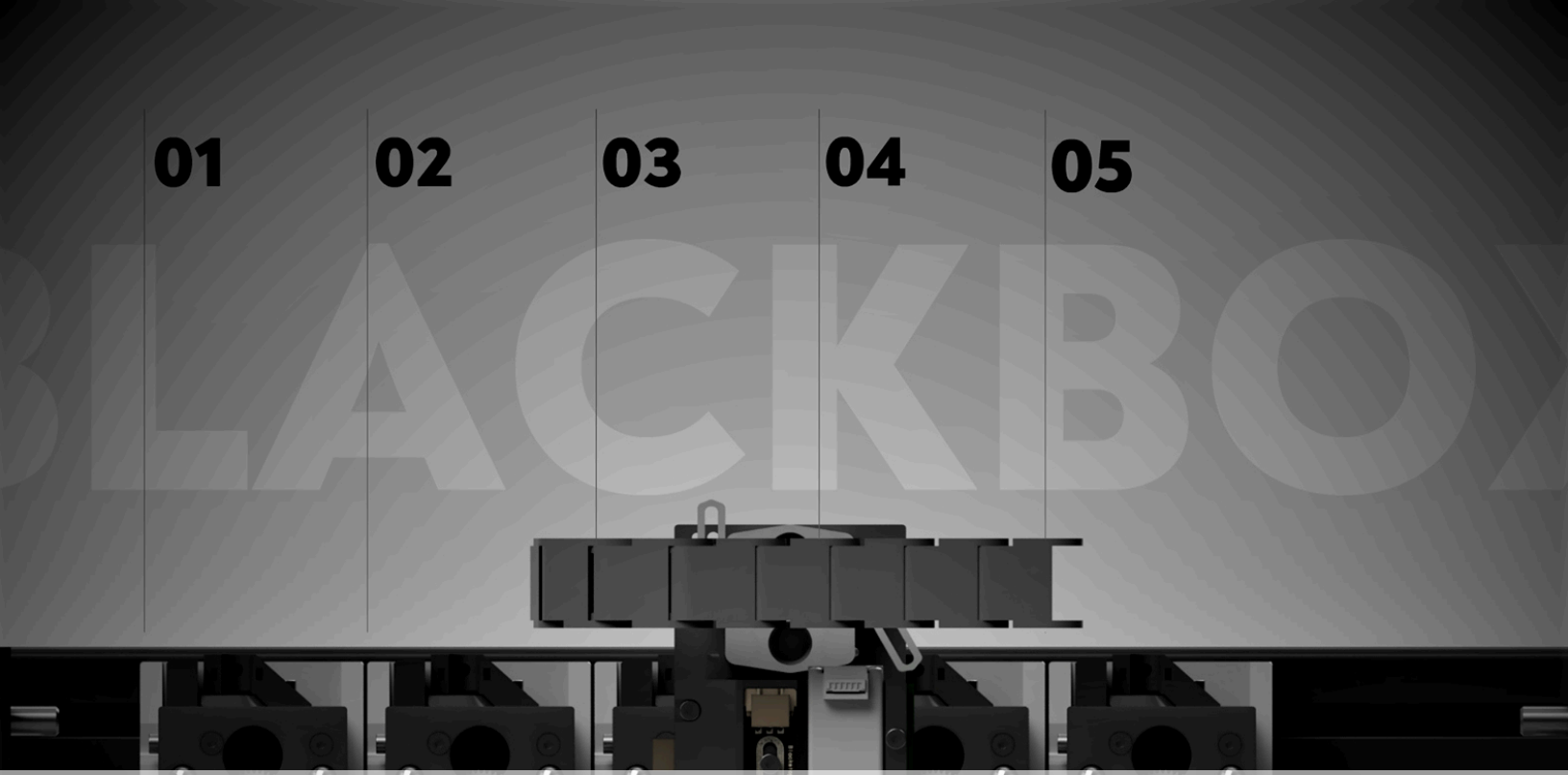


BLACKBOX CE

Tool Dock

DOCUMENTATION VERSION 1

Blackbox CE Mechanical Assembly:

06. Tool Dock

Change Log

Version	Notes
1	Initial Release
1.1	Wiper Assembly changes, PCB standoffs

Tools

Description
2 Part Epoxy or CA Glue
Epoxy Mixing stick or Toothpick
Hand Tap Wrench
Hex Wrenches
Heat Sinking Paste
M3x0.5mm Tap
Reamers
Threadlocker
Soldering Iron with Heatset insert tip
Electric Drill

Parts

QTY	Description
1	CNC_Toolbank_Cooler_Passive_R2
5	CNC_Silicone_Leak_Blocker
10	CNC_Silicone_Wiper
5	Neodymium_Cylinder_Magnet_5x10mm
10	Linear_Shaft_4x30mm
5	Tool Dock PCB
1	Water_Block_NorthBridge_V2
1	64mm Water Tubing
65	M3_4.6x4mm_Heat_Set_Insert
10	Tnut_40Series_M4
5	DIN7991_M3_8mm_FHHS
10	DIN7991_M3_12mm_FHHS
5	DIN7991_M3_35mm_FHHS
10	DIN912_M3_6mm_SHCS
10	DIN912_M3_8mm_SHCS
10	DIN912_M3_10mm_SHCS
10	DIN912_M3_16mm_SHCS
4	DIN914_M3_20mm_SHCS
10	DIN912_M4_30mm_SHCS
10	DIN916_M3_6mm_Set_Screw
10	DIN125A_Washer_Nylon_M3_6mm_1mm

Printed Parts

QTY	Description	Material	Ver	Link
1	Print_ToolBank_Installation_Tool	PLA	1	
5	Print_ToolWiper_part_01	>=ABS	1	
5	Print_ToolWiper_part_04	>=ABS	1	
5	Print_ToolWiper_part_02	>=ABS	1	
10	Print_ToolWiper_part_03	>=ABS	1	
5	Print_ToolDock	>=ABS	2	
5	Print_ToolDockSpacer_Part_01	>=ABS	2	
5	Print_ToolDockSpacer_Part03_CE	>=ABS	1	
5	Print_ToolDockSpacer_Part_02	>=ABS	1	
5	Print_ToolDockWireGuide	>=ABS	1	

Step 1 – Preparation

Do not overtighten any hardware going into a roll-in nut installed to a 2010 or 2020 extrusion to prevent deformation. The lengths of hardware are not substitutable, and a shorter length will prevent proper hold strength while a longer length will deform the 2010 or 2020 profile. You must request or acquire the proper hardware specified in the guide. Hardware going through printed parts can be substituted only with adjustments made to the associated printed part.

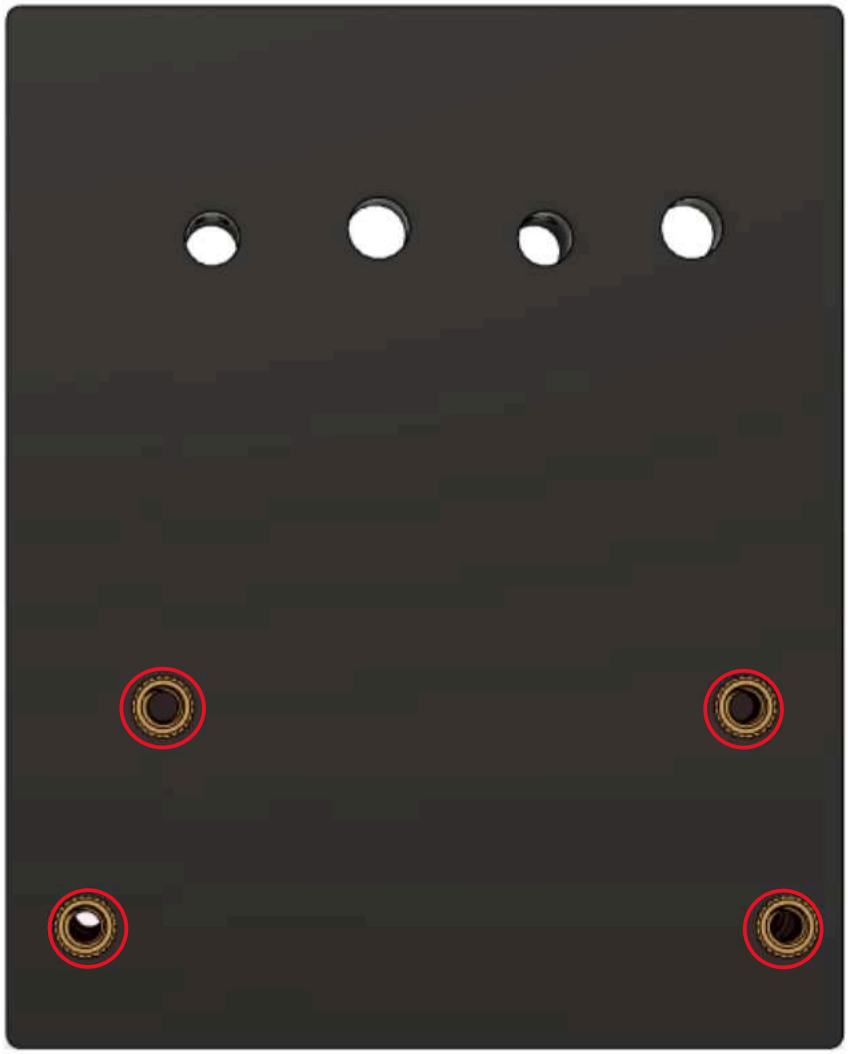
Step 2 – Tool Docks

Locate the tool dock printed parts shown below. Use an M3x0.5 tap to create threads at these 2 locations. Be sure to tap all the way down and into the 4mm bores to which they intersect.

Install M3 heat set inserts (6) in the following locations:

Firstly, two here:

Flip the dock and install the remaining heat set inserts here:



Install a 5x10mm Neodymium magnet here. Note that we will be repeating these steps to build up all 5 tool docks. It is important to keep the polarity of the magnets in a consistent direction during assembly. This will keep you from tool docking issues later in the build. For now, we only need to ensure that the polarity is consistent across all docks. It can be helpful to mark the “top” of the (5) 5x10 magnets at this time. Be sure each magnet is fully seated into the printed dock. Once installed and seated the magnet should have a snug fit. Since there is no retention mechanism other than a friction fit for these magnets, some 2-part epoxy can be used to further secure them in case of a loose fit.

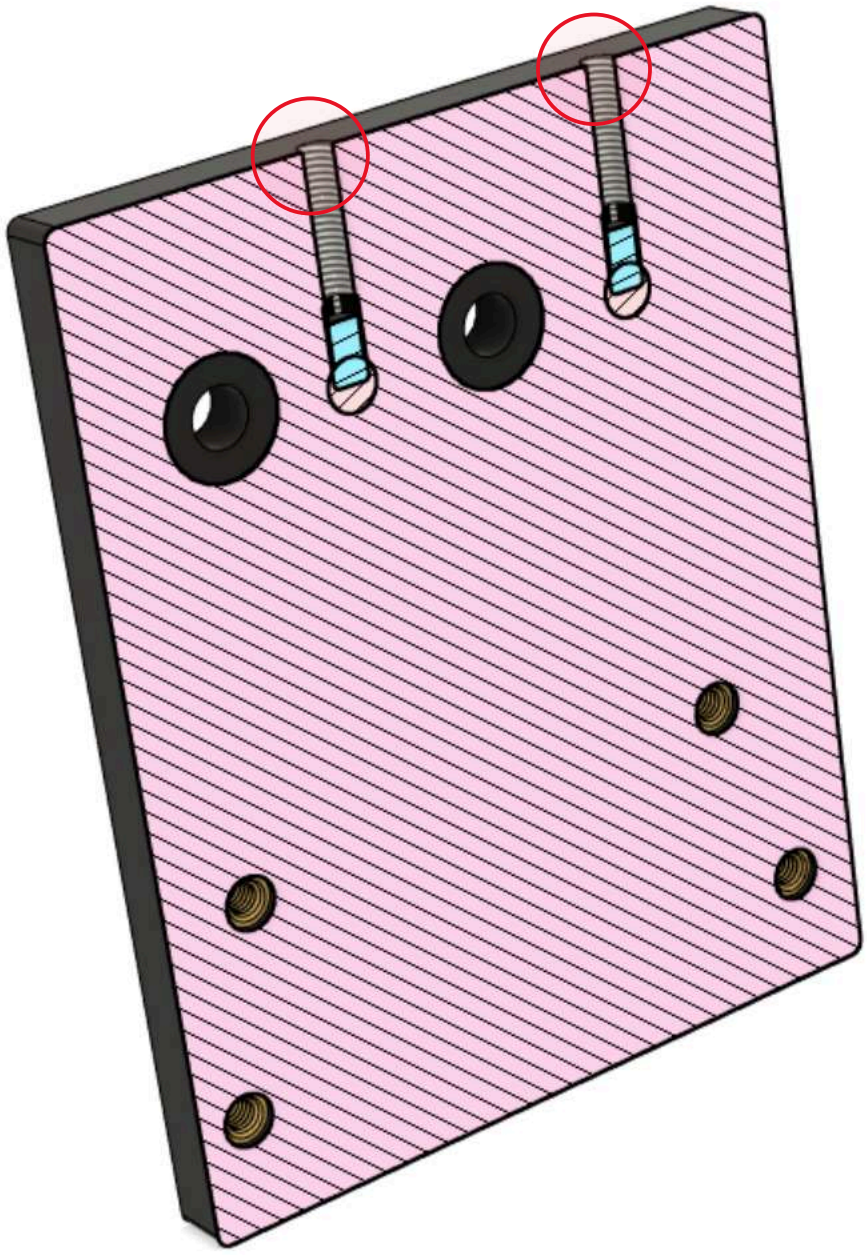
Before Using Epoxy if necessary: See the first page of Step 4!

Install (2) 4mmx30mm shafts as shown:

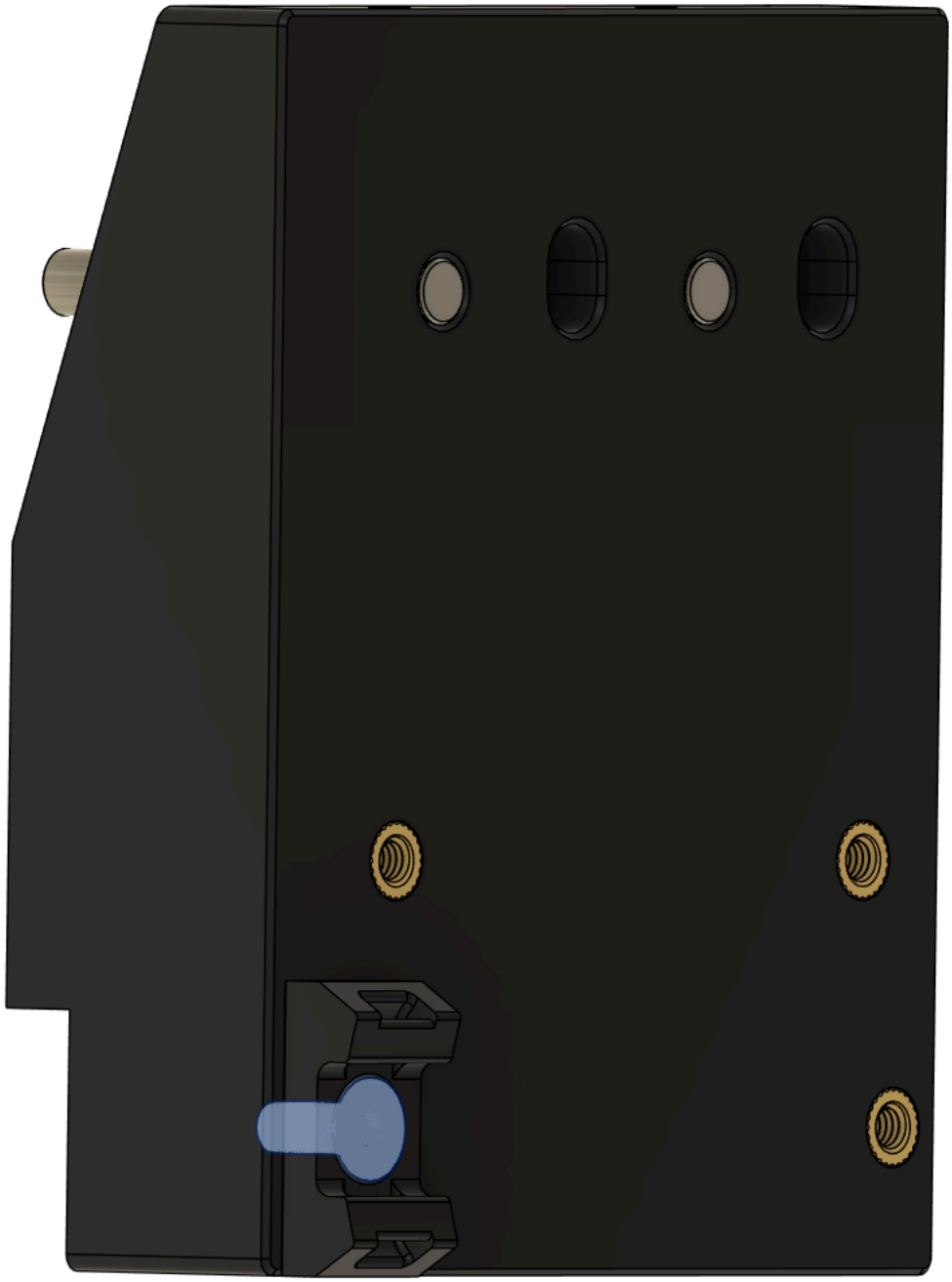
Note that the final position of these shafts may be adjusted later in the building process. Nominally though they will begin flush with the back-side of the dock.

NOTE: It is important that these shafts be perpendicular to the face of the printed part when finished with this step. If your print tolerance requires opening the hole diameter to accept the shafts be sure to use ONLY a squarely driven 4mm reamer included in the kit.

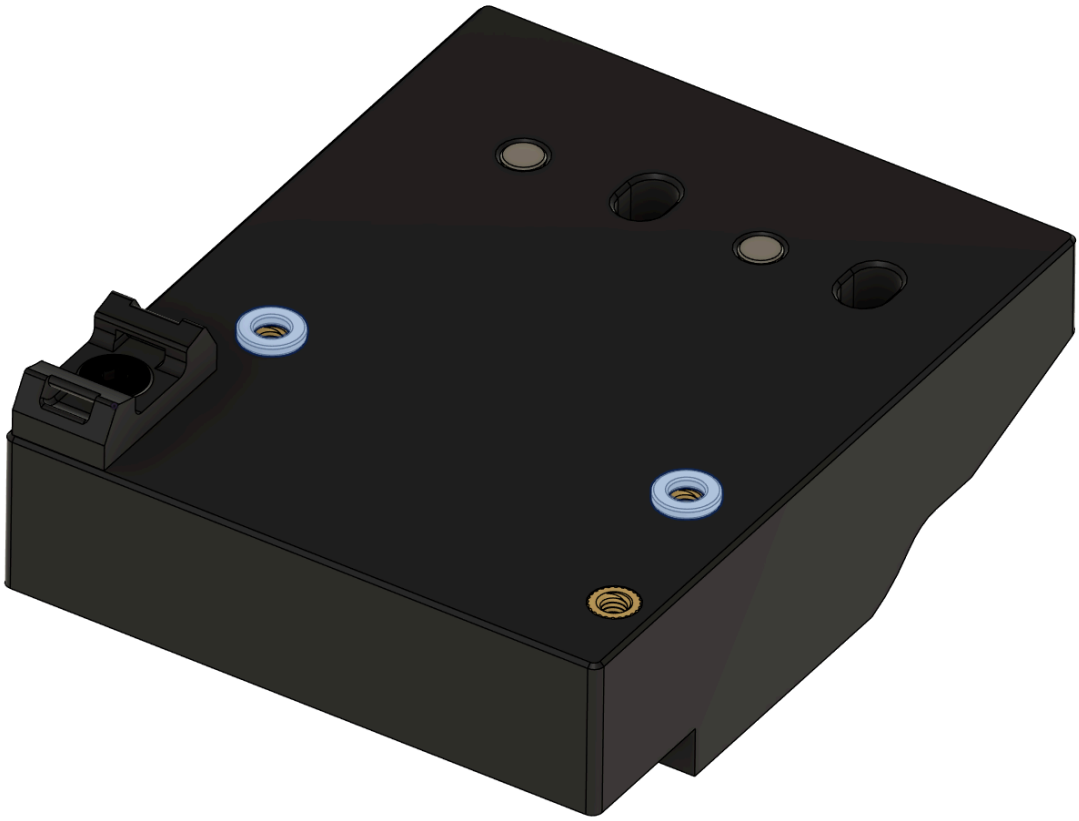
Install and seat (2) M3x6mm set screws into the now threaded bores and tighten to secure the 4x30 shafts. The set screws travel well into the printed part, so a longer reach hex key may be required. The below view should help visualize the function of the set screws.



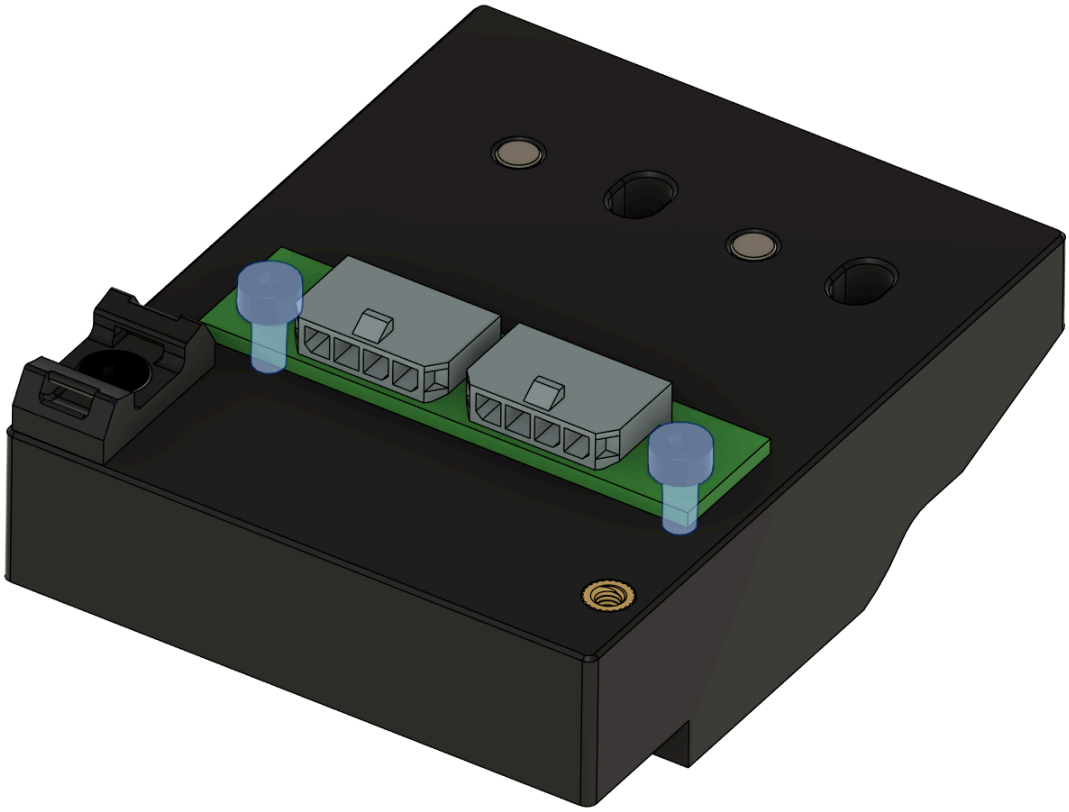
Install a printed tool dock wire guide and secure with an M3x8 FHHS.



Position (2) M3 Nylon washers on the dock



Install a Tool Dock PCB using (2) M3x6mm SHCS



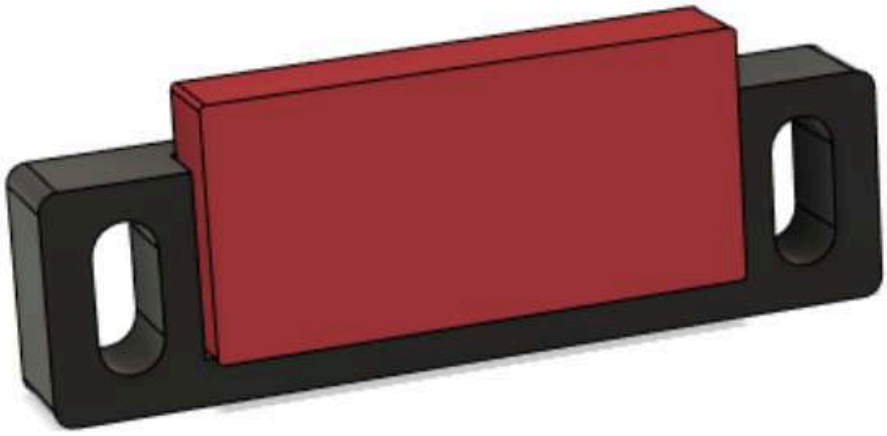
Repeat step 1 four additional times for each remaining tool dock.

Step 2 – Tool Wiper Assemblies (For FDM Tools)

Locate one of the below printed parts and install (4) M3 heat set inserts in the shown locations. Note that the (2) inside inserts are to be installed from the back side of the printed part. Be sure that they ultimately are located flush with the inside face of the printed part!

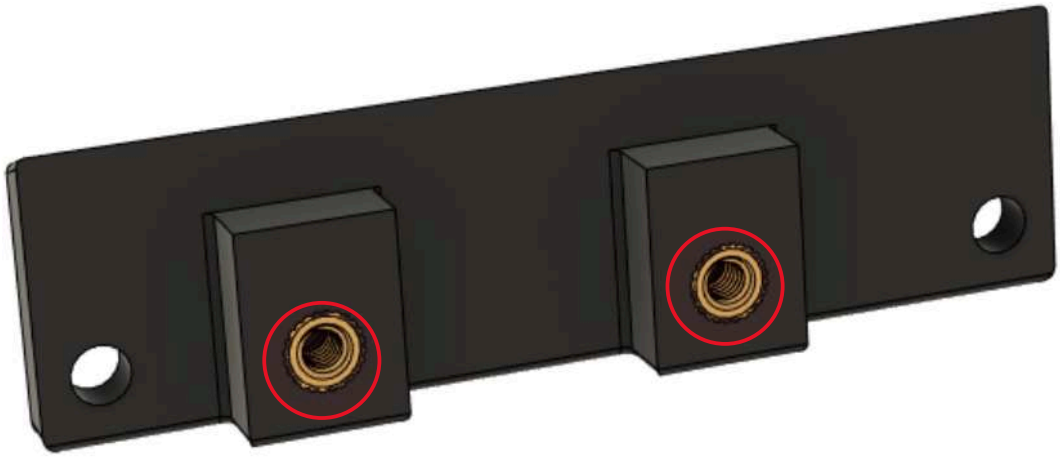
Locate the below printed part and install a Silicone Leak Blocker into the channel as shown.

NOTE: This part is located in an FDM Tool Hardware Kit!



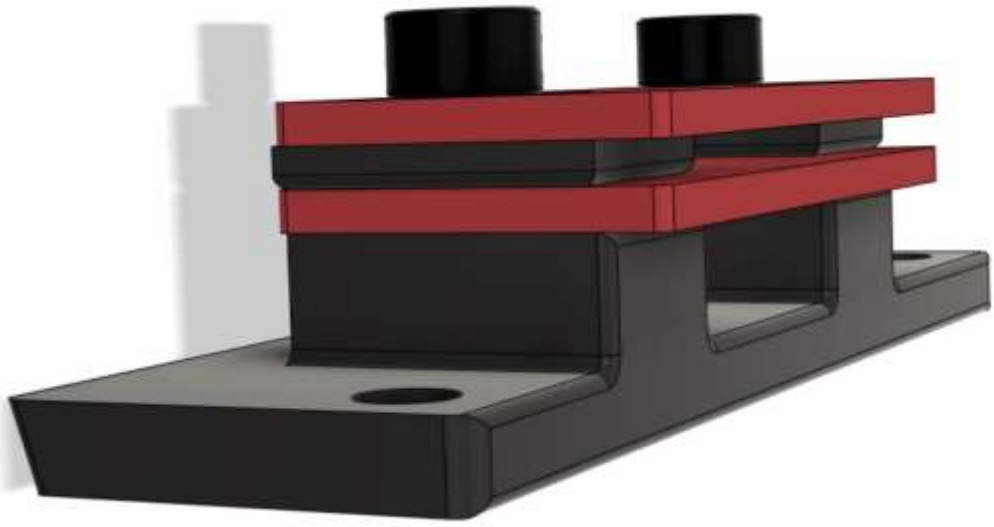
Install onto the main nozzle wiper printed part and fasten using (2) M3x12FHHS.

Locate the below printed part and install (2) M3 heat set inserts in these locations:



Locate (2) Silicone Nozzle Wipers and (2) Print_Nozzle_Wiper_Part03. Each wiper will be separated by the two printed parts as shown in the stack below. Secure the stack loosely using (2) M3x8 SHCS.

Note that the height of the nozzle wipers will be set later in the build process. Be careful not to over tighten the M3x8 SHCS to avoid deforming the silicone wipers.



Secure the nozzle wiper sub assembly to the main nozzle wiper assembly using (2) M3x10 SHCS

NOTE: This part is located in an FDM Tool Hardware Kit!

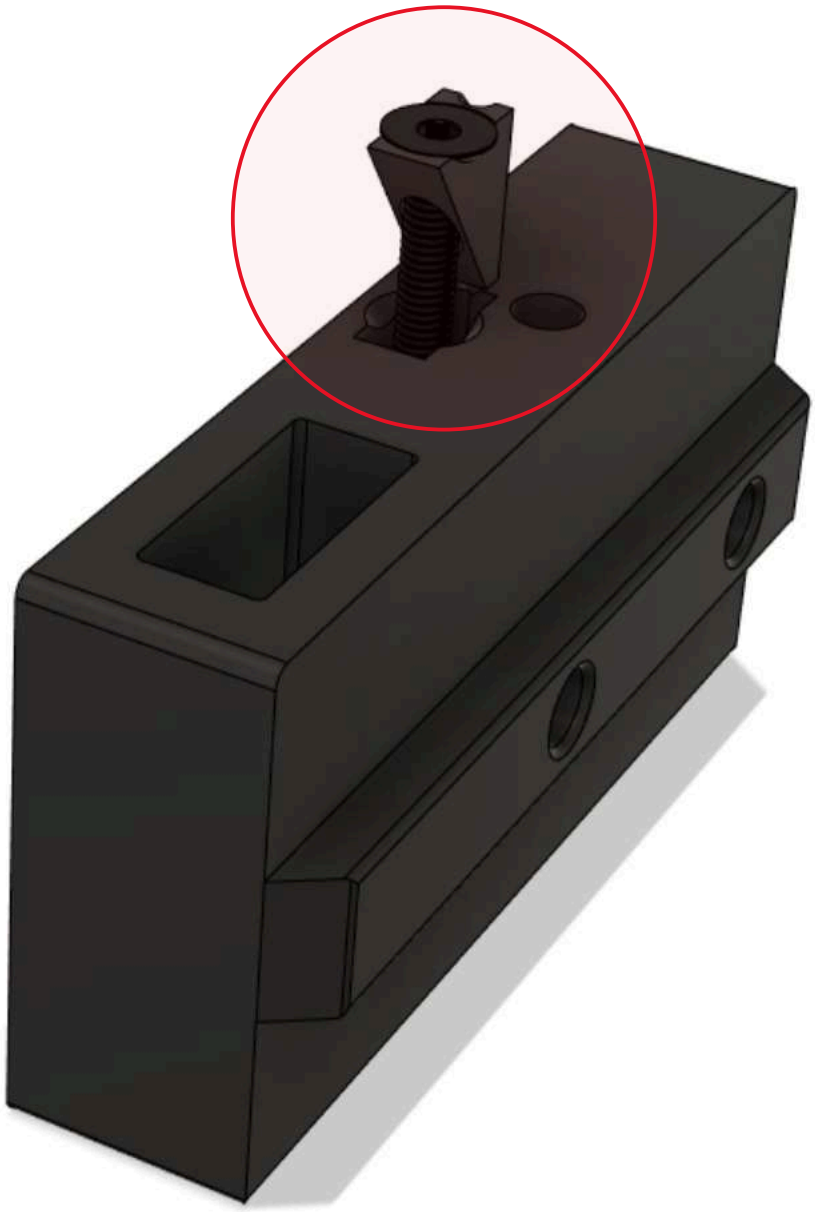
Repeat this process for as many FDM Tool Head you will be installing on your Blackbox.

Step 3 – Tool Dock Spacer Assemblies

Locate a printed Tool Dock Spacer housing and install an M3 heat set insert at the shown location.

Locate the shown printed part and snap into place as pictured below.

Locate Print_ToolDockSpacer_Part02 and temporarily (loosely) secure with an M3x35 FHHS. This piece will eventually be used to secure a spring wire that helps manage the wire hoops to each equipped tool.



Repeat this step 4 additional times.

Step 4 – Full Sub-Assembly

Locate idle tool cooler and orient as shown.

Place each tool dock assembly against the idle tool cooler. The 5x10 magnet is the only contact point until the next step. The magnets should pass into the tool cooler with a slight press fit. If required, the tool cooler can be reamed to 5mm.

VERY IMPORTANT: - All of the magnets should be either flush with the face of the tool cooler or slightly below flush. Any magnets that extend past the surface of the tool cooler will cause a loss of conductive heat transfer on docked tools. If one or more magnets are too far exposed, now is the time to press them further or diagnose the cause of the extra height.

Fix all tool wiper assemblies (and thus docks) to the idle tool cooler using (10) M3x16 SHCS and loosely tighten. These fasteners will be fully tightened at a later step.

Locate 1 of the two water blocks and install (2) BSPT tube fittings as shown.

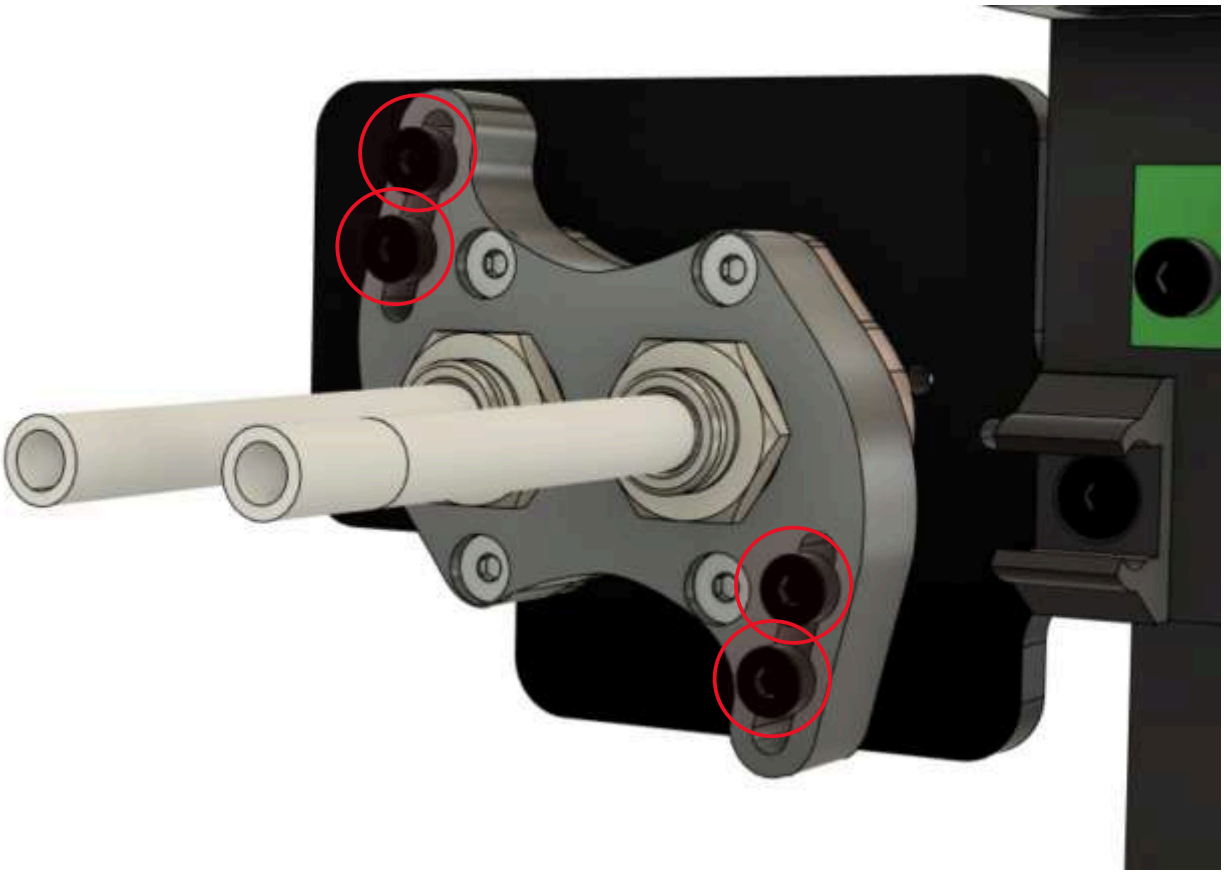
Insert two 64mm lengths of tubing into each fitting. Achieving perfect lengths and square cut ends is not necessary. The sealing surface for these fittings is an O-ring seal against the OD of the tubing. Ensure that no cut debris enters the tubing before installation. A sharp razor blade can be used to achieve clean cuts, but always practice good safety when working with blades. Be sure the tube is fully seated in each fitting!

Before performing this next step, it is important to clean any residual dust and/or machining oils from the (back) face of the idle tool cooler bar. Isopropyl alcohol and acetone are great for this purpose, but please use gloves, lung, and eye protection in a well-ventilated area when using these chemicals. They are also highly flammable!

NOTE: Be sure to remove the plastic protection film from the copper face of the water block if equipped! Leaving this in place will result in near-zero cooling ability for the idle tool bar.

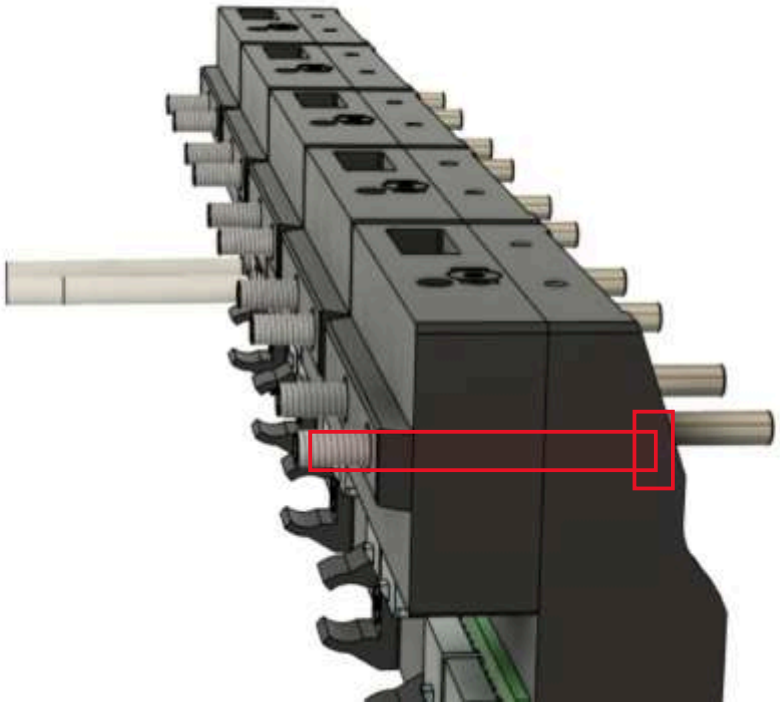
Deposit a pea-sized amount of thermal compound to the middle of the copper face of the water block. Install and secure as shown using (4) M3x20 SHCS at the indicated locations. Ensure the orientation of the cooler block is correct by confirming that the hose and fittings are parallel to the X axis of the machine.

These fasteners should be tightened uniformly and without high torque to avoid warping the cooler itself.



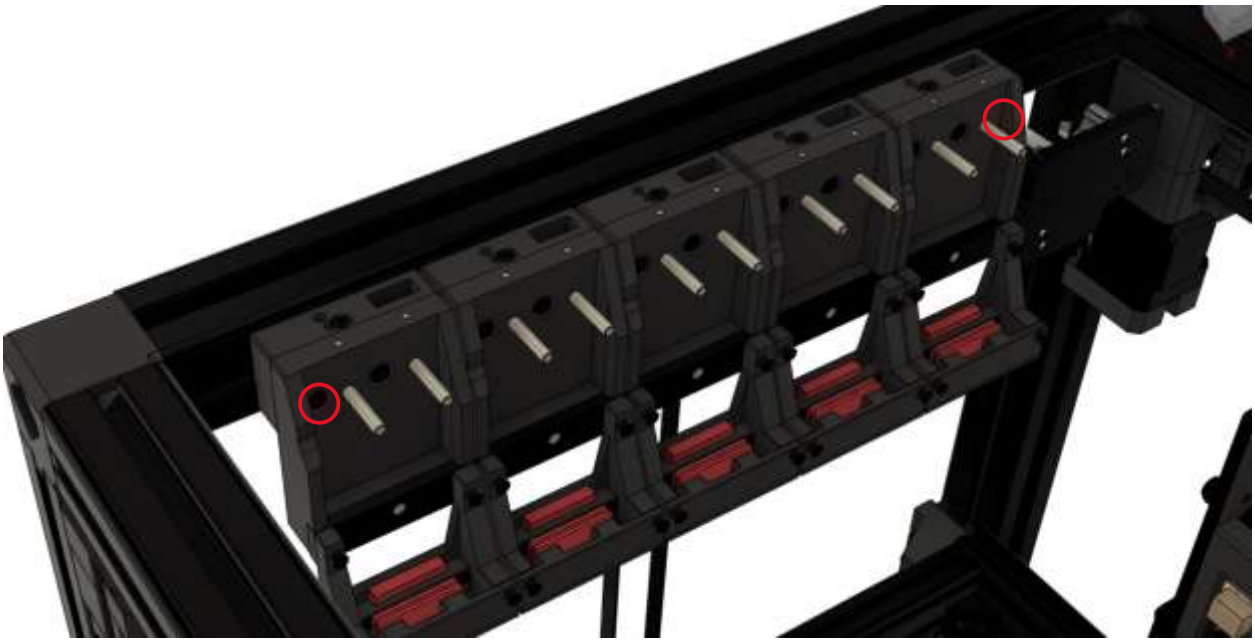
Install (10) 4040 M4 T nuts into the left upper inside extrusion as shown.

Working with the entire tool bank sub-assembly, capture each of the remaining Tool Dock Spacer sub-assemblies using (10) M4x30 SHCS.

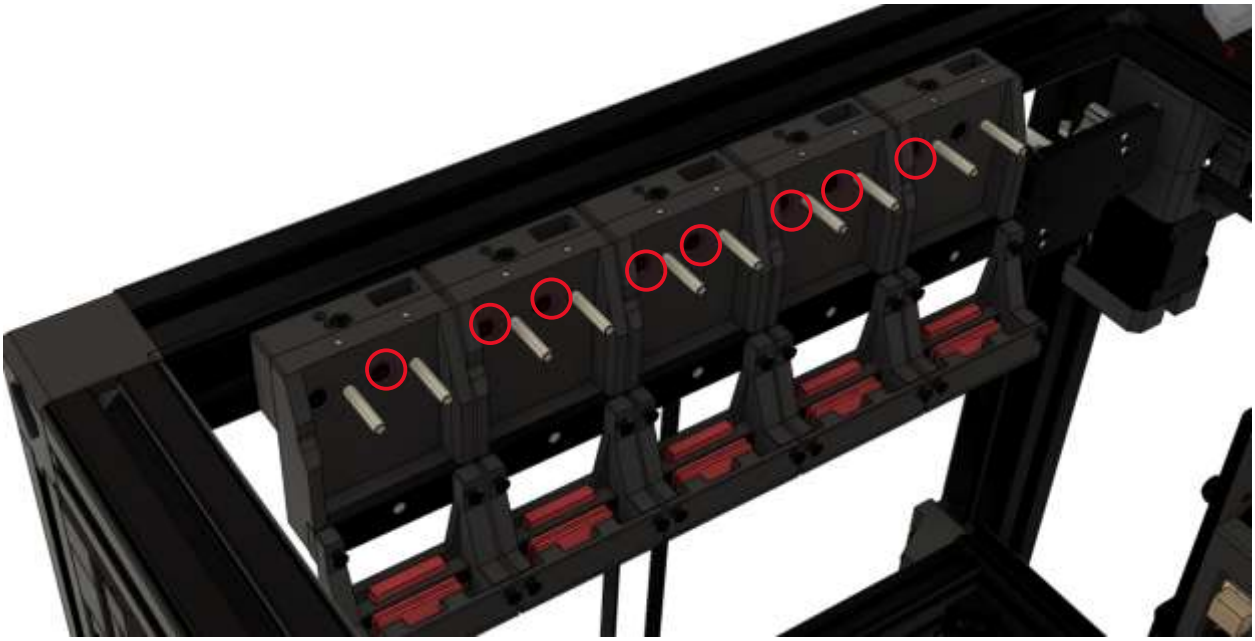


A second view of the fully assembled Tool Dock Assembly ready for installation.

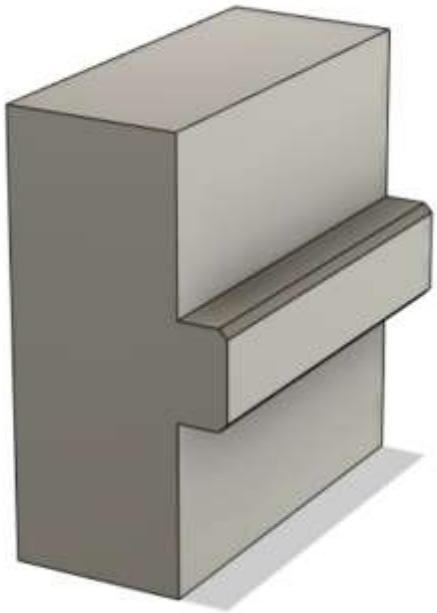
Move each T-nut into its estimated final position manually before proceeding. Loosely fasten the subassembly to the frame using the two far corners first.



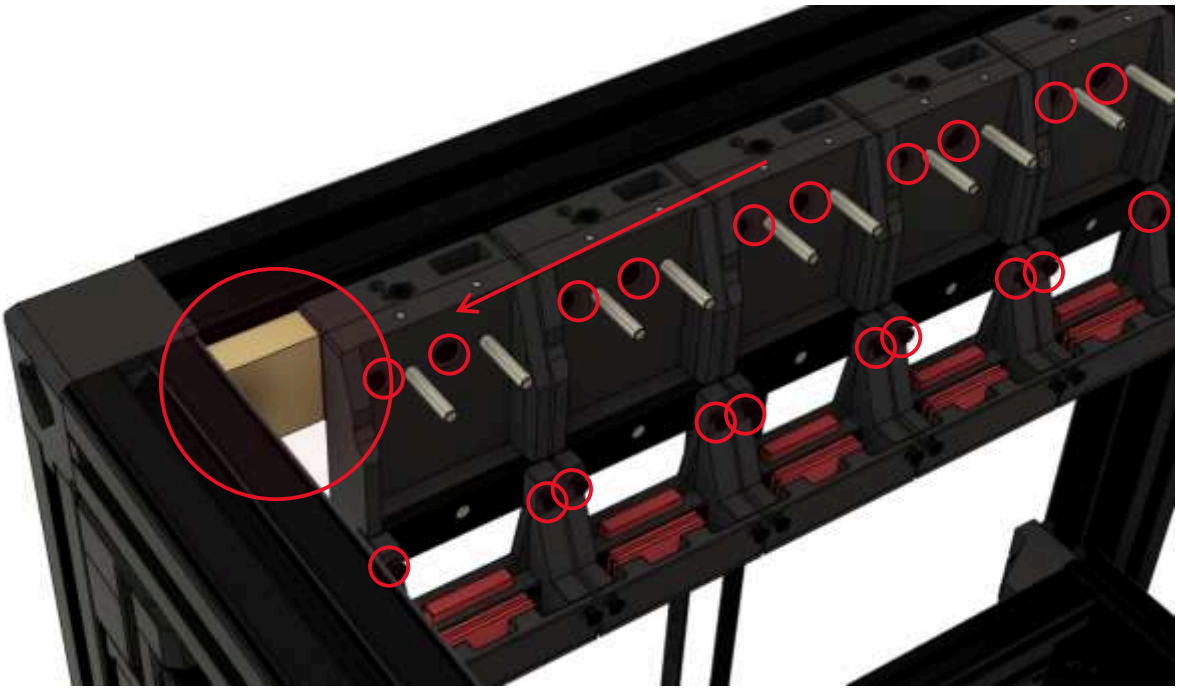
Loosely tighten the remaining 8 fasteners after making any final micro adjustments to the Tnuts that accept them.



Locate the Print_ToolDock_Installation_Tool pictured below:



Place the printed tool between the tool bank assembly and upper forward 4040 extrusion. Slide the Tool Dock assembly and printed tool forward (toward front of machine) until no gap remains. Fully tighten all Tool Bank screws. Finally, fully tighten all the M3 SHCS that secure each Nozzle Wiper Assembly to each tool dock. Remove printed tool.



Congratulations! You have completed all the steps for the assembly of the Tool Dock.