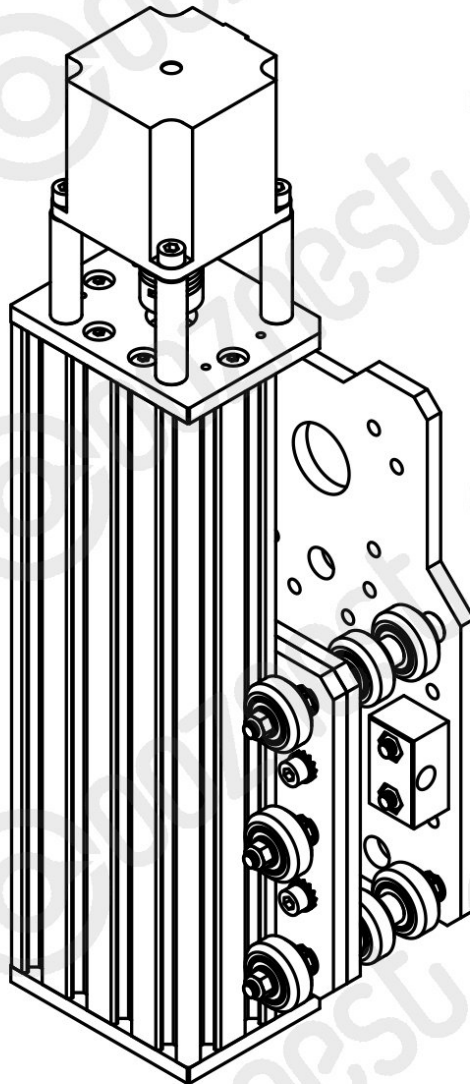


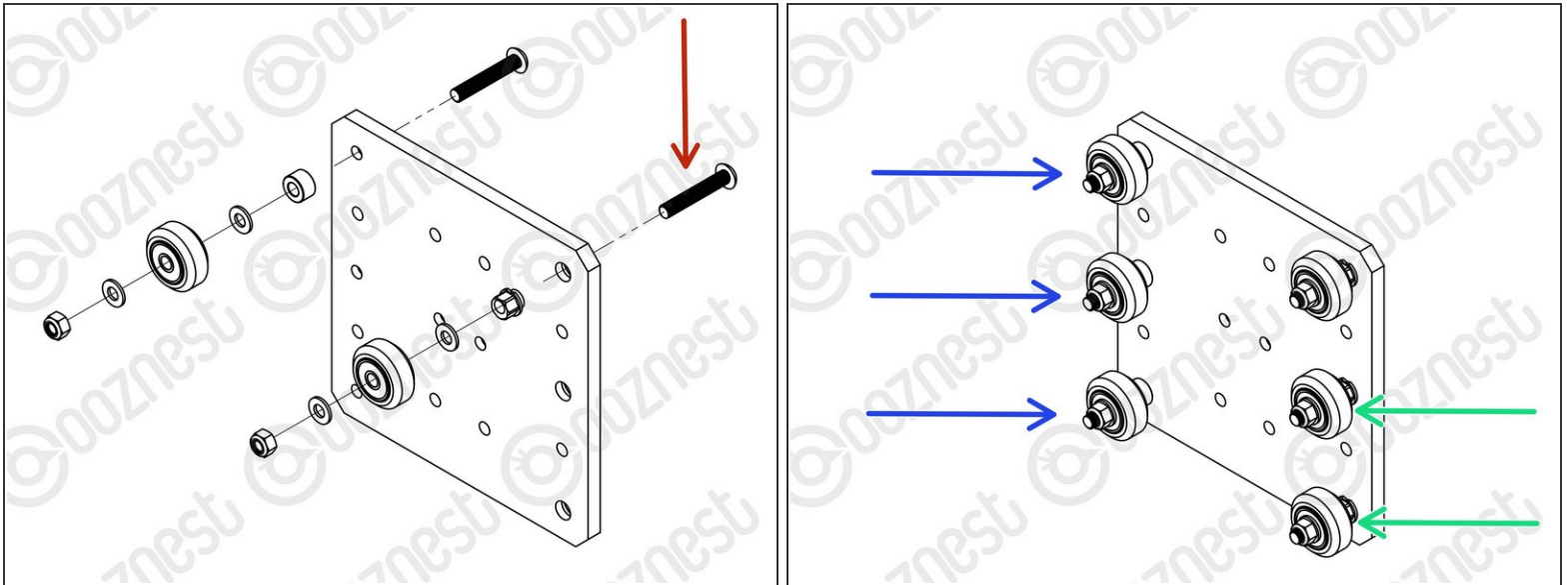


## 3. X-Carriage Assembly

Written By: Ryan Christy

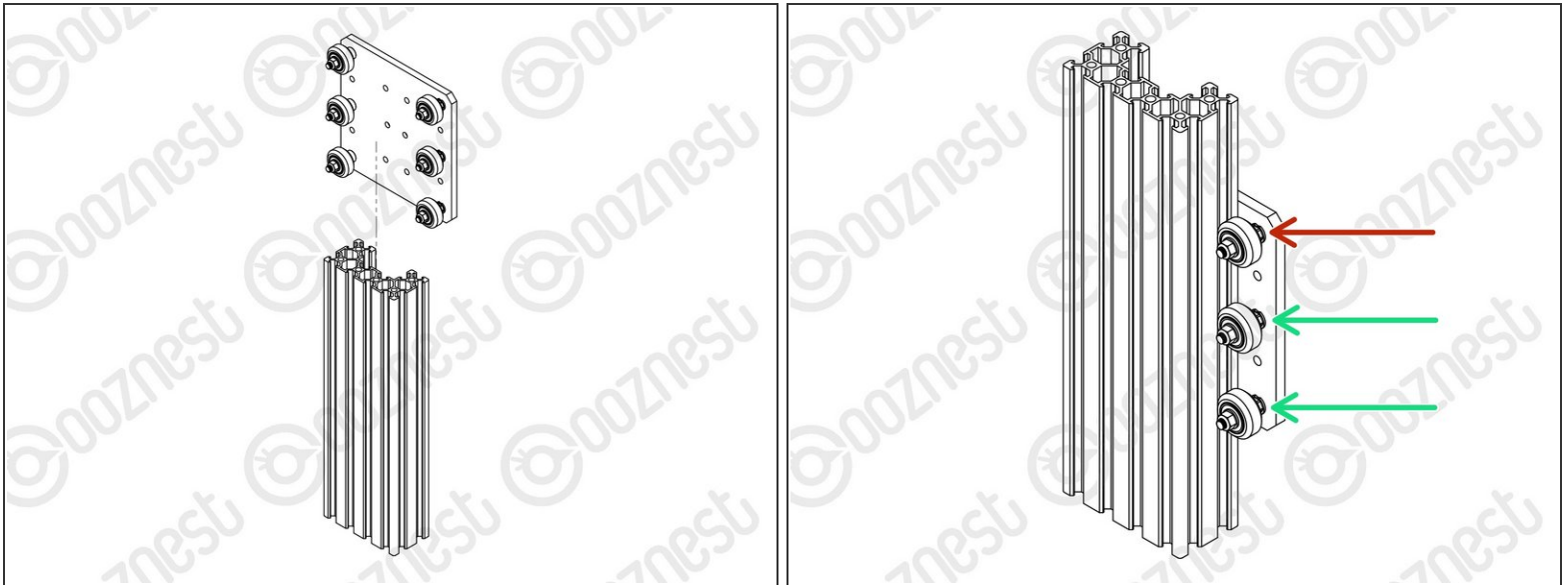


## Step 1 — Z-Axis Wheels



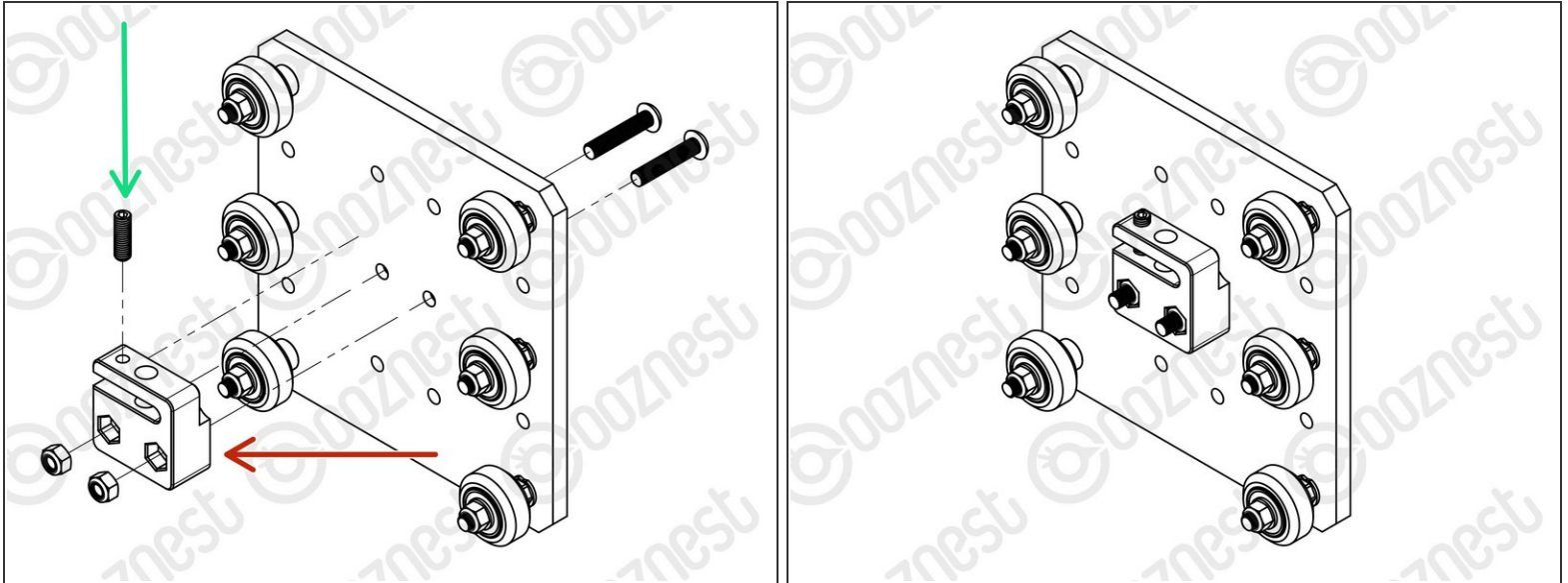
- Assemble the top right Solid-Wheel set first. Insert a M5-Button-Head-Bolt-30mm through the Z-Plate from the back.
- ① The back is the side **with** the insets
  - On to the bolt add an Eccentric-Spacer-6mm. (Rounded portion into the Z-Plate)
  - Then add a Precision-Shim - -> - Solid-Wheel - -> - Precision-Shim
  - Finally add a M5-Nyloc-Nut. This can be tightened. Ensure that the Solid-Wheel still rotates freely.
- Repeat the above for the other 2 x Solid-Wheel set on the right row.
- Repeat for the 3 x Solid-Wheel sets on the left row, but use a Aluminium-Spacer-6mm instead of each Eccentric-Spacer-6mm.

## Step 2 — Z-Axis Wheel Adjustment



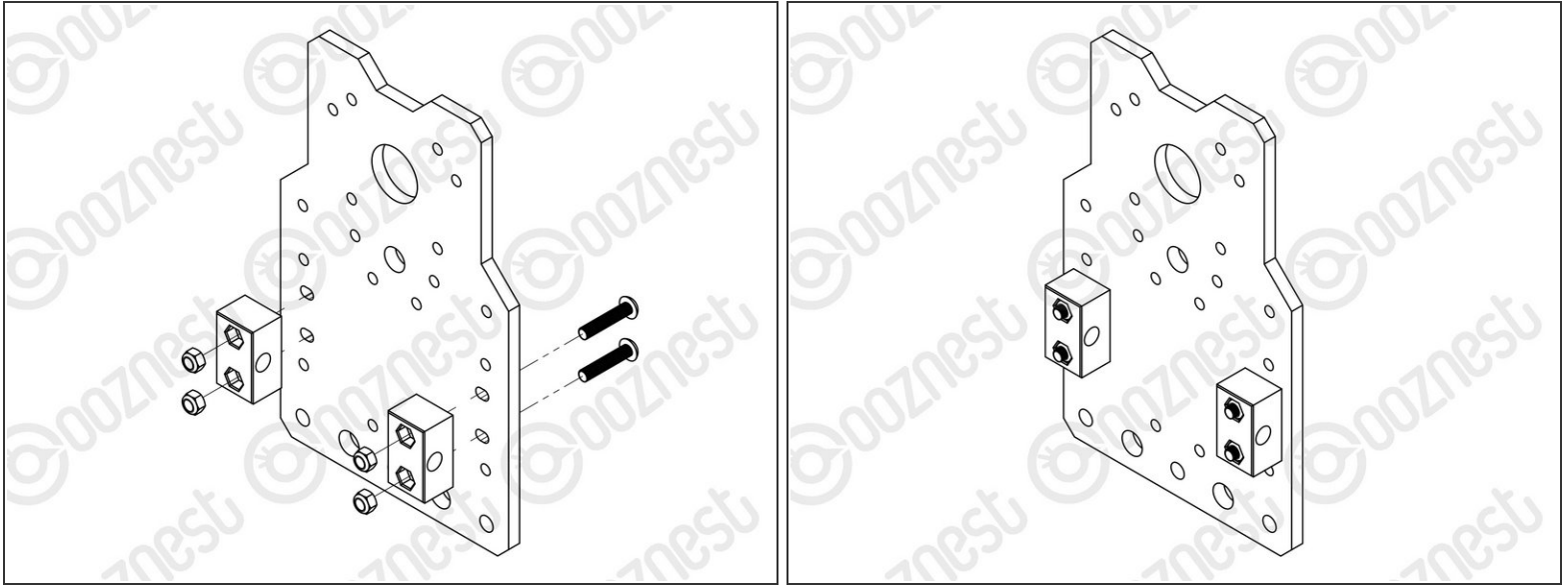
- On the hexagonal portion of the Eccentric-Spacer-6mm, there will be a face that is marked with '6mm'.
  - Using a 8mm spanner, rotate each Eccentric-Spacer-6mm so that this face is facing right. (Doing this maximises the gap between the left and right row of Solid-Wheels)
  - Insert Extrusion-D in-between the two rows of wheels. Turn the assembly on to it's left side so Extrusion-D is sitting on the left row of Solid-Wheels.
  - Starting with the top right Solid-Wheel. Rotate the Eccentric-Spacer-6mm until there is a small amount of friction between the Solid-Wheel and Extrusion-D
  - Repeat for the bottom right Solid-Wheel. Then repeat for the middle right Solid-Wheel.
  - Slide Extrusion-D back and forth. This should require a small amount of force, and all Solid-Wheels should spin.
  - Check there is no wobbling of Extrusion-D. Once happy, double-check the tightness of the M5-Nyloc Nuts.
- i** Try to get all the Solid-Wheels touching Extrusion-D as best as possible. If not, it is not a problem, we will check the Eccentric-Spacers-6mms again once the machine is built.

### Step 3 — Z-Axis Nut Block



- Attach the Z-Axis-Nut-Block to the Z-Plate using 2 x M5-Button-Head-Bolt-25mm & 2 x M5-Nyloc-Nuts.
- In the Z-Axis-Nut-Block bag there is a set screw. Screw it into the top of the Z-Axis-Nut-Block until it just touches the surface on the opposite side of the gap.
- ⓘ The set screw will later be used to remove any backlash from the Z-Axis.
- ⓘ Discard the nut left in the bag with the Z-Axis-Nut-Block.
- ⓘ Moving forward this will be known as the Z-Plate-Assembly

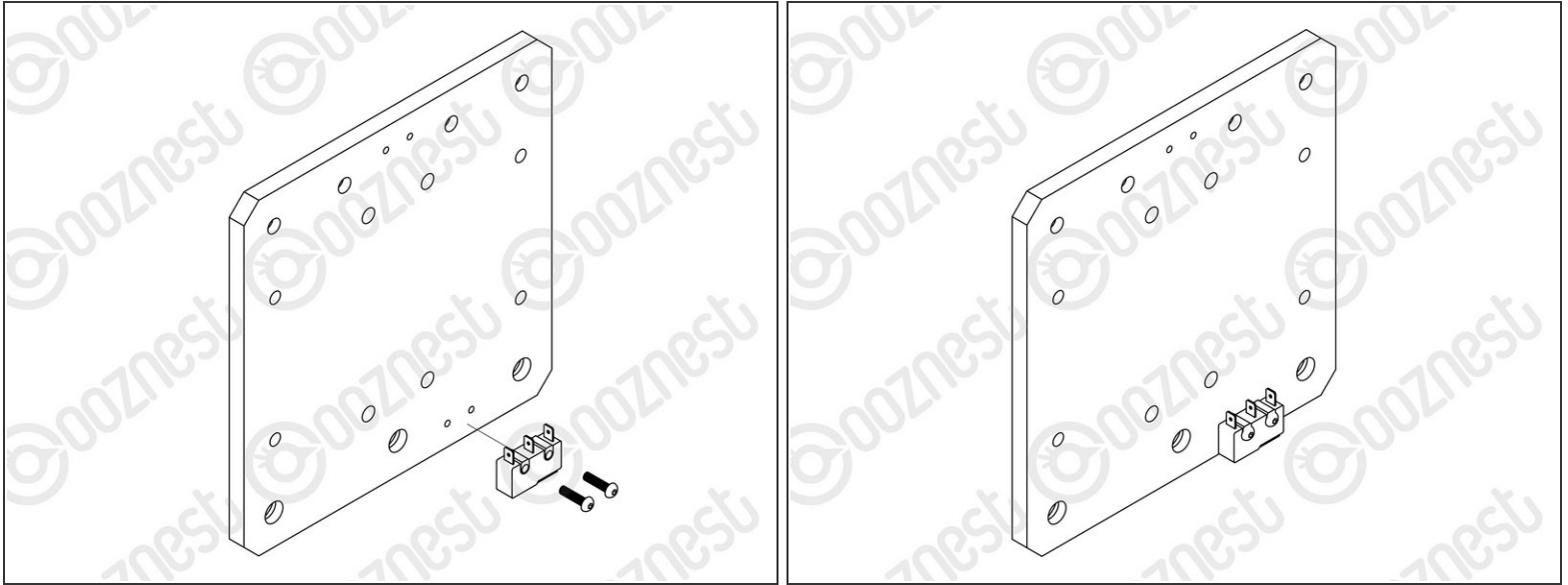
## Step 4 — X-Axis Nut Blocks



- Attach 2 x Nut-Blocks to the X-Plate-Back using 2 x M5-Button-Head-Bolt-25mm & 2 x M5-Nyloc-Nuts.

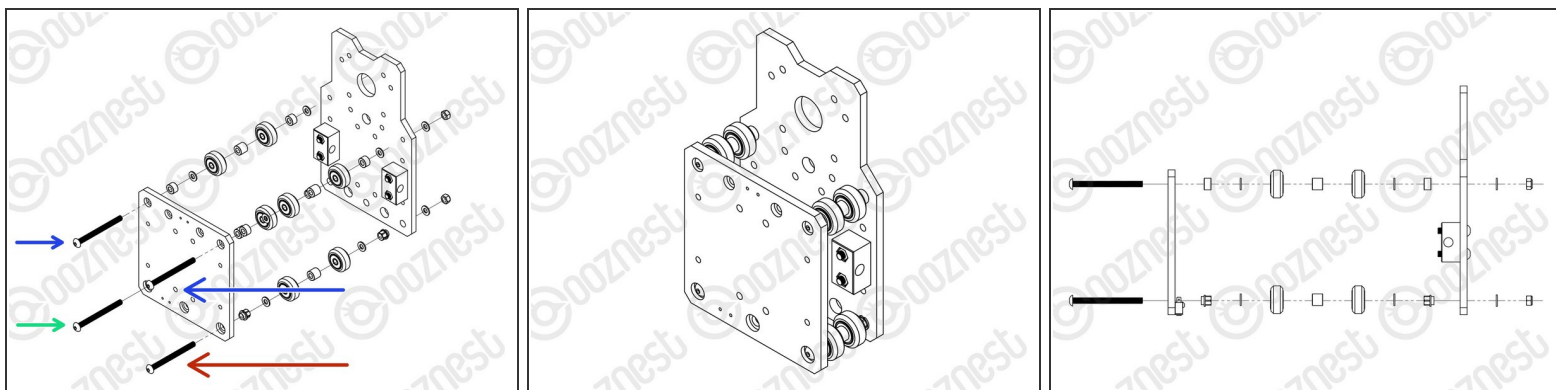
**⚠ Keep these bolts loose so the Nut-Blocks can still move side to side.**

## Step 5 — Z-Axis Limit Switch



- ❗ The Limit-Switches are located in the 'Wires' box. They have red/black wires attached to them. The wires are not shown in the assembly picture.
- Attach the Limit-Switch-2 to the threaded holes on the back of the X-Plate-Front using 2 x M2.5-Button-Head-Bolt-10mm.
- ❗ The back is the side **without** the insets.
- ❗ Look at the [Cheat Sheet](#) to find the correct Limit-Switch.
- ❗ The wire will be sorted later in the manual.

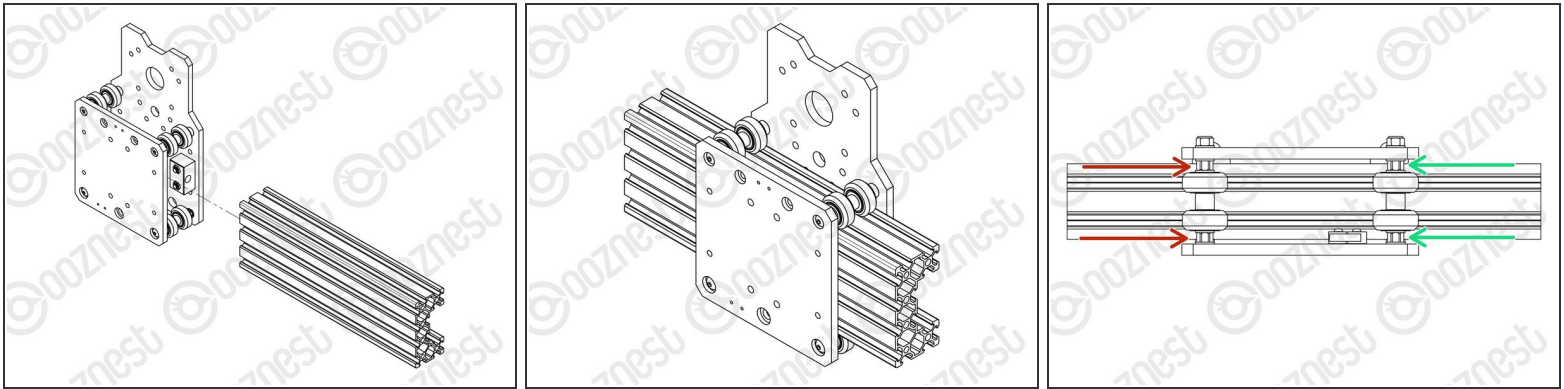
## Step 6 — X-Axis Wheels



- Assemble the bottom right Solid-Wheel set first. Insert a M5-Button-Head-Bolt-60mm through the X-Plate-Front from the front.
- On to the bolt add an Eccentric-Spacer-6mm. (Rounded portion into the X-Plate-Front)
- Then add a Precision-Shim - -> - Solid-Wheel - -> - Aluminium-Spacer-9mm - -> - Solid-Wheel - -> - Precision-Shim
- Add an Eccentric-Spacer-6mm then the X-Plate-Back. (Rounded portion of the Eccentric-Spacer-6mm goes into the X-Plate-Back)
- On the outside of the X-Plate-Back add onto the bolt a Precision Shim then a M5-Nyloc-Nut. Only slightly thread on the M5-Nyloc-Nut.
- Repeat the above for the other Solid-Wheel set on the bottom row.
- Repeat for the 2 x Solid-Wheel sets on the top row, but use a Aluminium-Spacer-6mm instead of each Eccentric-Spacer-6mm.
- The M5-Nyloc-Nuts can now be tightened. Ensure that each Solid-Wheel still rotates freely.



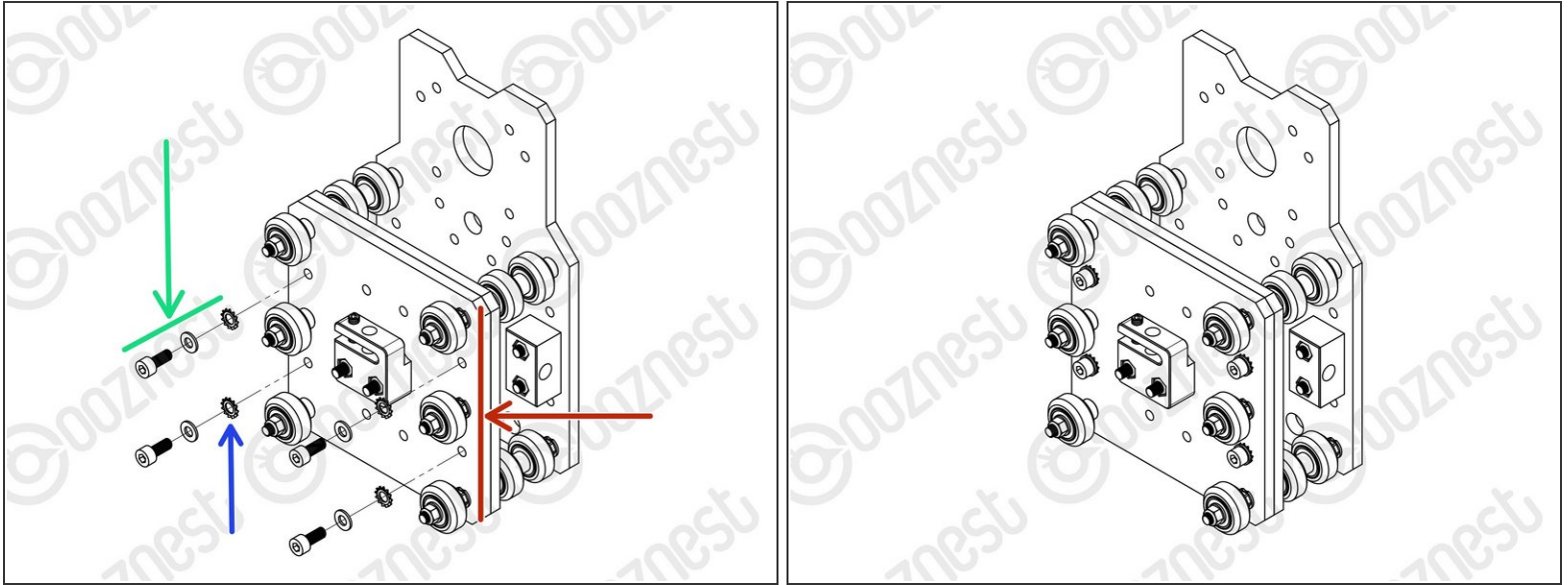
## Step 7 — Adjusting X Wheels



- On the hexagonal portion of the Eccentric-Spacer-6mm, there will be a face that is marked with '6mm'.
    - Using a 8mm spanner, rotate each Eccentric-Spacer-6mm so that this face is facing downwards. (Doing this maximises the gap between the top and bottom row of Solid-Wheels)
    - Insert Extrusion-D in-between the two rows of wheels. Turn the assembly upside down so Extrusion-D is sitting on the top row of Solid-Wheels.
    - Rotate both Eccentric-Spacer-6mms on one set of Solid-Wheels until there is a small amount of friction between the Solid-Wheels and Extrusion-D
    - Repeat for the other set of Solid-Wheels.
  - Slide Extrusion-D back and forth. This should require a small amount of force, and all Solid-Wheels should spin.
  - Check there is no wobbling of Extrusion-D. Once happy, double-check the tightness of the M5-Nyloc Nuts.
- ⓘ Try to get all the Solid-Wheels touching Extrusion-D as best as possible. If not, it is not a problem, we will check the Eccentric-Spacers-6mms again once the machine is built.

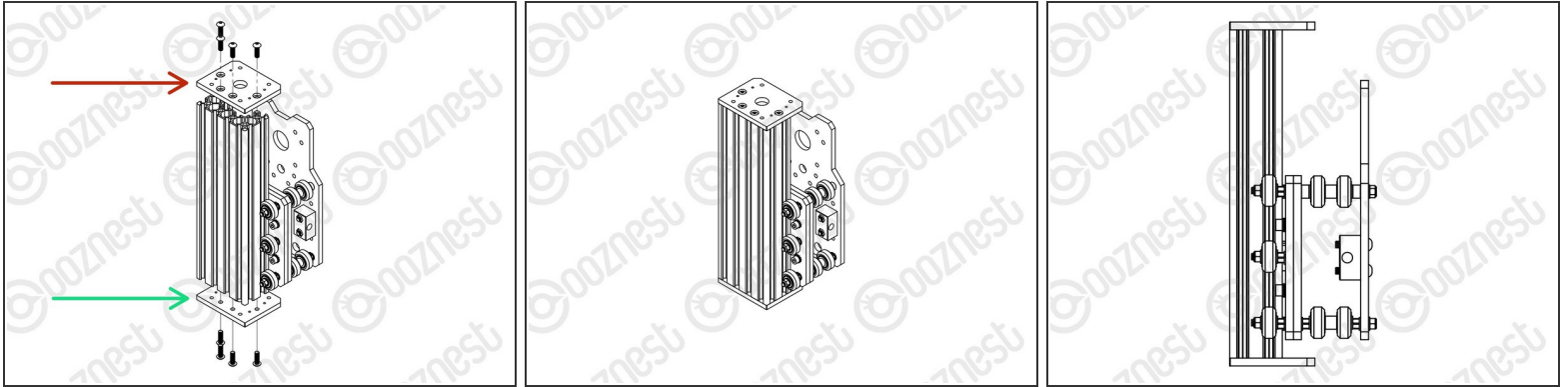


## Step 8 — X & Z Mating



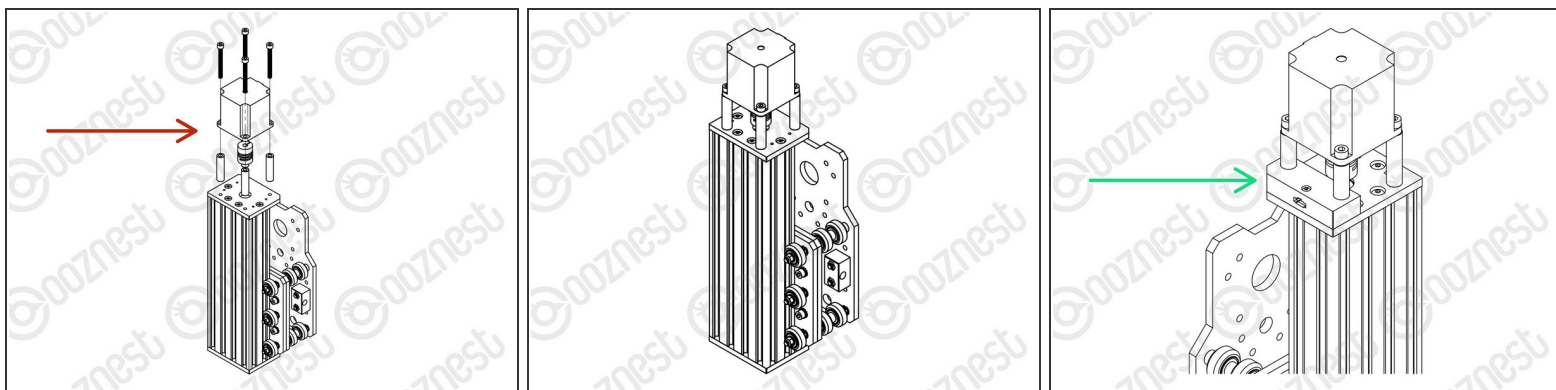
- Mate the Z-Plate-Assembly to the X-Plate-Front.
    - The Z-Plate-Assembly should be orientated with the Eccentric-Spacer-6mms on the right side.
    - Secure using 4 x M5-Cap-Head-Bolt-12mm, 4 x Precision Shim and 4 x Locking-Washer.
    - The Locking-Washer should go in-between the Precision-Shim and Z-Plate.
- ⚠ Make sure the Z-Plate-Assembly is square to the X-Carriage-Assembly.
- ⚠ Do not over-tighten the M5-Cap-Head-Bolt. If over-tightened it will reduce the effectiveness of the Locking-Washer.

## Step 9 — Z-Axis Extrusion



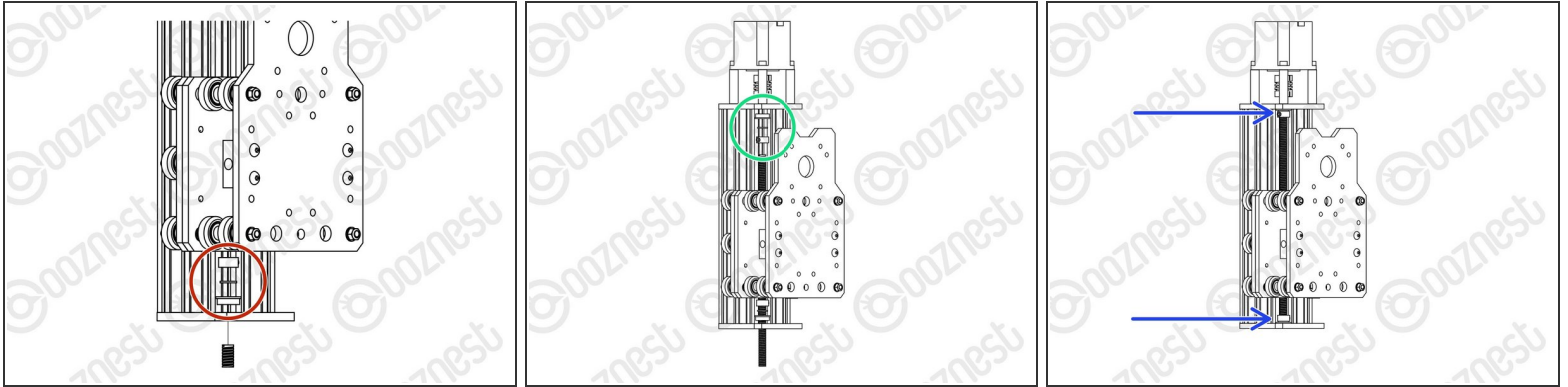
- Slide Extrusion-D through the Solid-Wheels on the Z-Plate-Assembly.
- Attach a Z-End-Plate to the top of Extrusion-D using 4 x M5-Button-Head-Bolt-16mm.
  - Tighten the bolts fully.
- Attach a Z-End-Plate to the bottom of Extrusion-D using 4 x M5-Button-Head-Bolt-16mm.
  - Tighten the bolts fully, and then loosen by a single full turn.
- ⓘ The reason for this will become clear later.

## Step 10 — Z-Axis Stepper Motor



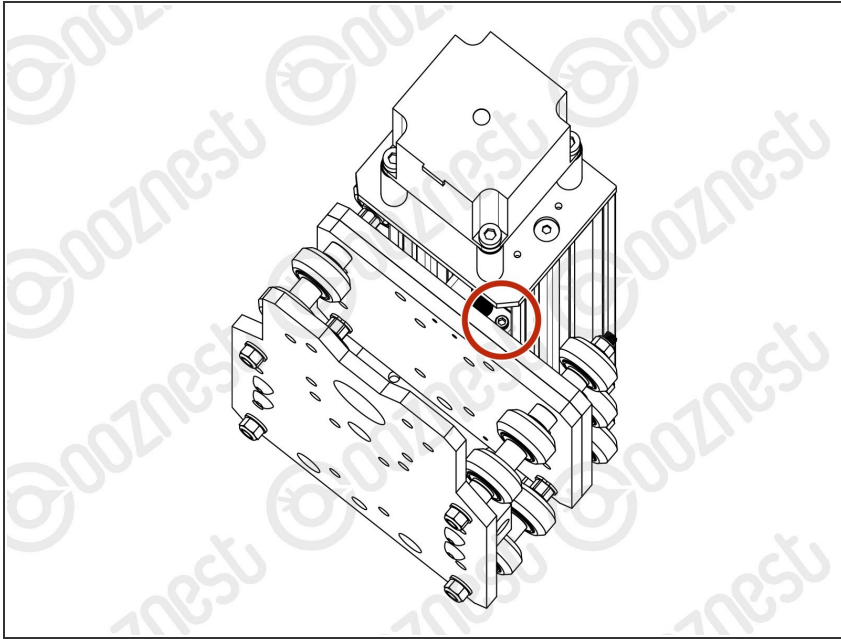
- Slide the 1/4" side (the side with the smallest hole) of the Flexible-Coupler onto the shaft of the Stepper-Motor. Don't tighten it down at this point.
  - Attach the Stepper-Motor to the threaded holes on the top Z-End-Plate using 4 x M5-Cap-Head-Bolt-50mm and 4 x Aluminium-Spacer-40mms.
  - ① Orient the Stepper-Motor so that the wire is towards the back of the X-Carriage-Assembly.
- ⚠ If you have the Touch Probe, follow [Step 3 of Assembling Your Original WorkBee XYZ Touch Probe](#) to attach the left side of the Stepper Motor.
- In this case it should look like Image 3.

## Step 11 — Z-Axis Lead Screw



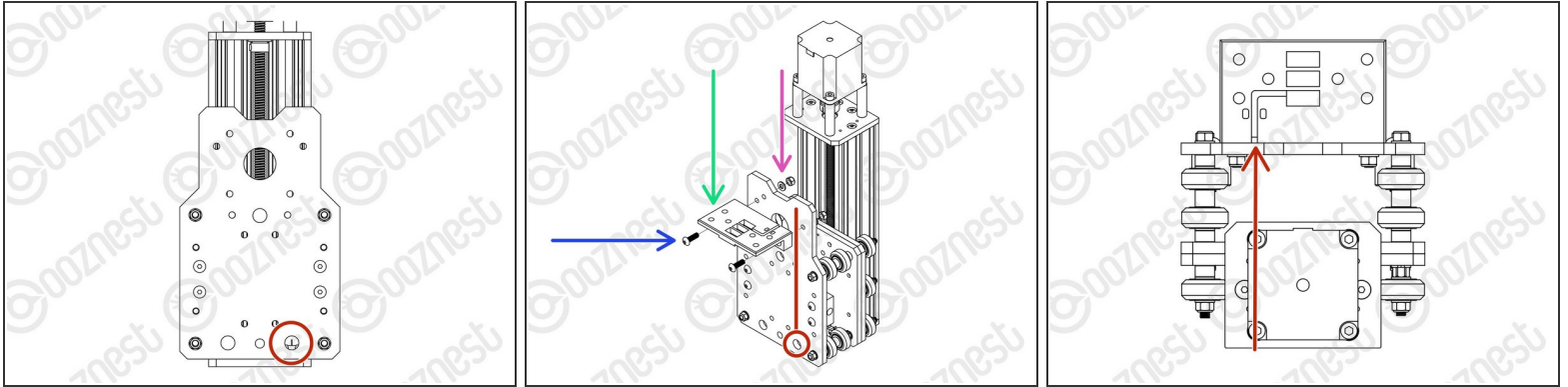
- Slide the Lead-Screw-Z through the bottom Z-End-Plate. Then slide on a Flanged-Radial-Bearing (facing downwards) - -> - Bearing-Shim - -> - Lock-Collar.
- Thread the Lead-Screw-Z through the Z-Axis-Nut-Block. Then slide on a Lock-Collar - -> - Bearing-Shim - -> - Flanged-Radial-Bearing (facing upwards).
- Continue threading through the Lead-Screw-Z until it is touching the Stepper-Motor shaft.
  - Position the Flexible-Coupler so it is half on the Lead-Screw-Z and half on the Stepper-Motor shaft.
- ⚠ On the Stepper-Motor side make sure the Flexible-Coupler grub screw is on the flat portion of the Stepper-Motor shaft. Once in position, on both sides tighten the clamping bolts first, then the grub screws.
- Top & Bottom, slide the Flanged-Radial-Bearings along the Lead-Screw-Z until they seat fully in the Z-End-Plates.
  - Slide the Bearing-Shim against the Flanged-Radial-Bearing, and finally slide the Lock-Collar so it is firmly against the Bearing-Shim. Lock each Lock-Collar in place using the grub screw on the side.
- Locate the four bottom M5-Button-Head-Bolt-16mm that were loose from Step 9. These can now be fully tightened. This will remove any play that may be present.

## Step 12 — Z-Axis Backlash Adjustment



- Firmly hold the Assembly, and check for any up and down play in Extrusion-D.
  - If there is any, this is due to backlash in the Z-Axis-Nut-Block.
  - The set screw which was inserted in Step 3 into the Z-Axis-Nut-Block can be tightened to remove backlash.
- ⚠ Do not over tighten this, as it can make the Lead-Screw-Z difficult to turn. You can test this by rotating the Flexible-Coupler by hand.**
- i** It should require a small to medium amount of force. This will need to be checked once the router is attached, and periodically checked when in use.

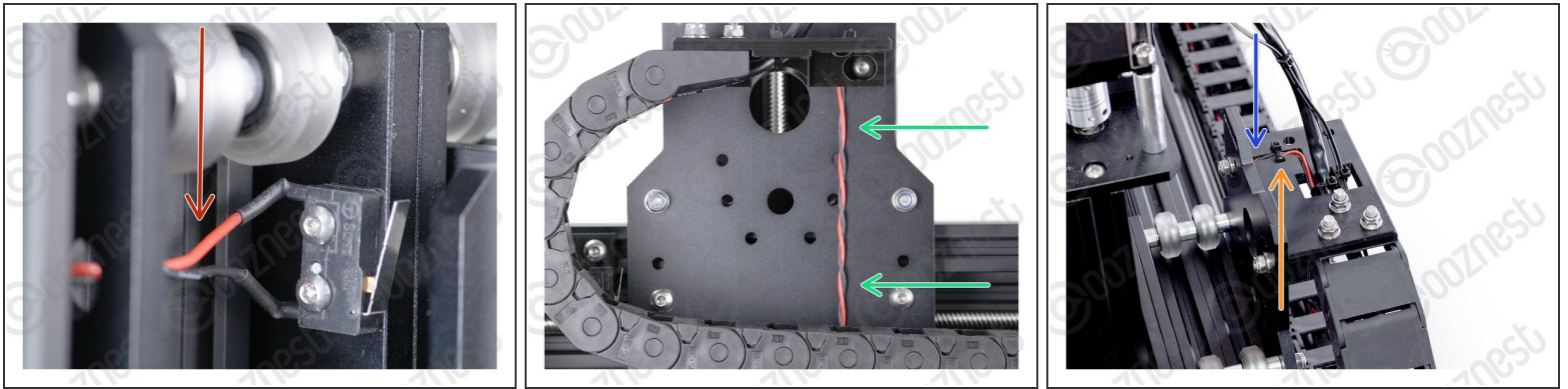
## Step 13 — Drag Chain Mount



- Feed the wire of Limit-Switch-2 attached in Step 5 through the hole opposite on the X-Plate-Back.
- A Drag-Chain-Mount needs to be attached to the X-Plate-Back.
  - Insert 2 x M5-Button-Head-Bolt-16mms through the Drag-Chain-Mount.
- Notice on the back of the Drag-Chain-Mount there is a slot. The Limit-Switch-2 wire goes up the X-Plate-Back and through this slot.
- Put the Drag-Chain-Mount against the X-Plate-Back with the Limit-Switch-2 wire in this slot.
- Then add a Precision-Shim and M5-Nyloc-Nut on the opposite side of the X-Plate-Back.
- Tighten the Drag-Chain-Mount against the X-Plate-Back



## Step 14 — Limit Switch Wire



**⚠ Pull the Limit-Switch-2 Wire taught all the way from the switch to the Drag-Chain-Mount.**

- Image 1 shows it taught in-between the Solid-Wheels.
- Image 2 shows it taught up the back of the X-Plate-Back.
- Image 3 shows it inside the slot on the Drag-Chain-Mount.

**⚠ Make sure it is taught the whole way.**



- Use a small cable tie to secure it to the Drag-Chain-Mount.

**⚠ Make sure your Limit-Switch-2 Wire looks exactly like the images.**

**⚠ Double Check - Make sure your Limit-Switch-2 Wire looks exactly like the images.**

## Step 15 — Guide Complete



-  Clear the table, you are going to need room. Keep this X-Carriage with you.
-  Guide Complete - Proceed to [4. X-Gantry Assembly](#)

Thanks for following the guide. Any issues, please contact us!