



VORON STEALTHBURNER

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

VERSION 2023-07-07



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

Introduction	04
Hardware	07
Overview	08
ClockWork2	10
Tool Cartridge	41
StealthBurner	44
X Carriage	58
ADXL Mount	68
Next Steps	70

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)

INFILL TYPE

Grid, Gyroid, Honeycomb, Triangle or Cubic

MATERIAL

ABS

INFILL PERCENTAGE

Recommended: 40%

LAYER HEIGHT

Recommended: 0.2mm

WALL COUNT

Recommended: 4

EXTRUSION WIDTH

Recommended: Forced 0.4mm

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
Example z_joint_lower_x4.stl These files will have nothing at the start of the filename.	Example [a]_tensioner_left.stl We have added “[a]” to the front of any STL file that is intended to be printed with accent color. The parts are marked with a heart in the manual.	Example [c]_led_diffuser.stl 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).	Example [o]_led_diffuser_mask.stl 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).	Example [a]_z_belt_clip_lower_x4.stl If any file ends with “_x#”, that is telling you the quantity of that part required to build the machine.

HOW TO GET HELP

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



<https://discord.gg/voron>

REPORTING ISSUES

Should you find an issue in the documentation or have a suggestion for an improvement please consider opening an issue on GitHub (<https://github.com/VoronDesign/Voron-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.



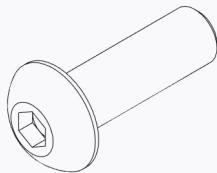
<https://github.com/vorondesign>



<https://docs.vorondesign.com>

HARDWARE REFERENCE

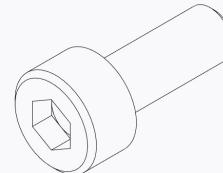
VORONDESIGN.COM



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)

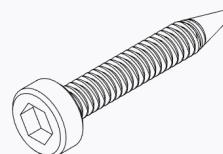
Metric fastener with a cylindrical head and hex drive. The most common fastener used on the Voron.

ISO 4762



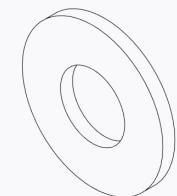
FLAT HEAD CAP SCREW (FHCS)

Metric fastener with a flat head and hex drive.
ISO 10642



SELF TAPPING SCREW

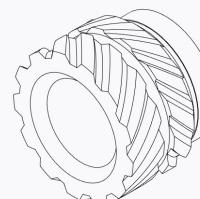
Fastener with a pronounced thread profile that is screwed directly into plastic.



WASHER

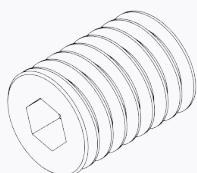
Usually stamped from sheet metal this type of spacer is not as consistent in thickness as the shims are. Only used in M3 size.

DIN 125



HEAT SET INSERT

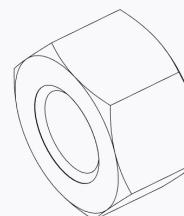
Heat inserts with a soldering tip so that they melt the plastic when installed. As the plastic cools, it solidifies around the knurls and ridges on the insert for excellent resistance to both torque and pull-out.



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.

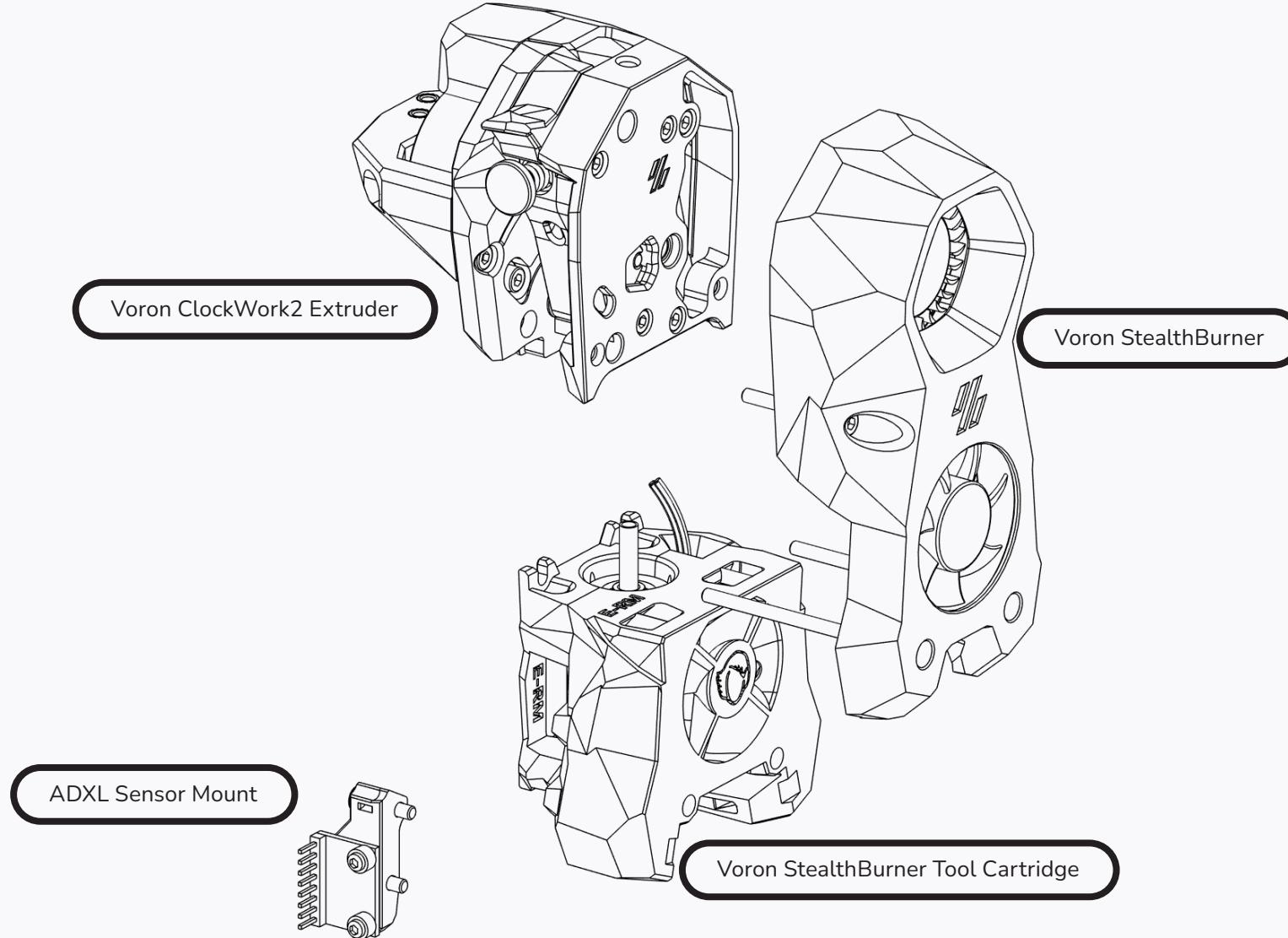
ISO 4032

VORONDESIGN.COM



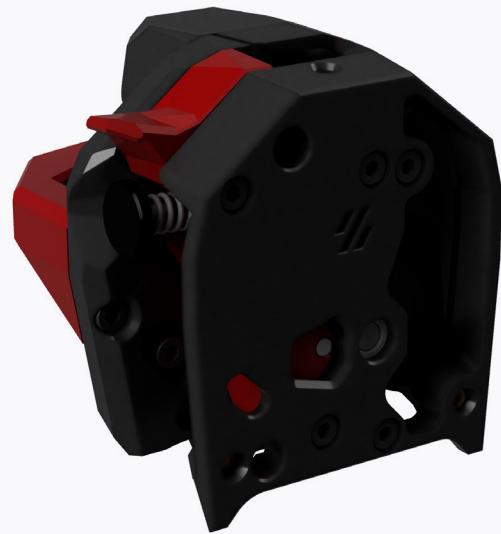
OVERVIEW

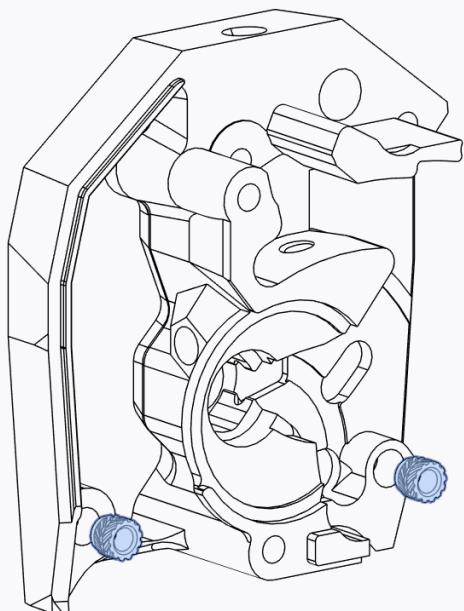
VORONDESIGN.COM



VORON CLOCKWORK2

VORONDESIGN.COM



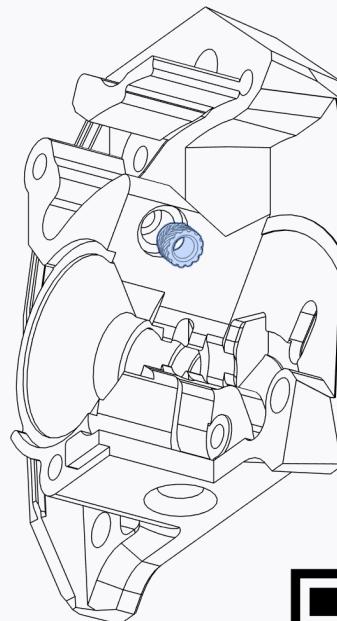


HEAT SET INSERTS

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.

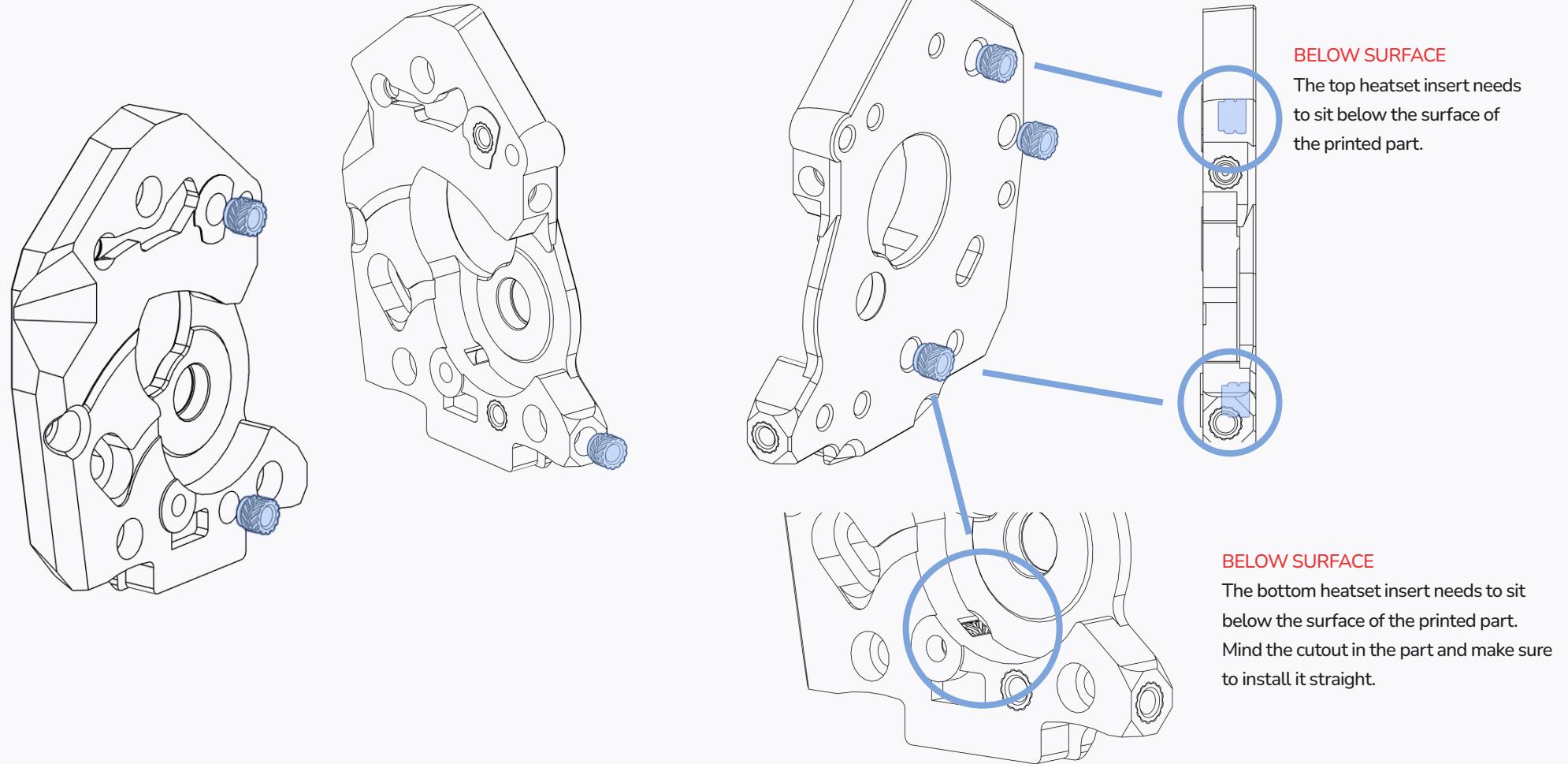
Heat Set Insert



<https://voron.link/m5ybt4d>

HEAT SET INSERTS

VORONDESIGN.COM



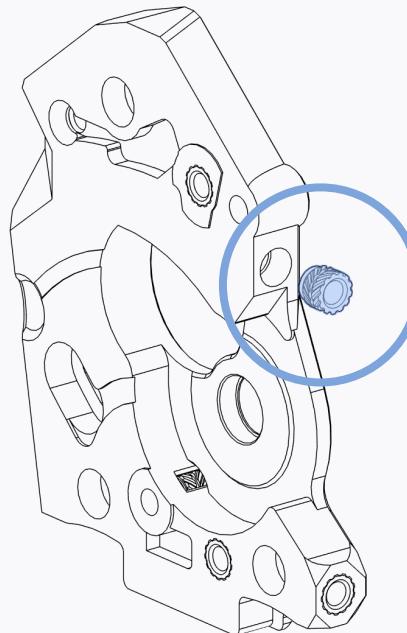
You use a Toolhead PCB, so install these two heat inserts.

HEAT SET INSERTS

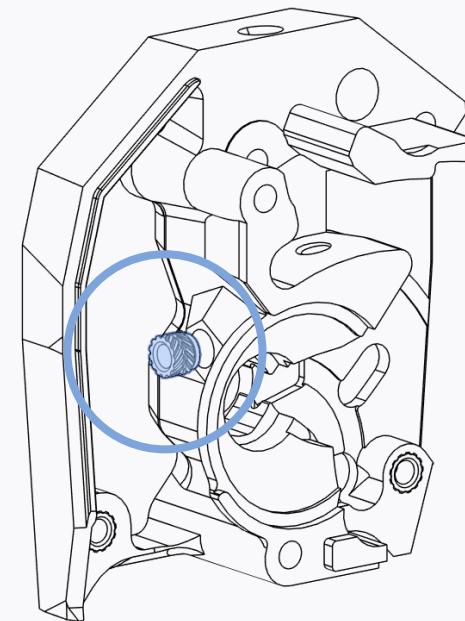
VORONDESIGN.COM

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.

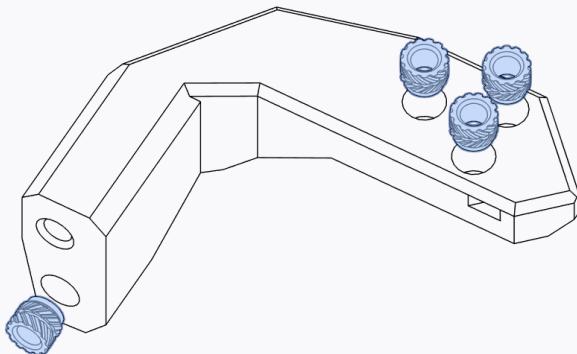
Skip

HEAT SET INSERTS

VORONDESIGN.COM

GENERIC CABLE CHAINS

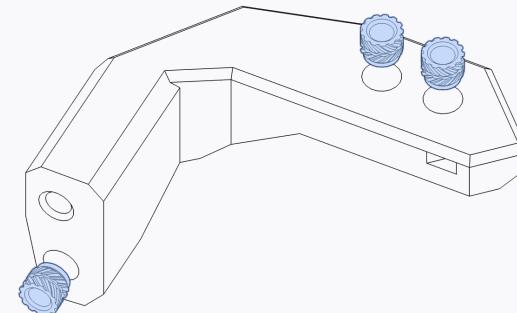
The 3-hole pattern is usually found on generic cable chains.



Heat Set Insert

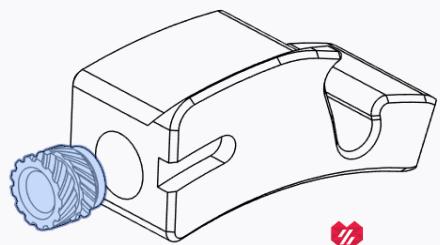
IGUS CABLE CHAINS

IGUS chains have 2 mounting holes.

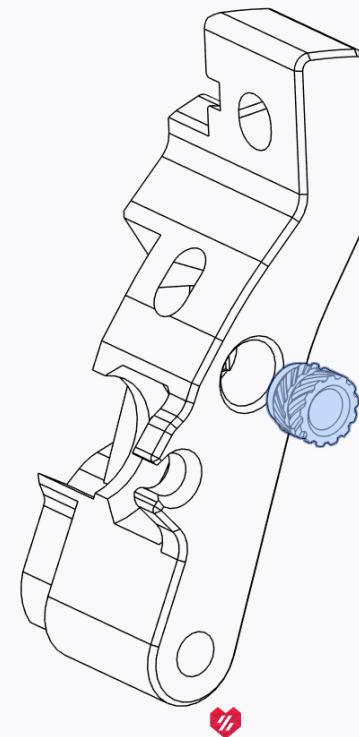
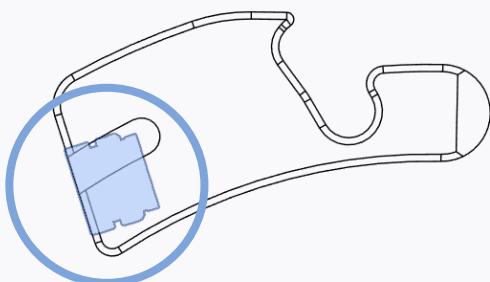


PRINTER SPECIFIC MOUNTS

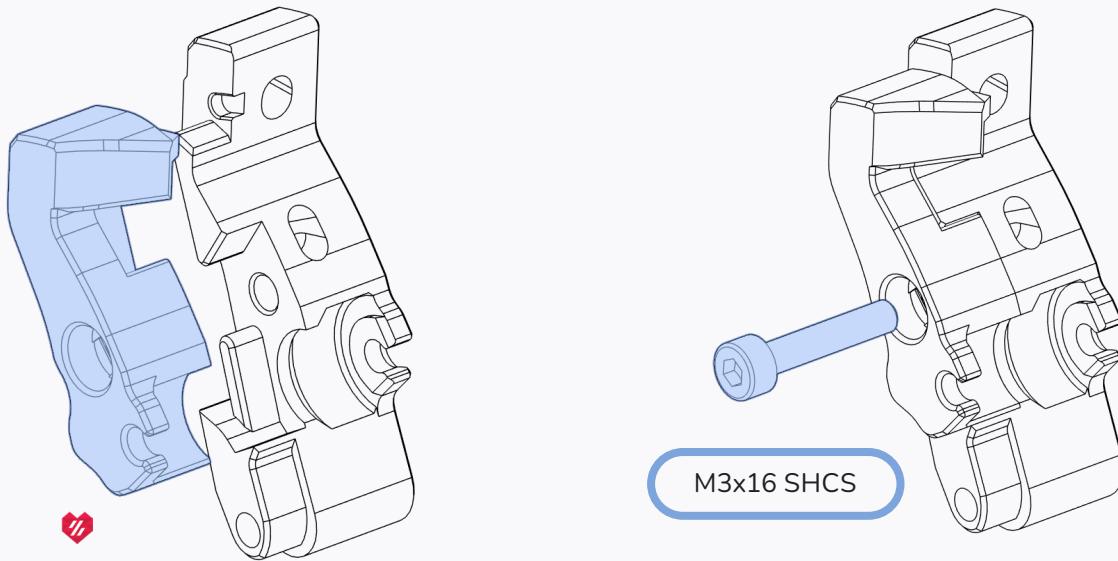
V2, Trident and Legacy use the same printed parts. Extra parts are included for SwitchWire.

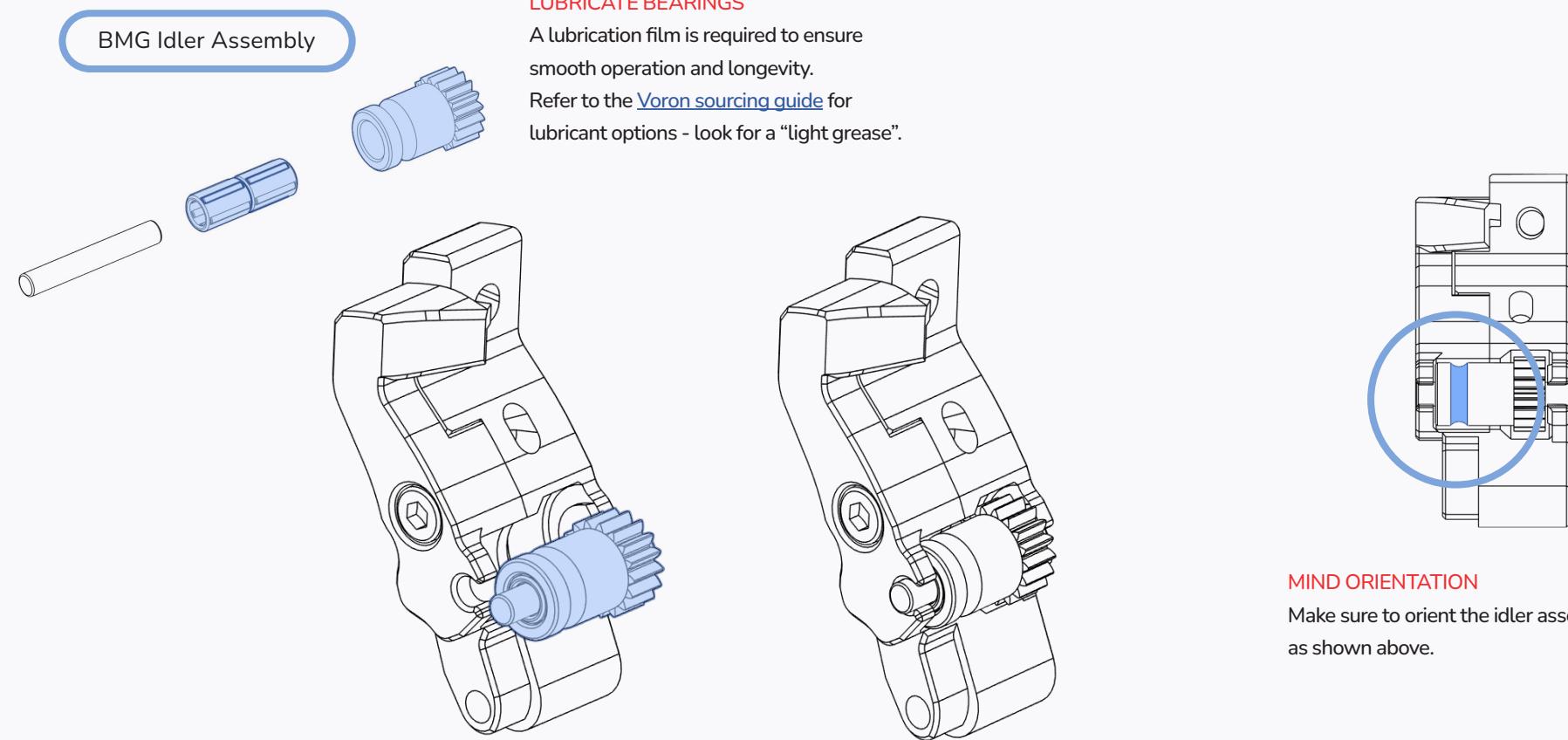
**FLUSH WITH SURFACE**

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

**ACCENT PART?**

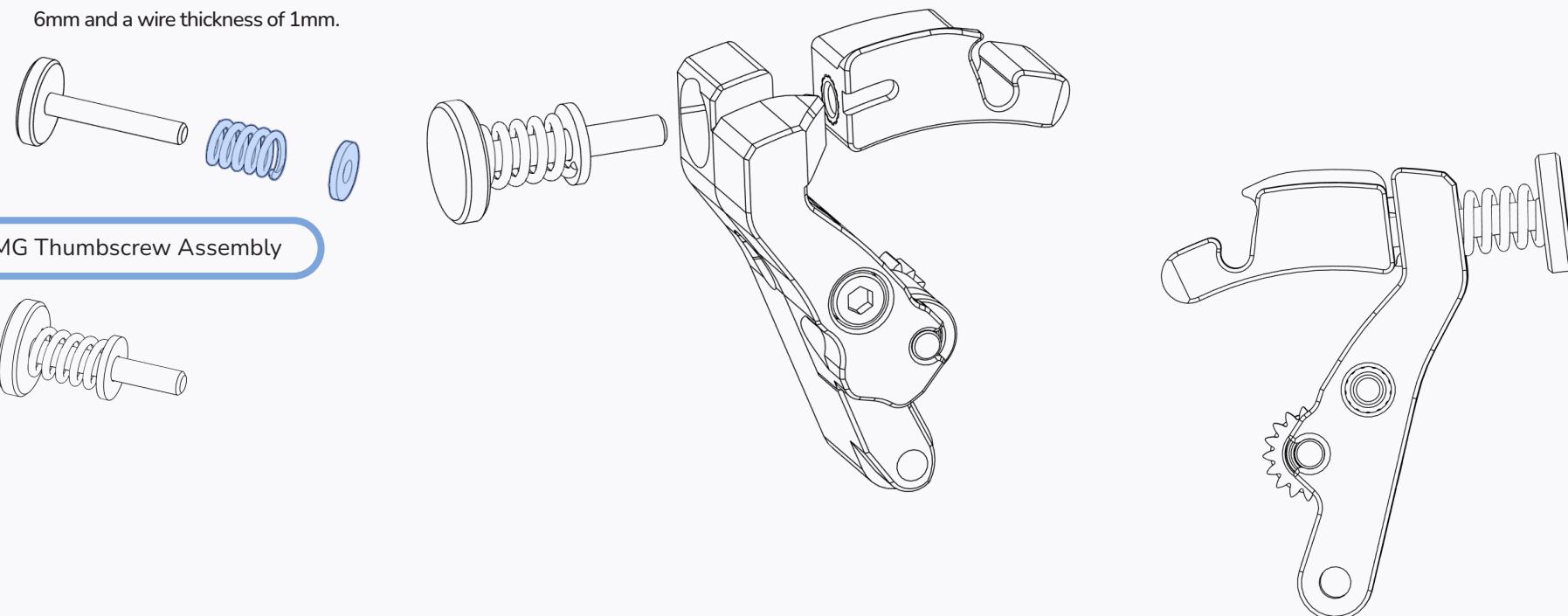
Look for Voron heart next to the part. It indicates that this is a part that is usually printed in the accent color.





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.

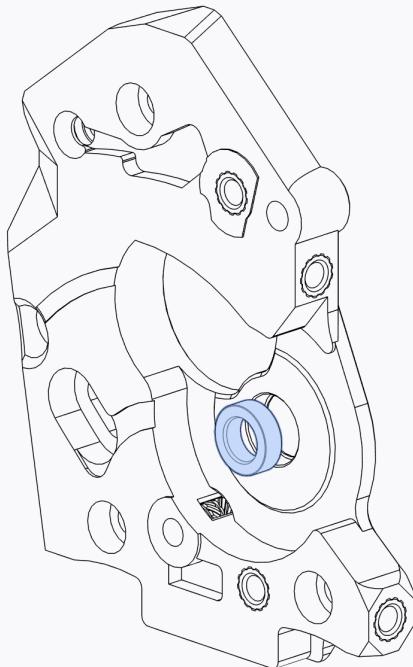
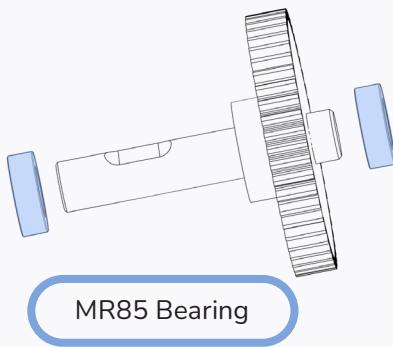


CHECK BEARING FIT

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.

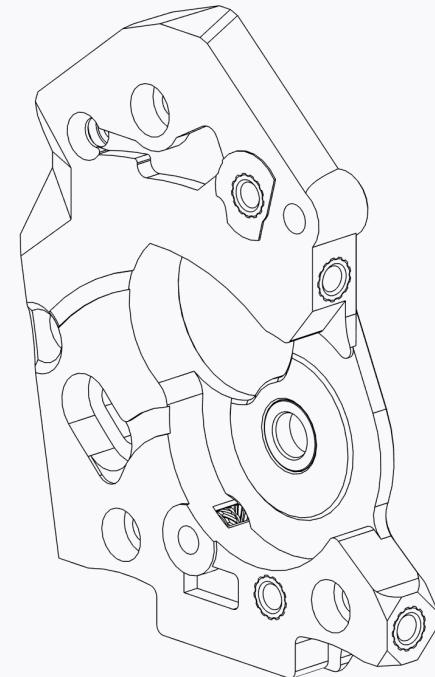


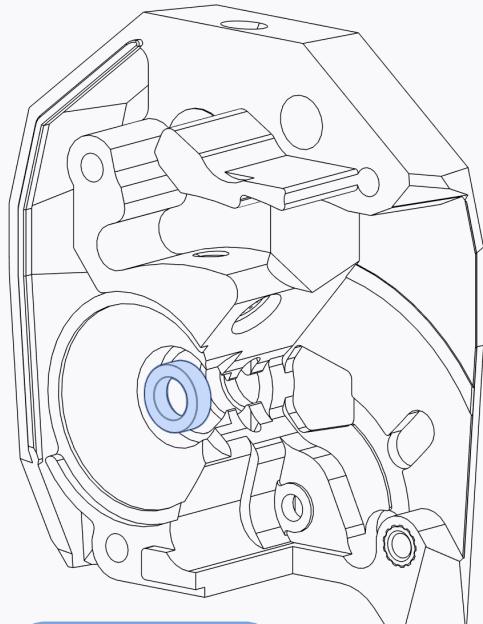
MR85 Bearing

BEARING FIT

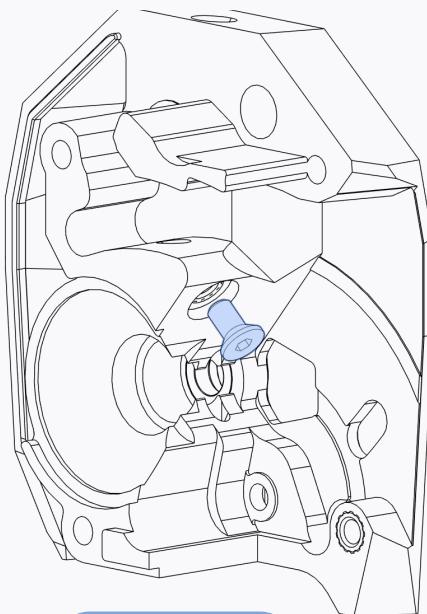
Fully seat the bearing into the plastic pocket. Apply even pressure to insert them. Avoid pressing on the inner ring of the bearing.

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





MR85 Bearing



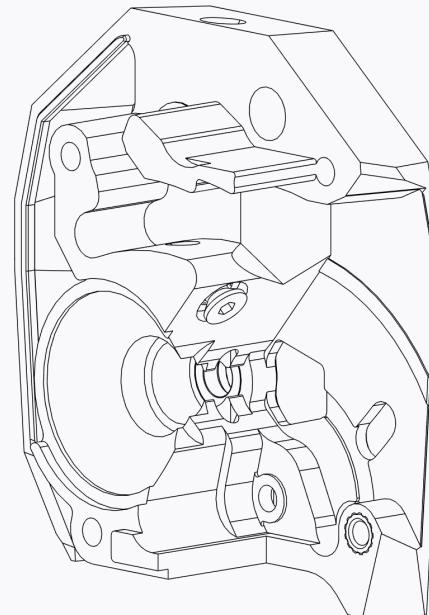
M3x6 FHCS

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.

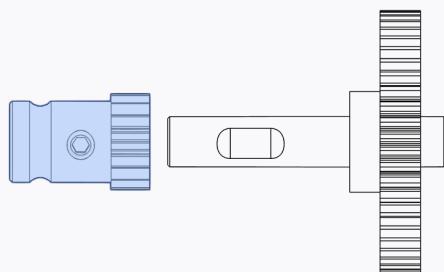
THREAD LOCKER PLEASE

Adding a small amount of medium strength thread locker to this flat head screw will keep it from coming loose over time.

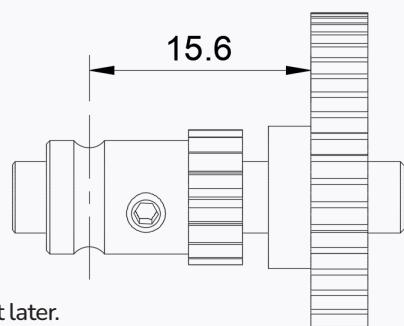


A NOTE ON GEARS

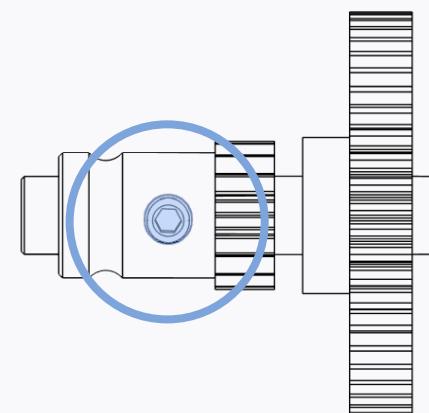
Poorly made gears often cause print quality issues. For best performance consider sourcing the [original Bondtech parts](#).

**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**

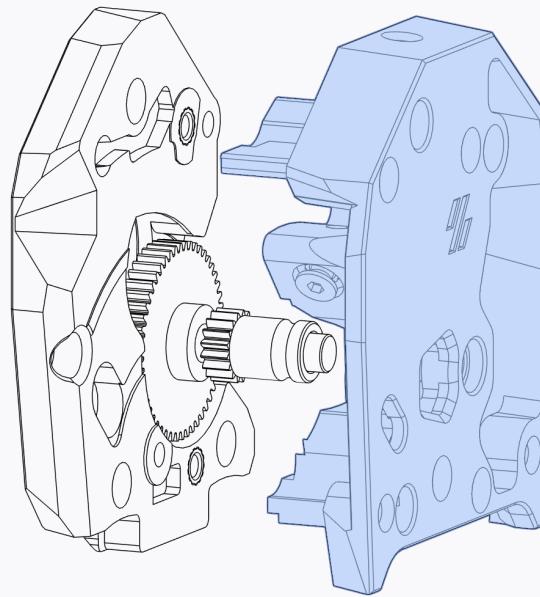
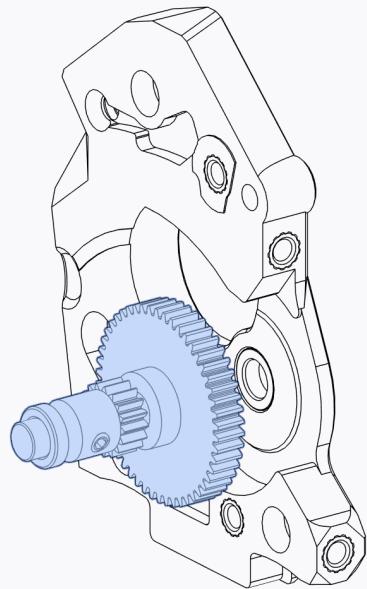
The final position of the drive gear is set in a later step. Common thread lockers have a long enough working time to complete the steps without issues.

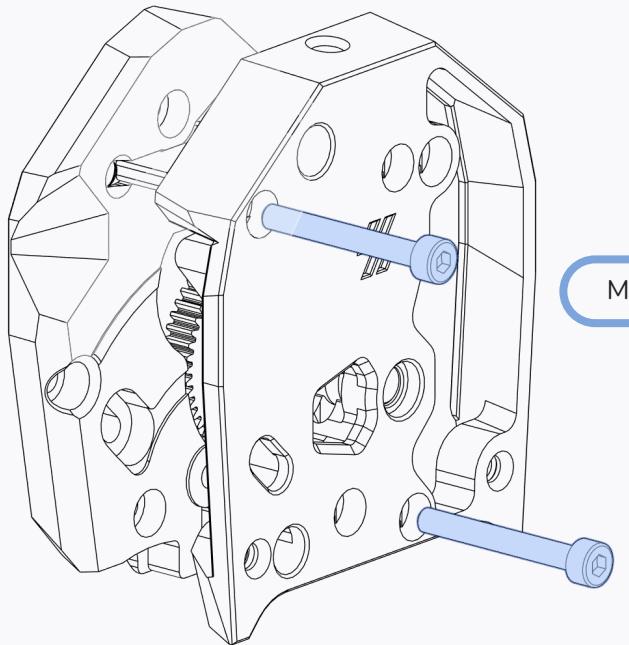
Familiarize yourself with the steps on the next 3 pages before you apply thread locker.

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

MAIN BODY

VORONDESIGN.COM

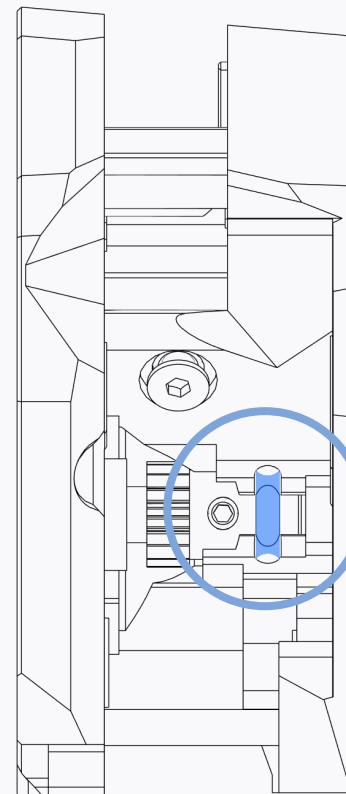




M3x25 SHCS

DON'T OVERTIGHTEN

Tighten until the plastic bends and cracks.
Back up 2 turns, discard parts, reprint and
try again.

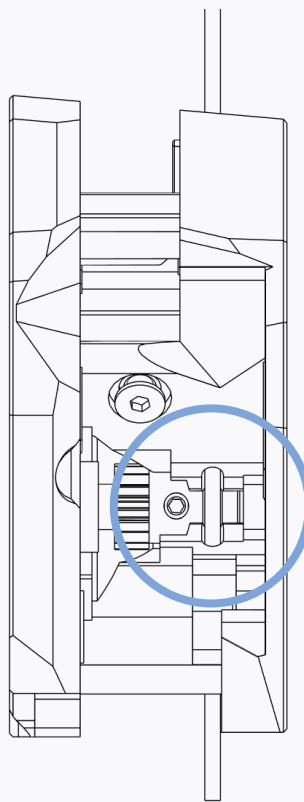
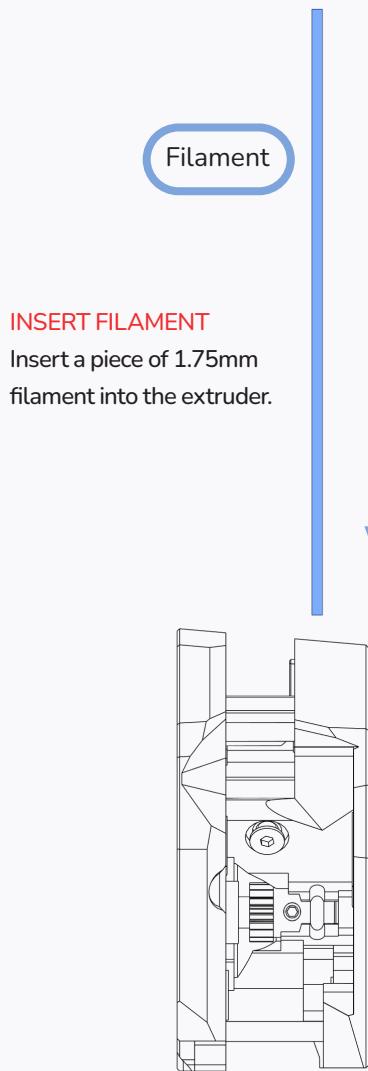


INITIAL ALIGNMENT CHECK

Check if the filament path aligns with the
toothed section of the drive gear.

DRIVE ALIGNMENT

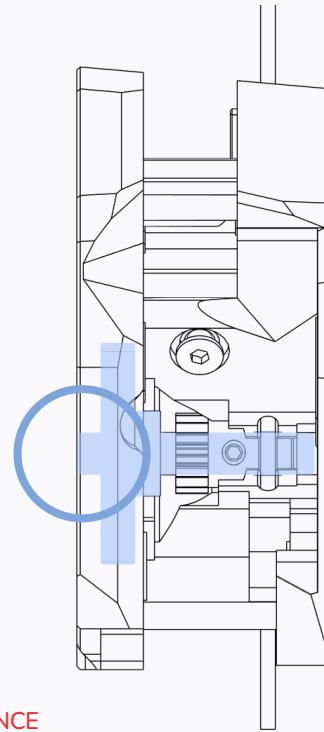
VORONDESIGN.COM



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

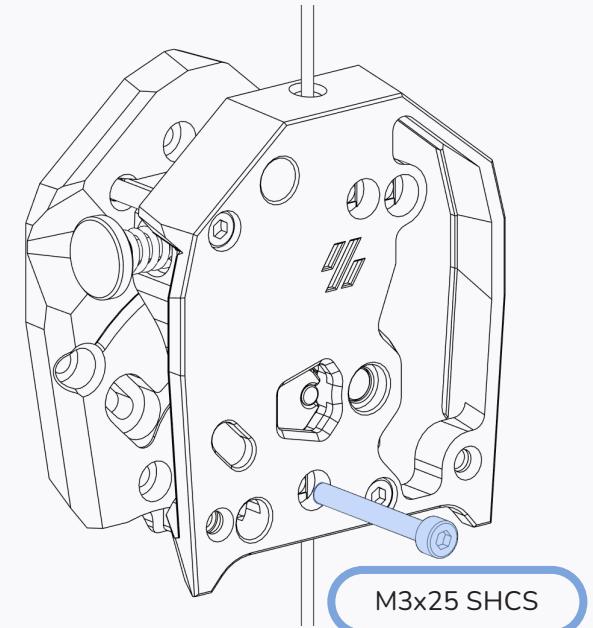
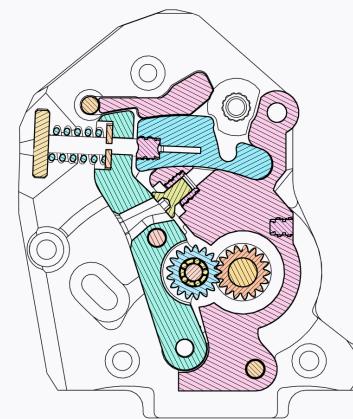
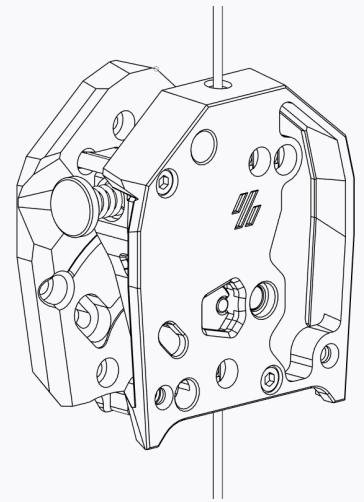
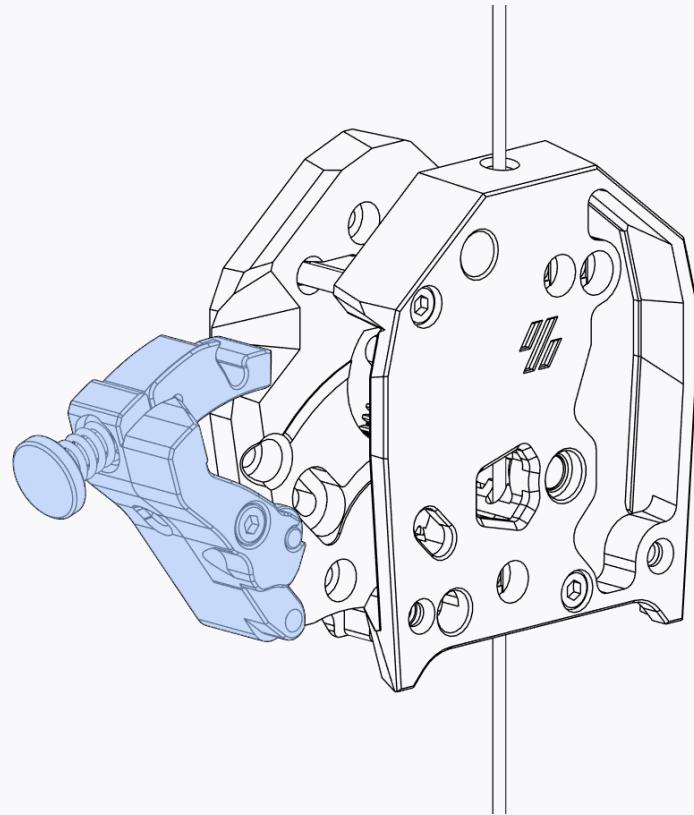
The drive shaft must not touch the motor housing. Make sure it does not sit above the surface of the printed part.

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

VORONDESIGN.COM

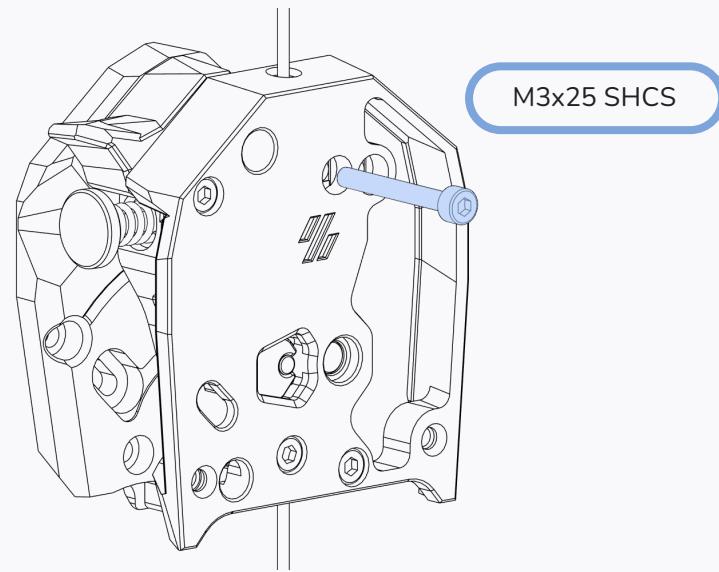
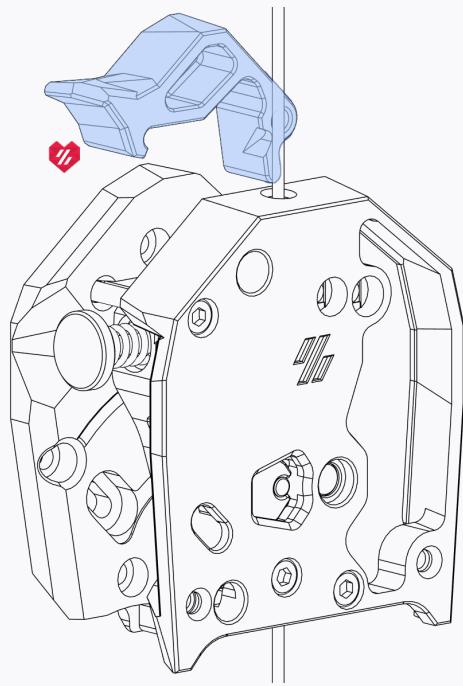


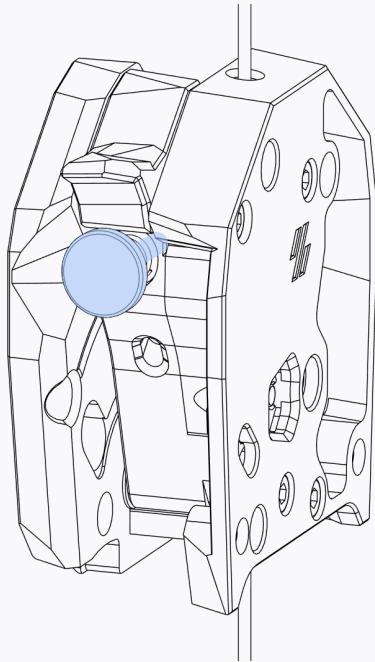
DON'T TIGHTEN

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

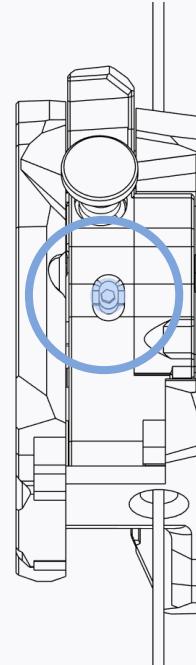
LATCH

VORONDESIGN.COM

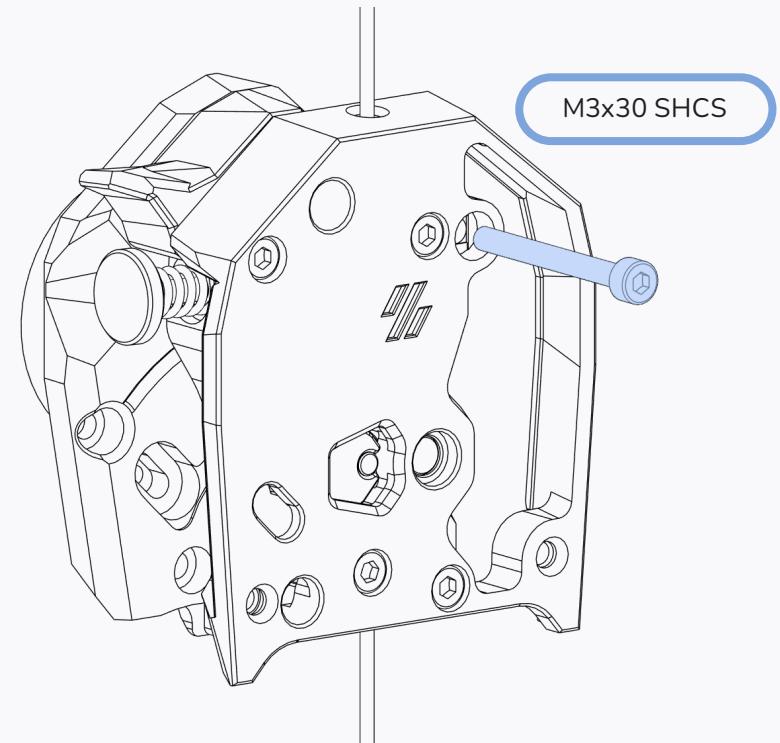
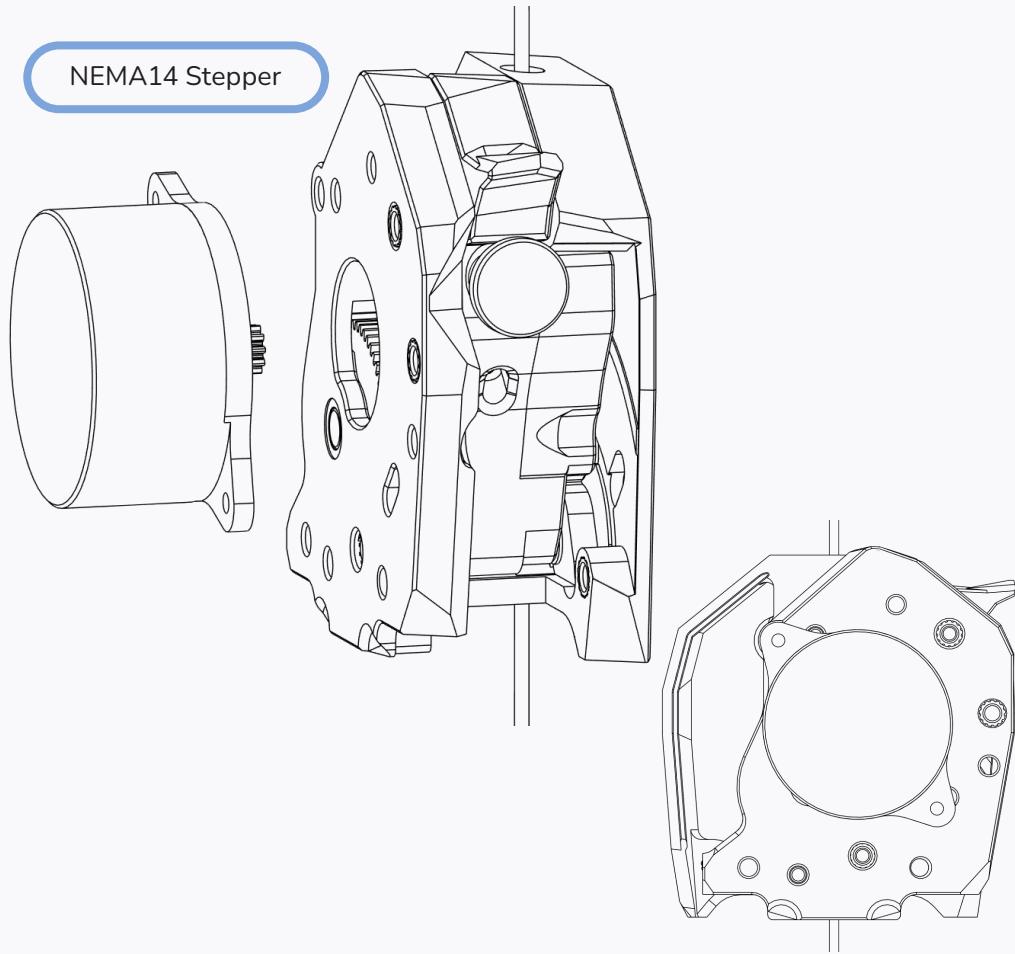


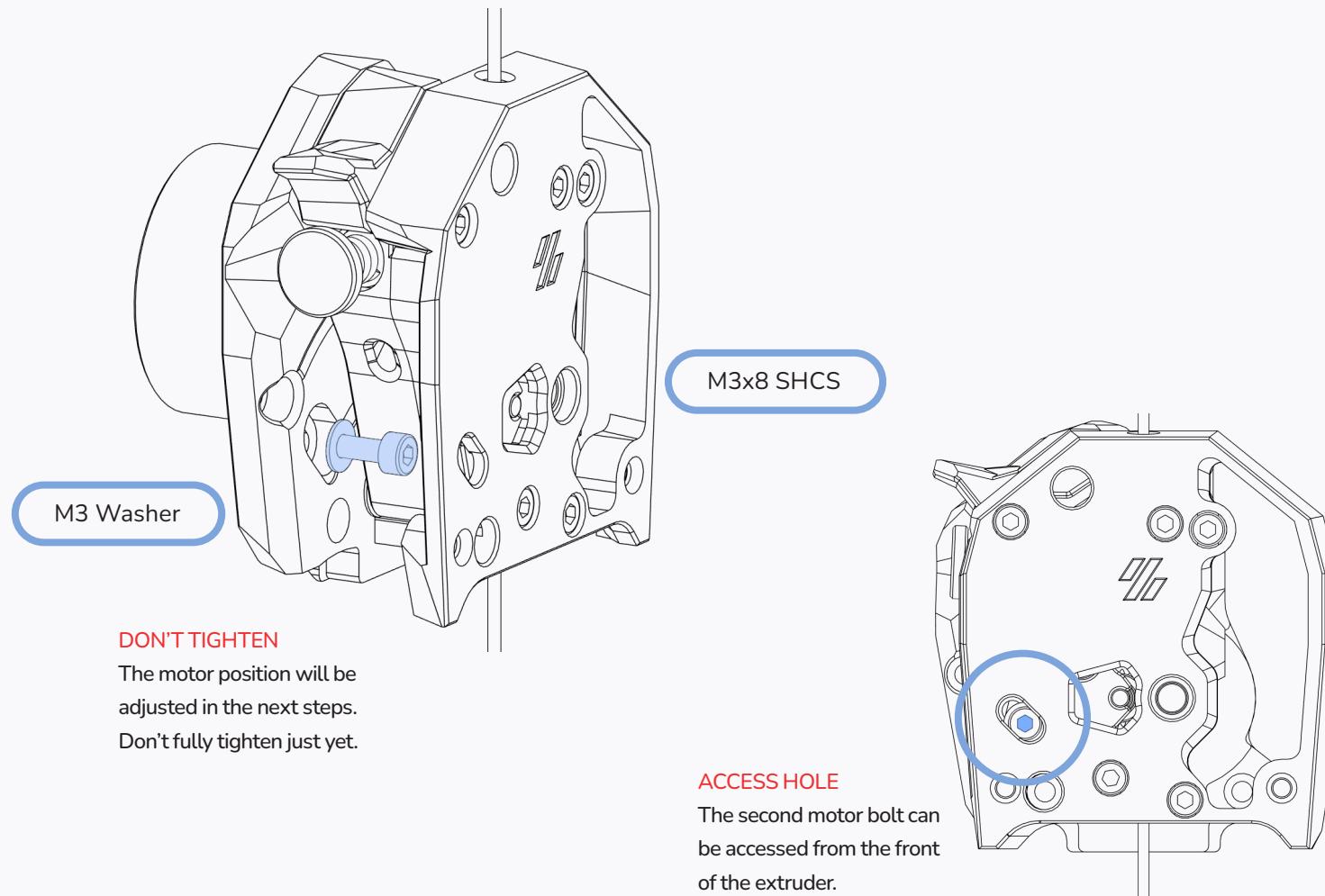
**TENSION KNOB**

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.

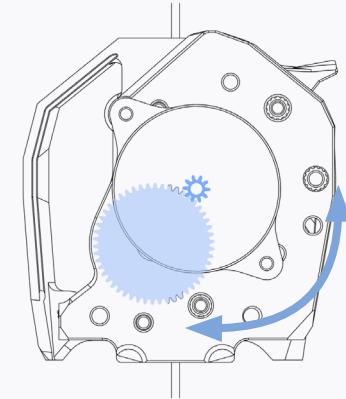




Follow this Video Guide on how to set the gear mesh on your CW2. Follow this video Guide on how to set the Anti-Squish as well.

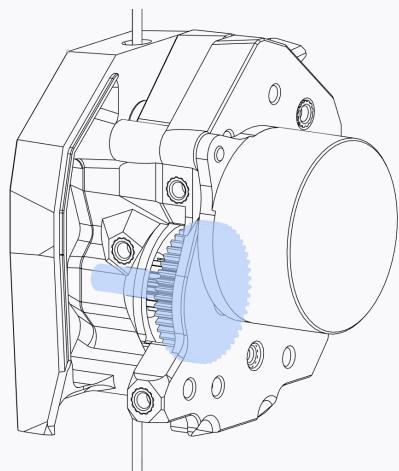
STEPPER MOTOR

VORONDESIGN.COM



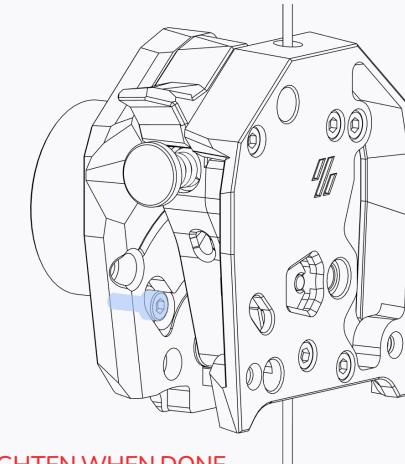
SET GEAR MESHING

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.

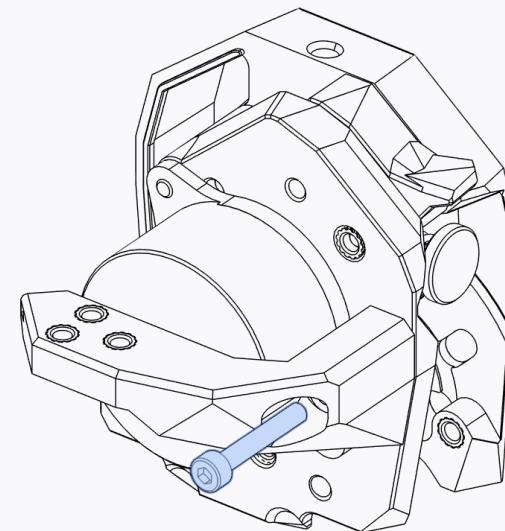
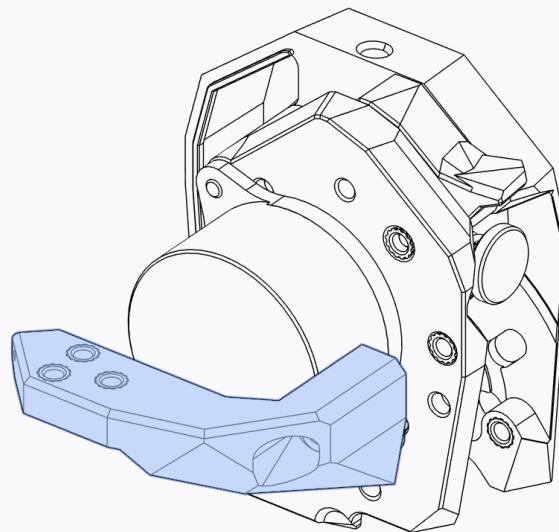


<https://voron.link/u6ehxsw>

Skip for now, we will install our Version of the Anchor later.

CHAIN ANCHOR

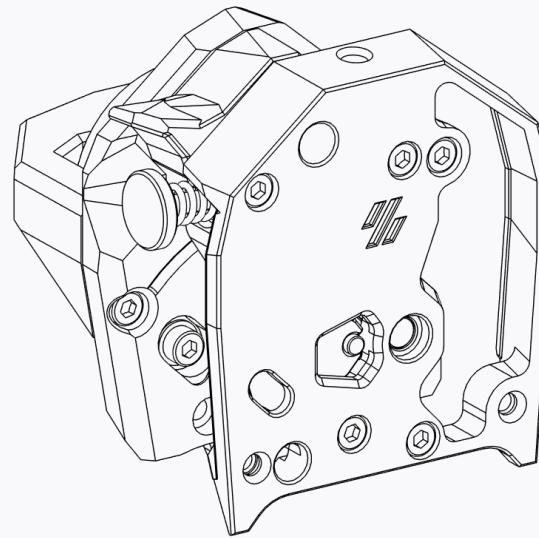
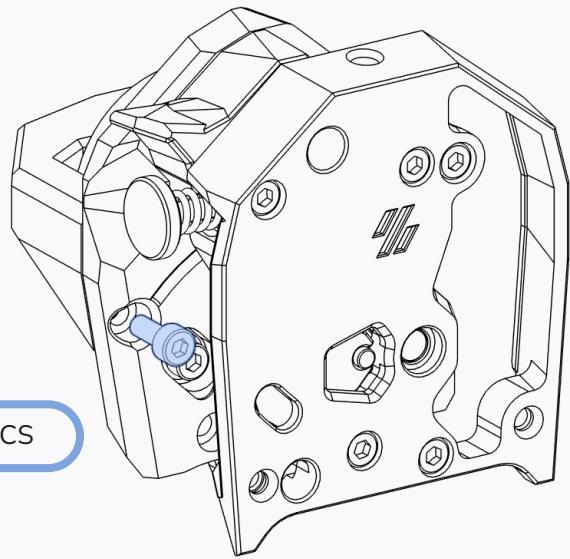
VORONDESIGN.COM

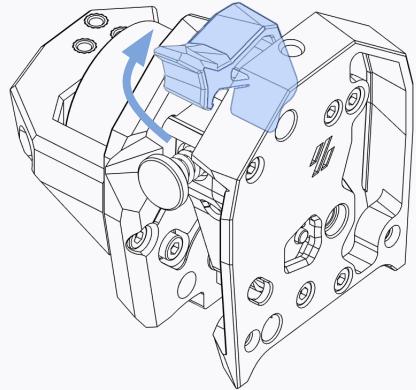


M3x20 SHCS

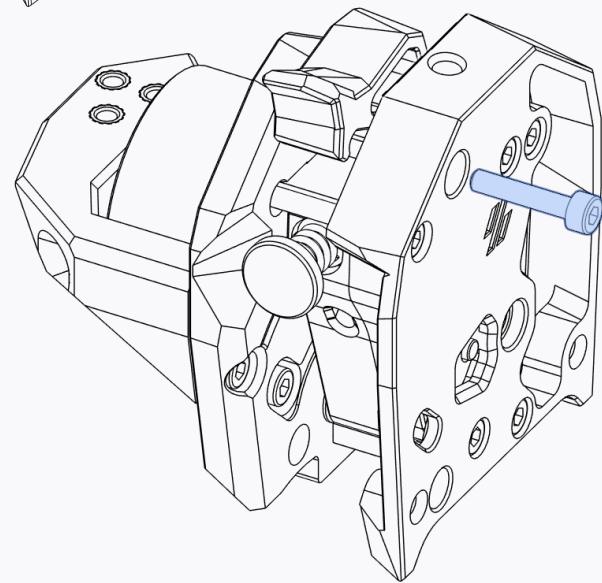
CABLE BRIDGE

VORONDESIGN.COM

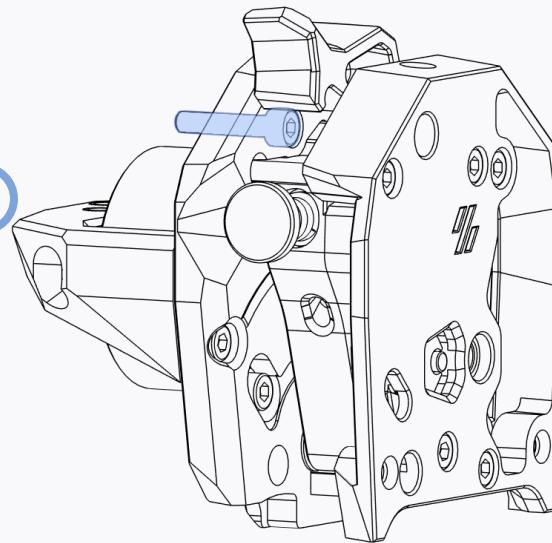


**OPEN LATCH**

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



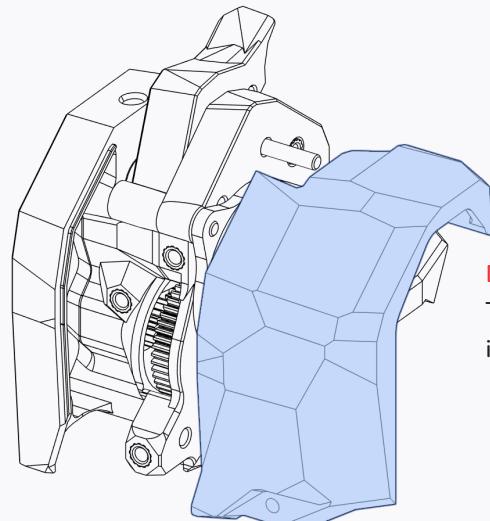
M3x16 SHCS



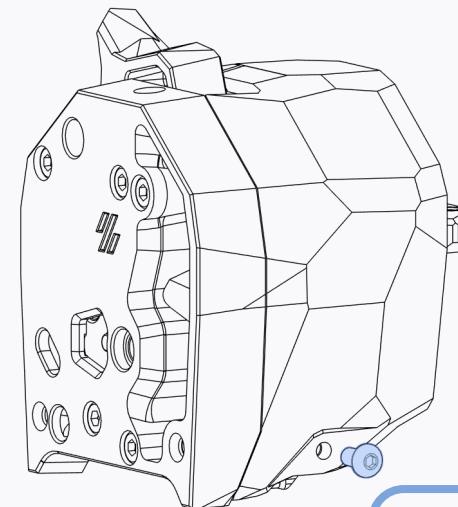
You dont need to fix the Cable Cover down with the m3x6 BHCS now, you will need to access this later.

CABLE COVER

VORONDESIGN.COM

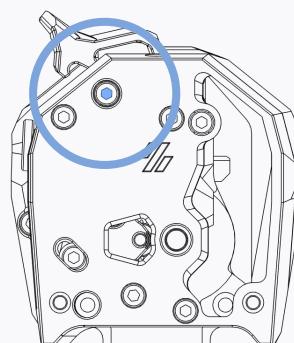


DON'T OVER-TIGHTEN
The bolt is threaded directly
into plastic.



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?’”

All Hotends are mounted in a similar pattern and pretty self-explaining, your hotend mount and hotend will look different.

VORONDESIGN.COM



All Hotends are mounted in a similar pattern and pretty self-explaining, your hotend mount and hotend will look different.

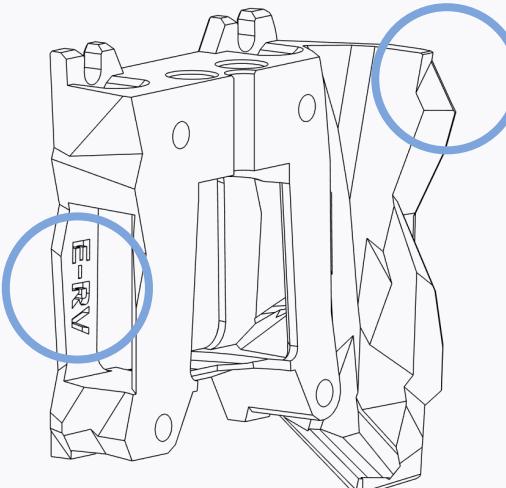
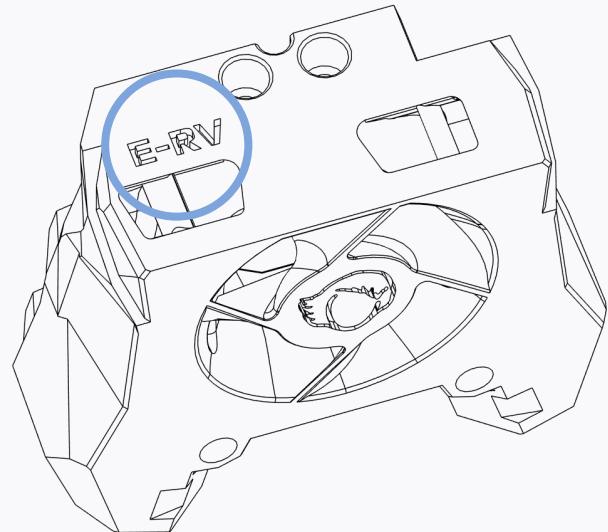
PART MARKINGS

VORONDESIGN.COM

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

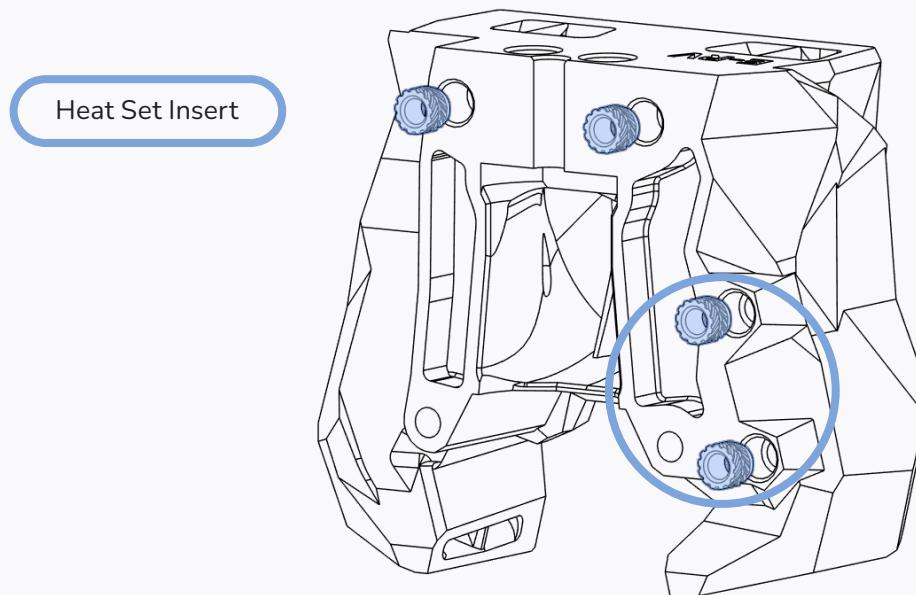
We also provide mounts for other hotends. They are assembled in a similar manner.

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

All Hotends are mounted in a similar pattern and pretty self-explaining, your hotend mount and hotend will look different.

PART PREP

VORONDESIGN.COM



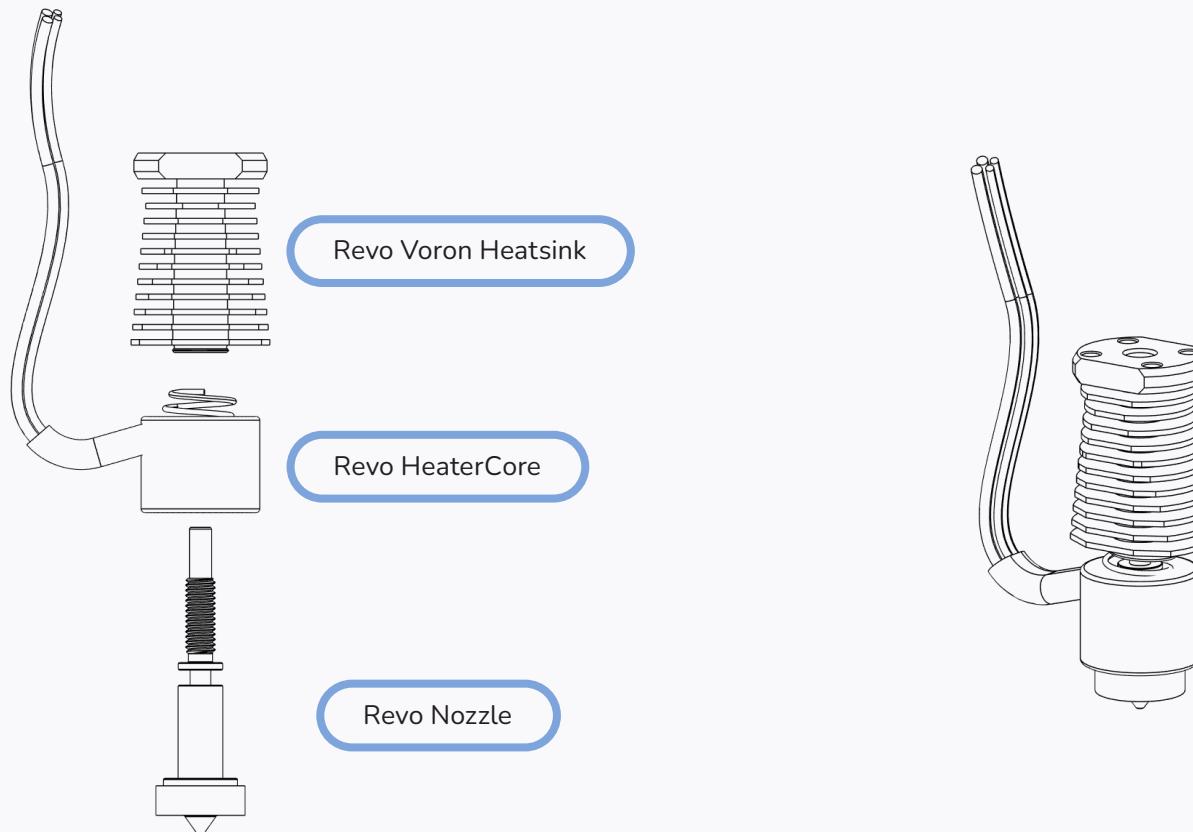
OPTION: ADXL PCB MOUNT

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

All Hotends are mounted in a similar pattern and pretty self-explaining, your hotend mount and hotend will look different.

PART PREP

VORONDESIGN.COM



All Hotends are mounted in a similar pattern and pretty self-explaining, your hotend mount and hotend will look different.

PART PREP

VORONDESIGN.COM

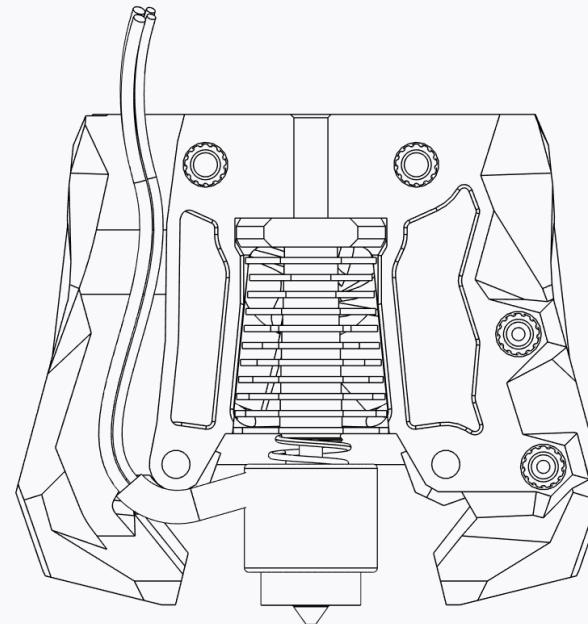
HOTEND WIRE ROUTING

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.

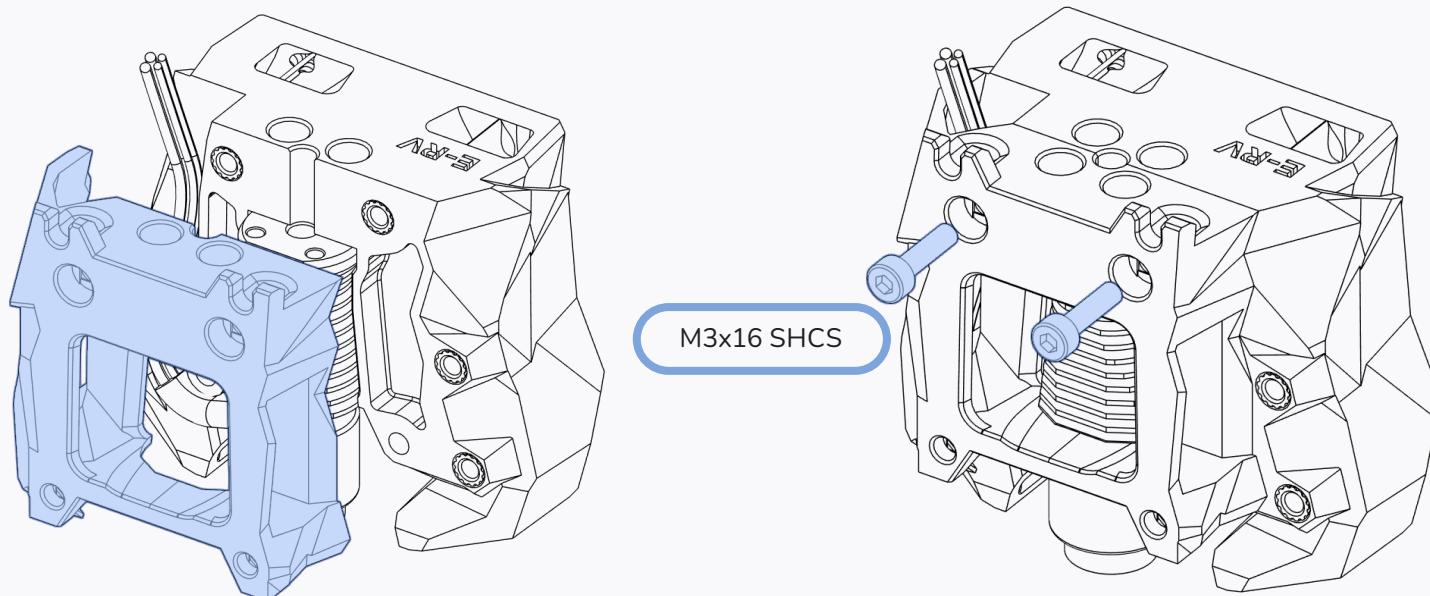
It is critical that the Revo Nozzle is fully hand tightened into the heatsink. You MUST bend the strain relief to achieve this.



All Hotends are mounted in a similar pattern and pretty self-explaining, your hotend mount and hotend will look different.

TOOL CARTRIDGE

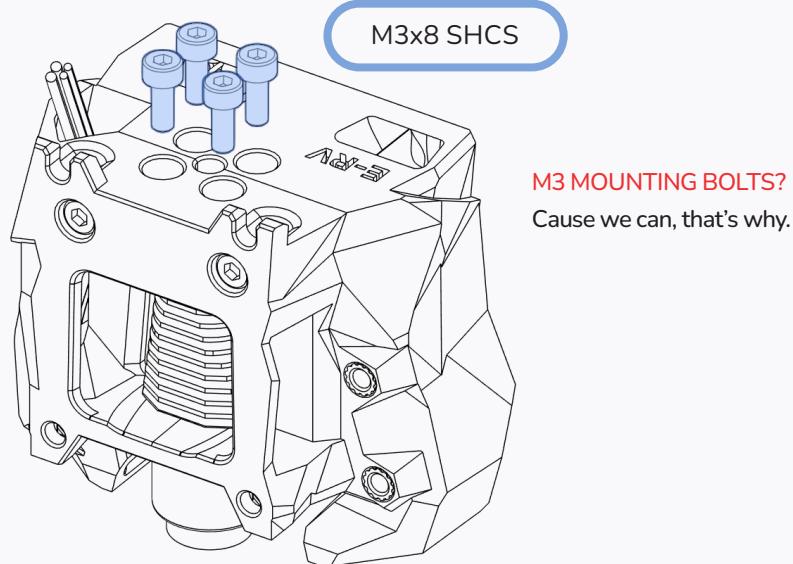
VORONDESIGN.COM



All Hotends are mounted in a similar pattern and pretty self-explaining, your hotend mount and hotend will look different.

TOOL CARTRIDGE

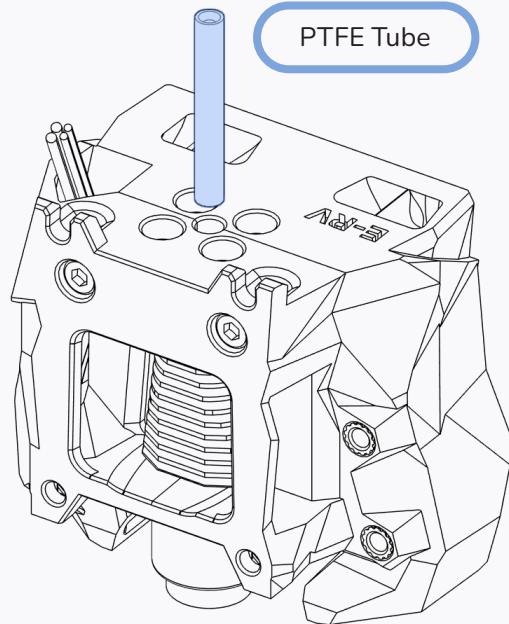
VORONDESIGN.COM



All Hotends are mounted in a similar pattern and pretty self-explaining, your hotend mount and hotend will look different.

TOOL CARTRIDGE

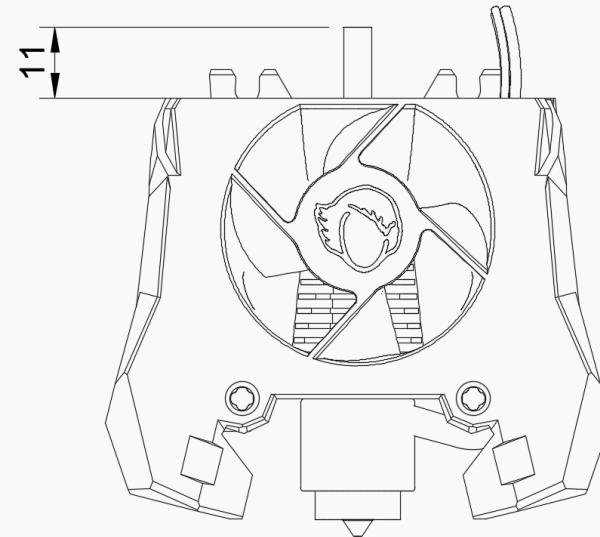
VORONDESIGN.COM



PTFE STICKOUT

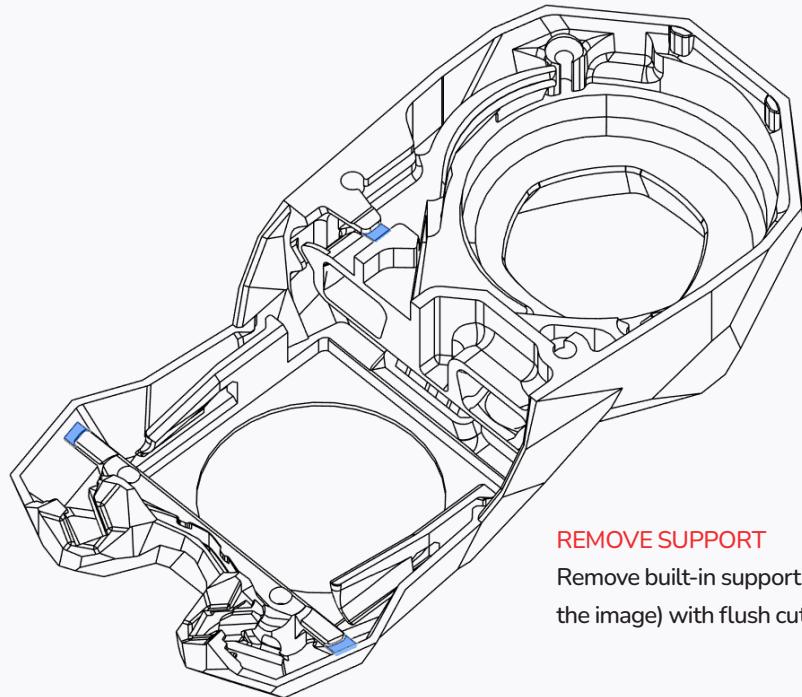
The PTFE tube should stick out 11mm above the surface of the printed part.

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



VORONDESIGN.COM

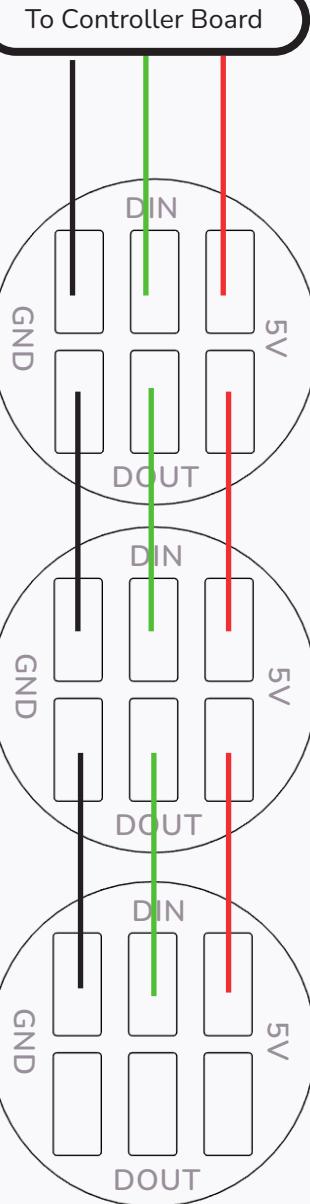




REMOVE SUPPORT

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

Be very careful with the cables, you can easily rip them off the LED PCB which leads to this LED and the following ones not working.

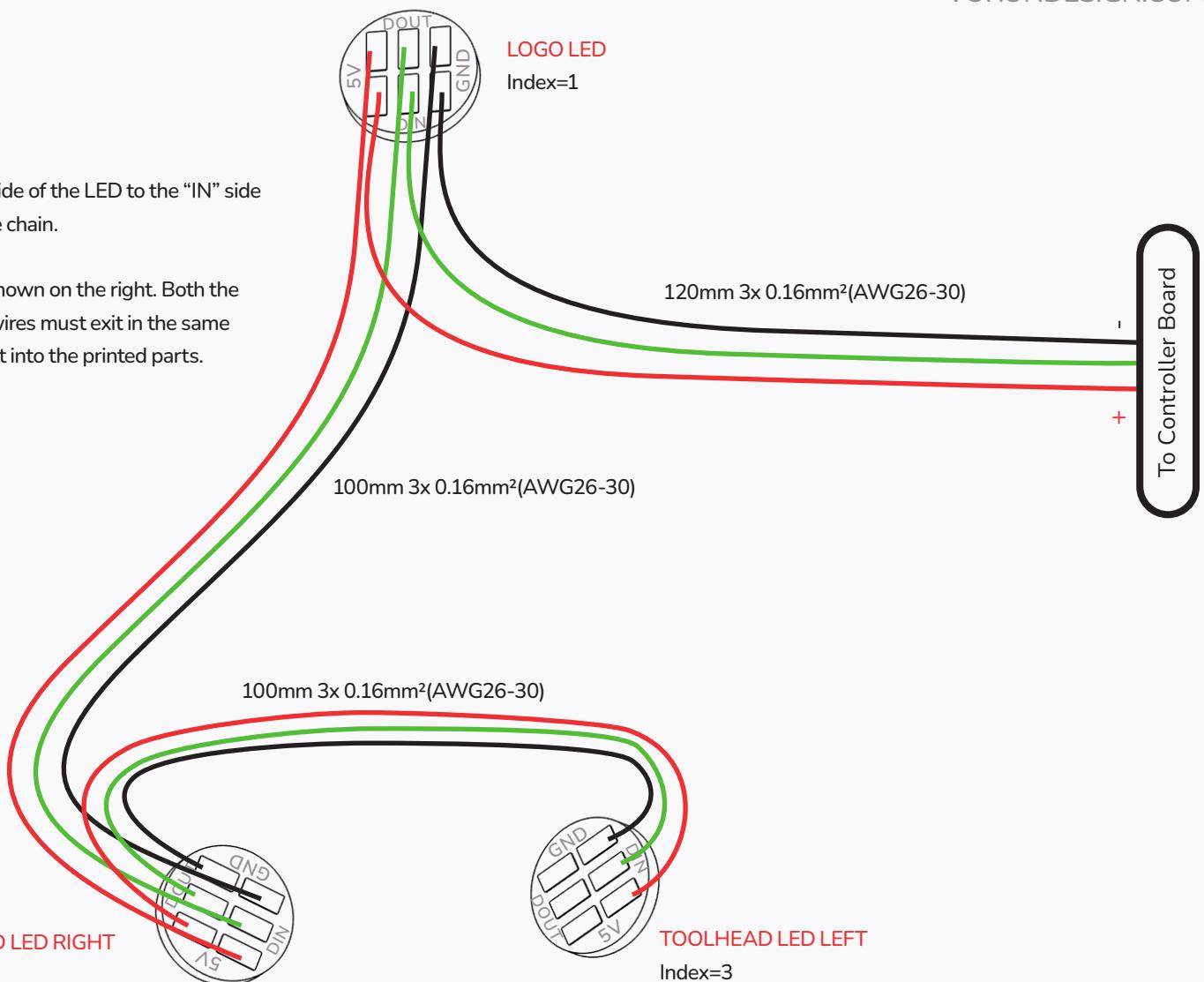


For Illustration Only. Read "LED Wiring" Callout

LED WIRING

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

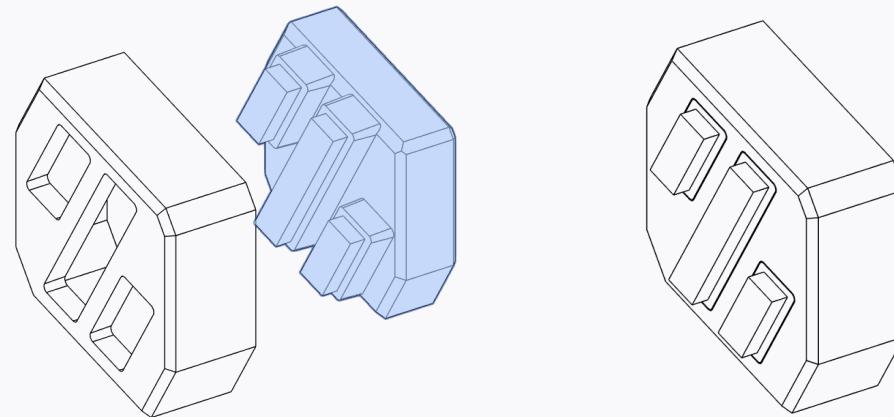
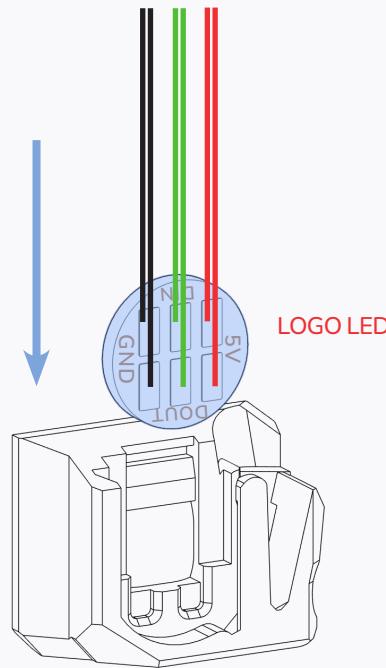
Solder the wires as shown on the right. Both the "IN" and the "OUT" wires must exit in the same direction in order to fit into the printed parts.



Be very careful with the cables, you can easily rip them off the LED PCB which leads to this LED and the following ones not working.

LEDS

VORONDESIGN.COM



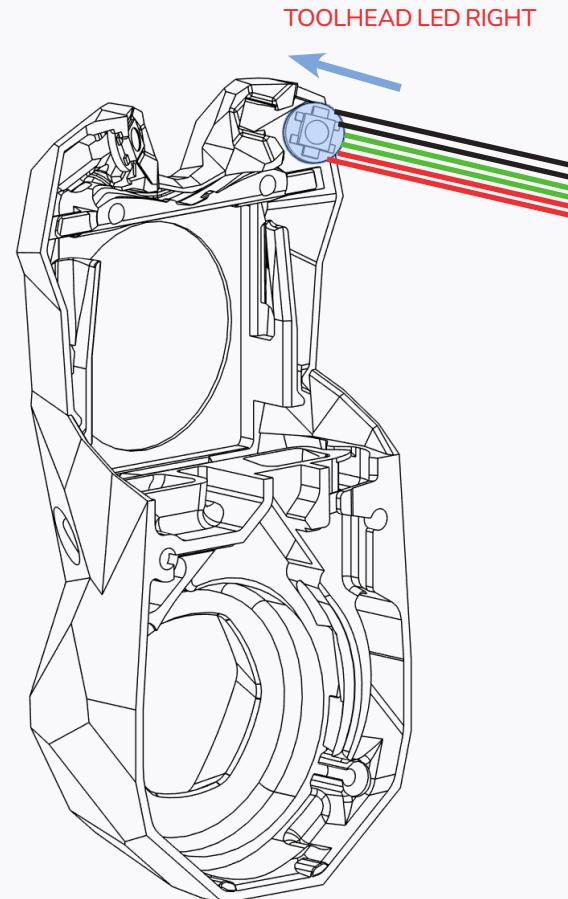
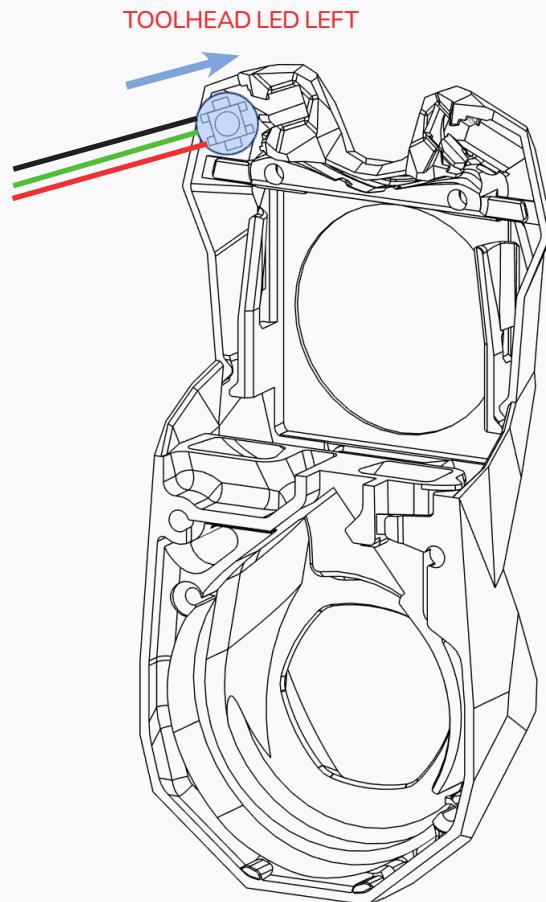
LED DIFFUSER AND MASK

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.

Be very careful with the cables, you can easily rip them off the LED PCB which leads to this LED and the following ones not working.

LEDS

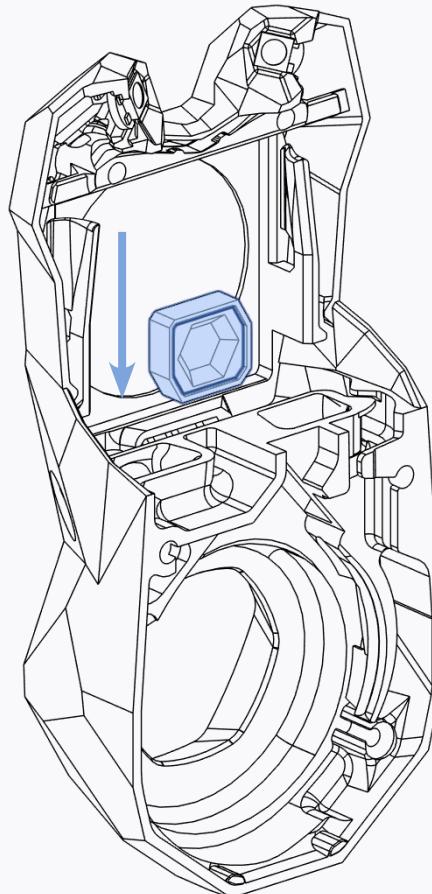


VORONDESIGN.COM

Be very careful with the cables, you can easily rip them off the LED PCB which leads to this LED and the following ones not working.

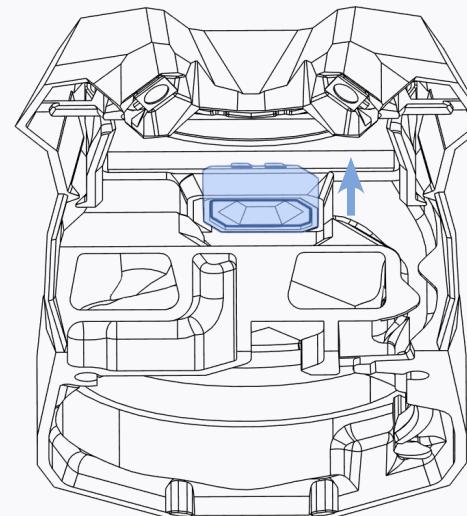
LEDS

VORONDESIGN.COM



DIFFUSER INSERTION

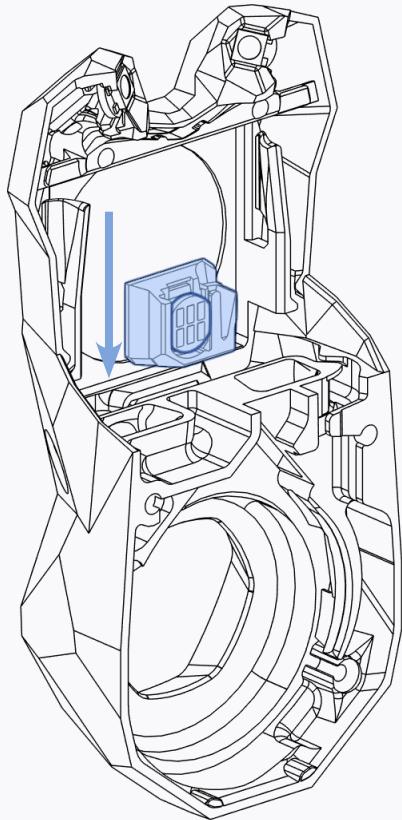
Insert the printed parts and push them towards the front.



Be very careful with the cables, you can easily rip them off the LED PCB which leads to this LED and the following ones not working.

LEDS

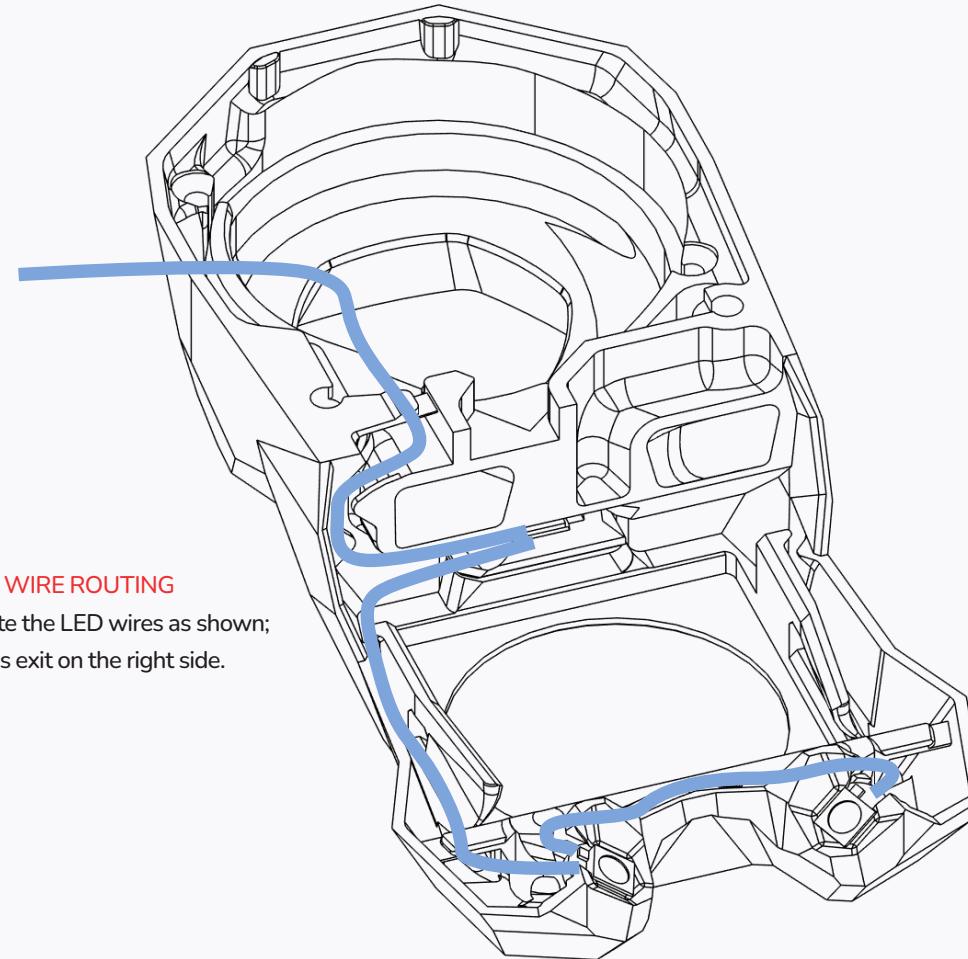
VORONDESIGN.COM

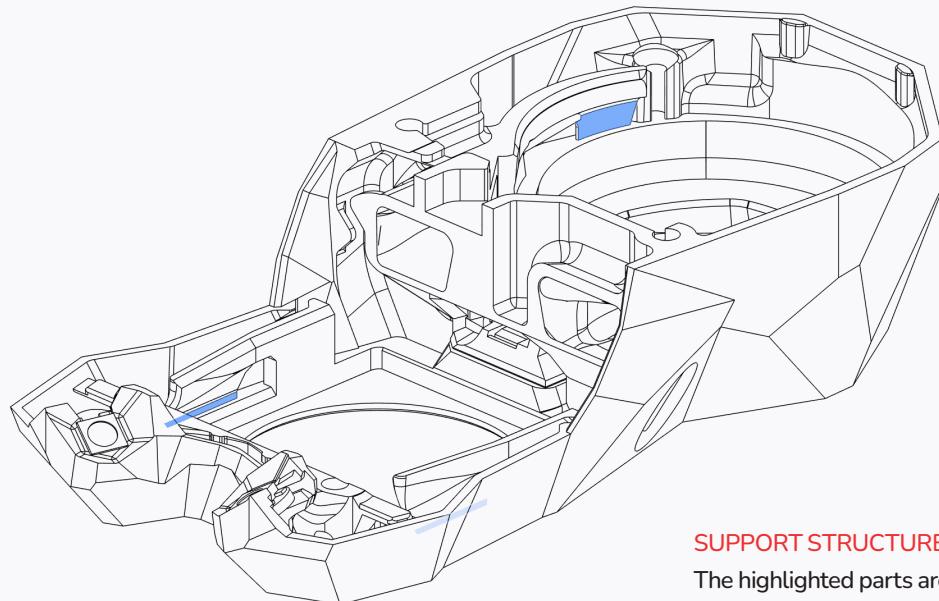


Be very careful with the cables, you can easily rip them off the LED PCB which leads to this LED and the following ones not working.

LEDS

VORONDESIGN.COM





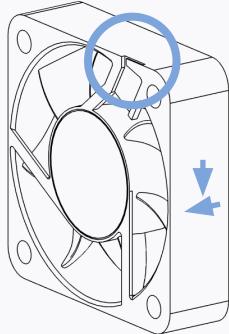
SUPPORT STRUCTURE

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

Be sure that your fan blows in the right Direction. Look at the arrows on the fan. Additionally, the Sticker on the fan is on the back pointing towards the Hotend. You want the fan to blow air into the hotend, not trying to pull the air out. This destroys your fan and your whole hotend mount because of heatcreep.

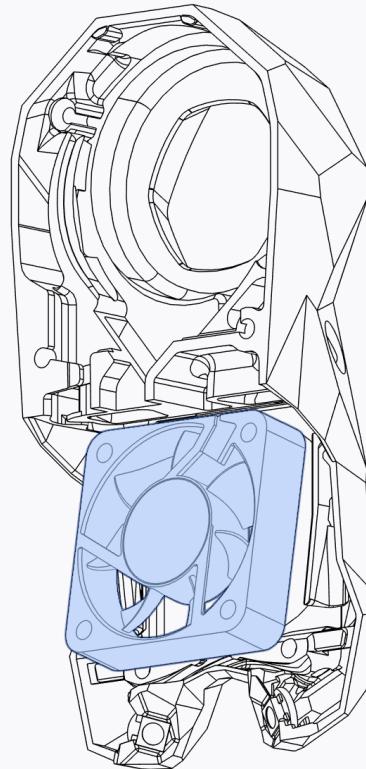
HOTEND FAN

VORONDESIGN.COM



FAN ORIENTATION

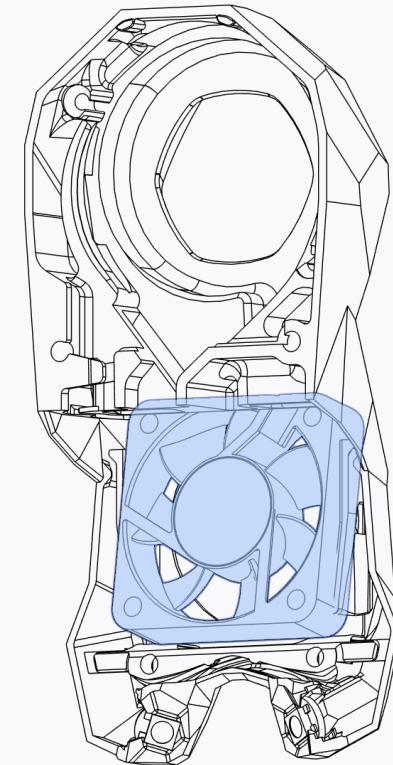
Rotate the fan so that the wires exit on the top and the air is pushed “inwards”.



FAN INSERTION

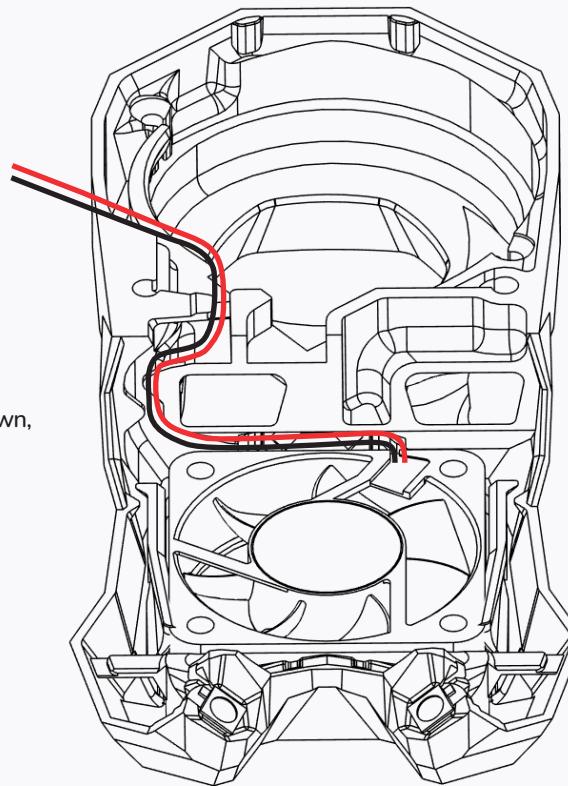
Insert the fan at a slight angle and clip it into place.

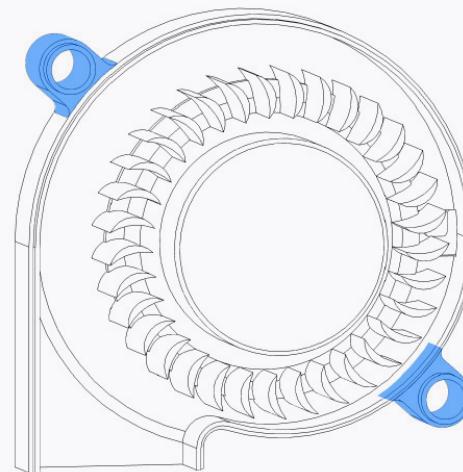
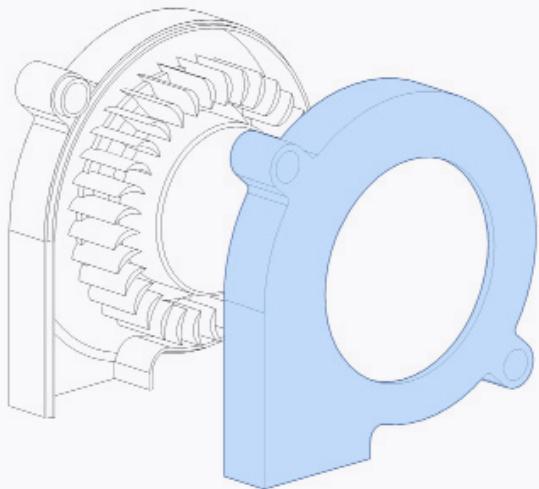
Mind the fan orientation.



FAN WIRE ROUTING

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





FAN PREPARATION

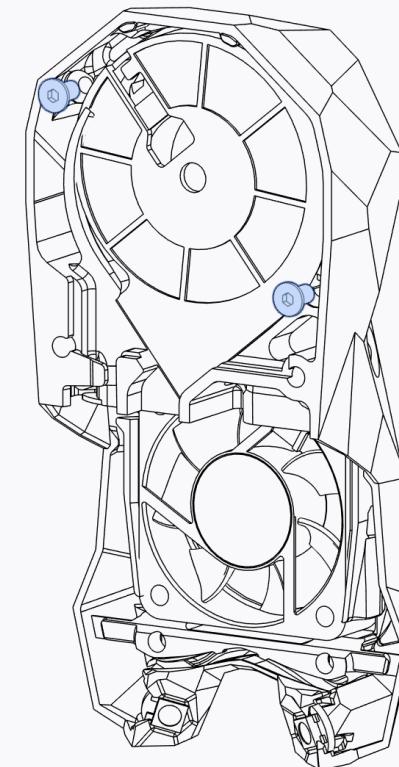
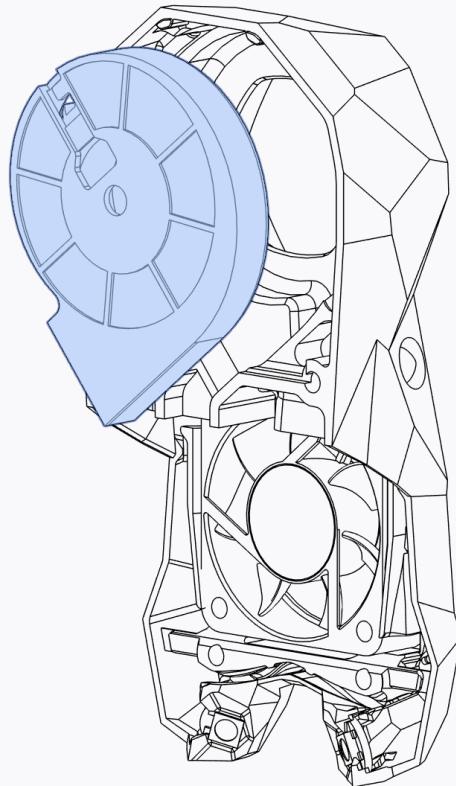
Remove the front of the 5015 fan. Clip off and file down the stock mounting ears.

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

You dont need to screw the 5015 fan into the SB Face, you will install the SB0000 Fan PCB there later.

PART COOLING FAN

VORONDESIGN.COM



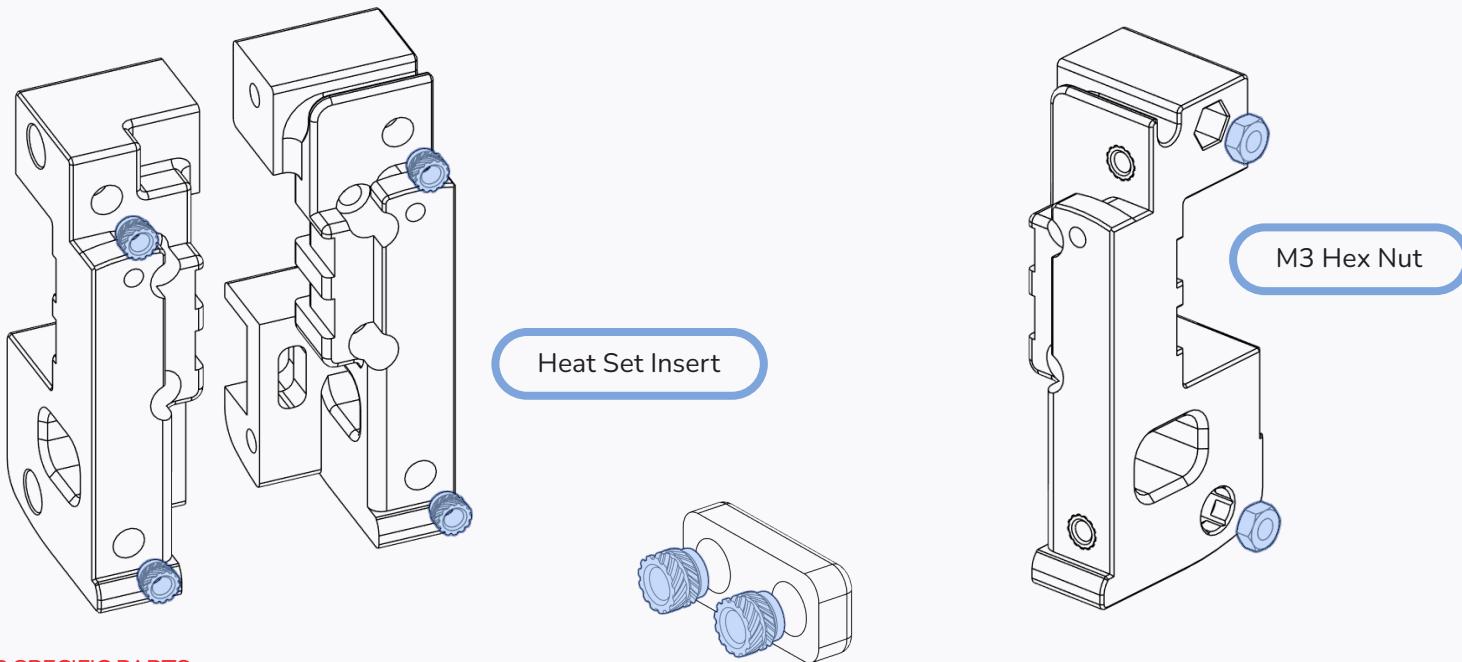
Yeah, it went about as expected.

All parts of the Stealthburner are now pretty much finished. Now you will need to install the Can-Board on there and do some basic wiring. Switch to the SB2209 RP2040 Manual.

X CARRIAGE

VORONDESIGN.COM



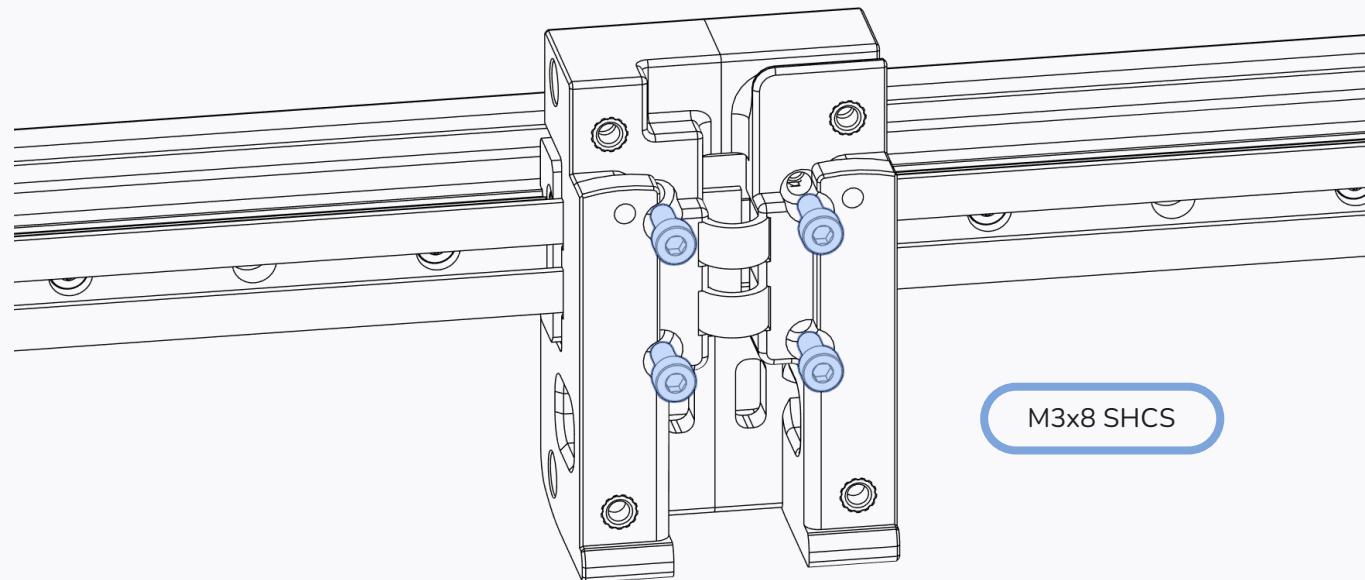


PRINTER SPECIFIC PARTS

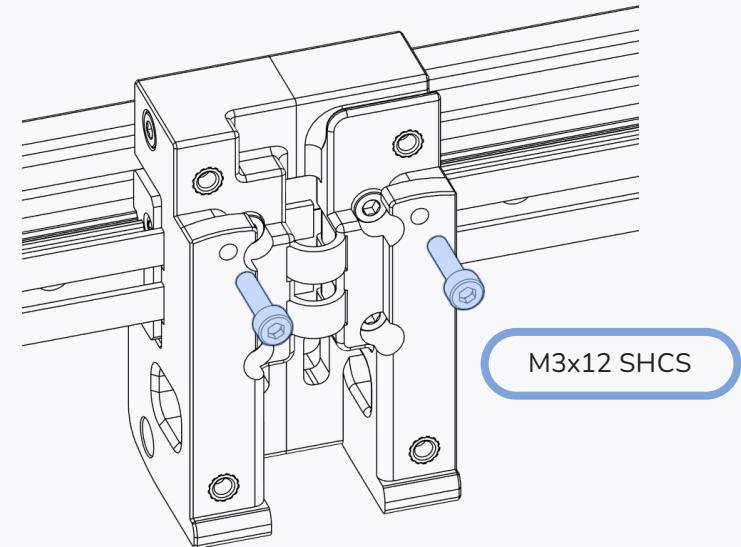
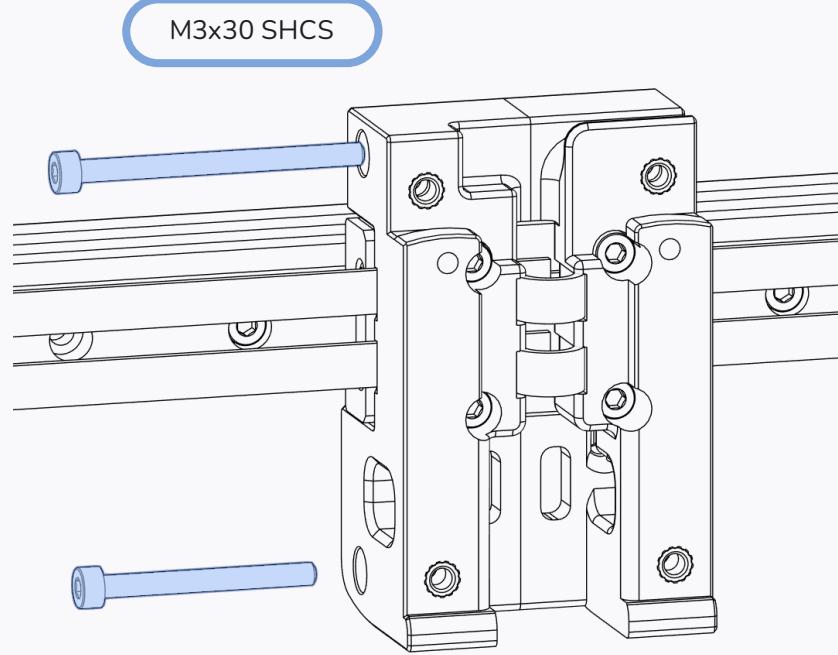
We provide different versions of the carriage to fit our different printer designs. Be sure to pick the right one for your printer. the next few pages may look slightly different if you are building a Switchwire printer.

FOLLOW BELTING AND X CARRIAGE INSTALLATION OUTLINED IN PRINTER MANUAL

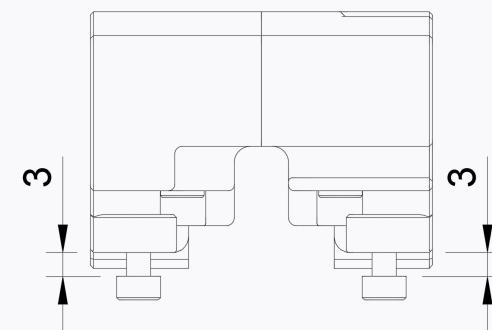
Consult the printer's manual for instructions on how to run the belts and details on carriage mounting.

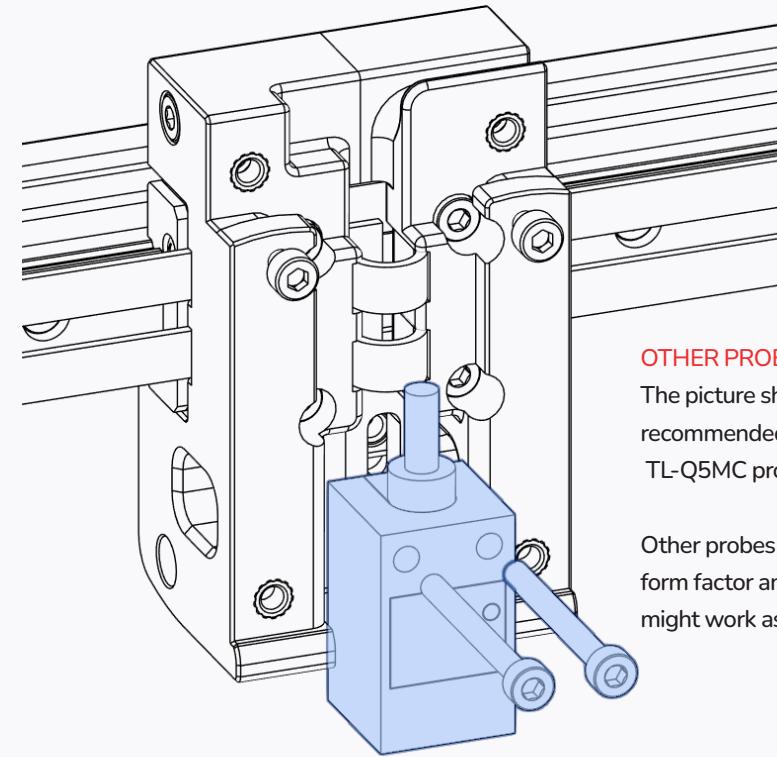
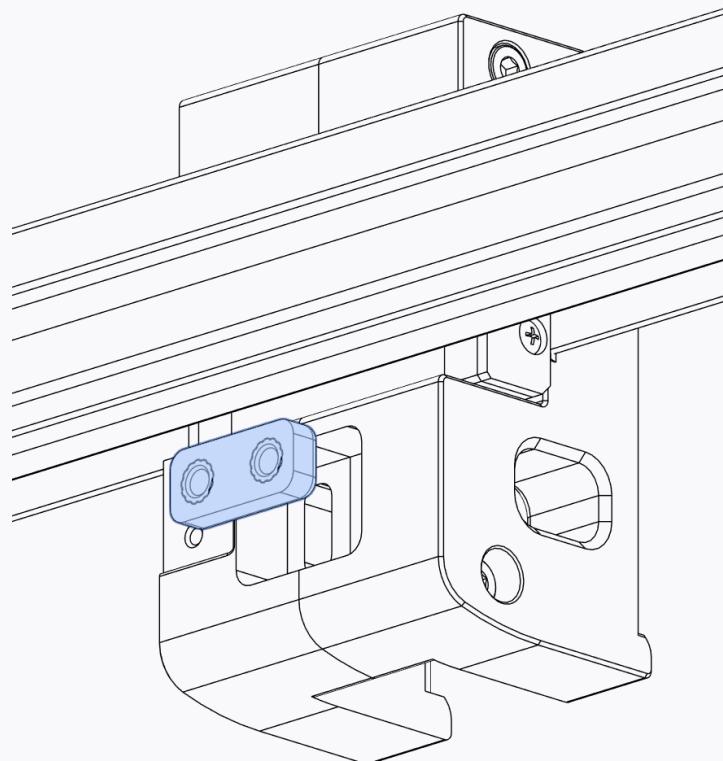


M3x8 SHCS

**30MM OR 40MM?**

the length of these two bolts can be different based on the specific printer you are building. This step has some overlap with the printer manuals. please refer to the printer psecific manual for the correct bolt lengths



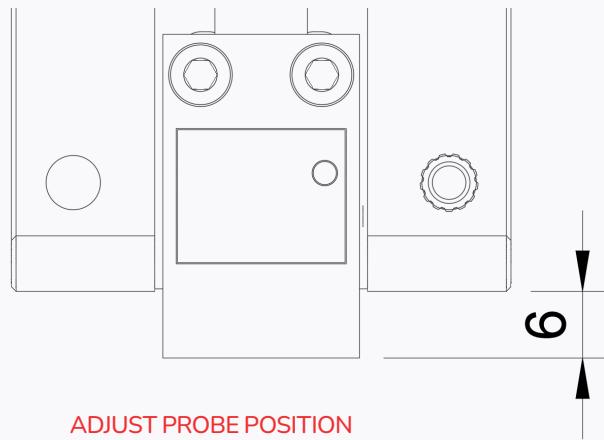
**OTHER PROBE TYPES**

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

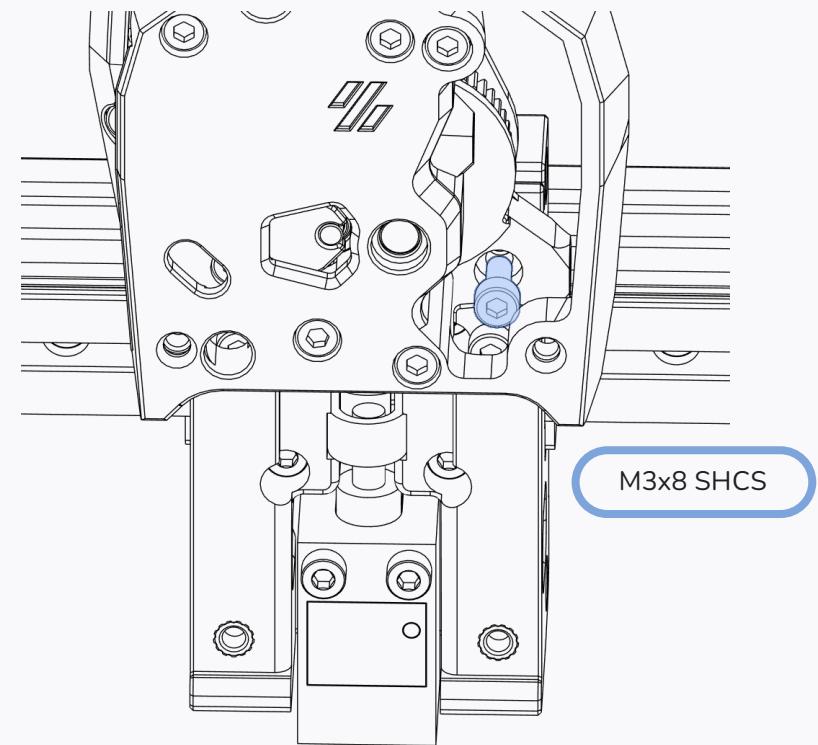
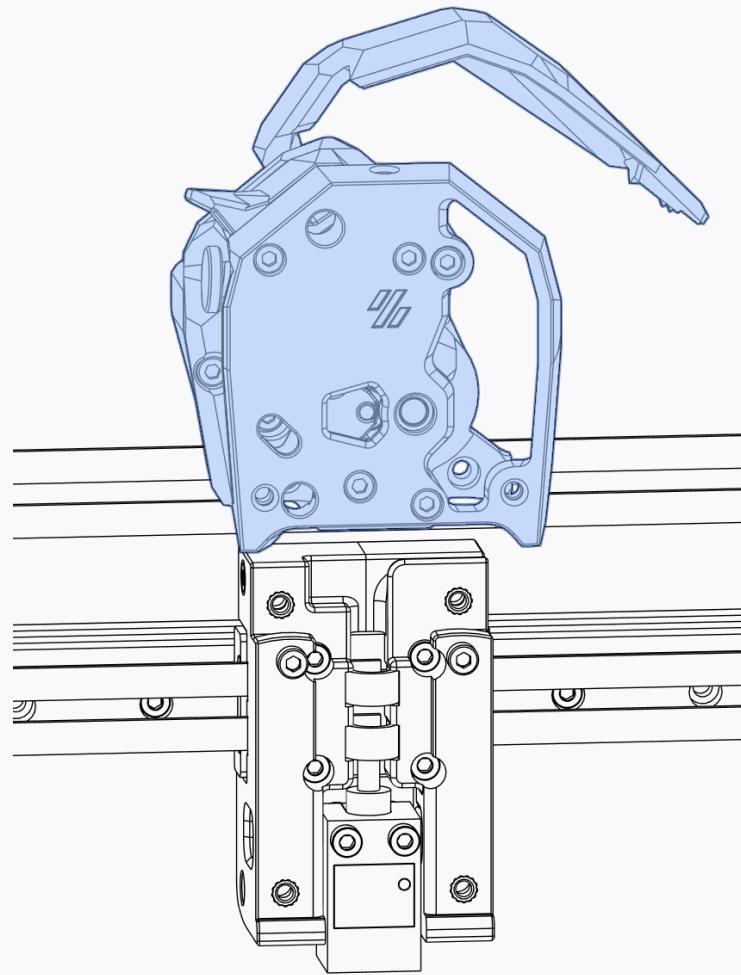


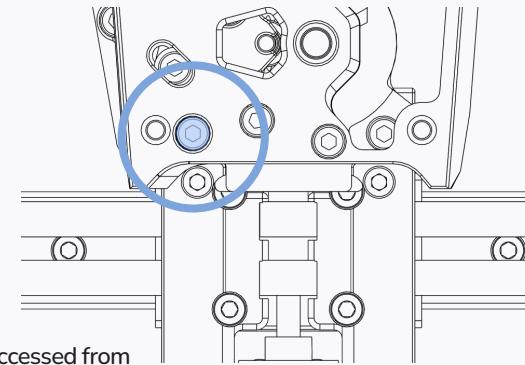
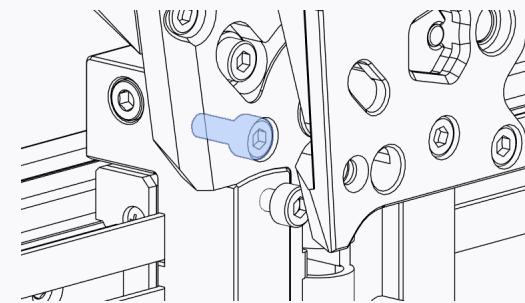
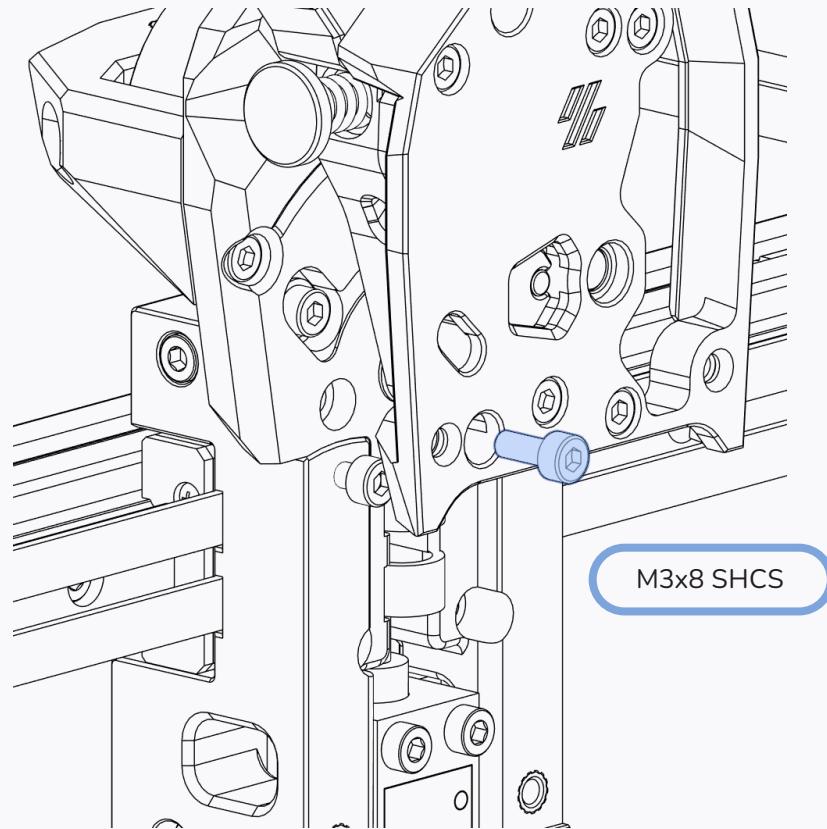
ADJUST PROBE POSITION

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

CW2 MOUNTING

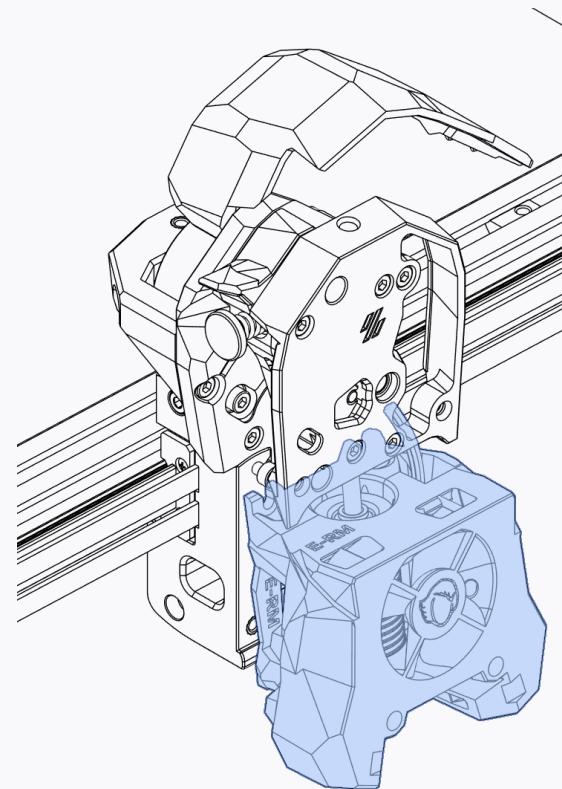
VORONDESIGN.COM





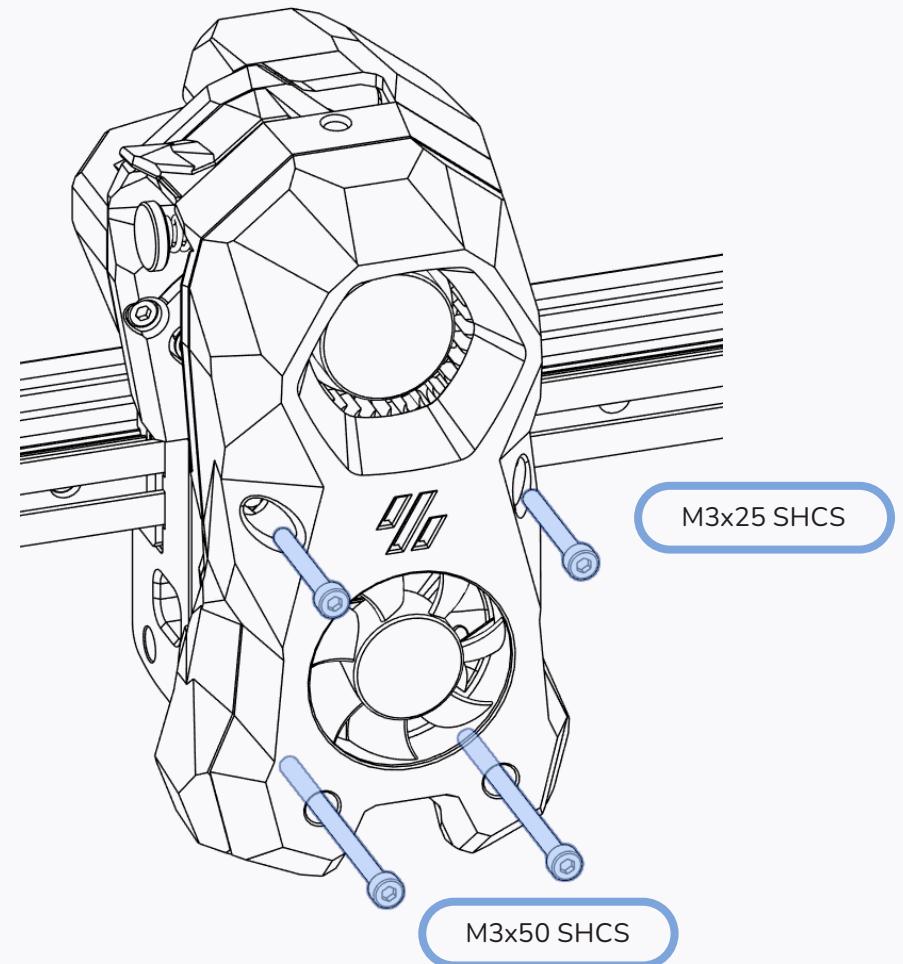
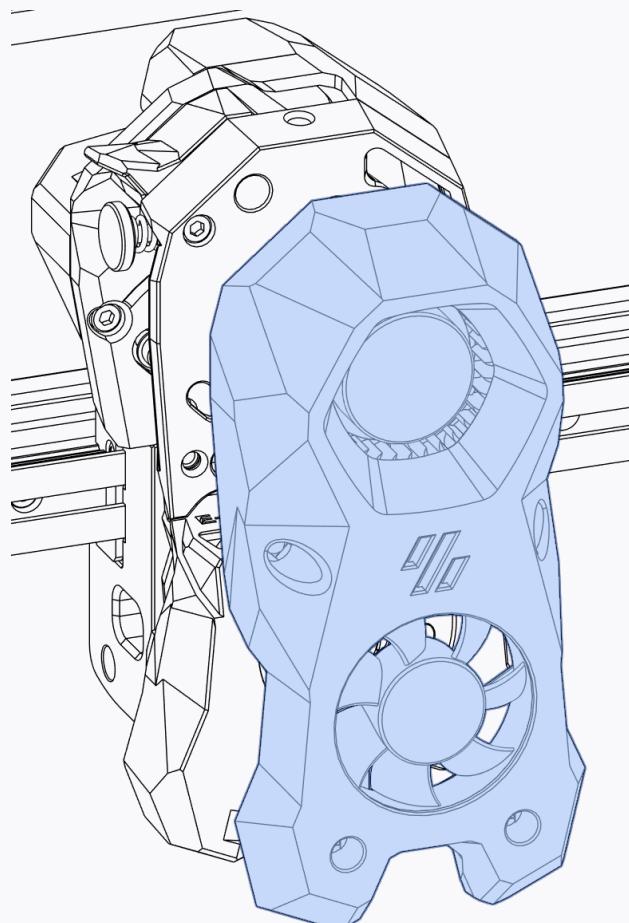
TOOL CARTRIDGE MOUNTING

VORONDESIGN.COM



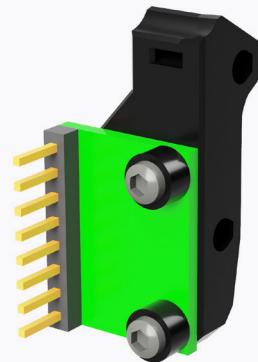
SB MOUNTING

VORONDESIGN.COM



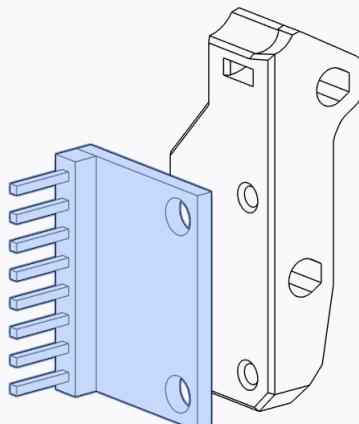
ADXL345 MOUNT

VORONDESIGN.COM

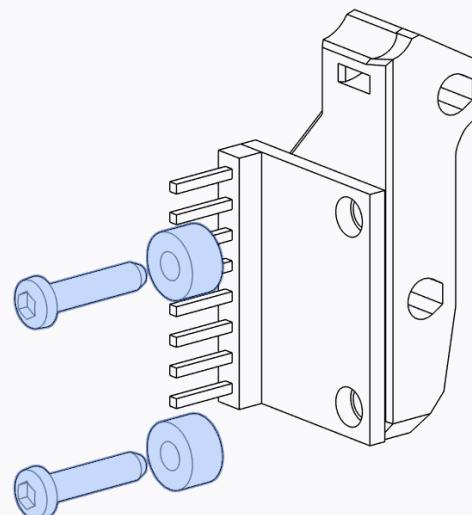


ADXL MOUNT AND INPUT SHAPER CALIBRATION

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.



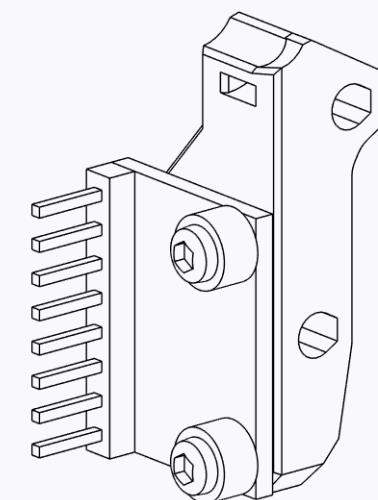
ADXL345 Prototype Board



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.

**MOUNTING TO THE TOOLHEAD**

You can use M3x12 screws to mount this assembly to your toolhead.

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.



Website
vorondesign.com

Github
github.com/vorondesign

Docs
docs.vorondesign.com

Discord
discord.gg/voron

