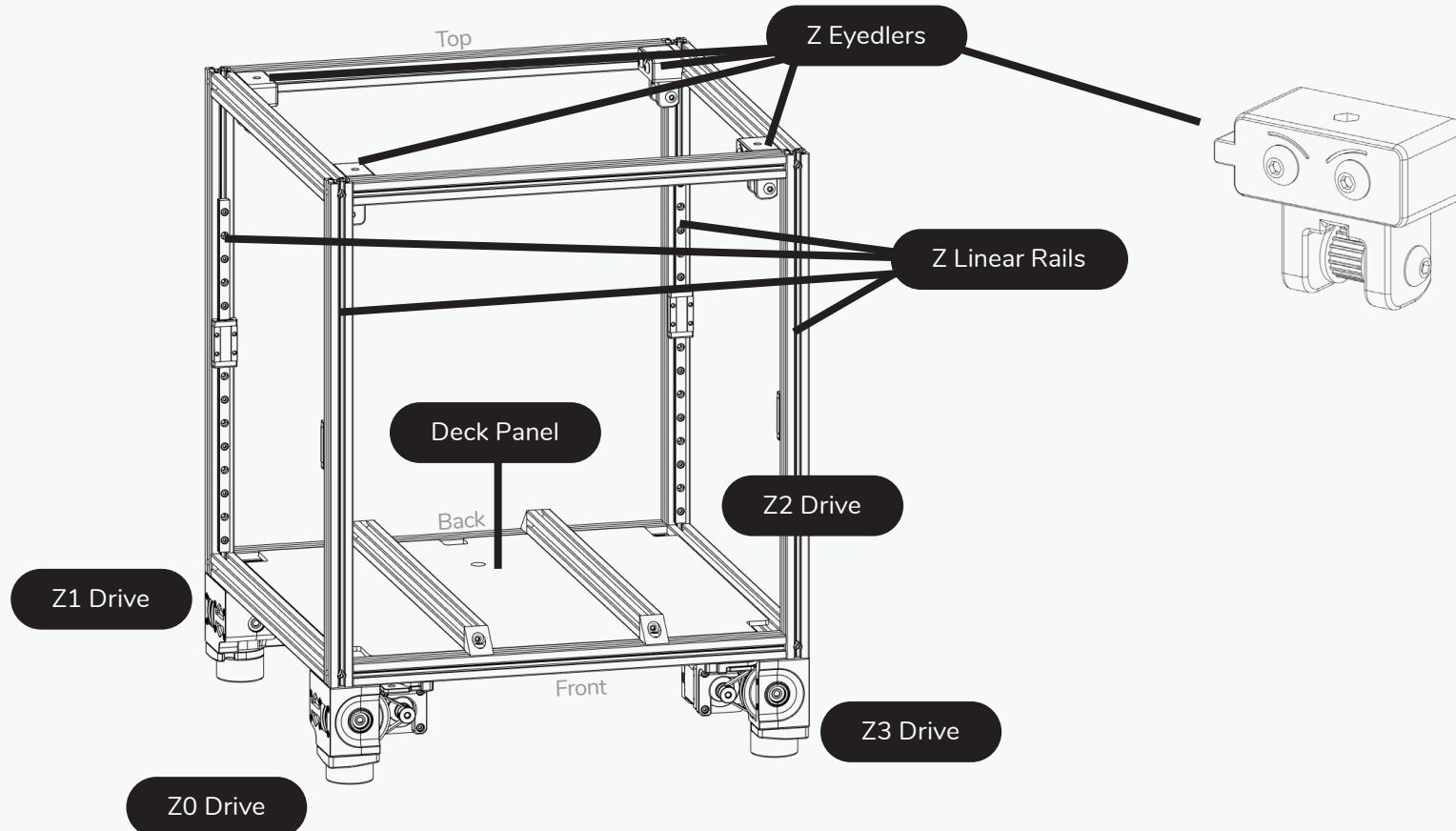


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Z DRIVES



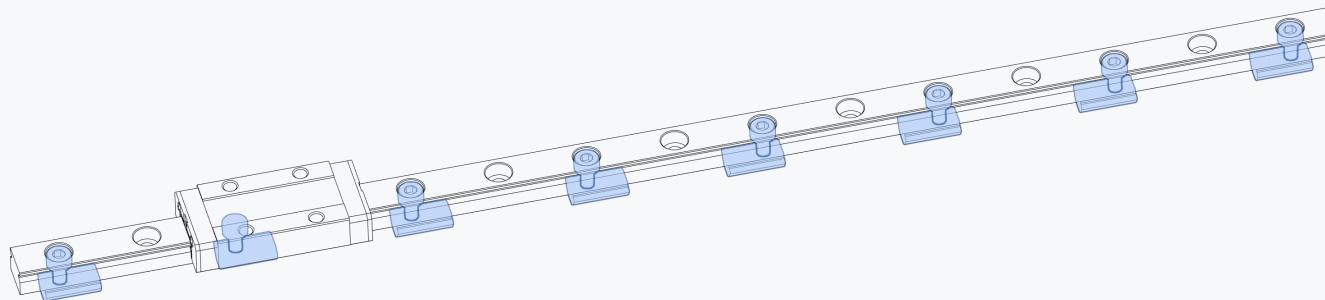


### OVERVIEW

Individual chapters start with an overview of the components that will be built/added to the printer in the chapter.

### HANDLE WITH CARE

The carriage can slide off the rail if not handled properly. Dropping the carriage will likely damage it. Any marks, dents or nicks might cause the linear rail to misbehave in operation.



### LINEAR RAILS - PREPARATION AND MOUNTING

Most linear rails arrive with shipping oil. To ensure a smooth gliding motion and long service life, this oil needs to be removed and its rail carriage greased. See the Voron sourcing guide for a recommended list of lubricants. We attached a link to a video guide to get you started.

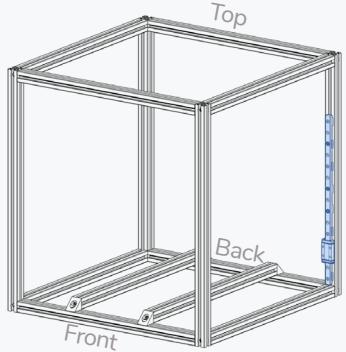
We opted to skip every other mounting hole in the linear rail when designing the mounting pattern for this printer. This cuts down on mounting hardware and still meets the requirements for our use case.

When tightening the bolts tighten them from the center outward to ensure that the rail sits flush on the extrusion.



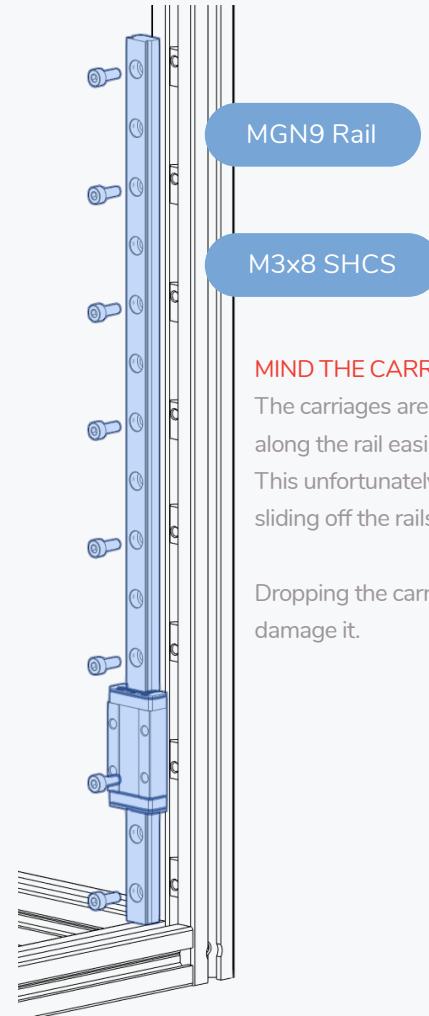
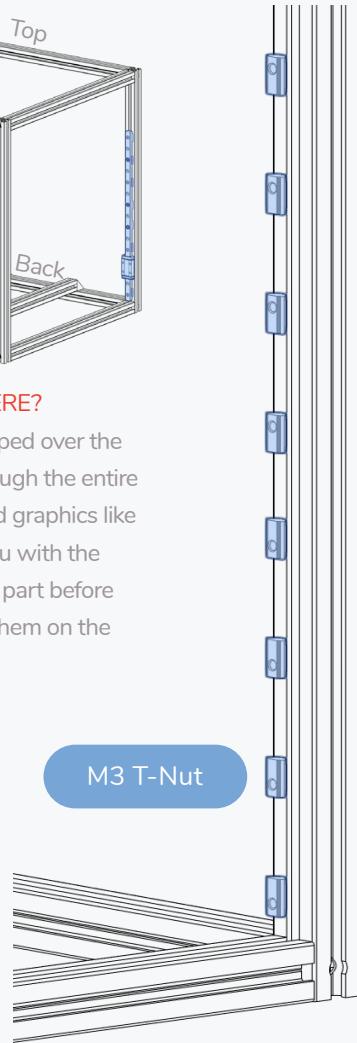
<https://voron.link/aguOnes>

## Z RAILS



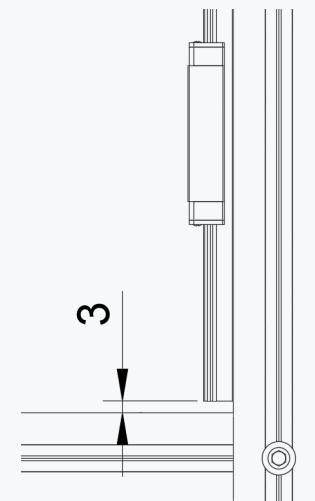
### WHY IS THIS HERE?

As you likely skipped over the advice to flip through the entire manual we added graphics like these to assist you with the orientation of the part before you actually put them on the printer.

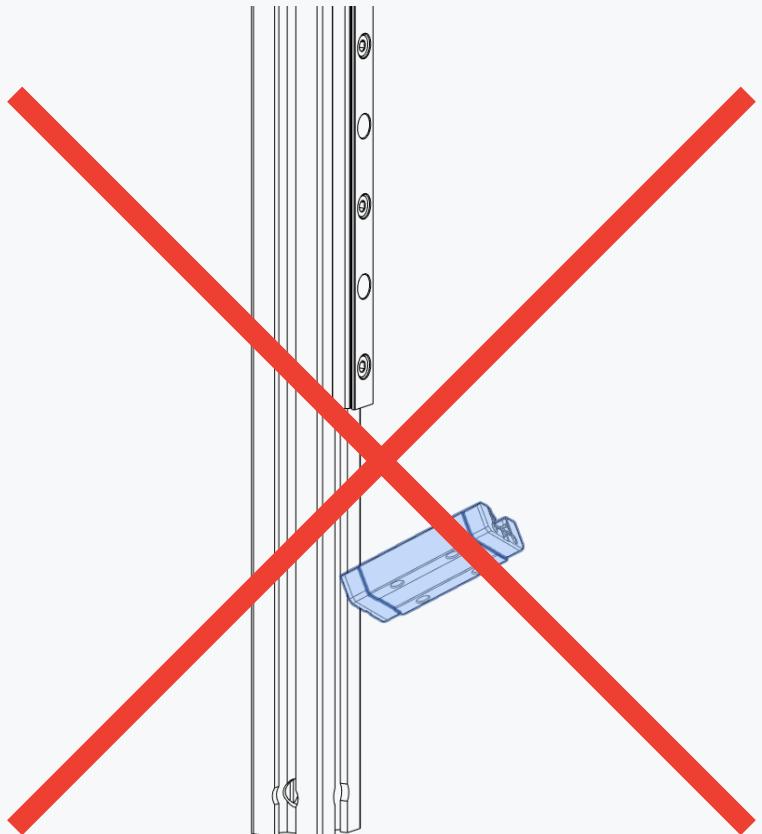


### CENTRED RAIL INSTALLATION GUIDE

Use the MGN9 guides to position the rail in the center of the extrusion prior to fastening the screws.



**BOTTOM GAP**  
Leave a gap between the printer frame and the rail. ~3mm is fine.

**RAIL SAFETY**

As we will turn the printer upside down during further assembly make sure to fix each carriage in position with a piece of sticky tape.

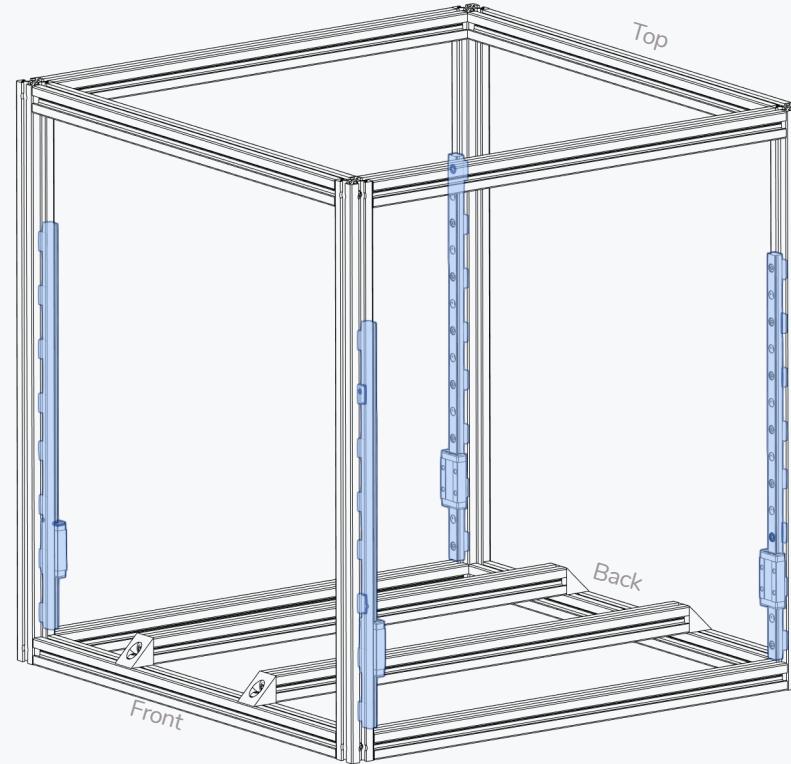
If your rails were delivered with plastic stoppers you can also temporarily reinstall them to prevent carriages from falling off their rails and spilling their bearing balls..

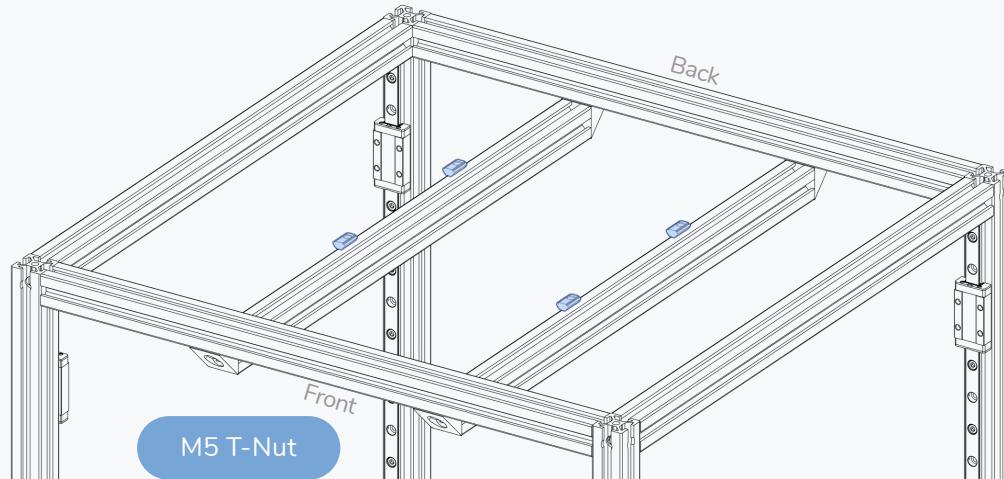
For illustration purposes only. Do not attempt to replicate.

**INSTALL REMAINING Z RAILS**

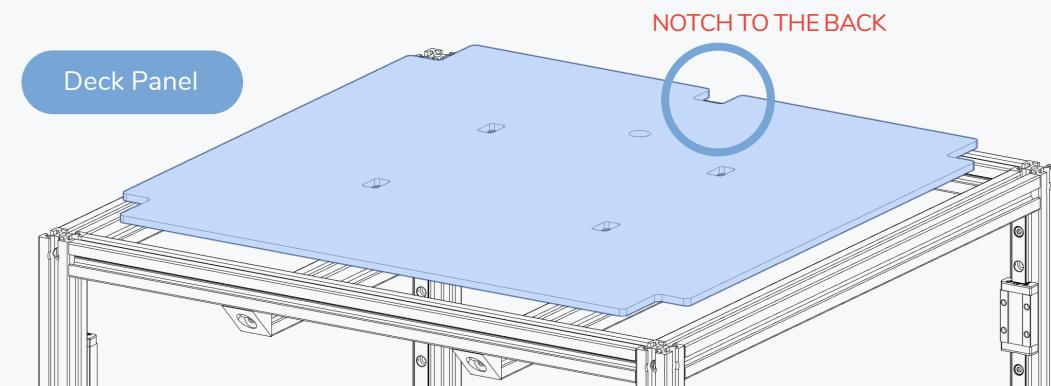
Add the remaining Z rails  
following the same instructions.

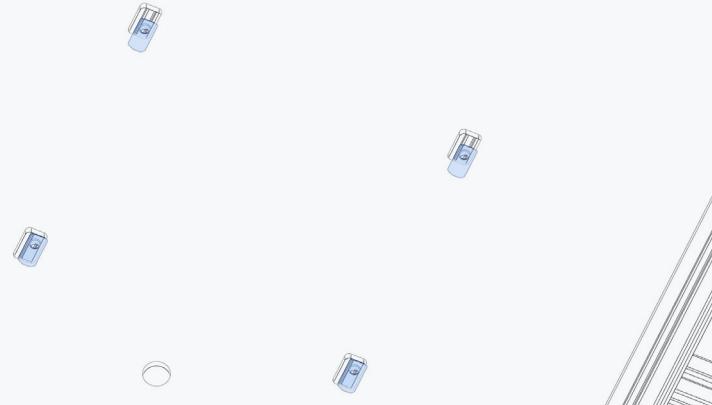
Make sure the rails face each  
other as shown in the graphic.



**FLIP PRINTER UPSIDE DOWN**

It's easier working with gravity than against it. But make sure the rail carriages are secure before doing so.



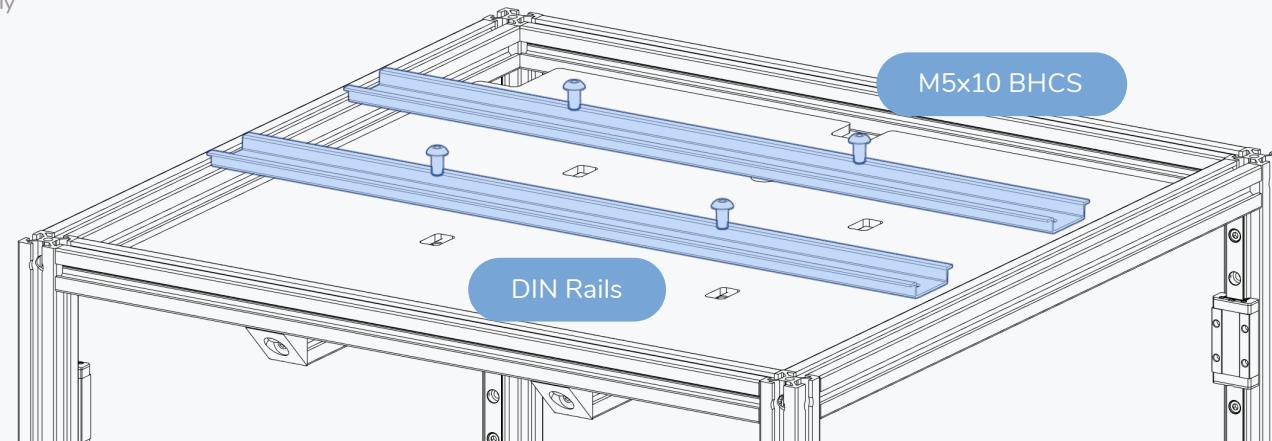


#### ALIGN T-NUTS WITH HOLES

Position the 4 T-nuts so they are directly below the 4 holes in the deck panel.

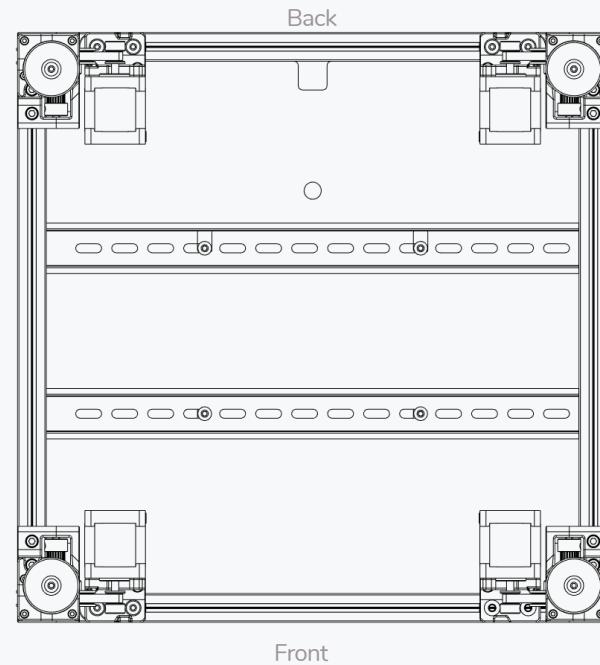
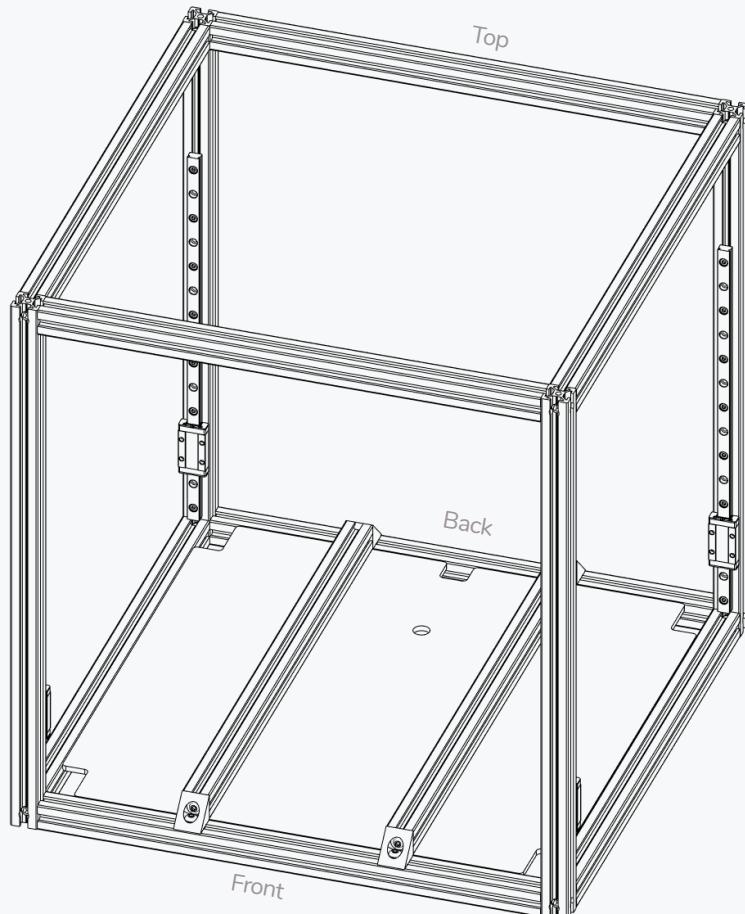
#### DIN RAIL SLOTS

If the slots in the rails do not line up with the t-nut you can shorten the DIN rails by a few mm.



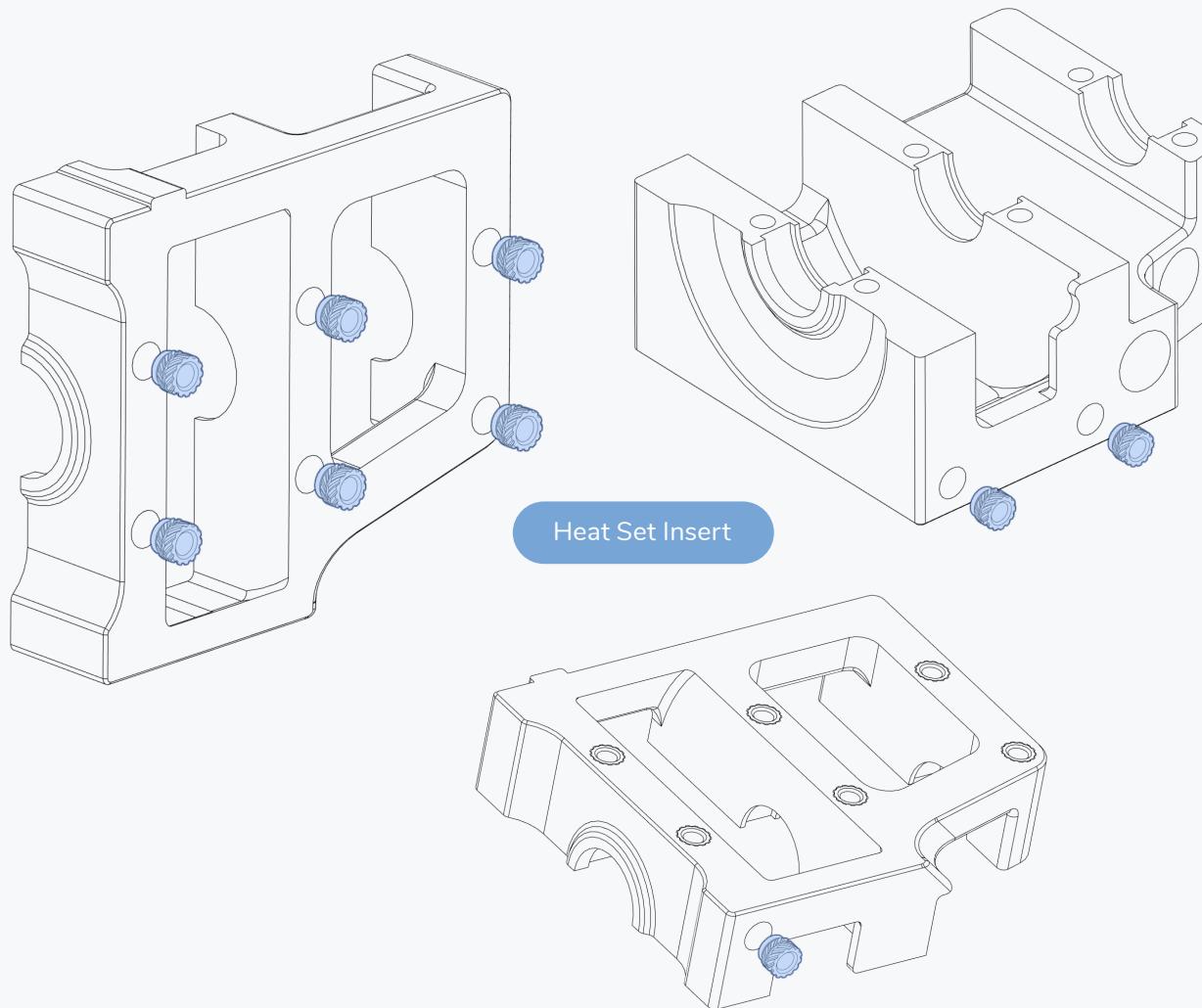
## ORIENTATION

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## PRINTER ORIENTATION

We regularly insert graphics like the ones above to help you along the build process. The sides are labeled to make it easier to keep track.



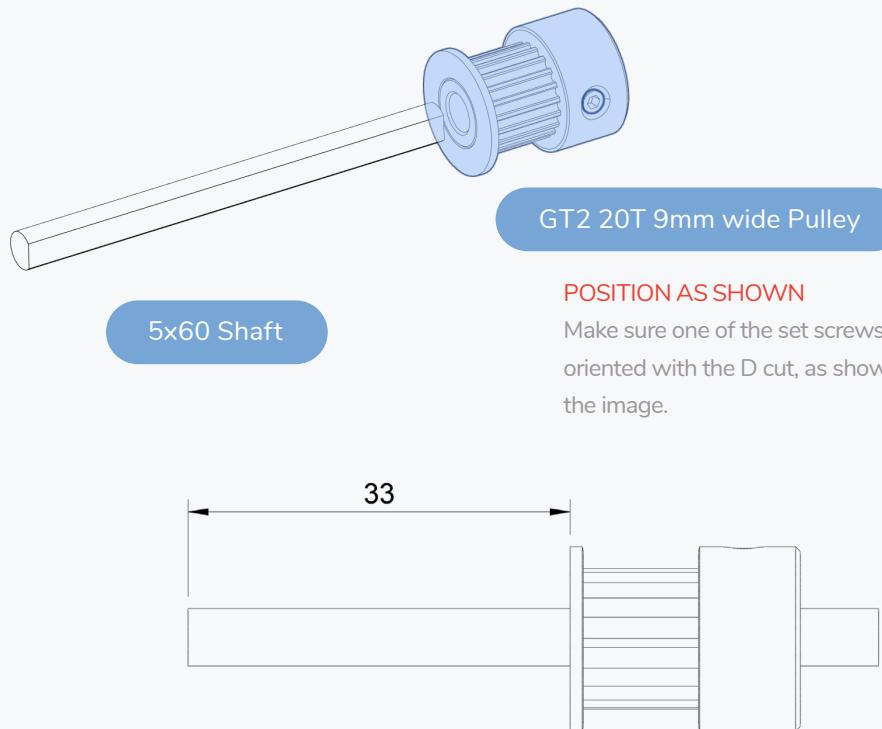
#### HEAT SET INSERTS

This design relies heavily on heat set inserts. Make sure you have the proper inserts (check the hardware reference for a close up picture and the BOM for dimensions).

If you've never worked with heat set inserts before we recommend you watch the linked guide.

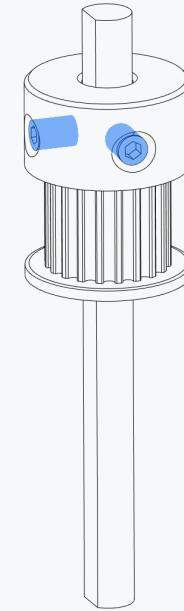


<https://voron.link/m5ybt4d>



**POSITION AS SHOWN**

Make sure one of the set screws is oriented with the D cut, as shown in the image.



**SET SCREWS**

**AKA THE ROOT OF ALL ISSUES**

Insert both set screws and use thread locker on all set screws.

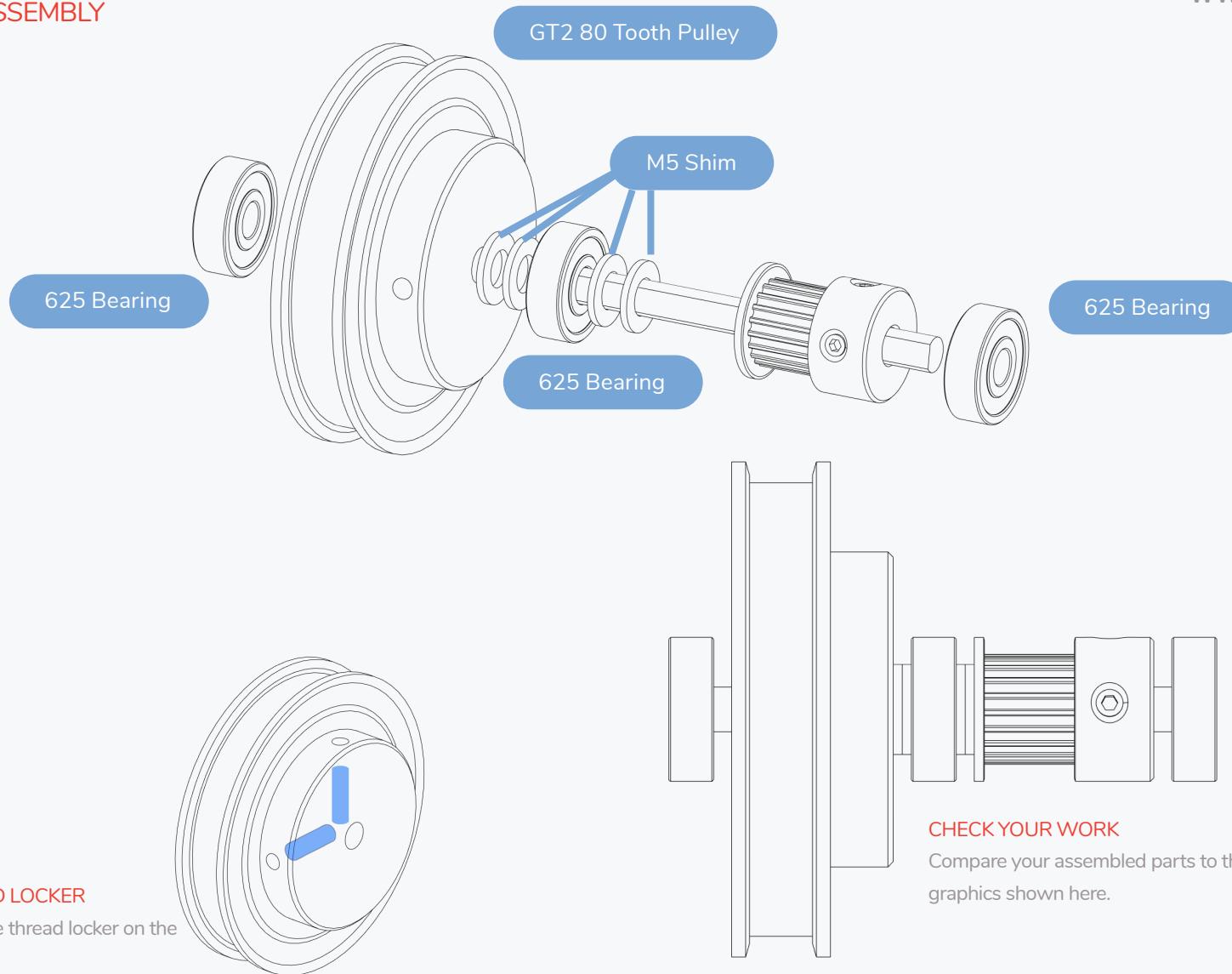
Use a high quality hex driver to prevent the hex profile from stripping. Ball-end drivers are not recommended.

Loose set screws account for the majority of issues that our users report. Save yourself hours of troubleshooting and apply thread locker to all set screws during the build.

See the product's application notes for instructions - keep away from printed parts.

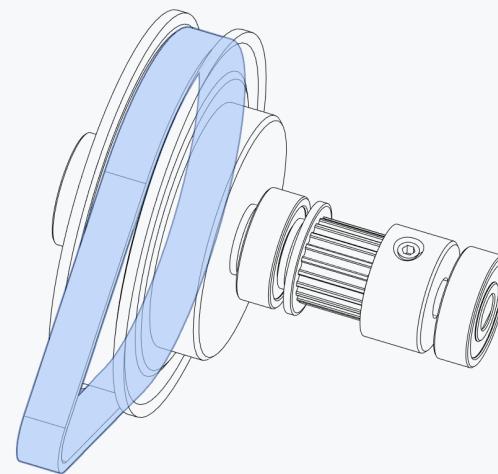
## BELT DRIVE ASSEMBLY

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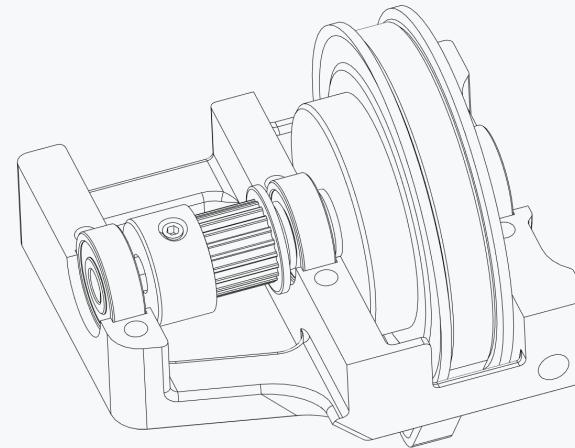
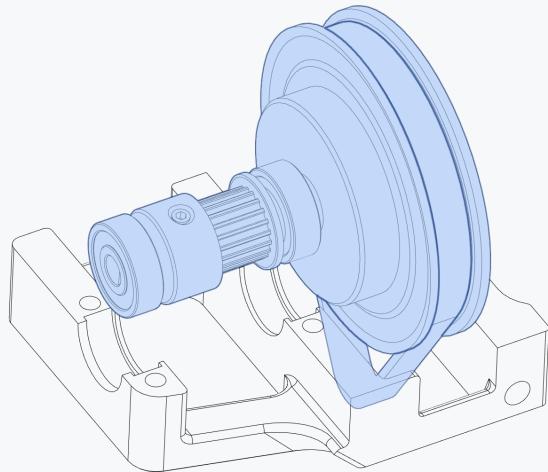


Z DRIVE

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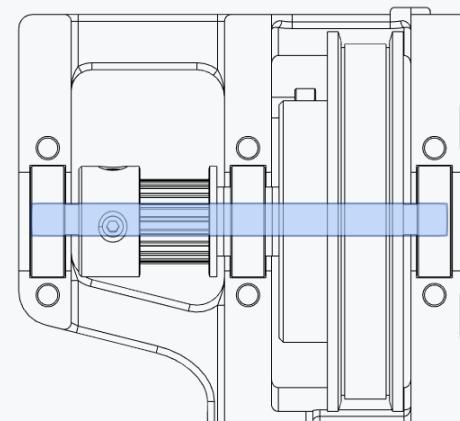


GT2 188mm Belt Loop



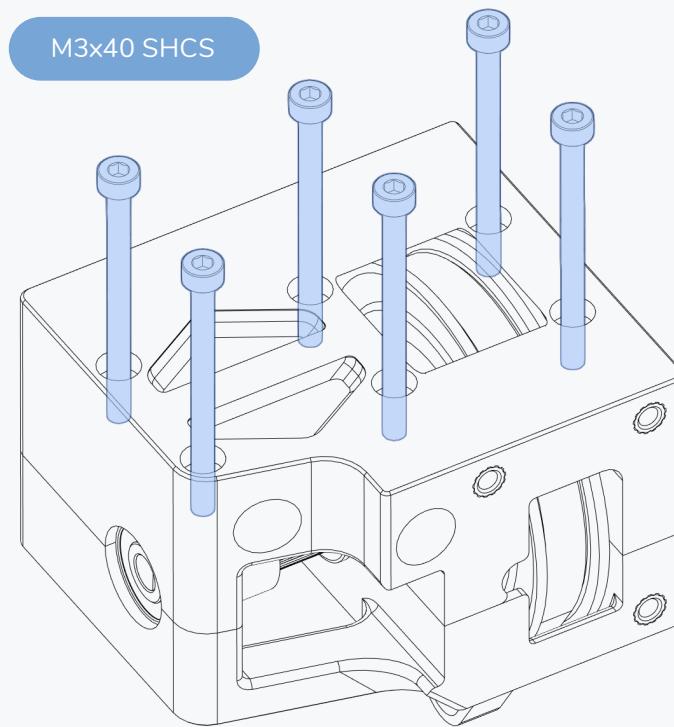
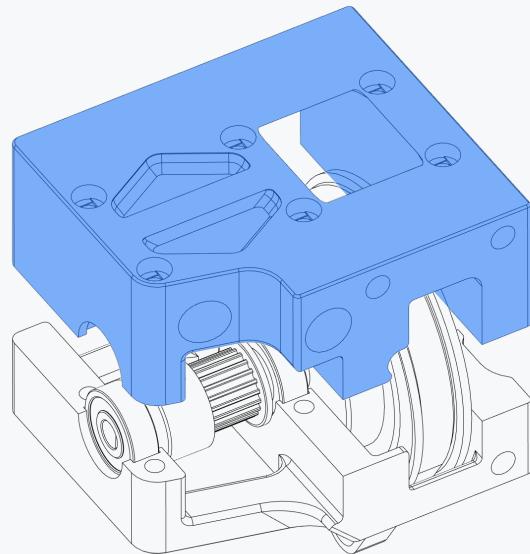
CHECK SHAFT POSITION

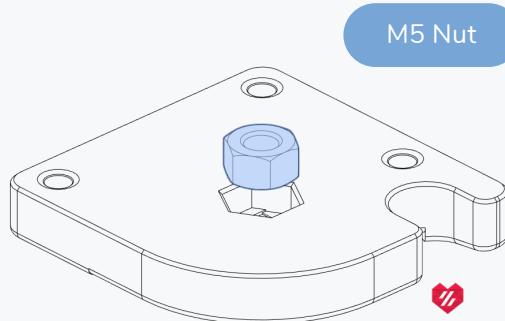
Compare your assembled parts to the graphics shown here.



Z DRIVE

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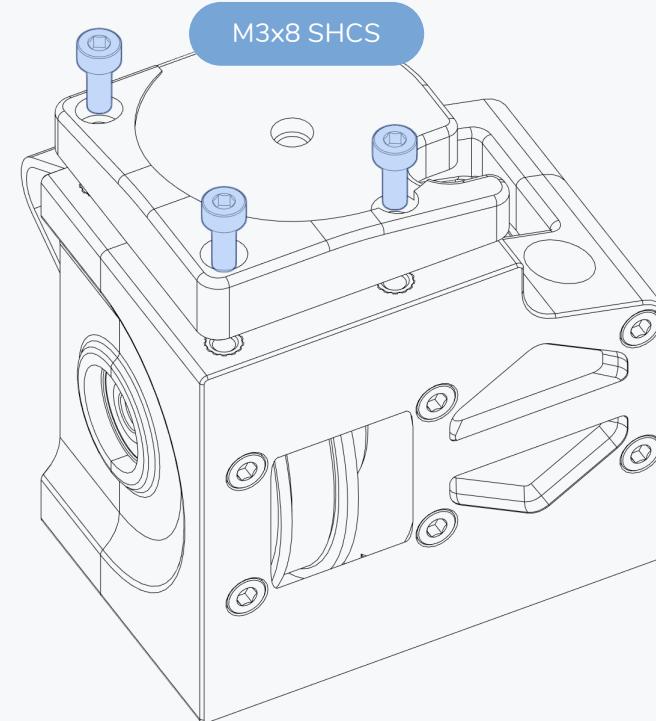




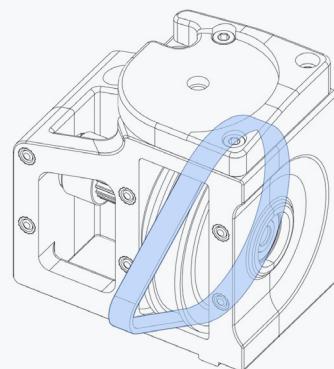
M5 Nut

**ACCENT PART?**

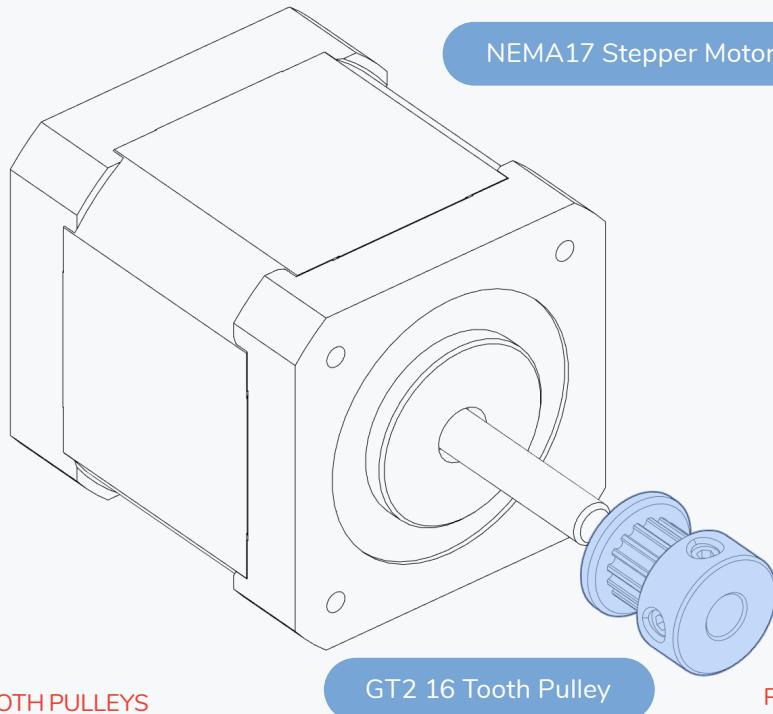
Look for Voron heart next to the part.  
It indicates that this is an accent part.



M3x8 SHCS

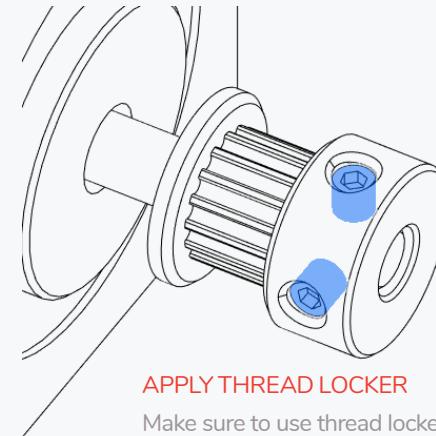
**CHECK FOR BELT**

Make sure the closed belt loop is in the part.



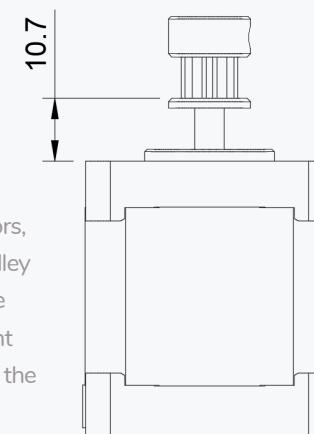
#### 16 TOOTH PULLEYS

The Z drive motors are the only place in the printer that use 16 tooth pulleys! Remove the pulleys from your work surface after you finish this chapter.



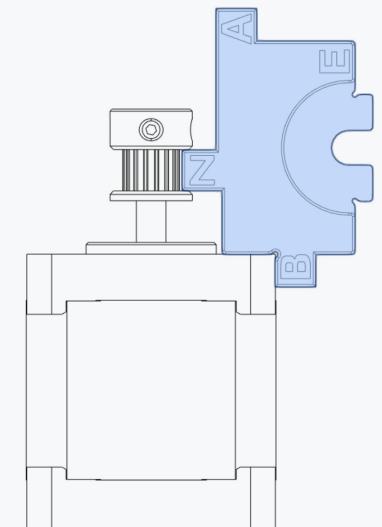
#### APPLY THREAD LOCKER

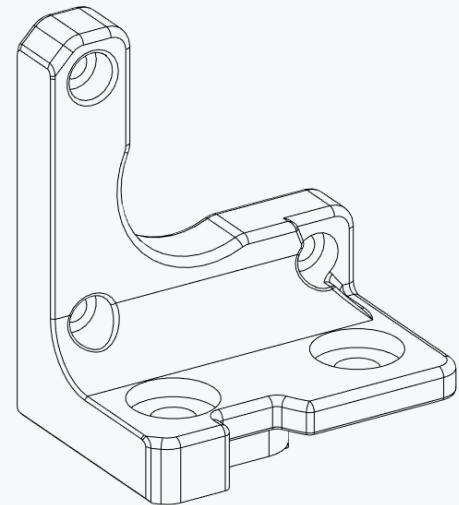
Make sure to use thread locker on the set screws. Ensure that at least one of the set screws is contacting the flat section of the drive shaft.



#### PULLEY POSITION

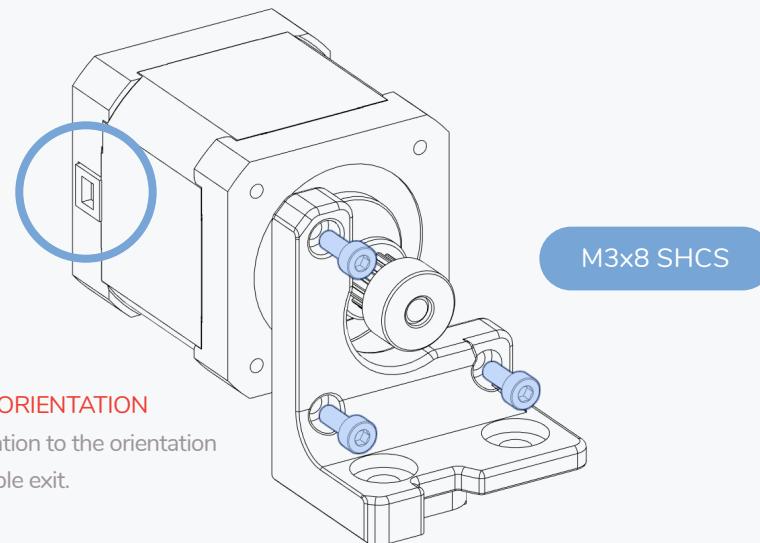
Depending on your motors, you may find that the pulley sits better in the opposite orientation. The important thing is the placement of the actual teeth.





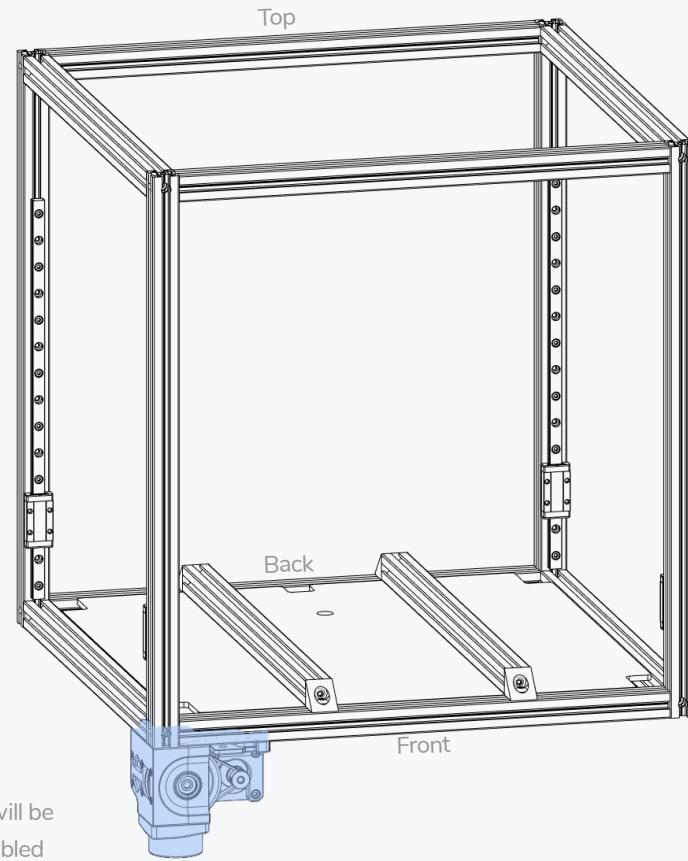
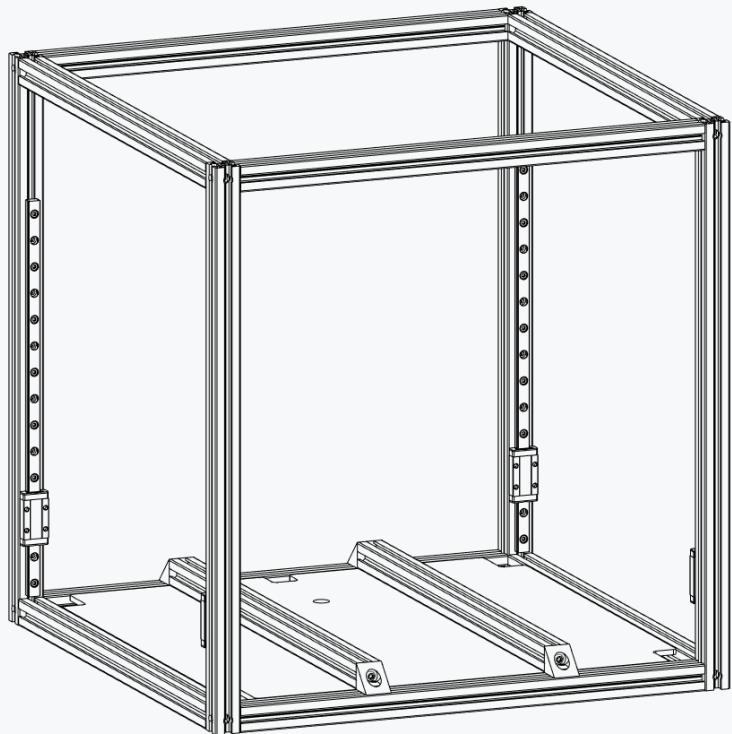
MOTOR ORIENTATION

Pay attention to the orientation  
of the cable exit.



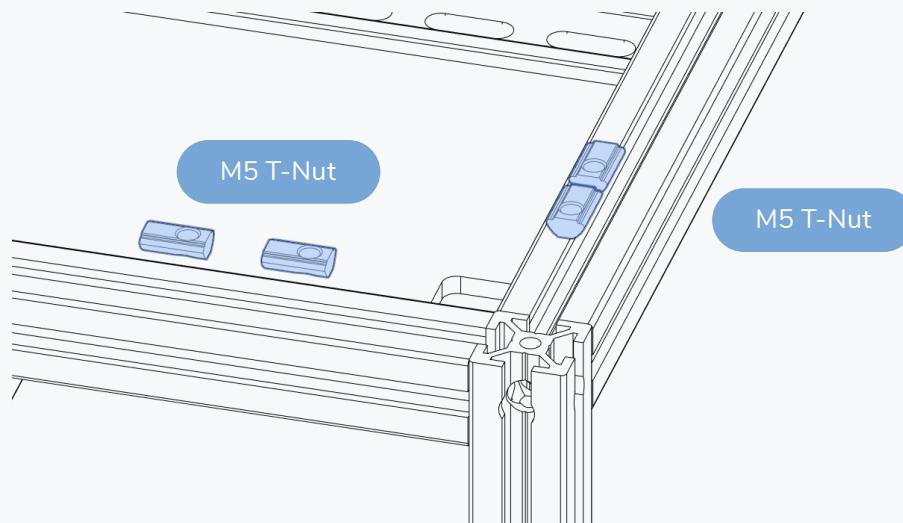
## ORIENTATION

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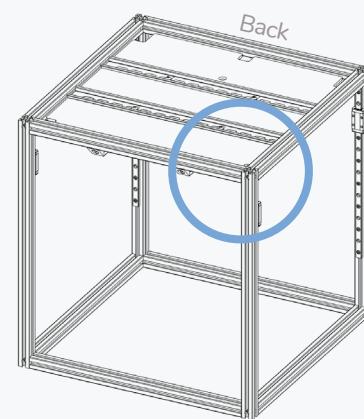


### PICTURE FOR ORIENTATION

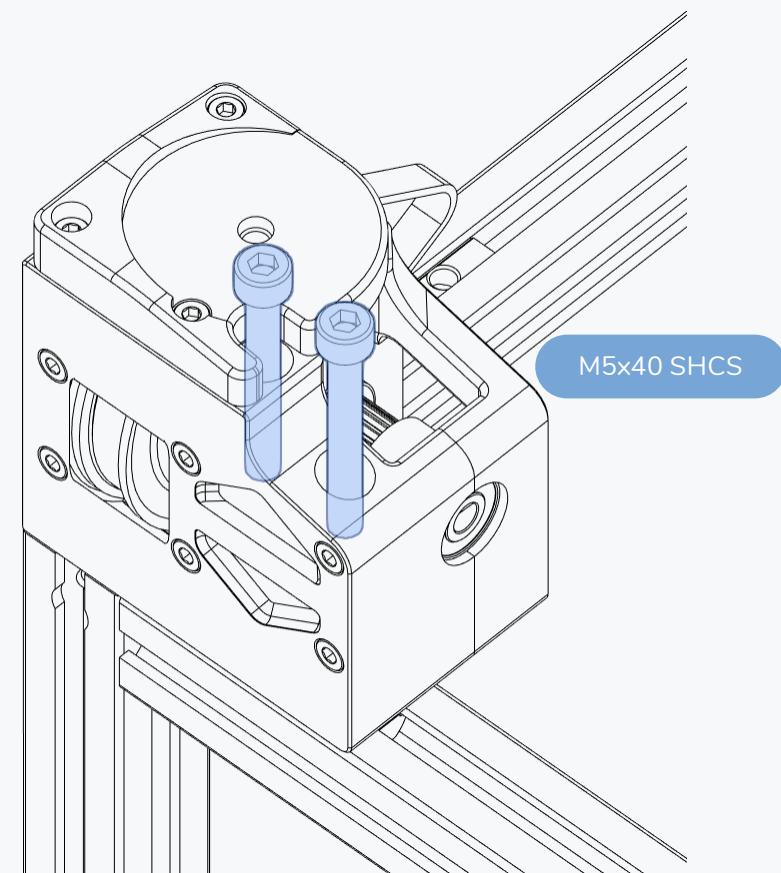
The Z0 drive is the first Z drive that will be added to the printer. The fully assembled Z Drive is highlighted in blue.

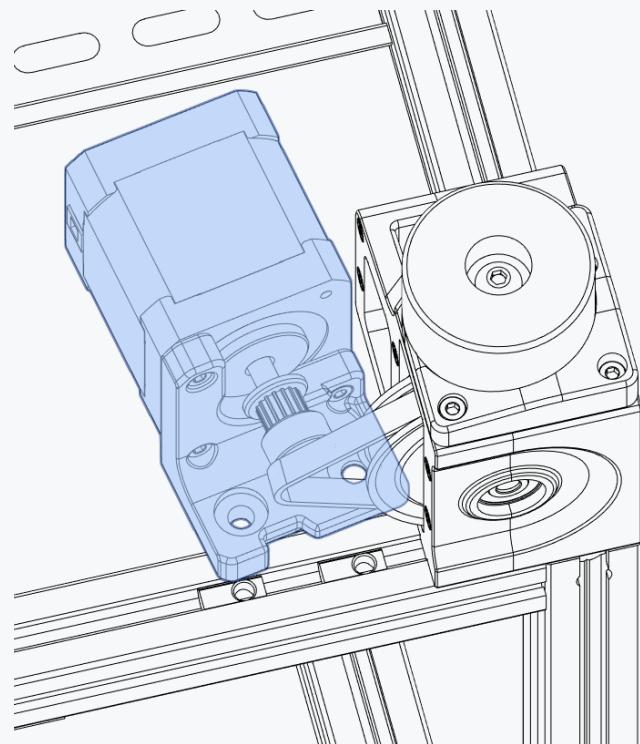
**WHICH CORNER IS THIS?**

We highlighted the corner with a circle.

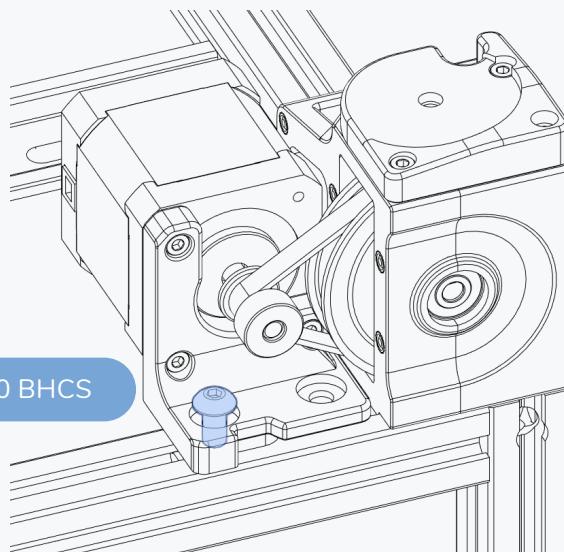
**UPSIDE DOWN ASSEMBLY**

For ease of assembly we recommend flipping the printer on its head for the next steps.



**SLIDE INTO PLACE**

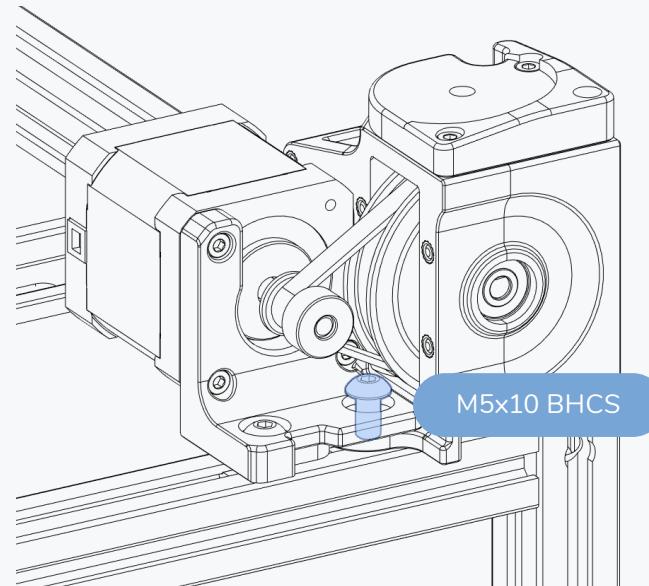
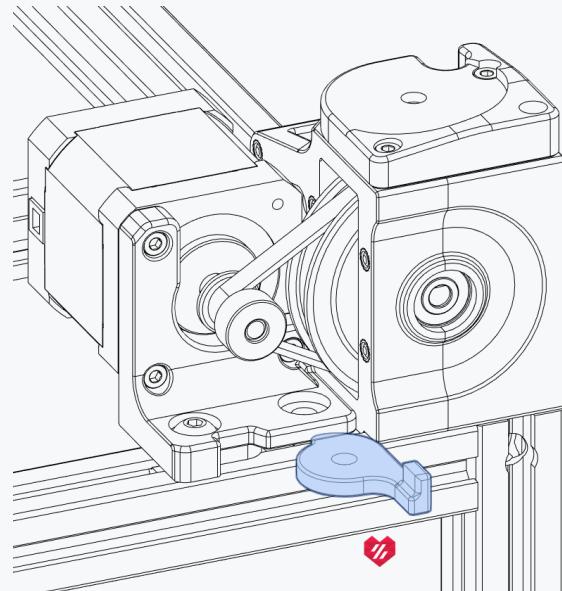
Insert at an angle and slide into place.

**M5x10 BHCS****DON'T TIGHTEN**

Leave the bolt loose for the next step.

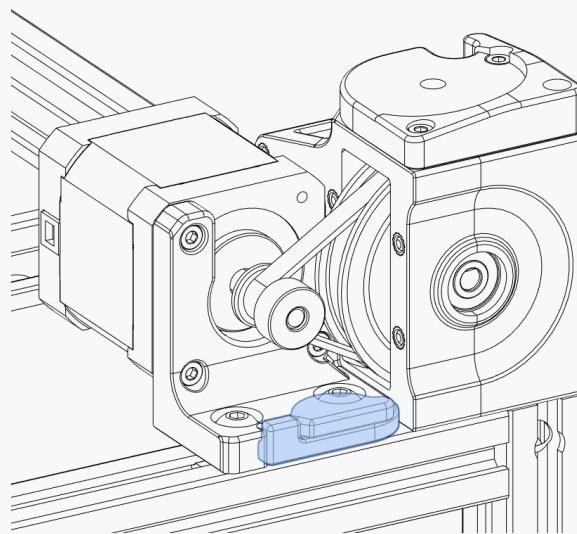
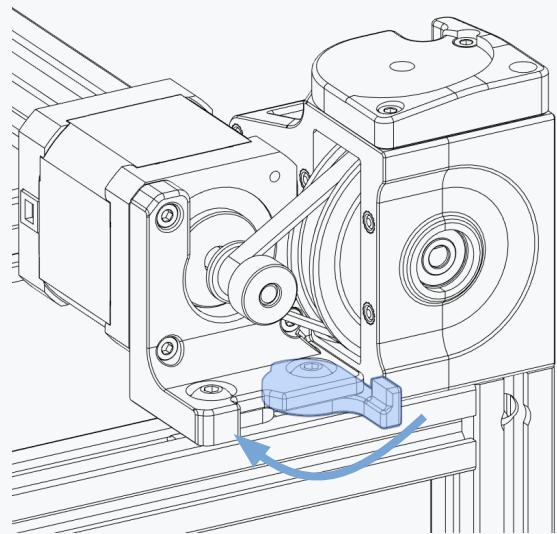
Z DRIVE

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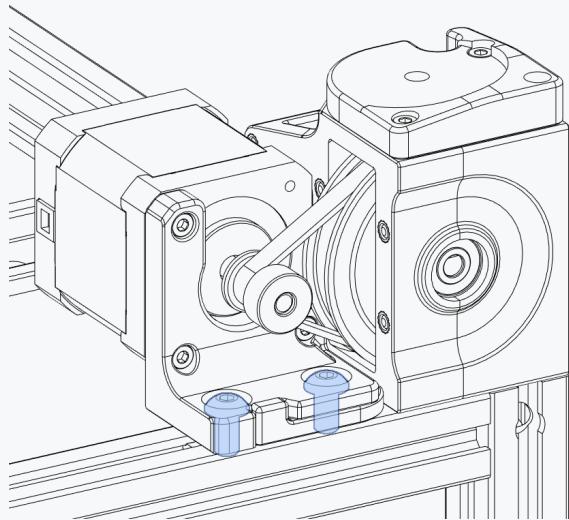
DON'T TIGHTEN

Leave the bolt loose for the next step.

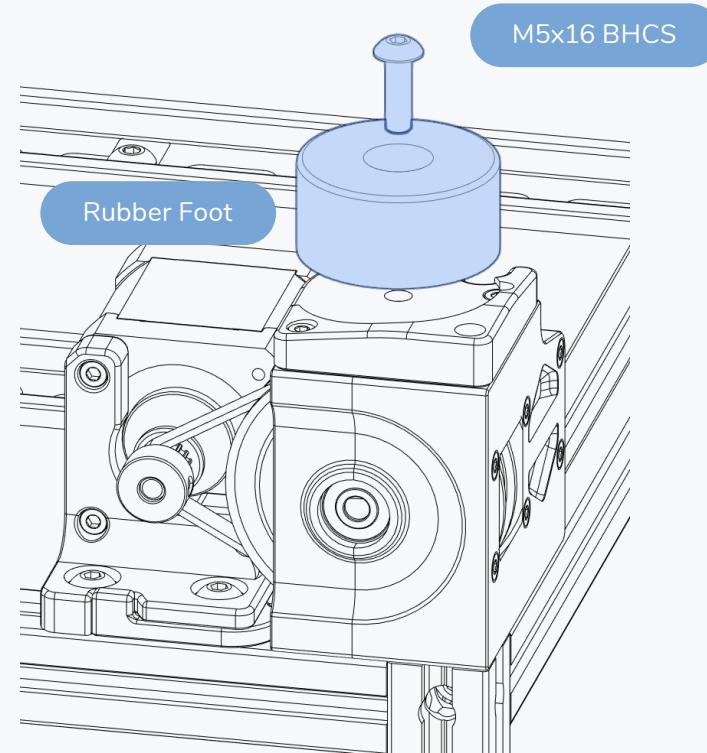


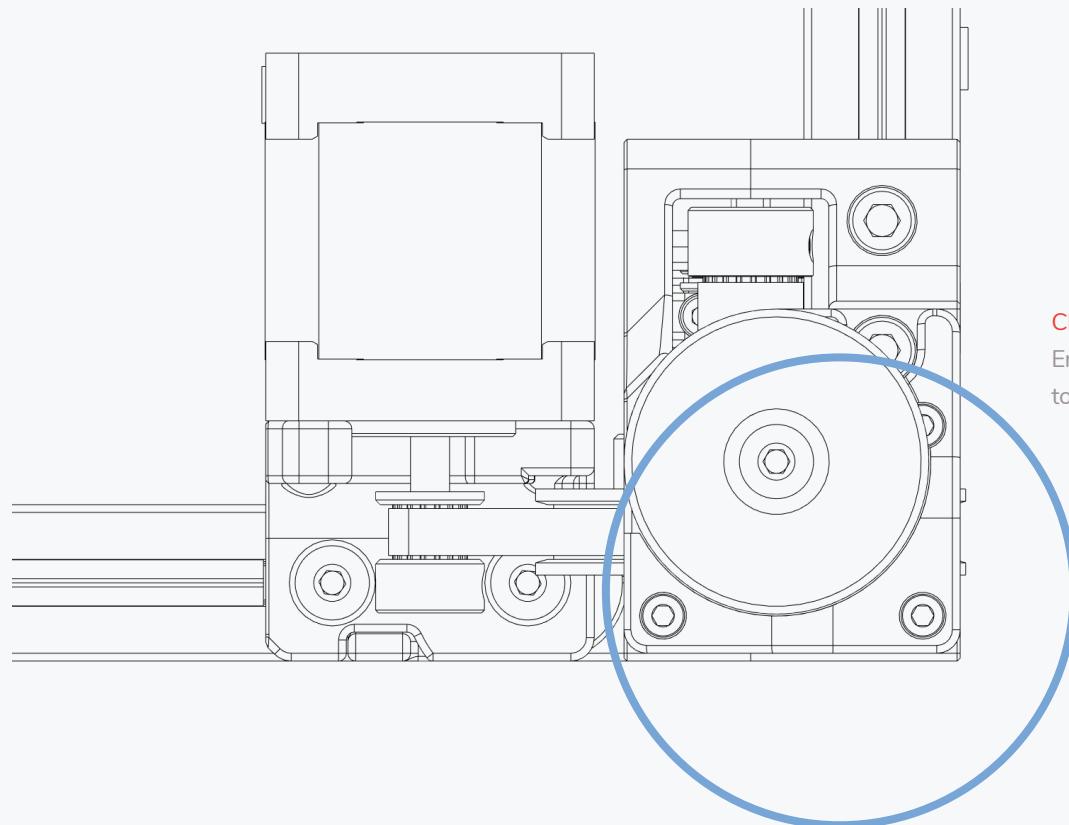
CLOSE THE BELT TENSIONER

Flip the belt tensioner latch closed.

**TIGHTEN BOLTS**

After closing the tensioner the M5 bolts can be properly fastened.



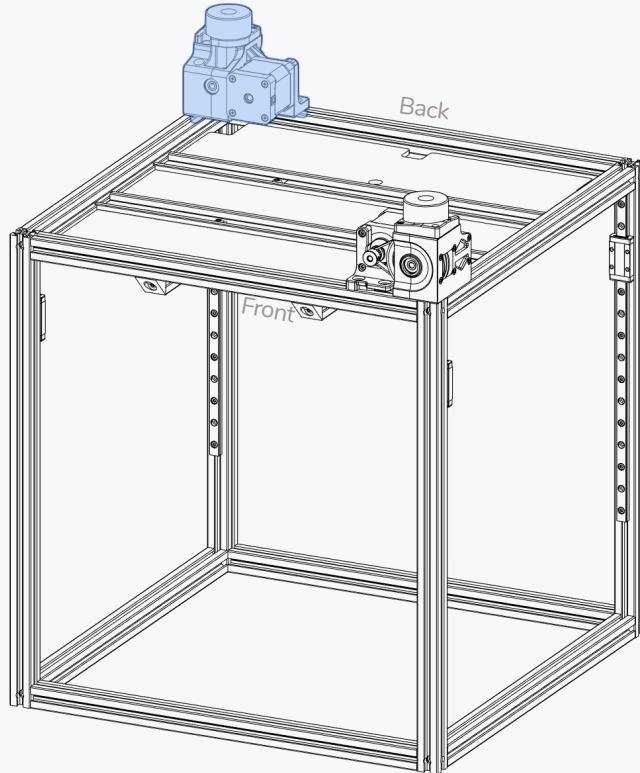


**CHECK POSITION**

Ensure that closing the belt tensioner did not cause the Z Drive to move/shift. If it did undo the bolts and realign.

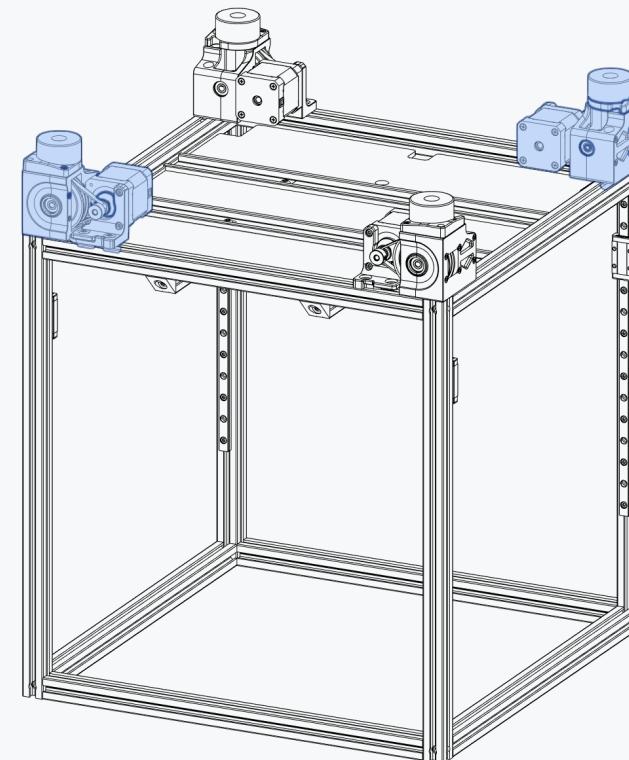
## OTHER Z DRIVES

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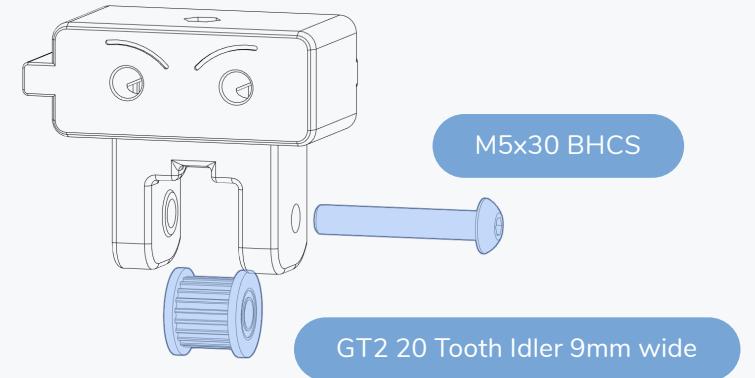
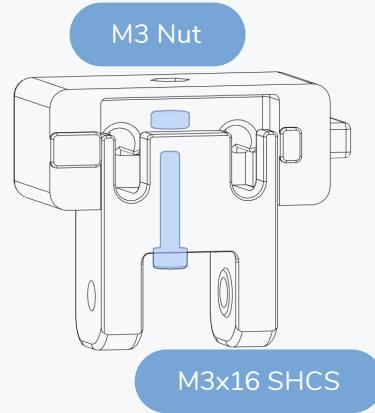
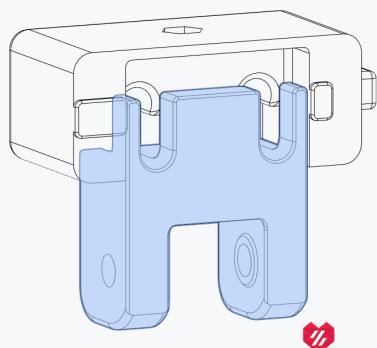
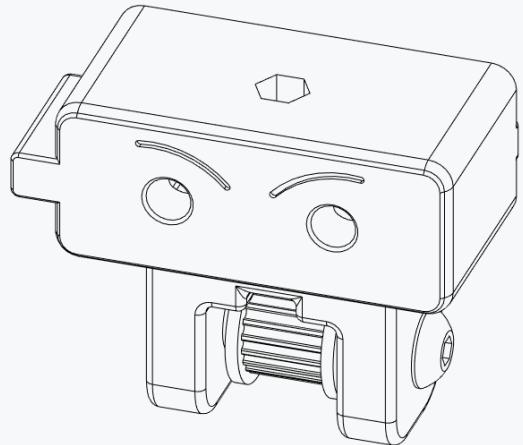
### REPEAT INSTRUCTIONS FOR OPPOSING CORNER

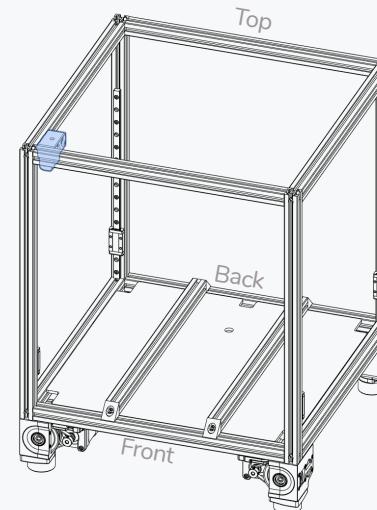
Build another Z drive, following the same instructions.



### REPEAT INSTRUCTIONS FOR THE MIRRORED DRIVES

Build two more Z drives following the instructions that came before. The printed parts are mirrored.

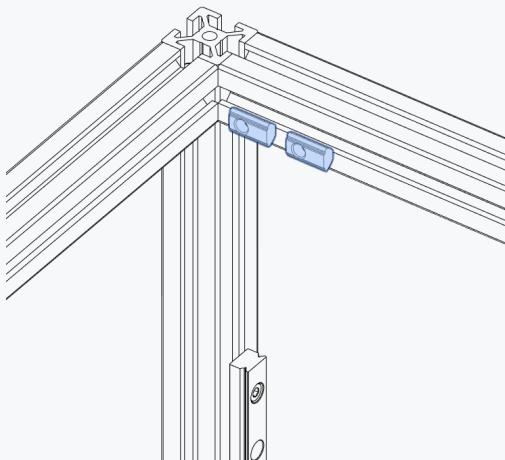




#### IDLER ORIENTATION

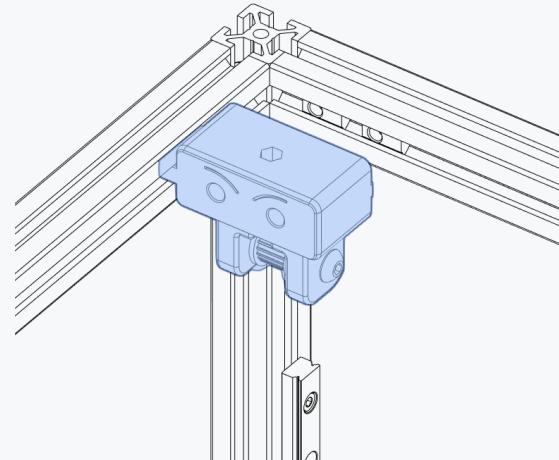
Mind the idler orientation. The idler must face in the same orientation as the pulley in the drive below it.

M5 T-Nut

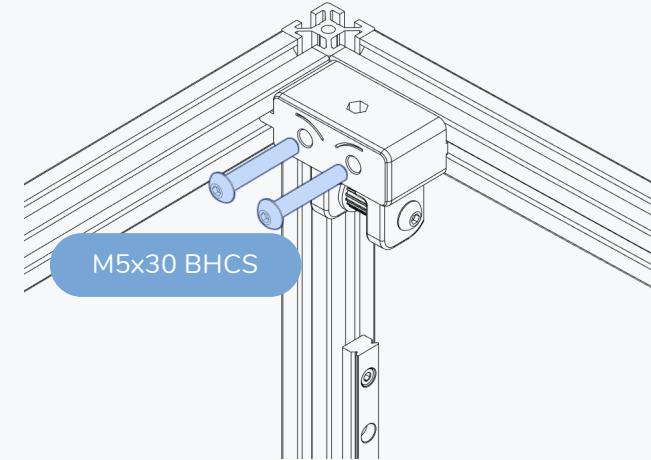


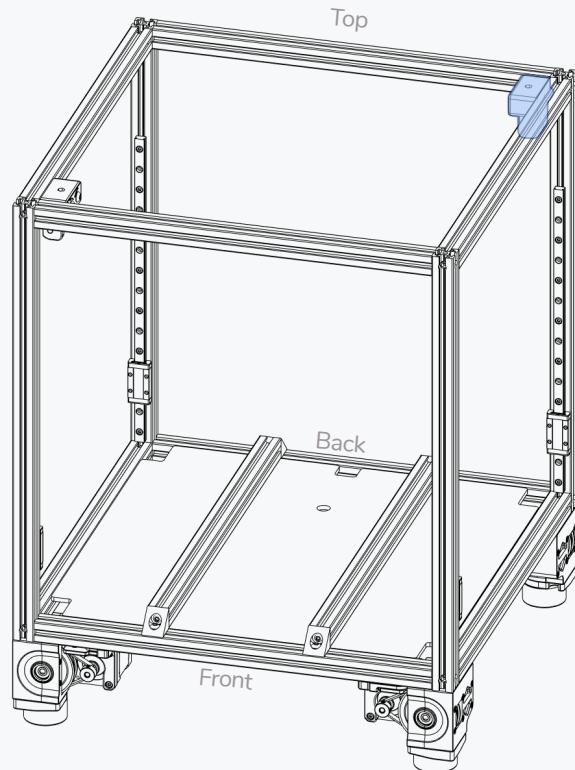
#### SEAT IN CORNER

Ensure idler is pressed firmly into corner before tightening.



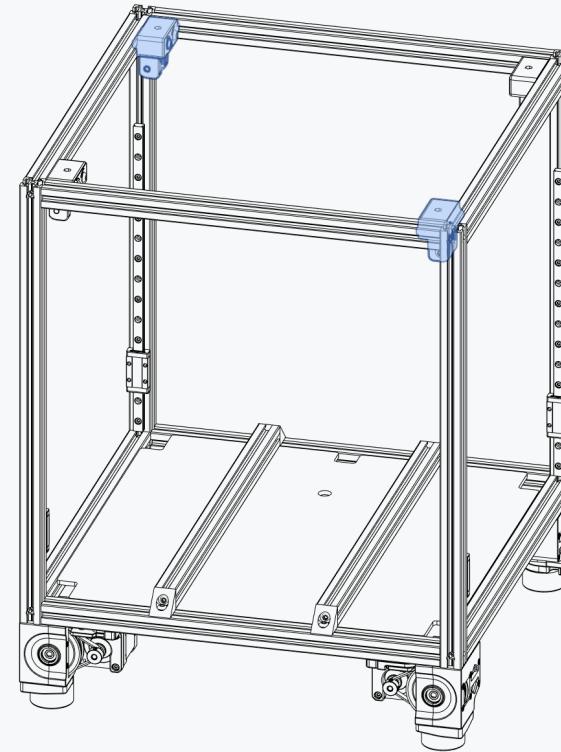
M5x30 BHCS





**REPEAT INSTRUCTIONS FOR OPPOSING CORNER**

Build another Z idler following the same instructions.



**REPEAT INSTRUCTIONS FOR THE MIRRORED DRIVES**

Build two more Z idlers following the instructions that came before. The printed parts are mirrored.

The first design released under the name Voron was the “Voron Geared Extruder”. This was on January 28 2015.