3. X-Carriage Assembly

Written By: Robert

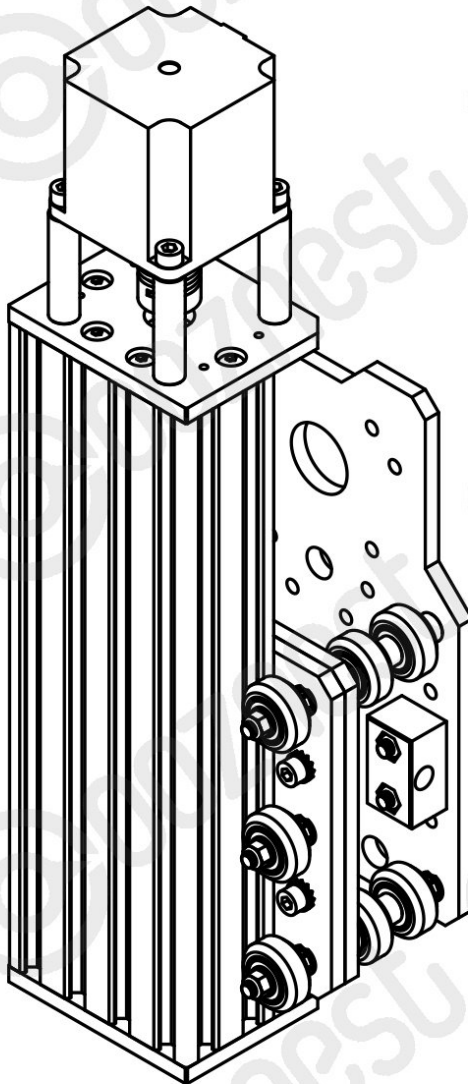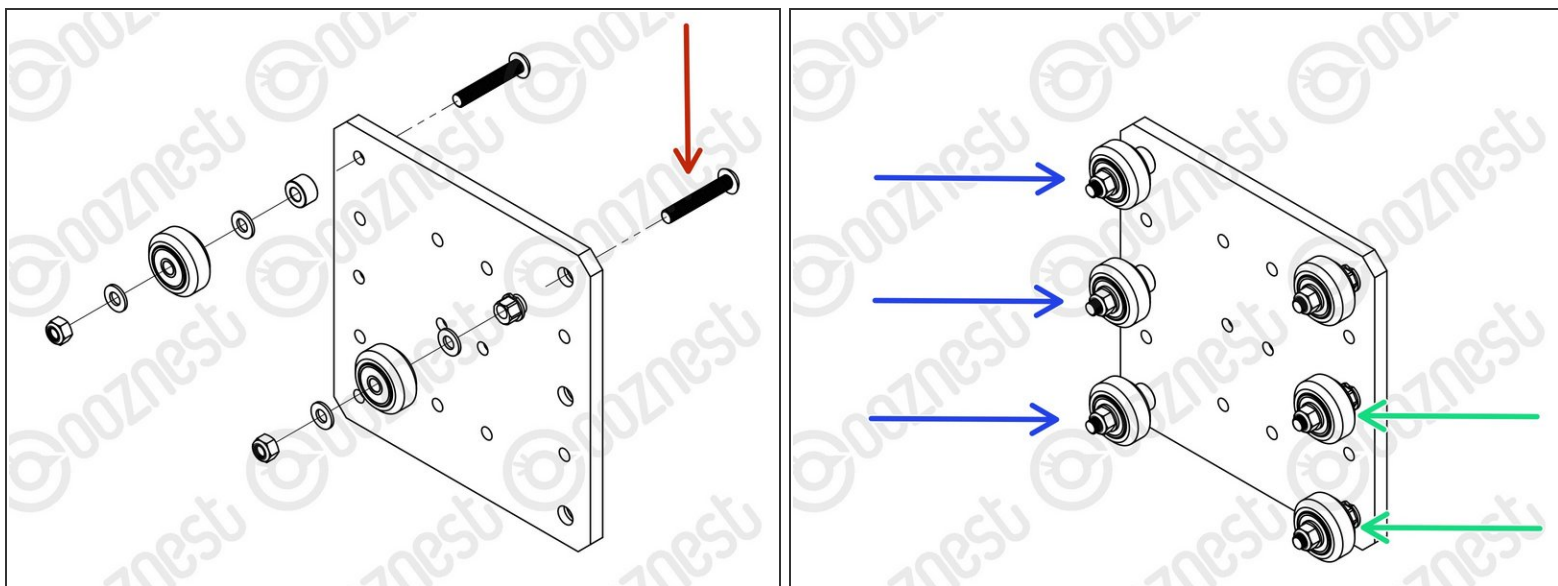This document was generated on 2022-09-06 02:46:17 PM (MST).

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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.

  ⓘ The back is the side **with** the counterbores.

  - 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.

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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.

- ⓘ 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.

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Step 3 — Z-Axis Nut Block
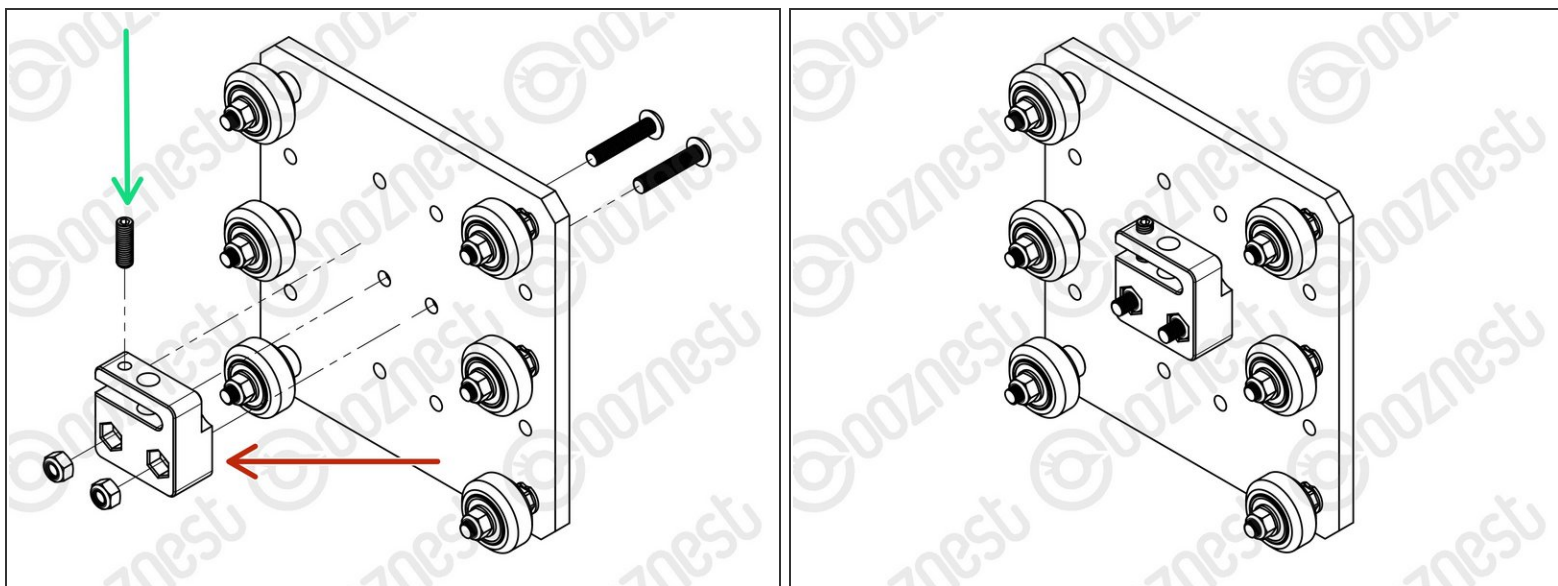
- Attach the Z-Axis-Nut-Block to the Z-Plate using 2 x M5-Button-Head-Bolt-25mm & 2 x M5-Nyloc-Nuts.

  - 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.

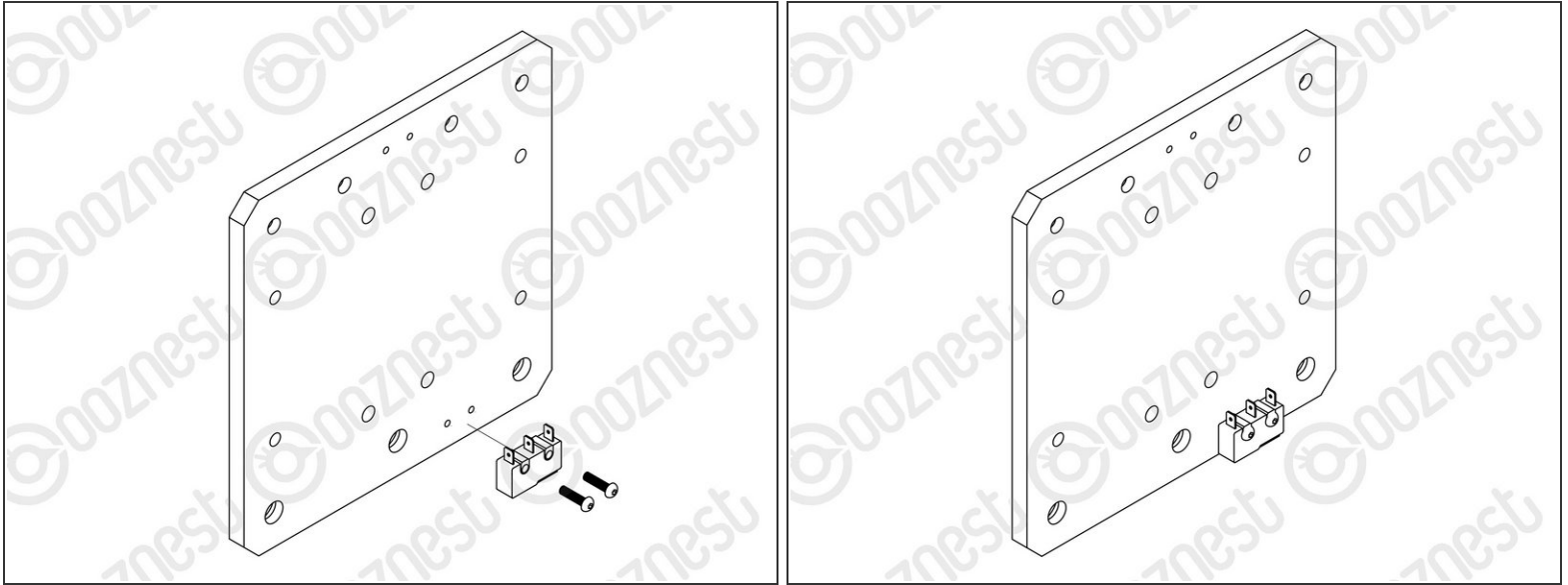- ⓘ Moving forward this will be known as the Z-Plate-Assembly

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Step 4 — X-Axis Nut Blocks
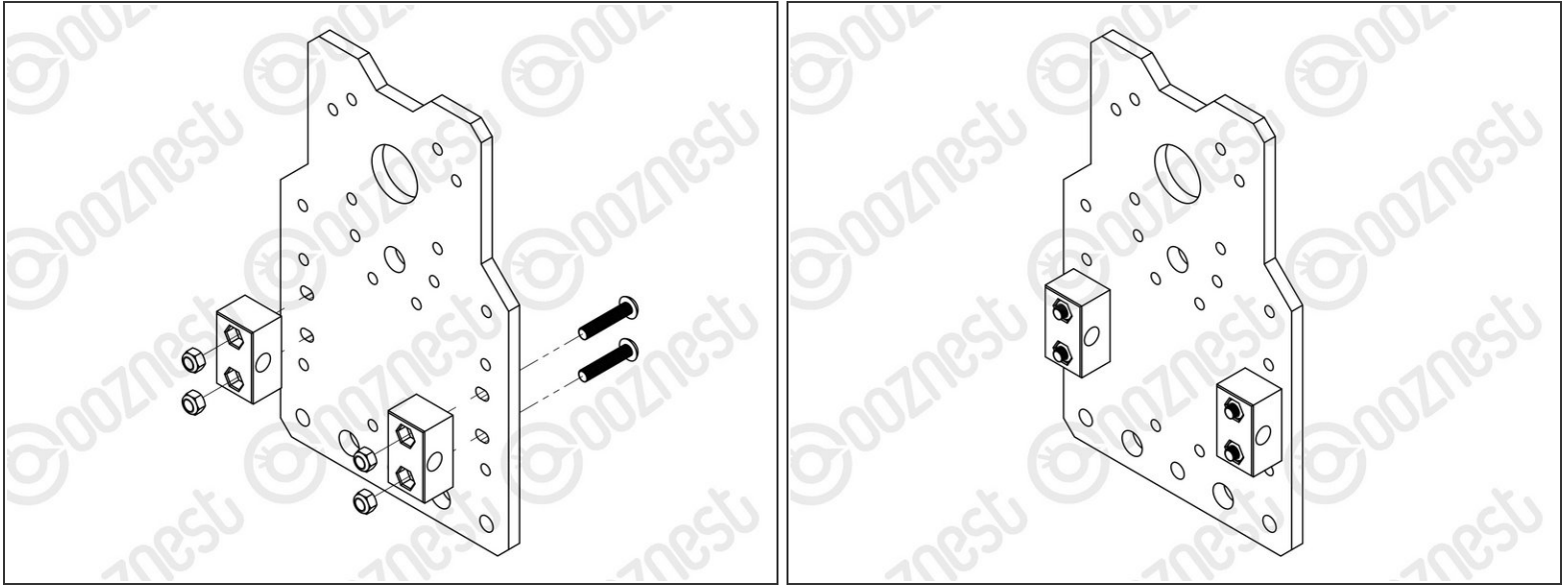
● Attach 2 x Nut-Blocks to the X-Plate-Back using 2 x M5-Button-Head-Bolt-25mm & 2 x M5-Nyloc-Nuts.

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

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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 counterbores.

   ⓘ Look at the [Cheat Sheet](#) to find the correct Limit-Switch.

   ⓘ The wire will be sorted later in the manual.

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Step 6 — X-Axis Wheels
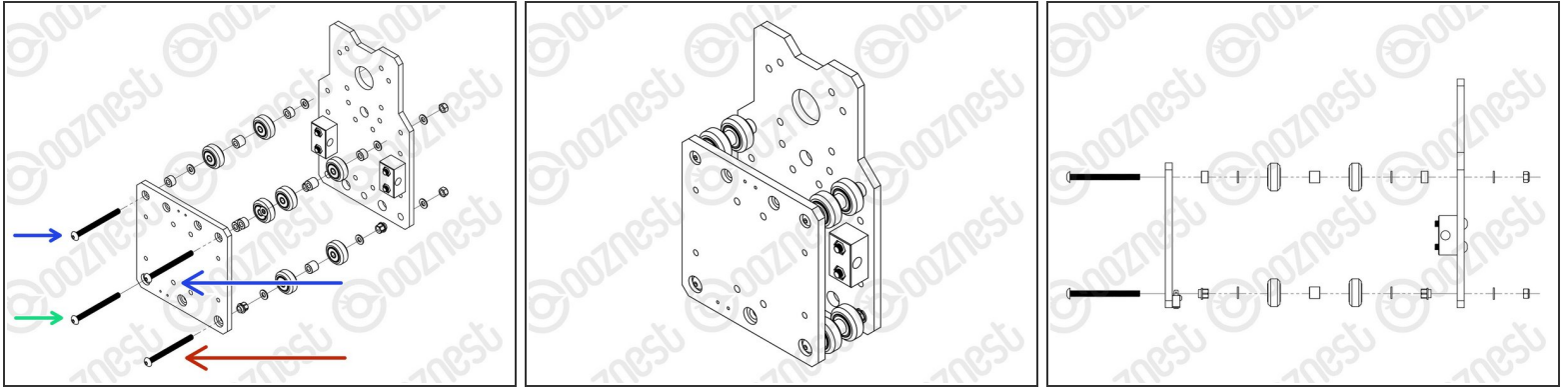
- Assemble the bottom right Solid-Wheel set first. Insert a M5-Button-Head-Bolt-60mm through the X-Plate-Front from the front.

  - 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.

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Step 7 — Adjusting X Wheels
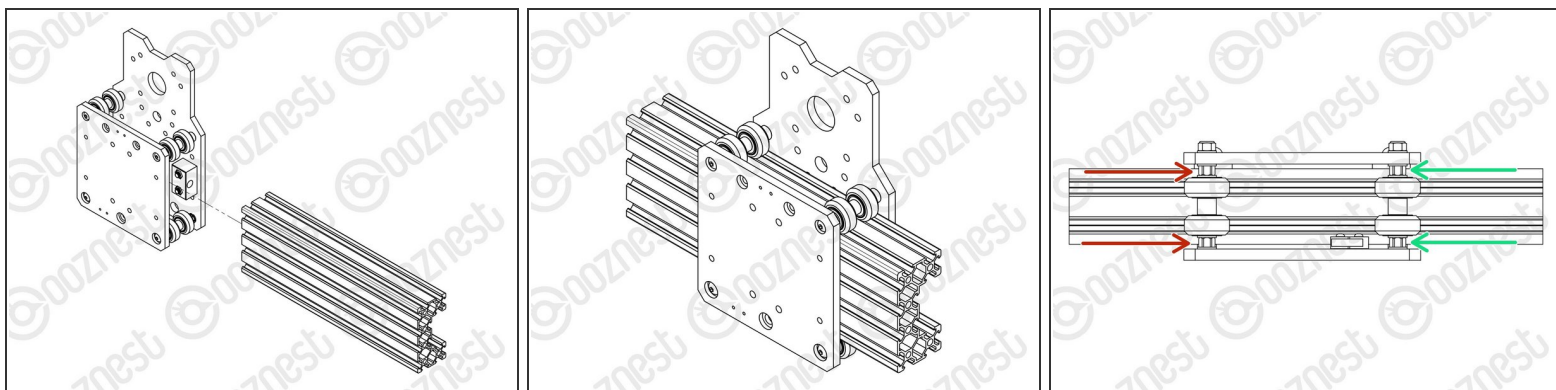
- On the hexagonal portion of the Eccentric-Spacer-6mm, there will be a face that is marked with '6mm'.

  - 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.

- (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.

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Step 8 — X & Z Mating
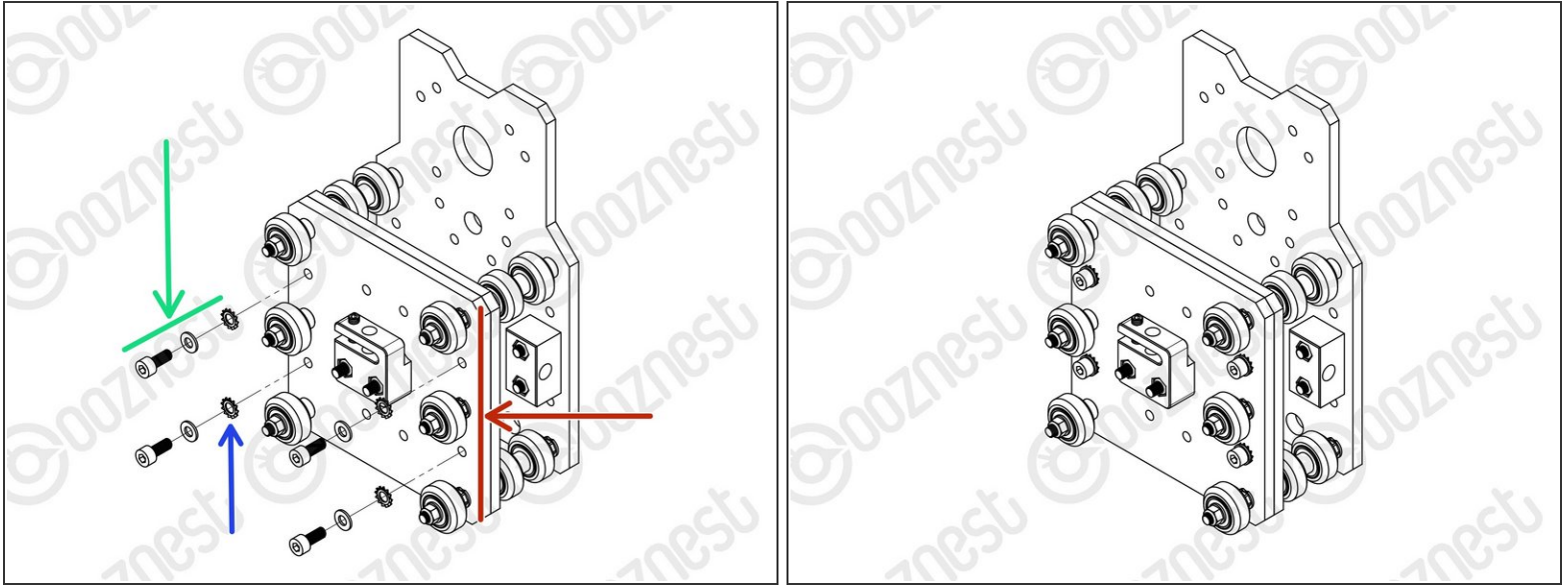
- Mate the Z-Plate-Assembly to the X-Plate-Front.

  - 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.

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Step 9 — Z-Axis Extrusion
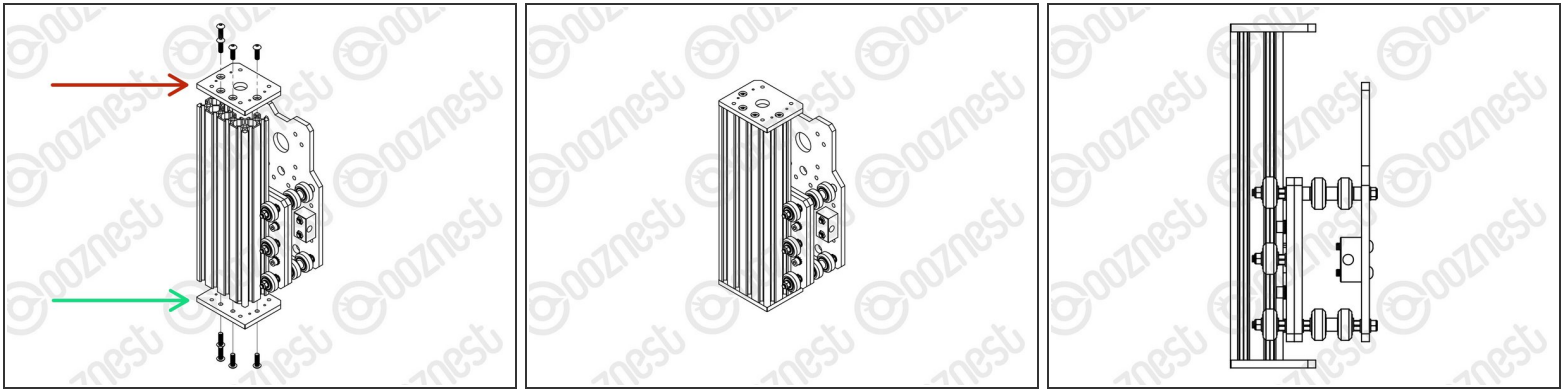
- Slide Extrusion-D through the Solid-Wheels on the Z-Plate-Assembly.

- 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.

  (i) The reason for this will become clear later.

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Step 10 — Z-Axis Stepper Motor
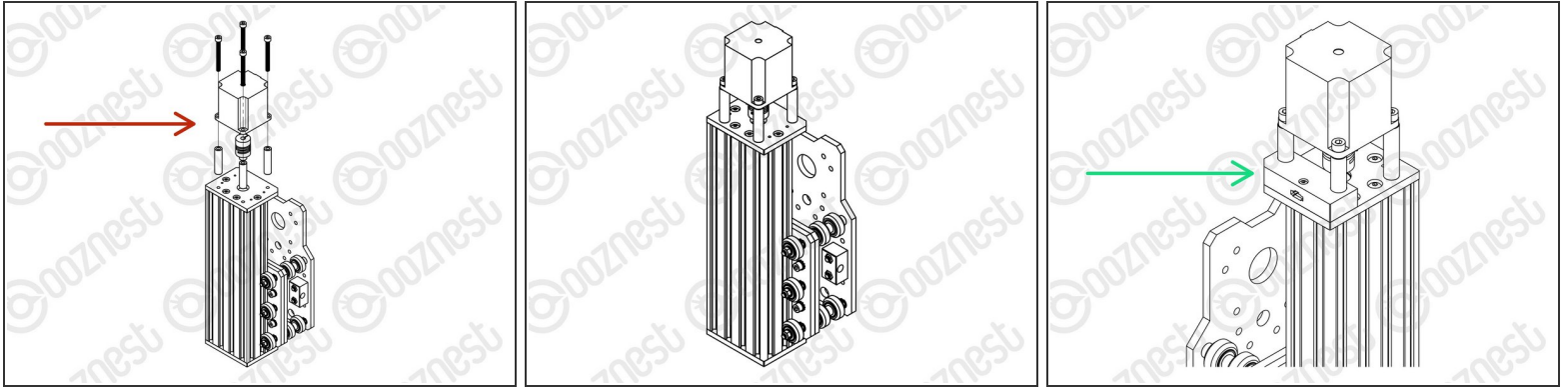
- Slide the 1/4" side (the side with the smallest hole) of the Flexible-Coupler onto the shaft of the Stepper-Motor. Don't tighten it down at this point.

- 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.

  (i) 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.

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Step 11 — Z-Axis Lead Screw
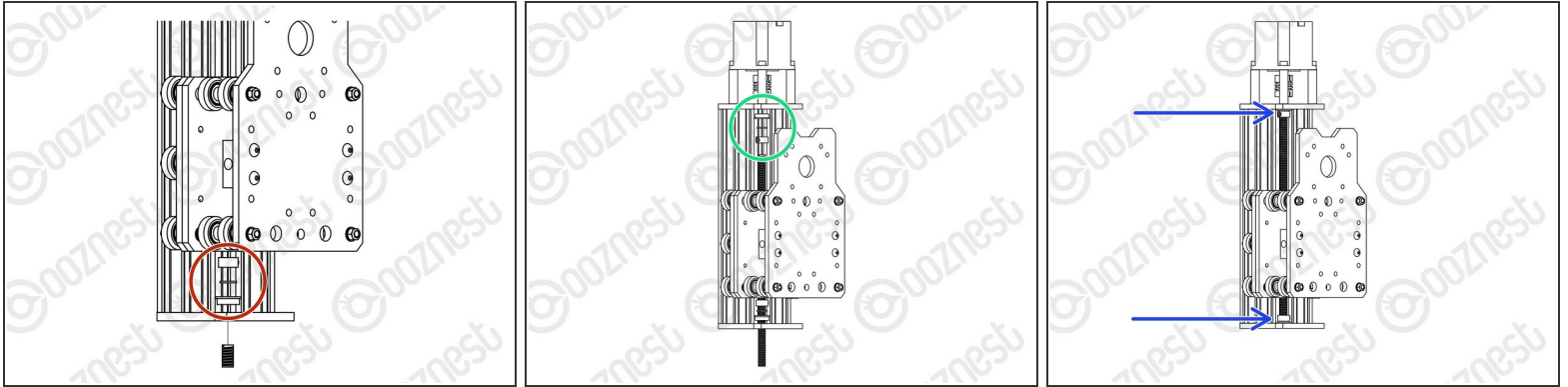
- Slide the Lead-Screw-Z through the bottom Z-End-Plate. Then slide on a Flanged-Radial-Bearing (facing downwards) - ->- - Bearing-Shim - ->- - Lock-Collar.

  - 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.

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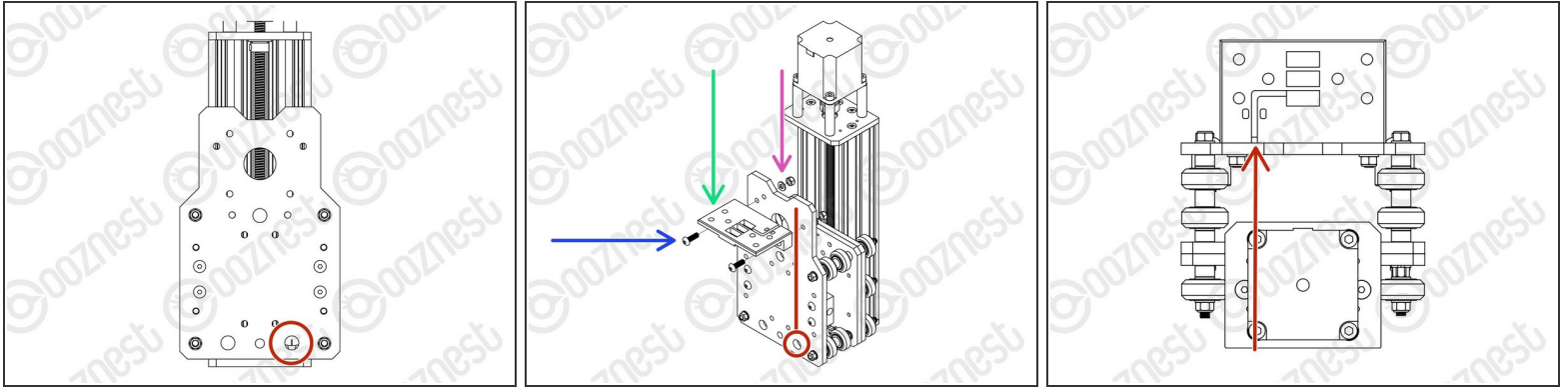
Step 12 — Z-Axis Backlash Adjustment
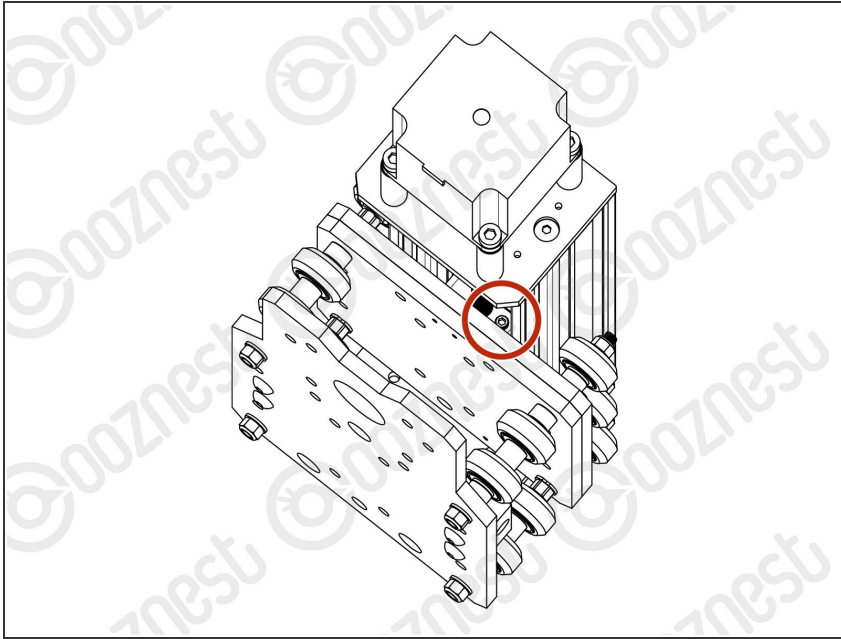
- Firmly hold the Assembly, and check for any up and down play in Extrusion-D.

  - 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.

- ⓘ 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.

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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

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Step 14 — Limit Switch Wire
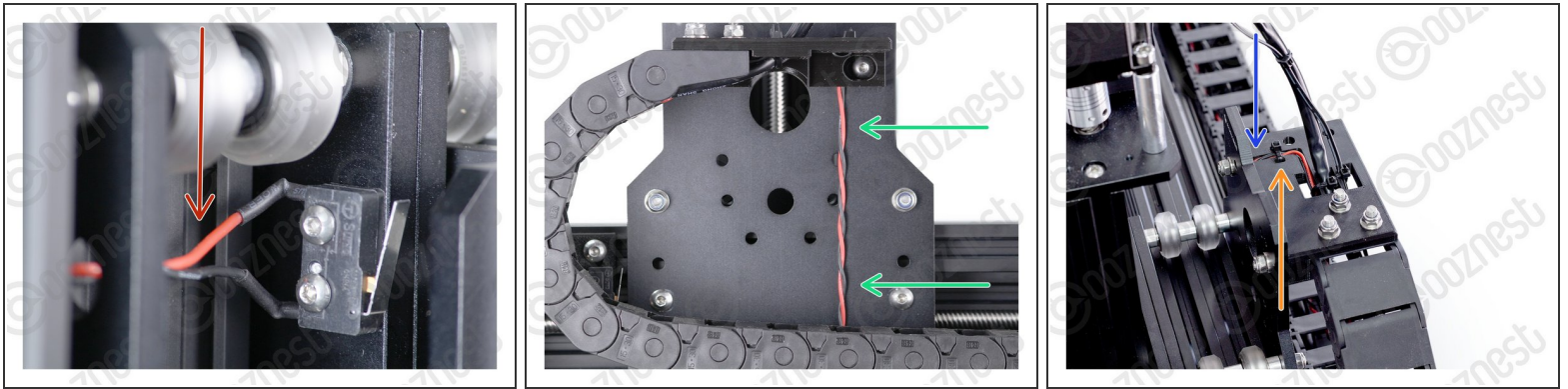
⚠ Pull the Limit-Switch-2 Wire taught all the way from the switch to the Drag-Chain-Mount.

- 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.

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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!

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