VORON

GALILEO 2 Z DRIVE

Planetary power for your gardening-tool-built space shuttle.

VERSION 15AUG2023

Introduction	03
Galileo 2 Introduction	07
Hardware	10
Motor Plate	13
G2 Module	15
Front Body	20
Stepper Mount	21
Feet	23

PART PRINTING GUIDELINES

Galileo 2 follows the Voron Team standards. The Voron Team has provided the following print guidelines for you to follow in order to have the best chance at success with your parts. There are often questions about substituting materials or changing printing standards, but we recommend you follow these.

3D PRINTING PROCESS

Fused Deposition Modeling (FDM)

MATERIAL

ABS/ASA

LAYER HEIGHT

Recommended: 0.2mm

EXTRUSION WIDTH

Recommended: Forced 0.4mm

INFILL TYPE

Grid, Gyroid, Honeycomb, Triangle or Cubic

INFILL PERCENTAGE

Recommended: 40%

WALL COUNT

Recommended: 4

SOLID TOP/BOTTOM LAYERS

Recommended: 5

FILE NAMING

By this time you should have already downloaded the STL files from the Galileo 2 GitHub repository. You might have noticed that we have used the Voron standard naming convention for the files. This is how to use them.

PRIMARY COLOR

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

ACCENT COLOR

[a]_front_bearing_holder.stl
We have added “[a]” to the front of any STL file that is intended to be printed with accent color. The parts are marked with a heart in the manual when they first appear.

HOW TO GET HELP

If you need assembly assistance, we're here to help. Head on over to the Voron Discord group and post your questions. This is our primary medium to help Voron Users and we have a great community that can help you out if you get stuck.

Discord https://discord.gg/voron

VORON FORUM https://forum.vorondesign.com

REPORTING AN ISSUE

Should you find an issue in the documentation or have a suggestion for an improvement please consider opening an issue on GitHub (https://github.com/JaredC01/Galileo2/issues). When raising an issue please include the relevant page numbers and a short description; annotated screenshots are also very welcome. We periodically update the manual based on the feedback we get.

https://github.com/VoronDesign

https://docs.vorondesign.com

WHAT IS GALILEO?

Galileo is a series of planetary-geared projects designed for use in Voron printers designed by JaredC01. This document covers Galileo 2, or G2, which has an incredible 9:1 gear ratio in a custom-designed planetary gearbox. This manual covers the Galileo 2 Z Drives, or G2Z, specifically. There are also other G2-based projects, such a G2E extruder and a standalone extruder design, which will be covered in separate manuals.

WHAT BIG GEARS YOU HAVE!

In addition to the planetary gear reduction, G2E also features a custom 16mm RNC-coated filament drive gear. This means more grip on the filament, helping to minimize filament slip and maximize extruder output.

DROP IN REPLACEMENT FOR V2.4 Z DRIVES

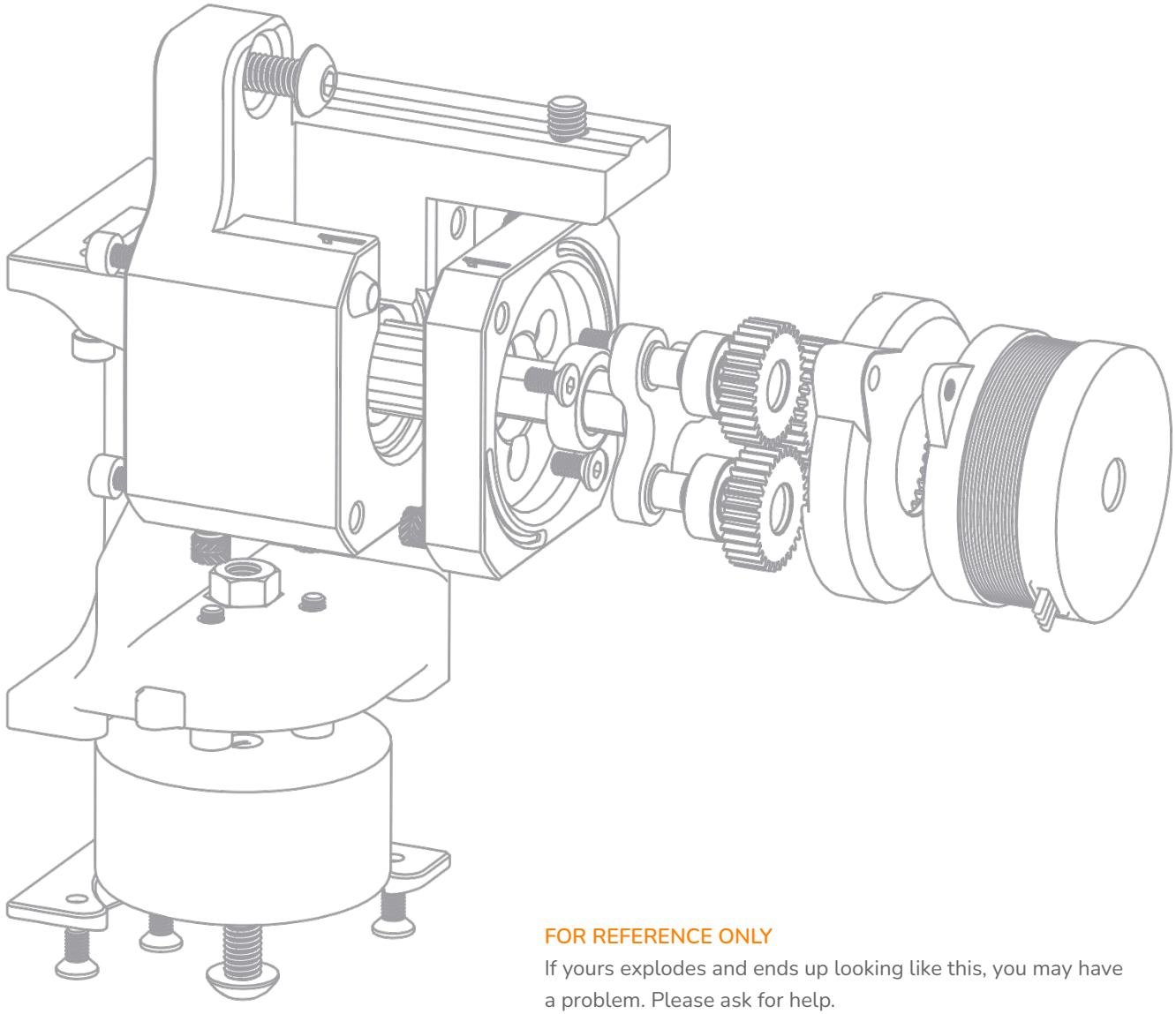
The G2Z is a drop in replacement for the stock V2.4 Z drives. Recommended only for smaller printers, 250x250 V2.4 and Micron builds.

RECONFIGURATION REQUIREMENTS

You must update both the gear_ratio and rotation_distance in your Klipper configuration after installing the Galileo 2 Z Drive. Additionally, your run_current will need to be updated.

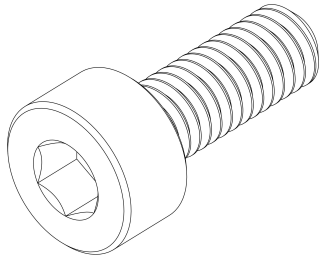
```
[stepper_z]
rotation_distance: 40
gear_ratio: 9:1
microsteps: 32

[tmc2209 stepper_z]
run_current: 0.8
```



FOR REFERENCE ONLY

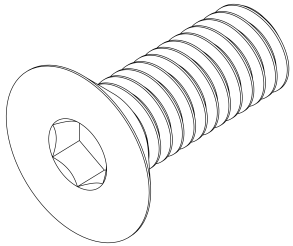
If yours explodes and ends up looking like this, you may have a problem. Please ask for help.



SOCKET HEAD CAP SCREW (SHCS)

Metric fastener with a cylindrical head and hex drive. The most common fastener used on the Voron.

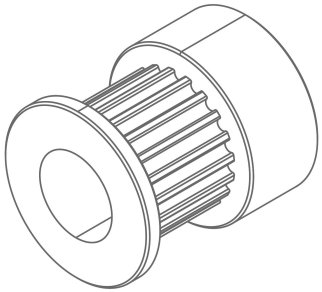
ISO 4762



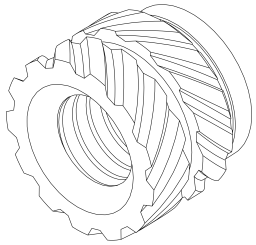
FLAT HEAD COUNTERSUNK SCREW (FHCS)

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

ISO 10642

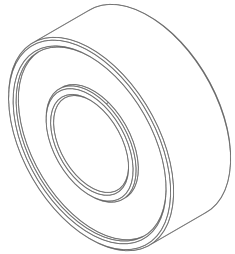


GT2-20T PULLEY



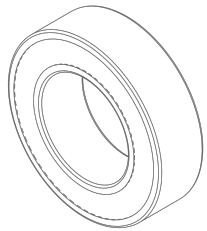
HEAT SET INSERT

Heat inserts with a soldering tip 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.



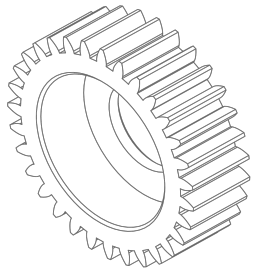
MR148 BEARING

Main shaft support

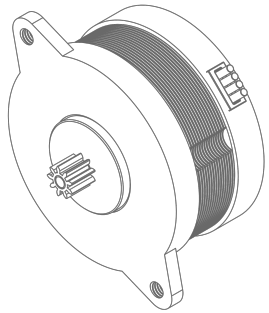


MR115 BEARING

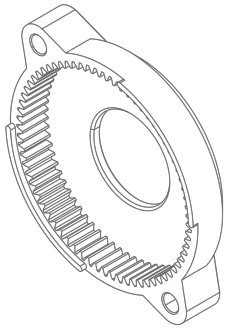
Planetary and idlers



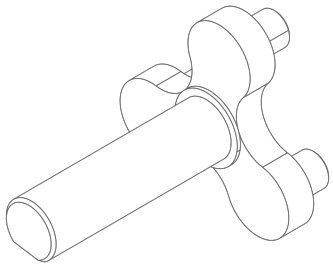
PLANETARY GEAR
31-Tooth MJF Gear



NEMA 14 PANCAKE STEPPER
9T, 20mm

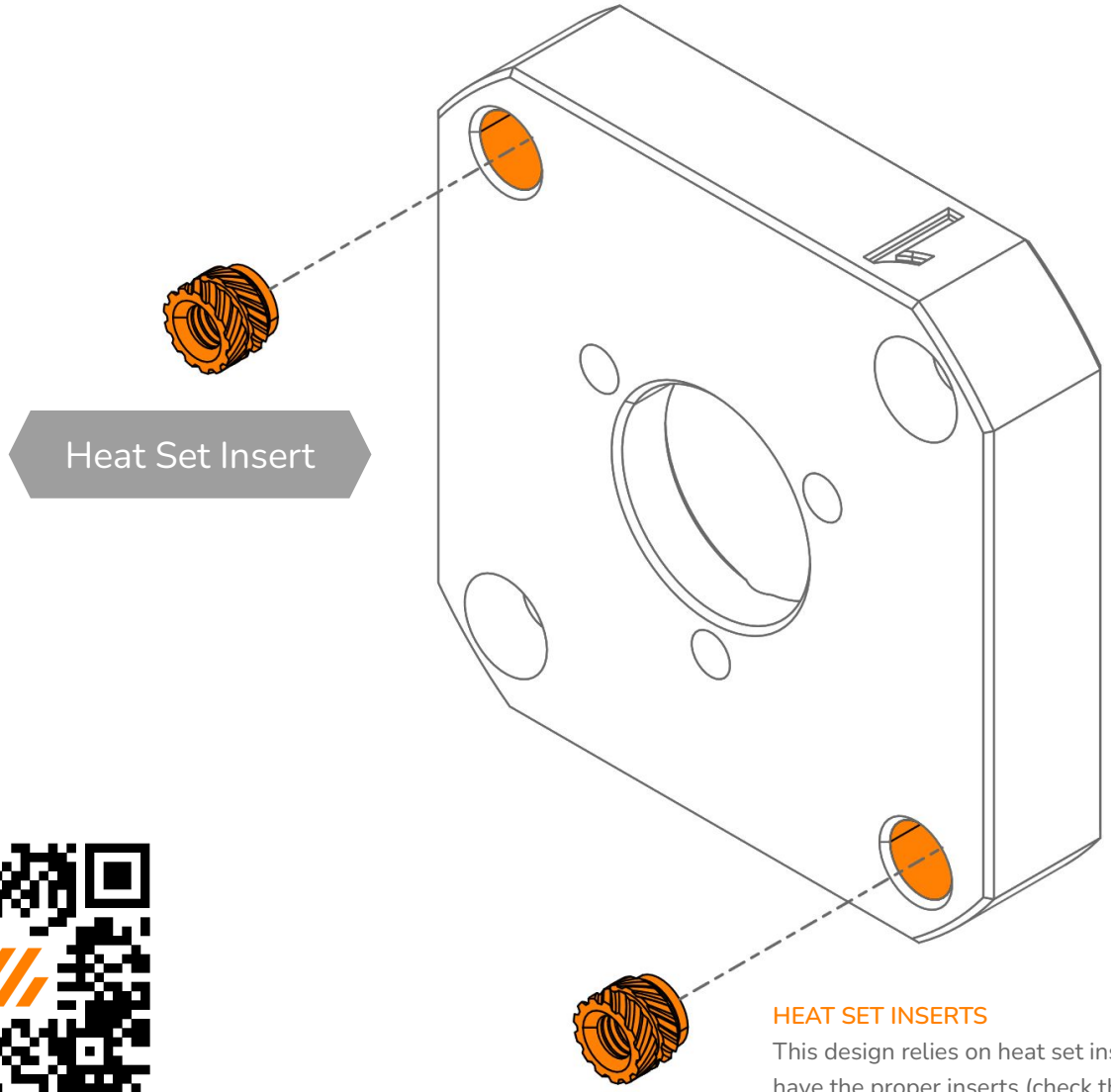


RING GEAR HOUSING
72-Tooth MJF Housing



PLANETARY CARRIER SHAFT
Aluminum Carrier


GALILEO 2

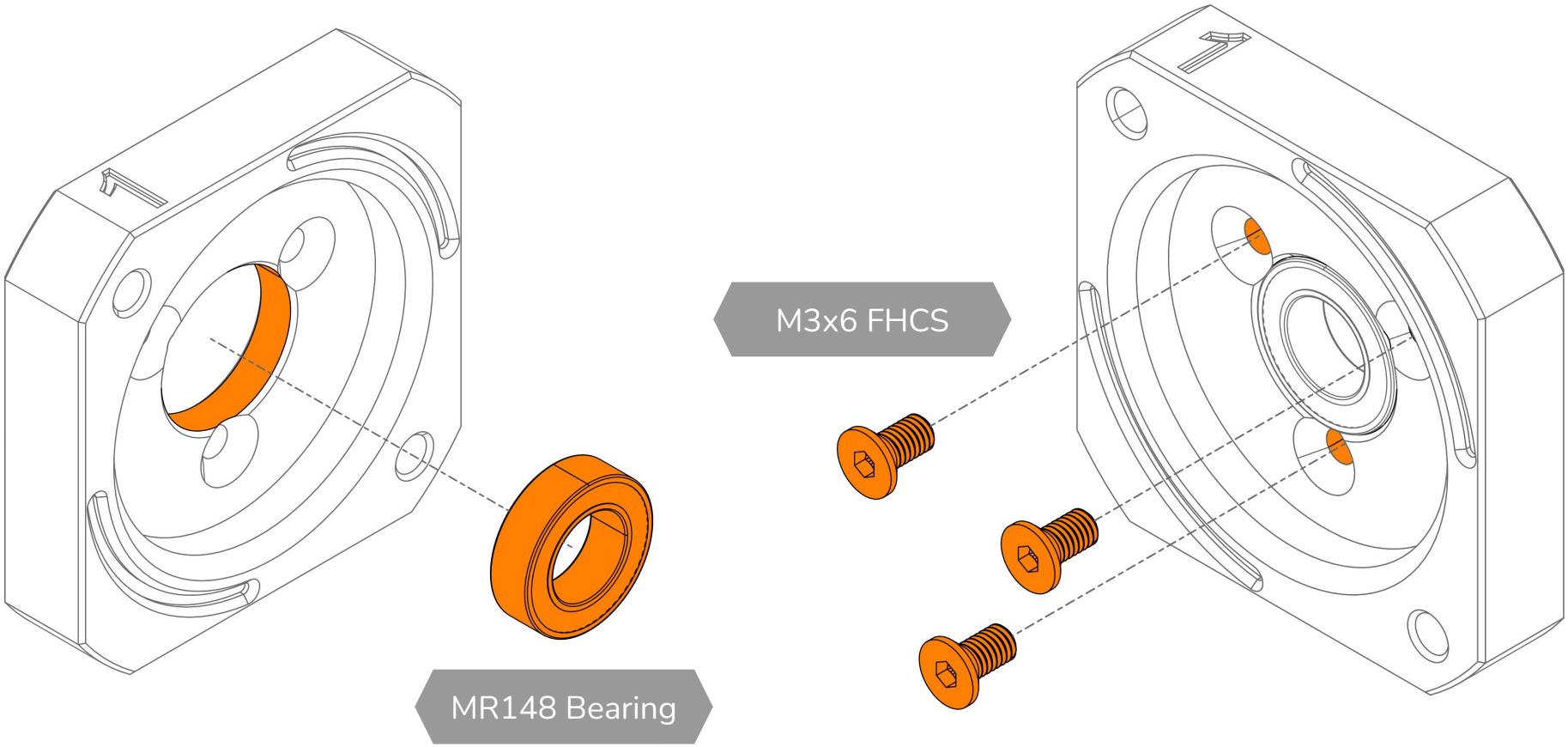


https://voron.link/m5ybt4d

HEAT SET INSERTS

This design relies 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.



BEARINGS

Insert MR148 bearing into slot.
No grease needed.

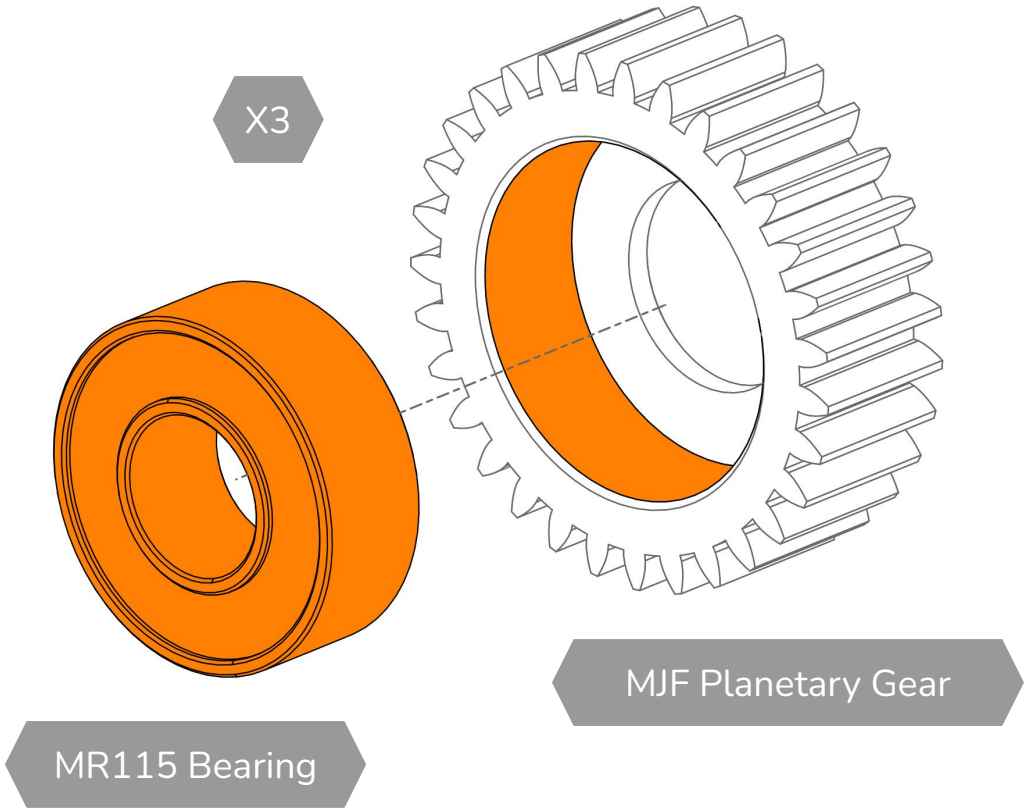
BEARING SCREWS

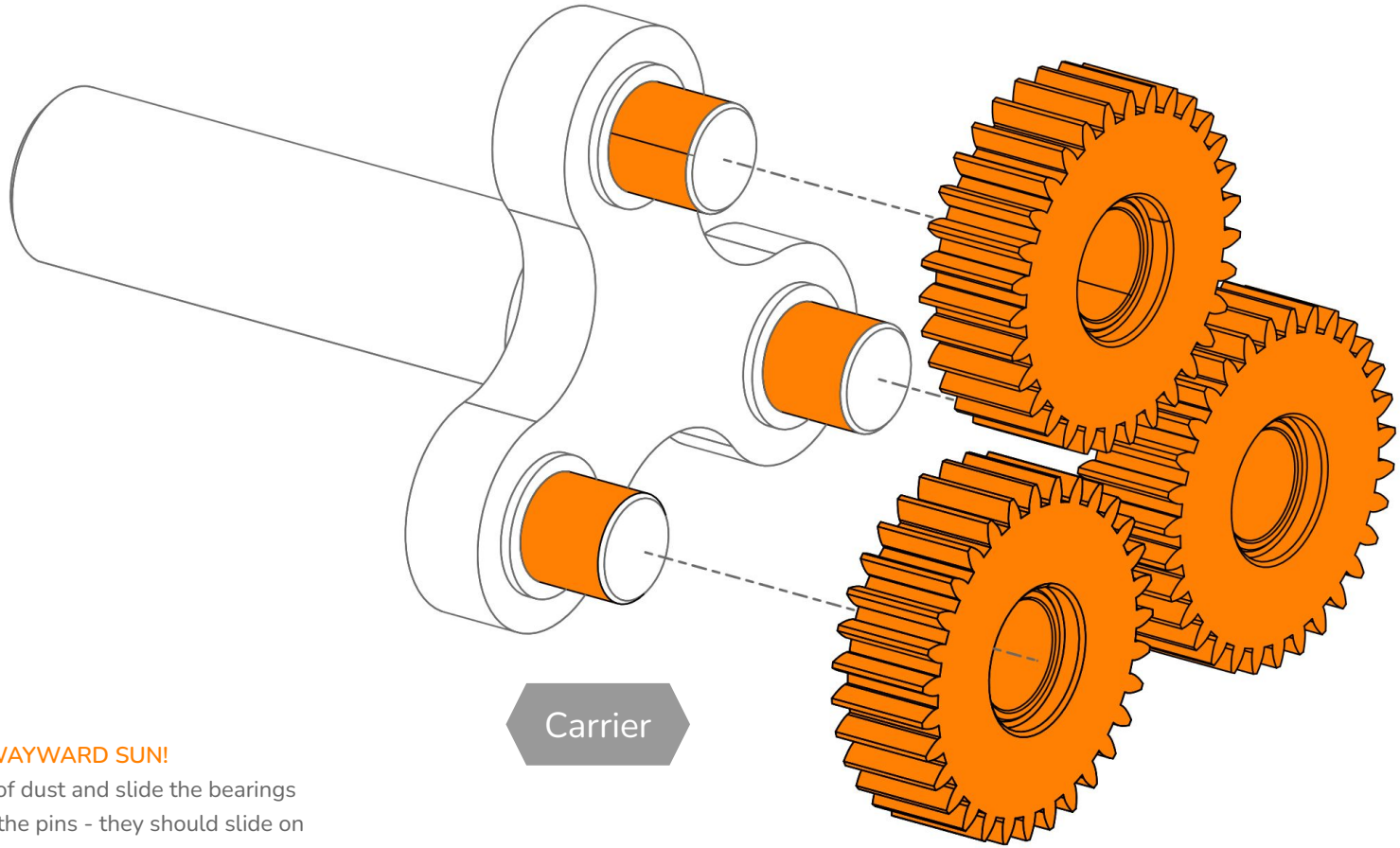
These capture the outer edge of the bearing and will retain it in the printed part. They should be just above flush when fully tightened. DO NOT OVERTIGHTEN, they are threaded into plastic!


GALILEO 2

HOW DO YOU THROW A PARTY ABOUT SPACE?.....YOU PLANET

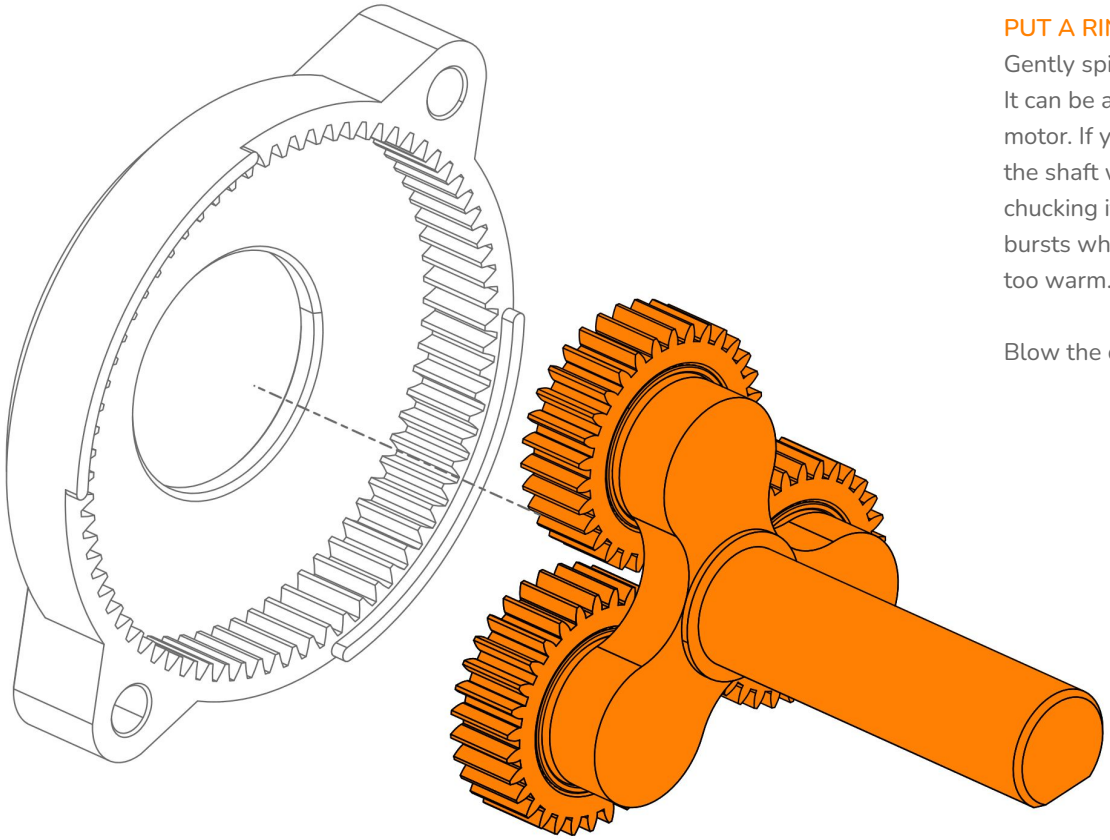
Insert the 3 MR115 bearings into the 3 small planetary gears in preparation for the carrier assembly.





CARRIER ON MY WAYWARD SUN!

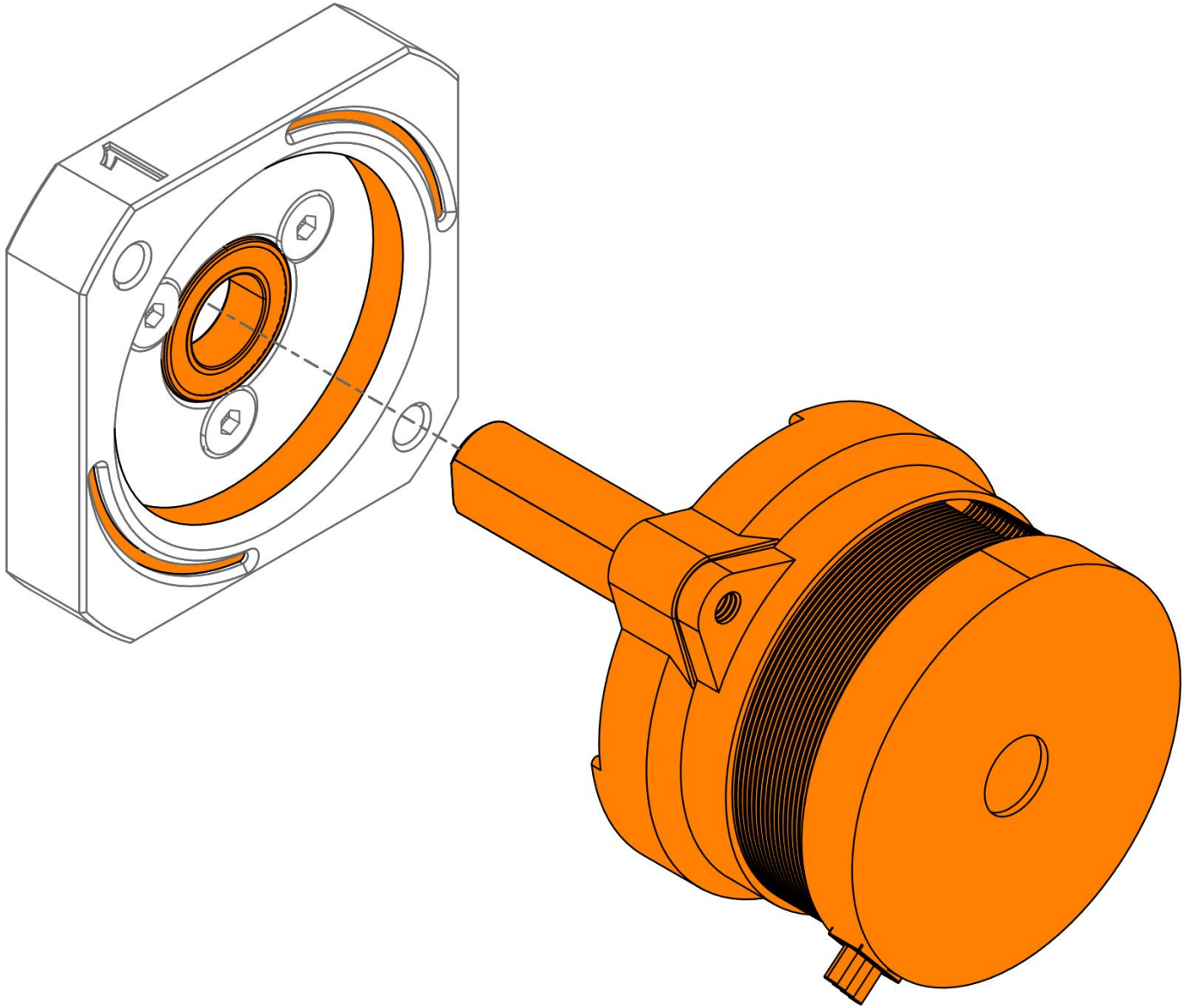
Wipe the pins free of dust and slide the bearings in the planets onto the pins - they should slide on smoothly. If they don't, pull them off and look for burrs/scratches..

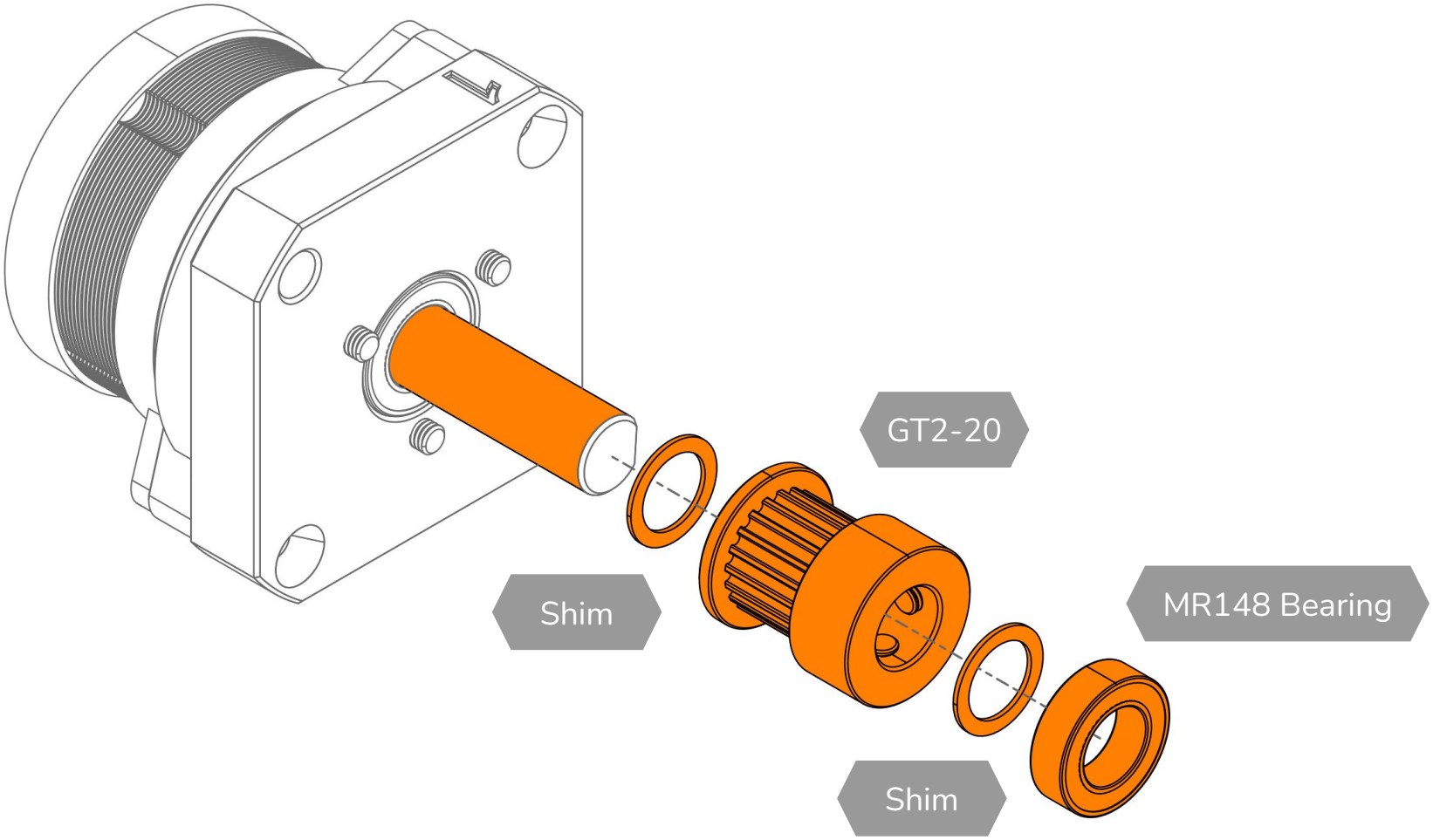


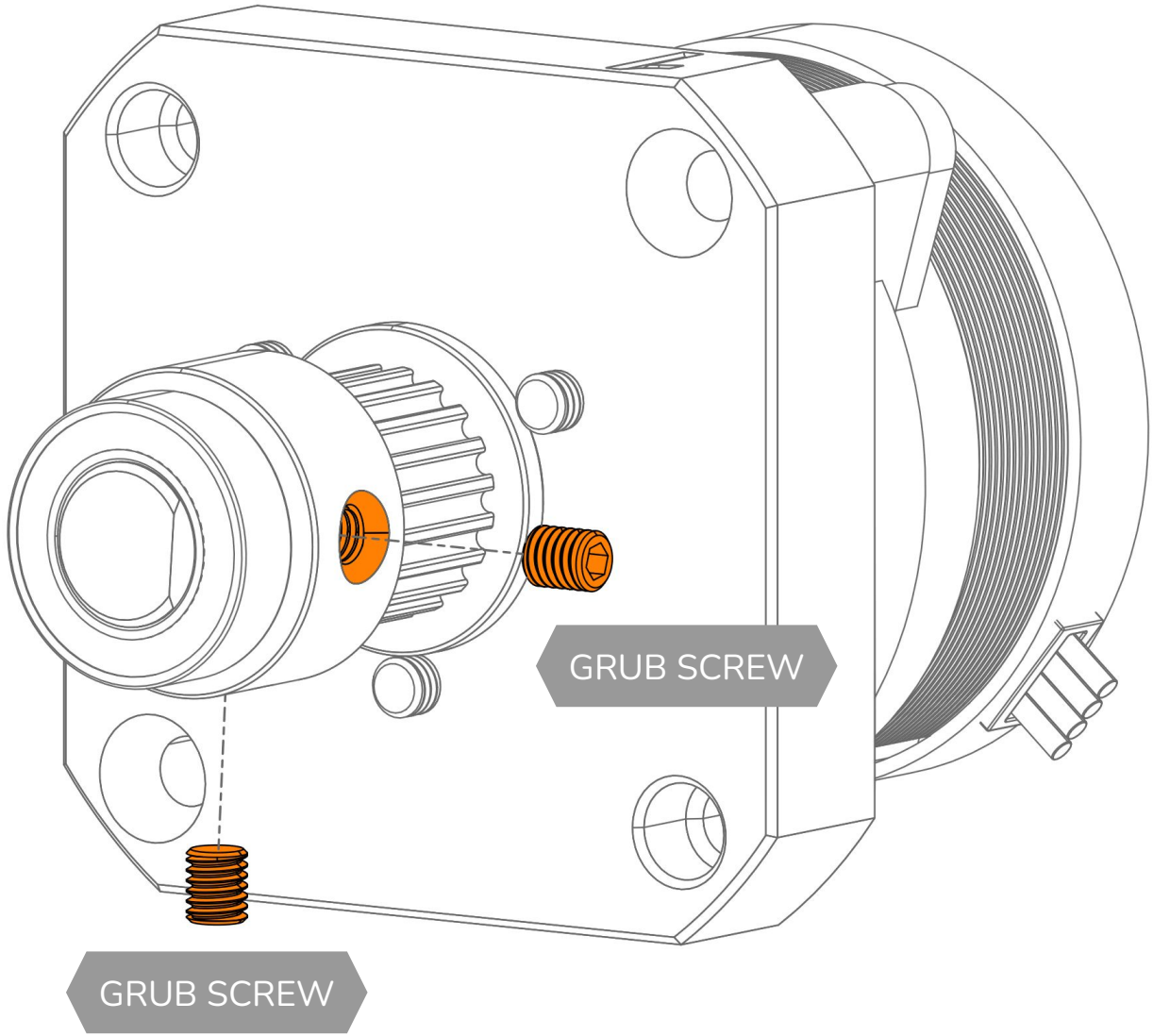
PUT A RING ON IT AND DON'T FORGET THE LUBE

Gently spin the carrier as you walk it into the ring gear. It can be a tight fit, and spinning it may feel like a stepper motor. If you want, you can speed the wear-in by wrapping the shaft with a strip of paper to protect it, then loosely chucking it in a drill. Spin the carrier back and forth in short bursts while you hold the ring to make sure it doesn't get too warm. Don't overdo it trying to get it buttery smooth.

Blow the dust out, then lubricate it with silicone grease.



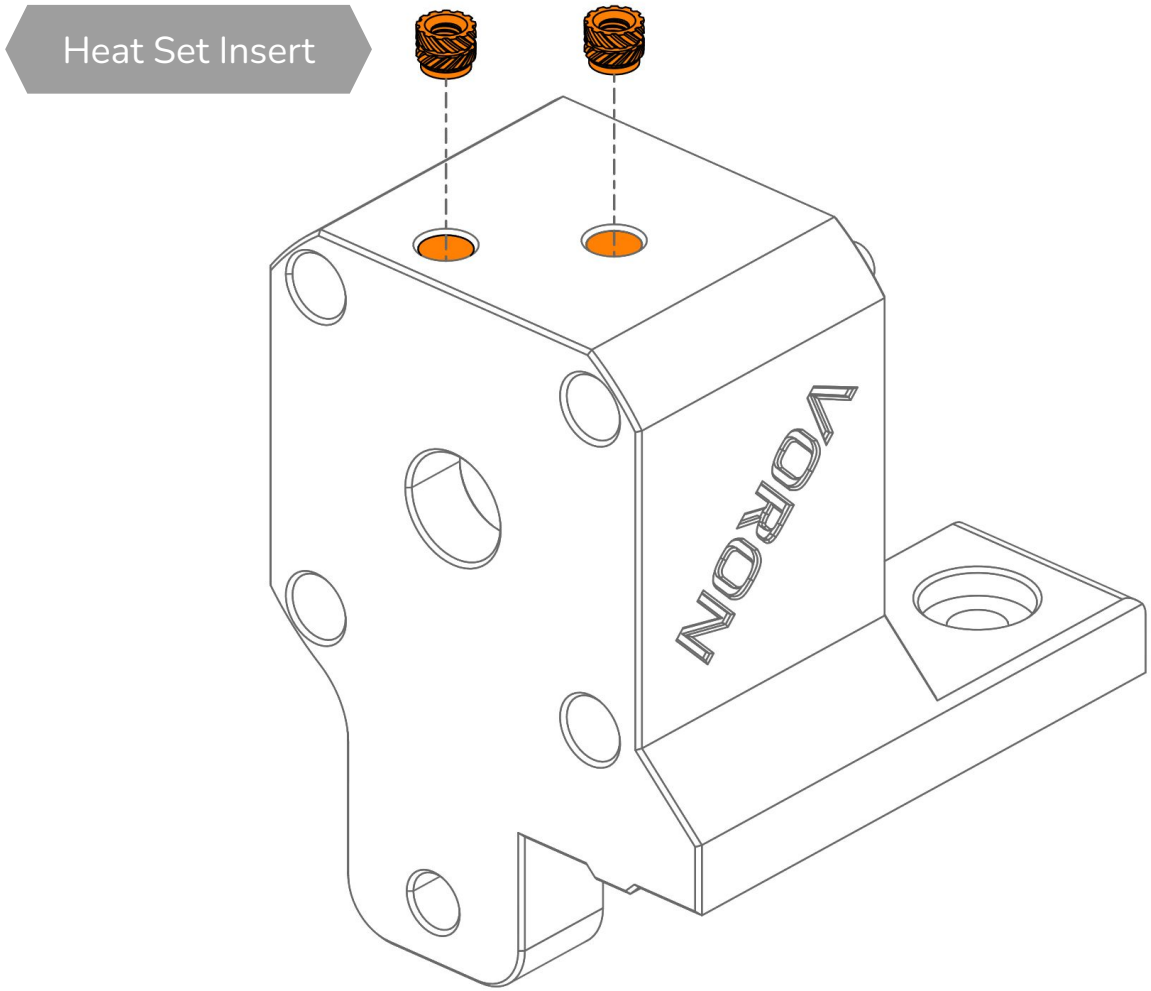

GT2-20
Shim
MR148 Bearing
Shim

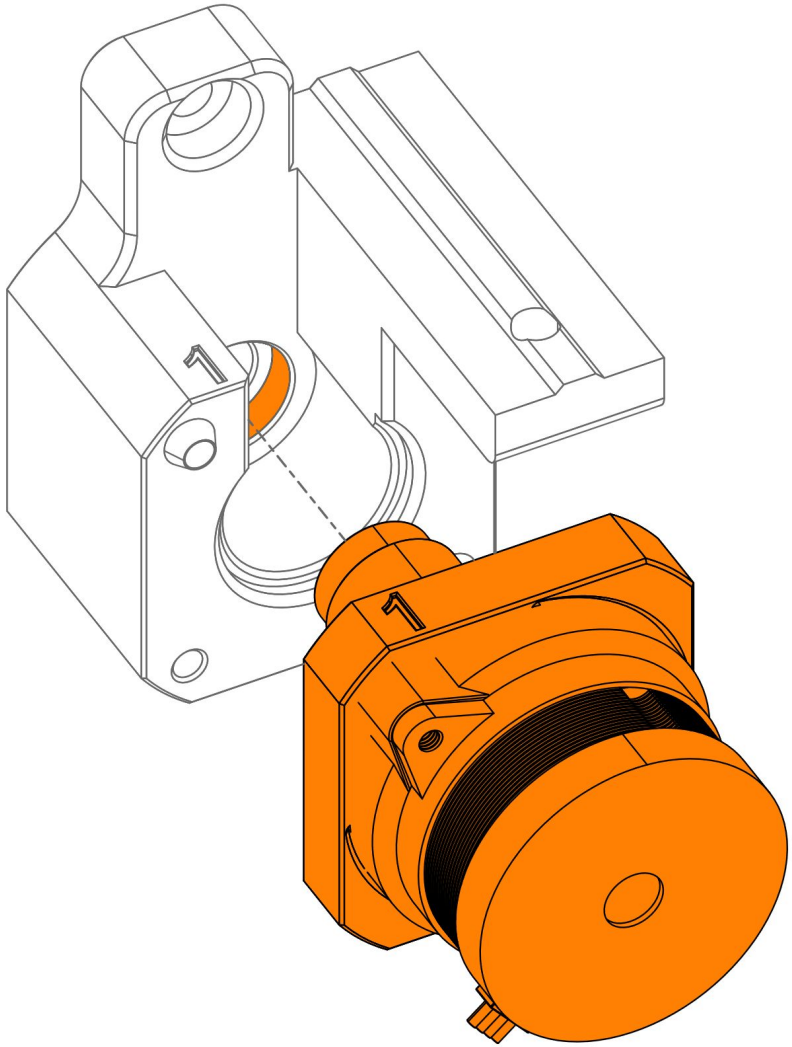


LOCTITE IS YOUR FRIEND

Add Loctite thread locker on your grub screws before install. Don't be that person....

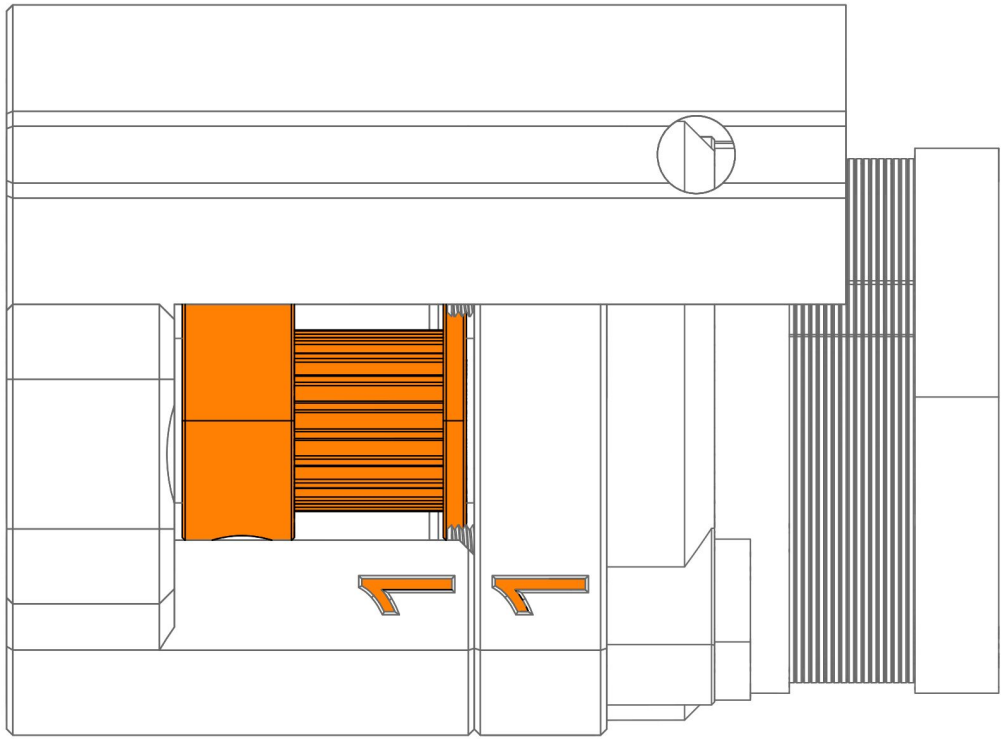

VORON
GALILEO 2

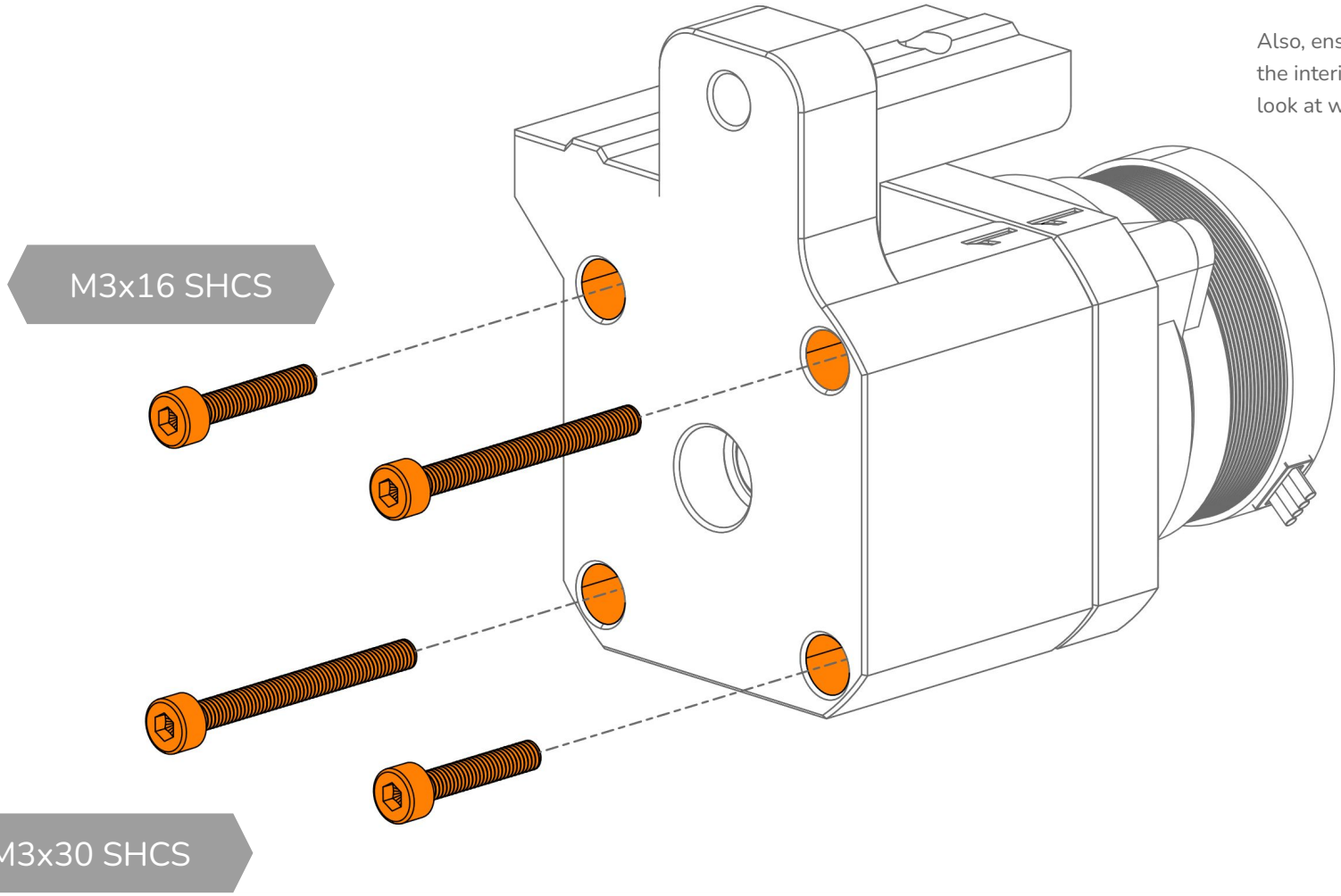

Heat Set Insert
VORON



INSTALL GALILEO ASSEMBLY

Install drive assembly into the stepper mount. Don't force it—if the assembly won't tighten up, go back through the previous steps and ensure everything is snugged up correctly.



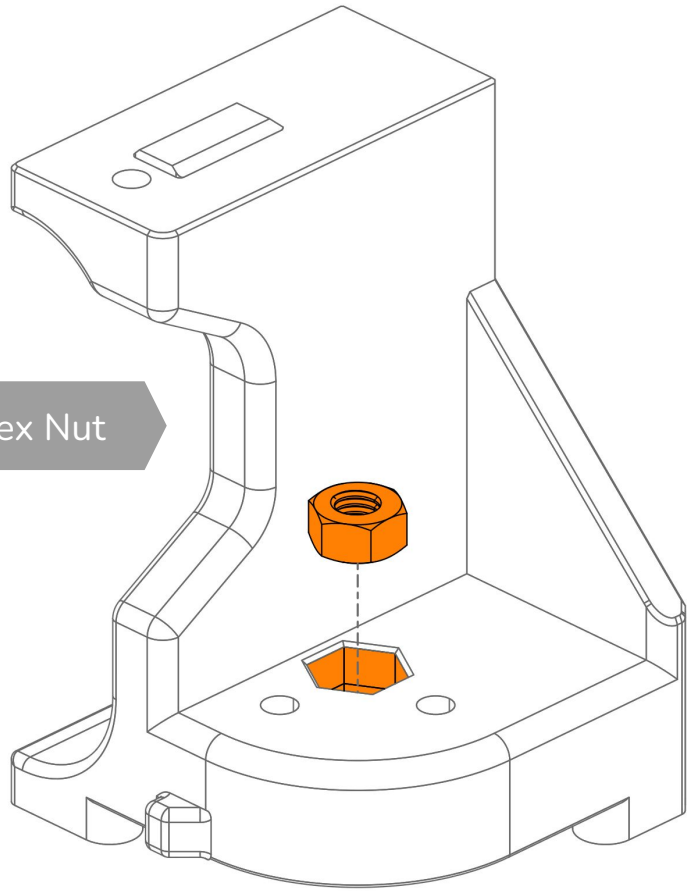


MOUNT GEARBOX

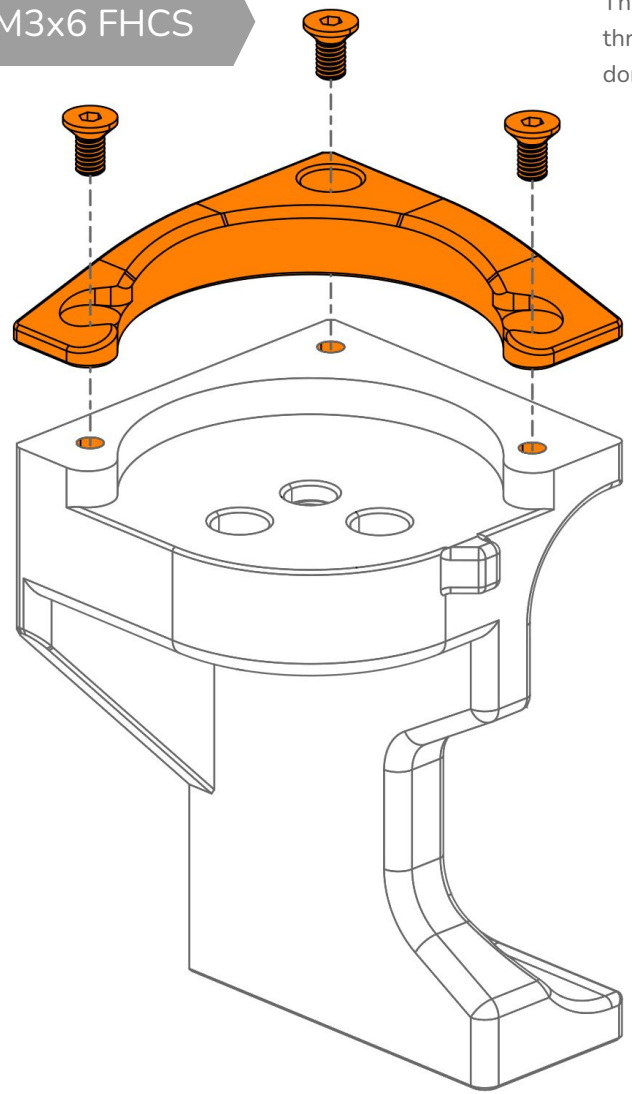
Pay attention to the screws in this step. The M3x30 go through the whole assembly into the motor.. The M3x16 screws to heat sets in the gearbox main body.

Also, ensure your motor wires are routed to the interior of the printer, unless you like to look at wires.

M5 Hex Nut

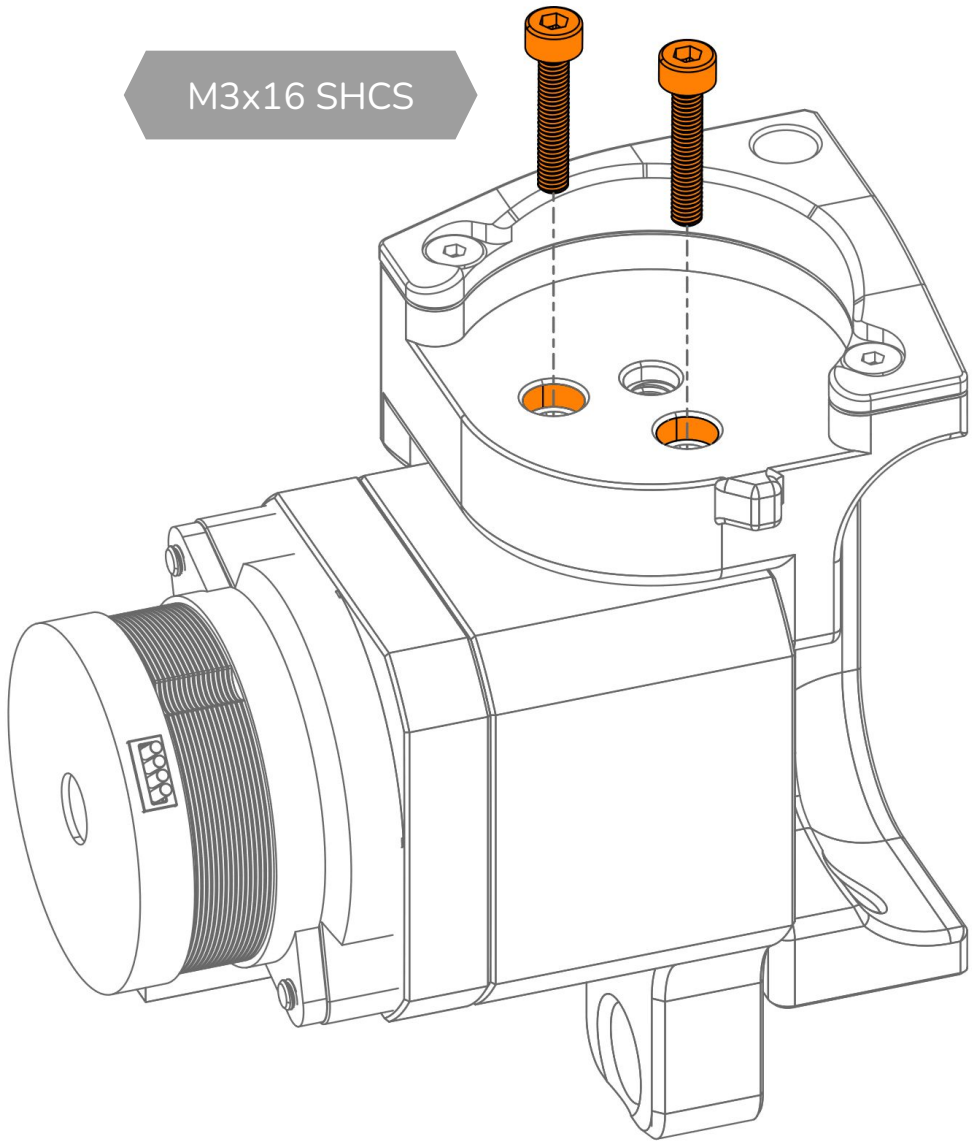


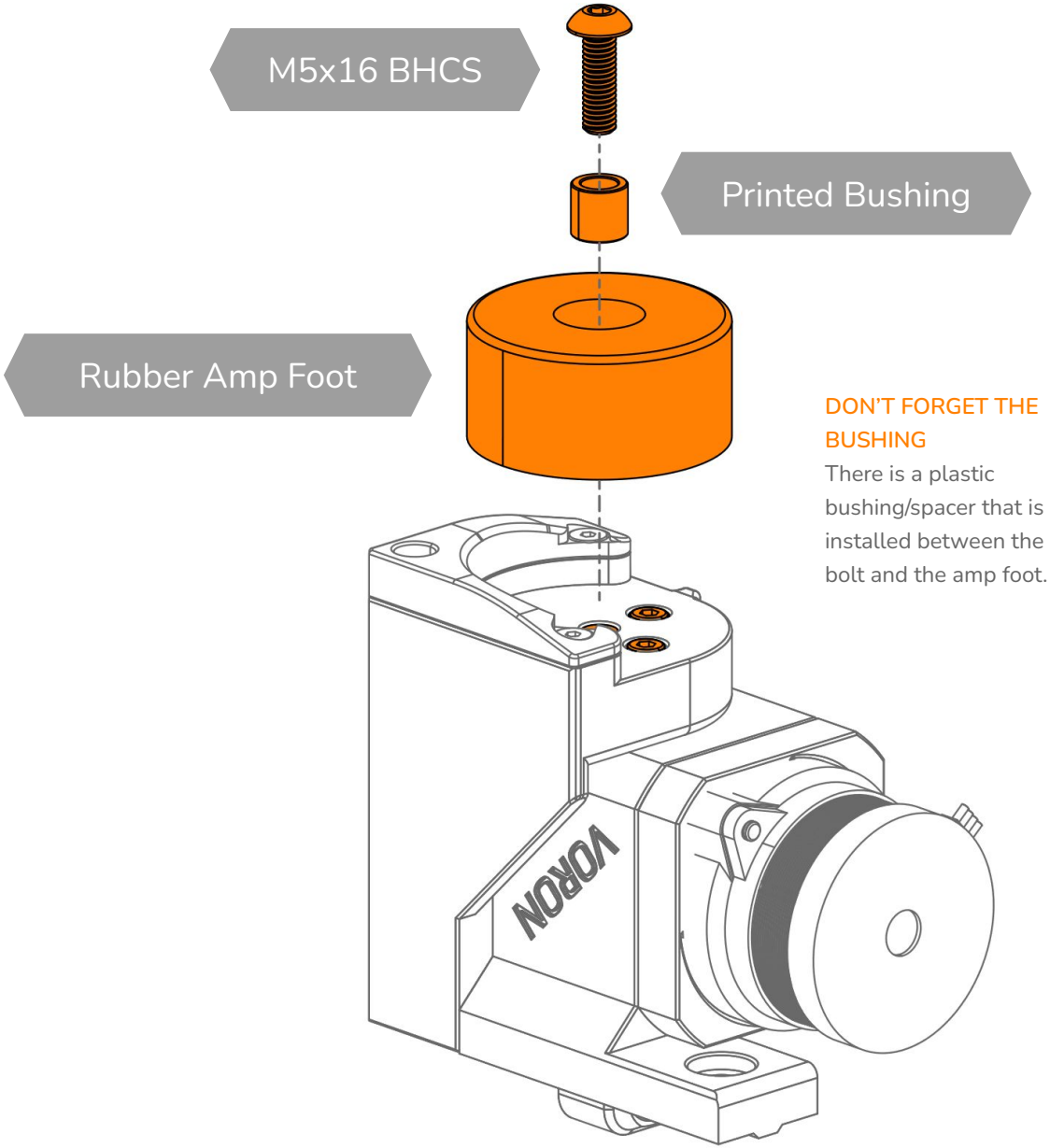
M3x6 FHCS



CAREFUL!!

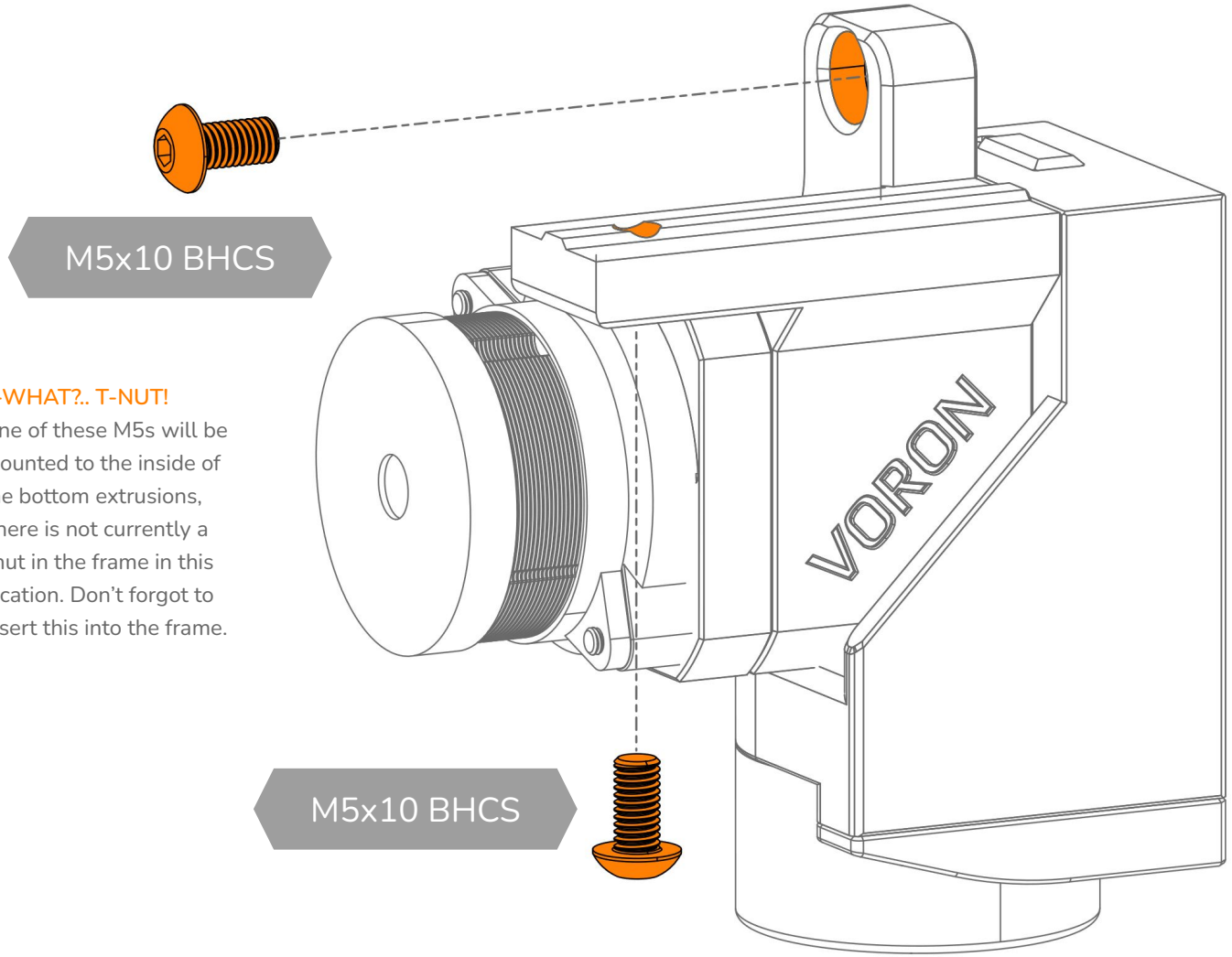
These screws are threading into plastic, don't overtighten.


M3x16 SHCS



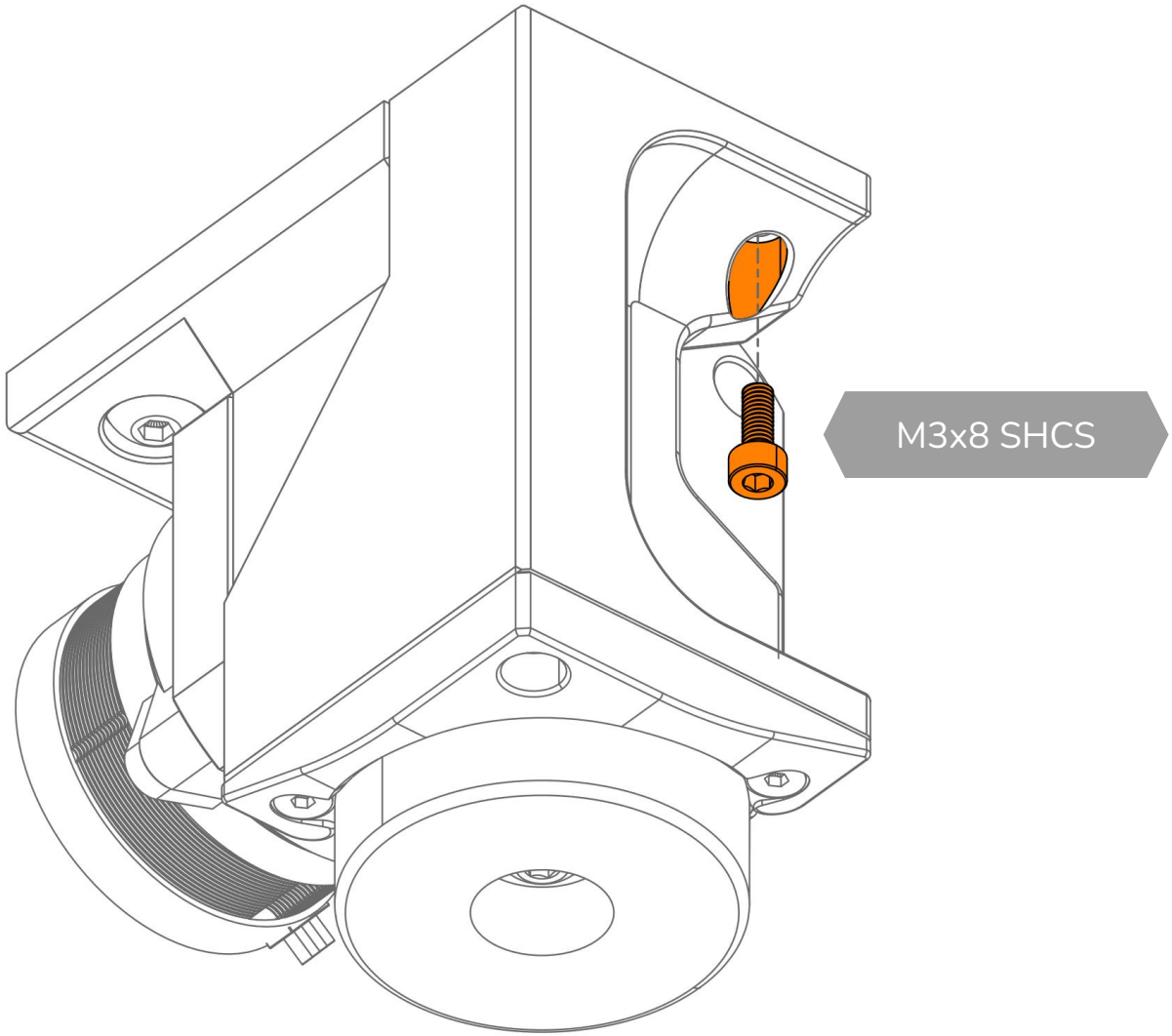
DON'T FORGET THE BUSHING

There is a plastic bushing/spacer that is installed between the m5 bolt and the amp foot.



T-WHAT?.. T-NUT!

One of these M5s will be mounted to the inside of the bottom extrusions, There is not currently a Tnut in the frame in this location. Don't forgot to insert this into the frame.


M3x8 SHCS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