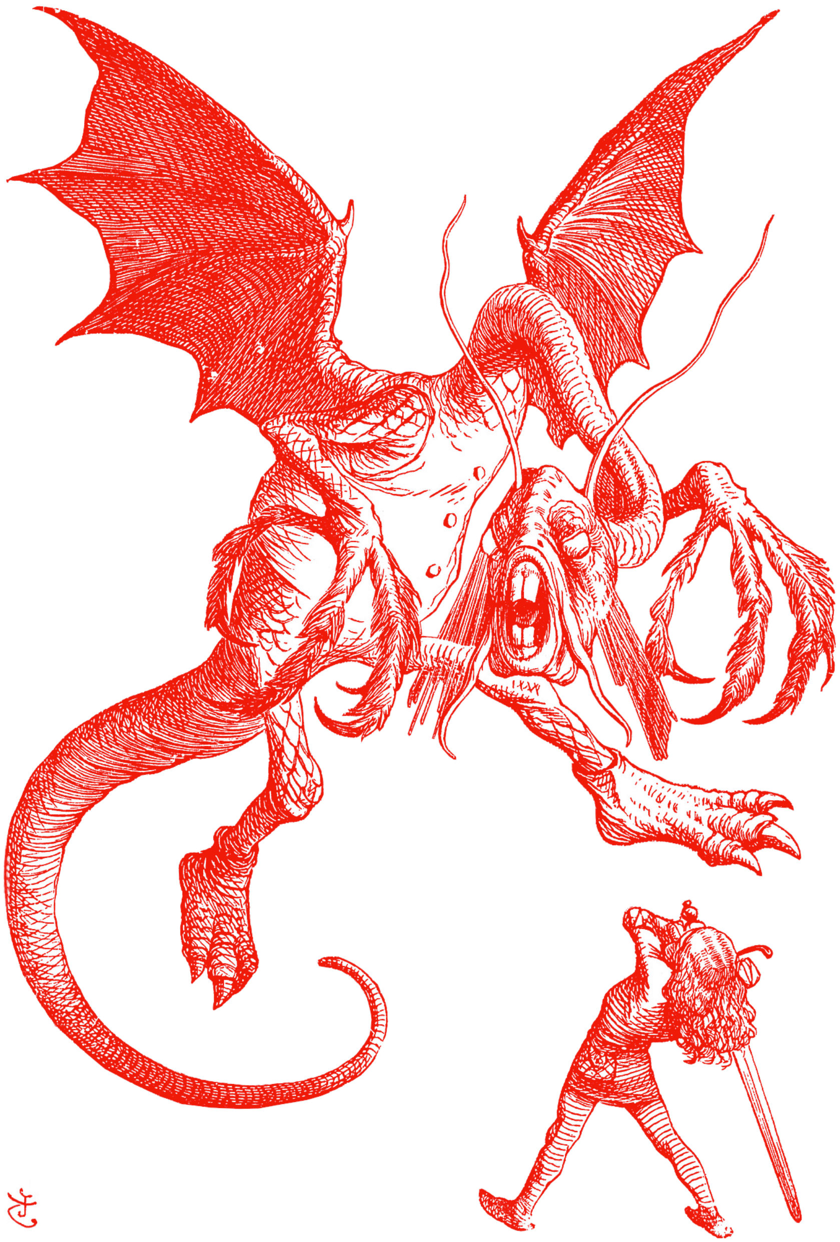
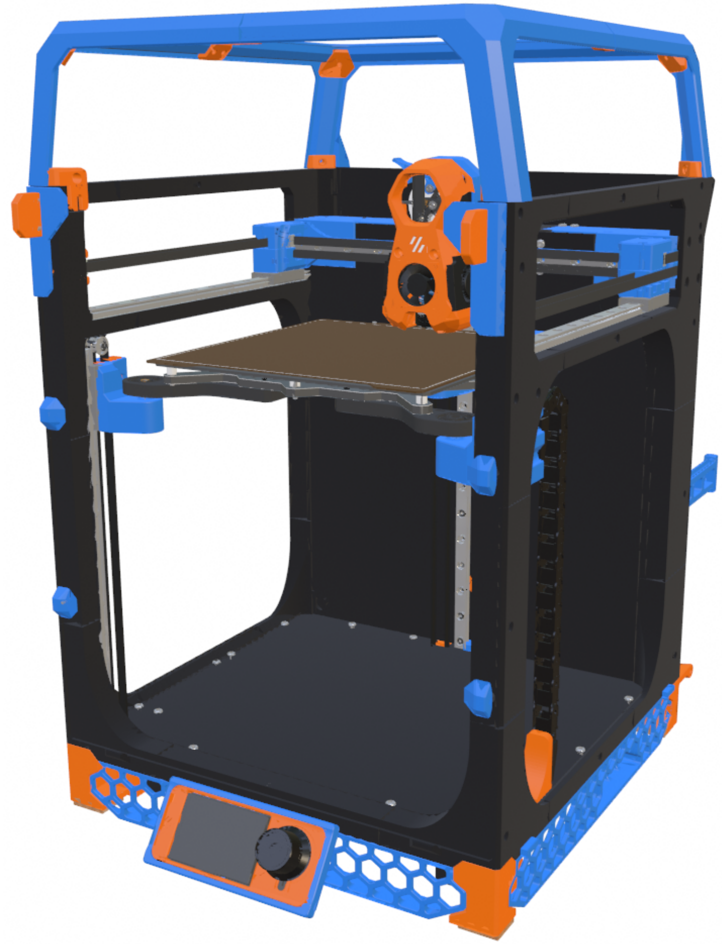




VORPAL 180 ASSEMBLY

Take up your sword and fight your dragons

VERSION 2023-11-10

TABLE OF CONTENTS

PREPARATION

PART PRINTING GUIDELINES

This printer was designed to utilize the Voron process as much as possible. Their material and print settings should be followed to ensure a mechanically sound machine.

3D PRINTING PROCESS
Fused Deposition Modeling (FDM)

MATERIAL
ABS

LAYER HEIGHT
Recommended: 0.2mm

EXTRUSION WIDTH
Recommended: Forced 0.4mm

WALL COUNT
Recommended: 4

SOLID TOP/BOTTOM LAYERS
Recommended: 5

INFILL TYPE
Grid, Gyroid, Honeycomb, Triangle or Cubic

INFILL TYPE: FRAME PIECES
Cubic

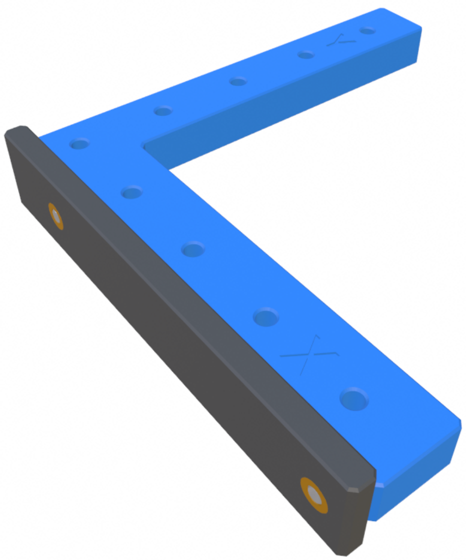
INFILL PERCENTAGE
Recommended: 40%

COLORS AND QUANTITIES

All .stl files with a suffix of "xN" need to be printed N times. Any .stl file without an "x2" style suffix is a unique part in the assembly of the printer.

The color naming convention is as follows:

[b]_xxxx.stl → Base Color - 900 grams needed
[p]_xxxx.slt → Primary Color - 500 grams needed
[a]_xxxx.stl → Accent Color - 200 grams needed



PRINT CALIBRATION

The Calibration_square_100mm.stl is provided in the Tools folder to help verify the dimensional accuracy and squareness of the printer/material used to produce parts for the Vorpal 180. ABS has a rather high shrinkage ratio and this needs to be accounted for while printing. With the larger printed pieces of the Vorpal design, accuracy becomes more crucial.

By measuring the Calibration Square with calipers, you can determine the X and Y shrinkage factor for your printer/material. Measure the X and Y dimensions separately and use the equation below to find a value to put into your slicing software.

10000 / [measured] = ScalingFactor
example:
X → 10000 / 99.32mm = 100.68
Y → 10000 / 99.48mm = 100.52

You can use each of these values separately or take the average and use that for both X and Y. The Z axis shrinkage is not usually an issue and should be left at 100.0. In your slicer I suggest manually setting the X/Y scale factors for every printed part. This cannot be applied to the released files because each printer and material will have unique values. This process is different and more accurate than the XY Size Compensation setting found in some slicers but will not address issues such as holes being undersized or part thickness accuracy due to over/under extrusion. A whole build plate can be scaled at once. Just be sure to uncheck the lock icon.

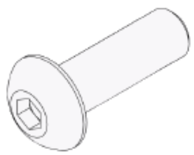
Using different brands of ABS or using a mix of ABS and ASA parts might require separate calibrations per material/printer.

Another feature of the Calibration Square is the inclusion of 3mm holes with 20mm spacing. When calibrated well, each row of holes should line up with the holes of an MGN9 rail and allow a full row of M3 screws to be installed with no binding. The Z_axis_rear_stiffener_x2.stl in the Electronics Bay folder is a good part for verifying the scale factor due to its length and its hole pattern that should also align with an MGN9 linear rail.

The Calibration Square can also be used to verify the squareness of the printer being used to generate parts. Using a pair of heat-set inserts and M3x20 BHCS, it can be assembled with its Base in order to follow the method described in the video linked below. Keep in mind that the measured error is double the actual mm out-of-square per 100mm of the printers' gantry.
https://youtu.be/hvVK2lOirBM?t=185

If the lines diverge from the bottom to the top then the right side of the gantry needs to be brought forward. If the lines converge from the bottom to the top then the left side needs to be adjusted towards the front of the printer.

HARDWARE



BUTTON HEAD CAP SCREW (BHCS)

Metric fastener with a domed shaped head and hex drive. Most commonly used fastener in this build.

ISO 7380-1

FLAT HEAD CAP SCREW (FHCS)

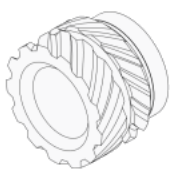
Metric fastener with a cone shaped head and a flat top.

ISO 10642

SHIM

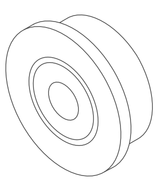
Not to be confused with stamped washers. These are used in all M3 call-out locations in this manual.

3x6x0.5 DIN 988



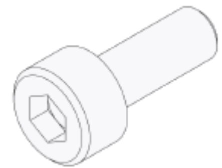
HEAT SET INSERT

Heat the inserts with a soldering iron so that they melt the plastic when installed. As the plastic cools, it solidifies around the knurls and ridges on the insert for excellent resistance to both torque and pull-out.



F623 BEARING

A ball bearing with a flange used for the gantry and Z axis idler pulleys.



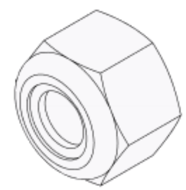
SOCKET HEAD CAP SCREW (SHCS)

Metric fastener with a cylindrical head and hex drive. Mostly used for connecting the linear rails and carriages.

ISO 4762 / DIN 912

SELF TAPPING SCREW

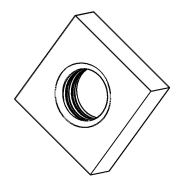
Fastener with a pronounced thread profile that is screwed directly into plastic.



LOCK NUT

Hex nut with a nylon filled center which prevents the components from loosening.

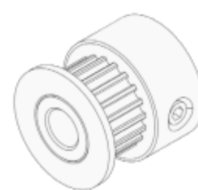
ISO 10511/DIN 982



M3 SQUARE NUT

Used for the Z belt tensioners.

DIN 562



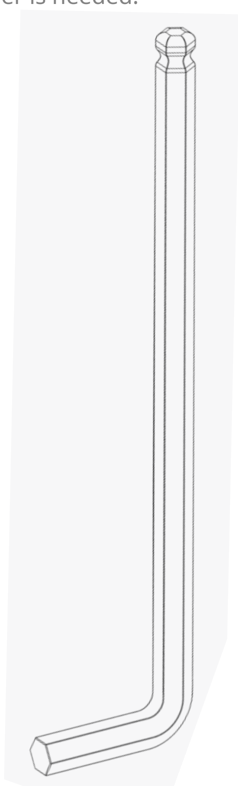
PULLEY

16 tooth GT2 drive pulley used on the motion system of the Vorpal 180.

TOOLS

BALL-END DRIVER

When building the Mini Stealth toolhead, it is useful having long ball-end hex drivers. For many of the hotends with M2.5 screws you will need a 1.5mm driver. For installing most extruders with M3 button-head screws, a 2.0mm driver is needed.



HEX-BIT DRIVER SET

NICE TO HAVE | NEEDED FOR BUILD

Find .stl in Tools folder. Print in ABS or ASA with standard Voron/Vorpal settings.
Hex-bit should be a very tight fit.

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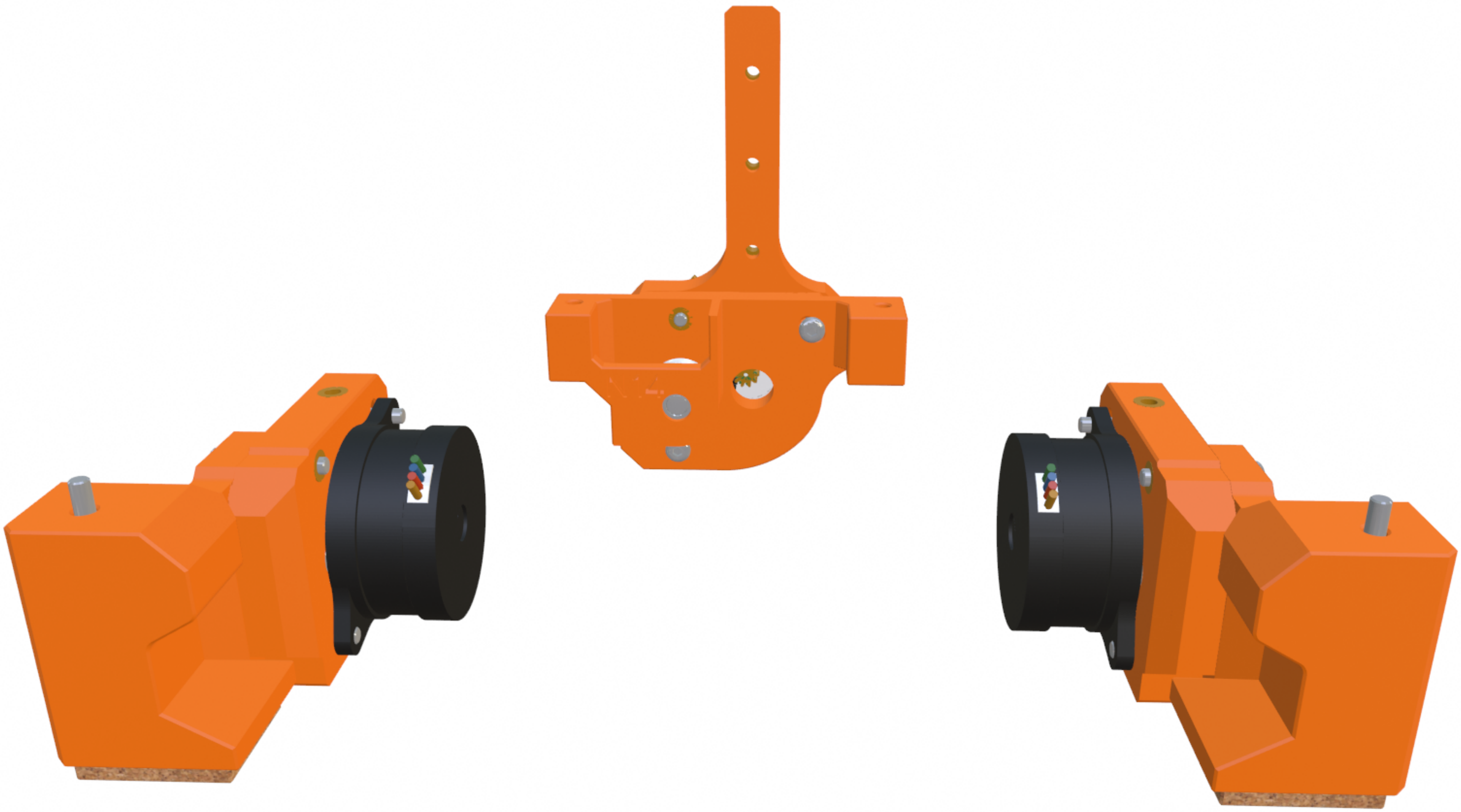
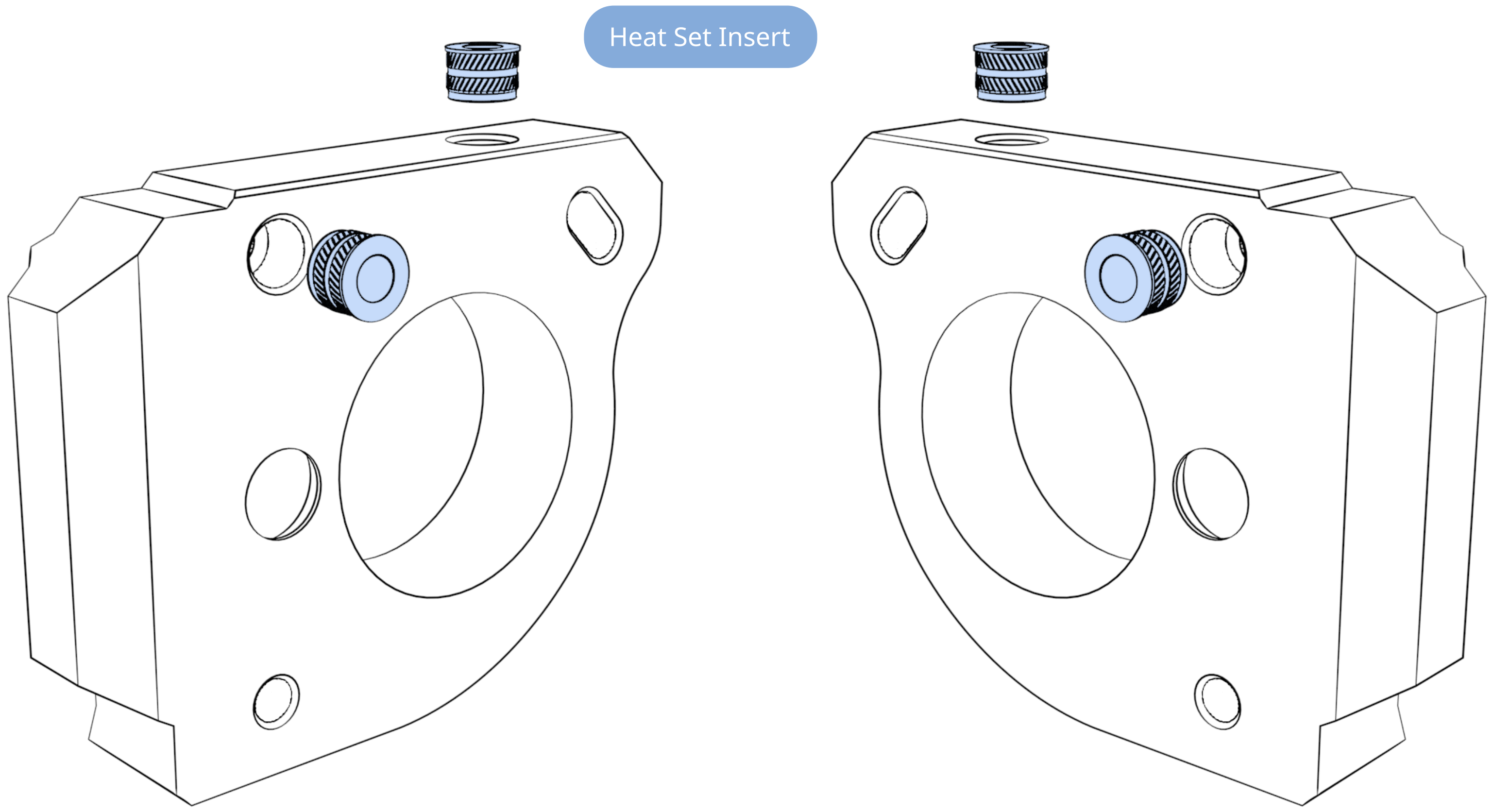
Z DRIVES ASSEMBLY

NEMA 14 OPTION

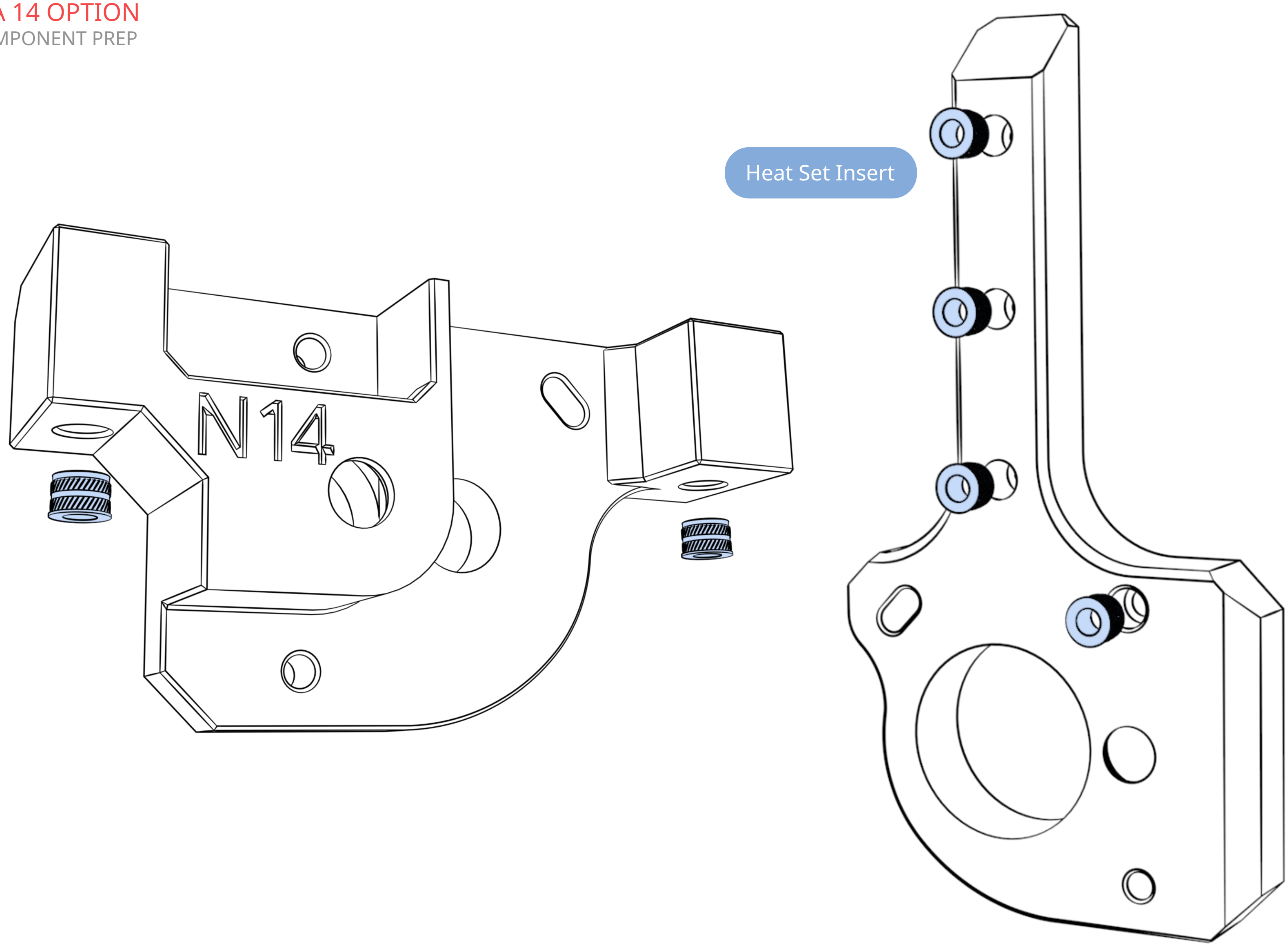


NEMA 14 OPTION

COMPONENT PREP

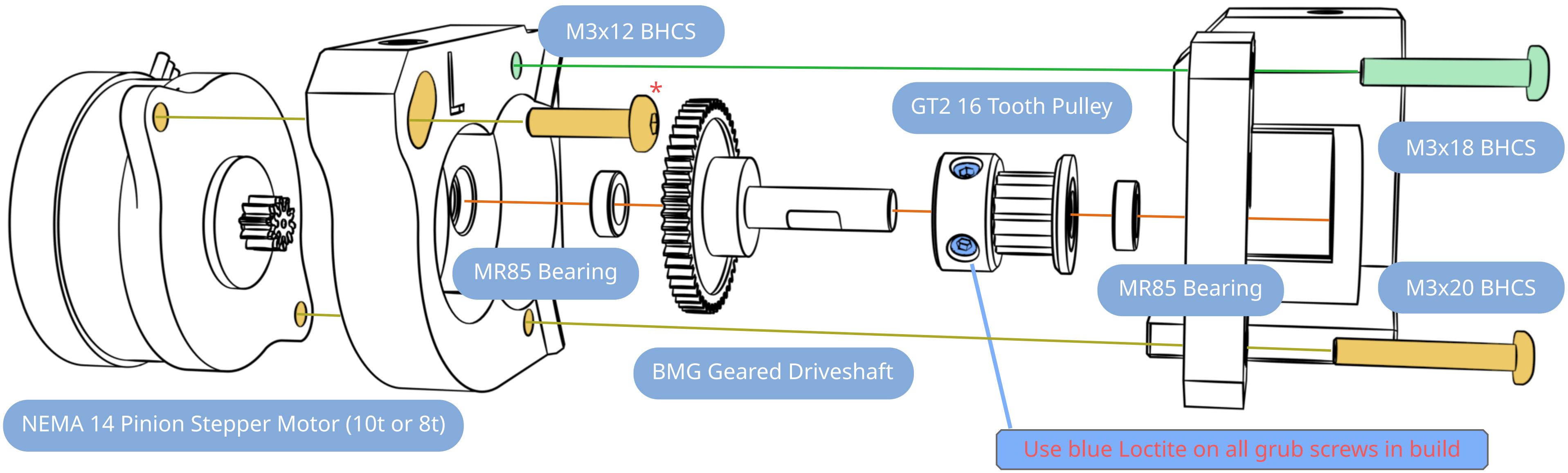


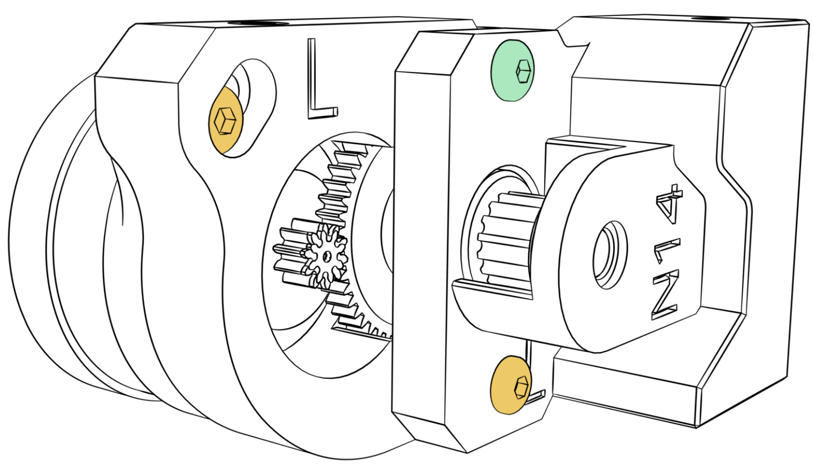
[a]_Motor_mount_front_left_Nema14.stl
[a]_Motor_mount_front_right_Nema14.stl



[a]_Z_axis_drive_rear_Nema14.stl
[a]_Motor_mount_rear_Nema14.stl

Z DRIVE LEFT





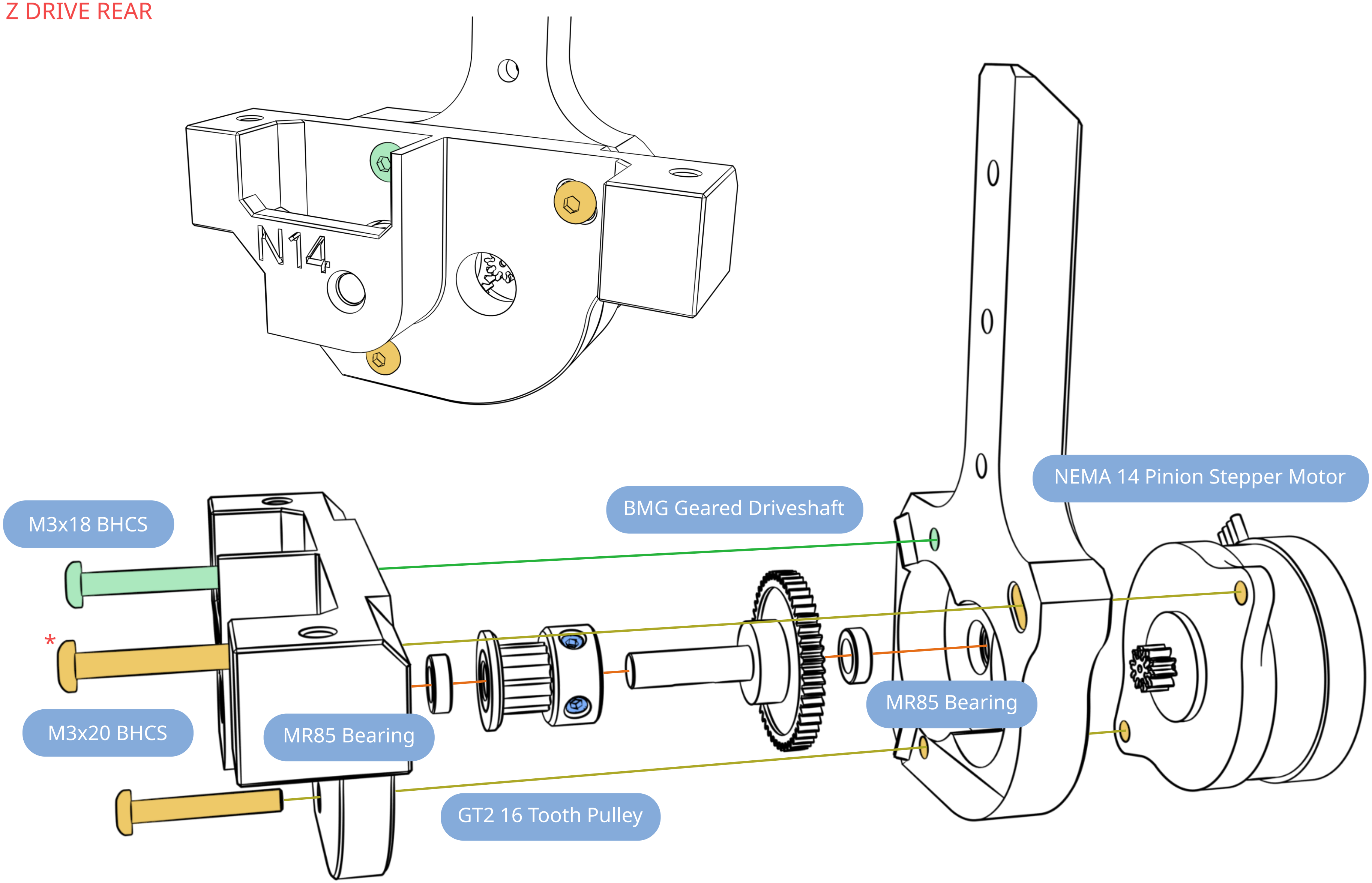
10 Tooth pinion
[stepper Z, Z1, Z2]
gear_ratio: 50:10

8 Tooth pinion
[stepper Z, Z1, Z2]
gear_ratio: 50:8

* Tighten this screw after ensuring the gears mesh together well

[a]_Motor_mount_front_left_Nema14.stl
[a]_Foot_front_left_Nema14.stl

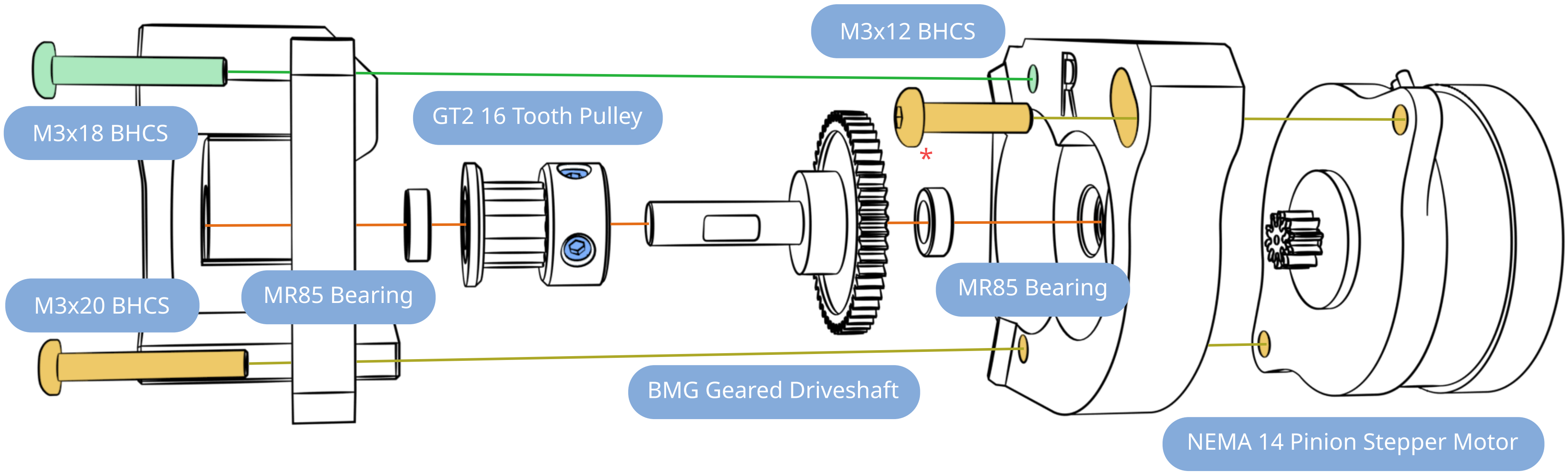
Z DRIVE REAR

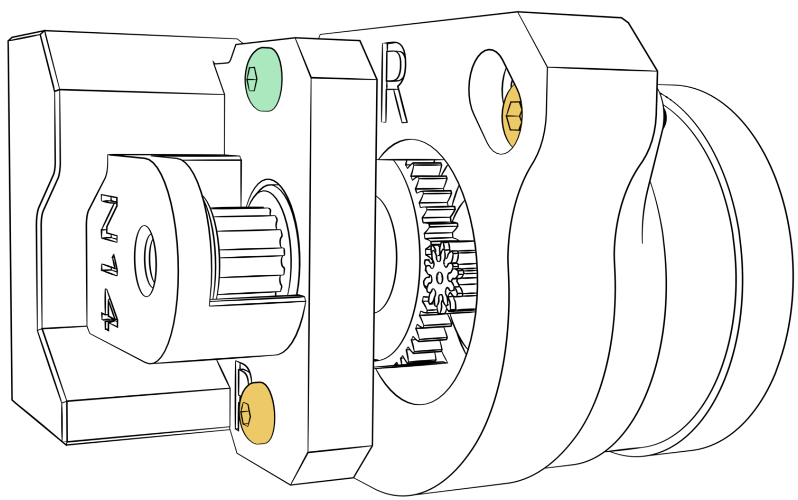


* Tighten this screw after ensuring the gears mesh together well

[a]_Z_axis_drive_rear_Nema14.stl
[a]_Motor_mount_rear_Nema14.stl

Z DRIVE RIGHT

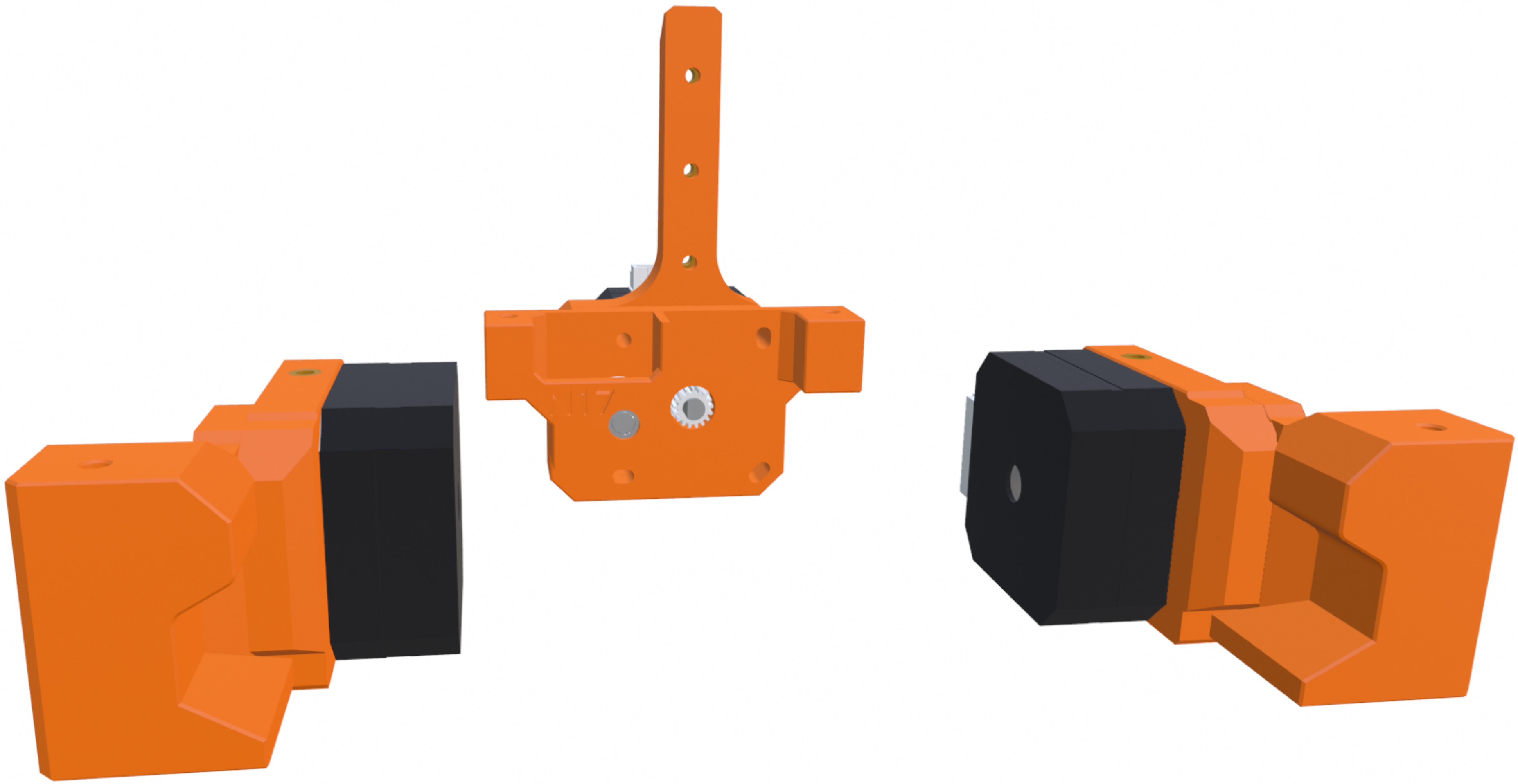


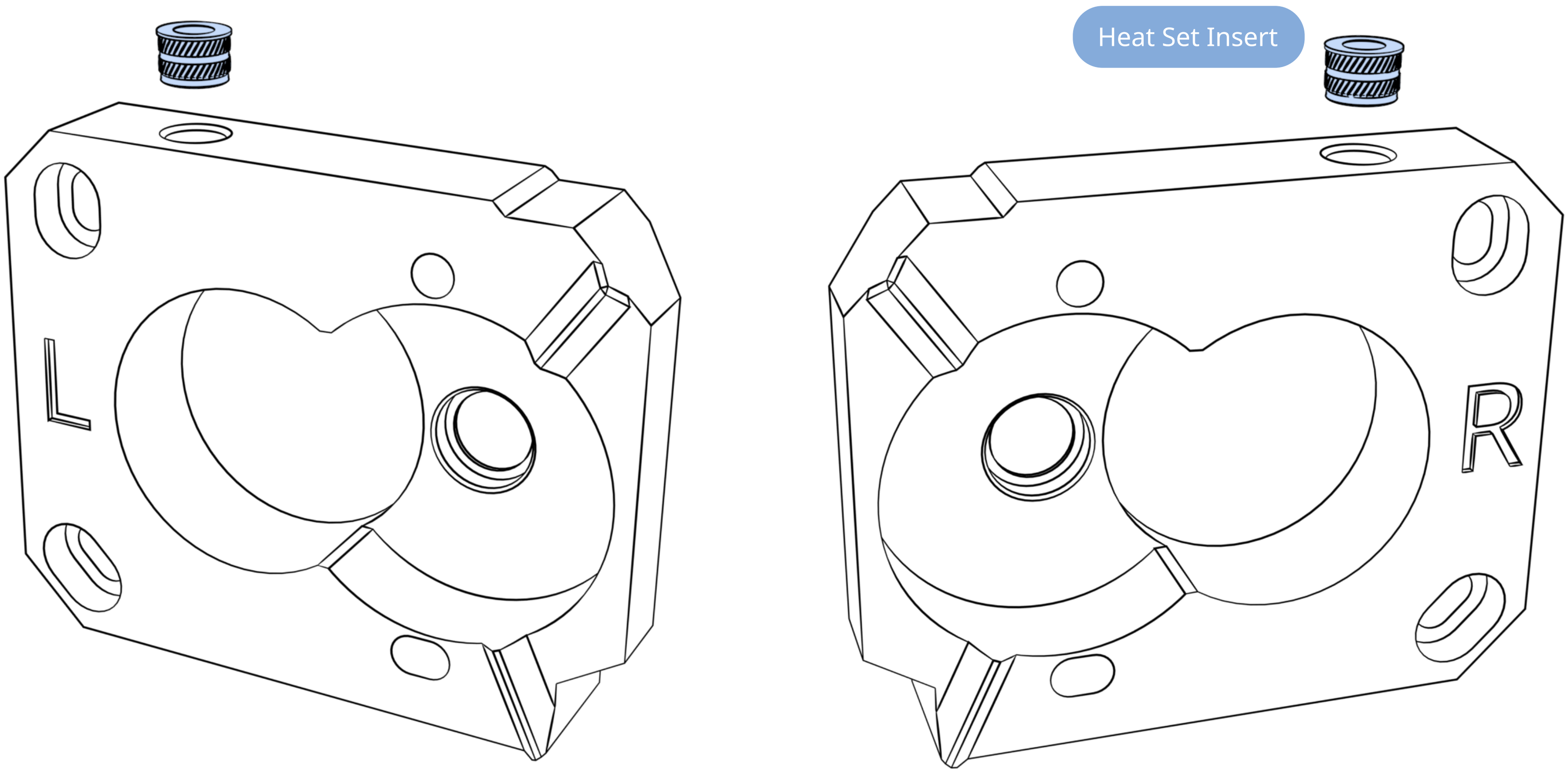


* Tighten this screw after ensuring the gears mesh together well

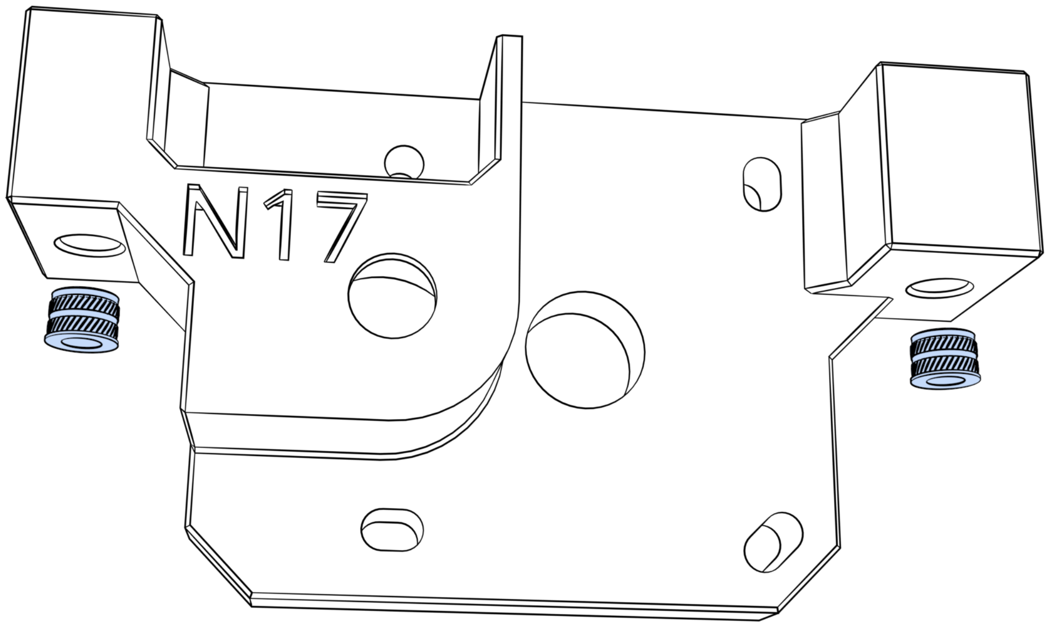
[a]_Foot_front_right_Nema14.stl
[a]_Motor_mount_front_right_Nema14.stl

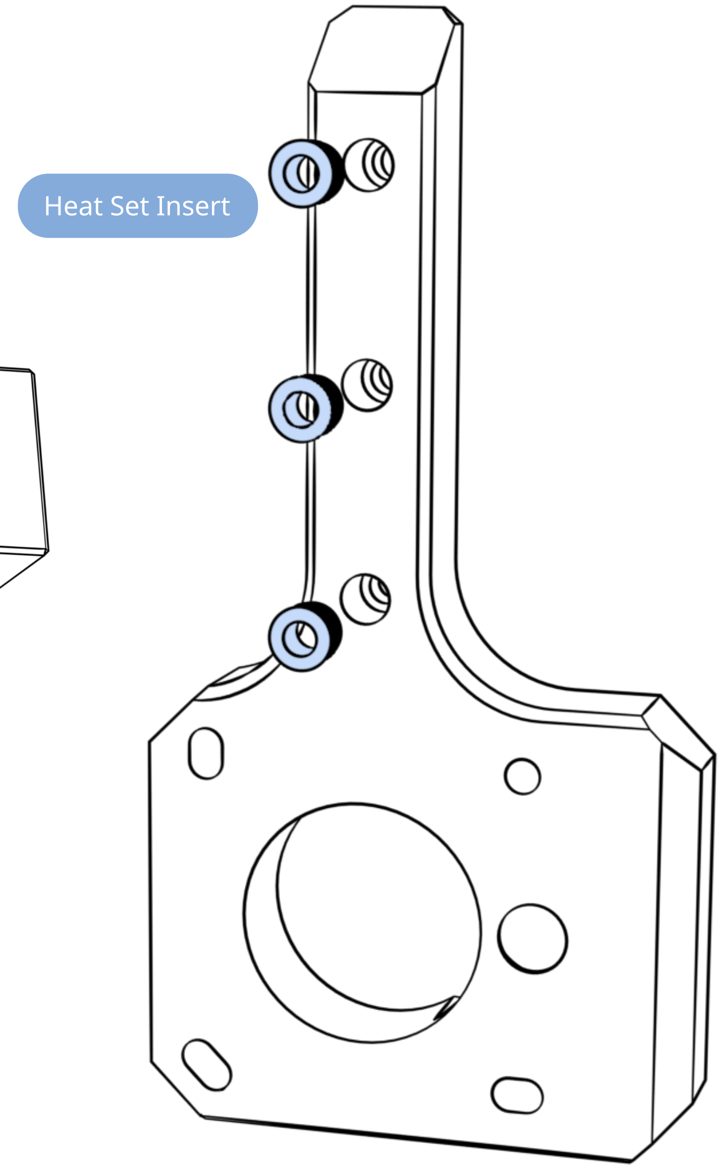
Z DRIVE ASSEMBLY
NEMA 17 OPTION





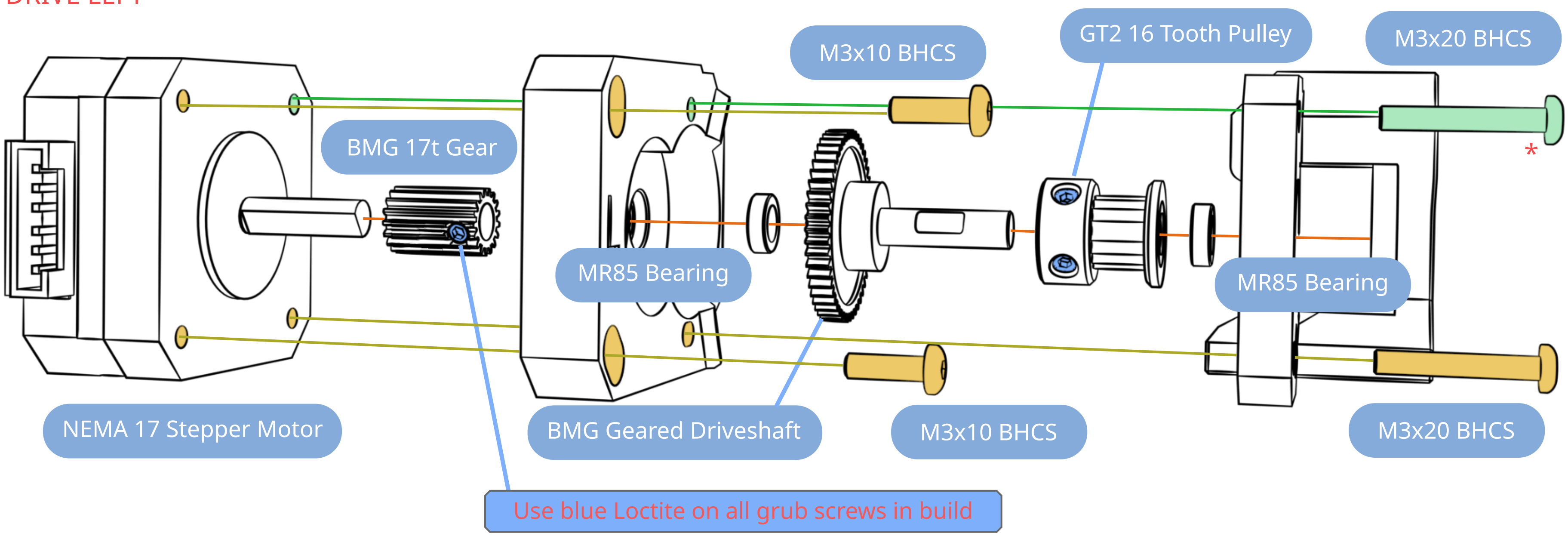
[a]_Motor_mount_front_left_Nema17.stl
[a]_Motor_mount_front_right_Nema17.stl

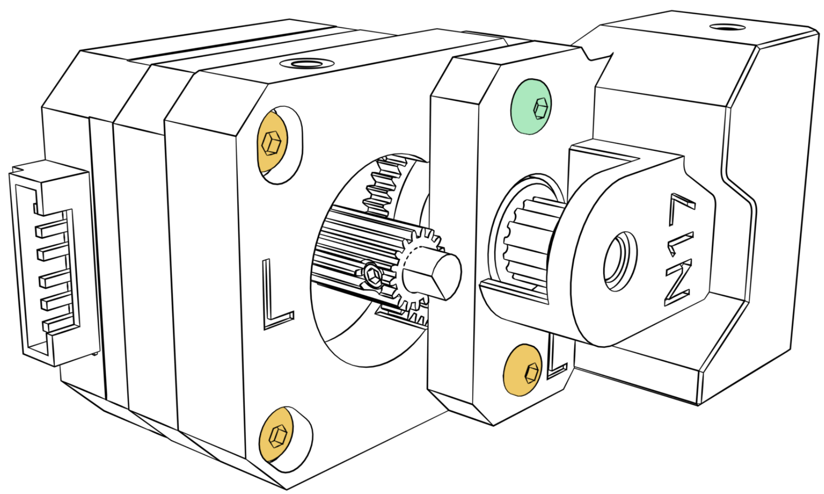




[a]_Z_axis_drive_rear_Nema17.stl
[a]_Motor_mount_rear_Nema17.stl

Z DRIVE LEFT



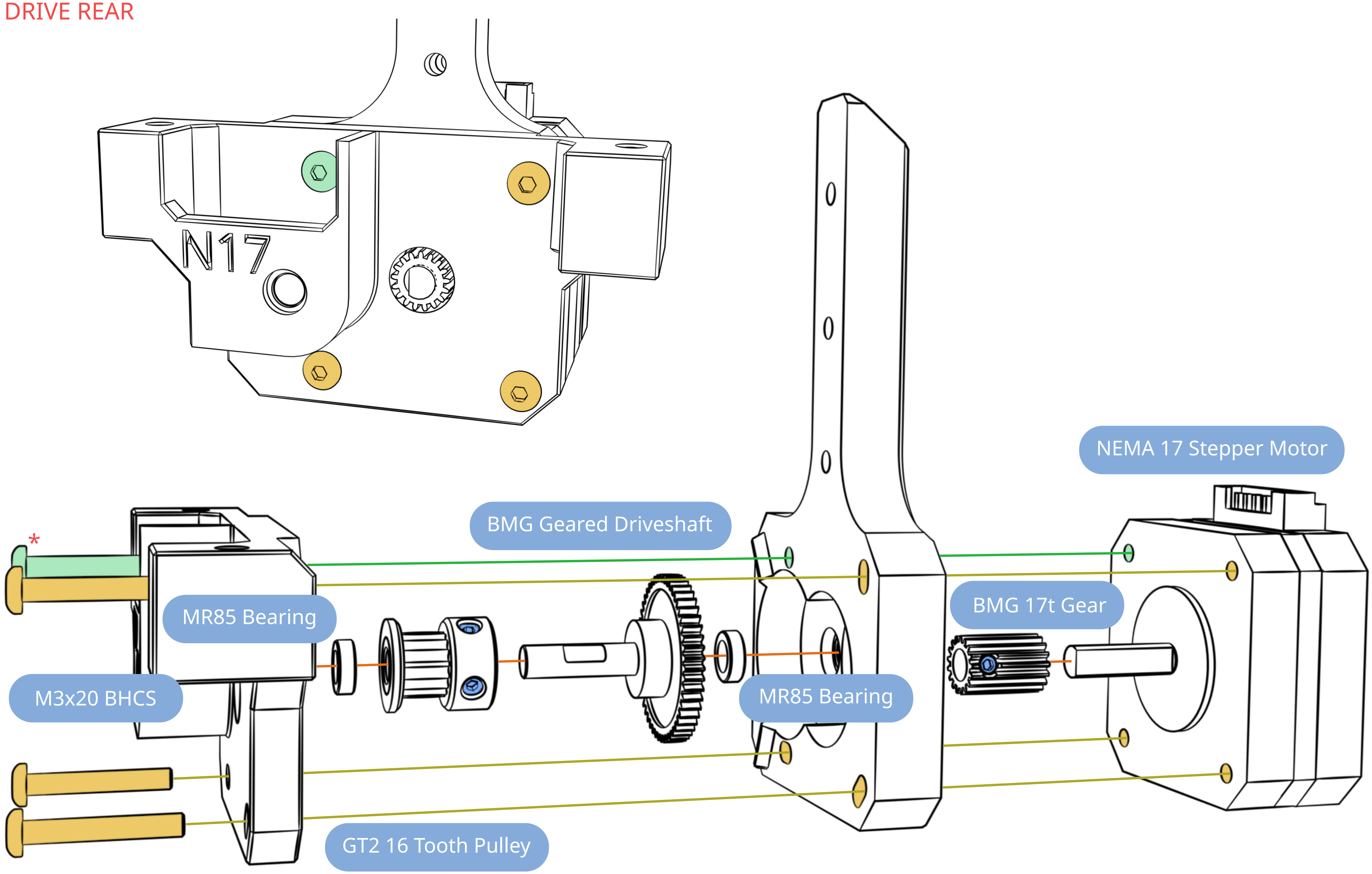


* The stepper motor rotates about this
screw to achieve proper gear meshing

[a]_Motor_mount_front_left_Nema17.stl
[a]_Foot_front_left_Nema17.stl

17 Tooth pinion
[stepper Z, Z1, Z2]
gear_ratio: 50:17

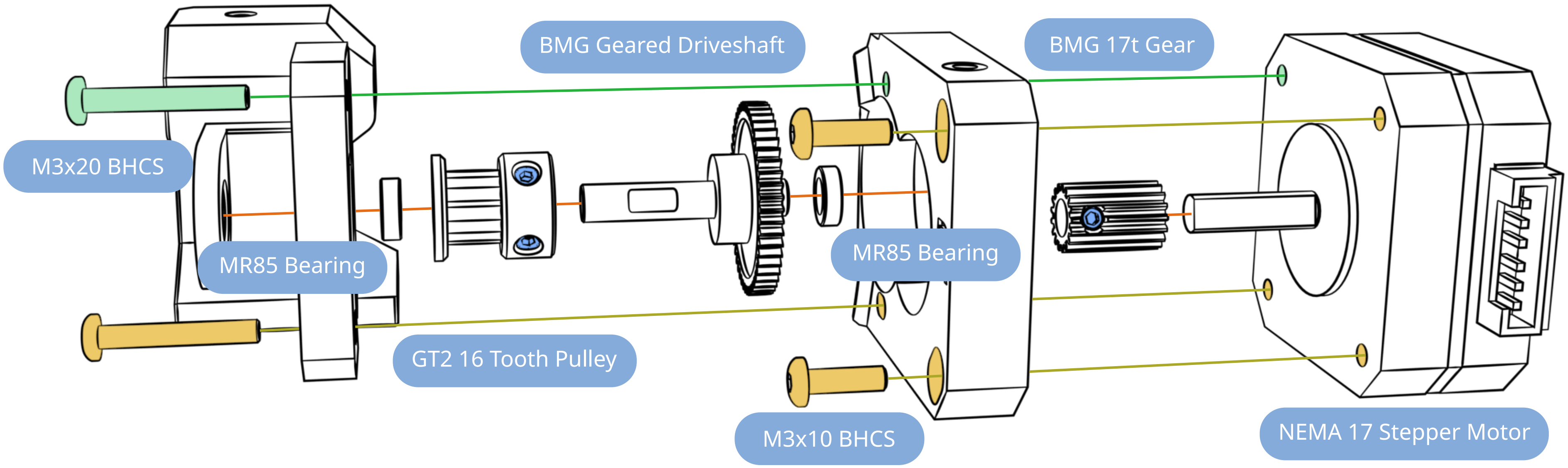
Z DRIVE REAR

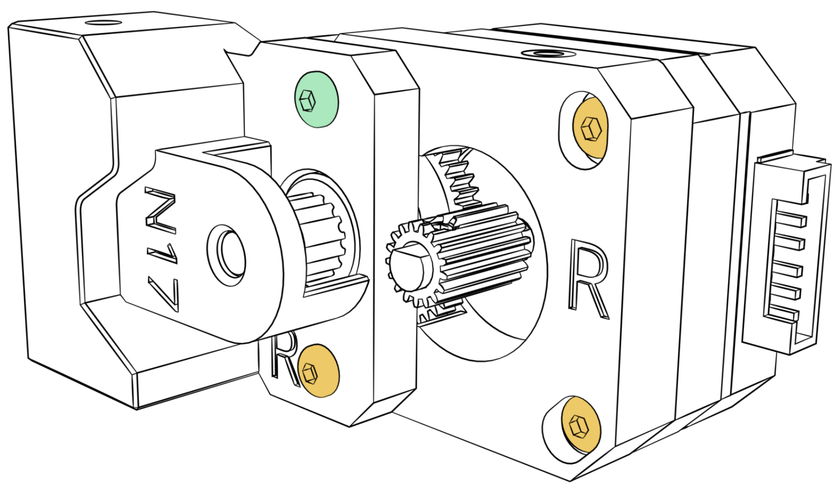


* The stepper motor rotates about this screw to achieve proper gear meshing

[a]_Z_axis_drive_rear_Nema17.stl
[a]_Motor_mount_rear_Nema17.stl

Z DRIVE RIGHT





* The stepper motor rotates about this
screw to achieve proper gear meshing

[a]_Foot_front_right_Nema17.stl
[a]_Motor_mount_front_right_Nema17.stl

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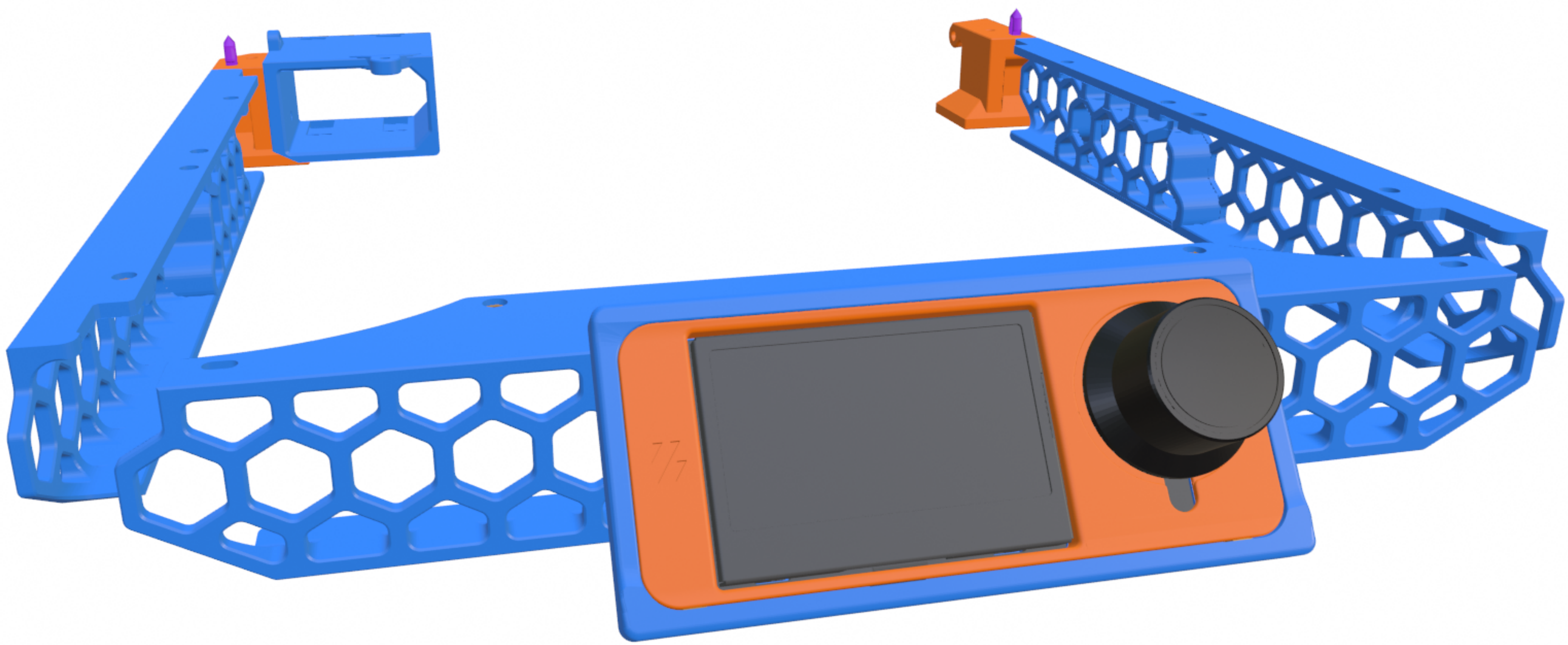
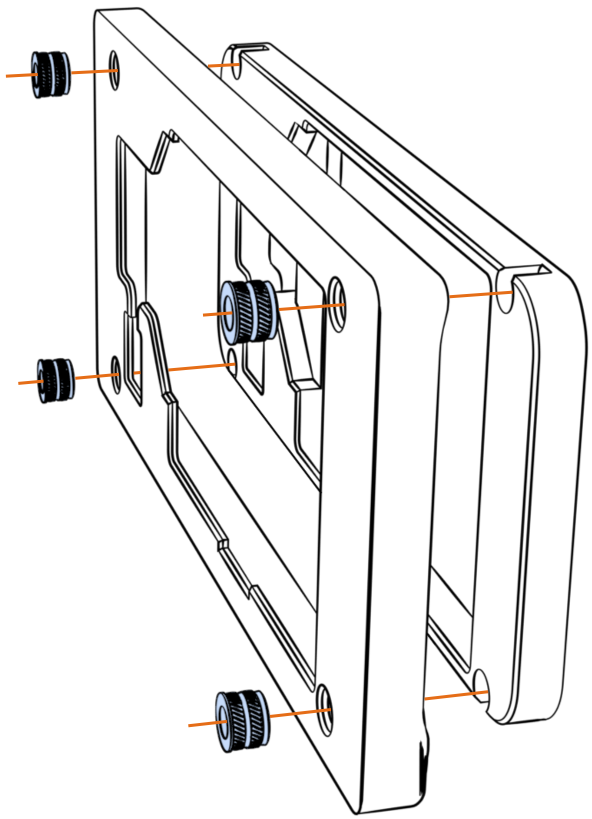
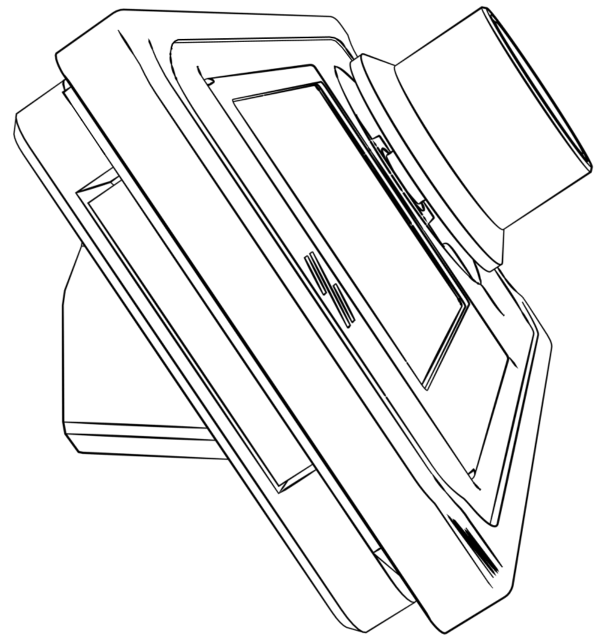


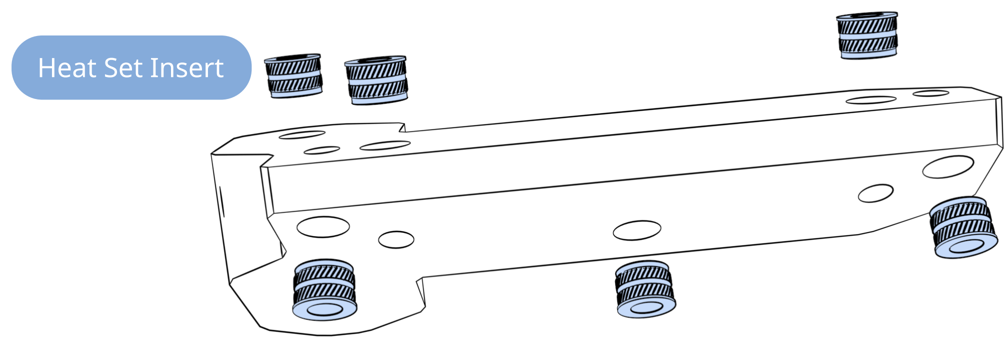
MINI 12864 DISPLAY
COMPONENT PREP

FRONT COVER

The front cover is held in place by the heat set inserts. Hold the front face firmly in place while inserting the heat set inserts

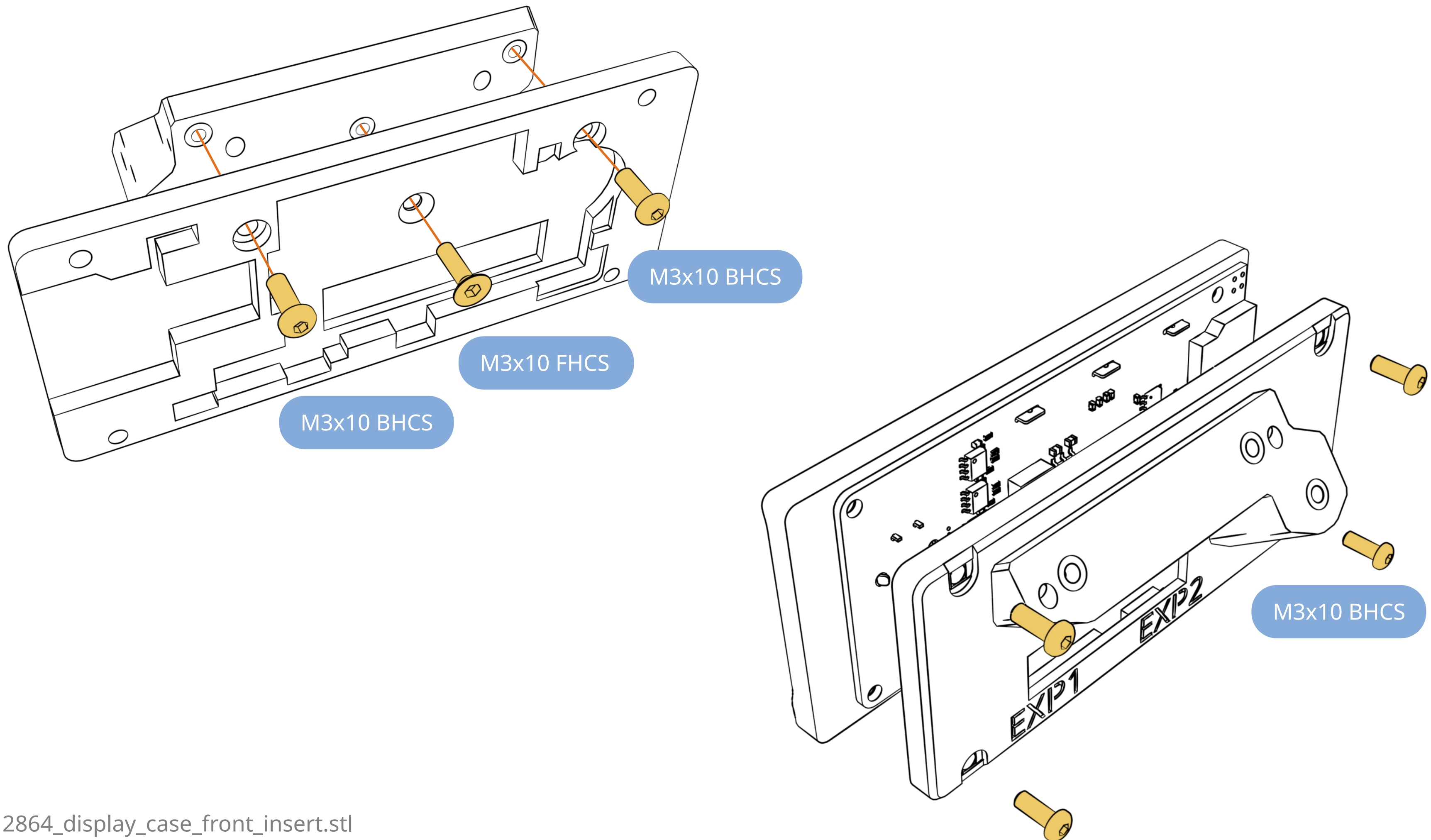






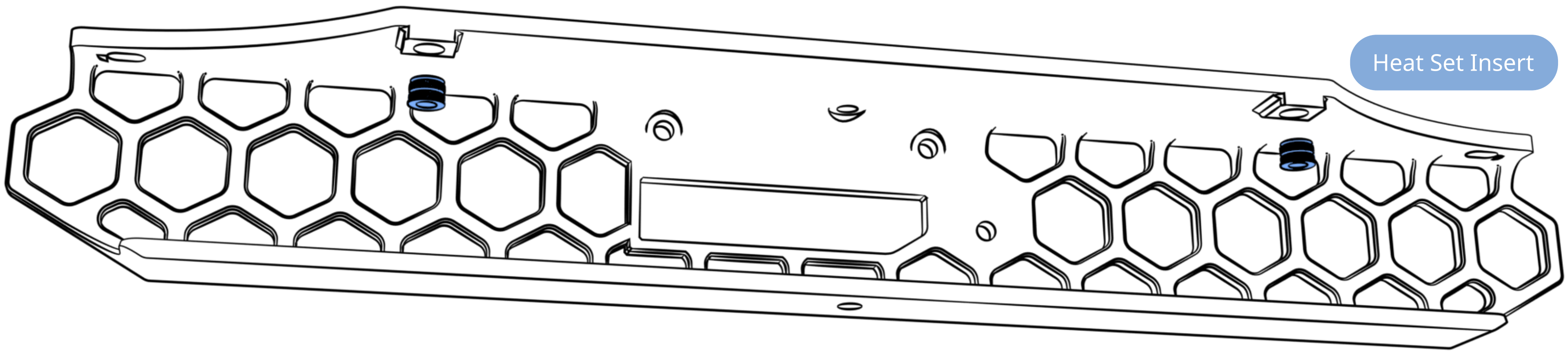
[p]_12864_display_case_front.stl
[a]_12864_display_case_front_insert.stl
[a]_Display_wedge_mount_35deg.stl

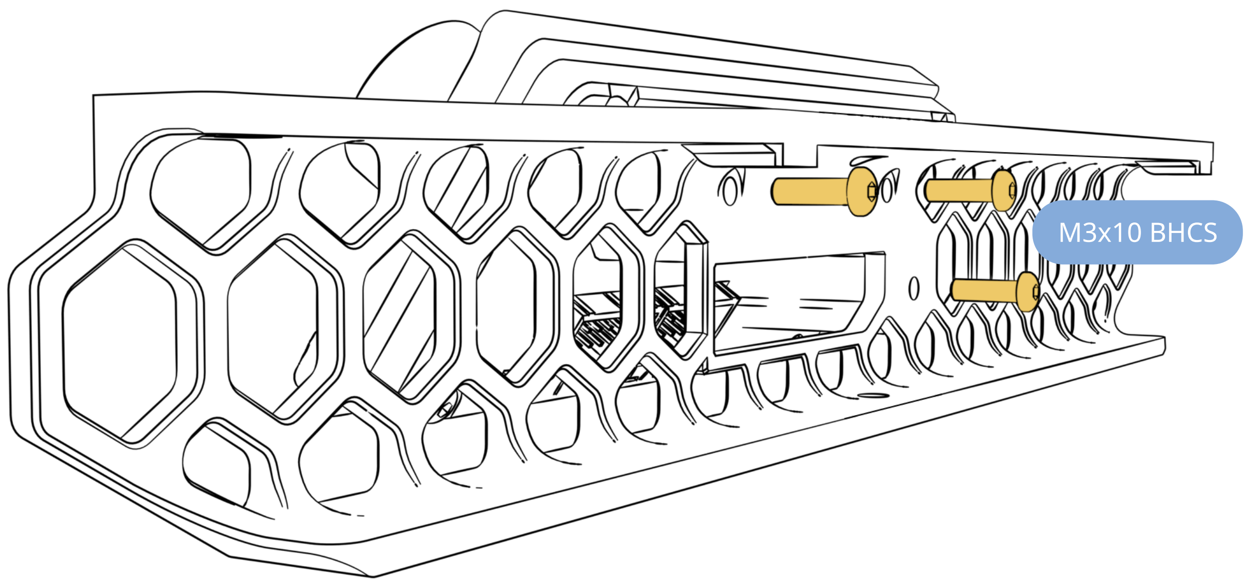
MINI 12864 DISPLAY



[a]_12864_display_case_front_insert.stl
[p]_12864_display_case_front.stl
[p]_12864_display_case_rear.stl
[a]_Display_wedge_mount_35deg.stl

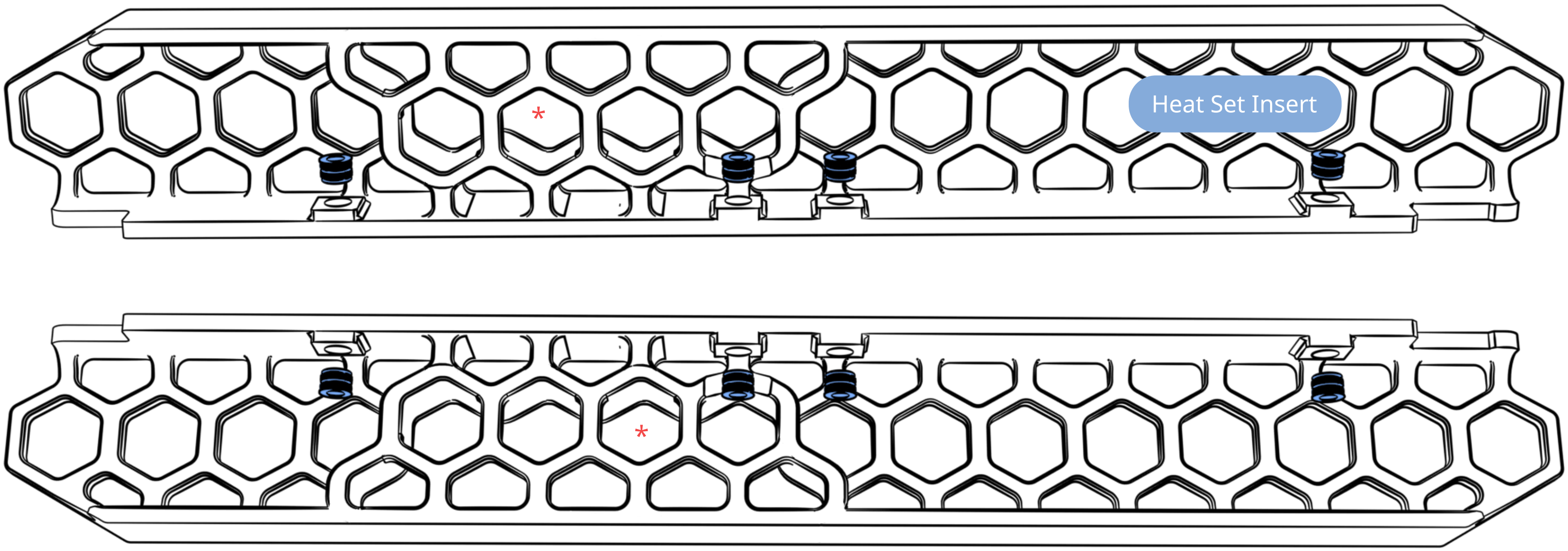
FRONT SKIRT





[p]_Side_skirt_front.stl
assembled Mini 12864 display

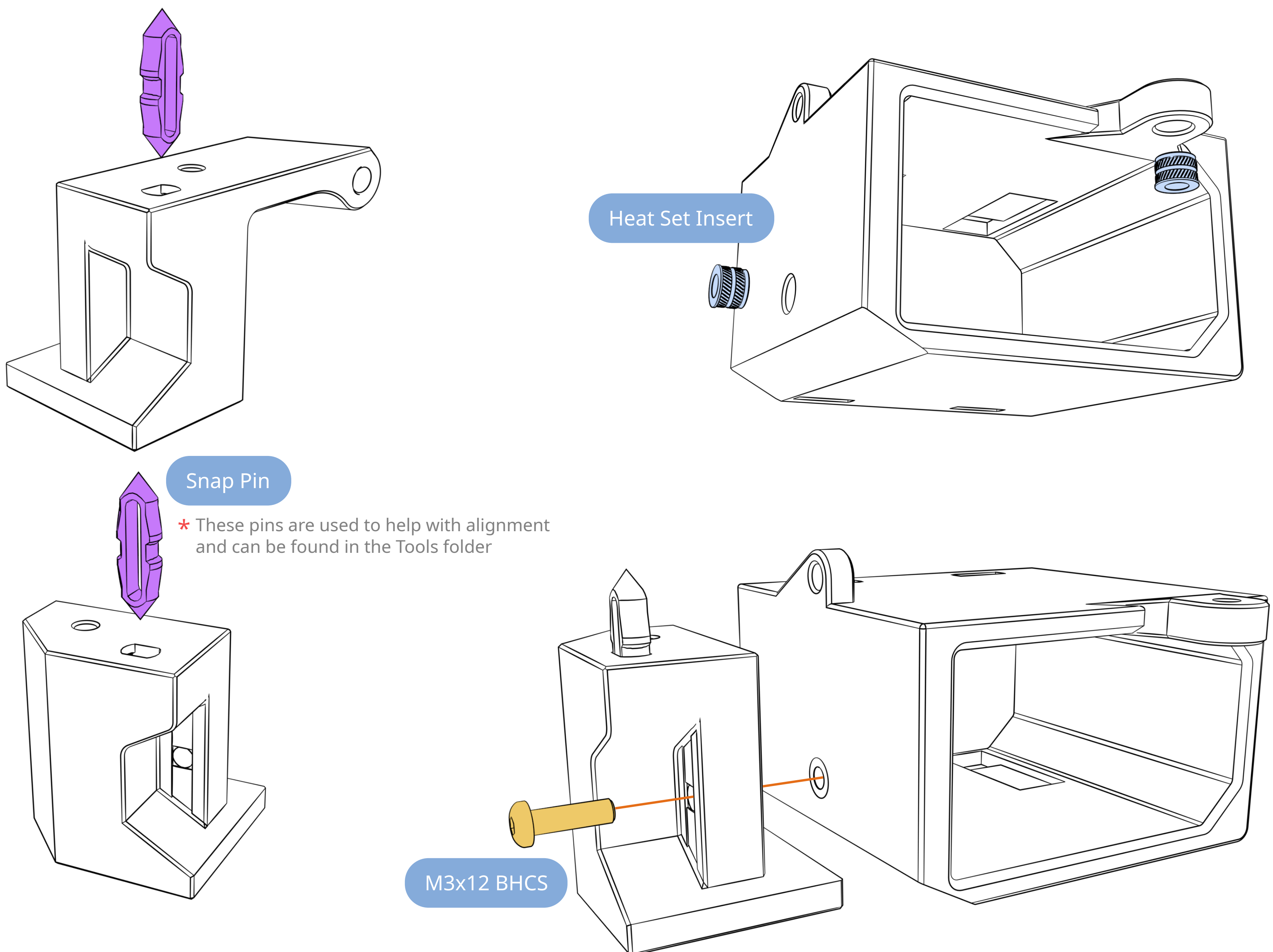
SIDE SKIRTS



* The hidden handles feature of the side skirts require support on build plate only

[p]_Side_skirt_left.stl
[p]_Side_skirt_right.stl

REAR FEET



[a]_Foot_rear_left.stl
[a]_Foot_rear_right.stl
[p]_Power_inlet.stl (Electronics Bay folder)