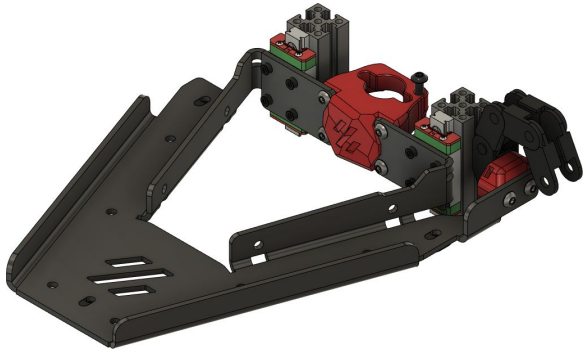
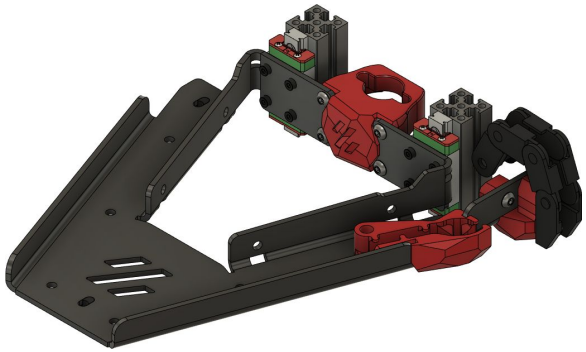
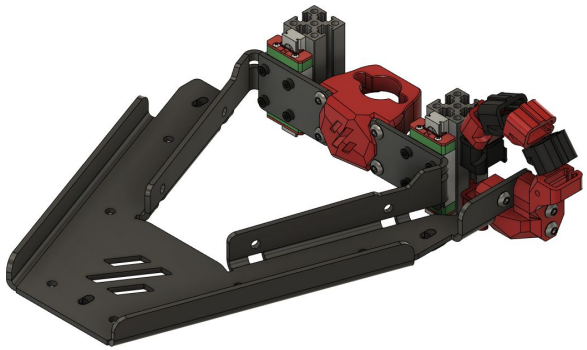
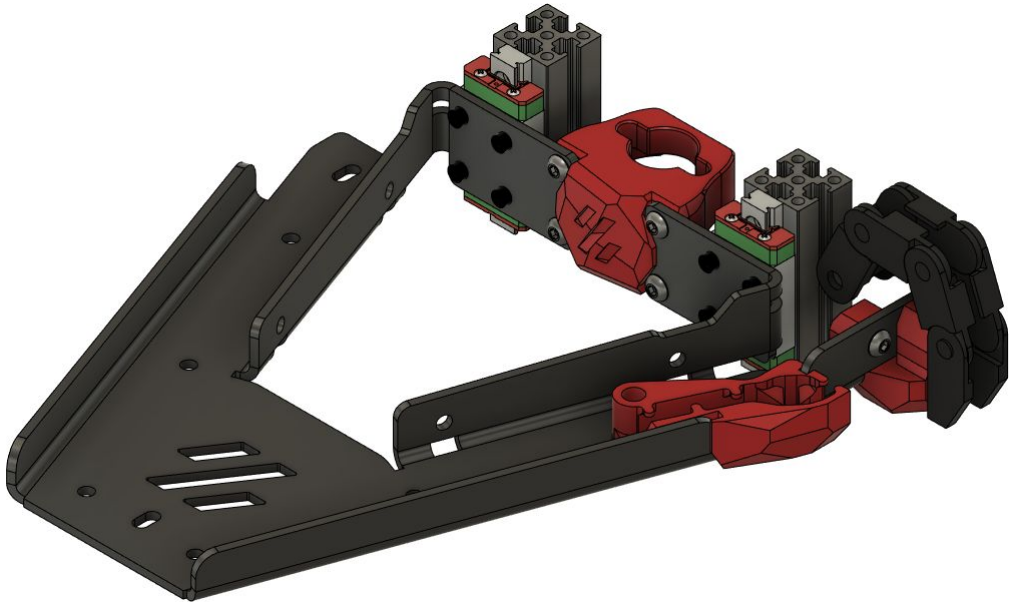








KIRIGAMI ASSEMBLY MANUAL

A sheet metal bed for the Voron Zero.
Lightweight and stiff bed with full access to the mounting screws.

VERSION PRE-RELEASE

TABLE OF CONTENTS

**REMEMBER TO MAKE THESE CLICKABLE LINKS,
BOTH TEXT AND NUMBERS**

Introduction 3

Check your bed 5

Hardware reference 6

To BOM or not to BOM 7

Printed parts reference 8

Printed parts reference (optional/mods) 12

How this manual was made

KIRIGAMI BED

The Kirigami bed is a stiff and lightweight, bent, single piece metal bed upgrade for the Voron 0 series. It replaces the entire bed carrier from the original Voron V0 design, i.e. everything between the Z-axis rail carriages and the heated bed.

HOW TO USE THIS MANUAL

This manual is a complement to the official Voron Zero assembly manual. You can consider it a replacement for parts of the manual.

V0.2R1 manual (2023-06-07 version)

This manual complements/replaces pages 36-47.
Remember to use the correct printed nut holder on pages 92-93.

V0.2 manual (2023-03-03 version)

This manual complements/replaces pages 36-46.
Remember to use the correct printed nut holder on pages 92-93.

V0.1 manual

This manual complements/replaces pages 13, 19-20, and 27-30.
Remember to use the correct printed nut holder on pages 59-60..

V0.0 manual

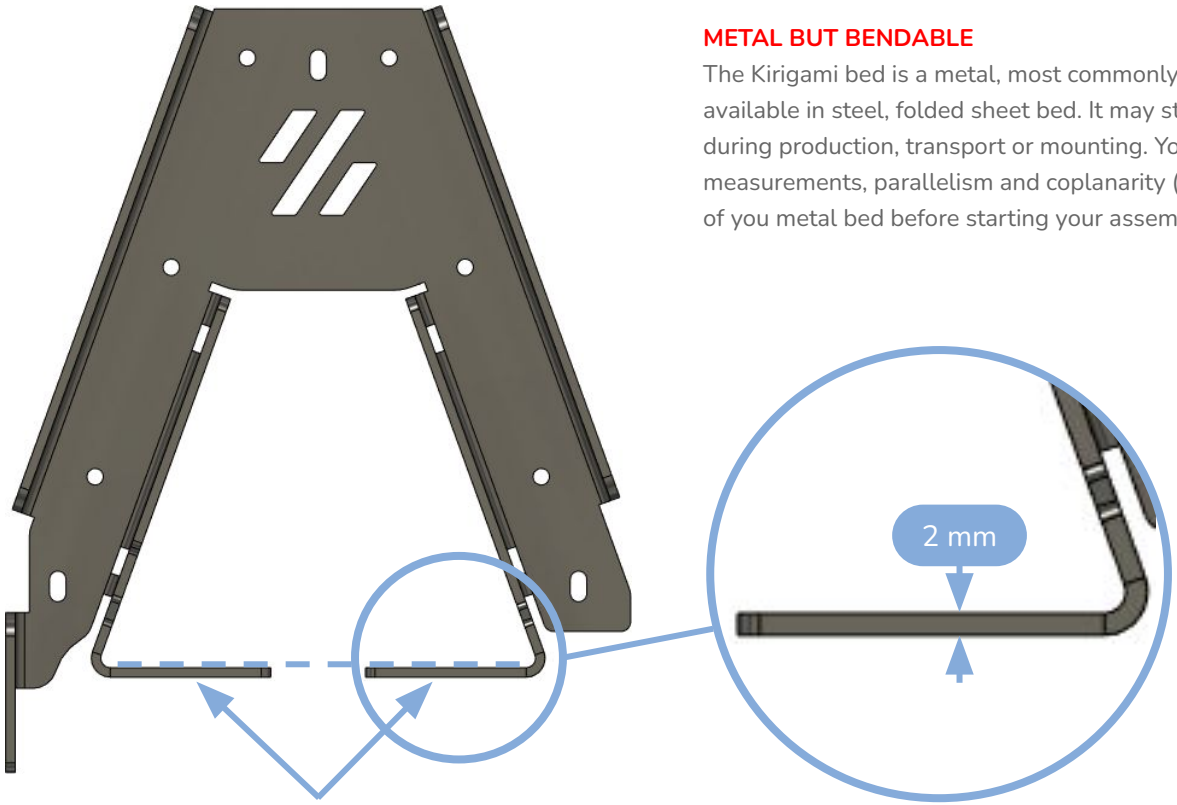
This manual complements/replaces pages 12-20.
Remember to use the correct printed nut holder on pages 27 and 32.

LDO PRINTER KIT OR LDO KIRIGAMI KIT

Please be aware that LDO also have their own guide from a Kirigami bed on a V0.1 (https://www.ldomotion.com/p/guide/Kirigami-Bed-for-Voron-V01) and for the V0.2/v0.2R1 (https://www.ldomotion.com/p/guide/Kirigami-Bed-for-Voron-V02.)

These guides should be enough if you are building based on a LDO kit, but this guide includes the same information.

The LDO Kirigami V0.2/V0.2R1 guide is using graphics from this guide with permission.

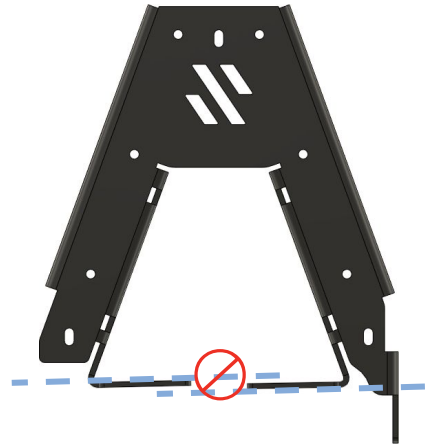


METAL BUT BENDABLE

The Kirigami bed is a metal, most commonly aluminum, but also available in steel, folded sheet bed. It may still be bent out of spec during production, transport or mounting. You should check the measurements, parallelism and coplanarity (flat in respect to each other) of you metal bed before starting your assembly.

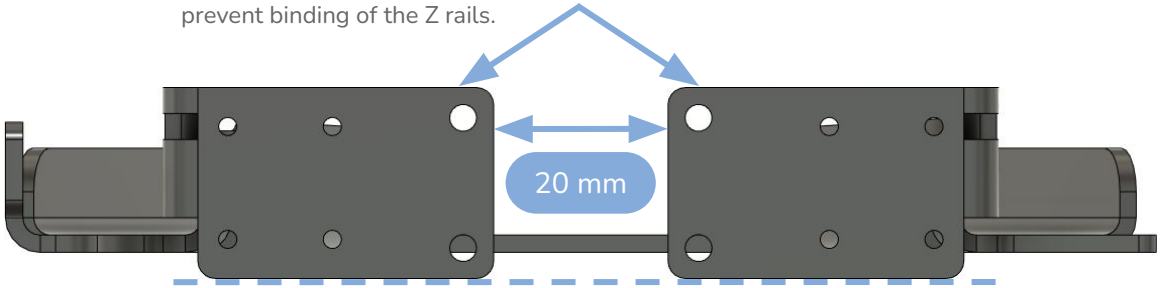
NUT BLOCK

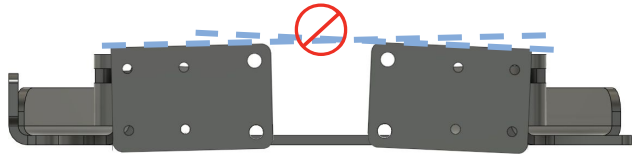
The spec on the metal frame is 2 mm thickness and a 20 mm gap where the nut block attaches to the frame. The nut block is designed with a absolute maximum of 2.2 mm thickness, and a absolute minimum gap of 19.5 mm.

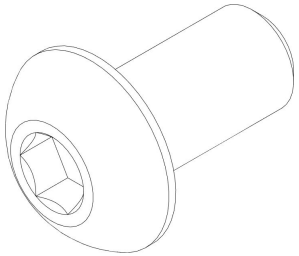


CHECK BED MOUNT FLATNESS

These two surfaces **MUST** be coplanar (flat in respect to each other) to prevent binding of the Z rails.



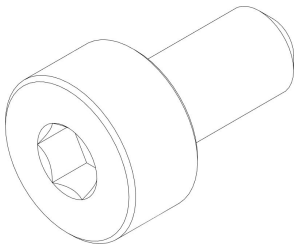




BUTTON HEAD CAP SCREW (BHCS)

Metric fastener with a domed shaped head and hex drive.

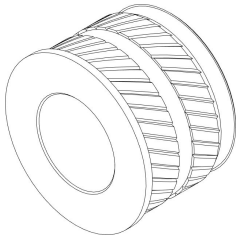
ISO 7380-1



SOCKET HEAD CAP SCREW (SHCS)

Metric fastener with a cylindrical head and hex drive.

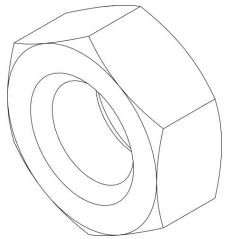
ISO 4762 / DIN 912



HEAT SET INSERT

A heat set insert heated by a soldering iron allows you to install metal threads into plastic parts.

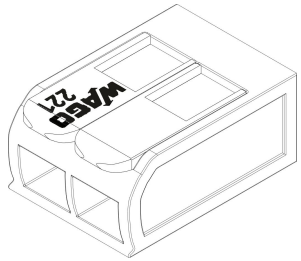
Voron designs commonly use heat set inserts with M3 internal threads, a 5mm outer diameter and a height of 4mm.



HEX NUT

Hex nuts couple with bolts to create a tight, secure joint. Used in some **optional parts** instead of heat set inserts.

ISO 4032 / DIN 934



SPLICING CONNECTOR

A WAGO splicing connector is a tool-free, lever-actuated connector used in some **optional parts** for splicing bed power wiring.

WAGO 221-412

BILL OF MATERIALS

Here we could have had a BOM.

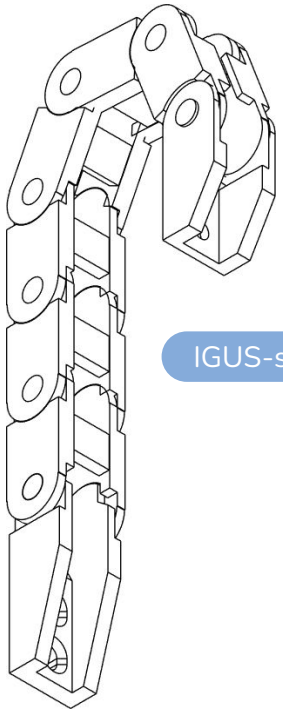
With all the V0 versions and optional parts this guide describes, we figured it would be better if you **read through the following pages and sum up the totals yourself**.

Printed parts will have a list of parts required to mount and use them.

You will need **8x M2x4 (preferably SHCS)** screws to mount the metal bed to the carriages. Be aware that **the default V0 extrusion bed uses M2x8, not x4.**

If screw type (BHCS, SHCS) is not mentioned in this guide, assume **BHCS** is recommended.

IGUS is a common supplier of cable chains, with multiple **generic versions** available from chinese suppliers. This is the most common type of cable chain on V0 printers.



IGUS-style chain

PRINTED PARTS (REQUIRED)

Depending on where you got your Kirigami bed, what accessories it included, what version of a Voron V0 you are building, and depending on what kind of cable chain you are using, the printed parts you will need differ.

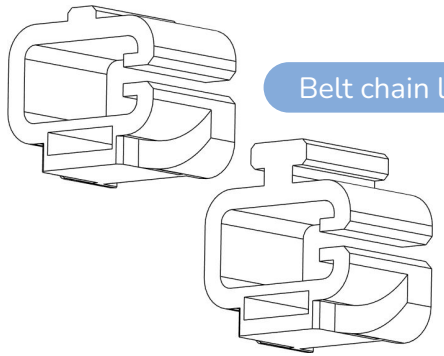
Use the same recommended settings as in the official manual. The positions the parts have in the STL files are the recommended printing positions. Supports should not be required.

The next four pages will list **four possible combinations** of parts you will need to get a functional bed.

In the **top middle** of the pages you will see if this options is for a **V0.0/V0.1** or **V0.2/V0.2R1**, and if it is for a **IGUS or Generic Chinese chain**, or for a **belt chain**.

STEALTH EVERYTHING!!!

When looking at printed parts you may notice the word stealth in many names. This is simply to indicate it is of the **stealth design style**, made popular by the Voron Stealthburner toolhead design.



Belt chain links

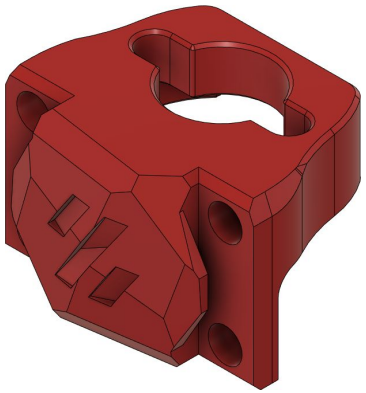
The **V0 beltchains** mod by lakabos is a alternative cable chain for the Z axis of V0 printer. Instead of using a mass produced standard chain, it is made up uf several printed links that are held together by a GT2 belt, as used in the V0 motion system.

A belt chain is a advanced mod, and not recommended for beginners. If you are using a belt chain, it is assumed you know how to build it. It is not explained further in this manual.

https://mods.vorondesign.com/detail/F5KwWIjcSXwIeghsMo3A

WHAT VERSION OF VORON V0 ARE YOU BUILDING?

This page lists the parts for building a **Voron V0.2/V0.2R1 with a IGUS or Generic Chinese chain.**

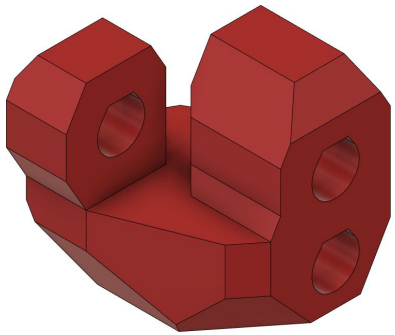


NUT BLOCK

This is the nut block that connects the Kirigami frame to the anti-backlash nut and thus to the Z lead screw.

4x M3 heat set inserts, 4x M3x6 screws.

VORON_v0.2_stealth_nut_block.stl

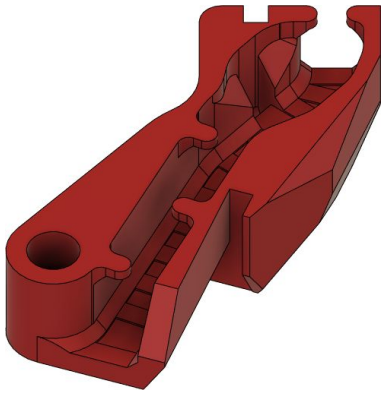


CHAIN MOUNT BLOCK

Chain mounting block. Sits between the Kirigami metal frame and chain.

3x M3 heat set inserts, 3x M3x6 screws.

VORON_v0.2_stealth_chain_mount.stl

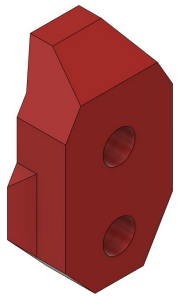


WIRE GUIDE

Wire guide to feed the cables from the outside to the inner Kirigami channel.

1x M3 heat set inserts,1x M3x6 screw.

VORON_v0.2_stealth_wire_guide.stl



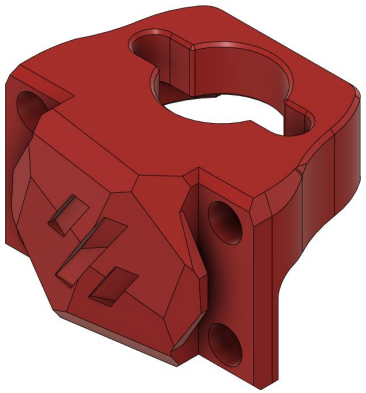
(OPTIONAL) CHAIN MOUNT SPACER

This is a optional spacer between the chain mount block and chain for some Chinese chains that has a wider bend radius than more common chains.

VORON_v0.2_stealth_chain_mount_5mm_spacer.stl

WHAT VERSION OF VORON V0 ARE YOU BUILDING?

This page lists the parts for building a **Voron V0.2/V0.2R1 with a belt chain.**

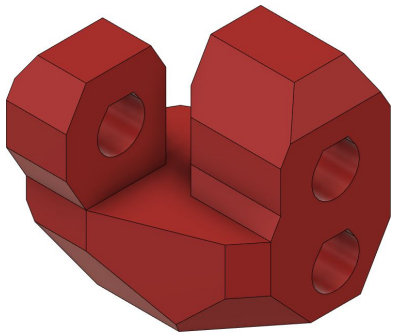


NUT BLOCK

This is the nut block that connects the Kirigami frame to the anti-backlash nut and thus to the Z lead screw.

4x M3 heat set inserts, 4x M3x6 screws.

VORON_v0.2_stealth_nut_block.stl

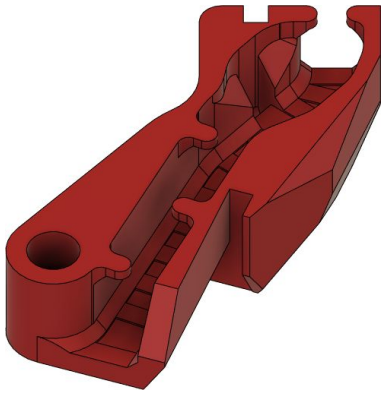


CHAIN MOUNT BLOCK

Chain mounting block. Sits between the Kirigami metal frame and chain.

3x M3 heat set inserts, 3x M3x6 screws.

VORON_v0.2_stealth_chain_mount.stl

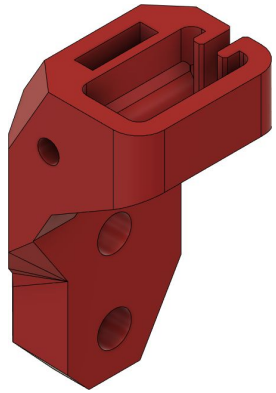


WIRE GUIDE

Wire guide to feed the cables from the outside to the inner Kirigami channel.

1x M3 heat set inserts, 1x M3x6 screw.

VORON_v0.2_stealth_wire_guide.stl



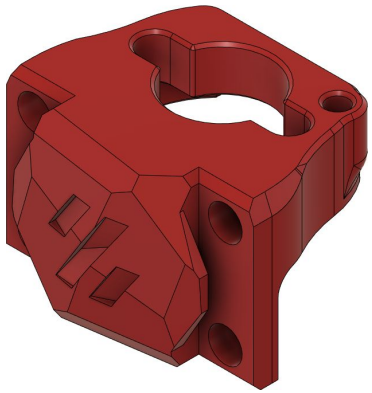
BELT CHAIN MOUNT

Bottom mounting block to adapt the belt chain to the chain mounting block. **If you are using a belt chain, it is assumed you know how to build it. It is not explained further in this manual.**

VORON_v0.2_belt_chain_mount.stl

WHAT VERSION OF VORON V0 ARE YOU BUILDING?

This page lists the parts for building a **Voron V0.0 or 0.1 with a IGUS or Generic Chinese chain.**



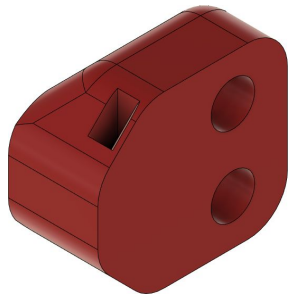
NUT BLOCK

This is the nut block that connects the Kirigami frame to the anti-backlash nut and thus to the Z lead screw.

4x M3 heat set inserts, 4x M3x6 screws.

Notice the top screw hole for Z endstop adjustment screw.

VORON_v0.0-v0.1_stealth_nut_block.stl



LEGACY CHAIN MOUNT BLOCK

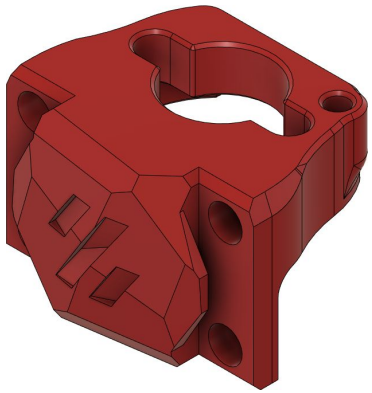
Chain mount block for IGUS or Generic Chinese chain.

4x M3 heat set inserts, 4x M3x6 screws.

VORON v0.0_v0.1_legacy_chain_mount.stl

WHAT VERSION OF VORON V0 ARE YOU BUILDING?

This page lists the parts for building a **Voron V0.0 or 0.1 with a a belt chain.**



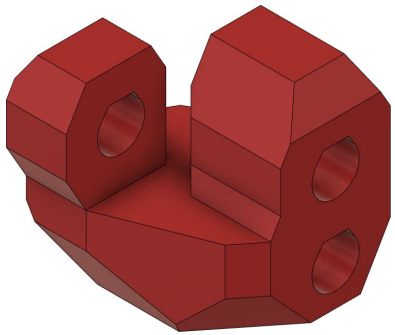
NUT BLOCK

This is the nut block that connects the Kirigami frame to the anti-backlash nut and thus to the Z lead screw.

4x M3 heat set inserts, 4x M3x6 screws.

Notice the top screw hole for Z endstop adjustment screw.

VORON_v0.0-v0.1_stealth_nut_block.stl

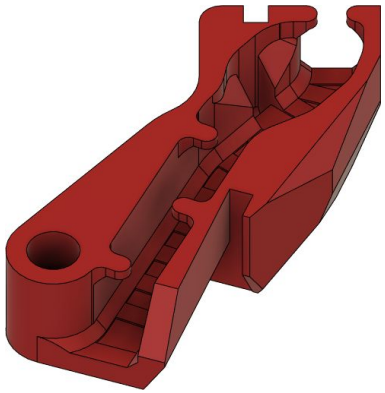


CHAIN MOUNT BLOCK

Chain mounting block. Sits between the Kirigami metal frame and chain.

3x M3 heat set inserts, 3x M3x6 screws.

VORON_v0.2_stealth_chain_mount.stl

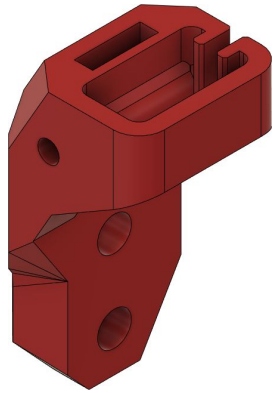


WIRE GUIDE

Wire guide to feed the cables from the outside belt chain to the inner Kirigami channel.

1x M3 heat set inserts, 1x M3x6 screw.

VORON_v0.2_stealth_wire_guide.stl



BELT CHAIN MOUNT

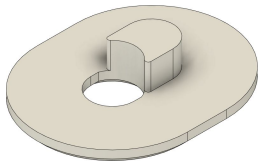
Bottom mounting block to adapt the belt chain to the chain mounting block. **If you are using a belt chain, it is assumed you know how to build it. It is not explained further in this manual.**

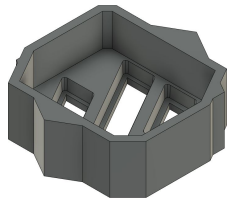
VORON_v0.2_belt_chain_mount.stl

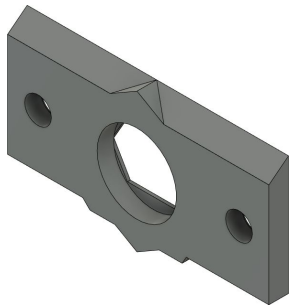
PRINTED PARTS (OPTIONAL/MODS)

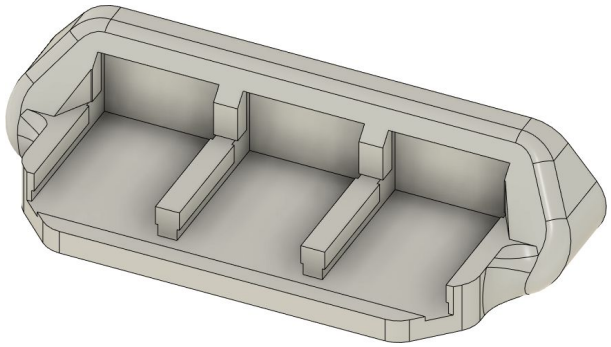
The following three pages list optional parts you may want for your bed.

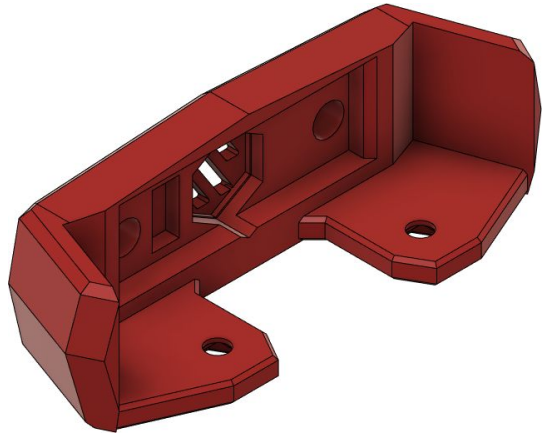
If you have a Kirigami bed as part of a **LDO kit**, you will probably need both the **LDO Wago Mount** and the **LDO Stealth Bed Front**.











OPTIONAL PARTS / MODS

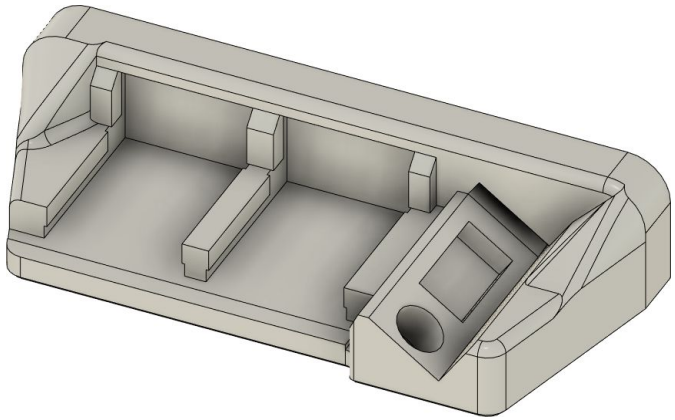
These parts are not required for a functional bed, but improve the use or look of the bed. **These two parts are LDO specific, and require PCBs from a LDO kit for proper use.**

LDO WAGO MOUNT

This mount allows you to mount two WAGO splicing connectors and the accompanying “Joiner PCB” that is part of the LDO Kirigami kit.
3x M3 heat set inserts, 3x M3x6 screw. Joiner PCB from LDO kit.

You probably want to print this part in your primary color. It is rendered grey/white on this page for better visuals.

Kirigami_LDO_Breakout_Mount.stl



LDO STEALTH BED FRONT

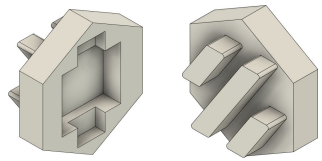
This is the LDO remix of the Maple Leaf Makers Stealth Bed Front (see the next page for the original). It is a visual part that mounts to the front of your bed, and come with a Neopixel-style PCB you can mount inside the front print.

You can either buy a full LDO Kirigami kit, or just the wiring and PCBs.

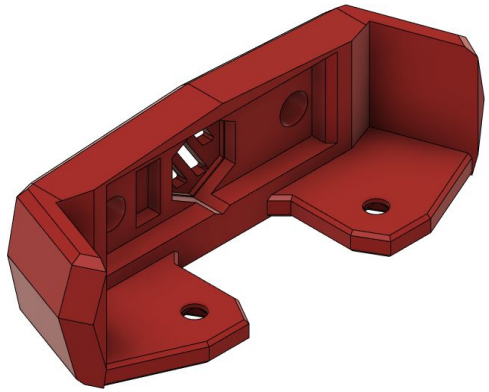
2x M3 heat set inserts, 4x M3x6 screw, 2 M3 hex nuts, Neopixel PCB from LDO kit.

The diffuser should be printed in a clear (transparent) filament, but is rendered opaque on this page for better visuals. **The bed front should be printed in your accent color.**

LDO Kirigami STLs



Diffuser (rear / front)



OPTIONAL PARTS / MODS

These parts are not required for a functional bed, but improve the use or look of the bed.

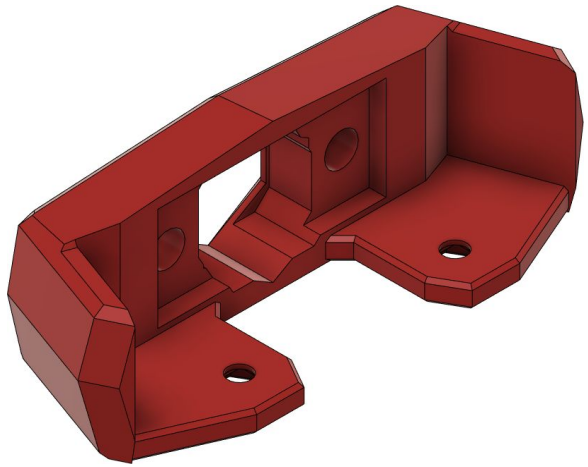
MAPLE LEAF MAKERS STEALTH BED FRONT

This is the Maple Leaf Makers Stealth Bed Front. It is a generic front for small printers that is compatible with the Kirigami. It is a visual part that mounts to the front of your bed and supports either the Rainbow Barf Logo LED (RBL) or a Neopixel Mini Button (NEO). (generic buttons should also fit)

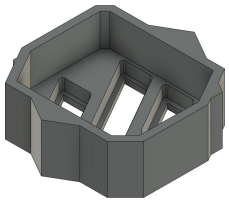
2x M3 heat set inserts, 4x M3x6 screw, 2 M3 hex nuts, RBL or NEO PCB.

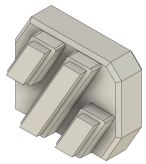
The diffuser should be printed in a clear (transparent) filament, but is rendered opaque on this page for better visuals. **The diffuser holder / logo insert and carrier boards should be printed in black. The bed front should be printed in you accent color.**

MapleLeafMakers Stealth Bed Front repository



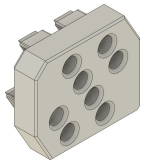
Diffuser holder / Logo insert



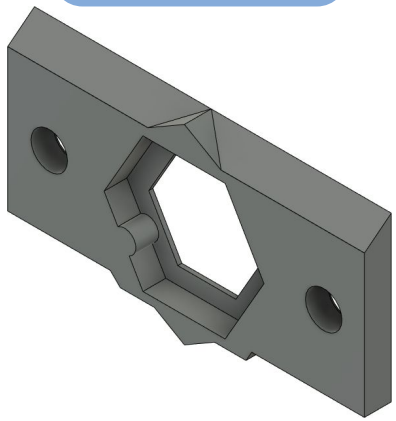


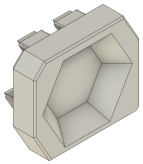
Diffuser front RBL/NEO

Diffuser rear RBL

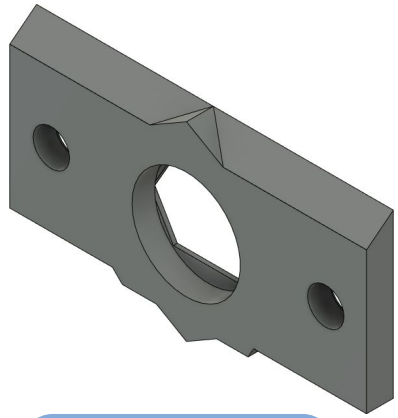


Carrier board RBL



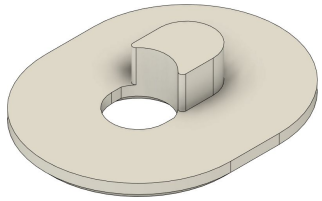


Diffuser rear NEO



Carrier board NEO

OPTIONAL PARTS / MODS
These parts are not required for a functional bed, but improve the use or look of the bed.



BED SPACERS
Steve Peterson/SteveBuilds has designed a set of bed spacers that can be used to align the bed screws to the from or rear of the slots in the Kirigami frame.

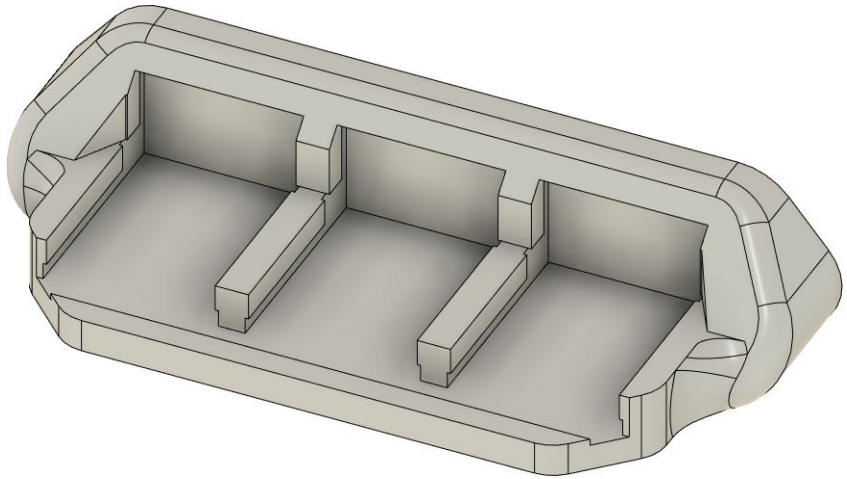
You will want **three** of these, one for each slot.

You want to print this part in your primary color. It is rendered grey/white on this page for better visuals.

Steve's bed spacer files

GENERIC WAGO MOUNT
This generic mount allows you to mount three WAGO splicing connectors on the inside of the Kirigami bed. This enables you to cut the bed wires for easier bed removal.
2x M3 heat set inserts, 2x M3x6 screw.

You probably want to print this part in your primary color. It is rendered grey/white on this page for better visuals.



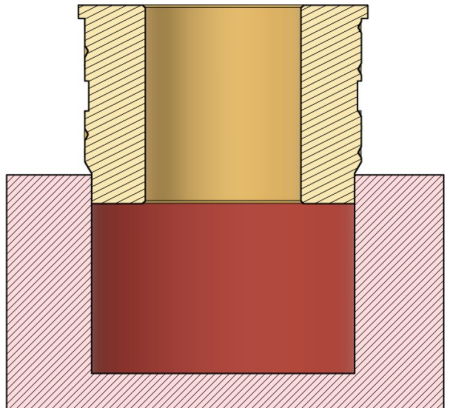
HEAT SET INSERTS

The printed parts for the Kirigami bed all need heat set inserts.

All the required and optional parts use the Voron standard heat set insert with M3 internal threads, a 5mm outer diameter and a height of 4mm.

It is generally recommended to **heat your soldering iron to the approximate printing temperature of the printed part** you are inserting the heat set inserts into.

The following pages have illustration for all required and optional parts. Simply **skip any parts you are not using** for on your build



HEAT SET INSERTS???

If you have **never worked with heat set inserts** before, your are recommend to watch a guide. The following guide from BV3D is the best guide we have found on the topic for far.
https://www.youtube.com/watch?v=hwq15qH-4x4

HEAT SET SOLDERING TIPS (NO TRICKS)

While you can insert heat set inserts with a blunt tip on your soldering iron, it will go a lot easier if you purchase **a tip specifically for heated inserts**.

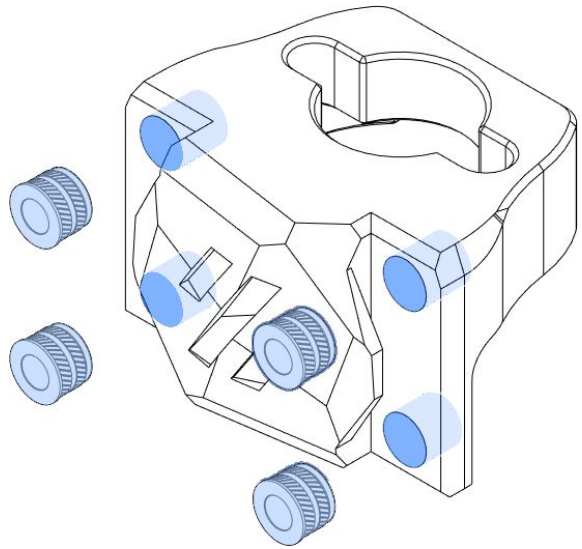
Our recommendations are either **a tip set from CNCKitchen**, or **LDOs adjustable tip for M3 inserts**. Also be aware that your heated inserts or printer build may already come with a heated insert tip.

CNCKitchen has tip sets for multiple types of soldering irons and insert diameters.
https://cnckitchen.store/collections/soldering-tips-and-sets

The LDO insert tool allows you to adjust the length of the tip according to the height of the insert to be used, but only fits M3 heated inserts, and requires a soldering iron compatible with 900M-T soldering tips. Compatible designs are however used in many soldering irons.
https://docs.ldomotors.com/guides/heatset_insert_tool_guide)

NUT BLOCK FOR V0.2 / V0.2R1

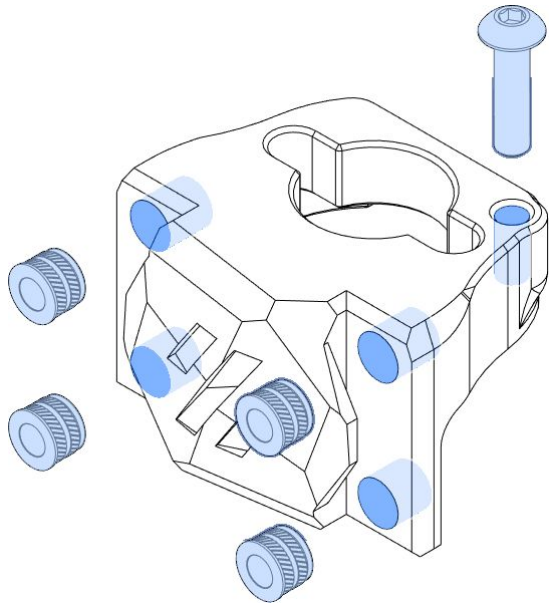
Be careful when working on the bottom two holes. The walls are intentionally made thin for backwards compatibility with V0.0.



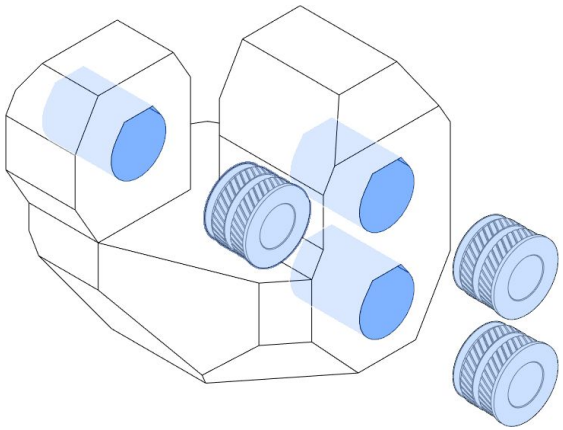
NUT BLOCK FOR V0.0 / V0.1

Be careful when working on the bottom two holes. The walls are intentionally made thin for backwards compatibility with V0.0.

You may also insert the screw for the Z-endstop.

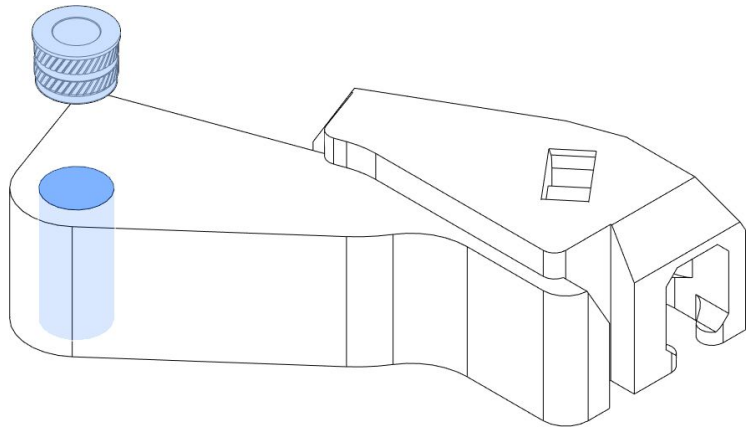


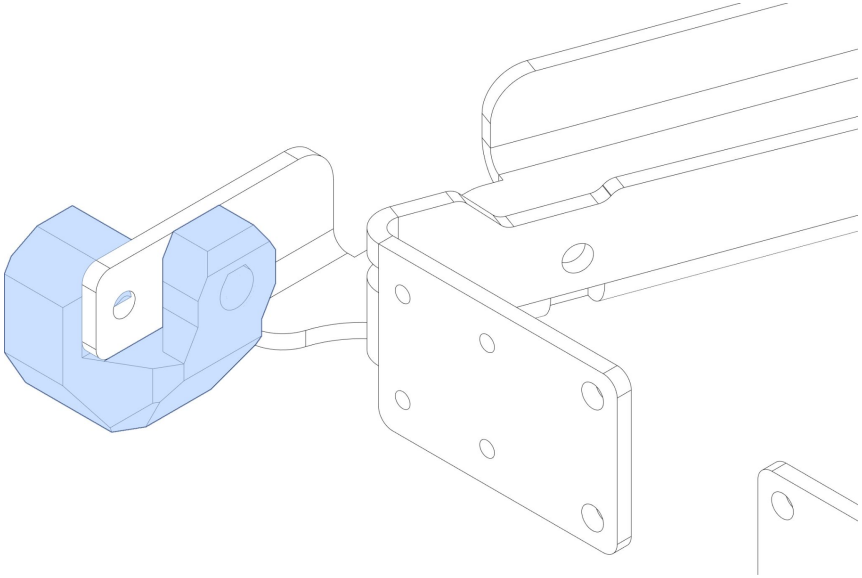
CHAIN MOUNT BLOCK FOR V0.2 / V0.2 R1



WIRE GUIDE FOR V0.2 / V0.2 R1 / V0.1 with belt chain / V0.0 with belt chain

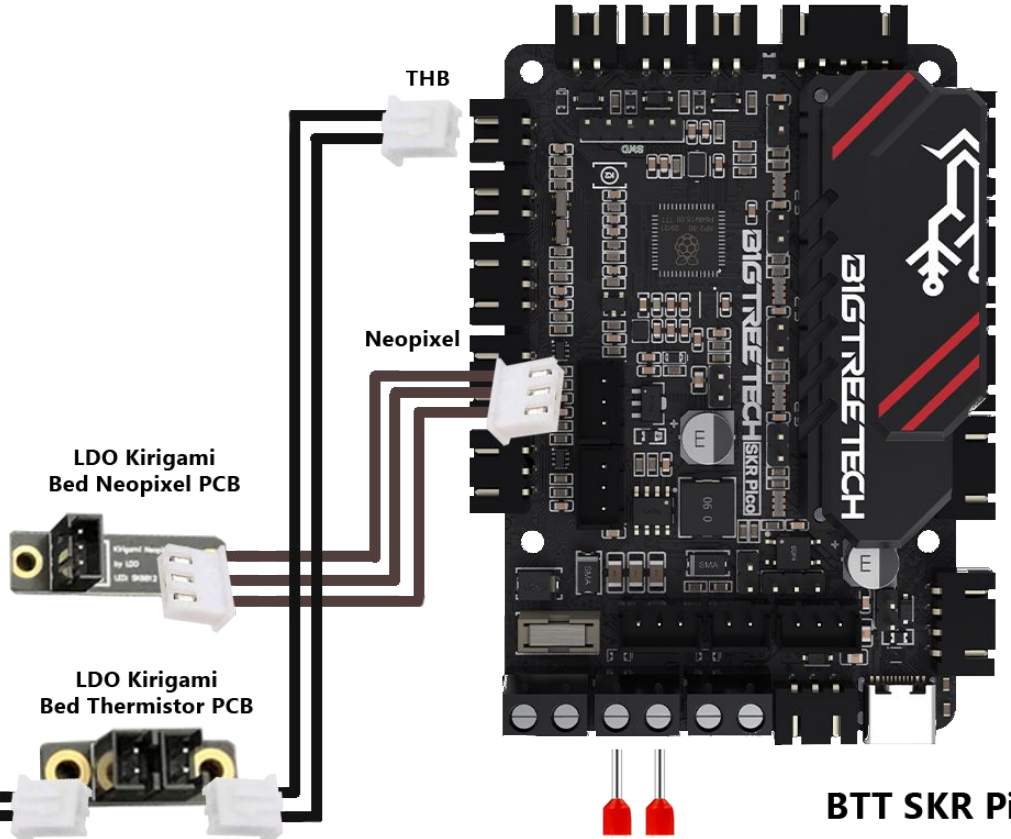
Insert the heated insert from the closed side of the wire guide.





Bed spacers:
Yea, nozzle position for 0.0 and 0.2 is the same. 0.1 was forward (screws forward)

LDO V0 Bed with Heater, Thermistor & Thermal Fuse



All 3 sets of wires run from under the Kirigami Frame, through chains, out the bottom of the printer and up to the board

https://github.com/VoronDesign/Voron-0/issues/302

https://blog.knottsco.com/blog/wagos-top-20-asked-questions-about-cage-clamp-connection-system-pt.-1

v0.2R1:
page 58 insert bottom plate.
page 107-112 z lead screw construction and mouting

v0.2:
page 58 insert bottom plate.
page 104-106 z lead screw construction and mouting

v0.1:
page 36 insert bottom plate.
page 59-64 z lead screw construction and mouting

v0.0:
page insert bottom plate.
page z lead screw construction and mouting

REMEMBER

Wash your hands after using the toilet.

ALSO REMEMBER

The banana in the Voron V0.2 CAD is not for human consumption.

TOOLS

Autodesk Fusion 360 (Shaded and wireframe images)
GIMP (editing and joining of images)
Imagemagick (for automatic cropping of images) - Link (Github Gist)
Google Slides (yes, really) - Link (Google Slides Template)

CADS

https://github.com/christophmuellerorg/voron_0_kirigami_bed (bed)
https://github.com/MotorDynamicsLab/LDOVoron0 (bed front)
https://github.com/MapleLeafMakers/Stealth_Bed_Front (bed front)
https://github.com/VoronDesign/Voron-0 (nuts, bolts, linear rails)
https://mods.vorondesign.com/detail/F5KwWIjcSXwIeghsMo3A (Belt chain parts)
https://github.com/Kagee/random-cads (WAGO, LDO PCBs, Zip ties)

IMAGES

Images (Dropbox shared folder) used in this manual. Most are taken using “Capture image...” from Design view in Fusion, and then cropped.
https://github.com/Kagee/kirigami-bed-manual

KIRIGAMI ASSEMBLY MANUAL

The Kirigami bed was designed by Christoph Mueller.

This manual was constructed by Kag_ee (Voron Discord) based on various CAD models and a Voron Manual template supplied by kyleisah (Voron Discord) and hartk#1213 (Voron Discord)

GITHUB
https://github.com/christophmuellerorg/voron_0_kirigami_bed

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