

## ERCF v2 BUILD GUIDE

COMMUNITY EDITION

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

---

VERSION 2023-11-21



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**

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## PART PRINTING GUIDELINES

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

### FDM MATERIAL

The ERCF was tested only with ABS, so I recommend to use ABS to build the ERCF.

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The ERCF was tested only with ABS, so I recommend to use ABS to build th

### 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

Beware that this project requires a well tuned printer and slicing profile, as there are many press fits and plastic on plastic mechanisms. You should first print the [ERCF\\_Calibration\\_Tool.stl](#), test the part, as shown in the manual, tune your printer and profile if needed, and then only print the rest of the parts.

## 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 [End\\_Bypass.stl](#)

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

### ACCENT COLOR

Example [\[a\]\\_End\\_Bypass\\_Foot.stl](#)

These files have an “[a]\_” prefix to denote that they should be printed with an **accent** color.

### QUANTITY REQUIRED

Example [Filament\\_Path\\_xN.stl](#)

Files ending with “\_x#” are telling you the **quantity** of that part required to build this system. For the ERCF, “N” means the number of channels.

### COLOR REQUIRED

Example  
[\[c\]\\_Cover\\_Lens\\_xN.stl](#)

These files have a “[c]”prefix to denote that they need to be printed in a **clear/transparent** material.

### COLOR REQUIRED

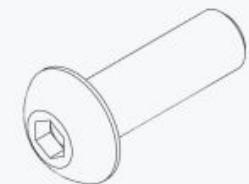
Example  
[\[o\]\\_Encoder\\_Slotted\\_Wheel.stl](#)

These files have an “[o]”prefix to denote that they need to be printed in an **opaque** material light can’t penetrate, preferably black.

### OPTIONAL MULTIMATERIAL

Example  
[\[mm\]\\_Voron\\_Logo\\_Plate.stl](#) †

These files have a “[mm]”prefix to denote that they should be printed in **multiple** colors. We always include single-color versions of these files too, for your first build.

**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 ERCF.

ISO 4762

**FLAT HEAD COUNTERSUNK SCREW (FHCS)**

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

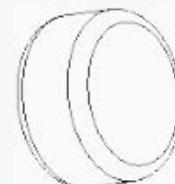
**SELF TAPPING SCREW**

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

**HEX NUT**

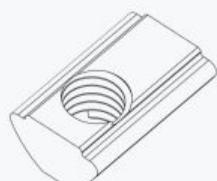
Hex nuts couple with bolts to create a tight, secure joint. You'll see these used in both M3 and M5 variants throughout this guide.

ISO 4032

**MAGNETS**

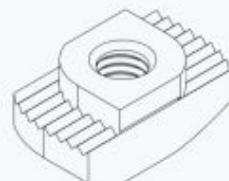
*How do they work?*

These are cylinders 6mm in diameter and 3 mm tall. Shorter ones are OK, down to 2.7 mm. N52 are preferred, but N35 can work.

**POST INSTALL T-SLOT NUT (T-NUT)**

Nut that can be inserted into the slot of an aluminium 2020 profile.

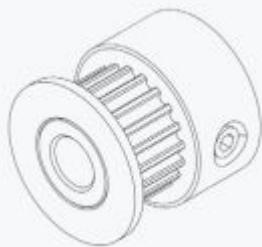
Often also called "roll-in t-nut."

**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.

**625 BEARING**

A ball bearing used on the Voron Z drives.

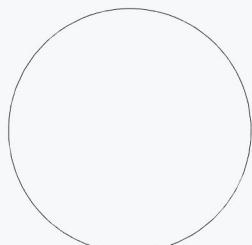
**PULLEY**

GT2 pulley used on 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

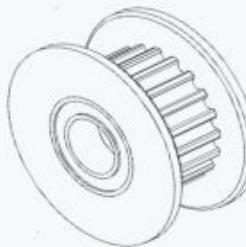
**5.5MM BALL BEARING**

A ball bearing used in the CottonTail Buffer.

**WASHER**

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

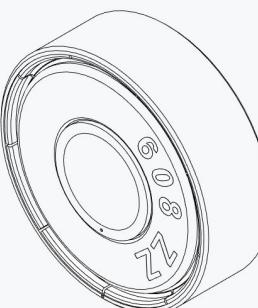
ISO 7380-1

**IDLER**

GT2 idler used in the motion system of the Voron.

**HEAT SET INSERT**

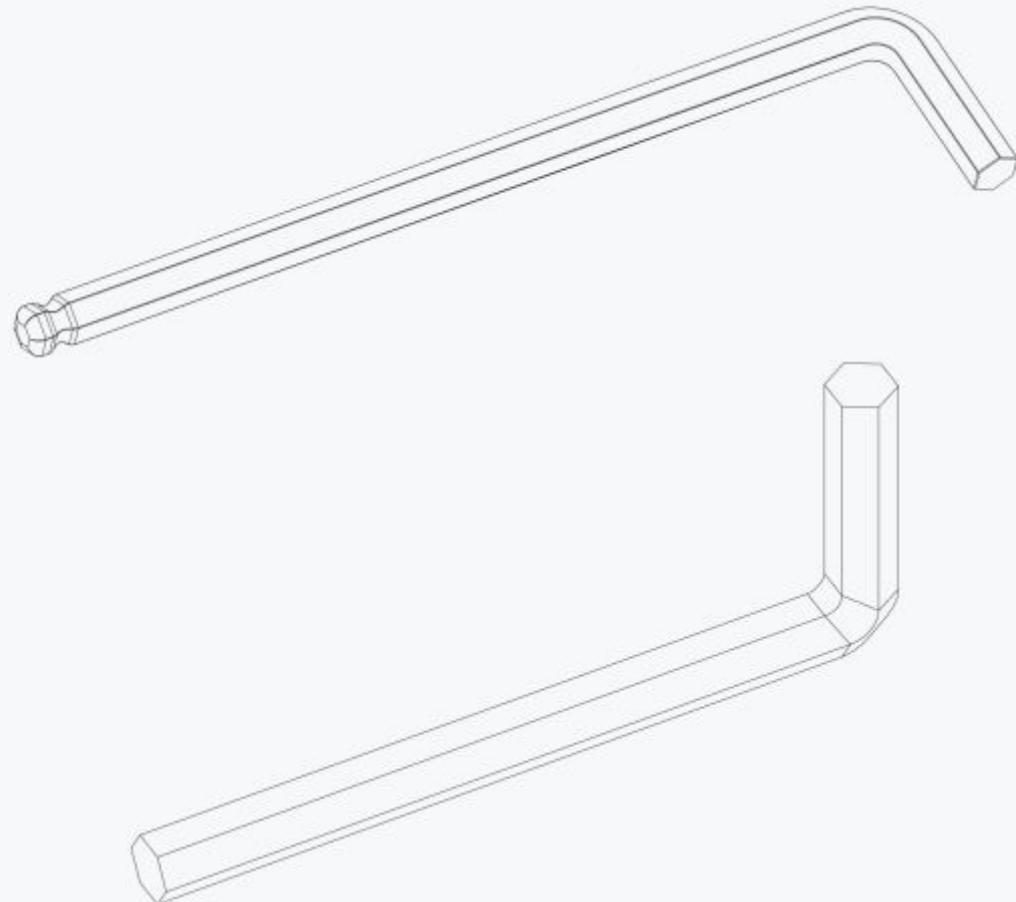
These are made of brass , threaded on the inside and has ridges on the outside. Heat them up to approx 250C with a soldering iron and push them into the plastic. As the plastic cools, it solidifies around the knurls and ridges on the insert for excellent resistance to both torque and pull-out.

**608 BEARING**

A ball bearing used on the ERCT Buffer (optional),

### 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](https://vorondesign.com/sourcing_guide) and switch to the “Voron Tools” tab at the bottom of the page.

### SOLDERING IRON

We use this for setting heat-set inserts into parts. Depending on your sensor choice, you might be soldering some wires together.

### ANGLE GRINDER/DREMEL

If you need to cut your 8mm smooth rods, nothing less than an angle grinder is going to cut it, literally. Leave your grandfather's trusty hacksaw in the toolbox: rods are usually hardened steel.

### VISE

A vise is handy if you have to cut your 8mm rods. A vise may also be helpful when press-fitting bearings into the Selector.

### WIRING CRIMPER

You'll need this to wire up the sensor. Or maybe there's a turnkey solution out there you can buy, check Discord. If you got this far without learning how to crimp, we don't judge.

### CAD SOFTWARE

[ERCF\\_v2/CAD/ERCF\\_V2.0.step](#)

Software is a tool too! The CAD file for the ERCFv2 was designed to be used along with this manual as a supplement or reference, even if you aren't a CAD Pro. You can use the free edition of Fusion360, or your choice of CAD program such as TinkerCAD or FreeCAD.

### SUPERGLUE

Yes, we consider this a tool. Superglue is useful as a plastic safe threadlock, and magnet glue. Cheap, single-use gel tubes are fine.

### PULLEY TOOLS

[ERCF\\_v2\Stls\Tools\Pulley\\_Tool\\_NEMA14.stl](#)

[ERCF\\_v2\Stls\Tools\Pulley\\_Tool\\_NEMA17.stl](#)

These take the guesswork out of setting your pulley heights. You will always need the NEMA17 version, but you only need the NEMA14 version if you're using the NEMA14 drive motor.

### 80T GEAR WHEEL GUIDE

[ERCF\\_v2\Stls\Tools\80T\\_Cog\\_Guide.stl](#)

This tool helps you align your printed 80T gear when you are assembling it.

### SLOTTED WHEEL PUSH TOOL

[ERCF\\_v2\Stls\Tools\Slotted\\_Wheel\\_Push\\_Tool.stl](#)

Helps you set the depth and align the Encoder slotted wheel without damaging it.

### FILAMENT BLOCK BEARING INSTALL TOOL

[ERCF\\_v2\Stls\Tools\Bearing\\_Install\\_Tool.stl](#)

This optional tool helps you install MR85ZZ bearings into the Filament Blocks without damaging the bearings.

### PRINTED PART TRACKER SPREADSHEET

There is a helpful interactive Printed Part Tracker for ERCFv2 here:

[insert link when live]

This project aims to bring multi material capabilities to 3D printers using a single Direct Drive toolhead. While this project is mainly designed to be used on VORON printers, it can also be used (or adapted) on any 3D printer that runs Klipper.

Find all the project information on the Github page : [https://github.com/Enraged-Rabbit-Community/ERCF\\_v2](https://github.com/Enraged-Rabbit-Community/ERCF_v2)

The project is composed of 5 different components, some of which are optional:

- **Enraged Rabbit Carrot Feeder (ERCF).** The Carrot Feeder is the main unit and allows use of a high number of different filaments (tested up to 14 tools but test team) and feed them, one at a time, into the printer toolhead on an as-needed basis.
- **Enraged Rabbit Cottontail (ERCT)** is a new integrated (but optional) filament buffer system to handle the filament when it is ejected from ERCF on a tool change. It can handle up to 1.5m bowden tube lengths. This has been specifically designed to minimize friction when setup in accordance with this manual which takes into account the natural filament memory. It has options for LED gate indicators and entry sensors.
- **Enraged Rabbit Filametrix (ERF):** This filament cutter is an optional toolhead modification to cleanly cut the tip of the ejected filament, so it can be loaded easily on next use. This option alleviates the frustrating job of tuning tip formation through movement of the filament within the extruder, which often still results in strings of filament causing clogs.
- **Toolhead Sensor:** This is a set of modifications for popular extruders that provides filament detection capability within the toolhead. Although optional, it is highly recommended, and makes filament change far more reliable and smooth.
- **Happy Hare Firmware:** This has become the go-to extension to Klipper for controlling various types of MMU. It is optimized to support ERCF.
- (Future) **Enraged Rabbit Pellet Purge (ERPP):** Envisioned, but currently unavailable, this will alleviate the need for a purge tower meaning more room for your prints. Stay tuned.

This is the place to recognize the origins and evolution of this project. ERCF was originally envisioned and created by Ette and the v1.1 release credits Tircown, the Voron Dev team (special mention to Dunar), Benoit, Dustin Speed, Kageurufu and the HonHonHonBaguette people!

Over time and significant adoption the shortcomings of ERCF v1.1 design came to light, and that inspired a set of modifications to address them: SturdyBunny, TripleDecky, Springy, Binky and other strange names appeared. It was then that Moggieuk, the author of Happy Hare, rounded up these project authors and created the beginnings of the ERCF v2 community release. As the project developed, Kinematicdigit developed and contributed CottonTail, Sorted developed and contributed Filametrix and we were joined by some awesome talent that polished, tested and documented to complete the project.

Many hundreds of hours of volunteer effort have gone into this project and we hope it pays tribute to Ette's wonderful original design. **The BMW of MMU's!**

- @moggieuk V0.1503 | V2.4088 (Happy Hare Dev & Chief whip)
- @gneu V2.5345 (Filament block and bling innovator)
- @sneakytreesnake V2.3804 (The project backbone!)
- @mneuhau5 VT.483 (Binky Dev)
- @Miriax (Designer & Doc Demon)
- @kinematicdigit (Cottontail Dev & Doc Illustrator)
- @ningpj (Tester, Breaker & Doc's)
- @fizzy (King of CAD)
- @gsx8299 (Test Builder Extraordinaire)
- @sorted (Filametrix "don't get enraged" filament cutting system Dev)
- @kieranthe man (Thumper Dev)



If you need assistance with your build you can head over the VORON Discord group and post your questions in the ercf\_questions channel. It is the primary medium to help people with their ERCF build and tuning! You can also check the Github page for the latest releases.

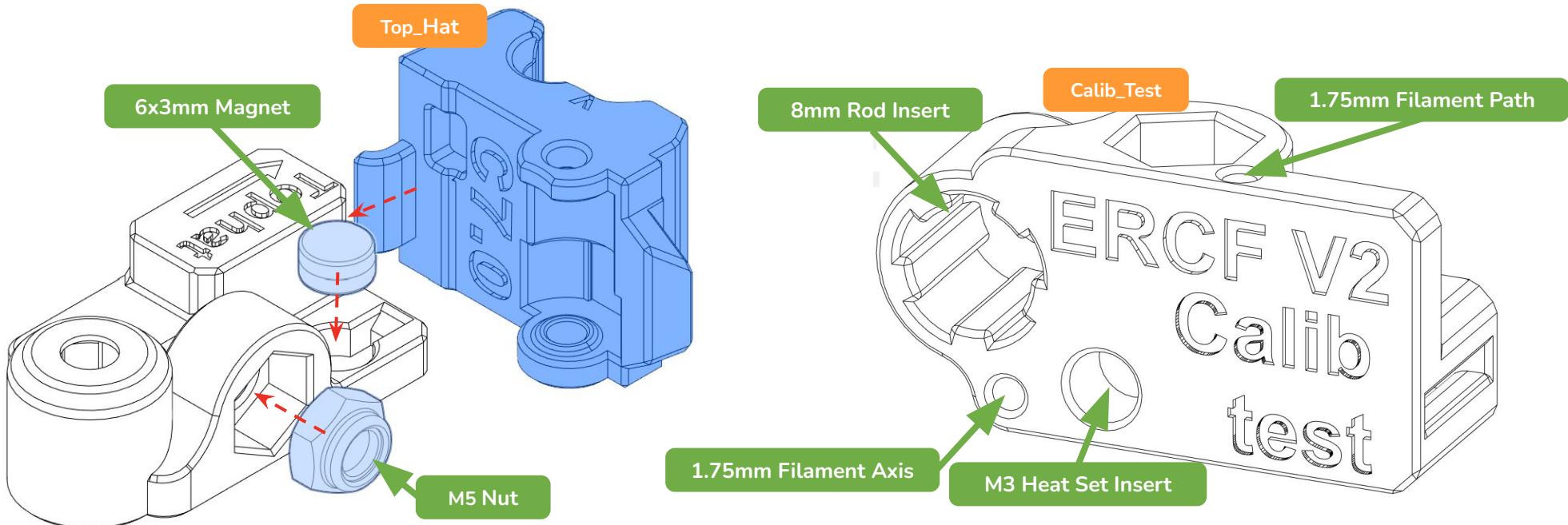
 <b>DISCORD</b>	<a href="https://discord.com/channels/460117602945990666/909743915475816458"><u>https://discord.com/channels/460117602945990666/909743915475816458</u></a>
<b>GitHub</b>	<a href="https://github.com/Enraged-Rabbit-Community/ERCF_v2"><u>https://github.com/Enraged-Rabbit-Community/ERCF_v2</u></a>

Constructing and operating a multi-filament system can be a challenging endeavor, often more intricate than assembling the 3D printer itself. Approach this task patiently, addressing each issue methodically. Be aware that minor complications during assembly can accumulate, potentially leading to greater challenges later. If you encounter any uncertainties or roadblocks, feel free to seek guidance on Discord - remember, there are no foolish questions!

You might have heard about the frequent challenges associated with multi-filament systems. Indeed, they can be demanding. However, the Enraged Rabbit Project aims to provide a system that is not only innovative and reliable but also user-friendly. Despite these efforts, encountering some difficulties is not uncommon. In such instances, consult the available documentation and guides, and don't hesitate to ask for help on Discord. Many common issues have likely been encountered and resolved before, so assistance is readily available.

Enjoy the process of building as much as utilizing your Enraged Rabbit Carrot Feeder (ERCF)!

Use this test to ensure your printer and slicing profile are properly tuned, in order to have a pleasant ERCF assembly experience.



## TESTS

Insert the different pieces of hardware in their dedicated slots: 6x3mm magnet, M5 nut, and 8mm rod. They should grip the hardware so that they don't fall out easily, but they should not be very difficult to insert or remove. Test the heat set insert hole using a soldering iron and insert.

Use the Filament Path to check that 1.75mm filament slides through without friction. The Filament Axis should have some light friction.

To check the Top Hat, insert the arm of a Top Hat into the slot. It should insert without much force. Once inserted, the Top Hat should be able to move up and down easily. To remove the Top Hat, pull it up while rotating it.

This design relies heavily on heat set inserts. If you've never worked with heat set inserts before, watch this guide :

<https://www.youtube.com/watch?v=cyof7fYFcuQ>

Here is a list of all the pages of this manual where you need to insert those in the 3D printed parts, so you can do this step at once for the whole assembly :

- [Page 24](#)
- [Page 29](#)
- [Page 38](#)
- [Page 81](#)
- [Page 82](#)
- [Page 83](#)
- [Page 92](#)
- [Page 103](#)

Optionally, for the ERCT / CottonTail Buffer:

- [Page 130](#)
- [Page 133](#)
- [Page 137](#)

We have provided the ERCFv2 CAD files ([ERCFv2/CAD/ERCFv2.STEP](#) and [ERCFv2.F3D](#)), so that you can follow along with the instructions in a 3D view, if you like.

The CAD file is organized into folders based on the instructions in this manual. First hide all the parts, and then reveal the parts up to the step you are on in this manual, and the CAD should match what you are building.

All of the non-printed parts are in each section's Fasteners folder.

If you are upgrading from ERCFv1 or v1.1, you can re-use some of the printed parts. These parts will have a dagger † every time we mention the file name, in case you want to re-use those parts. Here is a list:

**ERCF\_v2 / STLs / Gear\_Box**

[a]\_Bearing\_Spacer\_x2.stl †  
[a]\_Knob.stl †  
[a]\_Logo\_Plate.stl †  
[a]\_M4\_80T\_Wheel.stl †  
[a]\_Side\_Latch\_x2.stl †  
[mm]\_Voron\_Logo\_Plate.stl †  
Motor\_Arm\_NEMA14.stl †  
Motor\_Arm\_NEMA14\_EASYBRD.stl †  
Motor\_Arm\_NEMA17.stl †  
Motor\_Arm\_NEMA17\_EASYBRD.stl †

**ERCF\_v2 / STLs / Linear\_Axis**

[a]\_Drag\_Chain\_Anchor\_Bottom.stl †  
[a]\_Motor\_Lock.stl †

**ERCF\_v2 / STLs / Selector**

Belt\_Tensioner.stl †  
Drag\_Chain\_Anchor.stl †

**ERCF\_v2 / STLs / Supports / Adjustable\_Mount**

[a]\_Screw\_x3.stl †  
Junction\_Plate\_Flat\_x2.stl †  
Junction\_Plate\_Gear\_Box.stl †

**ERCF\_v2 / STLs / Supports / Adjustable\_Mount / 2020**

2020\_Mount.stl †  
2020\_Mount\_Mirrored.stl †

**ERCF\_v2 / STLs / Supports / Adjustable\_Mount / 3030\_(SW\_with\_panels)**

3030\_Flat\_Mount.stl †  
3030\_Flat\_Mount\_Mirrored.stl †

**ERCF\_v2 / STLs / Supports / Adjustable\_Mount / 3030\_(SW\_without\_panels)**

3030\_Mount.stl †  
3030\_Mount\_Mirrored.stl †

**ERCF\_v2 / STLs / Supports / Adjustable\_Mount / Option**

ERCF\_Easy\_Brd\_Bracket\_Mount.stl †

**ERCF\_v2 / STLs / Supports / V1\_V2**

[a]\_Support\_Feet\_4mm\_x4.stl †  
[a]\_Support\_Feet\_5mm\_x4.stl †

**ERCF\_v2 / STLs / Tools**

Pulley\_Tool\_NEMA14.stl †  
Pulley\_Tool\_NEMA17.stl †

### LOCAL MCU VS REMOTE MCU

When we say “local MCU” we mean a “buddy board” or other dedicated MCU that will be mounted near the ERCF. Examples include the BTT MMB (preferred and shown in this manual) and the EASY BRD. Skip to page 20 if you’re using a local MCU.

When we say “remote MCU” we mean the dedicated MCU(s) for your printer. It is unusual to have enough spare motor, servo, and endstop ports to run an ERCF unless you’re using a dual SKR board setup, but if that’s you, then you can save some money on the buddy board by using this option.

### PREPARING THE WIRES

For an ease of installation, it is recommended to prepare the wiring before assembly.

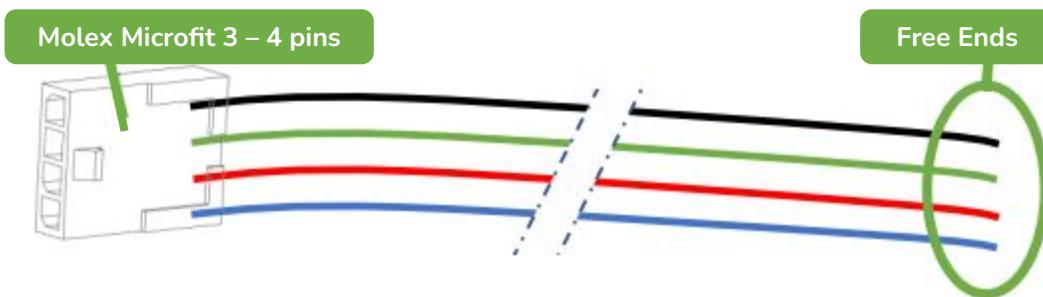
There are two wire looms to do:

- One that goes from the connector plate to the selector motor
- One that goes from the connector plate to all the other components, namely the endstop, the servo and the encoder

Channels	Selector Motor Wire Length (mm)
N	175 + 25N
4	275
5	300
6	325
7	350
8	375
9	400
10	425
11	450
12	475
13	500
14	525
15	550

### SELECTOR MOTOR WIRE

Prepare the 4 wire selector motor cable as shown. Don’t crimp the free ends for now.



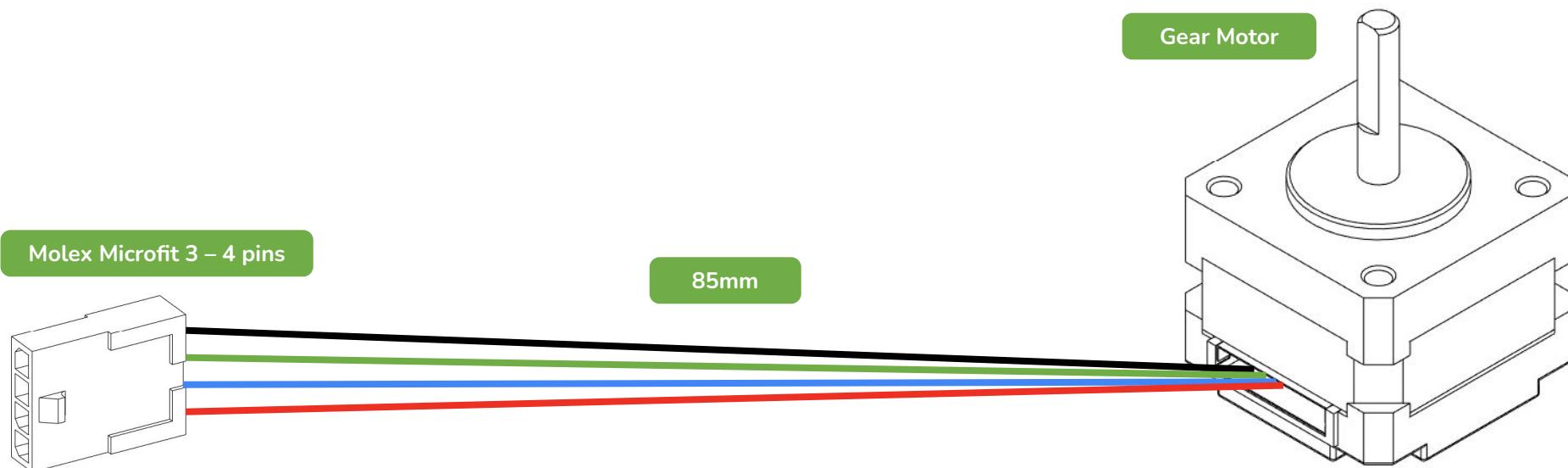
### CONNECTION TO THE SELECTOR MOTOR

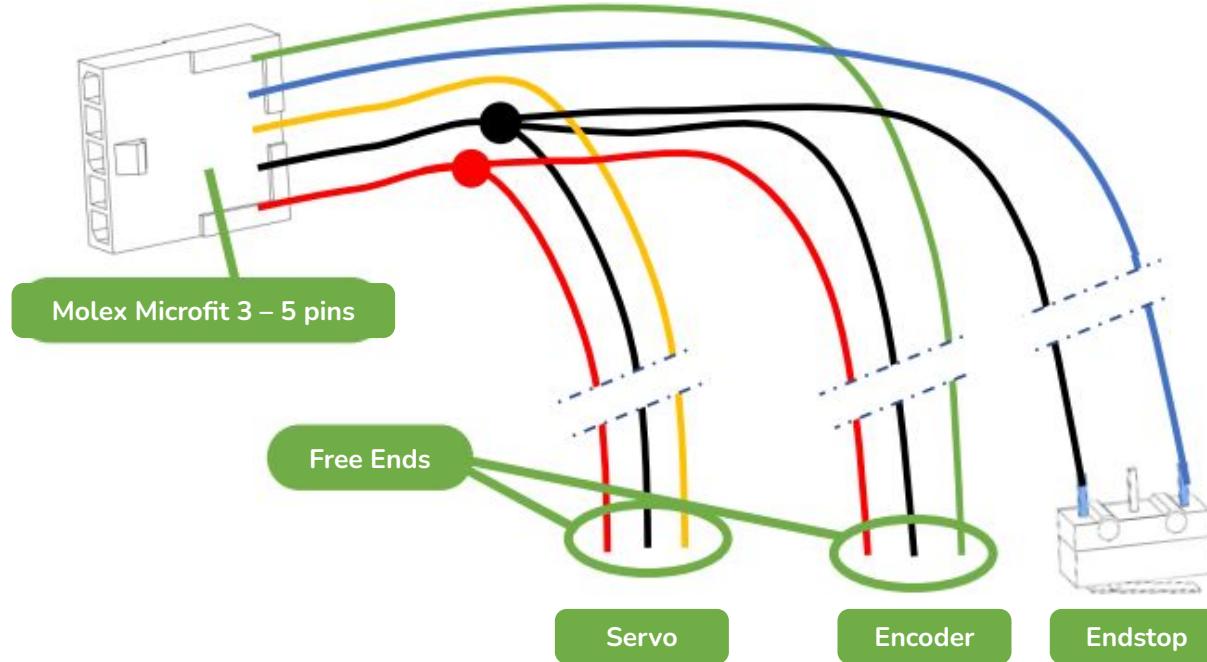
It is recommended to finish the selector motor connection later in the assembly, for ease of assembly and to ensure the crimps are done with the proper wire length.

### WIRING THE GEAR MOTOR WIRE

Double-check. You're supposed to skip this page if you're using a local MCU. You wouldn't want to cut your wires too short!

Trim your Gear Motor wires to 85mm, then crimp and add the 4-pin Molex Microfit connector. That's it!





Channels	Wire Length (mm)		
	Endstop	Servo	Encoder
N	60	35 + 5N	45 + 5N
4	60	55	65
5	60	60	70
6	60	65	75
7	60	70	80
8	60	75	85
9	60	80	90
10	60	85	95
11	60	90	100
12	60	95	105
13	60	100	110
14	60	105	115
15	60	110	120

## 5 WIRE BUS

Prepare the 5 wire bus for the ERCF as shown. The GND is shared between the Servo, the Encoder and the Endstop. The +5V is shared between the Servo and the Encoder.

To join the multiple GND//+5V lines, either crimp them together or make a splice prior to the crimp position.

Only the Endstop is directly connected to this wire bundle, typically by soldering the wires directly on the microswitch pins. It is recommended to finish the Servo and Encoder connections later in the assembly, for ease of assembly and to ensure the crimps are done with the proper wire length.

This should be a 6-wire bus with a wire to control the Apron LEDs, but we added them late in development for RC1 release!

## WIRING THE LEDs

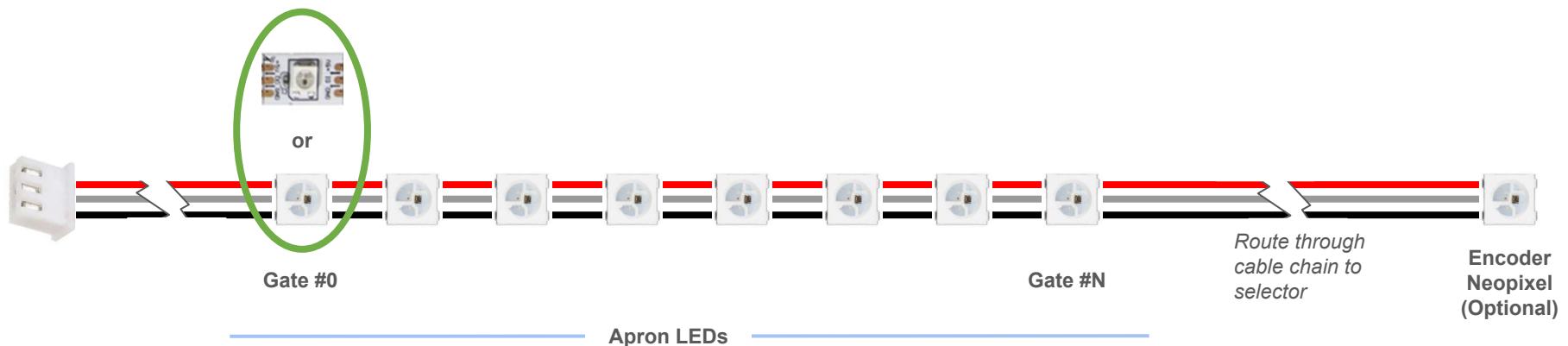
The default option is to use a premade flexible LED strip. Unfortunately, you will need to cut up the strip and re-solder it in order to get to our desired 23mm spacing. The suggested method is to stick the segments of LED strip to the inside of the

If you are using NeoPixels or individual LED PCBs, we provide a wiring jig: [ERCF\\_v2 / Stls / Apron\\_Leds / Options / LED\\_Soldering\\_Tool\\_24mm.stl](#)

For the wires between each LED, cut 20mm sections of wire and strip them back about 1.5mm on each end. Then use the jig to solder the LEDs in place.

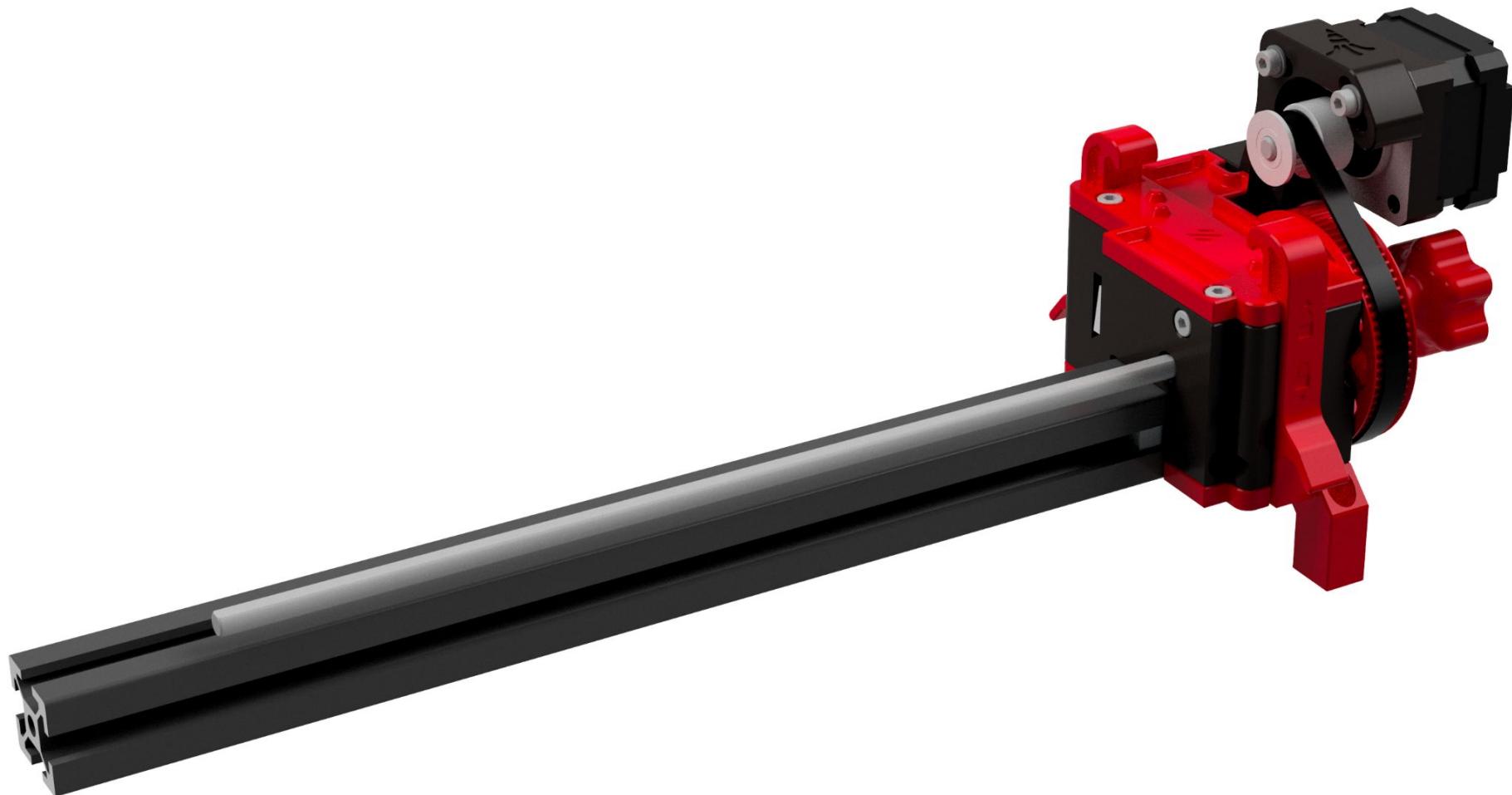
If using a local MCU, the connection between the first LED and the MCU should be about 250mm.

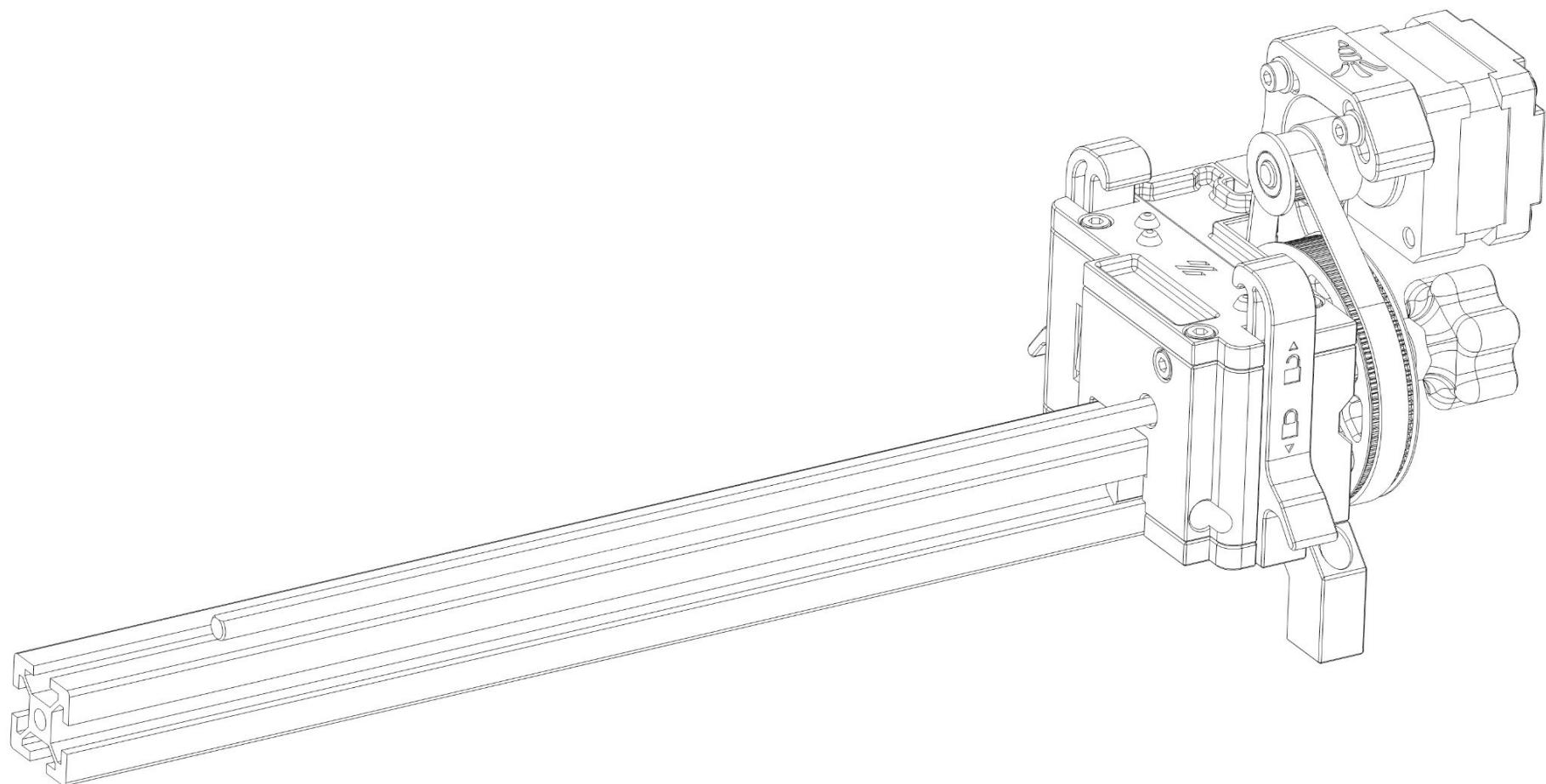
If using a remote MCU, the connection between the first LED and Molex plug is 175mm.



Consistent with the ethos of the Voron community, the ERCF is open-source. This means its designs and software are freely available for anyone to use, modify, and improve, fostering a collaborative and innovative environment

What do you call an ERCF MMU on a coffee break? A "retract-relaxer."



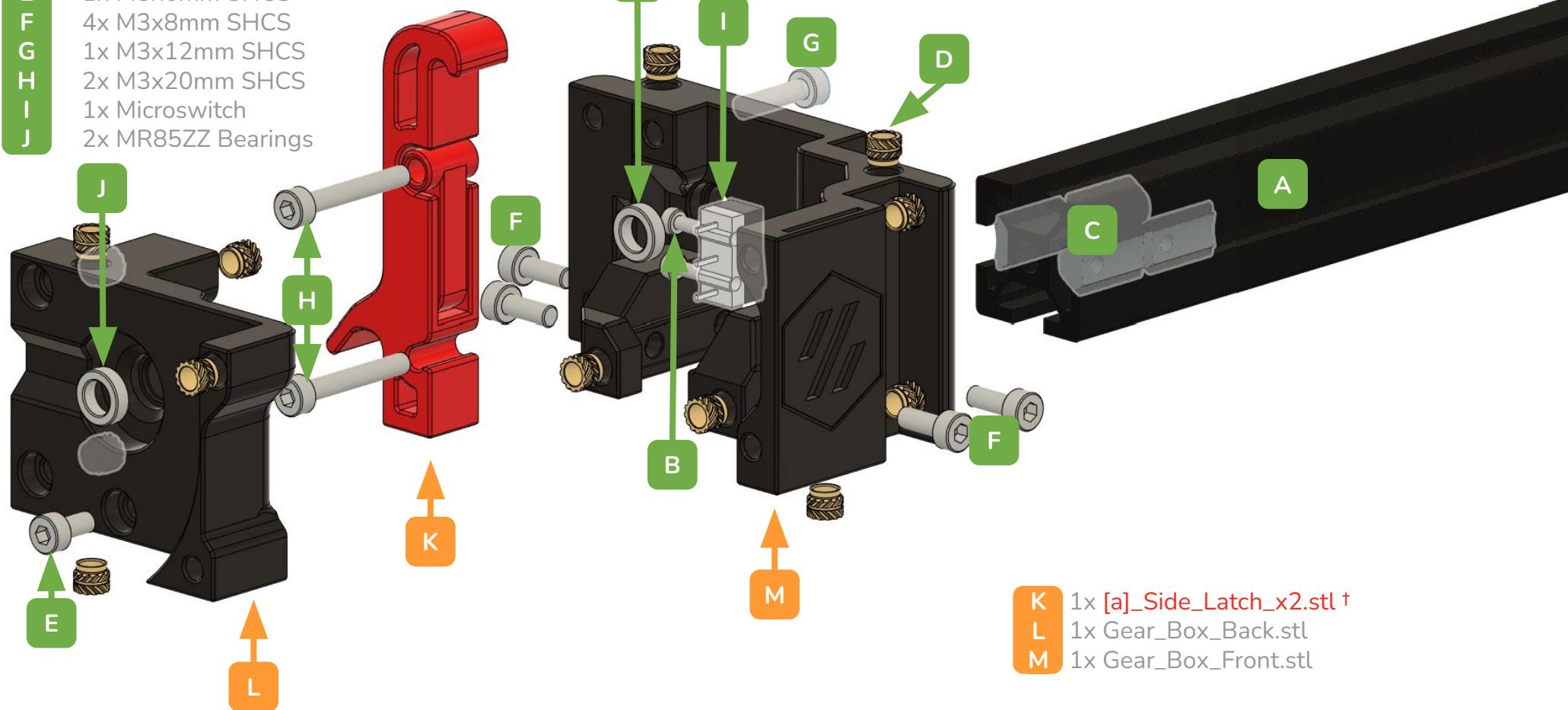


## GEARBOX

## EXPLODED VIEW

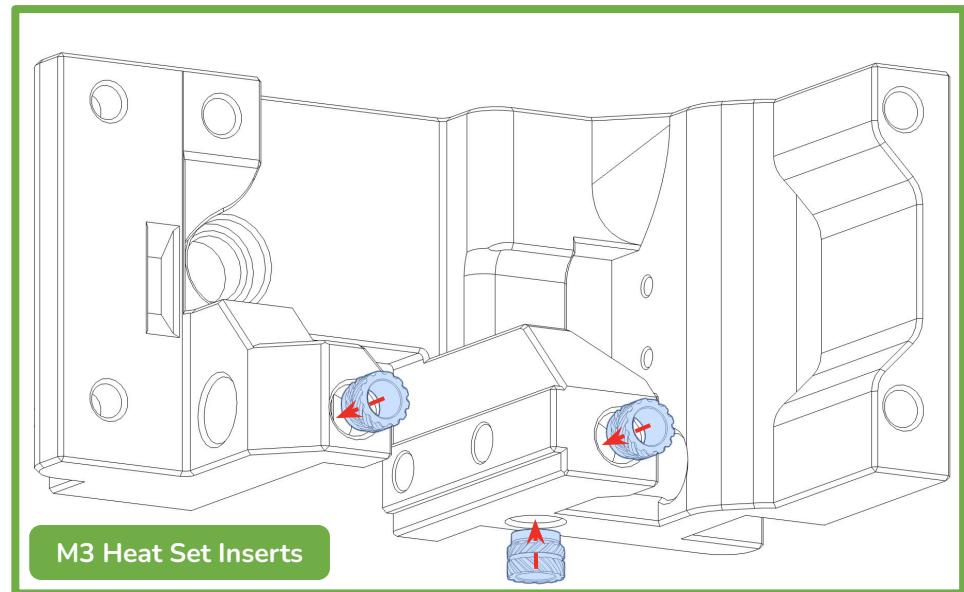
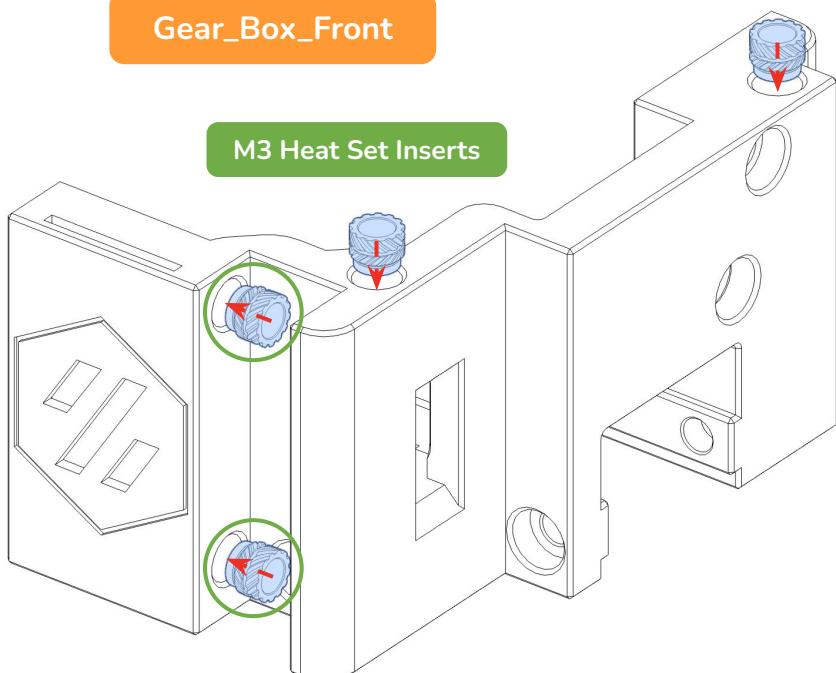
### GEARBOX SUB-BOM FOR STEP 1

**A** 1x 2020 Extrusion  
**B** 2x M2x8mm SHCS  
**C** 4x M3 Roll In Nuts  
**D** 13x M3 Threaded Inserts  
**E** 1x M3x6mm SHCS  
**F** 4x M3x8mm SHCS  
**G** 1x M3x12mm SHCS  
**H** 2x M3x20mm SHCS  
**I** 1x Microswitch  
**J** 2x MR85ZZ Bearings

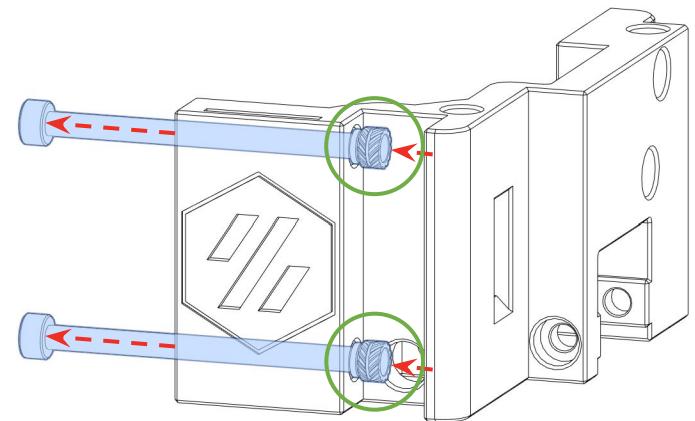


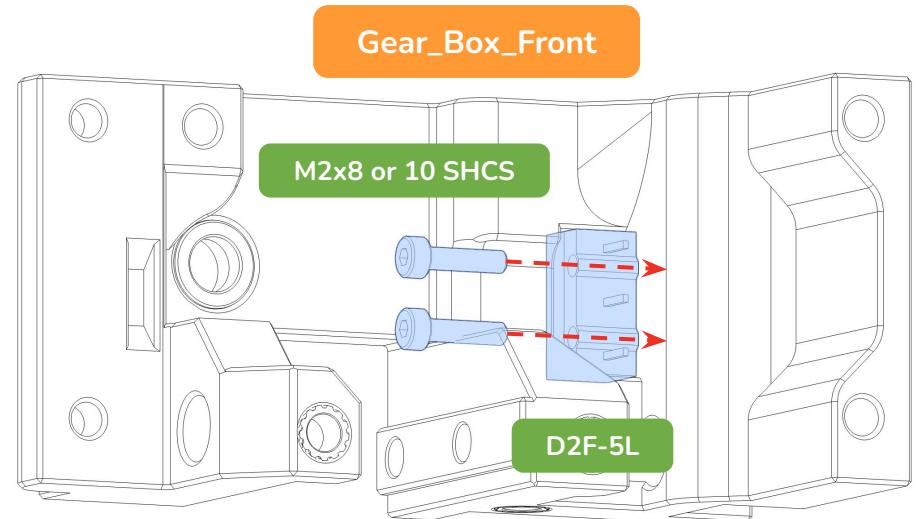
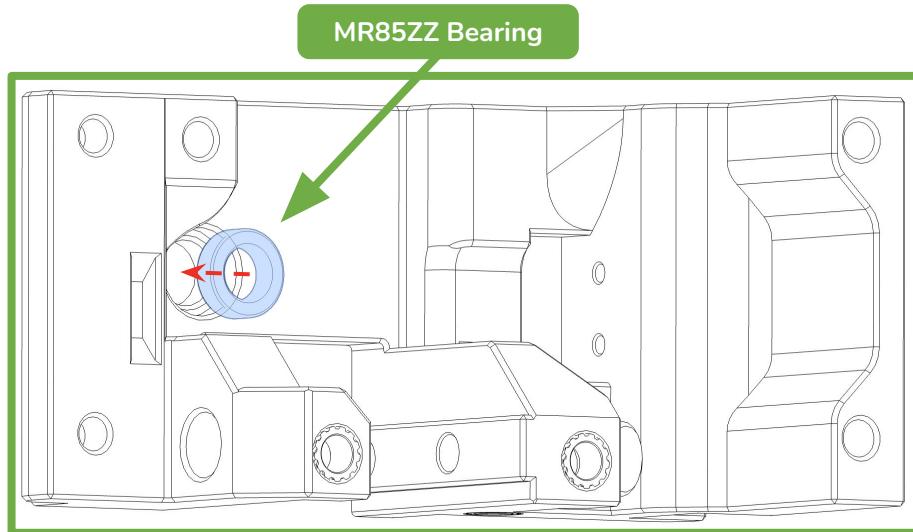
**HEAT SET INSERTS**

The list of pages with heat set inserts is on [page 19](#).

**HEAT SET INSERTS TIP**

Pull these inserts using the soldering iron from the side and take your time to make them flush with the surface and aligned with the screw path. You can use a long M3 screw, inserted from the left, to hold and pull the heat insert in their slot.





#### MR85ZZ BEARING INSERTION

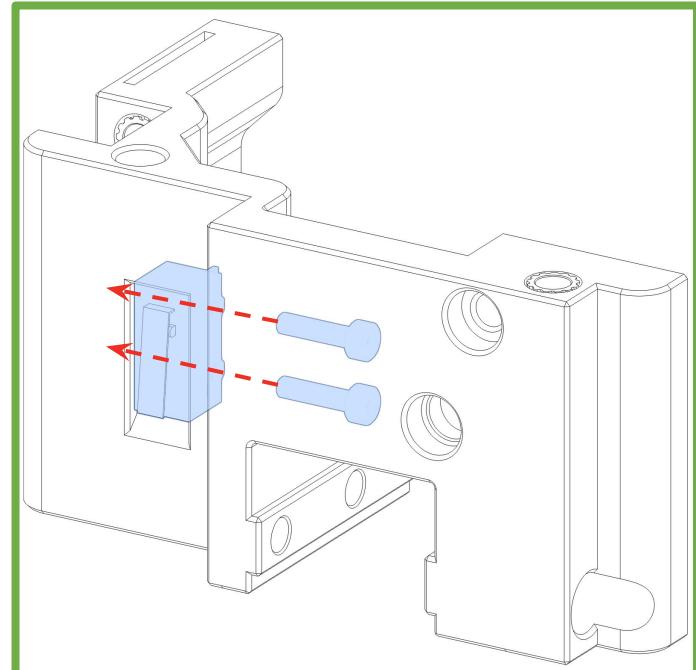
If your printed parts are accurate, the bearing should press-fit easily into place. If you're having trouble seating the bearings, make sure the channel is clear of drooping overhangs, and try pulling the bearing into place with an M5 bolt.

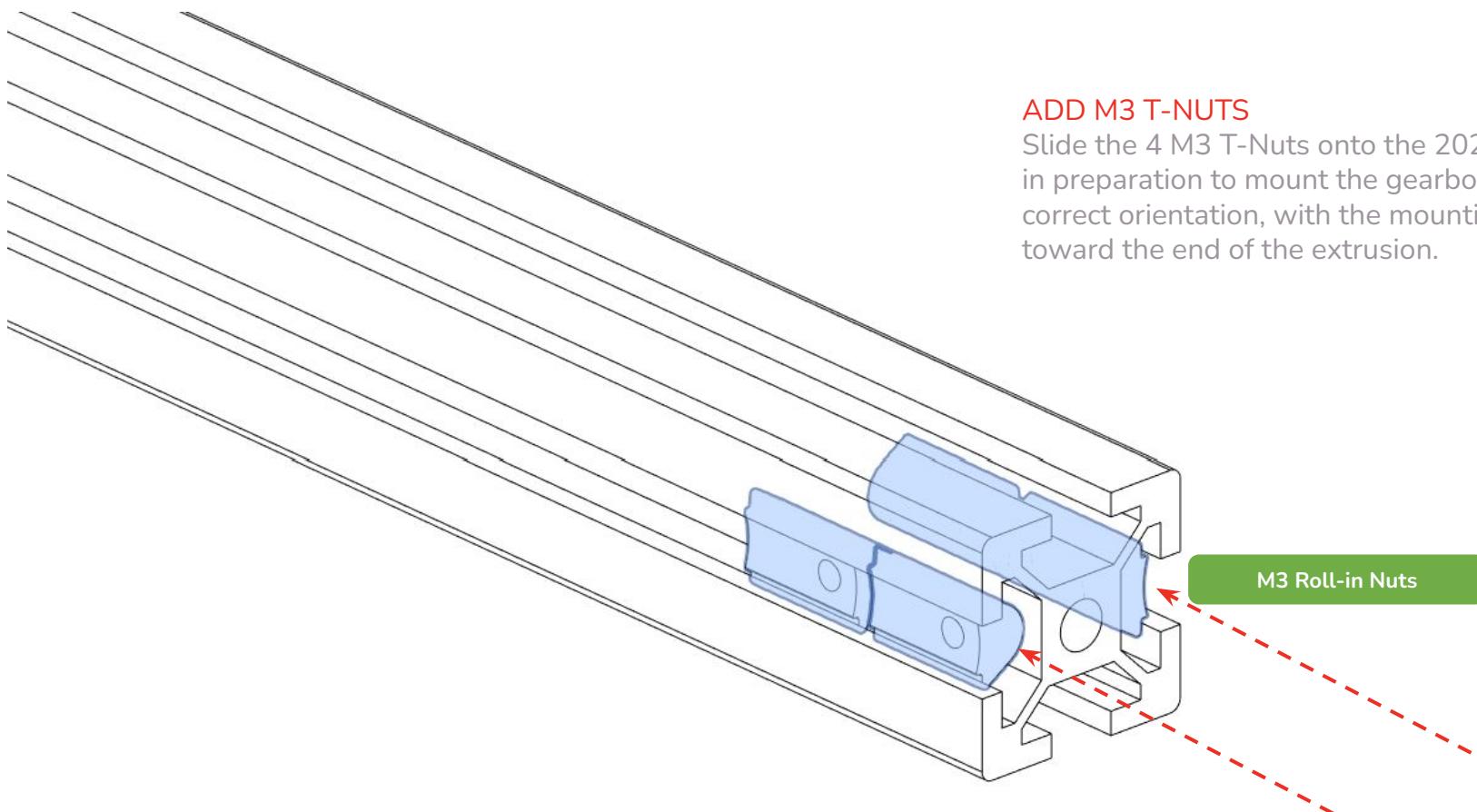
#### M2 SCREWS

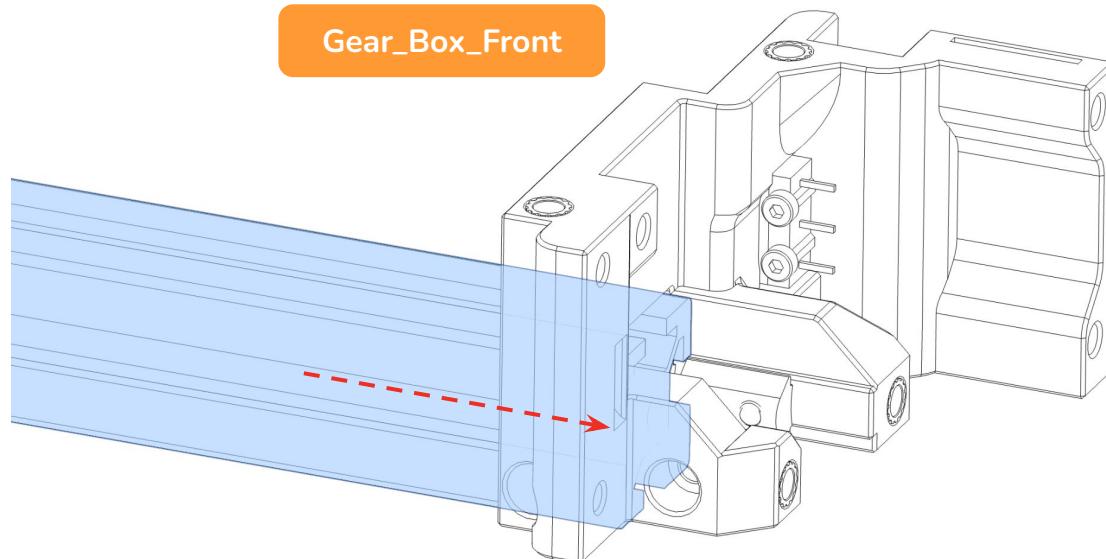
It can be helpful to pre-thread the holes with one of the M2 screws. Remember not to go too deep, you might strip it out! Use an extra-long 1.5mm hex wrench if you have it.

#### MICRO SWITCH ORIENTATION

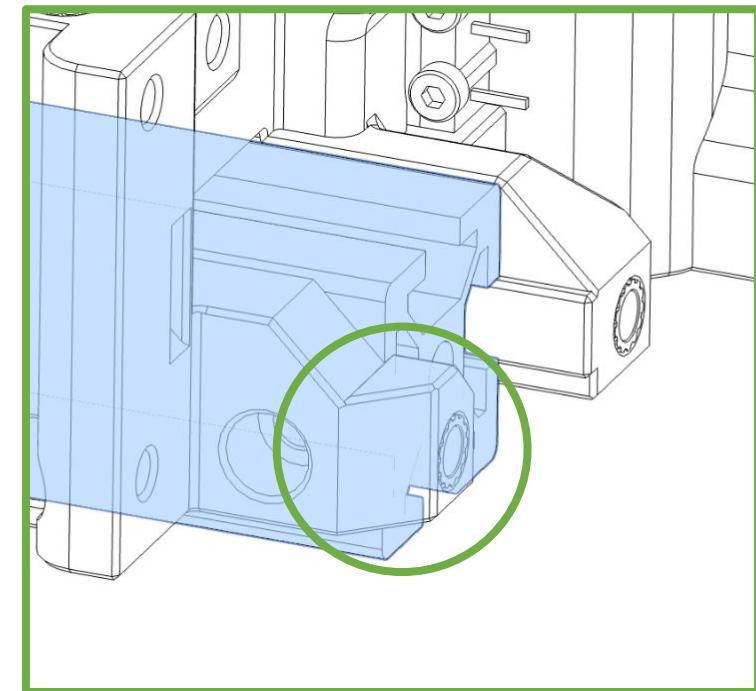
If you are using a levered micro switch, install it as shown, with the lever opening to the bottom. In case you are using a micro switch without a lever, invert it so the button is on the bottom and will line up with the Encoder M3 SHCS end stop.

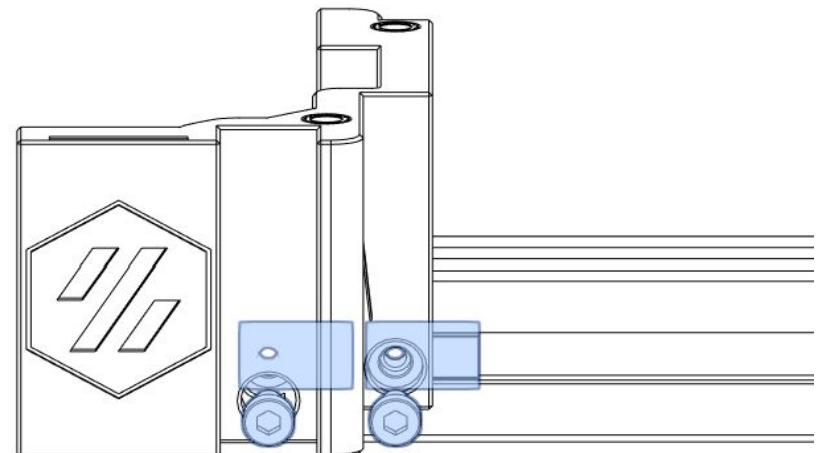
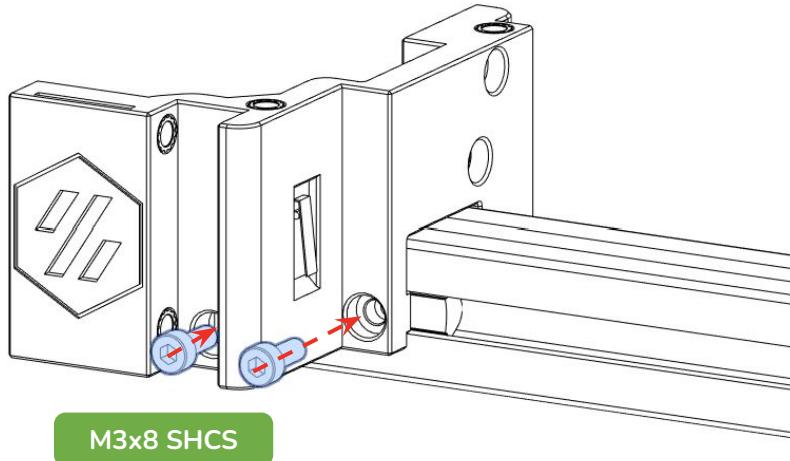




**CHECK POINT**

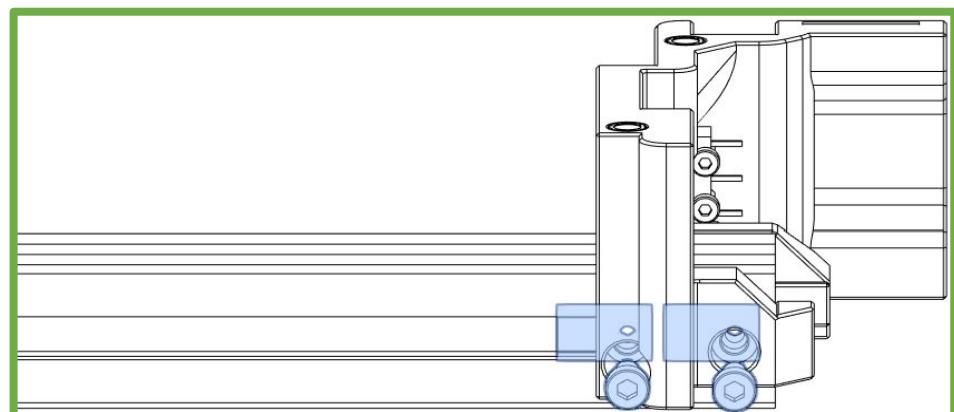
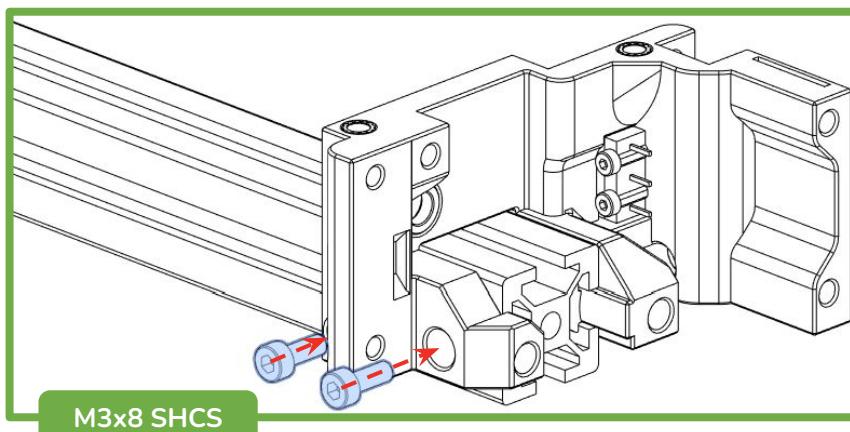
Make sure the 2020 extrusion is fully seated against the stop built into Gear\_Box\_Front part.

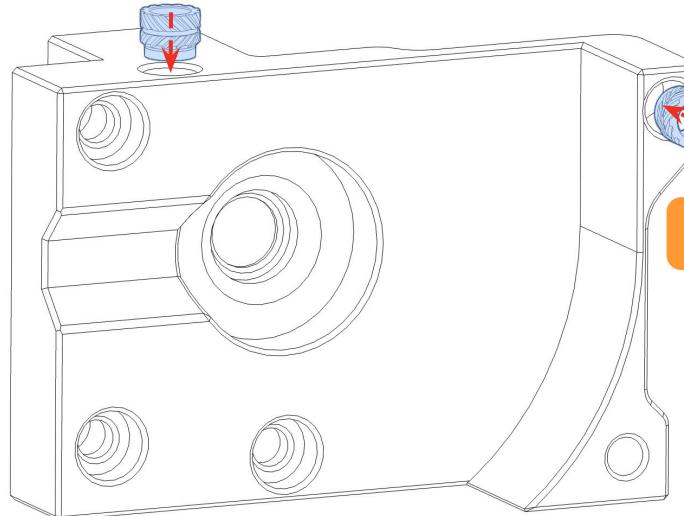




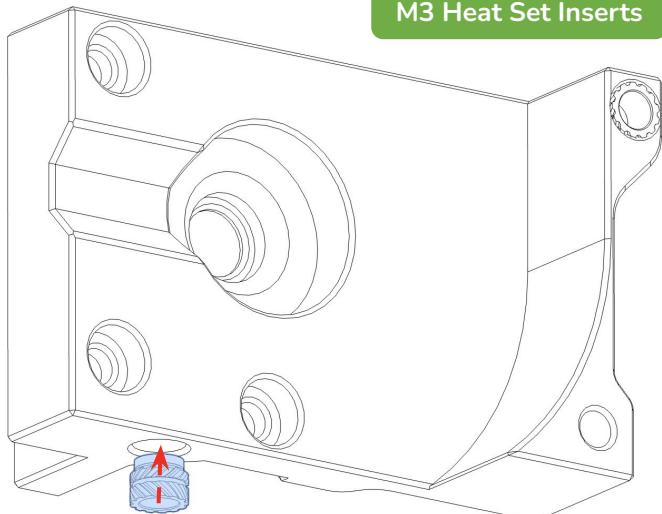
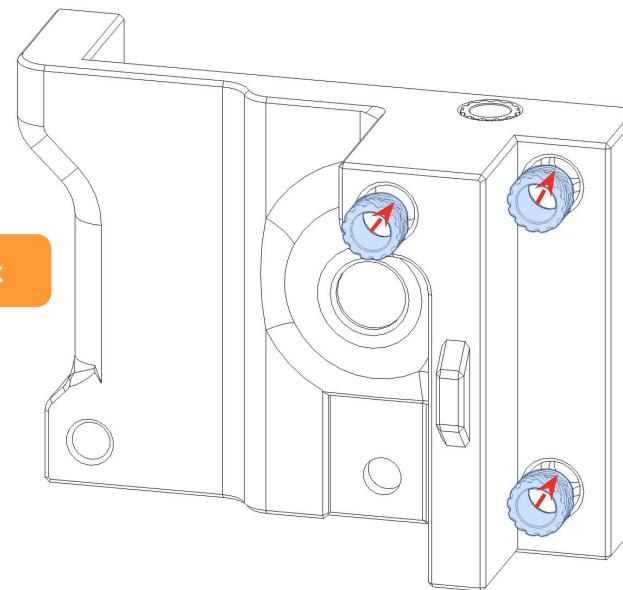
### SEATING THE 2020

Start each of the 4 M3x8 screws into the M3 T nuts that you inserted earlier. Once all four are started, take care the 2020 extrusion remains seated against Gear\_Box\_Front while tightening the M3x8 screws. It is important for the alignment of the Gearbox.





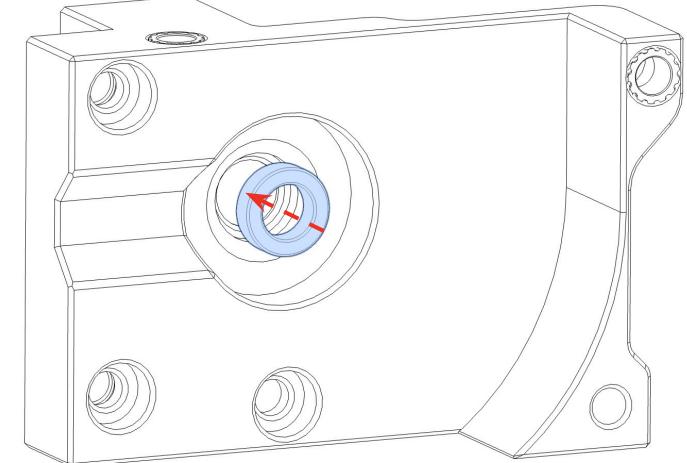
Gear\_Box\_Back



M3 Heat Set Inserts

### MR85ZZ BEARING INSERTION

If your printed parts are accurate, the bearing should press-fit easily into place. If you're having trouble seating the bearings, make sure the channel is clear of drooping overhangs, and try pulling the bearing into place with an M5 bolt.

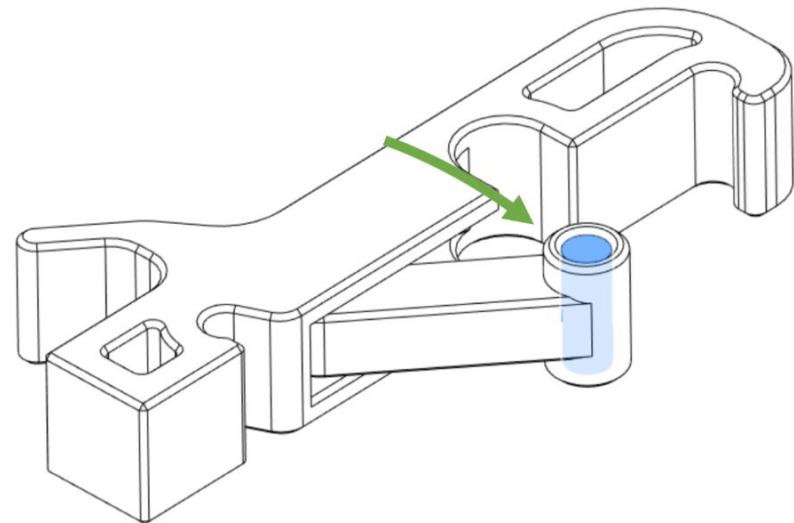
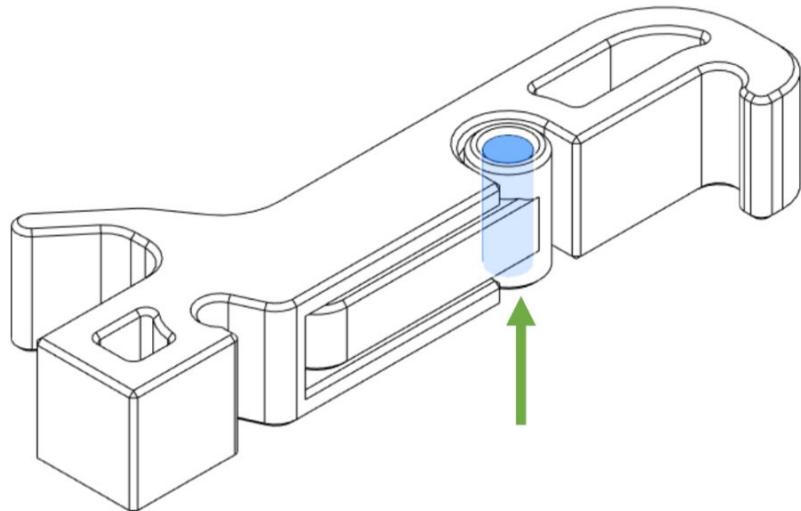


MR85ZZ Bearing

### HEAT SET INSERTS

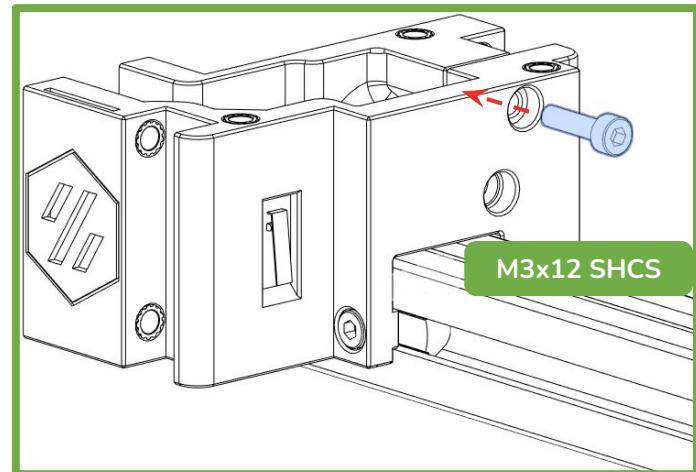
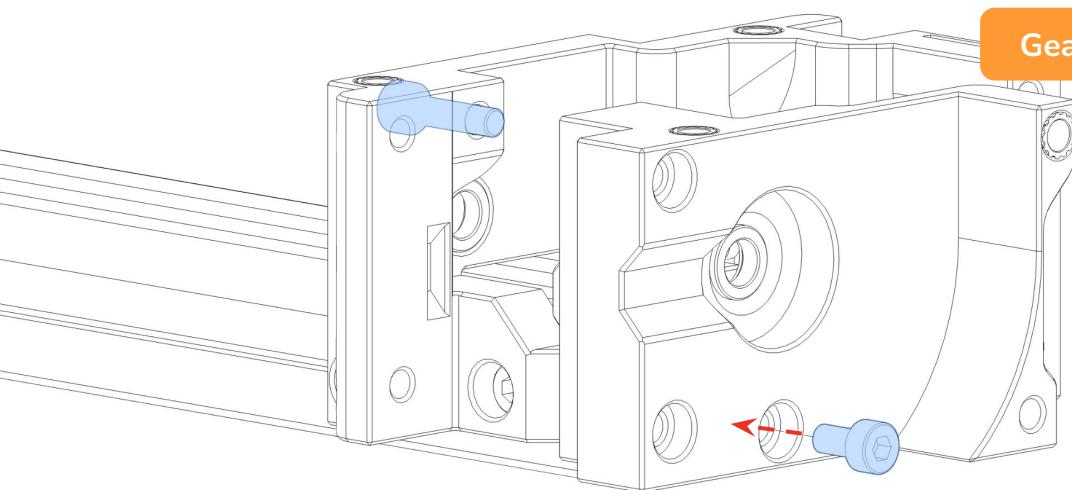
The list of pages with heat set inserts is on [page 19](#).

[a]\_Side\_Latch\_x2 †



#### HINGE UNLOCK

Use a small tool (like an allen key) inserted into the hinge hole to free the print-in-place mechanism and ensure it rotates freely.  
Do this for both latches.



M3x6 SHCS

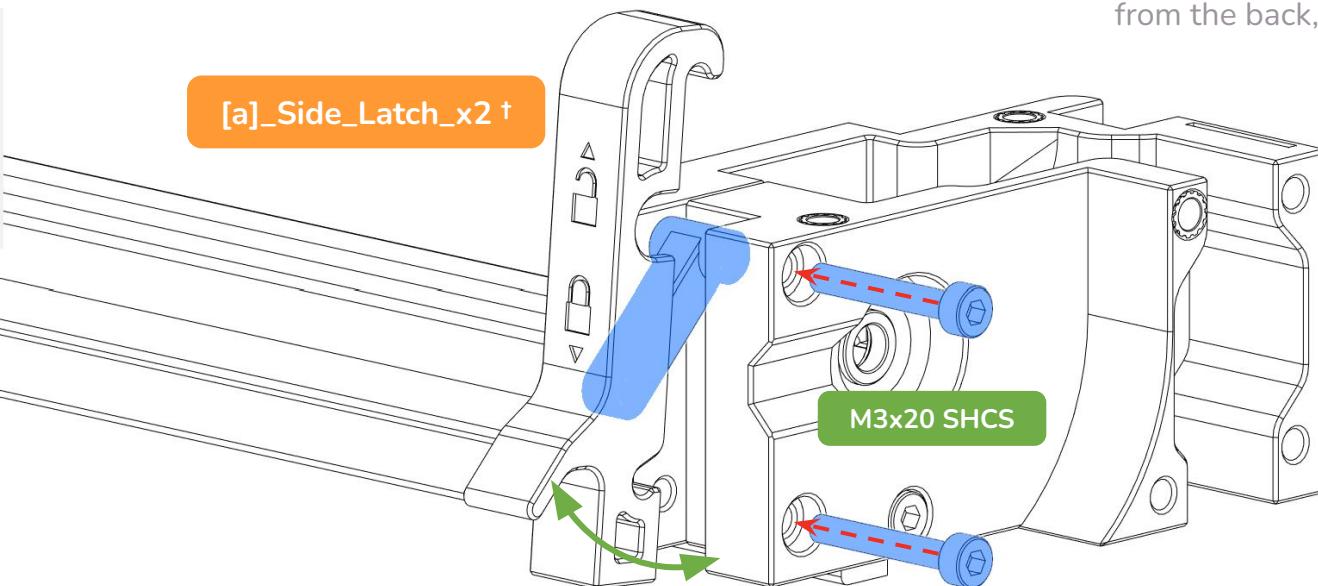
Gear\_Box\_Back

**ALIGNMENT**

Align the Gearbox Front and Back with the keyed slot on the front left and secure the Gearbox Back with 1 M3x6mm screw from the back, and 1 M3x12 screw from the front.

[a]\_Side\_Latch\_x2 †

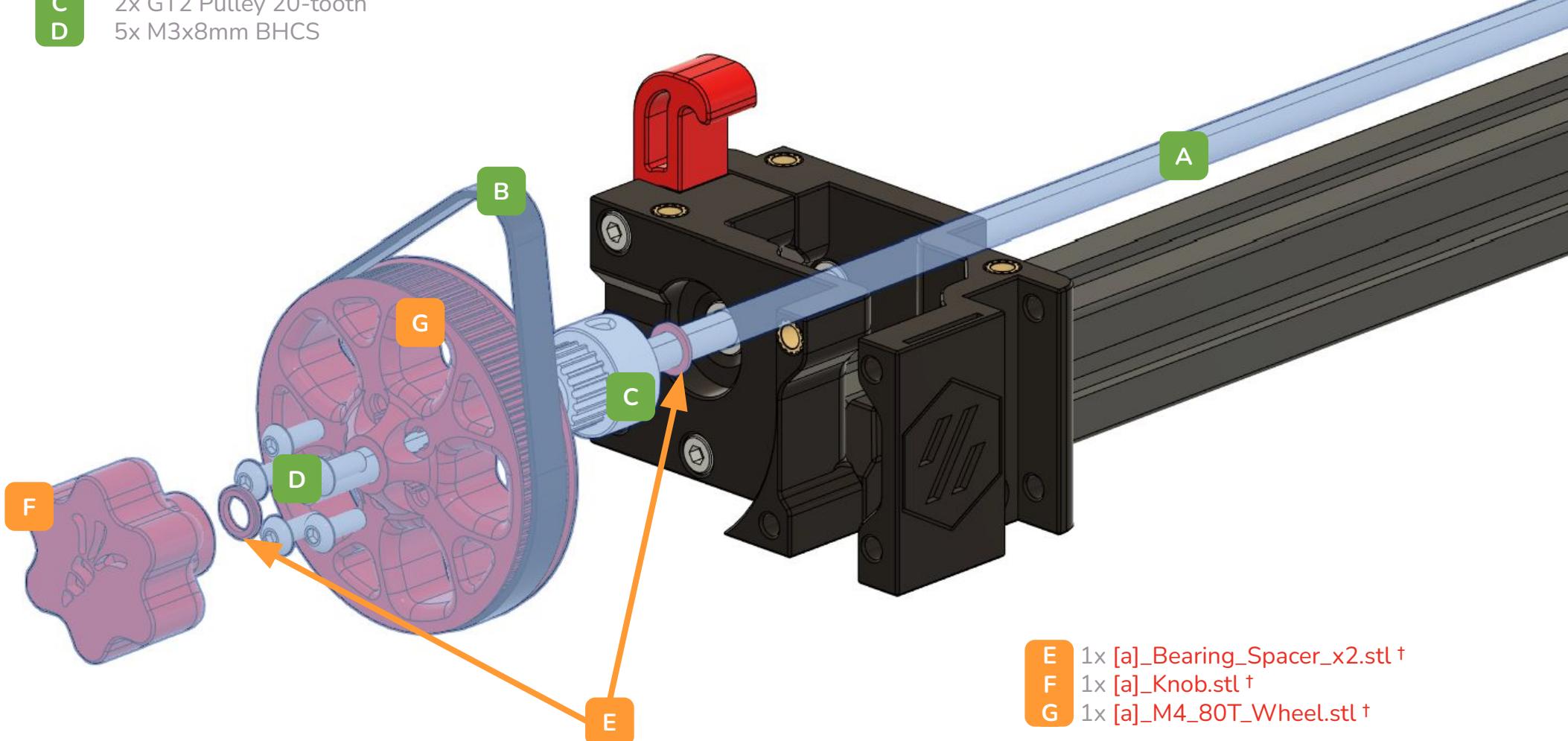
M3x20 SHCS

**LATCH SCREWS**

Extend the arm of the Latch and hold it in place while you thread the top M3x20mm screw. Screw the top screw all the way in, then screw in the bottom M3x20mm screw. With both screws in place, close the latch.

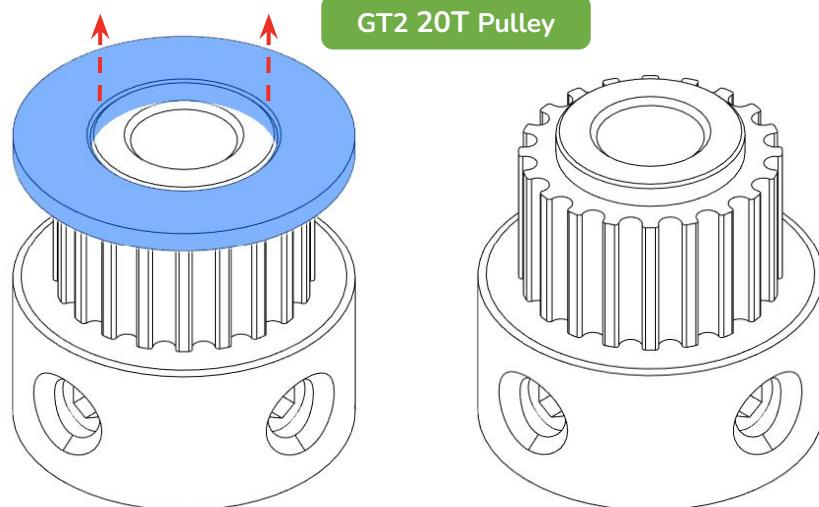
Don't over tighten the two screws; you should be able to lock and unlock the latch without trouble.

## GEARBOX SUB-BOM FOR STEP 2

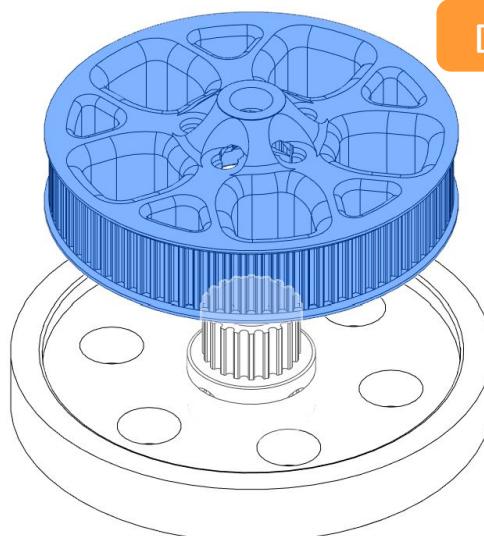
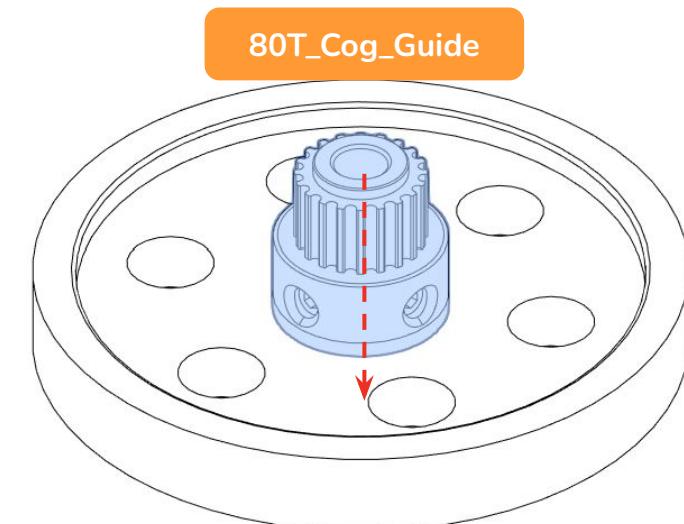
**A**1x 5mm D-Cut Rod  
1x GT2 Belt Loop, 188mm  
2x GT2 Pulley 20-tooth  
5x M3x8mm BHCS**B****C****D**

**REMOVE FLANGE**

Use pliers to gently remove the top flange of the GT2 pulley.

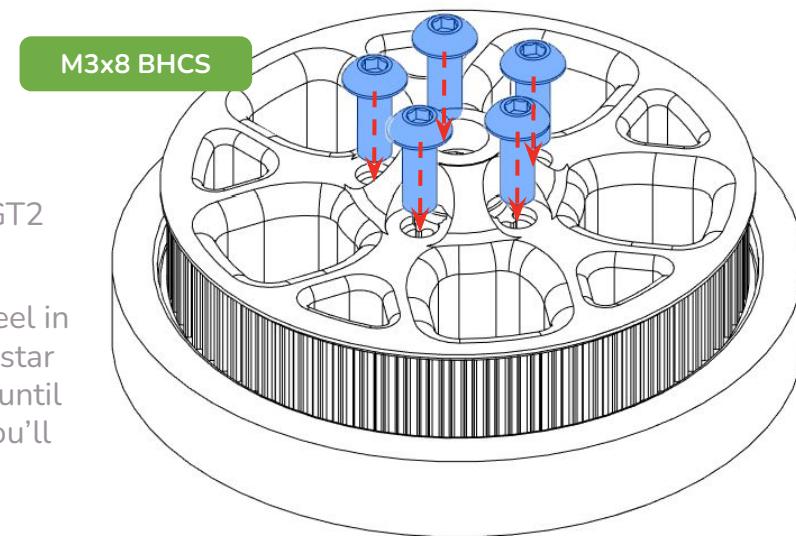
**INSERT PULLEY**

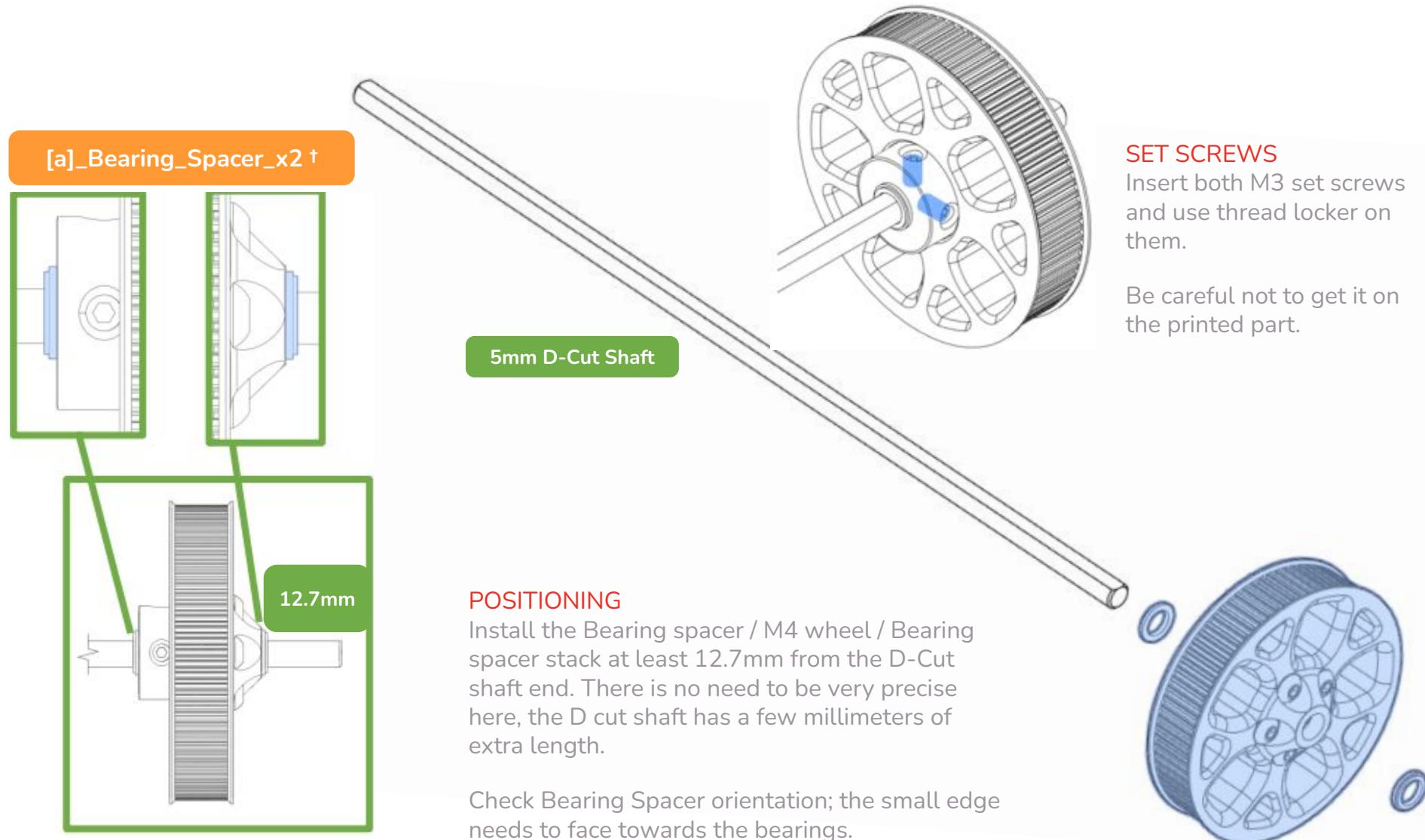
Place the GT2 pulley into the 80T\_Cog\_Guide.

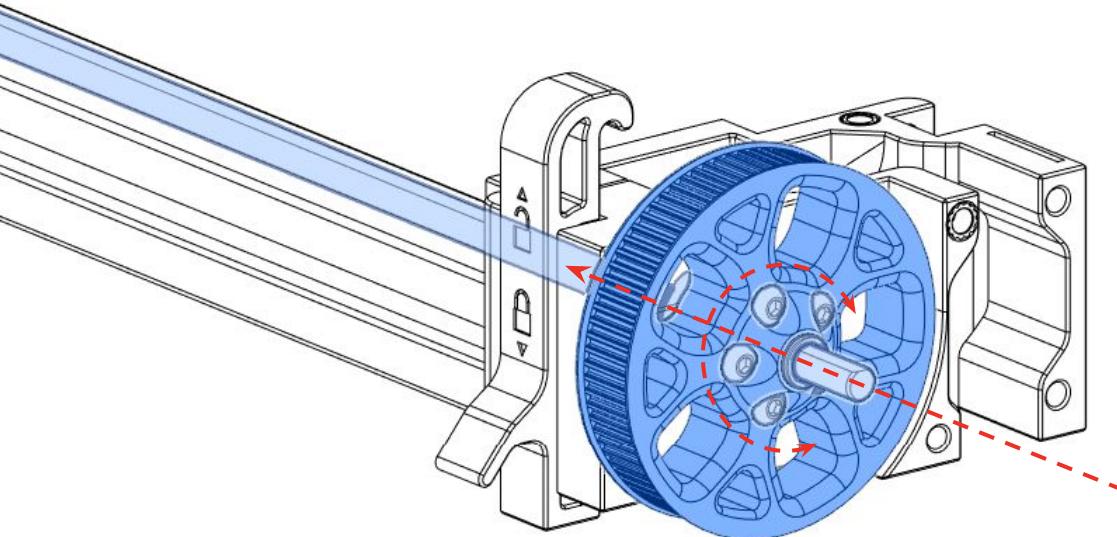
**FINISH MOUNTING**

Insert the M4\_80T\_Wheel onto the GT2 pulley and press it flat to the jig.

Add 5 M3x8 BHCS to secure the wheel in place. Gently tighten the screws in a star pattern (skipping every other screw) until the hub is snug. Don't overtighten, you'll strip the plastic, or worse, the pulley!







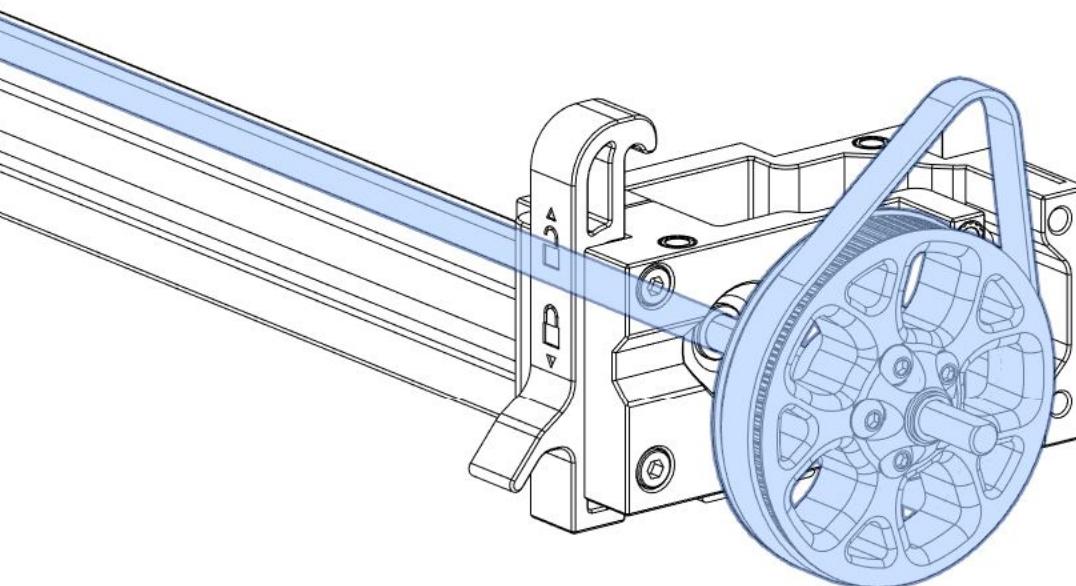
### ASSEMBLY

Gently insert the D-Cut shaft assembly through the Gearbox bearings.

Depending on how well your D-Cut shaft has been machined, you may need to use a fine file or sandpaper to smooth machined edges to allow it to slide smoothly through the bearings and Bondtech gears.

Adjust the M4 wheel so it spins with as little wobble as possible, and doesn't rub. Use the back edge of the Gearbox as a guide and gently adjust the wheel / tweak BHCS screw tension until you are satisfied. **It will never be perfect.**

We will add the knob later!



### GEAR BELT

Now we need to install the 188mm GT2 belt loop around the M4 wheel. It will be impossible to do so after the next steps. You can either spin it onto the wheel, or pull the Drive Shaft back out of the Gearbox and wrap the belt around the wheel before re-inserting the Drive Shaft.

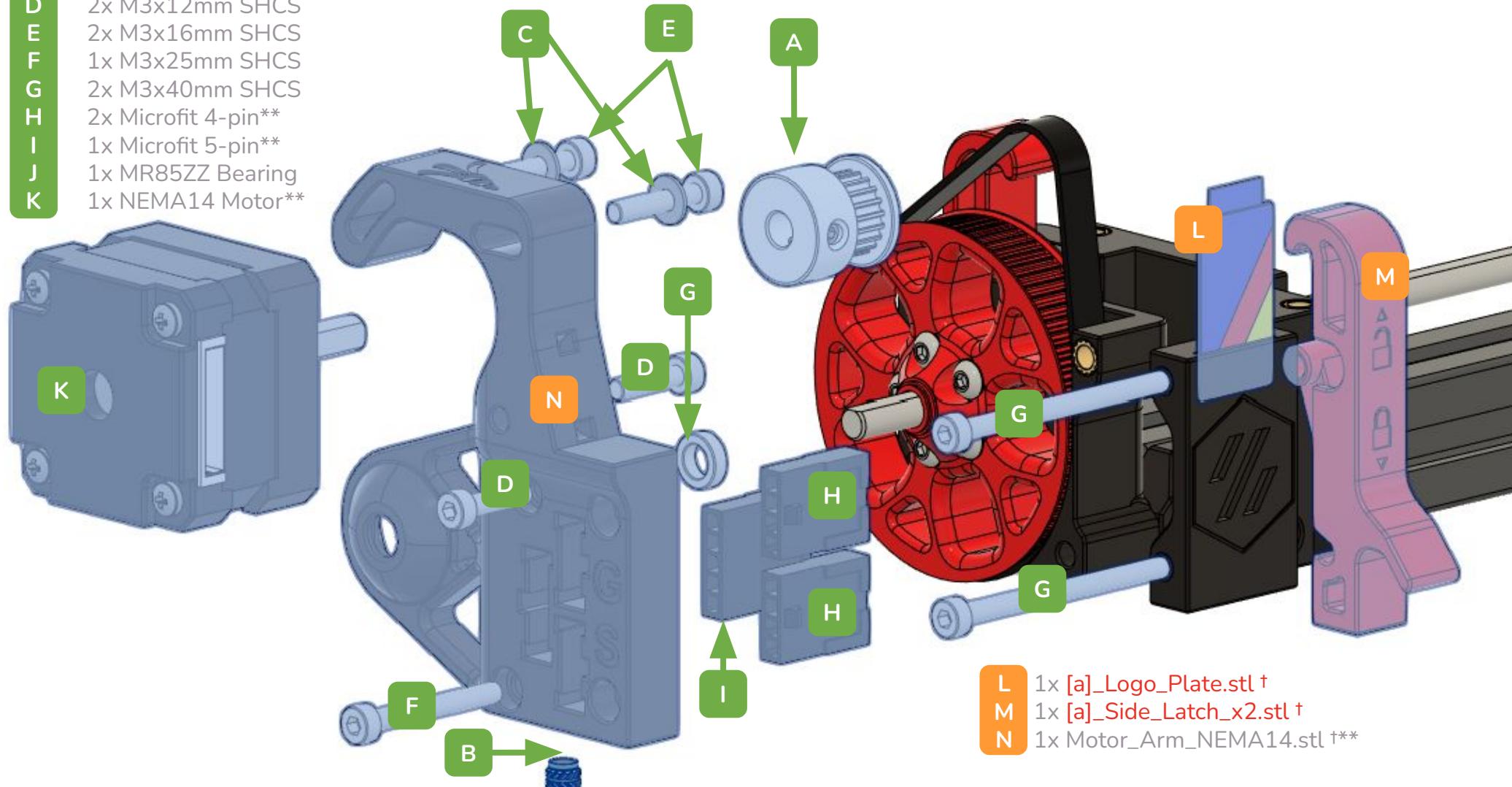
If you pull out either of the bearings, make sure they re-seat correctly. It may be necessary to fully remove the Drive Shaft to re-seat the bearings.

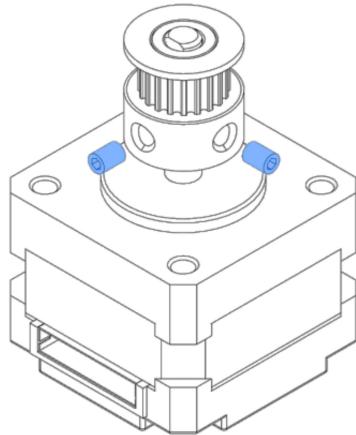
## GEARBOX SUB-BOM FOR STEP 3

- A 2x GT2 Pulley 20-tooth
- B 1x M3 Threaded Insert
- C 2x M3 Washers
- D 2x M3x12mm SHCS
- E 2x M3x16mm SHCS
- F 1x M3x25mm SHCS
- G 2x M3x40mm SHCS
- H 2x Microfit 4-pin\*\*
- I 1x Microfit 5-pin\*\*
- J 1x MR85ZZ Bearing
- K 1x NEMA14 Motor\*\*

## \*\*NOTE: VARIATIONS

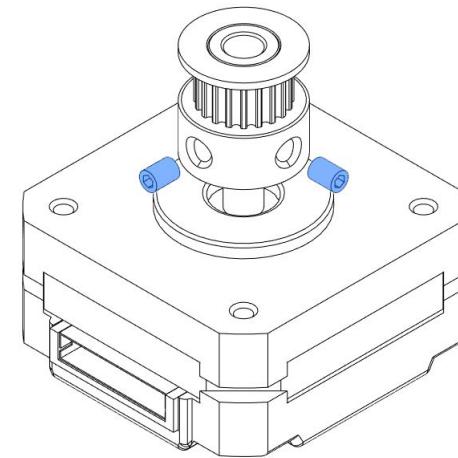
There are 4 options for the Motor Arm: NEMA 14 Motor or NEMA 17 Motor, and with or without Microfit connectors, for local or remote MCUs respectively. We're showing the NEMA 14 version with the connectors, but suit yourself!





### MOTOR VARIATIONS

While the NEMA 14 motor is what is called for in the BOM, we also support NEMA 17 motors for those who are sourcing their own parts. NEMA 17 motors tend to have more torque but need to run at lower speeds. Use what works for you!

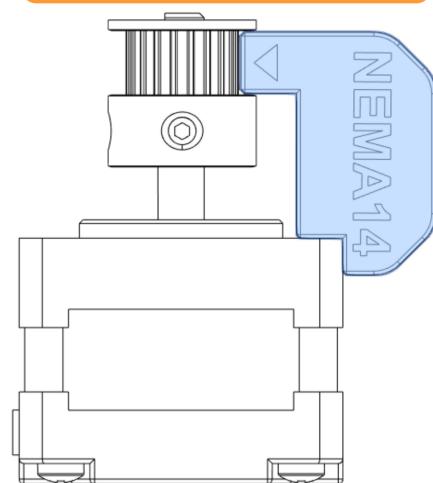


### SET SCREWS

Insert both M3 set screws and use thread locker on them.

Use the appropriate pulley tool to install the pulley at the correct height on the motor shaft.

Pulley\_Tool\_NEMA14 †

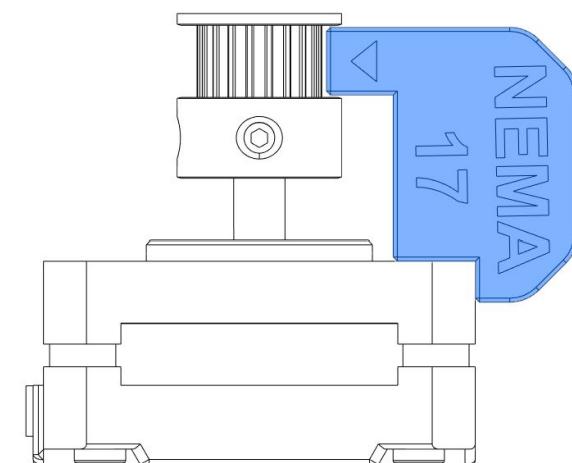


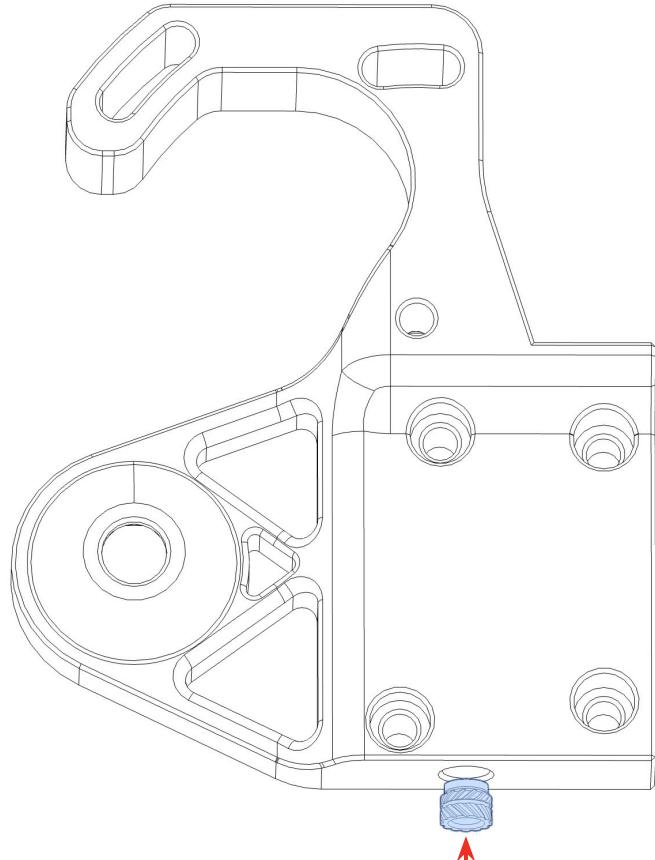
### PULLEY HEIGHT

Use the NEMA 14 pulley tool to set the correct height of the GT2 20T gear.

If you are using a NEMA 17 motor for the gear axis, assembly is the same but you'll need to use the NEMA 17 pulley tool and print a different Motor Arm to mount it.

Pulley\_Tool\_NEMA17 †



**Motor\_Arm\_NEMA14 †****HEAT SET INSERTS**

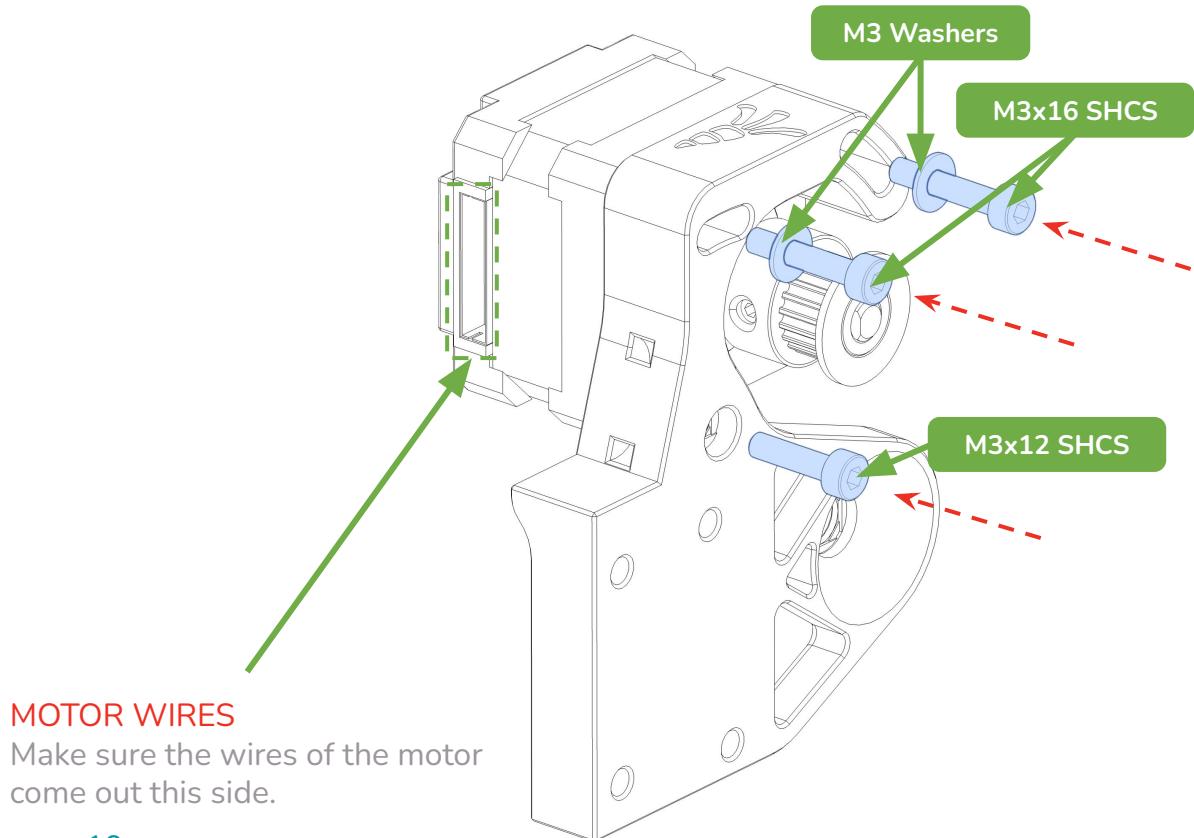
The list of pages with heat set inserts is on [page 19](#).

**MOTOR ARMS**

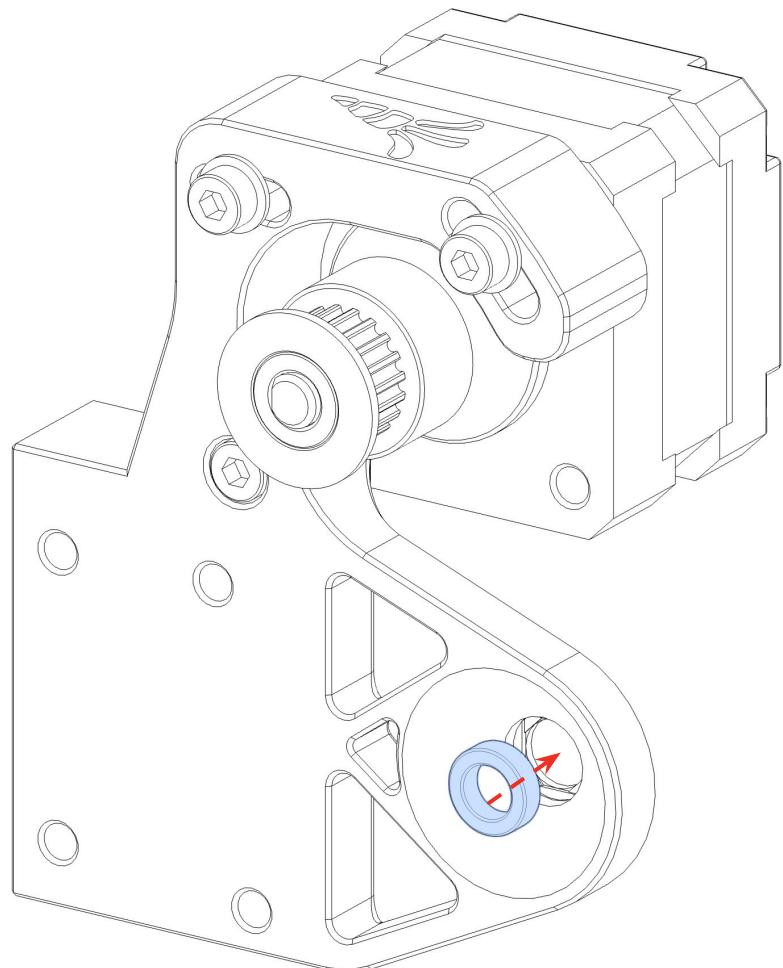
There is one version for each motor size, NEMA 14 vs NEMA 17.

There are two versions of each of those sizes: One with microfit connectors, for connecting to an external MCU, and one *without* connectors for use with external MCU's like ERCF Easy BRD, Mellow Fly ERCF BRD, Fystec ERB and BTT MMB.

We will show both versions in this manual. Use what works for you!

**MOTOR WIRES**

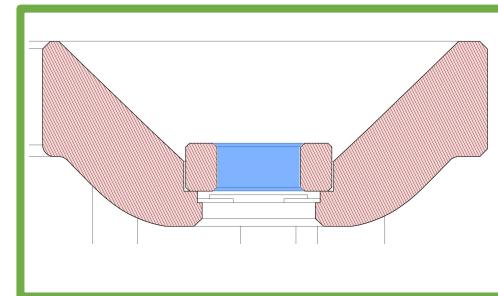
Make sure the wires of the motor come out this side.



MR85ZZ Bearing

#### MR85ZZ BEARING INSERTION

If your printed parts are accurate, the bearing should press-fit easily into place. If you're having trouble seating the bearings, make sure the channel is clear of drooping overhangs, and try pulling the bearing into place with an M5 bolt.

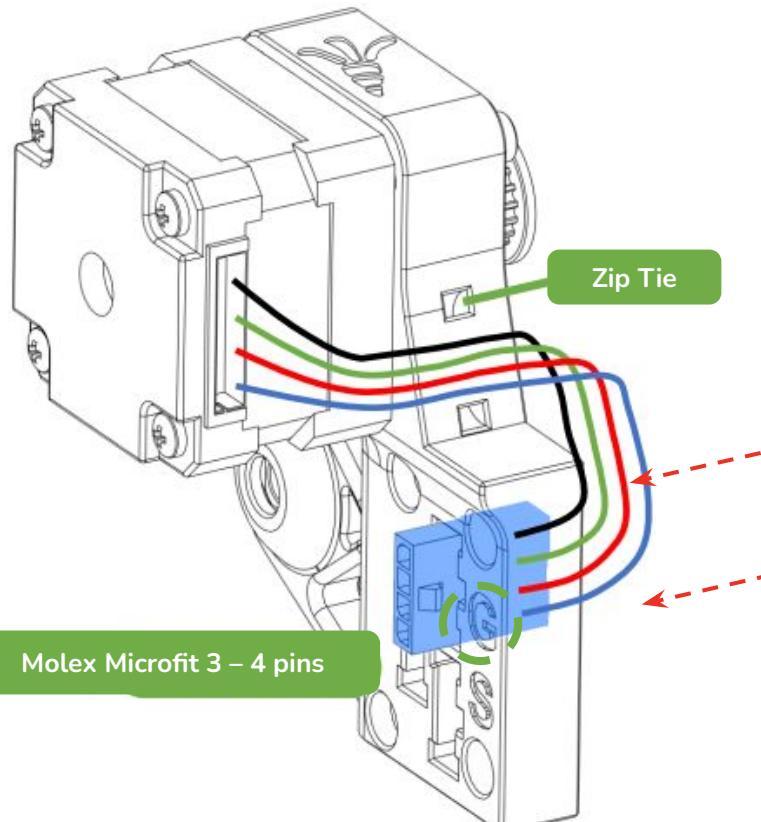


#### BEARING POSITION

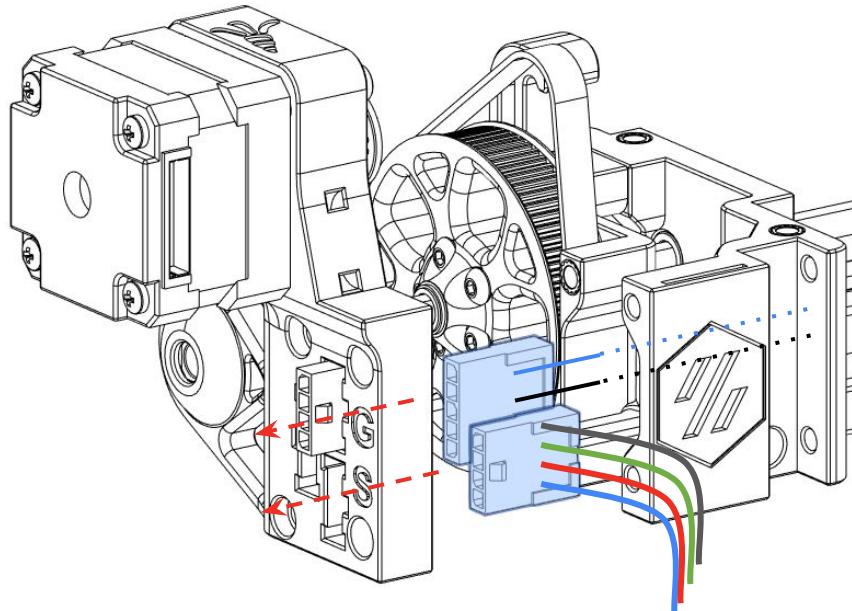
Once installed, the bearing will not be flush and will stick out as shown.

**GEAR MOTOR WIRING**

**NOTE:** This is an optional step to install Microfit connectors for users who want to use an external MCU to control their ERCF. If you are using a daughterboard like ERCF Easy BRD, Mellow Fly ERCF BRD, Fystec ERB or BTT MMB, you don't need to do this!

**GEAR MOTOR CONNECTOR**

Crimp the gear motor wiring into a 4-pin MicroFit 3 female connector as shown. Push the connector into the top left slot of the motor arm, marked G.

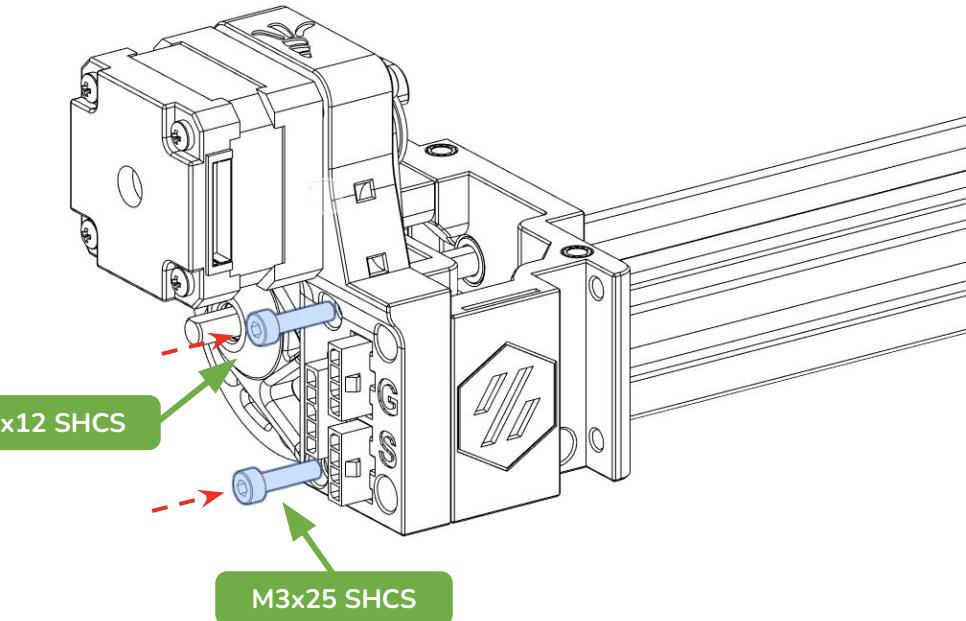
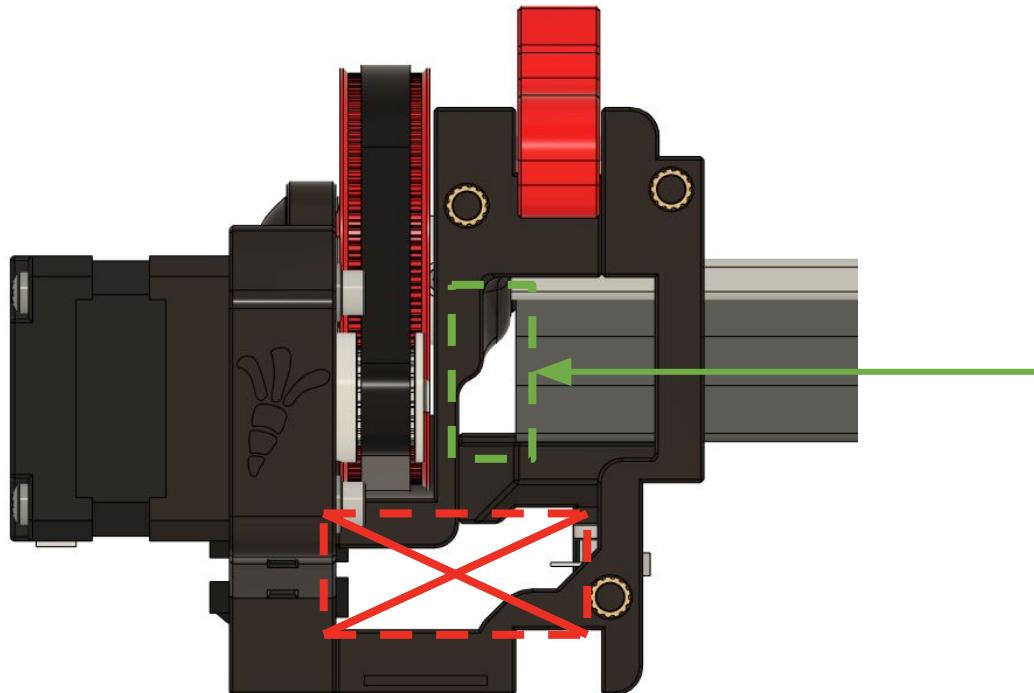
**INSERT THE MICROFIT CONNECTORS**

Insert the two microfit connectors from the wire bundles into their dedicated holes in the Motor Arm. For picture clarity, only the microswitch wires are shown for the 5-pin connector (but the other wires are assumed present).

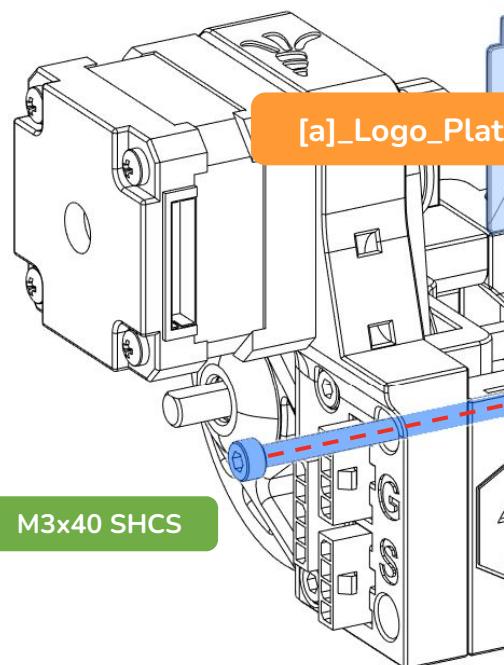
**CLOSING THE GEARBOX**

Install the Motor Arm and pass the belt around the GT2 pulley of the Gear Motor, but don't tension it yet.

Carefully insert and tighten the M3x25mm screw first, and then the M3x12mm screw. Take your time. Make sure no wires are pinched between parts.

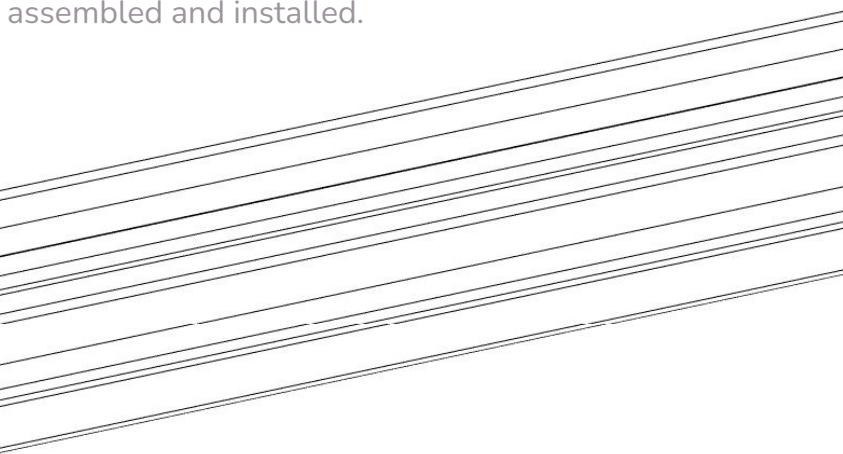
**CABLE MANAGEMENT**

Make sure the wires are routed in the channel between the 2020 extrusion and the Gear\_Box\_Back. If you route the wires through the other opening, you won't be able to connect the wires later!



### VORON LOGO

Insert the Logo Plate into its slot. You can use single or multicolor options to customize your unit. It can be changed easily once the ERCF is fully assembled and installed.

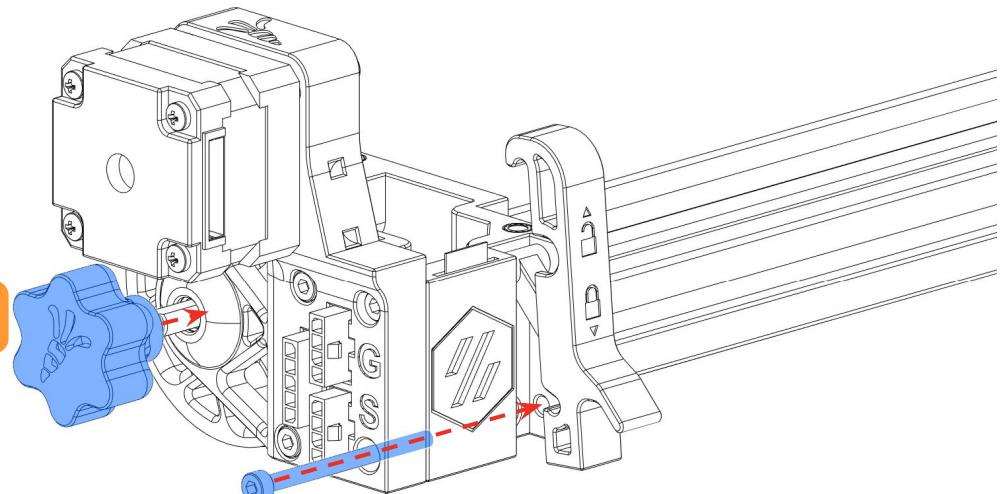


### KNOB

Insert the Knob into the 5mm D-Cut shaft (beware of the D-Cut position). It shouldn't quite touch the motor arm.

Add the bottom M3x40mm screw for the latch and close the latch.

[a]\_Knob †



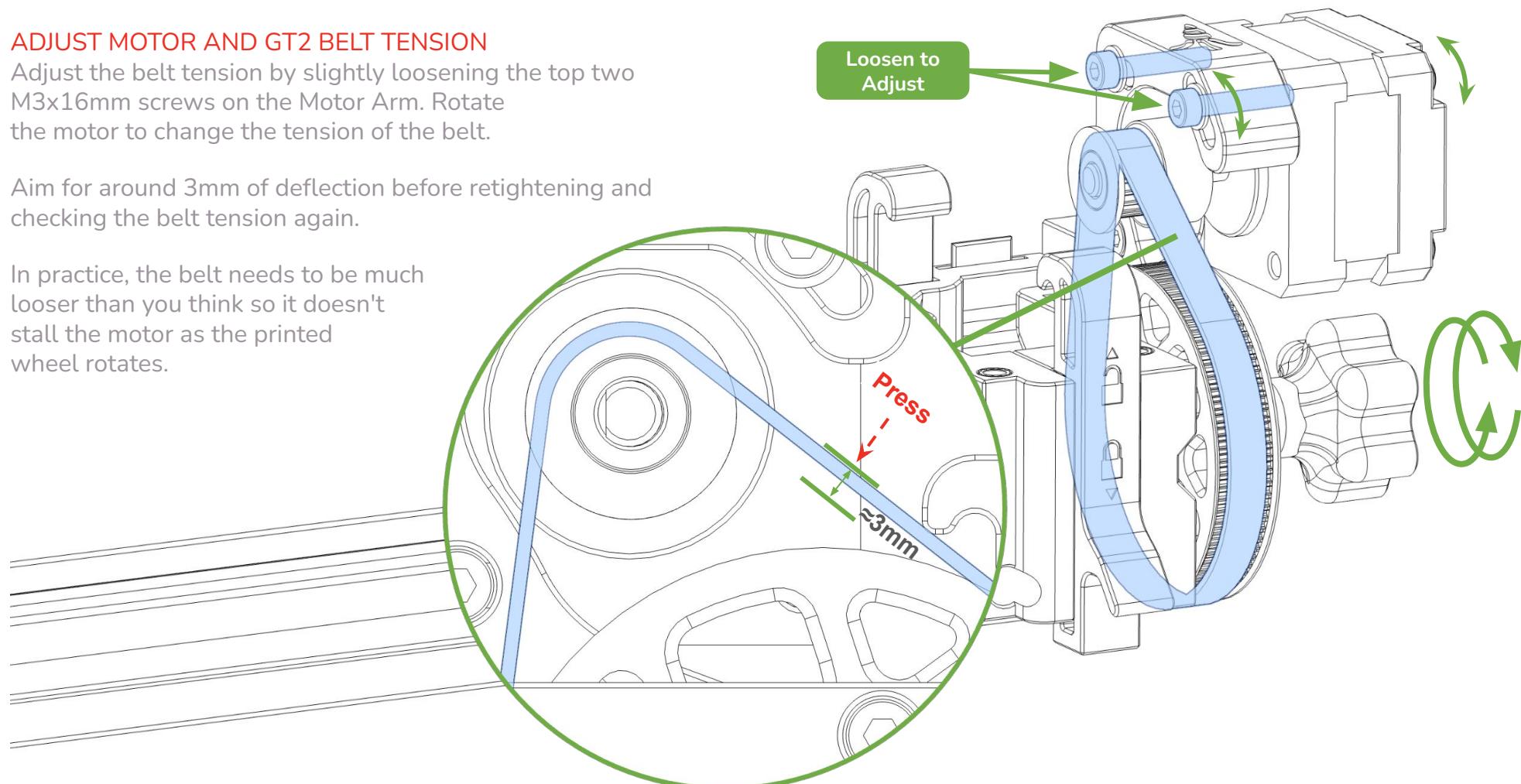
M3x40 SHCS

**ADJUST MOTOR AND GT2 BELT TENSION**

Adjust the belt tension by slightly loosening the top two M3x16mm screws on the Motor Arm. Rotate the motor to change the tension of the belt.

Aim for around 3mm of deflection before retightening and checking the belt tension again.

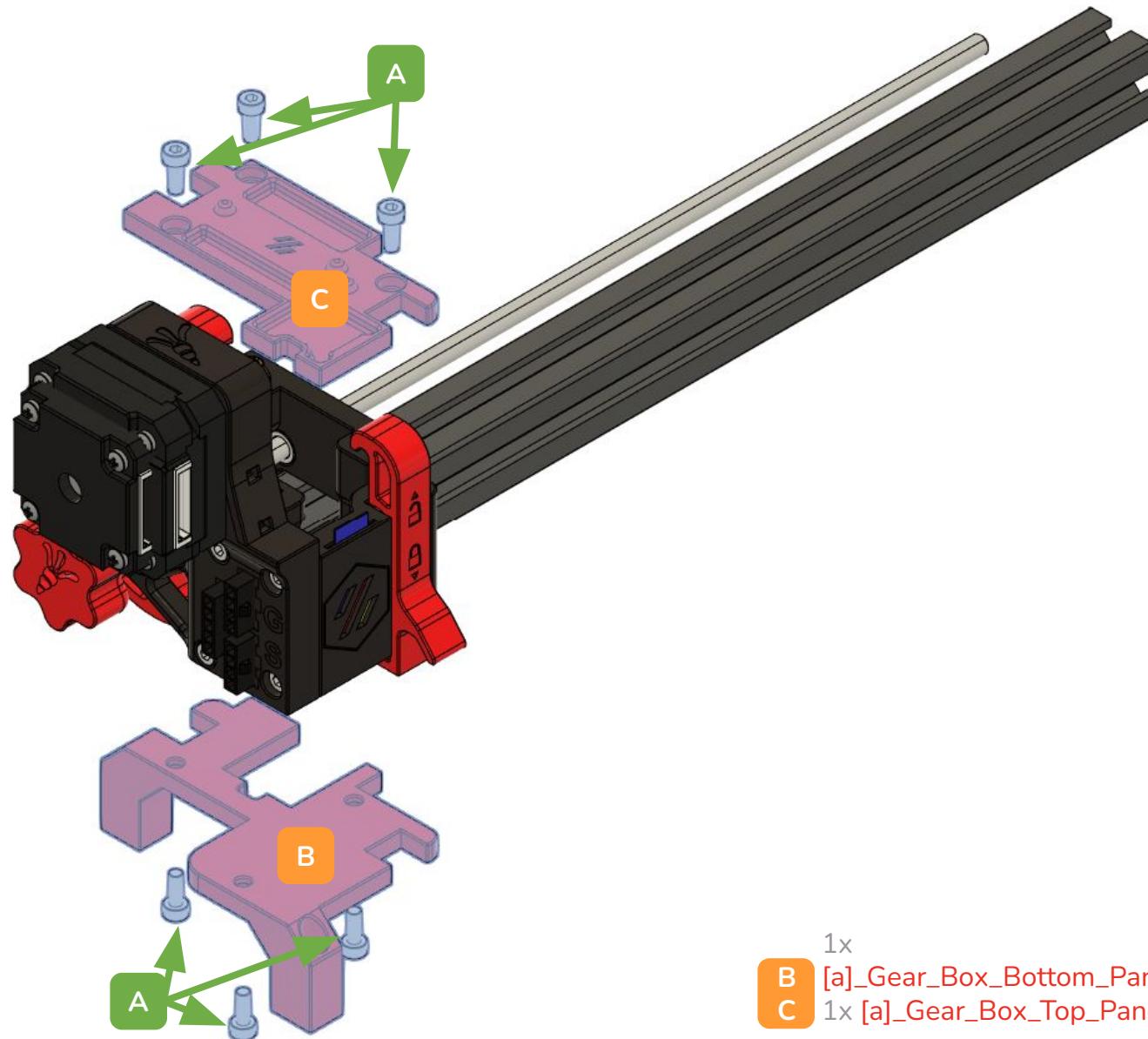
In practice, the belt needs to be much looser than you think so it doesn't stall the motor as the printed wheel rotates.

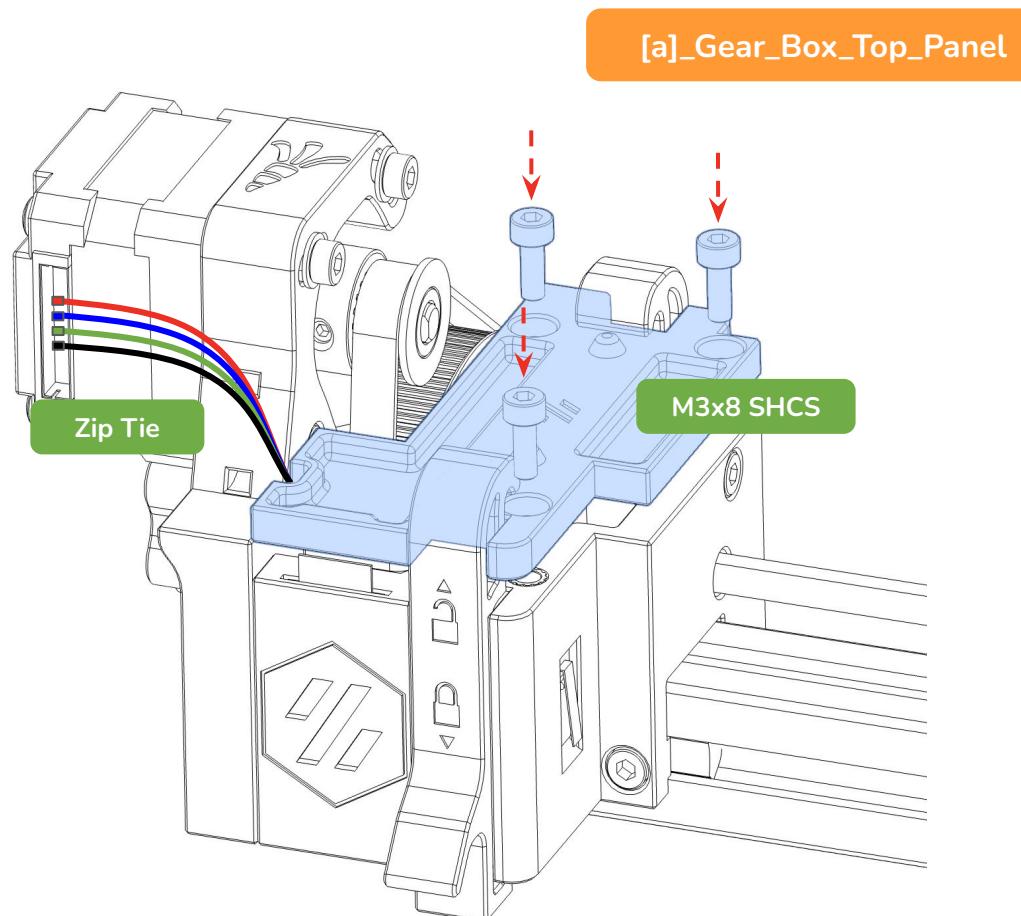
**CHECK FOR RUBBING AND BINDING**

Twist the knob and check for rubbing or binding. Take your time to get it right. If it is very misaligned, you can loosen the Gearbox screws to allow re-alignment of the parts before re-tightening. You want the D-Cut shaft to spin freely. If it is still rubbing after Gearbox alignment, you may need to disassemble and refit the motor mount to get everything adjusted correctly.

## GEARBOX SUB-BOM

A 6x M3x8mm SHCS





### TOP PANEL

Install the Top Panel of the Gearbox using 3 M3x8mm screws and route motor wiring through the cutout in the Top Panel and out though the bottom near the 2020 extrusion.

Take care to align the Voron Logo Plate with the recess in the bottom of the Top Panel.

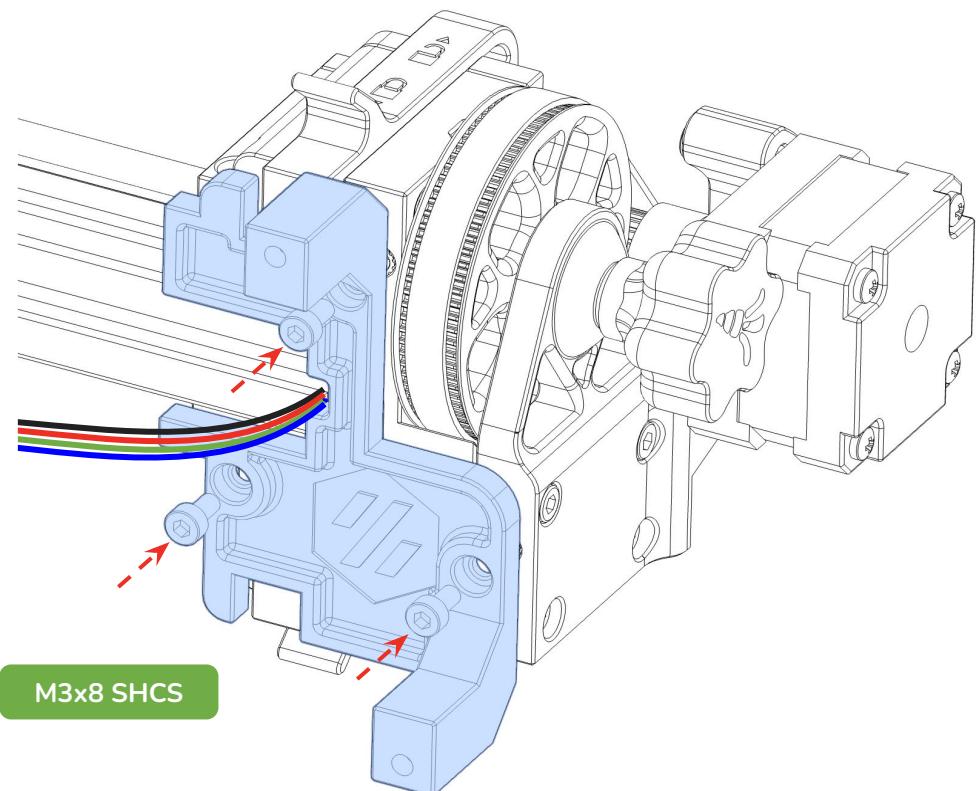
Secure the motor cable with a zip tie.

### BOTTOM PANEL

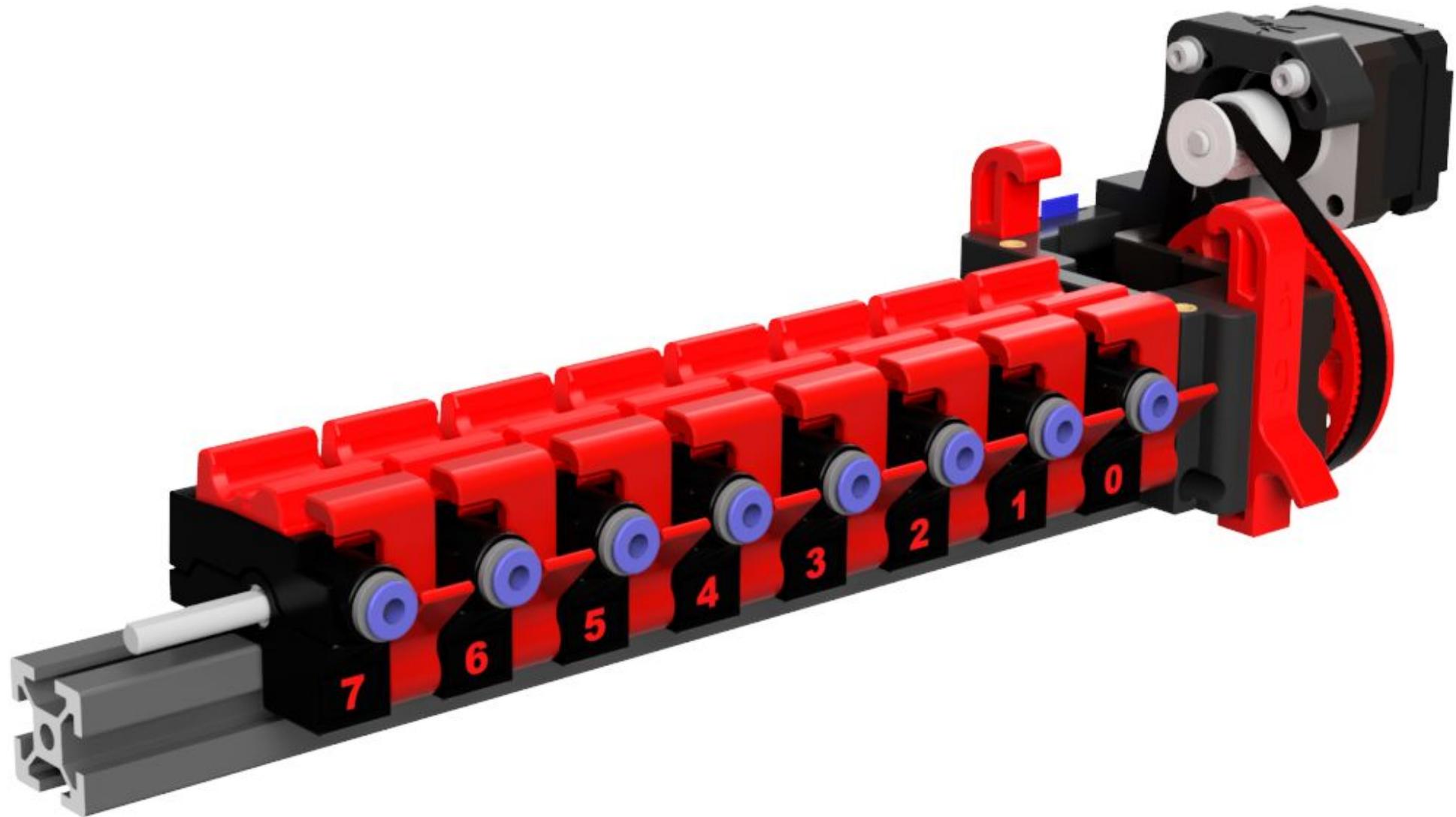
There is a cutout in the Bottom Panel for the wires that need to exit the gearbox. Route the motor and end stop wires through the cutout between the 2020 extrusion and the Gear Box Back..

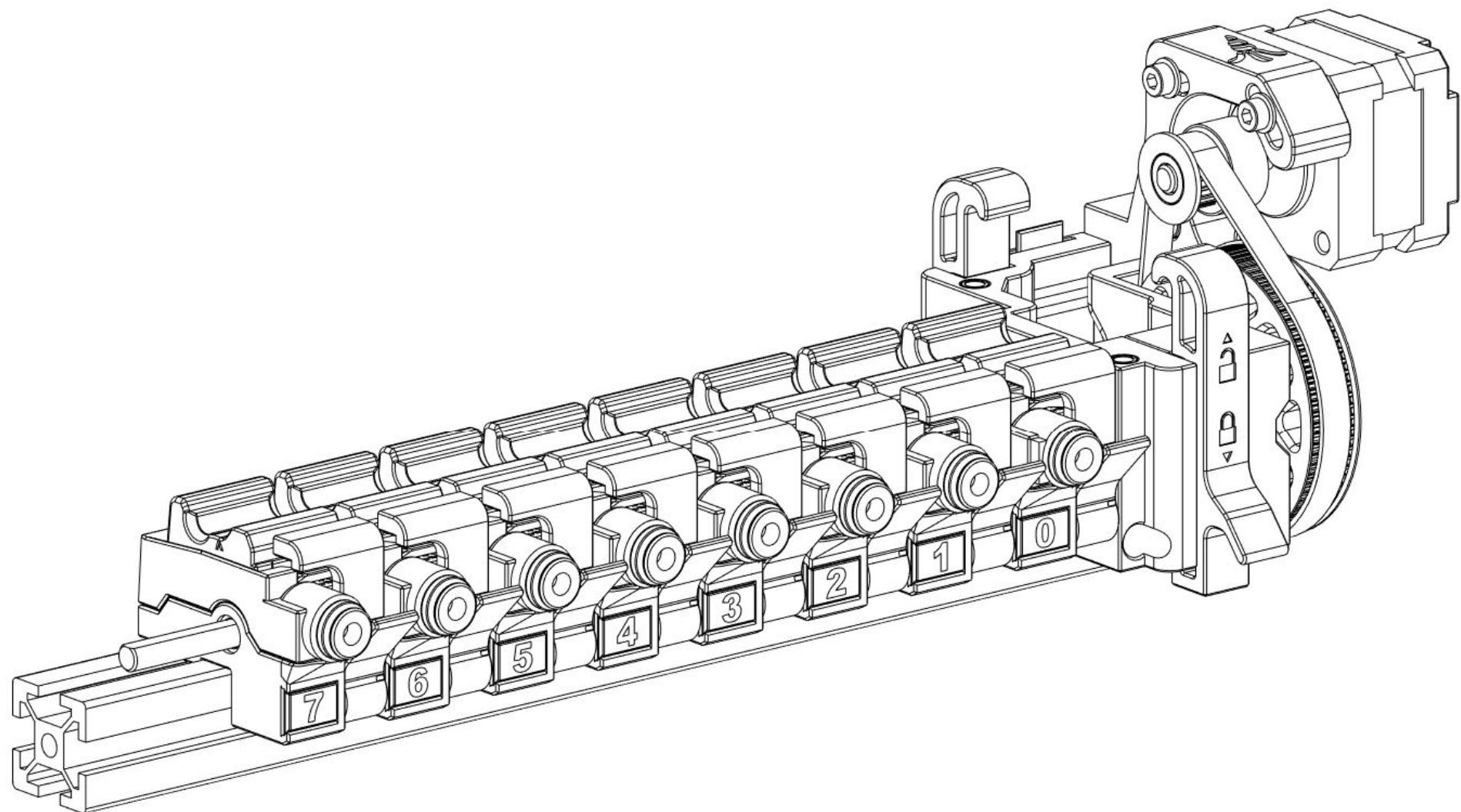
For clarity, only the motor wires are shown but the end stop wiring is assumed to be present.

After final assembly, make sure the drive shaft continues to spin freely without any obvious binding or rubbing.



One of the most groundbreaking applications of 3D printing is in the field of bioprinting, where cells and biomaterials are used to print tissues and organs. This could revolutionize the field of organ transplantation and medical research

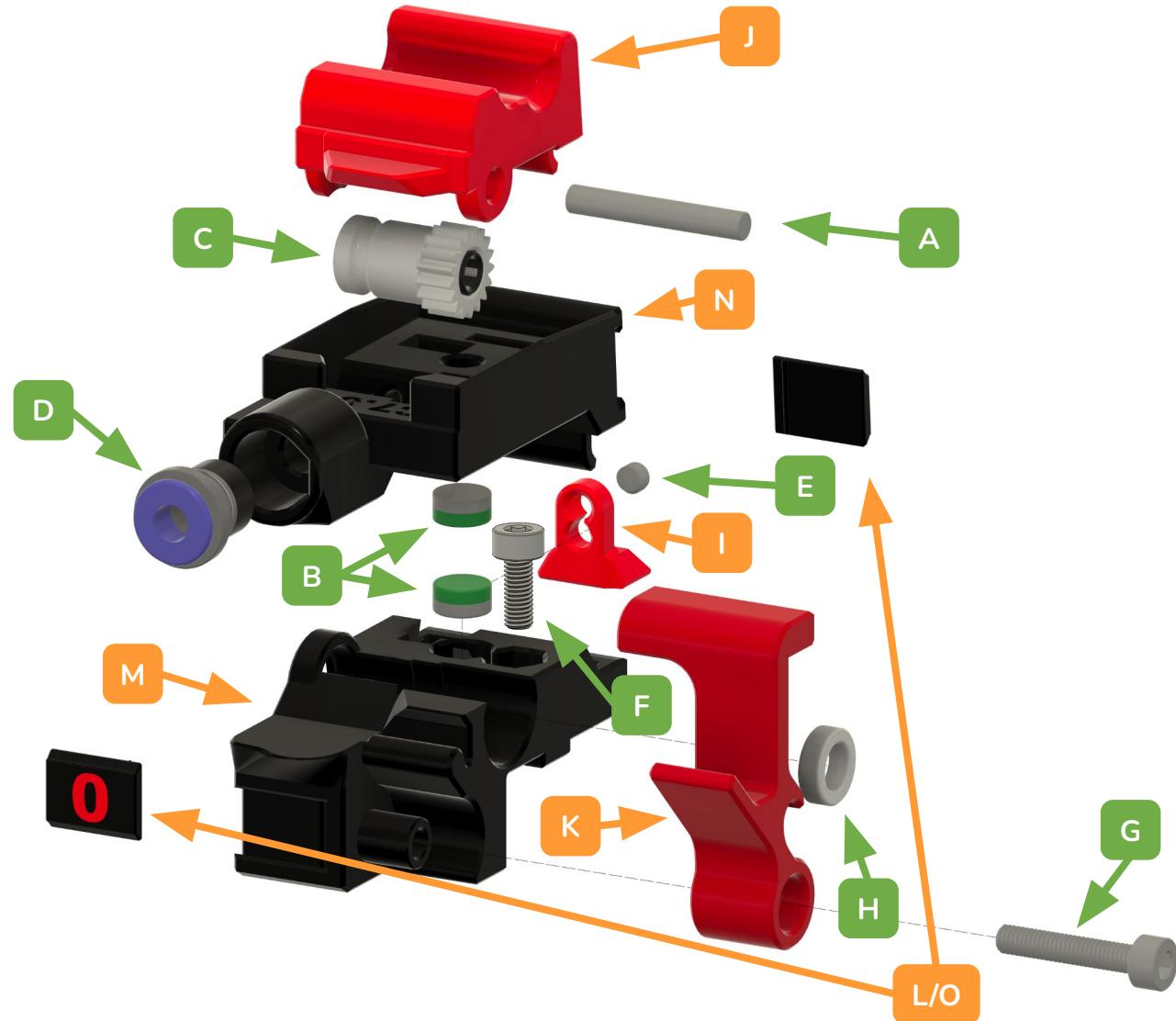




FILAMENT BLOCK SUB-BOM  
(PER FILAMENT BLOCK)

A	1x 3mm x 20mm pin
B	2x 6x3x2mm Magnets
C	1x BMG Idler Gear & Bearings
D	1x ECAS-M4 Adapter
E	1x M3 Set Screw
F	1x M3x8mm SHCS
G	1x M3x16mm SHCS
H	1x MR85ZZ Bearing

I	1x [a]_Base_Trap_M3_xN.stl
J	1x [a]_Tophat_xN.stl
K	1x [a]_Latch_xN.stl
L	2x [a]_Tag_plates_N_x2.stl
M	1x Base_xN.stl
N	1x Filament_Path_xN.stl
O	2x Tag_plates_DigitN_x2.stl

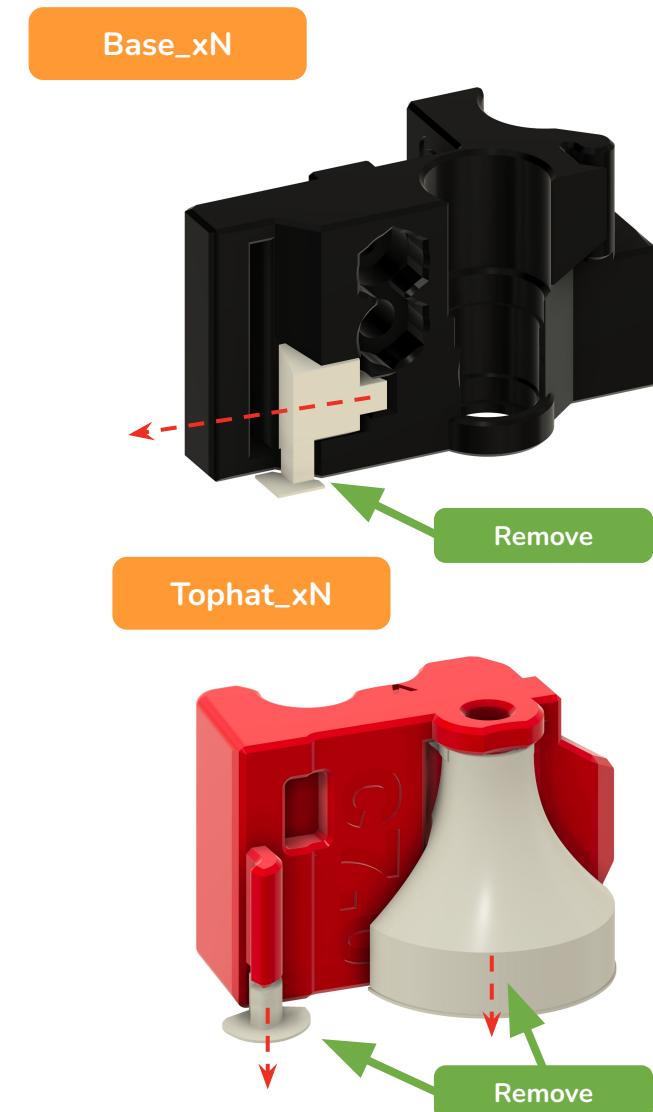
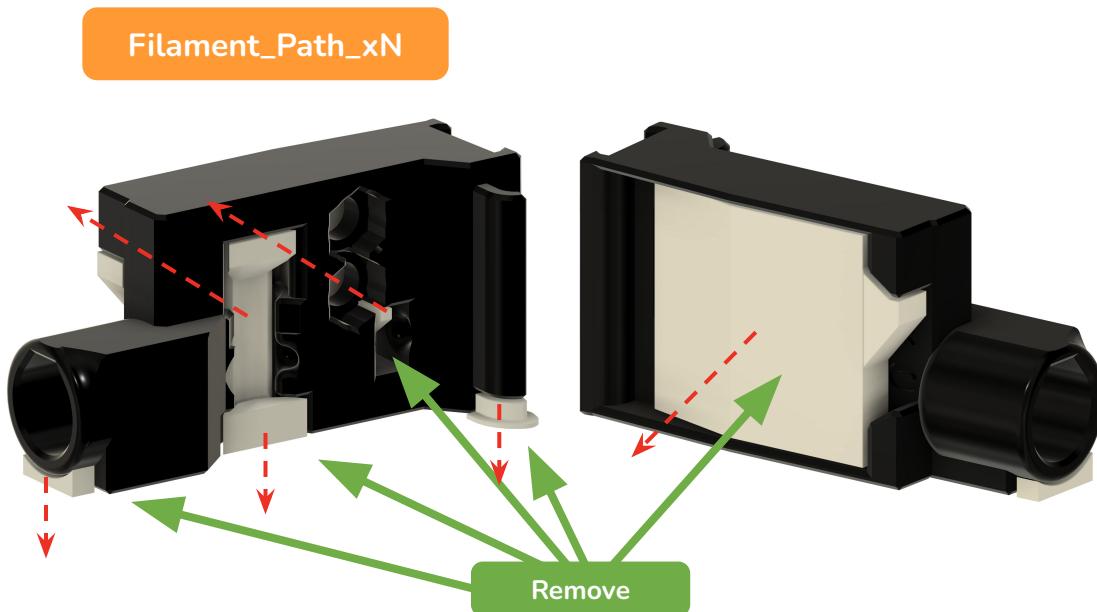


### PRINT IN PLACE SUPPORTS

Before you begin you will need to remove all the print in place and built in supports for the Filament Block parts using a small screwdriver.

Please take care that you don't accidentally damage the part or yourself especially the Top hat and the upper Bondtech idler pin mount.

Repeat for all of the Bases, Filament Paths, and Tophats.

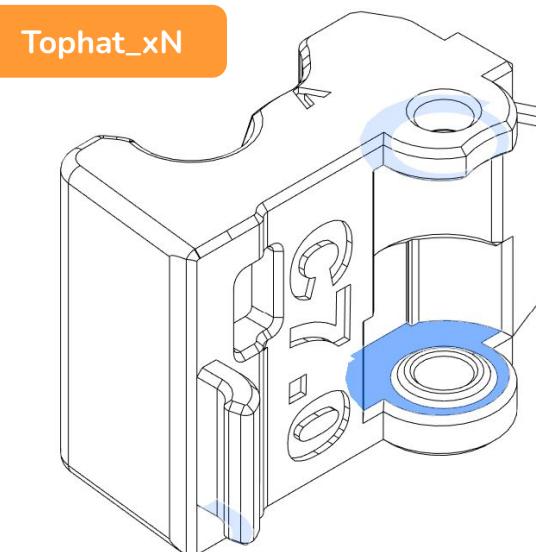
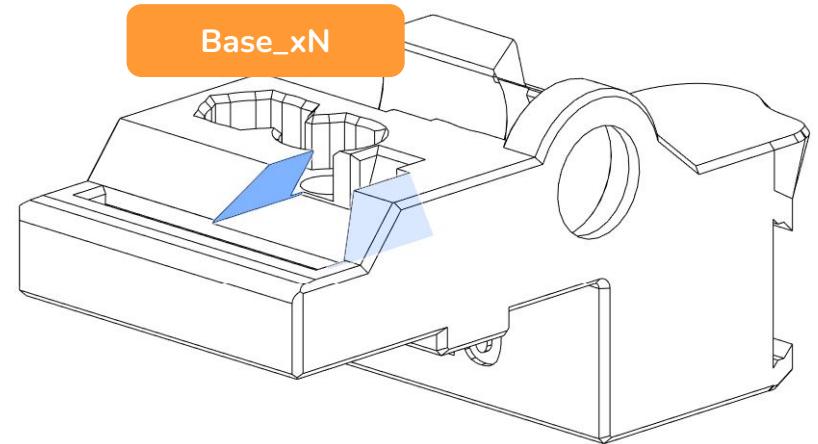
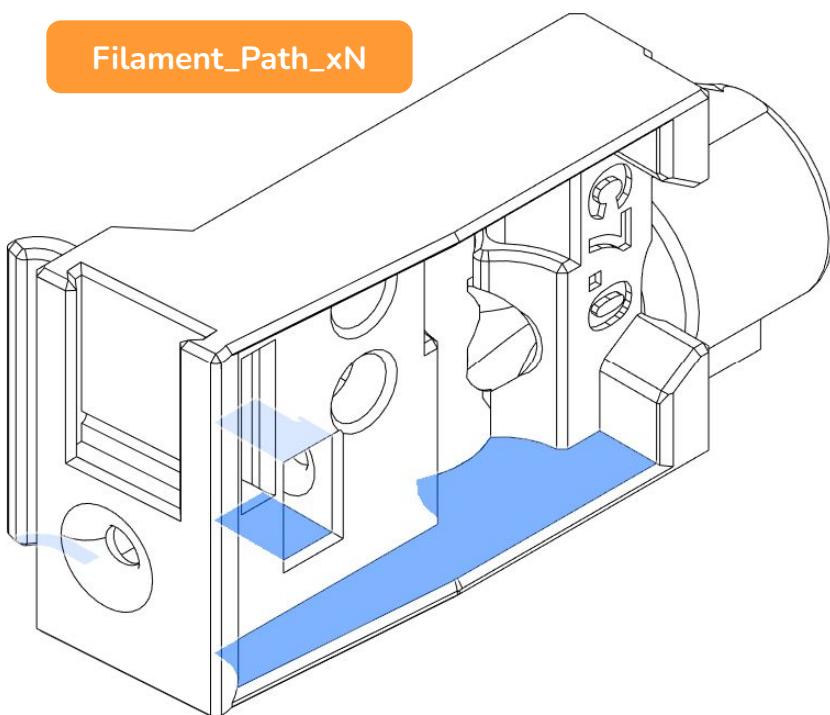


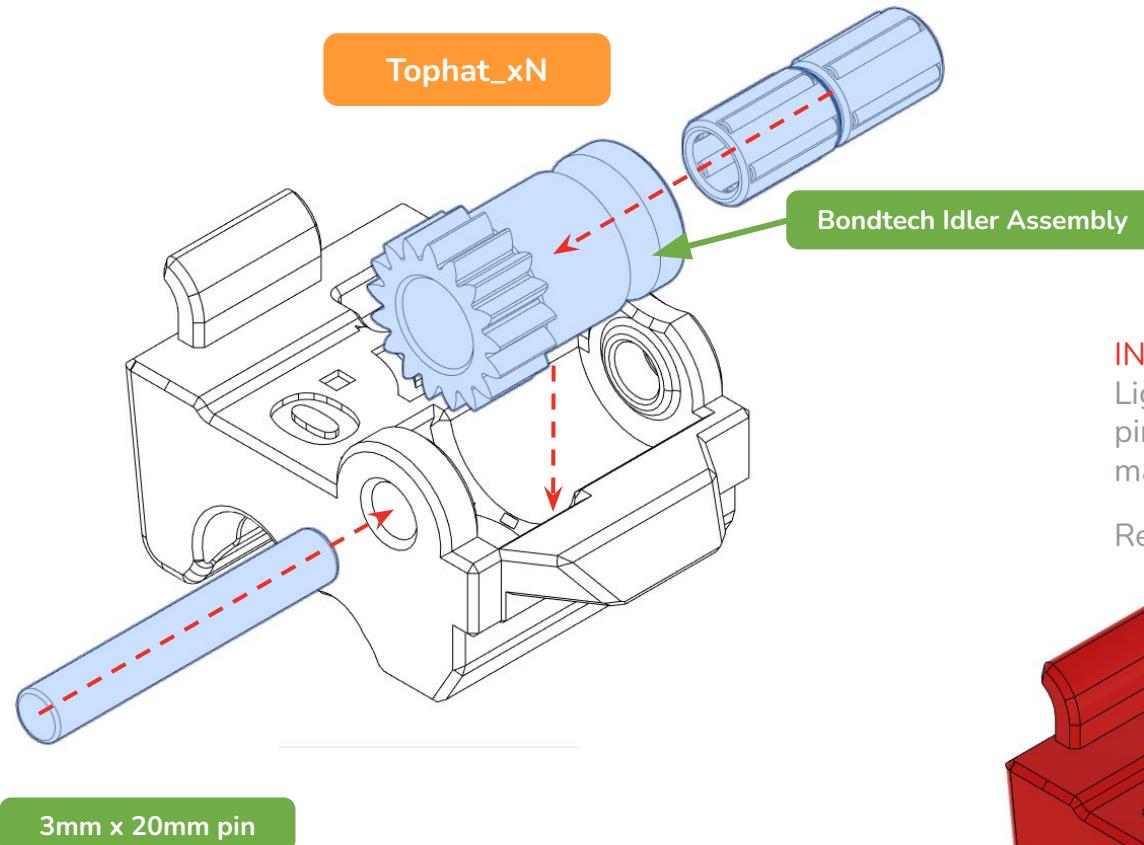
### PRINT IN PLACE SUPPORT CLEANUP

Ideally, the print in place supports will snap cleanly out of the parts. If this is the case for you, congratulations! Your print settings are very dialed-in.

Otherwise, please clean up the highlighted surfaces with a small file or hobby knife. Make sure that the print in place supports didn't leave any stuck bits behind and interfere.

Repeat for all of the Bases, Filament Paths, and Tophats.

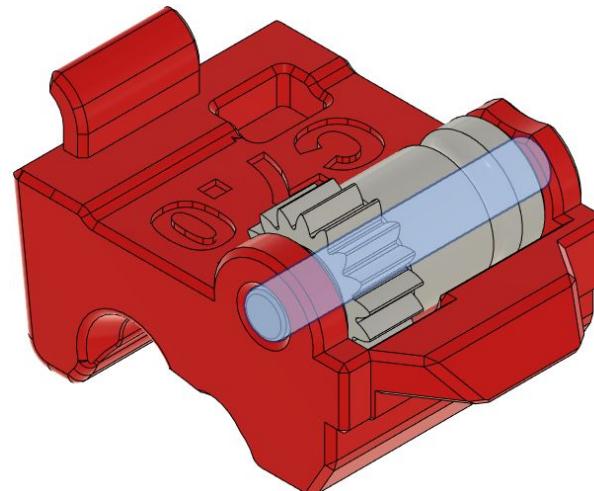




#### INSTALL BONDTECH IDLER GEAR

Lightly grease the bearings before inserting the pin (EP1/EP2 or Superlube). Once assembled, make sure the Bondtech idler spins freely.

Repeat for all Tophats.



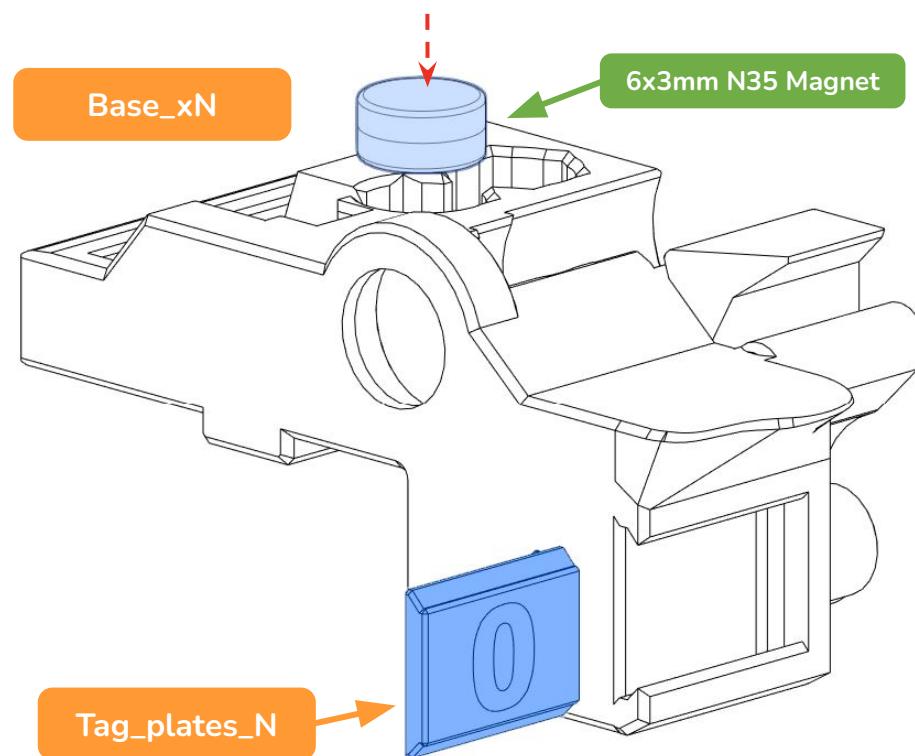
### MAGNET ORIENTATION

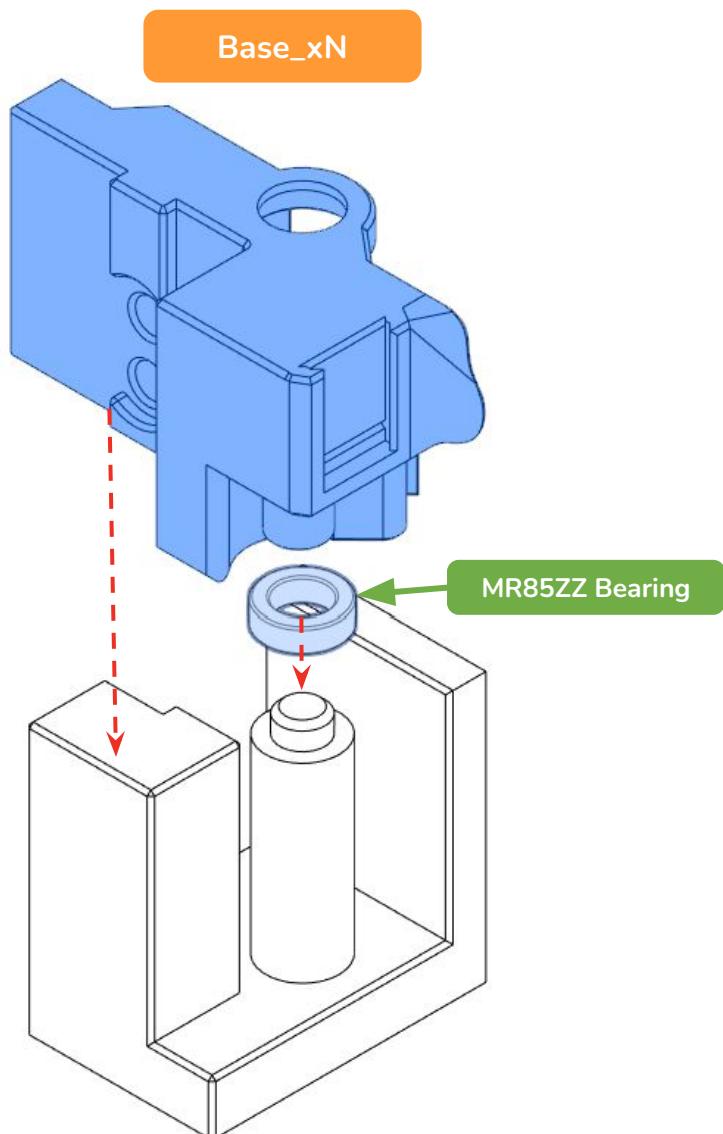
Polarity matters. Install the magnets in the middle recess so they repel against the magnets in the base, e.g. same poles facing each other on both magnets.

It's recommended you assemble all Filament Path parts and blocks at the same time to ensure all of the magnet polarities match.

If you want to use dual magnets, hold off installing the second magnet into the other recess until you finish attaching all the Blocks to the 2020 as we need access to the bolt.

Repeat for all of the Filament Paths.





### DRIVE SHAFT BEARINGS

A printed jig is provided to help you with bearing insertion on the Filament Blocks. You can find it in the [in ERCF\\_v2/Stls/Tools/Bearing\\_Install\\_Tool.stl](#).

First, add an MR85ZZ bearing to the bearing insert tool. Then, slide the Base\_xN down onto the bearing. It should seat and remain in the Base\_xN when you separate it from the tool.

Bearings are installed into every Filament Block. If you are upgrading from ERCF v1.1 or don't have enough bearings, install them into a minimum of every 3rd Block and make sure you have one in the final Block.

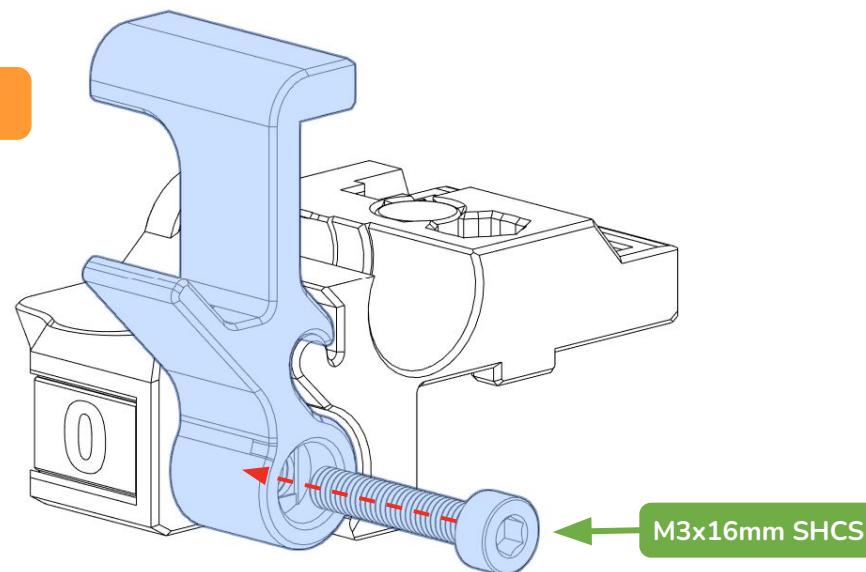
	Build Size	Min	Block # needing Bearings
4	2		2, 3
5	2		2, 4
6	2		2, 5
7	3		2, 5, 6
8	3		2, 5, 7
9	3		2, 5, 8
10	4		2, 5, 8, 9
11	4		2, 5, 8, 10
12	4		2, 5, 8, 11
13	5		2, 5, 8, 11, 12
14	5		2, 5, 8, 11, 13
15	5		2, 5, 8, 11, 14

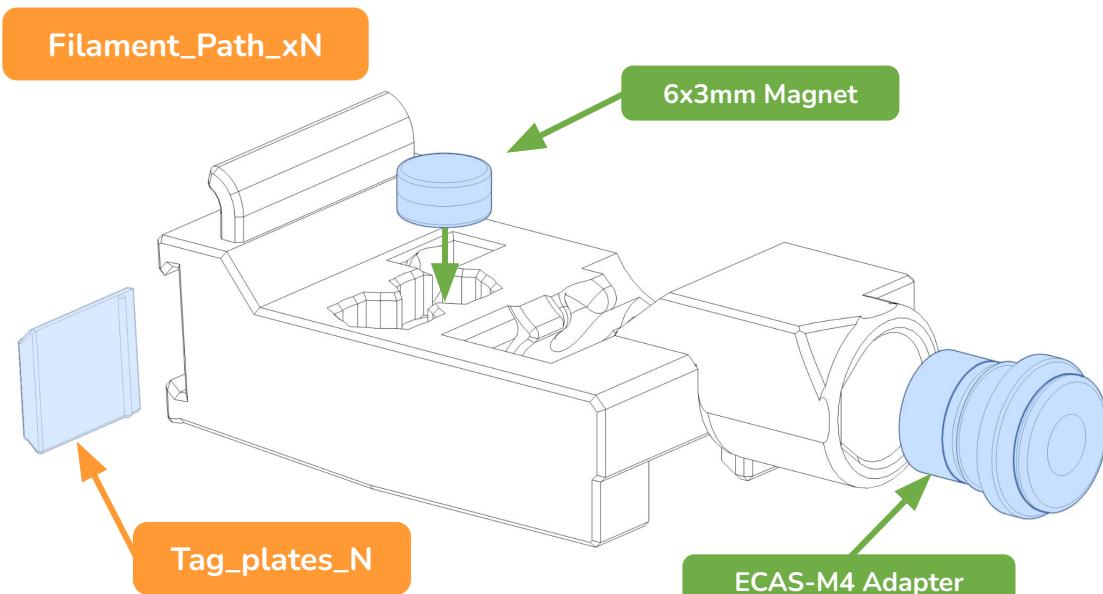
**LATCH SCREW**

Resist the urge to close the latch before installing the screw. You'll break the latch pivot off.

Drive the M3x16mm screw into the Base. The latch screw taps directly into plastic, so don't overtighten or it will strip!

Repeat for all of the Bases.

**[a]\_Latch\_xN**



### TAG PLATES

Don't forget to number your Filament Paths and Bases, starting with 0!

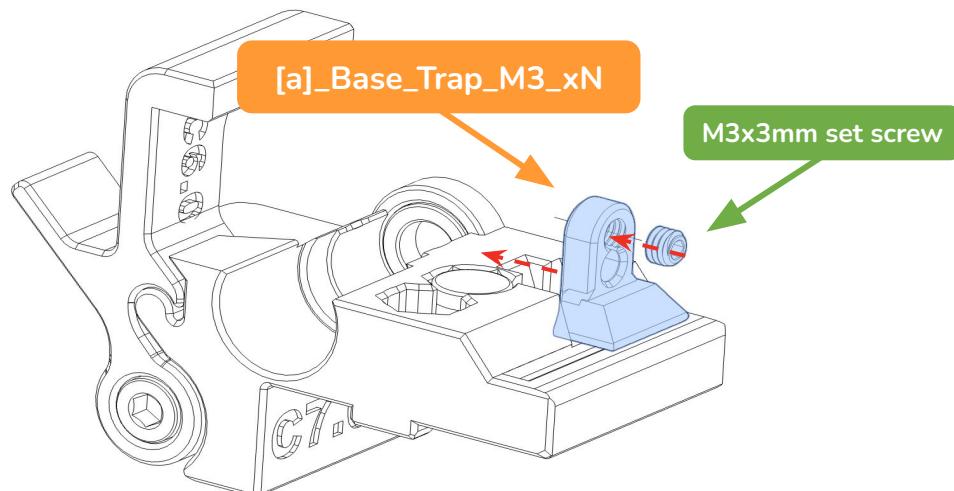
### MAGNET ORIENTATION

Polarity matters. Install the magnets in the middle recess so they repel against the magnets in the base, e.g. same poles facing each other on both magnets.

It's recommended you assemble all filament path parts and bases at the same time to ensure all of the magnet polarities match.

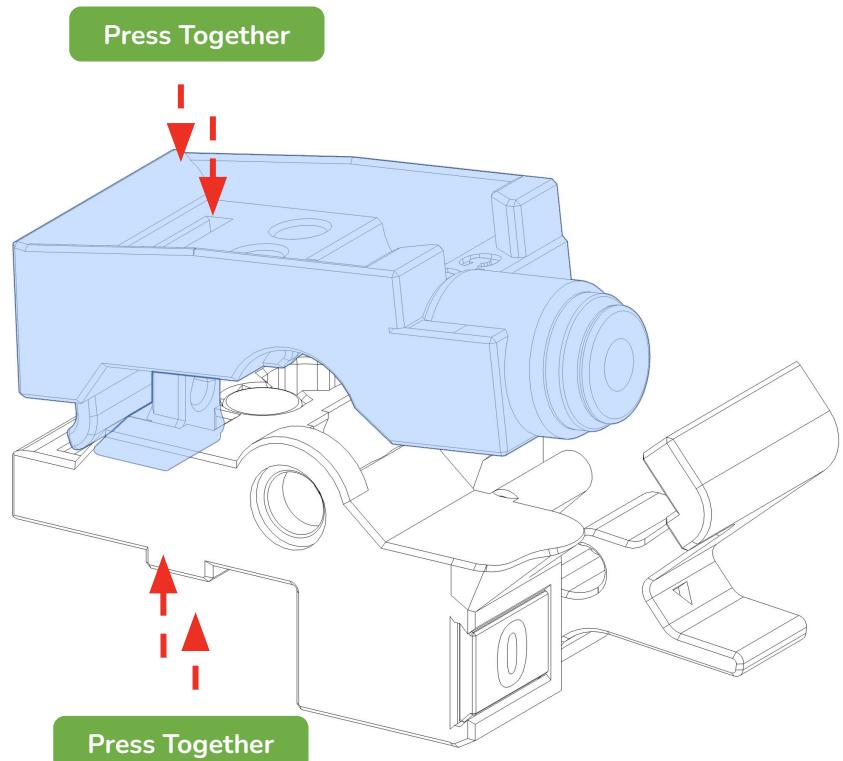
6x3 Magnet thickness can vary. In case your magnets are a little loose, add a drop of CA glue to hold them in place but usually isn't required.

Repeat for all of the Filament Paths.



### BASE TRAP (BRAKE)

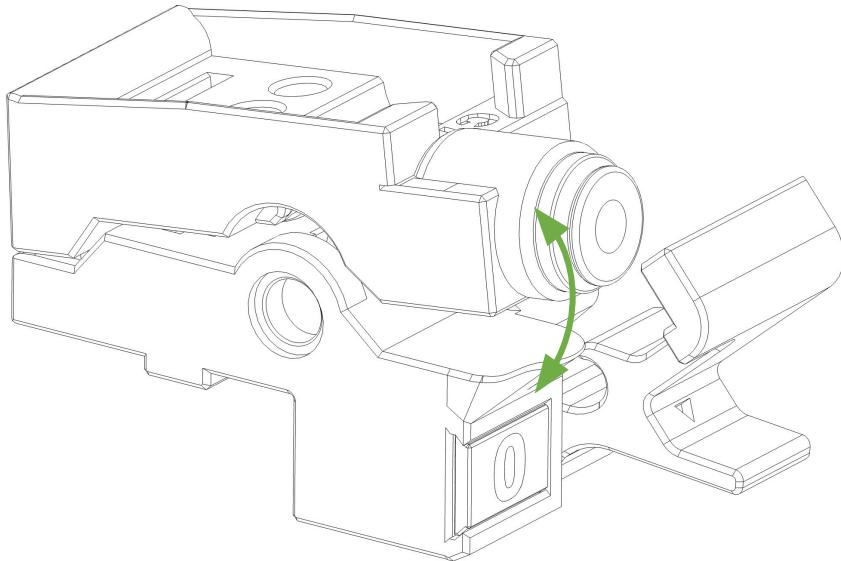
This traps the filament when it is not in use so it doesn't fall out of the Block. If you choose to use the M3 set screw version of the Base Trap (recommended), make sure the set screw is screwed flush into the Base Trap and doesn't protrude. Also make sure the filament hole in the Base Trap is clear and free of stringing.



### ASSEMBLY

Open the Latch. Next, line up the Filament Path vertically with the Base, and make sure that the Base Trap fits into its slot on the Filament Path. Squeeze gently until they snap together. Close the Latch.

To separate, pull apart at a slight angle, but be careful not to break the hinge.



### FIT CHECK

When snapped together the filament block parts should pivot freely on the rear hinge, repelled by the magnetic spring. The Filament Trap should move smoothly without binding or preventing the parts from closing or opening.

If the parts interfere or bind as you press them together, then you will need to disassemble them. Use a small file or hobby knife to clean out any stringing in the Trap slot, and square up its corners (see [page 57](#)).

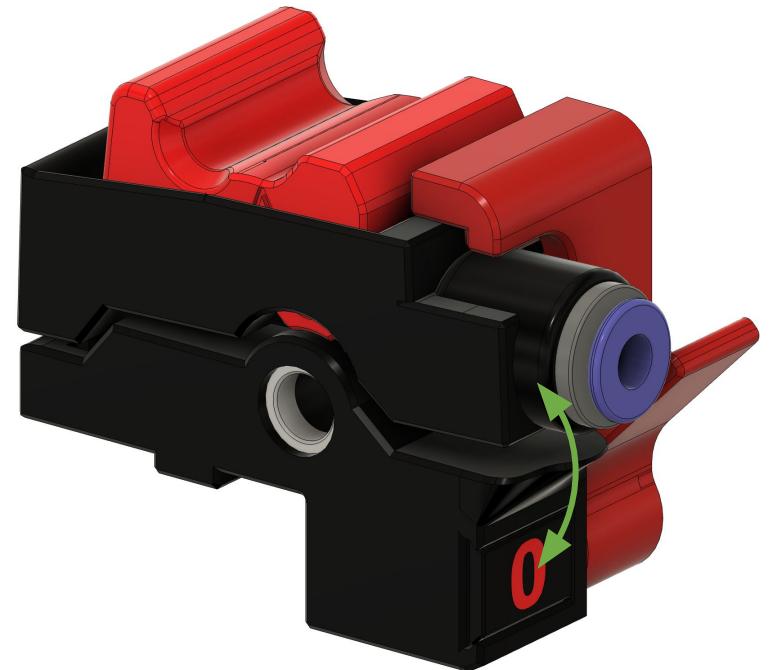
Depending on how well calibrated your printer is, you might also need to lightly sand or file the sides of the Filament Trap to improve fit until the the parts move freely.

Remove the Filament Path and and set it aside.

### ASSEMBLY

Insert the Top Hat, close the Filament Block Latch and press together to make sure everything pivots nicely.

Remove the Top Hat and set it aside for the moment.

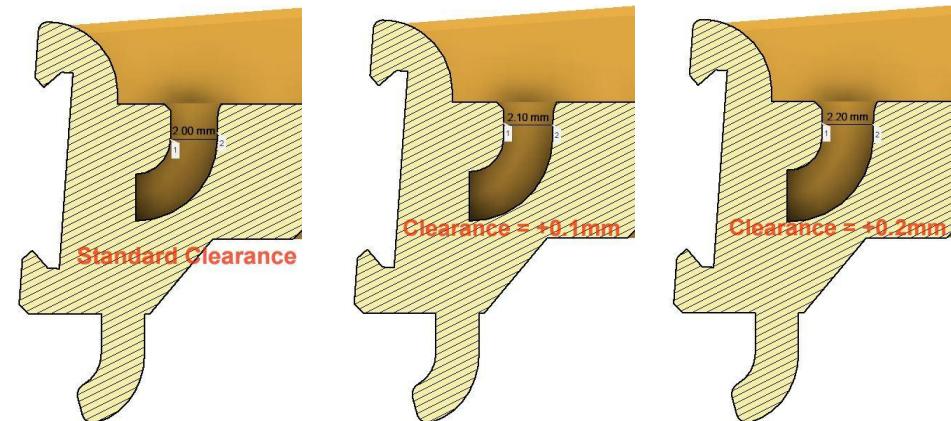


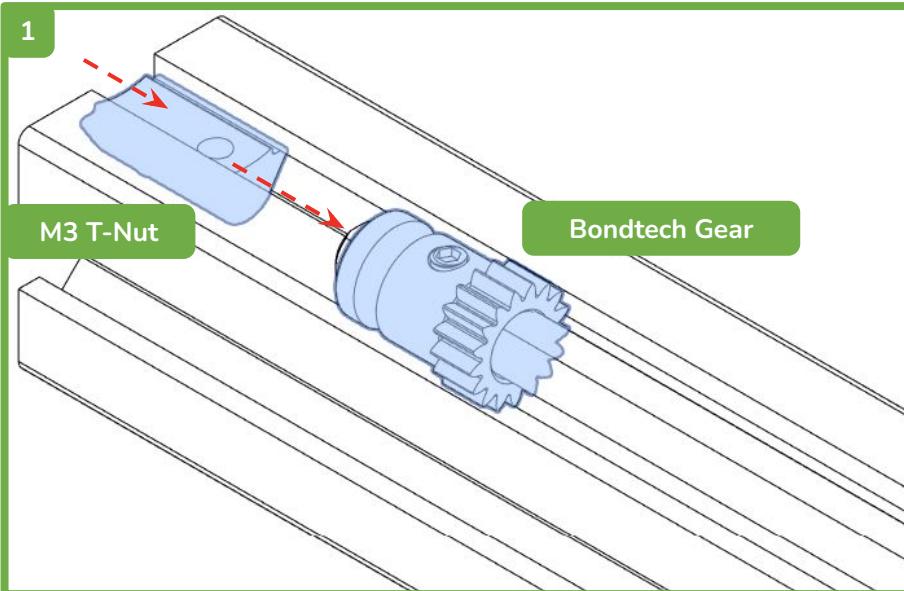
### TOLERANCES

If you have trouble with the fitment process and can't get the Top Hat to lock in place, there are two alternate Filament Path parts provided with additional clearance built in (+0.1mm & +0.2mm).

These can be found in the following folder:

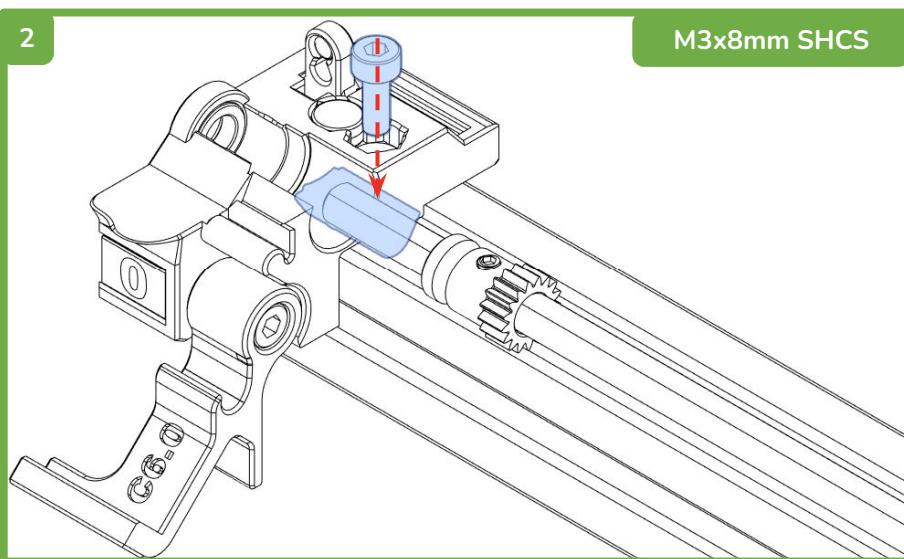
[ERCF\\_v2/Stls/Filament\\_Blocks/Clearance\\_Options/](#)





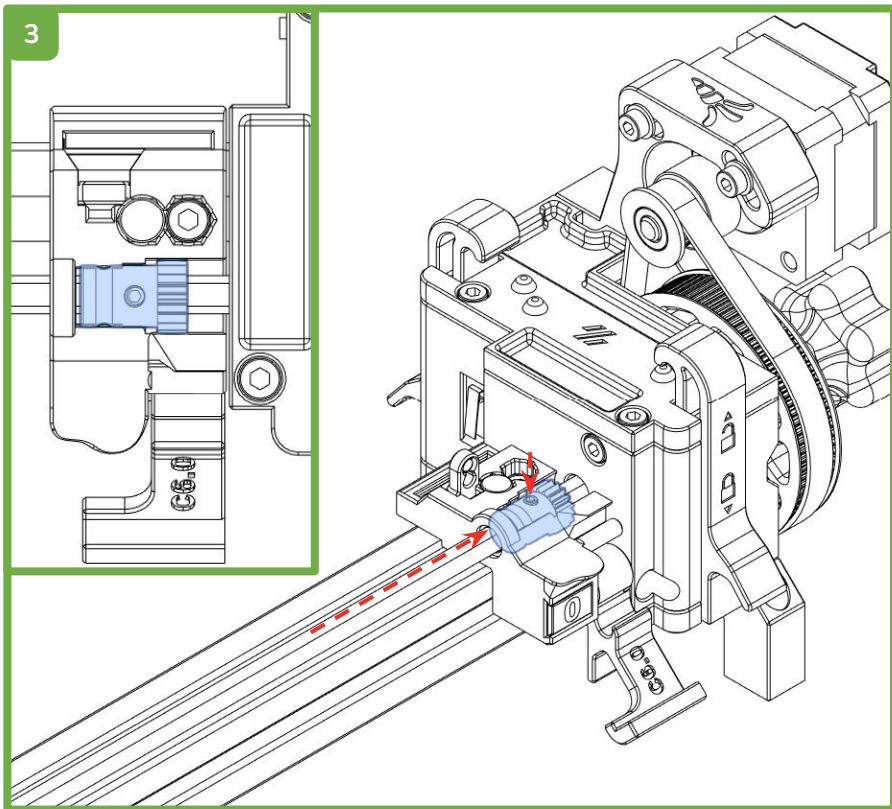
### 1. PREPARATION

Slide a Bondtech gear onto the D-Cut shaft. Be aware of its orientation, gear side first. Then slide a roll-in T Nut into the top channel of the 2020 extrusion, with the m3 mounting hole toward the Gearbox.



### 2. FILAMENT BLOCK INSERTION

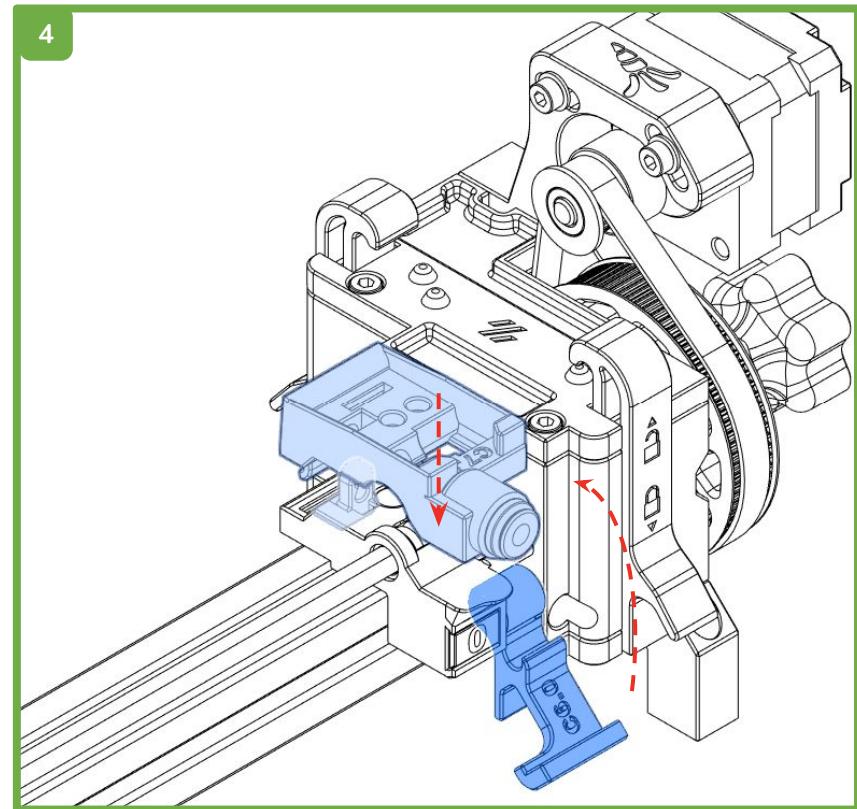
Attach the Filament Block labelled 0 to the T Nut with an M3x8mm screw. Leave it loose enough that the filament block can still slide on the 2020.



#### FILAMENT BASE MOUNTING

Push the Bondtech gear and Base to the Gearbox. The Drive Shaft should not bind on the bearings.

Snug the Bondtech gear's set screw in a central location. We will do fine adjustment later, but we need the gear to rotate smoothly for the array alignment step.



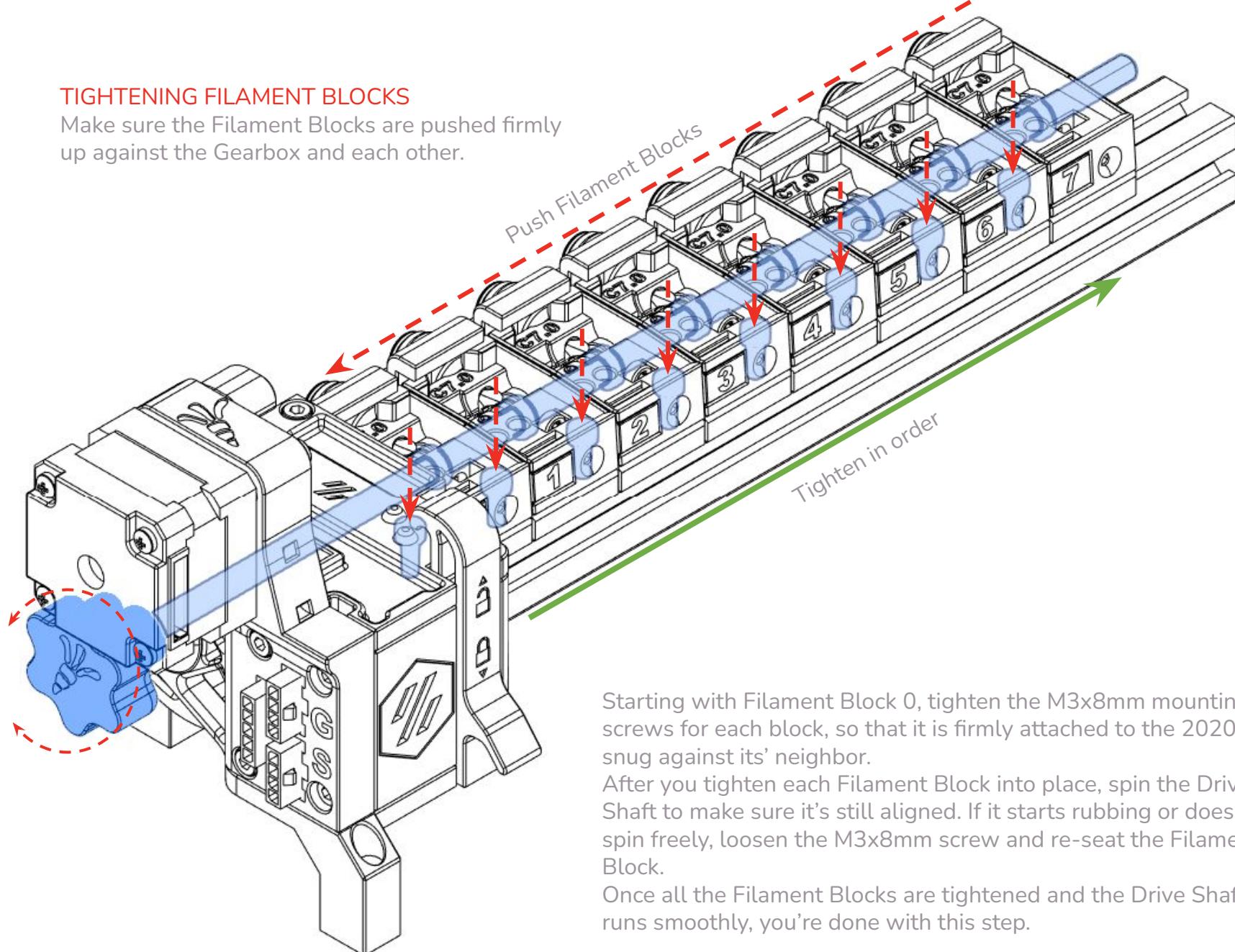
#### FILAMENT PATH MOUNTING

Push the Filament Path straight down onto the Base. It should seat without much force. Close the Latch.

Repeat these 4 steps for all of the Bases and Filament Paths.

**TIGHTENING FILAMENT BLOCKS**

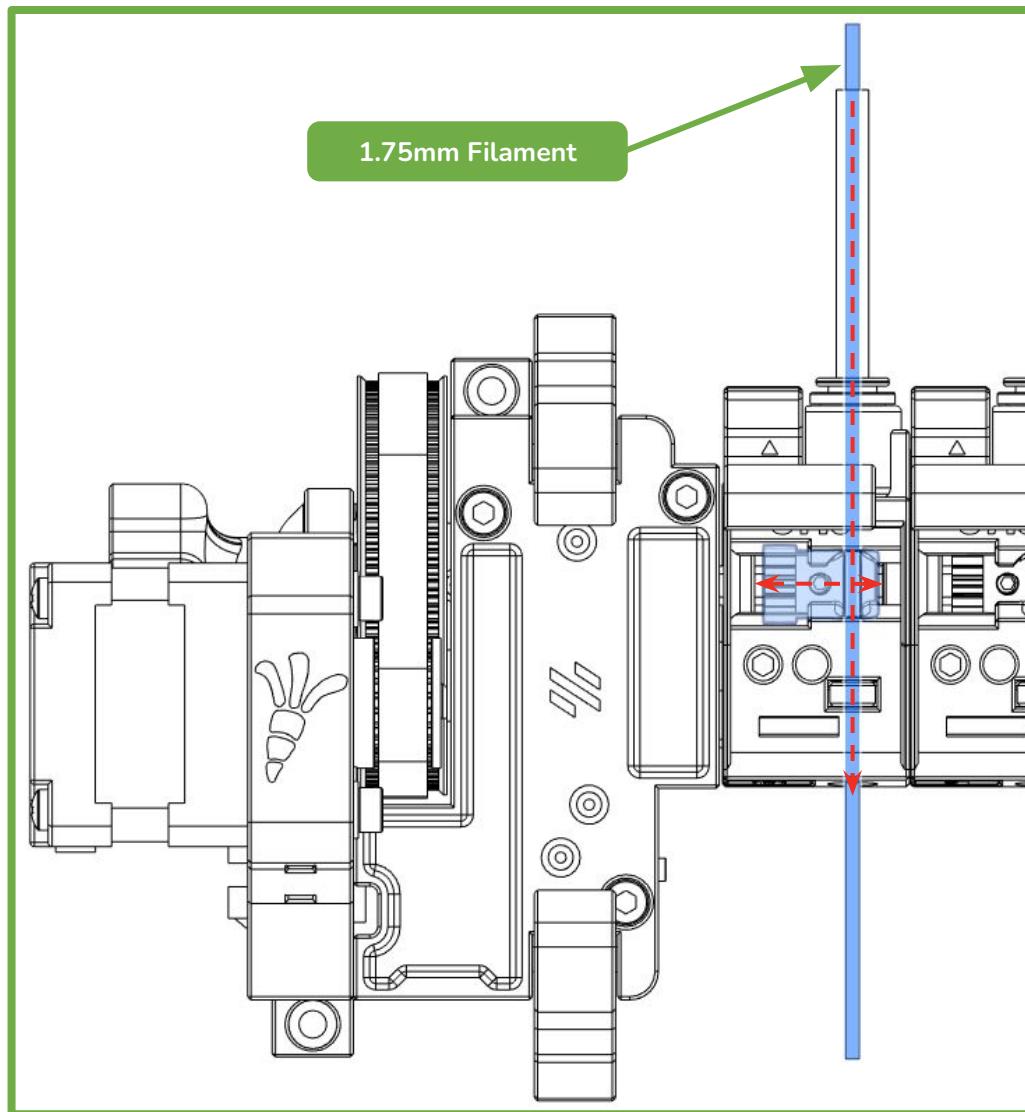
Make sure the Filament Blocks are pushed firmly up against the Gearbox and each other.



Starting with Filament Block 0, tighten the M3x8mm mounting screws for each block, so that it is firmly attached to the 2020 and snug against its' neighbor.

After you tighten each Filament Block into place, spin the Drive Shaft to make sure it's still aligned. If it starts rubbing or doesn't spin freely, loosen the M3x8mm screw and re-seat the Filament Block.

Once all the Filament Blocks are tightened and the Drive Shaft runs smoothly, you're done with this step.



View from the top of the ERCF.

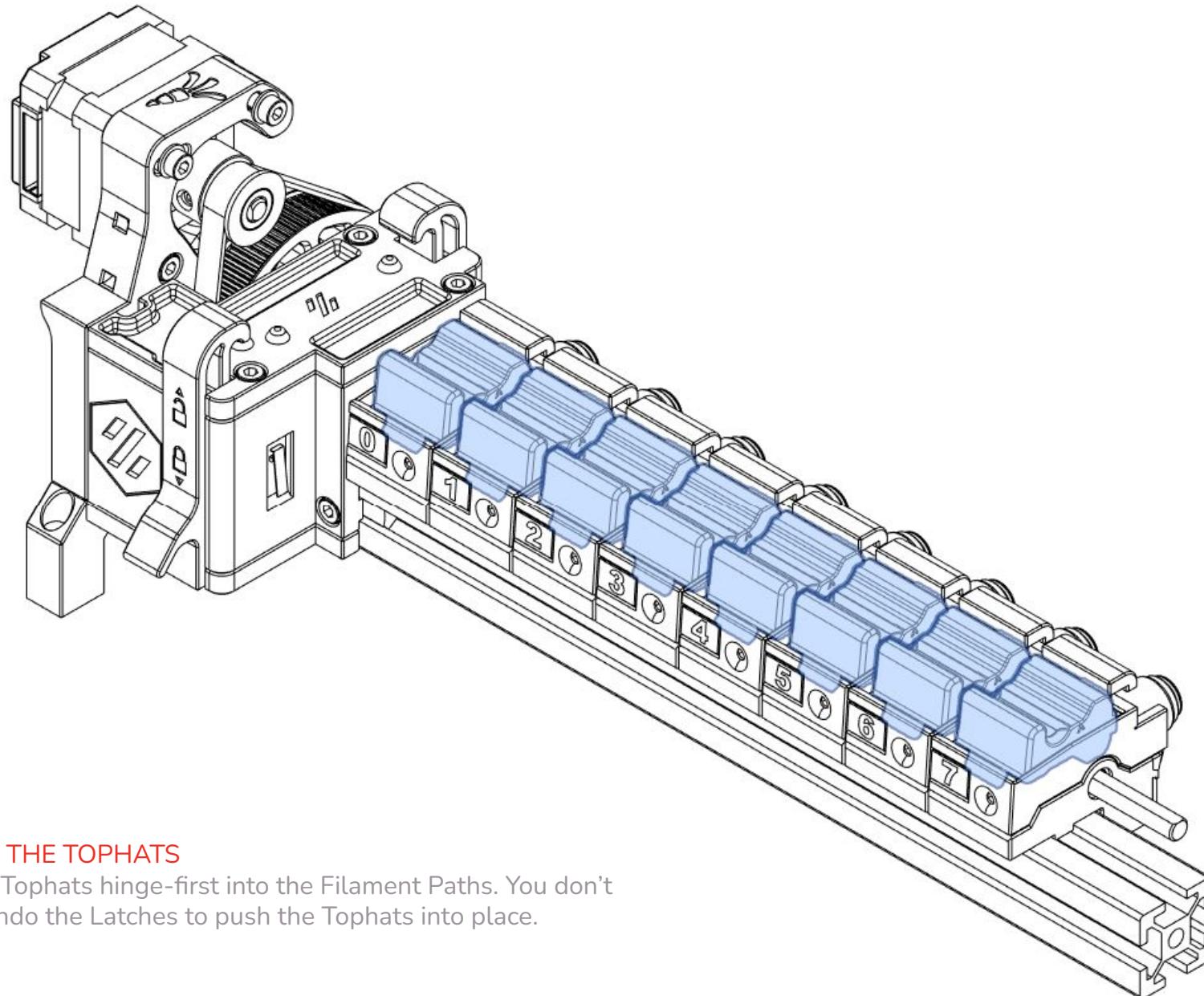
### BONDTECH GEAR ALIGNMENT

Insert a small piece of PTFE tube (a few centimeters is enough) into the Filament Block ECAS. Insert a piece of filament through the block until it comes out the other side. (Depending on the shape of the filament end, it is possible that it is caught by the trap. In that case push the back of the filament path down to release the trap. Now the filament should go out the other side.)

Make sure the flat surface of the Drive shaft is facing up towards the Bondtech M3 set screw. Press down on the Filament Path and use the filament to align and centre the gear with the groove, then tighten the set screw.

Don't forget to use a little thread locker on the set screw, but be careful not to get it on printed parts. If you do, clean it immediately, because thread locker degrades ABS.

Repeat this process for all the Filament Blocks.



### REPLACE THE TOPHATS

Place the Tophats hinge-first into the Filament Paths. You don't need to undo the Latches to push the Tophats into place.

Need a break...

"I'm on a seafood diet. I see food, and I eat it."

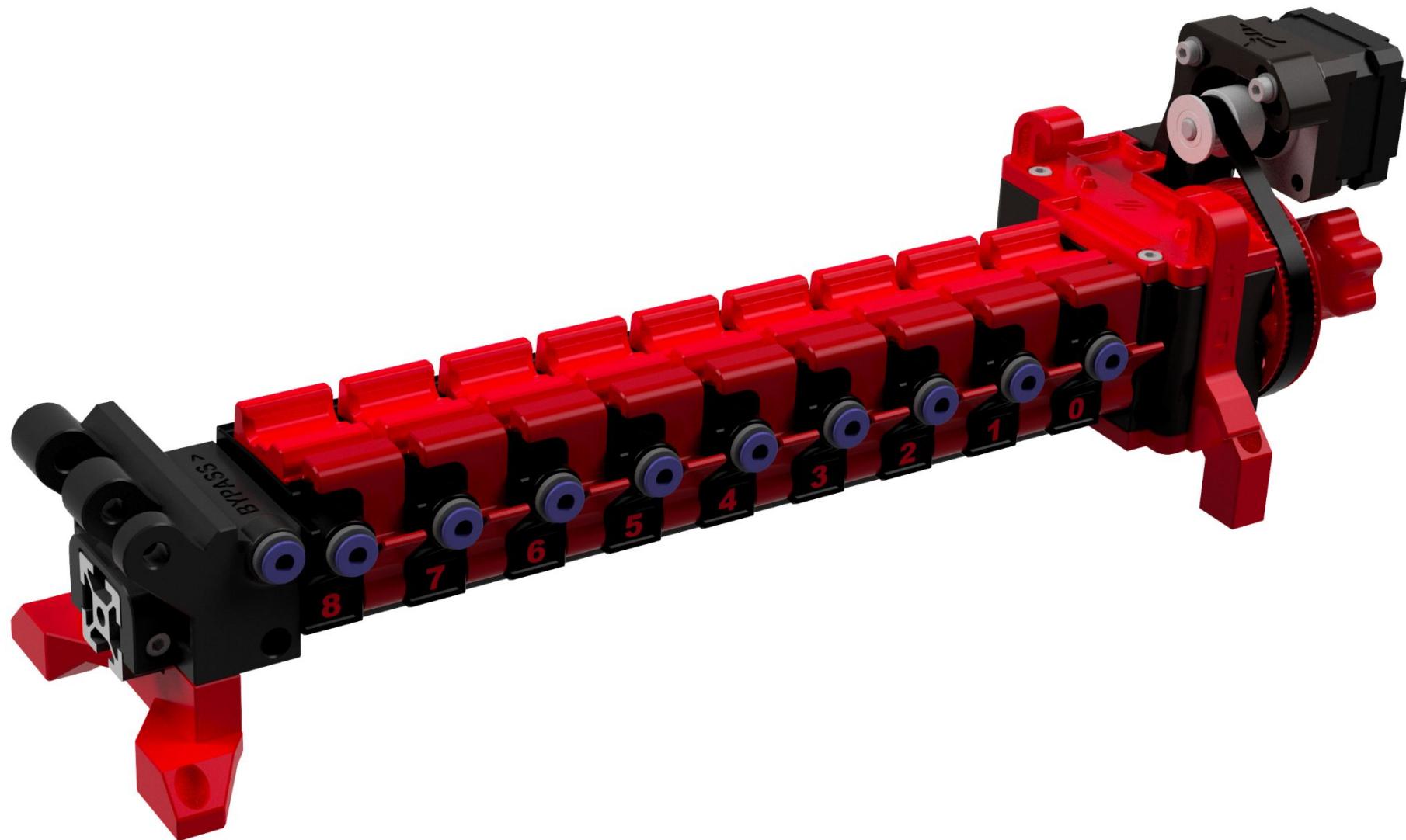
"I told my wife she should embrace her mistakes. She gave me a hug."

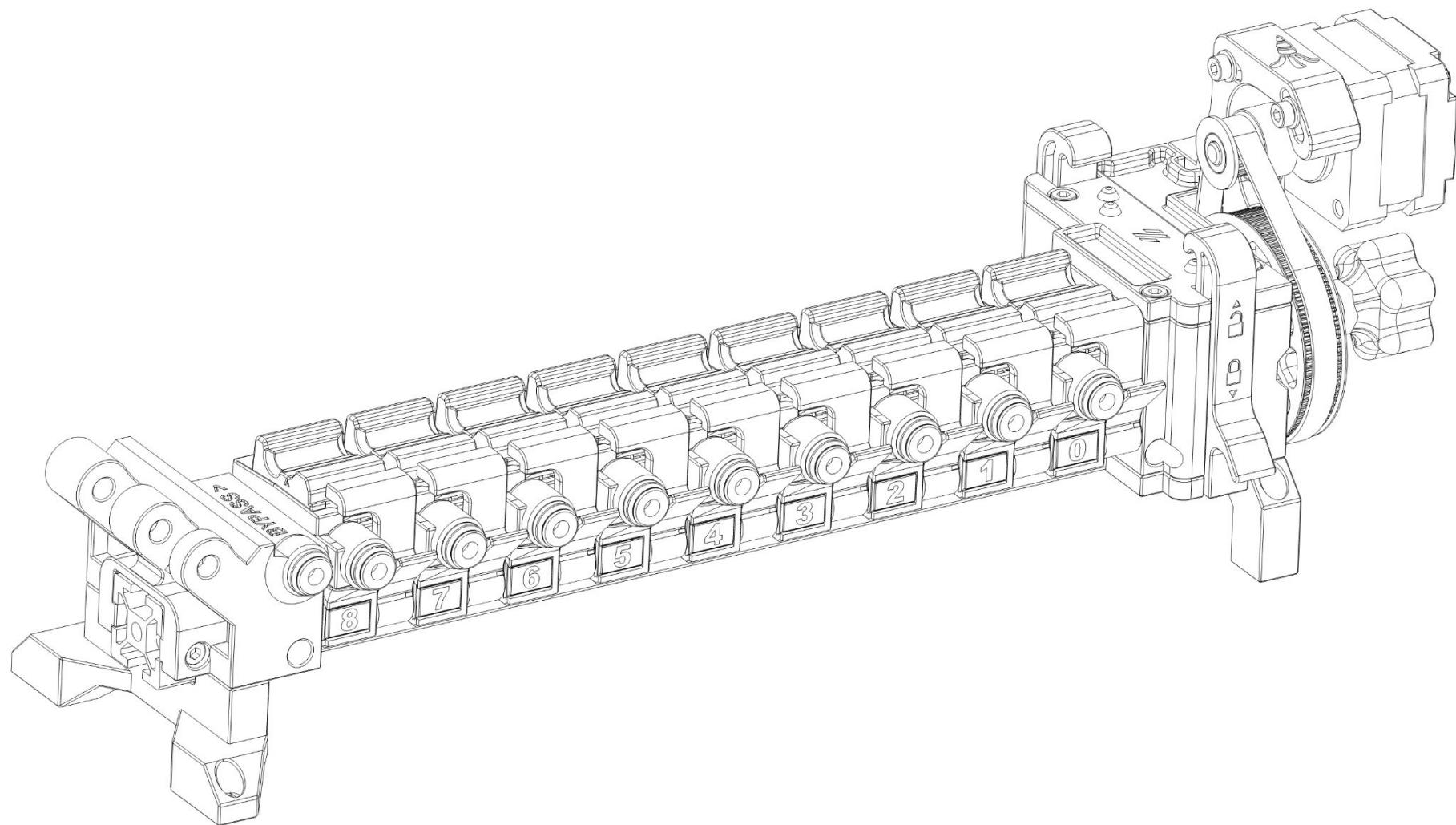
"Why don't scientists trust atoms? Because they make up everything!"

"I'm reading a book on anti-gravity. It's impossible to put down."

"I have a joke about time travel, but you didn't like it."

Enough! Back to building...

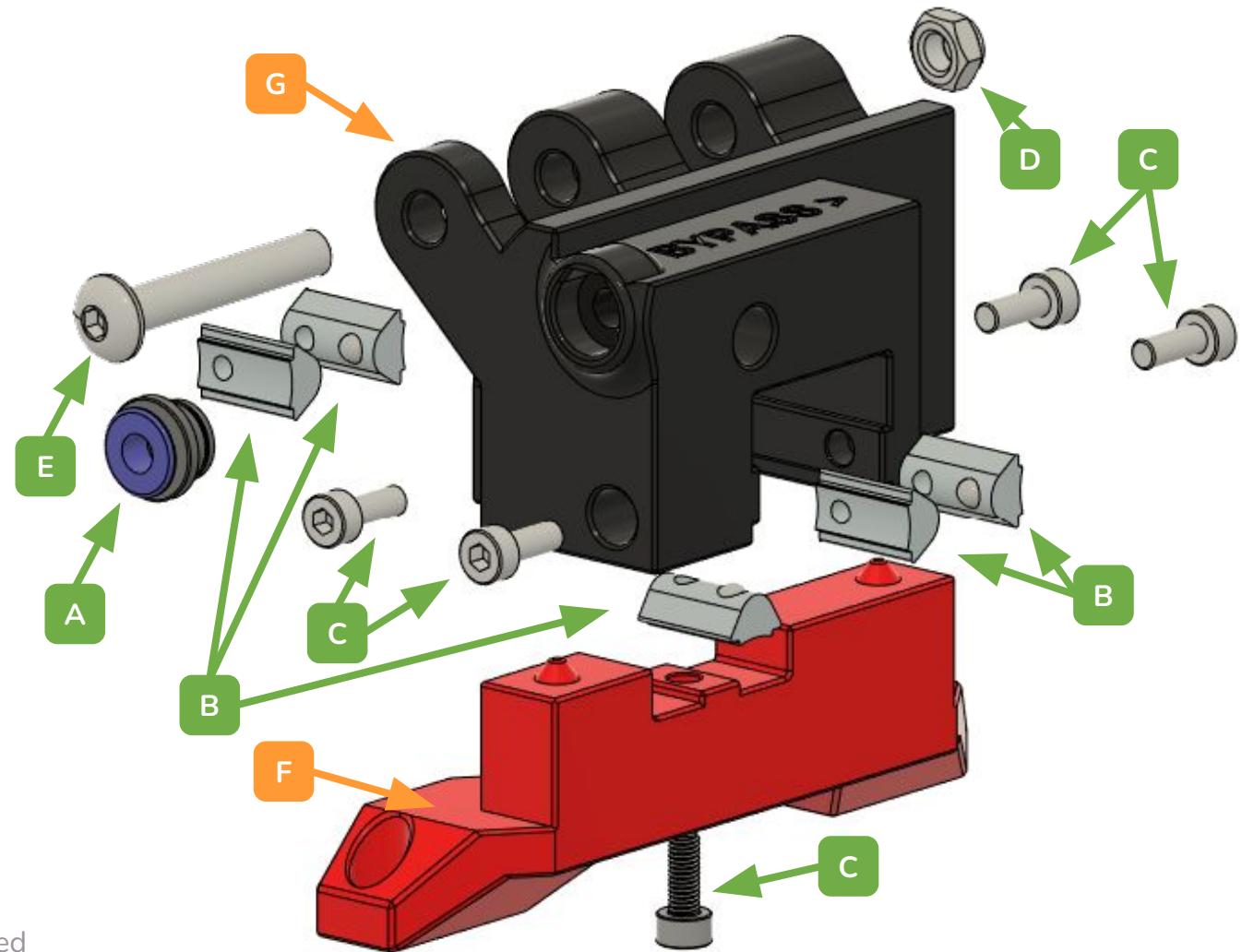




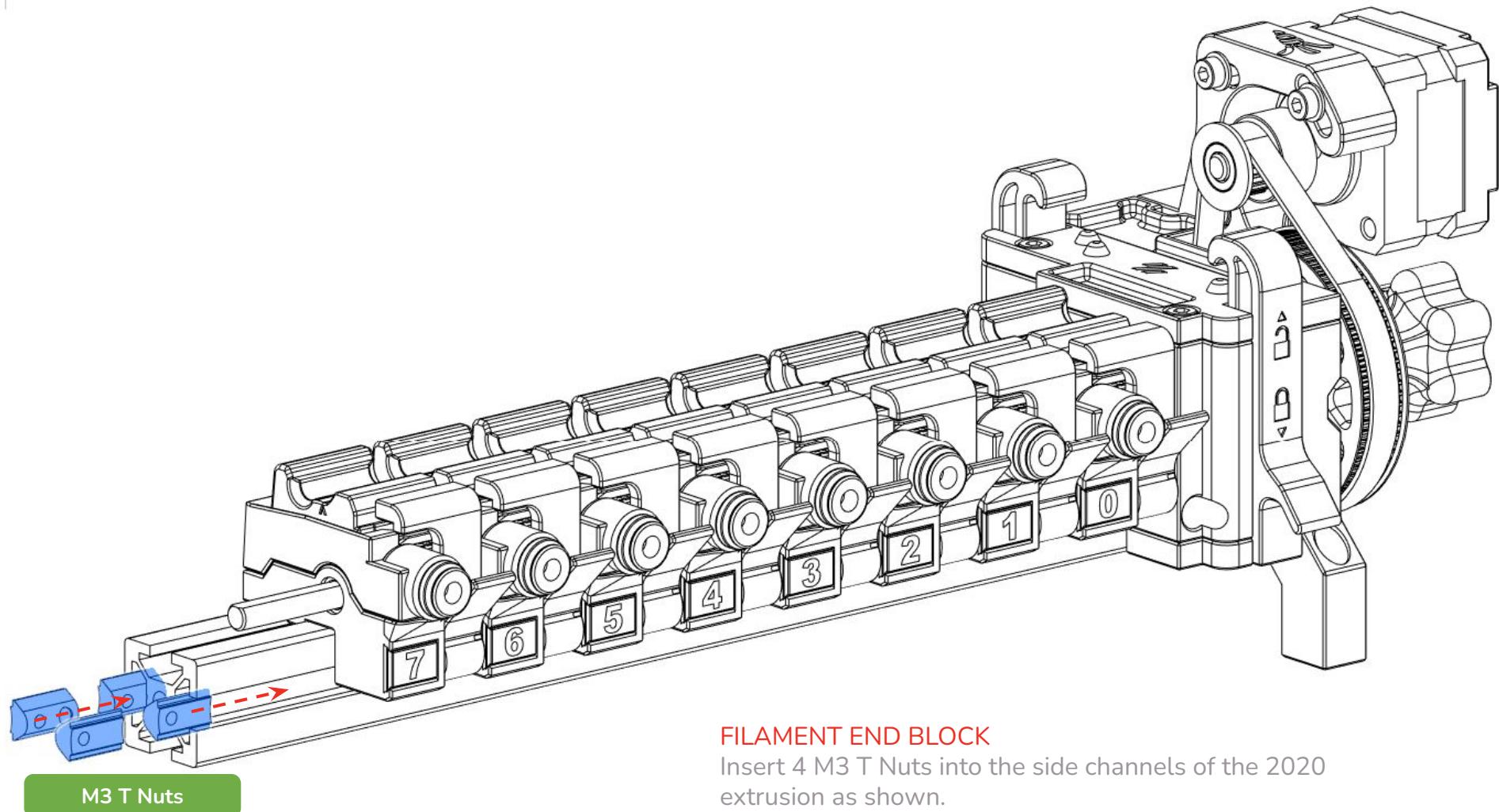
## END BLOCK AND FOOT SUB-BOM

**A** 1x ECAS-M4 Adapter  
**B** 5x M3 Roll-In T Nut  
**C** 5x M3x8mm SHCS  
**D** 1x M5 Locking Nut\*\*  
**E** 1x M5x30 BHCS\*\*

**F** 1x [a]\_End\_Bypass\_Foot.stl  
**G** 1x End\_Bypass.stl



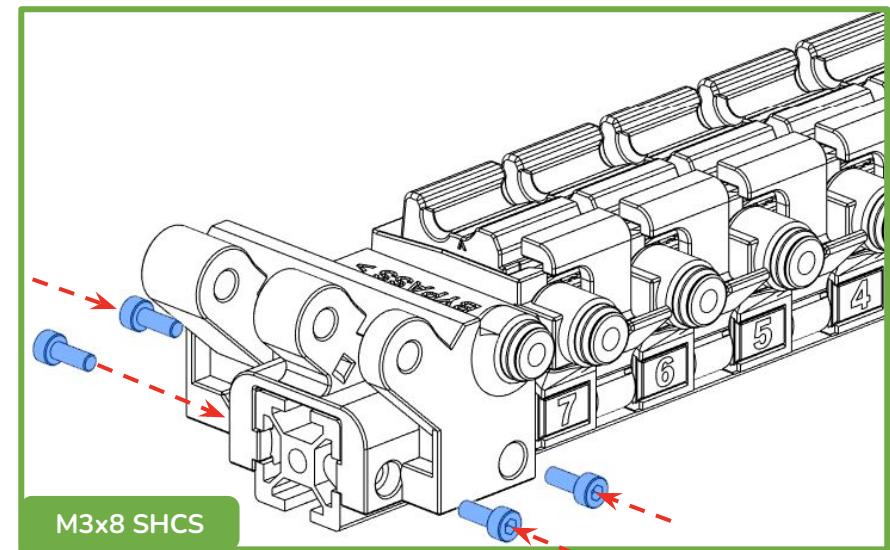
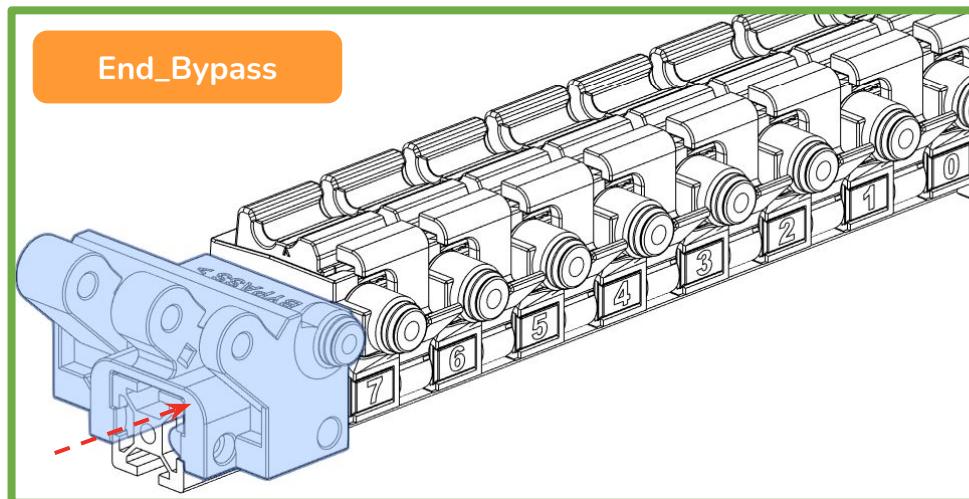
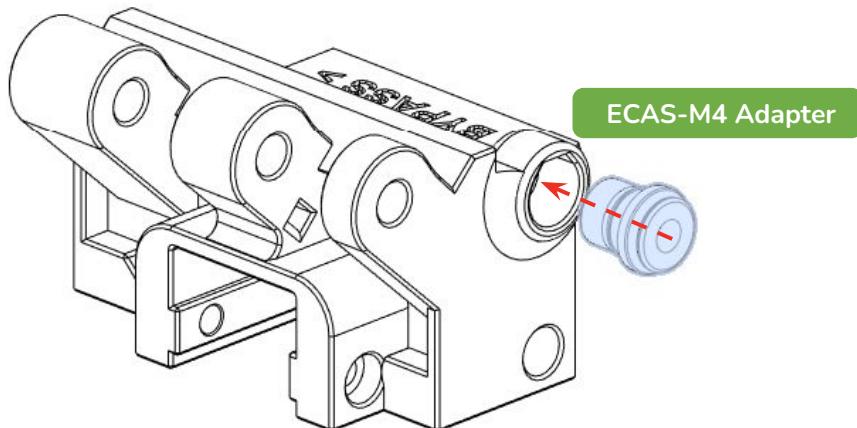
\*\* Depicted for completeness, but used in later steps.

**FILAMENT END BLOCK**

Insert 4 M3 T Nuts into the side channels of the 2020 extrusion as shown.

**ECAS ADAPTER**

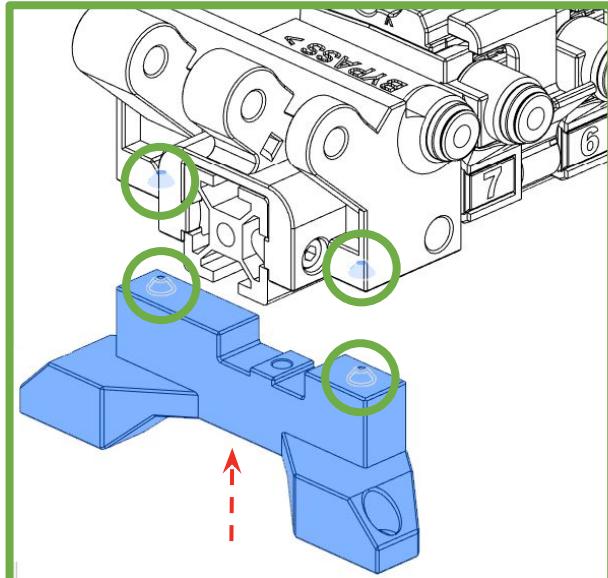
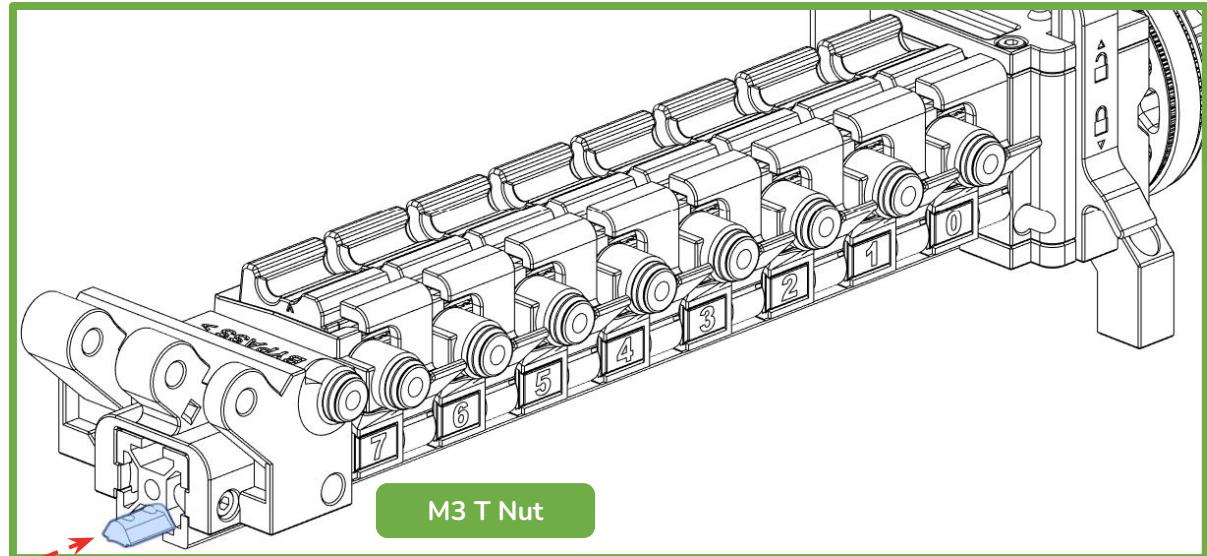
Insert an ECAS-M4 adapter into the End\_Bypass Block.

**INSTALL END FILAMENT BLOCK**

Slide the End\_Bypass Block onto the 2020 and secure with 4 M3x8 SHCS screws.

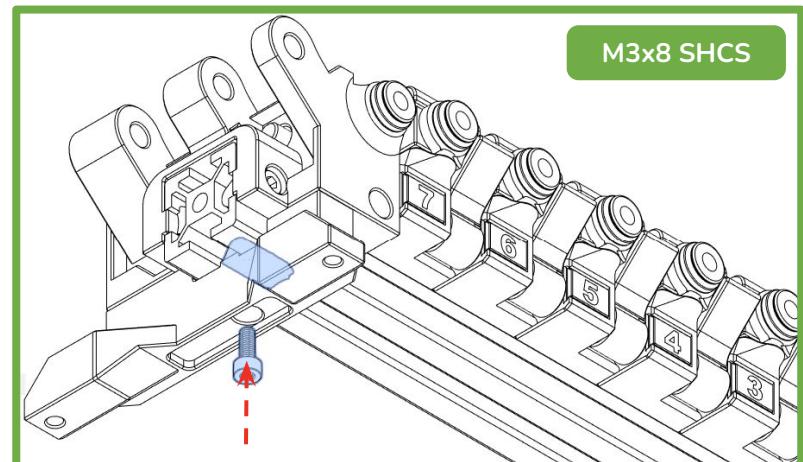
## END BLOCK

Insert an M3 T Nut into the bottom channel of the 2020 extrusion as shown.



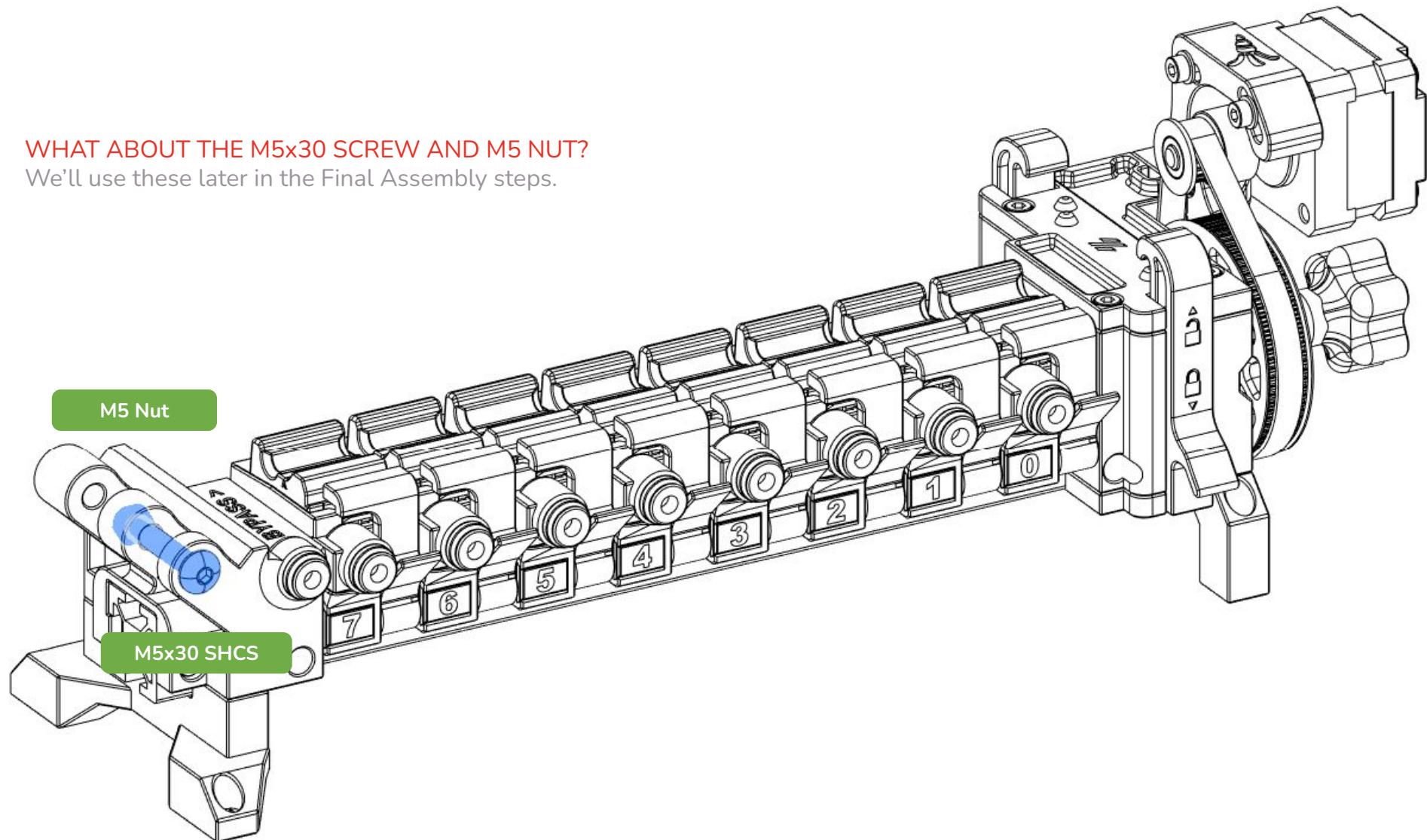
[a]\_End\_Bypass\_Foot

ATTACH THE FOOT  
Align End\_Bypass\_Foot dimples with the End\_Bypass block and secure it with an M3x8 SHCS screw.



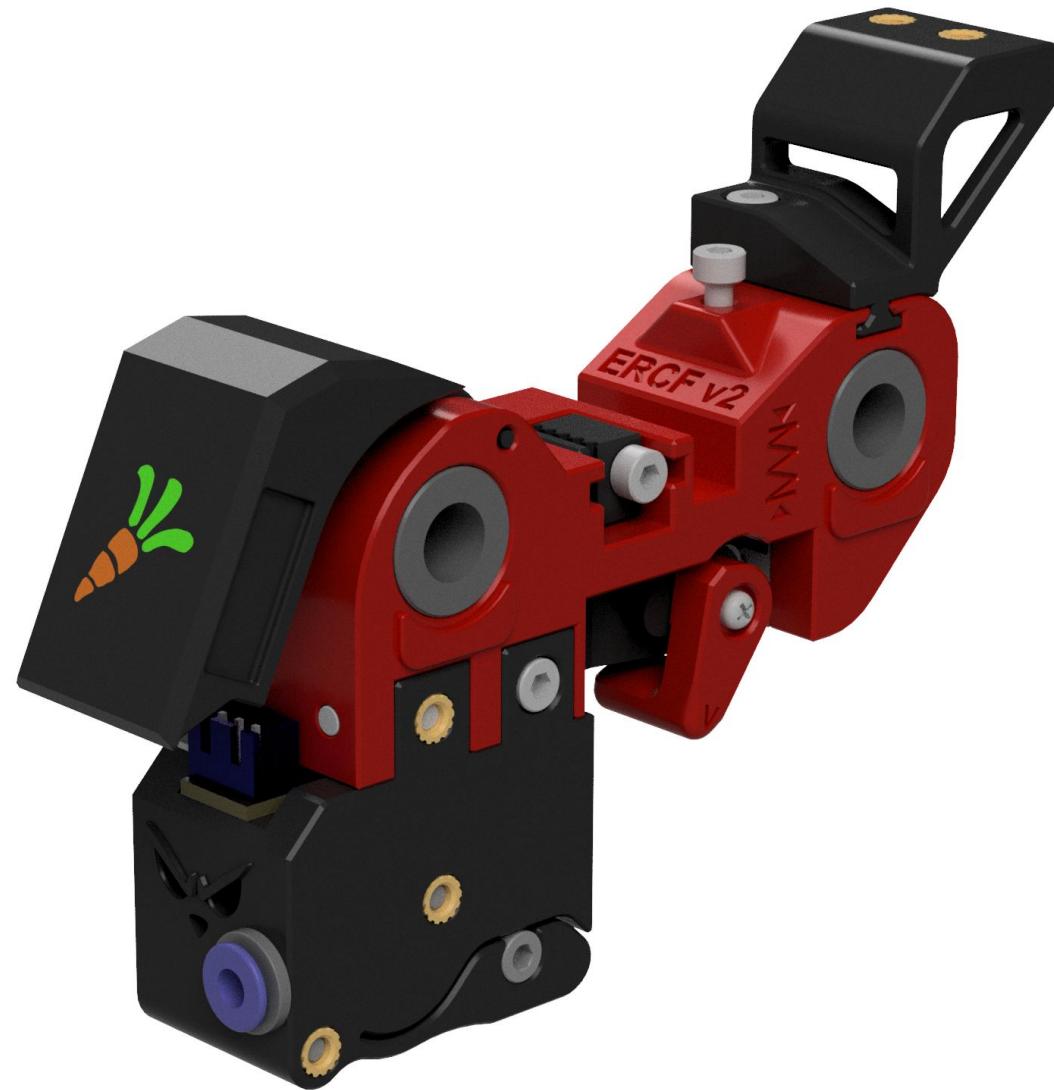
WHAT ABOUT THE M5x30 SCREW AND M5 NUT?

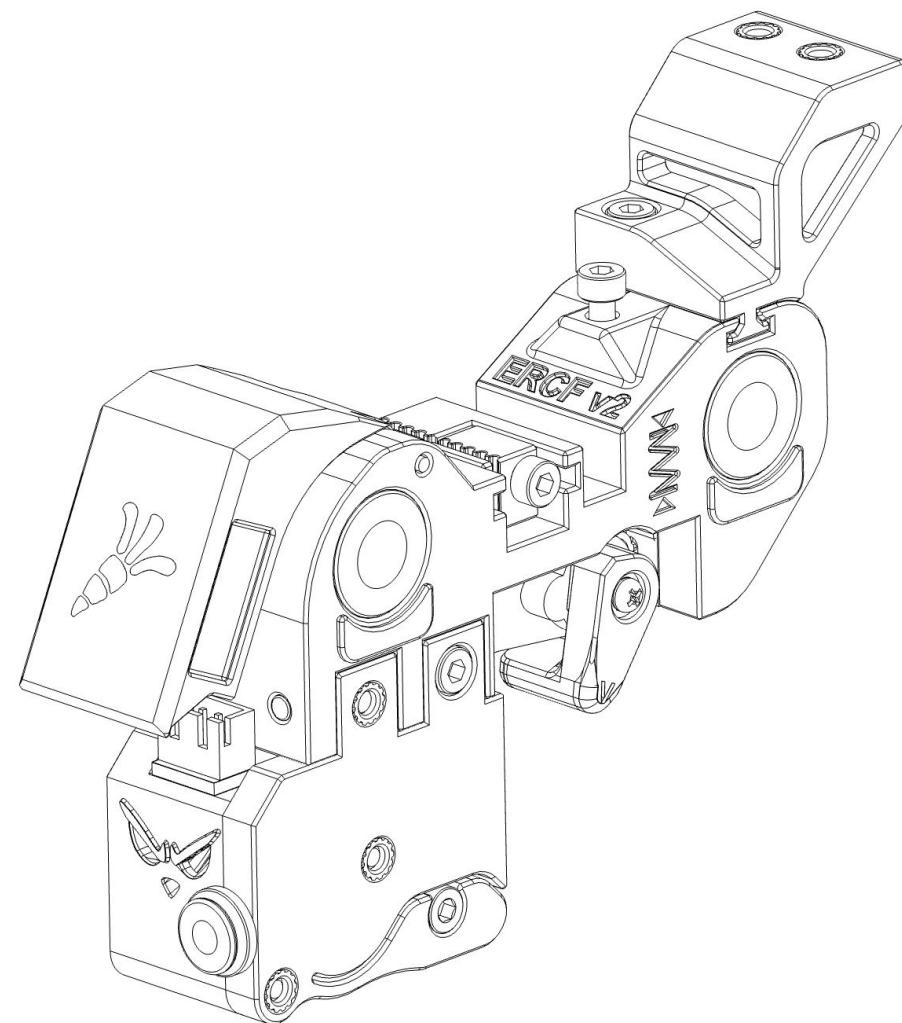
We'll use these later in the Final Assembly steps.



Why did the ERCF MMU go to school?

Because it wanted to learn about multi-"filament"ary education!





## SELECTOR

## EXPLODED VIEW

WWW.VORONDESIGN.COM

### SELECTOR SUB-BOM

A  
B  
C  
D  
E  
F  
G  
H

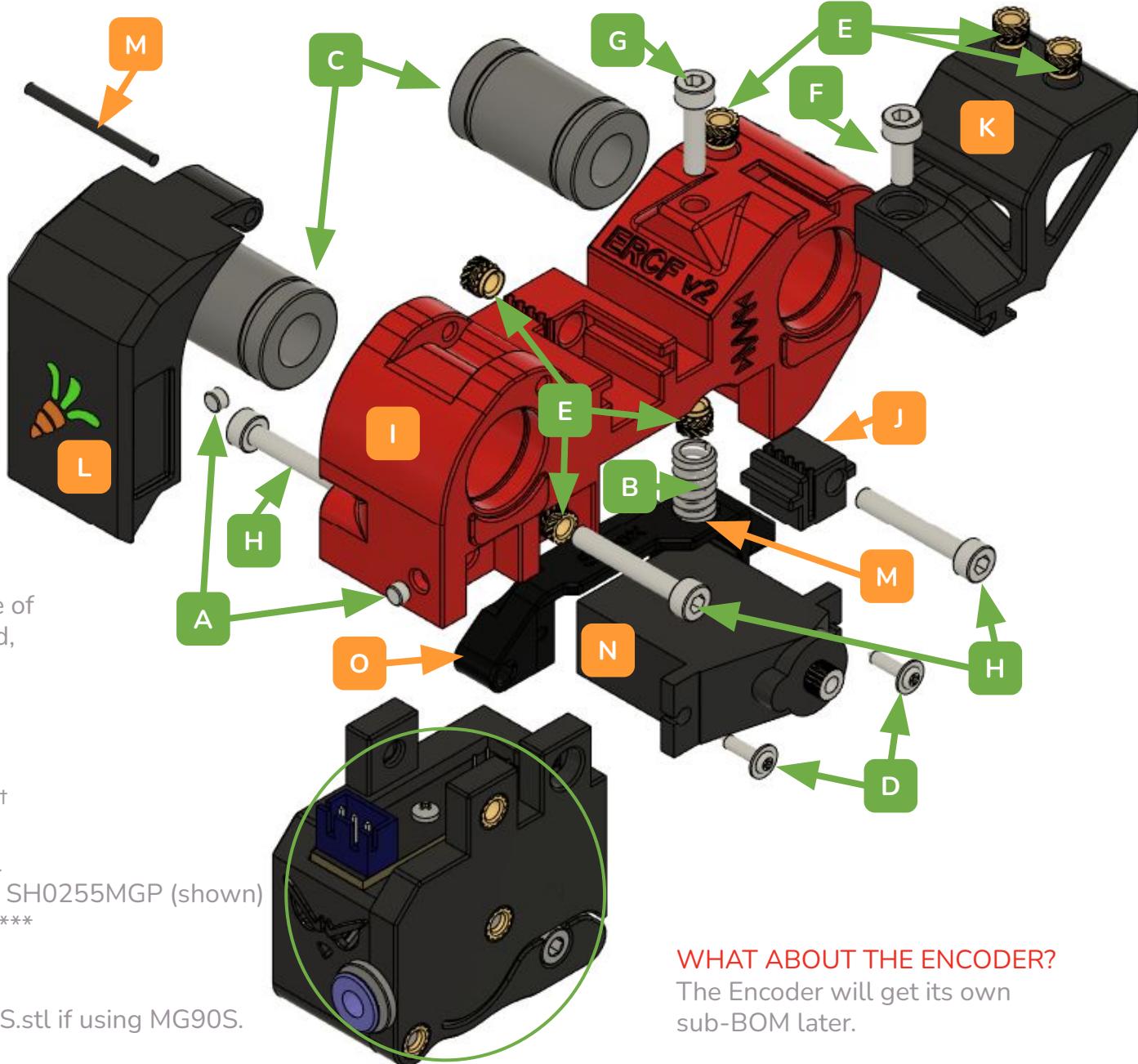
- 2x 3x2mm Magnet
- 1x 6x12x1mm Spring
- 2x LM8UU or RJ4JP-01-08
- 2x M2x10 Self-Tapping\*\*
- 6x M3 Threaded Inserts
- 1x M3x8mm SHCS
- 1x M3x12mm SHCS
- 3x M3x20mm SHCS

\*\*Supplied with your choice of servo. If none were supplied, use M2x8mm SHCS.

I  
J  
K  
L  
M  
N  
O  
P

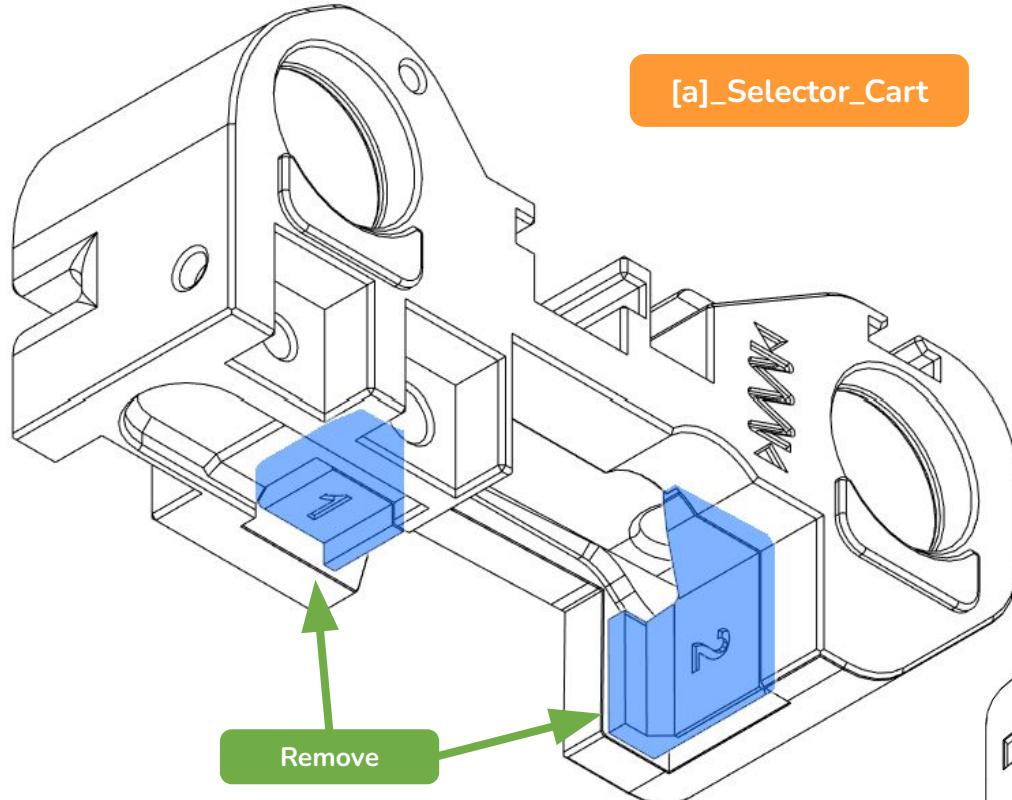
- 1x [a]\_Selector\_Cart.stl
- 1x Belt\_Tensioner.stl †
- 1x Drag\_Chain\_Anchor.stl †
- 1x Selector\_Door.stl
- 1x Selector\_Spring\_Cap.stl
- 1x Servo, MG90S or Savox SH0255MGP (shown)
- 1x Servo\_Mount\_Savox.stl\*\*\*
- 1x Piece of Filament

\*\*\*Or Servo\_Mount\_MG90S.stl if using MG90S.



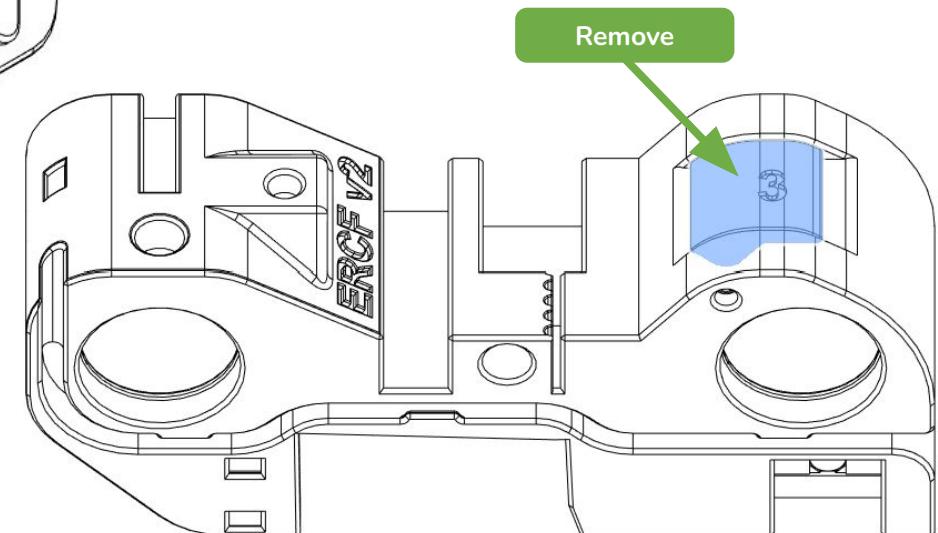
### WHAT ABOUT THE ENCODER?

The Encoder will get its own sub-BOM later.



#### REMOVE BUILT-IN SUPPORTS

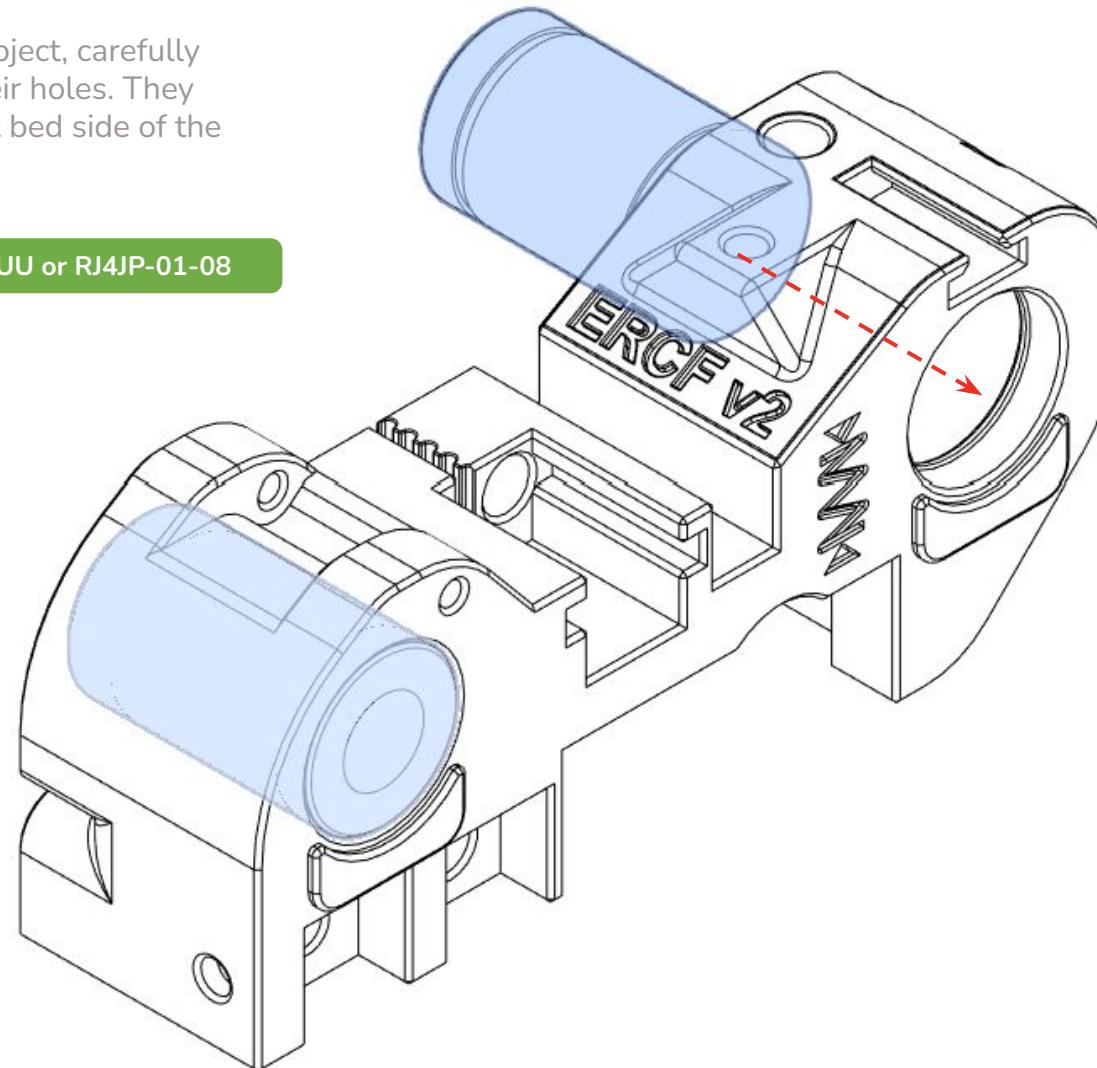
Use a small tool, like a small flat screwdriver, to carefully remove the built-in supports.



**BEARING INSERTION**

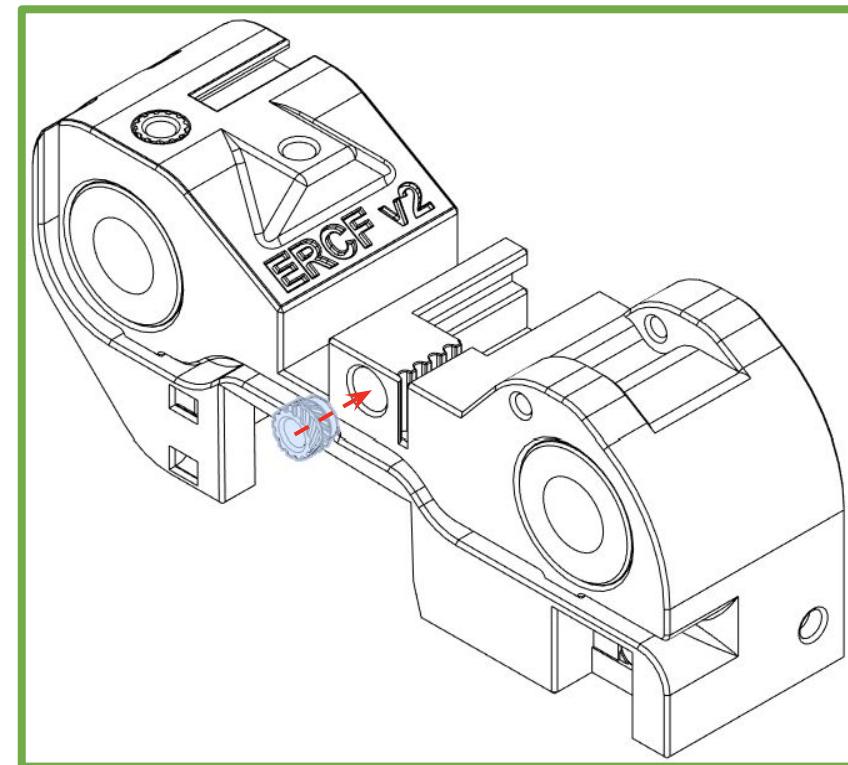
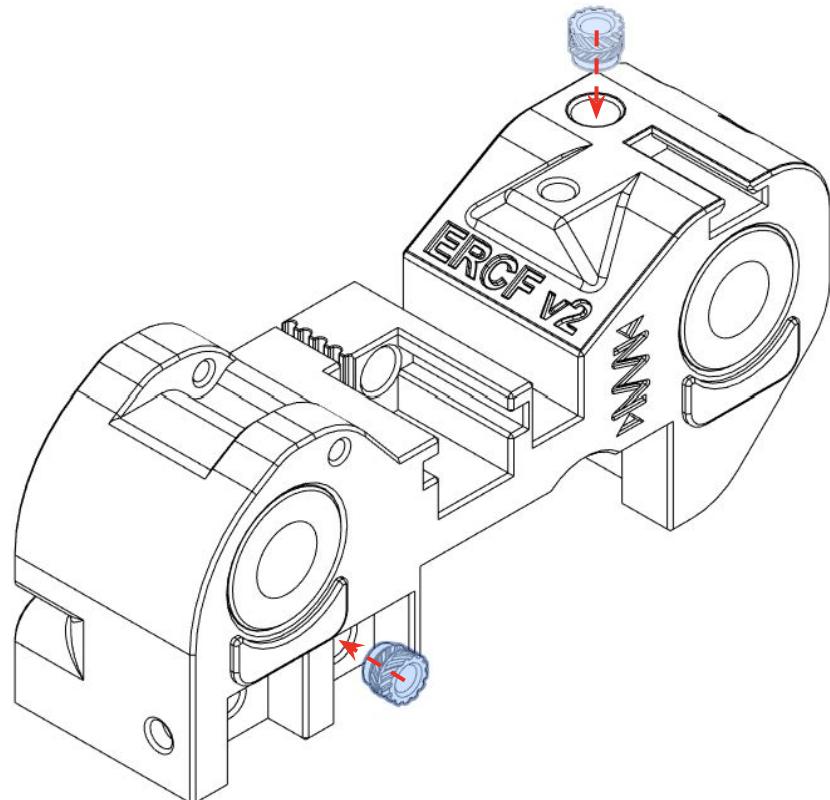
Using a soft jaw vice or flat object, carefully press-fit the bearings into their holes. They should be flush with the print bed side of the Selector Cart.

LM8UU or RJ4JP-01-08



**HEAT SET INSERTS**

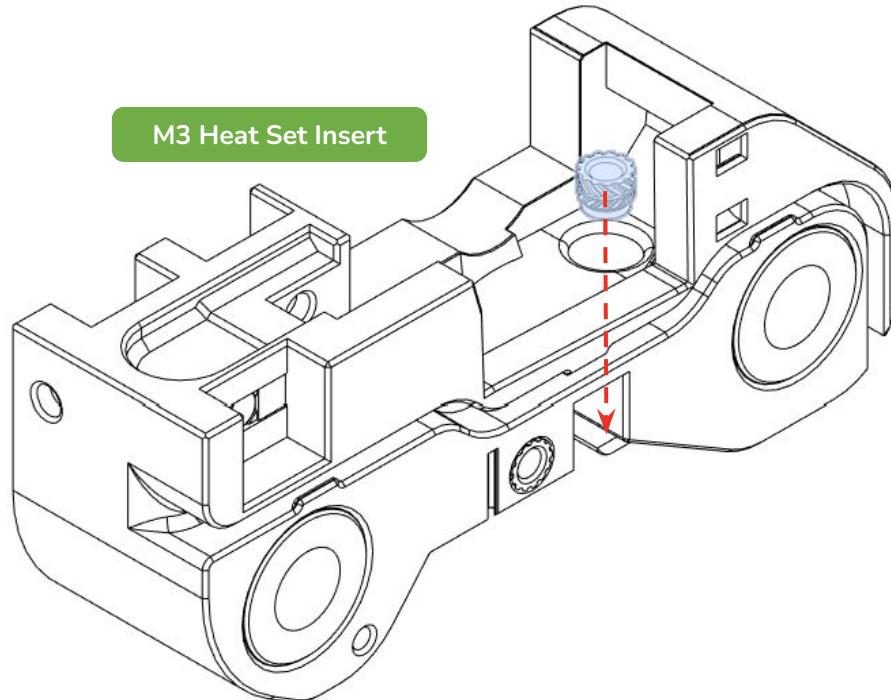
The list of pages with heat set inserts is on [page 19](#).



M3 Heat Set Inserts

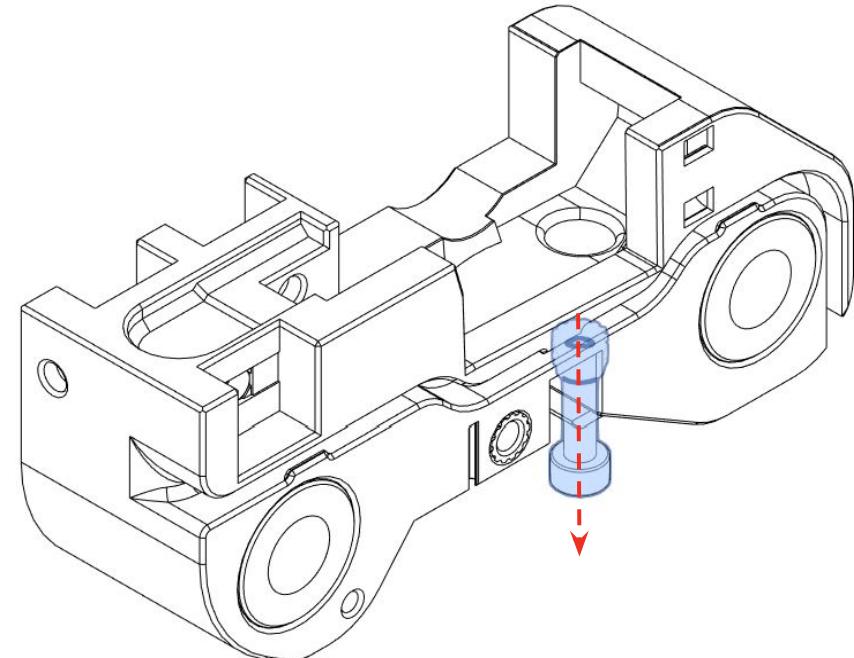
**HEAT SET INSERTS**

The list of pages with heat set inserts is on [page 19](#).

**HEATSET INSERTION**

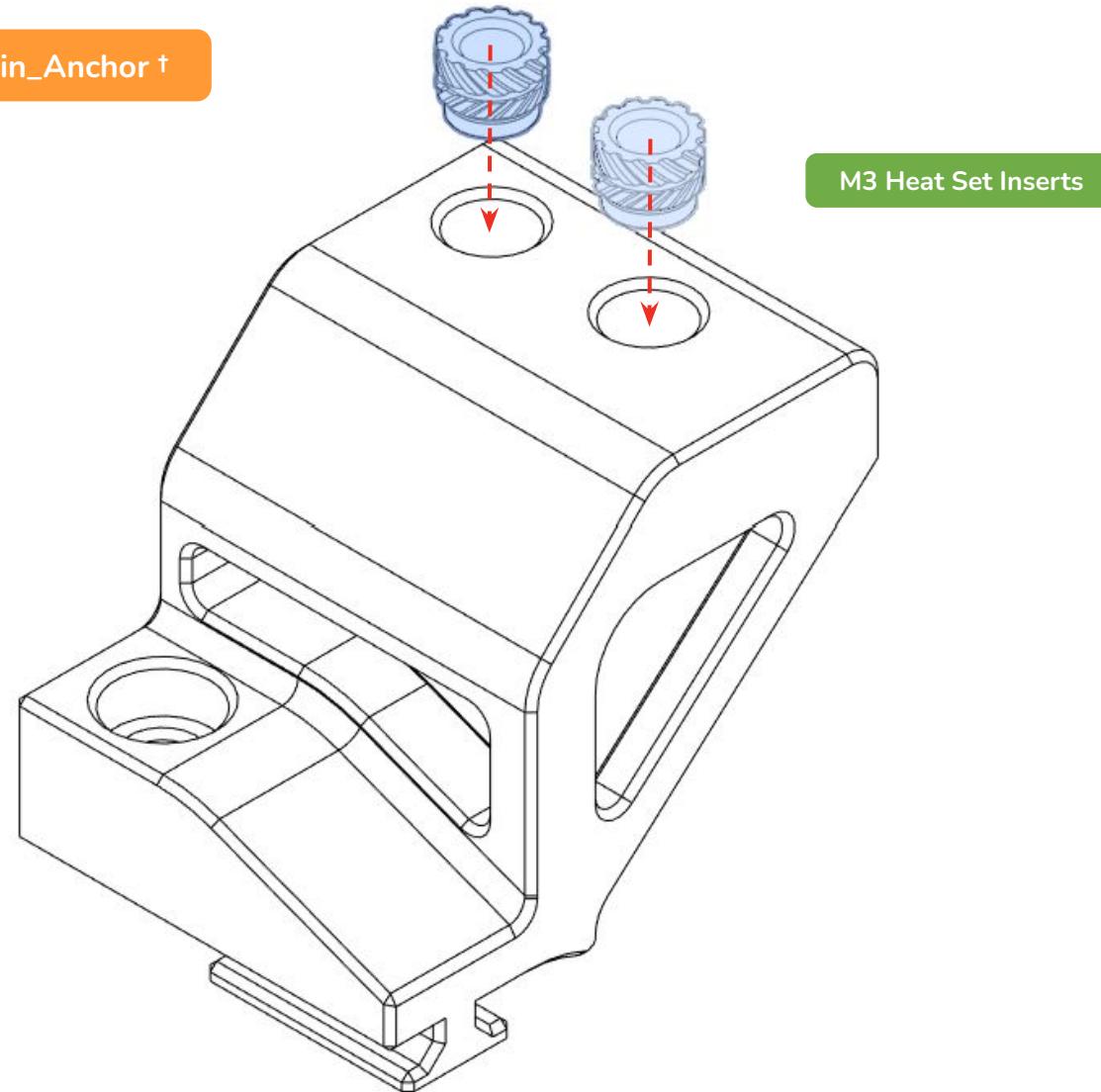
This heatset insert is a tricky one. Take your time. It may help to use a screw to pull from the opposite side during insertion.

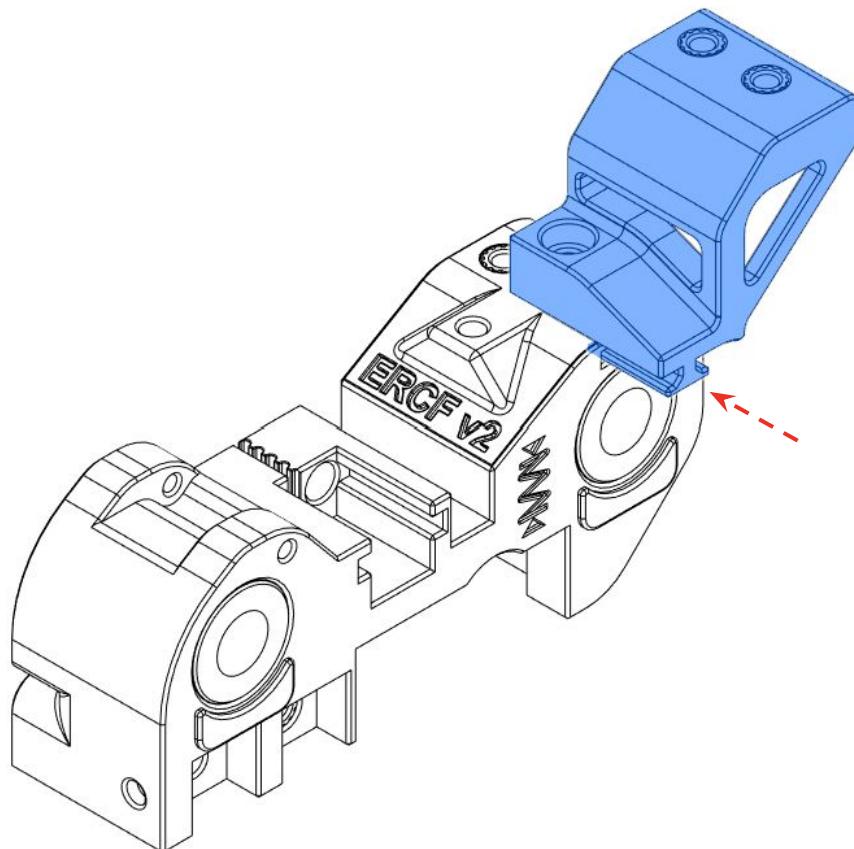
If you wind up melting the spring hole, either reprint the piece and try again, or clean up the hole with a drill bit. The bore size is 6.6mm, so use 6mm,  $\frac{1}{4}$ ", or  $17/64"$  sized bits.



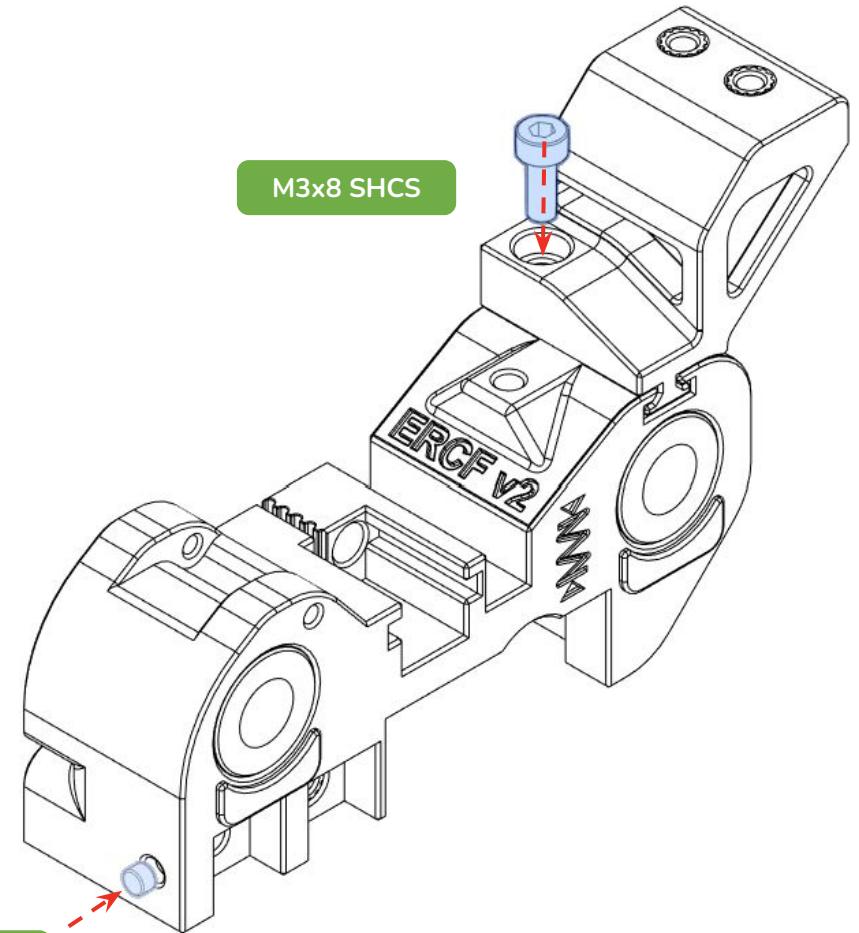
**HEAT SET INSERTS**

The list of pages with heat set inserts is on [page 19](#).

**Drag\_Chain\_Anchor †****M3 Heat Set Inserts**



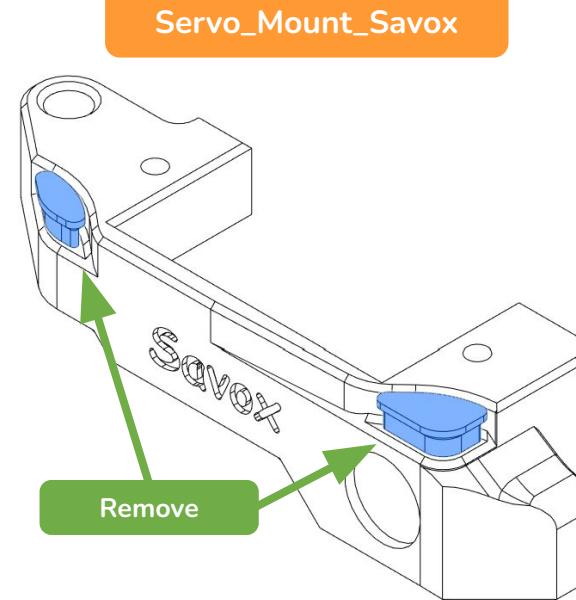
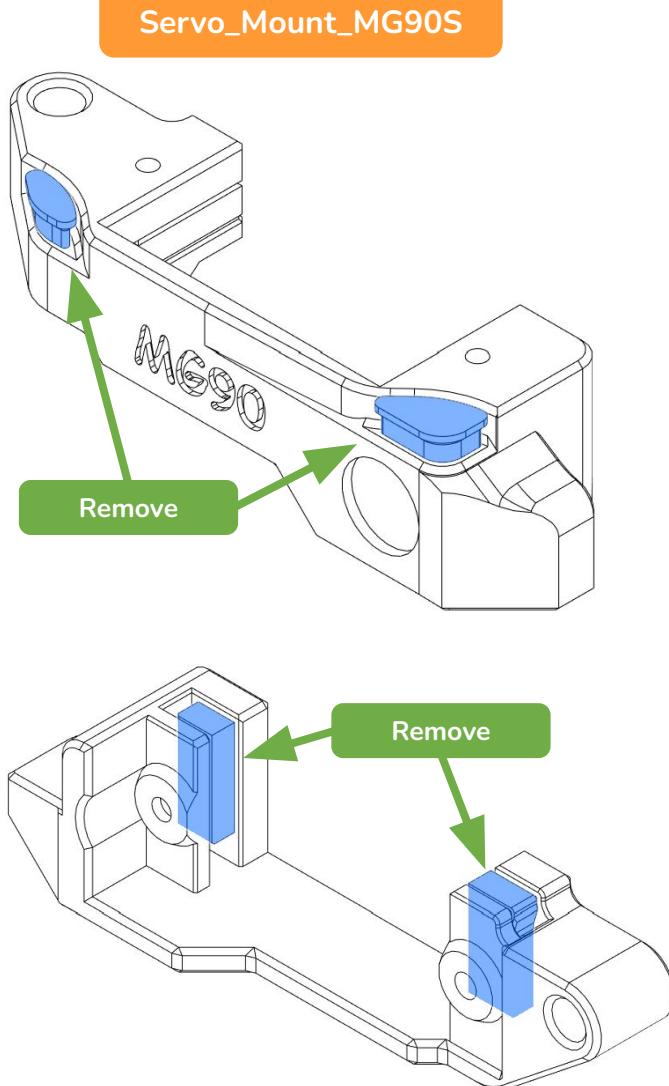
Drag\_Chain\_Anchor †



#### DRAG CHAIN AND MAGNET

Slide the drag chain mount into the dovetail groove on the selector cart and install with an M3x8 SHCS screw.

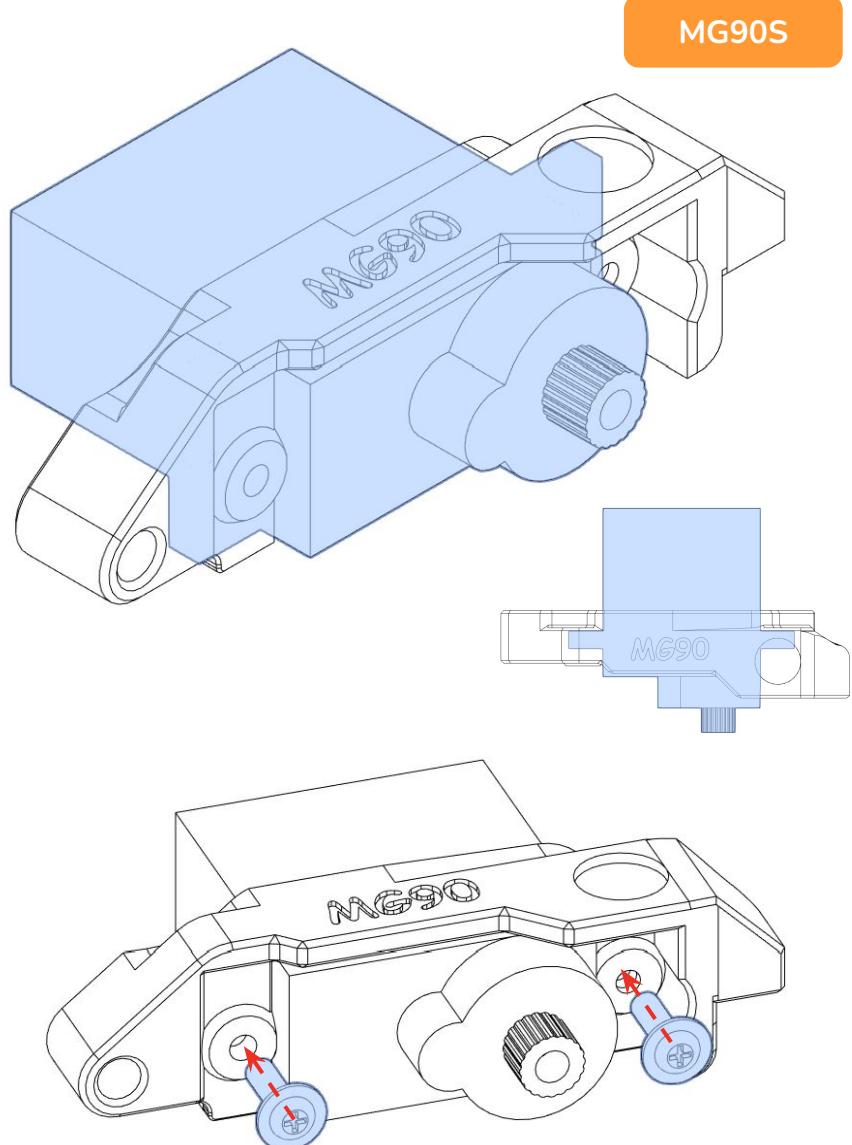
Add a drop of CA glue and Insert the 3x2mm magnet into its slot.



#### SERVO MOUNT PRINT IN PLACE SUPPORTS

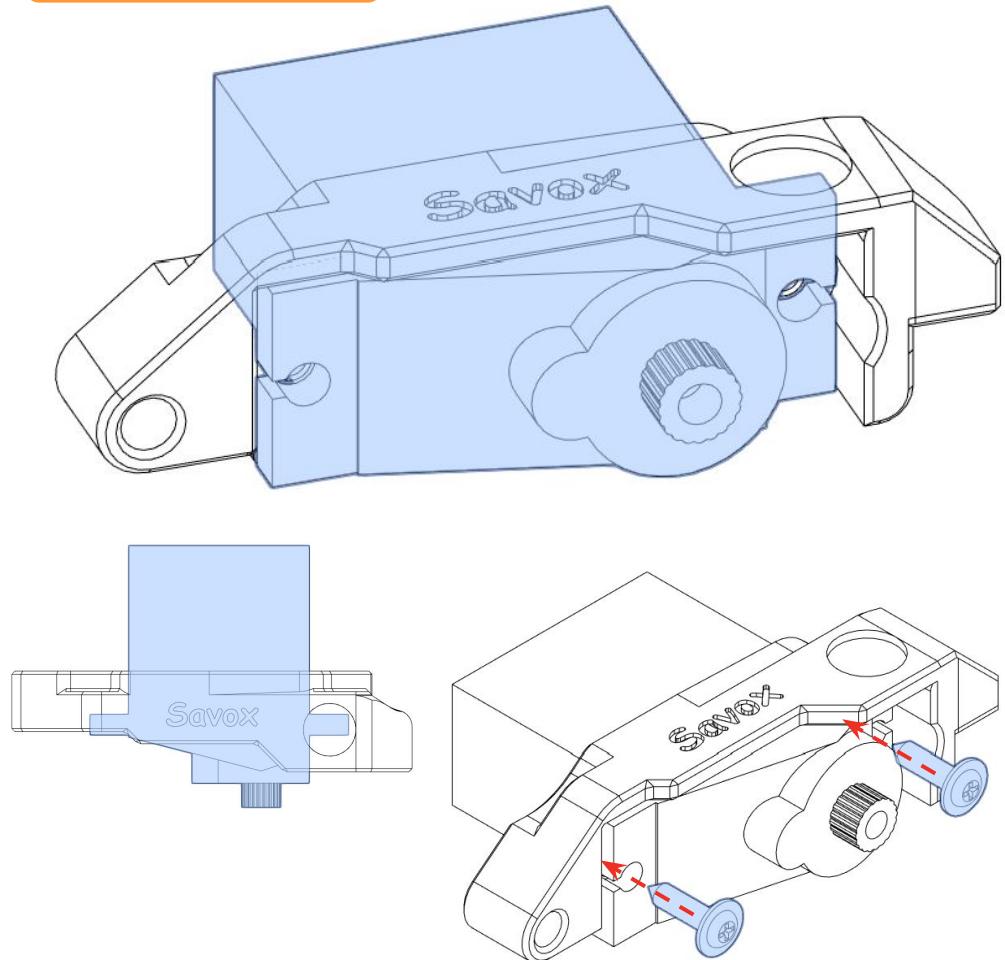
Use a small tool, like a small flat screwdriver to remove the built-in supports.

The Towerpro MG90S version has 4 supports. If the inner supports don't break out cleanly, you may need to clean up the slot with a file or hobby knife to get a good fit.



MG90S

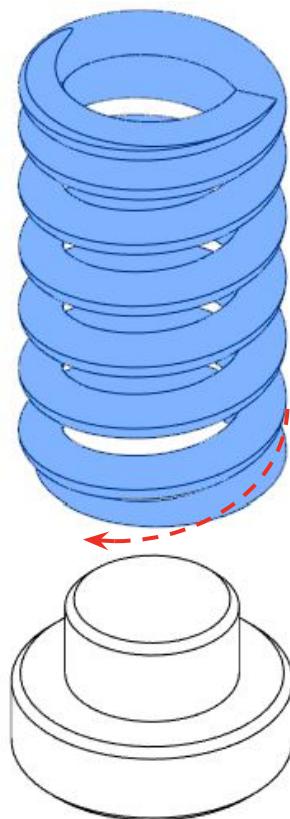
Savox SH0255MGP



### SERVO SCREWS

Use the 2 mounting screws from the servo kit. They tap directly into the selector cart plastic, so don't overtighten. If the screws strip or weren't provided, use M2x8mm SHCS instead.

12x6mm 1mm OD  
Compression Spring

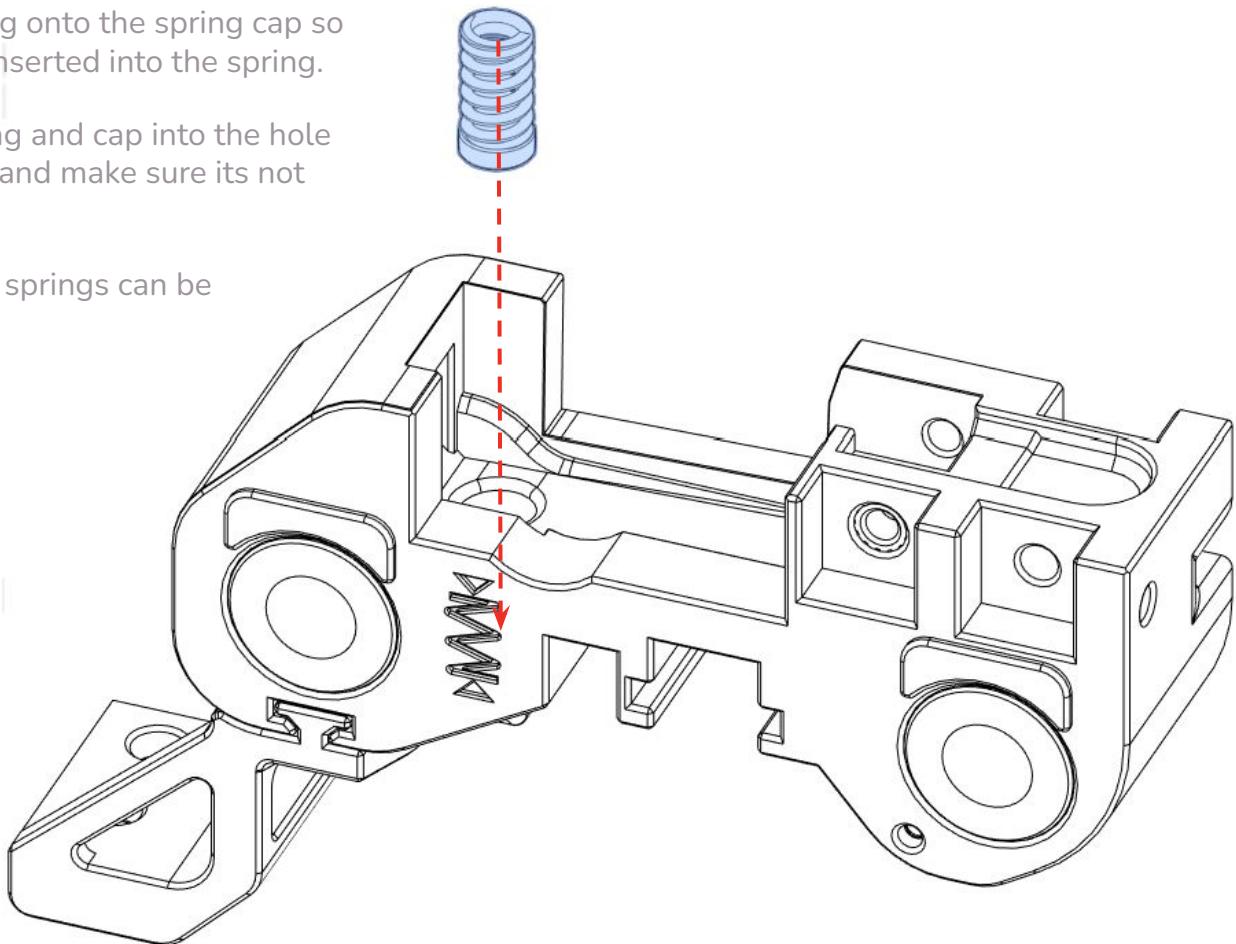


### SPRING CAP

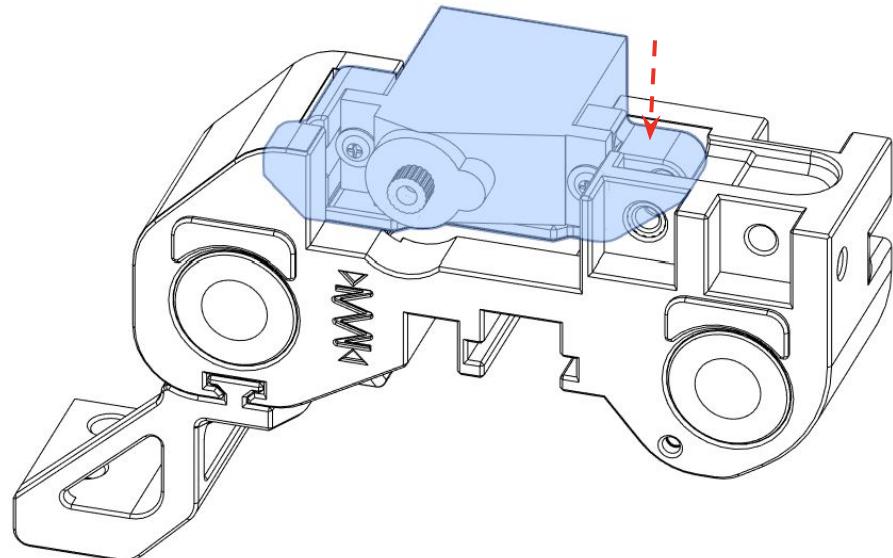
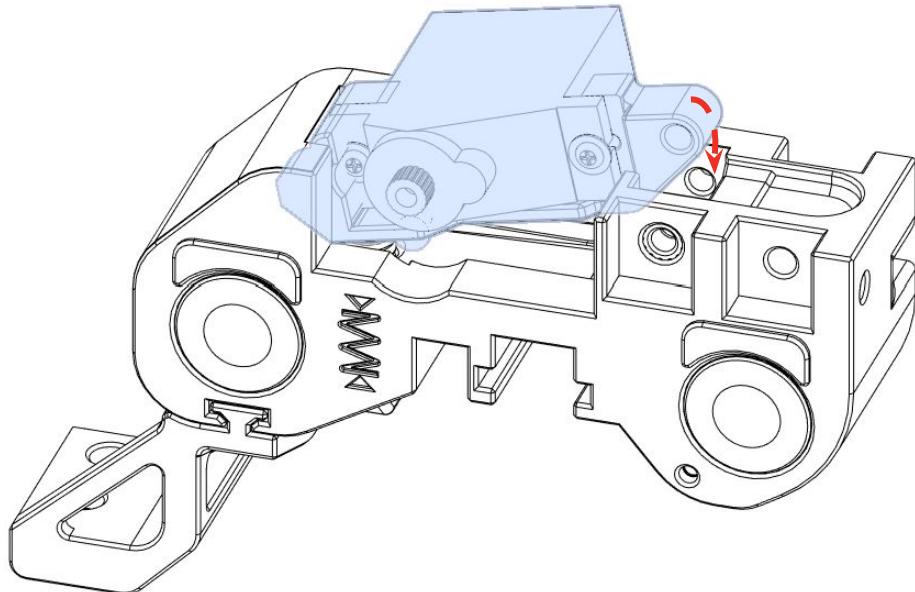
Twist the spring onto the spring cap so the cap stays inserted into the spring.

Insert the spring and cap into the hole in the selector and make sure its not obstructed.

Shorter 10mm springs can be used as well.



Selector\_Spring\_Cap

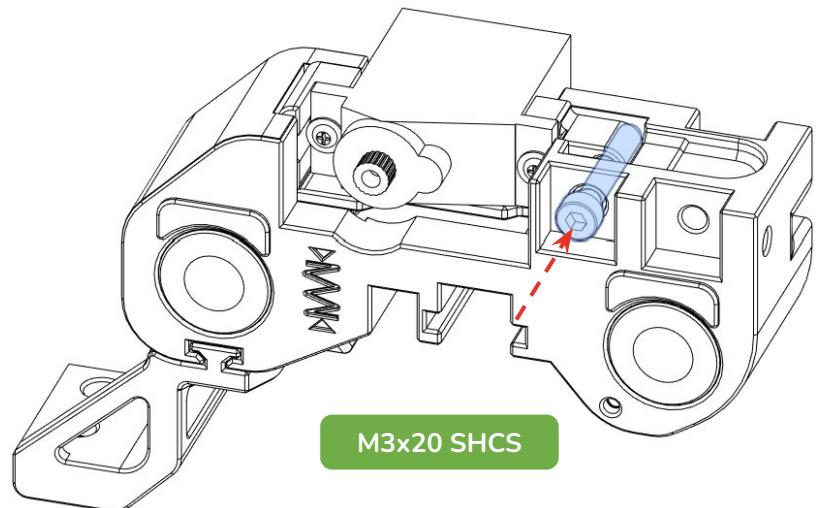


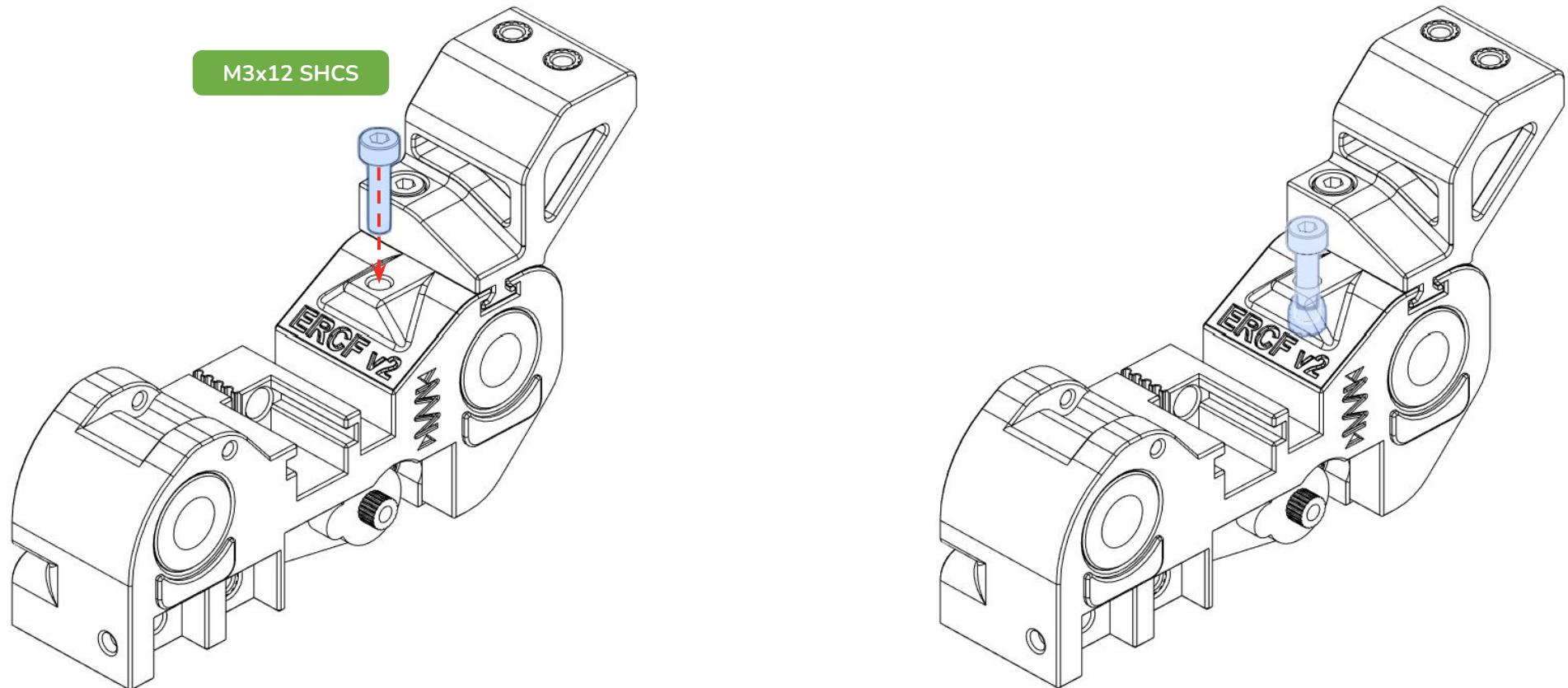
### SERVO INSTALLATION

Angle the servo mount, insert it into the captive channel and press down into the pivot point. The spring should push against the servo mount preventing it from fully seating.

Push the servo mount into place and temporarily secure it with an M3x20 screw used for mounting the encoder.

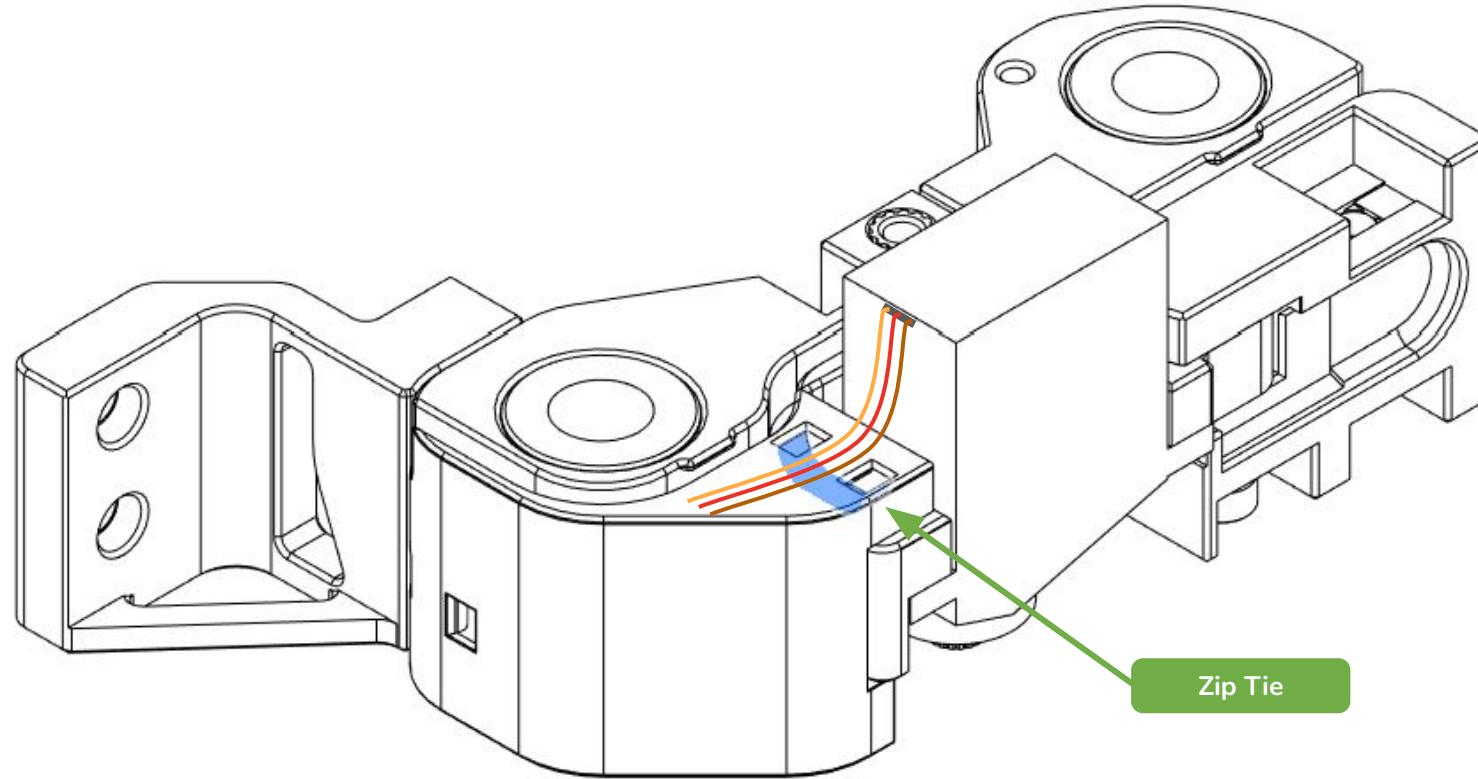
SAVOX SH-0255MGP servo option shown, installation is identical for the Towerpro MG90S servo.





#### SPRING TENSION SCREW INSTALLATION

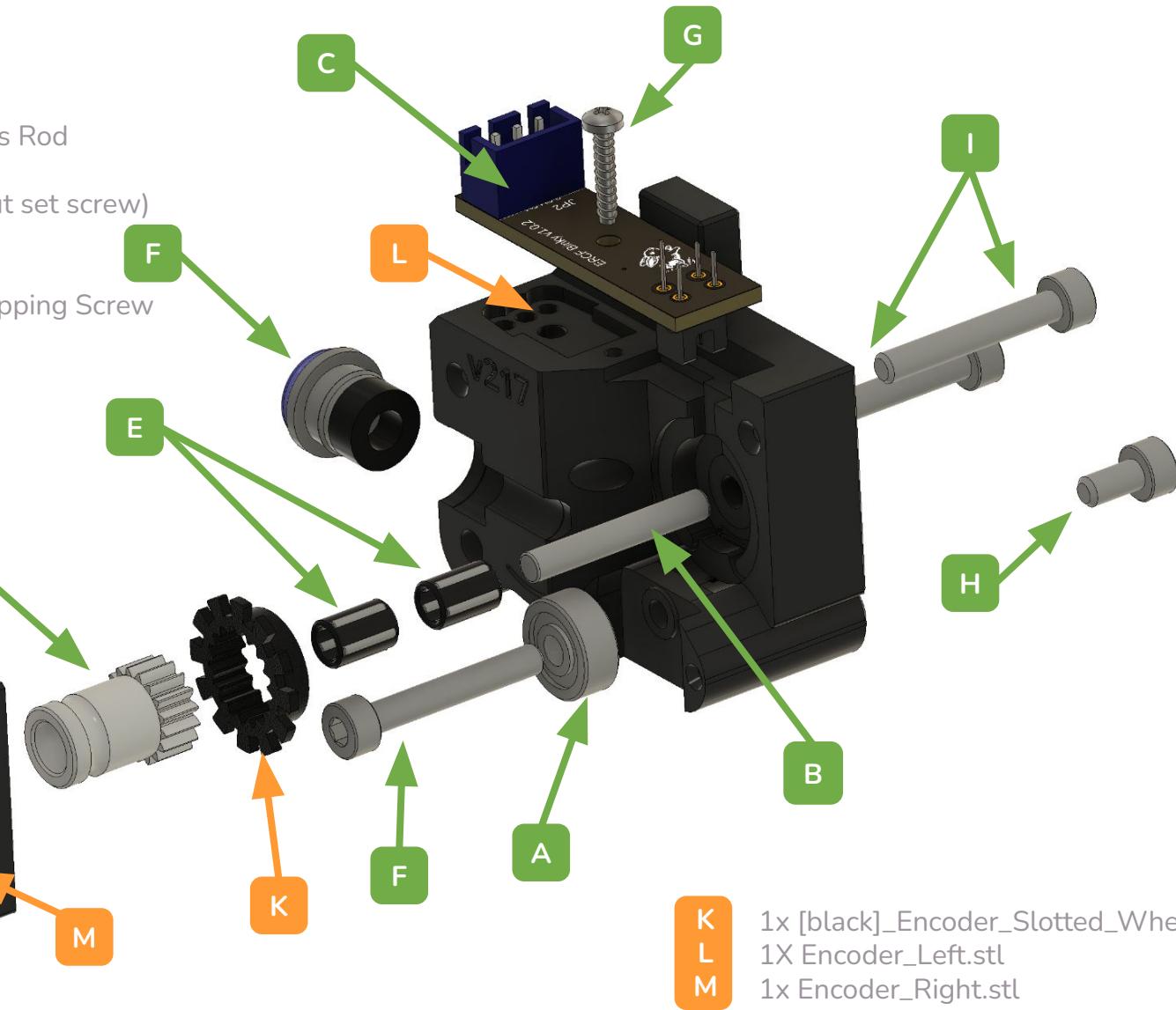
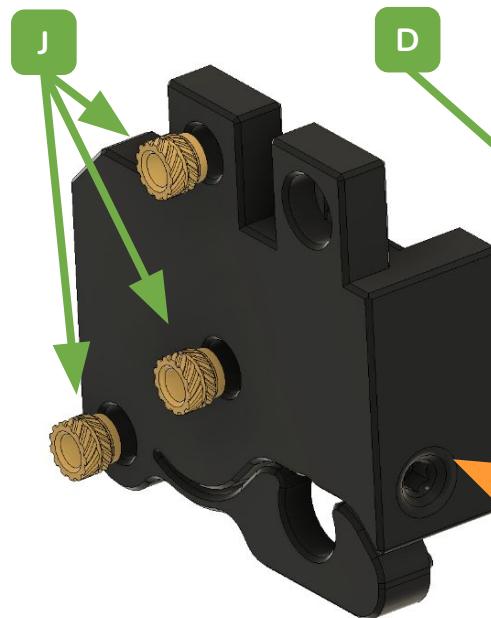
Install the servo spring tension screw. Only tighten until it touches the spring cap - we will adjust and tension it later.

**SERVO WIRES**

Secure the servo wires using a zip tie. Make sure the wires lie flat against the side of the servo as shown.

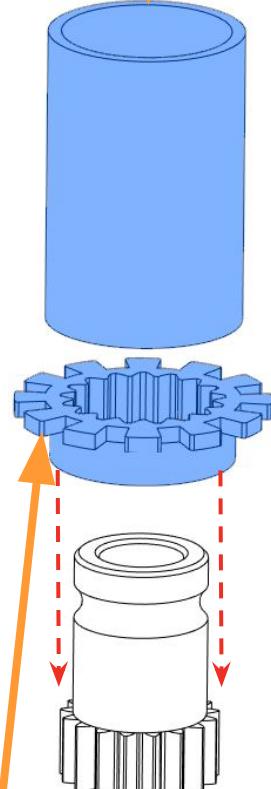
## ENCODER SUB-BOM

A	1x 623ZZ Bearing
B	1x BMG 3x20mm Stainless Rod
C	1x Binky PCB
D	1x BMG Idler Gear (without set screw)
E	2x BMG Needle Bearings
F	1x ECAS-M4 Adapter
G	1x M2x8 or 10mm Self-Tapping Screw
H	1x M3x8mm SHCS
I	3x M3x20mm SHCS
J	3x M3 Threaded Insert



K  
L  
M  
1x [black]\_Encoder\_Slotted\_Wheel.stl  
1X Encoder\_Left.stl  
1x Encoder\_Right.stl

## Slotted\_Wheel\_Push\_Tool



BMG Idler Gear

Encoder\_Slotted\_Wheel

## INSTALL ENCODER WHEEL

Before fitting the slotted wheel to the Bondtech gear, make sure the top surface of the wheel and its vanes are smooth and clean. If there are “blobs” from printing, carefully sand or trim them so they are flush.

Place the Bondtech gear as shown in the diagram on a hard surface and slide the slotted wheel onto the gear until it reaches the teeth.

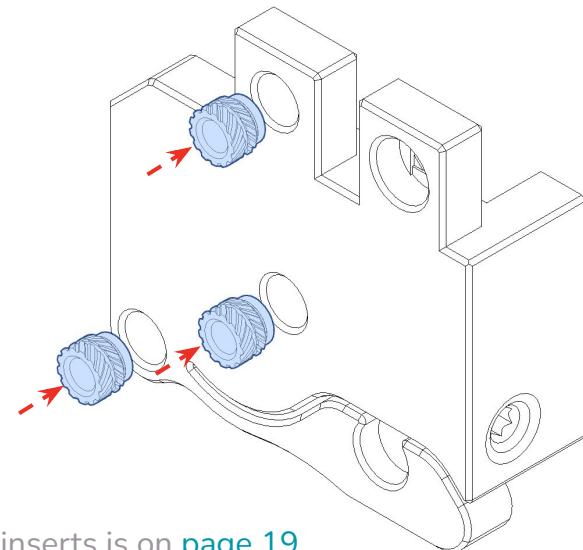
Use the Push Tool to **gently** push the slotted wheel into place until its flush with the end of the gear using a small hammer.

The slotted wheel should fit firmly on the Bondtech gear. Make sure its undamaged, isn't cracked and doesn't move easily.

**NOTE** The slotted wheel must be printed in black to prevent light shining through the vanes of the wheel to avoid false readings!

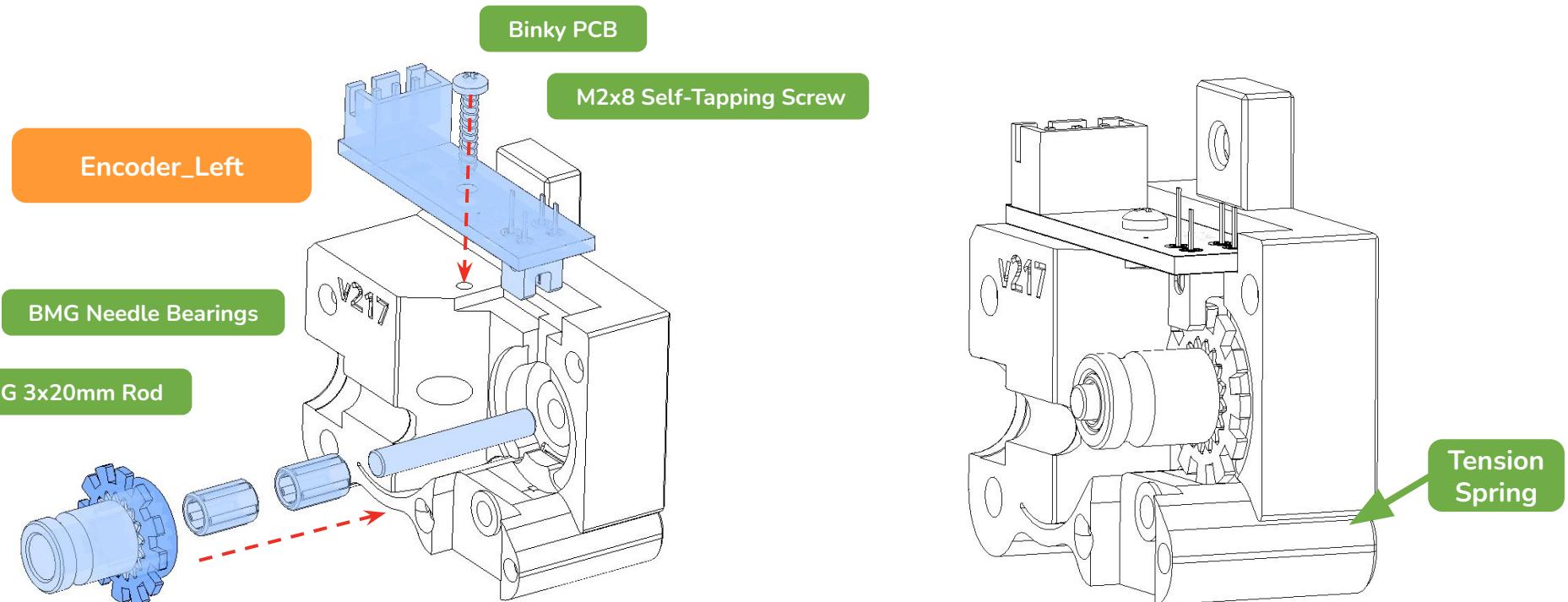
## Encoder\_Right

M3 Heat Set Inserts



## HEAT SET INSERTS

The list of pages with heat set inserts is on [page 19](#).



### ASSEMBLY

Start by fitting the metal rod into Encoder\_Right. Next, slide on the needle bearings and the Bondtech idler gear. Add a small dab of grease (EP1/EP2 or Superlube) on the bearings for lubrication. Slide the gear / slotted wheel assembly into place.

The slotted wheel should sit almost flush with the housing but make sure it doesn't rub on the printed part.

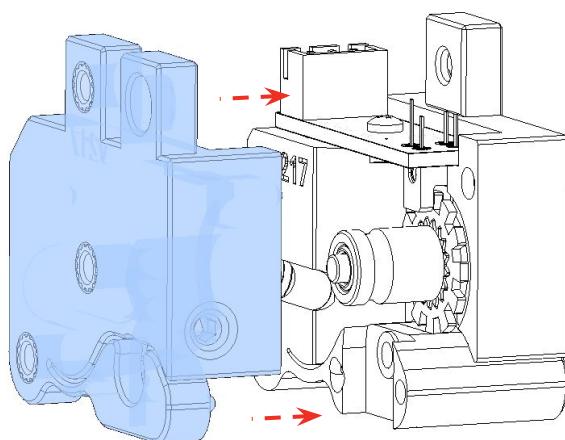
Insert and secure the Binky PCB with an M2x8 or 10mm screw. The sensor should fit snugly in the cutout provided.

### CHECK POINT

With the first half assembled, gently pull down and hold the Tension Spring to release the brake that prevents the encoder wheel from free spinning when filament is ejected.

The wheel should rotate easily and not rub on the Encoder housing or Binky optical sensor.

## Encoder\_Right



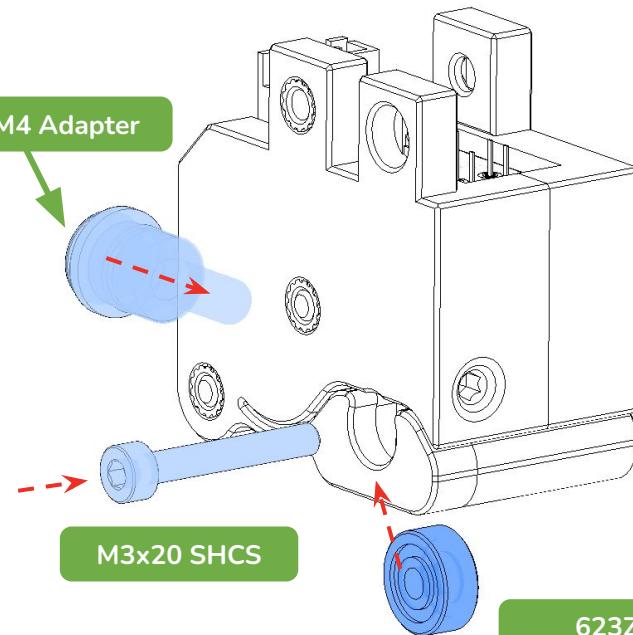
M3x20 SHCS

M3x8 SHCS

ECAS-M4 Adapter

M3x20 SHCS

623ZZ



## ASSEMBLY

Align the two halves of the encoder and press them together. Attach them loosely with two M3x20 SHCS screws.

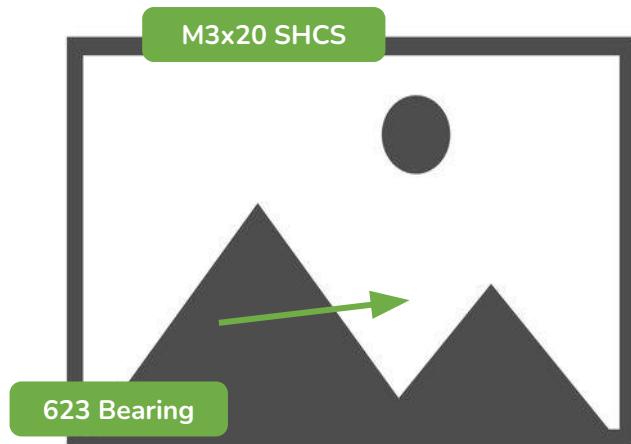
Screw and tap the M3x8 SHCS into the plastic hole on the Tension Spring as a standoff for the homing endstop microswitch located in the gear housing.

Insert the ECAS Bowden Collet from the back and tighten the two M3x20 SHSC screws you inserted earlier.

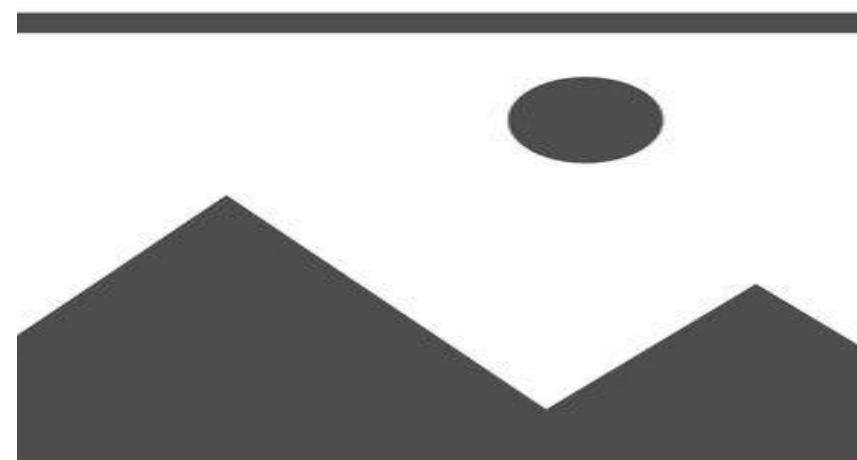
Slide the 623ZZ Filament Bearing in from the bottom and fasten with a M3x20 SHCS screw.

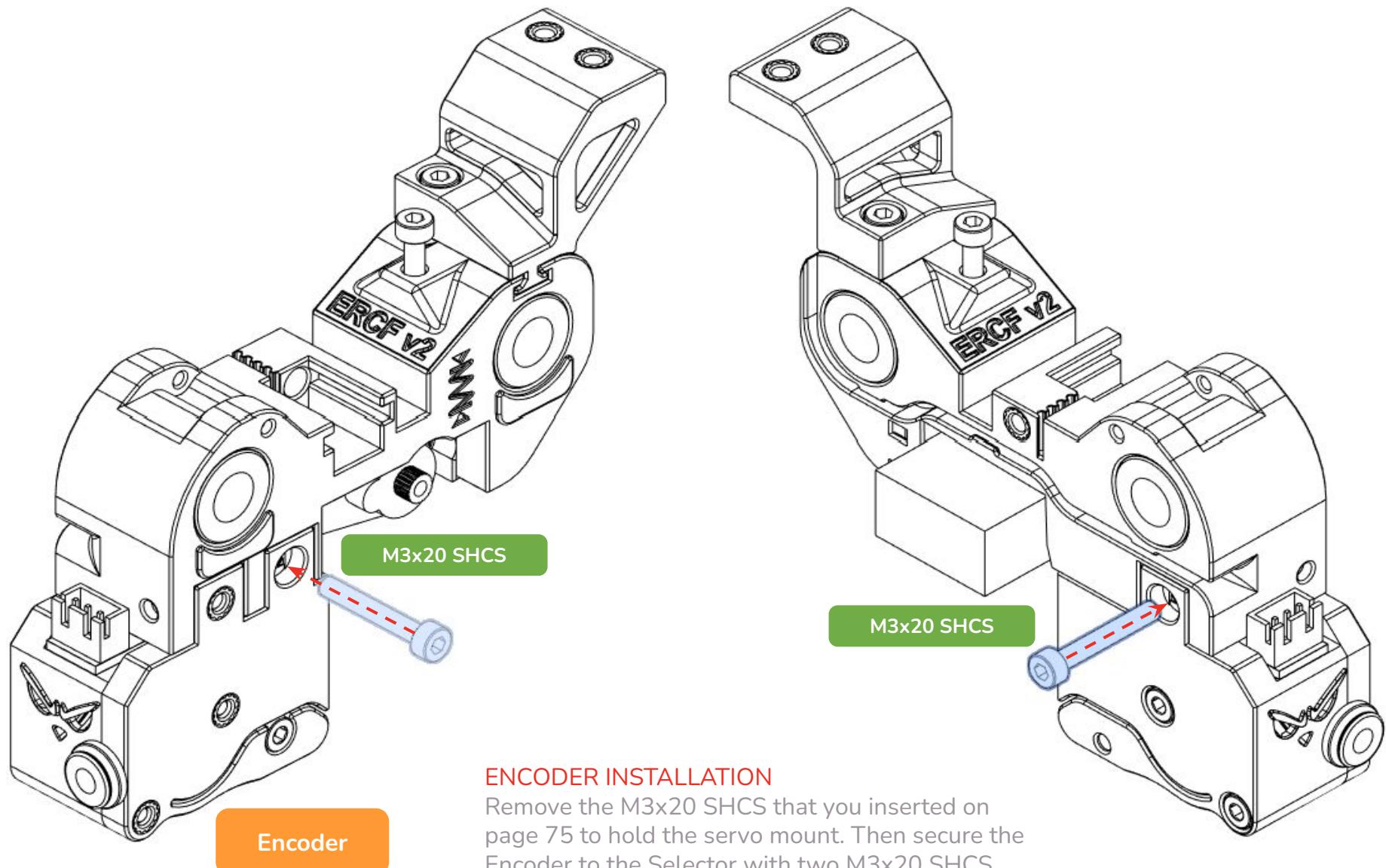
At this point use a small length of filament to verify everything runs smoothly and the Encoder Wheel doesn't rub on the Encoder body or Binky PCB Optical Sensor.

If you notice any issues, disassemble the Encoder & recheck. Adjust the position of the Encoder Wheel being careful not to damage it or its vanes.

**BMG GEAR ROTATION**

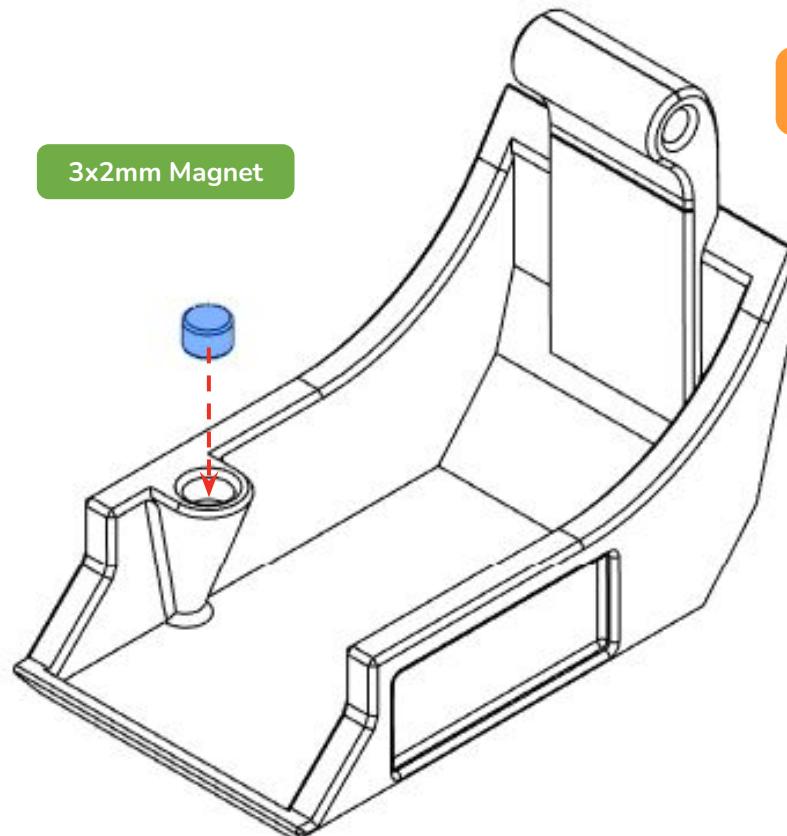
Using some 1,75mm filament, check that the BMG gear spins well when you slide the filament in the encoder cart.



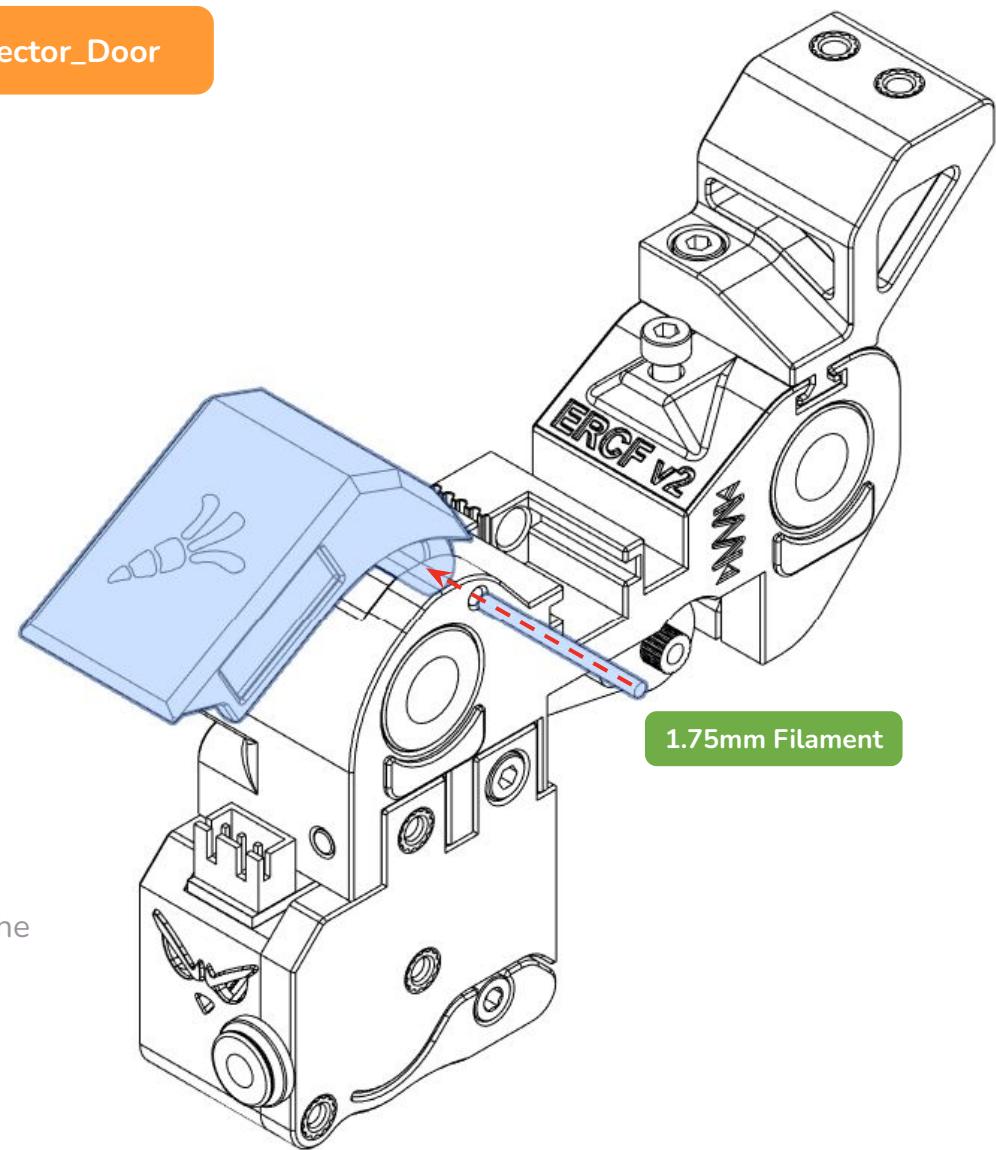


#### ENCODER INSTALLATION

Remove the M3x20 SHCS that you inserted on page 75 to hold the servo mount. Then secure the Encoder to the Selector with two M3x20 SHCS screws.



Selector\_Door



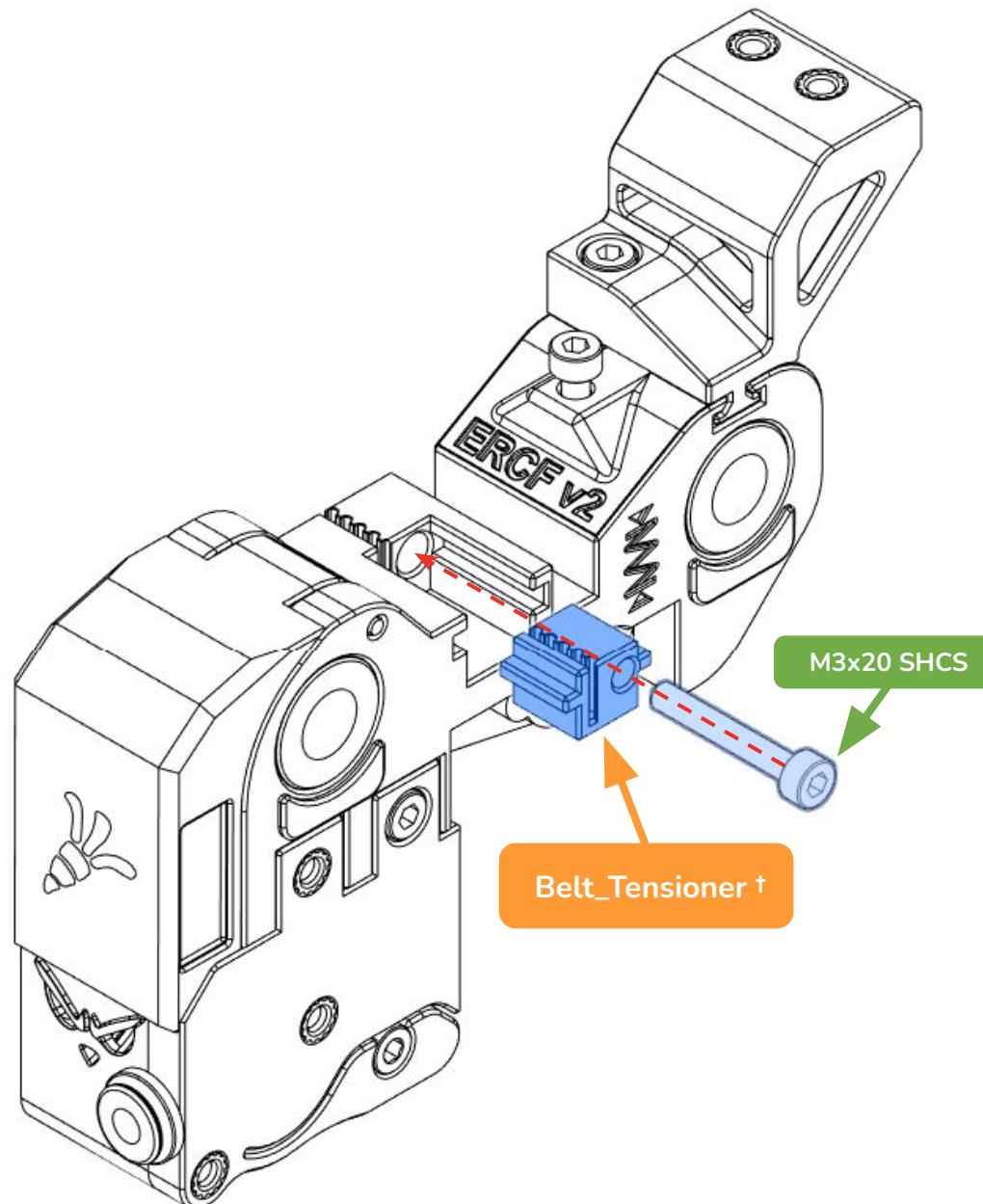
### DOOR INSTALLATION

Add a drop of CA glue and install the 3x2mm magnet into the door recess so that it attracts the door as a magnetic latch.

Attach the Selector Door to the Selector using piece of 1.75mm Accent filament & trim to length.

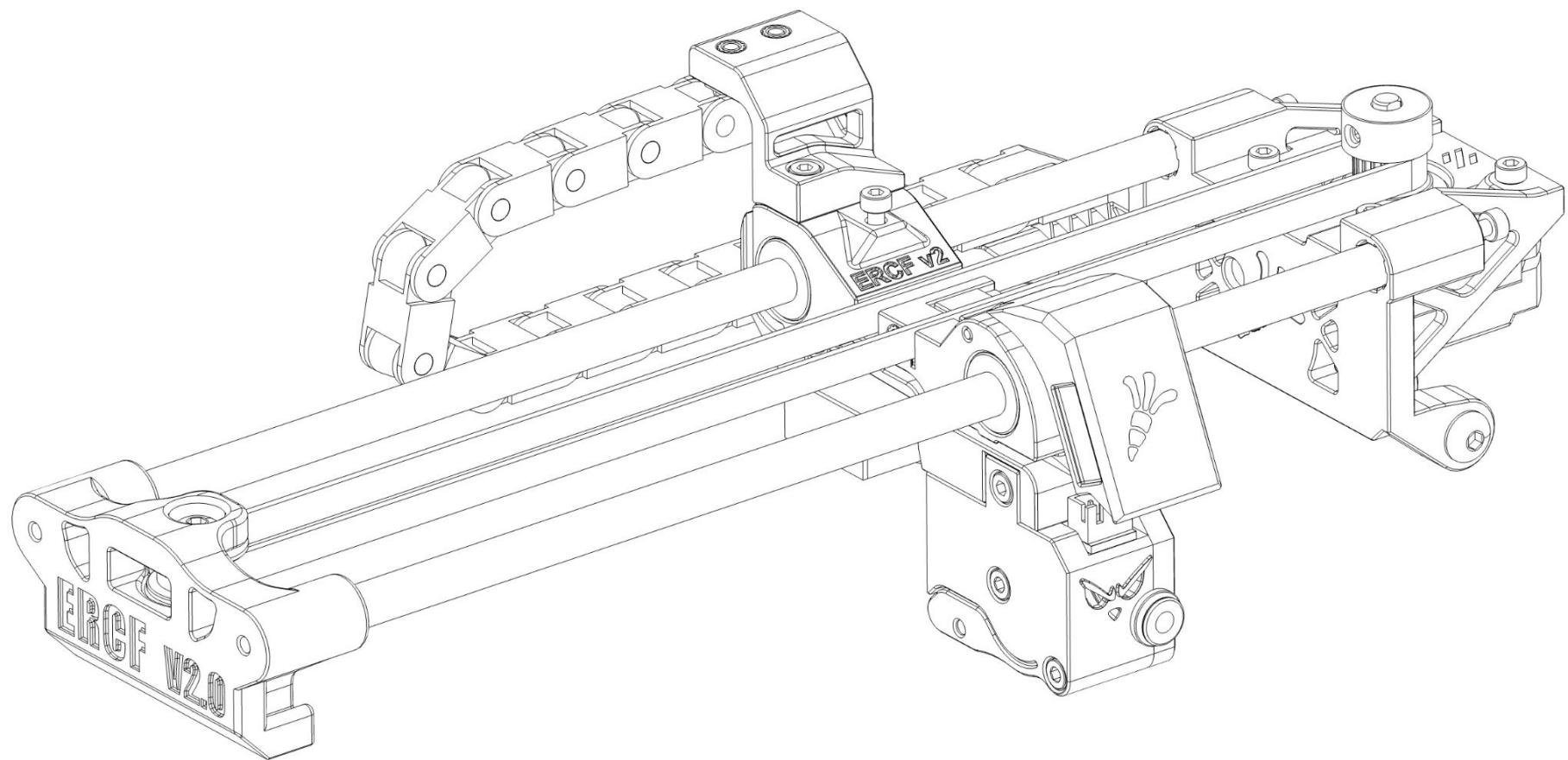
**TENSIONER INSTALLATION**

Insert the Belt Tensioner into the side of the Selector and fasten it with a M3x20 screw. We don't need to tighten it all the way yet.



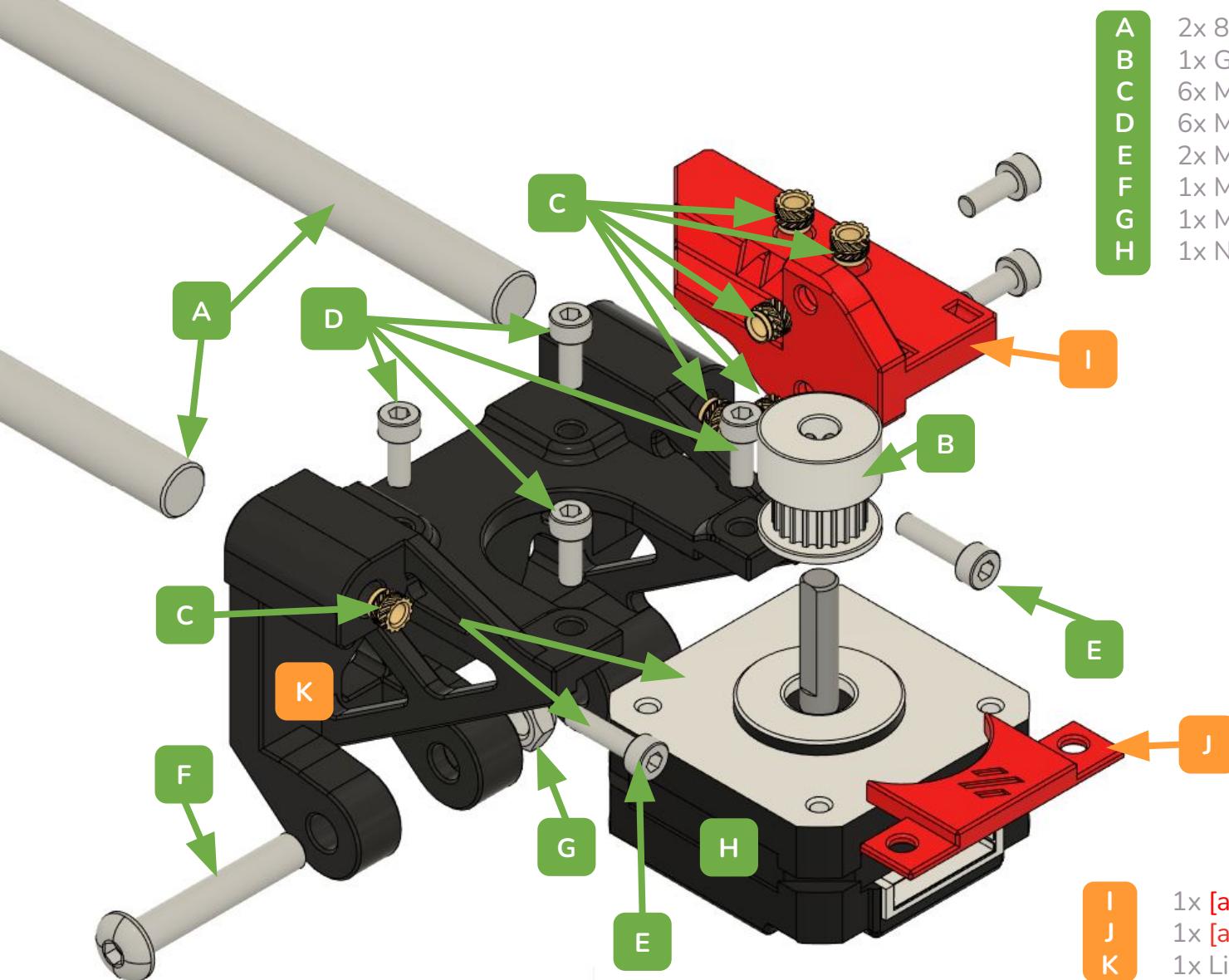
The first 3D printer was invented in 1986 by Chuck Hull, who called the process "stereolithography".





## LINEAR AXIS HINGE SUB-BOM

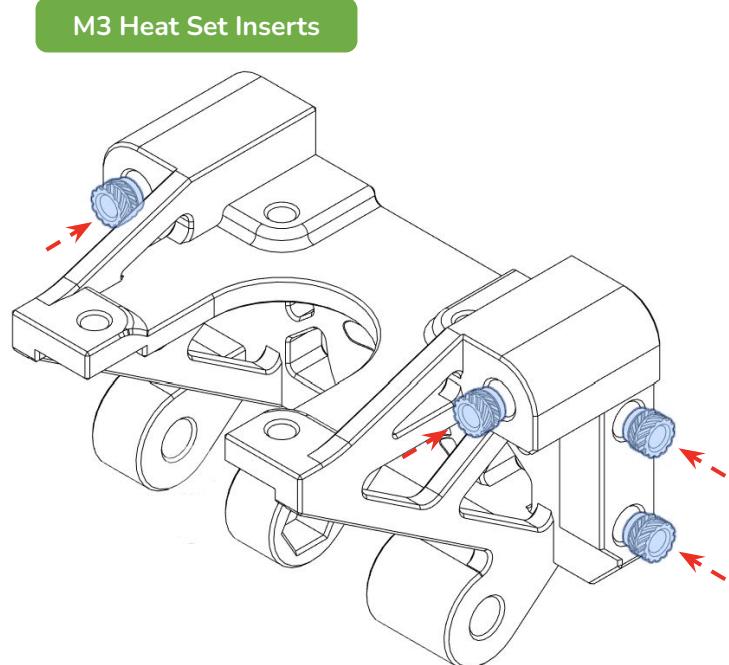
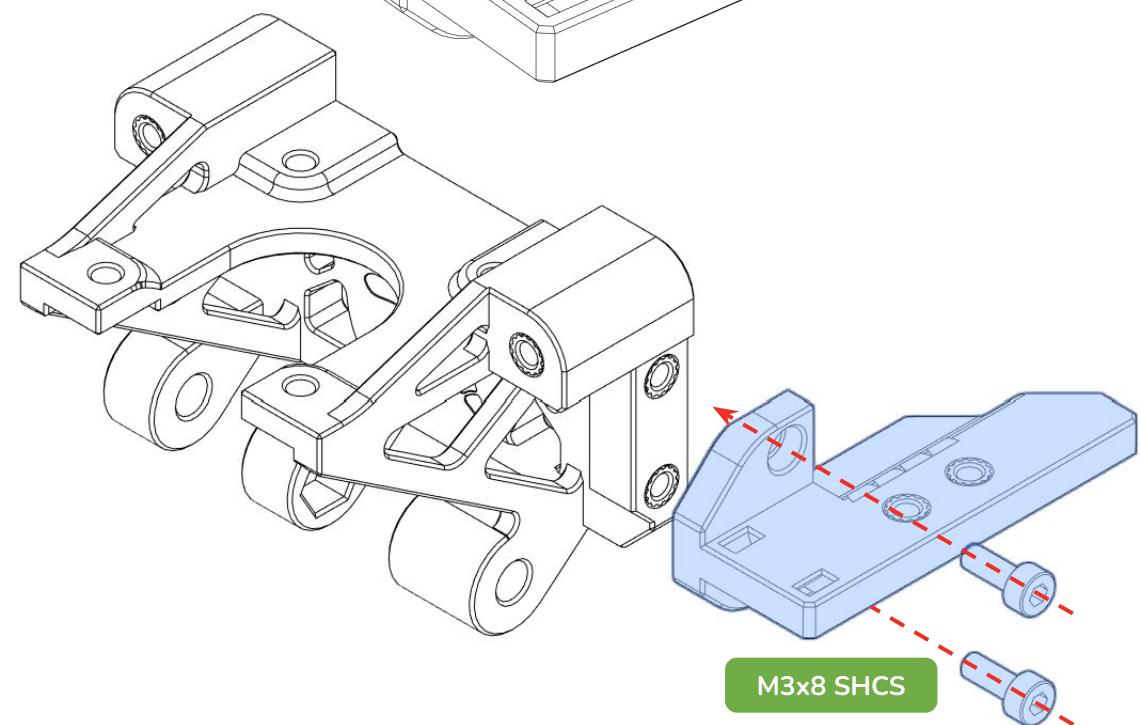
- A 2x 8mm rods  
B 1x GT2 20T pulley  
C 6x M3 Heatset Inserts  
D 6x M3x8mm SHCS  
E 2x M3x12mm SHCS  
F 1x M5x30mm BHCS  
G 1x M5 Nylock nuts  
H 1x NEMA17 Pancake Motor

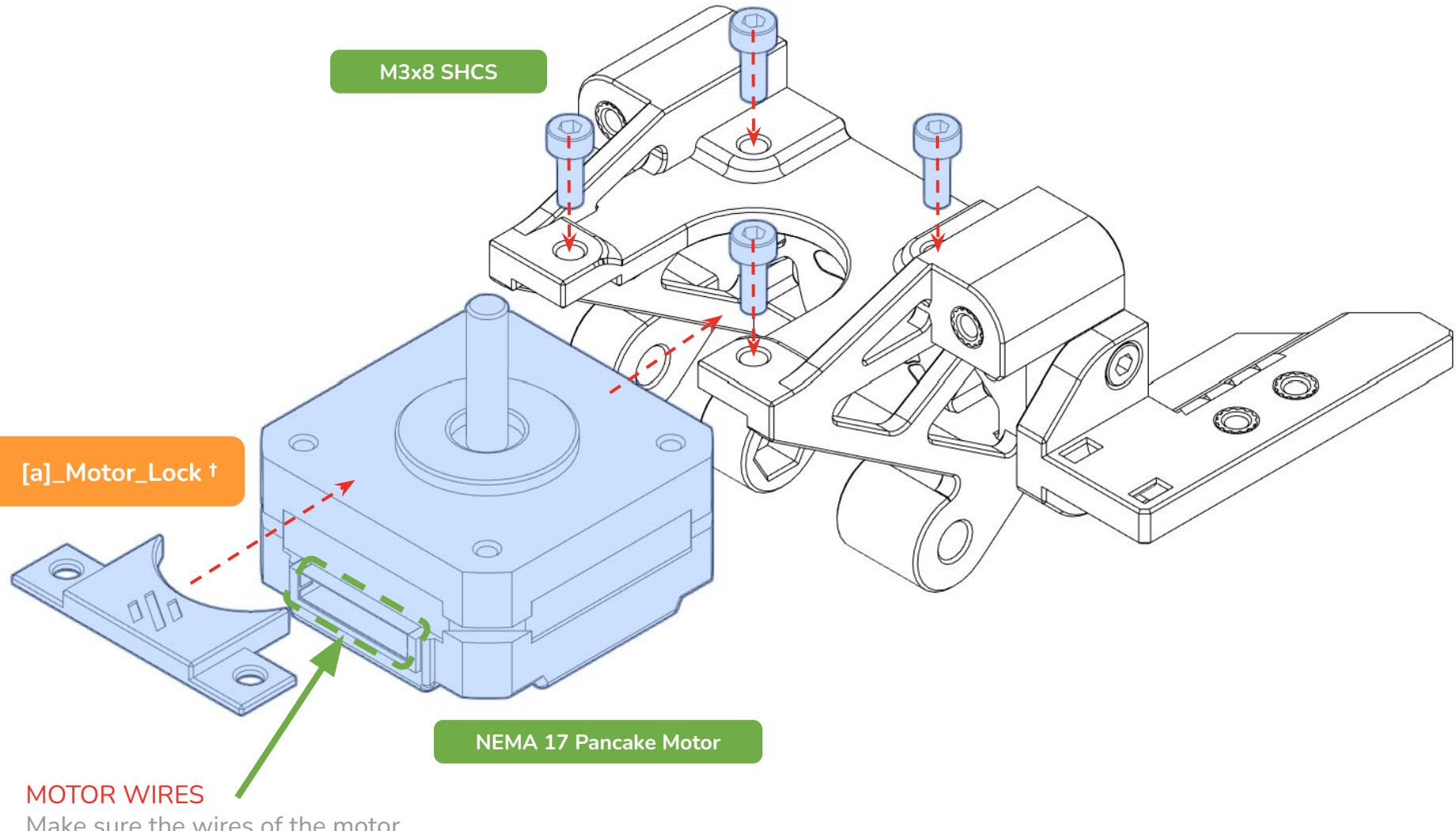


1x [a]\_Drag\_Chain\_Anchor\_Bottom.stl †  
1x [a]\_Motor\_Lock.stl †  
1x Linear\_Axis\_Selector\_Motor\_Support.stl

**HEAT SET INSERTS**

The list of pages with heat set inserts is on [page 19](#).

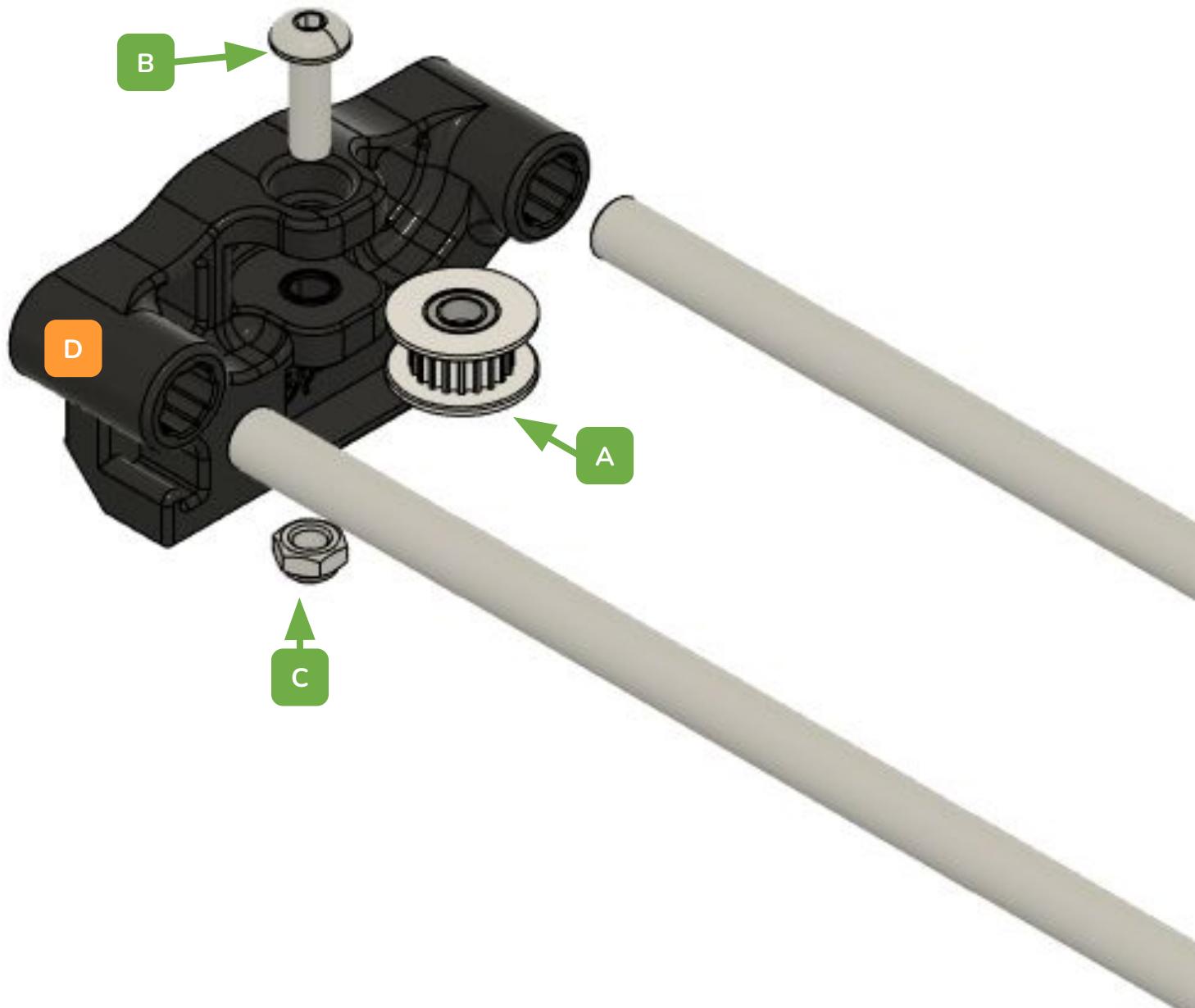
**Linear\_Axis\_Selector\_Motor\_Support**



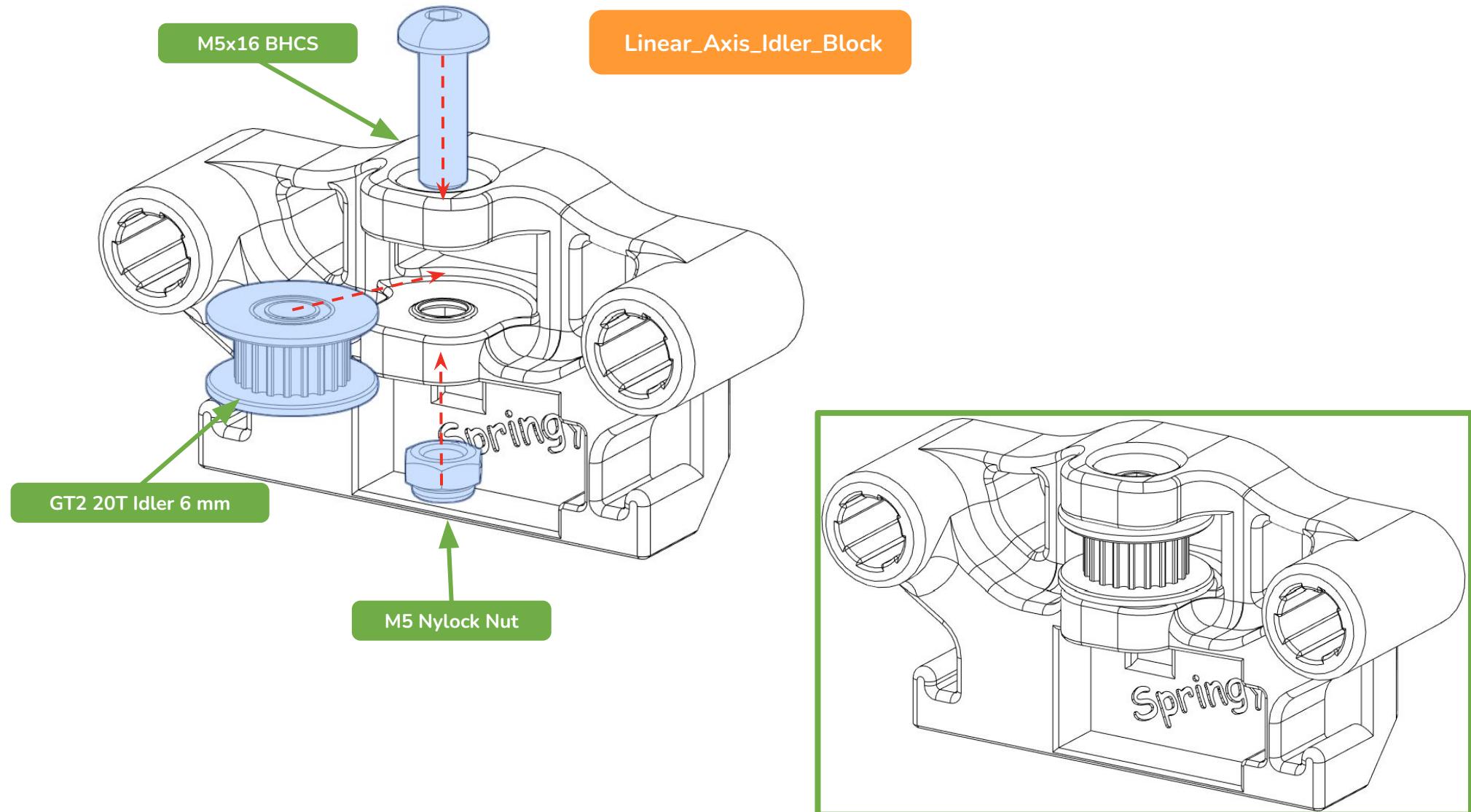
MOTOR WIRES

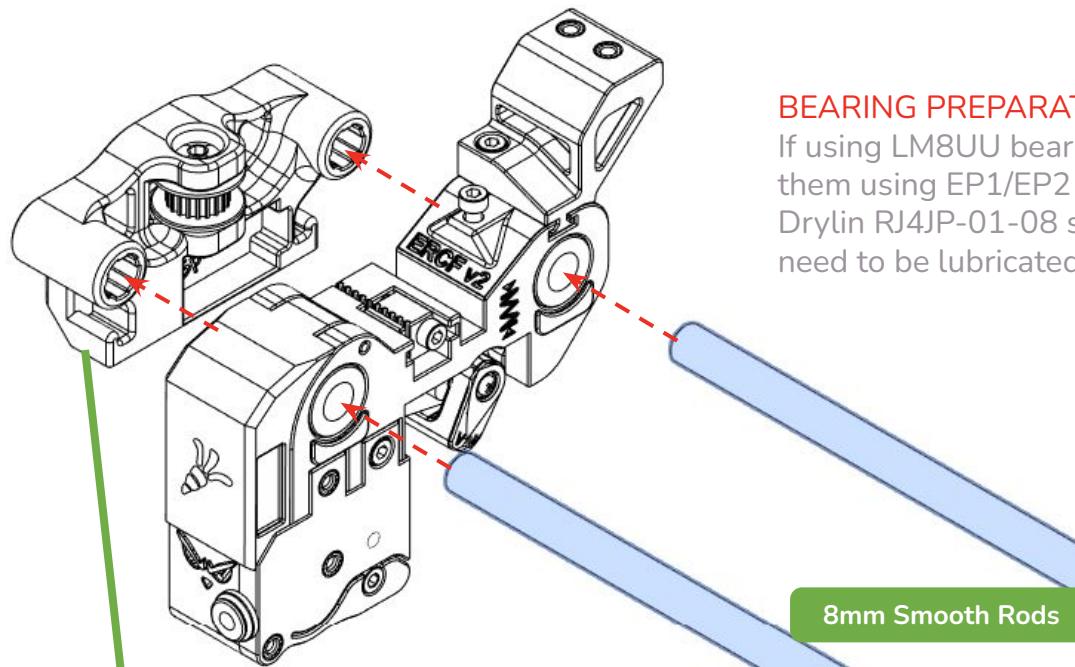
Make sure the wires of the motor  
are coming out from this side.

## LINEAR AXIS IDLER SUB-BOM

**A**1x GT2 20T toothed idler  
1x M5x16mm BHCS  
1x M5 Nylock nuts**D**

1x Linear\_Axis\_Idler\_Block.stl



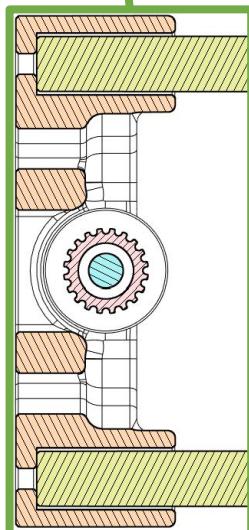
**BEARING PREPARATION**

If using LM8UU bearings, lightly grease them using EP1/EP2 or Superlube grease. Drylin RJ4JP-01-08 style bearings do not need to be lubricated.

**MOTOR SIDE**

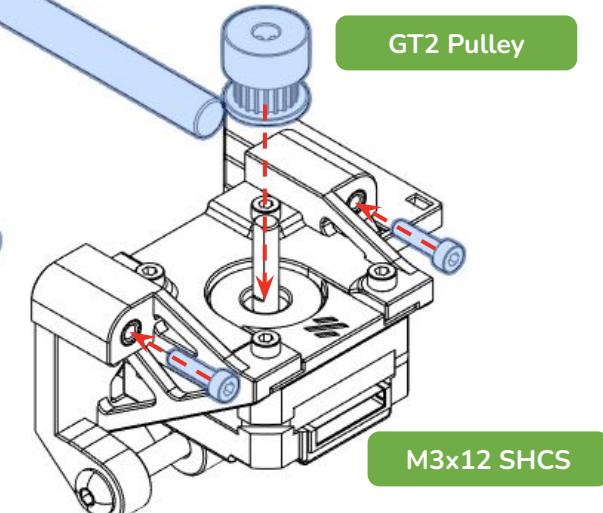
Don't fully insert the rods on the motor side for now, set them in a central position and just get the 2 M3x12 SHCS screws to contact.

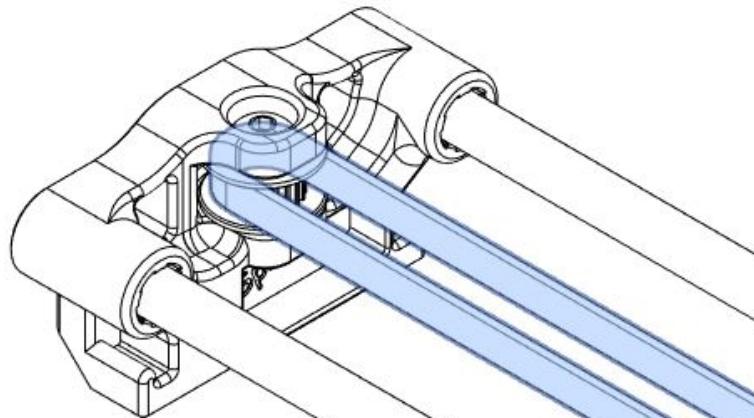
Add the GT2 pulley and snug the grub screw. We will adjust soon.

**IDLER SIDE**

Carefully insert the 8mm Smooth Rods through the LM8UU / RJ4JP-01-08 Selector bearings and fully into the idler until they bottom out.

There are holes at the end to allow you to check if the rods are fully seated.

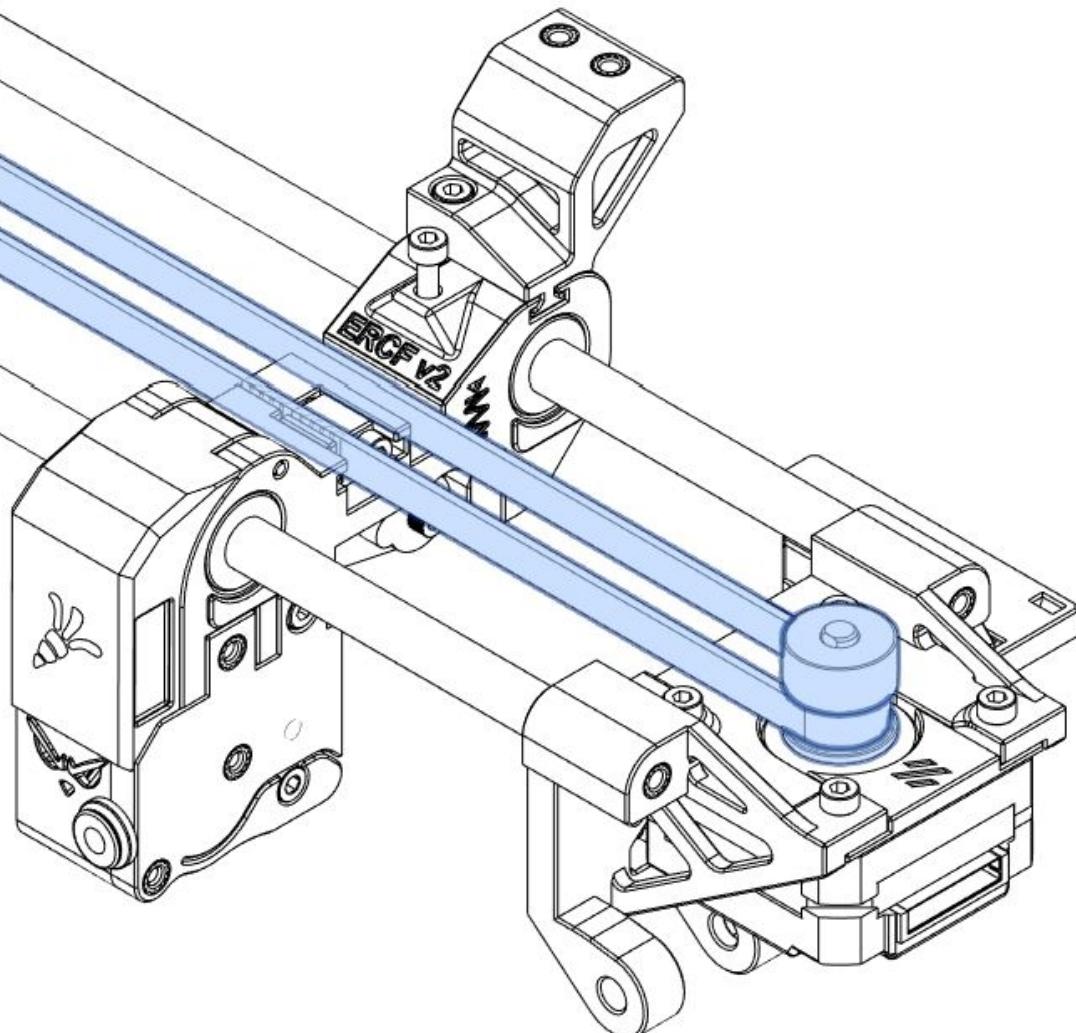




Channels	Approx Belt Length (mm)
N	165 + 46N
4	349
5	395
6	441
7	487
8	533
9	579
10	625
11	671
12	717
13	763
14	809
15	855

### BELT INSTALLATION

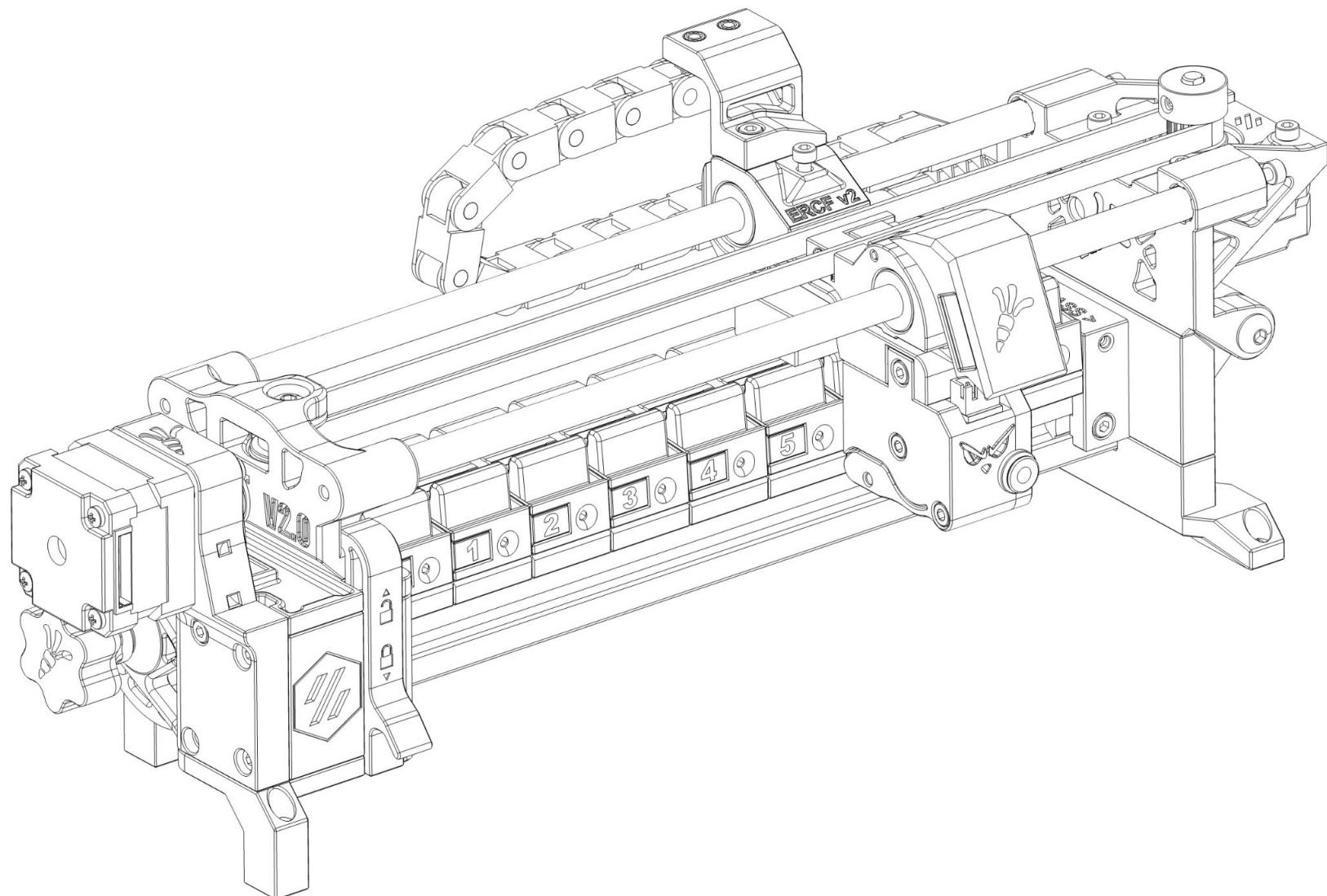
Install the pulley and run the belt clockwise from the Selector, around the Idler, back across to the Selector Motor, and back to the Selector. Mark the belt length with a paint pen or permanent marker. Now measure an additional 10mm of length, and cut the belt to the new mark. This ensures room for adjustment in a later step.

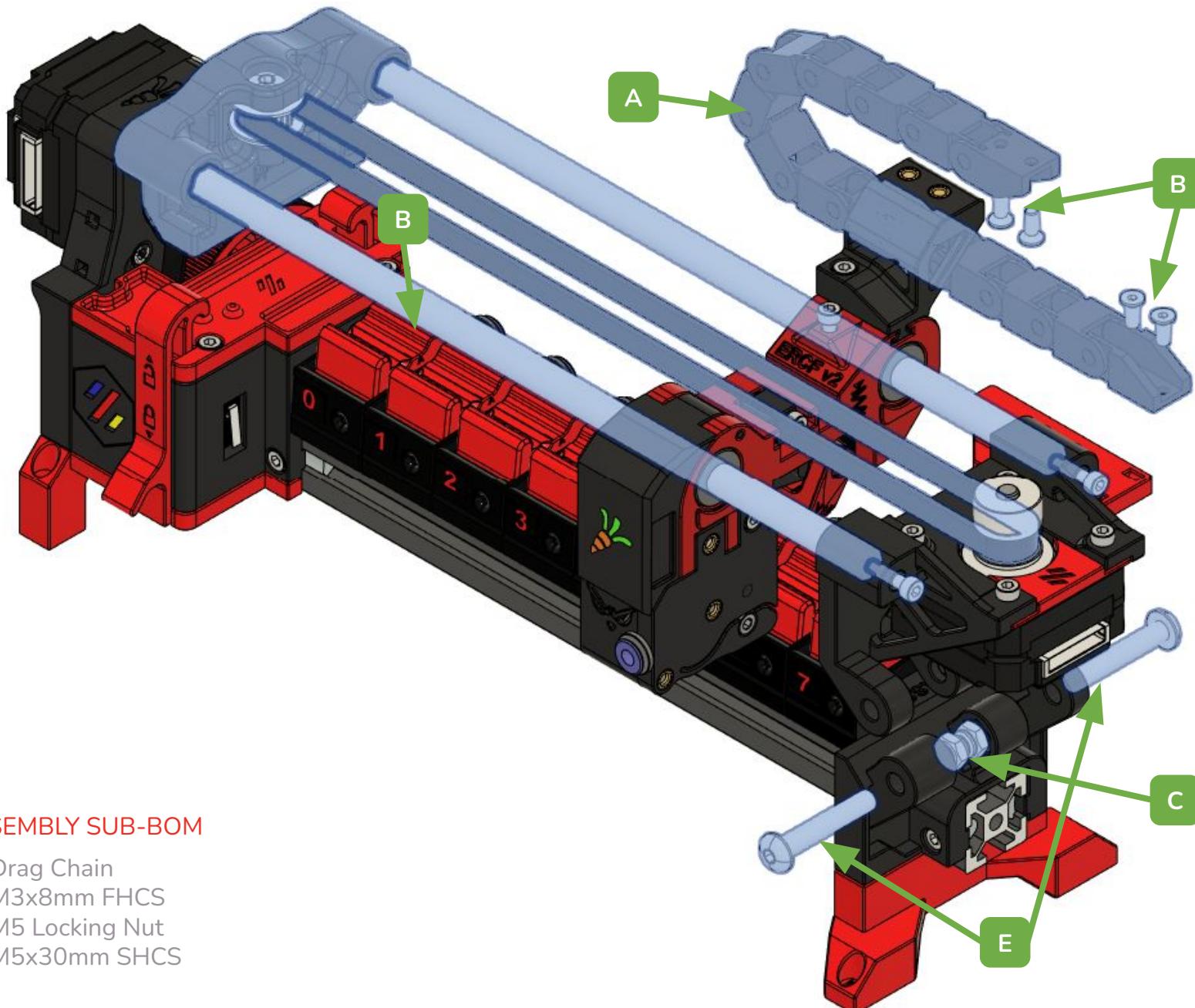


### ERCF in space?

The first 3D printer in space was installed on the International Space Station in 2014 and used by astronauts to create tools and parts, demonstrating the potential of this technology for long-duration space missions and even interplanetary travel.

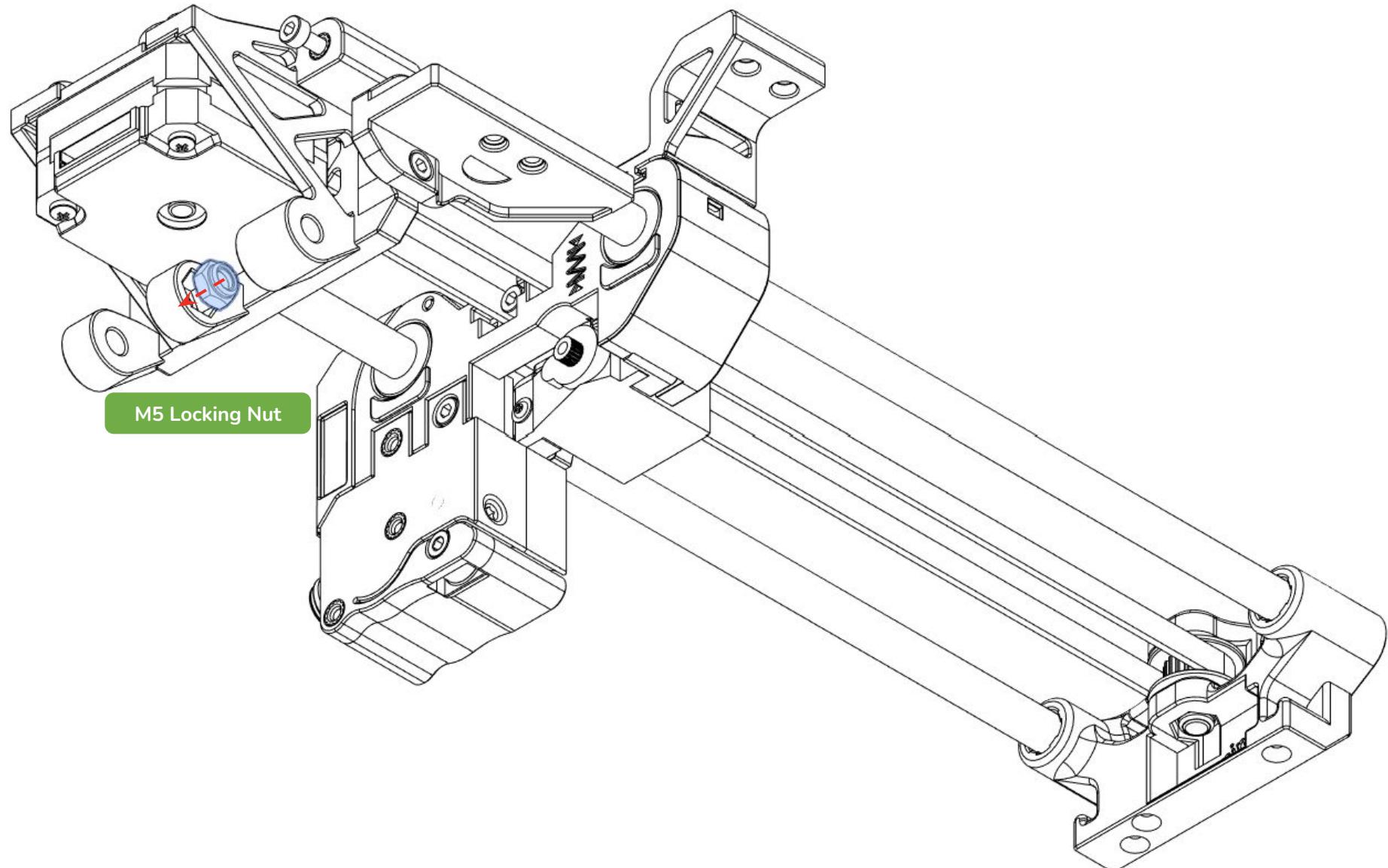


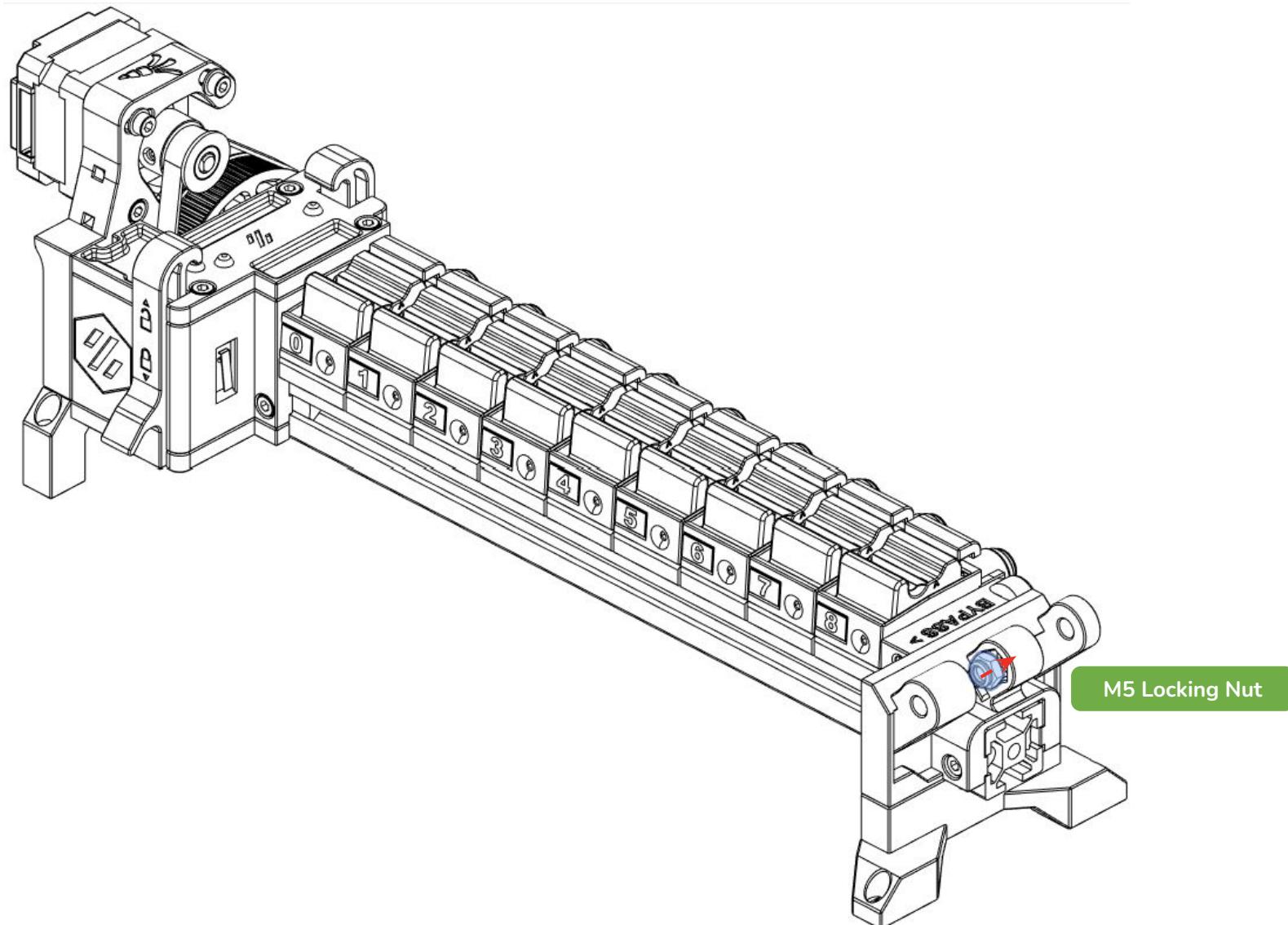


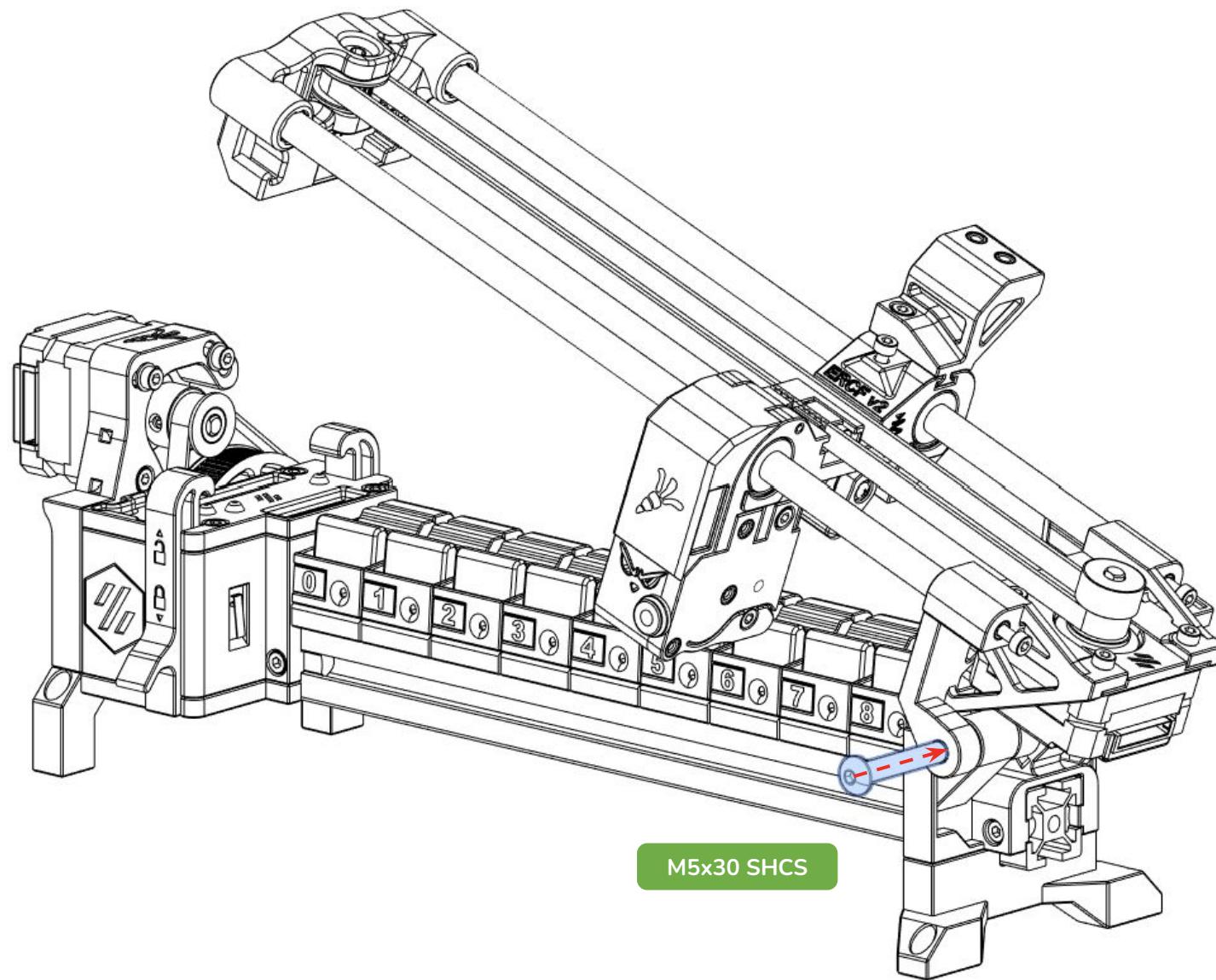


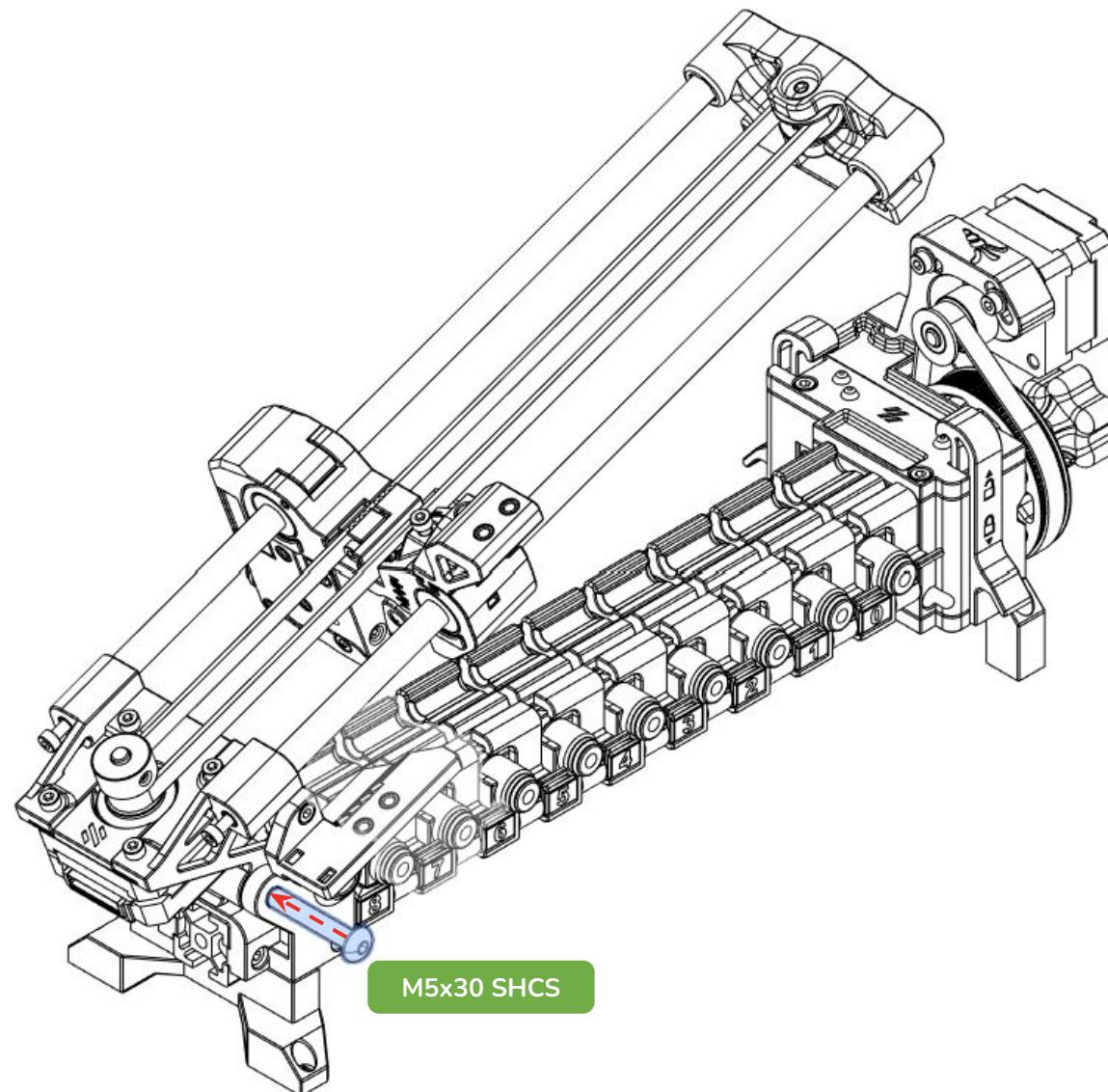
## FINAL ASSEMBLY SUB-BOM

- A 1x Drag Chain
- B 4x M3x8mm FHCS
- C 2x M5 Locking Nut
- D 2x M5x30mm SHCS







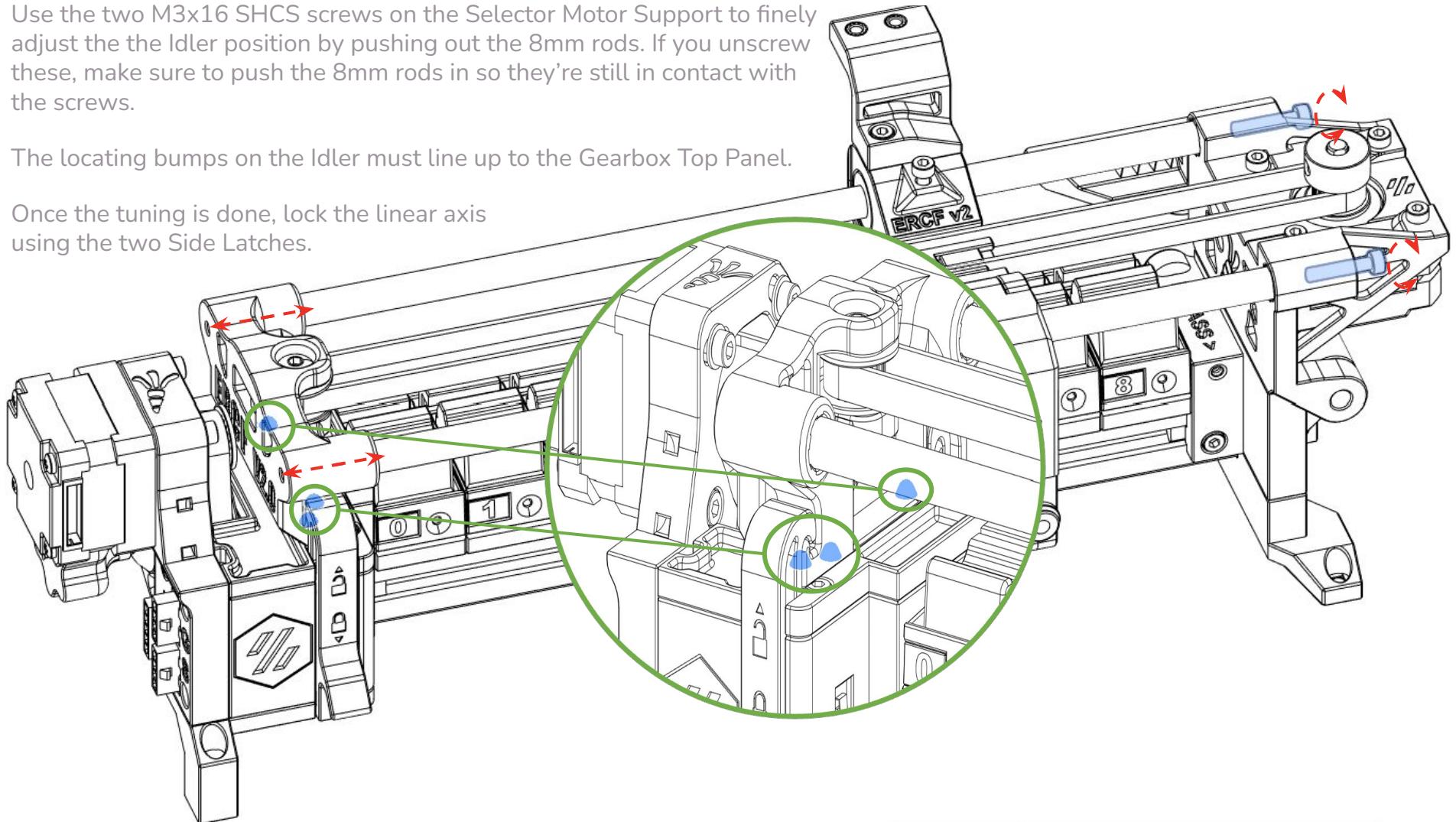


**IDLER POSITION**

Use the two M3x16 SHCS screws on the Selector Motor Support to finely adjust the the Idler position by pushing out the 8mm rods. If you unscrew these, make sure to push the 8mm rods in so they're still in contact with the screws.

The locating bumps on the Idler must line up to the Gearbox Top Panel.

Once the tuning is done, lock the linear axis using the two Side Latches.

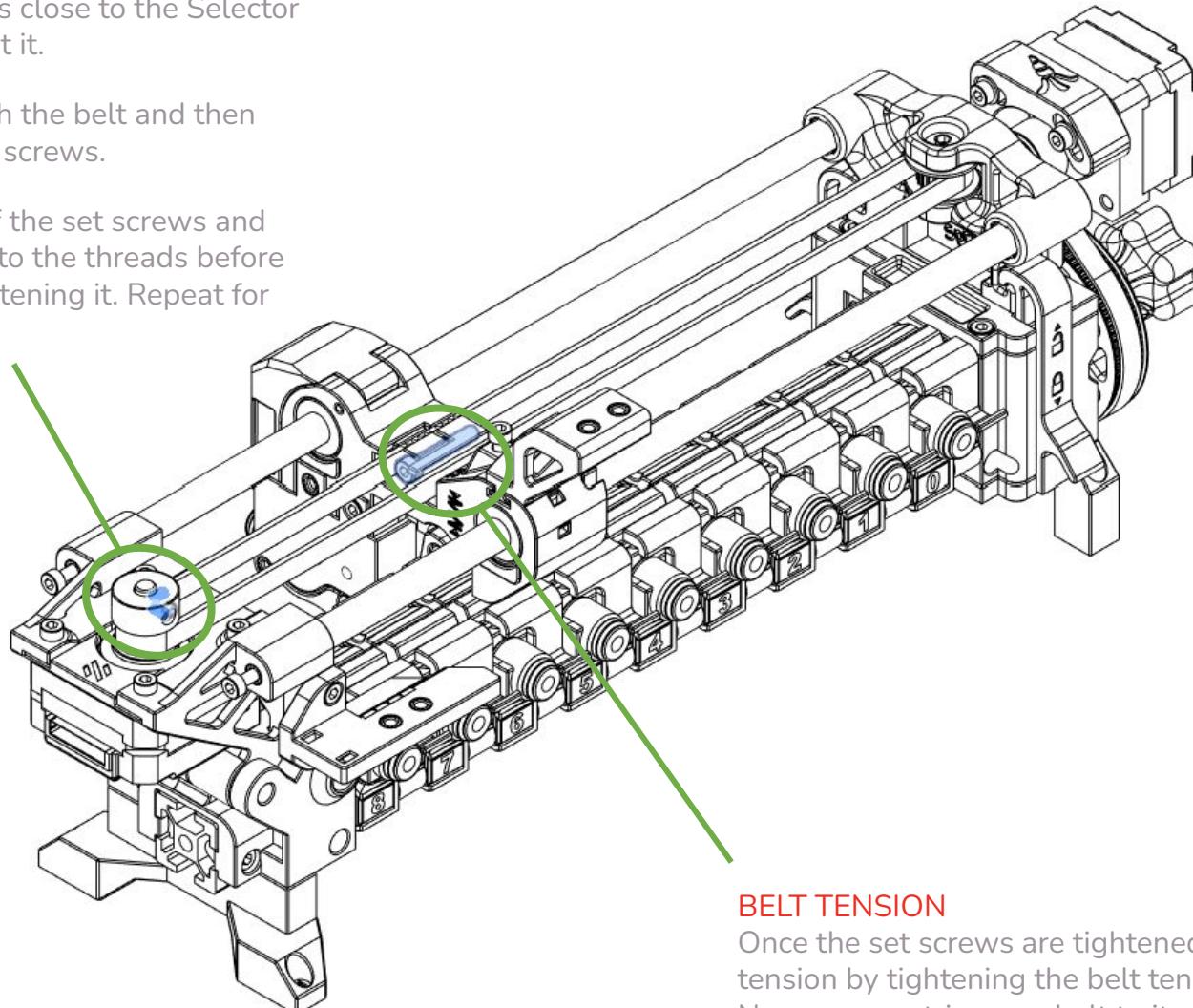


**SET SCREWS**

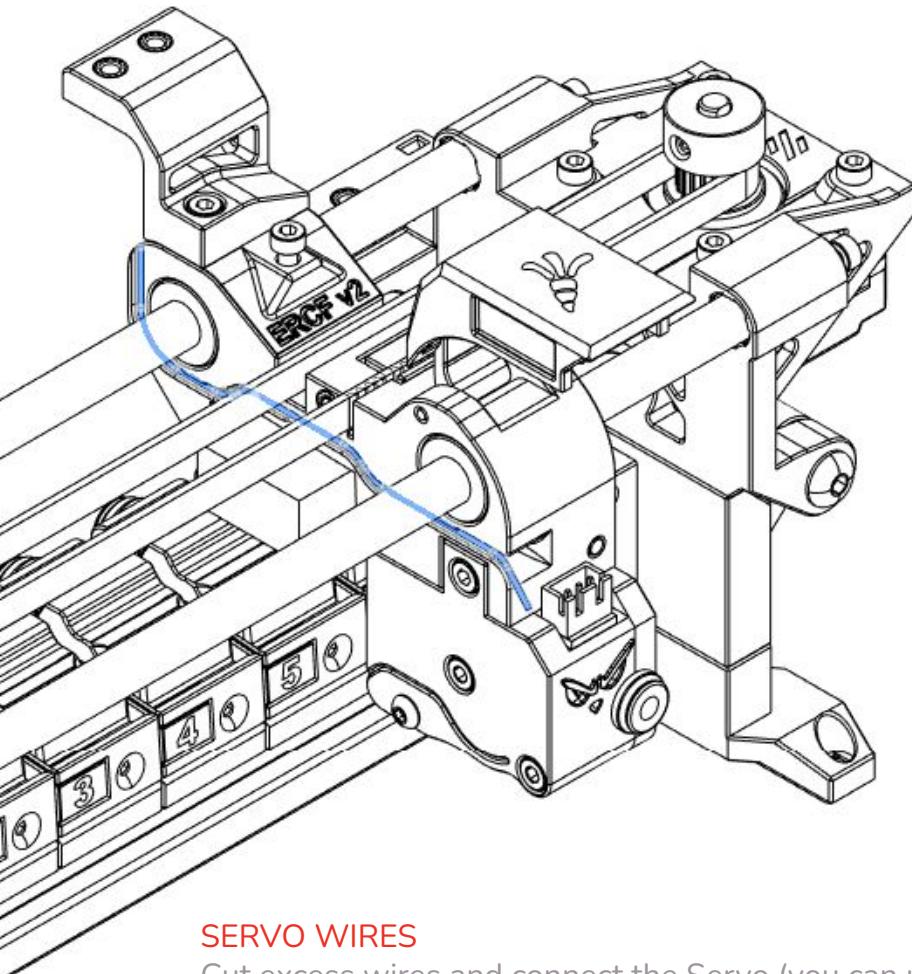
Move the Selector as close to the Selector Motor as you can get it.

Align the pulley with the belt and then tighten both M3 set screws.

Next, remove one of the set screws and apply thread locker to the threads before reinstalling and tightening it. Repeat for the other screw.

**BELT TENSION**

Once the set screws are tightened, adjust the belt tension by tightening the belt tensioner M3x20. Now you can trim your belt to its final length.



#### SERVO WIRES

Cut excess wires and connect the Servo (you can use a Dupont connector for example).

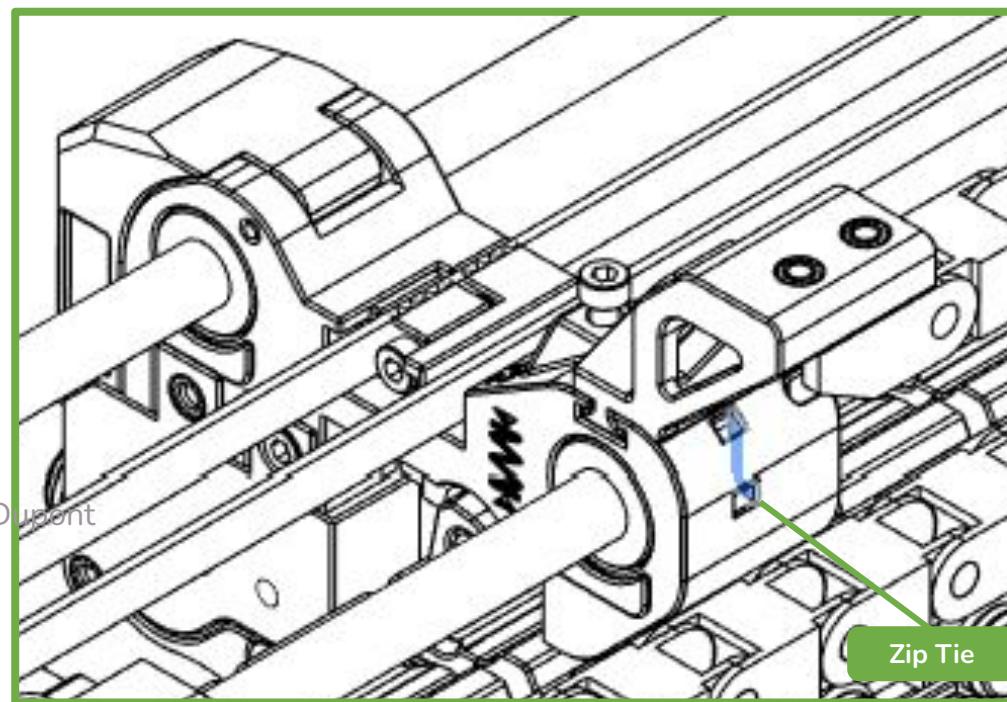
Secure both the Servo and Encoder wires using a zip tie.

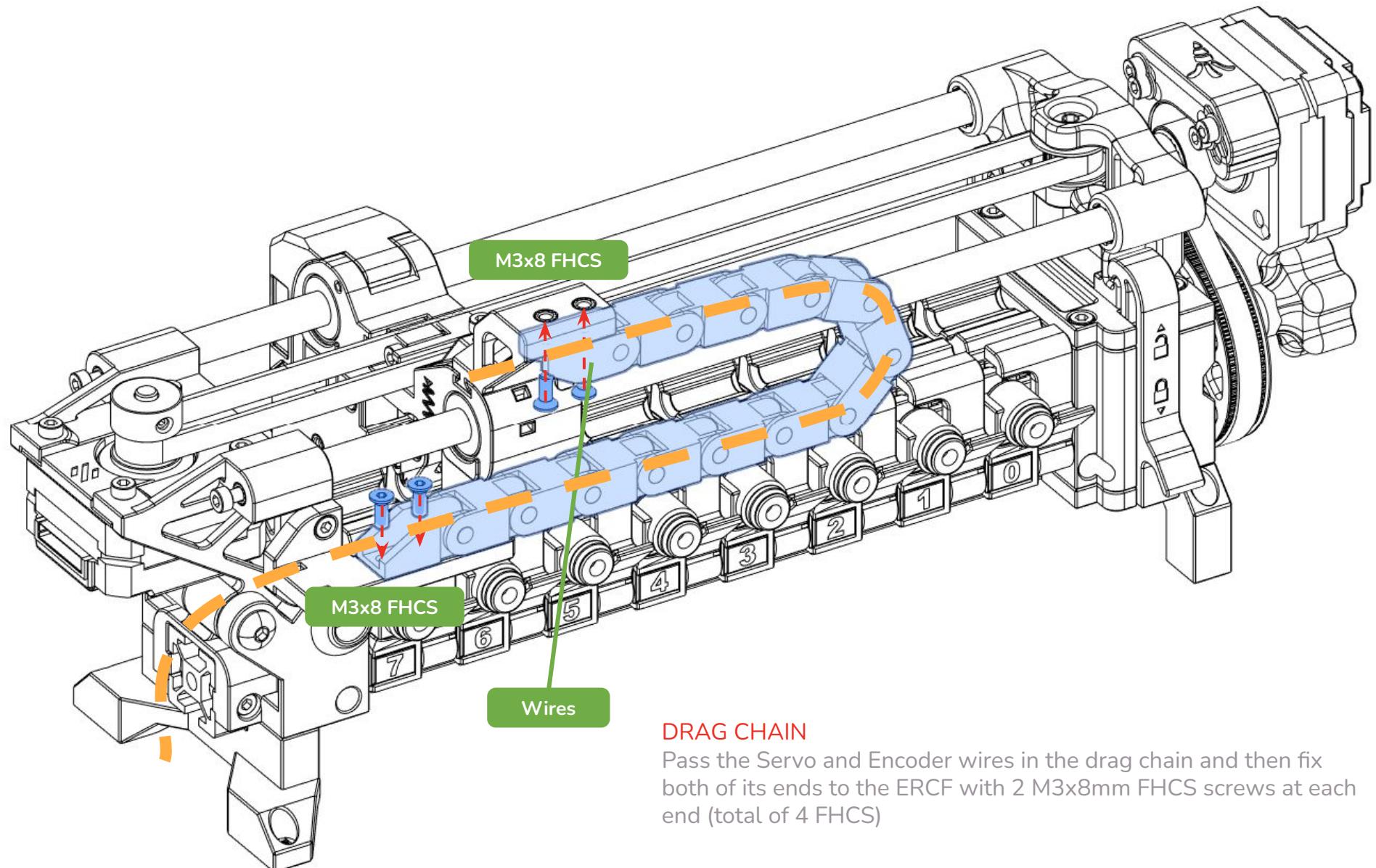
#### ENCODER WIRES

Pass one of the Encoder wires into the dedicated channel in the Selector Cart to define the wire length needed to plug into the Encoder.

Cut excess wire, remove the wire from the channel and do the crimps (Dupont or JST XH will work) for all wires.

Pass all the wires in the channel, then connect the Encoder and close the selector door.



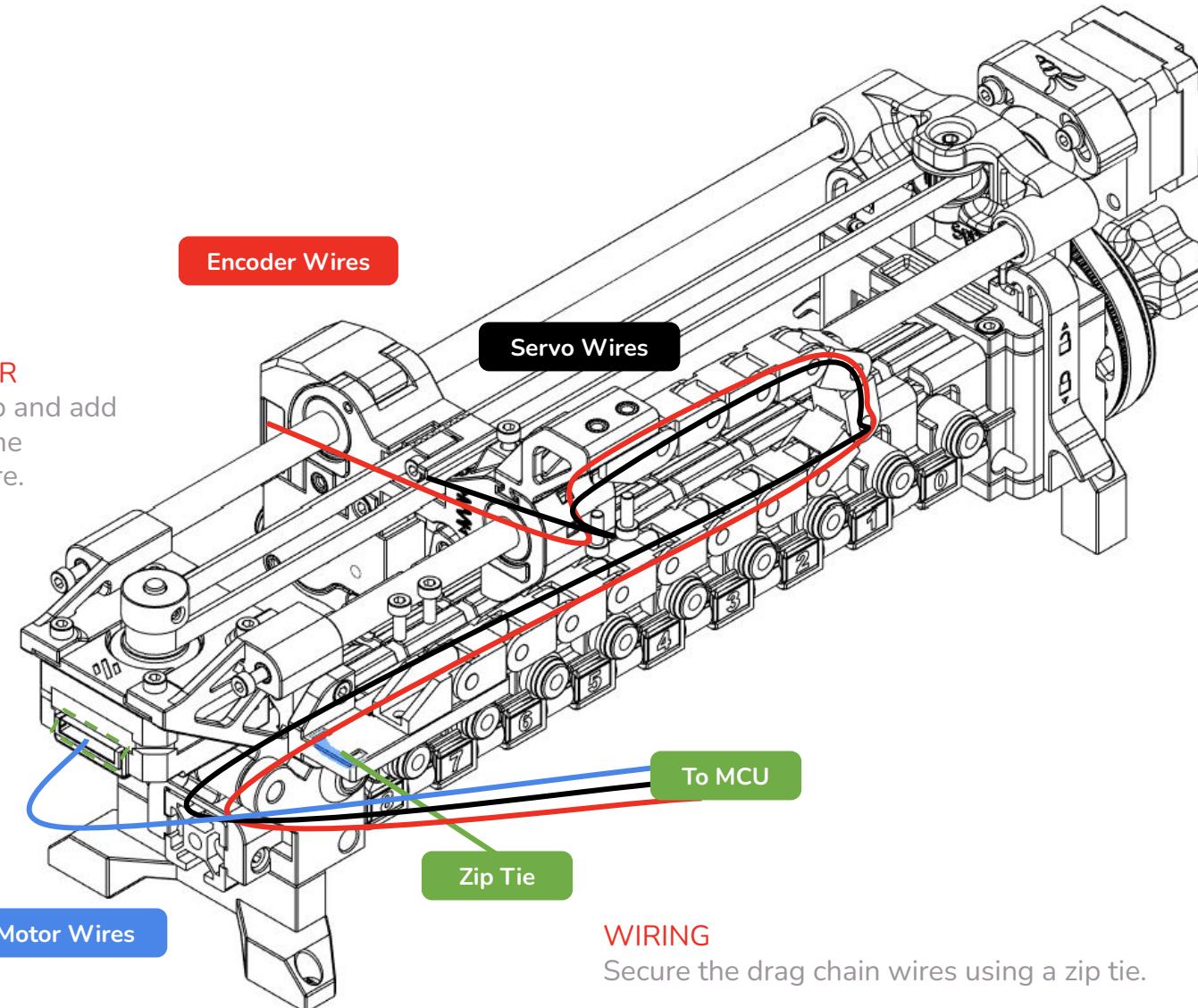


#### DRAG CHAIN

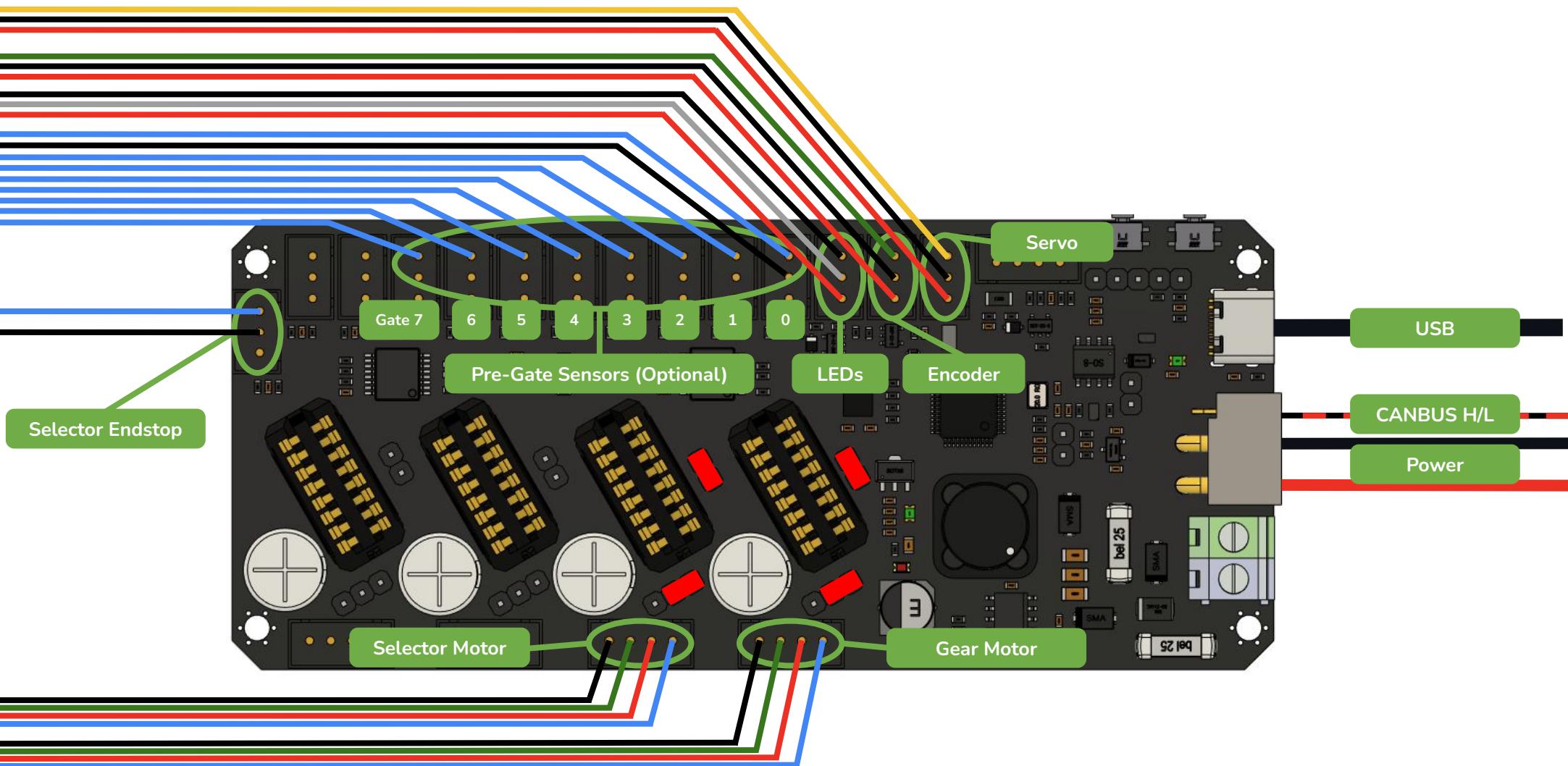
Pass the Servo and Encoder wires in the drag chain and then fix both of its ends to the ERCF with 2 M3x8mm FHCS screws at each end (total of 4 FHCS)

**SELECTOR MOTOR**

You can now crimp and add the connector to the Selector Motor wire.

**WIRING**

Secure the drag chain wires using a zip tie.

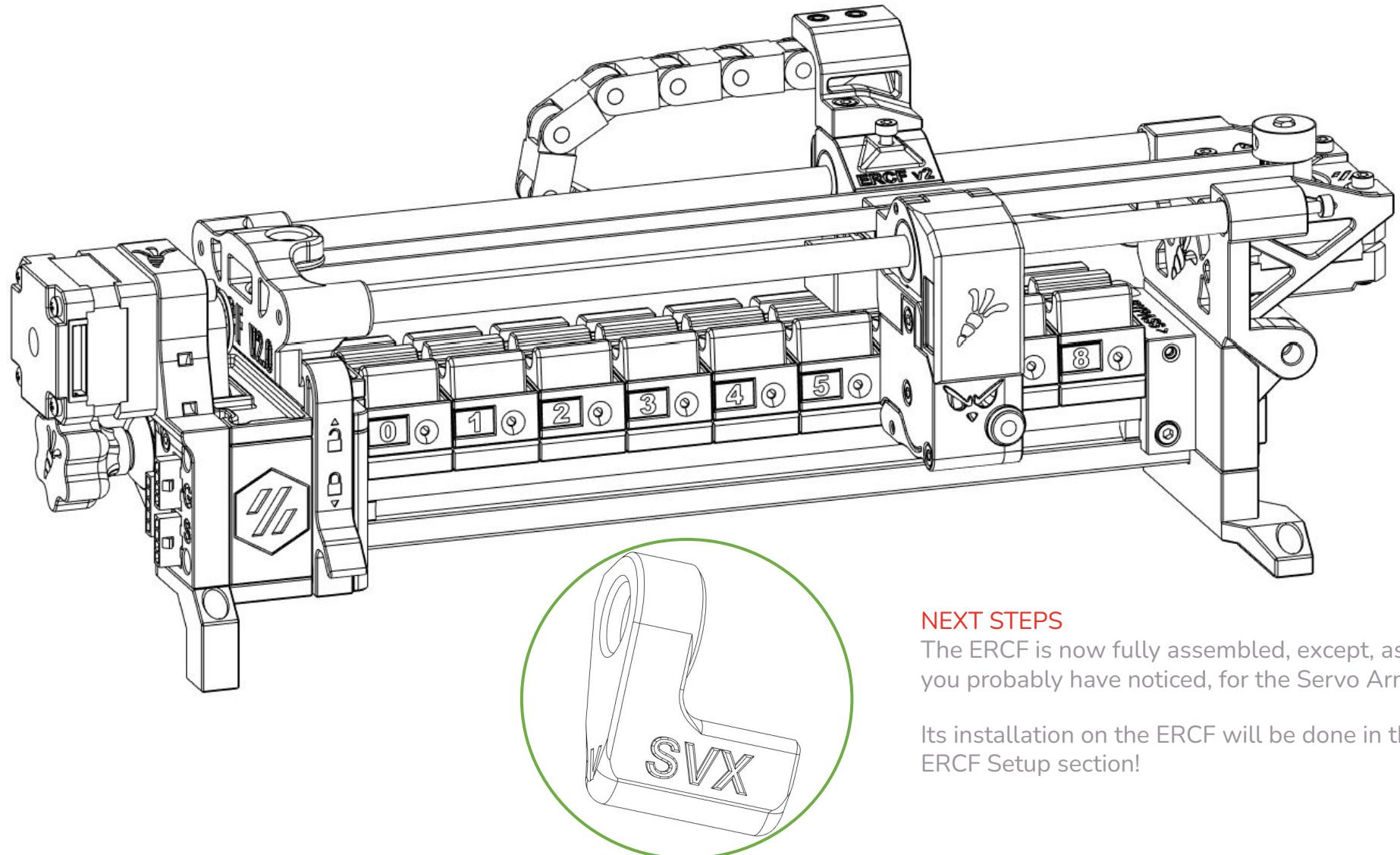


### MMB WIRING

Connect the Selector Endstop and optional Pre-Gate Sensor wires. Connect the Servo and Encoder wires.

Connect the Selector Motor and Gear Motor wires. Wiring color order may vary between manufacturers for stepper motors.

Keep a few cms of wires in the MMB box, it will be helpful in case you have to disassemble/reassemble.



#### NEXT STEPS

The ERCF is now fully assembled, except, as you probably have noticed, for the Servo Arm!

Its installation on the ERCF will be done in the ERCF Setup section!

WE UNDERSTAND THAT THE DOCUMENTATION IS NOT QUITE COMPLETE

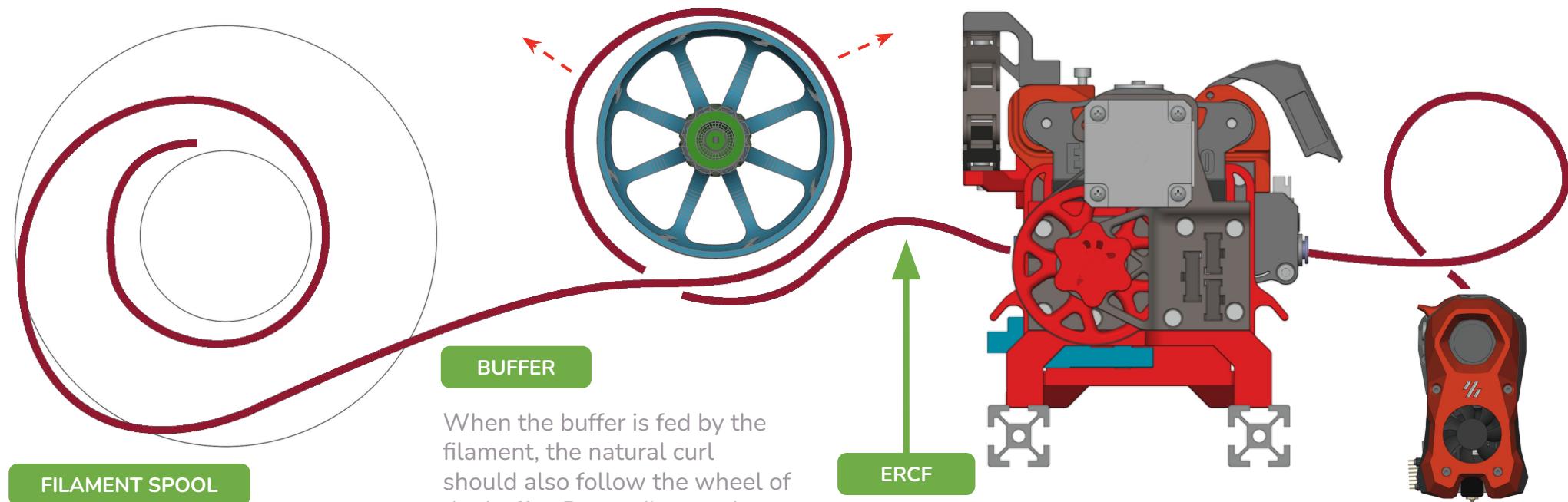
We are working to complete the documentation after RC1 launch...

If you want to help, please reach out to the team.

WIRING THE LEDS  
TODO

## BEST PRACTICES FOR FILAMENT TUBE MANAGEMENT

It is important to optimize your tube path to reduce any resistance for your MMU setup. This is to ensure that the path you choose does not go against the natural curl of your filament. ERCT, as an example is designed to support many of these best practices.



The ideal location for your filament spool will depend on how it feeds the buffer. The curl should naturally work with the path (filament and tube) that goes into the buffer. In this example feeding around to the back and below allows for the natural curl to remain in the tube to the buffer.

When the buffer is fed by the filament, the natural curl should also follow the wheel of the buffer. Depending on the choice of buffer design, this should be configured in such way, to follow the buffering expansion. It is essential that the buffer does not pull back filament on the encoder.

Many buffer designs require optimal paths that come into the ERCF to reduce pressure on the filament blocks. It is important in reducing that pressure by not allowing downward orientations. The tube as well should not be too long or it meets additional resistance.

A final turn to the toolhead can help maintain the natural curl. This doesn't have to be small, and can be a large radius but shouldn't be too long that will introduce additional resistance.

## INSTALL MMU FIRMWARE

ERCF v2 uses Happy Hare firmware for controlling MMU functions under Klipper.

Download from the github repo and run the installer.

Note: if you have a non standard Klipper installation pay attention to the '-c' and '-k' options

```
cd ~
git clone https://github.com/moggieuk/Happy-Hare.git
cd Happy-Hare

./install.sh -i
```

```
Klipper service found
Reading default configuration parameters...

-----
Let me see if I can get you started with initial configuration
You will still have some manual editing to perform but I will explain that later
(Note that all this script does is set a lot of the time consuming parameters in the config

What type of MMU are you running?
1) ERCF v1.1 (inc TripleDecky, Springy, Binky mods)
2) ERCF v2.0 (inc ThumperBlocks mod)
3) Tradrack v1.0
4) Other (Custom creations or variations not mentioned above...)
MMU Type? (1-4)? 2
Some popular upgrade options for ERCF v2.0 can automatically be setup. Let me ask you about them...
Are you using 'ThumperBlocks' filament block option (y/n)? n

-----
Select mcu board type used to control MMU
1) BTT MMB
2) Fysetc Burrows ERB
3) Standard EASY-BRD (with SAMD21)
4) EASY-BRD with RP2040
5) Not in list / Unknown
MCU type? (1-5)? 1
```

## RUN THROUGH INTERVIEW

Make sure you select ERCF v2.0 and correct MCU board (BTT MMB recommended)

If you are not sure of options, decline them at this stage – you can configure them later

Answer 'no' to ERCF compatibility



## FOLLOW HAPPY HARE SETUP GUIDELINES

A ERCF v2 landing page had been created to guide you through the essential hardware verification and setup process.

The basic steps are:

- Valid klipper configuration and control
- Run the sequence of calibration routines
- Fine tune options

Landing Page: [https://github.com/moggieuk/Happy-Hare/tree/main/doc/ercf\\_v2.md](https://github.com/moggieuk/Happy-Hare/tree/main/doc/ercf_v2.md)

## BASIC MMU COMMANDS

Happy Hare has a rich command set and extensive documentation but here is a quick reference of the basic commands

```
Happy Hare MMU commands: (use MMU_HELP MACROS=1 TESTING=1 for full command set)
MMU : Enable/Disable functionality and reset state
MMU_CHANGE_TOOL : Perform a tool swap
MMU_CHECK_GATE : Automatically inspects gate(s), parks filament and marks availability
MMU_STATS : Dump or reset the MMU statistics
MMU_EJECT : Eject filament and park it in the MMU or optionally unloads just the extruder (EXTRUDER_ONLY=1)
MMU_ENCODER : Display encoder position or temporarily enable/disable detection logic in encoder
MMU_ENDLESS_SPOOL : Display or redefine the EndlessSpool groups
MMU_FORM_TIP : Convenience macro to call the standalone tip forming functionality
MMU_HELP : Display the complete set of MMU commands and function
MMU_HOME : Home the MMU selector
MMU_LED : Manage mode of operation of optional MMU LED's
MMU_LOAD : Loads filament on current tool/gate or optionally loads just the extruder for bypass or recovery usage
MMU_MOTORS_OFF : Turn off both MMU motors
MMU_PAUSE : Pause the current print and lock the MMU operations
MMU_PRELOAD : Preloads filament at specified or current gate
MMU_PRINT_END : Restore MMU idle state after print
MMU_PRINT_START : Initialize MMU state and ready for print
MMU_RECOVER : Recover the filament location and set MMU state after manual intervention/movement
MMU_REMAP_TTG : Display or remap a tool to a specific gate and set gate availability
MMU_RESET : Forget persisted state and re-initialize defaults
MMU_SELECT : Select the specified logical tool (following TTG map) or physical gate
MMU_SELECT_BYPASS : Select the filament bypass
MMU_SERVO : Move MMU servo to position specified position or angle
MMU_GATE_MAP : Display or define the type and color of filaments on each gate and optionally spoolman ID
MMU_STATUS : Complete dump of current MMU state and important configuration
MMU_SYNC_GEAR_MOTOR : Sync the MMU gear motor to the extruder motor
MMU_TOOL_OVERRIDES : Displays, sets or clears tool speed and extrusion factors (M220 & M221)
MMU_UNLOCK : Wakeup the MMU prior to resume to restore temperatures and timeouts
```

## KLIPPER CONFIG FILE CHANGES

In addition to the '[include]' entries created by Happy Hare, there are a few changes that you must make to your klipper config in order to support an MMU:

Add to your '[extruder]' section:

```
[extruder]
max_extrude_cross_section: 50      # MMU needs this
max_extrude_only_distance: 200     # MMU needs this
```

Make sure '[virtual\_sdcard]' section exists similar to:

```
[virtual_sdcard]
path: ~/printer_data/gcodes
on_error_gcode: CANCEL_PRINT
```

This part of the manual will guide you through setting up your slicer to work with the ERCF. This guide assumes you are using SuperSlicer but it will most likely work the same with PrusaSlicer. Only the changes from a default (i.e. single extruder and single tool) profile will be discussed.

Cura and other slicers will not be covered.



Make sure you have access to all fields

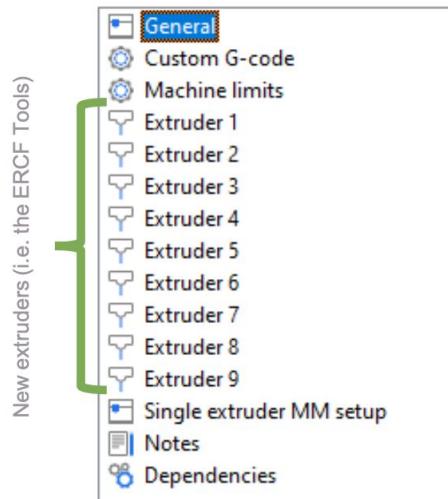
## GENERAL

In the general section of the Printer Settings Tab, activate the 'Single Extruder Multi Material' option and set the proper number of 'Extruders' (i.e. the number of channels on your ERCF)

The different extruders will then appear in the menu list

### Capabilities

- Extruders:  (with a green arrow pointing left)
- Single Extruder Multi Material:  (with a green arrow pointing left)
- Milling cutters:



## EXTRUDER N

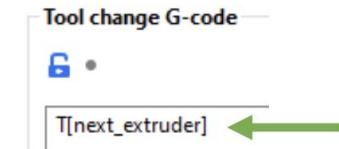
For each of the Extruder in your list, make sure that the 'Tool name' is left blank

### Name and Size

- Tool name:  (with a green arrow pointing left)
- Nozzle diameter:  mm

**CUSTOM G-CODE : TOOL CHANGE**

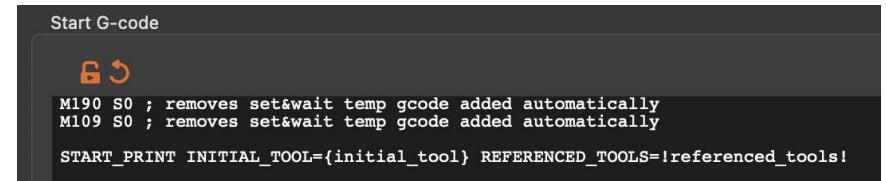
Set the 'Tool change G-code' to 'T[next\_extruder]', this will make the Gcode generate 'T0' Gcode to request a Tool Change for Tool 0 for example ('T1' for Tool 1 etc.)

**GLOBAL BEHAVIOR**

The Start and End gcode showed below are designed for using the ERCF as the filament management solution, even for single color prints. This means that the proper filament will be loaded at the beginning of the print (right after the print\_start macro has finished) and the filament will be unloaded at the end of the print. So, when your printer is not printing, no filament will be in the toolhead and the whole print\_start gcode will be executed without any filament loaded, so adapt it accordingly (e.g. if you have any purge sequence in it, that will be useless)

**CUSTOM G-CODE : PRINT START**

By default slicers do not load the first tool of a print, therefore you can either opt to always load the first tool prior to starting the print or else you need to pass the initial tool to your print start macro. This example also sets another variable with a list of tools used in a print (see START\_PRINT gcode for usage):



```
[gcode_macro START_PRINT]

description: Called when starting print
gcode:
  {%
    set REFERENCED_TOOLS = params.REFERENCED_TOOLS|default("")|string %
    set INITIAL_TOOL = params.INITIAL_TOOL|default(0)|int %

    {%
      if REFERENCED_TOOLS == "!referenced_tools!" %
        RESPOND MSG="Happy Hare gcode pre-processor is disabled"
        {%
          set REFERENCED_TOOLS = INITIAL_TOOL %
        }
      {%
        elif REFERENCED_TOOLS == "" %
          RESPOND MSG="Happy Hare single color print"
          {%
            set REFERENCED_TOOLS = INITIAL_TOOL %
          }
      {%
        endif %
      }

      : <your logic here>

      MMU_CHECK_GATE_TOOLS={TOOLS_USED}
      MMU_CHANGE_TOOL STANDALONE=1 TOOL={INITIAL_TOOL}
    {%
    }
  {%
  }
}
```

Read the parameters passed in by custom g-code in slicer

Optional: Run Happy Hare function to check that all tools are available

Load the initial tool used in the print

Example inclusion of logic to check that all tools used by the print are available and to load the initial tool

**CUSTOM G-CODE : PRINT END**

You might prefer to unload the filament at the end of a print. To support this, add the following to your custom end g-code in your slicer:



```
[gcode_macro END_PRINT]
description: Called when ending print
gcode:
  {%
    set EJECT_FILAMENT = params.EJECT_FILAMENT|default(0)|int %
  }
  {%
    if EJECT_FILAMENT|int == 1 %}
    MMU_EJECT
  {%
    endif %
  }
```

Example inclusion of logic to optionally eject filament after print

Parameter passed in from slicer

Filament ejection command

### TIP FORMING OPTIONS

There are three basic methods of dealing with filament tip creation:

1. Let the slicer do it in print (Happy Hare will do it when not in print)
2. Always let Happy Hare do it
3. Use filament cutter like ERF Filametrix to avoid “tip tuning” altogether

Without any changes, option 1 above will be the default. It however is not recommended, instead use option 2 or 3.

### TURNING OFF SLICER TIP CREATION (RECOMMENDED)

For both options 2 & 3 above it will be necessary to disable tip forming in your slicer. This will different from slicer to slicer but in general you need to zero out these settings.

To enable option 2, ensure the following two parameters are set in Happy Hare ‘mmu\_parameters.cfg’:

```
force_form_tip_standalone: 1
form_tip_macro: _MMU_FORM_TIP_STANDALONE
```

To enable option 3:

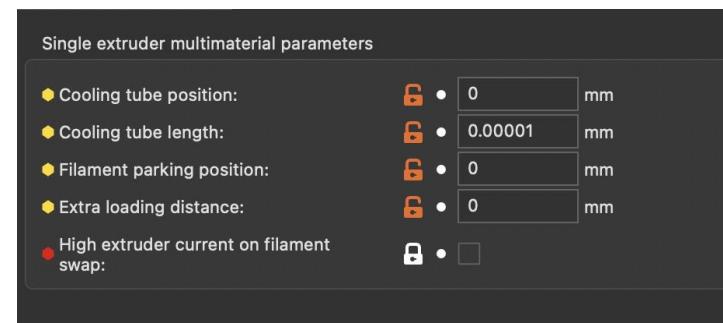
```
.force_form_tip_standalone: 1
form_tip_macro: _MMU_CUT_TIP
```

### SLICER TIP FORMING (NOT RECOMMENDED)

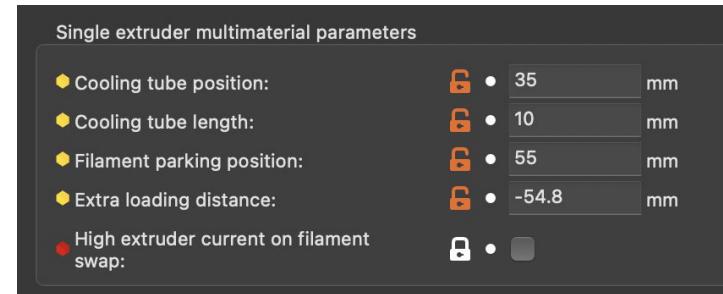
For option 1 you have to both setup tip forming in the slicer and in the Happy Hare firmware for use when not printing. To do this edit the slicer panel similar to this but with settings tuned to you specific toolhead:

Also ensure the following two parameters are set in Happy Hare ‘mmu\_parameters.cfg’:

```
force_form_tip_standalone: 0
form_tip_macro: _MMU_FORM_TIP_STANDALONE
```



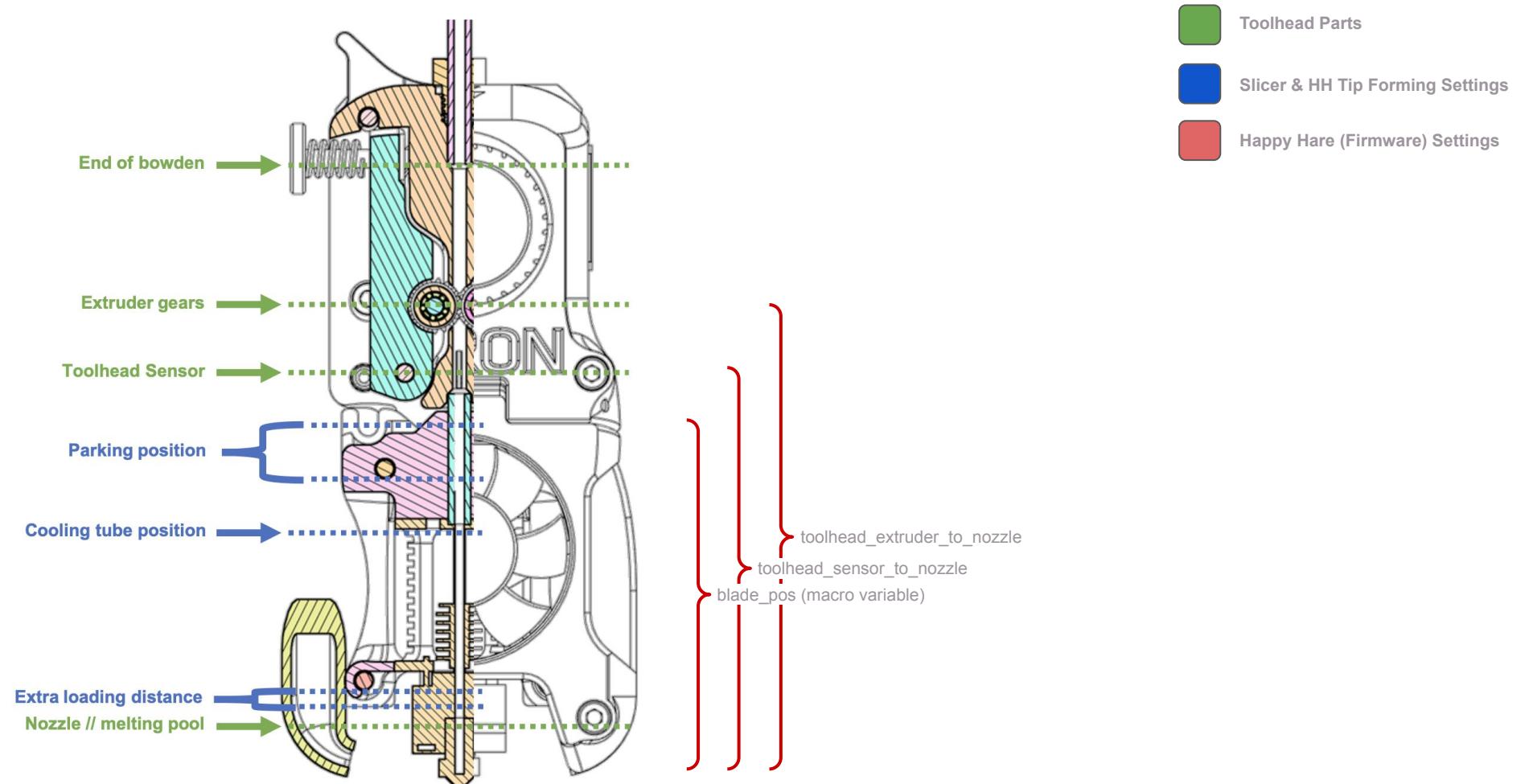
**Note:** A bug in SuperSlicer requires that one setting is near zero but not zero!



Consult your slicer documentation for setting these values

## REFERENCE TOOLHEAD SCHEMATICS

Important reference for dimensions in your toolhead.



**WE UNDERSTAND THAT THE DOCUMENTATION IS NOT QUITE COMPLETE**

We are working to complete the documentation after RC1 launch...

If you want to help, please reach out to the team.