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

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

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

Most of all, good luck!

THE VORON TEAM

PART PRINTING GUIDELINES

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

3D PRINTING PROCESS

Fused Deposition Modeling (FDM)

MATERIAL

ABS

LAYER HEIGHT

Recommended: 0.2mm

EXTRUSION WIDTH

Recommended: Forced 0.4mm

INFILL TYPE

Grid, Gyroid, Honeycomb, Triangle or Cubic

INFILL PERCENTAGE

Recommended: 40%

WALL COUNT

Recommended: 4

SOLID TOP/BOTTOM LAYERS

Recommended: 5

PRINT IT FORWARD (PIF)

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

FILE NAMING

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

PRIMARY COLOR

Example z_joint_lower_x4.stl

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

ACCENT COLOR

Example [a]_tensioner_left.stl

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

QUANTITY REQUIRED

Example [a]_z_belt_clip_lower_x4.stl

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

HOW TO GET HELP

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

DISCORD https://discord.gg/voron

REPORTING ISSUES

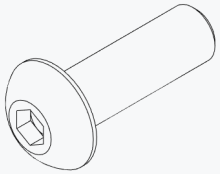
Should you find an issue in the documentation or have a suggestion for an improvement please consider opening an issue on GitHub (https://github.com/VoronDesign/Voron-2/issues). When raising an issue please include the relevant page numbers and a short description; annotated screenshots are also very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

THIS IS JUST A REFERENCE

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

https://github.com/vorondesign

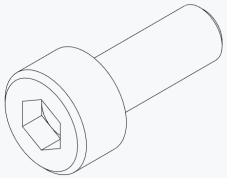
https://docs.vorondesign.com/



BUTTON HEAD CAP SCREW (BHCS)

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

ISO 7380-1



SOCKET HEAD CAP SCREW (SHCS)

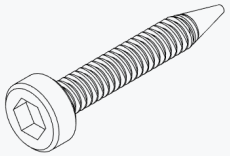
Metric fastener with a cylindrical head and hex drive. The most common fastener used on the Voron.

ISO 4762

FLAT HEAD COUNTERSUNK SCREW (FHCS)

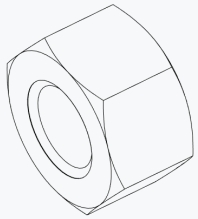
Metric fastener with a cone shaped head and a flat top.

ISO 10642



SELF TAPPING SCREW

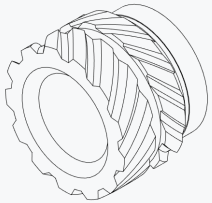
Fastener with a pronounced thread profile that is screwed directly into plastic.



HEX NUT

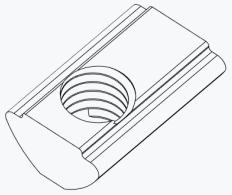
Hex nuts couple with bolts to create a tight, secure joint. You'll see these used in both M3 and M5 variants throughout this guide.

ISO 4032



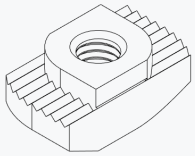
HEAT SET INSERT

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



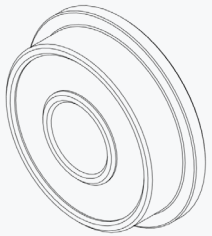
POST INSTALL T-SLOT NUT (T-NUT)

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



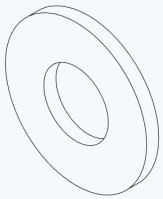
HAMMERHEAD NUT

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



F695 BEARING

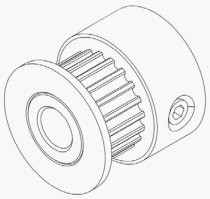
A ball bearing with a flange used in various gantry locations.



SHIM

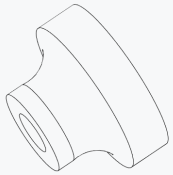
Not to be confused with stamped washers. These are used in all M5 call-out locations in this manual.

DIN 988



PULLEY

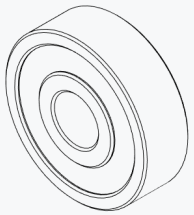
GT2 pulley used on the motion system of the Voron.



THUMB NUT

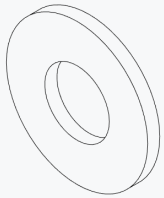
Used in the print bed as a spacer.

DIN 466-B



625 BEARING

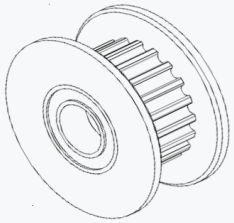
A ball bearing used on the Voron Z drives.



WASHER

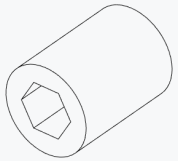
Usually stamped from sheet metal this type of spacer is not as consistent in thickness as the shims are. Only used in M3 size.

DIN 125



IDLER

GT2 idler used in the motion system of the Voron.



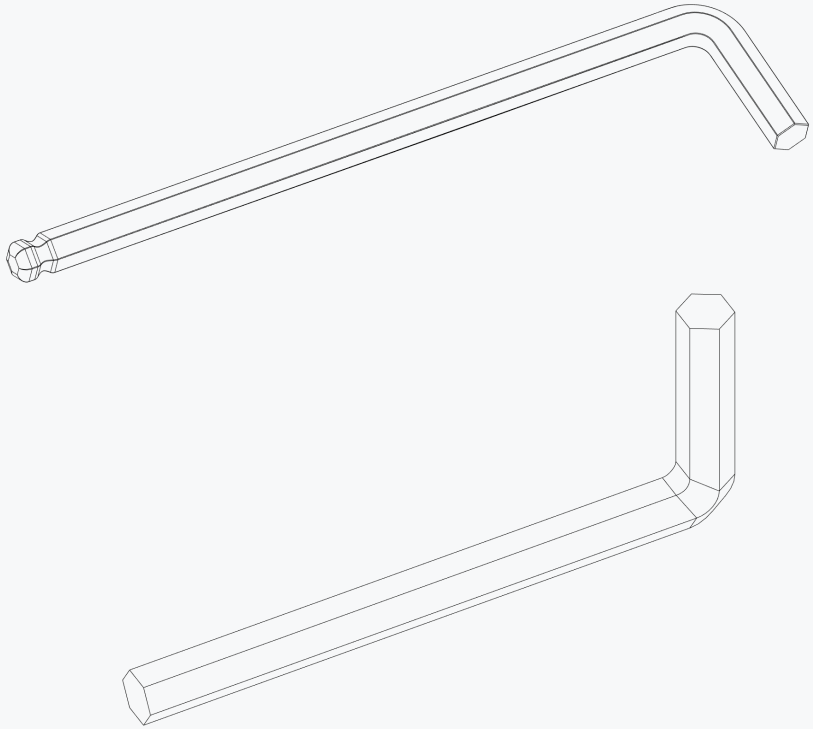
SET SCREW

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

ISO 4026

BALL-END DRIVER

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



2.5MM HEX DRIVER

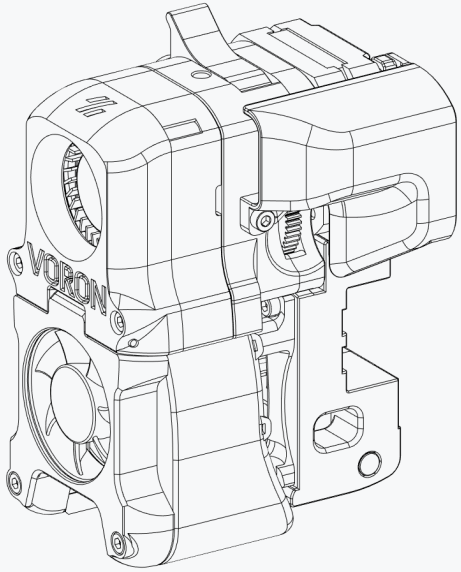
The 2.5mm hex driver will see a lot of use in this build. A quality driver is strongly recommended. Refer to the sourcing guide for suggestions.

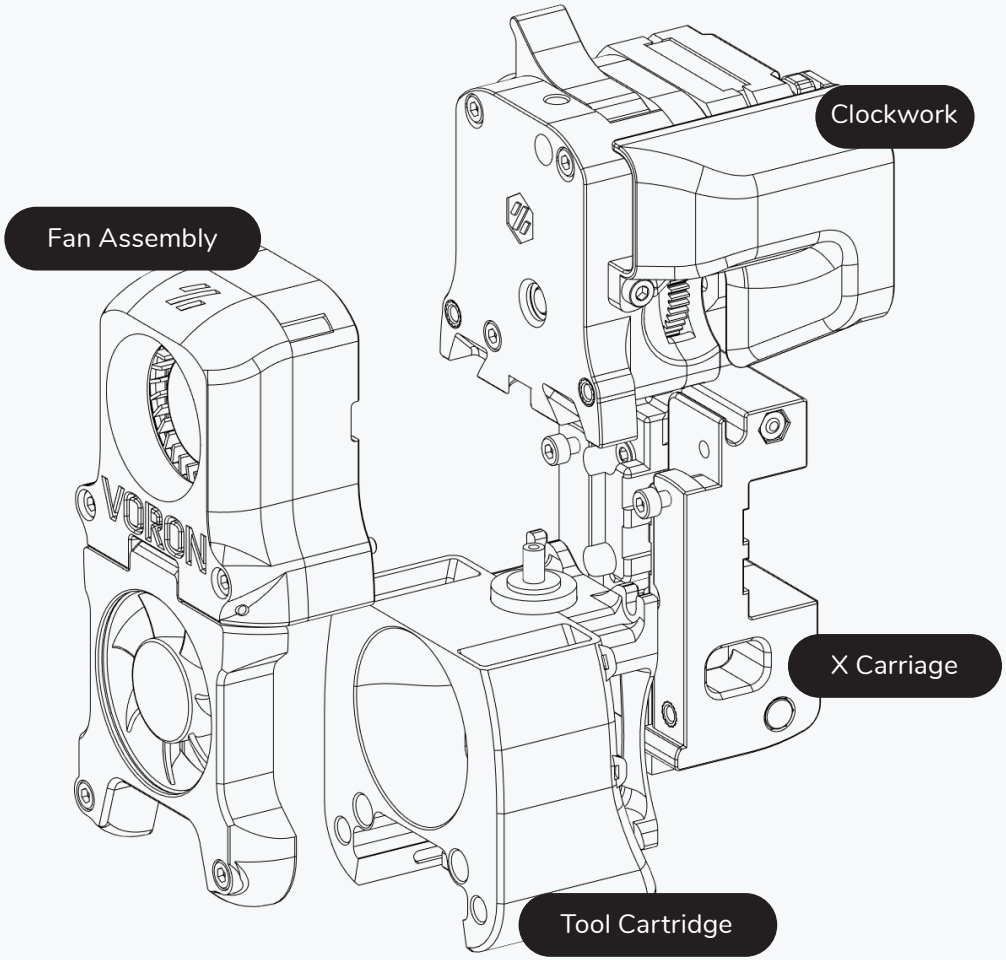
ADDITIONAL TOOLS

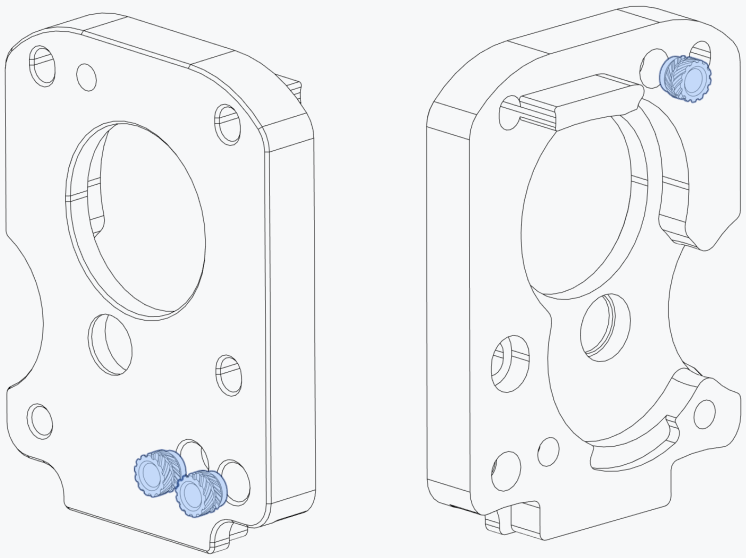
We provide additional tool recommendations in our sourcing guide. Visit https://vorondesign.com/sourcing_guide and switch to the "Voron Tools" tab at the bottom of the page.

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


VORON


VORON


Clockwork
Fan Assembly
VORON
X Carriage
Tool Cartridge



Heat Set Insert

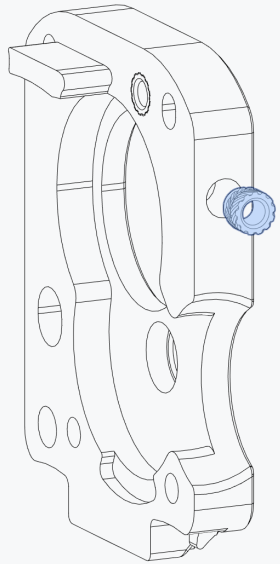
HEAT SET INSERTS

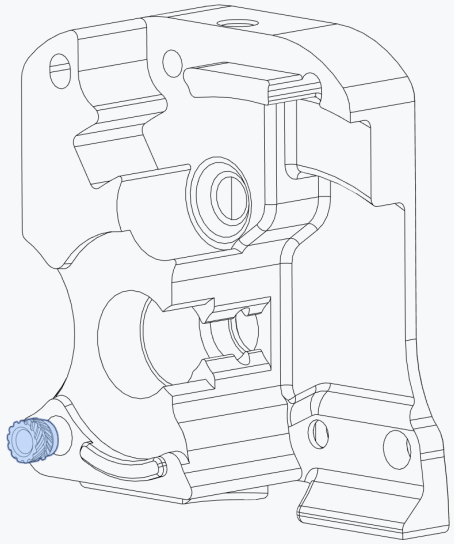
You will need to install heat set inserts into various plastic parts.

If you need help on the correct procedure, ask in Discord.

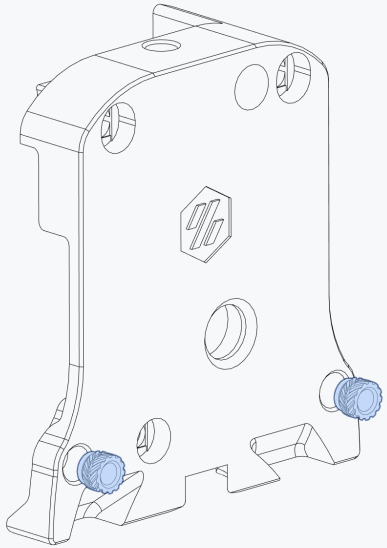
OPTION: TOOLHEAD PCB

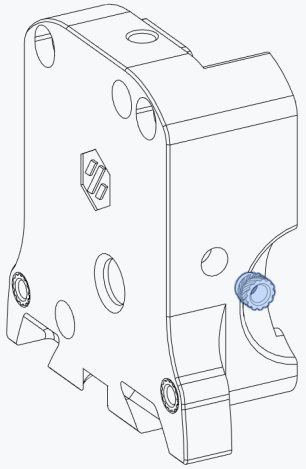
If you opt to use a toolhead PCB, add an additional heat set insert into the alternate part.





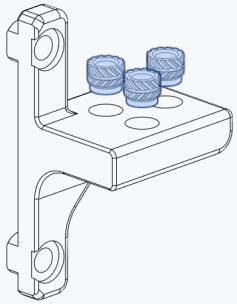
Heat Set Insert





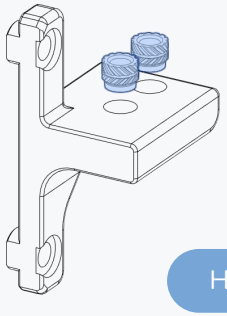
GENERIC CABLE CHAINS

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

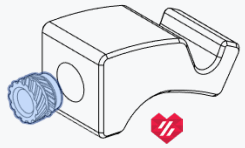


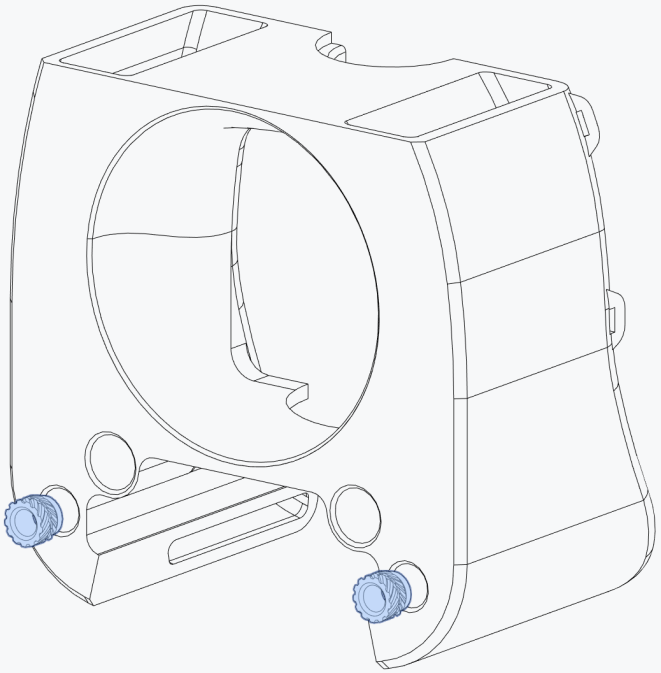
IGUS CABLE CHAINS

IGUS chains have 2 mounting holes.

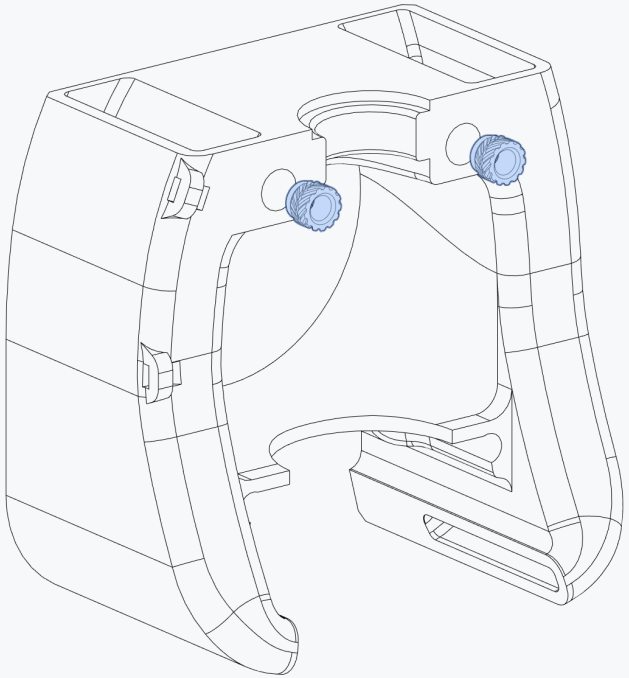


Heat Set Insert



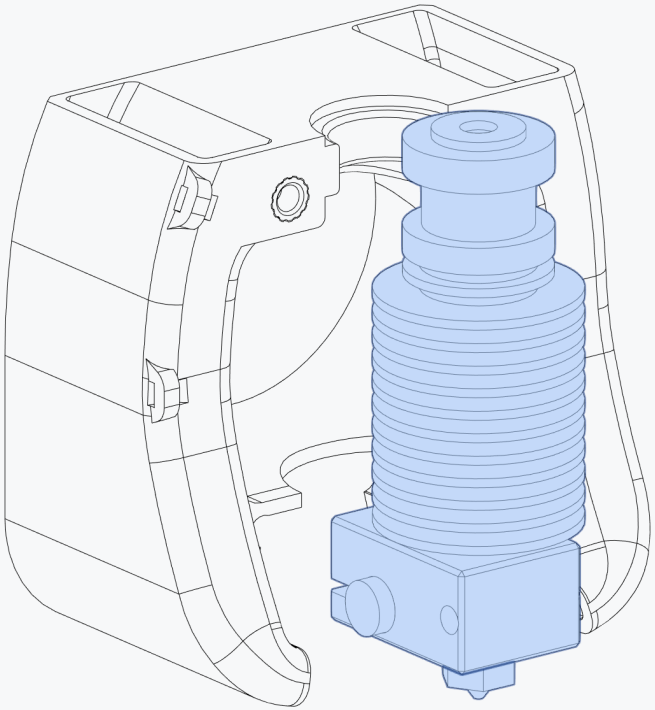


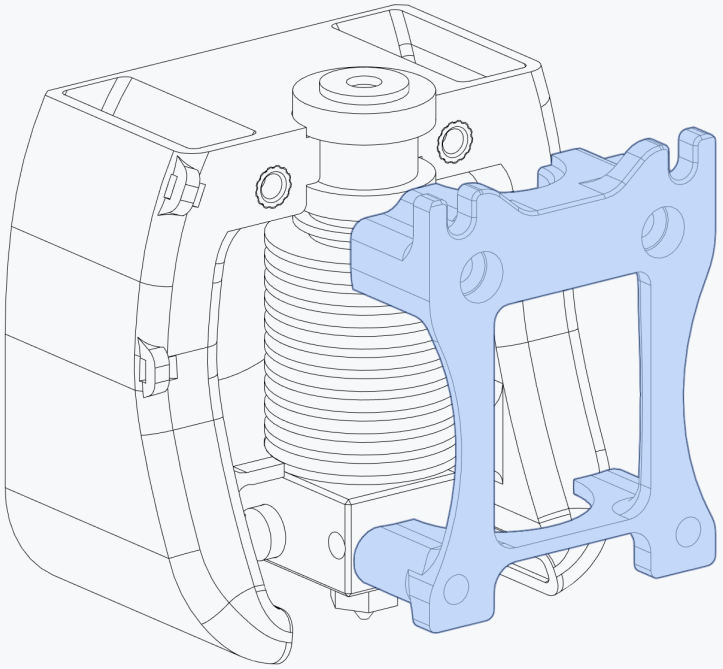
Heat Set Insert



AVAILABLE MOUNTS

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





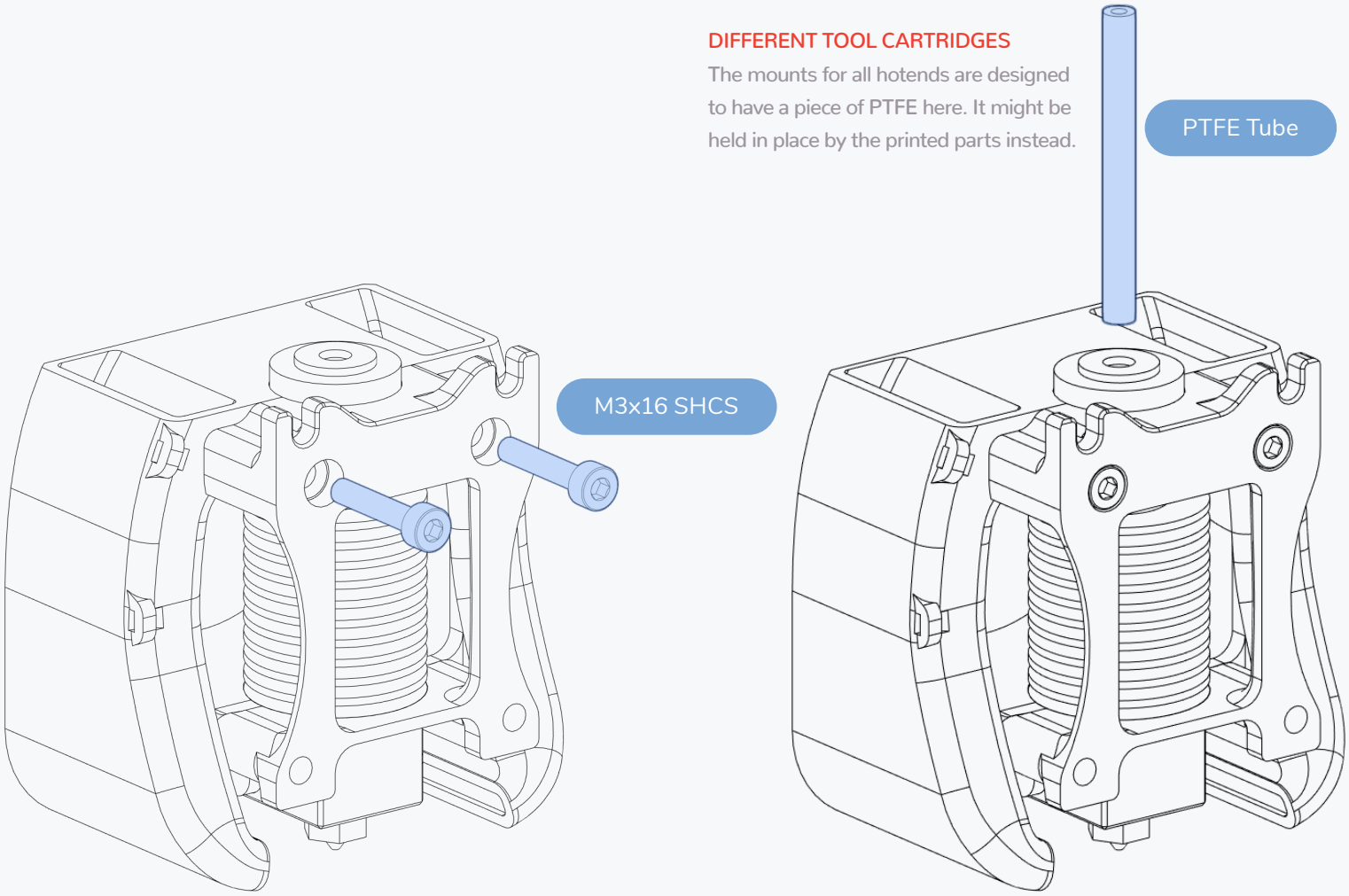
E3D V6 Hot End

HEATER AND SENSOR

We do not show the heater and temperature sensor cartridge in the drawing. Install them prior to assembling the toolhead.

DIFFERENT TOOL CARTRIDGES

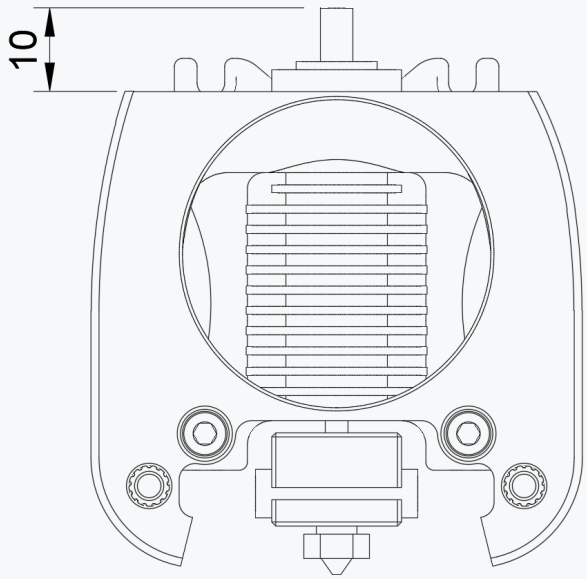
The mounts for all hotends are designed to have a piece of PTFE here. It might be held in place by the printed parts instead.

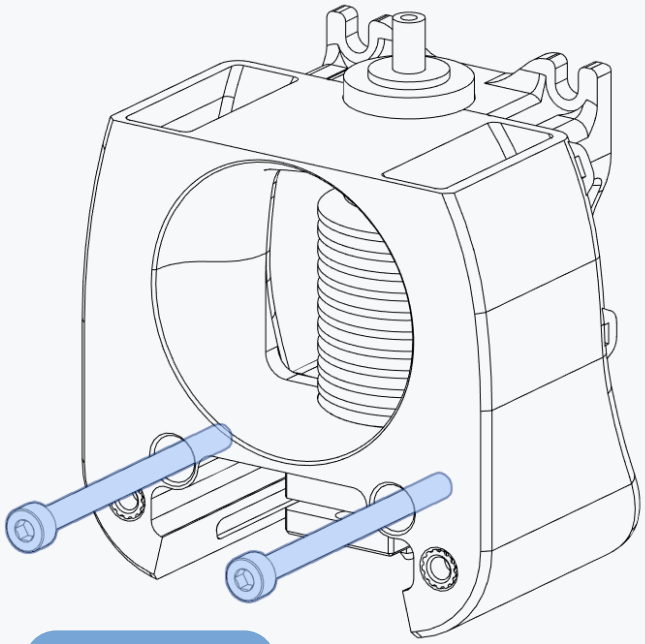


PTFE STICKOUT

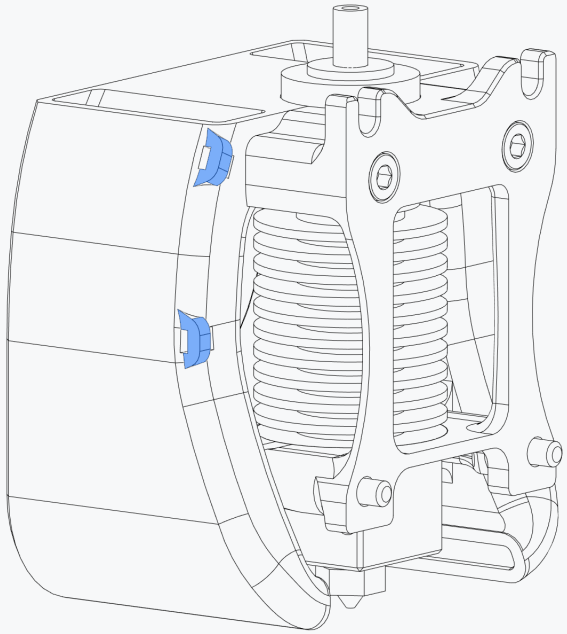
The PTFE tube should end 10mm above the surface of the printed part.

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



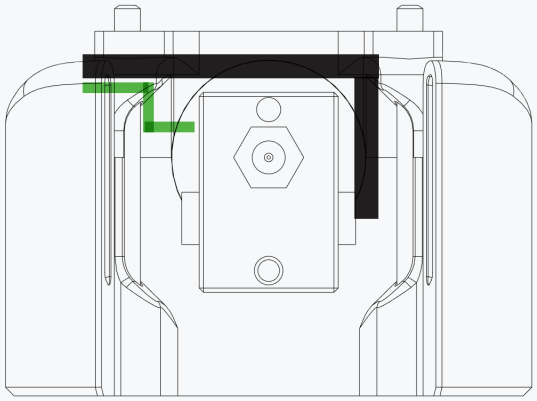


M3x40 SHCS



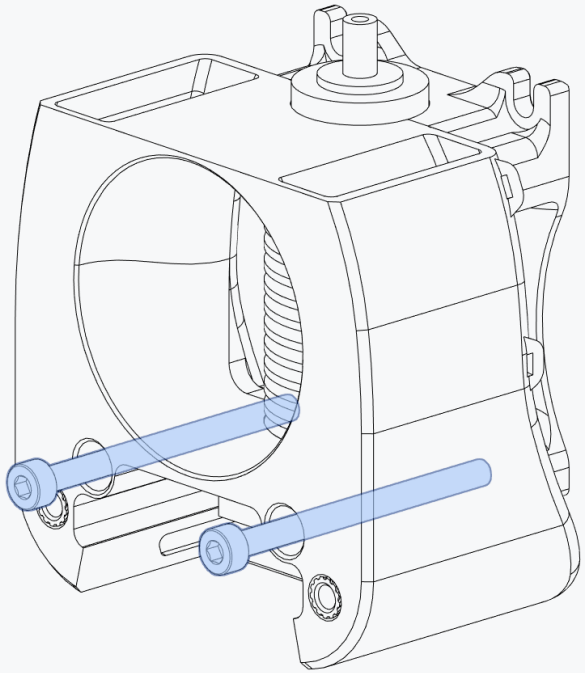
WIRING PATH

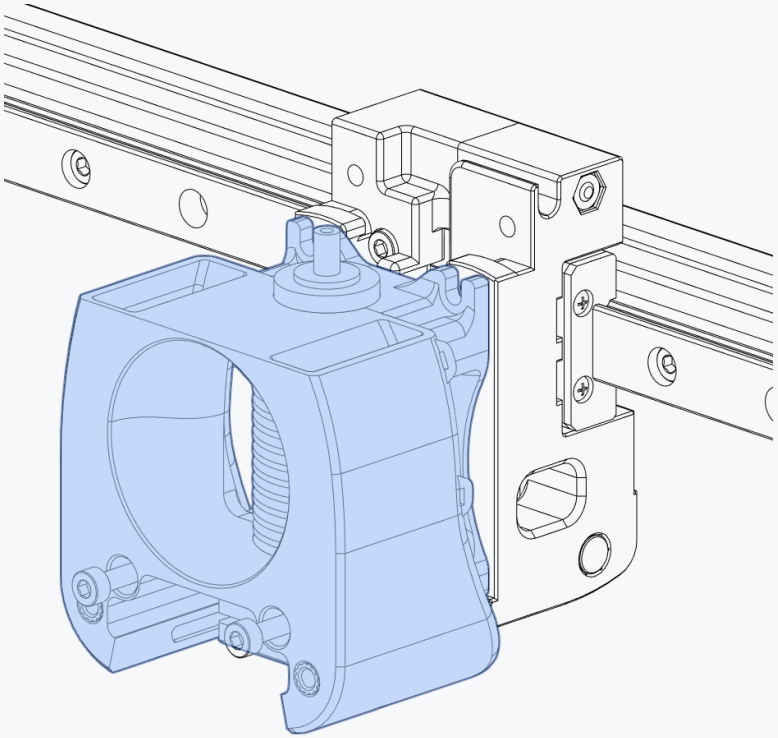
Guide the wires in the highlighted path.

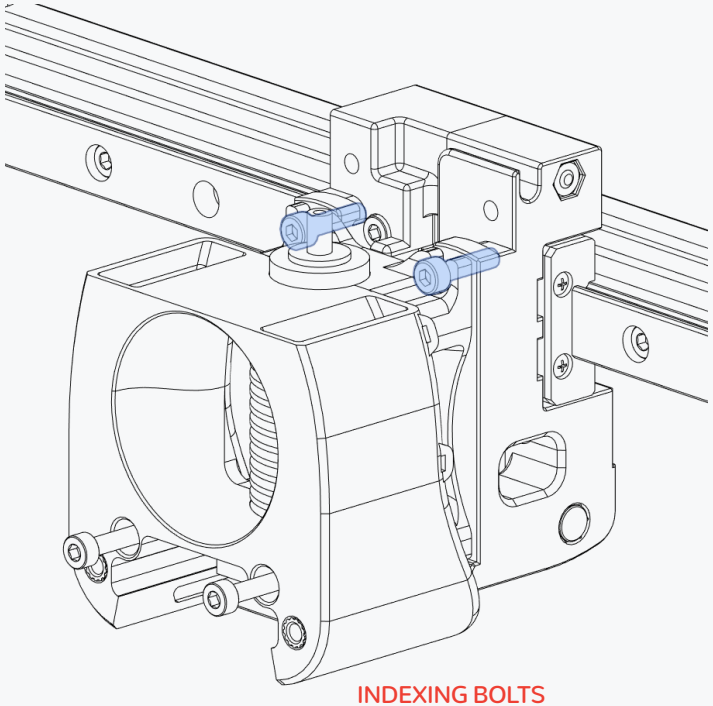


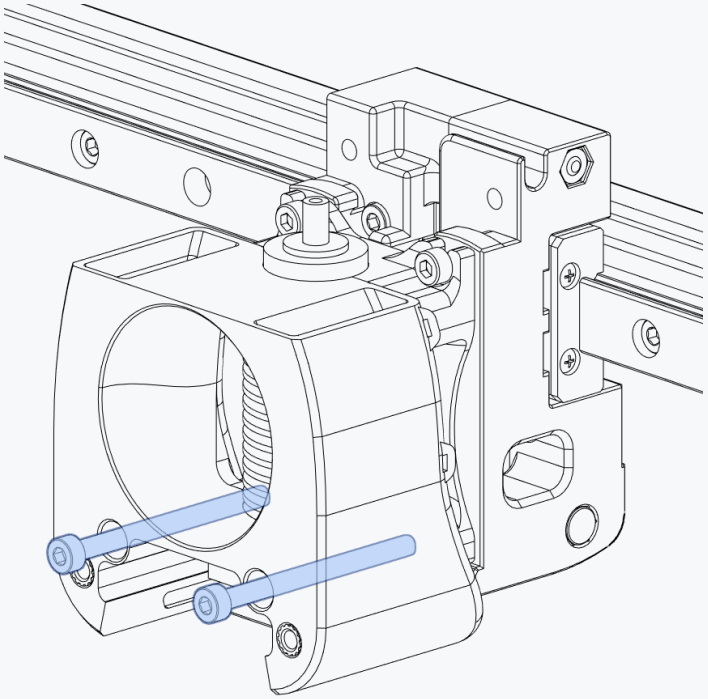
CHECK ORIENTATION

The heater block must point forwards.





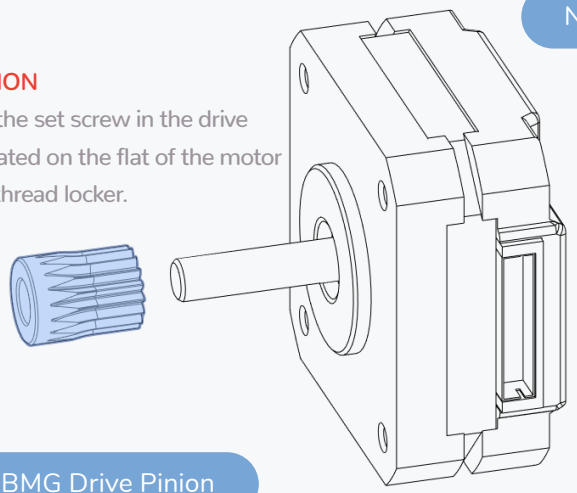




INDEXING BOLTS

The bolts are used to index the tool cartridge. Leave them slightly loose so that the cartridge can be slid out.

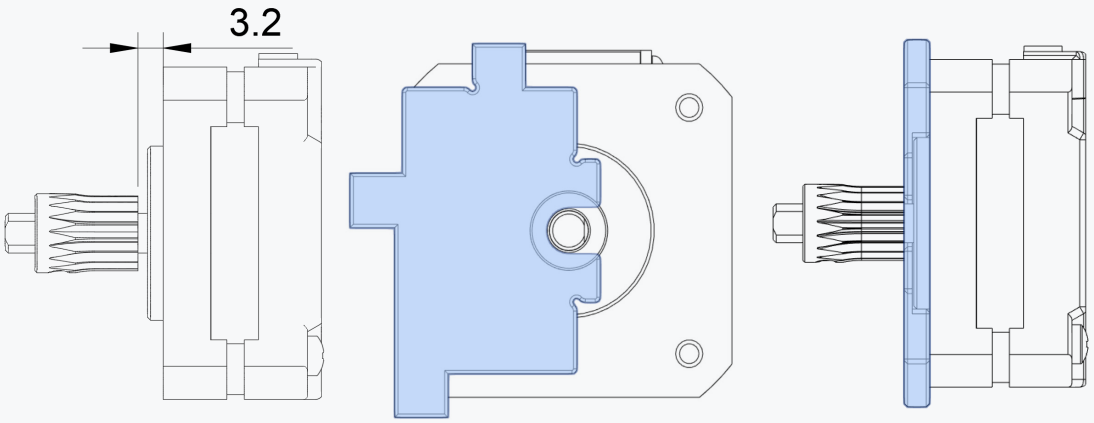
NEMA 17 Stepper

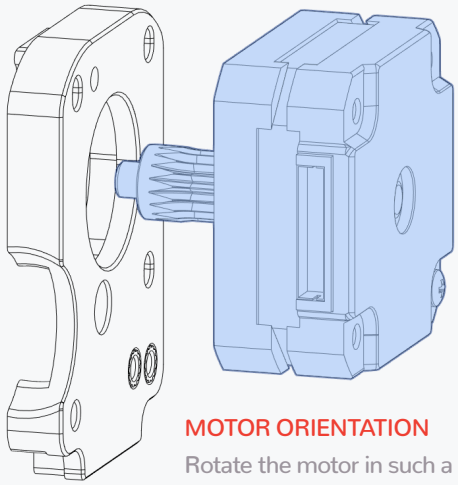


DRIVE PINION

Make sure the set screw in the drive pinion is seated on the flat of the motor shaft. Use thread locker.

BMG Drive Pinion

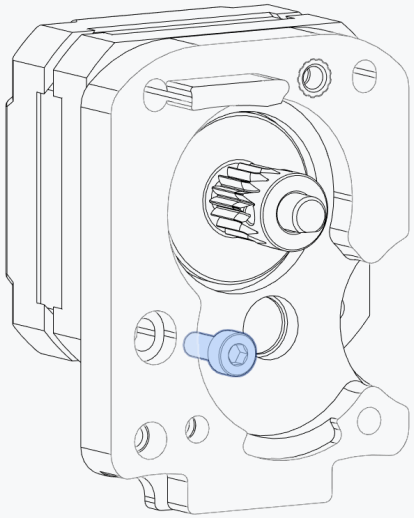




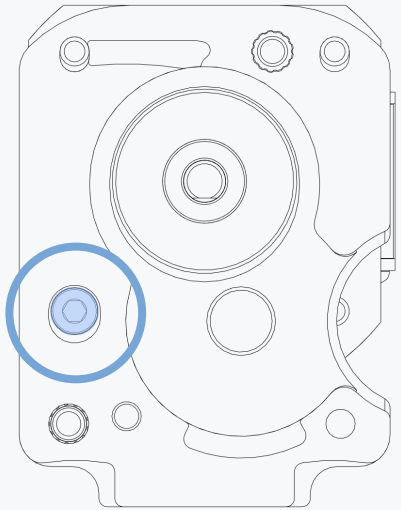
MOTOR ORIENTATION

Rotate the motor in such a way that the connector/wires are on the left side when looking at it from the back.

This side will be covered by the cable cover later.



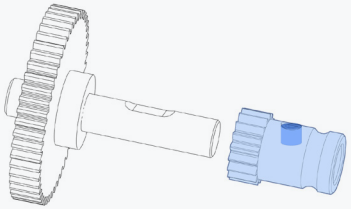
M3x8 SHCS



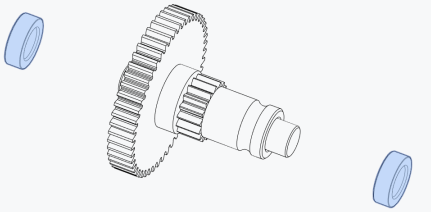
ADJUSTABLE MOTOR POSITION

The motor position is adjustable to allow for a proper meshing of the drive gears.

Start in the topmost position of the slot.



BMG Drive Gear



MR85 Bearing

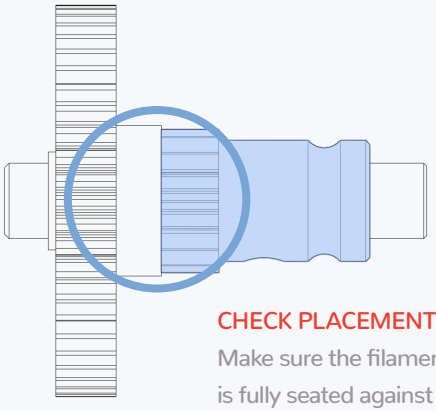
DRIVE GEAR

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.

CHECK BEARING FIT

The bearings must slip on and off the shaft easily to allow the gear to self-centre. Do not shim into position.

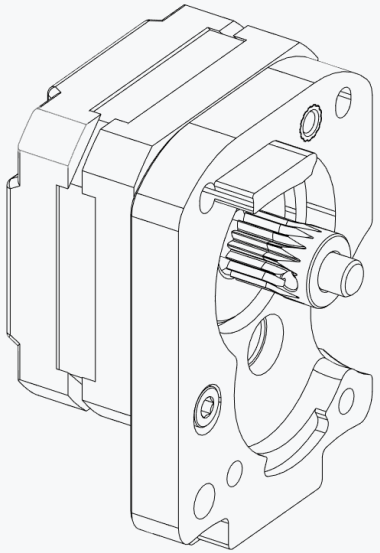
Pressing the bearings on the shaft will damage them.
Lightly sand the shaft if required.

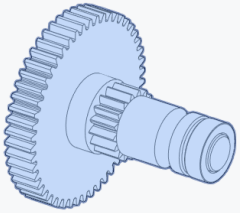


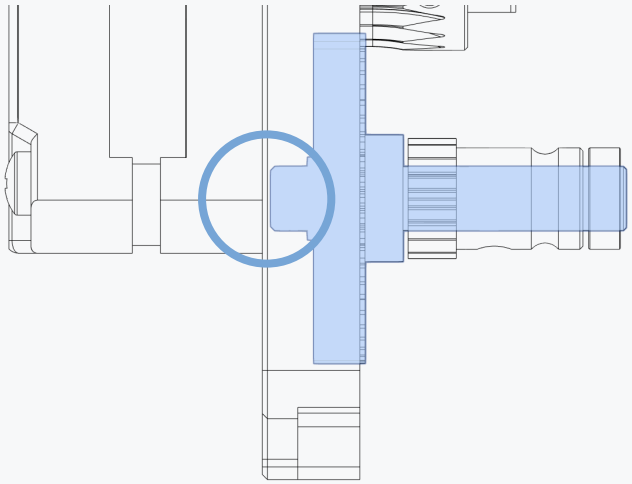
CHECK PLACEMENT

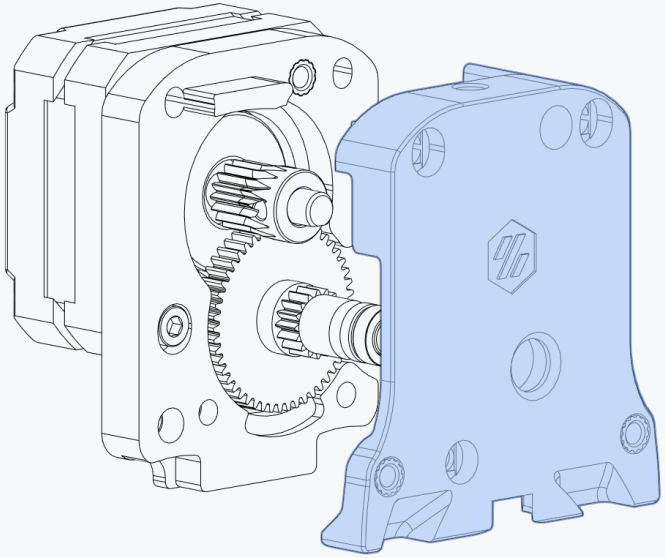
Make sure the filament drive gear is fully seated against the drive shaft gear.

https://voron.link/p0xac5e

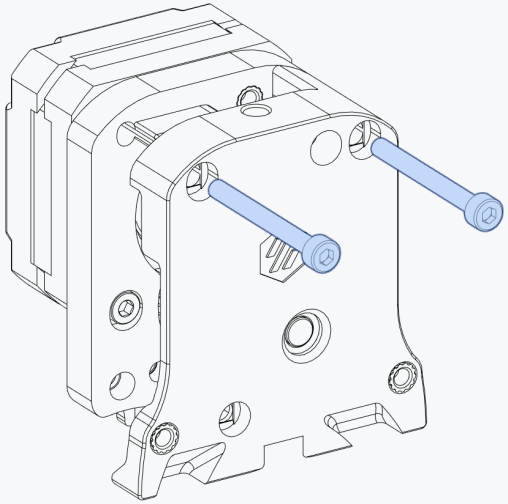








M3x30 SHCS

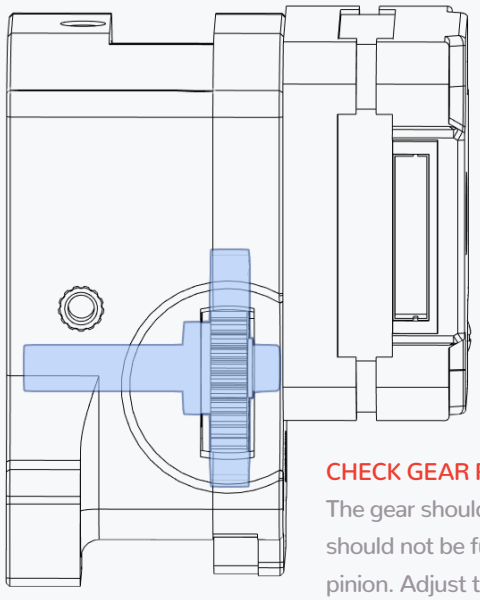


CHECK FOR CLEARANCE

The drive shaft must not touch the motor housing.

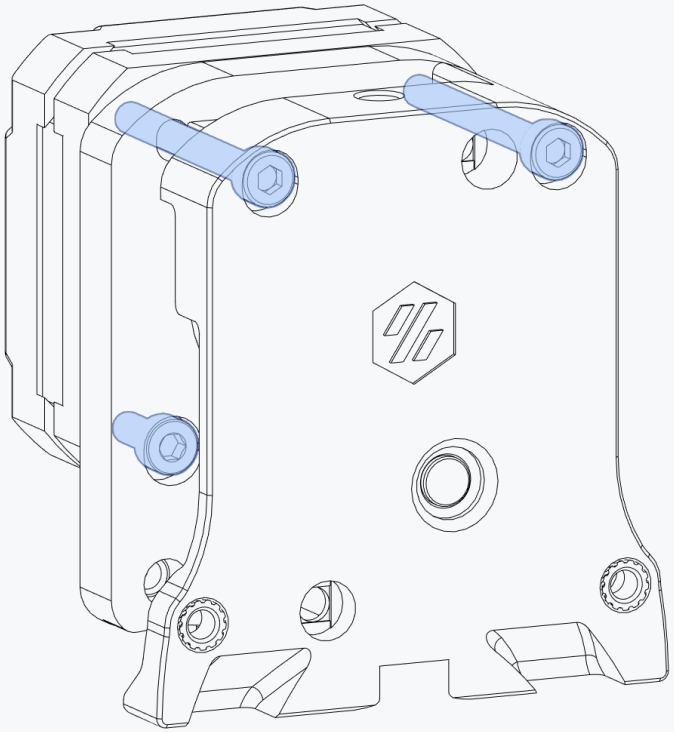
Check if the shaft has sufficient clearance when fully seated.

Sand the face of shaft if required.



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.

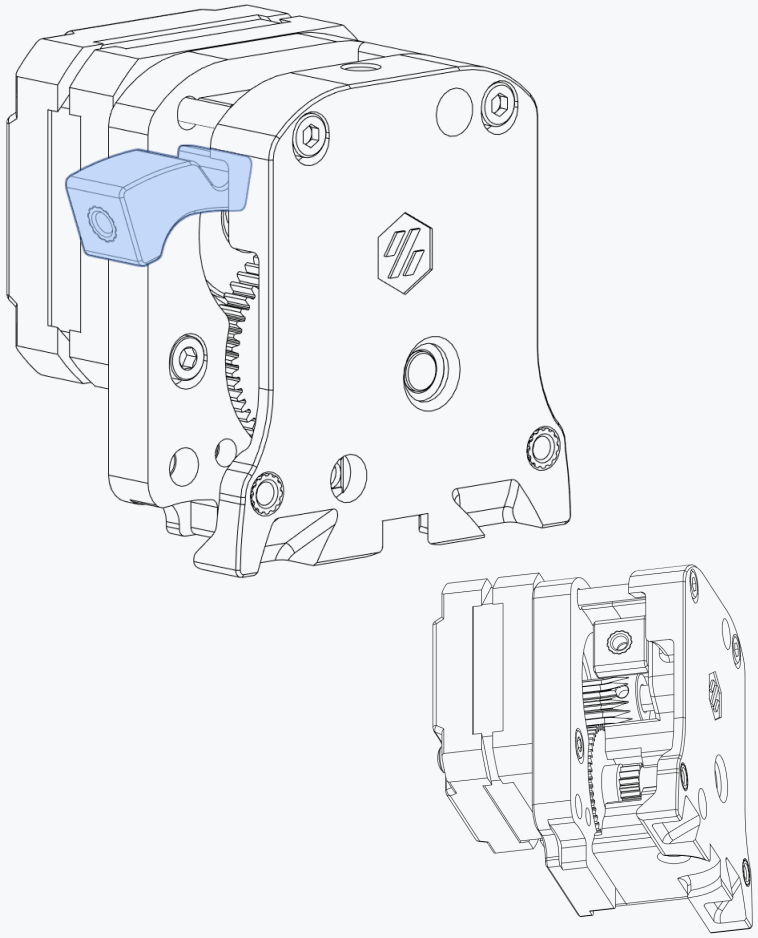


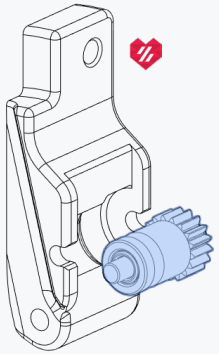
LUBRICATE BEARINGS

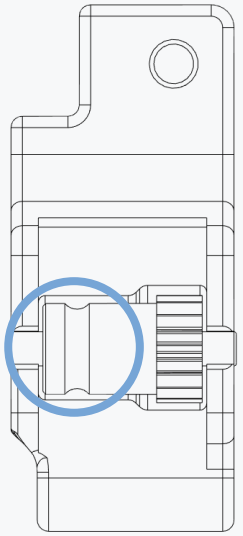
A lubrication film is required to ensure smooth operation and longevity.
Refer to the BOM for lubricant options - look for a “light grease”.

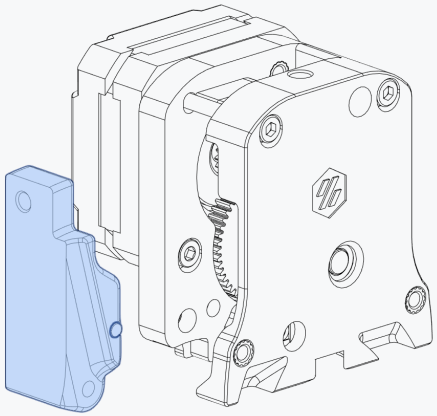
https://voron.link/dncvwdm

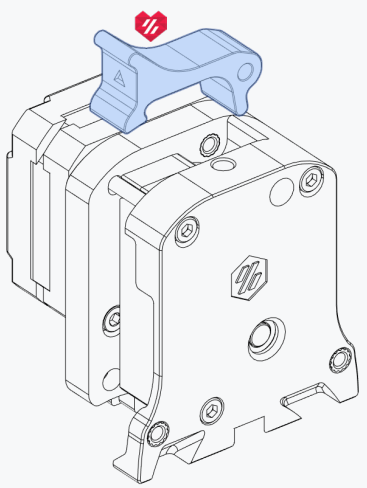
BMG Idler Assembly

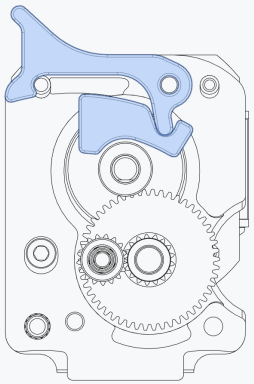


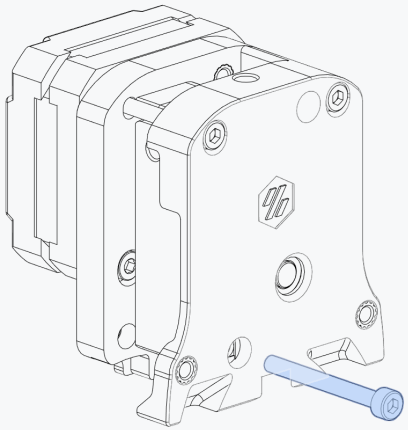




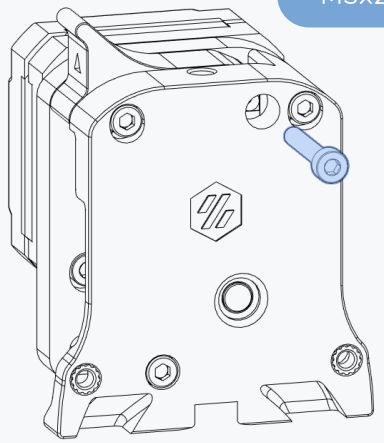






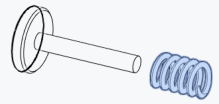


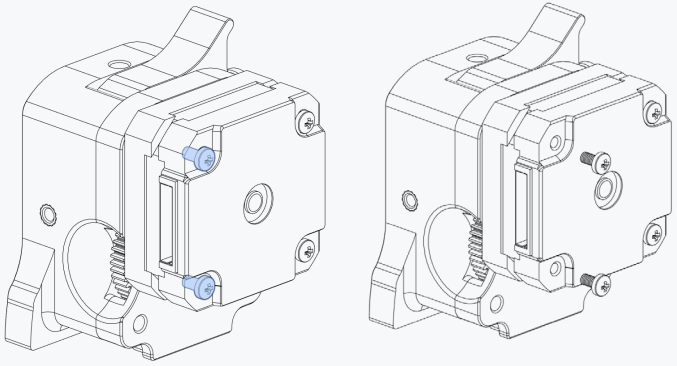
M3x30 SHCS



M3x20 SHCS

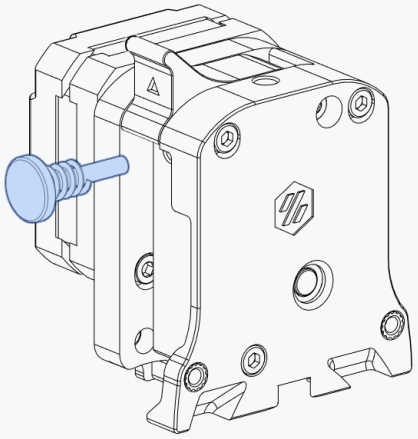
BMG Thumb Screw

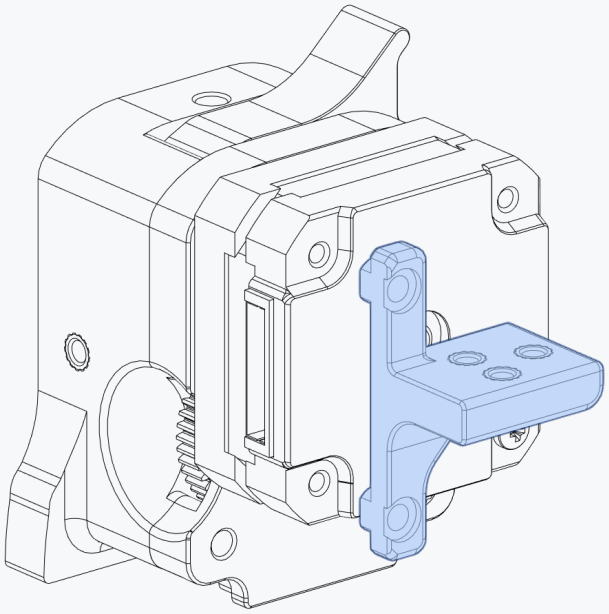


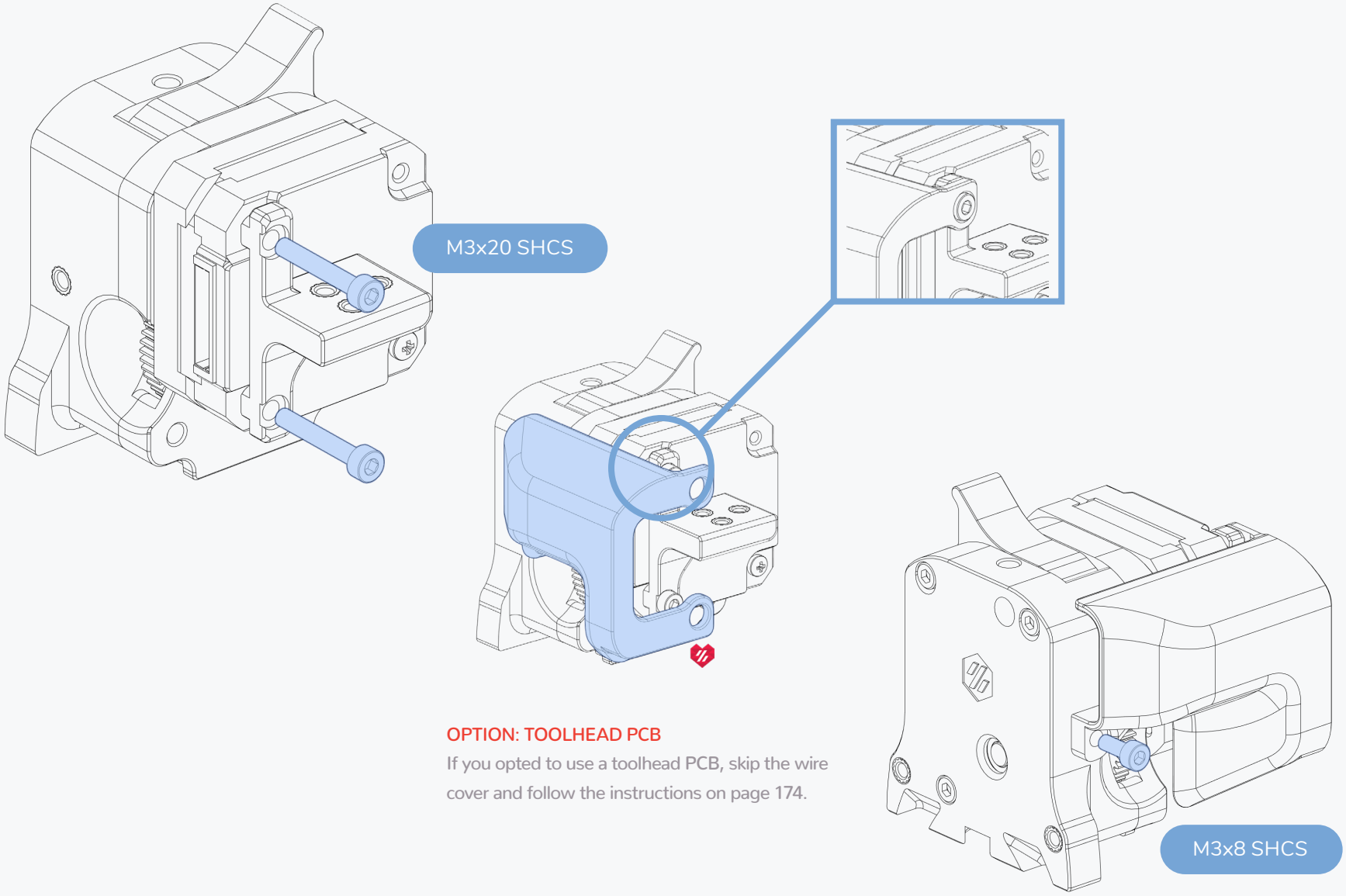


REMOVE SCREWS

Carefully remove the screws from the left side of the motor. They will be replaced with new bolts in the next step.

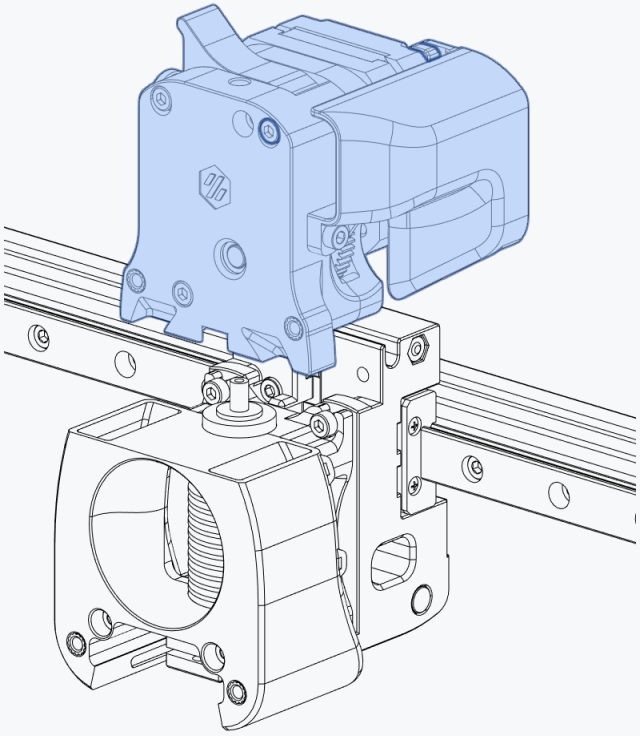


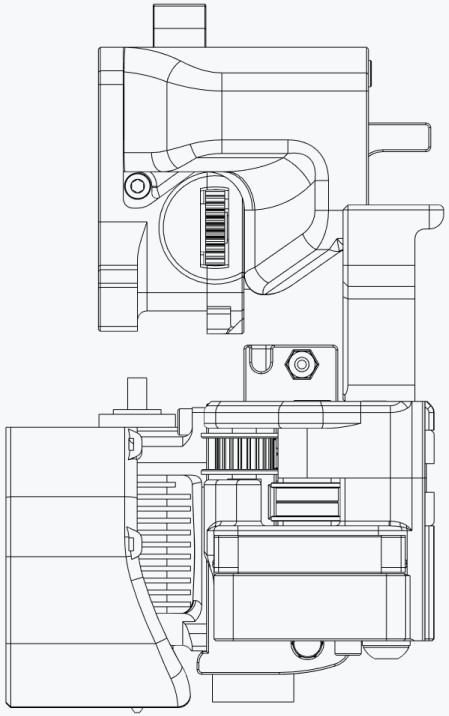


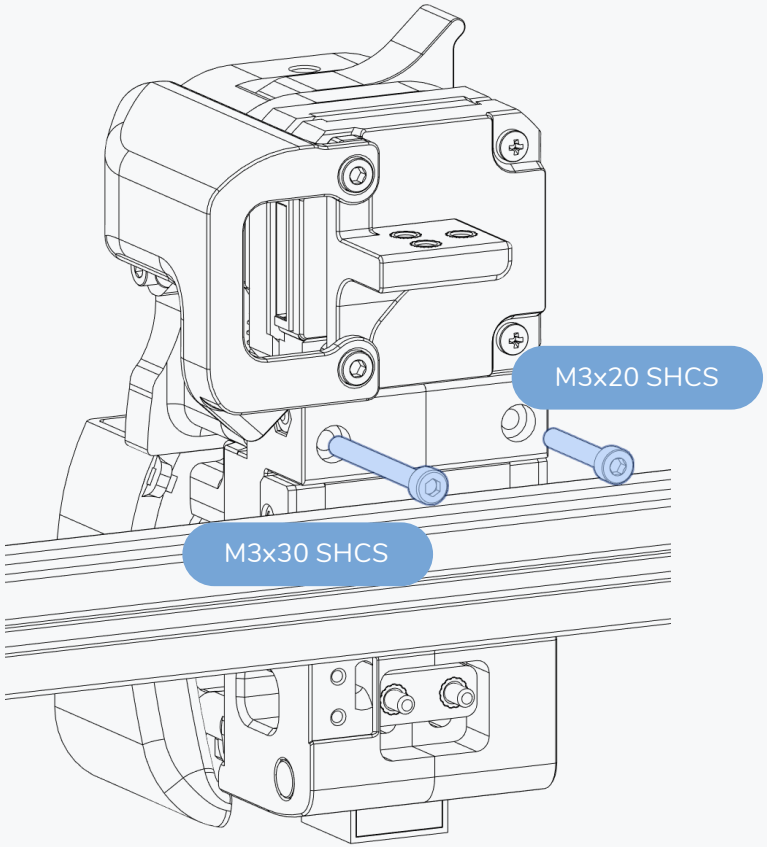


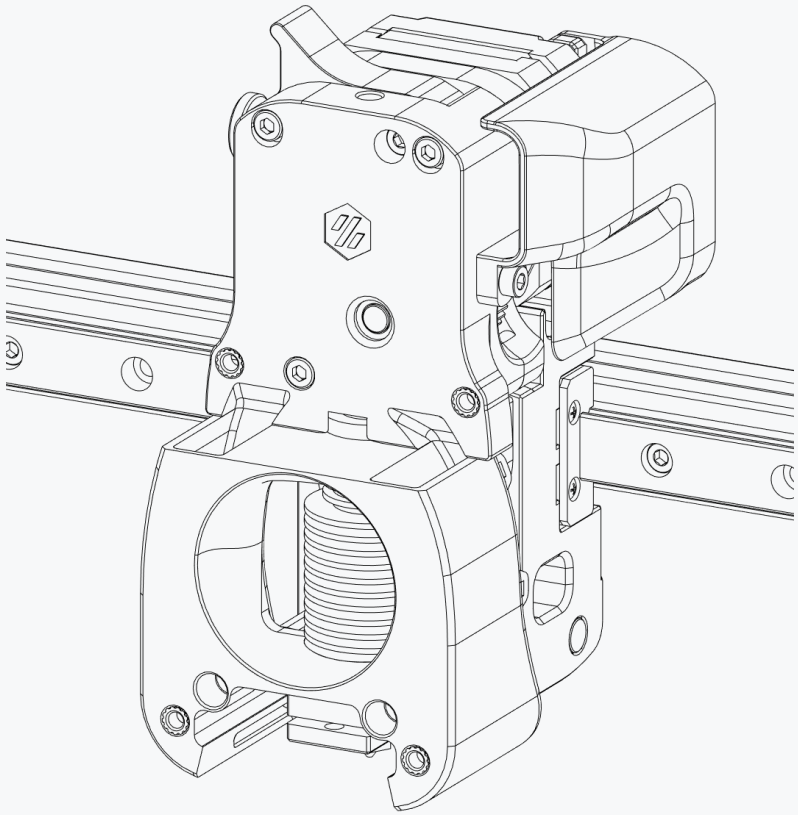
OPTION: TOOLHEAD PCB

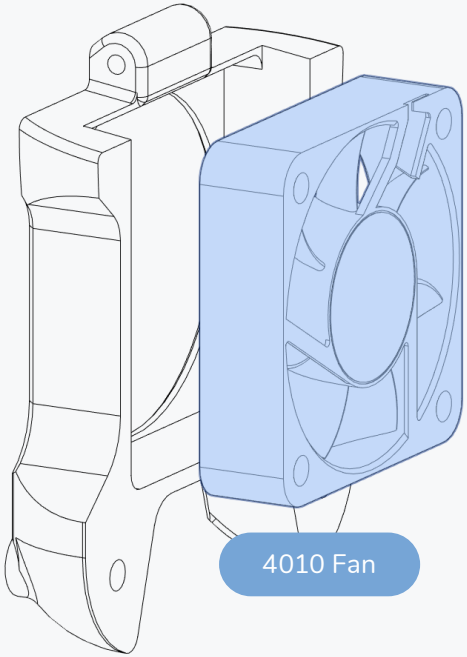
If you opted to use a toolhead PCB, skip the wire cover and follow the instructions on page 174.

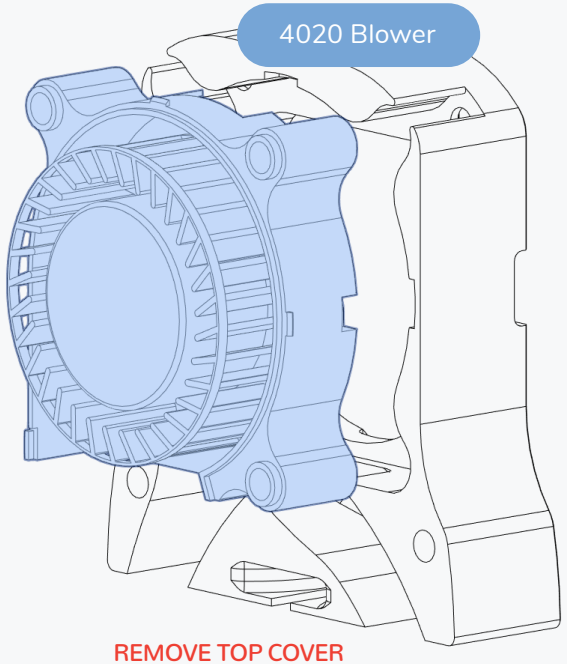





M3x20 SHCS
M3x30 SHCS



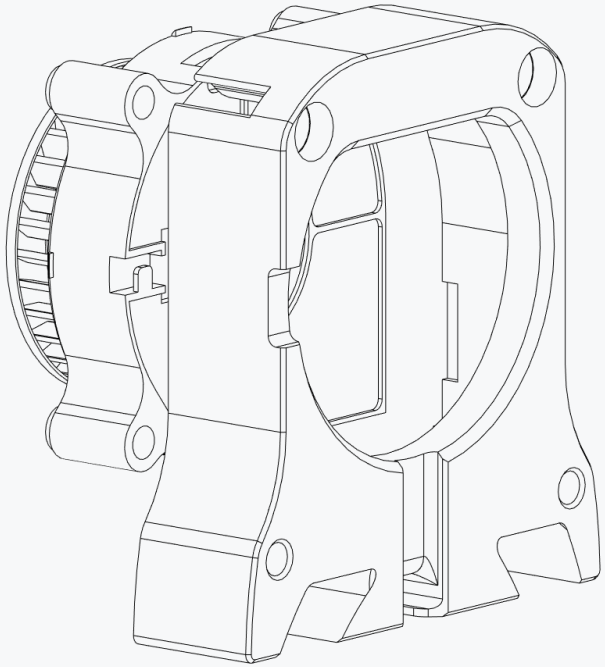


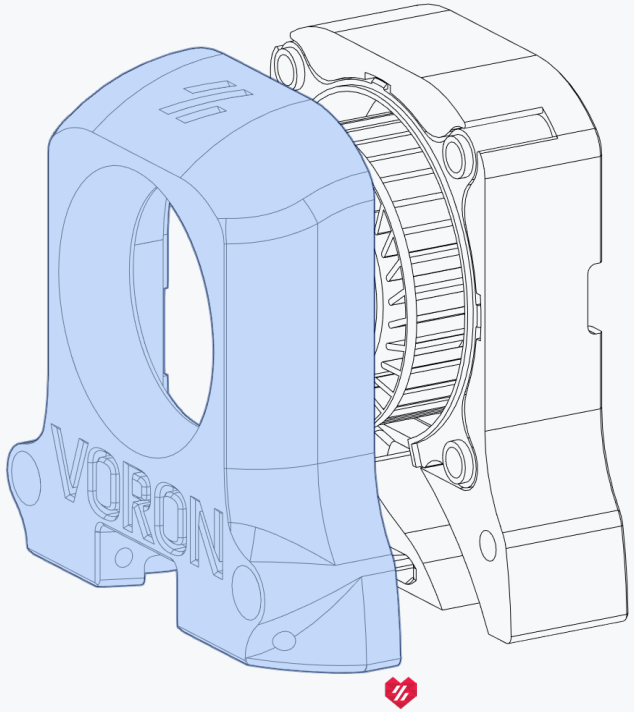


REMOVE TOP COVER

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

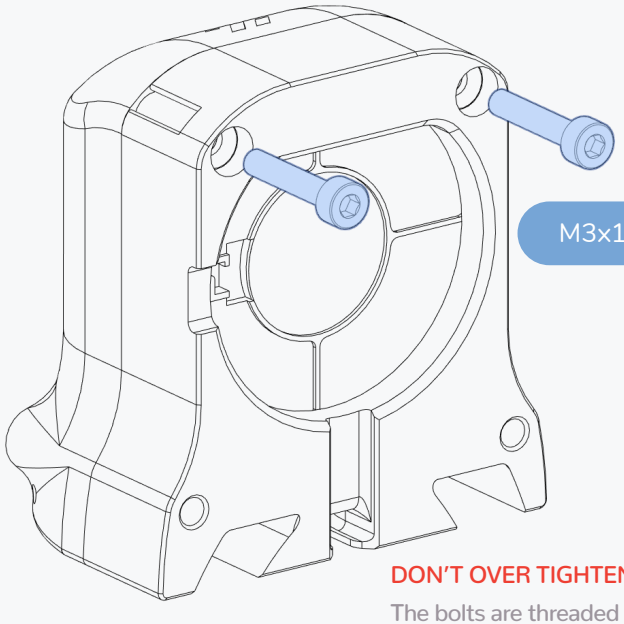
https://voron.link/vyvtcpa





WIRING PATH

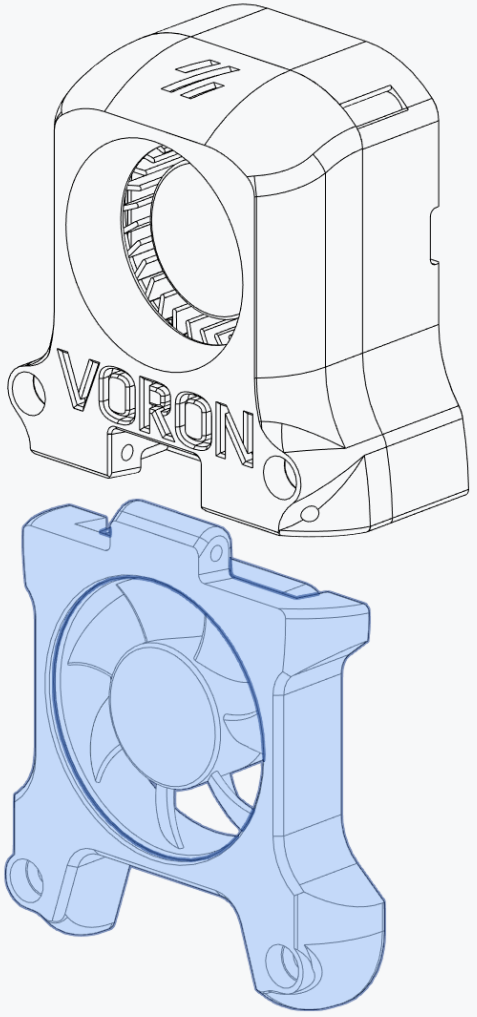
Route the wires through the large opening in the back.

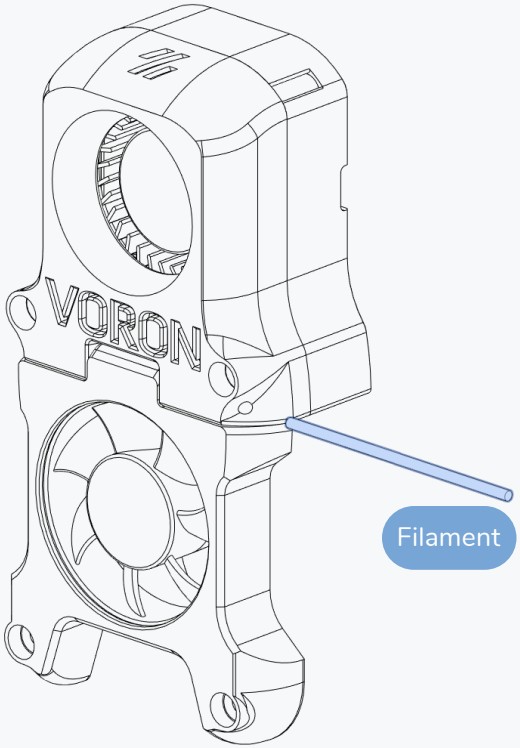


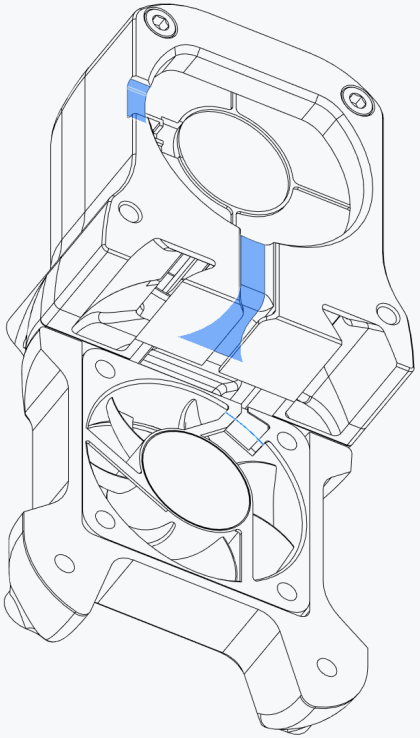
M3x16 SHCS

DON'T OVER TIGHTEN

The bolts are threaded directly into plastic.

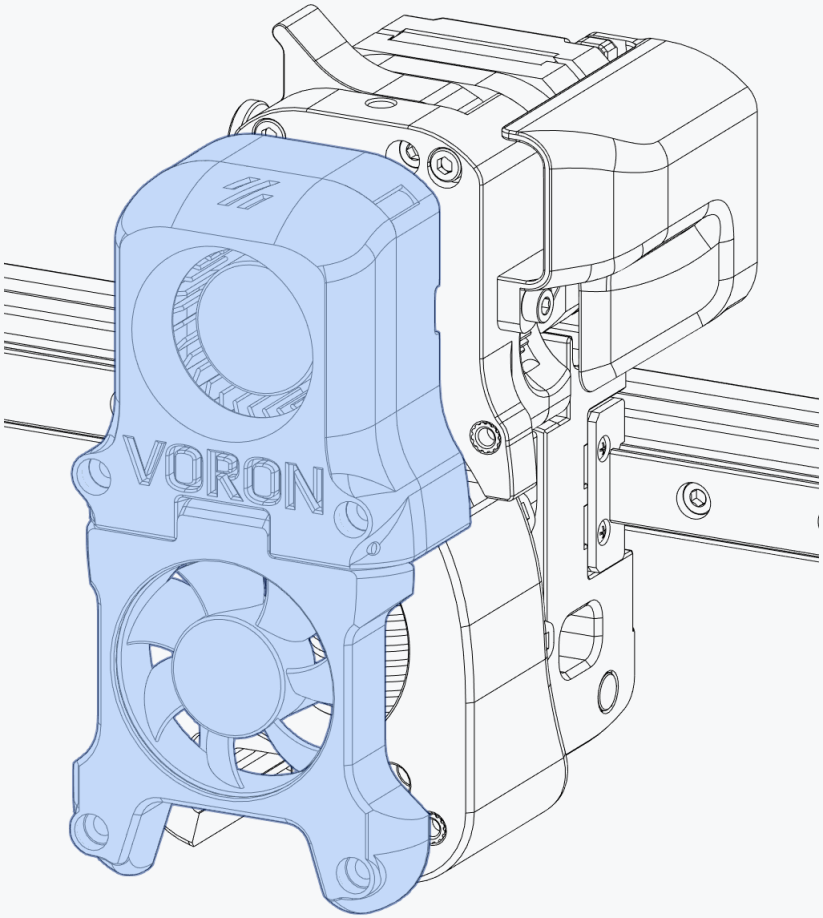


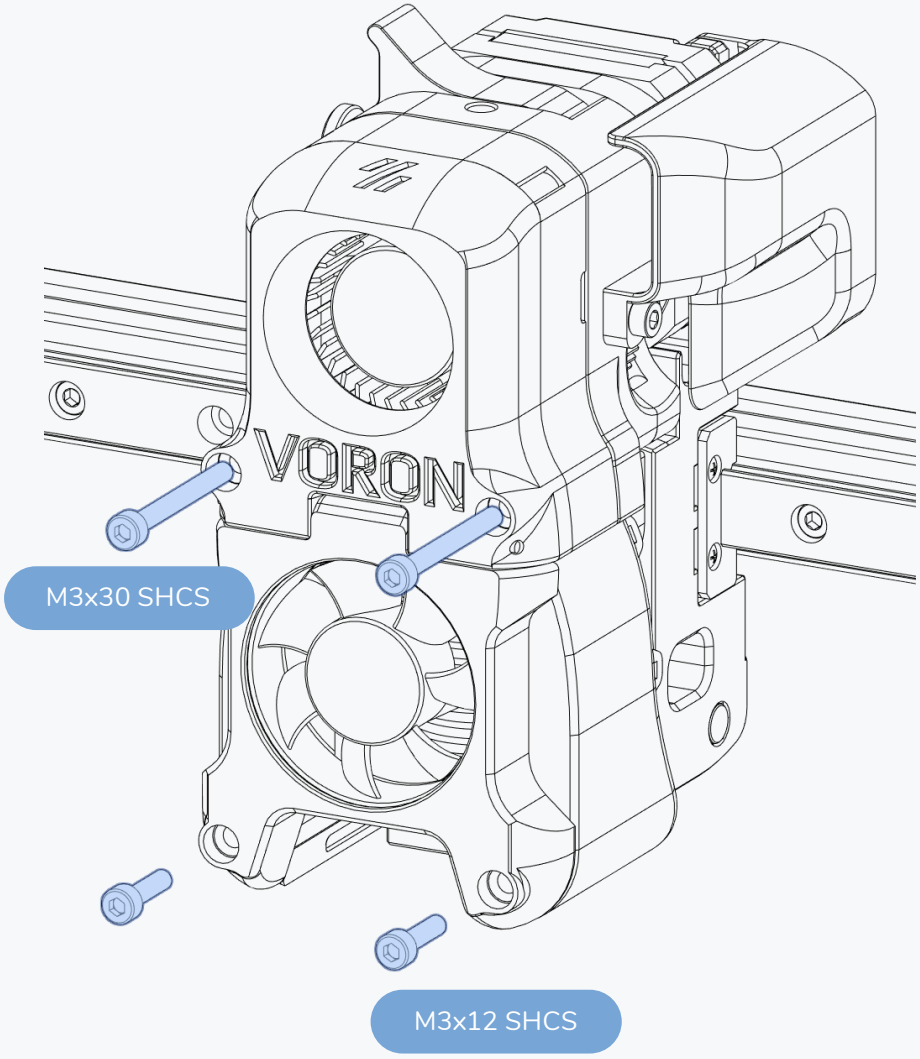




WIRING PATH

Guide the wires in the highlighted path.

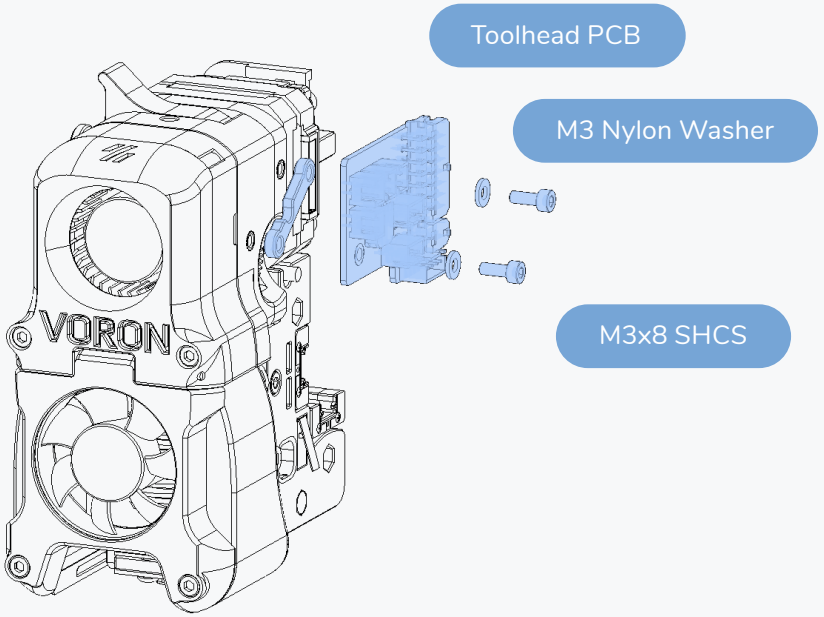

VORON


VORON
M3x30 SHCS
M3x12 SHCS

OPTION: TOOLHEAD PCB

If you opted to use a toolhead PCB, install it instead of the cable cover.

While not strictly required the use of plastic (e.g. nylon) washers is recommended.



Voron2.1 was released on November 5 2018.

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

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

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

https://docs.vorondesign.com/

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

HOW TO GET HELP

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

https://discord.gg/voron

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

REPORTING ISSUES

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

Enjoy your printer.

Website
www.vorondesign.com

Github
github.com/vorondesign

Docs
docs.vorondesign.com

Discord
discord.gg/voron