ERCF v2 BUILD GUIDE

COMMUNITY EDITION

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

VERSION 2024-05-20

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 ERCF fatality.
There is no special Discord 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 ERCF Team

TABLE OF CONTENTS

PRINT GUIDELINES

PART PRINTING GUIDELINES

The Voron Team has provided the following print guidelines. We recommend you to follow them 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 we recommend to use ABS to build the ERCF.

MATERIAL
The ERCF parts were designed for and tested with ABS, so we recommend to use ABS.

LAYER HEIGHT
Recommended : 0.2mm
First Layer: 0.25mm

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 along with a Tophat_xN.stl, and test the parts as shown in the manual. You may need to tune your printer and profile before you print the rest of the parts!

4

STL FILE KEY

FILE NAMING

By this time you should have already downloaded our STL files from the ERCF GitHub. You might have noticed that we have used the Voron 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.

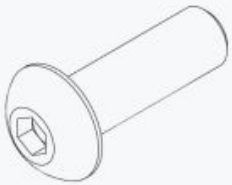
OPTIONAL MULTIMATERIAL

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.

5

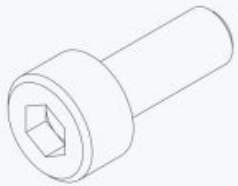
HARDWARE REFERENCE



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.

ISO 10642

SELF TAPPING SCREW

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

HEX NUT

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

ISO 4032

MAGNETS

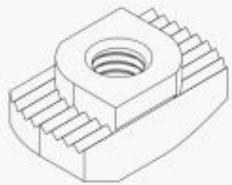
How do they work?

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.

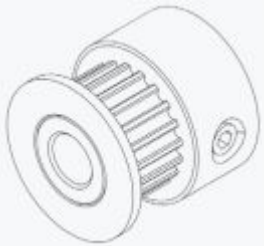
6

HARDWARE REFERENCE

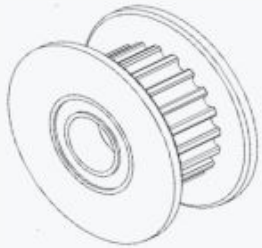
625 BEARING
A ball bearing used on the Encoder.

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

ISO 7380-1



PULLEY
GT2 pulley used on the linear motion system of the ERCF.

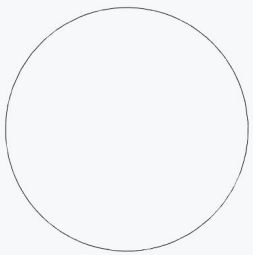


IDLER
GT2 idler used in the linear motion system of the ERCF.

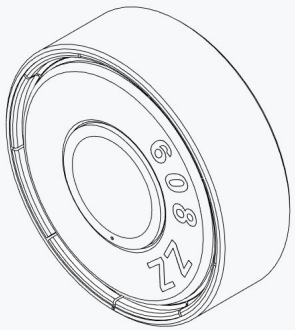
SET SCREW
Small headless screw with an internal drive. Used in pulleys and other gears. Also called a grub screw.

ISO 4026

HEAT SET INSERT
These are made of brass , threaded on the inside and 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.



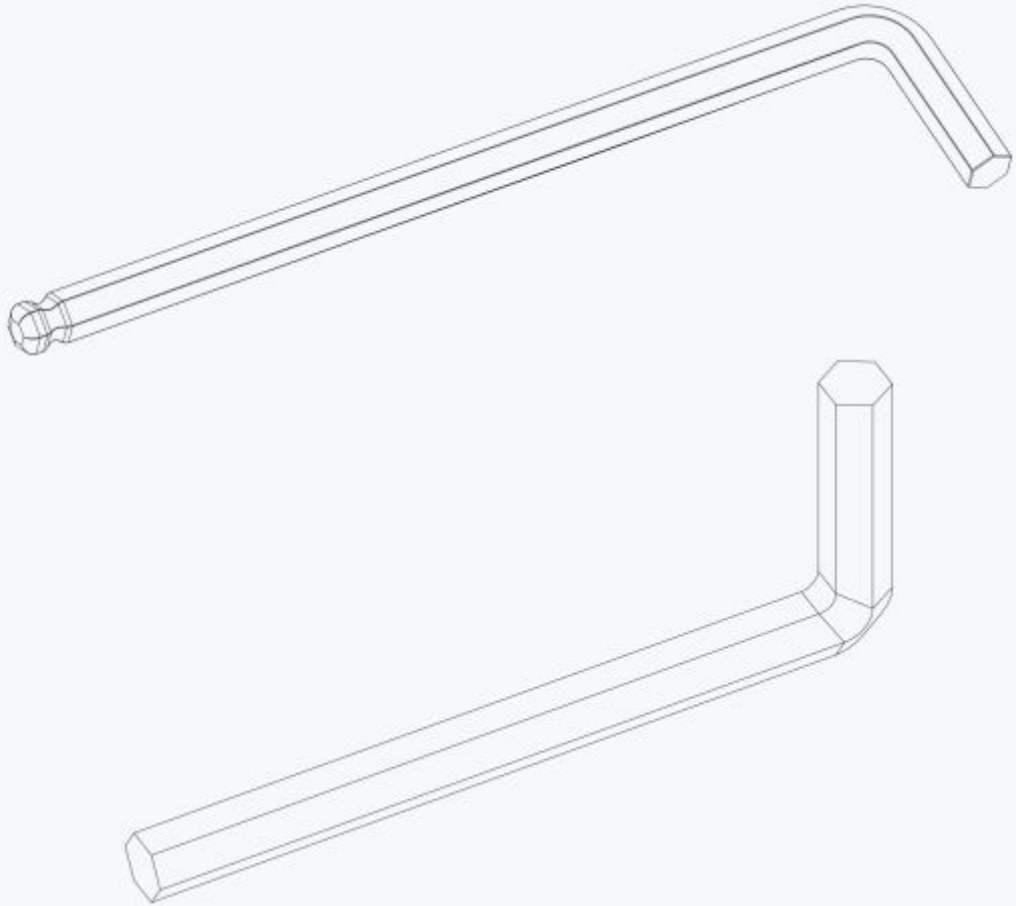
5.5MM BALL BEARING
A ball bearing used in the CottonTail Buffer (optional).



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

7

TOOLS



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

The tools needed are similar to those used building a Voron. For recommendations, visit https://vorondesign.com/ sourcing_guide and switch to the “Voron Tools” tab at the bottom of the page.

8

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.

TOOLS

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:

Printed Parts Tracker Google Sheet

9

THE ENRAGED RABBIT PROJECT

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

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 15 channels by the 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.

10

ACKNOWLEDGEMENTS

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!)
- @mneuhaus 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)
- @kierantheman (Thumper Dev)

👏👏👏

11

HOW TO GET HELP

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.

DISCORD

https://discord.com/channels/460117602945990666/909743915475816458

GitHub

https://github.com/Enraged-Rabbit-Community/ERCF_v2

12

FINAL THOUGHTS

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!

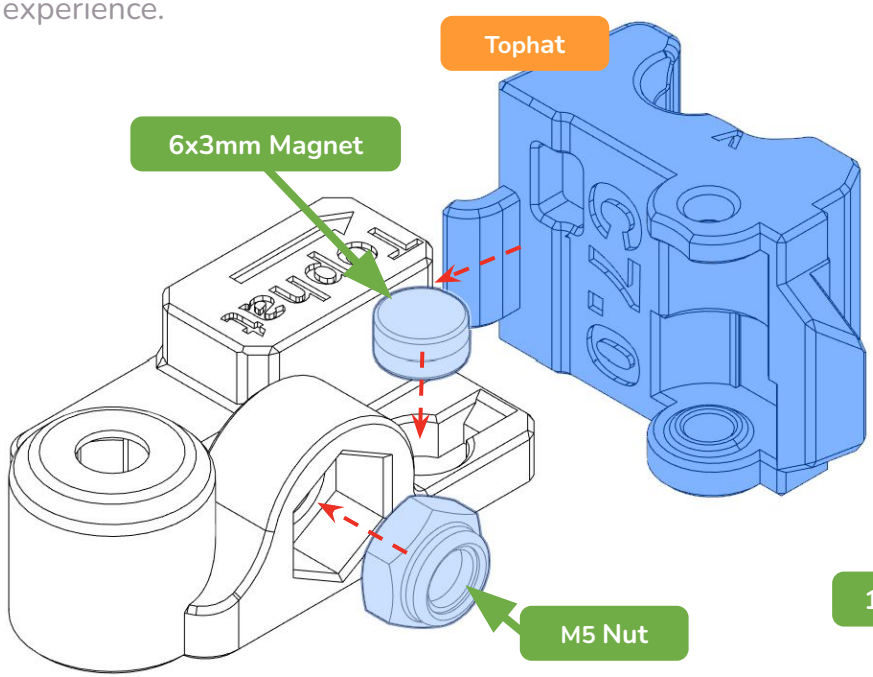
You might have heard about the frequent challenges associated with multi-filament systems. Indeed, they can be demanding. However, the Enraged Rabbit Project aims to provide a system that is not only innovative and reliable but also user-friendly. Despite these efforts, encountering some difficulties 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.

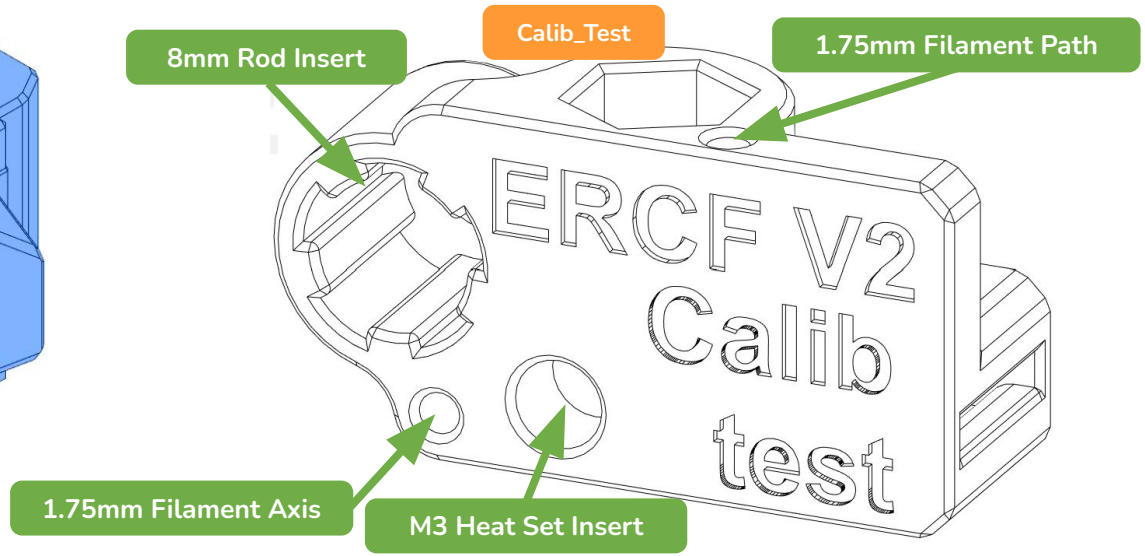
Enjoy the process of building as much as utilizing your Enraged Rabbit Carrot Feeder (ERCF)!

13

CALIBRATION TOOL

Print this test piece and a Tophat to ensure your printer and slicing profile are 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 Tophat, insert the arm of a Tophat into the slot. It should insert without much force. Once inserted, the Tophat should be able to move up and down easily. To remove the Tophat, pull it up while rotating it.

14

HEAT SET INSERTS

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 add the heatset inserts into the 3D printed parts, so you can add the headset inserts all at once if desired:

- Page 27 (Gear_Box_Front, 7 heatset inserts)
- Page 32 (Gear_Box_Back, 6 heatset inserts)
- Page 42 (Motor_Arm_XXX, 1 heatset insert)
- Page 85 ([a]_Selector_Cart, 3 heatset inserts)
- Page 86 ([a]_Selector_Cart, 1 heatset insert)
- Page 87 (Drag_Chain_Anchor †, 2 heatset inserts)
- Page 97 (Encoder_Right, 3 heatset inserts)
- Page 107 (Linear_Axis_Selector_Motor_Support and [a]_Drag_Chain_Anchor_Bottom †, 4 and 2 heatset inserts)

15

USING THE CAD FILE

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 Hardware folder.

16

UPGRADING FROM ERCFv1

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 †

17

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 22 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.

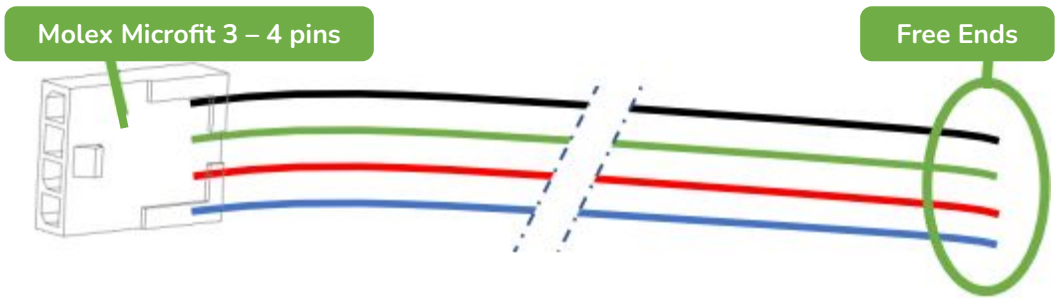
PREPARING THE WIRES FOR REMOTE MCU

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

SELECTOR MOTOR WIRE FOR REMOTE MCU

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



SELECTOR MOTOR WIRE

Wire Length Chart for remote MCU

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

All wire lengths include approximately 25-50mm of spare length for maintenance.

CONNECTION TO THE SELECTOR MOTOR

When using a remote MCU, 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.

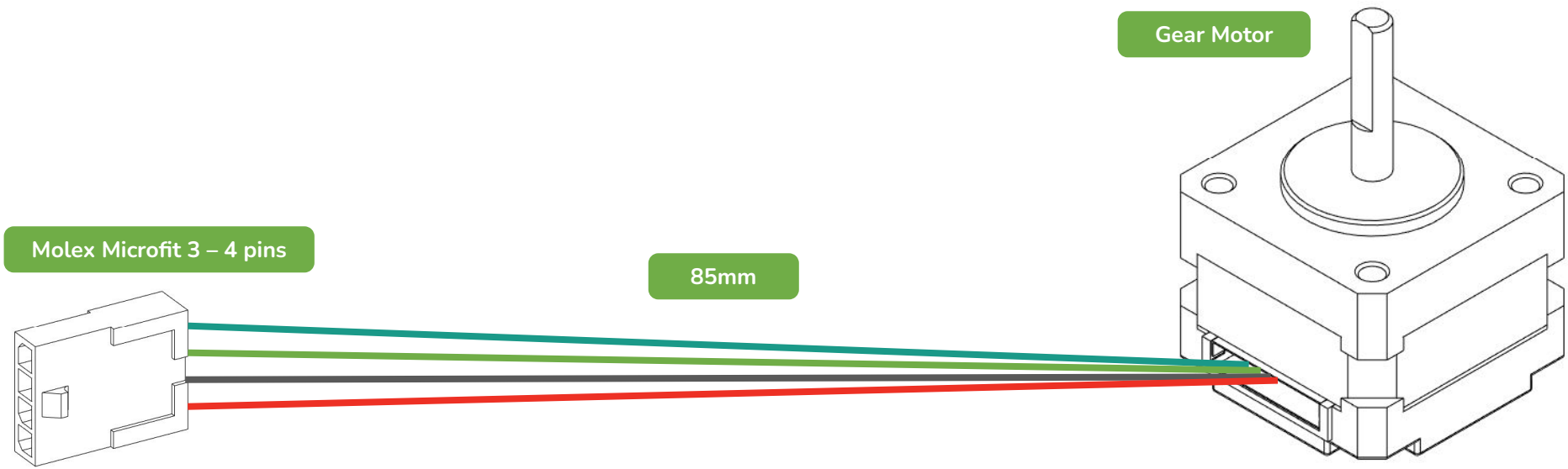
18

GEAR MOTOR WIRE

WIRING THE GEAR MOTOR WIRE

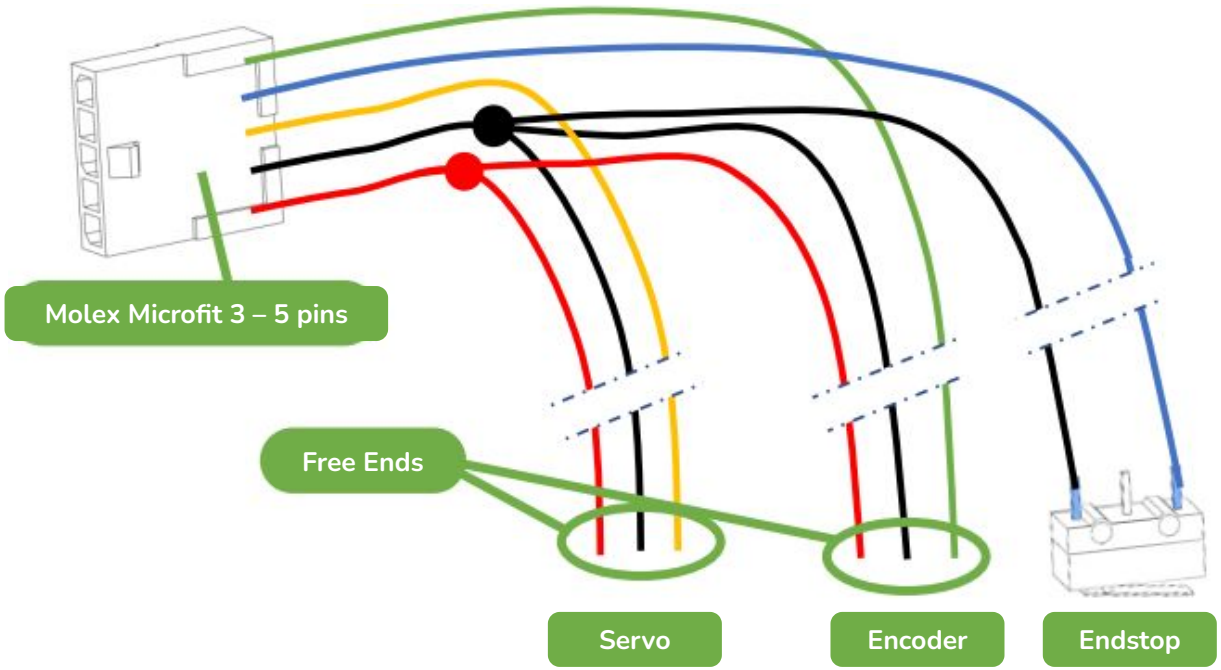
Double-check. You're supposed to skip this page if you're using a local MCU ("buddy board" like EASY BRD or BTT MMB). You wouldn't want to cut your wires too short!

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



19

SENSOR AND ENCODER WIRE BUS



Channels	Wire Length (mm)		
	Endstop	Servo	Encoder
N	60	350 + 50N	450 + 50N
4	60	550	650
5	60	600	700
6	60	650	750
7	60	700	800
8	60	750	850
9	60	800	900
10	60	850	950
11	60	900	1000
12	60	950	1050
13	60	1000	1100
14	60	1050	1150
15	60	1100	1200

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!

20

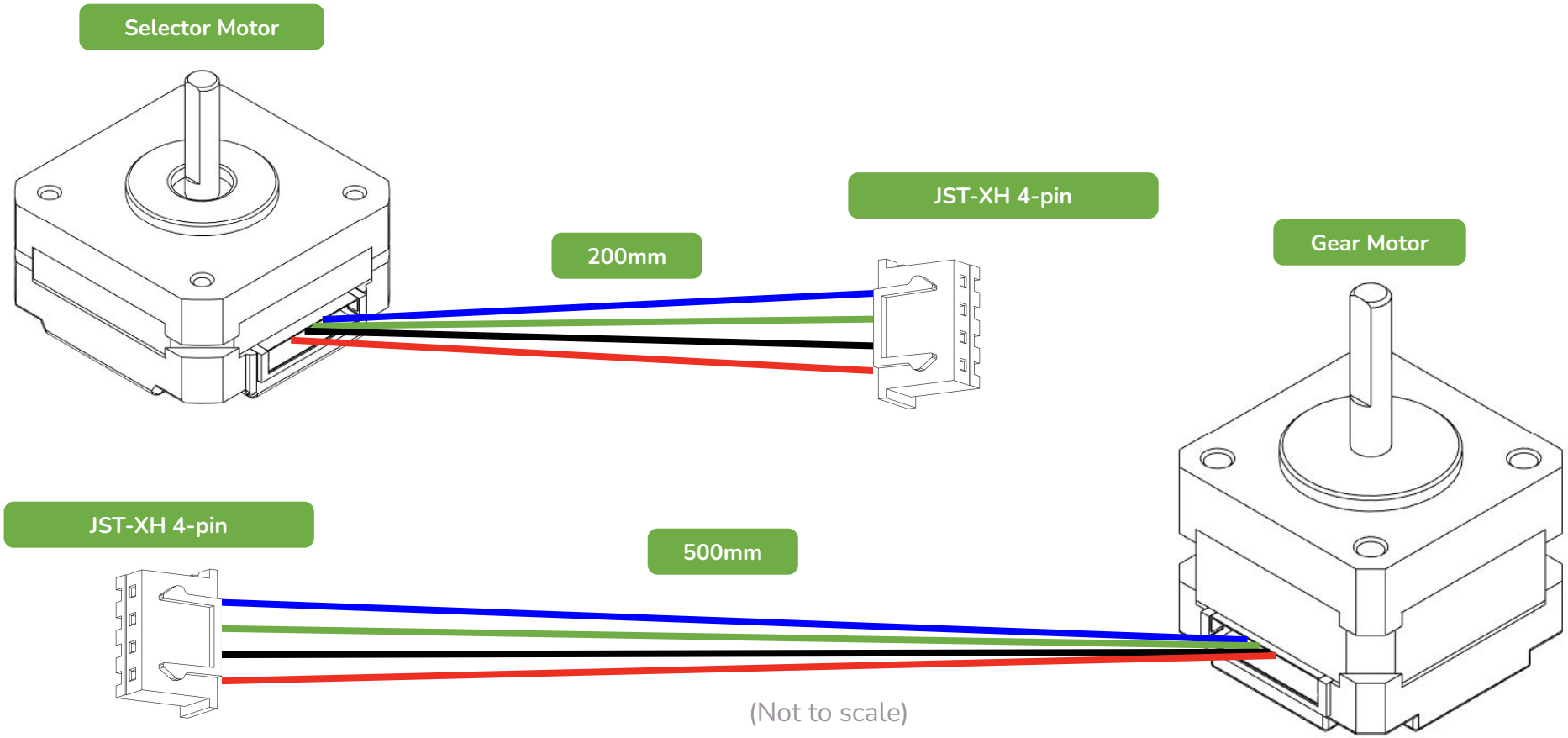
GEAR MOTOR WIRE

WIRING THE MOTORS

Now it's time for the local MCU wiring section! You can skip to the next page if you're not using a local MCU (like BTT MMB).

Trim Selector Motor wires to 200mm, then crimp and add a 4-pin JST-XH connector.

Trim Gear Motor wires to 500mm, then crimp and add a 4-pin JST-XH connector (NEMA14 shown, you may also use NEMA17).



(Not to scale)

21

WIRING THE LEDS

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 the necessary 23mm spacing. The suggested method is to stick the segments of LED strip to the inside of each of the Cover_Body_xN, attach all of the Cover_Body_xN to the 2020 extrusion, and solder short pieces of wire between the strips.

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

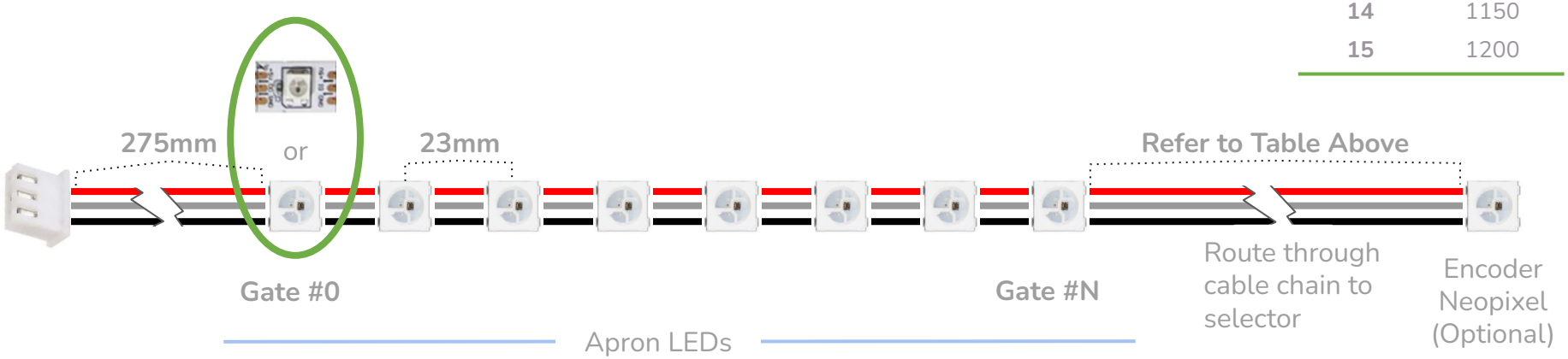
For the wires between each LED, cut 20mm sections of wire and strip them back about 1.5mm on each end. Then use the jig to solder the LEDs in place.

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.

There is an LED circuit board that is in development for later release, if you would rather wait and skip the soldering.

Channels	Encoder LED Wire Length (mm)
N	450 + 50N
4	650
5	700
6	750
7	800
8	850
9	900
10	950
11	1000
12	1050
13	1100
14	1150
15	1200



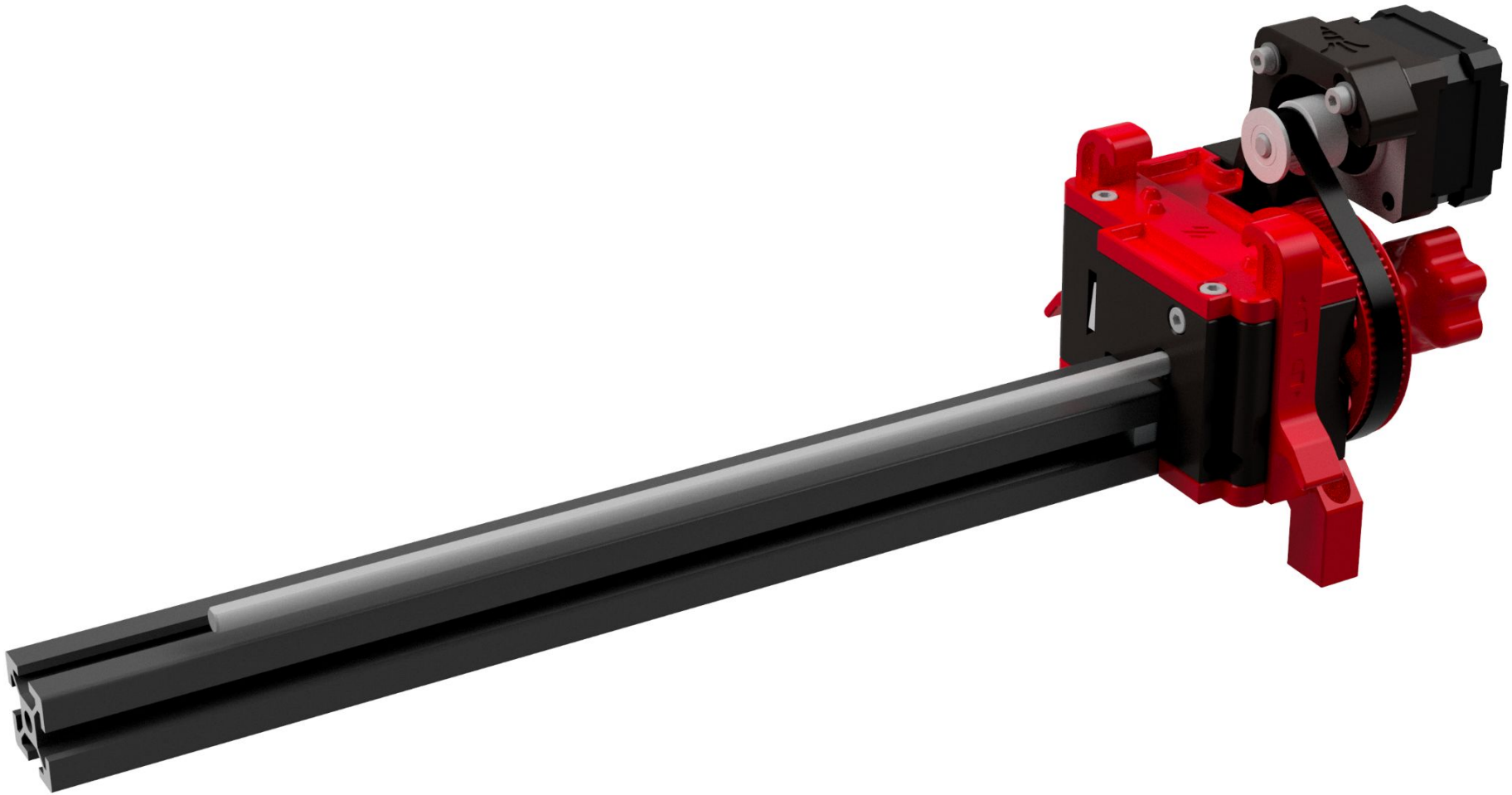
22

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."

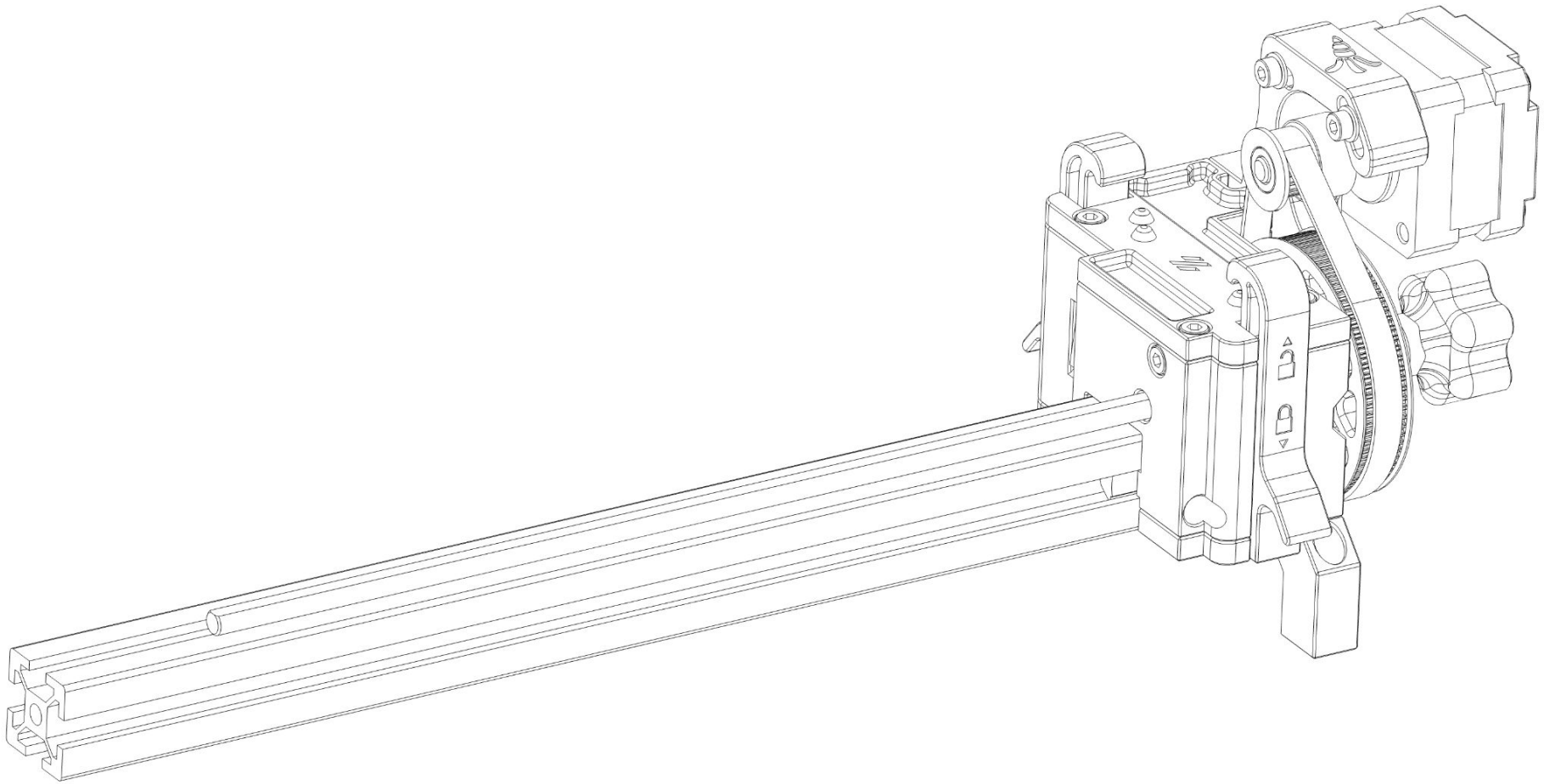
23

OVERVIEW



24

OVERVIEW

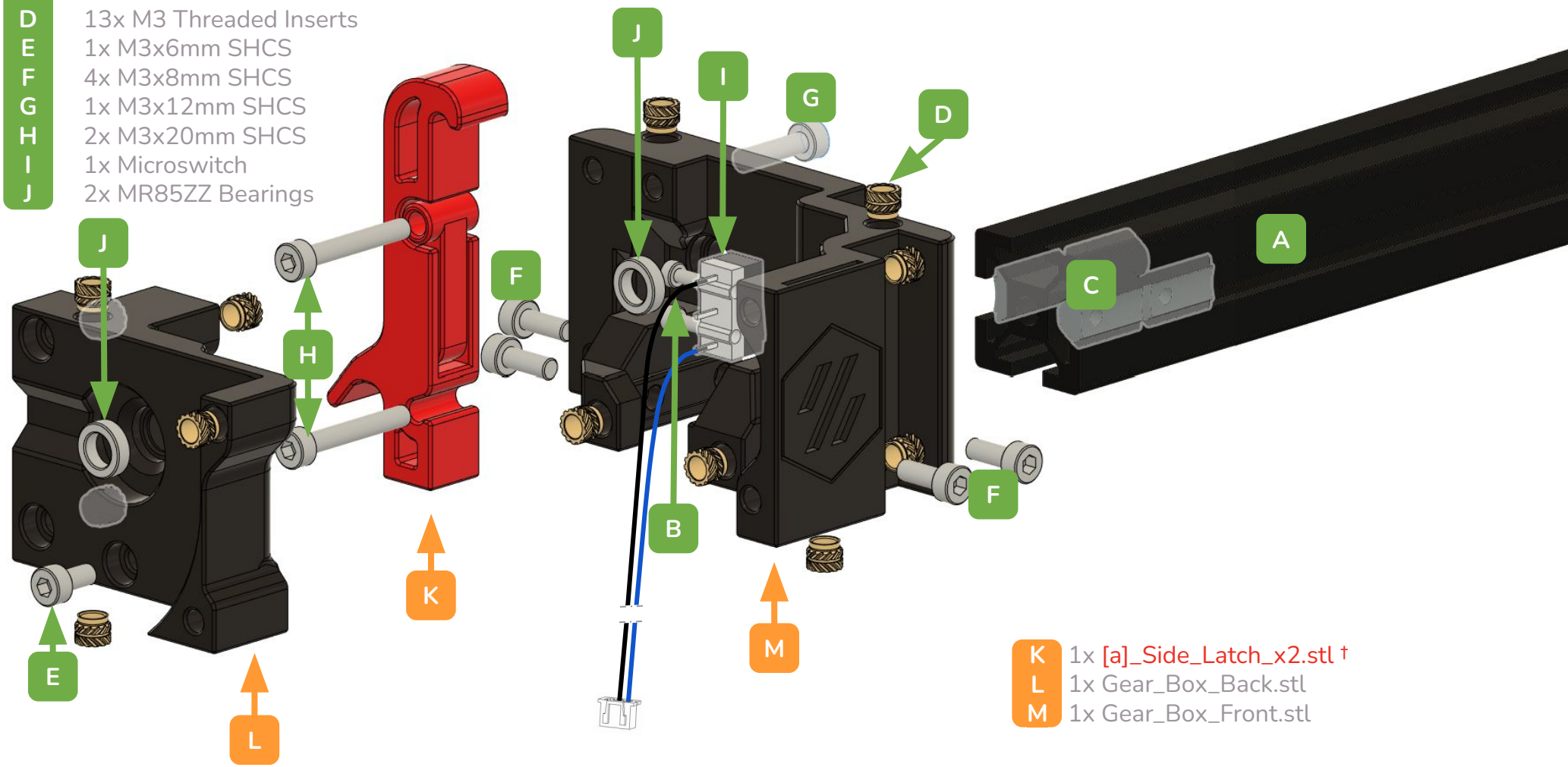


25

EXPLODED VIEW

GEARBOX SUB-BOM FOR PART 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



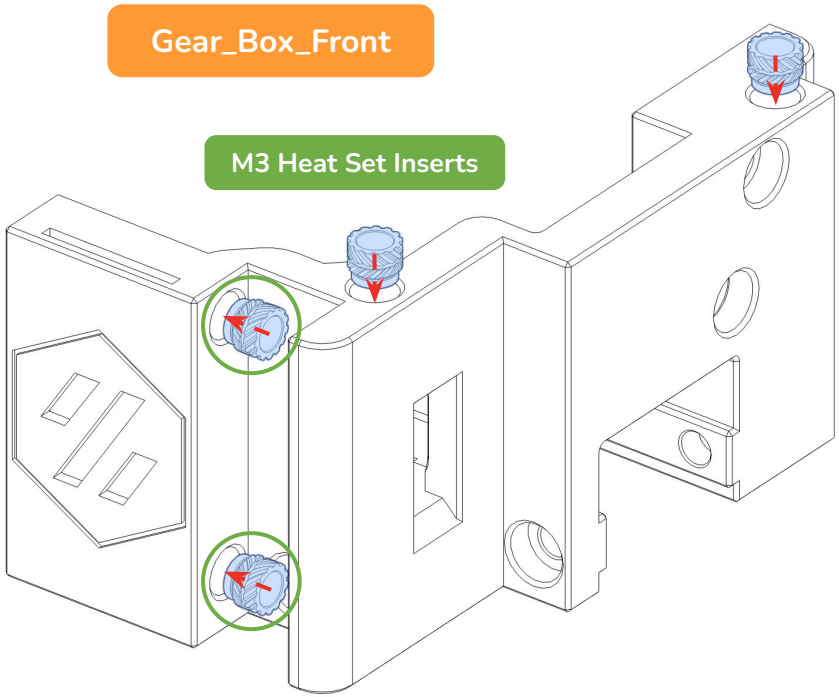
K	1x [a]_Side_Latch_x2.stl †
L	1x Gear_Box_Back.stl
M	1x Gear_Box_Front.stl

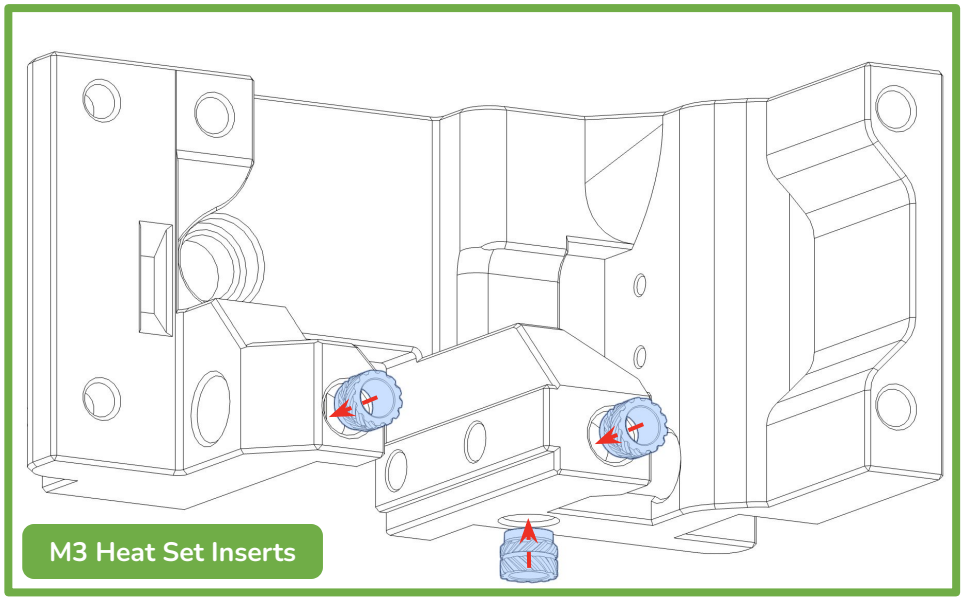
26

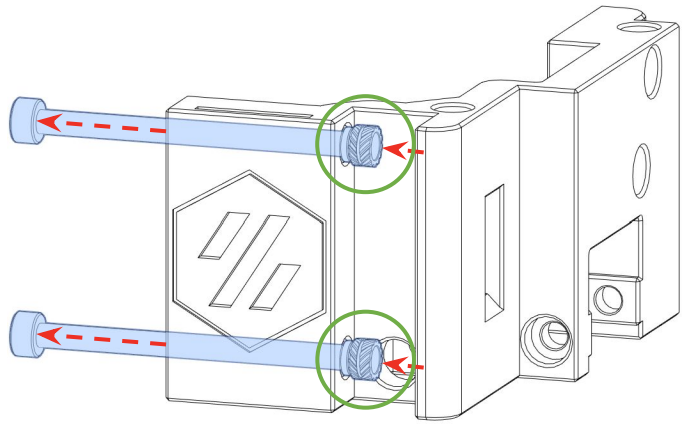
GEARBOX FRONT PREPARATION

HEAT SET INSERTS

The list of pages with heat set inserts is on Page 15.





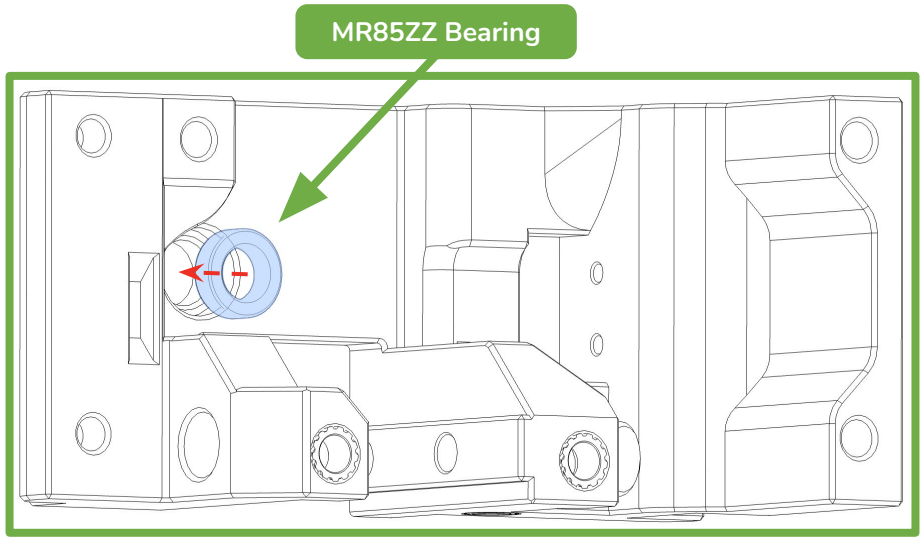


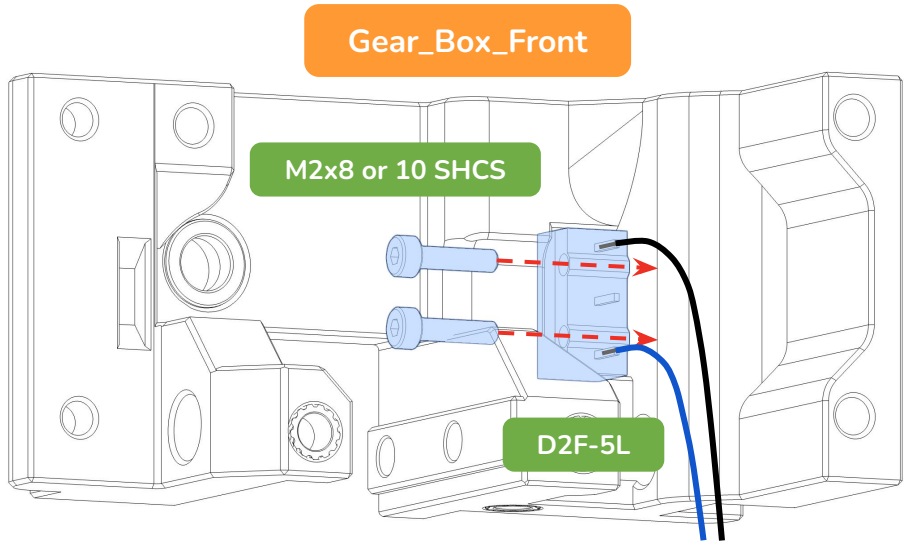
HEAT SET INSERTS TIP

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.

27

SELECTOR ENDSTOP INSTALLATION





MR85ZZ BEARING INSERTION

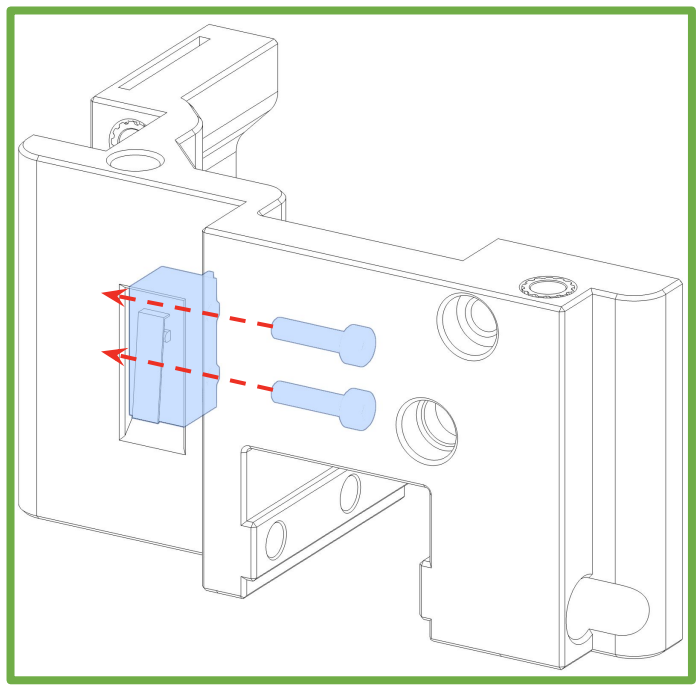
If your printed parts are accurate, the bearing should press-fit easily into place. If you're having trouble seating the bearings, make sure the channel is clear of drooping overhangs, and try pulling the bearing into place with an M5 bolt.

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.

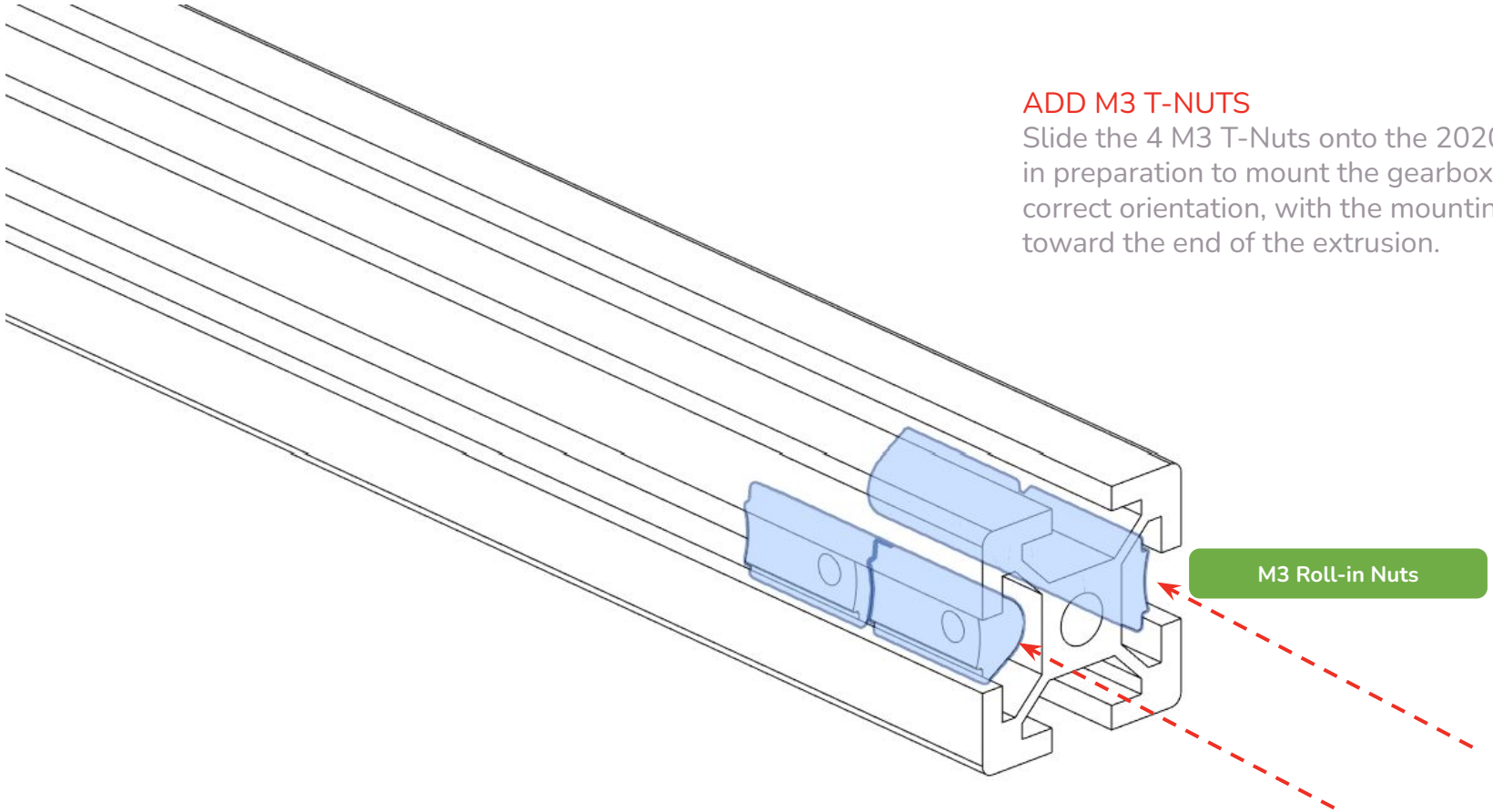
MICRO SWITCH ORIENTATION

Don't forget to attach the endstop wires! 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 M3 BHCS on the Encoder.



28

2020 PREPARATION

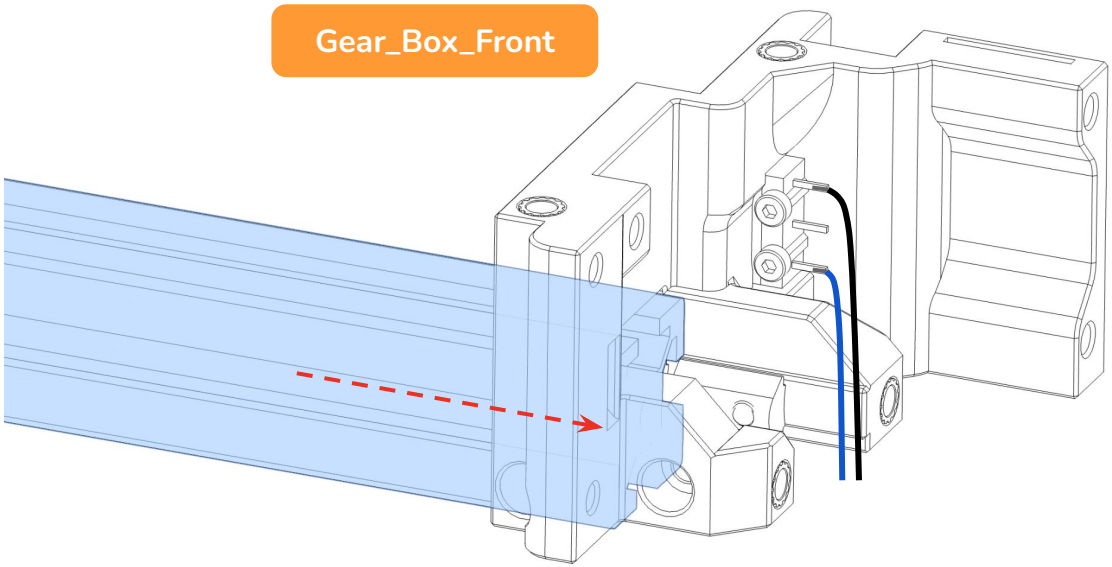


ADD M3 T-NUTS

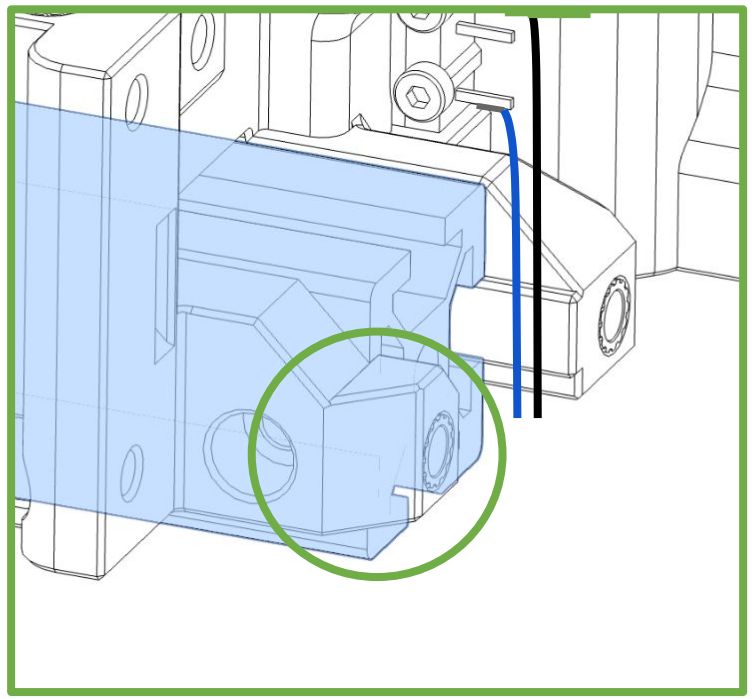
Slide the 4 M3 T-Nuts onto the 2020 extrusion in preparation to mount the gearbox. Note the correct orientation, with the mounting hole toward the end of the extrusion.

29

2020 INSTALLATION

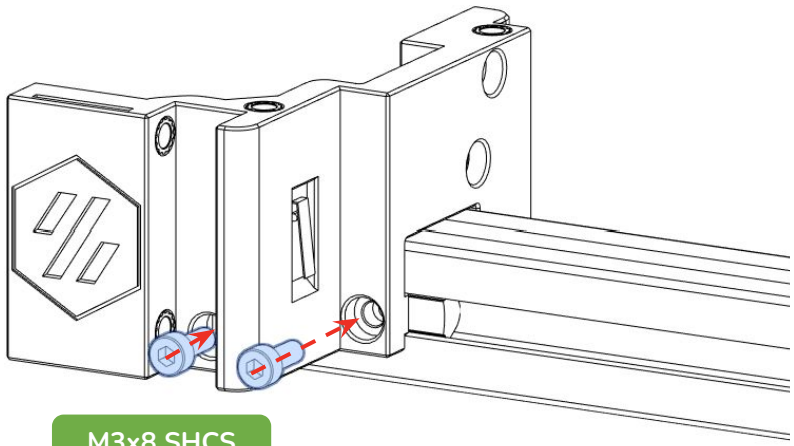


CHECK POINT
Make sure the 2020 extrusion is fully seated against the stop built into Gear_Box_Front.

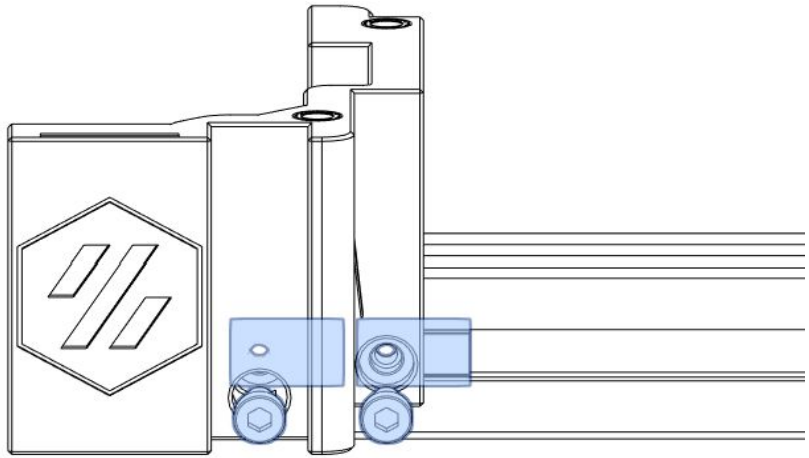


30

2020 INSTALLATION

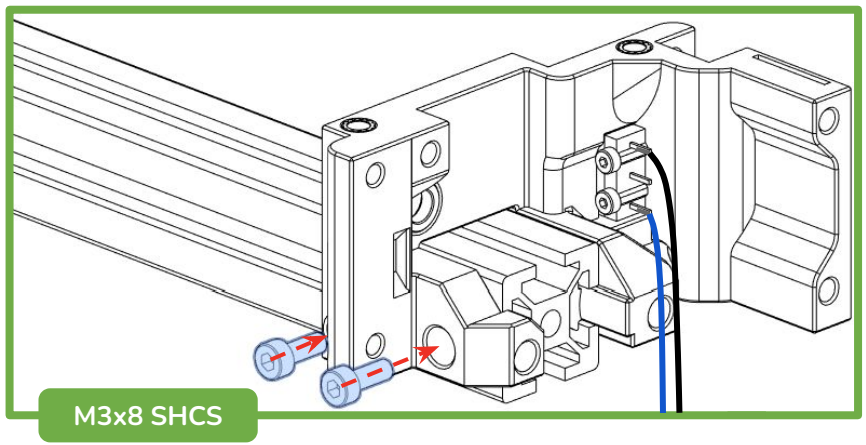


M3x8 SHCS

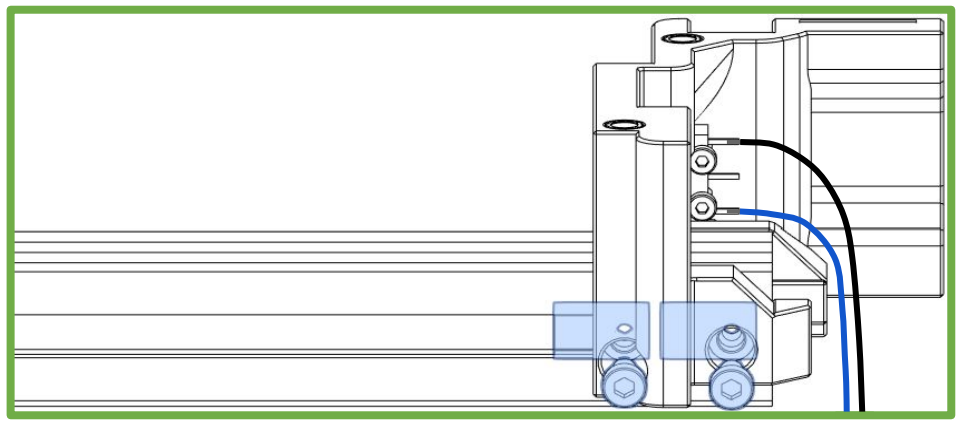


SEATING THE 2020

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 it important for the alignment of the Gearbox.

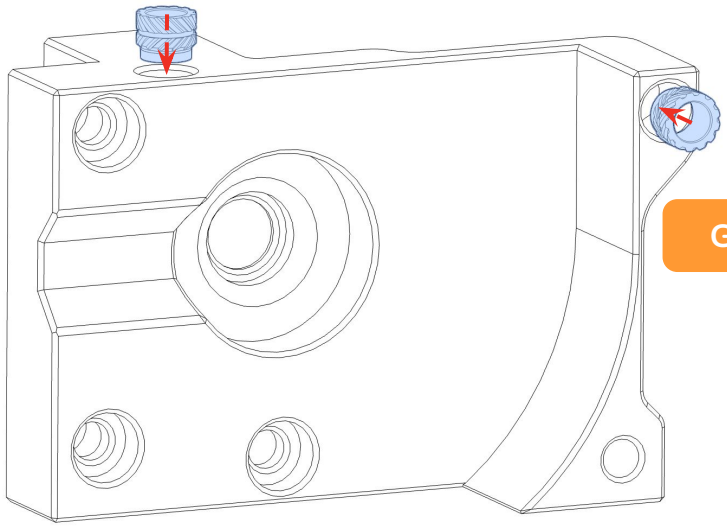


M3x8 SHCS

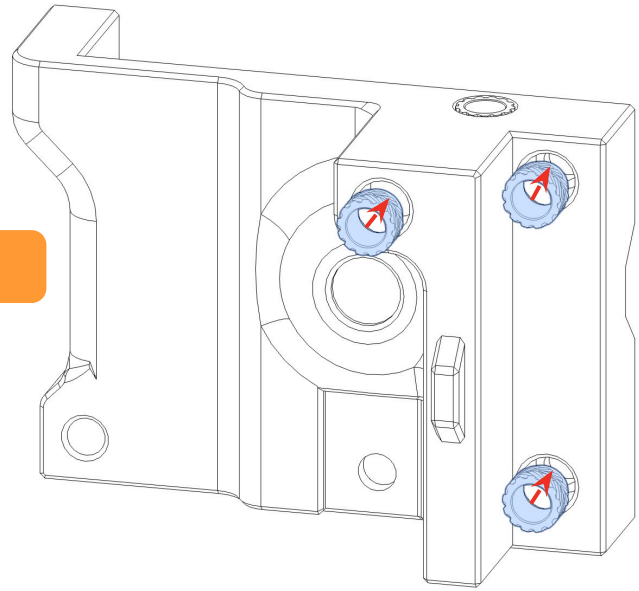


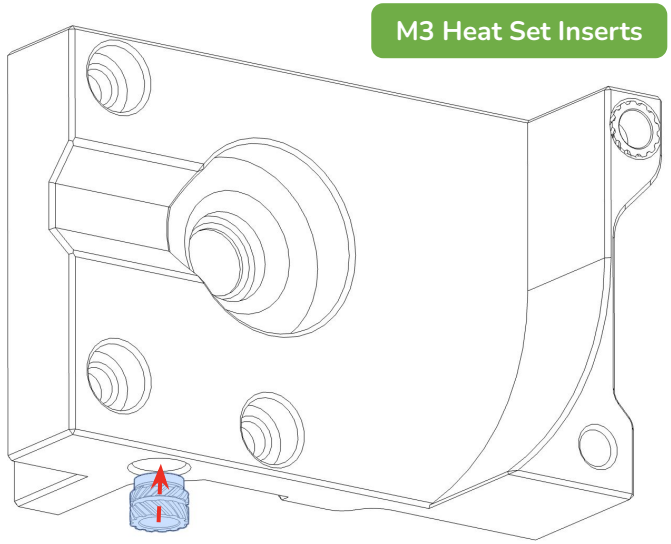
31

GEARBOX BACK PREPARATION



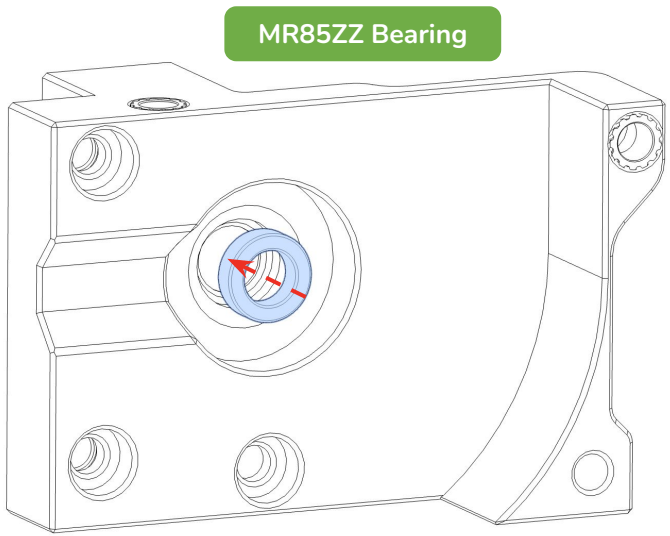
Gear_Box_Back





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.



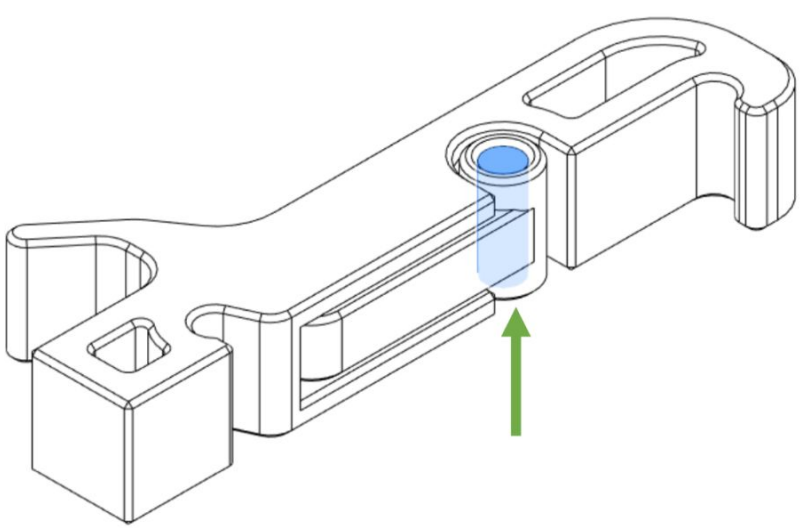
HEAT SET INSERTS

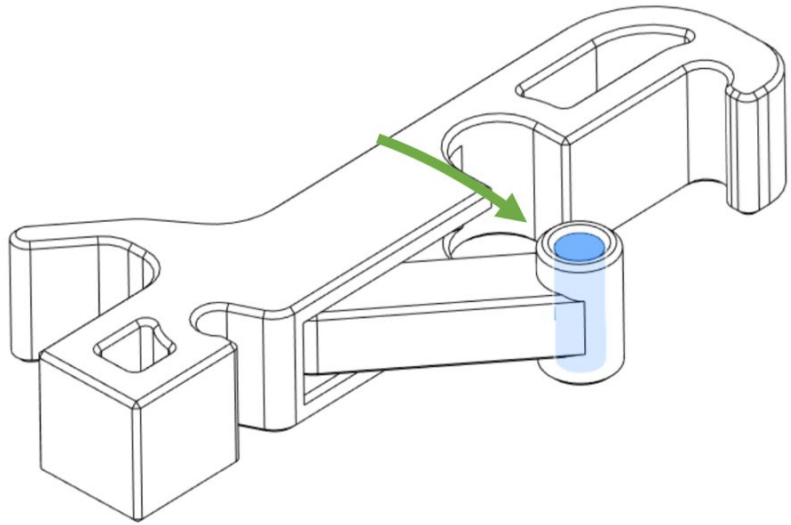
The list of pages with heat set inserts is on Page 15.

32

LATCH PREPARATION

[a]_Side_Latch_x2 †



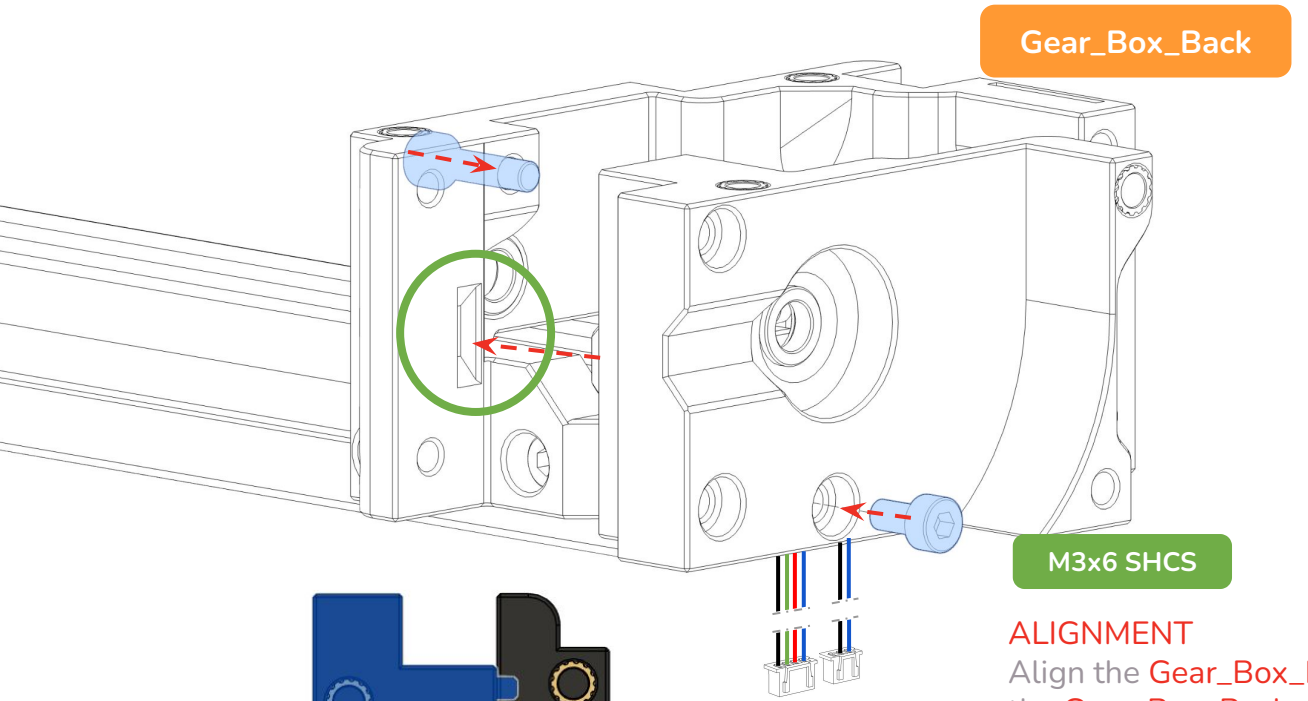


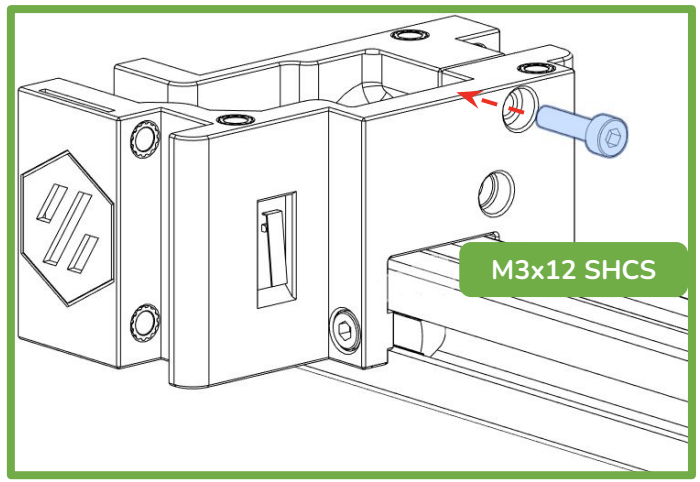
HINGE UNLOCK

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.

33

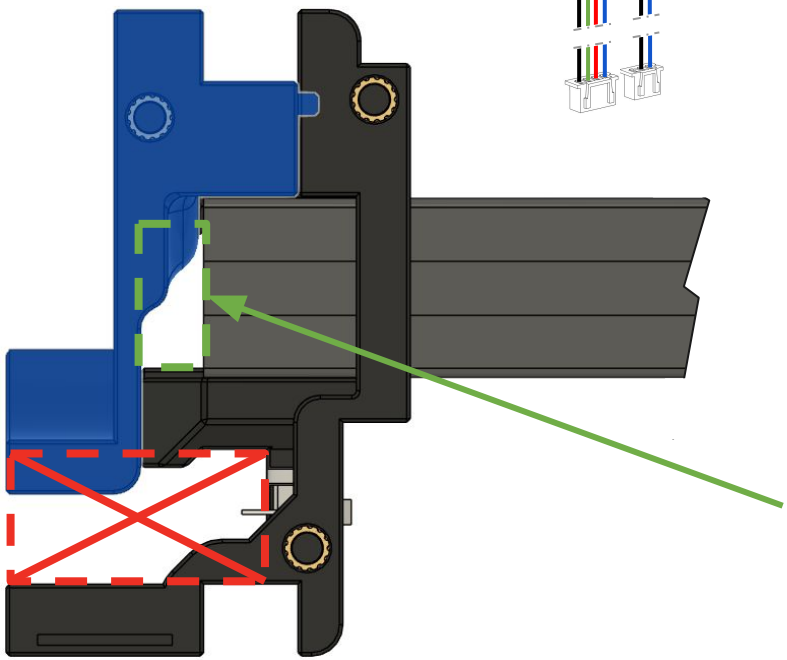
GEARBOX BACK & FRONT LATCH





ALIGNMENT

Align the Gear_Box_Front and Gear_Box_Back keyed slot, and secure the Gear_Box_Back with 1 M3x6mm screw in the back, and 1 M3x12 screw in the front.



CABLE MANAGEMENT

Installing the Gear_Box_Back finalizes the path out of the gear box for ALL wiring in this half of the ERCF. If your wiring is pre-crimped (e.g. you are upgrading from ERCF V1), make sure ALL wiring goes through the cable channel **NOW**. If you mess up and don't catch it until later, it's much more time-efficient to cut and recrimp than to disassemble the gear box. Route End Stop and Gear Stepper wiring through here.

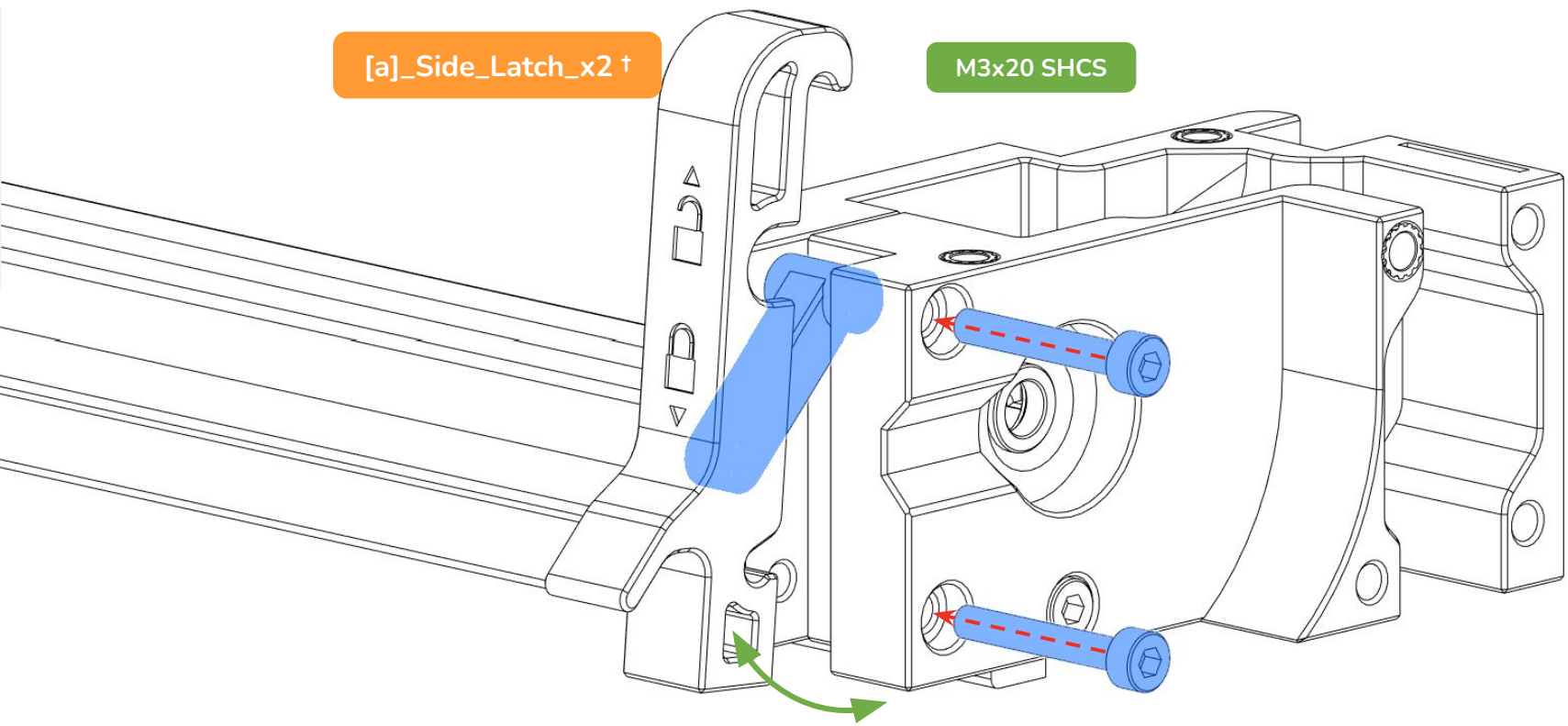
34

GEARBOX BACK & FRONT LATCH

LATCH SCREWS

Extend the arm of the Side_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.



35

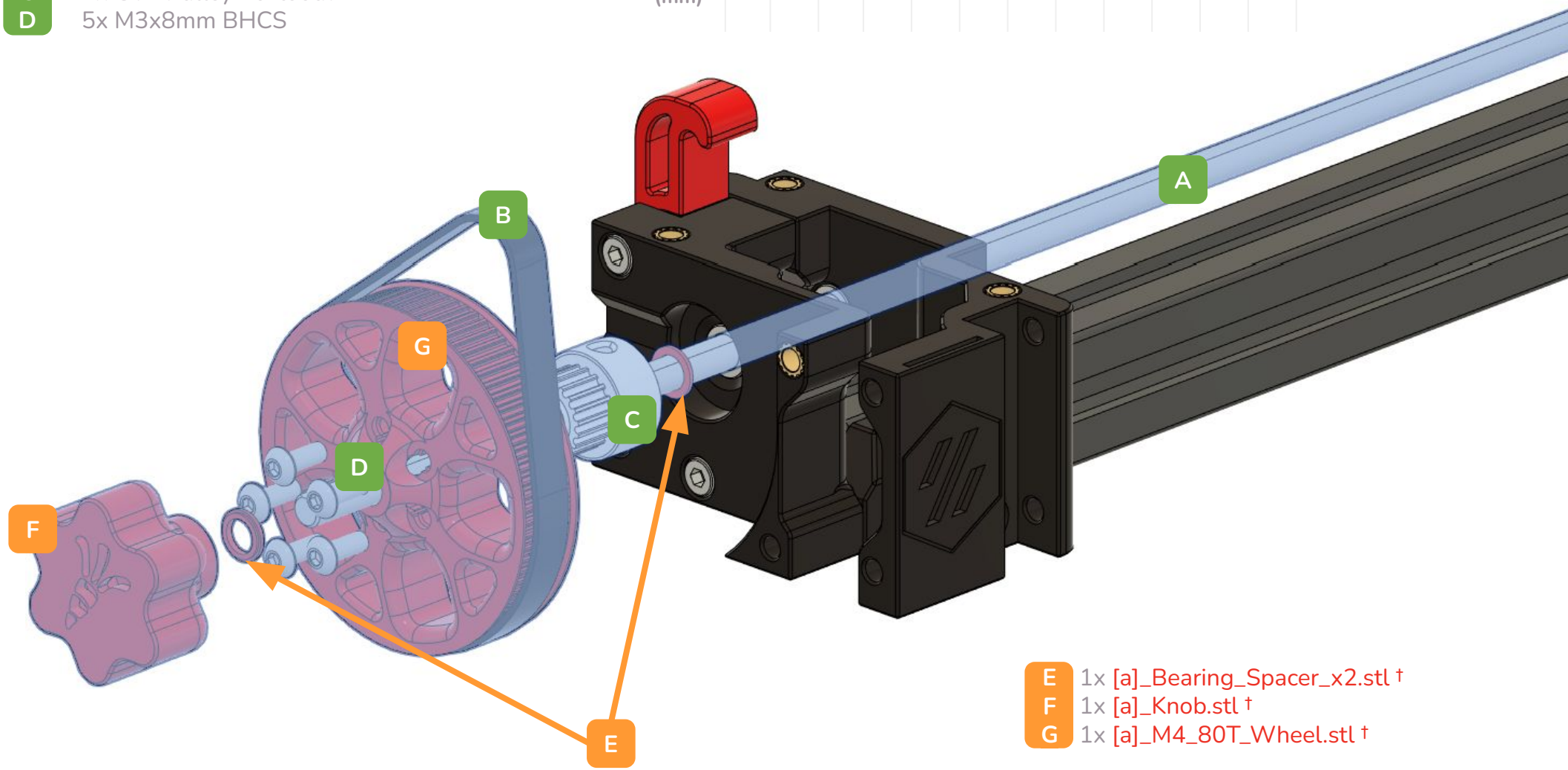
GEARBOX

GEARBOX SUB-BOM FOR PART 2

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

EXPLODED VIEW

Channels	N	4	5	6	7	8	9	10	11	12	13	14	15
2020 Length (mm)	55 + 23N	147	170	193	216	239	262	285	308	331	354	377	400



- E 1x [a]_Bearing_Spacer_x2.stl †
- F 1x [a]_Knob.stl †
- G 1x [a]_M4_80T_Wheel.stl †

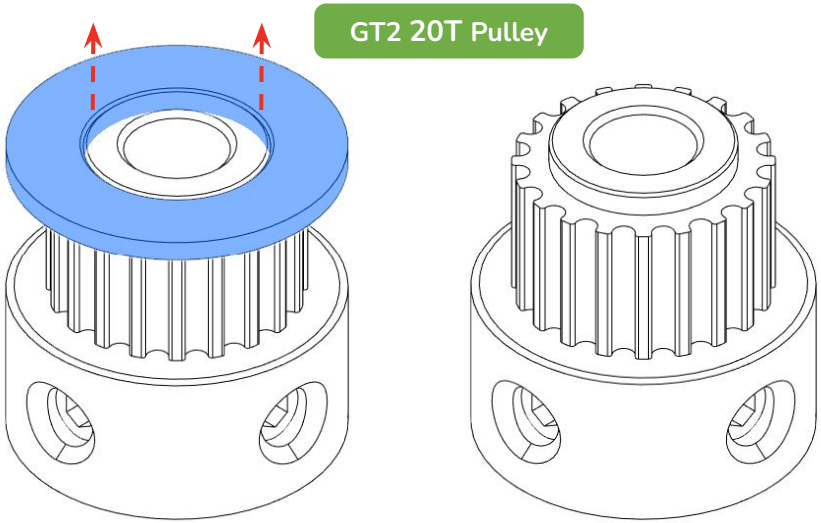
36

80T GEAR ASSEMBLY

REMOVE FLANGE

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

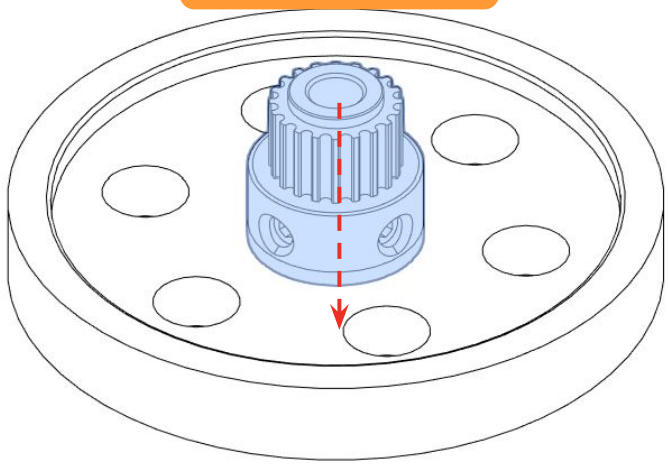
GT2 20T Pulley



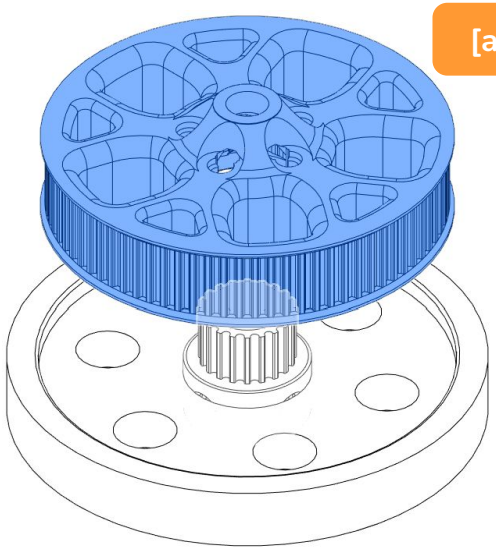
INSERT PULLEY

Place the GT2 pulley into the 80T_Cog_Guide.

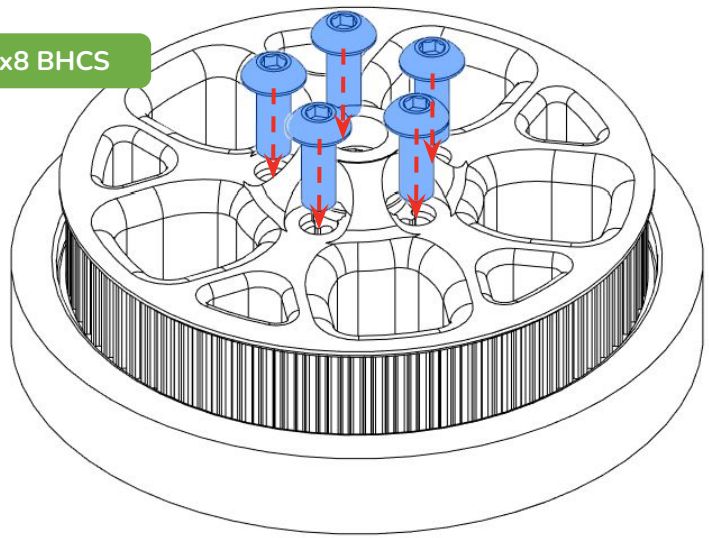
80T_Cog_Guide



[a]_M4_80T_Wheel †



M3x8 BHCS



FINISH MOUNTING

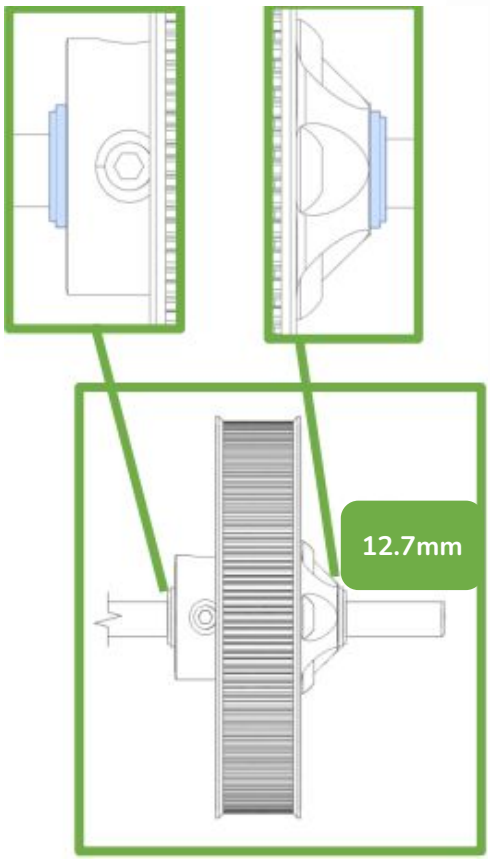
Insert the M4_80T_Wheel onto the GT2 pulley and press it flat to the guide.

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!

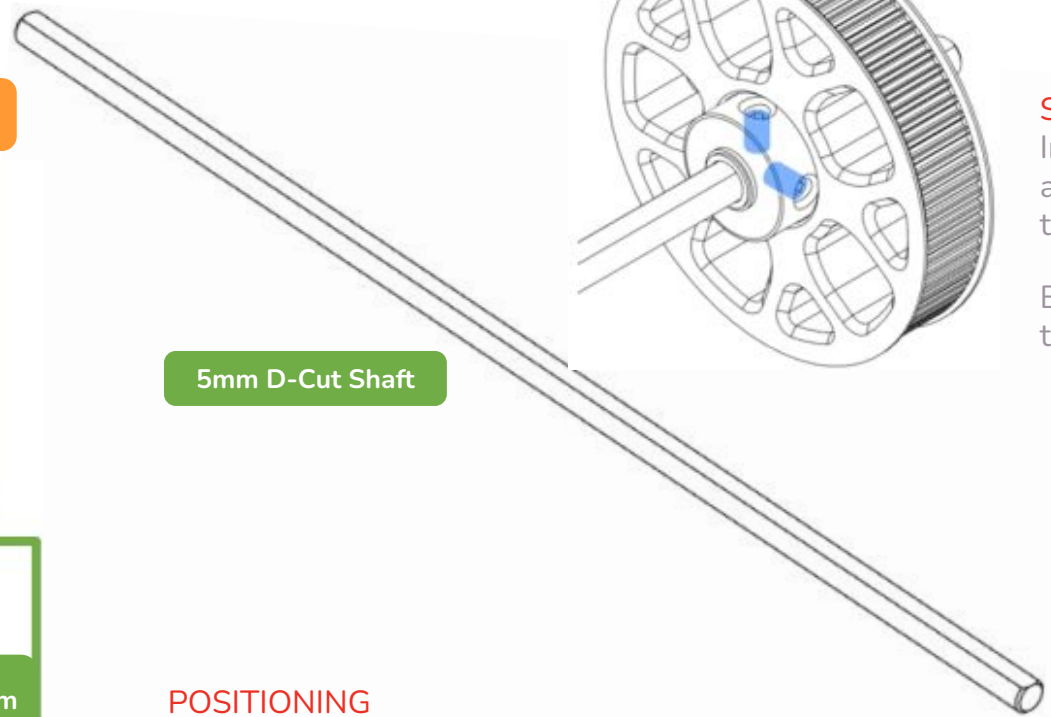
37

DRIVE SHAFT

[a]_Bearing_Spacer_x2 †



5mm D-Cut Shaft

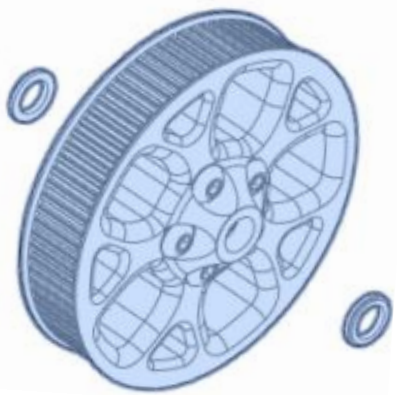


SET SCREWS
Insert both M3 set screws and use thread locker on them.

Be careful not to get it on the printed part.

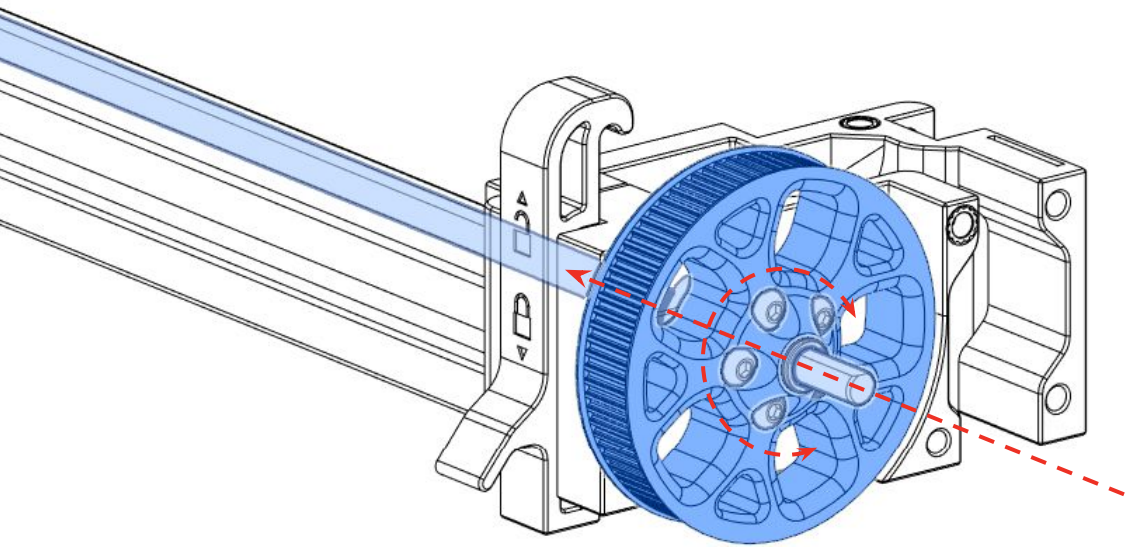
POSITIONING
Install the Bearing_Spacer / M4_80T_Wheel / Bearing_Spacer stack at least 12.7mm from the D-Cut shaft end. There is no need to be very precise here, the D cut shaft has a few millimeters of extra length.

Check Bearing_Spacer orientation; the small edge needs to face towards the bearings.



38

GEAR DRIVE BELT



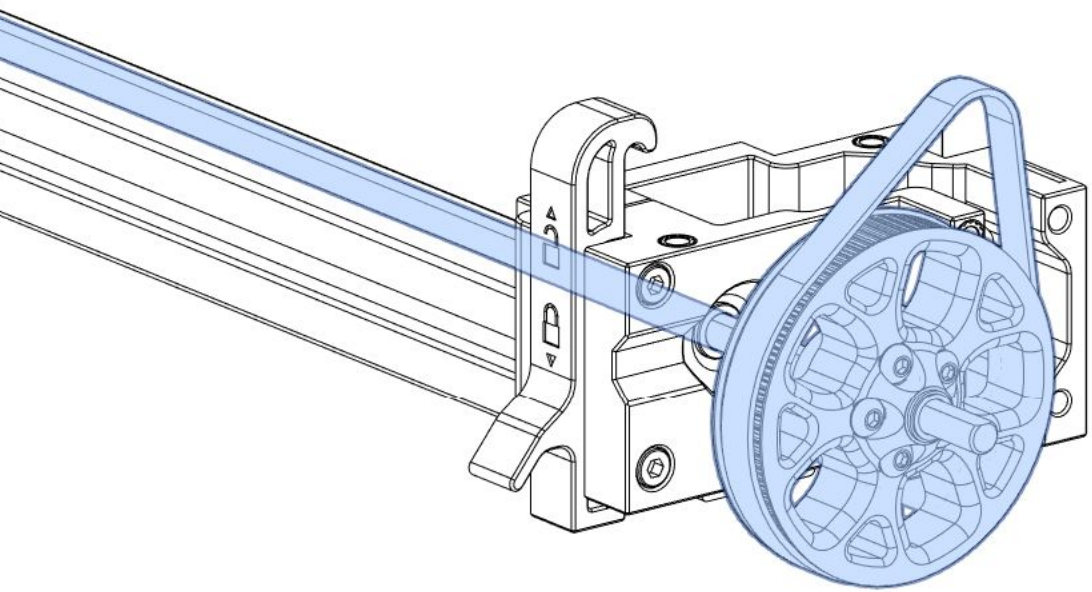
ASSEMBLY

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_80T_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_80T_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.

39

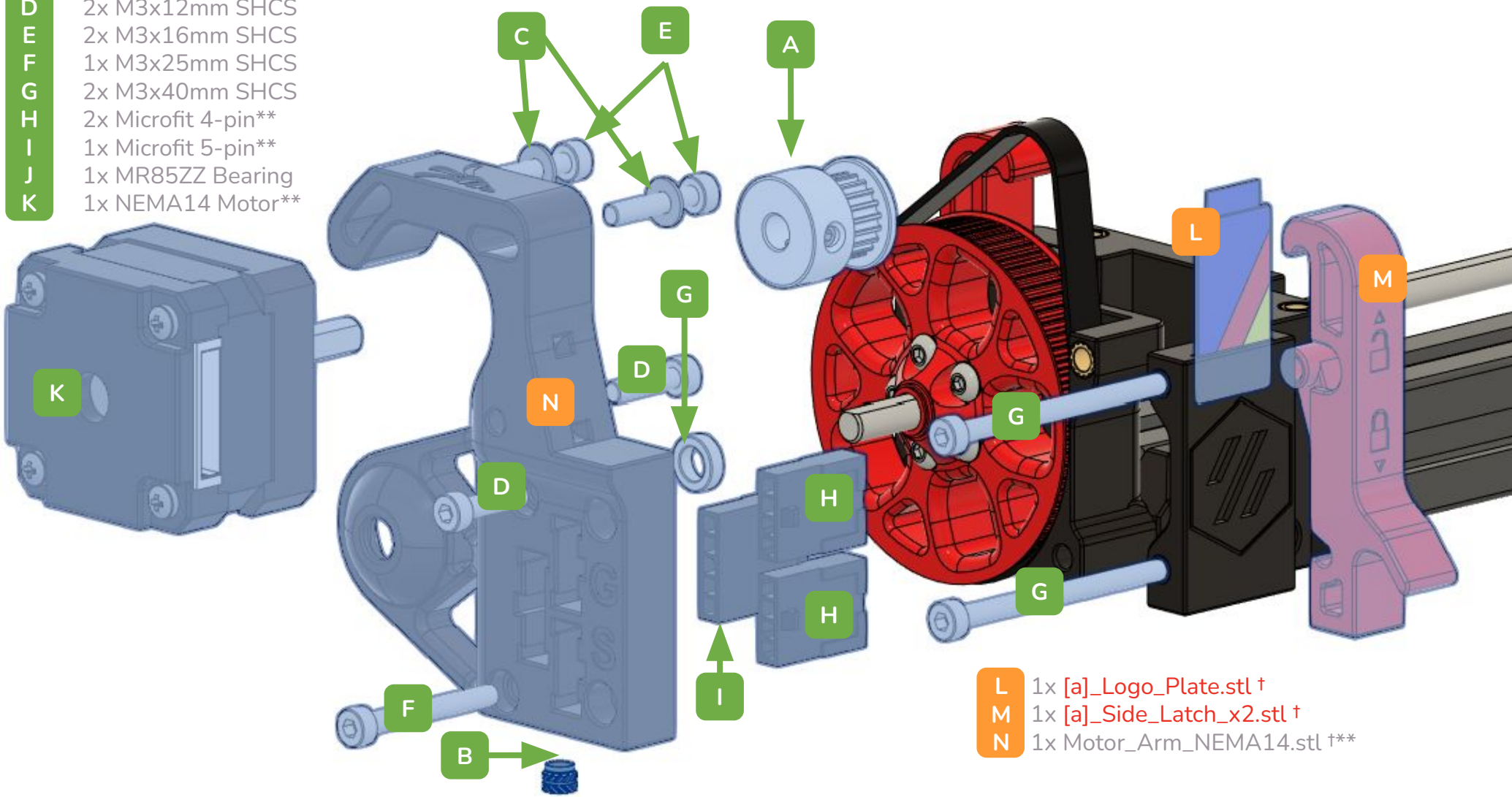
EXPLODED VIEW

GEARBOX SUB-BOM FOR PART 3

- A 1x 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**

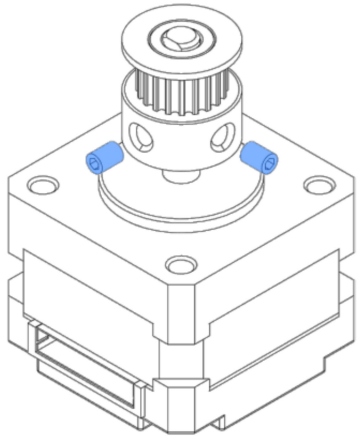
**NOTE: VARIATIONS

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



- L 1x [a]_Logo_Plate.stl †
- M 1x [a]_Side_Latch_x2.stl †
- N 1x Motor_Arm_NEMA14.stl †**

40



MOTOR PREPARATION

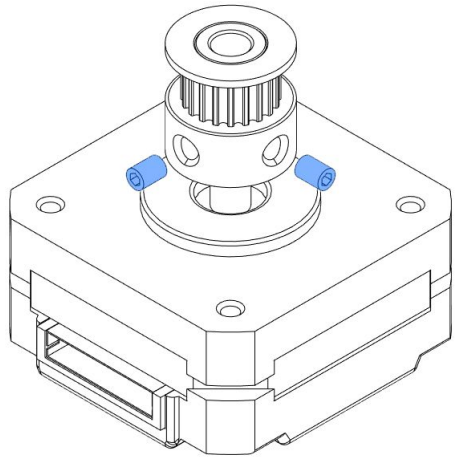
MOTOR VARIATIONS

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!

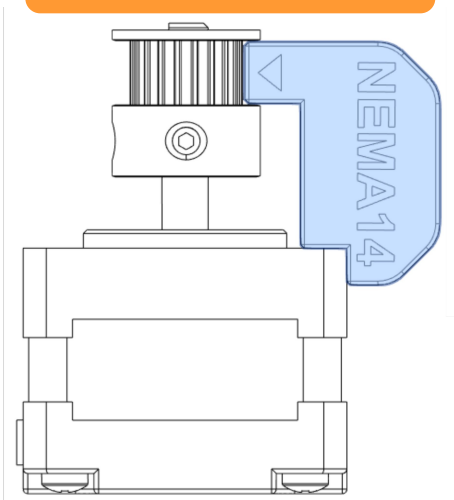
SET SCREWS

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 †

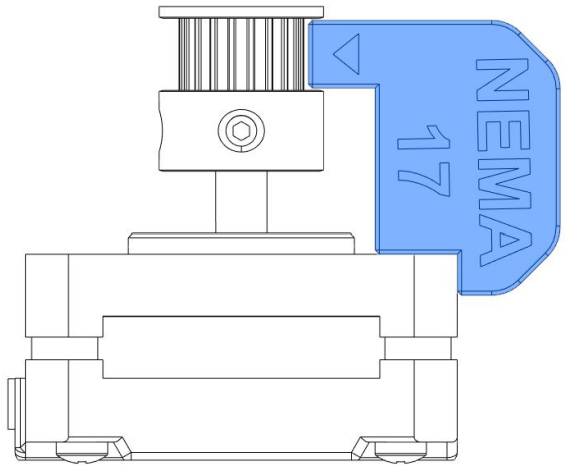


PULLEY HEIGHT

Use the Pulley_Tool_NEMA14 † 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 Pulley_Tool_NEMA17 † and print a different Motor Arm to mount it.

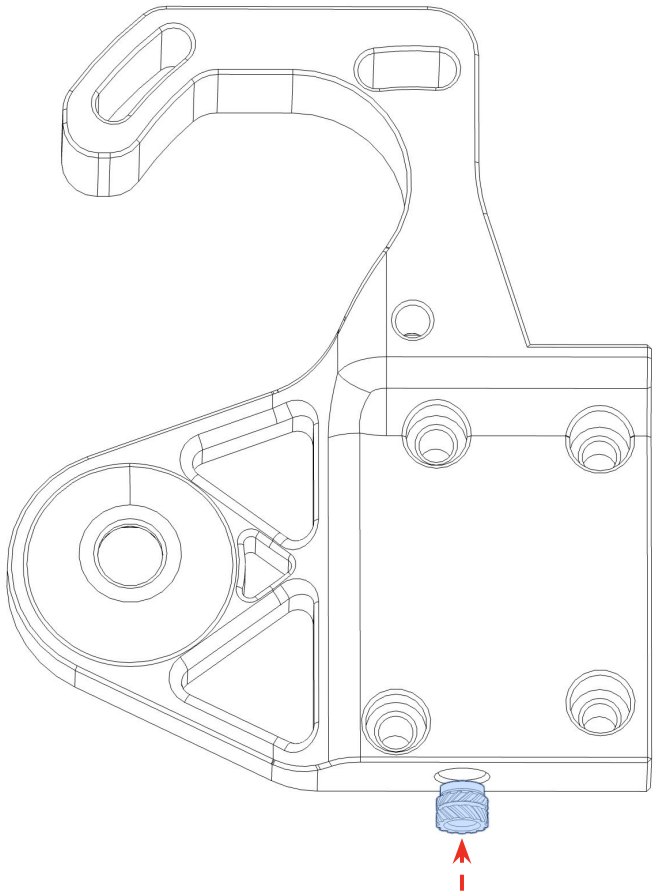
Pulley_Tool_NEMA17 †



41

GEARBOX

Motor_Arm_NEMA14 †



M3 Heat Set Insert

HEAT SET INSERTS

The list of pages with heat set inserts is on Page 15.

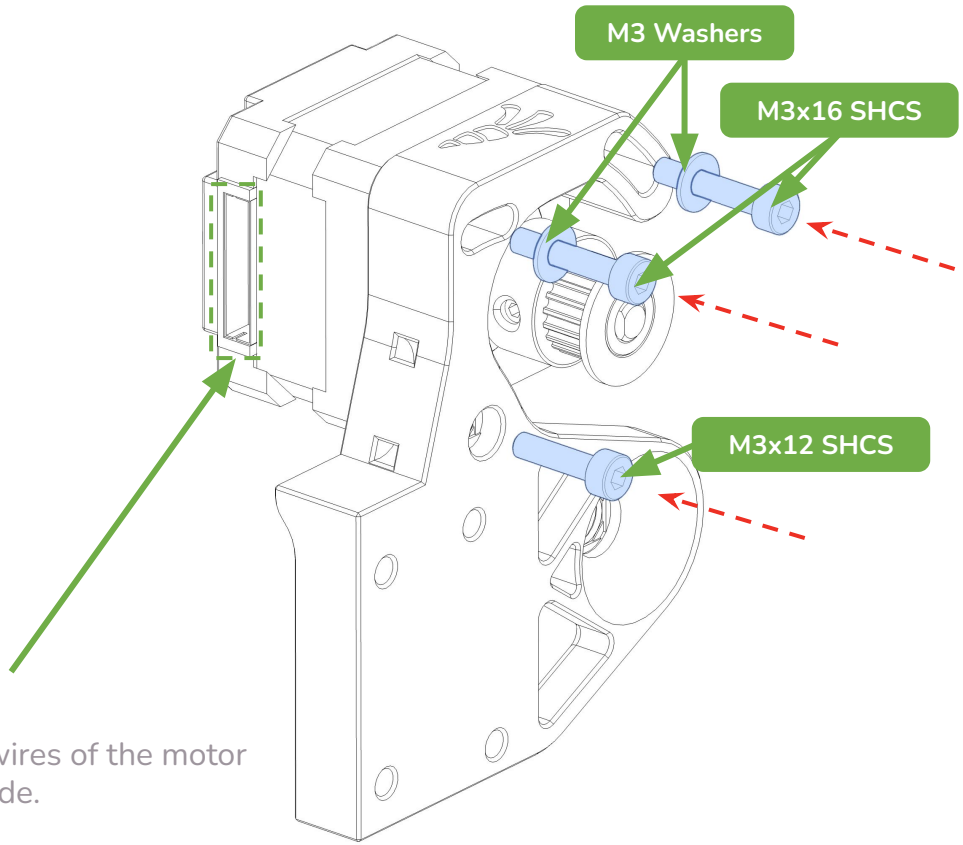
MOTOR ARM

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 internal 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!

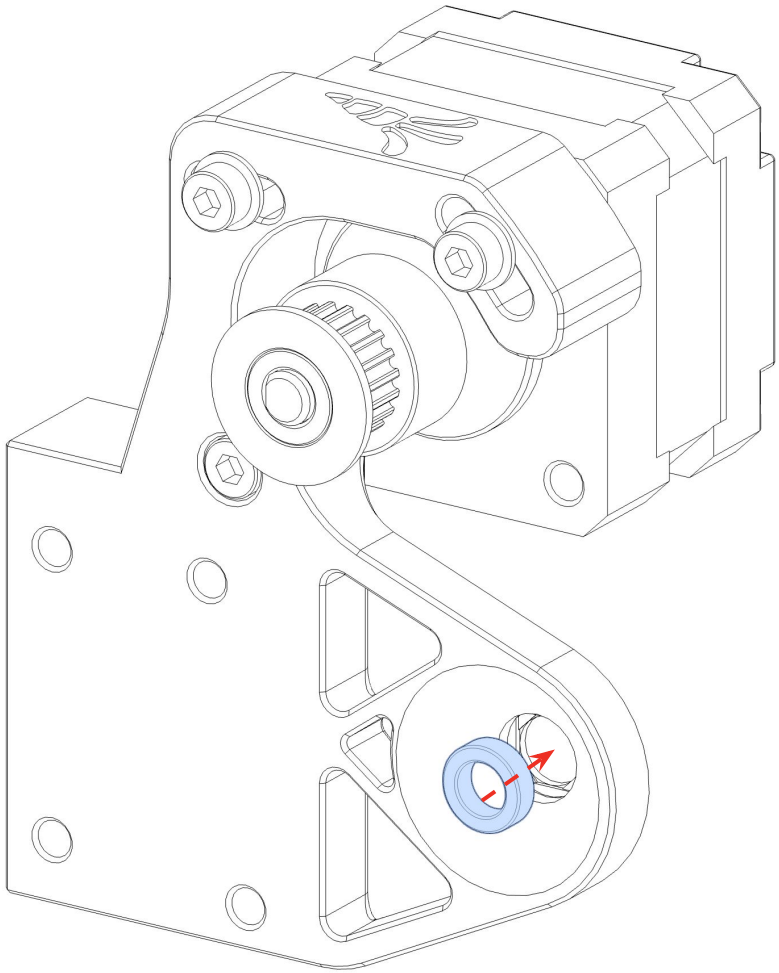


MOTOR WIRES

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

42

GEARBOX

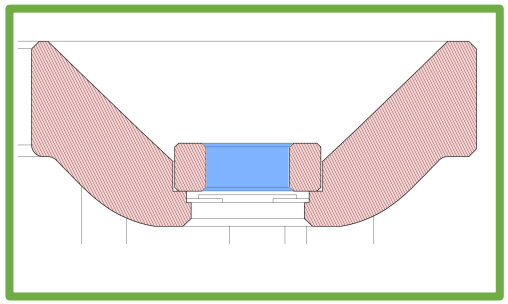


MR85ZZ Bearing

MOTOR ARM

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.

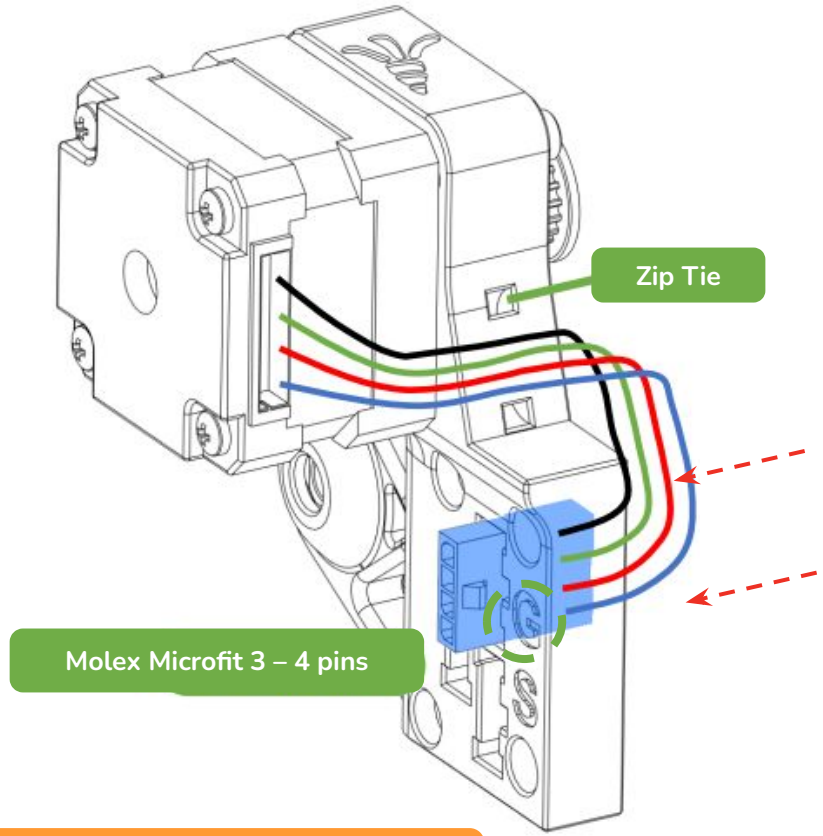
43

GEARBOX (REMOTE MCU)

(OPTIONAL) MICROFIT WIRING

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!

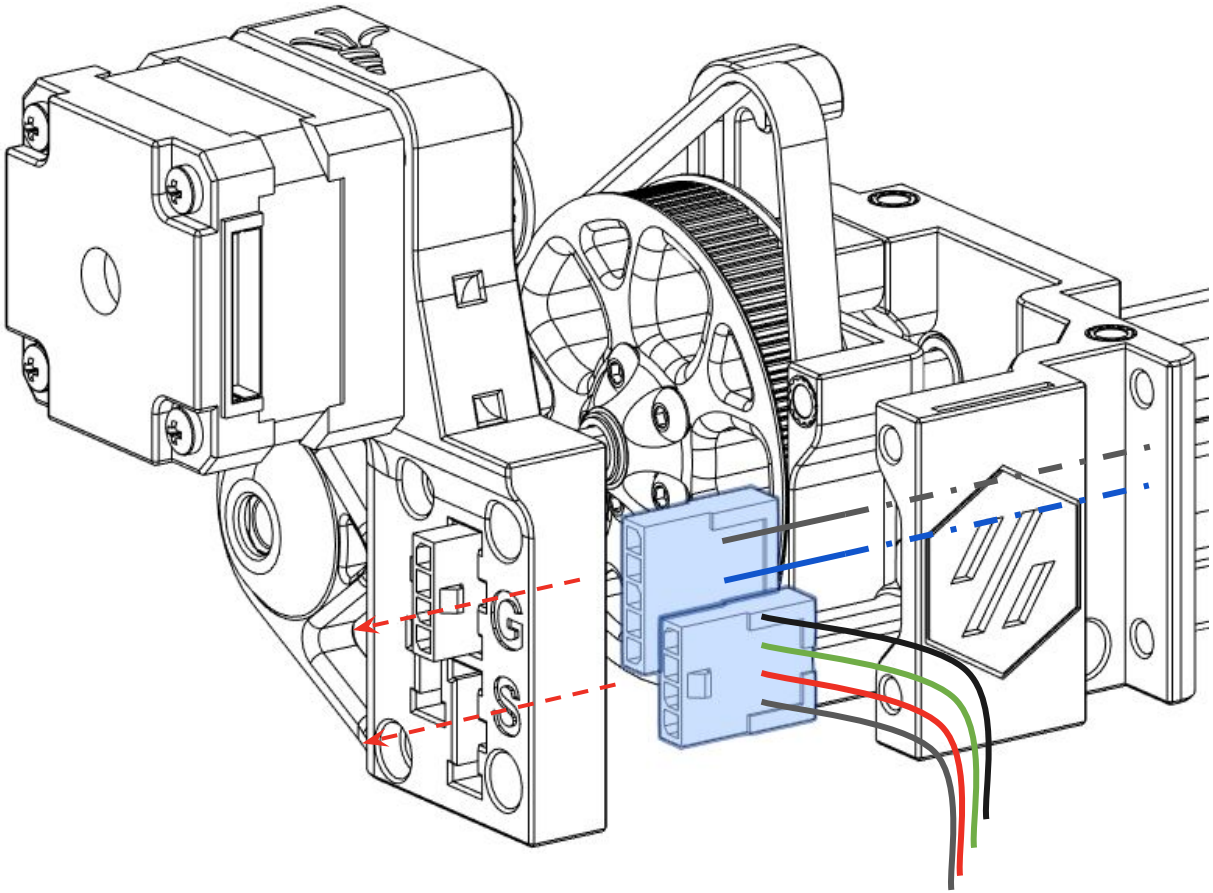


GEAR MOTOR CONNECTOR

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.

44

(OPTIONAL) MICROFIT WIRING



INSERT THE MICROFIT CONNECTORS

Insert the two microfit connectors from the wire bundles into their dedicated holes in the Motor_Arm_NEMA14.stl † (shown) or Motor_Arm_NEMA17.stl † .

For picture clarity, only the microswitch wires are shown for the 5-pin connector (but the other wires are assumed present).

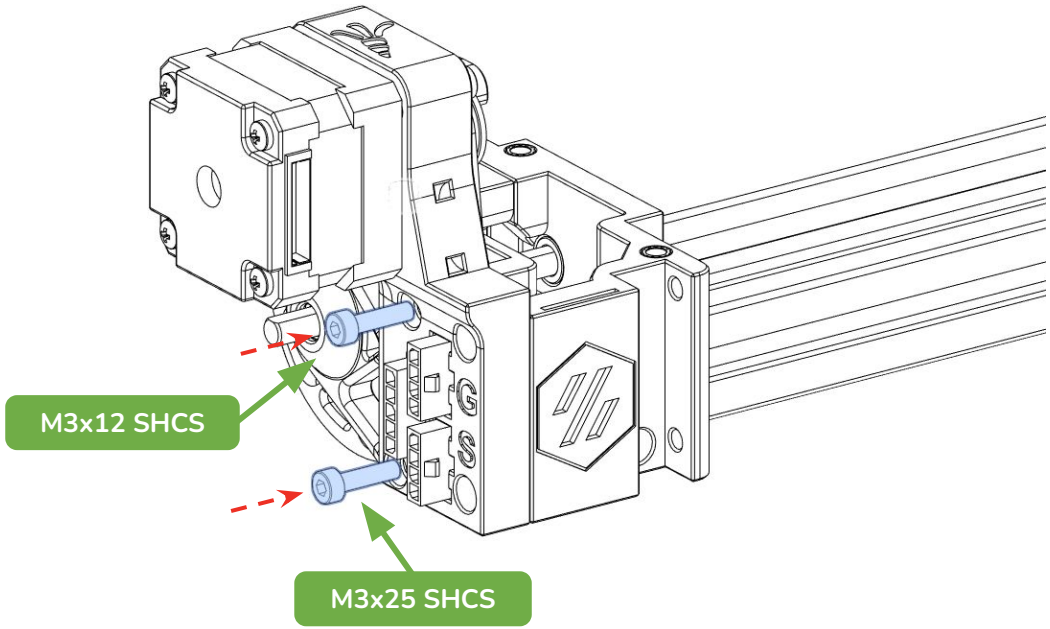
45

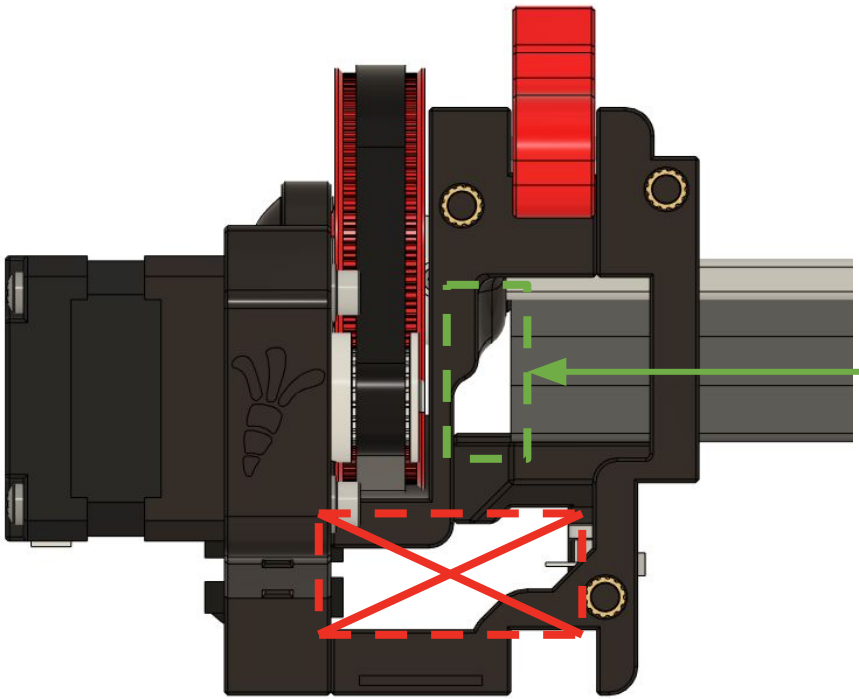
CLOSING THE GEARBOX

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

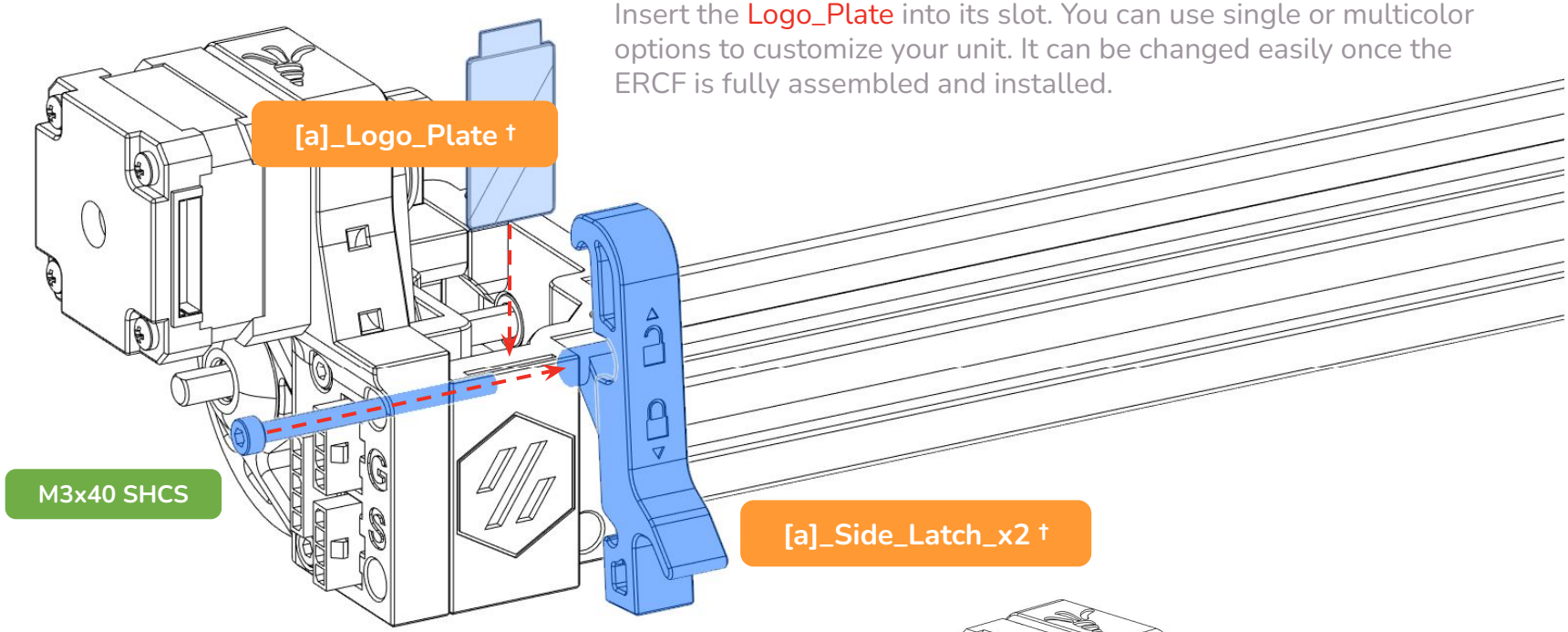
Make sure the wires are routed in the channel between the 2020 extrusion and the Gear_Box_Back. If you route the wires through the other opening, you won't be able to connect the wires later!

46

KNOB & VORON LOGO

VORON LOGO

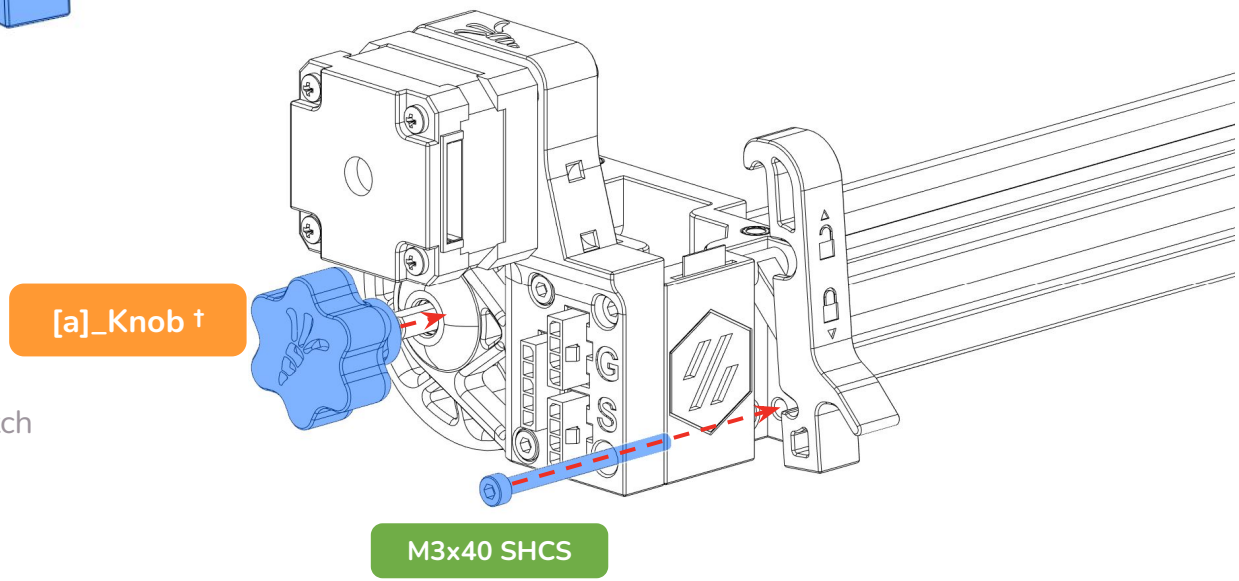
Insert the Logo_Plate into its slot. You can use single or multicolor options to customize your unit. It can be changed easily once the ERCF is fully assembled and installed.



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.



47

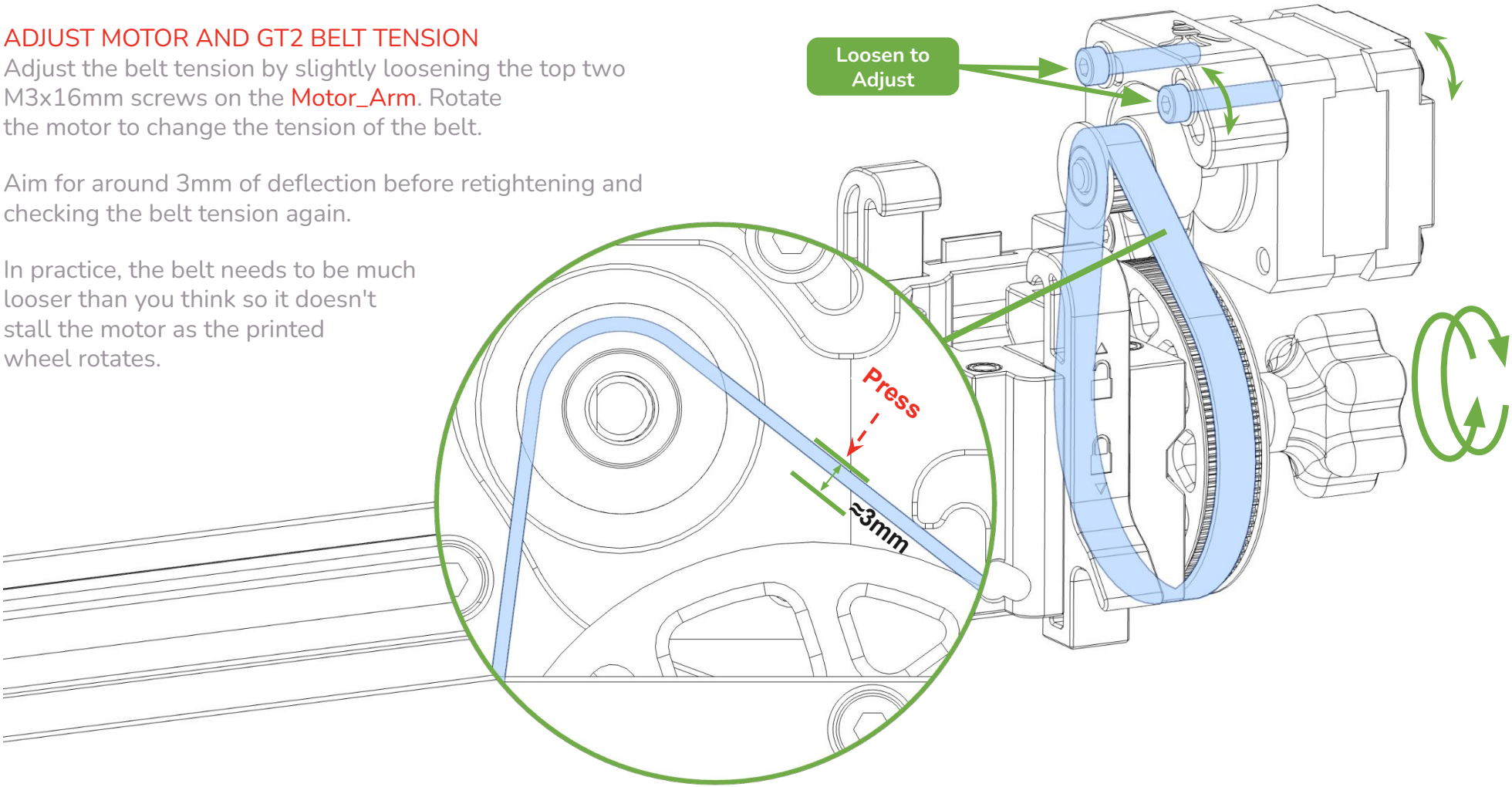
GEARBOX BELT TENSION

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.

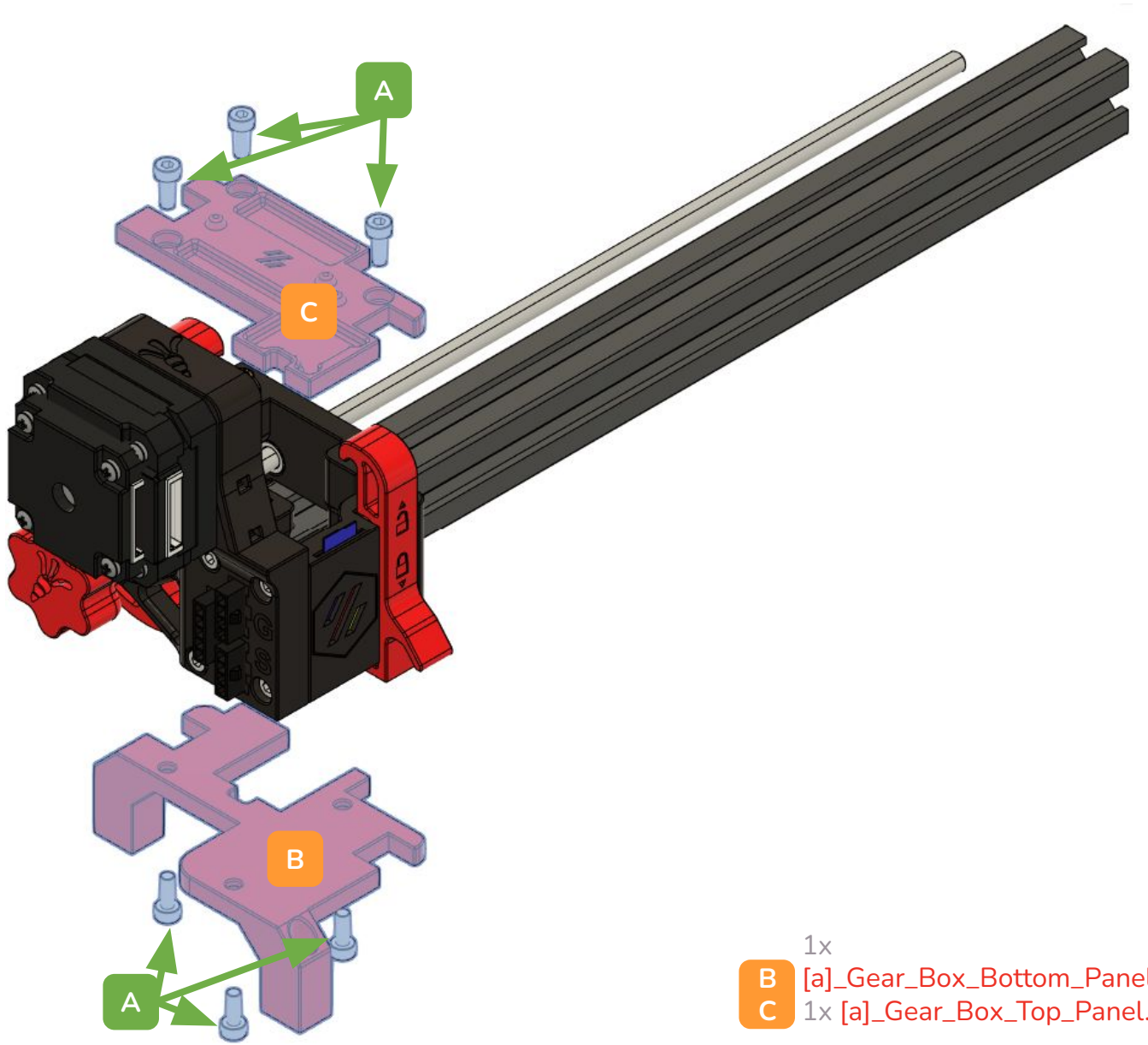
48

GEARBOX

EXPLODED VIEW

GEARBOX SUB-BOM

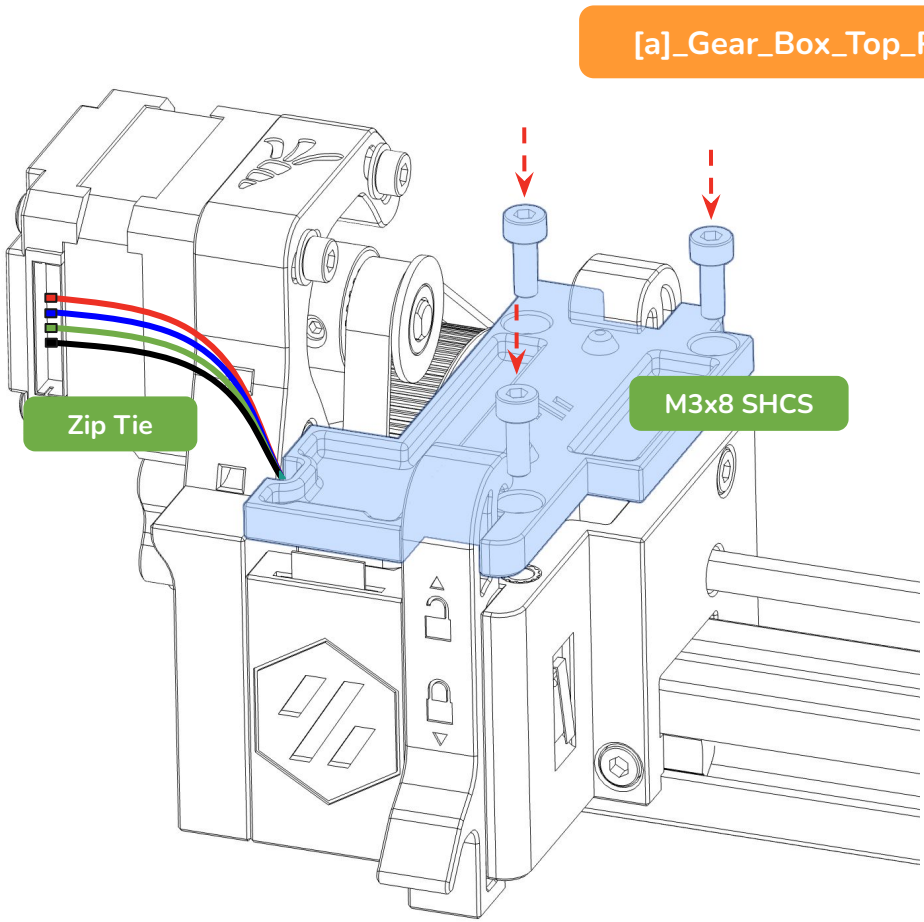
A 6x M3x8mm SHCS



B 1x [a]_Gear_Box_Bottom_Panel.stl
C 1x [a]_Gear_Box_Top_Panel.stl

49

TOP PANEL



TOP PANEL

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

Take care to align the Logo_Plate with the recess in the bottom of the Gear_Box_Top_Panel.

Secure the motor cable with a zip tie.

50

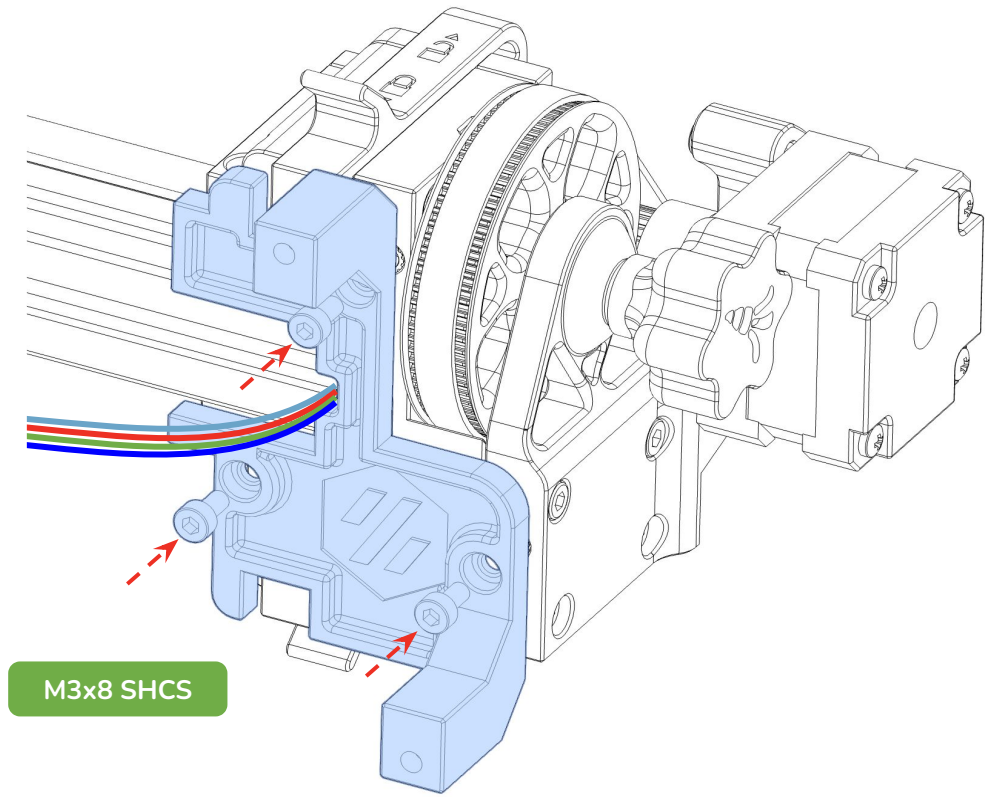
BOTTOM PANELS

BOTTOM PANEL

There is a cutout in the Gear_Box_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.



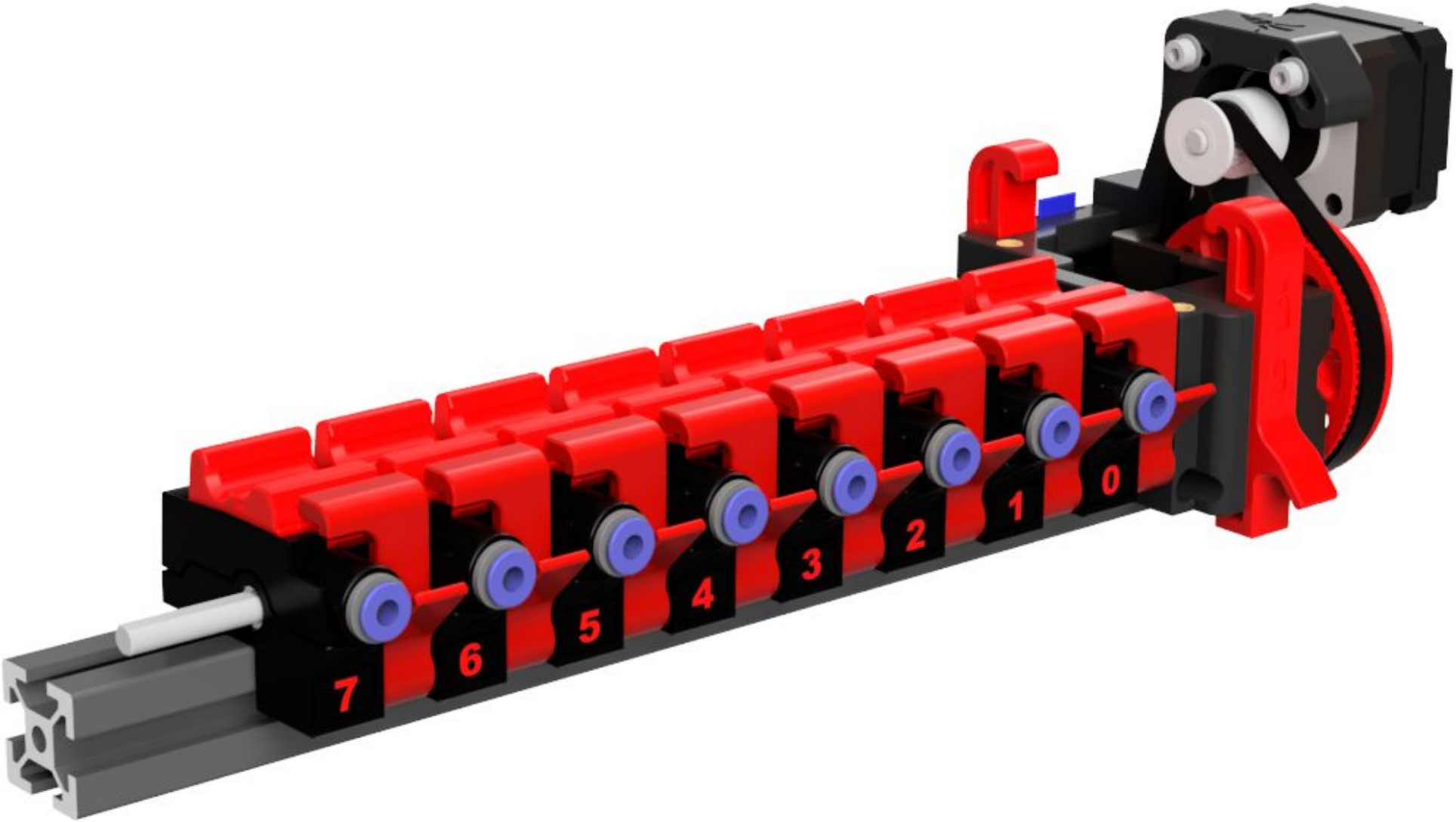
[a]_Gear_Box_Bottom_Panel

51

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

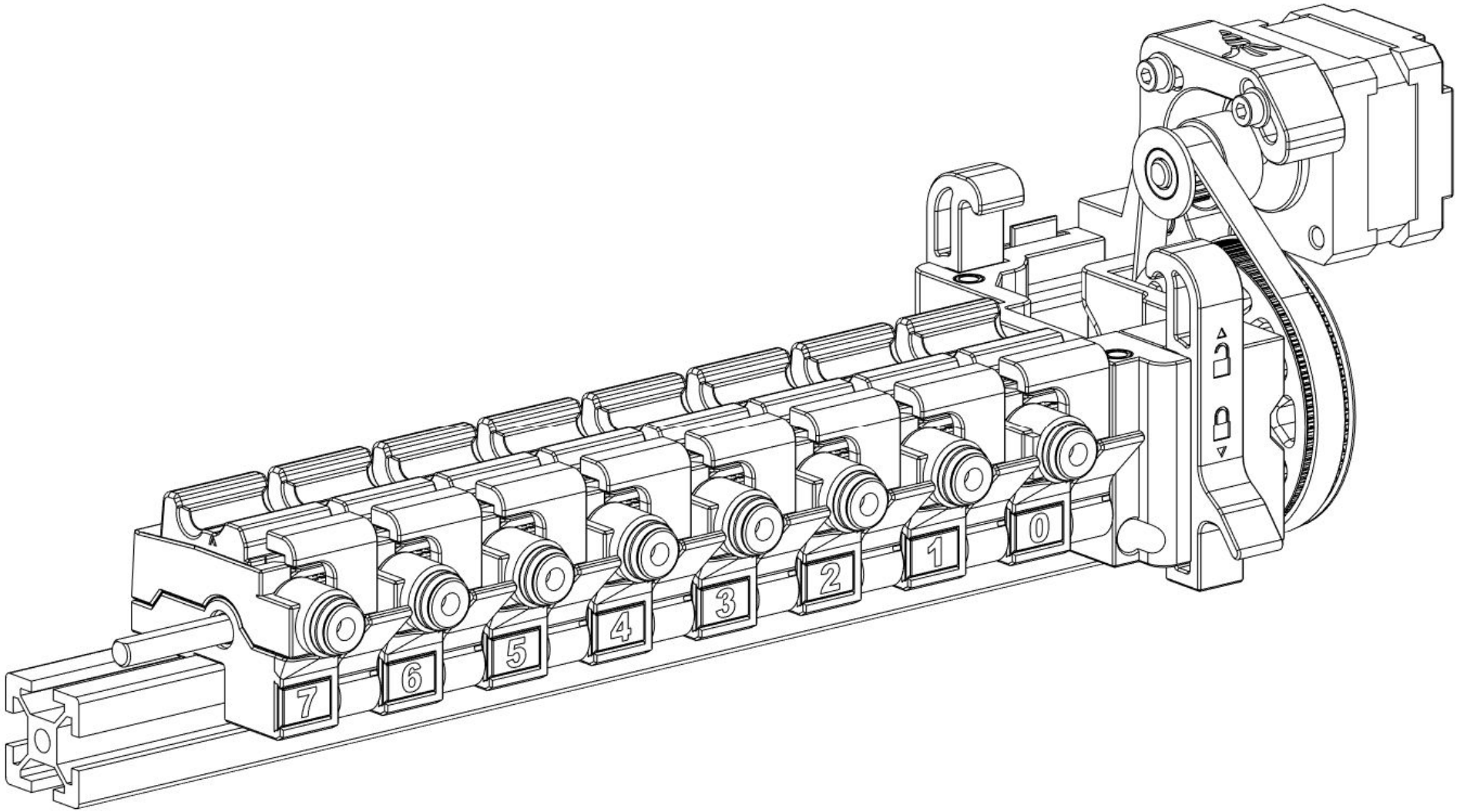
52

OVERVIEW



53

OVERVIEW



54

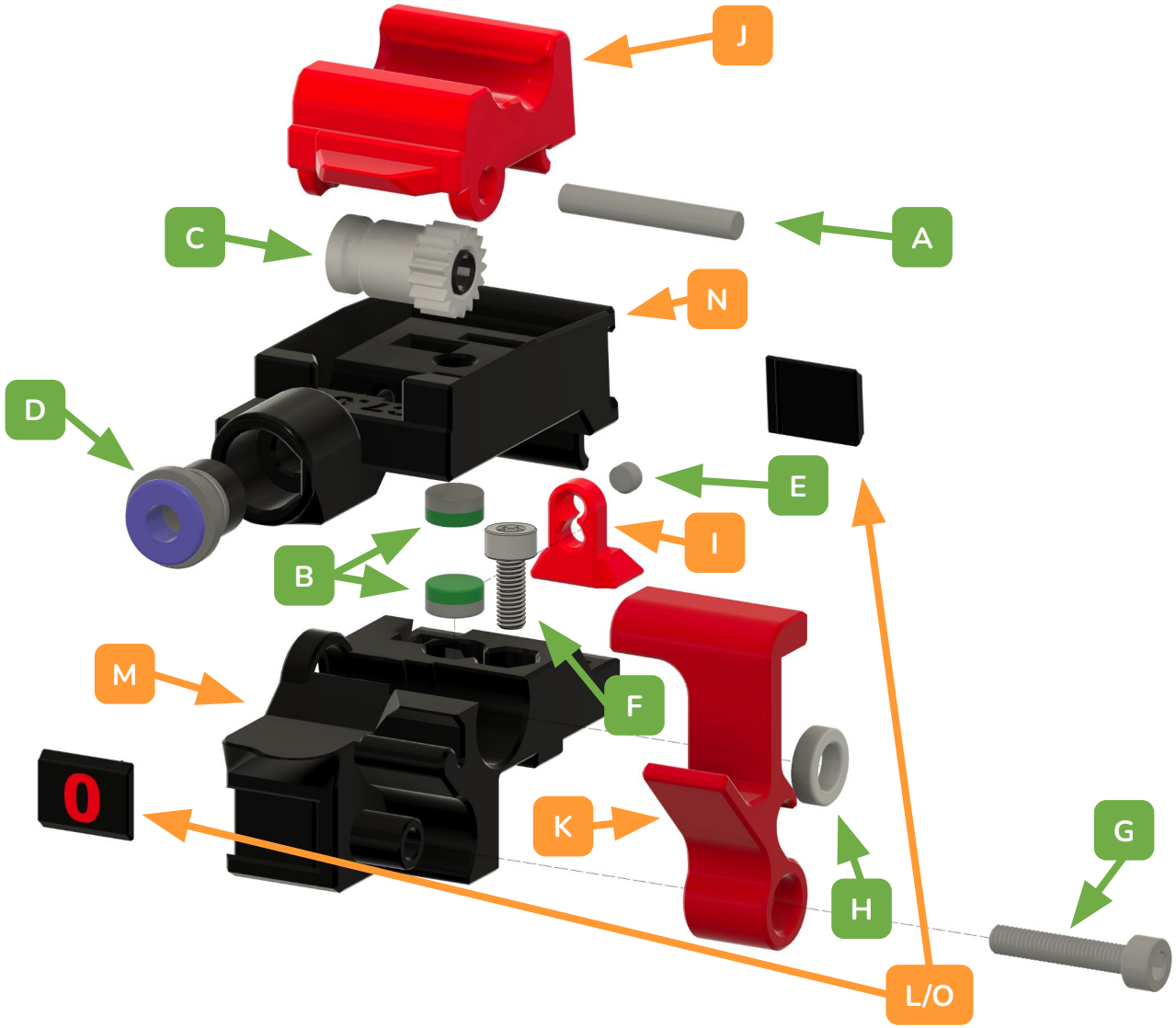
FILAMENT BLOCKS

EXPLODED VIEW

FILAMENT BLOCK SUB-BOM (PER FILAMENT BLOCK)

A	1x 3mm x 20mm pin
B	2x 6x3mm Magnets
C	1x BMG Idler Gear & Bearings
D	1x ECAS Coupler (2 piece)
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



55

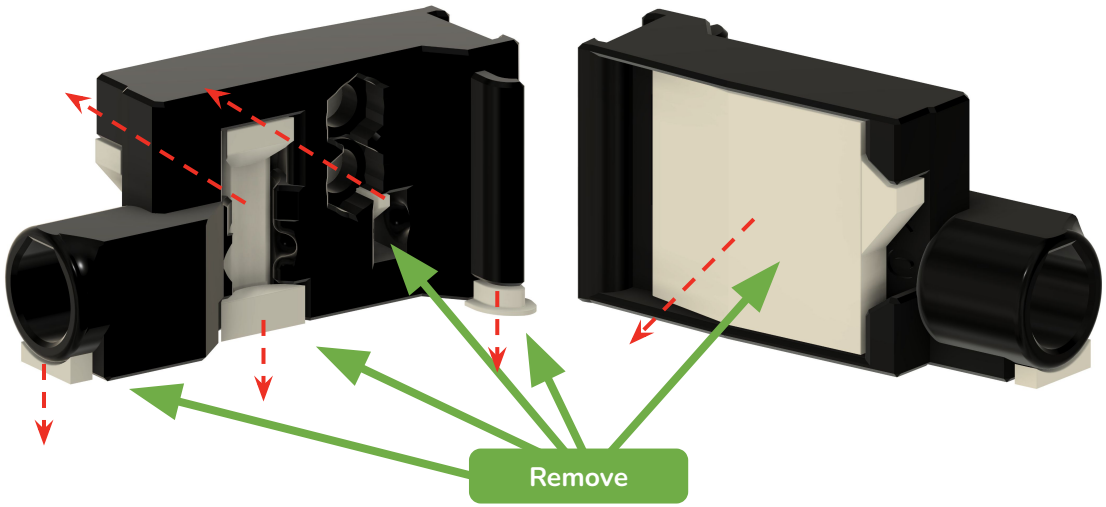
PRINT IN PLACE SUPPORTS

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.

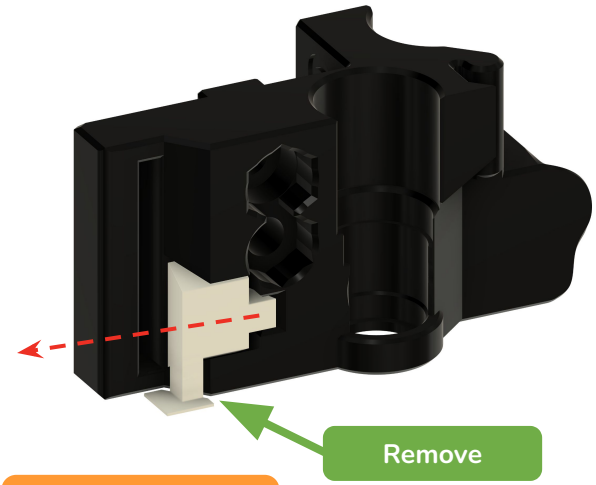
Please take care that you don't accidentally damage the part or yourself especially the Tophat and the upper Bondtech idler pin mount.

Repeat for all of the Bases, Filament_Paths, and Tophats.

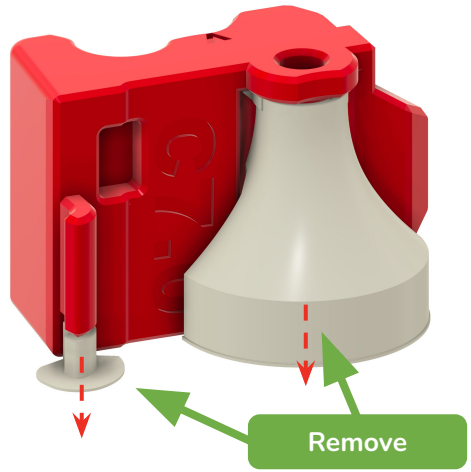
Filament_Path_xN



Base_xN



Tophat_xN



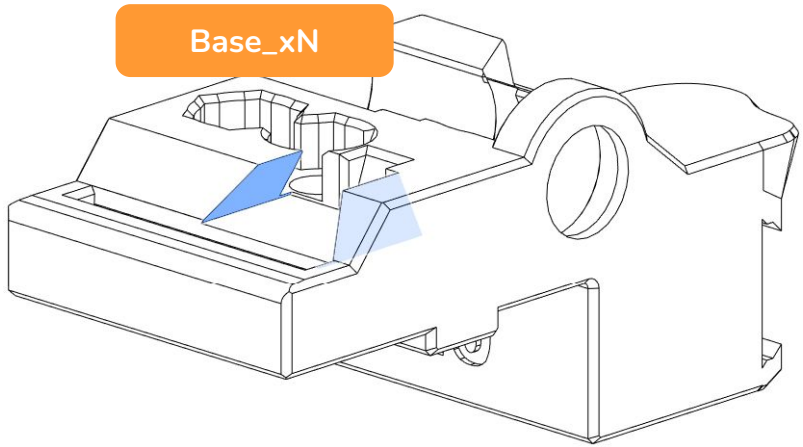
PRINT IN PLACE SUPPORT CLEANUP

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.

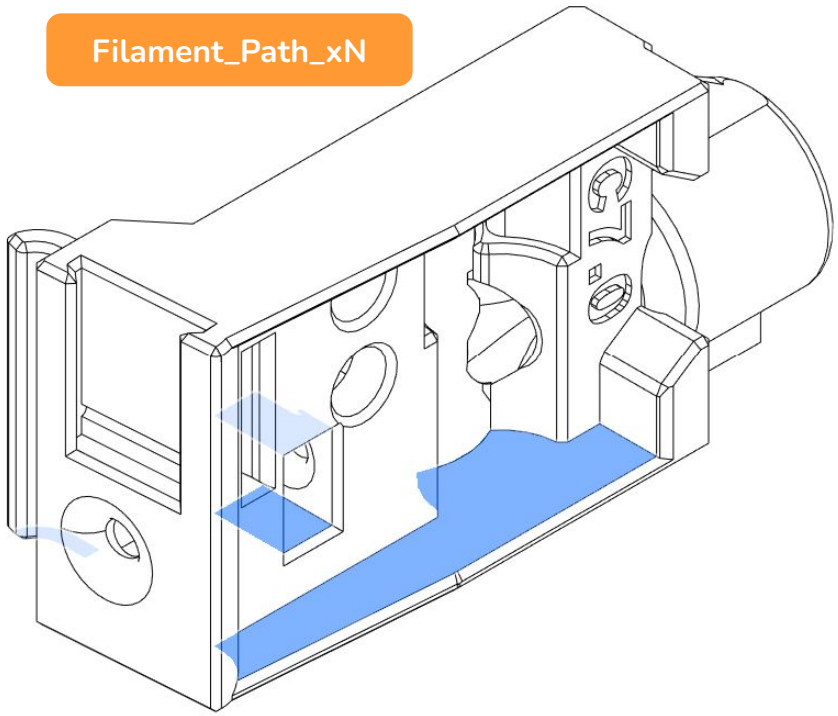
Otherwise, please clean up the highlighted surfaces with a small file or hobby knife. Make sure that the print in place supports didn't leave any stuck bits behind and interfere.

Repeat for all of the Bases, Filament_Paths, and Tophats.

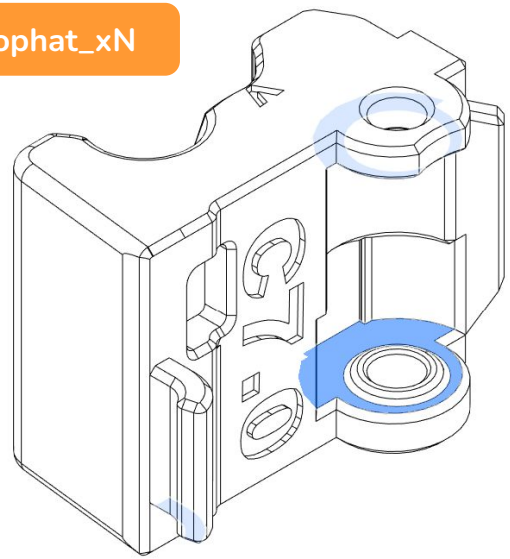
Base_xN



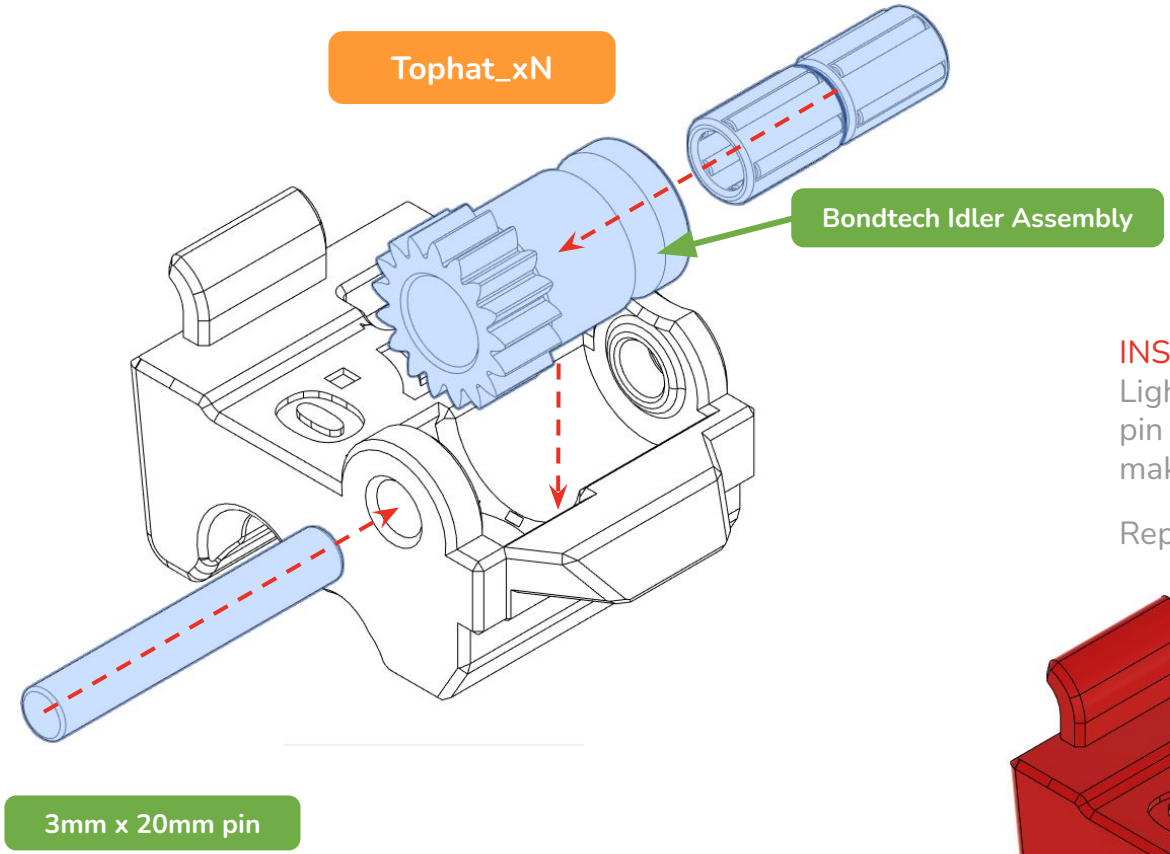
Filament_Path_xN



Tophat_xN



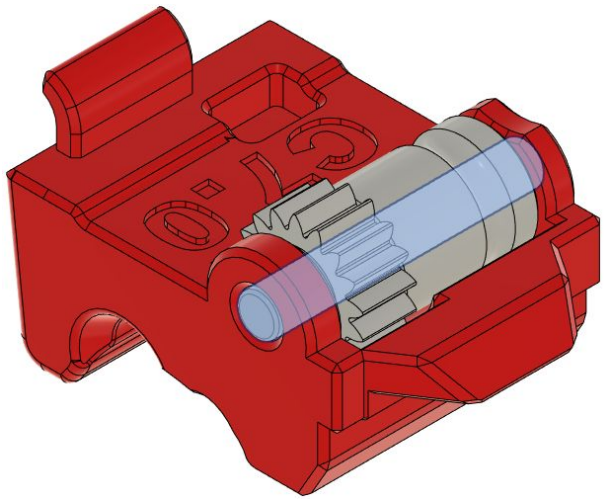
TOP HATS



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.



58

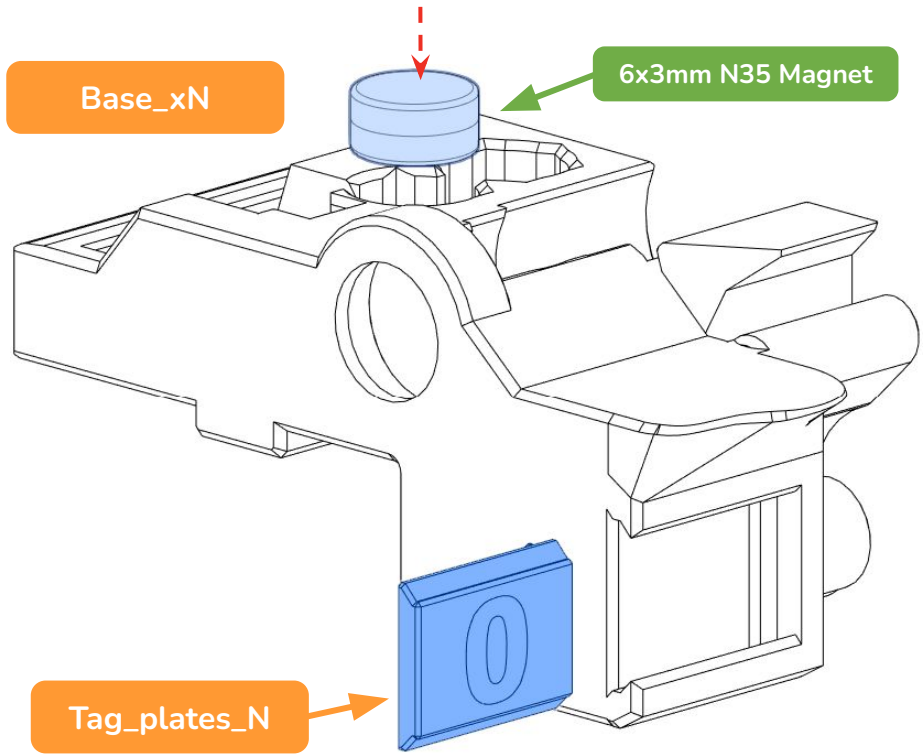
MAGNET ORIENTATION

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

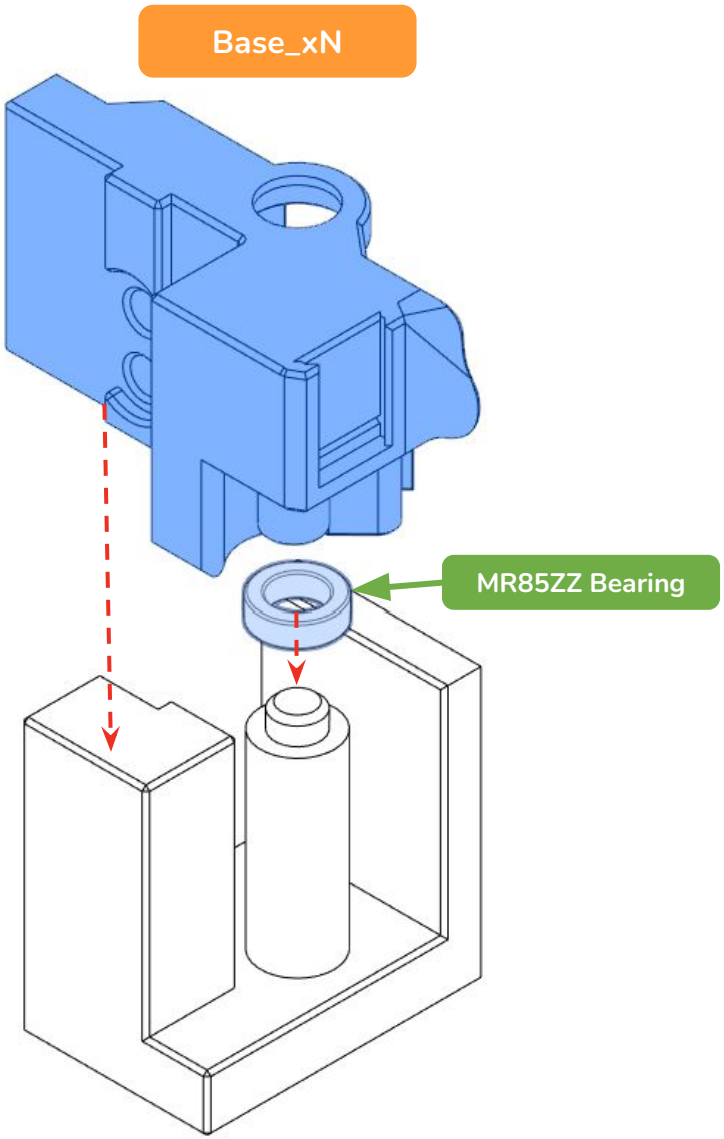
It's recommended you assemble all Filament_Path and Base parts at the same time to ensure all of the magnet polarities match.

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

Repeat for all of the Bases.



59



BASE BEARING INSERTION

DRIVE SHAFT BEARINGS

A printed jig is provided to help you with bearing insertion on the Bases. 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 down onto the bearing as shown, so that the 2020 mounting groove in the Base mates with the groove in the Bearing_Install_Tool. The bearing should seat and remain in the Base when you pull the Base off of the Bearing_Install_Tool.

Install them into at least every 3rd Base and make sure you have one in the final Base. Optionally, bearings may be be installed into every Base but there is no net benefit in doing so.

.

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

60

LATCH

LATCH SCREW

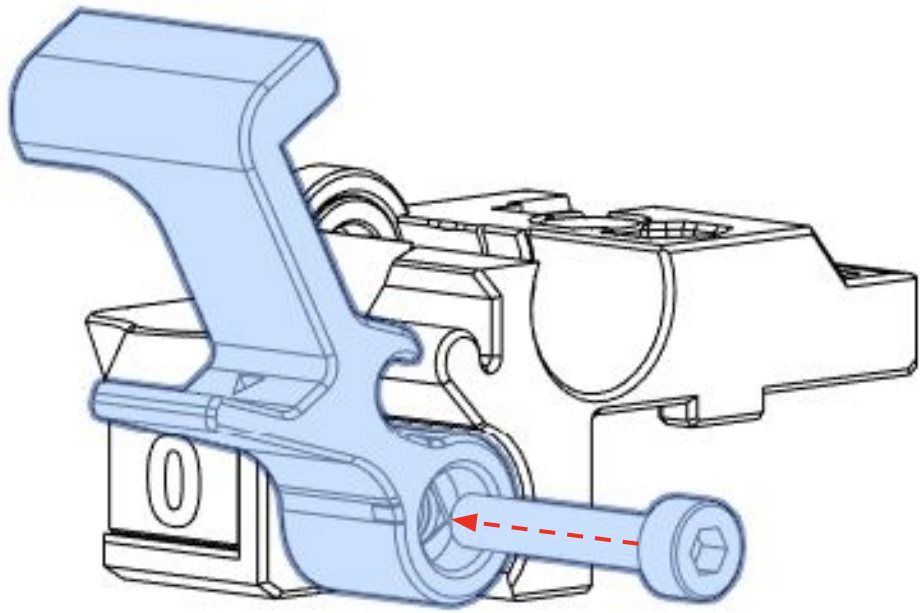
Resist the urge to close the Latch before installing the screw. You'll break the pivot off.

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

Once the screw is in, you can close the Latch with a satisfying click.

Repeat for all of the Bases.

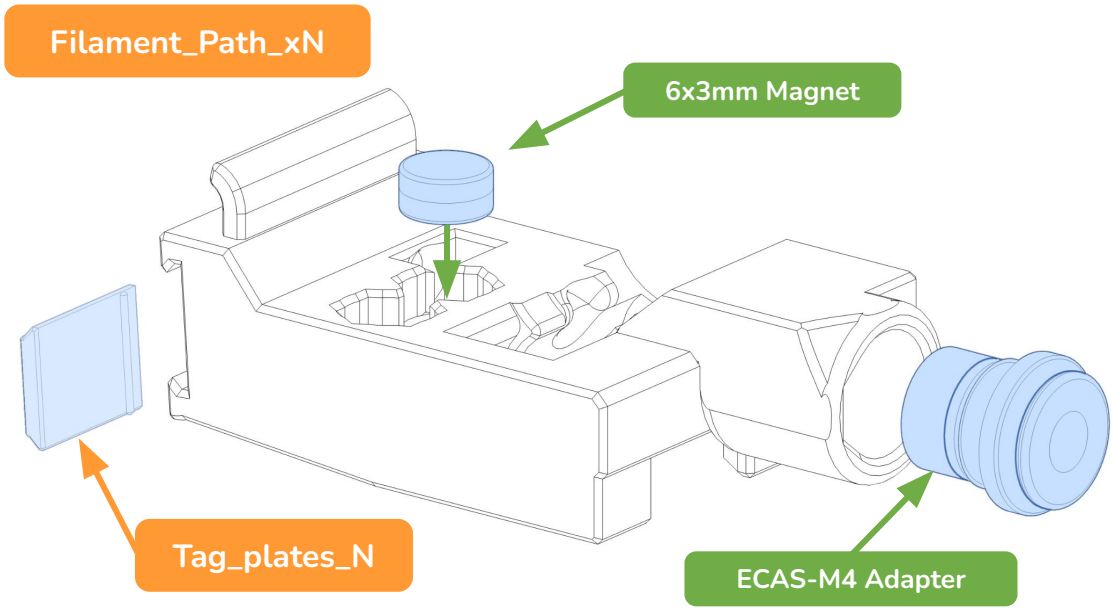
[a]_Latch_xN



M3x16mm SHCS

61

FILAMENT BLOCKS



TAG PLATES

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

FILAMENT PATH

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.

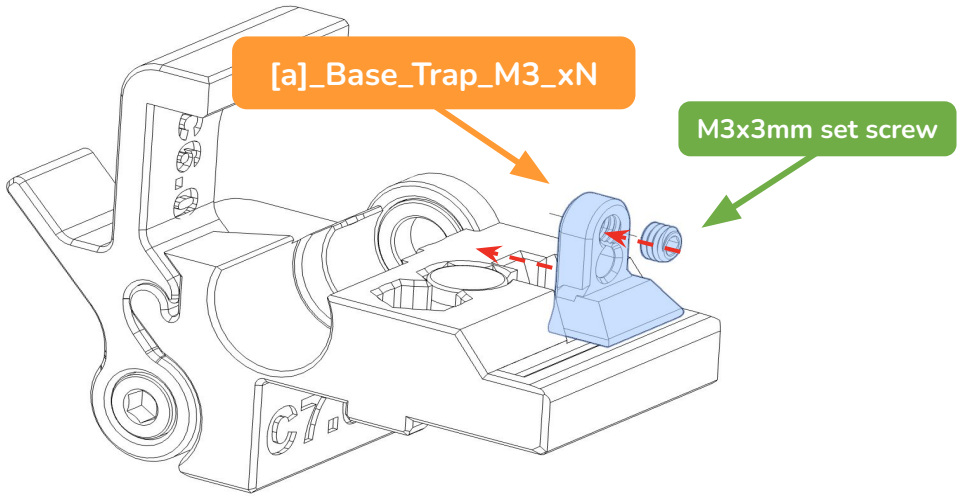
It's recommended that you assemble all of the Filament_Path and Base parts at the same time to ensure all of the magnet polarities match.

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.

62

TRAP AND BLOCK ASSEMBLY



BASE TRAP (BRAKE)

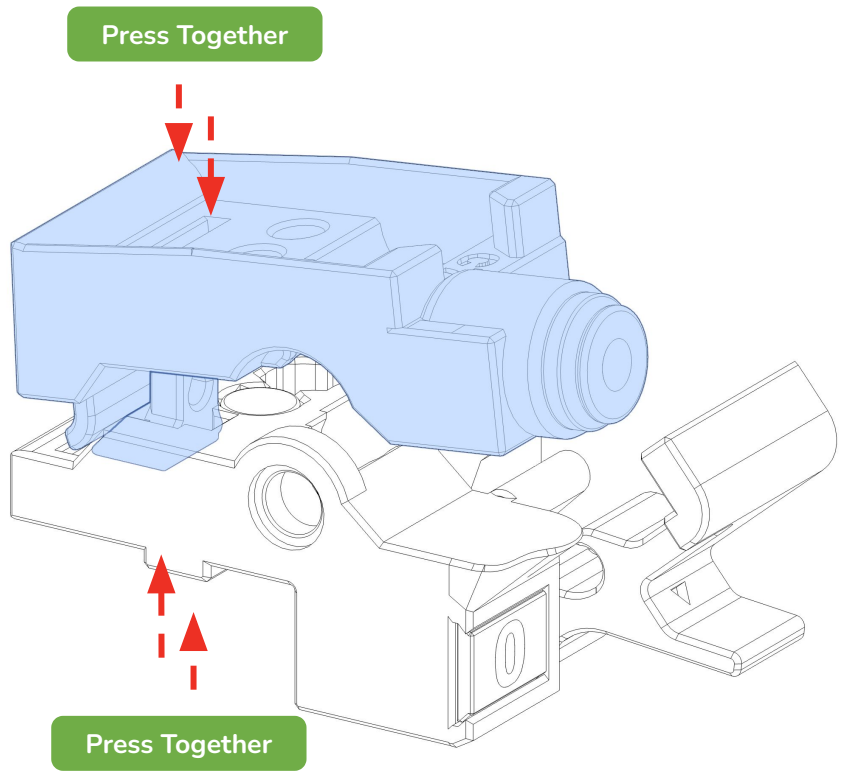
This traps the filament when it is not in use so it doesn't fall out of the Base. If you choose to use the M3 set screw version of the Base_Trap (recommended), make sure the set screw is screwed flush into the Base_Trap and doesn't protrude. Also make sure the filament hole in the Base_Trap is clear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

ASSEMBLY

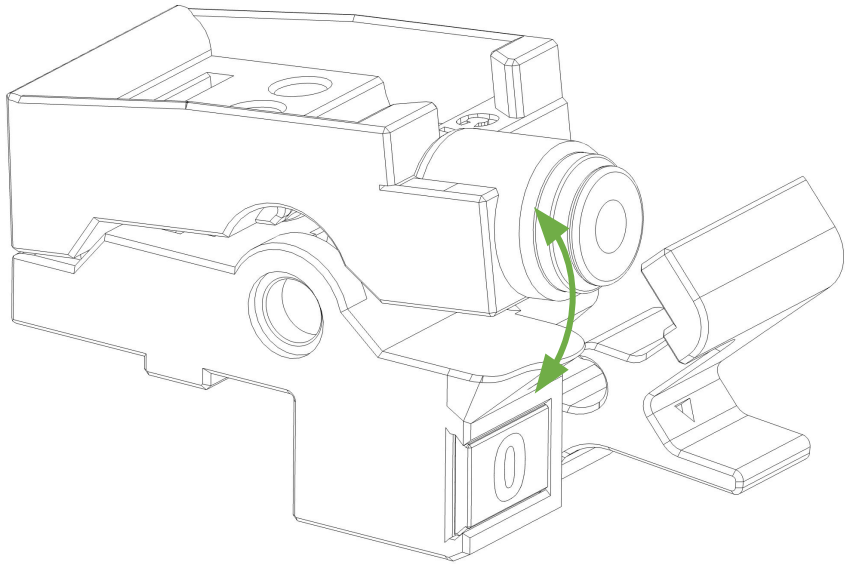
Open the Latch. Next, line up the Filament_Path vertically with the Base, and make sure that the Base_Trap fits into its slot on the Filament_Path. Squeeze gently until they snap together. Close the Latch.

Repeat assembly of all of the parts into Filament Blocks.

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



63



FIT CHECK

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

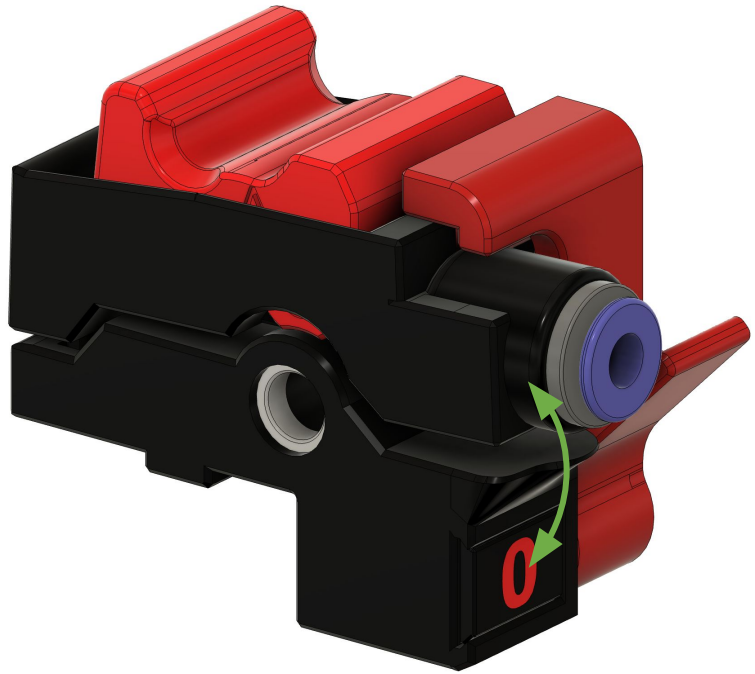
If the parts interfere or bind as you press them together, then you will need to disassemble them. Use a small file or hobby knife to clean out any stringing in the Base_Trap slot, and square up its corners (see page 57). Depending on how well calibrated your printer is, you might also need to lightly sand or file the sides of the Base_Trap to improve fit until the the parts move freely.

Remove the Filament_Path and and set it aside. Repeat for all Filament Blocks.

ASSEMBLY

Insert the Tophat, hinge into the groove on the Filament_Path. Close the Latch and press everything together to make sure that it pivots nicely.

Remove the Tophat and set it aside for the moment.



64

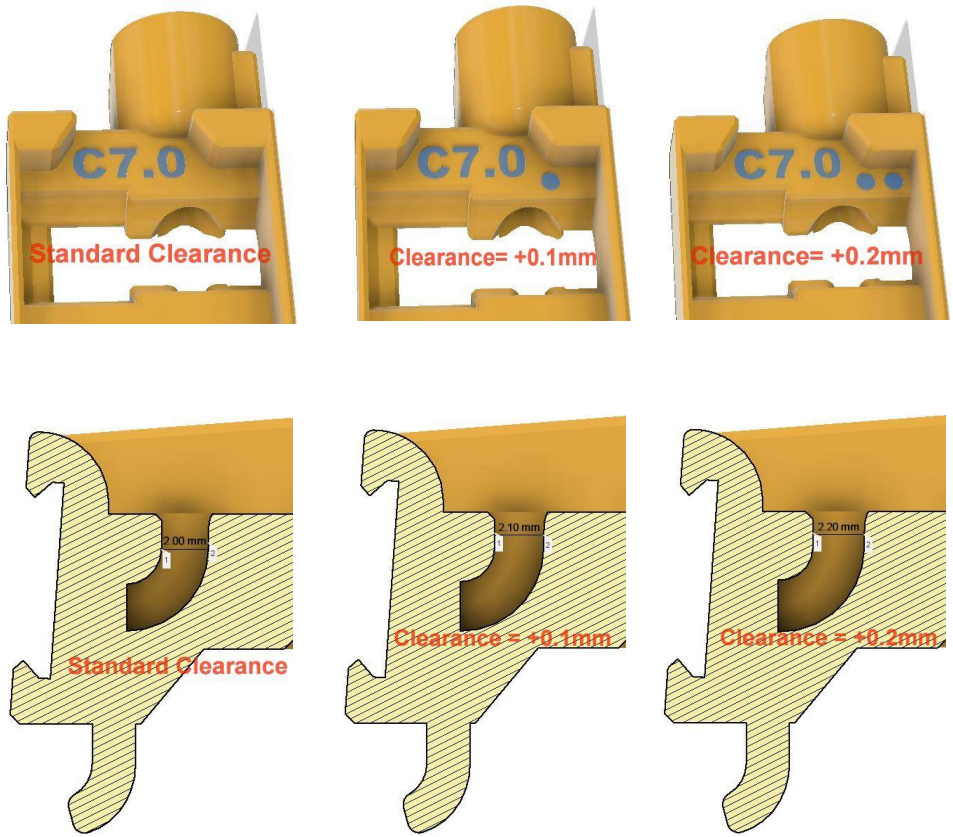
TOP HAT CLEARANCE OPTIONS

TOLERANCES

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

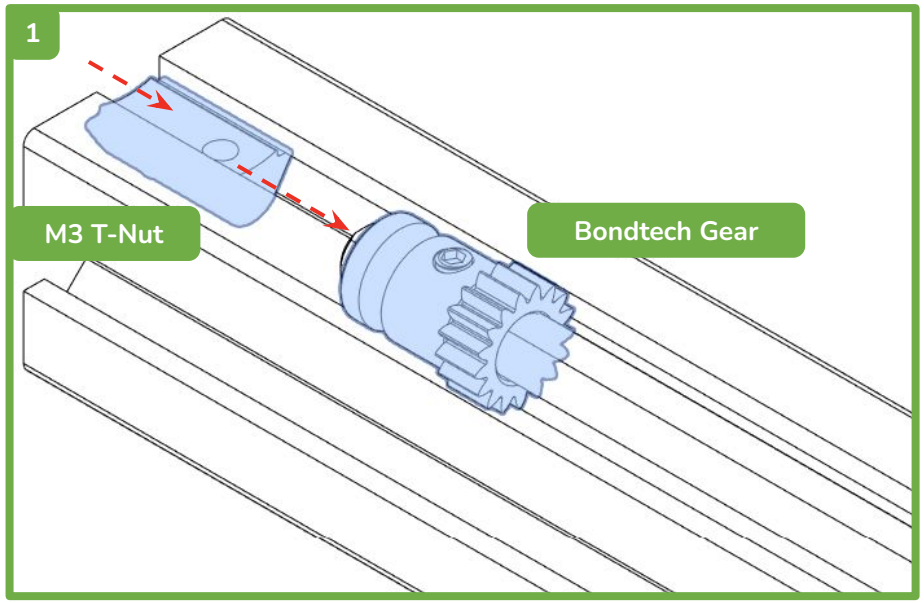
These can be found in the following folder:

ERCF_v2/Stls/Filament_Blocks/Clearance_Options/



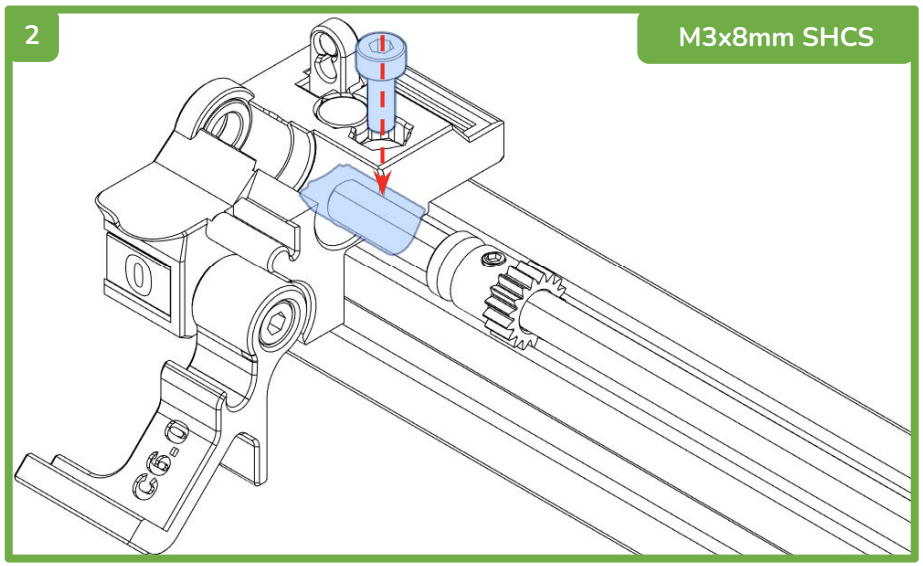
65

FILAMENT BLOCK ARRAY ASSEMBLY



1. PREPARATION

Slide a Bondtech gear onto the D-Cut shaft. Be aware of it's 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.

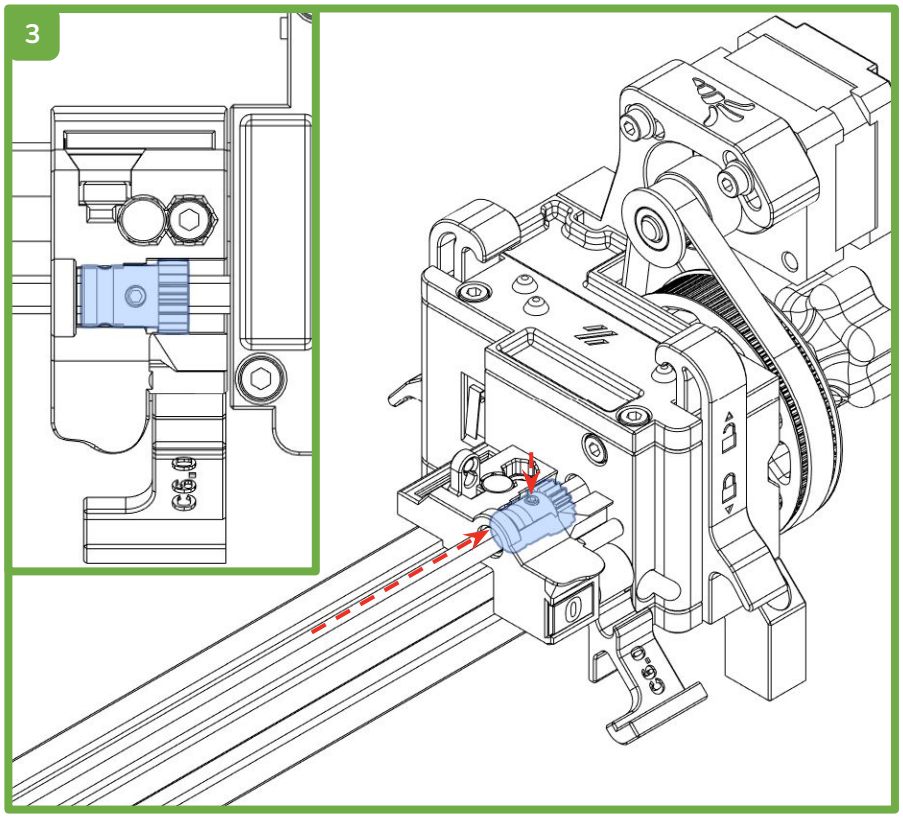


2. FILAMENT BLOCK INSERTION

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

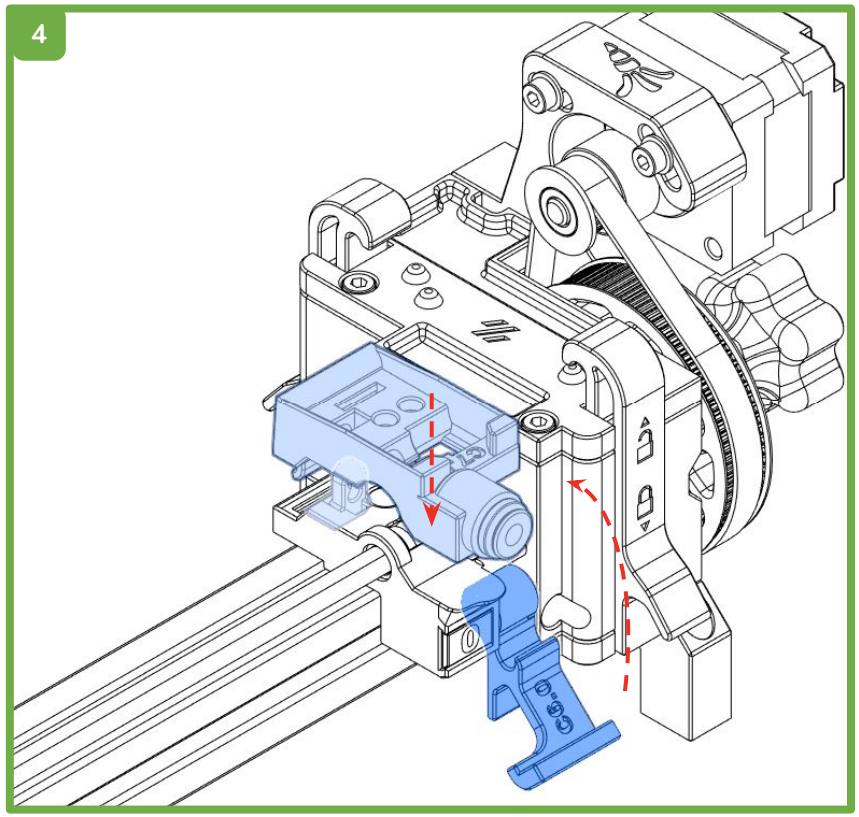
66

FILAMENT BLOCK ARRAY ASSEMBLY



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. Do not apply threadlocker yet. 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 labelled 0 straight down onto the Base. It should seat without much force. Close the Latch.

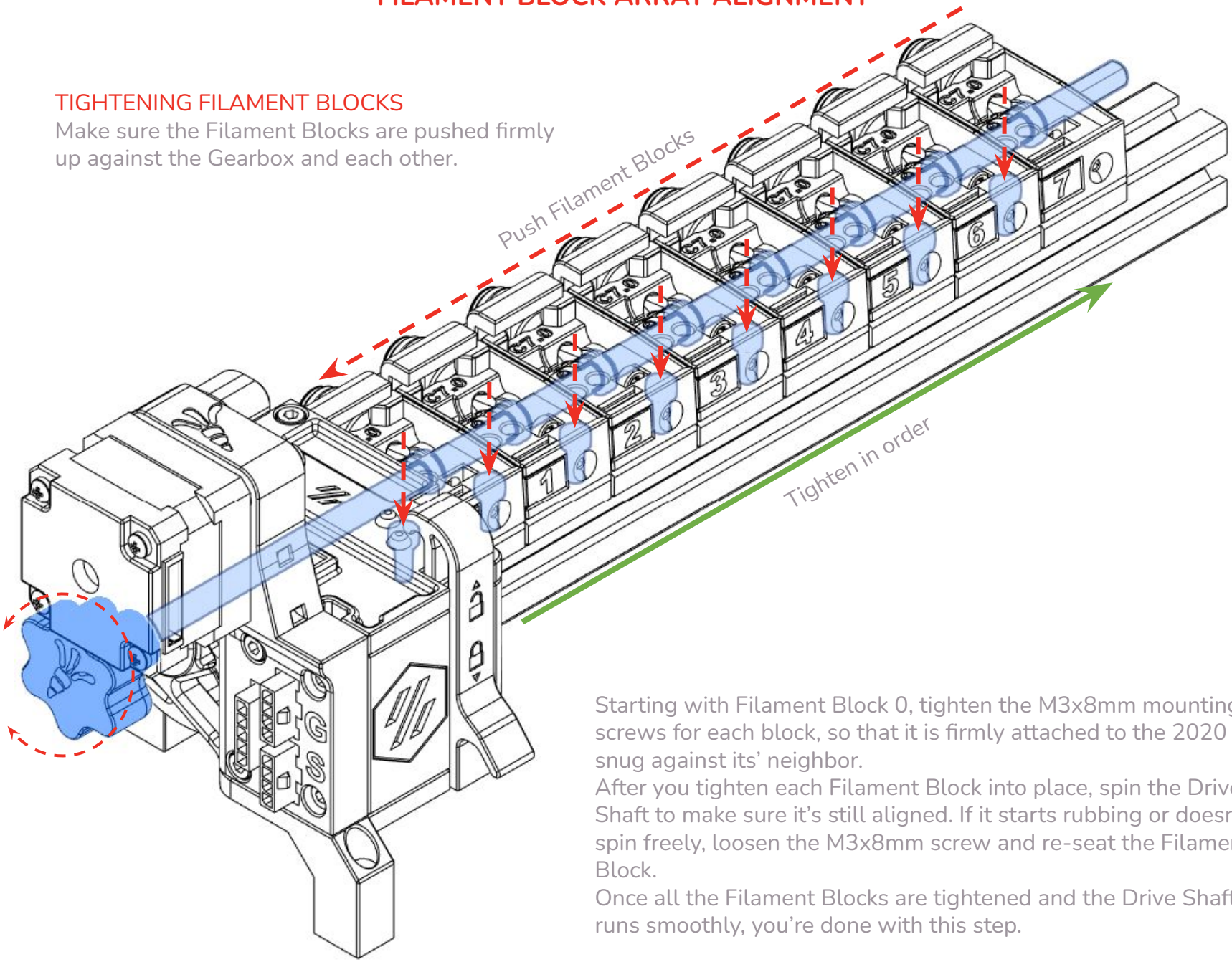
Repeat these 4 steps for all of the Bases and Filament_Paths.

67

FILAMENT BLOCK ARRAY ALIGNMENT

TIGHTENING FILAMENT BLOCKS

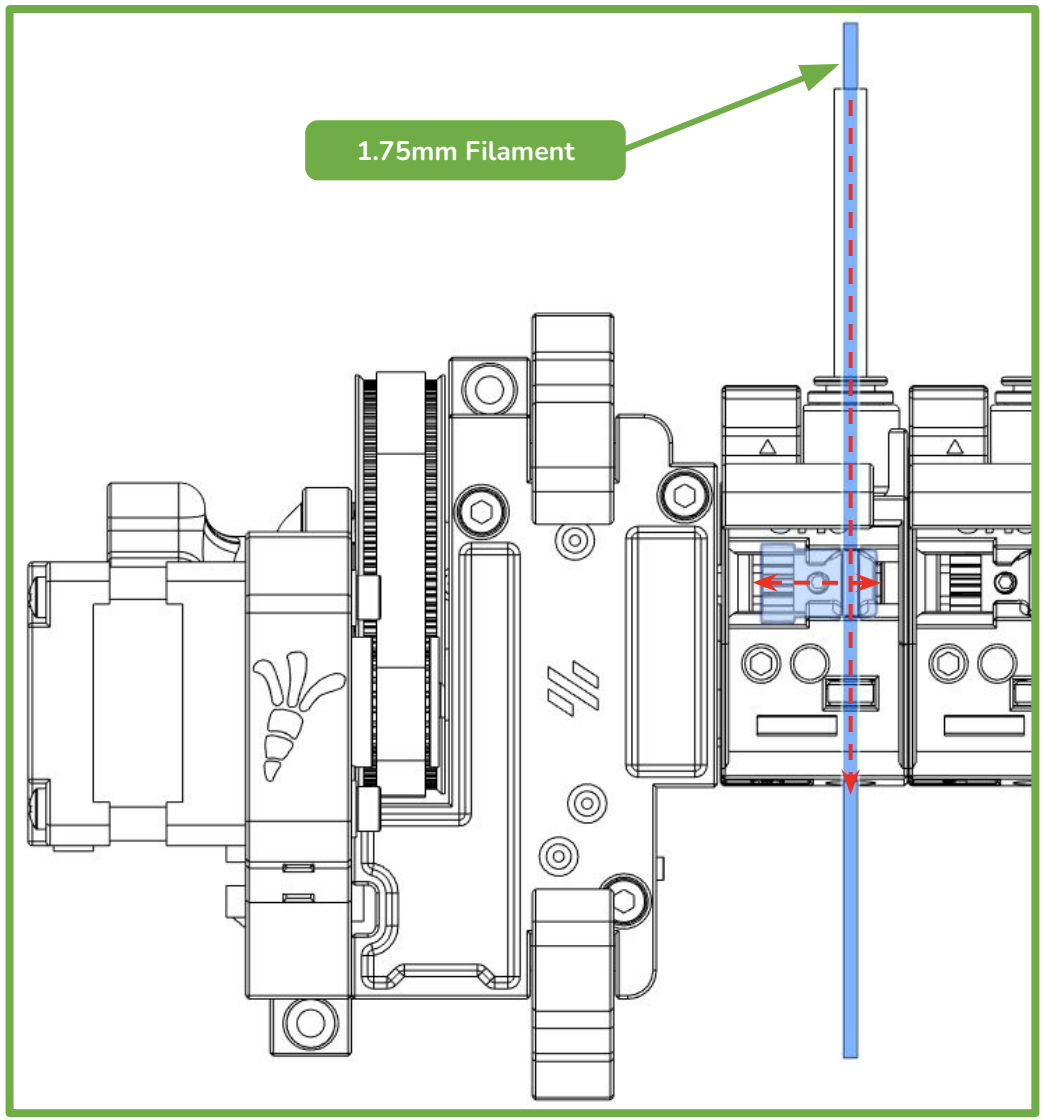
Make sure the Filament Blocks are pushed firmly up against the Gearbox and each other.



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.

68

BONDTECH GEAR ALIGNMENT



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 may get 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.)

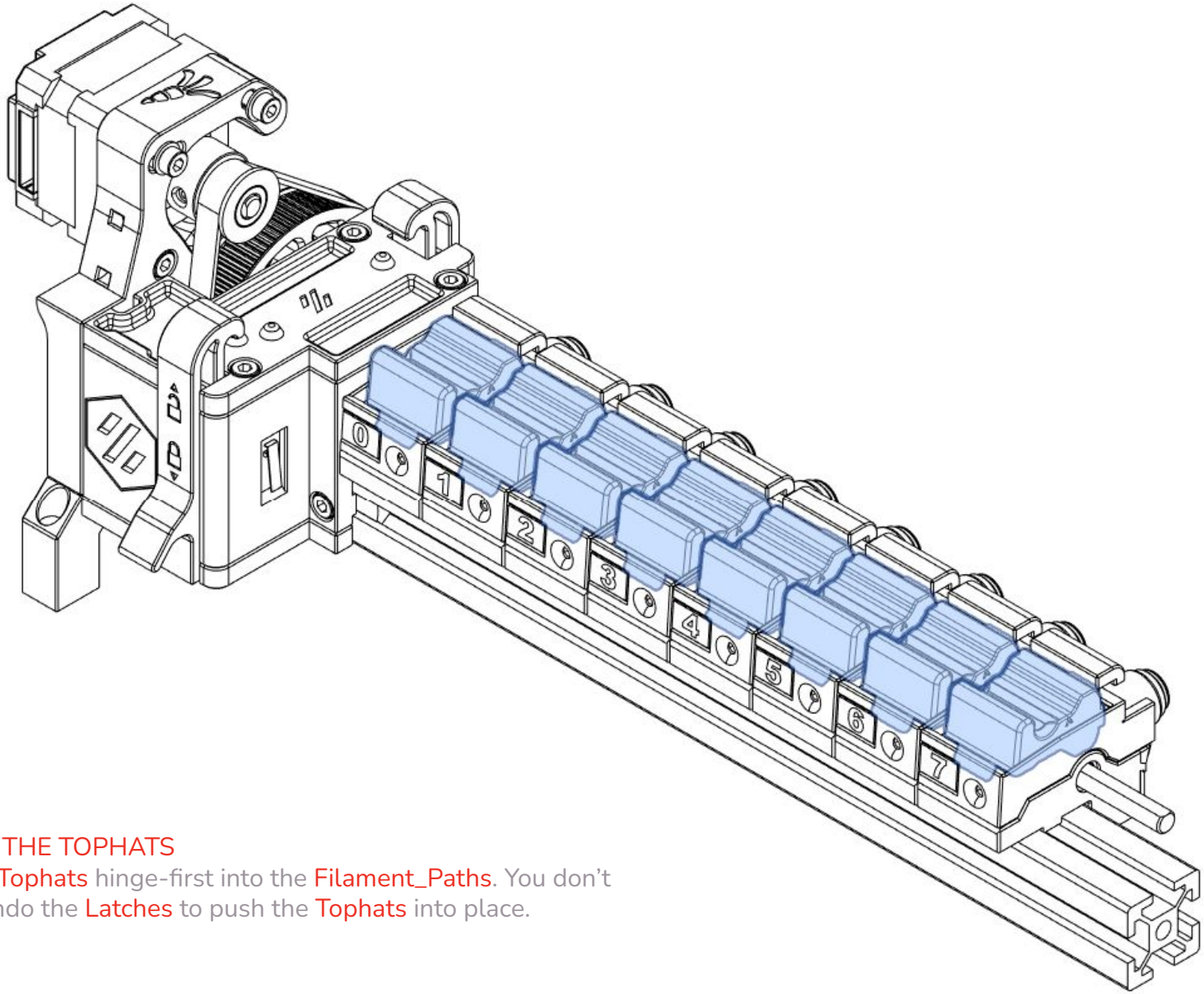
Make sure the flat surface of the Drive shaft is facing up towards the Bondtech M3 set screw. Press down on the Filament_Path and use the filament to align and centre the gear with the groove, then tighten the set screw.

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.

69

REPLACE TOPHATS



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.

70

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!"

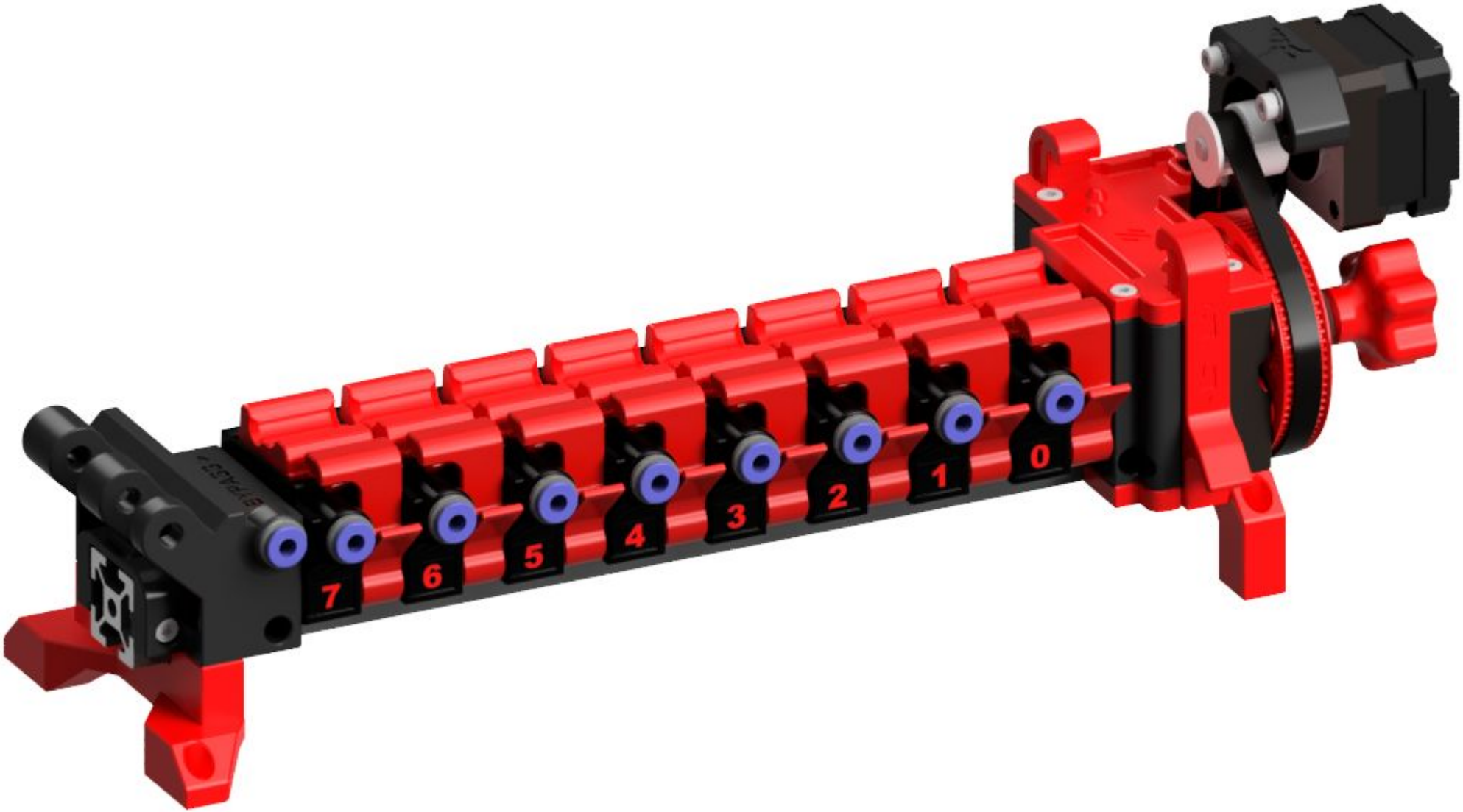
"I'm reading a book on anti-gravity. It's impossible to put down."

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

Enough! Back to building...

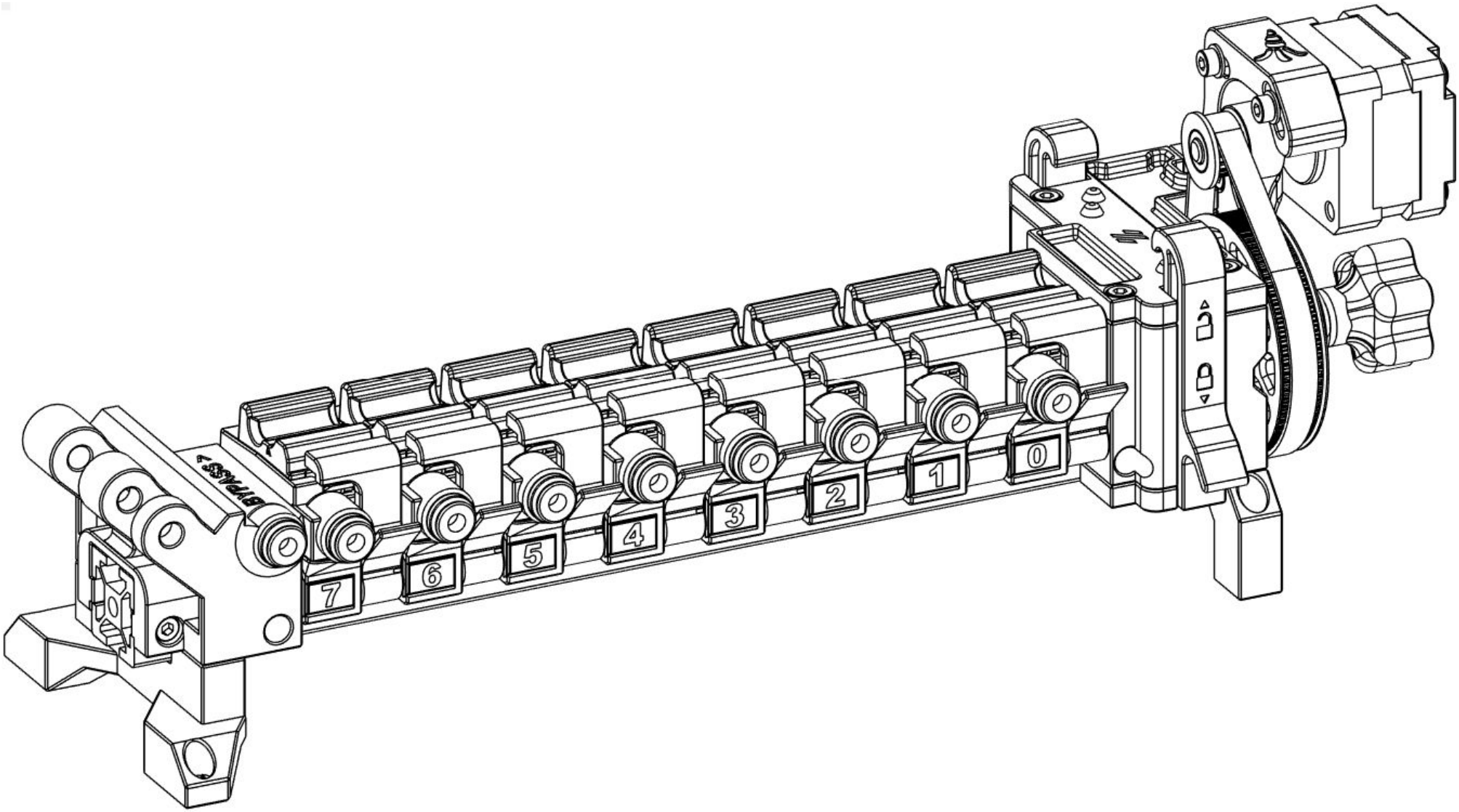
71

OVERVIEW



72

OVERVIEW



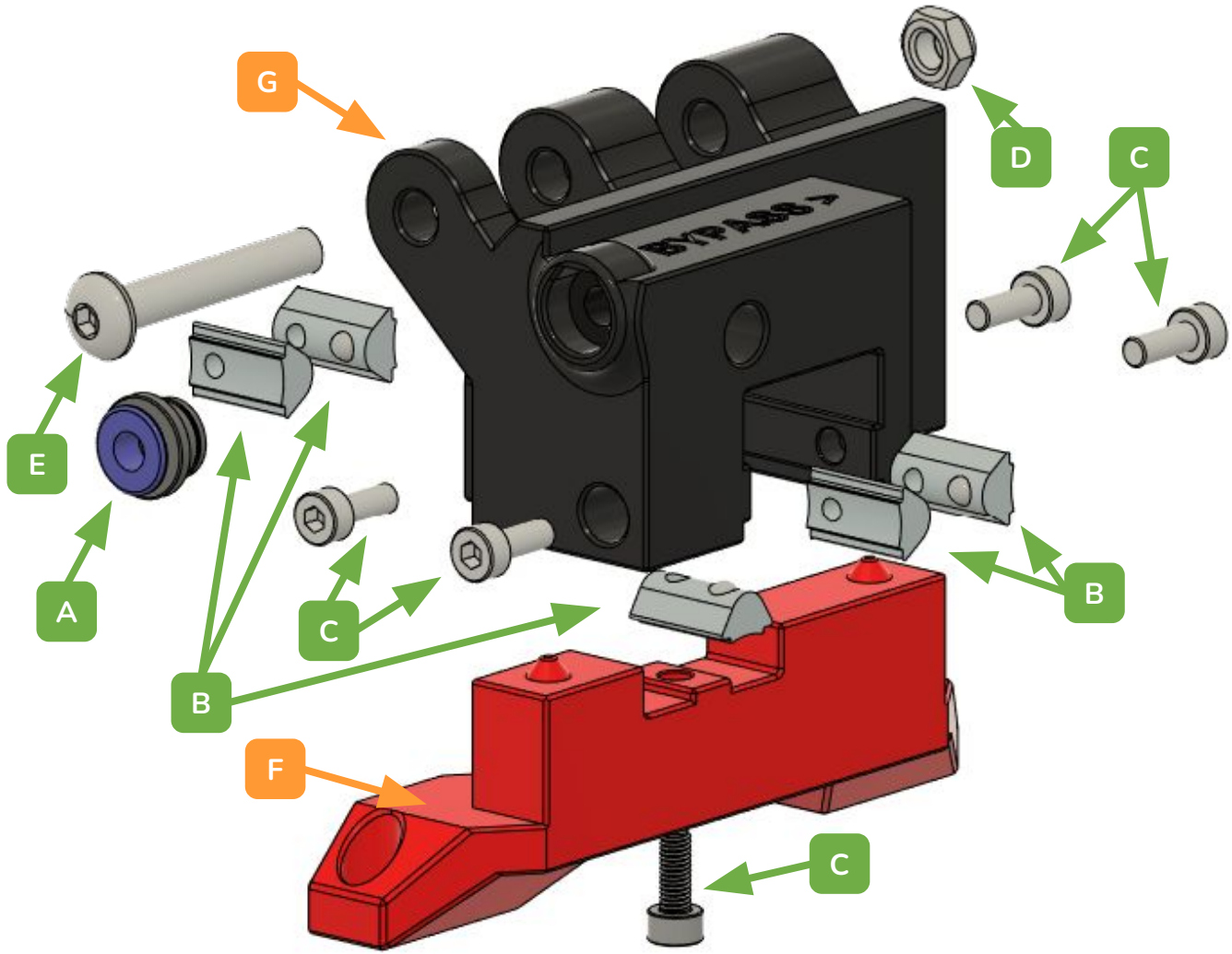
73

END BLOCK

END BLOCK AND FOOT SUB-BOM

A	1x ECAS Coupler (2 piece)
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

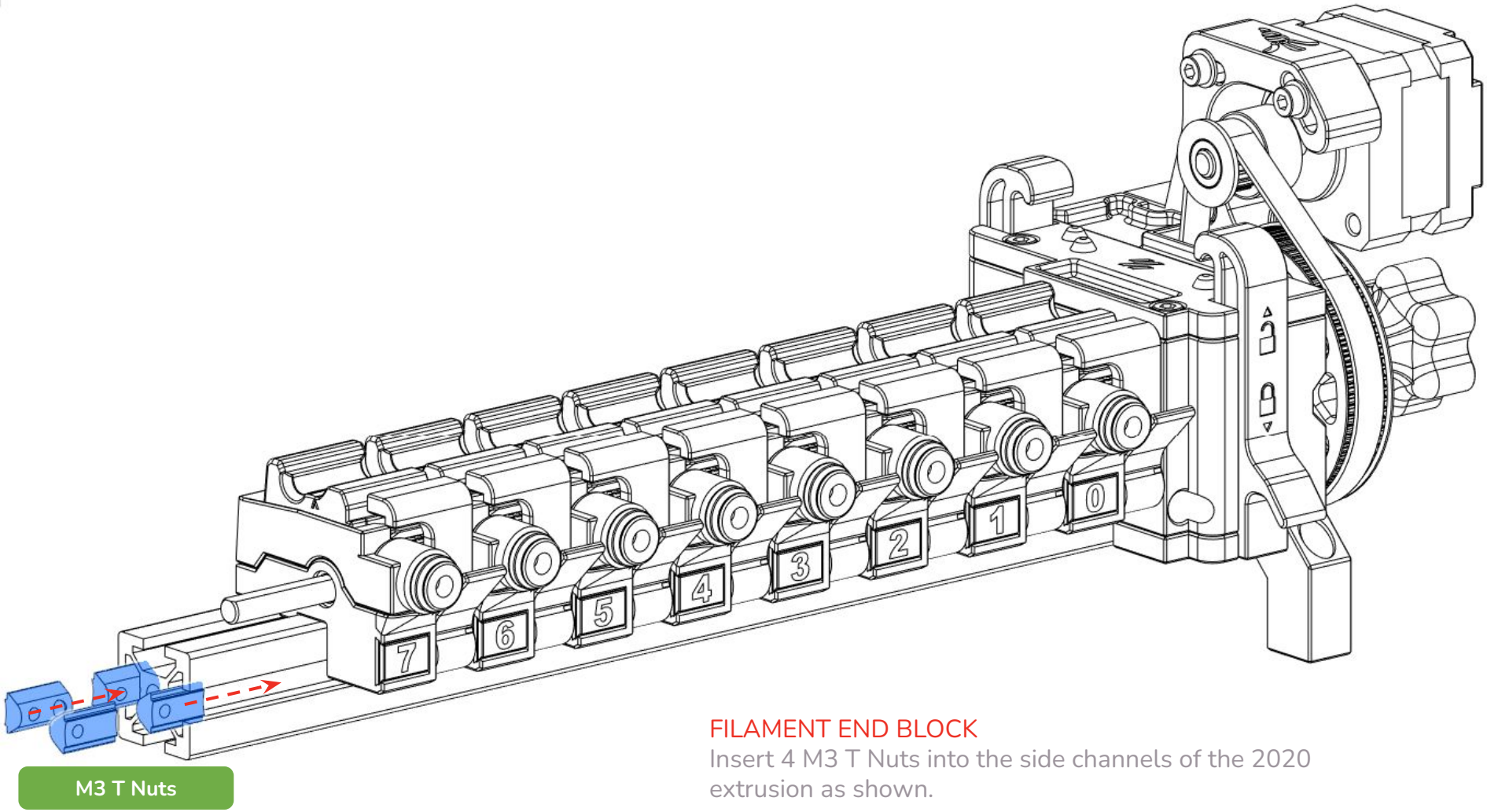
EXPLODED VIEW



**M5 screw and nut shown for completeness, but not used until Final Assembly.

74

FILAMENT END BLOCK



FILAMENT END BLOCK

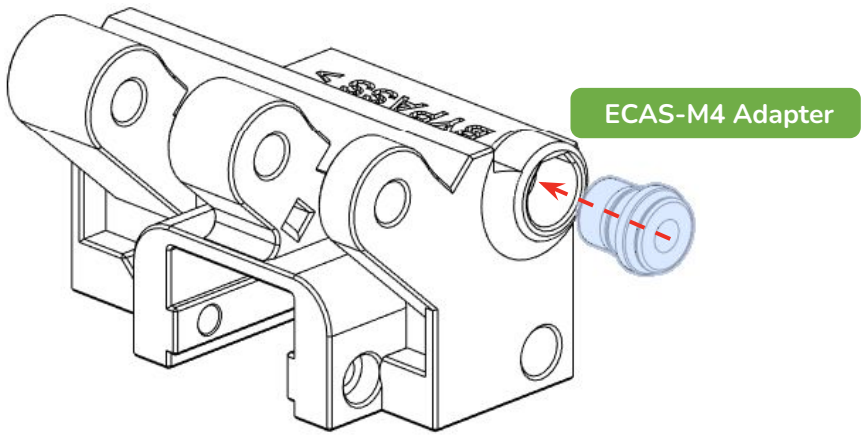
Insert 4 M3 T Nuts into the side channels of the 2020 extrusion as shown.

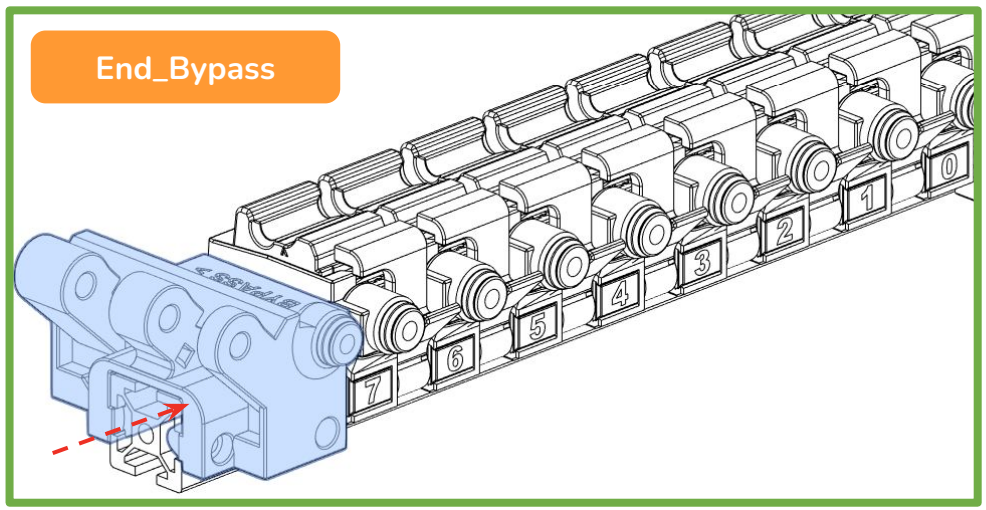
75

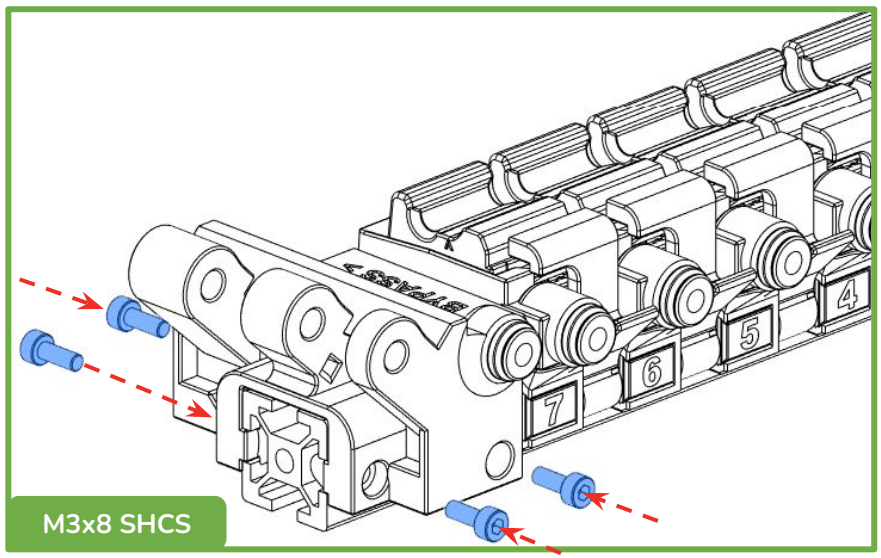
END FILAMENT BLOCK

ECAS ADAPTER

Insert an ECAS-M4 adapter into the End_Bypass Block.







INSTALL END FILAMENT BLOCK

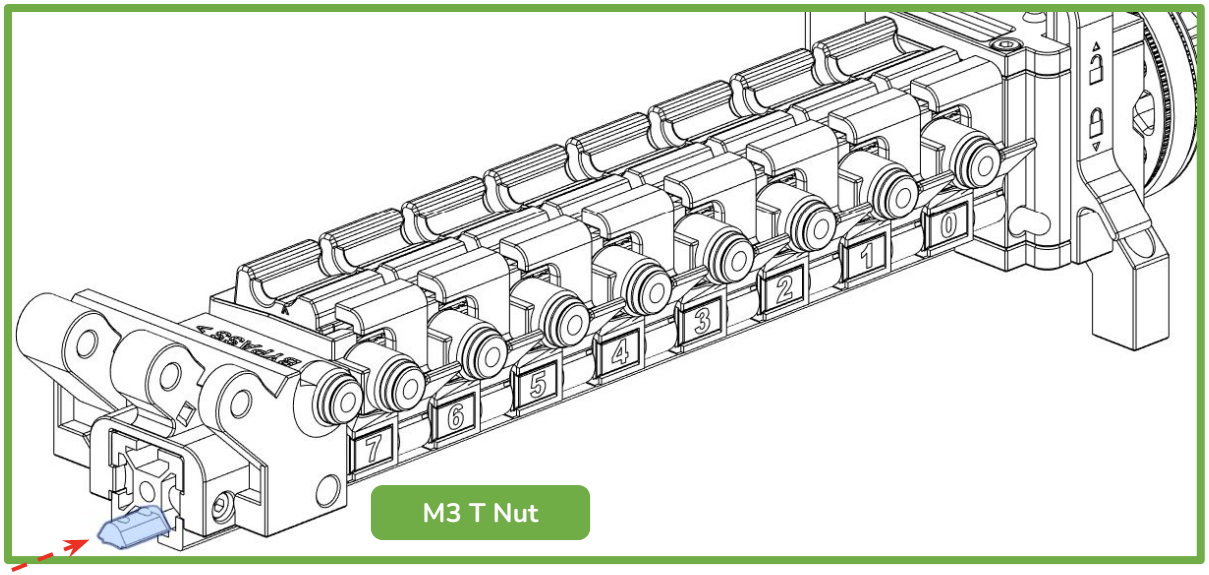
Slide the End_Bypass Block onto the 2020 and secure with 4 M3x8 SHCS screws.

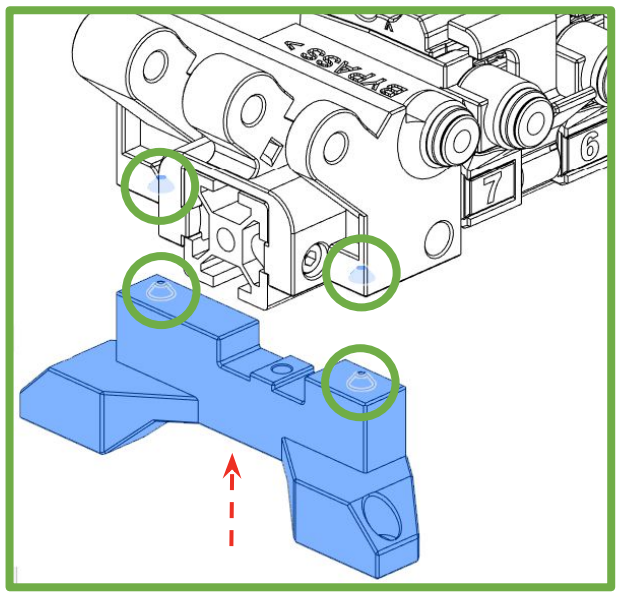
76

END BLOCK

FILAMENT BLOCK END FOOT

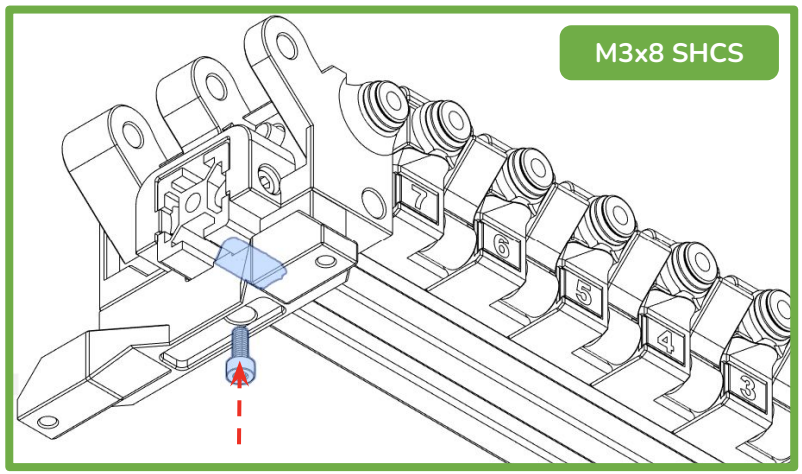
END BLOCK
Insert an M3 T Nut into the bottom channel of the 2020 extrusion as shown.





[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.

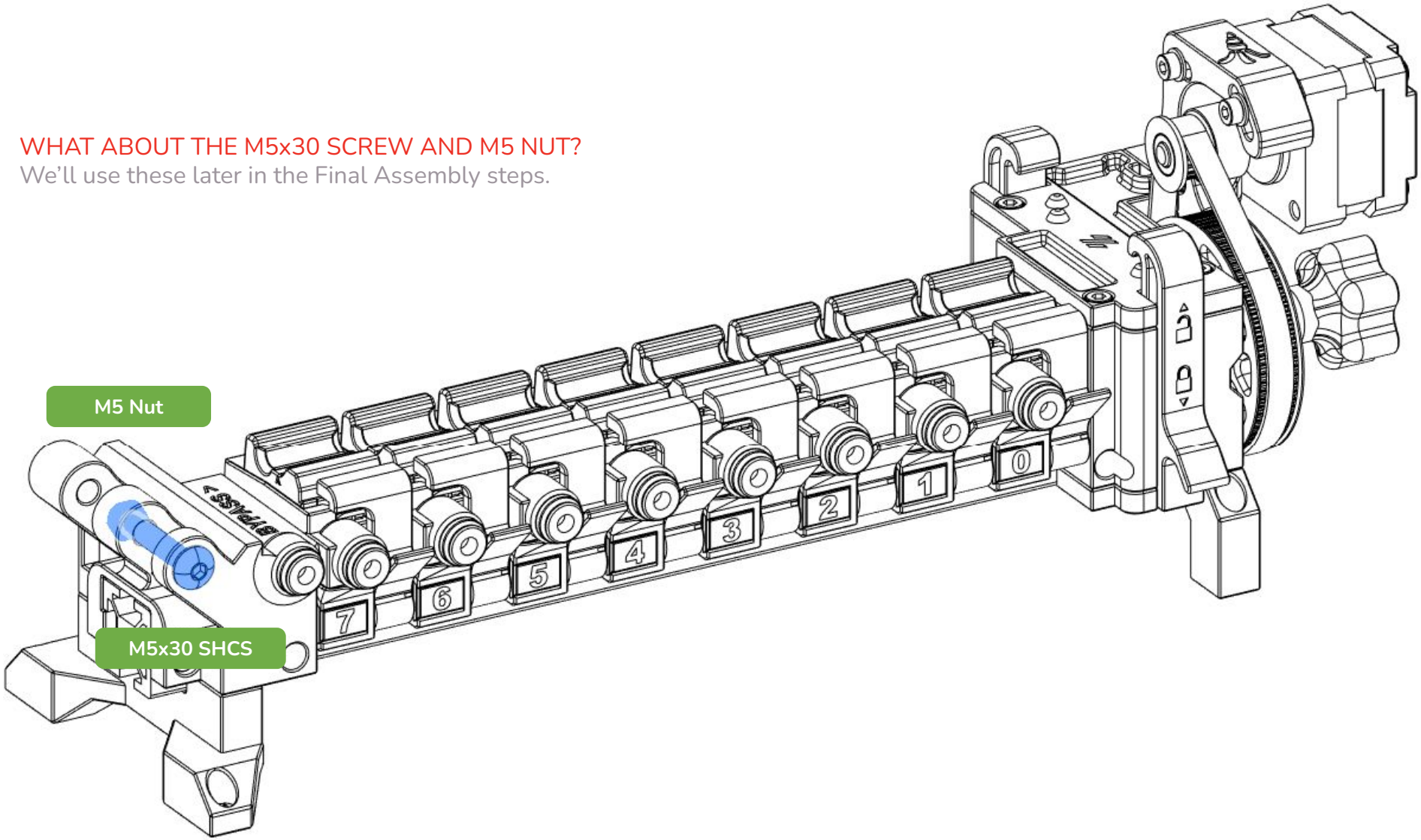


77

FILAMENT BLOCK END FOOT

WHAT ABOUT THE M5x30 SCREW AND M5 NUT?

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



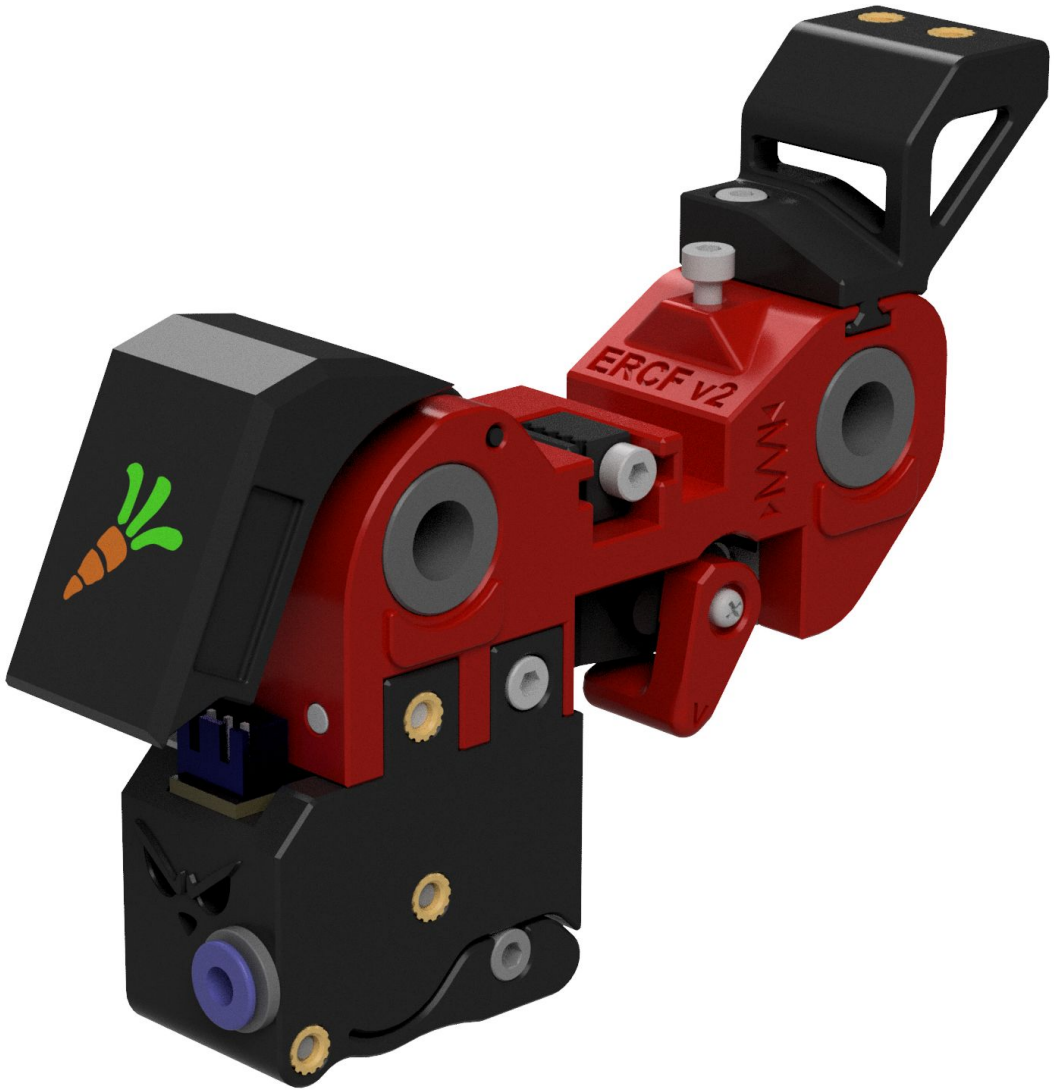
78

Why did the ERCF MMU go to school?

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

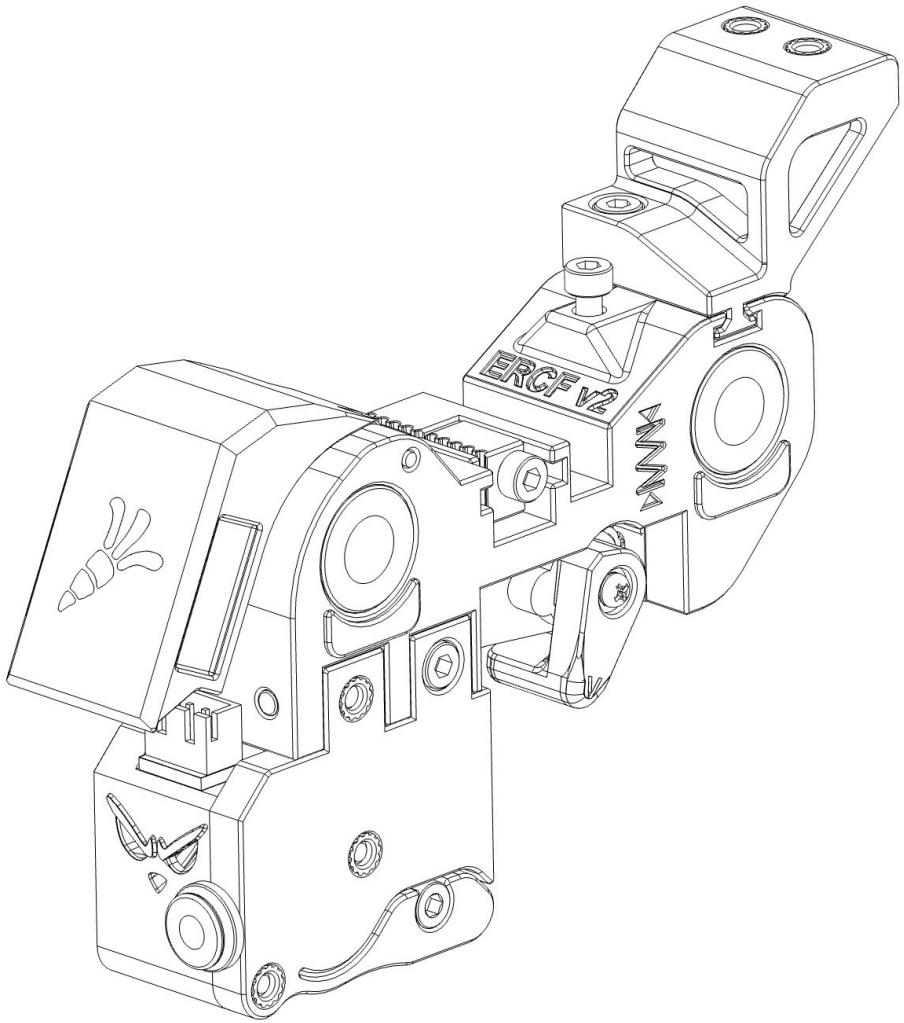
79

OVERVIEW



80

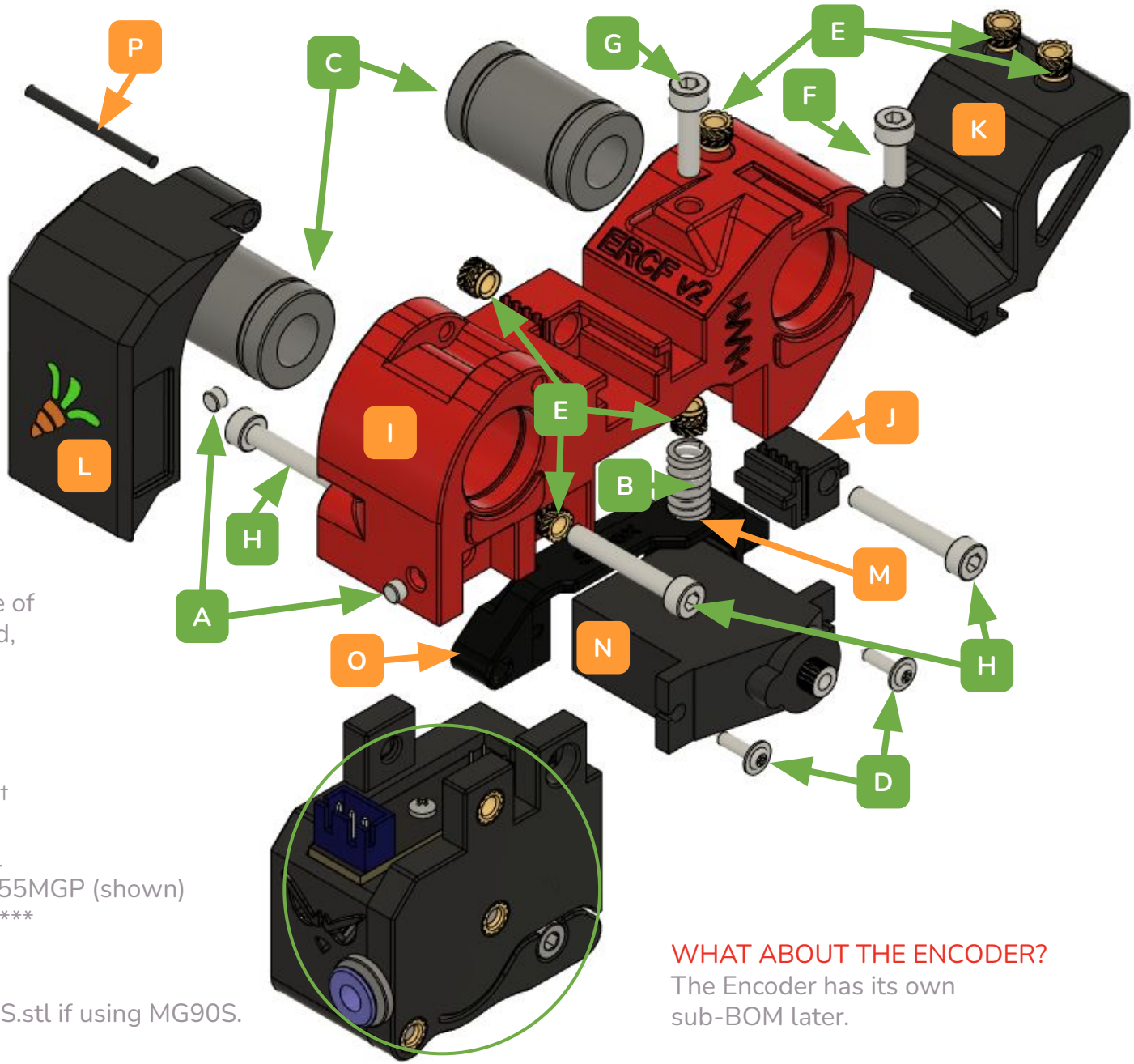
OVERVIEW



81

SELECTOR

EXPLODED VIEW



SELECTOR SUB-BOM

A	2x 3x2mm Magnet
B	1x 6x12x1mm Spring
C	2x LM8UU or RJ4JP-01-08
D	2x M2x10 Self-Tapping**
E	6x M3 Threaded Inserts
F	1x M3x8mm SHCS
G	1x M3x12mm SHCS
H	3x M3x20mm SHCS

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

I	1x [a]_Selector_Cart.stl
J	1x Belt_Tensioner.stl †
K	1x Drag_Chain_Anchor.stl †
L	1x Selector_Door.stl
M	1x Selector_Spring_Cap.stl
N	1x Servo, MG90S or SH0255MGP (shown)
O	1x Servo_Mount_Savox.stl***
P	1x Piece of Filament

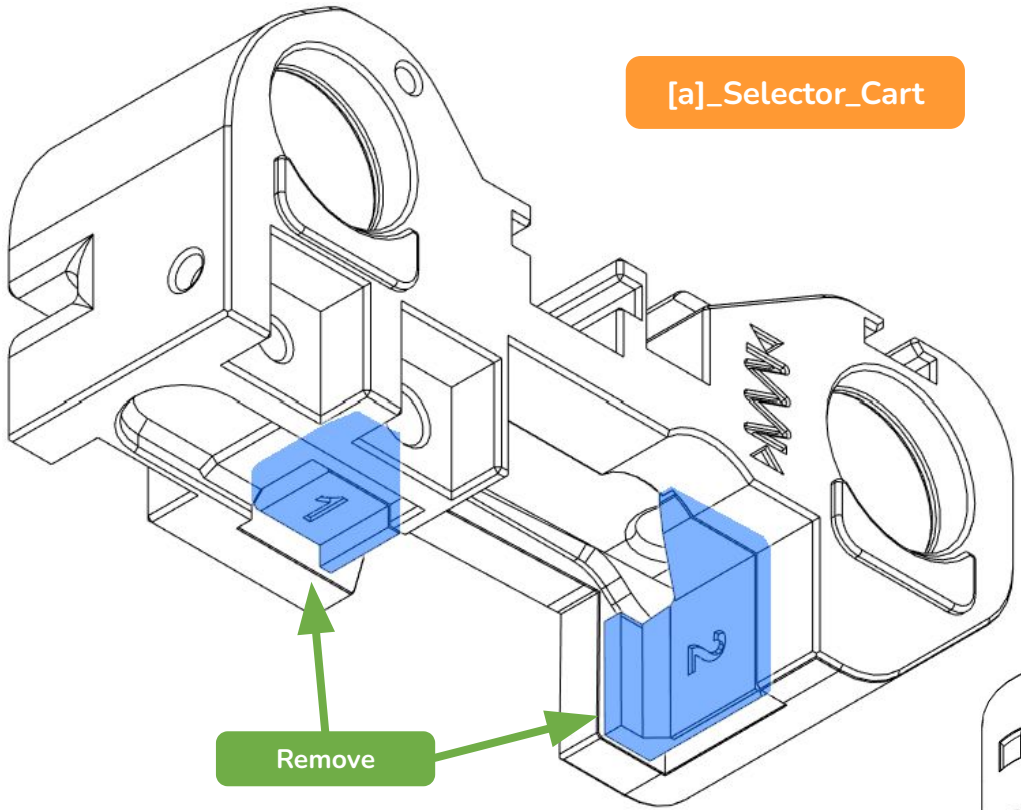
***Or Servo_Mount_MG90S.stl if using MG90S.

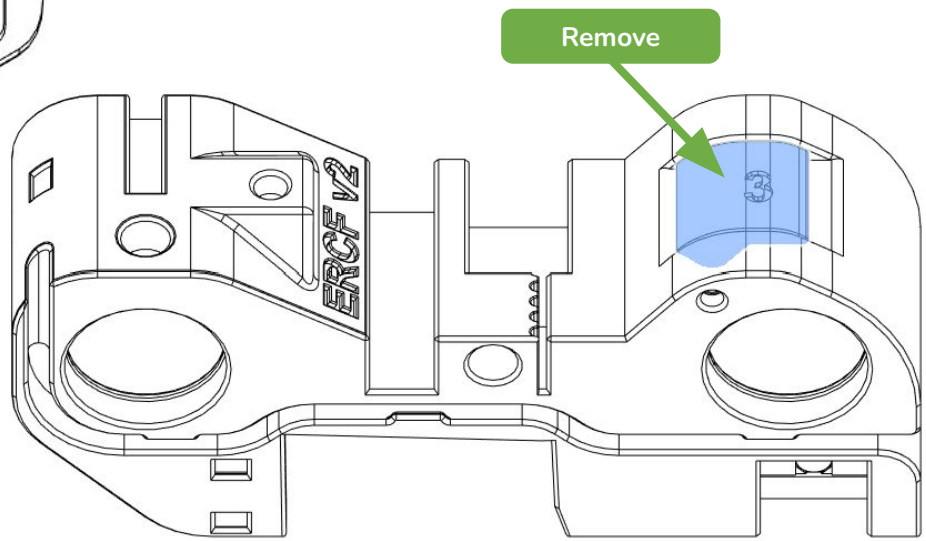
WHAT ABOUT THE ENCODER?

The Encoder has its own sub-BOM later.

SELECTOR CART PREPARATION

[a]_Selector_Cart





REMOVE BUILT-IN SUPPORTS

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

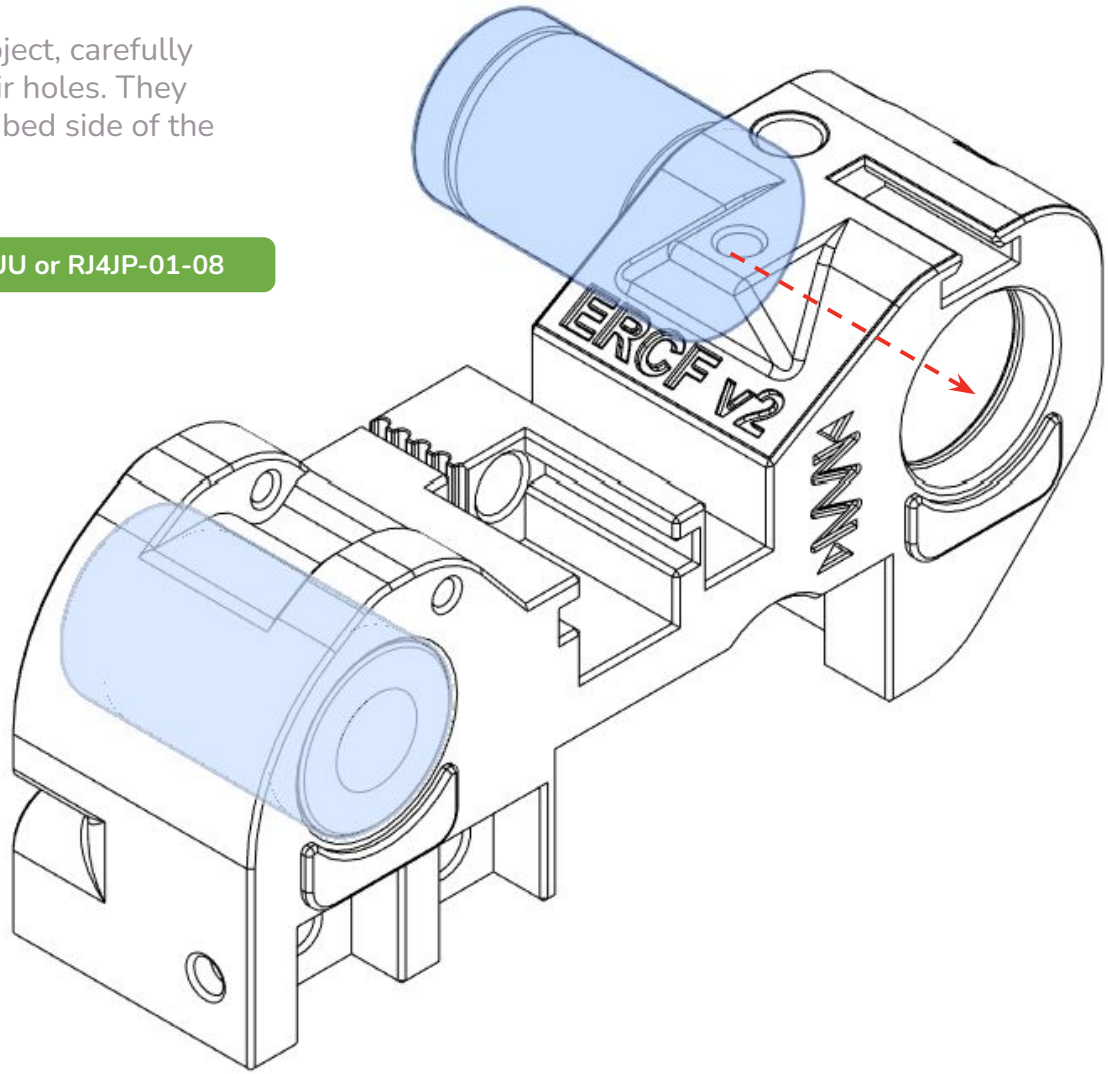
83

SELECTOR CART BEARINGS

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

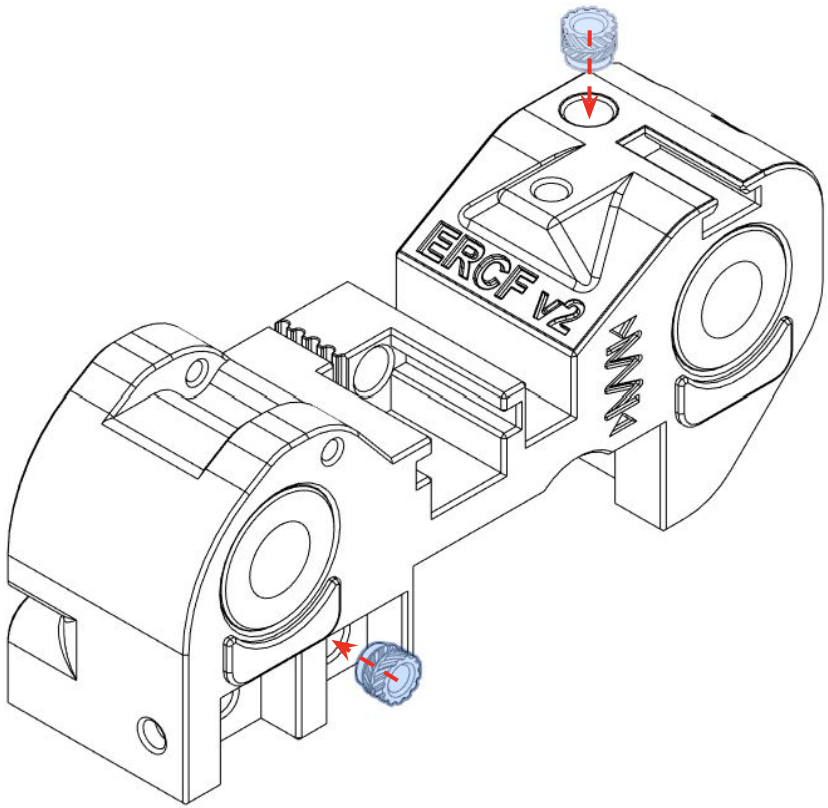


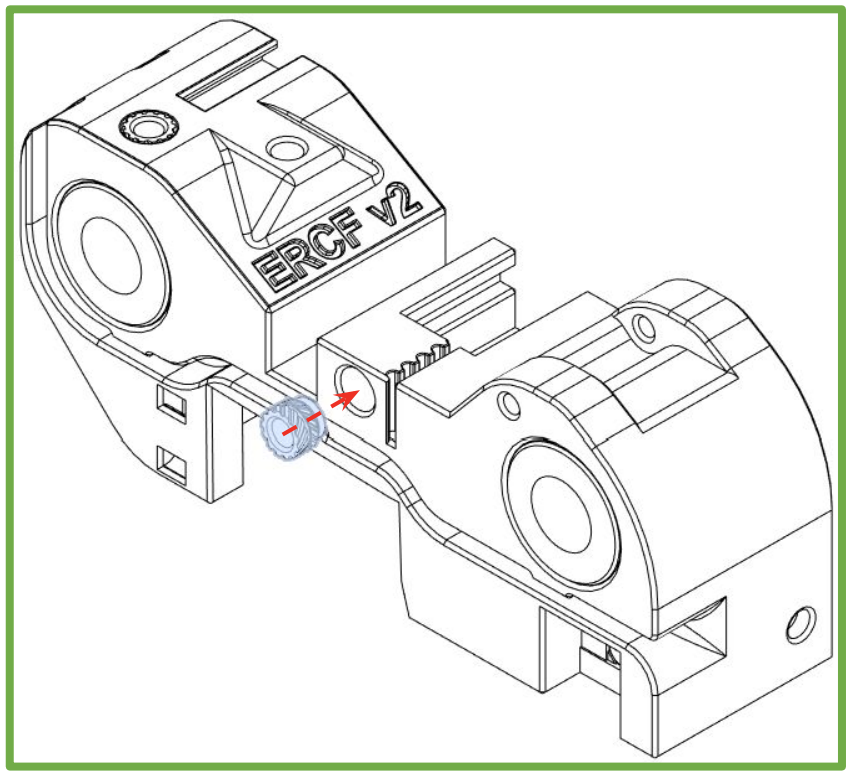
84

SELECTOR CART HEAT SET INSERTS

HEAT SET INSERTS

The list of pages with heat set inserts is on Page 15.





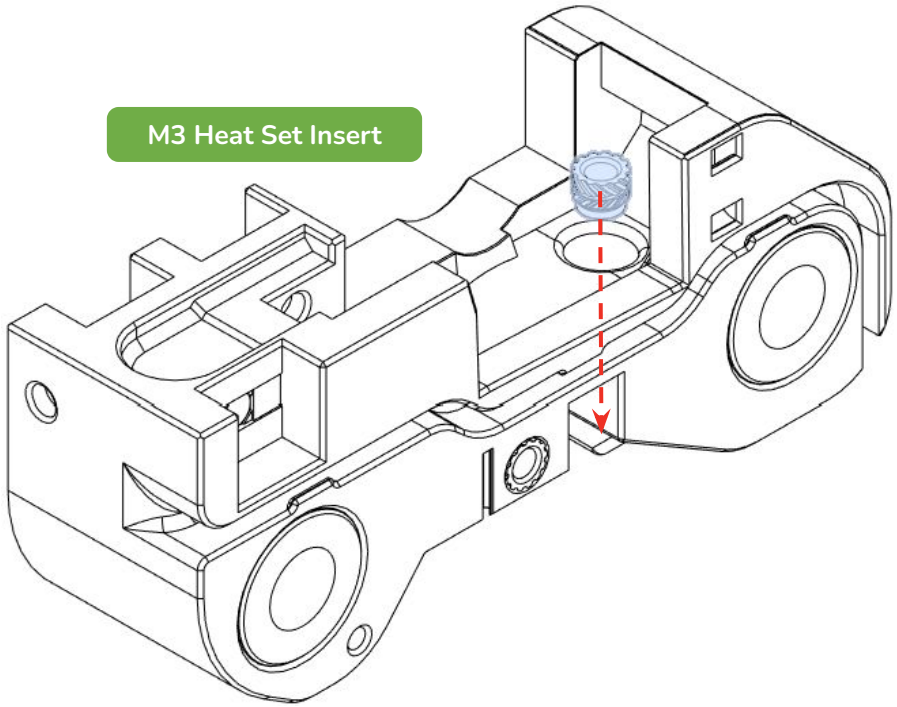
M3 Heat Set Inserts

85

SELECTOR CART SPRING HEATSET

HEAT SET INSERTS

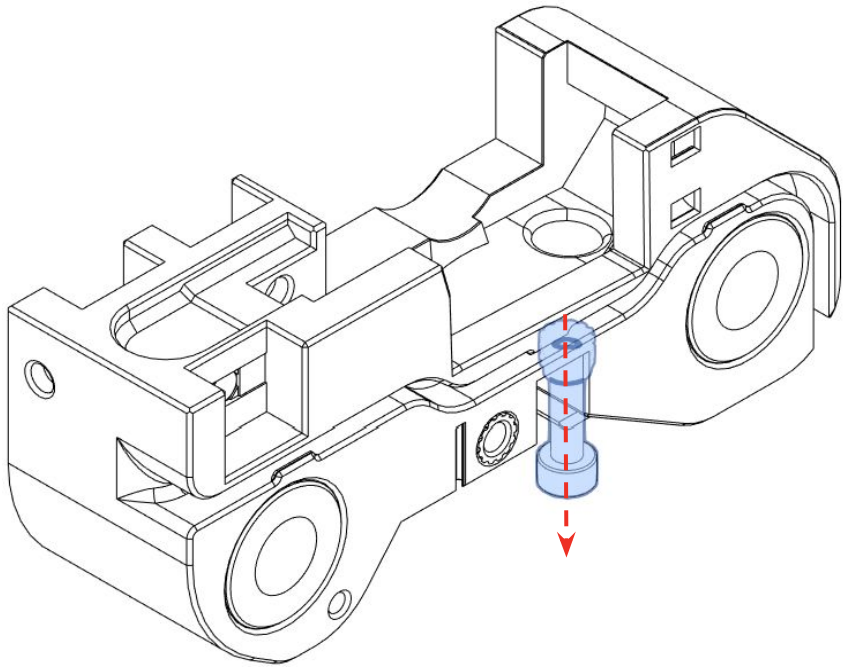
The list of pages with heat set inserts is on Page 15.



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, ¼", or 17/64" sized bits.



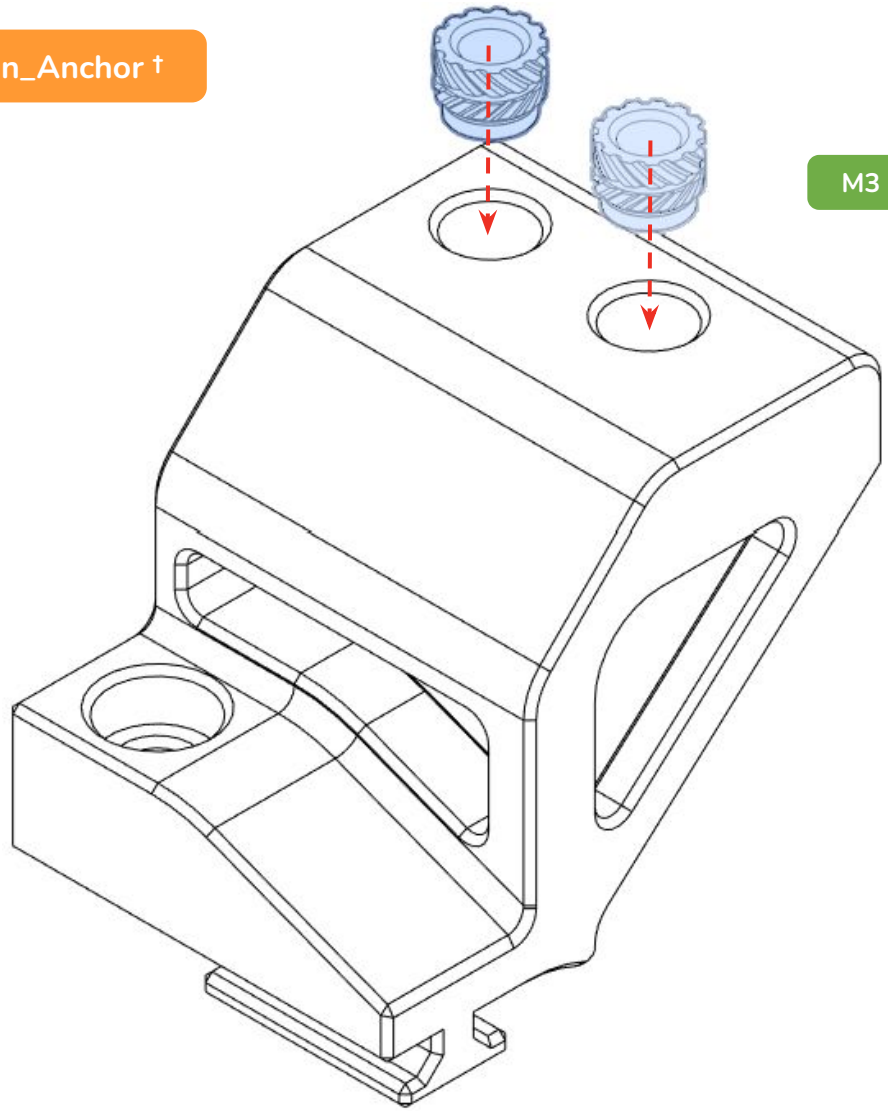
86

DRAG CHAIN ANCHOR HEAT SET INSERTS

HEAT SET INSERTS

The list of pages with heat set inserts is on Page 15.

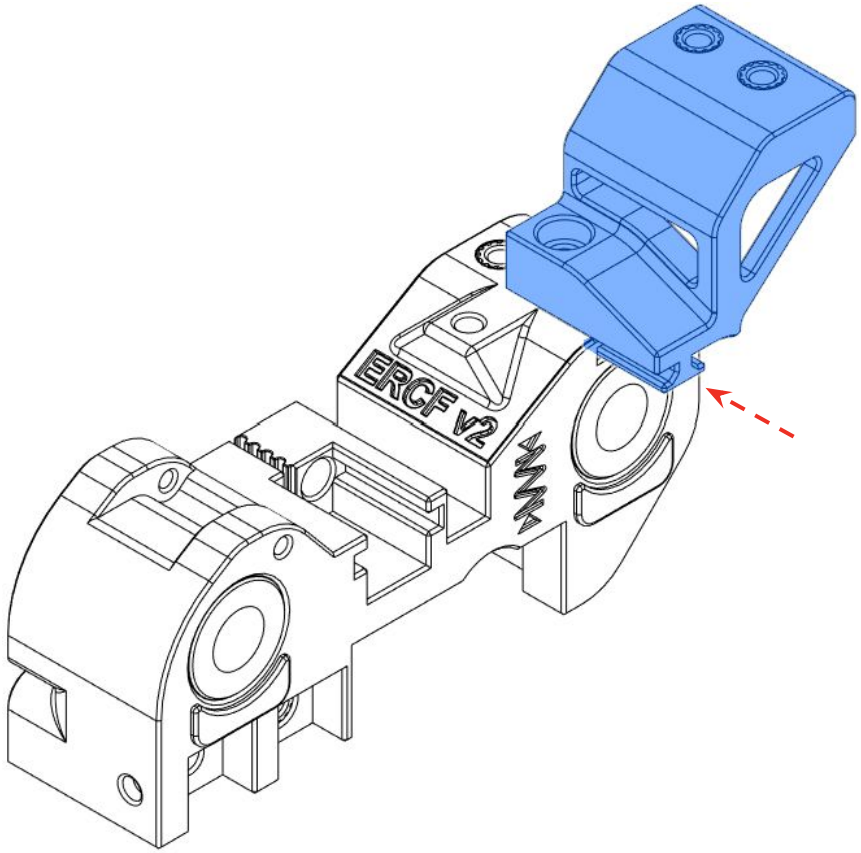
Drag_Chain_Anchor †



M3 Heat Set Inserts

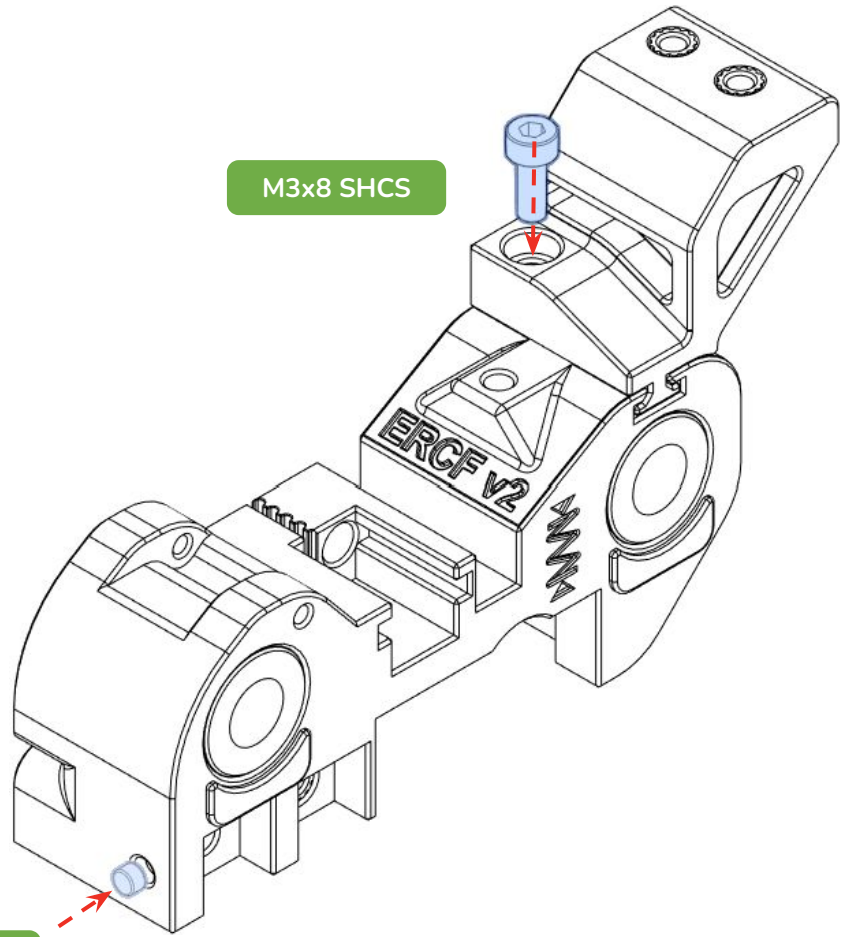
87

DRAG CHAIN ANCHOR



Drag_Chain_Anchor †

M3x8 SHCS



3x2mm Magnet

DRAG CHAIN AND MAGNET

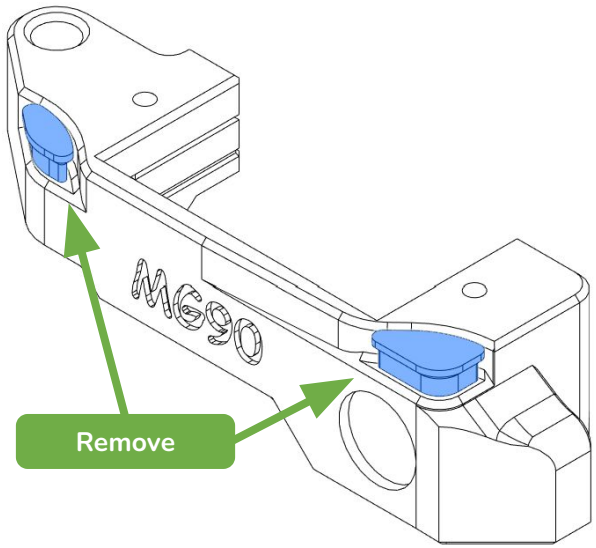
Slide the Drag_Chain_Anchor † into the dovetail groove on the Selector_Cart and install with an M3x8 SHCS screw.

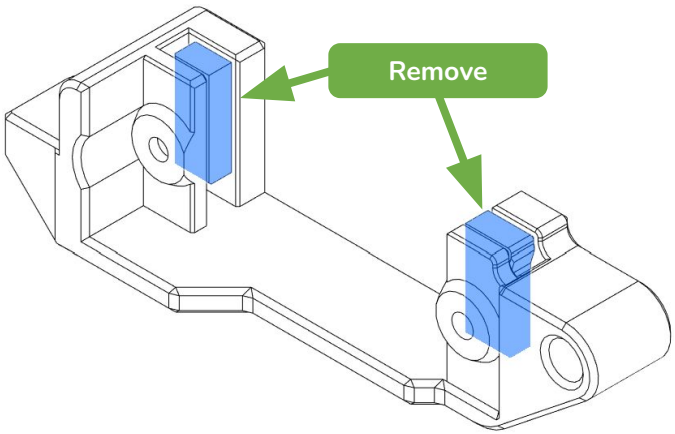
Add a drop of CA glue and Insert the 3x2mm magnet into its slot.

88

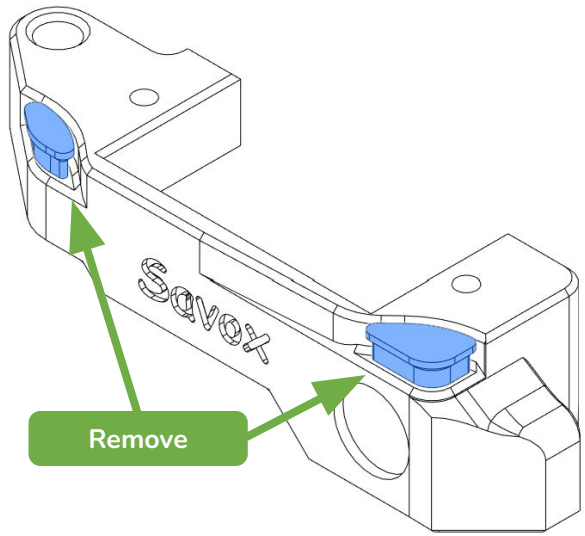
SERVO MOUNT PREPARATION

Servo_Mount_MG90S





Servo_Mount_Savox



SERVO MOUNT PRINT IN PLACE SUPPORTS

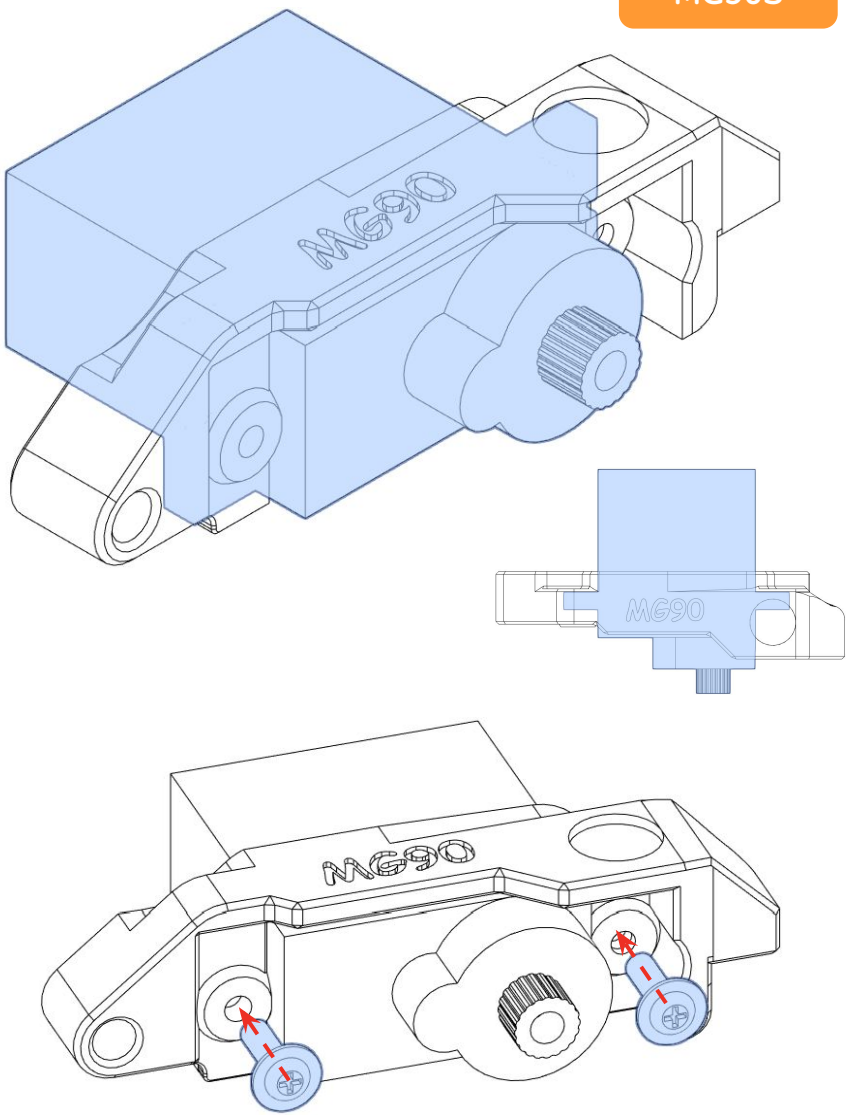
Use a small tool, like a small flat screwdriver to remove the built-in supports.

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.

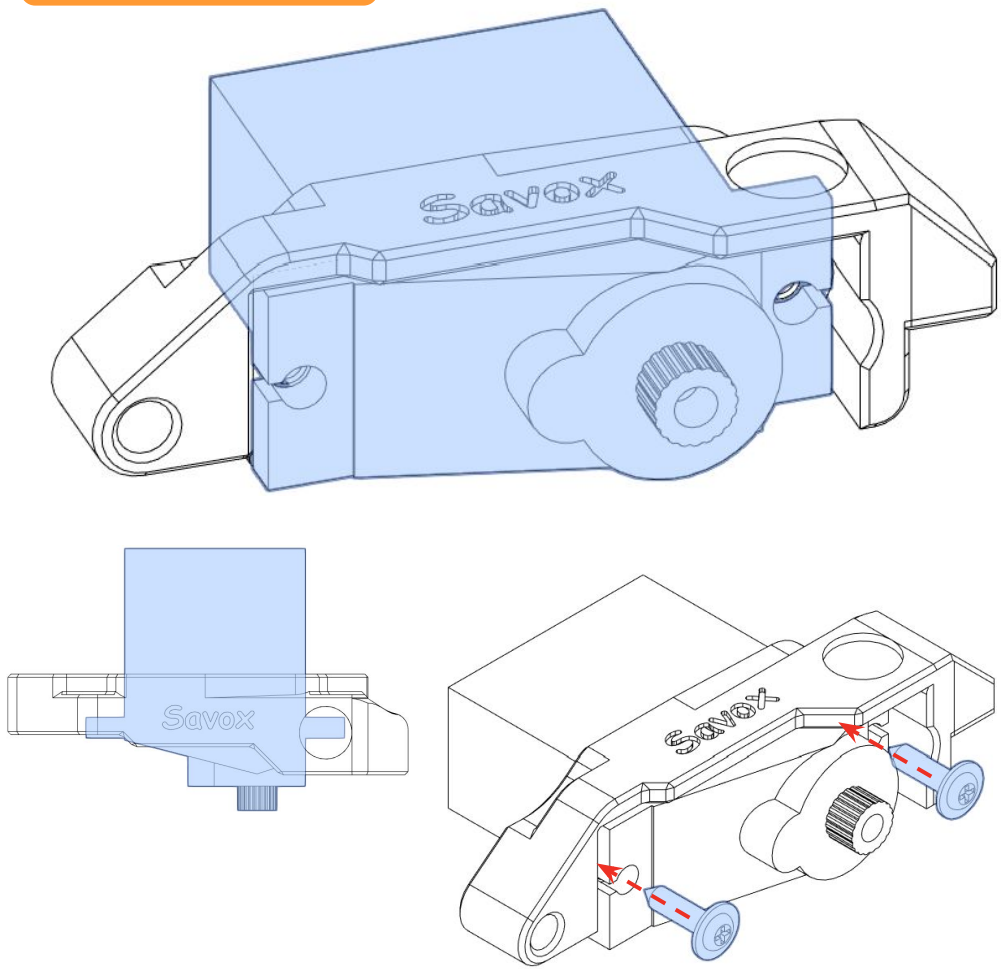
89

SERVO MOUNTING

MG90S



Savox SH0255MGP



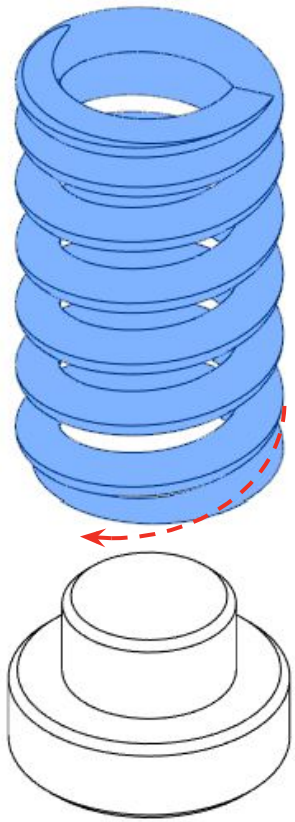
SERVO SCREWS

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.

90

SPRING INSTALL

12x6mm 1mm OD Compression Spring



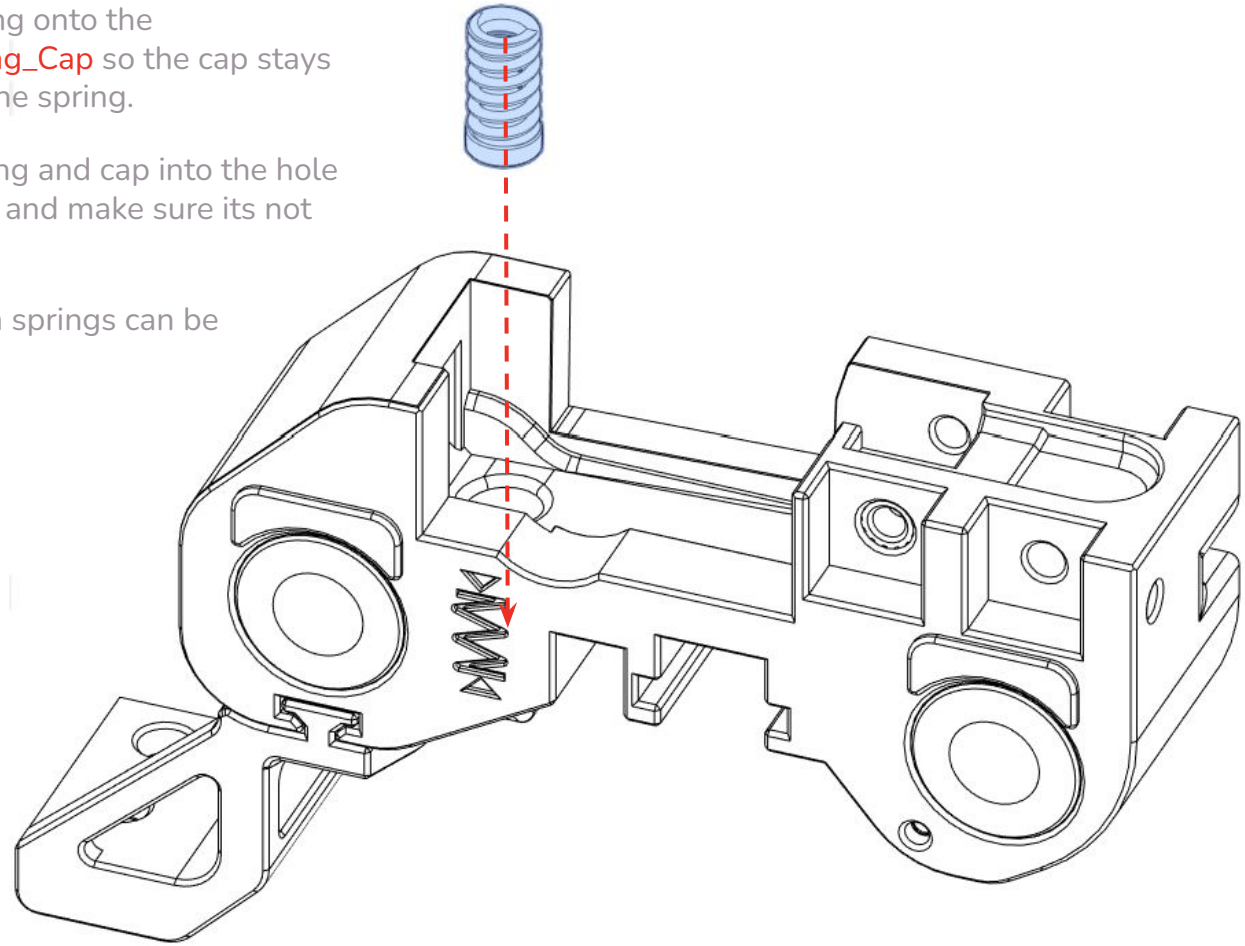
Selector_Spring_Cap

SPRING CAP

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

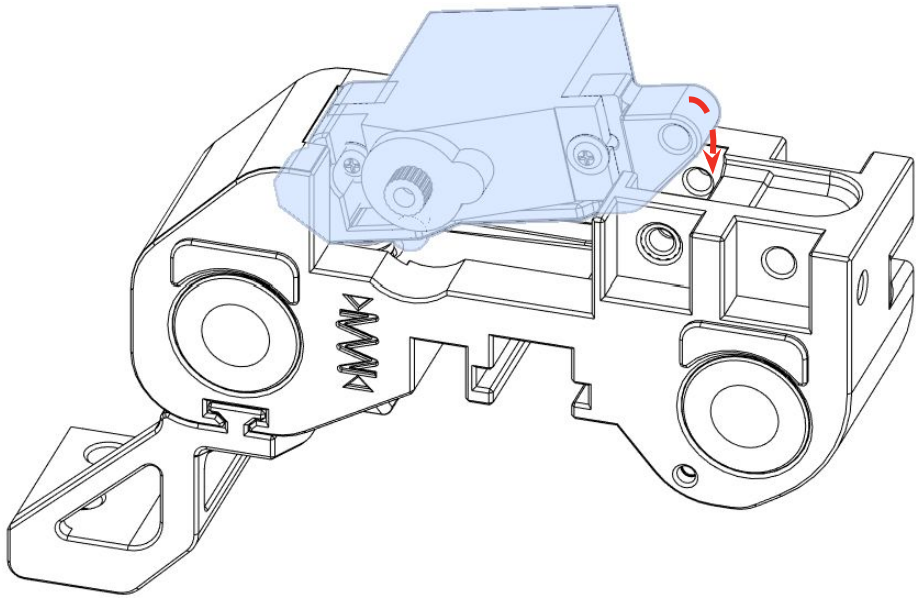
Insert the spring and cap into the hole in the selector and make sure its not obstructed.

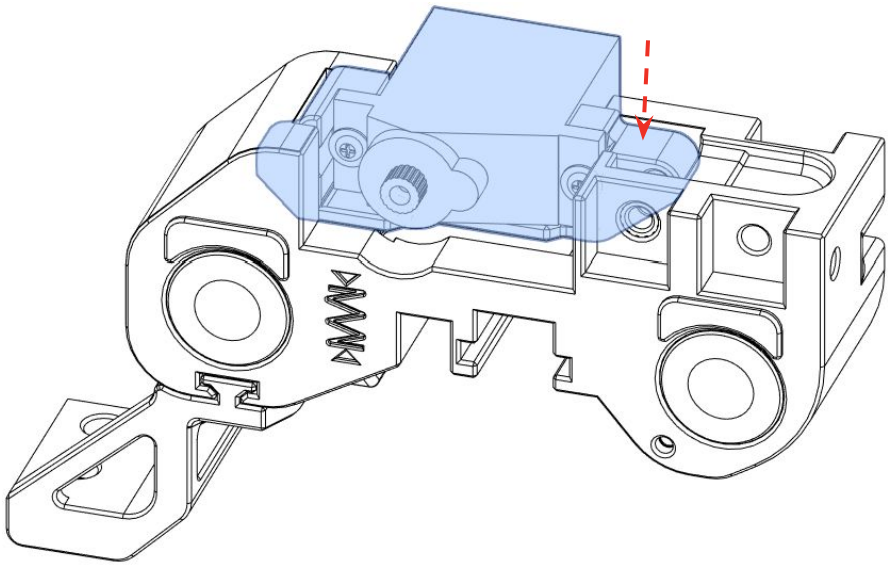
Shorter 10mm springs can be used as well.

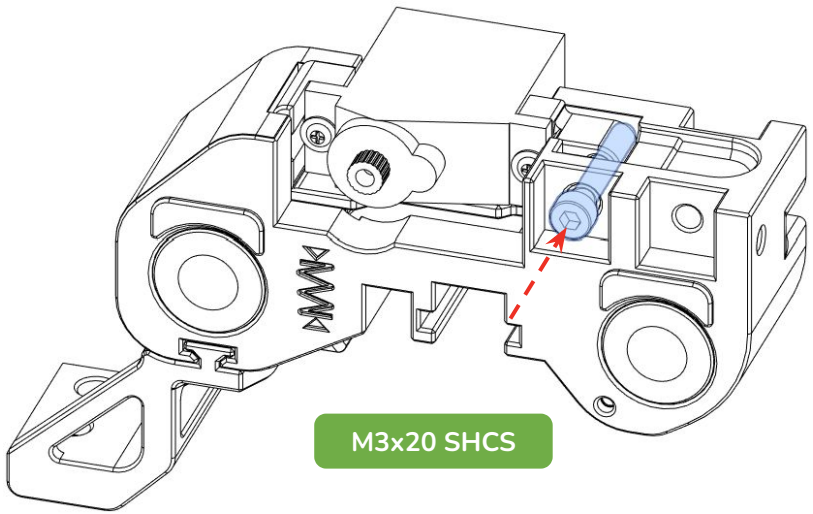


91

SERVO INSTALLATION







SERVO INSTALLATION

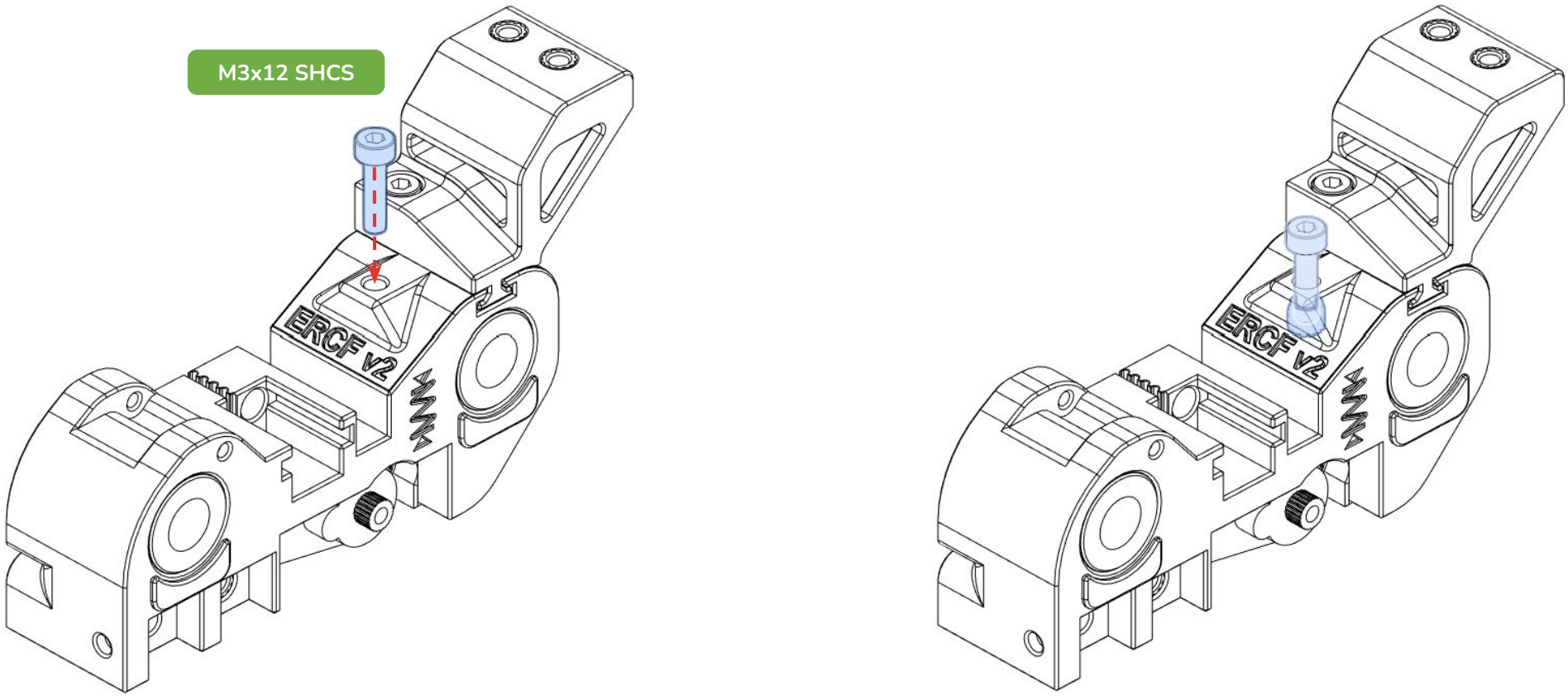
Angle the Servo_Mount, insert it into the captive channel in the Selector_Cart and press down into the pivot point. The spring should push against the Servo_Mount preventing it from fully seating.

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.

92

TENSION SCREW INSTALLATION

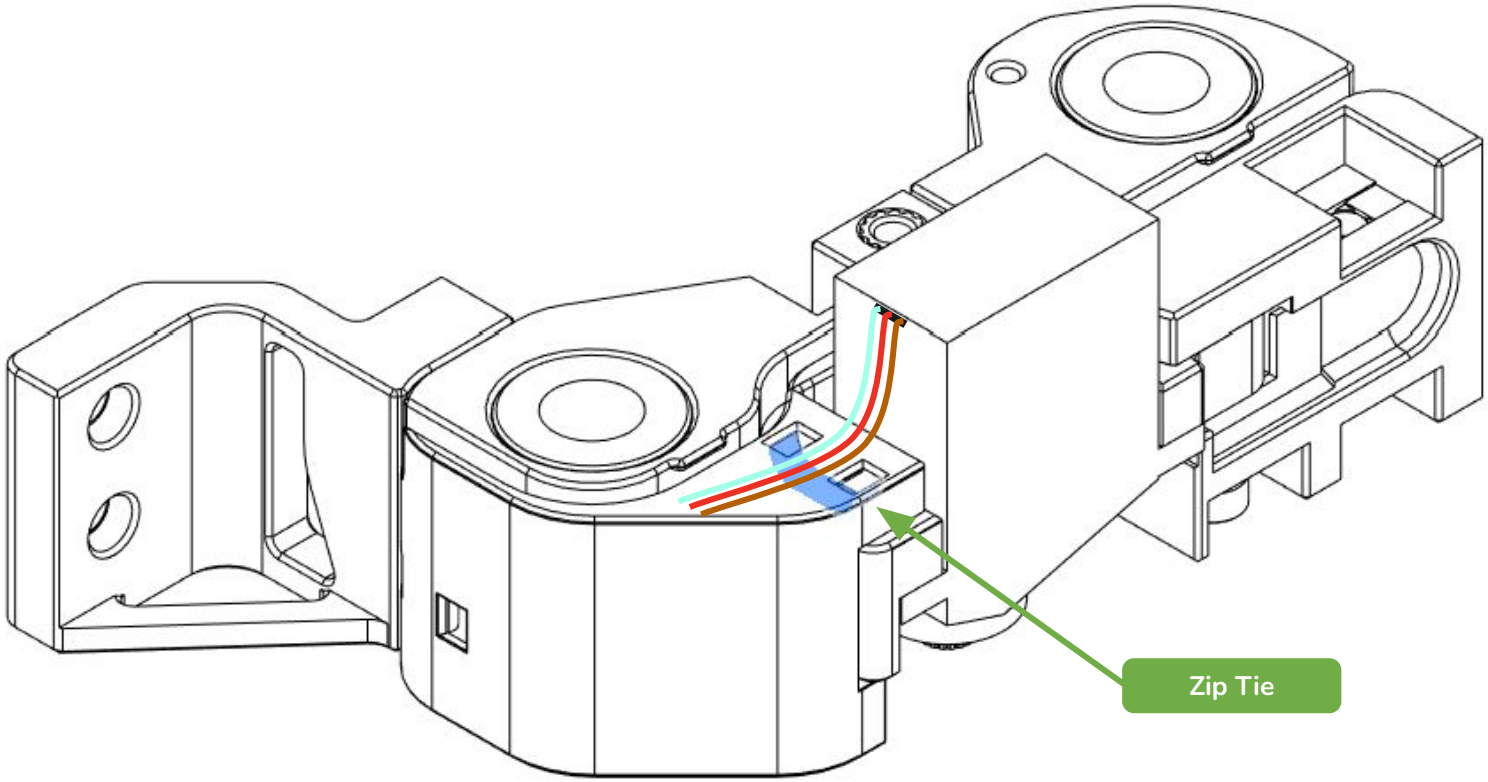


SPRING TENSION SCREW INSTALLATION

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

93

SERVO WIRES



SERVO WIRES

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

94

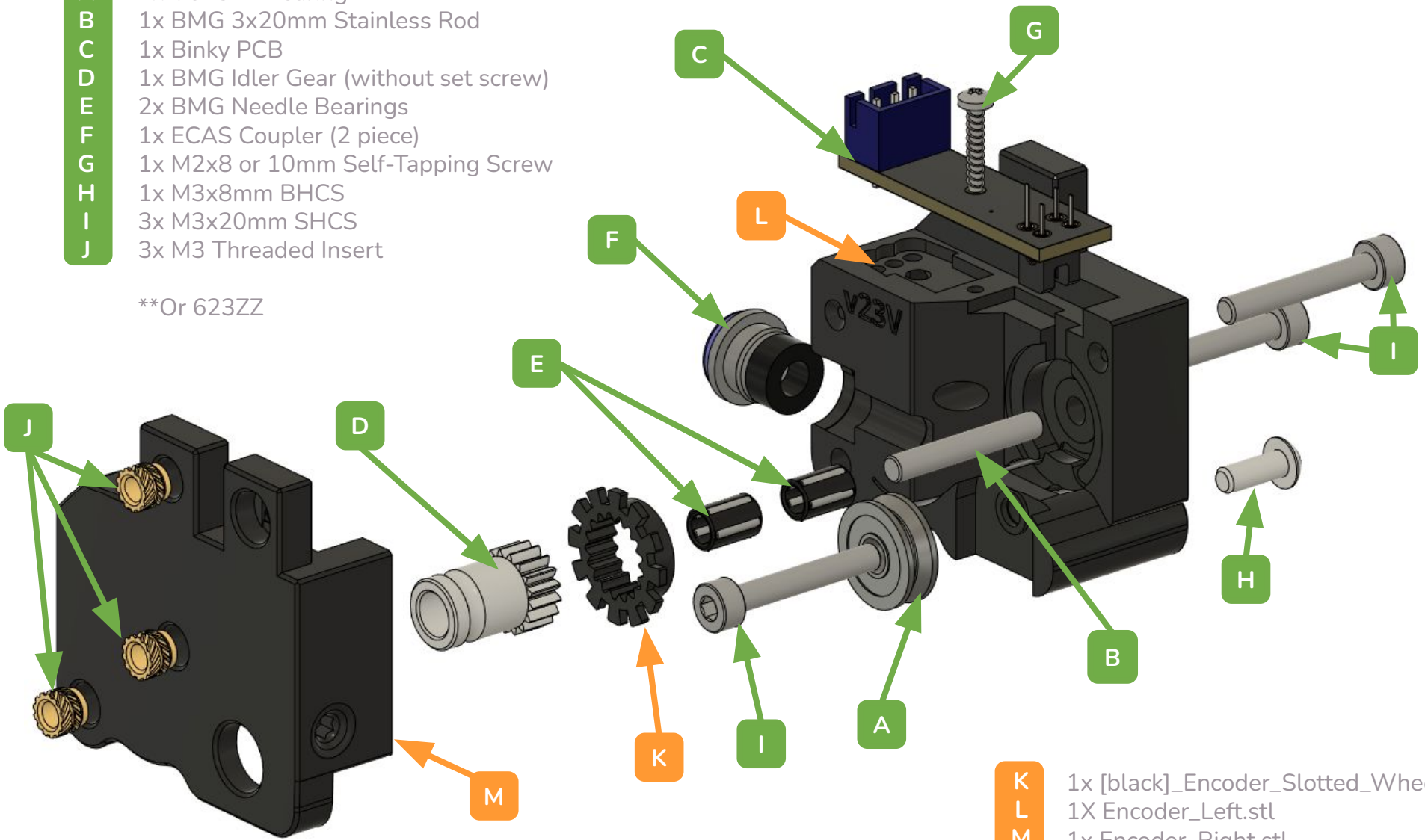
SELECTOR : ENCODER

ENCODER SUB-BOM

A	1x V623ZZ 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 Coupler (2 piece)
G	1x M2x8 or 10mm Self-Tapping Screw
H	1x M3x8mm BHCS
I	3x M3x20mm SHCS
J	3x M3 Threaded Insert

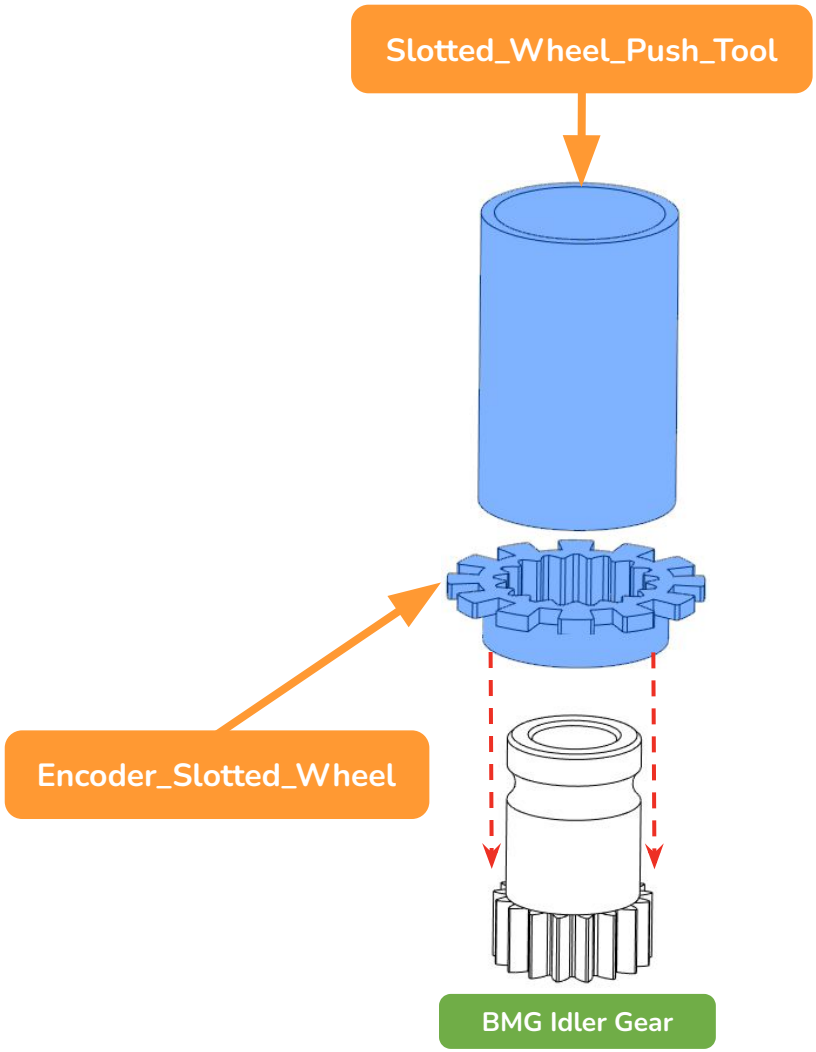
**Or 623ZZ

ENCODER EXPLODED VIEW



K	1x [black]_Encoder_Slotted_Wheel.stl
L	1X Encoder_Left.stl
M	1x Encoder_Right.stl

ENCODER PREPARATION



INSTALL ENCODER WHEEL

Before fitting the Encoder_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 Encoder_Slotted_Wheel onto the gear until it reaches the teeth.

Use the Slotted_Wheel_Push_Tool to **gently** push the Encoder_Slotted_Wheel into place until it is flush with the end of the gear using a small hammer.

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

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

96

SELECTOR : ENCODER

V623ZZ VS MR623ZZ BEARINGS

There are two versions of the Encoder:

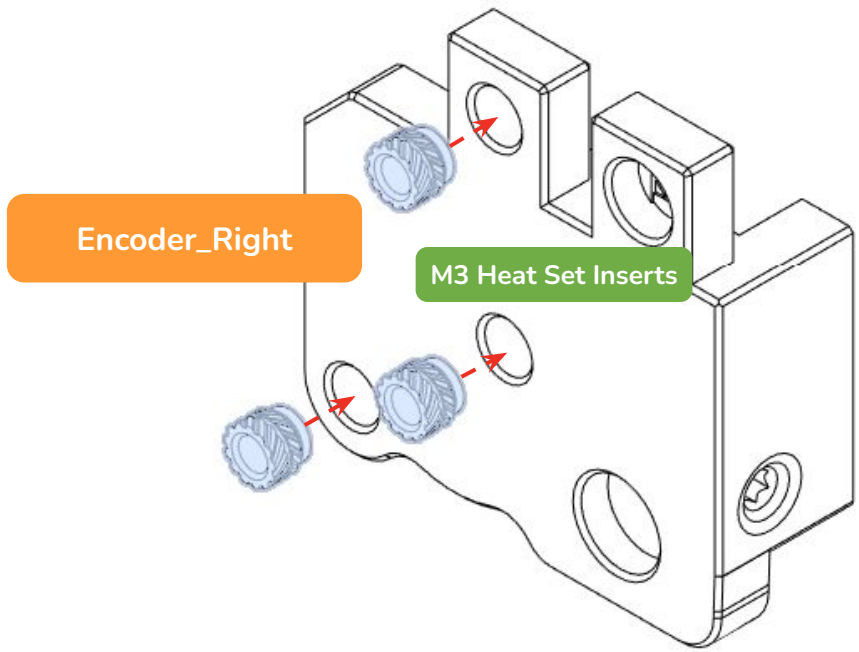
One using the rarer, but better-performing V623ZZ bearing. This is our default, preferred option.

One using the much more easily-sourced MR623ZZ flat bearing. These files are in the folder:

ERCF_v2 / Stls / Selector / Encoder_Flat_Bearing_Option

We will show the V623ZZ version of the Encoder. Installation is virtually identical for the MR623ZZ option.

ENCODER PREPARATION

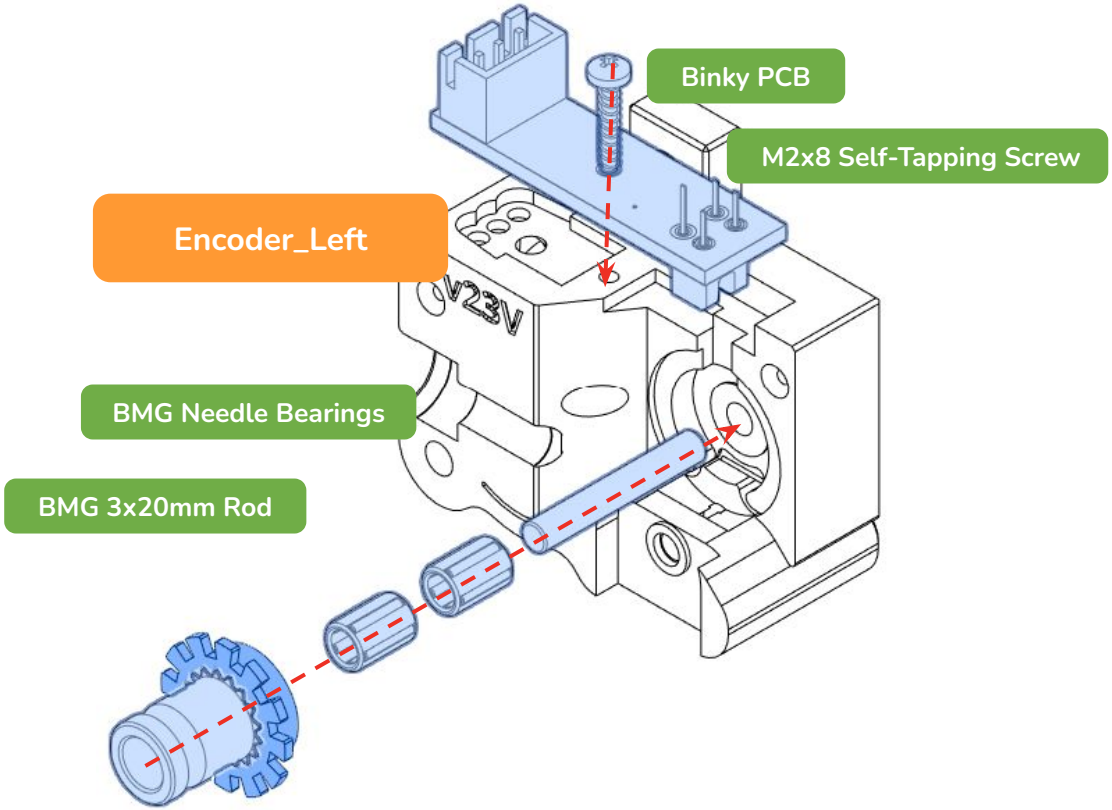


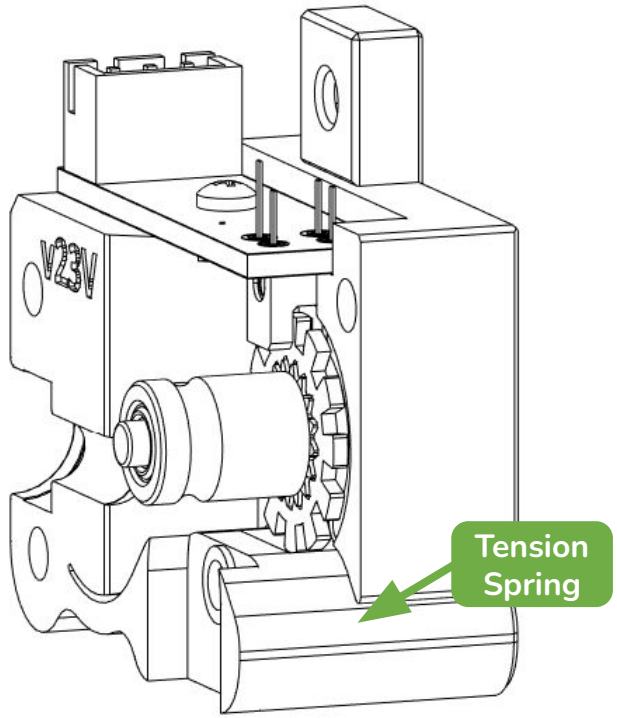
HEAT SET INSERTS

The list of pages with heat set inserts is on Page 15.

97

ENCODER ASSEMBLY





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.

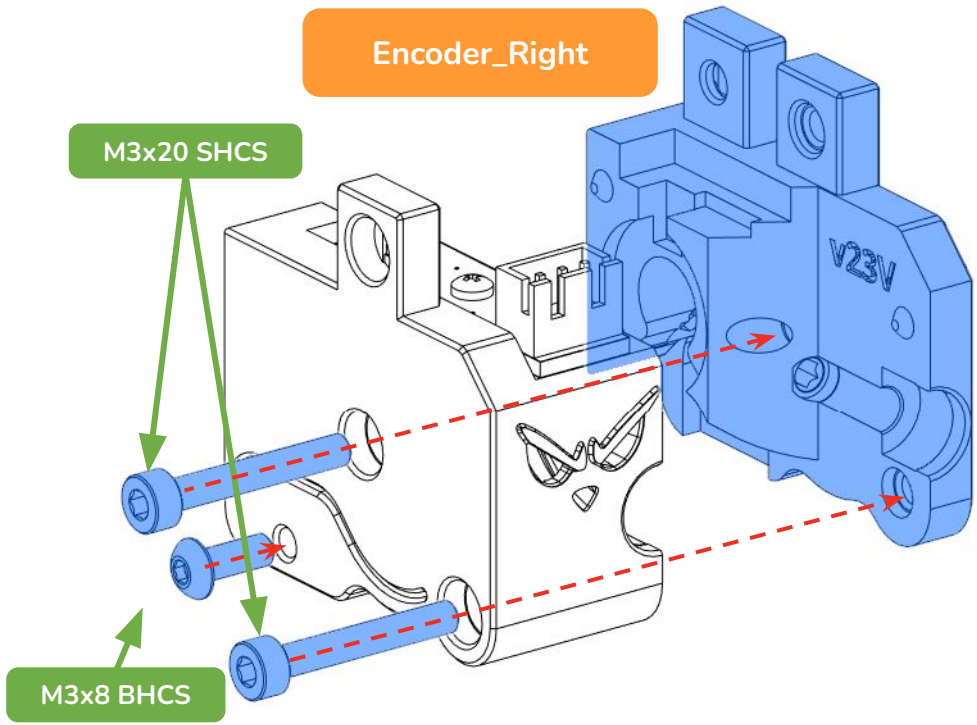
CHECK POINT

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.

98

SELECTOR : ENCODER

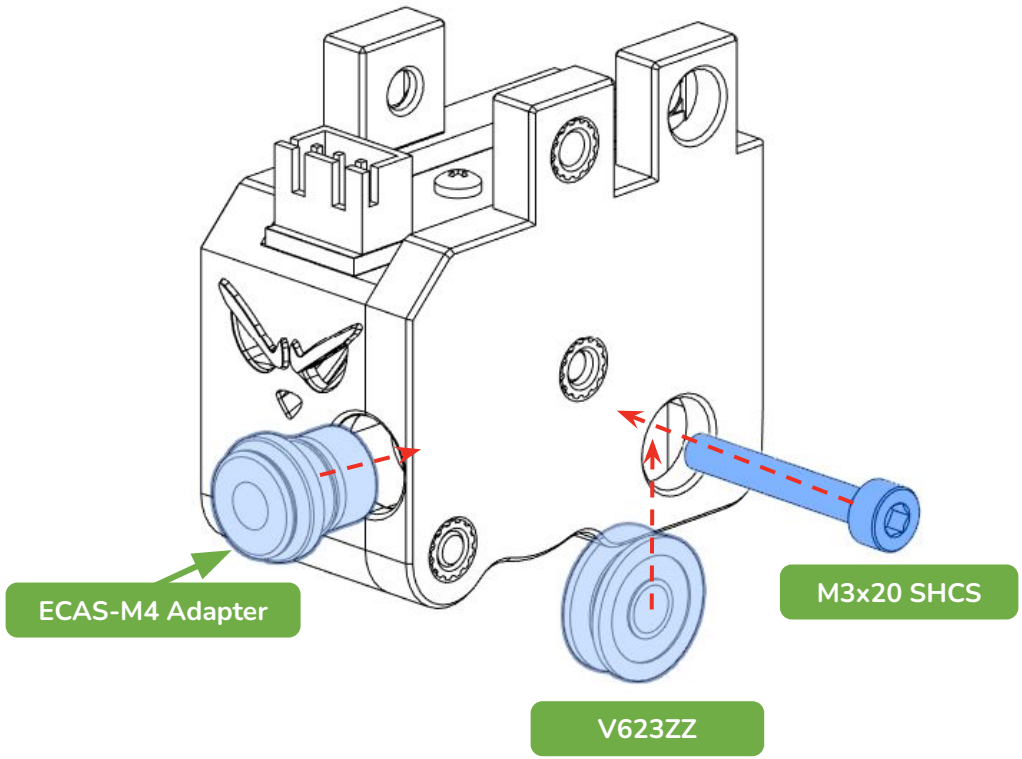


ASSEMBLY

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

Screw and self-tap the M3x8 SHCS into the plastic hole on the Tension Spring as the plunger for the homing endstop located in the gearbox housing. You can adjust the screw in or out to calibrate the home position during software setup. One full rotation of the screw will move it in or out 0.5mm.

ENCODER ASSEMBLY



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

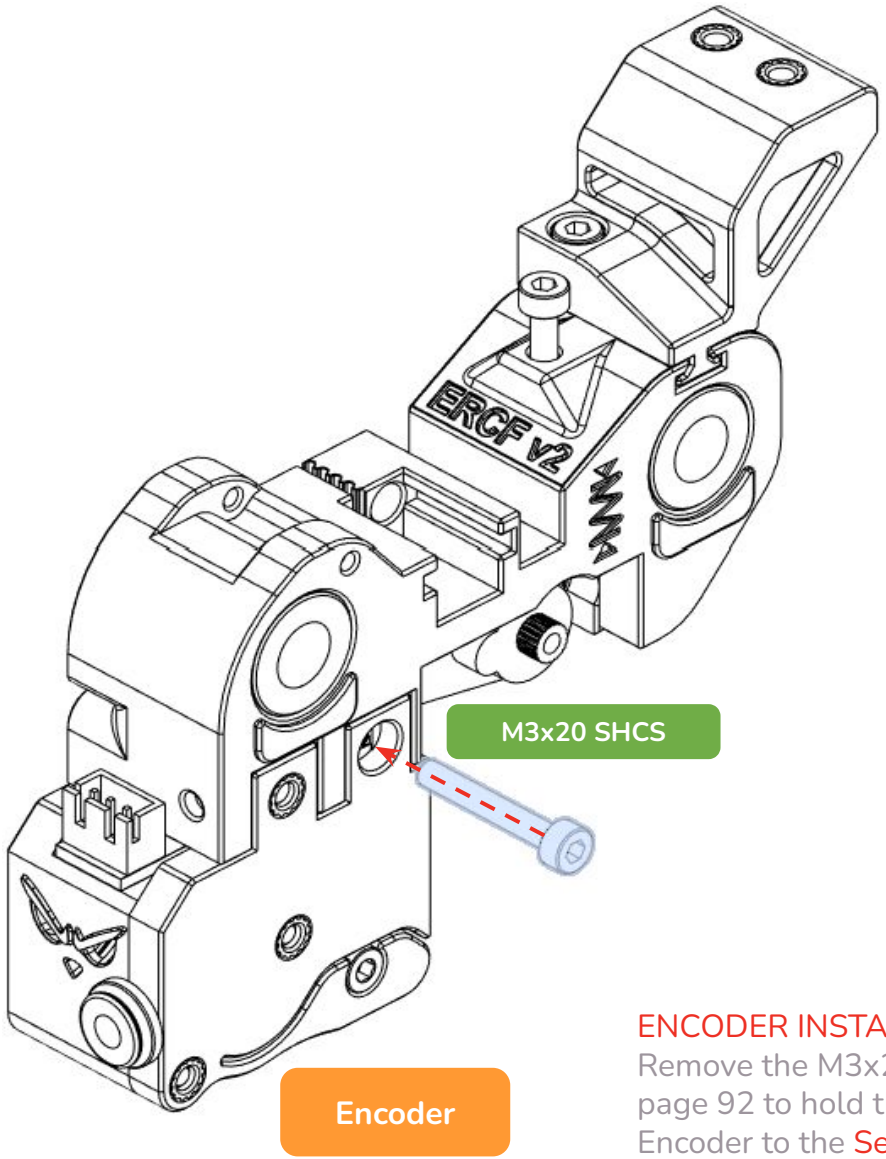
Slide the V623ZZ Filament Bearing in from the bottom and fasten with a M3x20 SHCS screw.

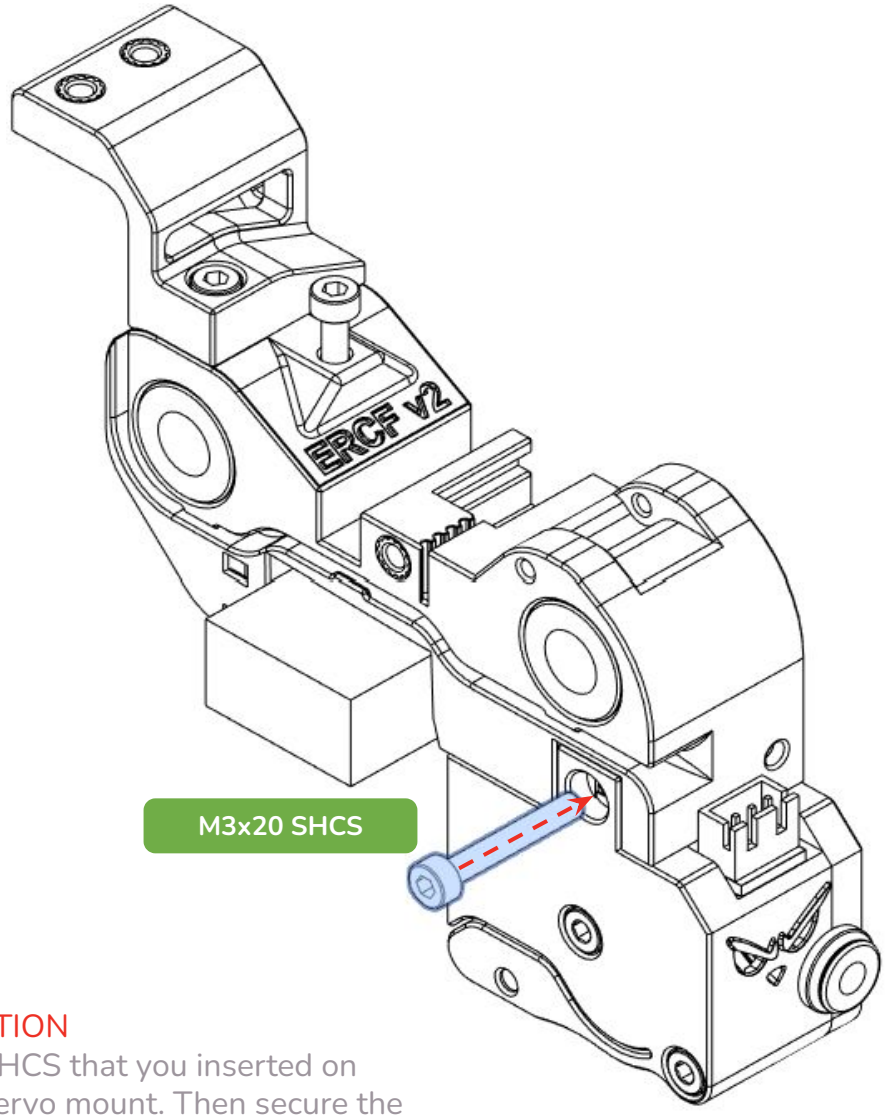
At this point use a small length of filament to verify everything runs smoothly and the Encoder_Slotted_Wheel doesn't rub on the Encoder body or Binky PCB Optical Sensor.

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

99

ENCODER INSTALLATION



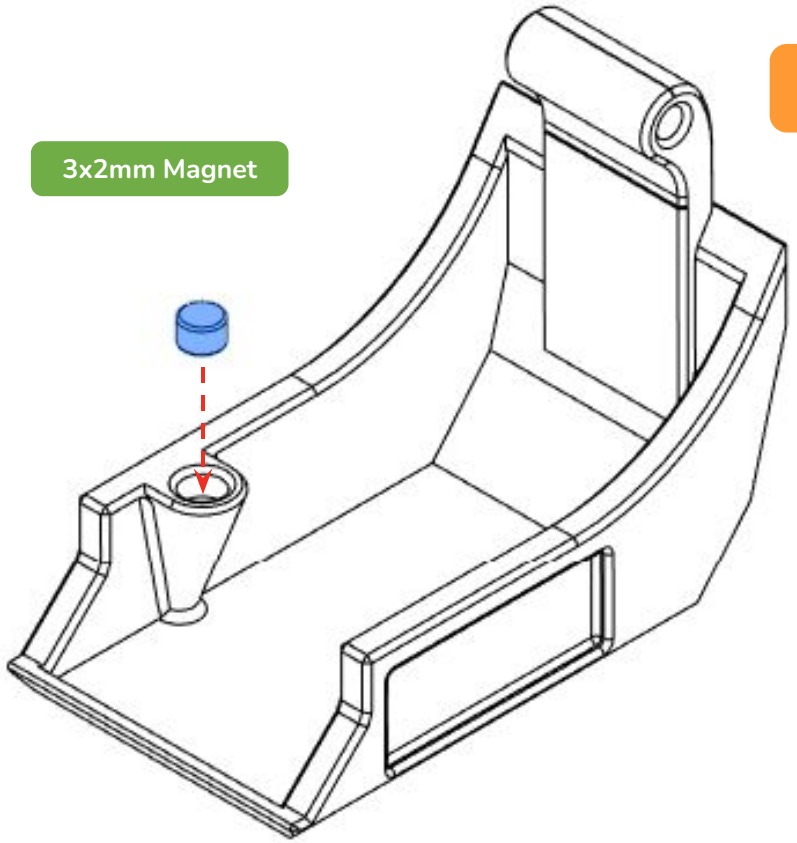


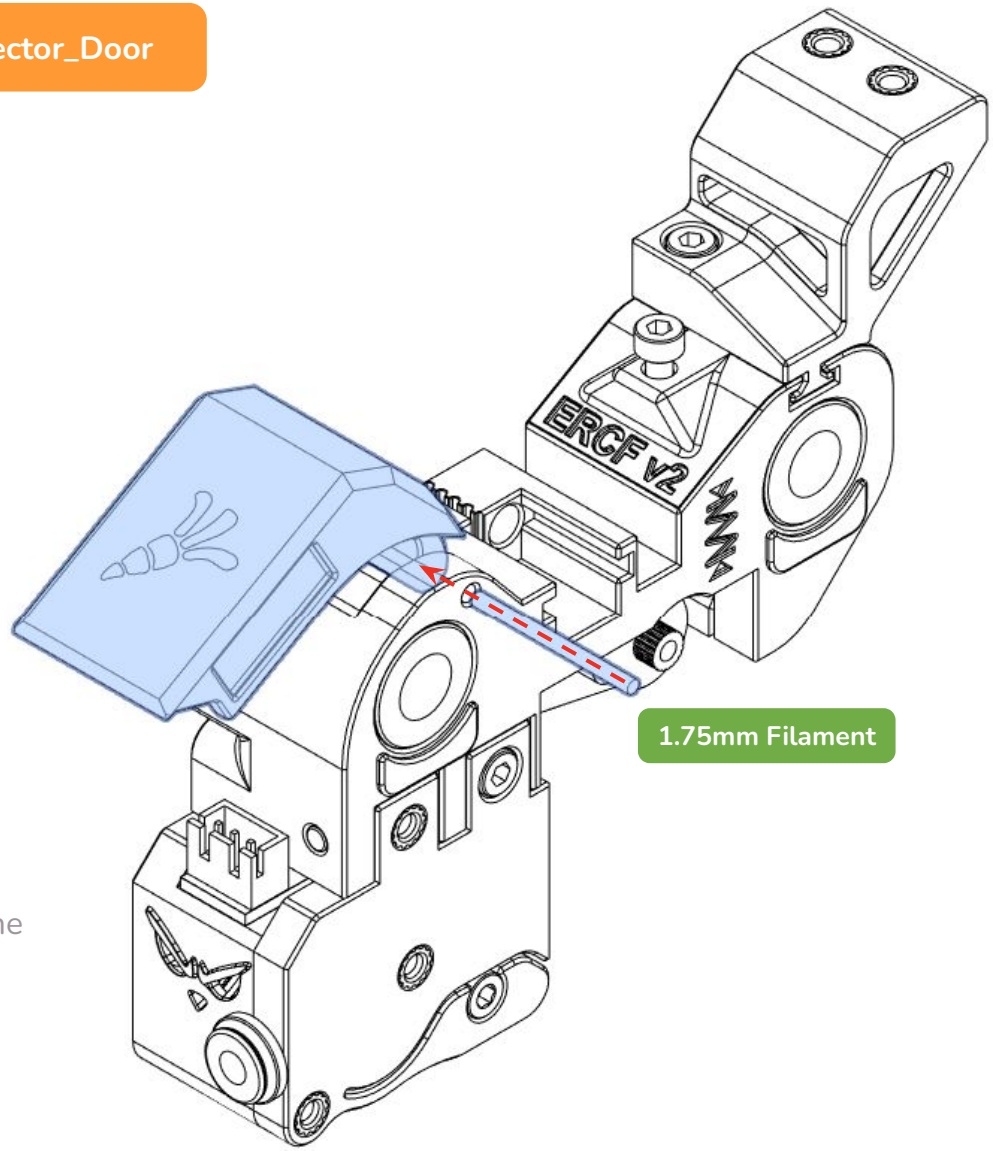
ENCODER INSTALLATION

Remove the M3x20 SHCS that you inserted on page 92 to hold the servo mount. Then secure the Encoder to the Selector_Cart with two M3x20 SHCS screws.

100

DOOR AND BELT TENSIONER





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.

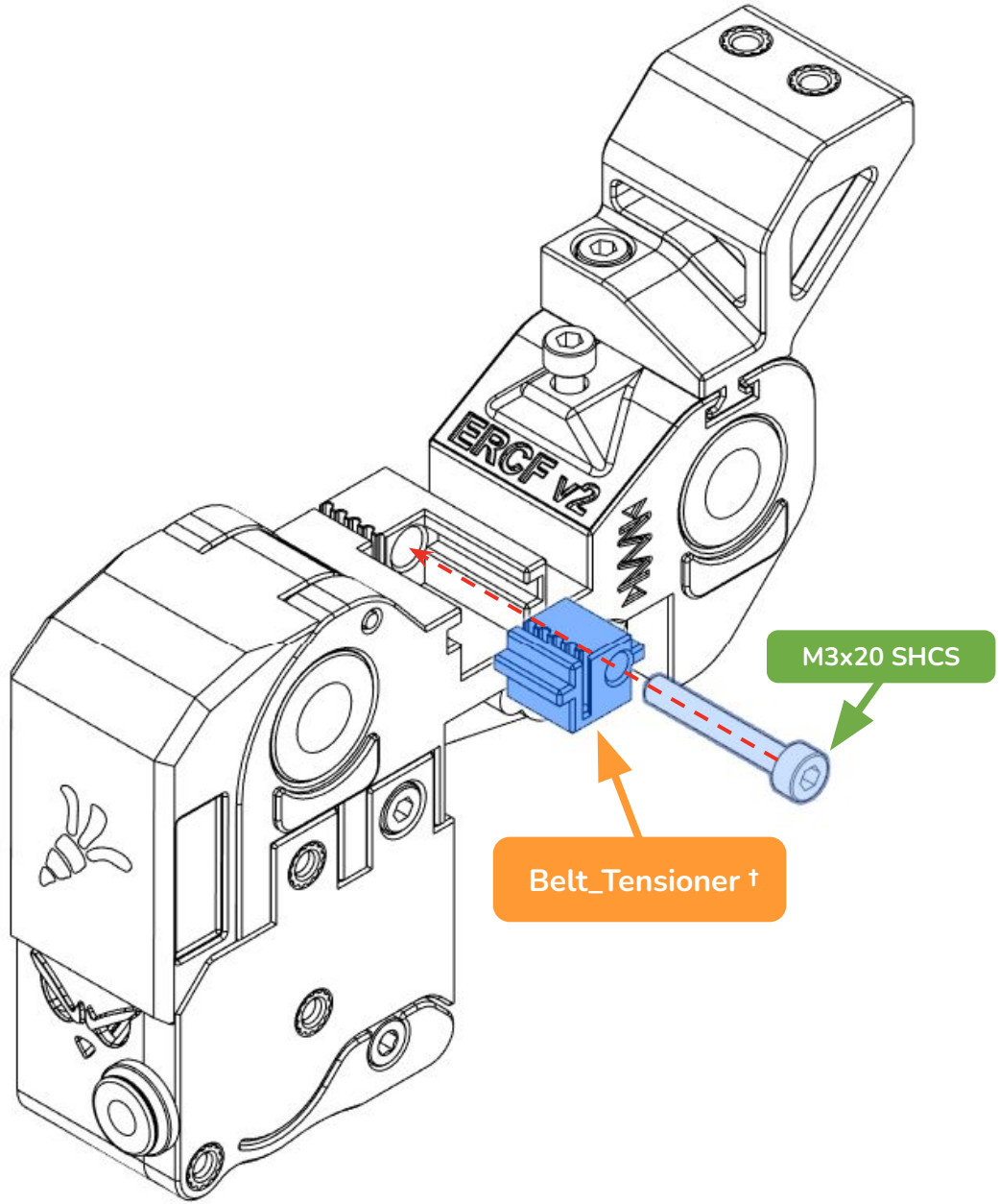
Attach the Selector_Door to the Selector_Cart using piece of 1.75mm Accent filament & trim to length.

101

DOOR AND BELT TENSIONER

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.



102

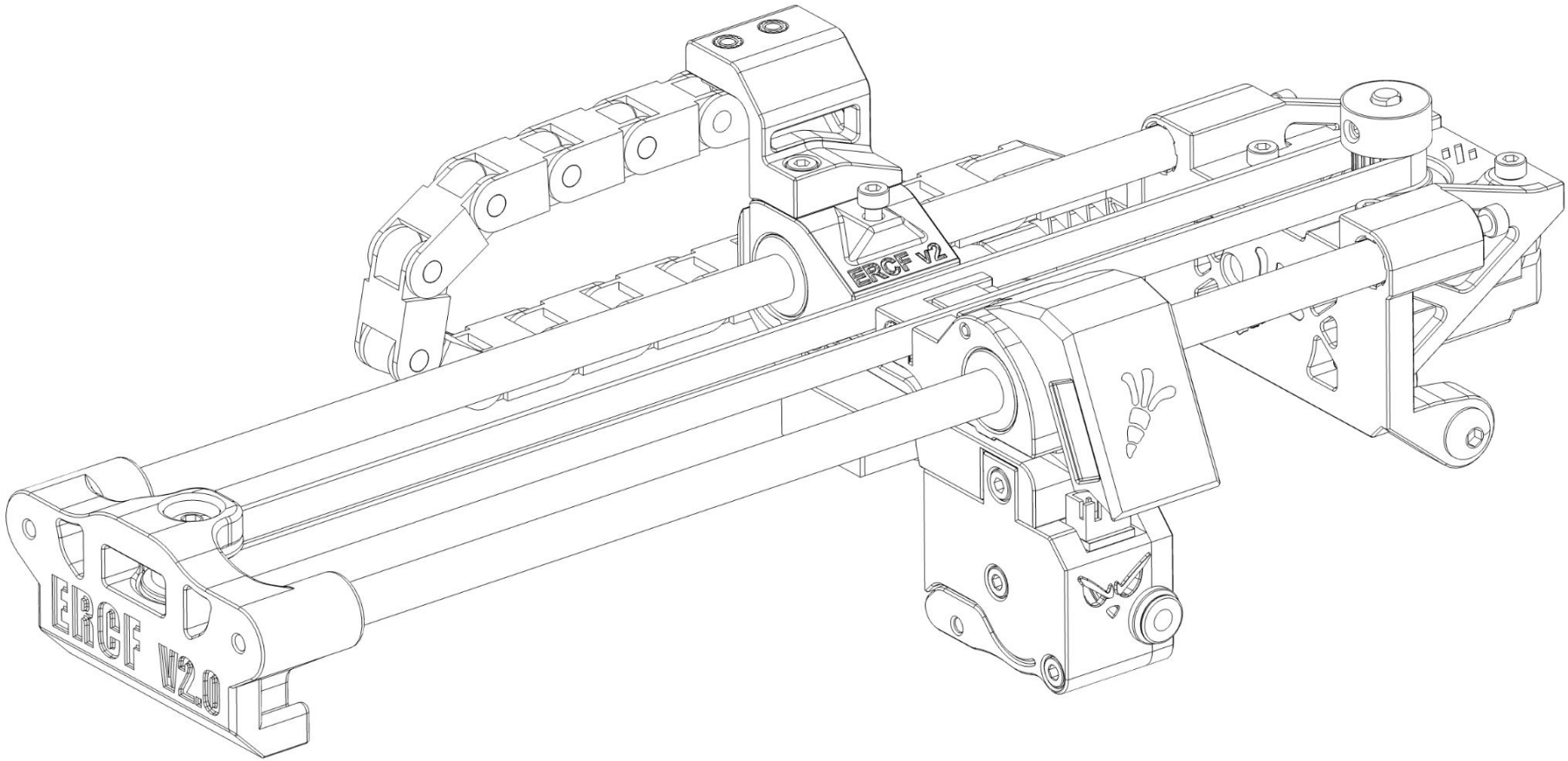
The first 3D printer was invented in 1986 by Chuck Hull, who called the process "stereolithography".

103

OVERVIEW

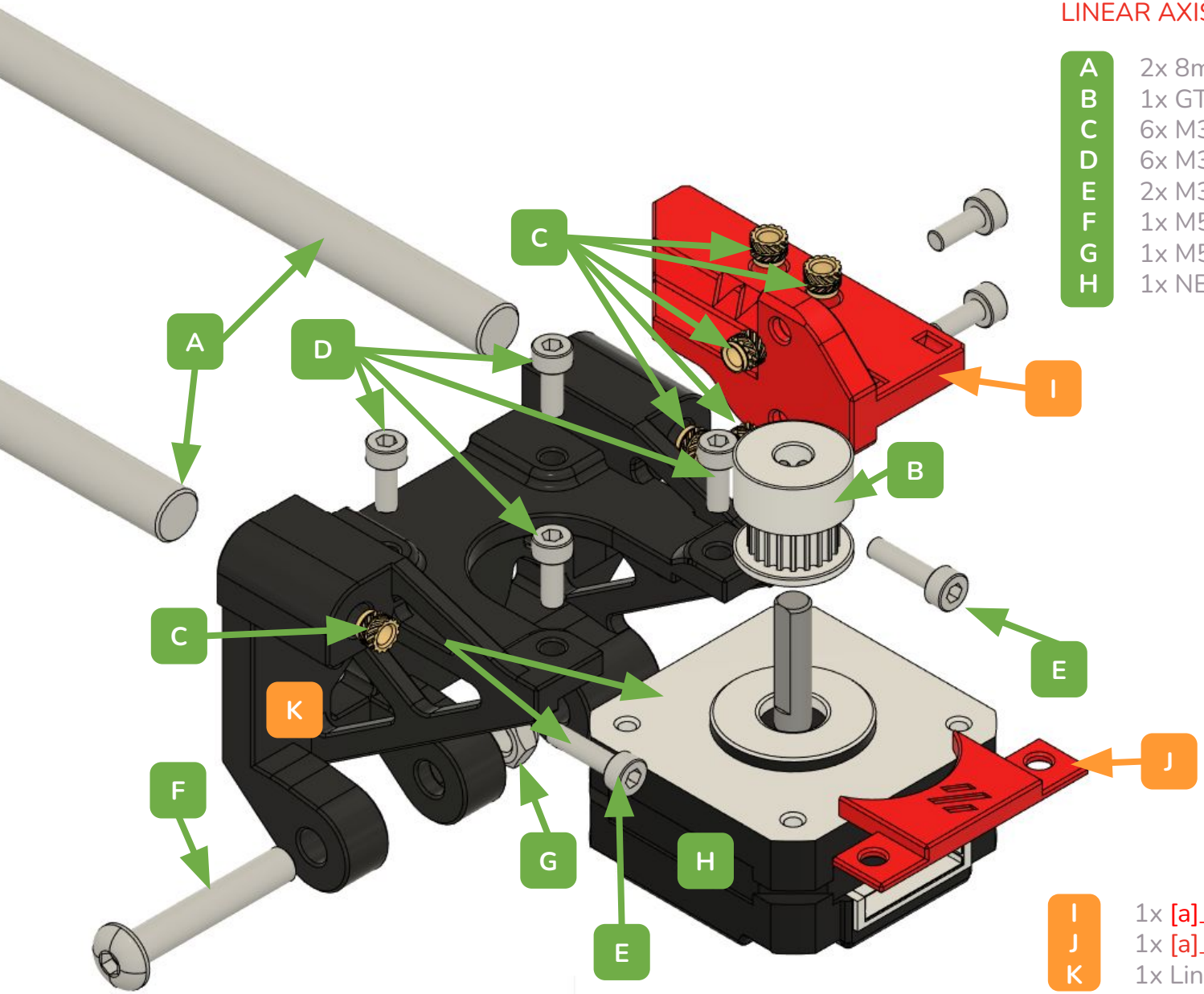
104

OVERVIEW



105

LINEAR AXIS HINGE EXPLODED VIEW



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 nut**
H	1x NEMA17 Pancake Motor

Channels	Rod Length (mm)
N	53 + 23N
4	145
5	168
6	191
7	214
8	237
9	260
10	283
11	306
12	329
13	352
14	375
15	398

I	1x [a]_Drag_Chain_Anchor_Bottom.stl †
J	1x [a]_Motor_Lock.stl †
K	1x Linear_Axis_Selector_Motor_Support.stl

**M3 screws, M5 screw, and nut shown for completeness, but not used until Final Assembly..

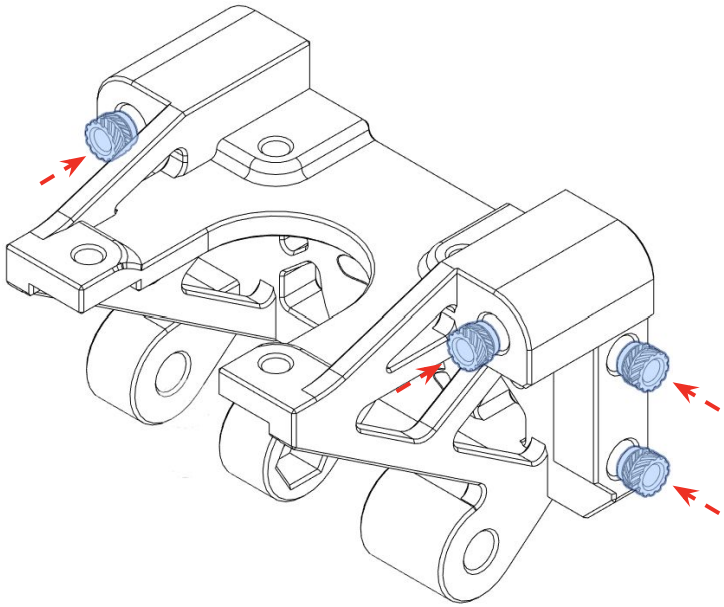
106

SELECTOR MOTOR SUPPORT

HEAT SET INSERTS

The list of pages with heat set inserts is on Page 15.

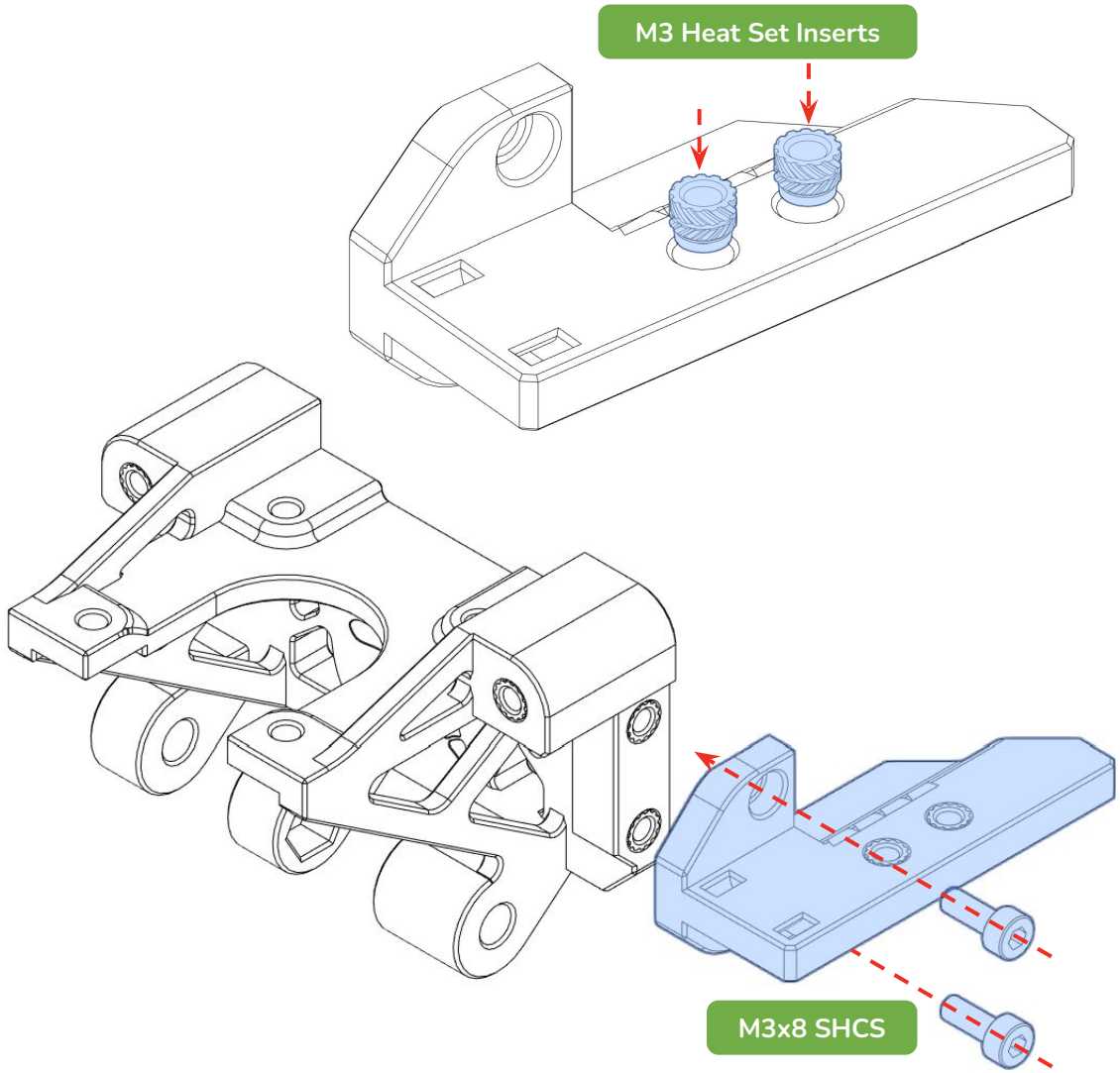
M3 Heat Set Inserts



Linear_Axis_Selector_Motor_Support

[a]_Drag_Chain_Anchor_Bottom †

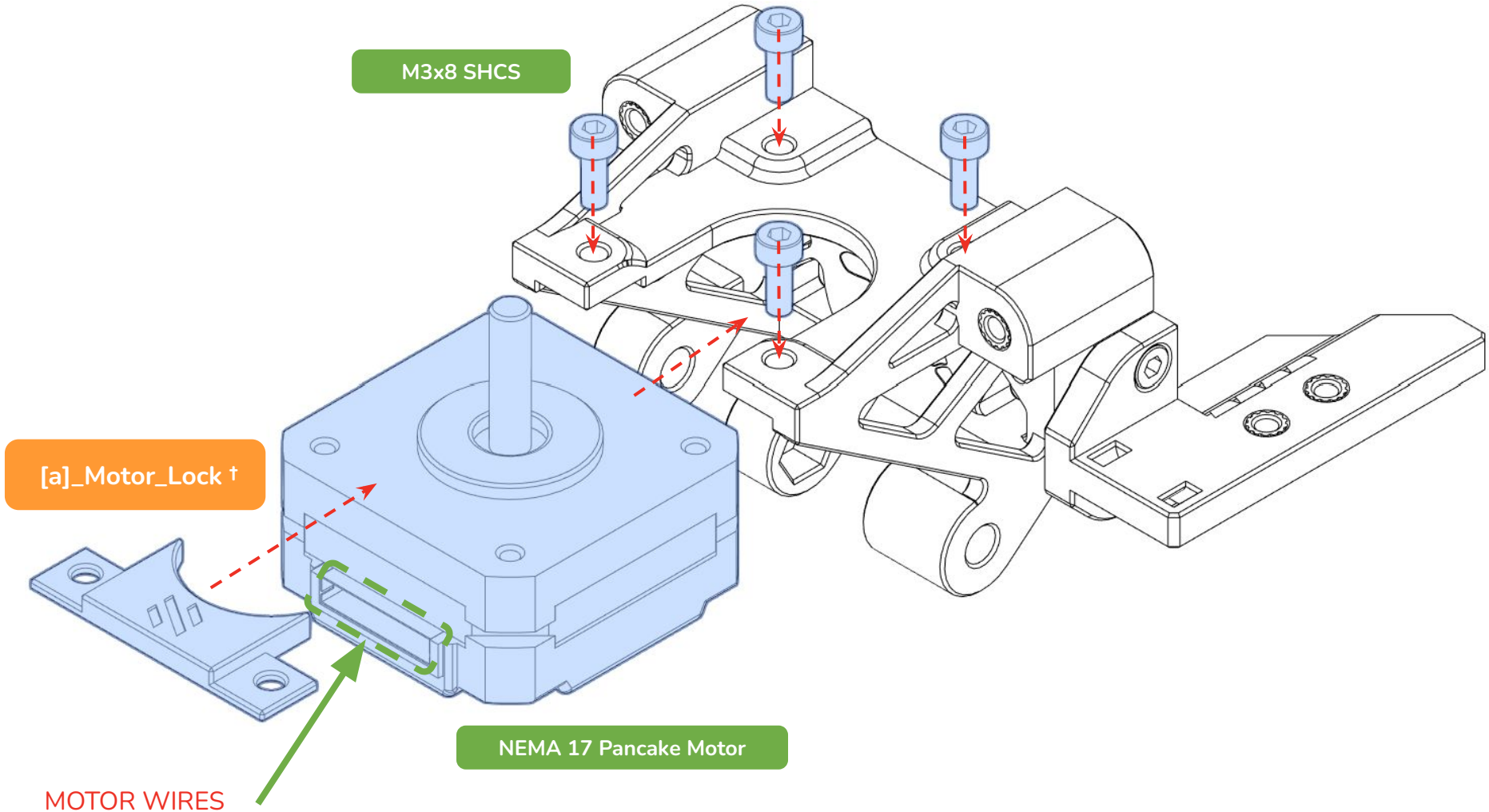
M3 Heat Set Inserts



M3x8 SHCS

107

SELECTOR MOTOR SUPPORT



MOTOR WIRES

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

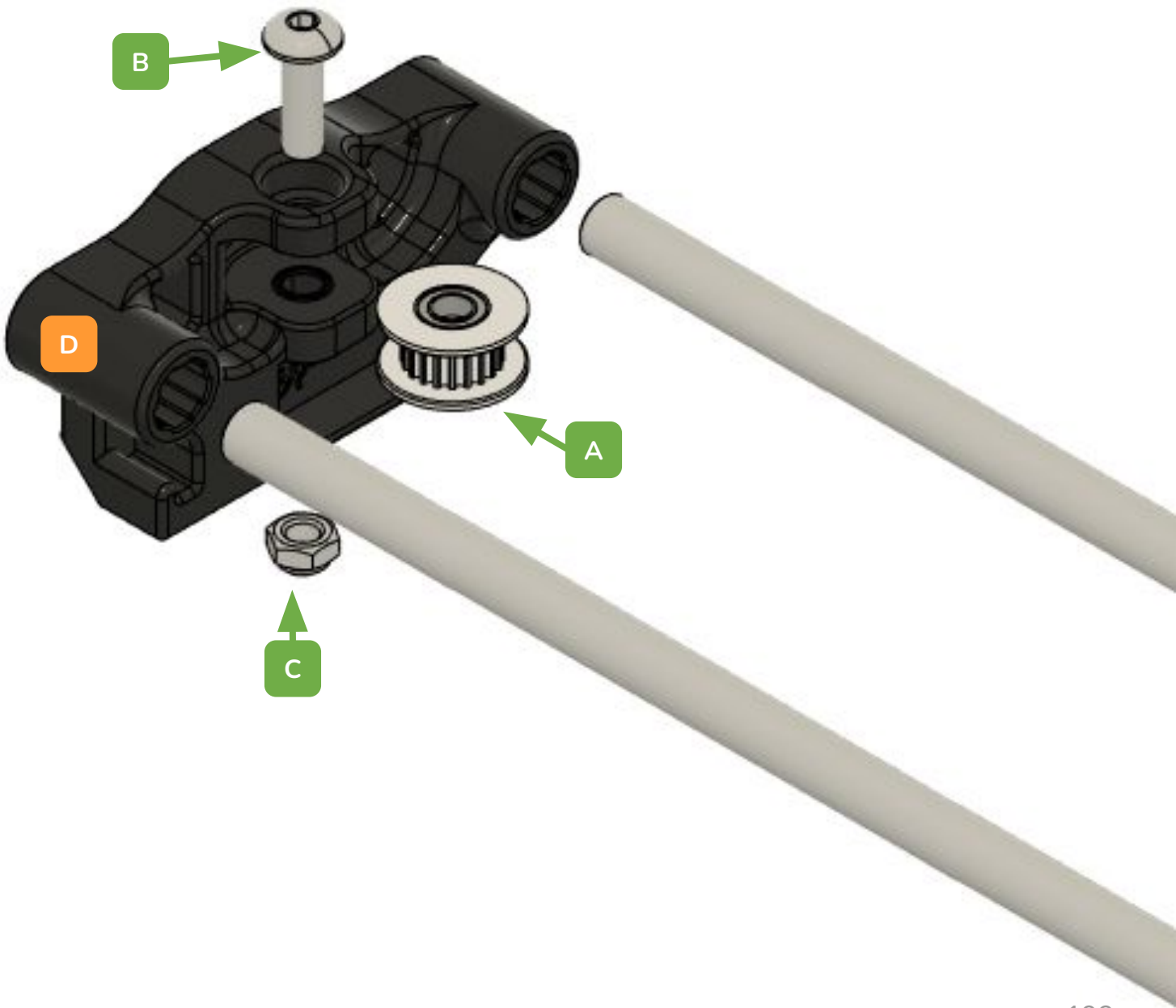
108

LINEAR AXIS IDLER SUB-BOM

A 1x GT2 20T toothed idler
B 1x M5x16mm BHCS
C 1x M5 Nylock nuts

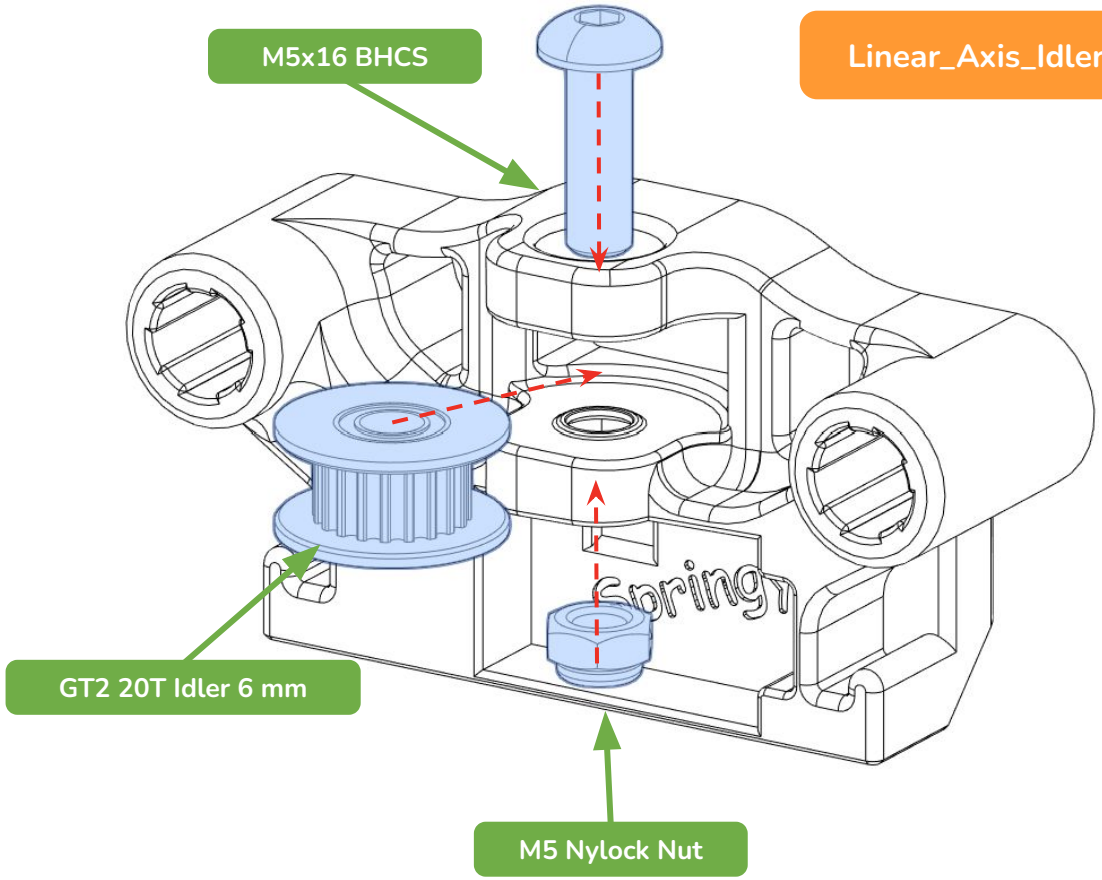
D 1x Linear_Axis_Idler_Block.stl

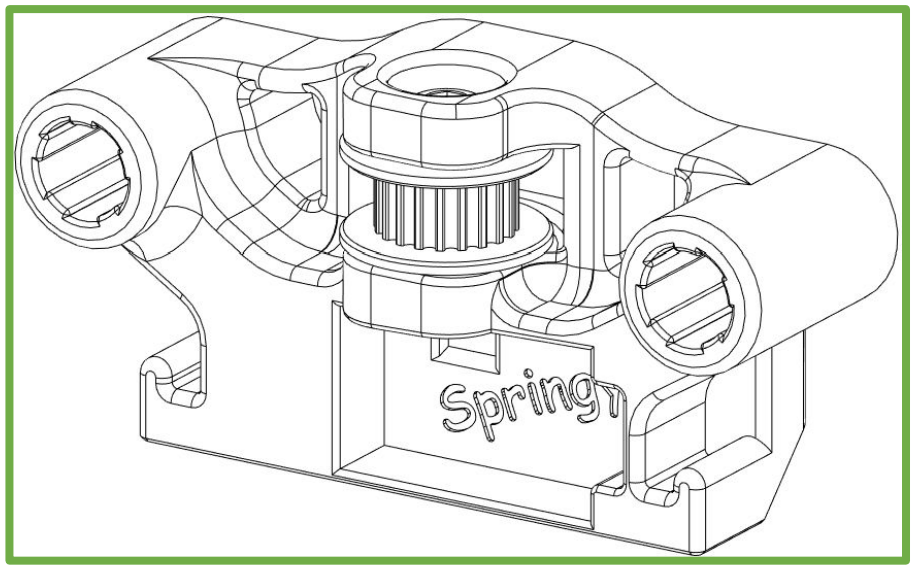
LINEAR AXIS IDLER EXPLODED VIEW



109

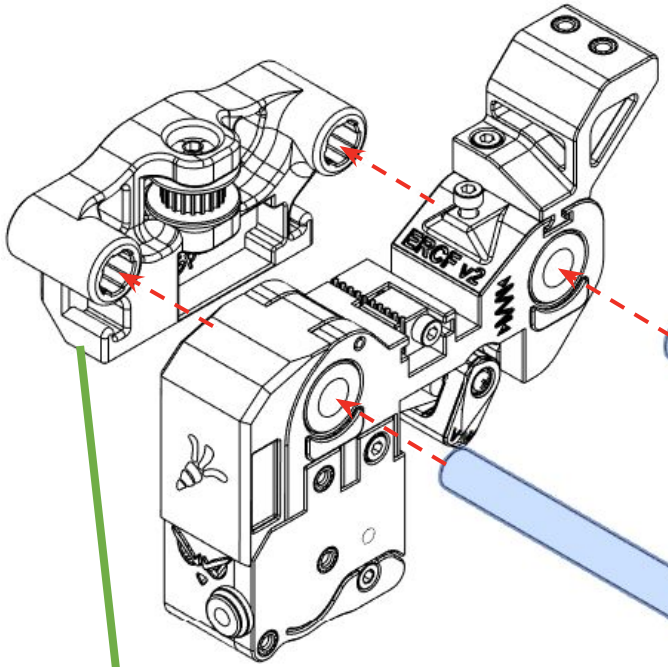
IDLER BLOCK





110

AXIS ASSEMBLY



BEARING PREPARATION

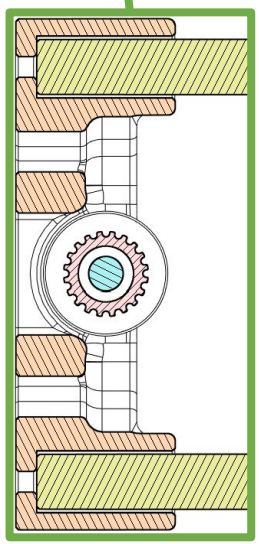
If using LM8UU bearings, lightly grease them using EP1/EP2 or Superlube grease. Drylin RJ4JP-01-08 style bearings do not need to be lubricated.

8mm Smooth Rods

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.

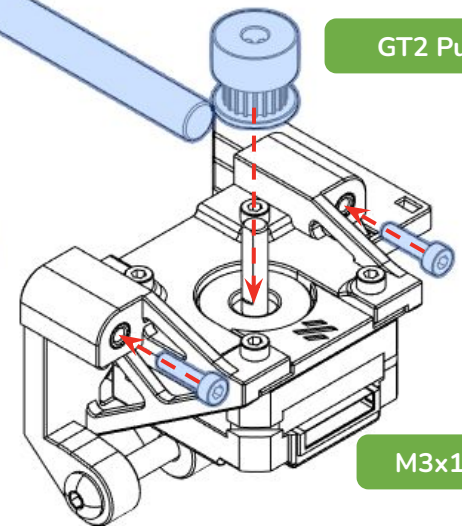
Add the GT2 pulley and snug the grub screw. We will adjust soon.



IDLER SIDE

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

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



GT2 Pulley

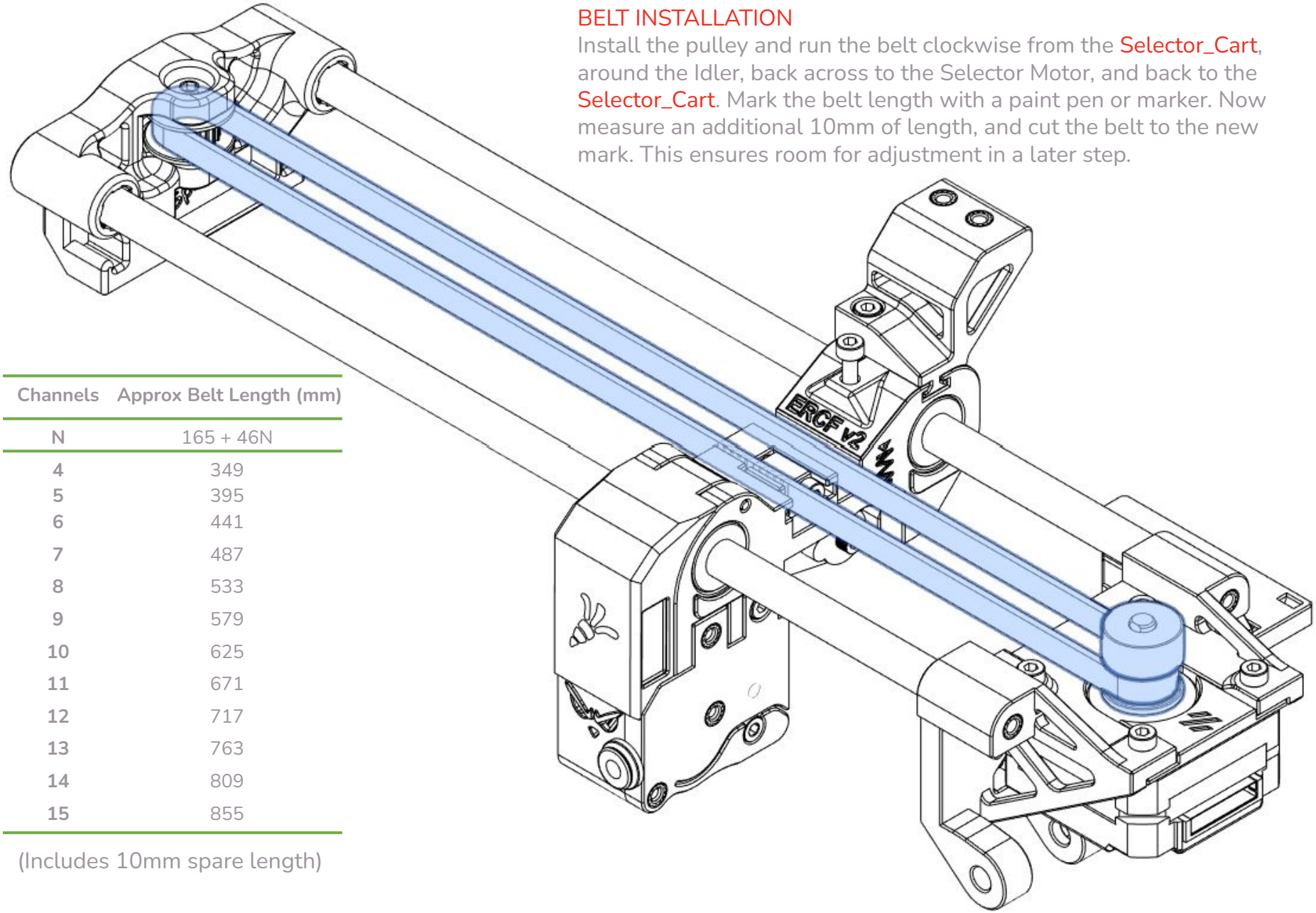
M3x12 SHCS

111

PULLEY AND BELT INSTALLATION

BELT INSTALLATION

Install the pulley and run the belt clockwise from the Selector_Cart, around the Idler, back across to the Selector Motor, and back to the Selector_Cart. Mark the belt length with a paint pen or 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.



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

(Includes 10mm spare length)

112

ERCF in space?

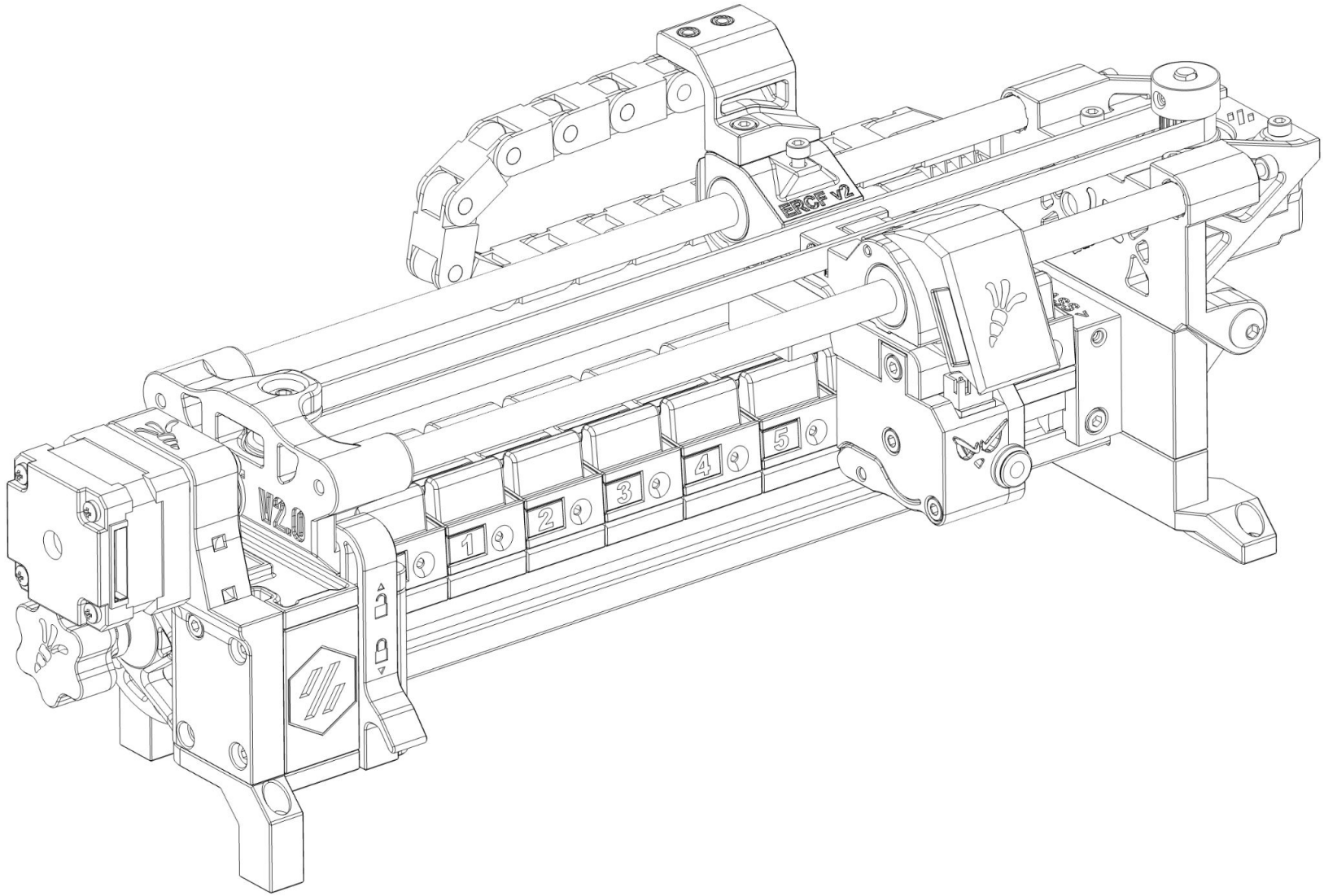
The first 3D printer in space was installed on the International Space Station in 2014 and used by astronauts to create tools and parts, demonstrating the potential of this technology for long-duration space missions and even interplanetary travel.

113

OVERVIEW

114

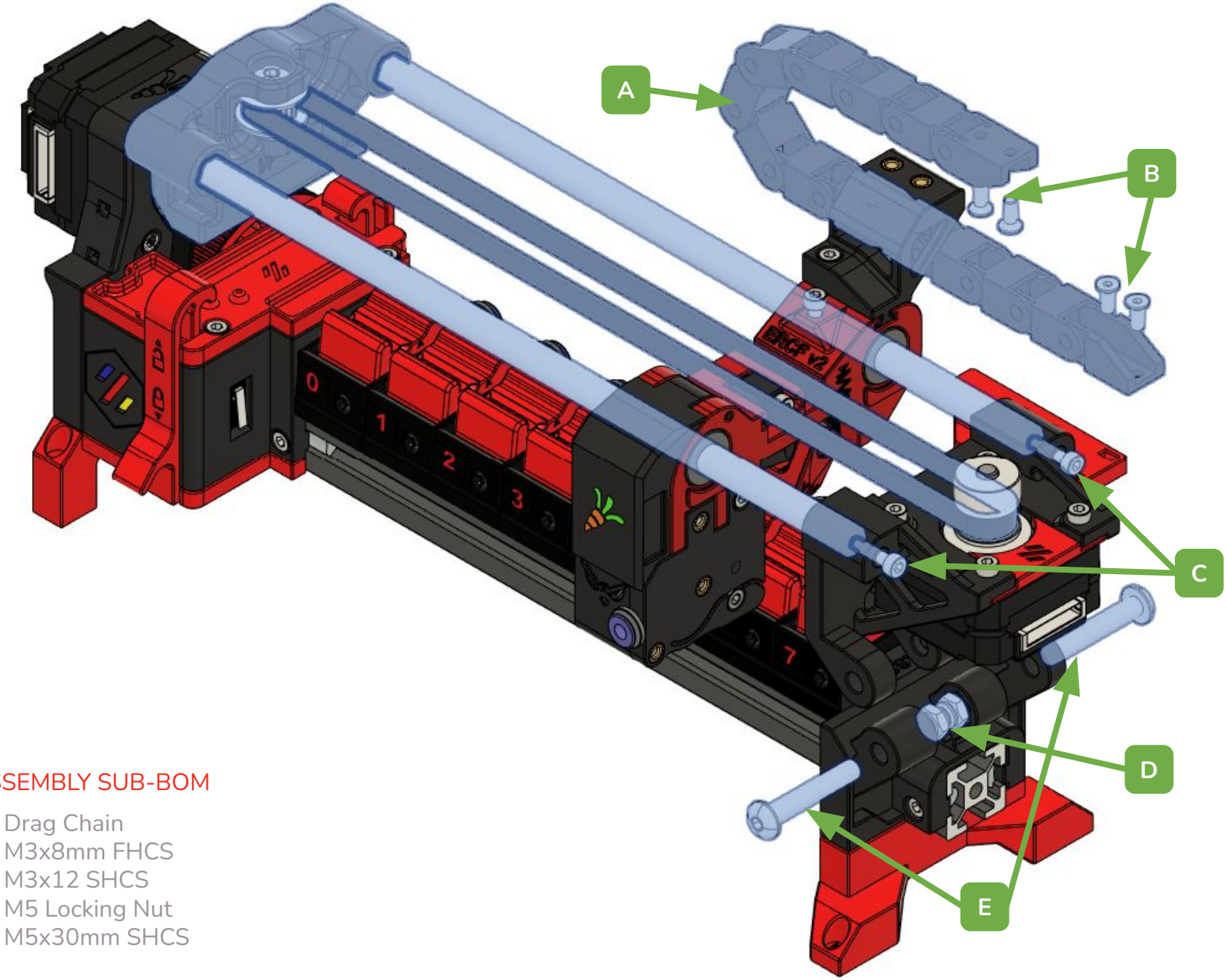
OVERVIEW



115

FINAL ASSEMBLY

EXPLODED VIEW

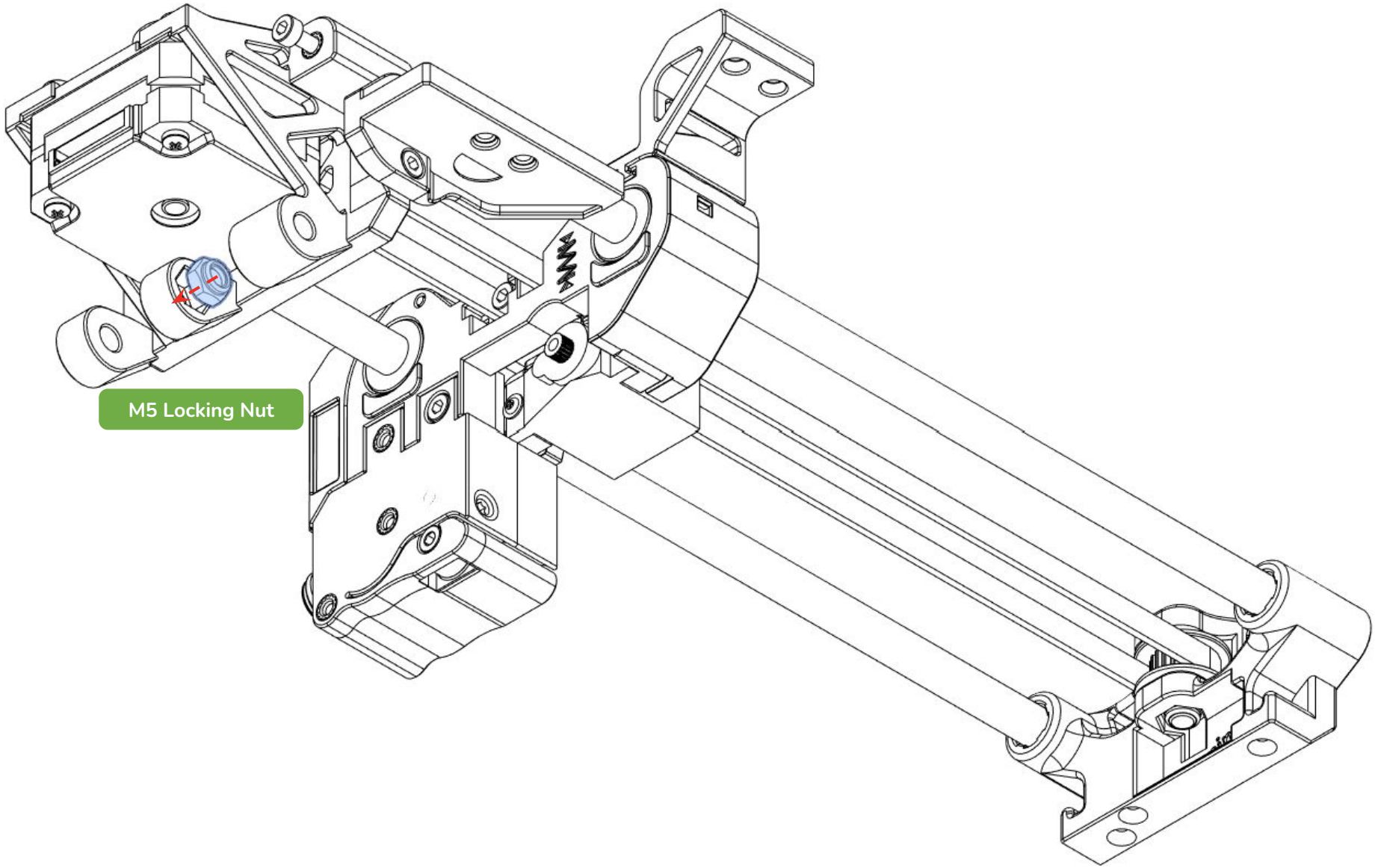


FINAL ASSEMBLY SUB-BOM

A	1x Drag Chain
B	4x M3x8mm FHCS
C	2x M3x12 SHCS
D	2x M5 Locking Nut
E	2x M5x30mm SHCS

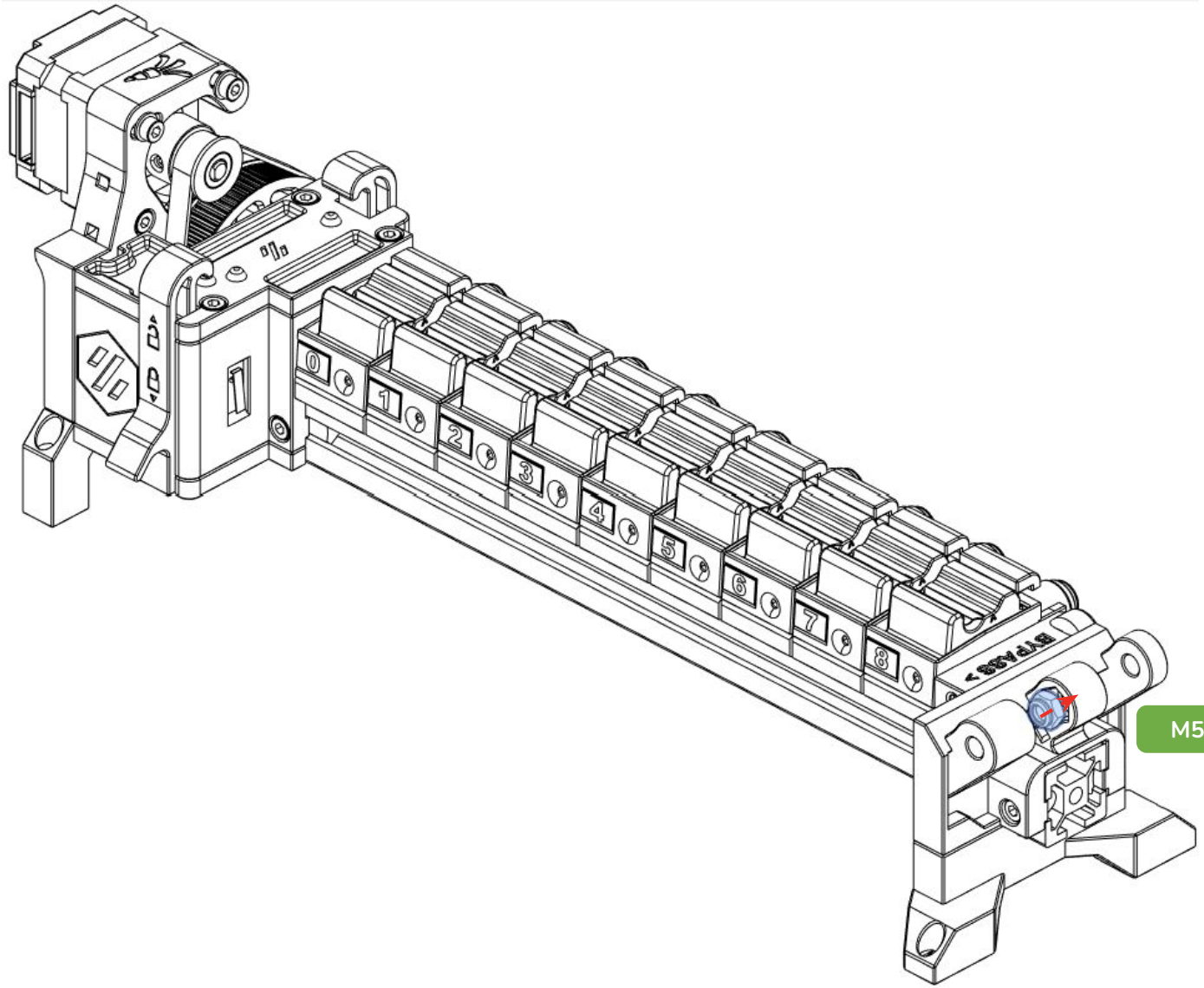
116

ADDING THE LOCKING NUTS



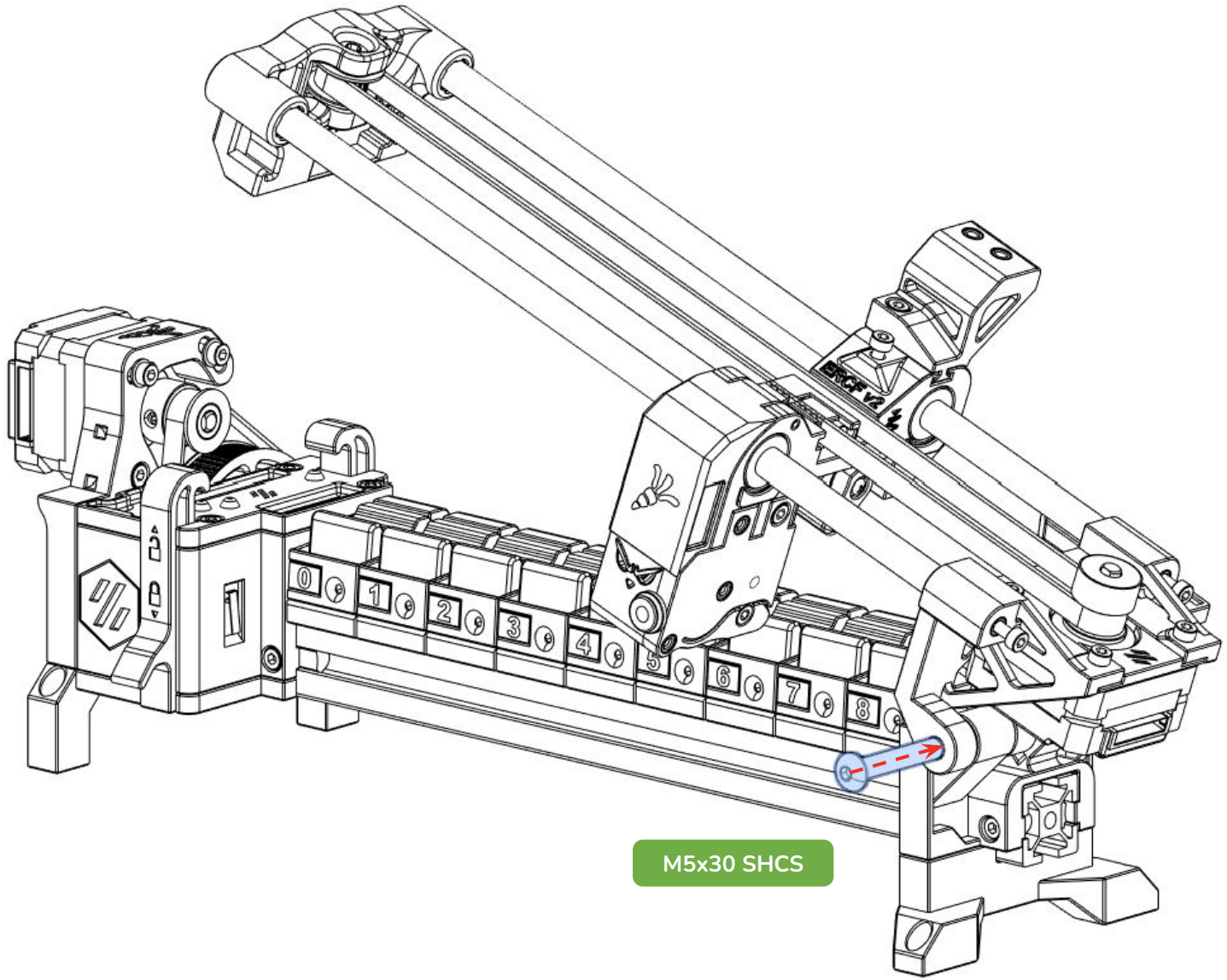
117

ADDING THE LOCKING NUTS



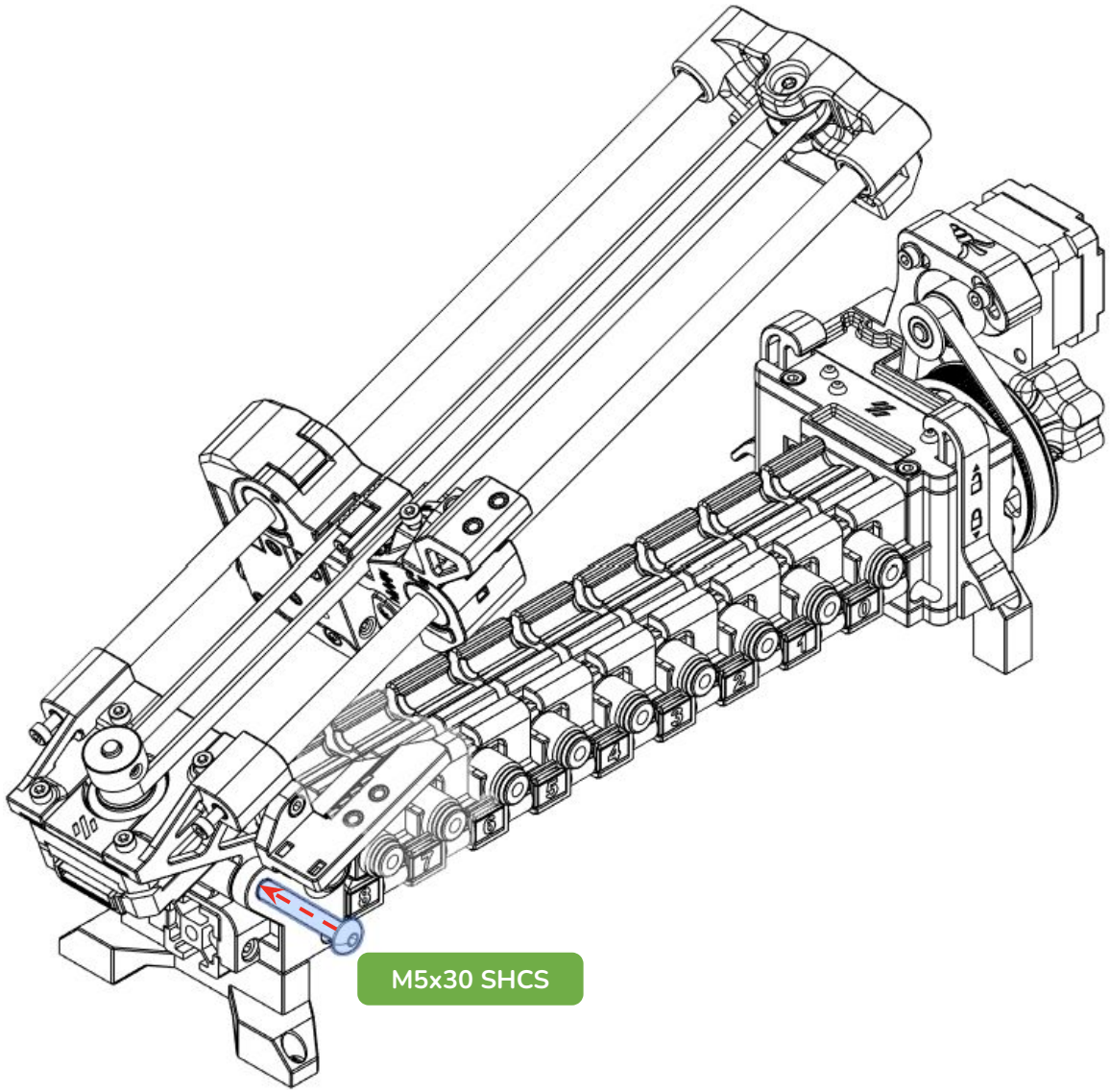
118

JOINING THE TWO BLOCKS



119

JOINING THE TWO BLOCKS



120

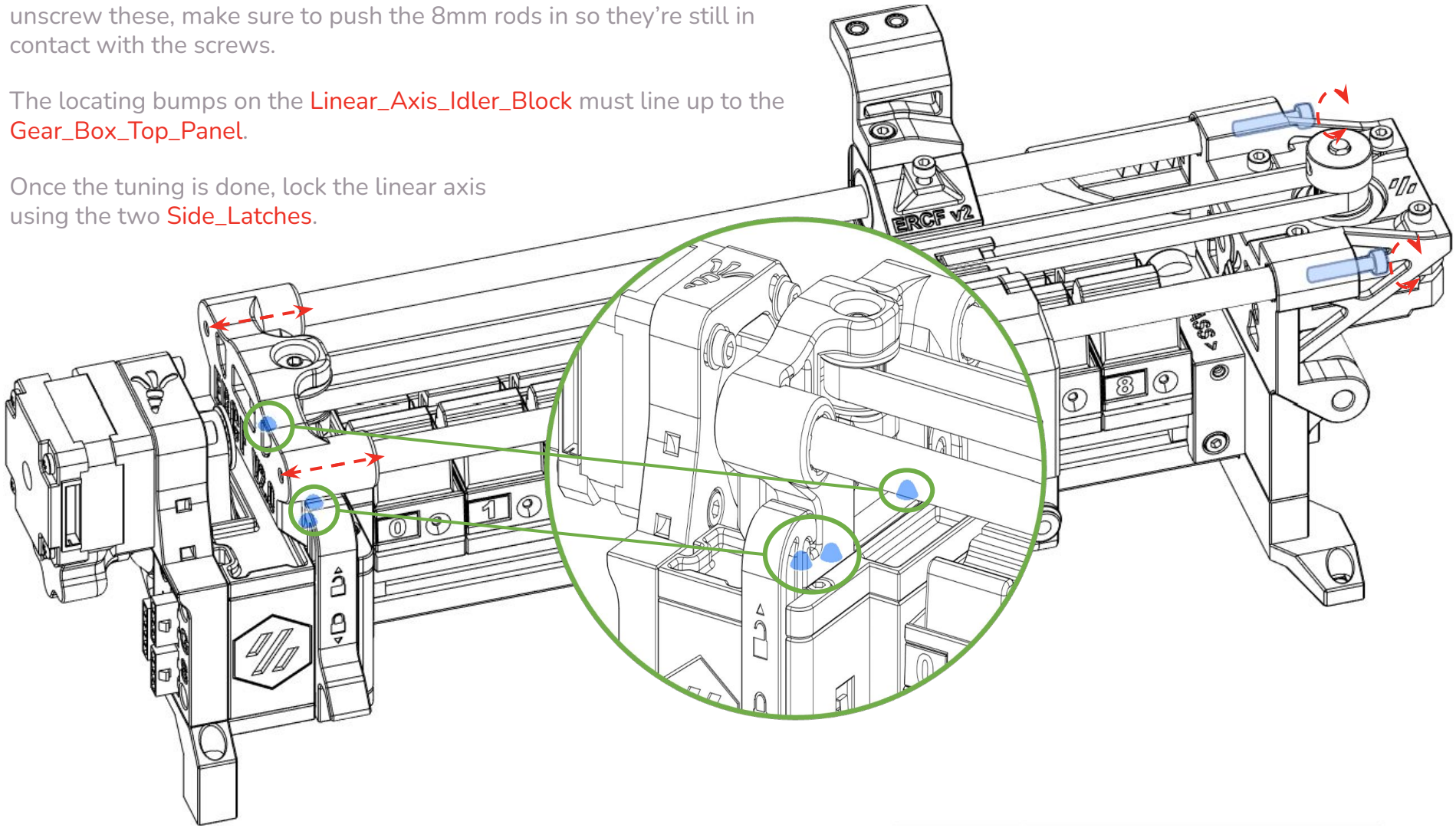
IDLER ADJUSTMENT

IDLER POSITION

Use the two M3x16 SHCS screws on the Linear_Axis_Selector_Motor_Support to finely adjust the the Linear_Axis_Idler_Block 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 Linear_Axis_Idler_Block must line up to the Gear_Box_Top_Panel.

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



121

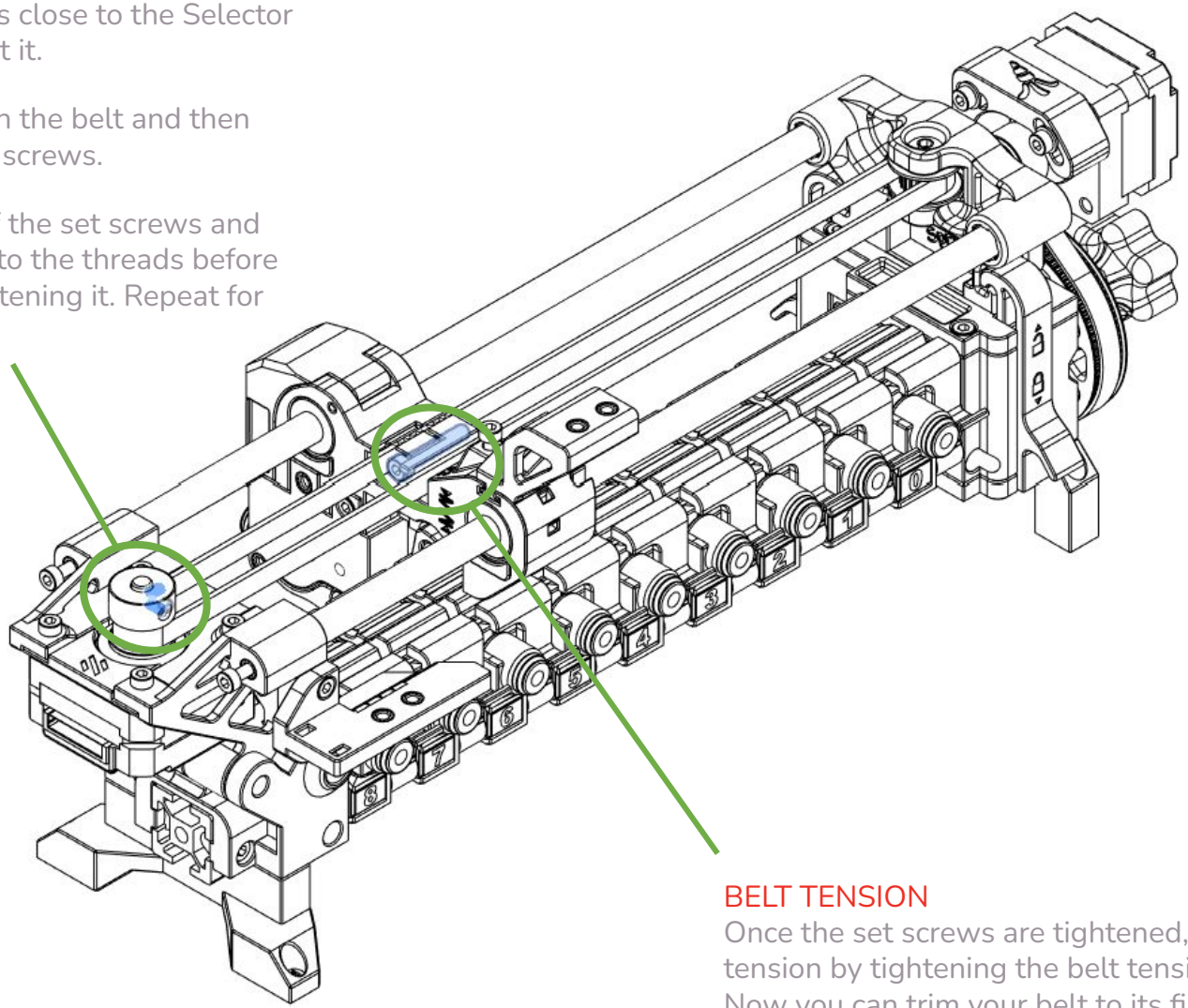
TENSIONING THE BELT

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.

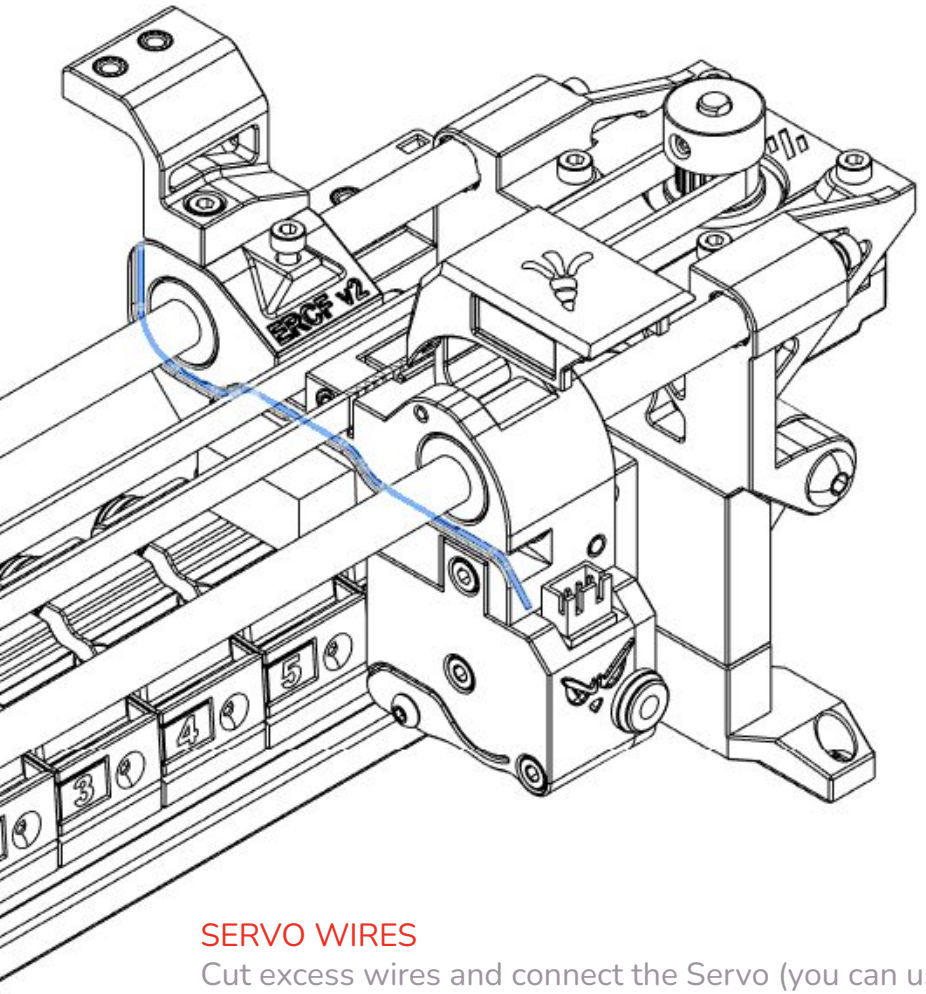
Next, remove one of the set screws and apply thread locker to the threads before reinstalling and tightening it. Repeat for the other screw.



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.

122



SERVO WIRES

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

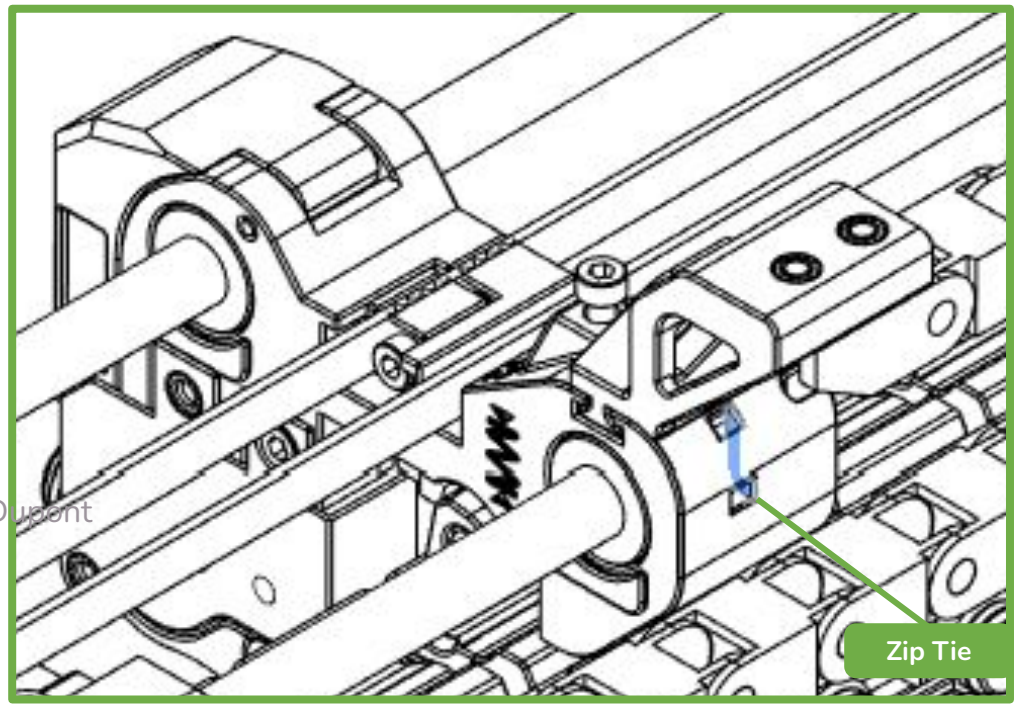
Secure both the Servo and Encoder wires using a zip tie.

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.

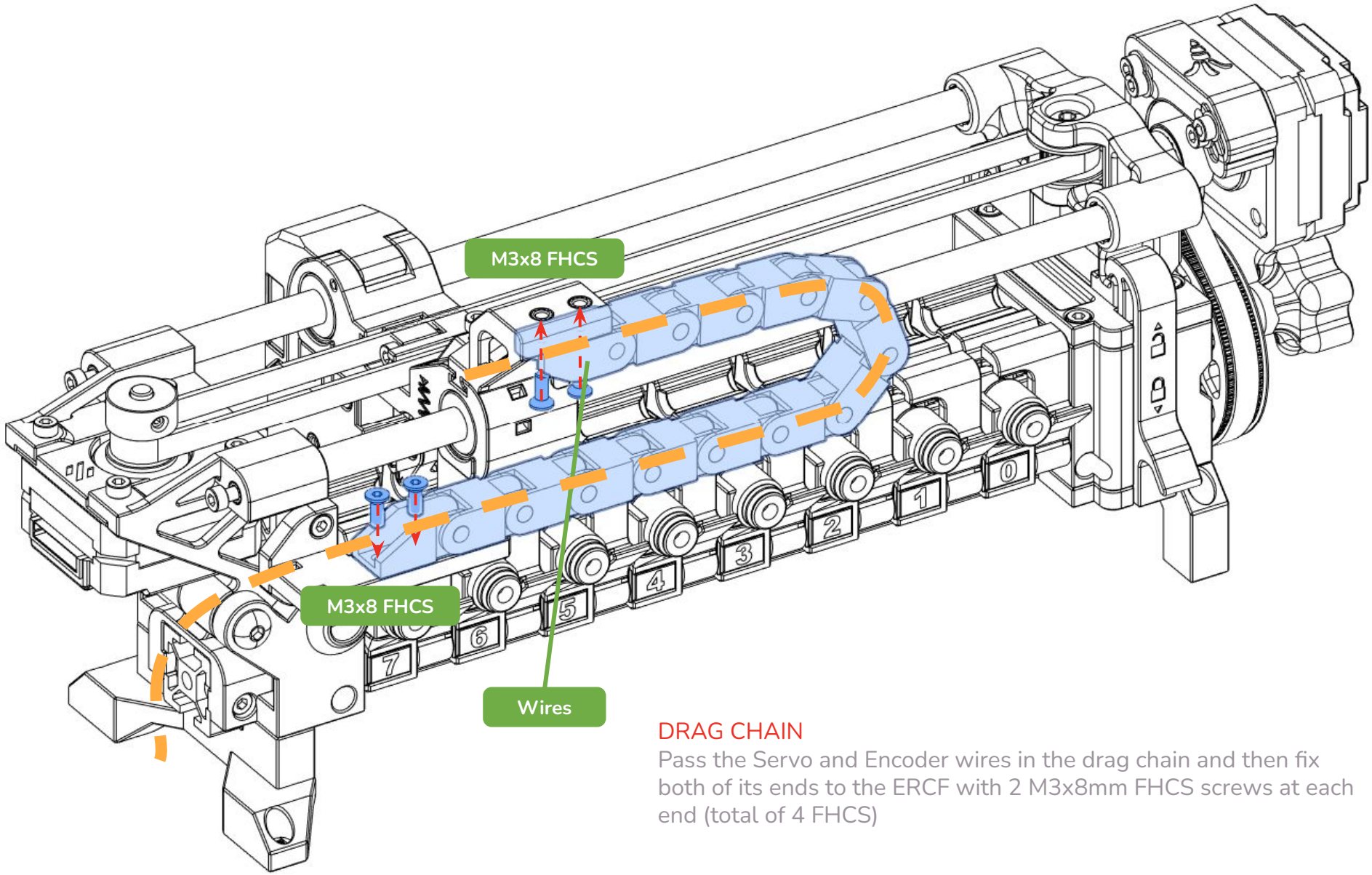
Cut excess wire, remove the wire from the channel and do the crimps (Dupont or JST XH will work) for all wires.

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



123

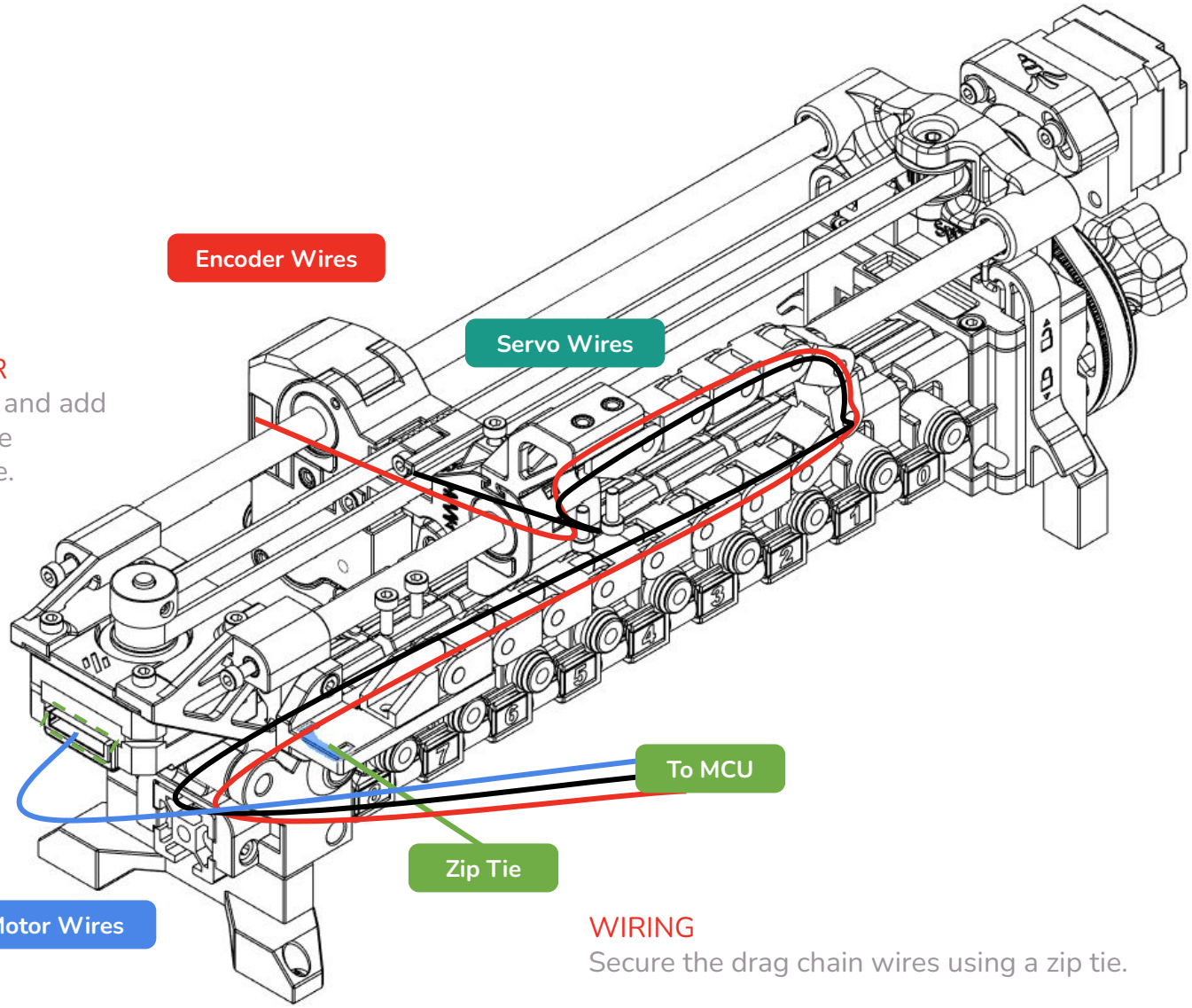
DRAG CHAIN



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)

124



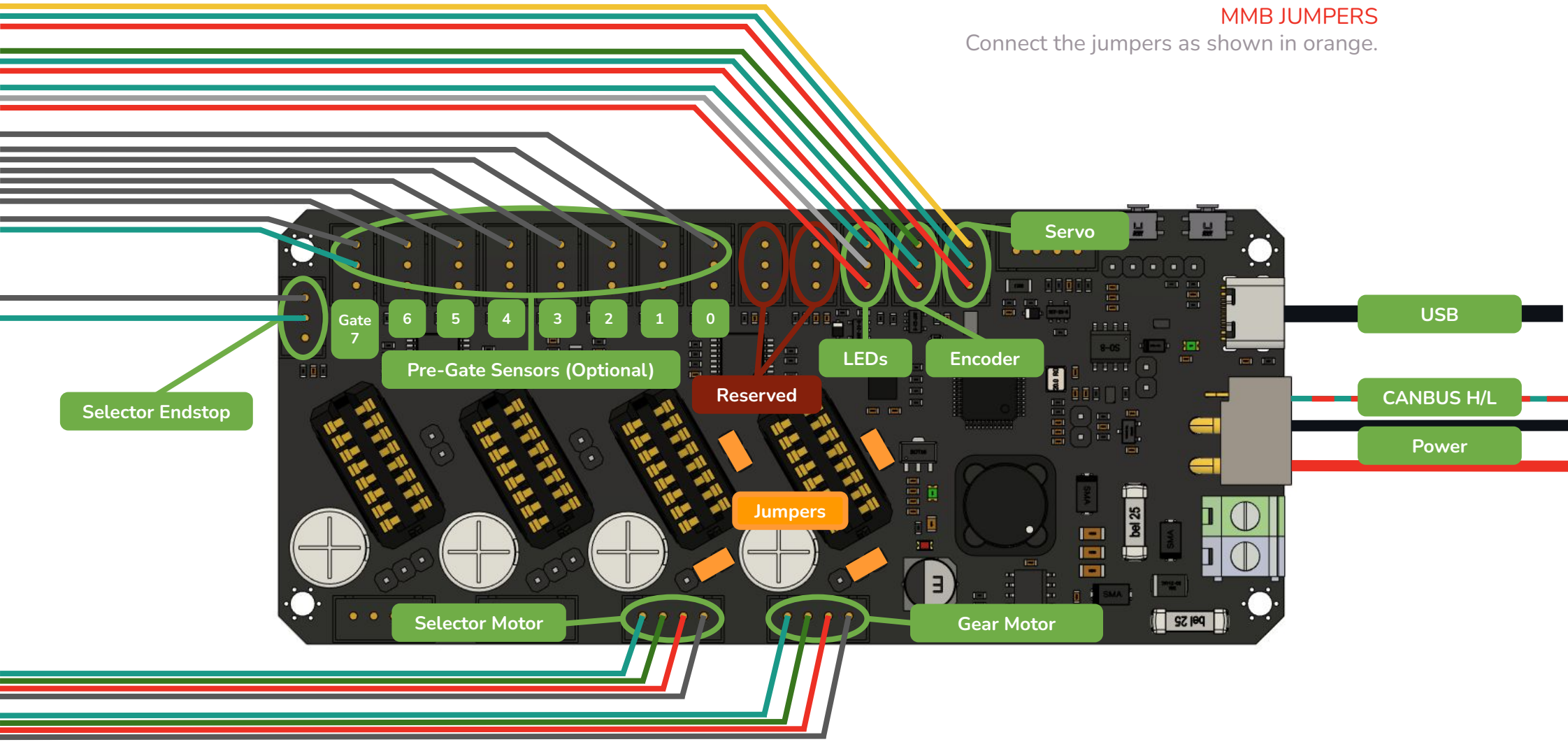
SELECTOR MOTOR

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

WIRING

Secure the drag chain wires using a zip tie.

WIRING THE MMB



MMB JUMPERS

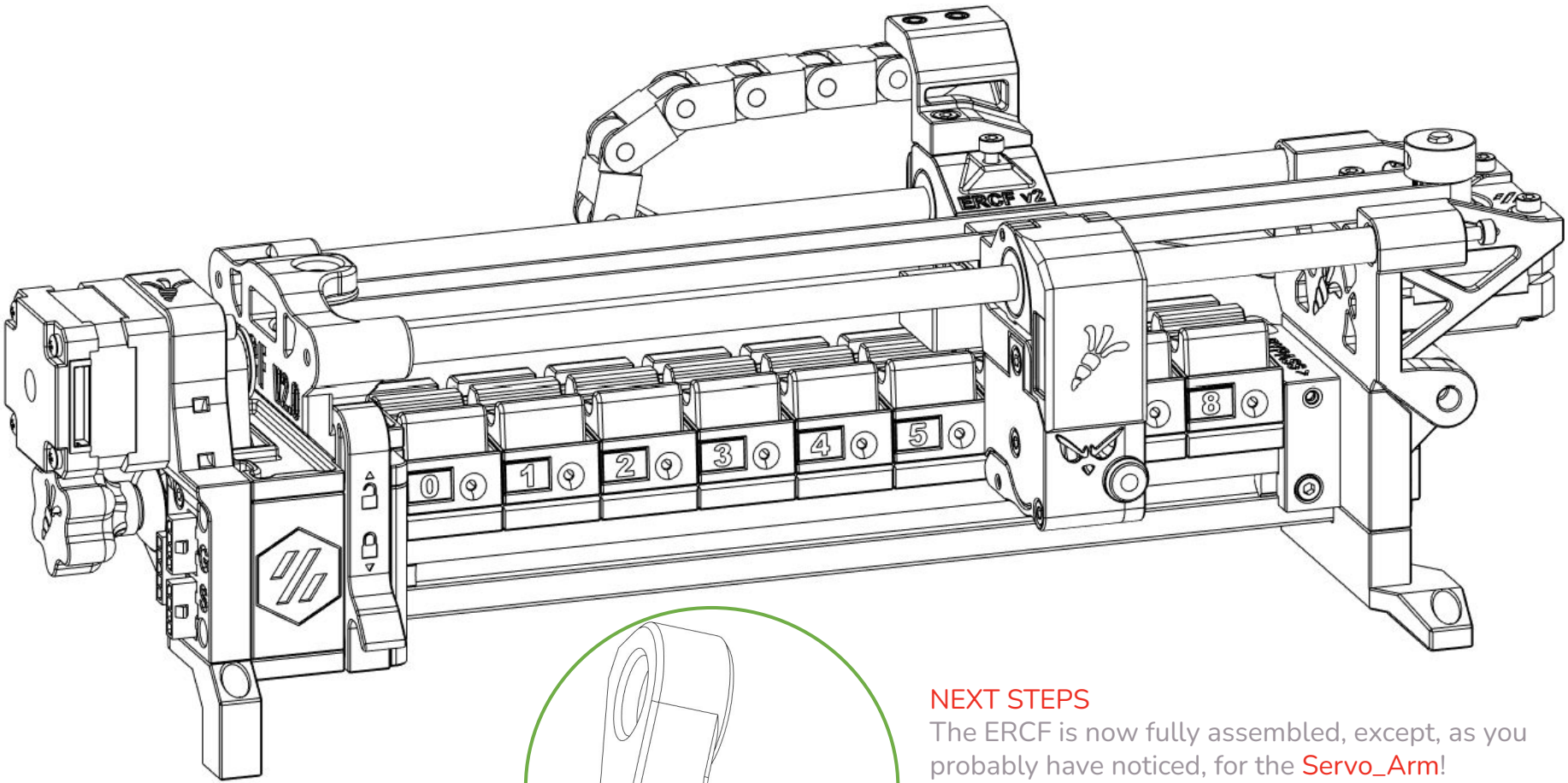
Connect the jumpers as shown in orange.

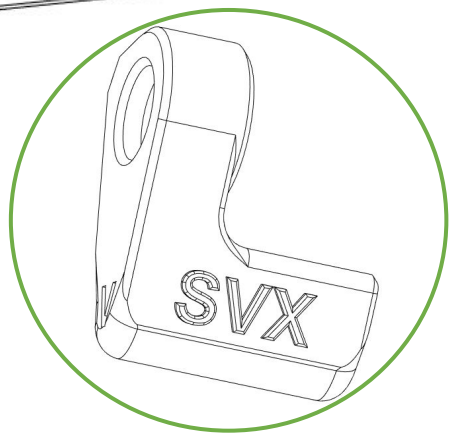
MMB WIRING

Connect the Selector Endstop and optional Pre-Gate Sensor wires (**do not use reserved ports**). 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.

126

THE END! ... OR ALMOST :D





NEXT STEPS

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

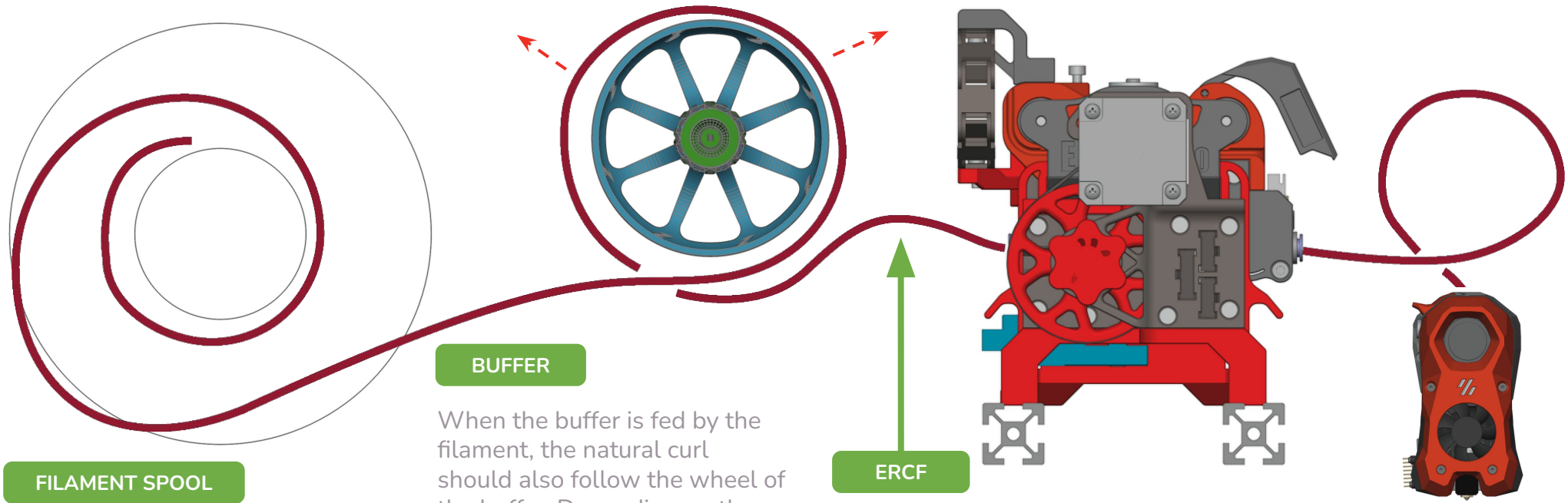
Its installation on the ERCF will be done as part of the setup and calibration step here:
https://github.com/Enraged-Rabbit-Community/ERCF_v2/blob/master/Documentation/Setup_Calibration.md

127

FILAMENT TUBE MANAGEMENT

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.



FILAMENT SPOOL

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.

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.

ERCF

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.

TOOLHEAD

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.

128

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

This manual is designed to be a reference manual for the build process of an Enraged Rabbit Carrot Feeder v2 MultiMaterial System. Additional details about the build and background on advanced topics can be found on our documentation page linked below. The software setup and other initial setup steps with your new printer can also be found on our documentation page. We recommend starting here.

https://github.com/moggieuk/Happy-Hare/blob/main/doc/ercf_v2.md

129

HOW TO GET HELP

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.

https://discord.com/channels/460117602945990666/909743915475816458

REPORTING ISSUES

Should you find an issue in this document or have a suggestion for an improvement please consider opening an issue on GitHub:

(https://github.com/Enraged-Rabbit-Community/ERCF_v2/issues).

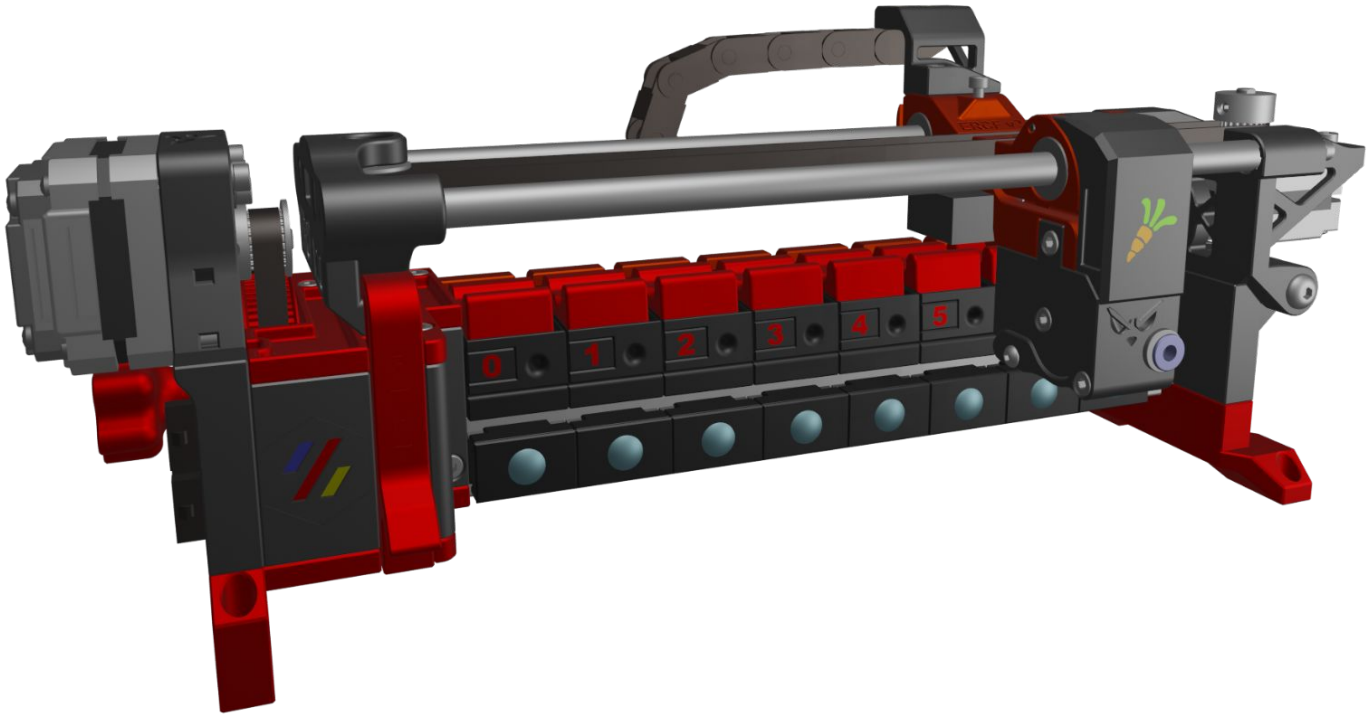
When raising an issue please include the relevant page numbers and a short description; annotated screenshots are also very welcome.

We will update the manual based on the feedback we get for the next release (ERCFv2.1).

130

Enjoy your MMU.

131


0
1
2
3
4
5