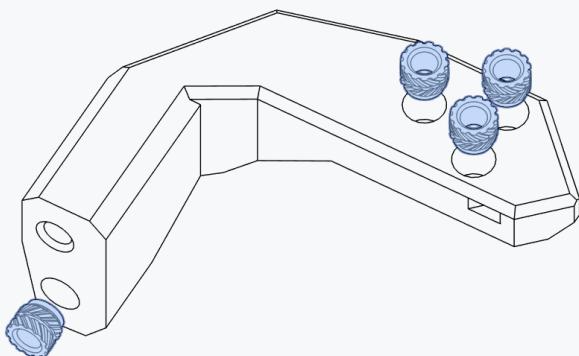


**HEAT SET INSERT**

Be careful when inserting this heat set insert. It's easy to accidentally touch the left side of the part with the soldering iron.

### GENERIC CABLE CHAINS

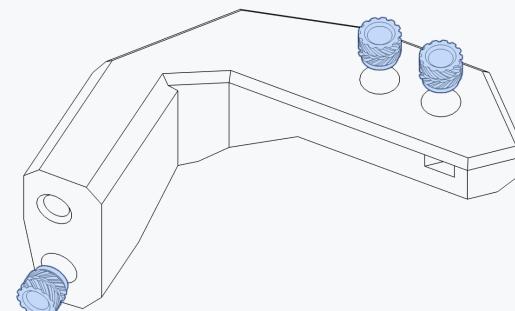
The 3-hole pattern is usually found on generic cable chains.



Heat Set Insert

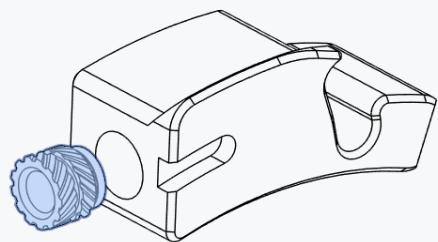
### IGUS CABLE CHAINS

IGUS chains have 2 mounting holes.

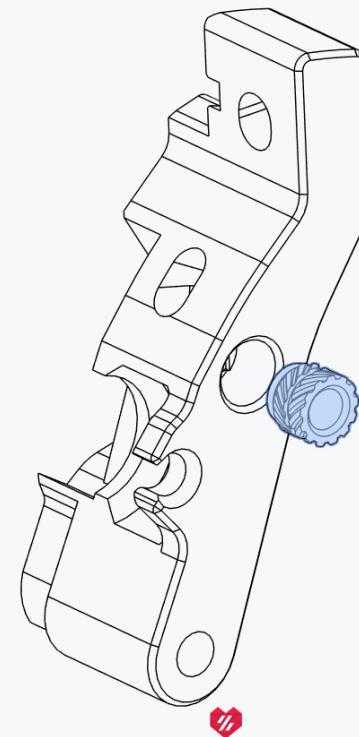
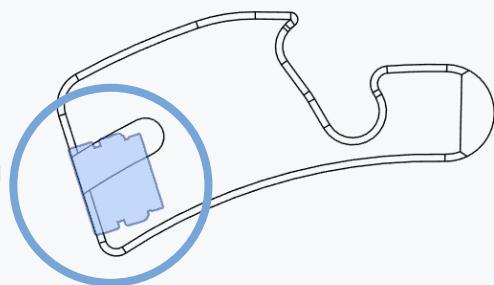


### PRINTER SPECIFIC MOUNTS

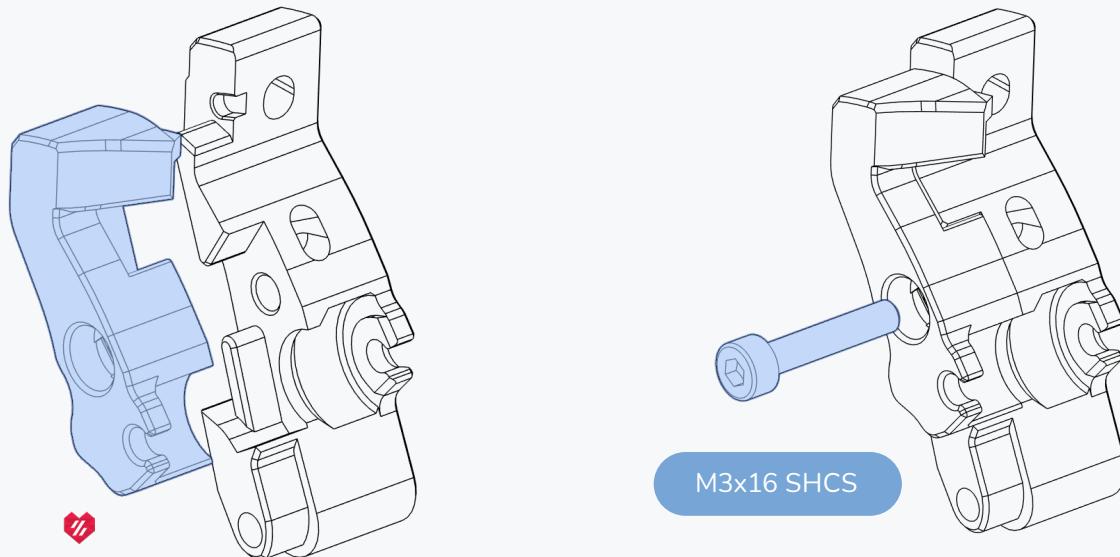
V2, Trident and Legacy use the same printed parts. Extra parts are included for SwitchWire.

**FLUSH WITH SURFACE**

The heatset insert needs to sit flush or slightly below the surface of the printed part.

**ACCENT PART?**

Look for Voron heart next to the part.  
It indicates that this is a part that is  
usually printed in the accent color.



#### TOLERANCES, EXTRUSION MULTIPLIERS AND YOU

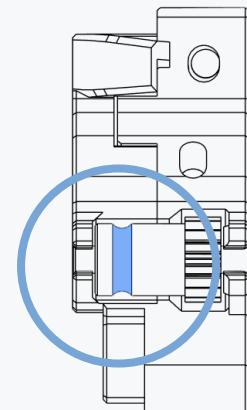
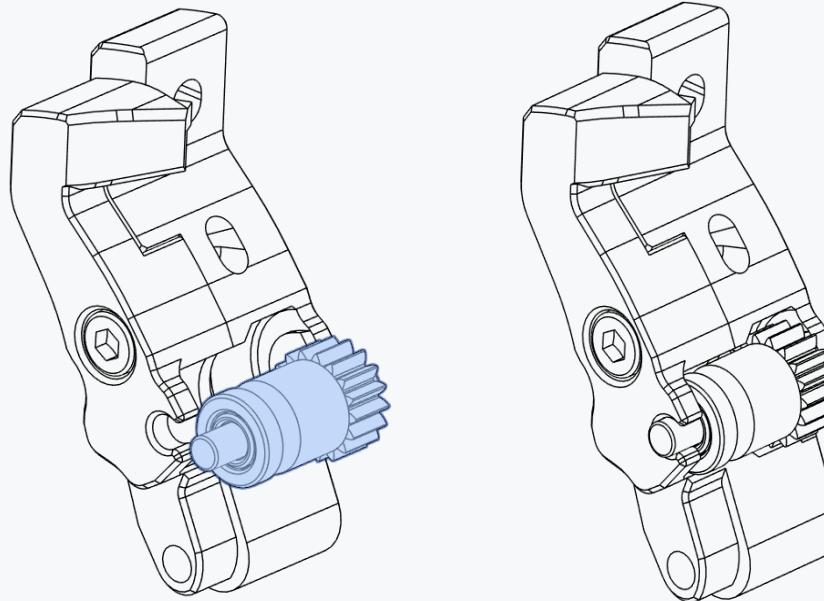
The part has tight tolerances. If it doesn't fit together well the printed parts are likely over-extruded.



#### LUBRICATE BEARINGS

A lubrication film is required to ensure smooth operation and longevity.

Refer to the [Voron sourcing guide](#) for lubricant options - look for a "light grease".

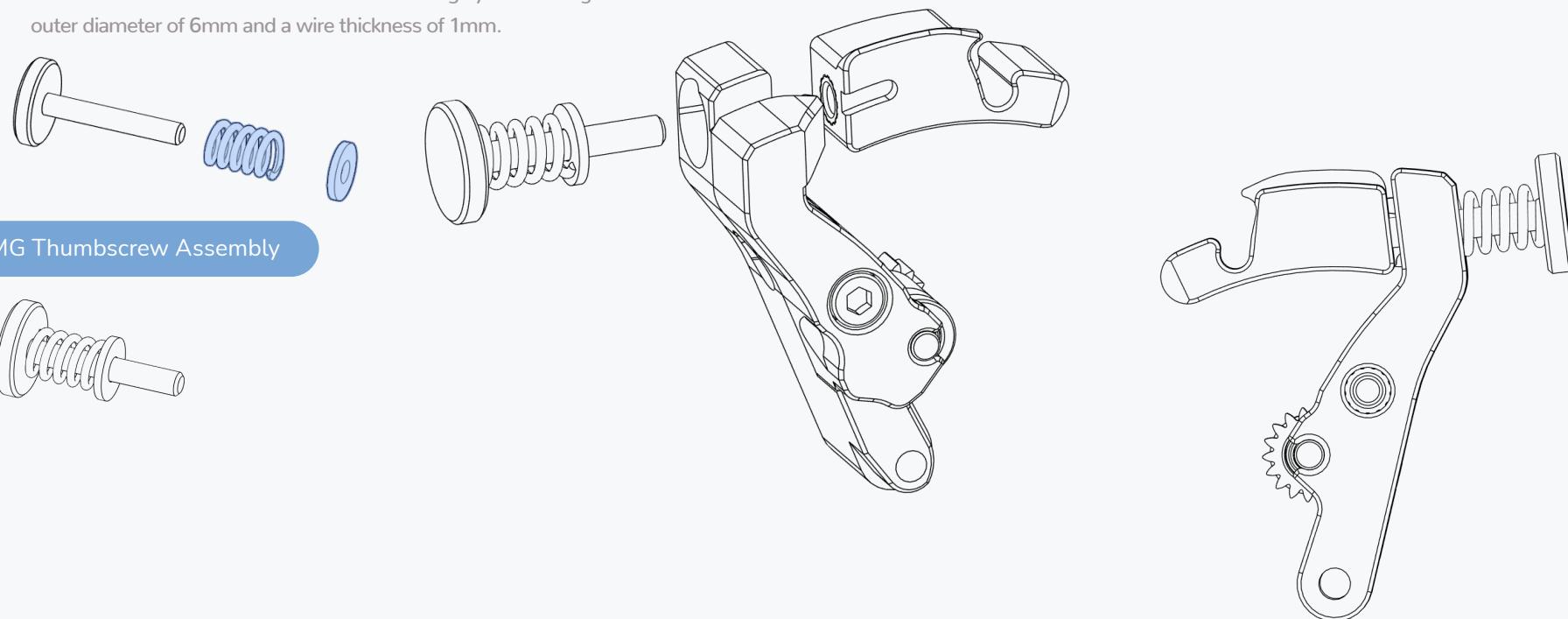


#### MIND ORIENTATION

Make sure to orient the idler assembly as shown above.

**A NOTE ON SPRINGS**

Longer/shorter/stiffer springs will change the tension characteristics and have an impact on how well the tension mechanism works. Consider buying the [original Bondtech part](#) as those are known to work well. If sourced from a different vendor check if it's roughly 12mm long with an outer diameter of 6mm and a wire thickness of 1mm.

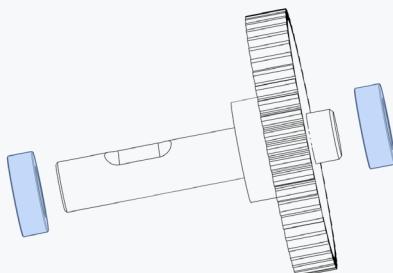


**CHECK BEARING FIT**

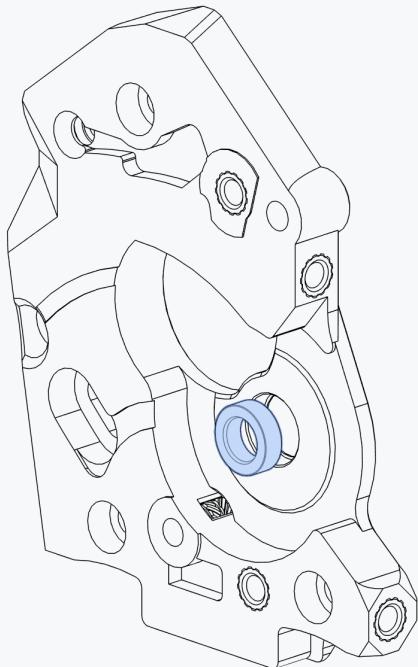
The bearings must slip on and off the shaft easily to allow the gear to self-centre.

Pressing the bearings on the shaft will damage them.

Lightly sand the shaft if required.



MR85 Bearing

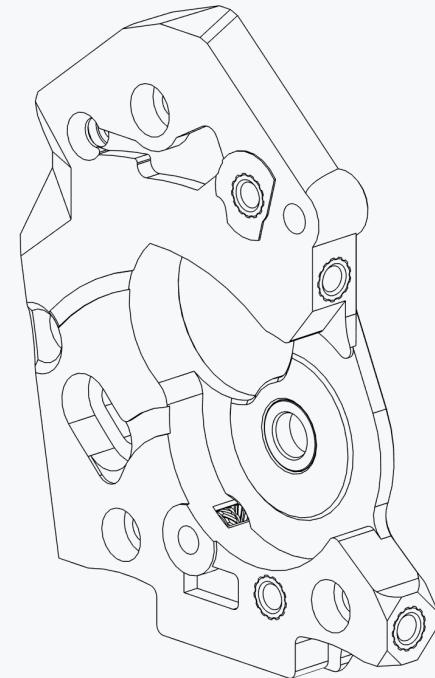


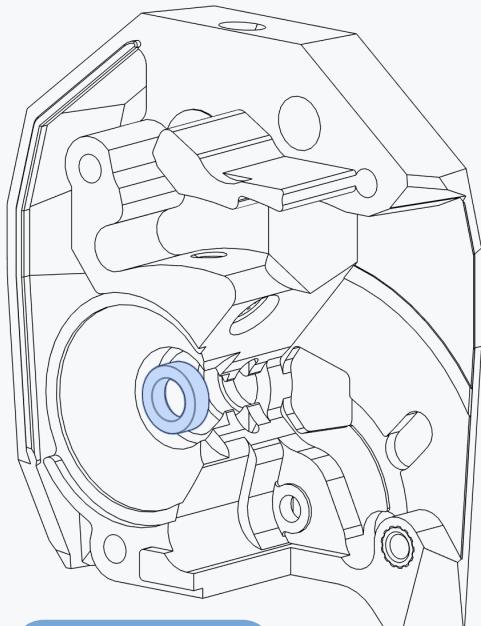
MR85 Bearing

**BEARING FIT**

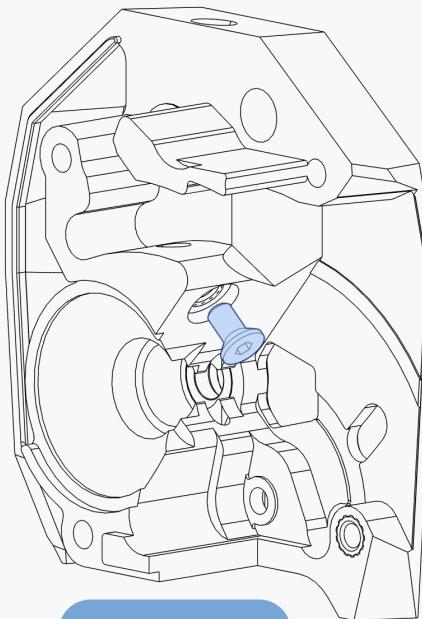
Fully seat the bearing into the plastic pocket. Apply even pressure to insert them. Avoid pressing on the inner ring of the bearing.

If the fit is too tight the printed parts are likely over-extruded.

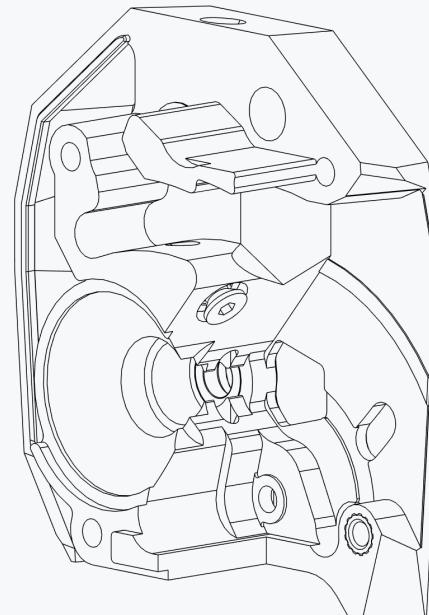




MR85 Bearing



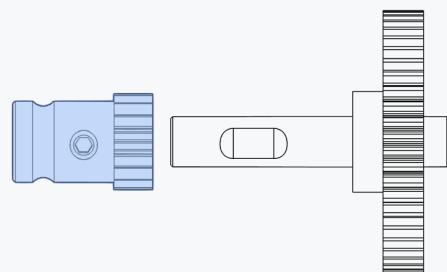
M3x6 FHCS

**BEARING FIT**

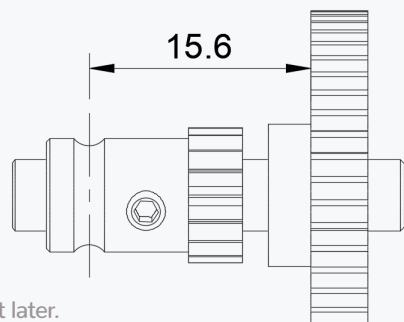
Fully seat the bearing into the plastic pocket.  
Apply even pressure to insert them. Avoid  
pressing on the inner ring of the bearing.

**A NOTE ON GEARS**

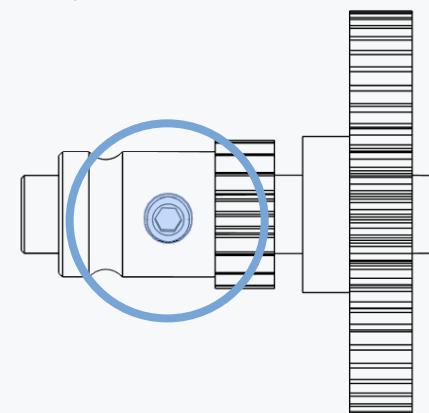
Poorly made gears often cause print quality issues. For best performance consider sourcing the [original Bondtech parts](#).

**INITIAL POSITION**

The final position is set later.

**DRIVE GEAR**

Make sure the set screw in the filament drive gear is seated against the notch in the shaft. Carefully tighten the set screw, the head is easy to strip.

**THREAD LOCKER**

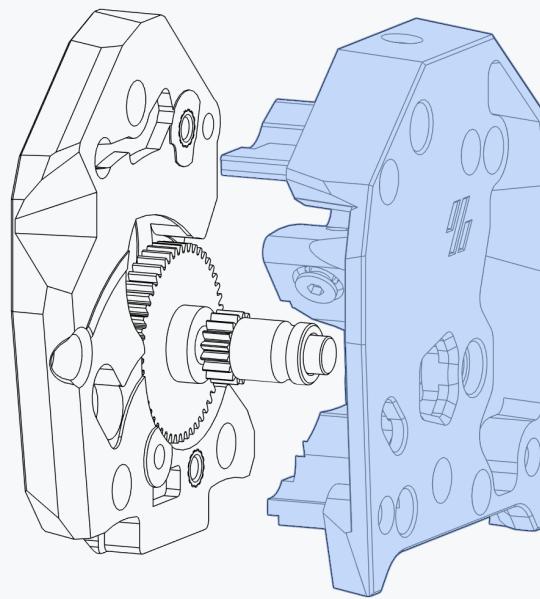
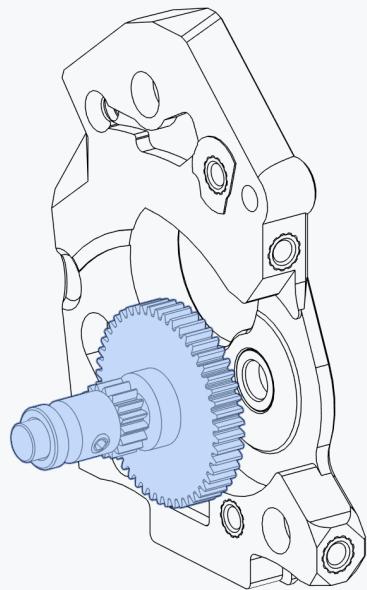
The final position of the drive gear is set in a later step. Common thread lockers have a long enough working time to complete the steps without issues.

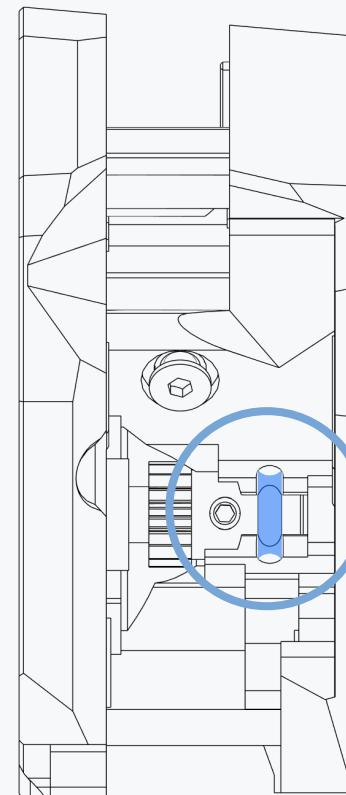
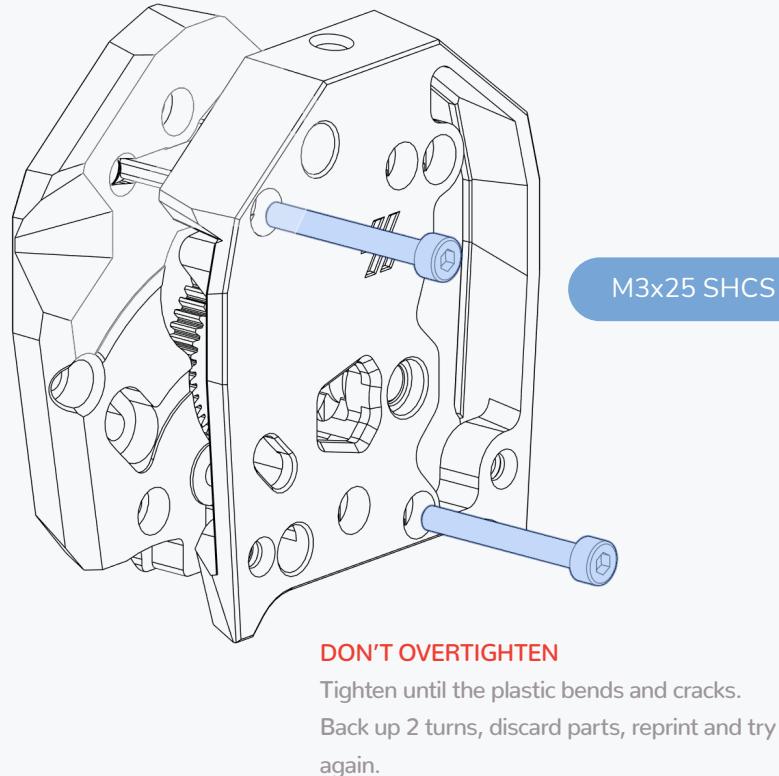
Familiarize yourself with the steps on the next 3 pages before you apply thread locker.

Complete the steps on the next 3 pages after applying the thread locker.

MAIN BODY

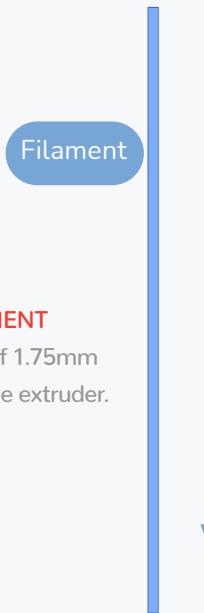
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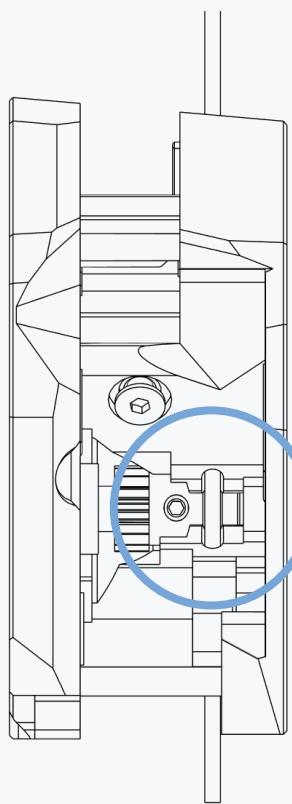
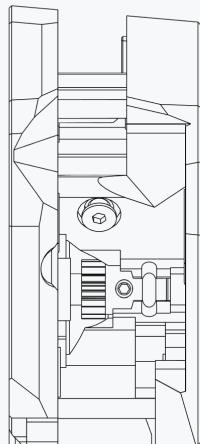
## DRIVE ALIGNMENT

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### INSERT FILAMENT

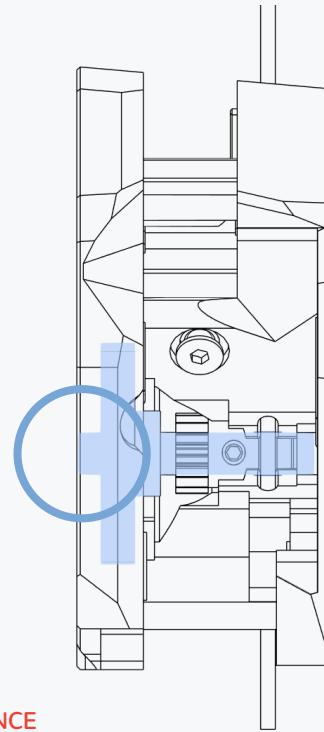
Insert a piece of 1.75mm filament into the extruder.



### CHECK ALIGNMENT

With the filament inserted, verify if the filament path and drive gear are aligned.

Loosen the set screw and adjust the position of the drive gear if required.



### CHECK FOR CLEARANCE

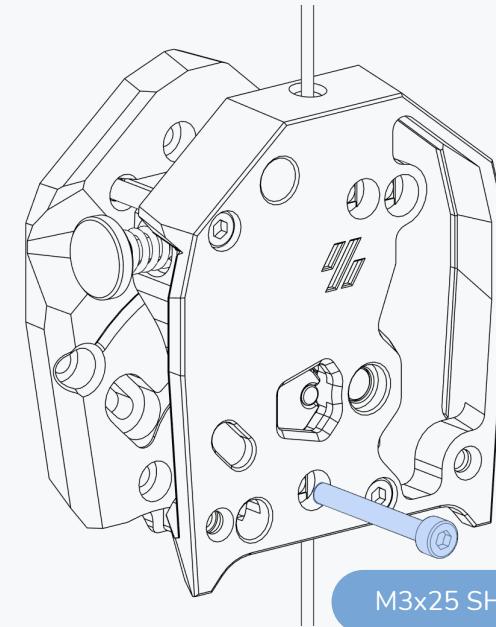
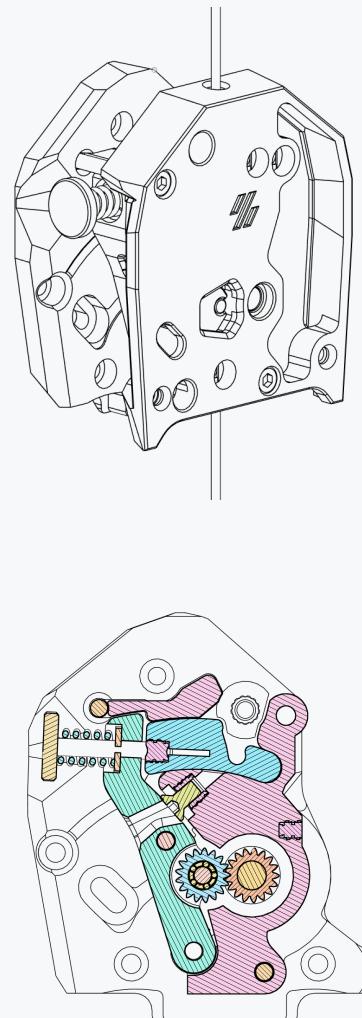
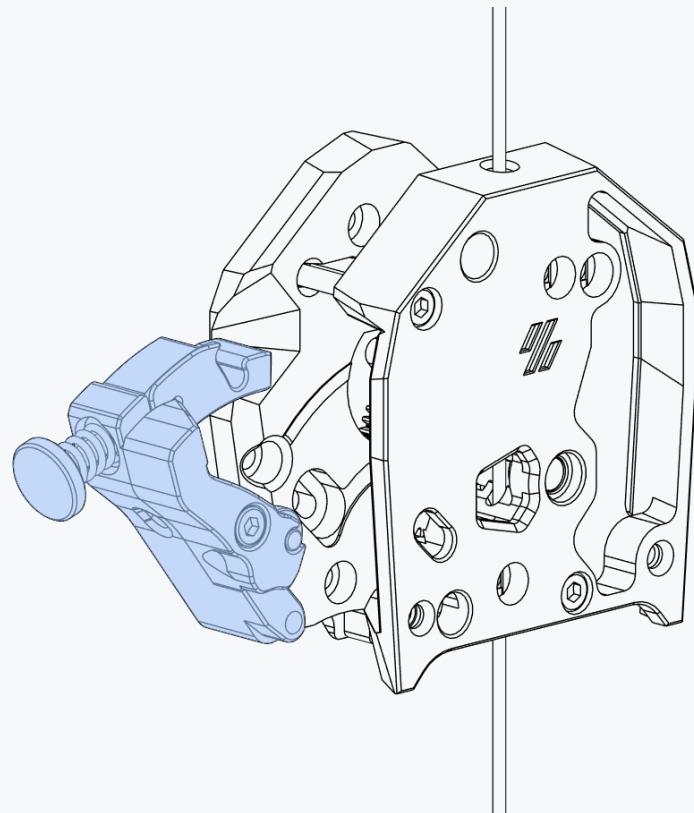
The drive shaft must not touch the motor housing. Make sure it does not sit above the surface of the printed part.

Check if the shaft has sufficient clearance when fully seated.

Depending on the shafts tolerances you may need to adjust the position of the drive gear or sand the face of shaft.

## TENSION ARM

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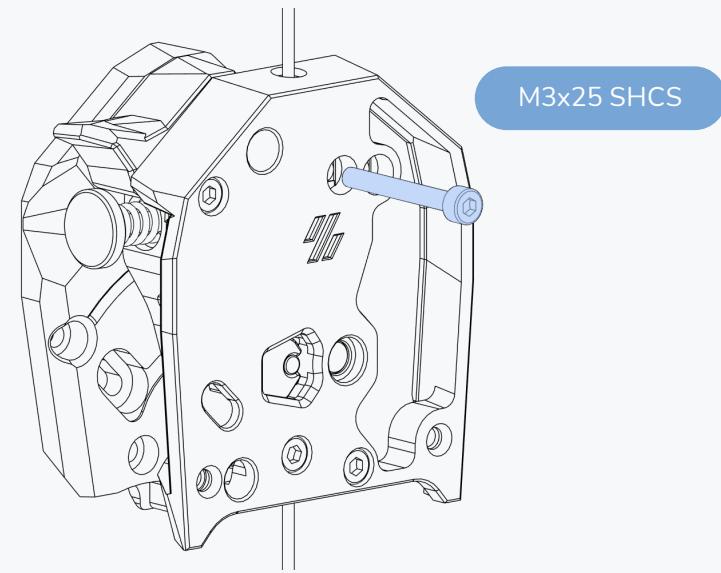
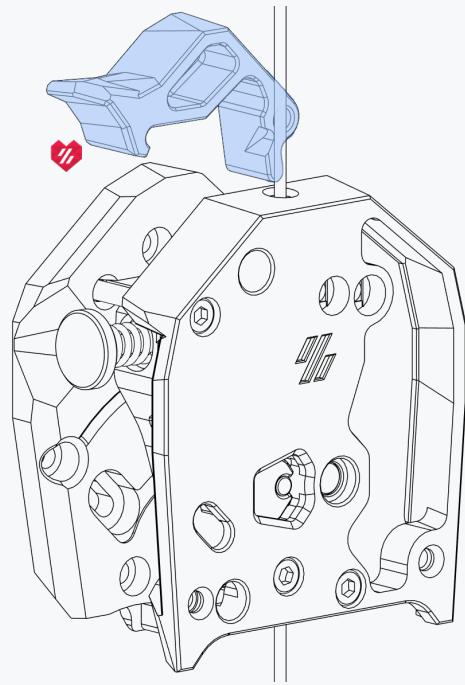


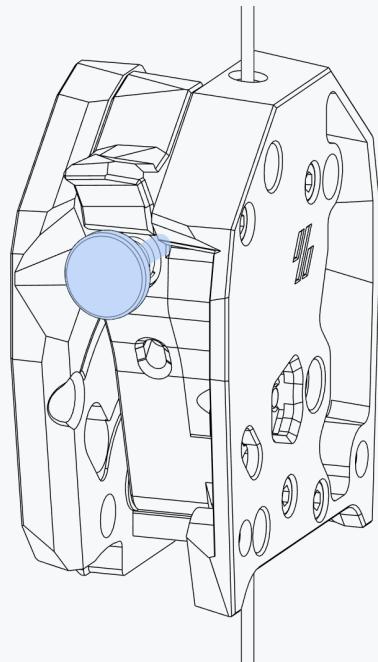
### DON'T TIGHTEN

The tensioning arm must move freely. Tightening the bolt may lock it in place.

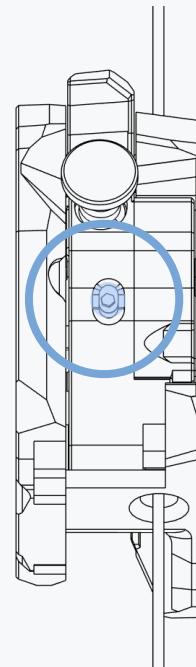
LATCH

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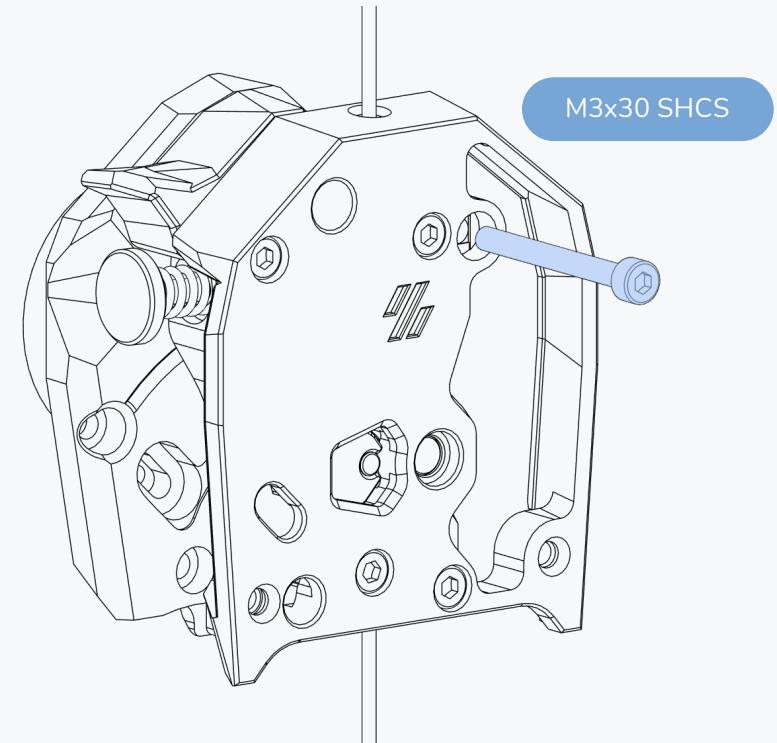
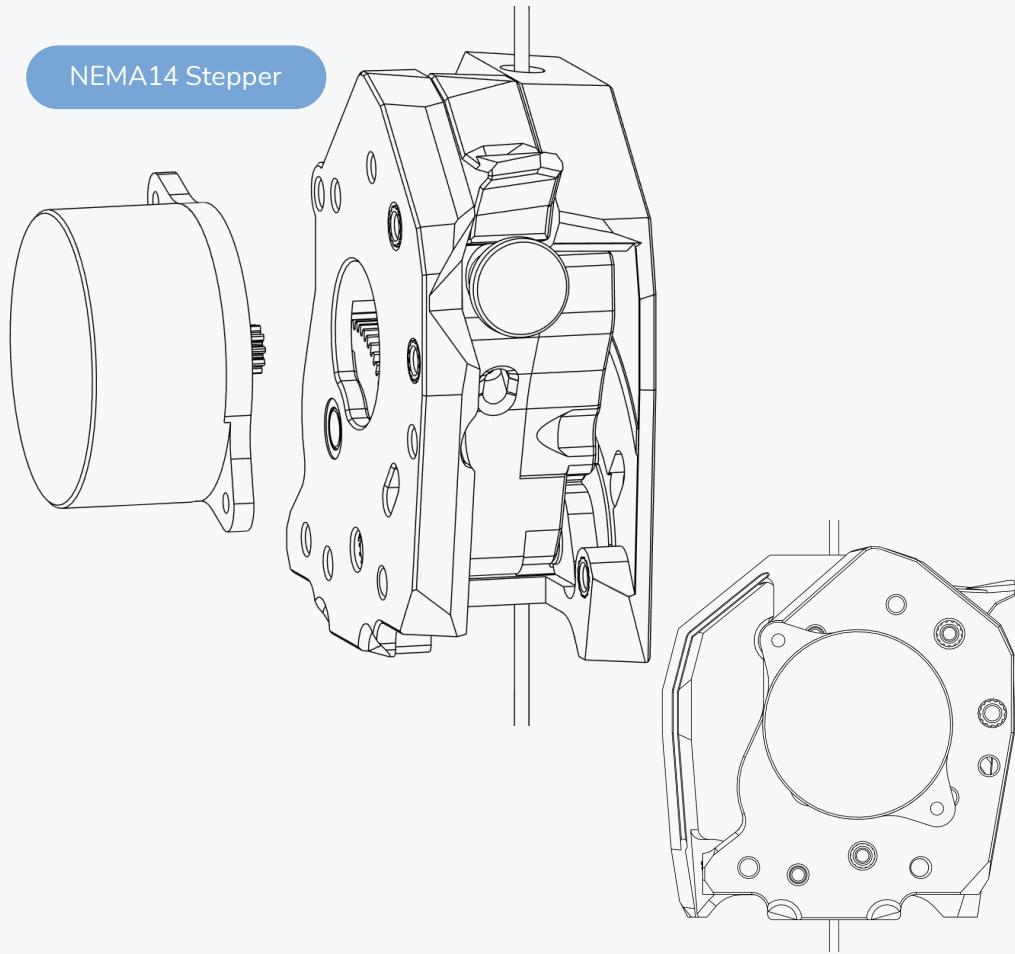


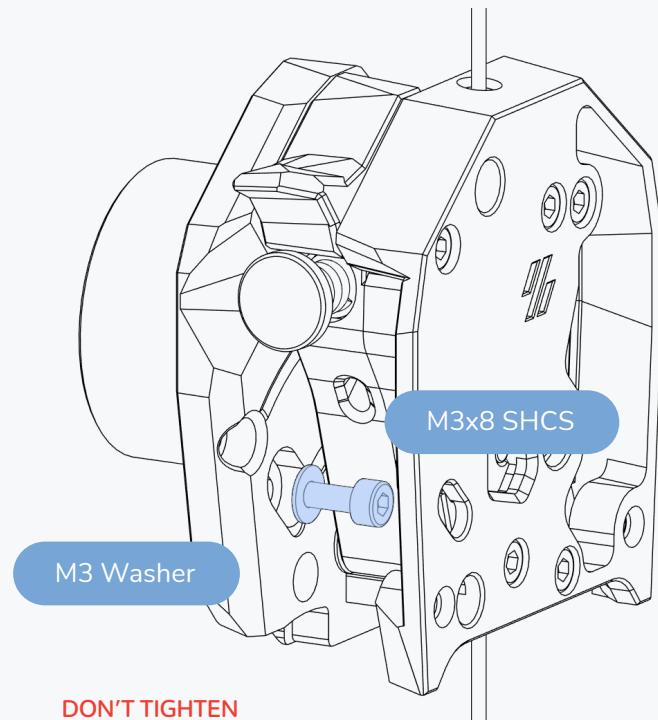
**TENSION KNOB**

Turning the thumb screw clockwise will increase the tension and grip on the filament. Too much tension will result in print issues.

**ANTI SQUISH THINGYMAJIG**

Softer and flexible materials will deform and extrude poorly under too much tension. ClockWork2 adds an adjustment feature to set the minimum distance between the drive gear and the idler, limiting the squish on the filament, and to prevent the gears from meshing too tightly or binding up the extruder.

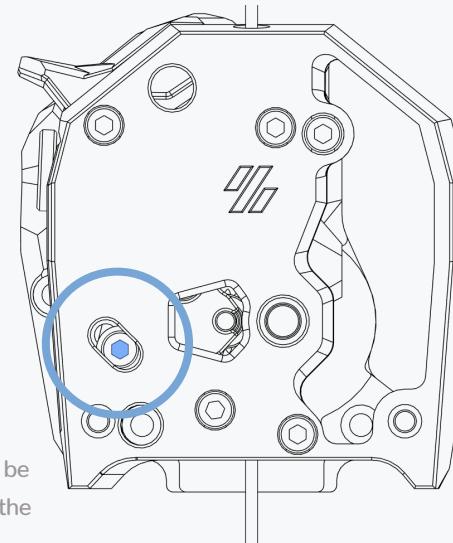


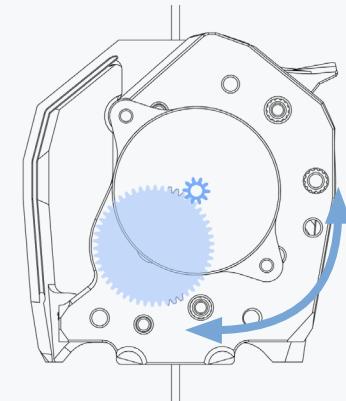


The motor position will be adjusted in the next steps. Don't fully tighten just yet.

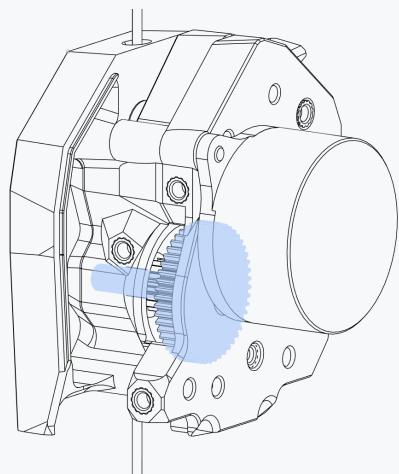
#### ACCESS HOLE

The second motor bolt can be accessed from the front of the extruder.

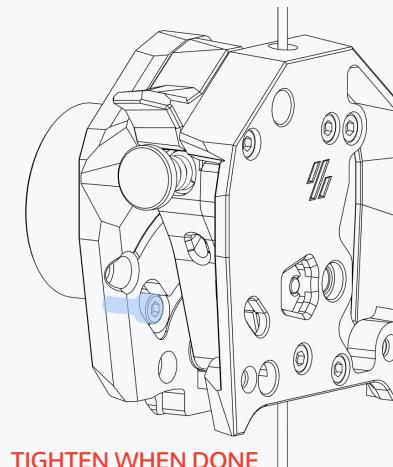


**SET GEAR MESHING**

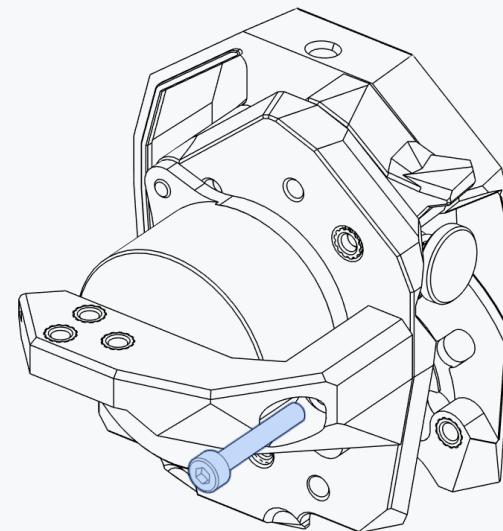
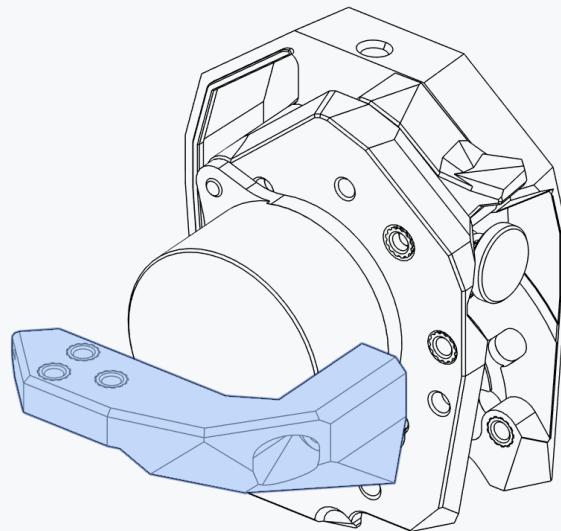
Adjust the stepper motor position so that the motor and extruder gear teeth fully mesh /overlap with each other. There should be a very small gap between the faces of the gear teeth; the gears must not press tightly against each other.

**CHECK GEAR PLAY**

The gear should have a slight play and should not be fully tight against the pinion. Adjust the position of the motor until you have a faint play.

**TIGHTEN WHEN DONE**

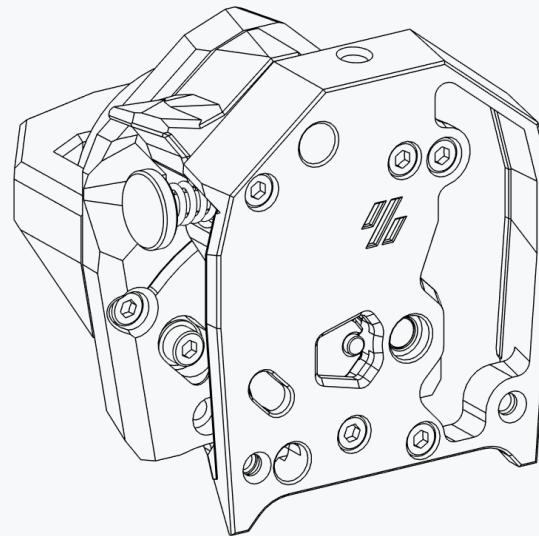
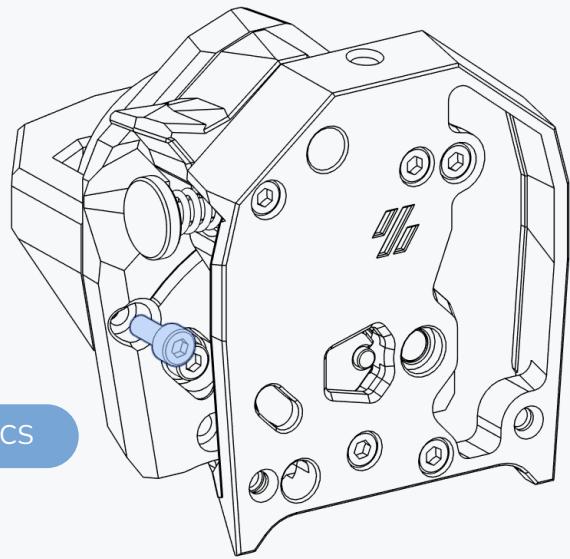
Don't forget to tighten the second motor bolt after adjusting.

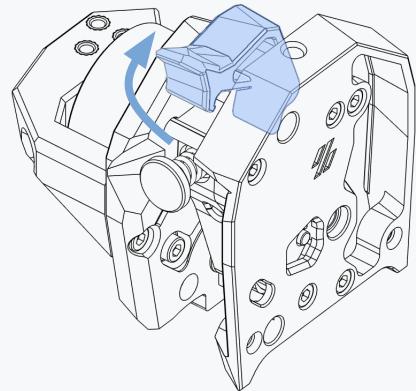


M3x20 SHCS

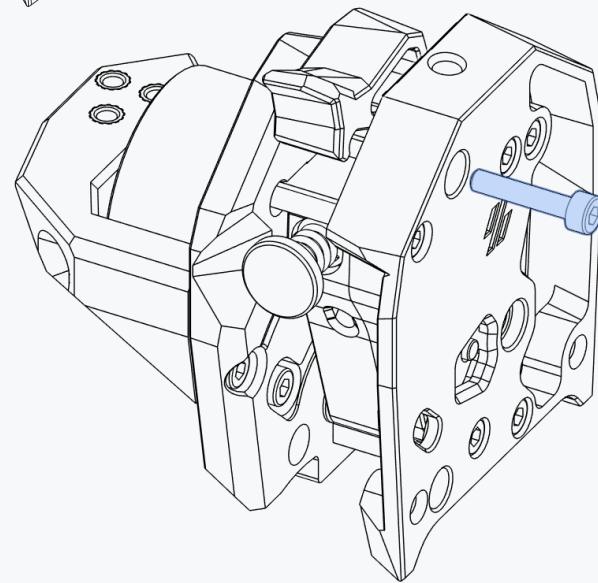
CABLE BRIDGE

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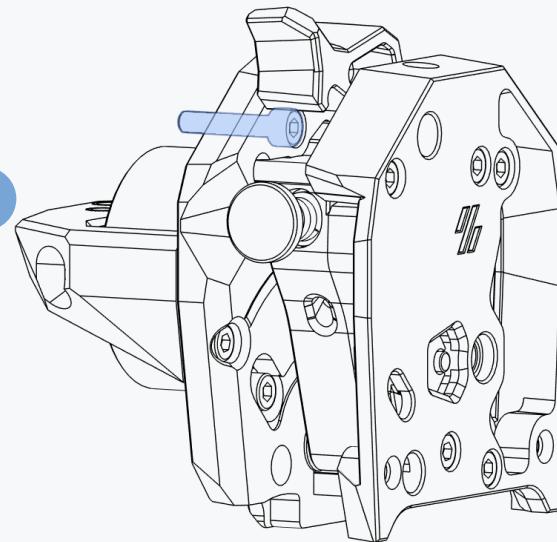


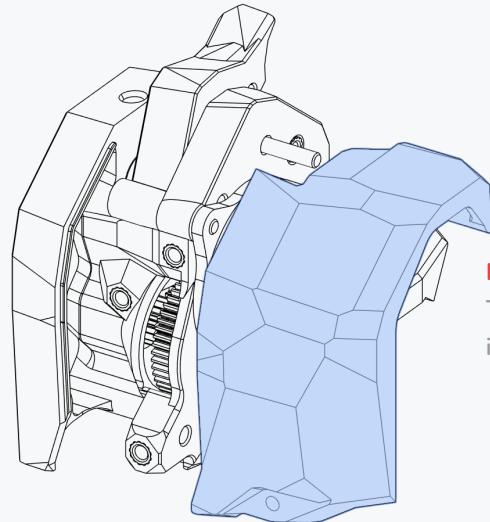
**OPEN LATCH**

Undo the filament latch to expose the bolt pocket for the cable cover.

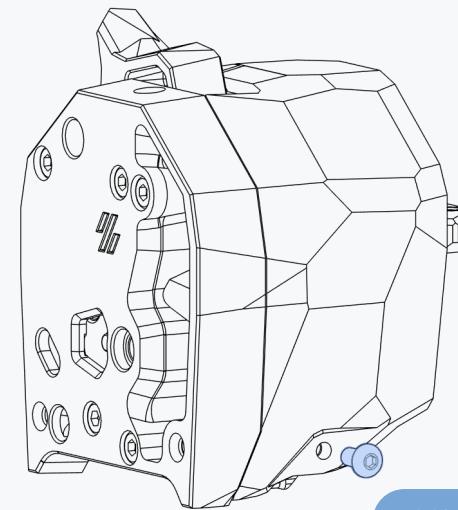


M3x16 SHCS





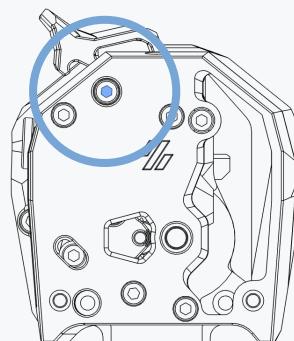
**DON'T OVER-TIGHTEN**  
The bolt is threaded directly  
into plastic.



M3x6 BHCS

#### ACCESS HOLE

The bolt drive can be accessed from the  
front of the extruder.



StealthBurner development started on 2021-04-13 with a simple: "I'm going to regret saying this but, 'How hard could it be?'"

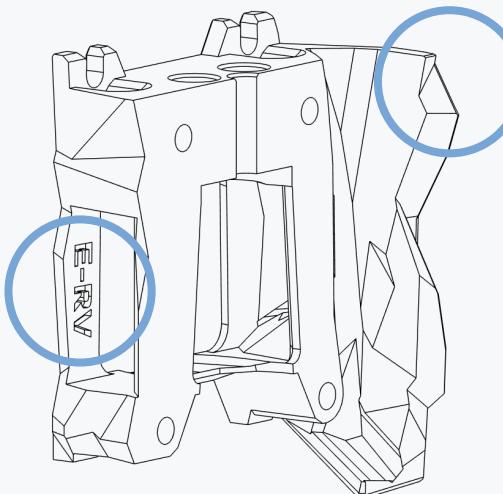
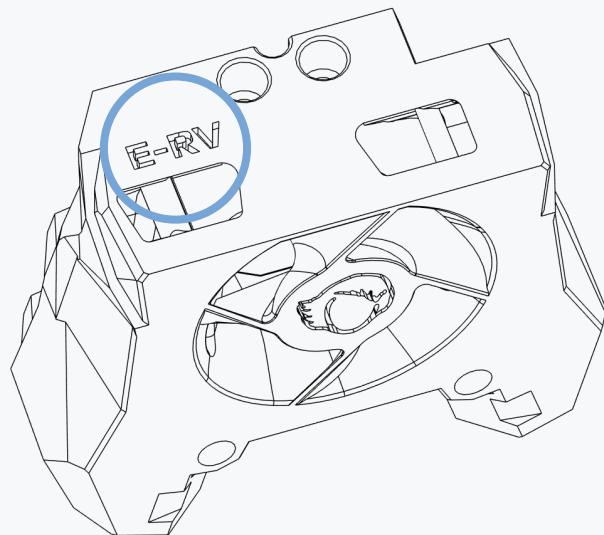
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**IDENTIFYING PRINTED PARTS**

The hotend type is embossed on the printed parts.

Make sure they match your hotend.

**MISSING CORNER? CW1? CW2?**

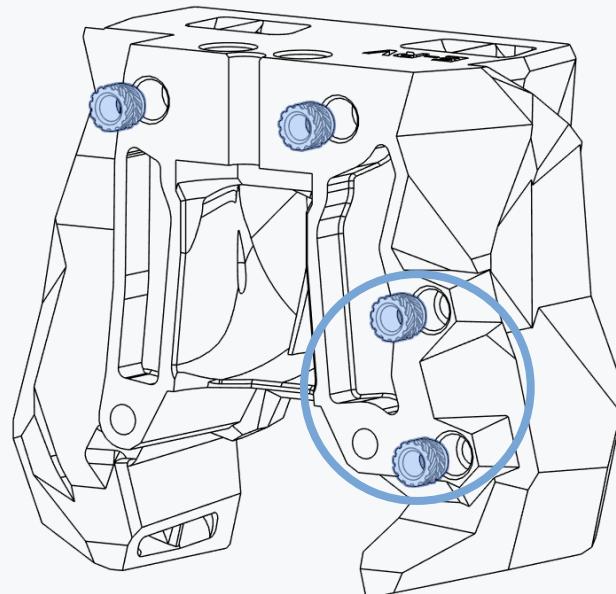
We also provide tool cartridge parts for ClockWork1, and other extruders designed as an alternative to CW1. They are identical except for an opening in the highlighted corner to help with wire routing for those designs.

**AVAILABLE MOUNTS**

We also provide mounts for other hotends. They are assembled in a similar manner.

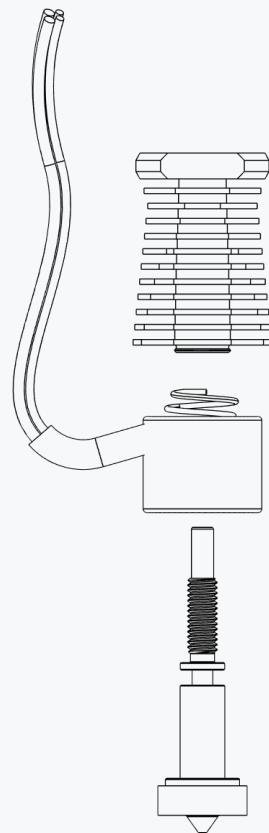
For a full list of available mounts and their identification code, see the readme file included in the toolheads folder.

Heat Set Insert



**OPTION: ADXL PCB MOUNT**

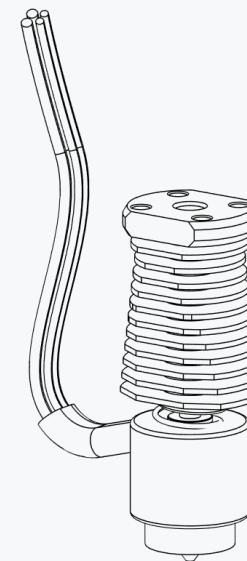
To use the optional ADXL PCB for Klipper's Input Shaper calibration, add additional heat set inserts into the holes in highlighted location.



Revo Voron Heatsink

Revo HeaterCore

Revo Nozzle



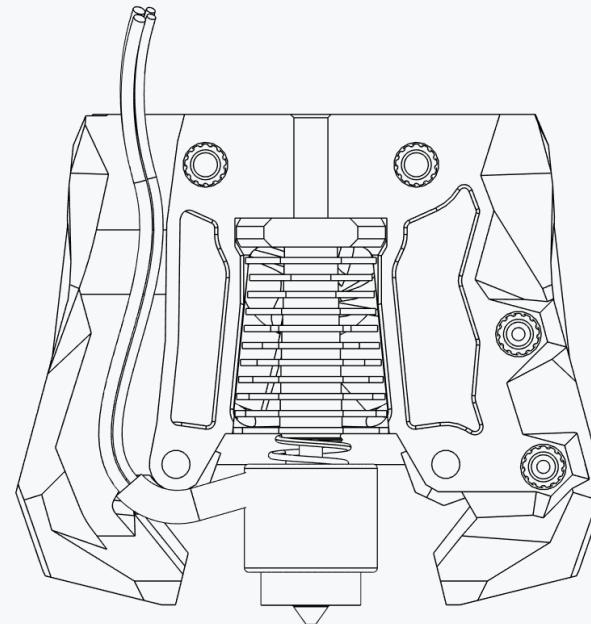
**HOTEND WIRE ROUTING**

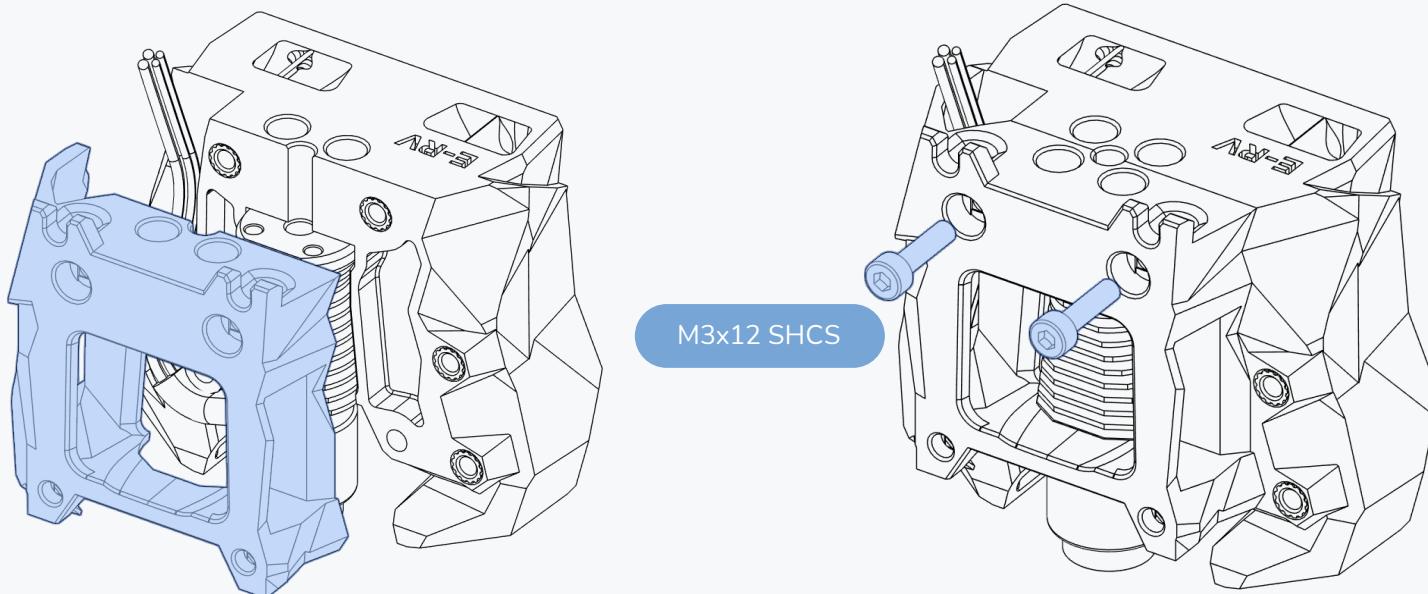
Route the wires as shown to the right. This is universal to all hotend types.

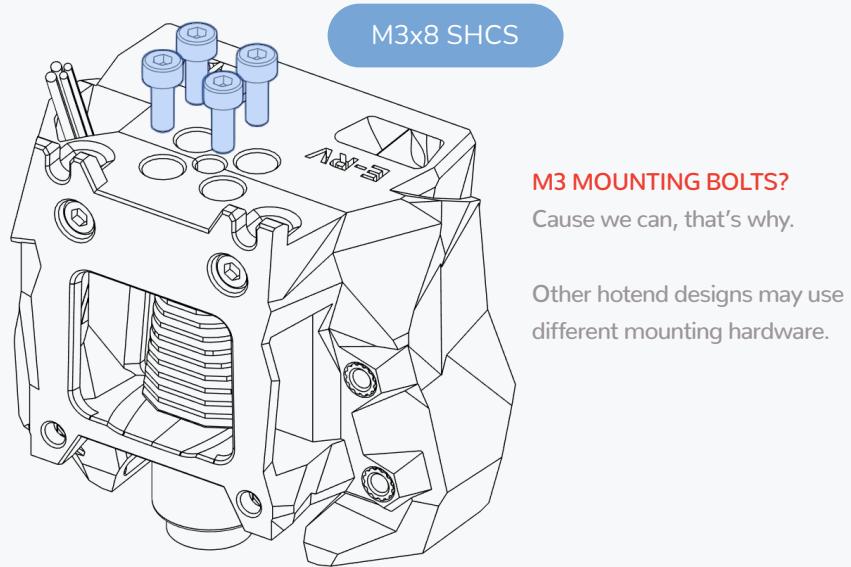
**BEND STRAIN RELIEF**

Carefully bend the strain relief to clear the printed part. Firmly hold the HeaterCore to prevent bending the Revo Nozzle.

It is critical that the Revo Nozzle is fully hand tightened into the heatsink. You MUST bend the strain relief to achieve this.



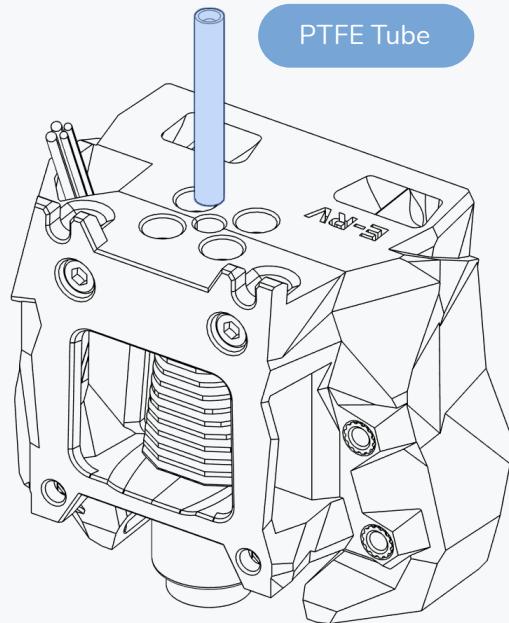




**M3 MOUNTING BOLTS?**

Cause we can, that's why.

Other hotend designs may use  
different mounting hardware.

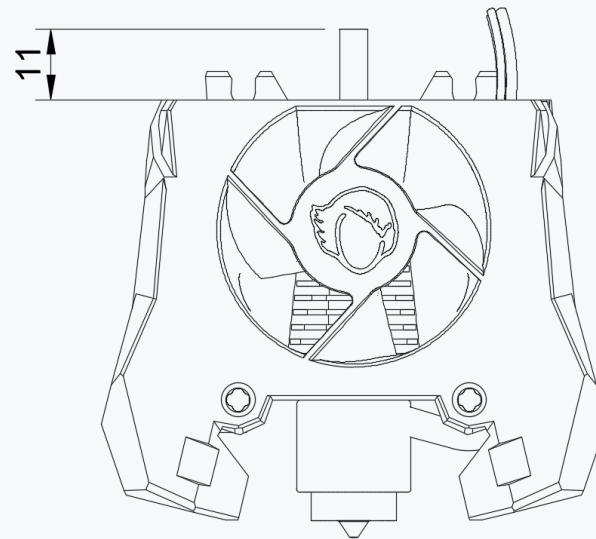


PTFE Tube

**PTFE STICKOUT**

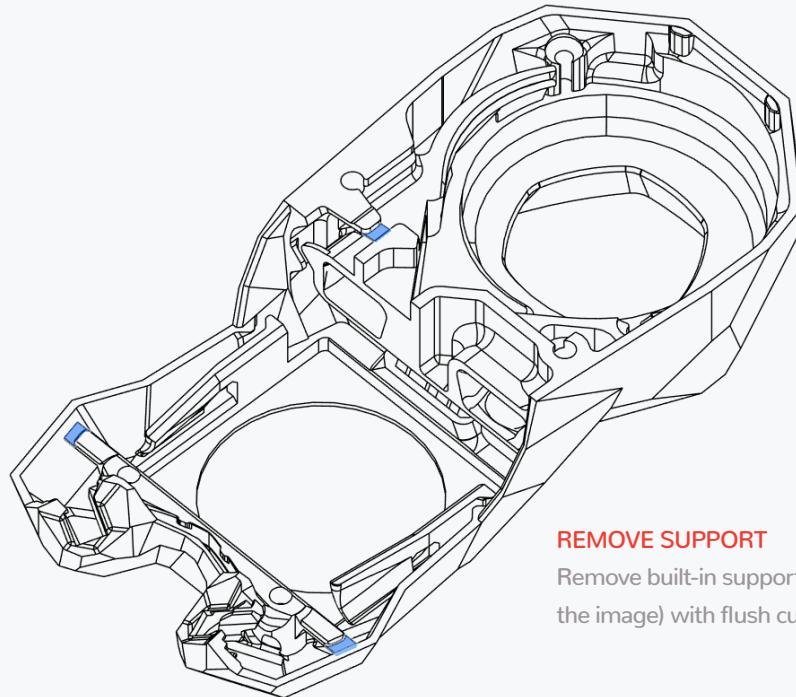
The PTFE tube should stick out 11mm above the surface of the printed part.

The stick out length might vary if you use an extruder other than the ClockWork2.



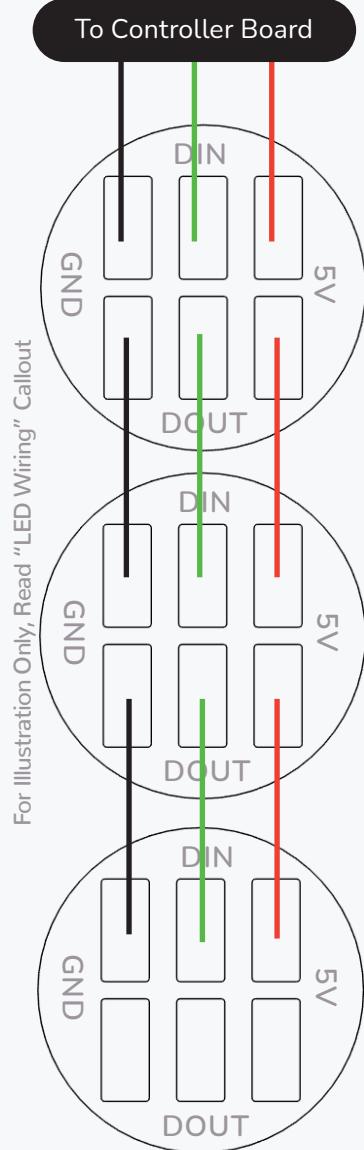
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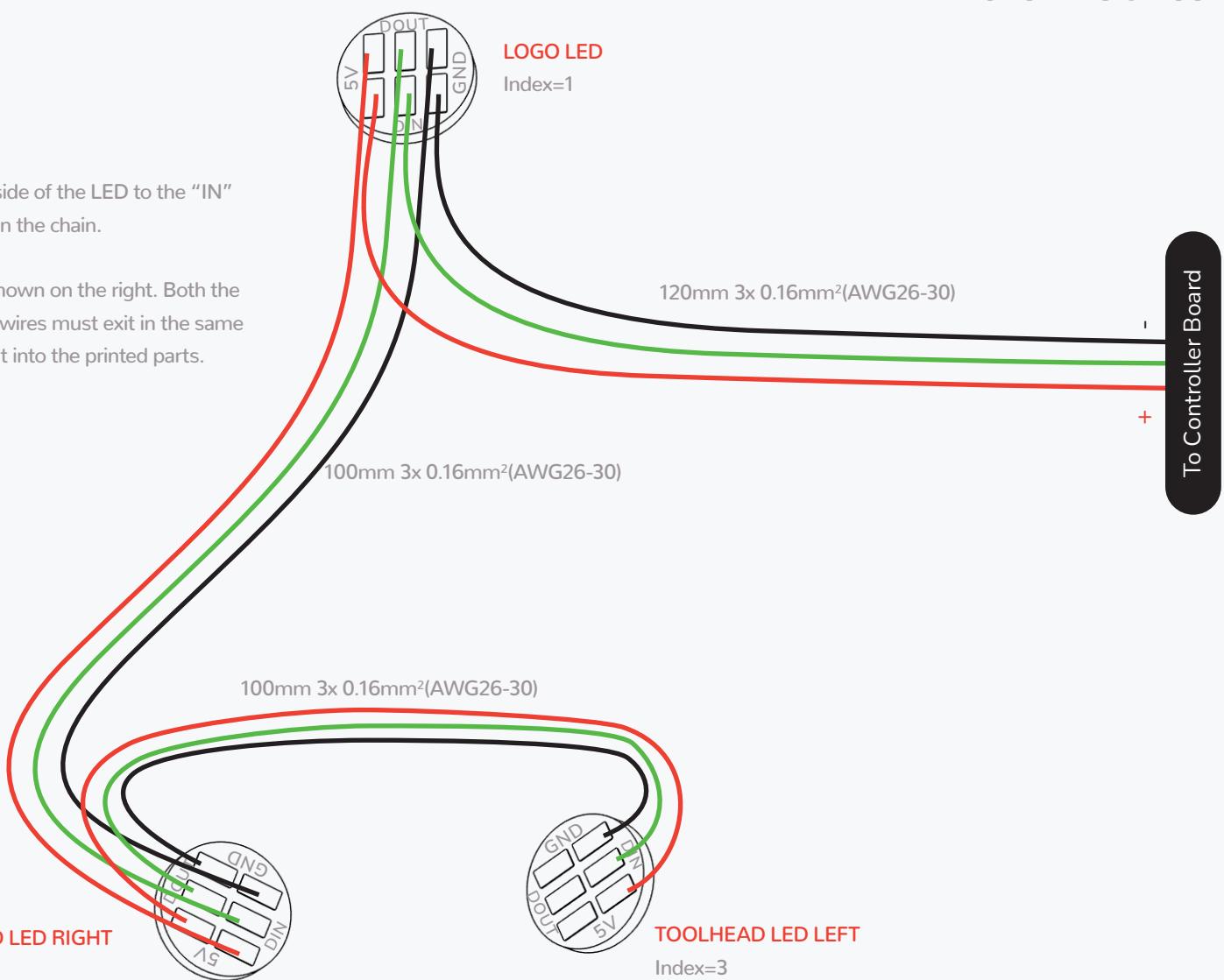
**REMOVE SUPPORT**

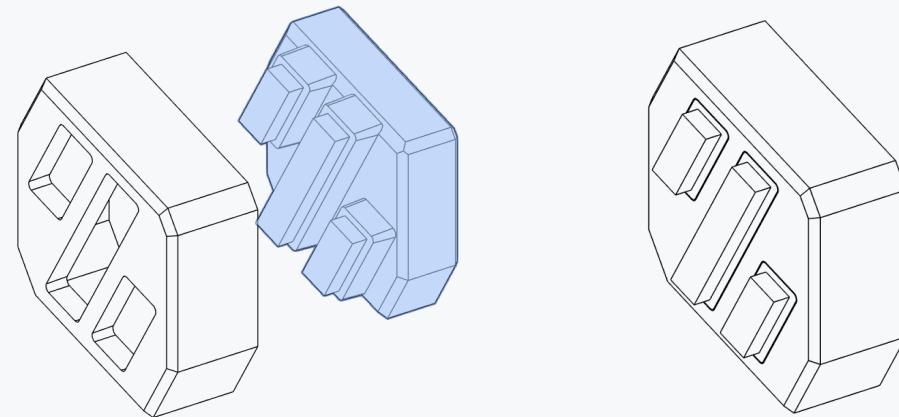
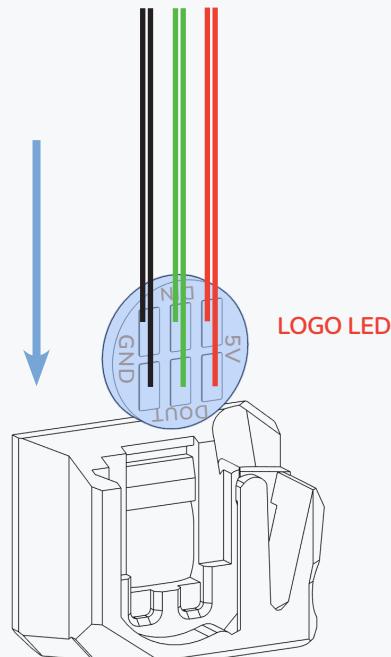
Remove built-in supports (highlighted in the image) with flush cutters.

**LED WIRING**

Connect the "OUT" side of the LED to the "IN" side of the next LED in the chain.

Solder the wires as shown on the right. Both the "IN" and the "OUT" wires must exit in the same direction in order to fit into the printed parts.





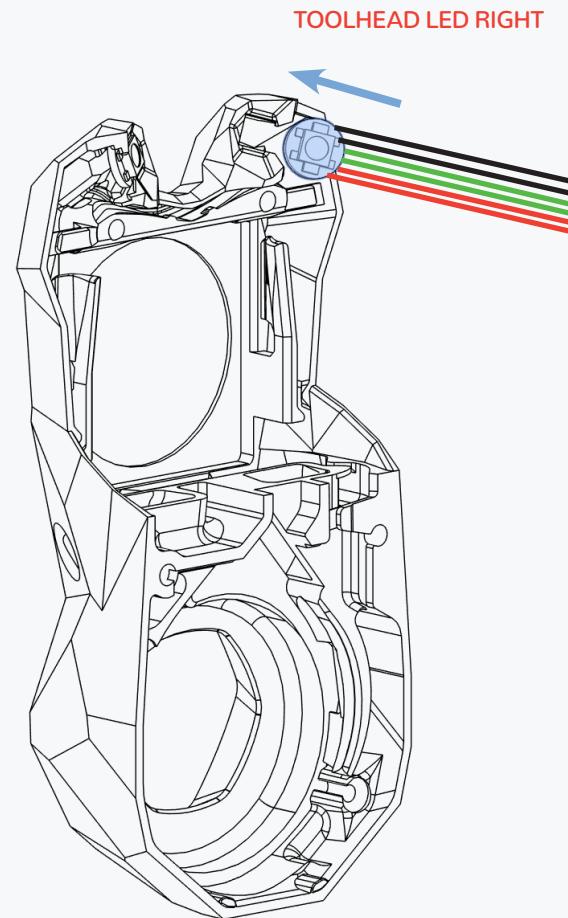
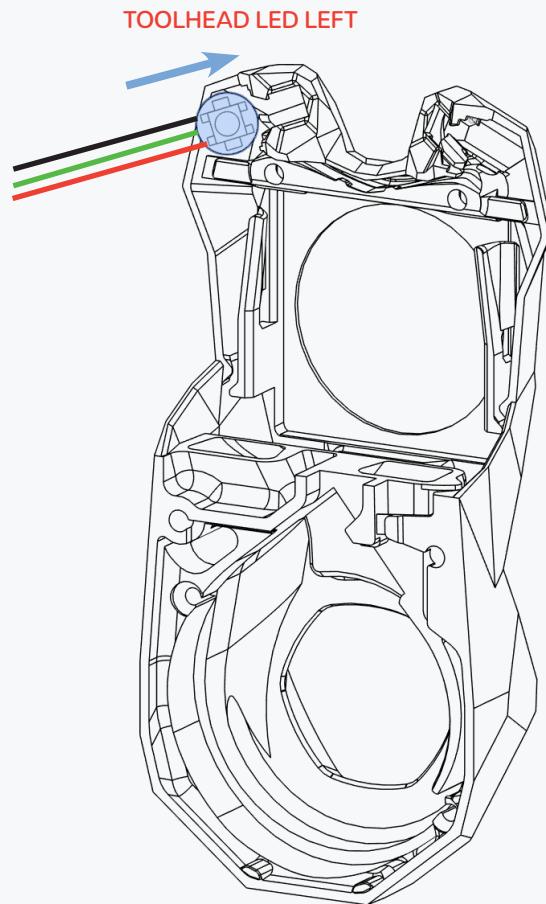
#### LED DIFFUSER AND MASK

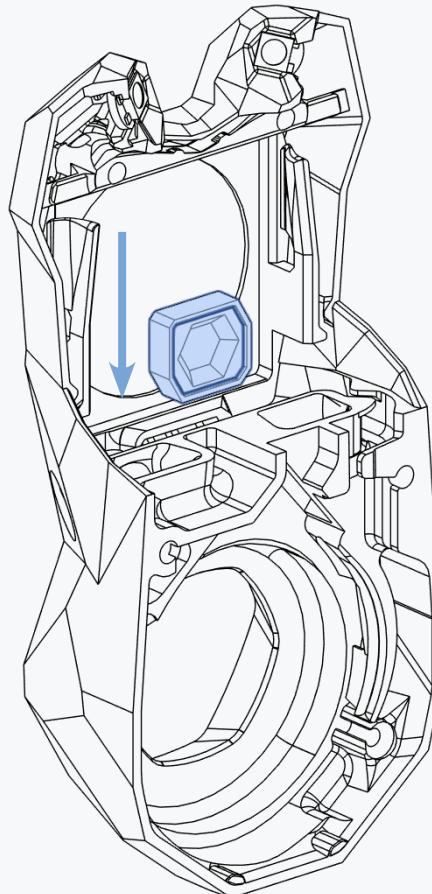
The diffuser (highlighted part) is printed in a translucent filament to evenly spread the light.

The mask (part to the left) is printed in an opaque filament to prevent the light from leaking, resulting in a crisp logo.

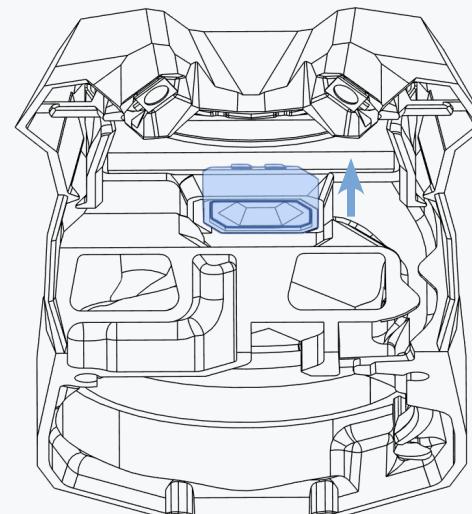
LEDS

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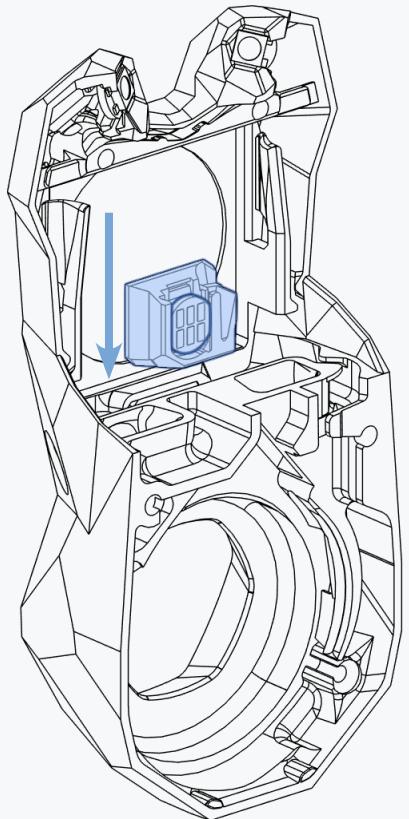
**DIFFUSER INSERTION**

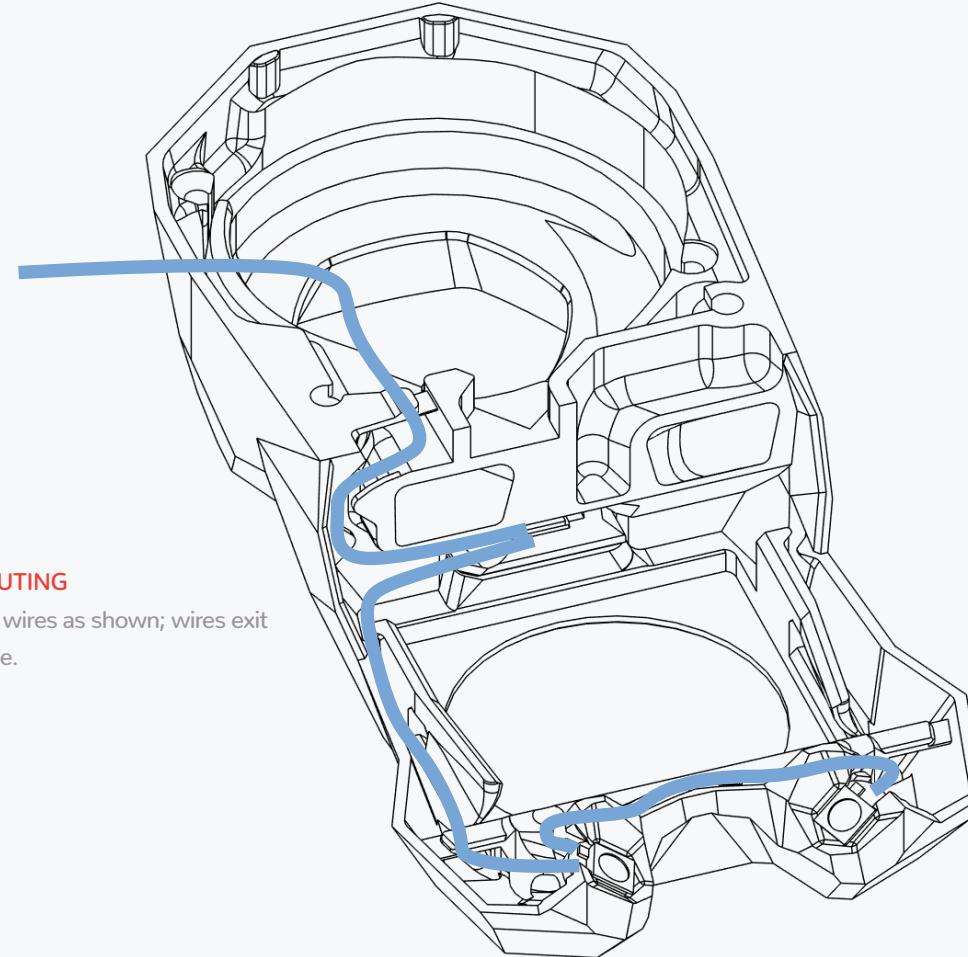
Insert the printed parts and push them towards the front.



LEDS

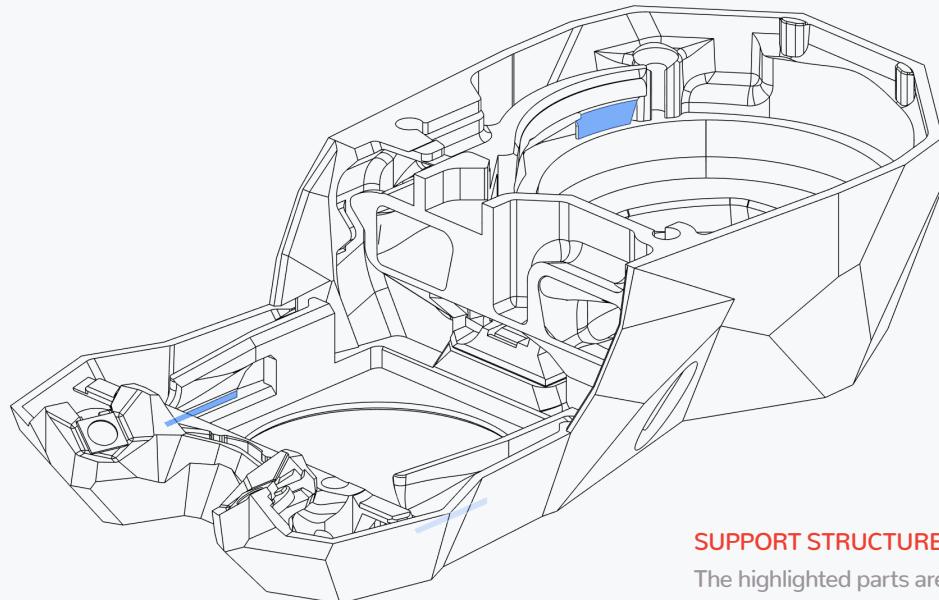
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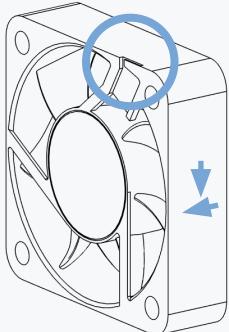
**LED WIRE ROUTING**

Route the LED wires as shown; wires exit on the right side.

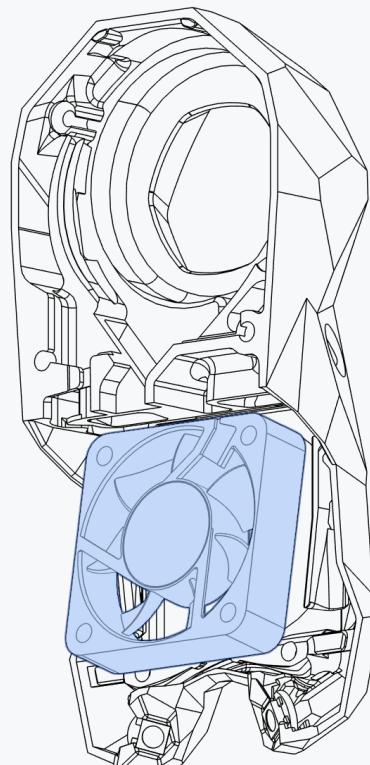


**SUPPORT STRUCTURE**

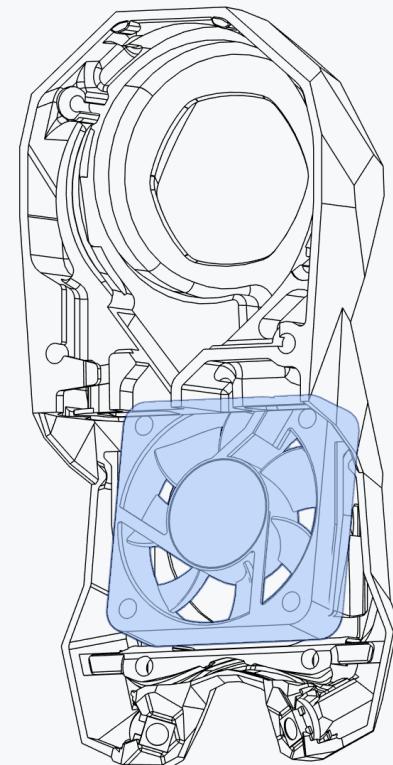
The highlighted parts are build-in support structures. They are designed to break during the fan installation.

**FAN ORIENTATION**

Rotate the fan so that the wires exit on the top and the air is pushed "inwards".

**FAN INSERTION**

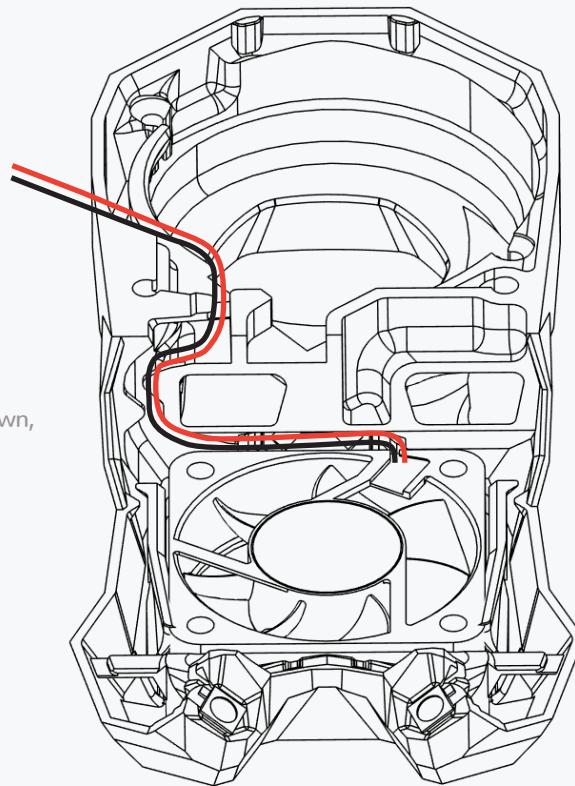
Insert the fan at a slight angle and clip it into place.

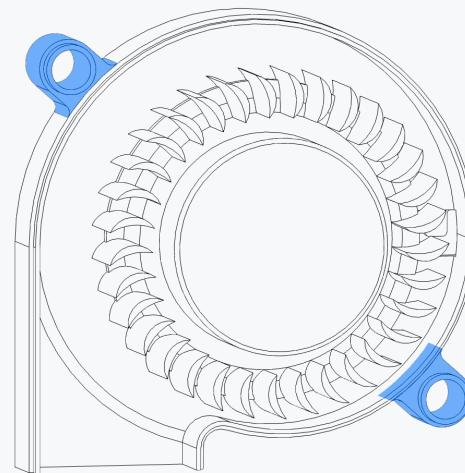
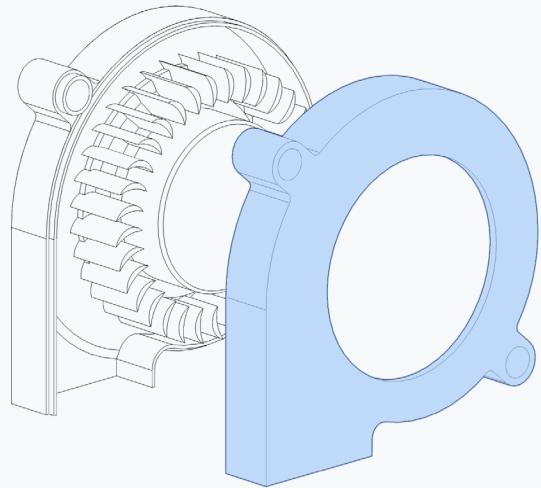


Mind the fan orientation.

**FAN WIRE ROUTING**

Route the fan wires as shown,  
exiting on the right side





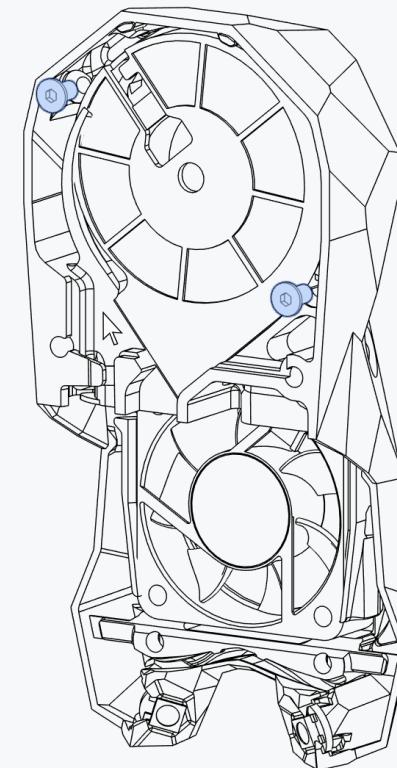
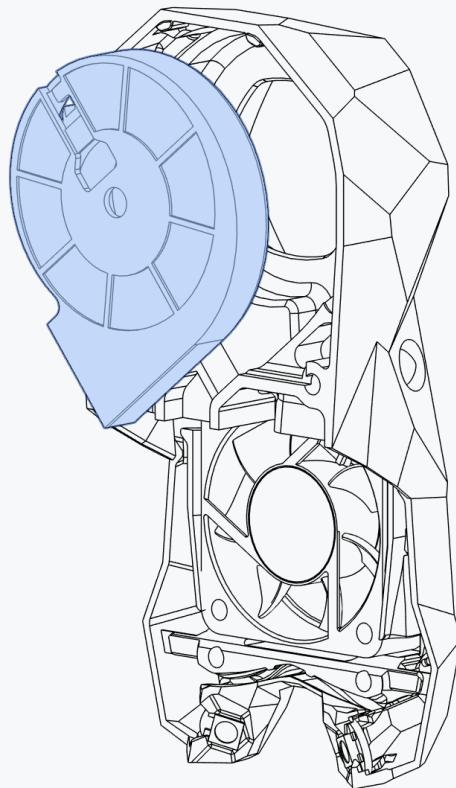
#### FAN PREPARATION

Remove the front of the 5015 fan. Clip off and file down the stock mounting ears.

There's a trimming jig STL included in the release to make this task easier.

PART COOLING FAN

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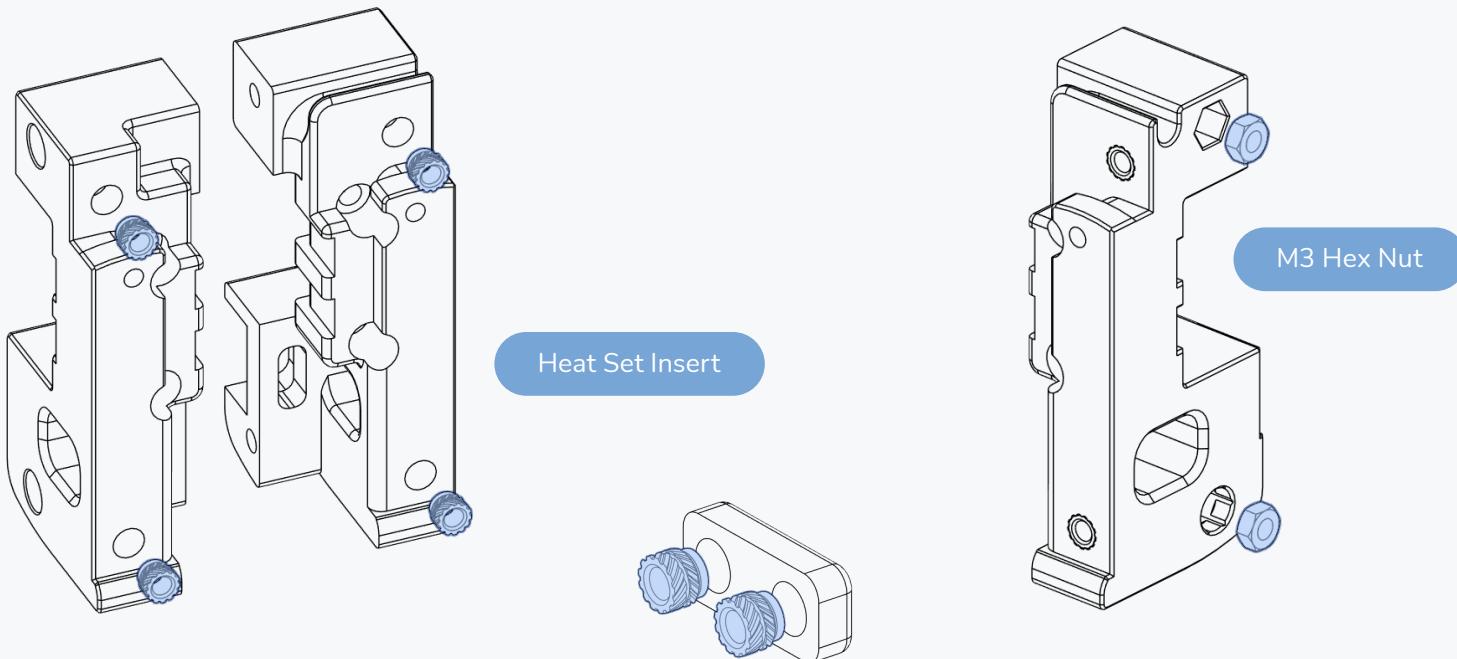


Yeah, it went about as expected.

X CARRIAGE

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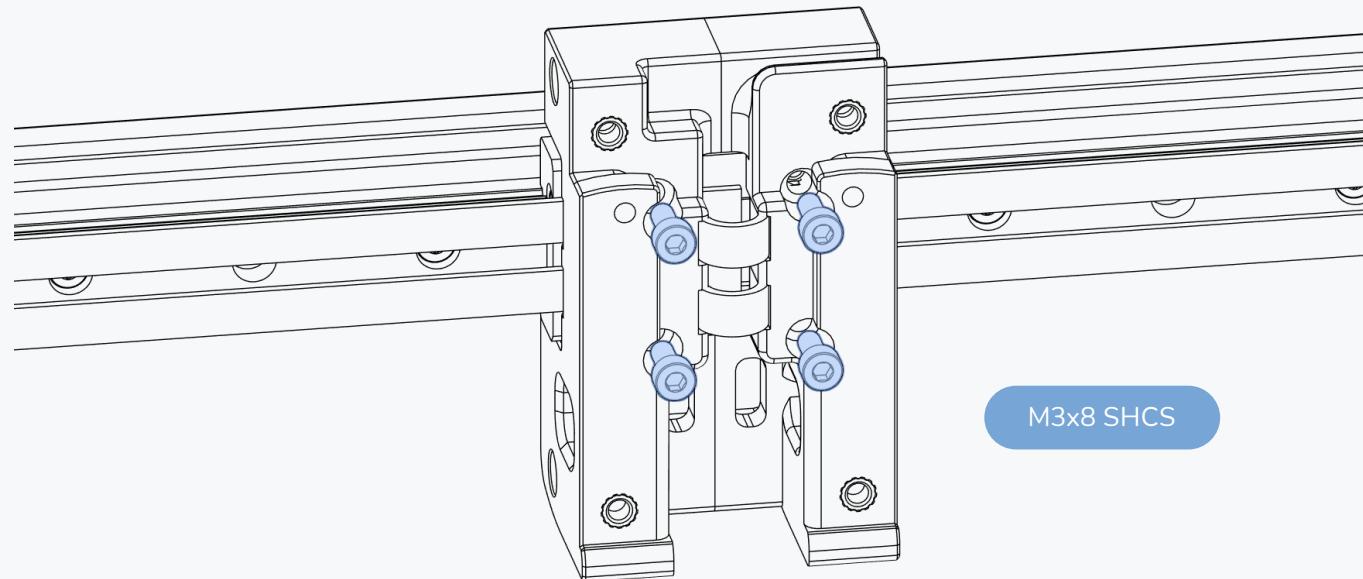


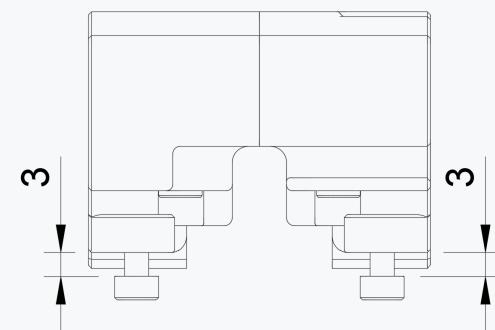
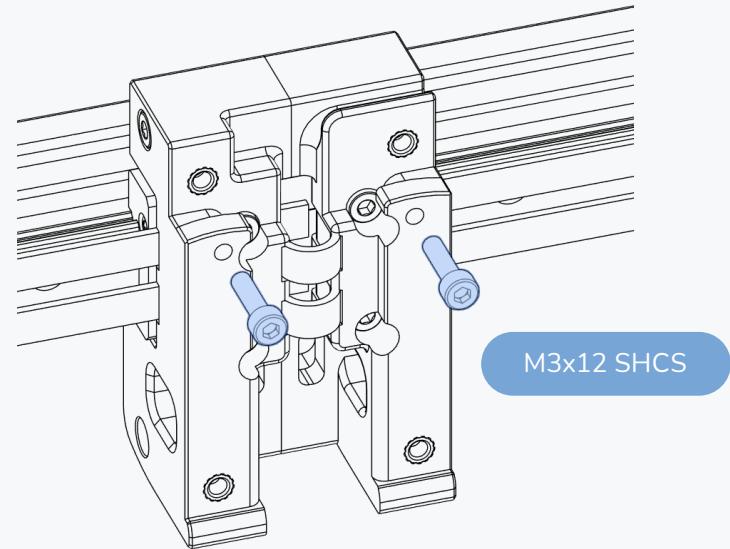
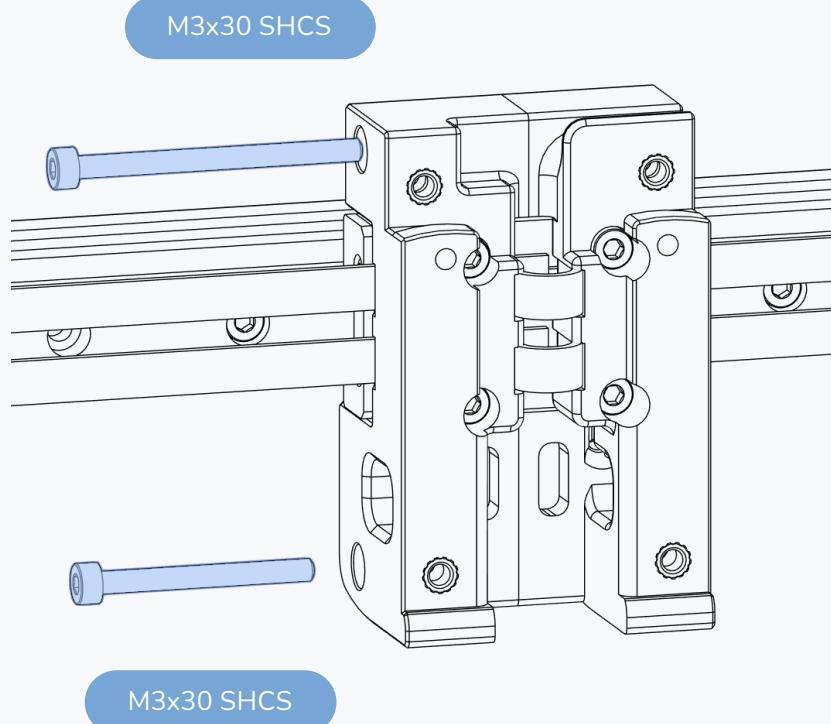
**PRINTER SPECIFIC PARTS**

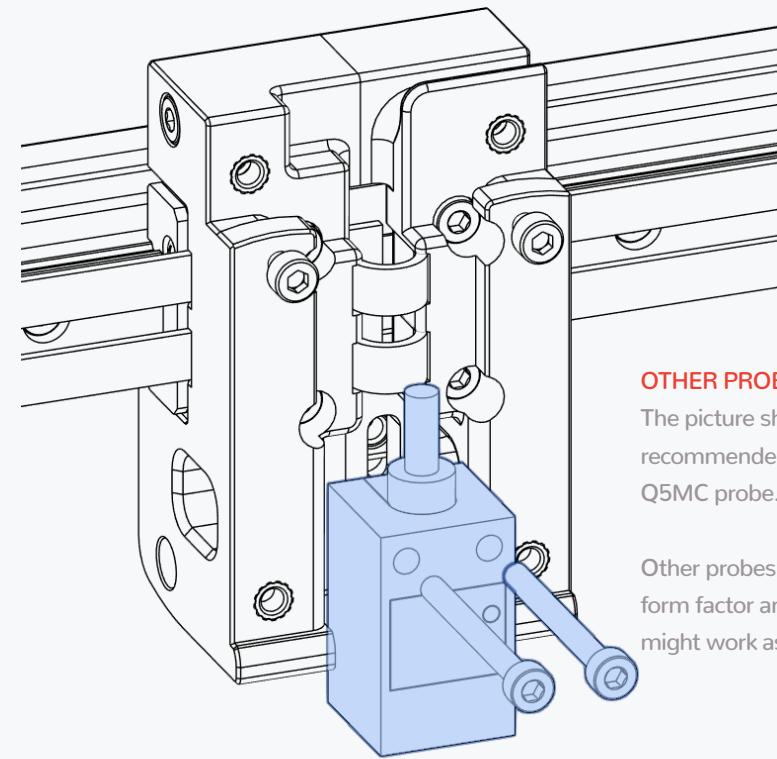
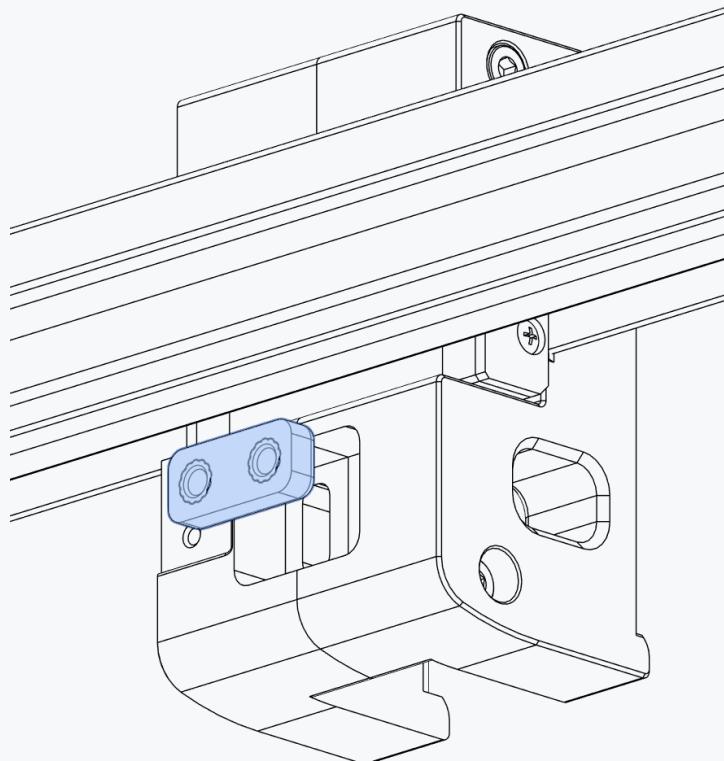
We provide different versions of the carriage to fit our different printer designs. Be sure to pick the right one for your printer.

**FOLLOW BELTING AND X CARRIAGE INSTALLATION OUTLINED IN PRINTER MANUAL**

Consult the printer's manual for instructions on how to run the belts and details on carriage mounting.



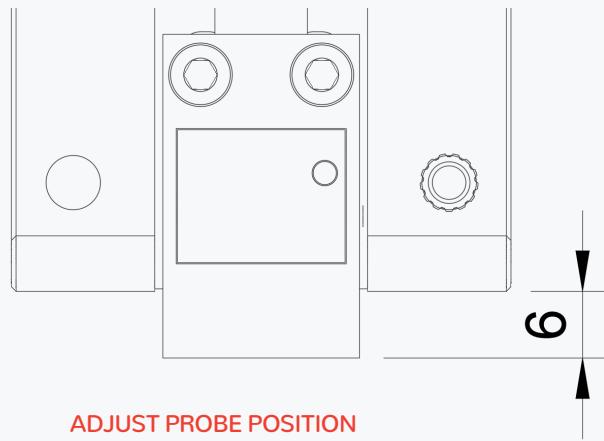


**OTHER PROBE TYPES**

The picture shows the recommended Omron TL-Q5MC probe.

Other probes with a similar form factor and characteristics might work as well.

**Omron Style Probe****M3x30 SHCS**

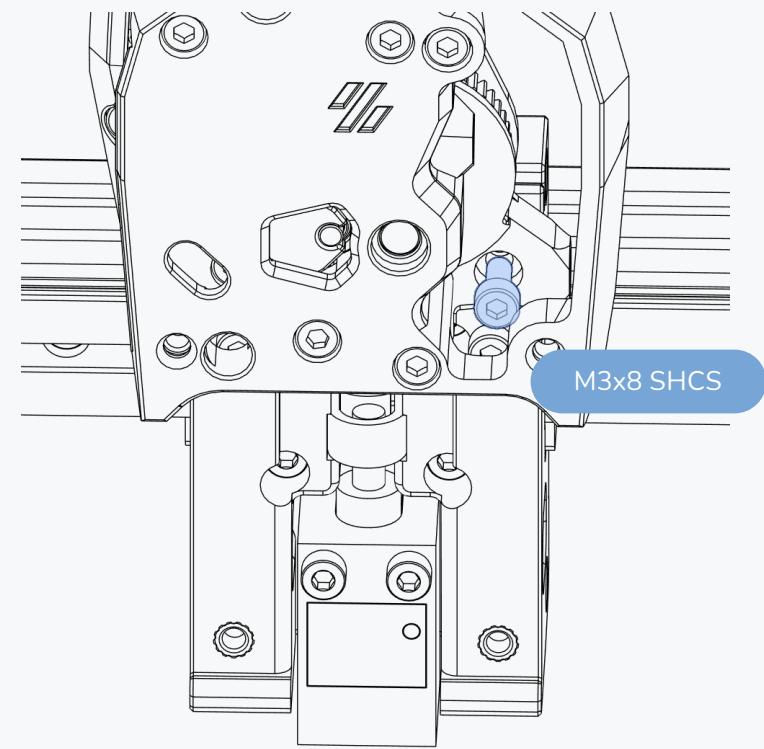
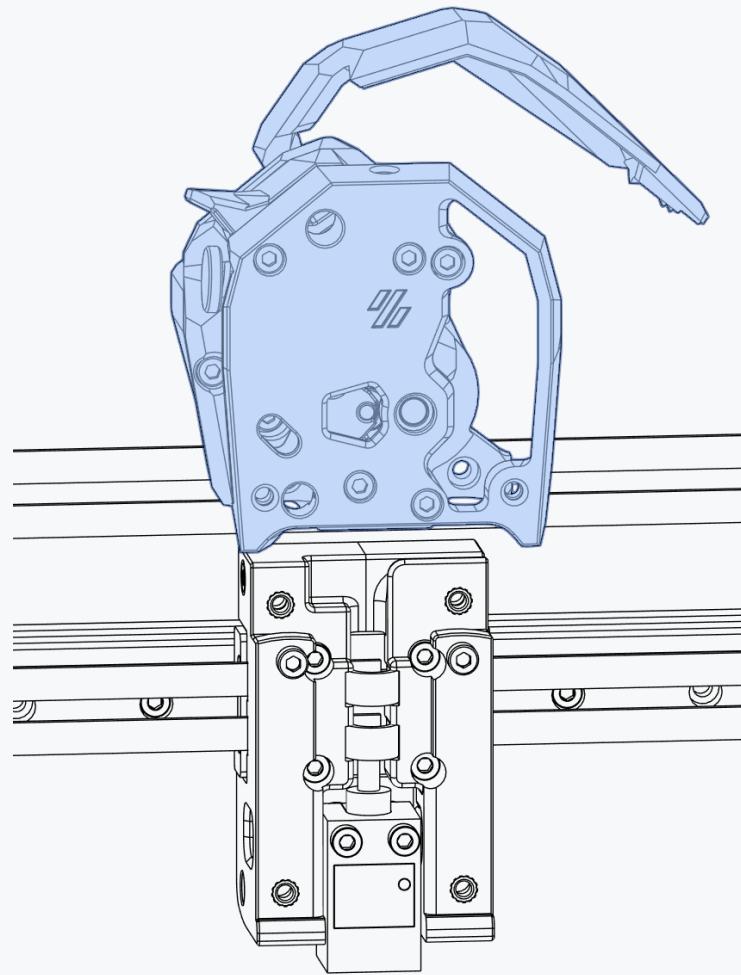


**ADJUST PROBE POSITION**

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

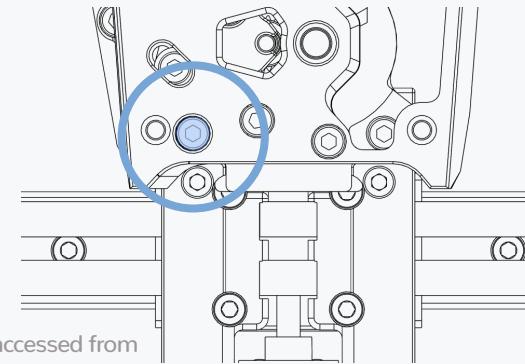
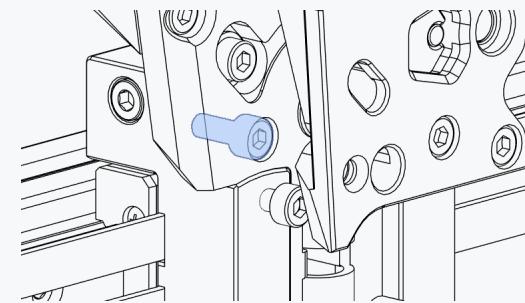
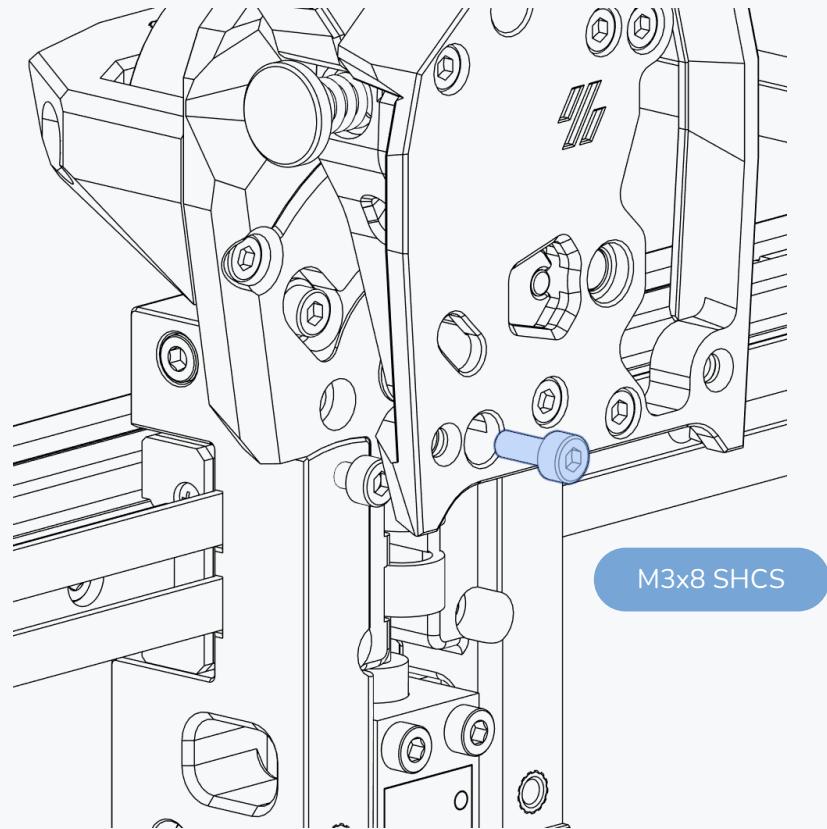
CW2 MOUNTING

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## CW2 MOUNTING

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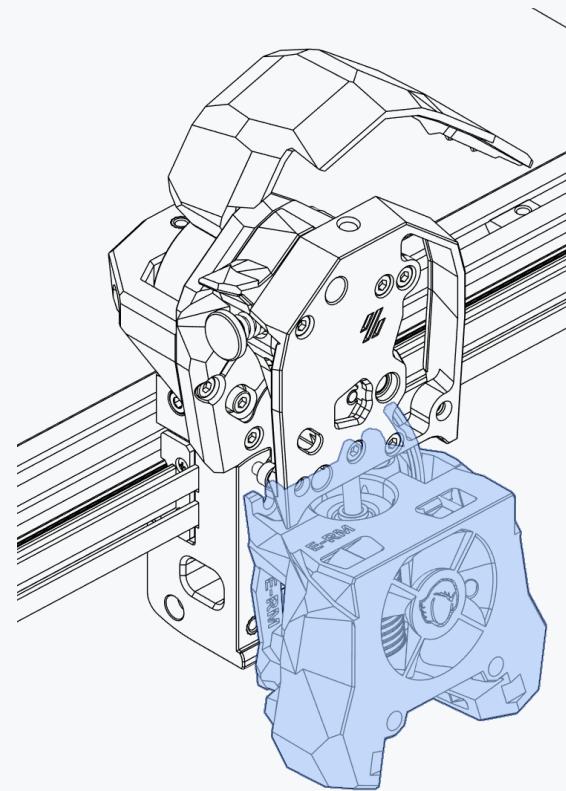


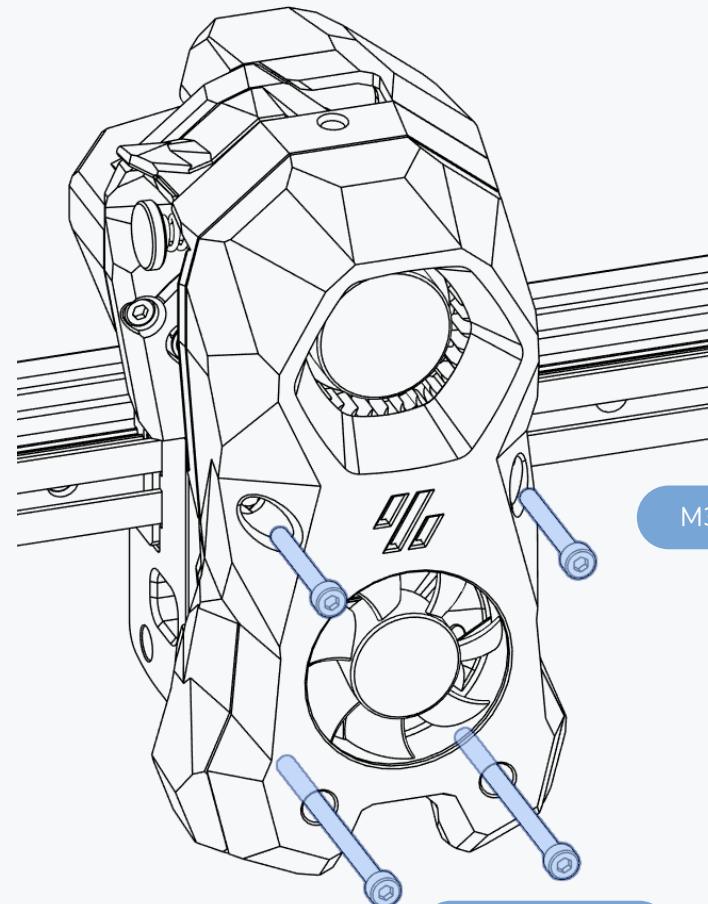
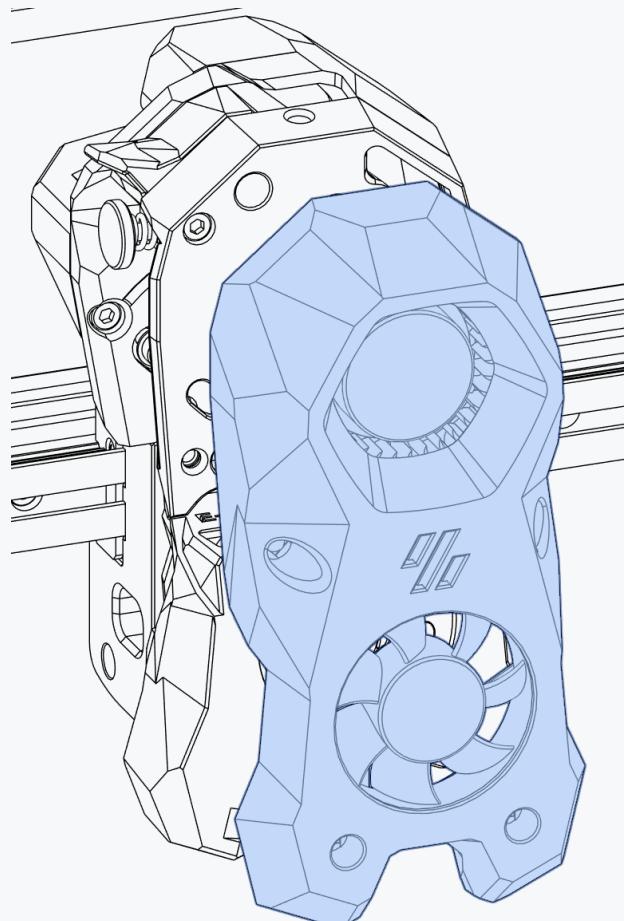
### ACCESS HOLE

The bolt can be accessed from the front of the extruder.

TOOL CARTRIDGE MOUNTING

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**25MM BOLTS?**

The bolts are slightly longer than necessary. This is on purpose and a QOL feature.

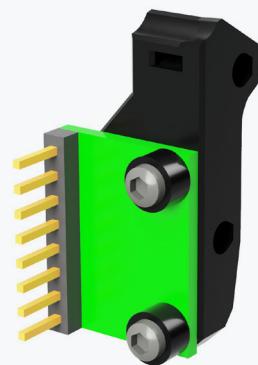
The longer bolts prevents the front from falling off.

M3x25 SHCS

M3x50 SHCS

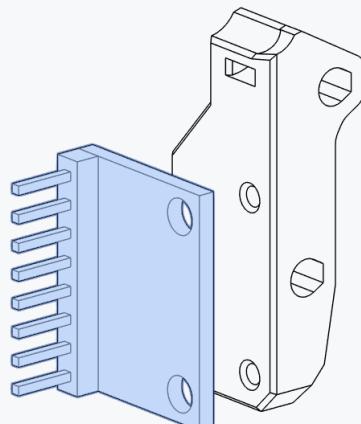
ADXL345 MOUNT

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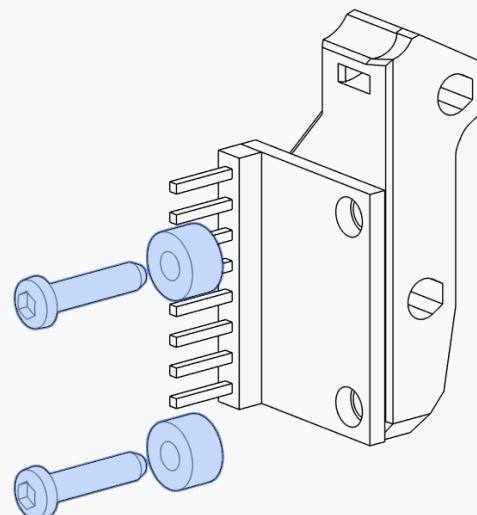


**ADXL MOUNT AND INPUT SHAPER CALIBRATION**

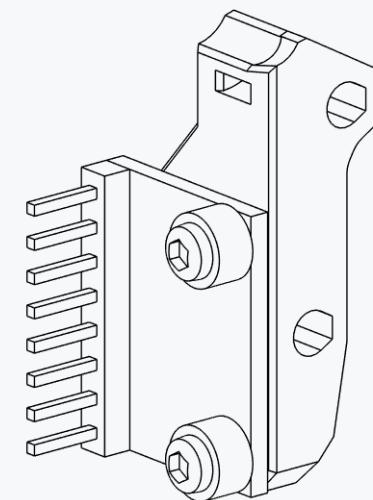
The ADXL is intended to be mounted only when doing vibration testing/input shaper calibration and should not be left on the tool head during normal printing.



ADXL345 Prototype Board



M2x10 Self Tapping Screws

**ISOLATION SPACERS**

Most ADXL345 prototype boards have circuit tracks close to the mounting holes.  
Make sure to install spacers to prevent damage to the board.  
We included printable spacers in the release

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

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

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



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



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

#### HOW TO GET HELP

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



**DISCORD**

<https://discord.gg/voron>



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

#### REPORTING ISSUES

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

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

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



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

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

**Docs**  
[docs.vorondesign.com](https://docs.vorondesign.com)

**Discord**  
[discord.gg/voron](https://discord.gg/voron)

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