



VORON NIGHTWATCH

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

VERSION 2023-01-23



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

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)

INFILL TYPE

Grid, Gyroid, Honeycomb, Triangle or Cubic

MATERIAL

ABS/ASA

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. Further Details about the PIF program can be found on the Discord server or by visiting <https://pif.voron.dev>.

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>



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



<https://forum.vorondesign.com>

REPORTING AN ISSUE

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/Pocket-Watch/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

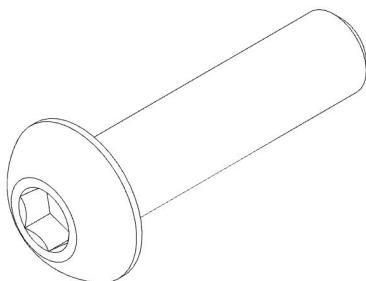
This manual is designed to be a simple reference manual. Building a Voron can be a complex endeavour and for that reason we recommend downloading the CAD files off our Github repository if there are sections you need clarification on. It can sometimes be easier to follow along when you have the whole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



<https://github.com/VoronDesign>

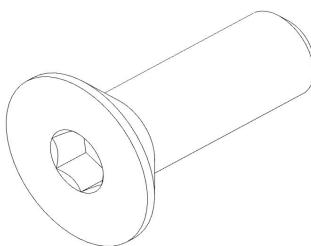


<https://docs.vorondesign.com>

**BUTTON HEAD CAP SCREW (BHCS)**

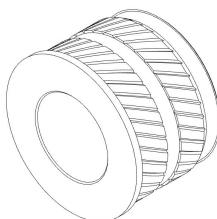
Metric fastener with a domed shaped head and hex drive. Most commonly found in locations where M3 fasteners are used.

ISO 7380-1

**FLAT HEAD CAP SCREW (FHCS)**

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

ISO 10642

**HEAT SET INSERT**

Heat the inserts with a soldering iron 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.

**MR85 BEARING**

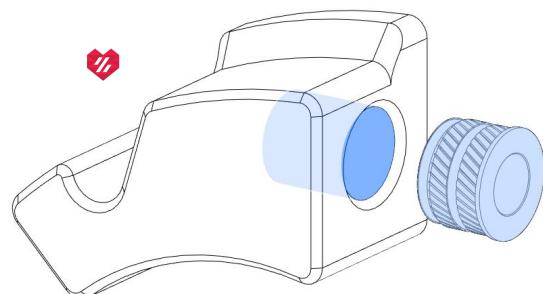
A small ball bearing. 5x8x2.5mm in size.

**ATTENTION BUBBLE**

This logo denotes steps that are common areas that mistakes can occur.

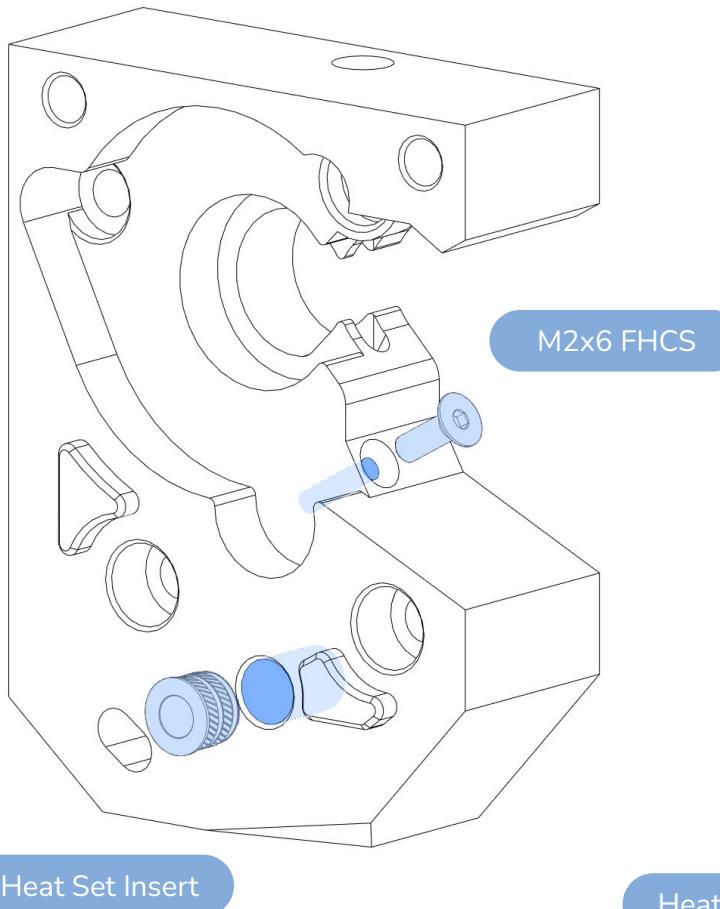
**VORON HEART**

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



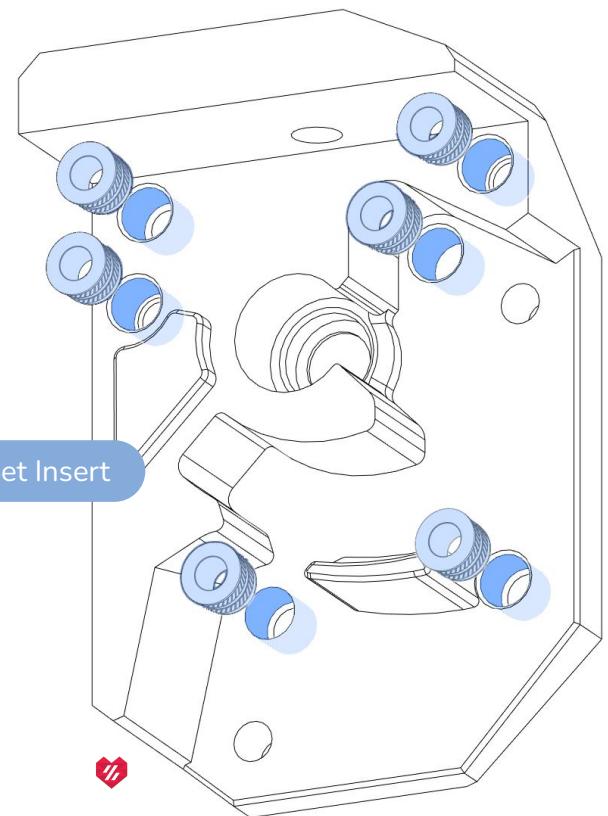
GETTING A GOOD BOND

The heat set insert in the shuttle will be in constant tension when assembly is complete. It's important to get a good bond between the insert and the plastic for this part.



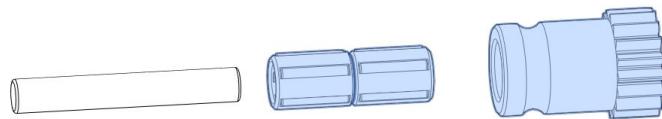
THREADING INTO PLASTIC

This M2 screw threads into the plastic of the Mid-Body part. It will be used to adjust the meshing of the BMG gears at a later step.

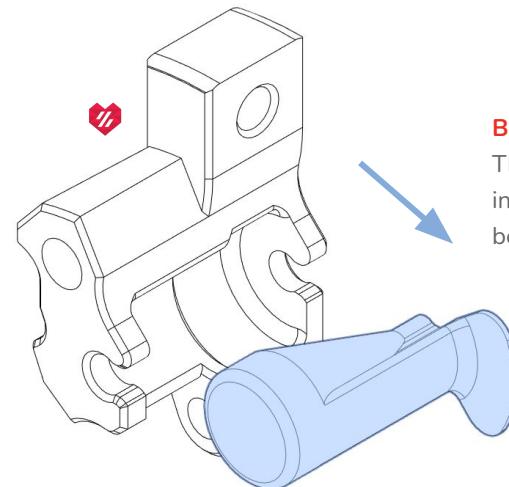


KNOW YOUR TARGET AND BEYOND

Before heating your iron, check that you will not contact, or unintentionally melt, surrounding plastic while installing heat inserts in the components.

BMG Idler Assembly**LUBRICATE BEARINGS**

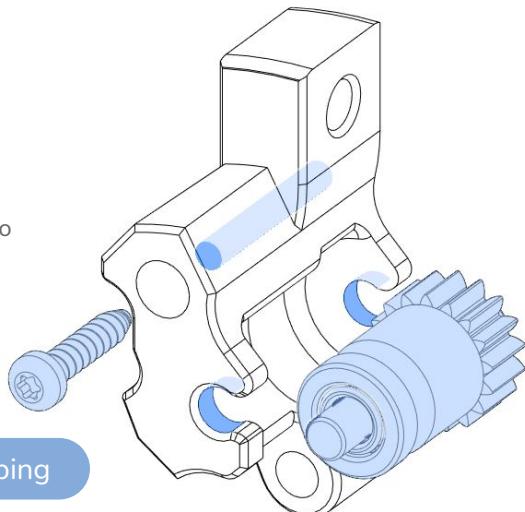
A lubrication film is required to ensure smooth operation and longevity. Refer to the [Voron sourcing guide](#) for lubricant options.

**BUILT-IN SUPPORT**

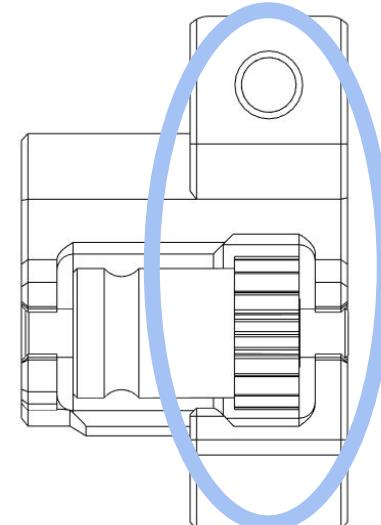
The guidler part prints with an integrated support. Remove this before moving to the next step.

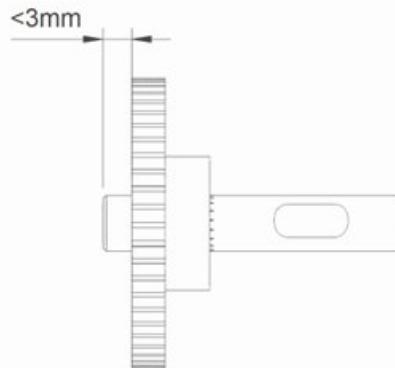
ADDED STRENGTH

This screw is there to provide extra strength to the guidler component along its layer lines.

**M2x10 Self Tapping****CHECK ORIENTATION**

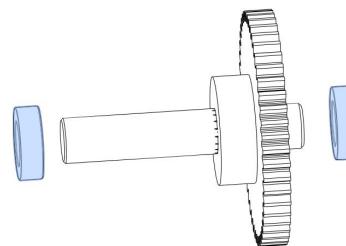
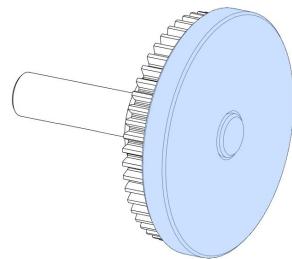
The larger gear section must be on the right hand side. Check for any rubbing or binding.





SHORT END OF THE SHAFT

Check the short end of the shaft. If it is longer than 3mm shorten it to under 3mm. The design for a printed jig that can be used to help sand down the shaft is included in the released files.



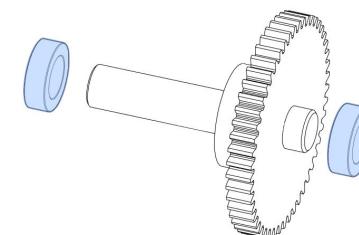
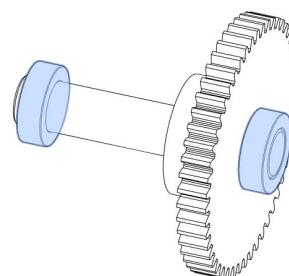
CHECK BEARING FIT

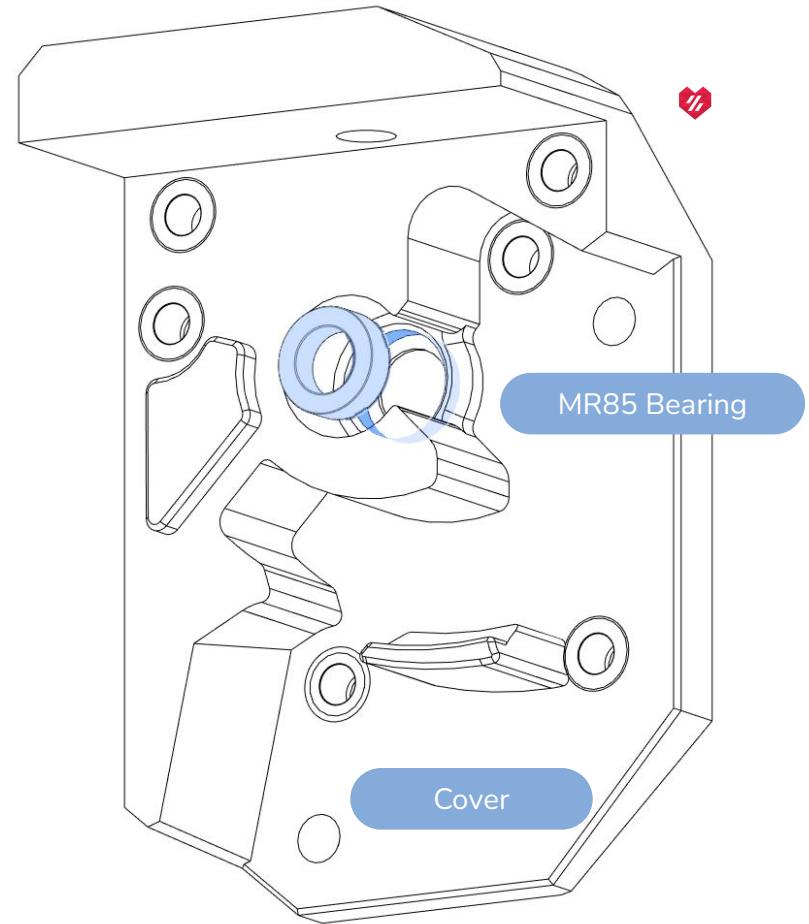
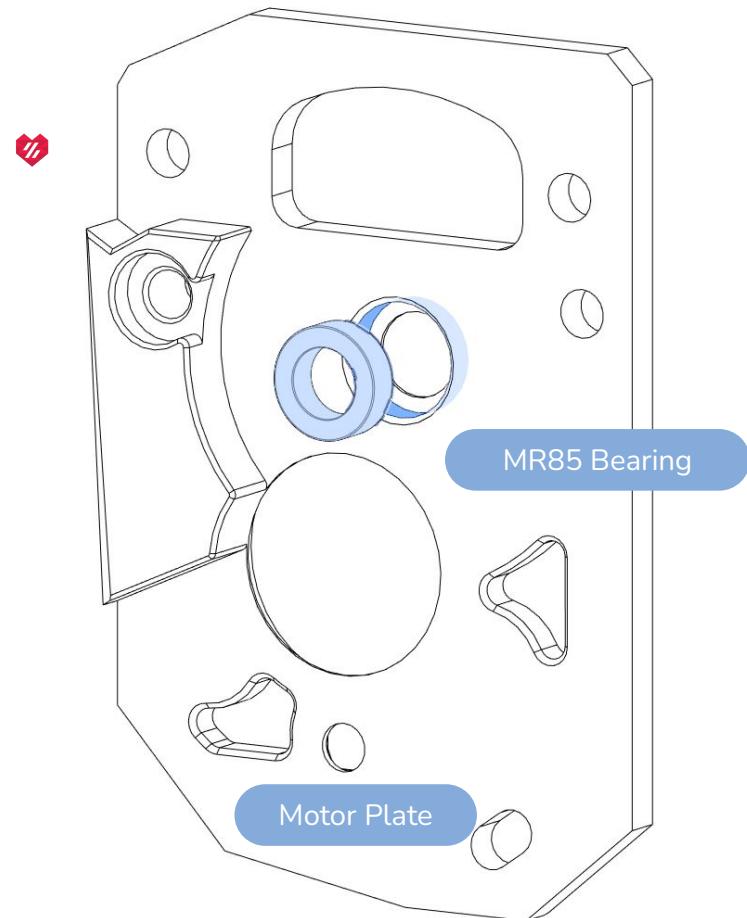
The bearings must slip on and off the shaft easily to allow the gear to self center. Do **not** shim into position.

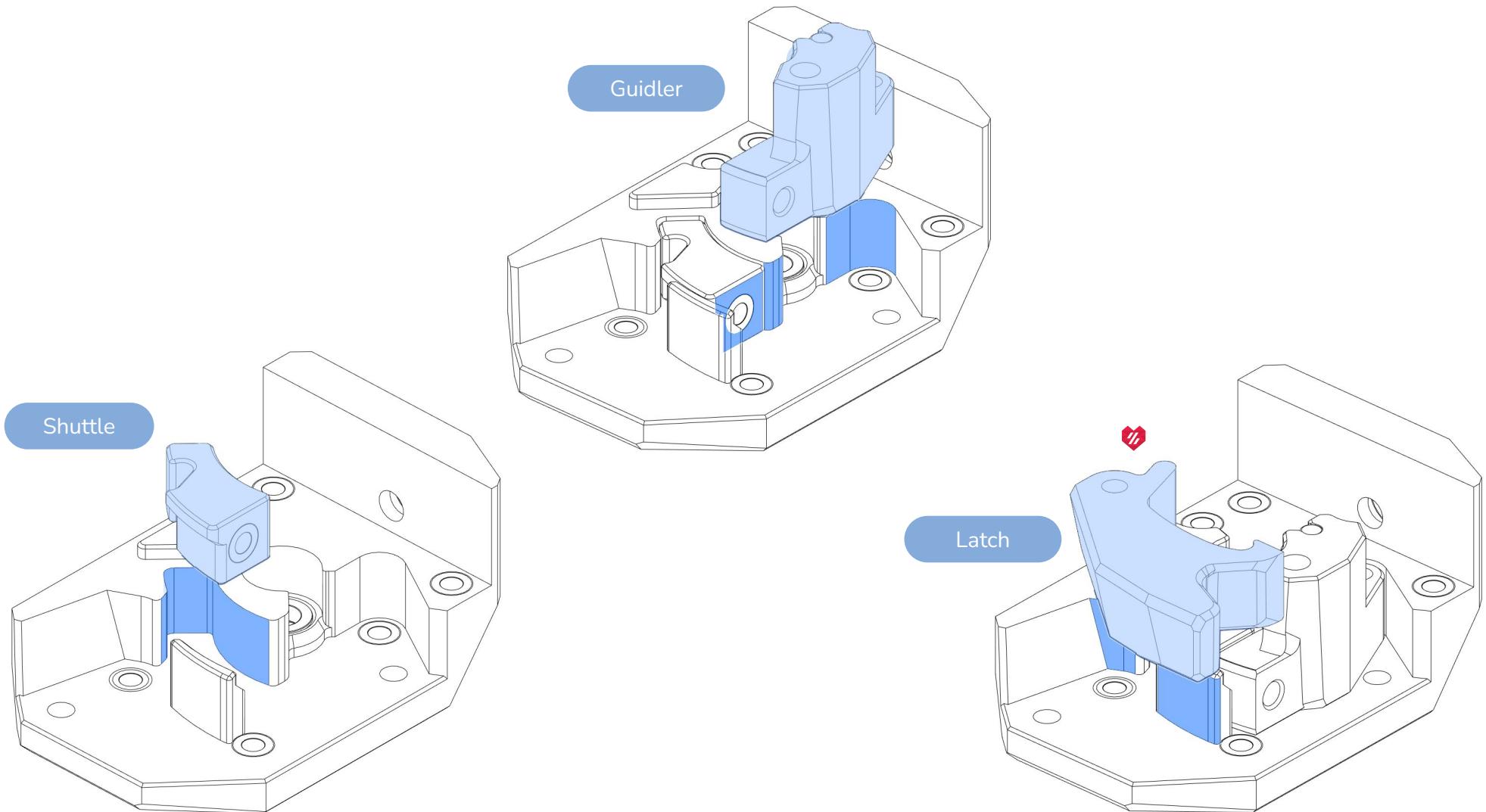
Pressing the bearings on the shaft will damage them.

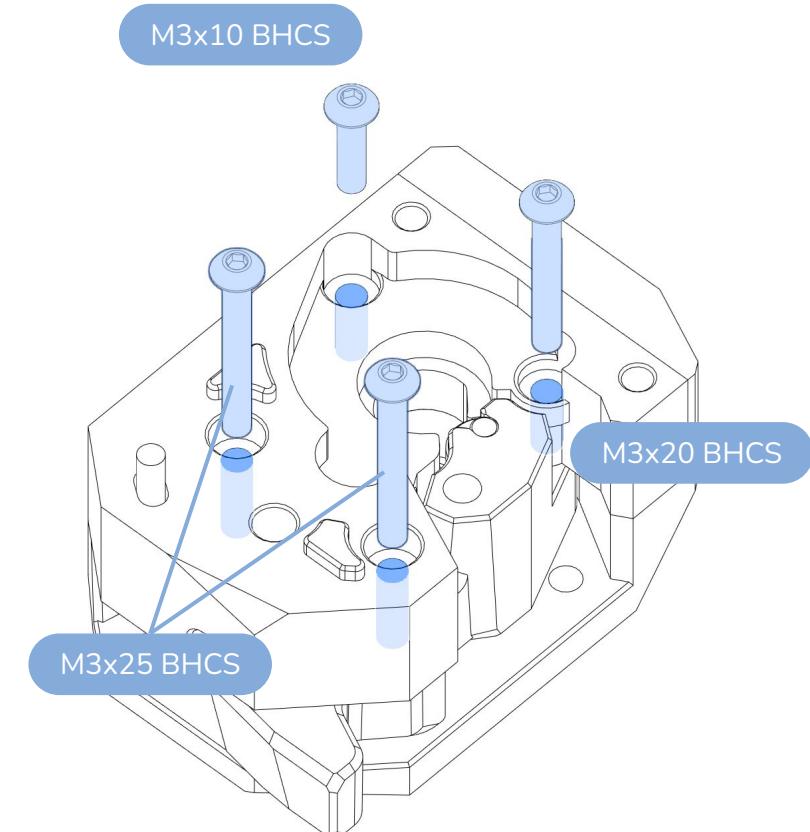
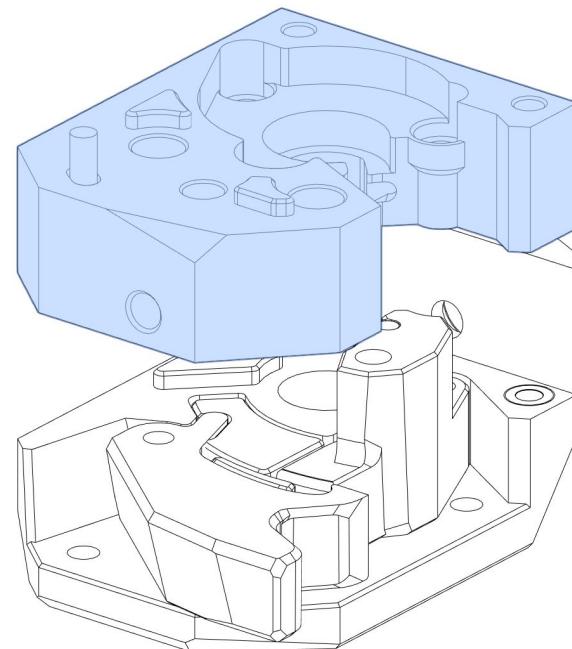
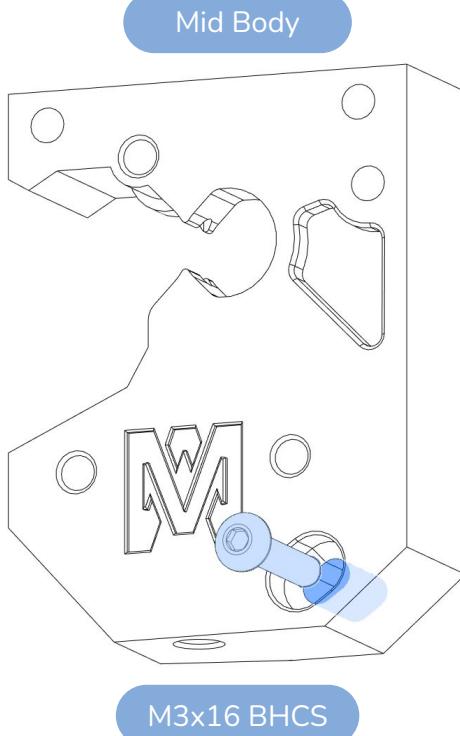
Lightly sand the shaft if required.

Remove the bearings from the shaft after checking the fit and continue with the assembly.



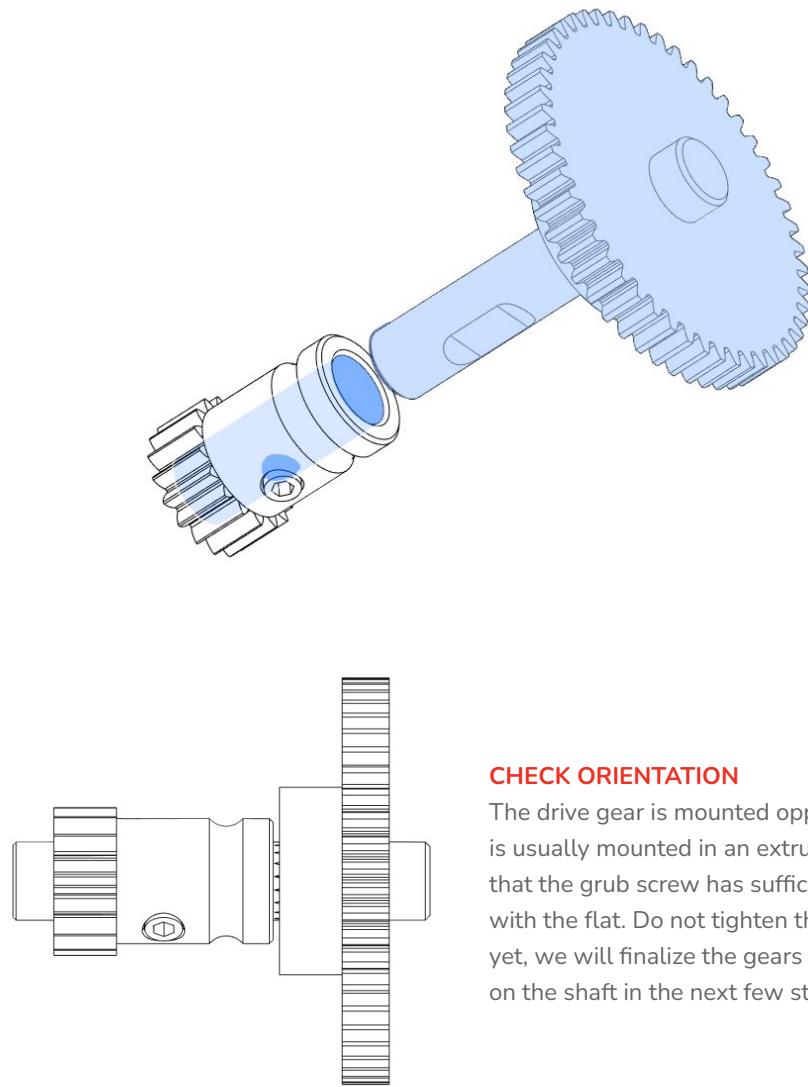




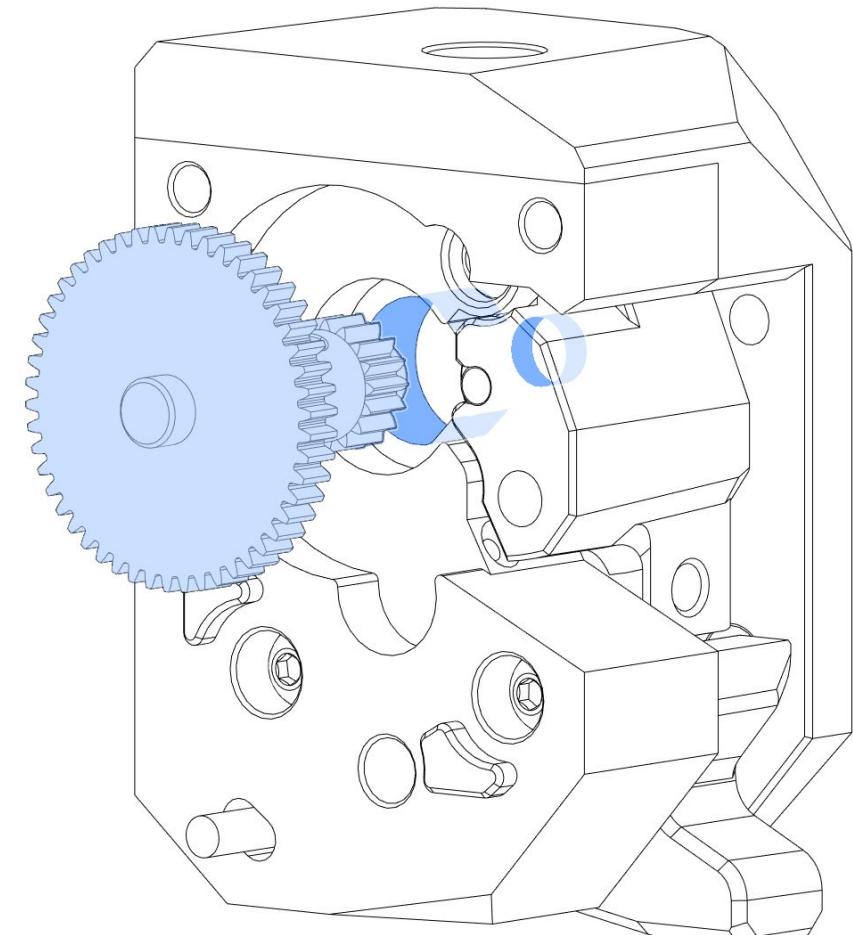


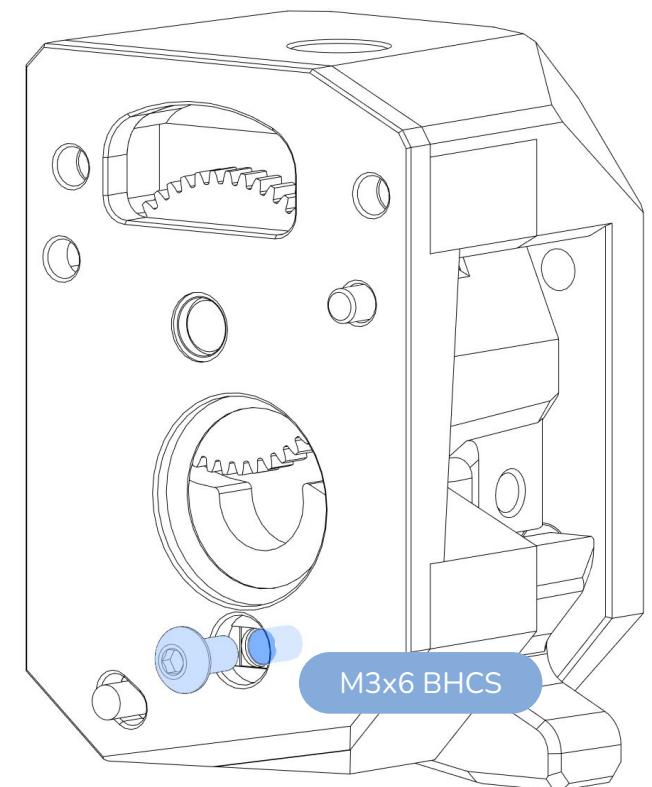
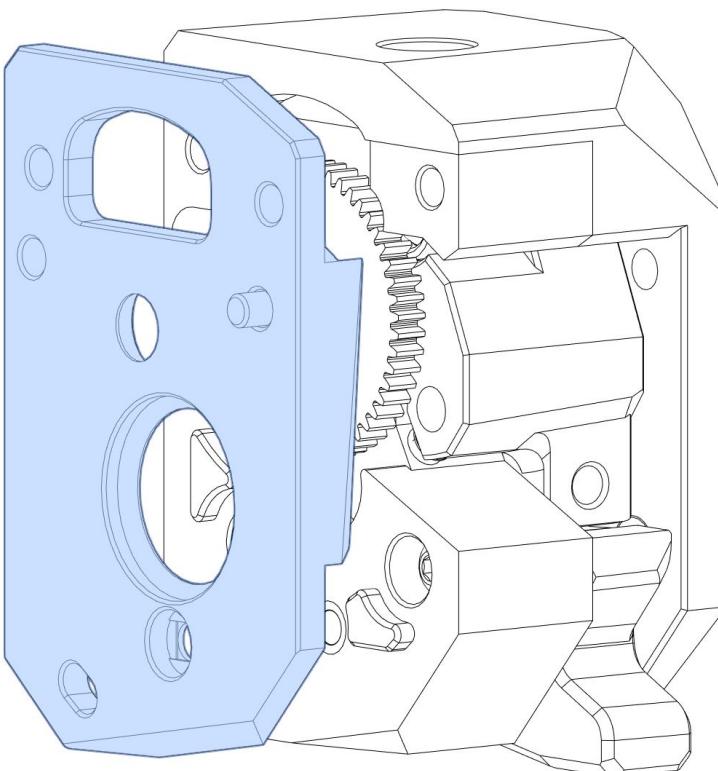
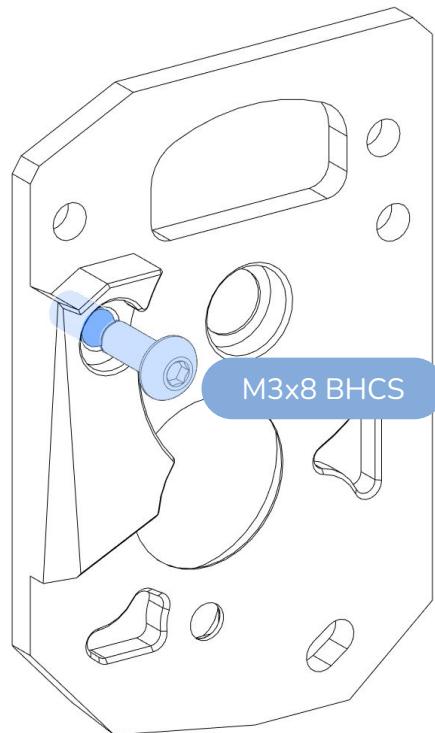
A FEW SCREWS LOOSE

Insert an M3x16 before continuing with assembly.
We'll use this later to mount and adjust the stepper
motor.

**CHECK ORIENTATION**

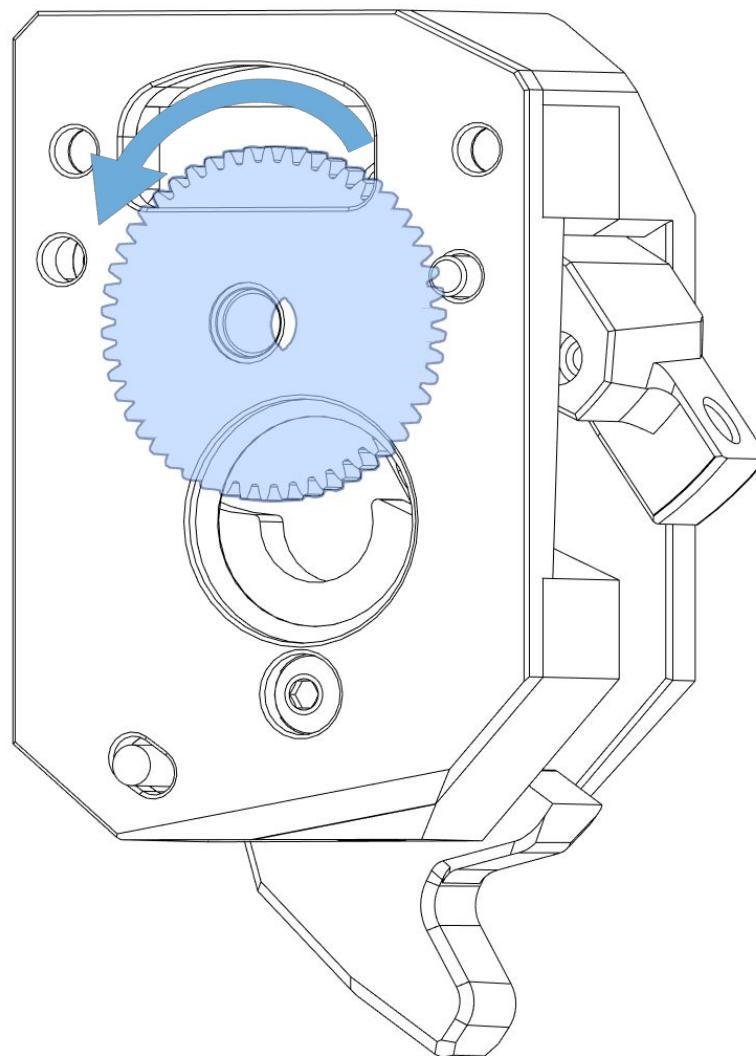
The drive gear is mounted opposite of how it is usually mounted in an extruder. Make sure that the grub screw has sufficient contact with the flat. Do not tighten the grub screw yet, we will finalize the gears exact position on the shaft in the next few steps.





A FEW SCREWS LOOSE (PART DEUX)

Insert an M3x8 into the Motor Plate before continuing with assembly. We'll use this later to mount the stepper motor.

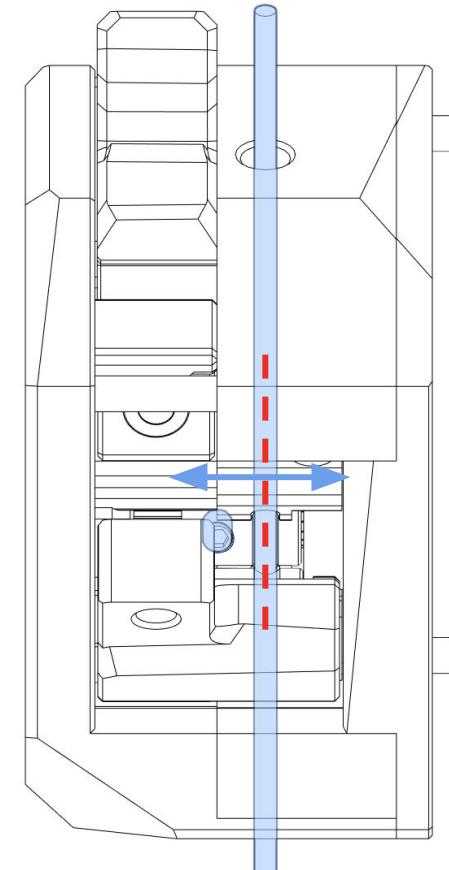
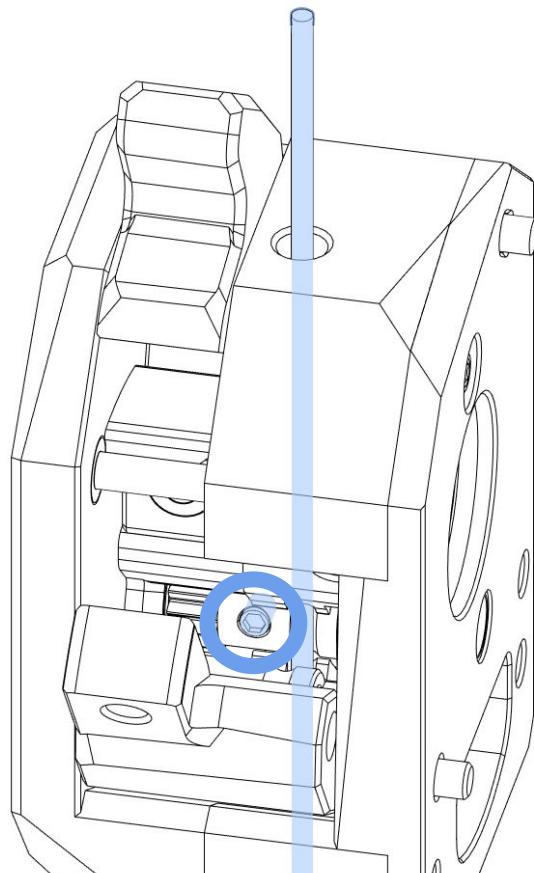


50T GEAR SPACING

For the next steps we need to ensure that the 50T gear is not rubbing on any of the plastic parts. Make sure your guidler door is open so that you can freely adjust the position of the 50T.

ALIGN THE DRIVE GEAR

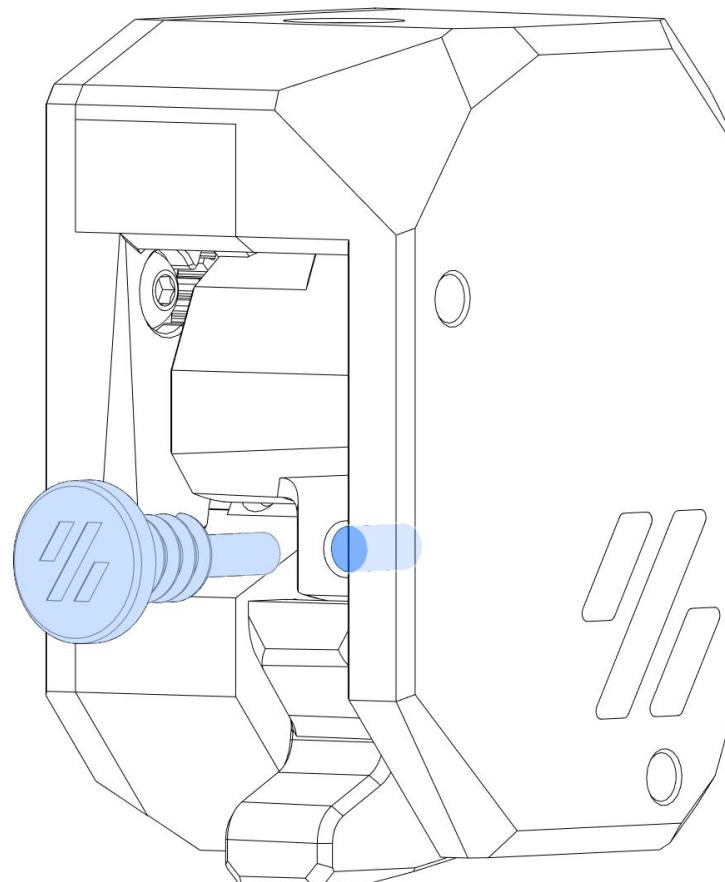
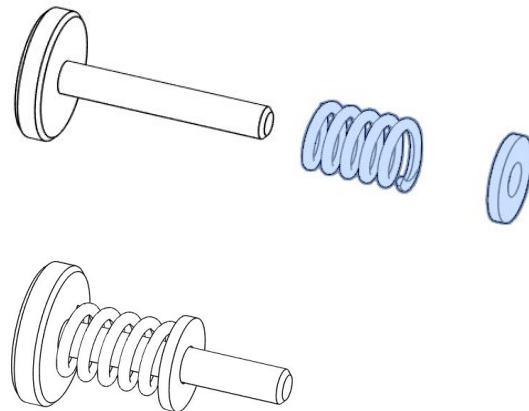
While the 50T gear is centered, open the guidler and loosen the grub screw on the BMG drive gear with a small allen key, then adjust its position left to right so that the filament path is aligned with the gear teeth. Hold the 50T in position while adjusting the drive gear so that it is still centered in its gap. Once happy, tighten the grub screw. Be sure to not rotate the 50T gear while doing this so that the flat section of the shaft is still under the grub screw location.

**USE A PIECE OF FILAMENT**

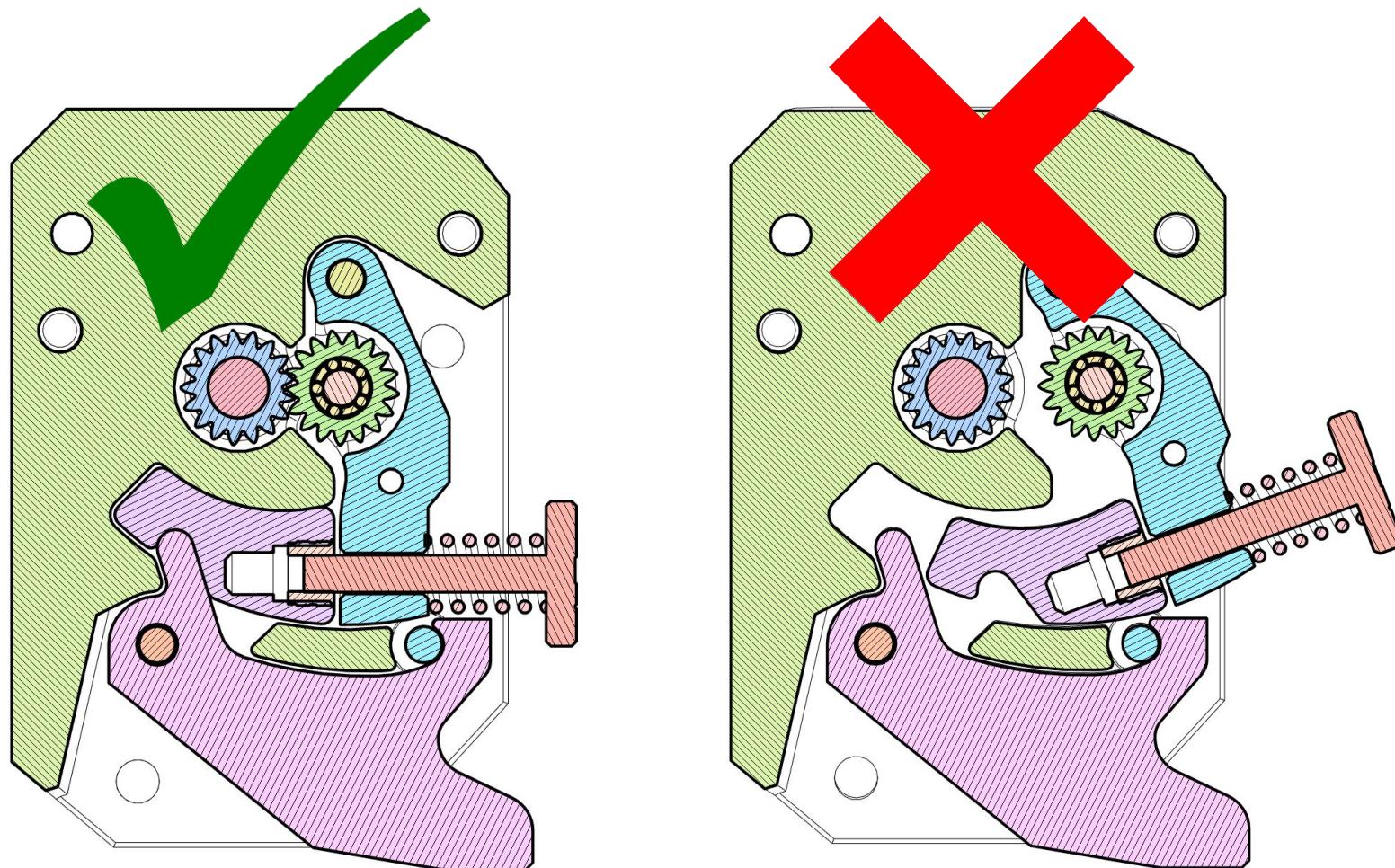
A piece of filament can be a handy guide to ensure the grooves in your drive gear align correctly with the filament path of the printed parts.

A NOTE ON SPRINGS

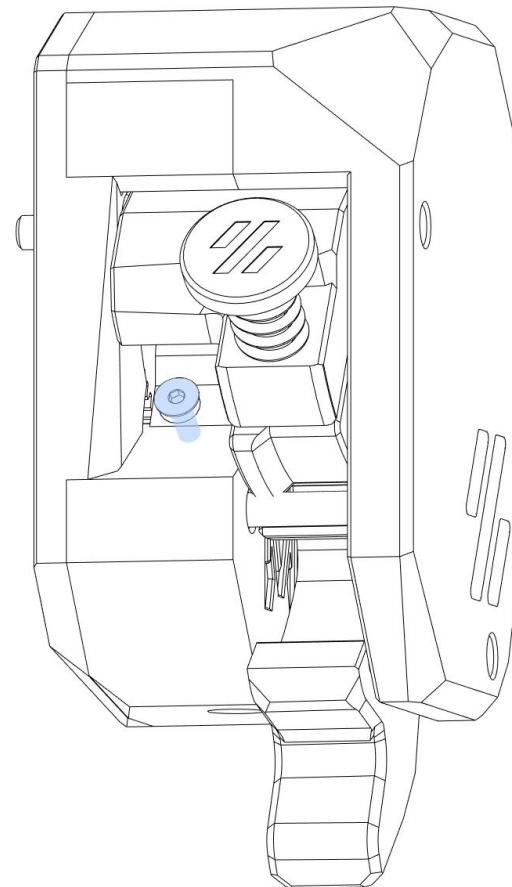
Longer/shorter/stiffer springs will change the tension characteristics and have an impact on how well the tension mechanism works. Consider buying the original Bondtech part as those are known to work well. If you sourced from a different vendor, check that it is roughly 12mm long with an outer diameter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

**TENSION KNOB**

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

**LATCH SHUTTLE**

The latch mechanism must seat into the groove of the shuttle piece. This is what allows the extruder to grip the filament effectively.

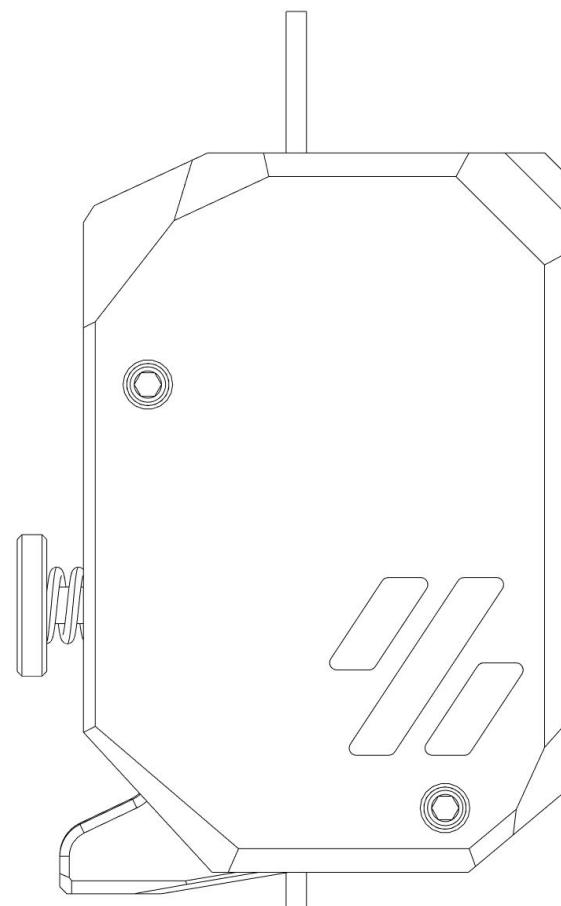


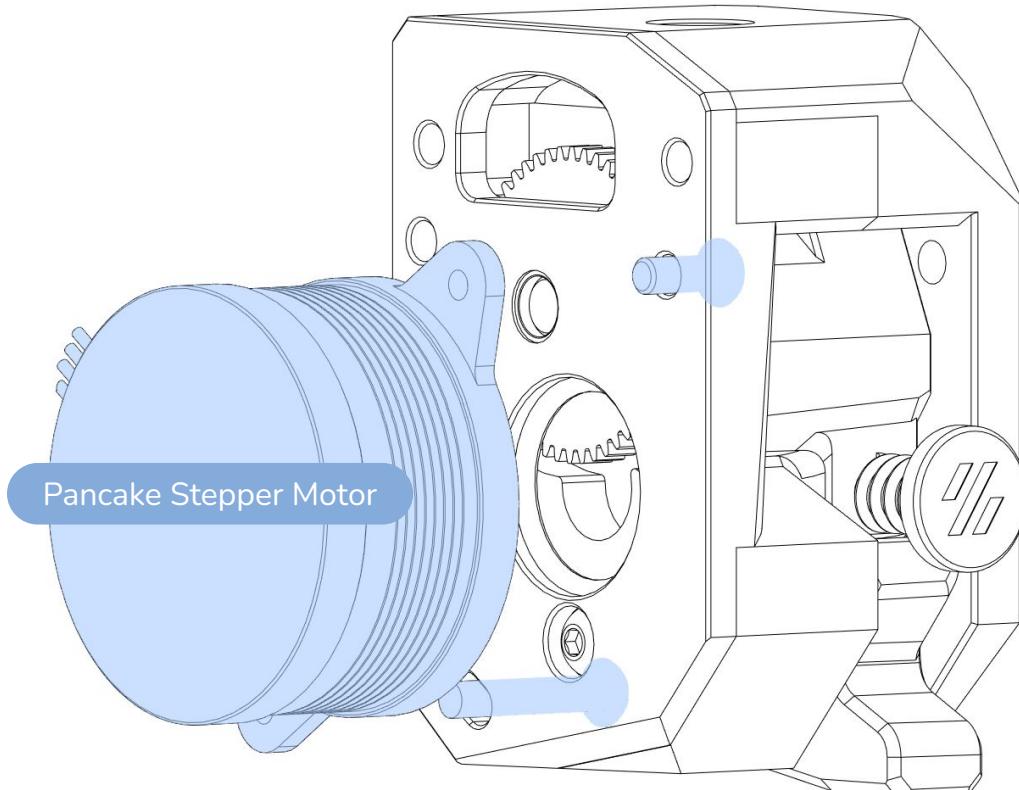
ANTI SQUISH THINGYMAJIG

Softer and flexible materials will deform and extrude poorly under too much tension. The Nightwatch adds an anti-squish thingymajig screw that sets the minimum distance between the drive gear and the idler. Backing this screw out increases this distance and tightening the screw in decreases this distance. Setting this minimum distance helps to prevent the gears from meshing too tightly or binding up in the extruder.

LIGHT TEETH MARKS

Close the latch and put a piece of filament through the extruder, then spin the 50T with your finger to test the feeding capability. You are looking for light teeth marks on the surface of the filament. We will repeat this step once more after the motor is installed.

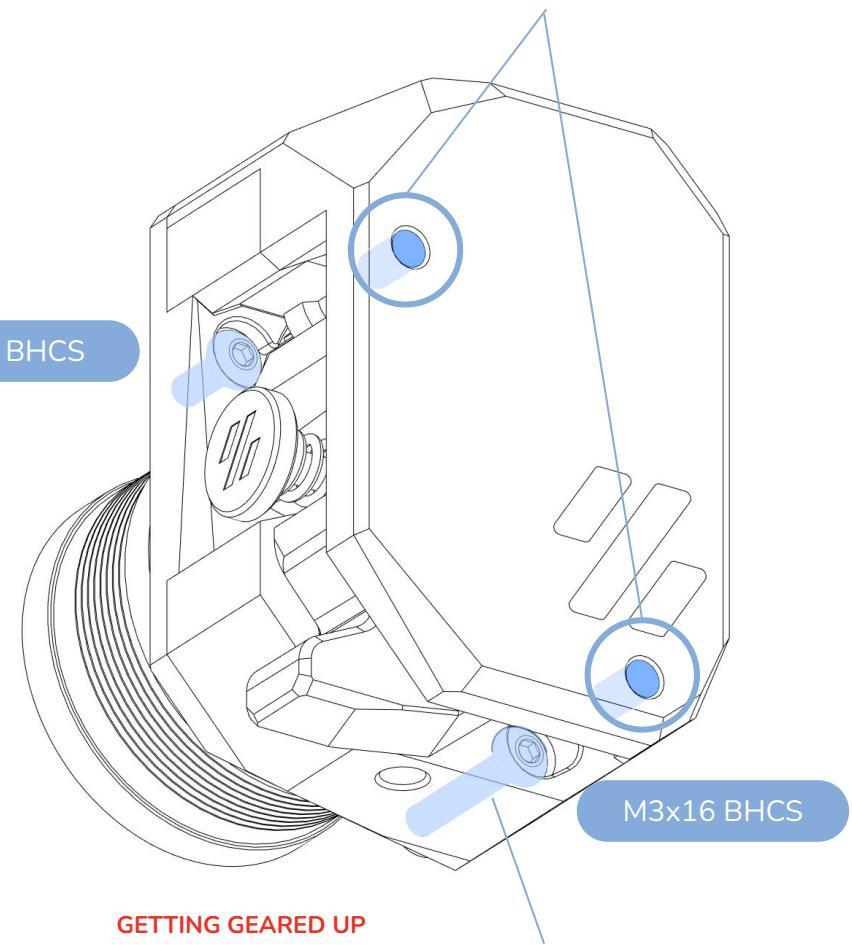




M3x8 BHCS

TOOL INSERTS

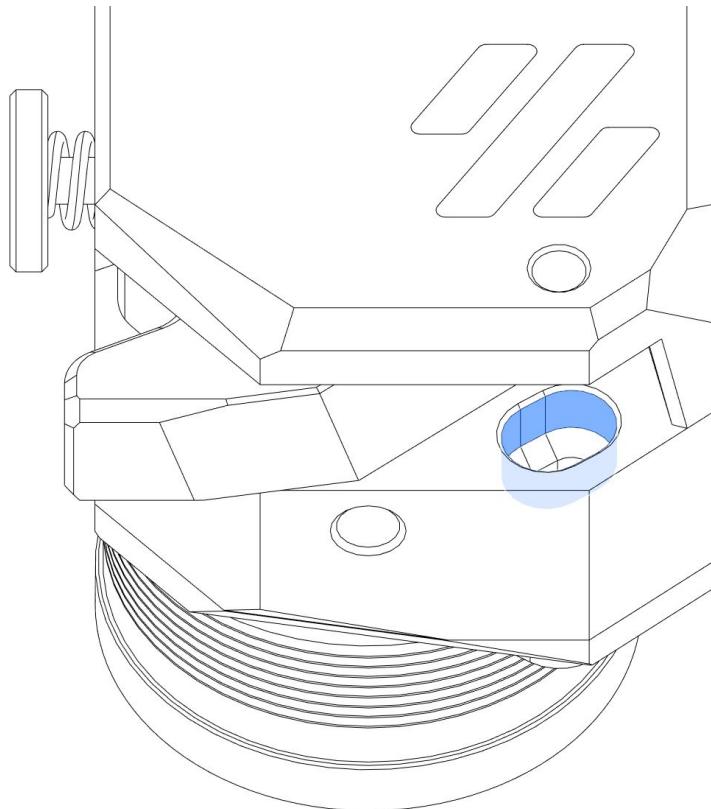
To access the screws that hold the stepper motor, insert your driver of choice into these holes.



M3x16 BHCS

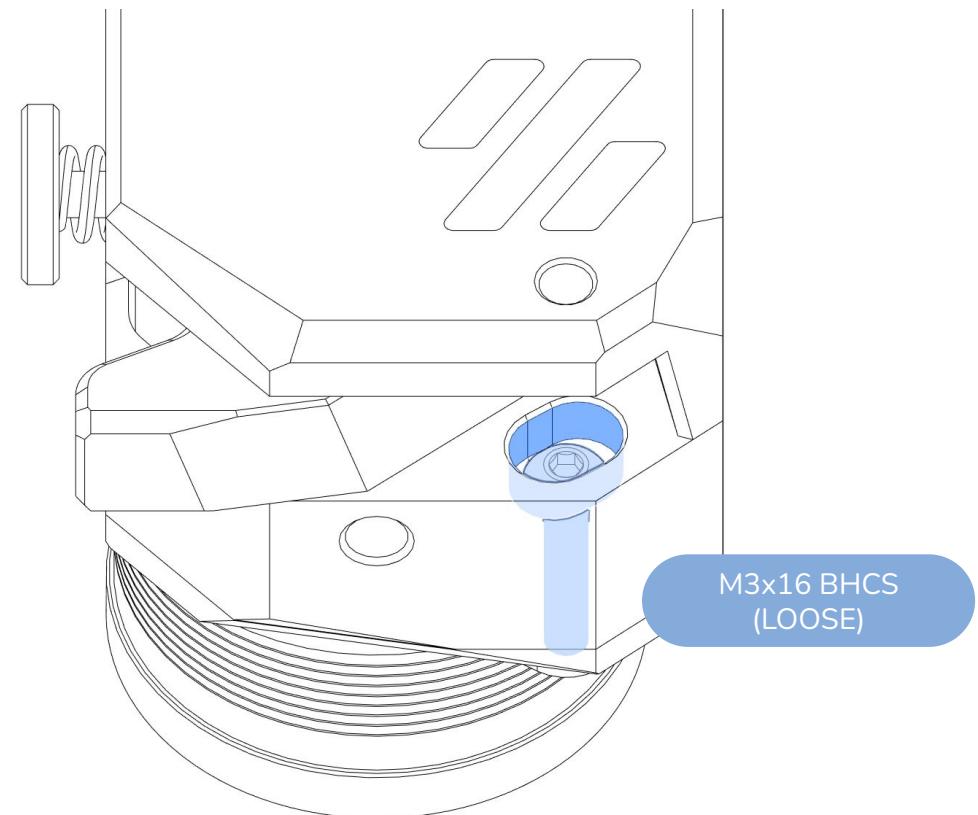
GETTING GEARED UP

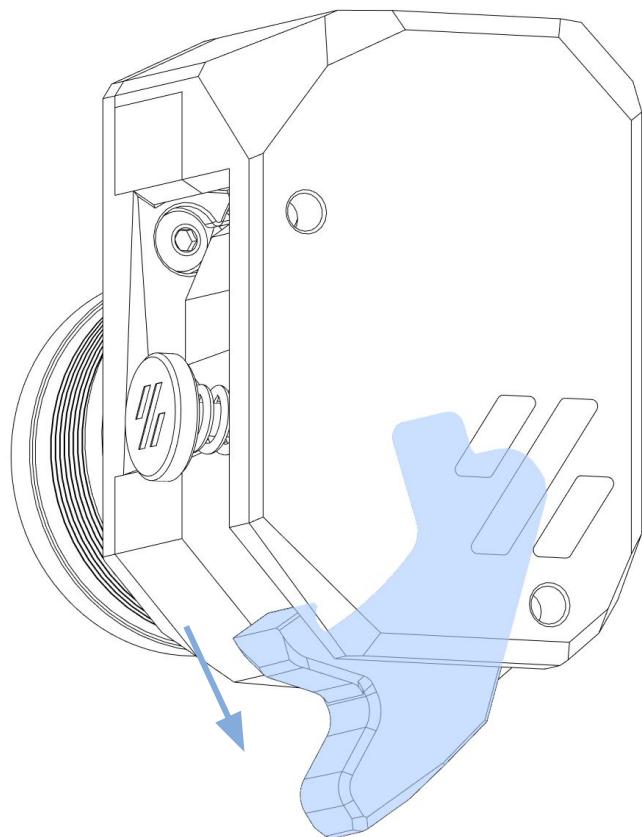
We are only slightly tightening this M3x16 for now. We will be setting the proper gear mesh before fully tightening the motor to the rear of the print head.

**DESIGN WITH INTENT**

The screw hole on the right of the motor plate is slotted to allow proper gear mesh adjustment. This is also called "backlash."

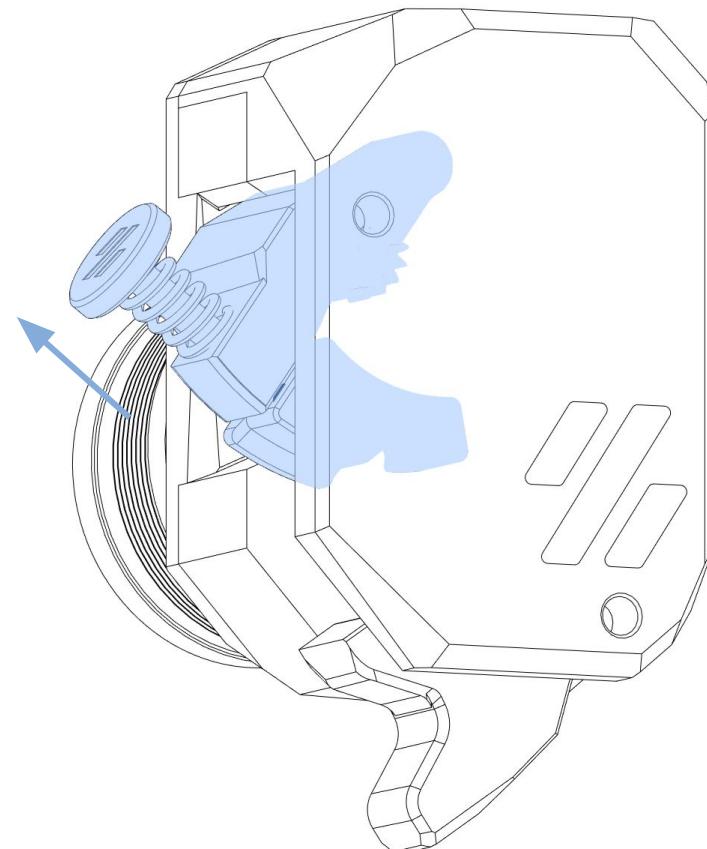
The M3x16 BHCS we are using here will need to be **loose** until proper backlash is found.

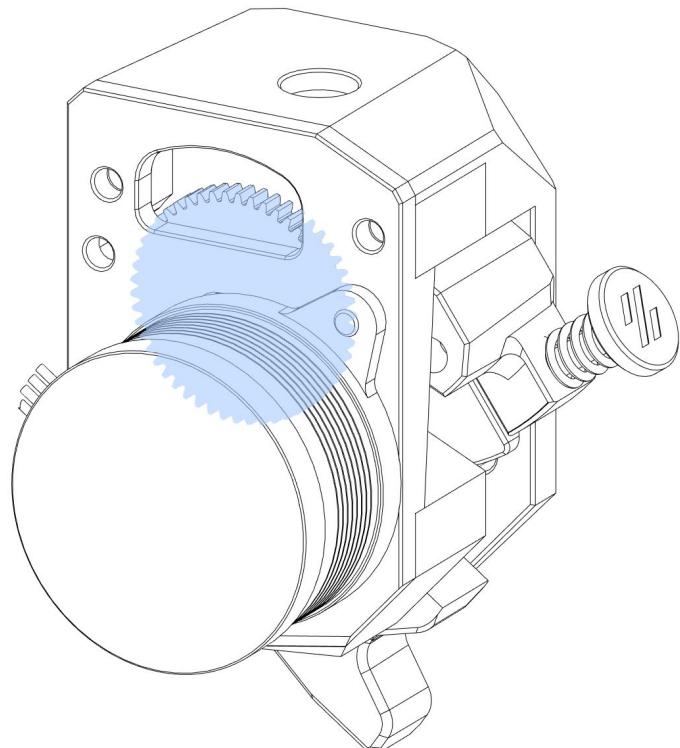


**BETTER GET YOUR BI-FOCALS**

Open up the extruder latch and drop the guidler down so you can freely rotate the 50T gear.

On the next page we will be setting the proper gear mesh between the motor 10T pinion and the BMG 50T gear. You will benefit from good lighting and some magnification, but it is not a requirement.





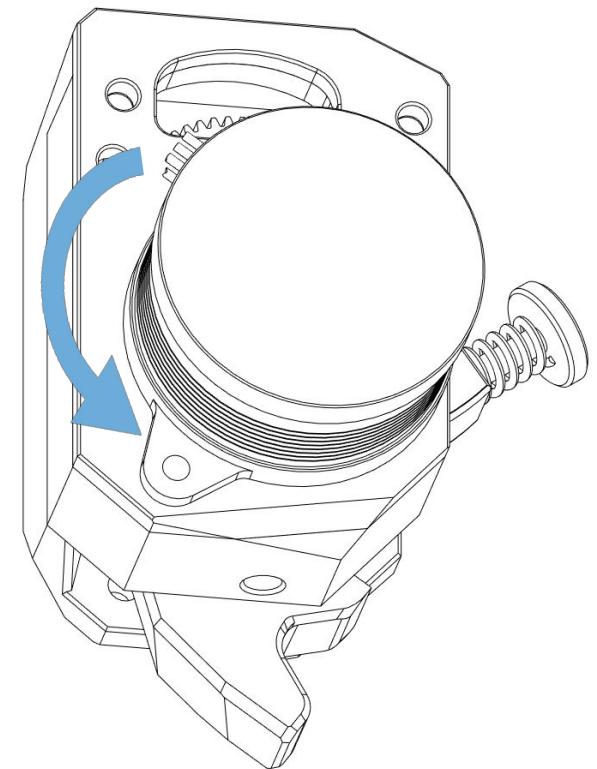
ADJUSTUSTING MOTOR BACKLASH

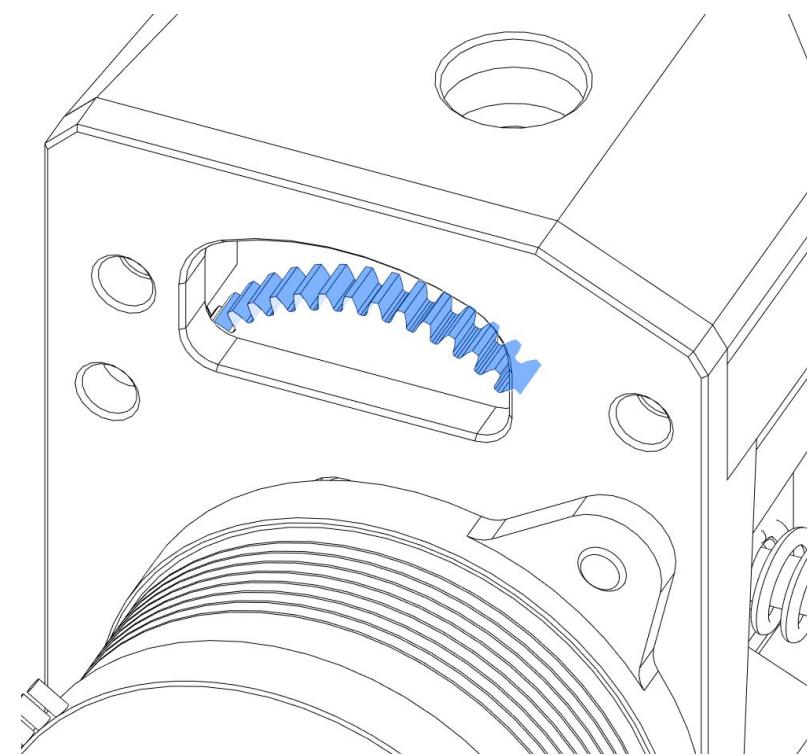
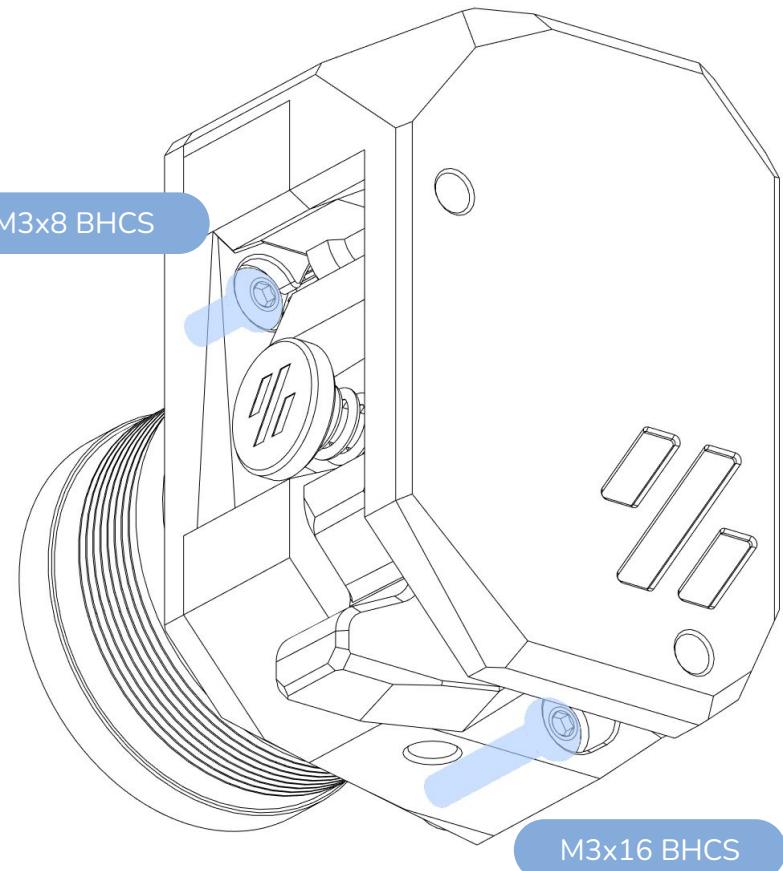
We need to adjust the amount of engagement between the motor pinion and the 50T gear.

With the latch and guidler open, hold the print head at an angle that allows you to easily see and move the 50T gear.

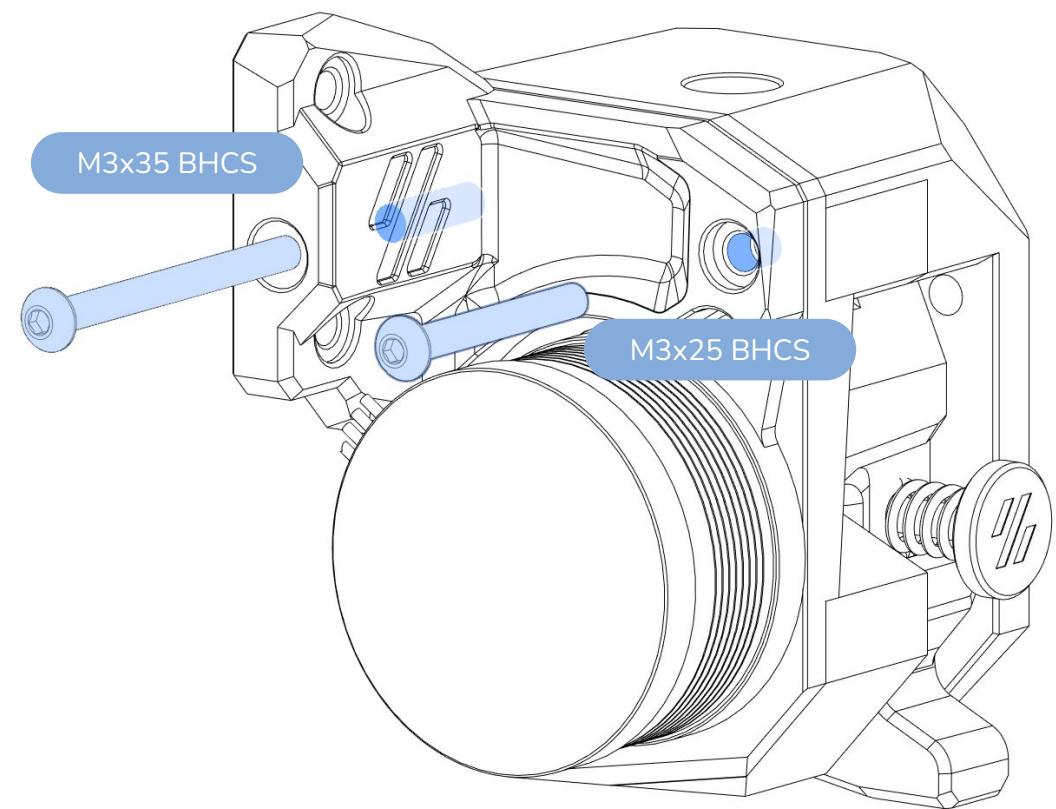
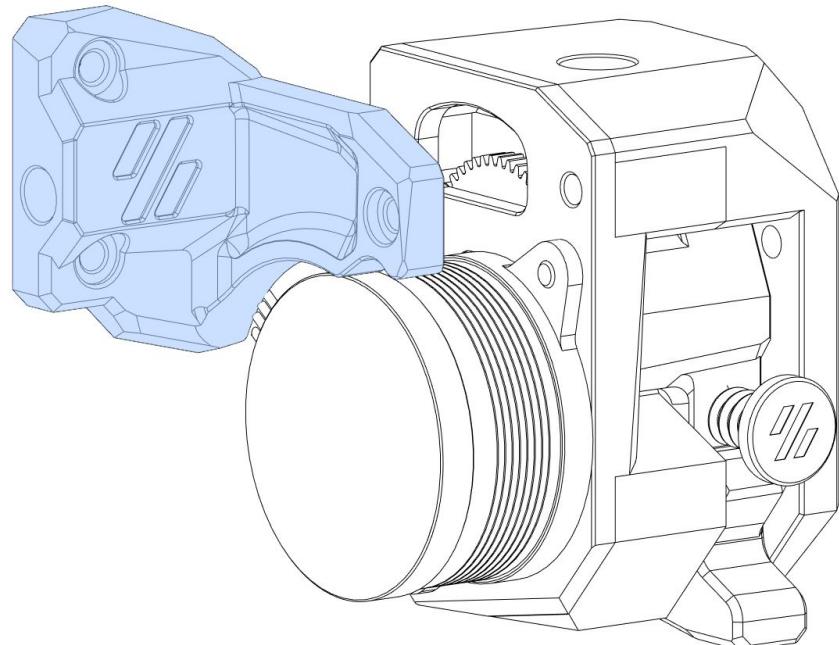
Use your finger to manipulate the 50T gear back and forth. As you do so rotate the motor down into the gear. As the two gears begin to mesh you will feel and see the play in the 50T gear become less and less. Once you have a very small amount of movement, your gear meshing is set.

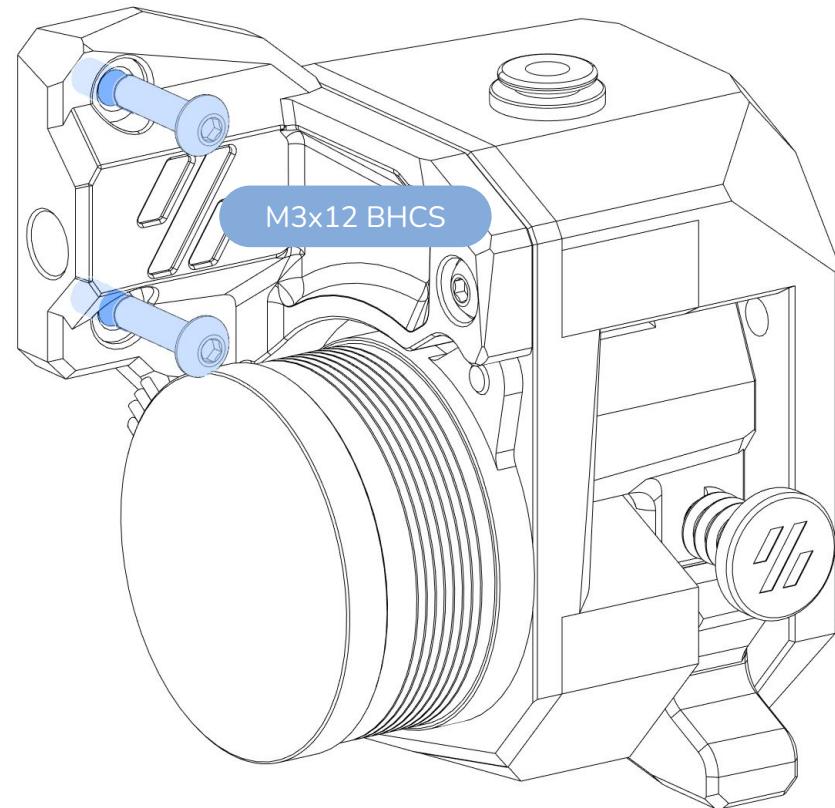
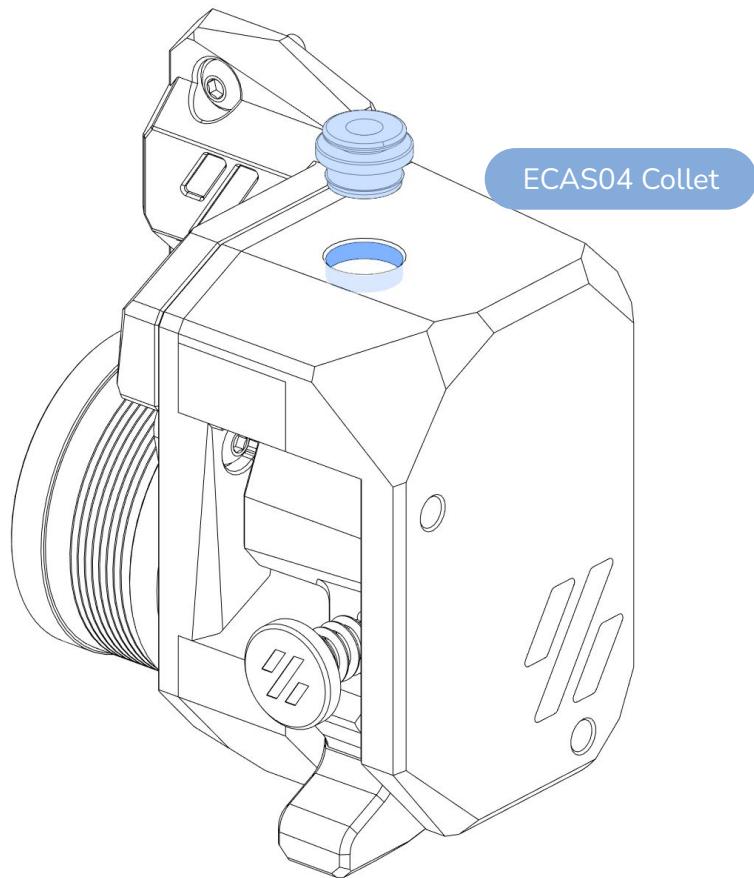
Once you feel good about the gear meshing you have, snug up the two screws in the next step, and make sure you still have some backlash after you have those screws tightened. Zero backlash will cause premature wear of the 50T gear.



**BETTER SAFE THAN SORRY**

After tightening down these 2 screws, be sure to re-check that you still have proper gear meshing and that you still get light teeth marks on the filament when it is fed through the extruder so there are no surprises when the time comes to push plastic.

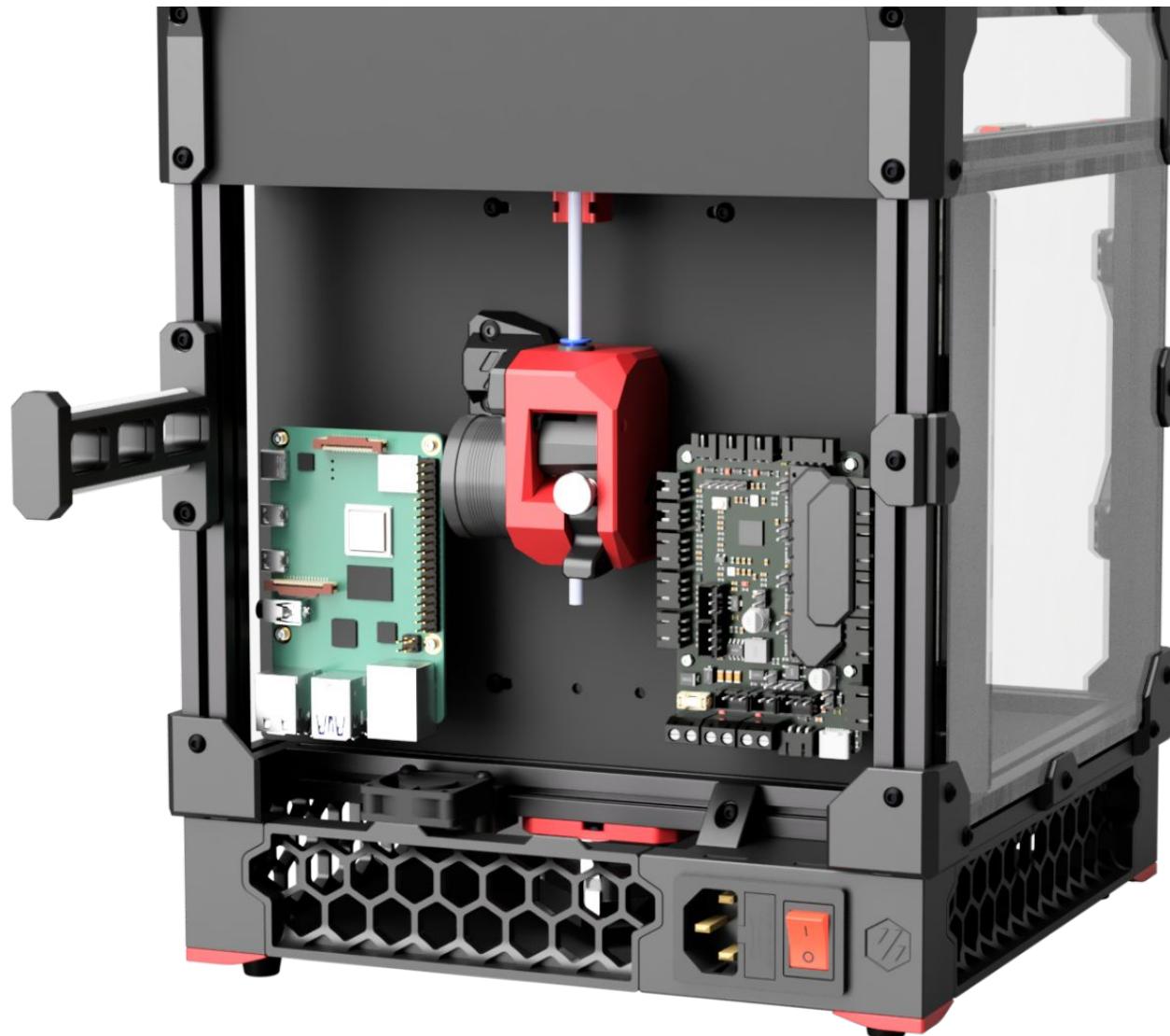


**ECAS04 COLLET**

Remove the lower rubber part
of the collet.

FINISHED

WWW.VORONDESIGN.COM



VORON



WEBSITE
www.vorondesign.com

GITHUB
<https://github.com/VoronDesign>

DISCORD
<https://discord.gg/voron>
