

# Rat Rig

## 09. EVA 3.0 Heat Insert Assembly

Written By: Rat Rig

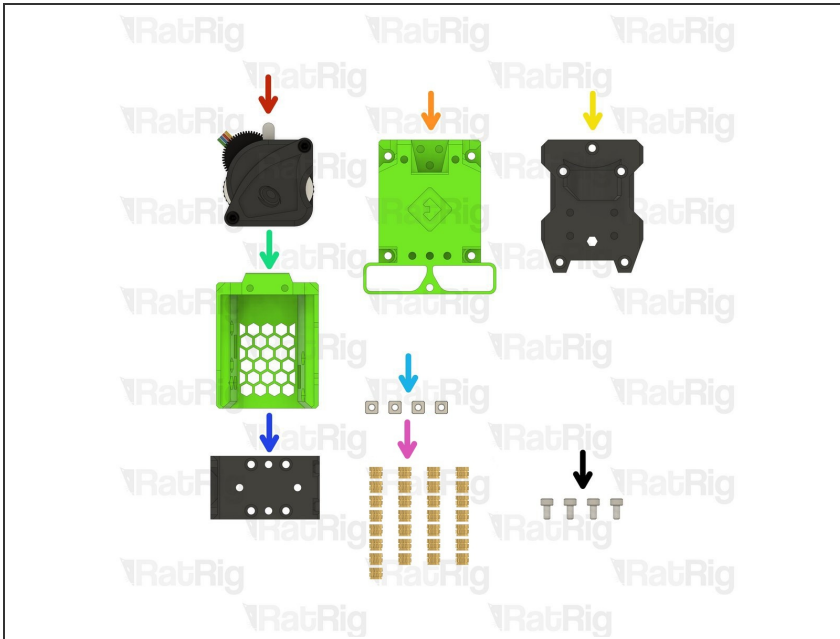


## INTRODUCTION

This guide covers the assembly of the EVA 3.0 print head. Whilst EVA 3.0 supports multiple combinations of extruder, hot end, and cooling, this guide focuses on the components supplied in the default V-Core 3.1 kit:

- Bondtech LGX Lite extruder
- Phaetus Rapido HF hot end
- 4028 part cooling fan
- Rat Rig “SuperPinda” Probe by P&F

Information regarding other component combinations can be found on the [EVA website](#)

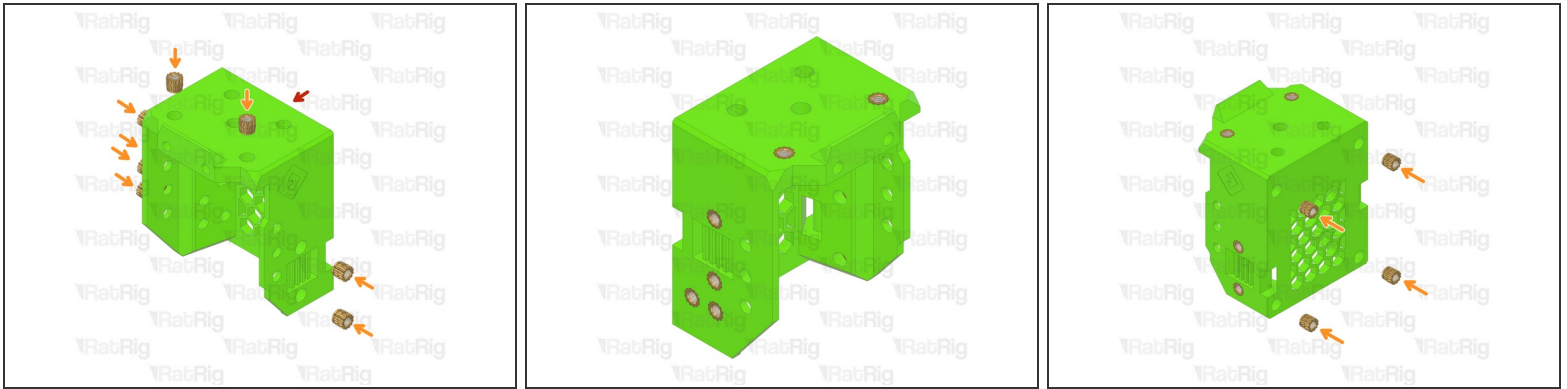
**Step 1 — Prepare EVA3 sub assembly parts - Part 1**

- 1x Bondtech LGX Lite Extruder
- 1x EVA3 back\_core\_xy\_fi Printed Part
- 1x EVA3 drive\_lgx\_lite Printed Part
- 1x EVA3 front\_universal\_fi Printed Part
- 4x Flat Square Nut - M3 (supplied with the LGX Lite - they could be pre-installed inside the extruder)
- 1x EVA3 top\_endstop\_mgn12c\_fi Printed Part
- 29x Heat Insert - M3
- 4x M3x8 Cap Head Screw

**Step 2 — Prepare EVA3 sub assembly parts - Part 2**

- ① Prepare also the remaining parts
- 1x EVA3 cable\_guide\_mount\_fi Printed Part
- 1x EVA3 40mm\_fan\_inlet\_fi Printed Part
- 1x EVA3 bottom\_horns\_fi Printed Part
- 1x EVA3 hotend\_rapido\_fi Printed Part

### Step 3 — Install heat inserts into the EVA3 front



☒ If you are using EVA with hex nuts skip to **Step 10**

● EVA3 universal\_front\_fi Printed Part

● 12x Heat Insert - M3

① Install a heat insert into each position shown, there should be four on the left, four on the back, two in the top, and two on the right.

**Step 4 — Install heat inserts into the Rapido UHF mount & EVA back**

- EVA3 hotend\_rapido\_fi Printed Part
  - 8x Heat Insert - M3
  - ① Install a heat insert into each position as shown
- EVA3 back\_core\_xy\_fi Printed Part
  - 3x Heat Insert - M3
  - ① Install a heat insert into each of the three positions shown

**Step 5 — Install heat inserts into the remaining EVA parts**

- EVA3 bottom\_horns\_fi Printed Part
  - 1x Heat Insert - M3
- EVA3 cable\_guide\_mount Printed Part
  - 2x Heat Insert - M3
- EVA3 top\_endstop\_mgn12c\_fi Printed Part
  - 3x Heat Insert - M3

**Step 6 — Install heat inserts into the EVA3 fan inlet**

- EVA3 40mm\_fan\_inlet\_fi Printed Part
- 4x Heat Insert - M3

## Step 7 — Prepare the Bondtech LGX Lite extruder - Part 1



- Bondtech LGX Lite extruder
- Remove the two M3x25 screws holding the Bondtech LGX Lite together
- Carefully remove the motor from the LGX Lite assembly
- ① Set the LGX Lite motor aside until **Step 25**

## Step 8 — Prepare the Bondtech LGX Lite extruder - Part 2



❗ If the 4x Flat Square Nut - M3 are pre-installed inside the LGX Lite, you can skip this step

- Carefully remove the face plate from the LGX Lite assembly
- M3 Square Nut
- Insert one M3 square nut into each of the marked holes on the LGX Lite
- Re-install the LGX Lite face plate
- Carefully remove the rear plate from the LGX Lite assembly
- Insert one M3 square nut into each of the marked holes on the LGX Lite
- Re-install the LGX Lite back plate

## Step 9 — Prepare the Bondtech LGX Lite extruder - Part 3



- Bondtech LGX Lite assembly
  - EVA3 drive\_lgx\_lite Printed Part
  - M3x8 Cap Head Screw
- ① Install an M3x8 screw into each of the four positions shown. This will secure the LGX Lite extruder to the printed part
- ⚠ Take care not to over tighten the M3 screws as you can damage the printed part or the LGX Lite
- Re-install the two M3x25 screws into the LGX Lite extruder

## Step 10 — Prepare the hotend assembly parts



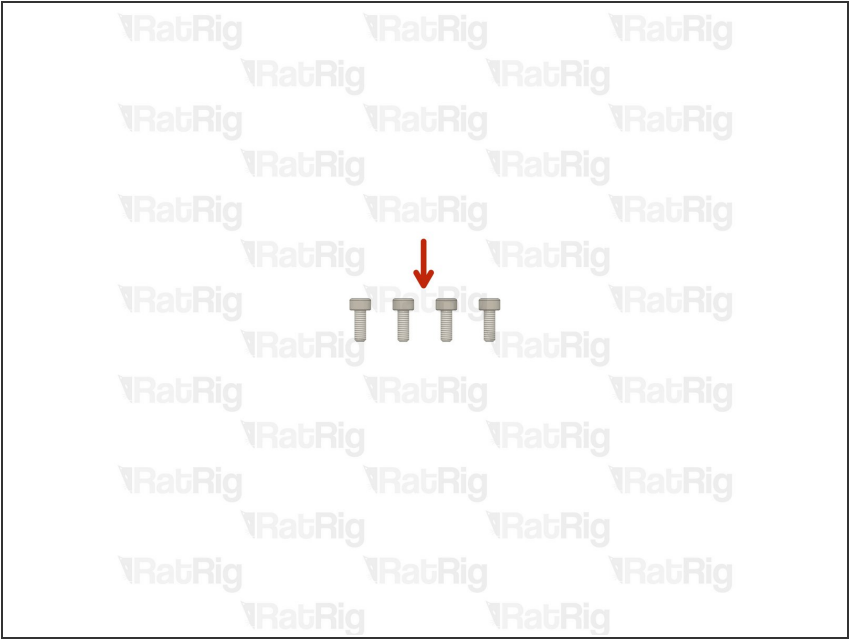
- 1x Phaetus Rapido HF Hotend  
(The Phaetus Rapido 2 is exactly the same)
- 4x M2.5x8 Cap Head Screw  
(Included with the Phaetus Rapido HF)
- 4x M3x35 Cap Head Screw
- 1x 43.7mm PTFE Tube

## Step 11 — Assemble the Rapido UHF mount



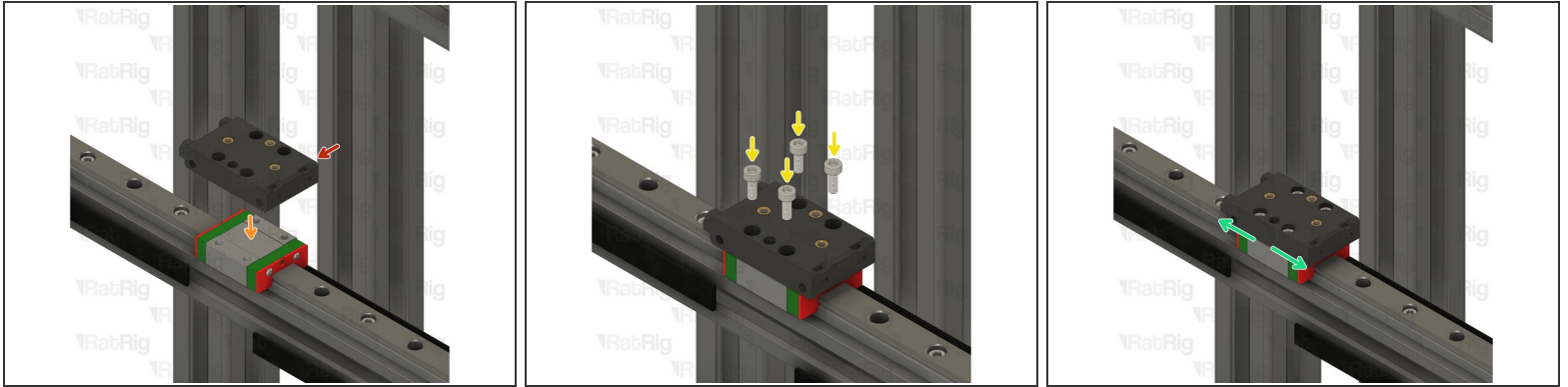
- Assembly from the previous step
- M2.5x8 Cap Head Screw
- Phaetus Rapido HF assembly
  - ① Insert the four M2.5x8 screws through the printed part and fasten them into the Rapido HF hotend
- 43.7mm PTFE Tube
  - ① Insert the PTFE tube as shown, ensure it is fully pushed down into the hotend
- ① Set this assembly aside until **Step 28**

Step 12 — Prepare the EVA3 MGN12 fasteners



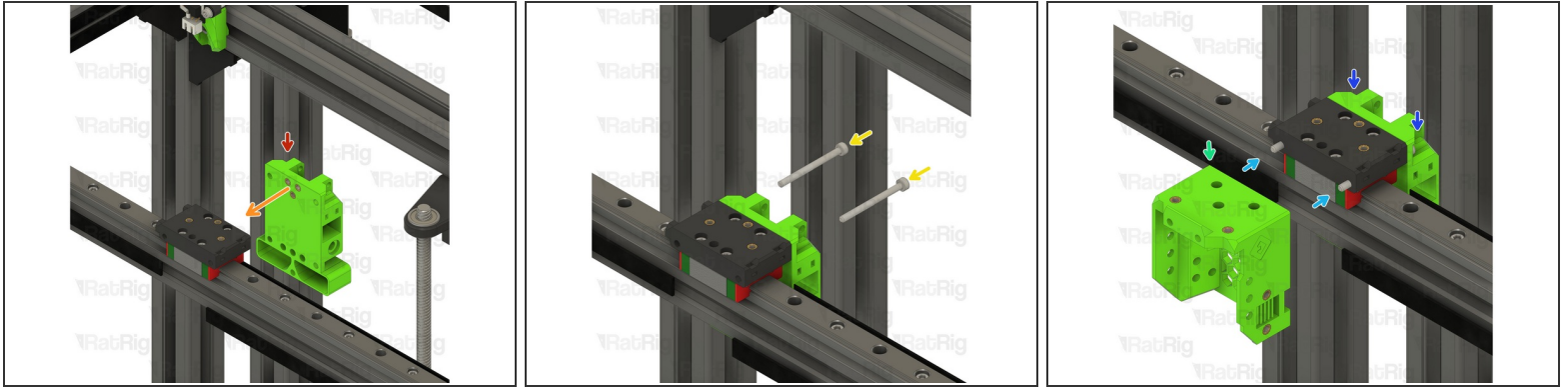
- 4x M3x8 Cap Head Screw

## Step 13 — Install the MGN12 EVA3 Connector



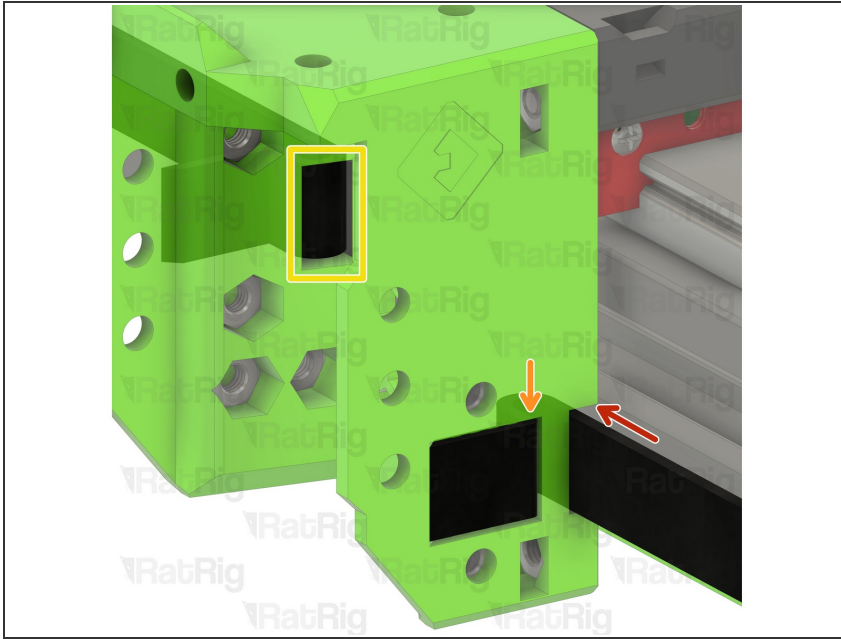
- Install the MGN12 EVA3 Connector
- Place the EVA3 top assembly atop the MGN12 carriage as shown
  - ⚠ Make sure the holes on the side of the printed part face towards the **left** of the x-axis
- M3x8 Cap Head Screw
  - ⓘ Fasten all four M3x8 screws to secure the EVA3 top assembly to the MGN12 carriage
- Slide the X-axis left and right along the rail to make sure it moves smoothly
  - ⚠ If the carriage binds at all, **slightly** loosen the M3x8 screws and check again

## Step 14 — Install the EVA3 CoreXY back



- EVA3 back assembly from **Step 6**
- Position the EVA3 back assembly as shown
- M3x35 Cap Head Screw
  - ① Insert the M3x35 screws through the EVA3 back assembly and into the MGN12 mount as shown
- EVA3 front assembly from **Step 2**
- Position the EVA3 front assembly as shown
- Tighten the M3x35 screws to secure the EVA3 front assembly to the x-axis carriage

## Step 15 — Install the belts into the EVA front assembly



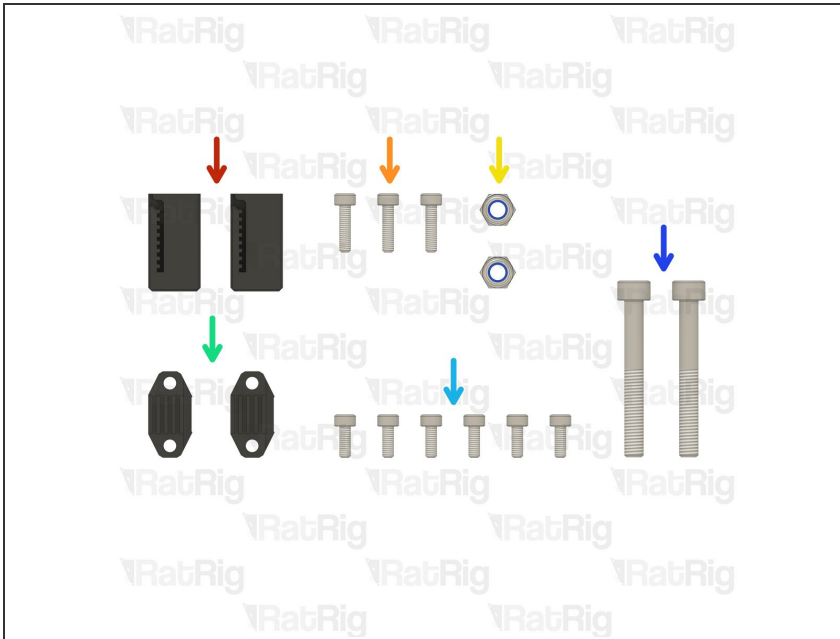
- ☑ Although this image shows the EVA with hex nuts, this step is exactly the same when using heat inserts
- Take the end of the lower CoreXY belt and pass it through the side of the EVA3 front as shown
- Pass the belt back out using the shown slot
- Repeat these steps for the top CoreXY belt

## Step 16 — Install the EVA3 horns duct



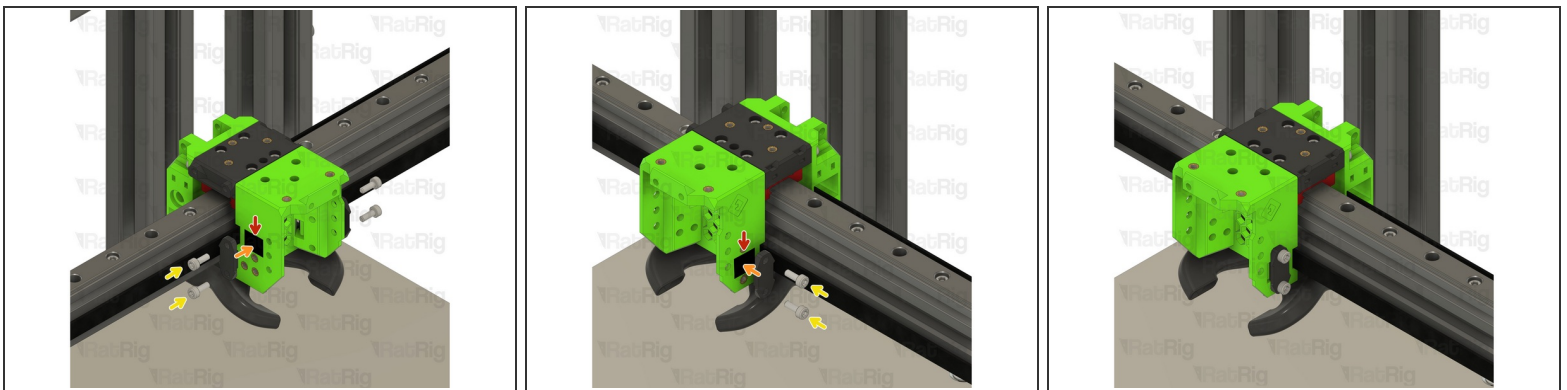
- EVA3 bottom\_horns\_fi Printed Part
- Position the EVA3 bottom as shown
- M3x35 Cap Head Screw
  - ① Install each M3x35 screw into the back, through the EVA3 bottom and secure them into the EVA3 front
- ⚠ Take care not to over tighten the M3 screws as you can damage the printed parts

## Step 17 — Prepare the EVA3 belt and extruder parts



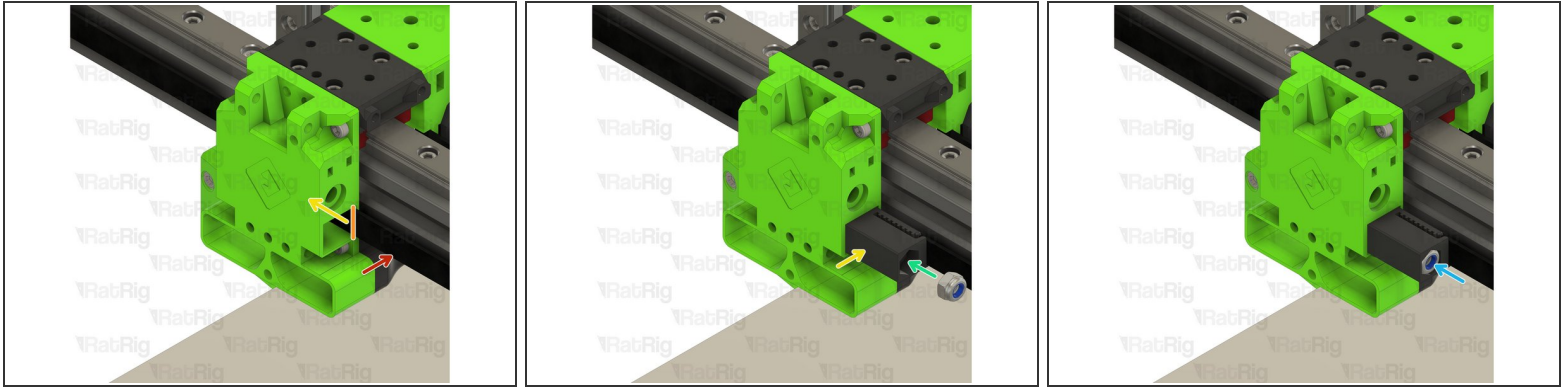
- 2x EVA3 core\_xy\_belt\_grabber Printed Part
- 3x M3x12 Cap Head Screw
- 2x M5 Nylon Locking Hex Nut
- 2x EVA3 face\_belt\_grabber Printed Part
- 6x M3x8 Cap Head Screw
- 2x M5x40 Cap Head Screw

## Step 18 — Attach the front belts to EVA3



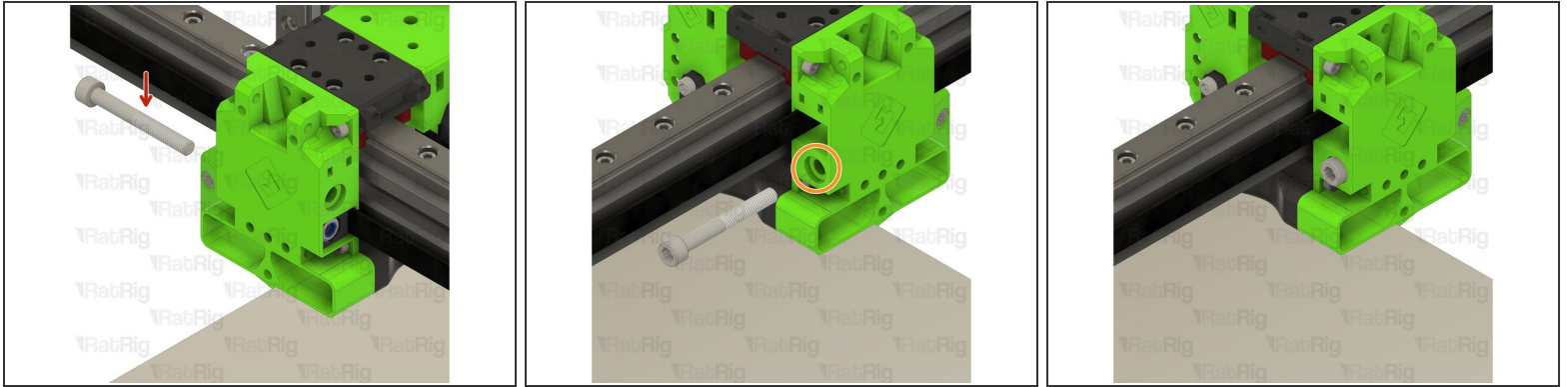
- Check that the CoreXY belt is still positioned from **Step 15**
- Place the EVA3 face\_belt\_grabber printed part over the exposed belt end
- Fasten two M3x8 screws through the EVA3 face\_belt\_grabber and into the universal face
- ① Repeat the process on the left side of the EVA3 assembly
- ⚠ Take care not to over tighten the M3 screws as you can damage the printed parts

## Step 19 — Install the rear CoreXY belt grabbers - Part 1



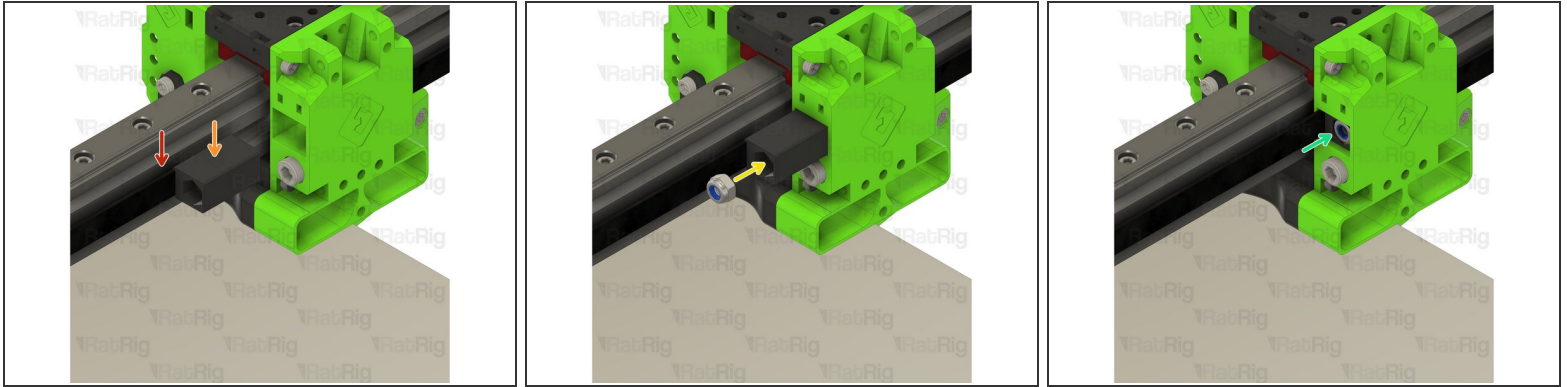
- Loose end of the lower CoreXY belt
- Mark the belt where it meets the EVA3 assembly. This can be with a marker, or simply by holding it.
- **From the mark, towards the loose end of the belt**, measure 24mm (or count 12 teeth)
  - ⚠ It is better to cut the belt too long than too short! If you are unsure, cut it longer than expected, you can always remove more if needed
- ① Double check your measurements and then cut the belt at this point
- Insert the cut end of the belt into the core\_xy\_belt\_grabber printed part
- Insert an M5 nylon locking nut into the core\_xy\_belt\_grabber as shown
- Insert the core\_xy\_belt\_grabber assembly into the EVA3 assembly as shown

## Step 20 — Install the rear CoreXY belt grabbers - Part 2



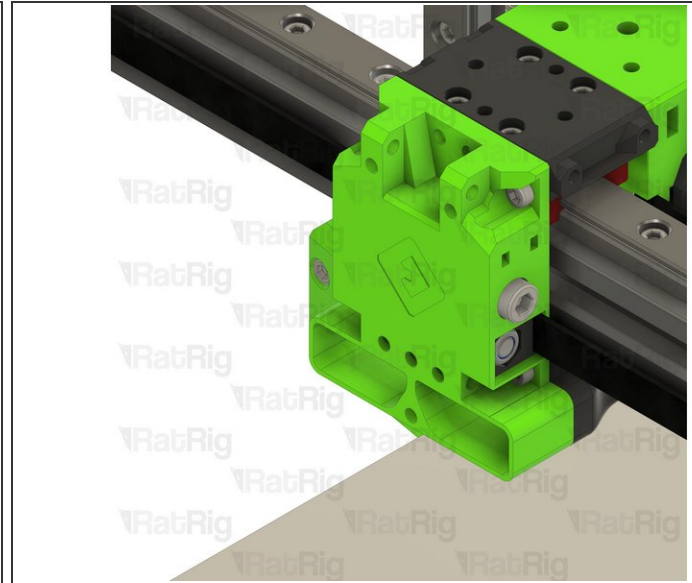
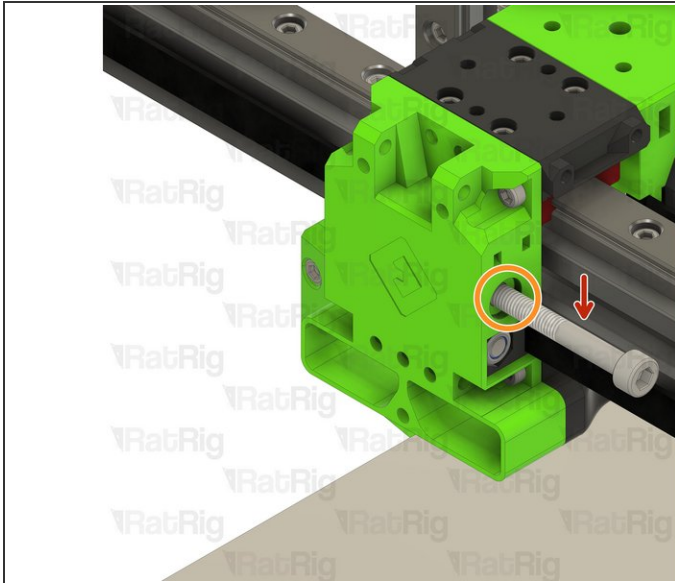
- M5x40 Cap Head Screw
  - Insert the M5x40 screw into the marked hole on the EVA3 assembly and fasten it **slightly** to engage with the M5 nylon locking nut
- ⚠ **Do not tighten the M5x40 screw at this point.** The belts will be tensioned correctly in a later guide

## Step 21 — Install the rear CoreXY belt grabbers - Part 3



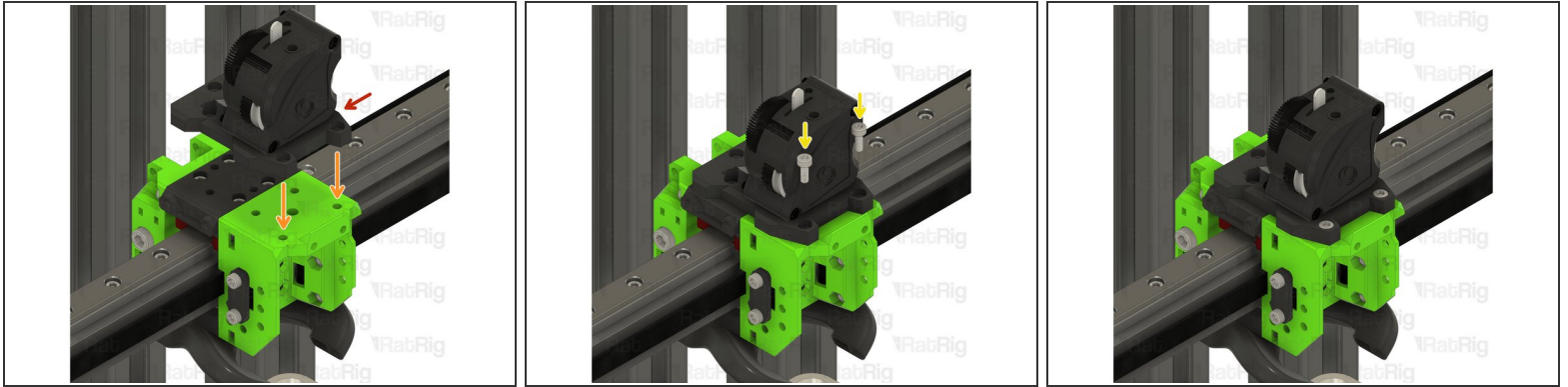
- Loose end of the upper CoreXY belt
- ① As in **Step 19**, mark the belt where it meets the EVA3 assembly. This can be with a marker, or simply by holding it.
- ① **From the mark, towards the loose end of the belt**, measure 24mm (or count 12 teeth)
  - ⚠ It is better to cut the belt too long than too short! If you are unsure, cut it longer than expected, you can always remove more if needed
  - ① Double check your measurements and then cut the belt at this point
- Insert the cut end of the belt into the core\_xy\_belt\_grabber printed part
- Insert an M5 nylon locking nut into the core\_xy\_belt\_grabber as shown
- Insert the core\_xy\_belt\_grabber assembly into the EVA3 assembly as shown

## Step 22 — Install the rear CoreXY belt grabbers - Part 4

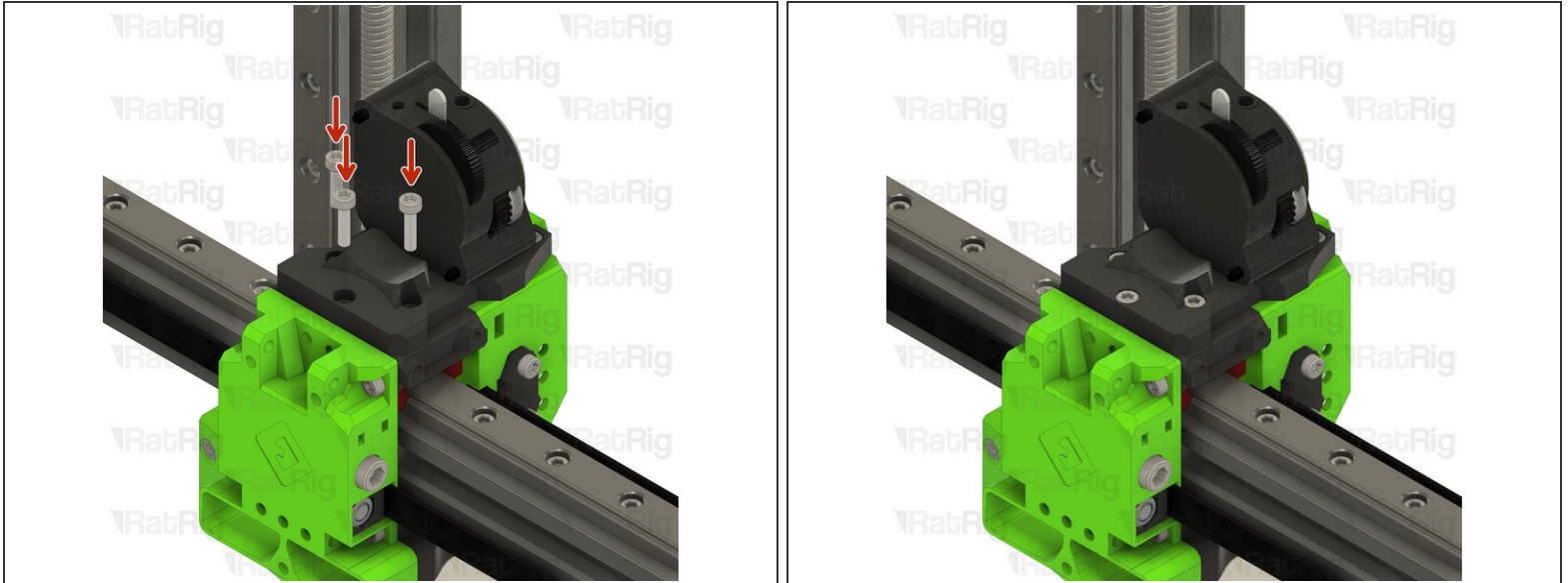


- M5x40 Cap Head Screw
- Insert the M5x40 screw into the marked hole on the EVA3 assembly and fasten it **slightly** to engage with the M5 nylon locking nut
- ① The M5x40mm screws are used to tighten the CoreXY belts
  - Tighten each M5x40 screw one-half turn at a time to tension the belts equally
  - Continue tightening the screws until the belts are no longer slack
  - Check that the X-axis gantry is square by moving it to the front of the machine. If it has skewed, it can be squared by adjusting the tension of one belt at a time
- ⚠ Make sure not to over-tension the belts as this can cause damage to the bearings, the belt, the motors or printed parts!
- ① An excellent article on correct CoreXY belt tensioning is available [on Mark Rehorst's website](#)

## Step 23 — Install the Bondtech LGX Lite extruder - Part 1



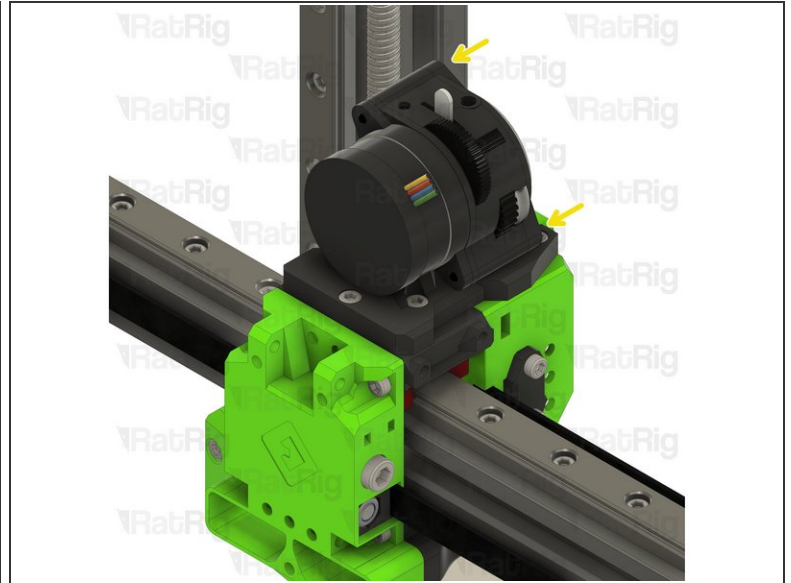
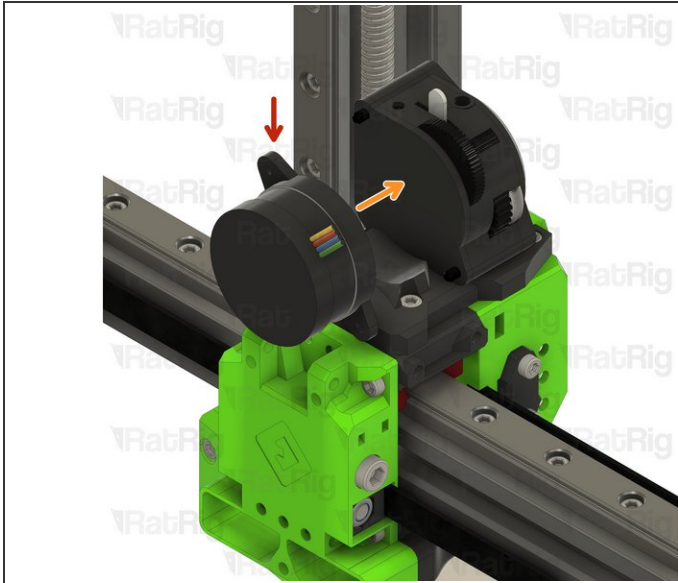
- Bondtech LGX Lite assembly from **Step 9**
- Place the Bondtech LGX Lite assembly onto the top of the EVA3 assembly as shown
- M3x8 Cap Head Screw
  - ① Fasten the two M3x8 screws through the drive\_lgx\_lite printed part into the EVA3 universal front
- ⚠ Take care not to over tighten the M3 screws as you can damage the printed parts

**Step 24 — Install the Bondtech LGX Lite extruder - Part 2**

- M3x12 Cap Head Screw

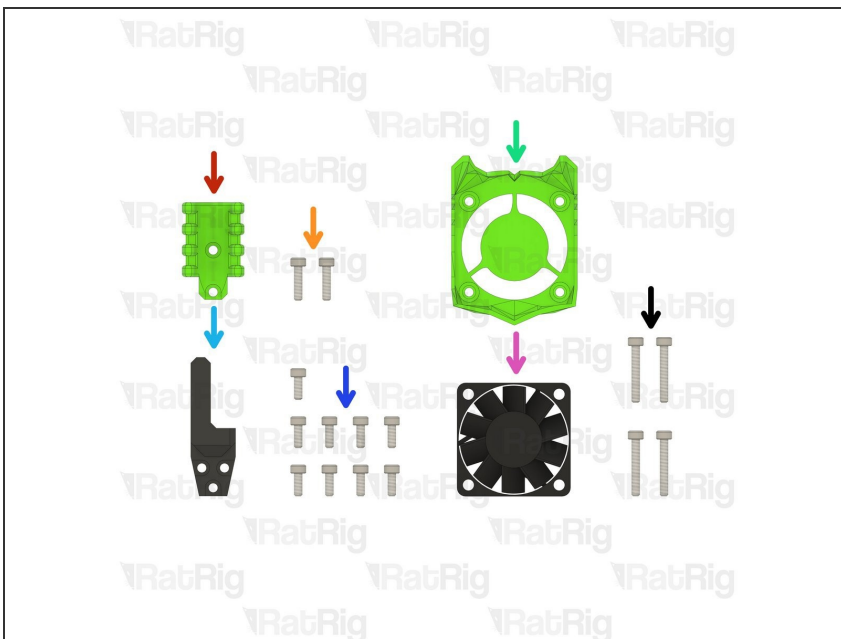
- ① Fasten the three M3x12 screws through the drive\_lgx\_lite printed part into the EVA3 universal front

## Step 25 — Install the Bondtech LGX Lite motor



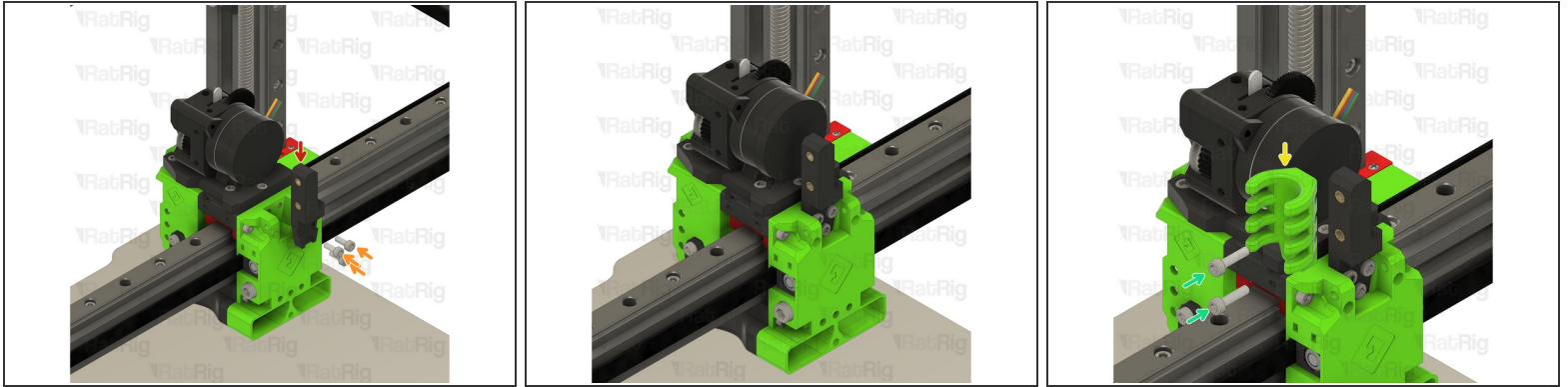
- Bondtech LGX Lite motor from **Step 7**
- Re-install the Bondtech LGX Lite motor into the back of the LGX Lite extruder
- Fasten the two M3x25 screws on the face of the LGX Lite to secure the motor in place

## Step 26 — Prepare the EVA3 cable guide & face parts

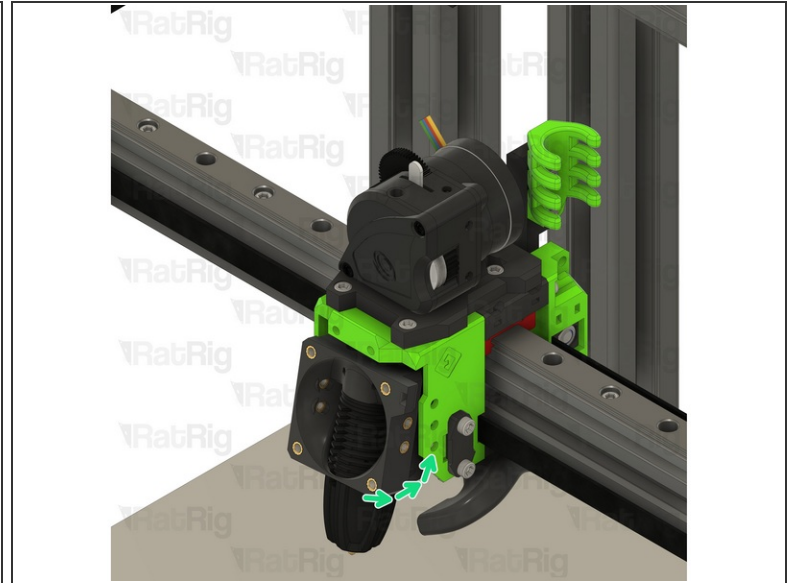
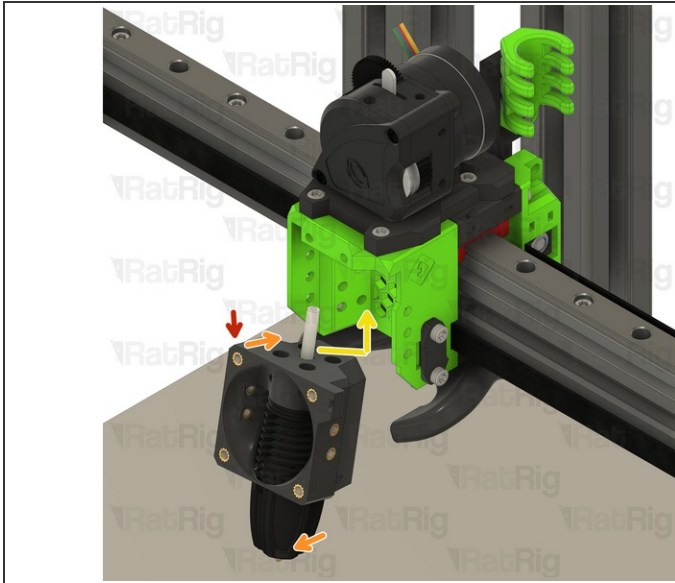


- 1x EVA3 cable\_guide Printed Part
- 2x M3x12 Cap Head Screw
- 1x ratrig\_eva3\_shroud Printed Part
- 1x EVA3 cable\_guide\_mount\_fi assembly
- 9x M3x8 Cap Head Screw
- 1x 40x10mm 24V Axial Fan
- 4x M3x20 Cap Head Screw

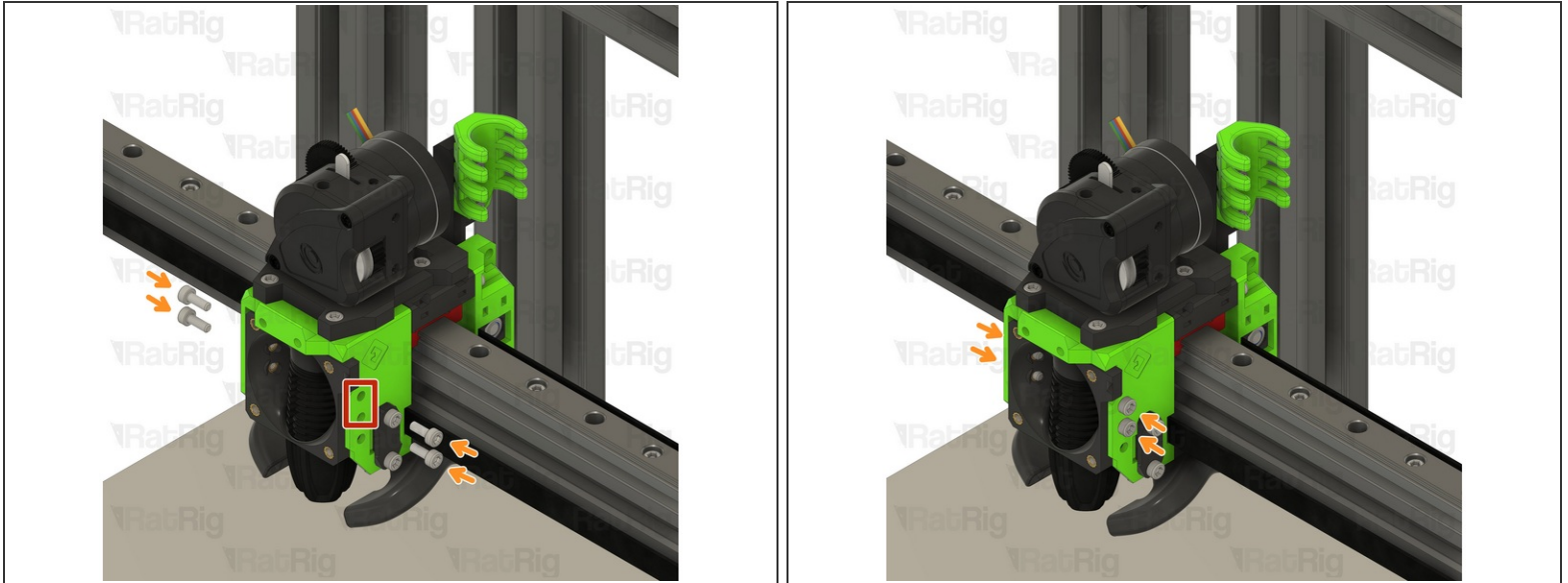
## Step 27 — Install the EVA3 cable guide



- EVA3 cable\_guide\_mount Printed Part
- M3x8 Cap Head Screw
  - ① Fasten the three M3x8 screws through the EVA3 cable\_guide\_mount printed part and into the EVA3 back
- EVA3 cable\_guide Printed Part
- M3x12 Cap Head Screw
  - ① Fasten the two M3x12 screws through the EVA3 cable\_guide and into the EVA3 cable\_guide\_mount\_fi

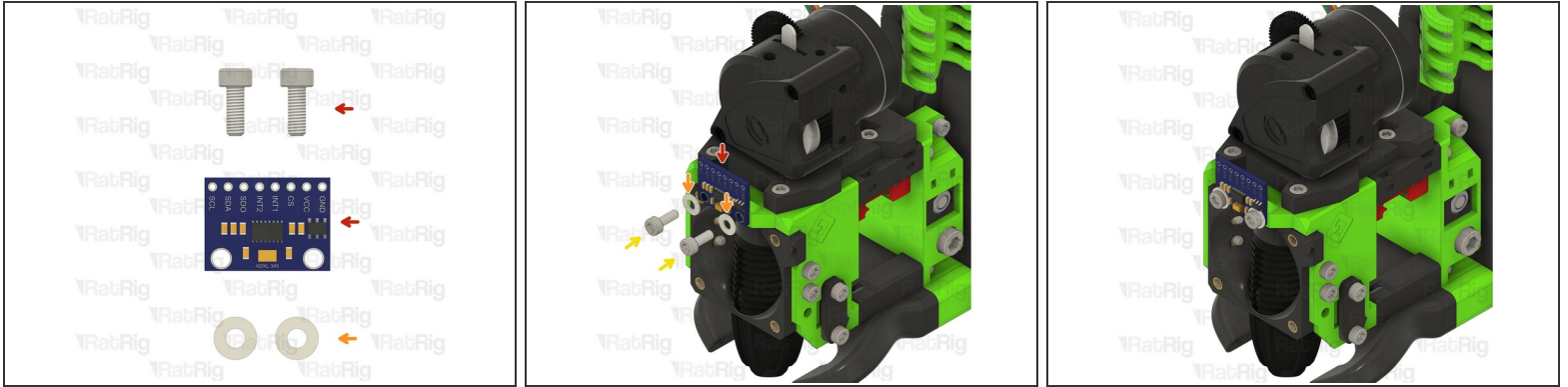
**Step 28 — Install the EVA3 hotend assembly - Part 1**

- Phaetus Rapido UHF hot end assembly from **Step 11**
- Angle the hot end assembly as shown
- Guide the PTFE tube into hole in the top of the EVA3 universal front
- Rotate the hot end assembly into position as shown

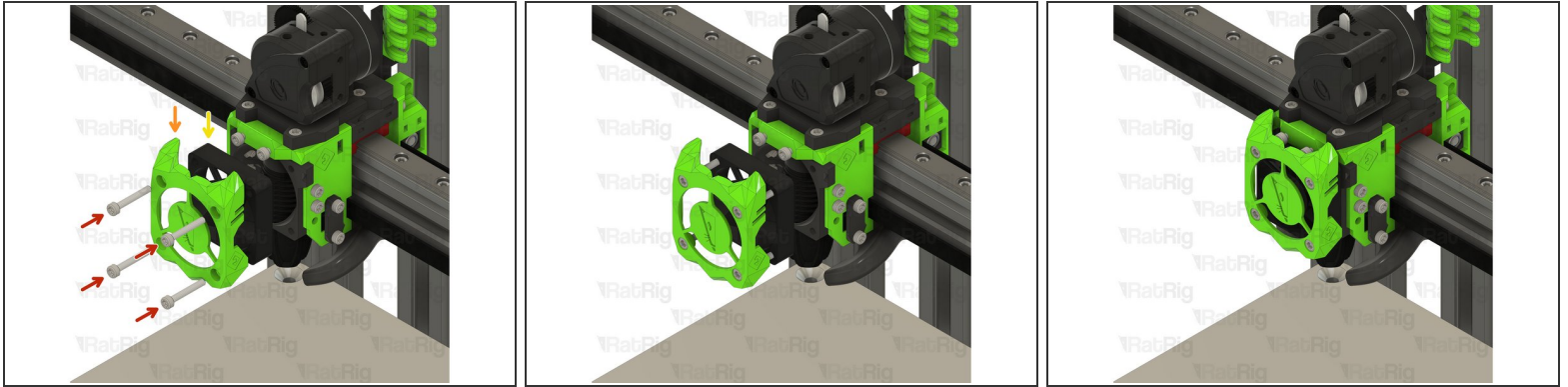
**Step 29 — Install the EVA3 hotend assembly - Part 2**

- Check that the assembly is aligned correctly. The heat inserts hex nuts should be visible through the marked holes
- M3x8 Cap Head Screw
  - ① Fasten the four M3x8 screws through the EVA3 universal front and into the hot end assembly to secure it in place
- ⚠ Take care not to over tighten the M3 screws as you can damage the printed parts

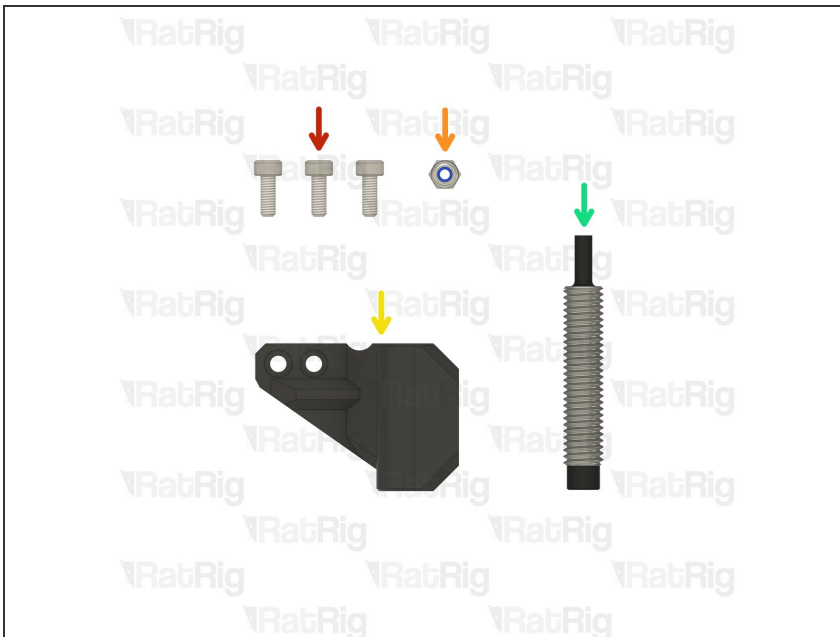
## Step 30 — Install the ADXL Accelerometer



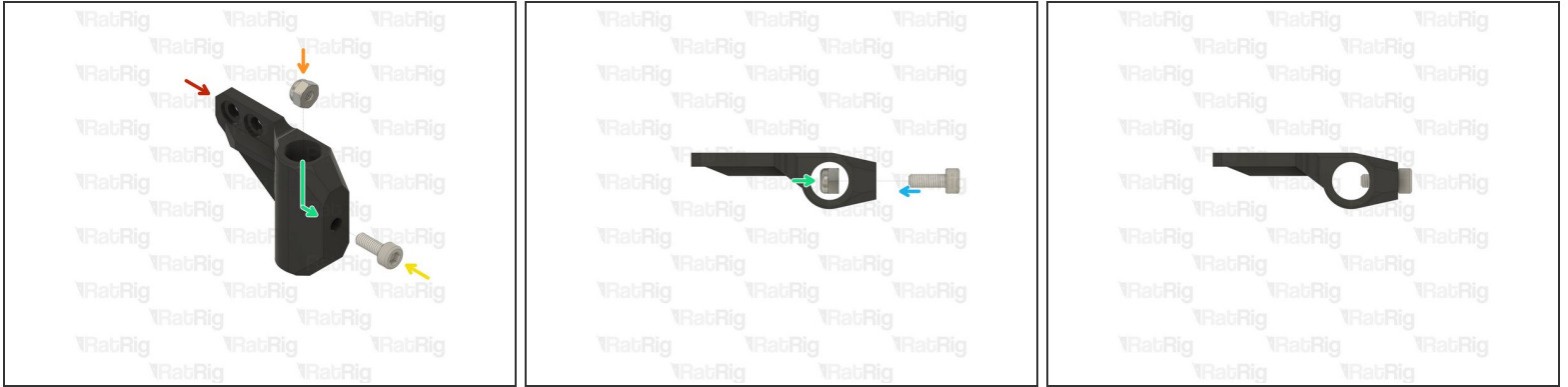
- ① The ADXL module won't appear in the rest of the guide, as it only started being offered in V-Core 3.1 kits since October 2023
- ADXL accelerometer module
  - ① Align the ADXL module with the two holes in the EVA assembly
- 2x M3 nylon washers
  - ① The nylon washers are required to prevent damaging the sensitive electronics on the ADXL board
- 2x M3x8 Cap Head Screw
  - ① Tighten the M3x8 screws to secure the ADXL in place
- ⚠ Do not overtighten the screws as the ADXL will be permanently damaged

**Step 31 — Install the hotend fan and EVA3 shroud**

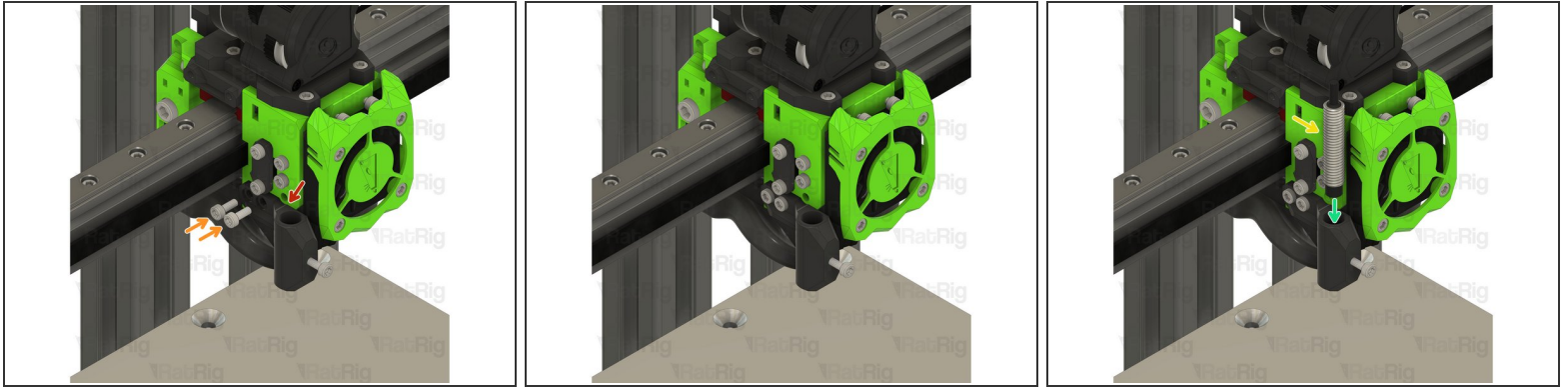
- M3x20 Cap Head Screw
  - ratrig\_eva3\_shroud Printed Part
  - 40x10mm 24V Axial Fan
- ❗ Insert the M3x20 screws into the ratrig\_eva3\_shroud, through the 40mm fan and fasten them into the EVA3 front

**Step 32 — Prepare the Z-probe parts**

- 3x M3x8 Cap Head Screw
- 1x M3 Nylon Locking Hex Nut
- 1x Rat Rig SuperPinda Probe by P&F
- 1x EVA3 Ij8\_probe\_mount Printed Part

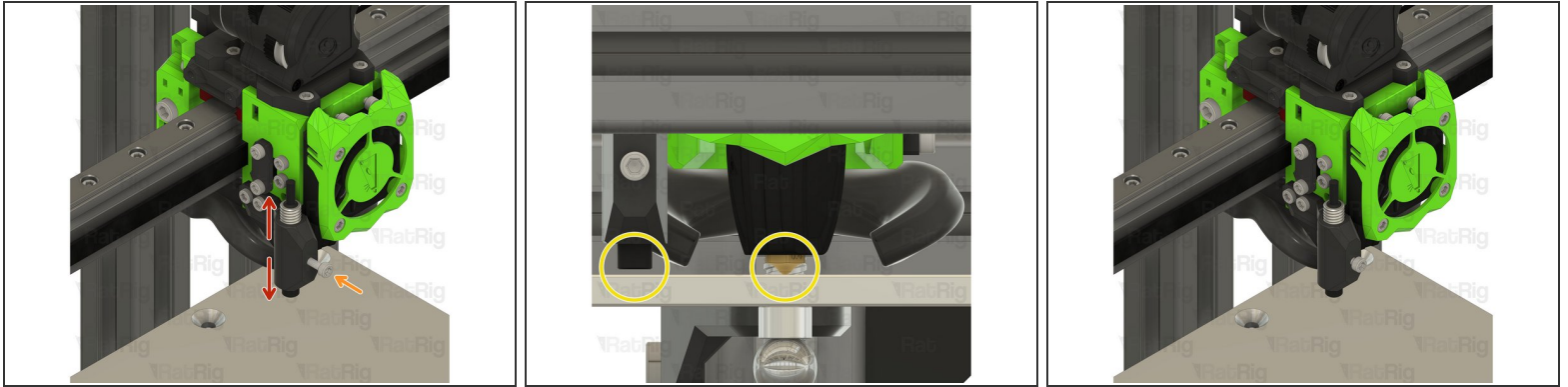
**Step 33 — Install the EVA3 Z-probe - Part 1**

- EVA3 Ij8\_probe\_mount Printed Part
- M3 Nylon Locking Hex Nut
- M3x8 Cap Head Screw
- The M3 nylon locking hex nut must be installed inside the Ij8\_probe\_mount printed part
- Fasten the M3x8 screw to pull the M3 nylon locking nut into position

**Step 34 — Install the EVA3 Z-probe**

- EVA3 lj8\_probe\_mount assembly from the previous step
  - ① Position the probe mount assembly as shown
- M3x8 Cap Head Screw
  - ① Fasten the two M3x8 screws through the probe mount and into the EVA3 assembly
- Rat Rig SuperPinda Probe by P&F
- Insert the probe into the probe mount as shown

## Step 35 — Align and secure the Z-probe

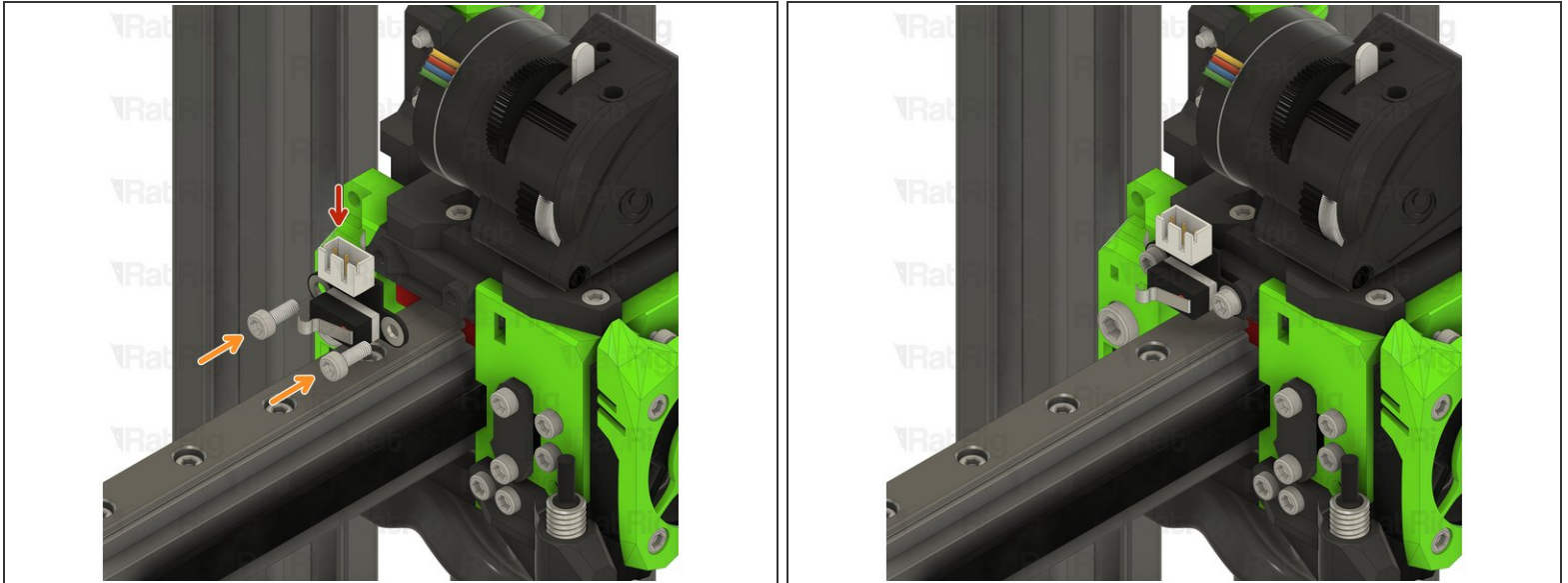


- ① The Rat Rig SuperPinda Probe needs to be at the correct height to trigger properly
- ① A recommended method to set the correct height is to rest the hot end nozzle on the bed, and then place a cable tie between the bed and the tip of the probe
- Adjust the probe up to down as necessary to position the tip 1mm higher than the hot end nozzle
- Tighten the M3x8 to secure the probe in place
- ⚠ Do not over-tighten the M3x8 screw, doing so can damage the probe or printed probe mount
- Correct probe vs nozzle position

**Step 36 — Prepare the EVA3 endstop and part cooling parts**

- 1x Endstop Module
- 2x M3x8 Cap Head Screw
- 5x M3x35 Cap Head Screw
- 1x M3x25 Cap Head Screw
- 1x EVA3 40mm\_fan\_inlet\_fi Printed Part
- 1x 4028 Part Cooling Fan
- 1x M3 Nylon Locking Hex Nut

## Step 37 — Install the X-axis endstop

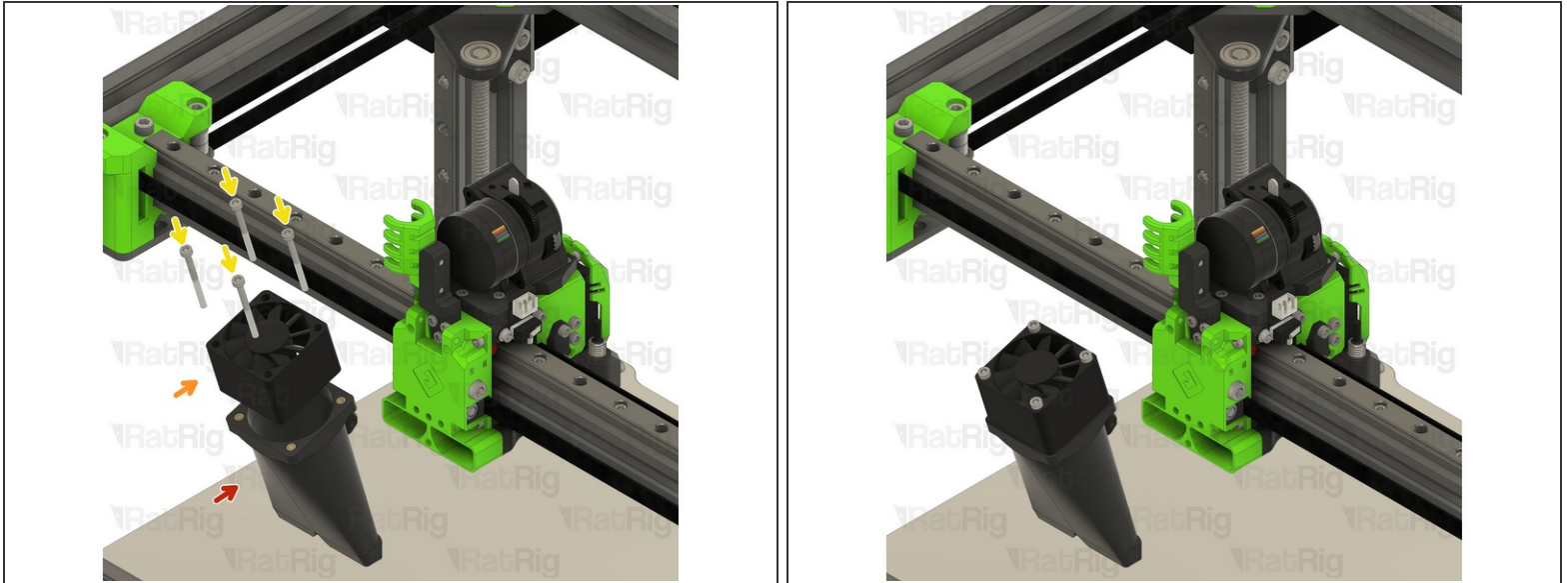


- Endstop Module

- M3x8 Cap Head Screw

① Fasten the endstop module to the EVA3 assembly, as shown, using the M3x8 screws

⚠ These M3 screws fasten directly into the printed part. Take care not to over tighten them

**Step 38 — Assemble the EVA3 4028 cooling duct - Part 1**

- EVA3 40mm\_fan\_inlet assembly

- 4028 Part Cooling Fan

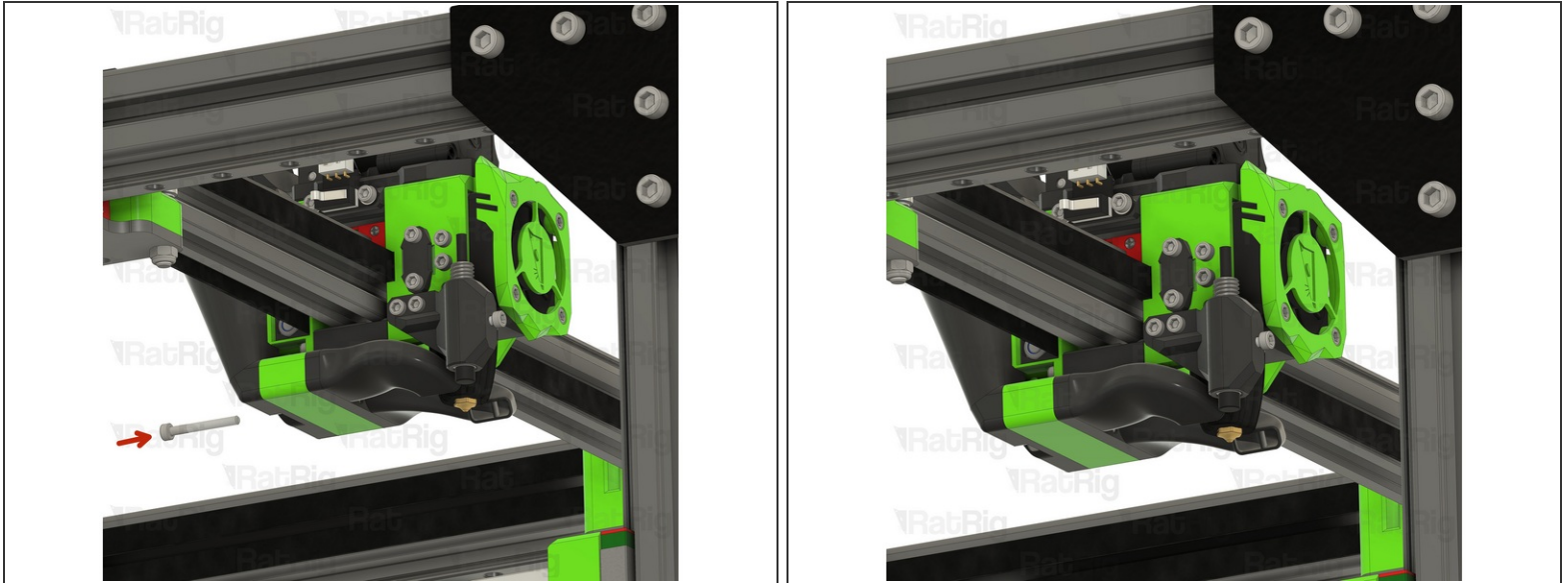
- M3x35 Cap Head Screw

① Fasten the four M3x35 screws through the 4028 cooling fan and into the heat inserts within the 40mm\_fan\_inlet\_fi

**Step 39 — Assemble the EVA3 4028 cooling duct - Part 2**

- Install the 40mm\_fan\_duct assembly as shown
- M3x35 Cap Head Screw
  - ① Push the M3x35 screw through the EVA3 assembly and 40mm\_fan\_duct as shown
- M3 Nylon Locking Hex Nut
  - ① Fasten the M3 nylon hex nut onto the M3x35 screw

## Step 40 — Assemble the EVA3 4028 part cooling duct - Part 3



- M3x25 Cap Head Screw

- ① Fasten the M3x25 screw through the 40mm\_fan\_duct\_fi and into the heat insert

- ⚠ Take care not to over tighten the M3 screw as you can damage the printed parts

## Step 41 — Next guide



- Continue with the next guide: [11. X-Axis Gantry Alignment](#)